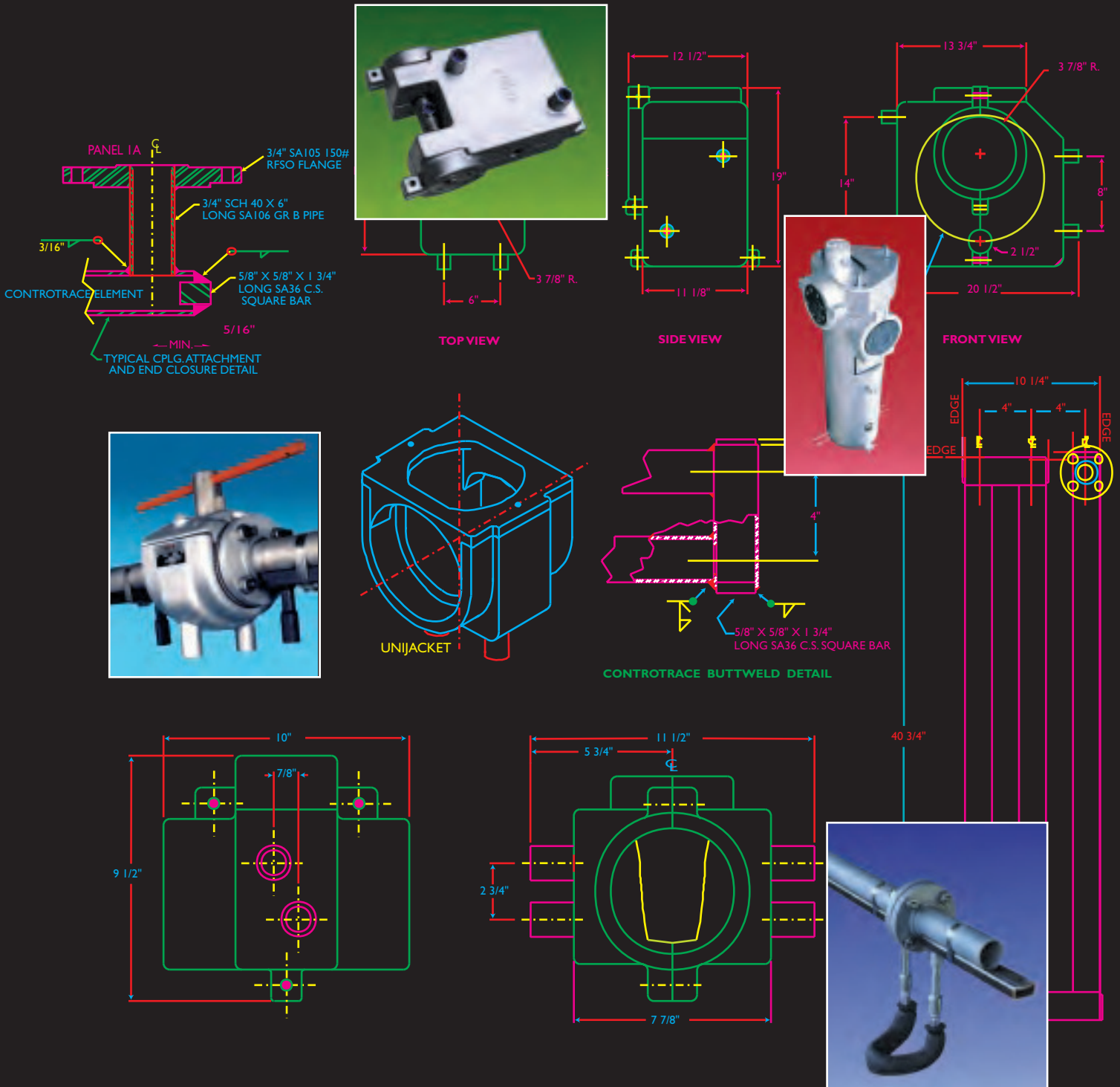


CSI Bolt-On Heating Systems



Piping • Valves • Pumps • Meters • Instruments • Tanks • Vessels

The CSI Bolt-On Heating System

Integrally jacketed piping systems and components have long been the preferred method used with processes that require elevated temperatures for efficient in-plant transfer of products such as sulfur, bitumens, phthalic anhydride, DMT and polymers. Pumpability, product quality, flow properties and reliable equipment operation for many of these processes depend on viscosity ranges controlled by temperature.

Integral jacketing offer the advantages of unit construction, high rates of heat transfer from the heating medium to the process, and the ability to maintain processing temperatures within close tolerances.

The disadvantages of integrally jacketed systems are the limited selections available for jacketed components, relatively long deliveries for these components, and inconsistencies of quality of the jacketed components due to the lack of industry-wide fabrication standards.

The CSI Bolt-On Heating System is comprised of products that respond positively

to the disadvantages cited for integral jacketing. The bolt-on system provides thermal performance necessary to meet narrow-envelope processing. The product heating options are

versatile, ranging from the primary function of temperature maintenance to more thermally complex applications of heat-up and melt-out, and, infrequently, heat exchanger duty of process heating or cooling.

The CSI Bolt-On Heating System consists of two basic product groups which are discussed in more detail on subsequent pages:

- **ControHeat Bolt-On Jackets** for valves, pumps, meters and other components.
- **ControTrace Heating Elements** for piping, tanks and vessels.

This brochure outlines the products and services offered by CSI to help designers and engineers optimize performance and value for specific bolt-on heating systems.



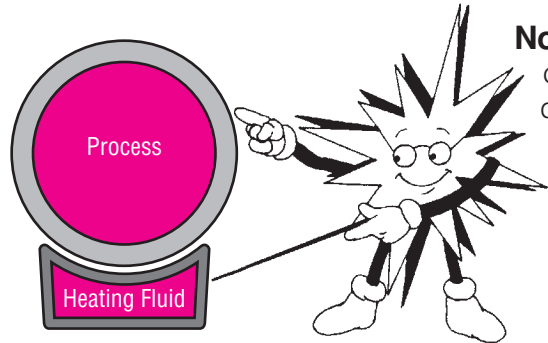
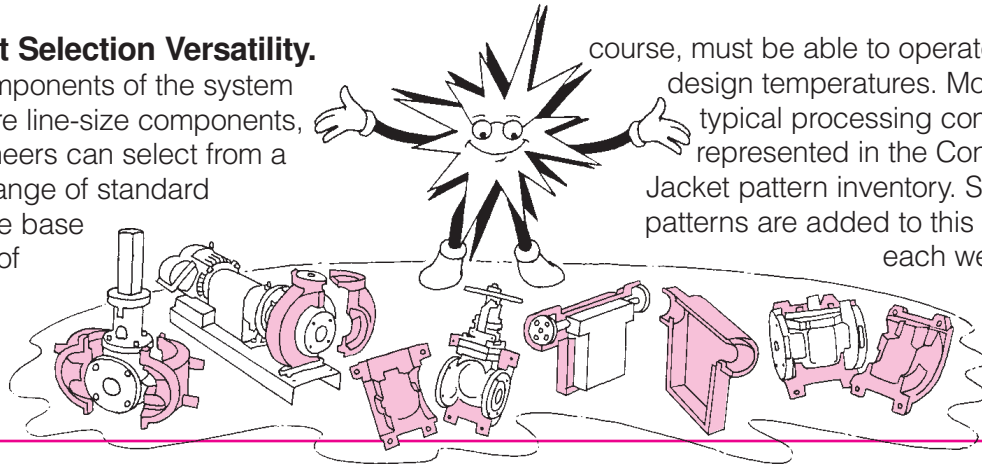
Benefits of the CSI Bolt-On Heating System

There are several benefits that accompany the CSI Bolt-On Heating System. The major ones are:

Component Selection Versatility.

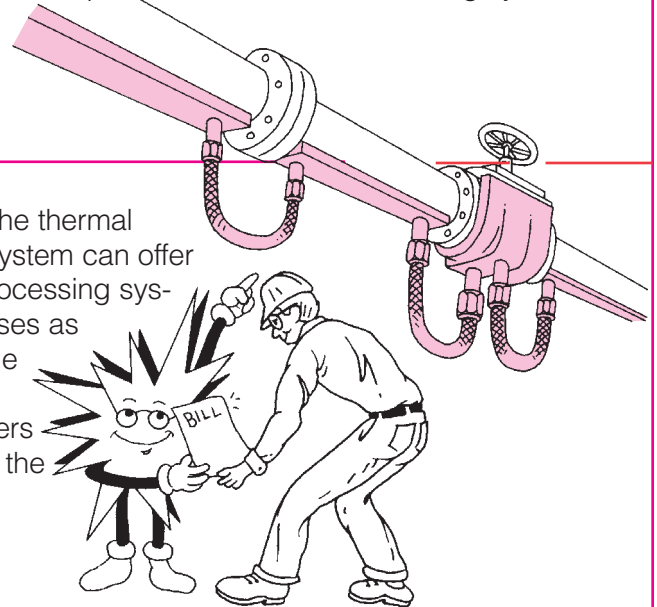
Because components of the system most often are line-size components, project engineers can select from a very broad range of standard products. The base component, of

course, must be able to operate at elevated design temperatures. More than 3500 typical processing components are represented in the ControHeat Jacket pattern inventory. Several new patterns are added to this inventory each week.



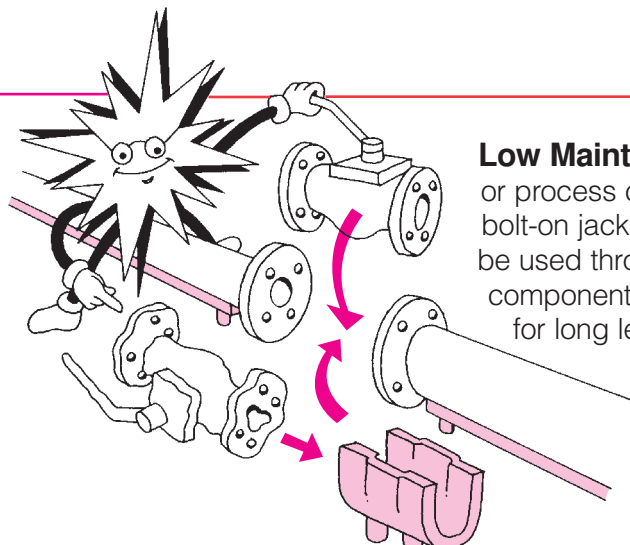
No Cross-Contamination.

Defects in castings or cracks in core piping cause cross-contamination. The double-wall design of the bolt-on heating system eliminates the possibility of cross-contamination. The heating fluid can't reach the process, and the process can't flood the heating system.



Economical Temperature Control.

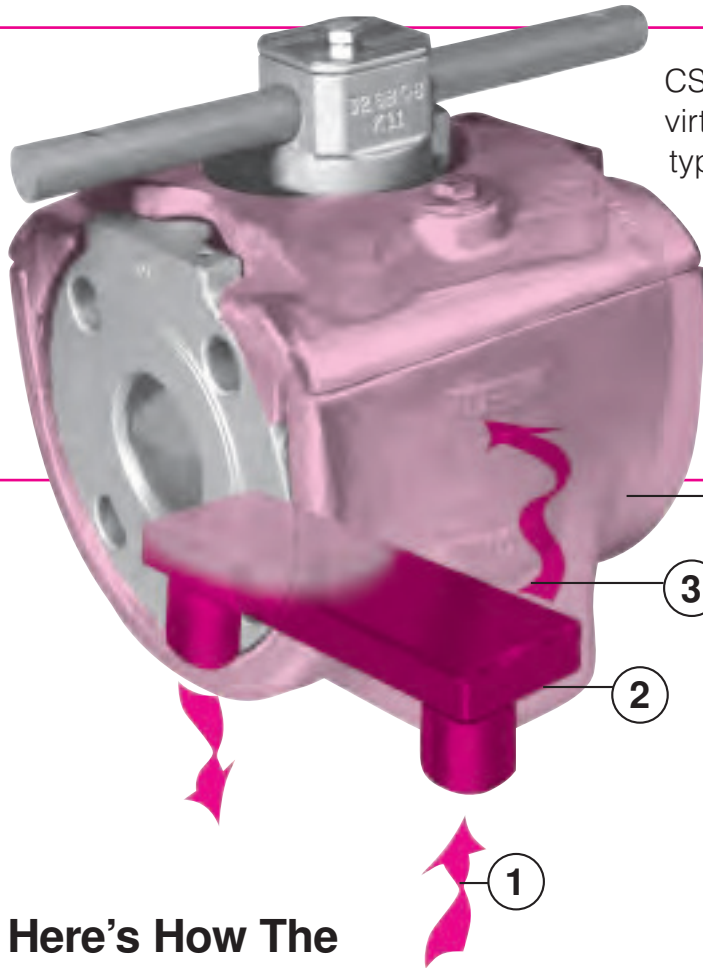
Depending on the thermal requirements of the process, the CSI Bolt-On Heating System can offer significant cost savings compared to a fully jacketed processing system. In general, the cost of the clamp-on system increases as the required temperature of the process approaches the temperature of the heating fluid. When the design temperature envelope is very narrow, say 2-4°F, designers must carefully analyze potential chill spots to determine the optimum heat coverage.



Low Maintenance Costs.

Practically any piece of equipment or process component can be economically heated with a bolt-on jacket. Because standard line-size components can be used throughout the system, the replacement of individual components like a valve can be made without concerns for long lead times and "crises" expediting.

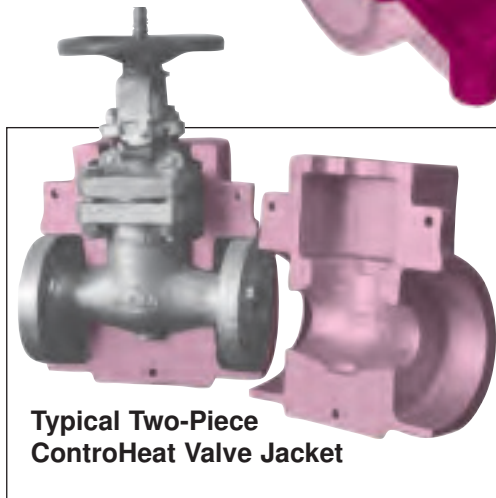
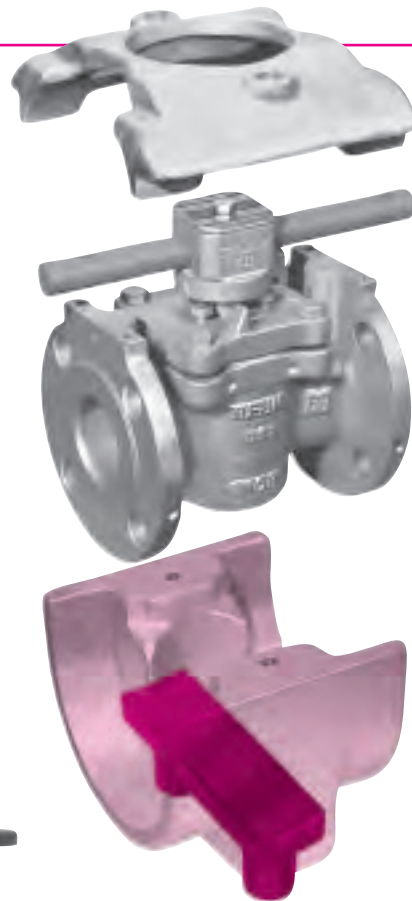
ControHeat Jackets Cover Valves



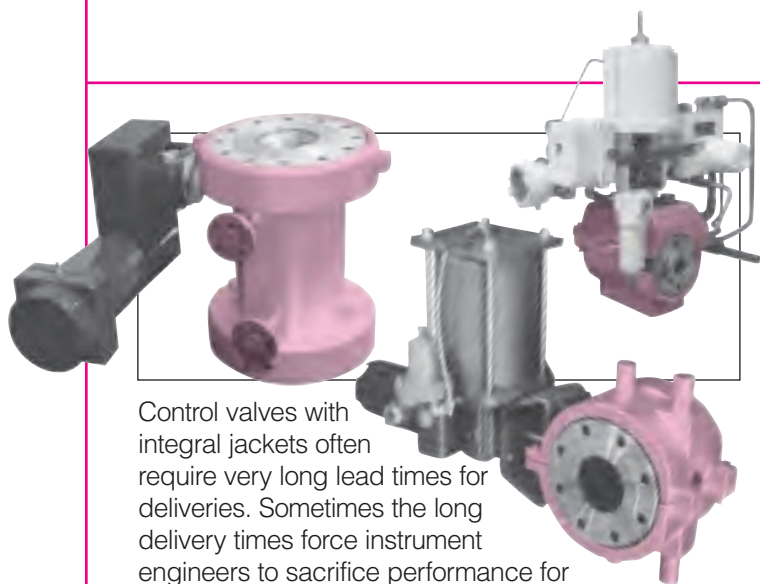
CSI makes ControHeat Bolt-On Jackets for virtually any valve. Generally, there are two types of jacket construction offered: One-piece jackets, called UniJackets, for valves sizes 3-inch and smaller; and two-piece jackets for valves sizes 4-inch and larger. Very large valves like 20-inch gate valves may utilize more than two pieces to accommodate ease of installation.

Here's How The ControHeat Jacket Works:

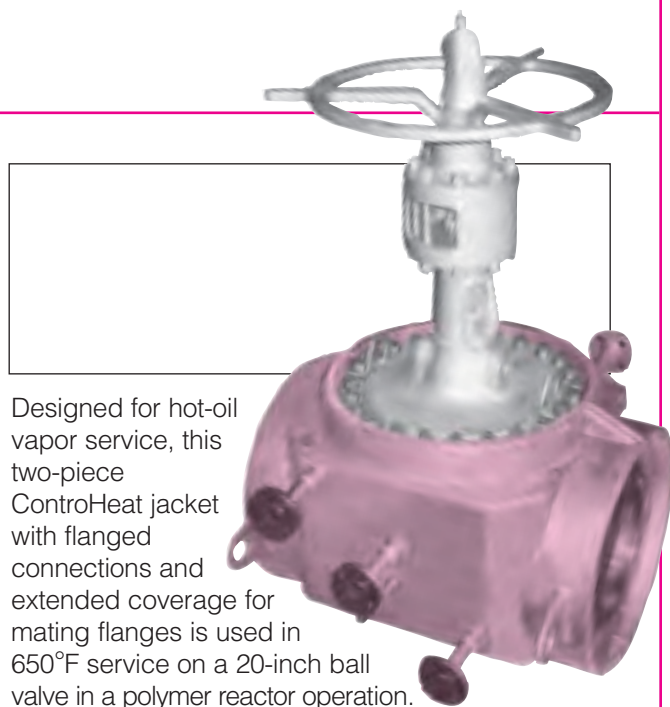
1. Pressurized heating fluid enters the pressure chamber embedded in the aluminum casting. The pressure chamber may be either carbon steel or stainless steel.
2. The pressure chamber is designed, manufactured and tested in accordance with the ASME Boiler and Pressure Vessel Code, Sec. VIII, Div. 1.
3. The aluminum casting, which never contacts the pressurized heating fluid, rapidly transfers heat from the pressure chamber to the external surface of the valve.
4. Normally, heat transfer cement is used with the jacket to minimize any air gap between the casting and the valve body. The cement promotes efficient heat transfer.



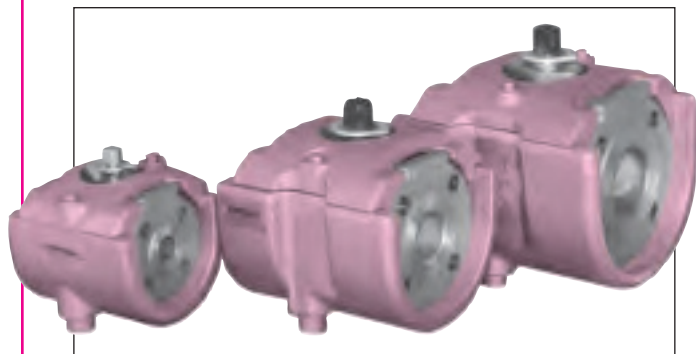
**Typical Two-Piece
ControHeat Valve Jacket**



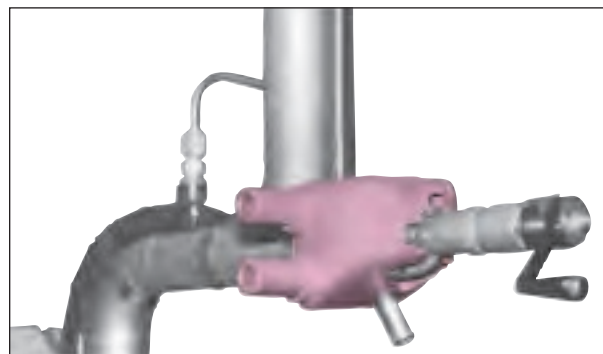
Control valves with integral jackets often require very long lead times for deliveries. Sometimes the long delivery times force instrument engineers to sacrifice performance for availability. ControHeat Jackets allow you to select the optimum valve for the process without concern for the jacket.



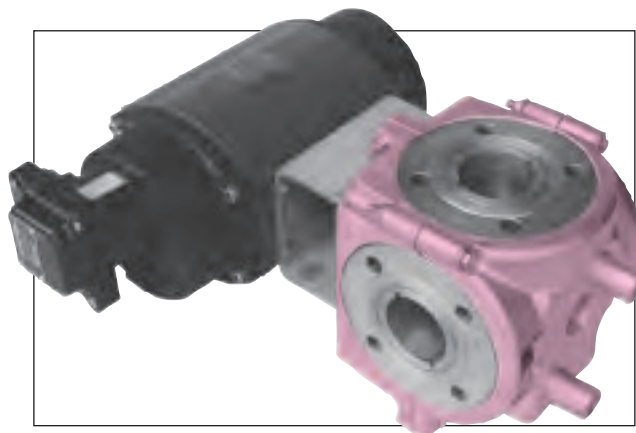
Designed for hot-oil vapor service, this two-piece ControHeat jacket with flanged connections and extended coverage for mating flanges is used in 650°F service on a 20-inch ball valve in a polymer reactor operation.



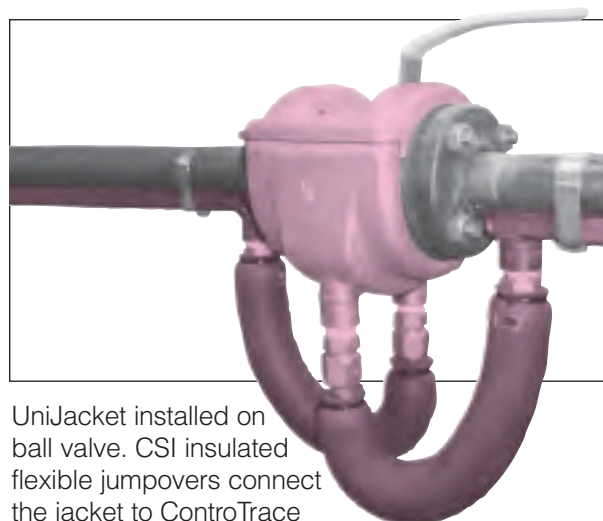
Any ControHeat Valve Jacket can be designed to heat mating pipe flanges as shown on these plug valve jackets used in BPA service.



This UniJacket on an off-the-shelf sampling valve keeps the valve plug-free, ready to operate at all times.



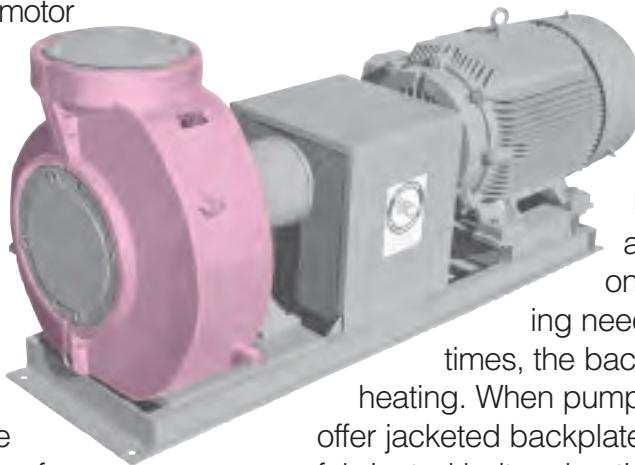
Three-way ball valves are easily heated with ControHeat Jackets. Various styles of actuator brackets can be accommodated.



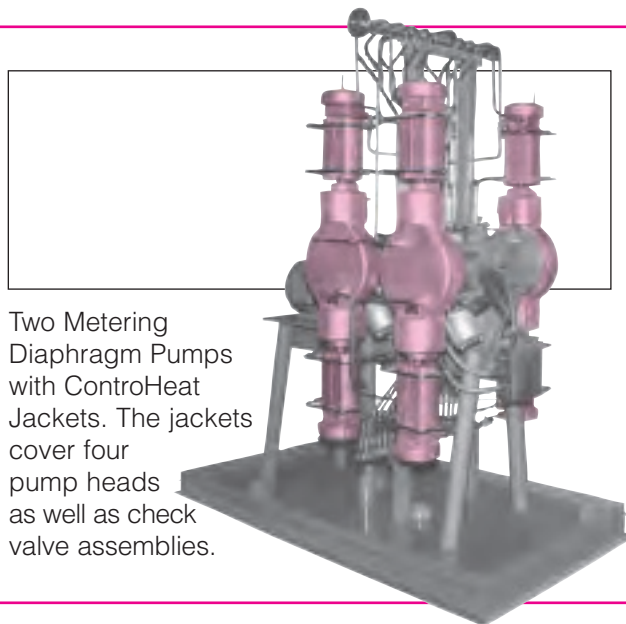
UniJacket installed on ball valve. CSI insulated flexible jumpovers connect the jacket to ControTrace Elements heating adjacent piping.

ControHeat Jackets for Pumps

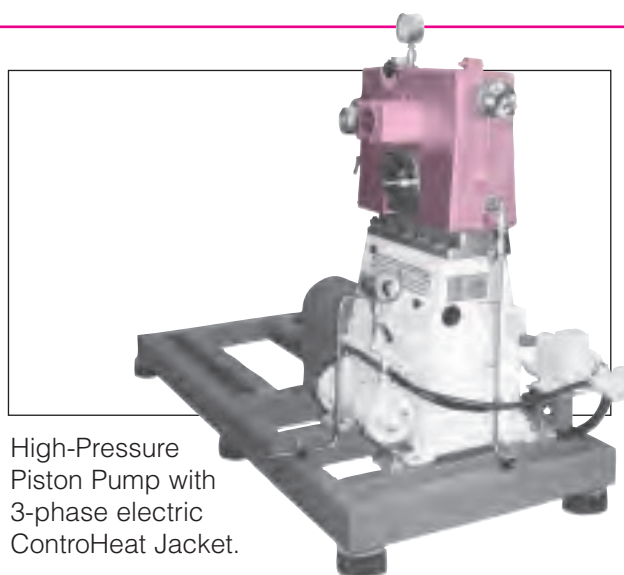
ControHeat Bolt-On Jackets are widely used throughout the processing industry to improve pump efficiencies, prevent motor burnout and promote uniform processing temperatures. Some critical metering pump applications require jacketing to assure accurate throughput. Certain gear pump applications require jacketing to minimize degradation of polymers and other products that are shear sensitive. The barrels of progressive cavity pumps may need to be



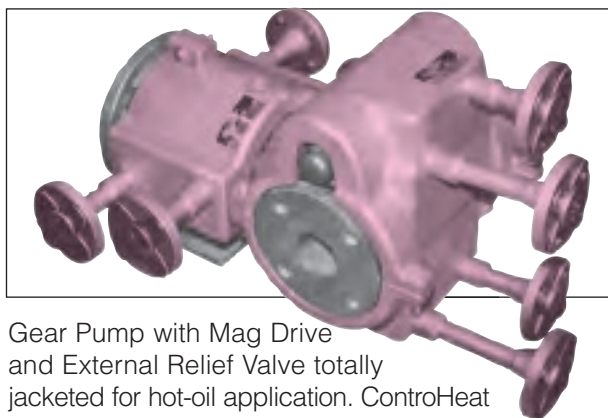
heated for foodstuffs such as chocolate, syrups and dairy products. In some batch-type operations, pump jacketing may be needed during start-up only. In pumping applications like sulfur, phthalic anhydride, or DMT, not only does the pump casing need to be heated at all times, the backplate also may need heating. When pump manufacturers do not offer jacketed backplates, CSI offers both fabricated bolt-on heating jackets as well as ControHeat Jackets.



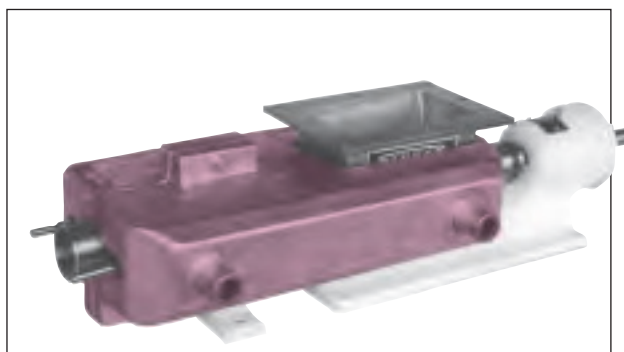
Two Metering Diaphragm Pumps with ControHeat Jackets. The jackets cover four pump heads as well as check valve assemblies.



High-Pressure Piston Pump with 3-phase electric ControHeat Jacket.



Gear Pump with Mag Drive and External Relief Valve totally jacketed for hot-oil application. ControHeat Jacket on mag drive used for heating.

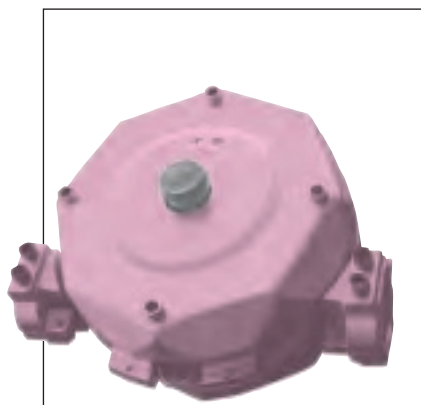
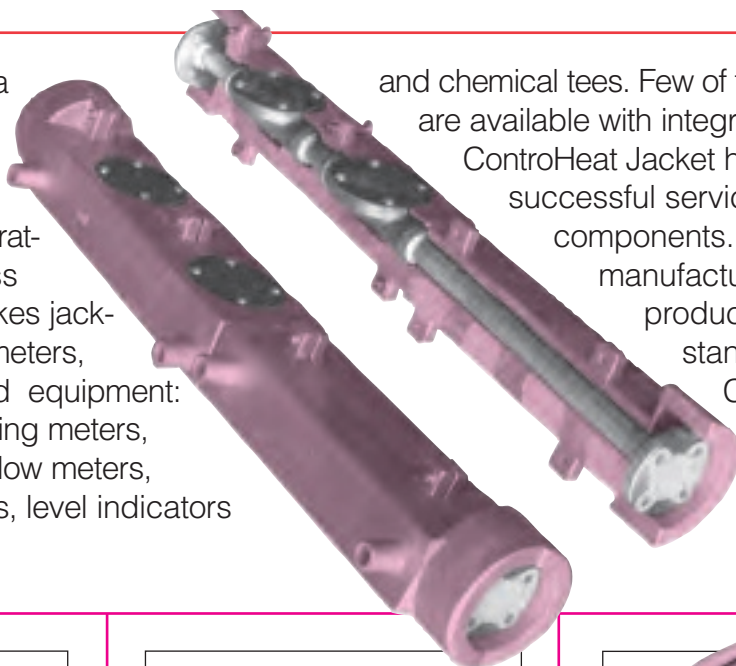


Progressive Cavity Pump for use in CIP service for foodstuffs.

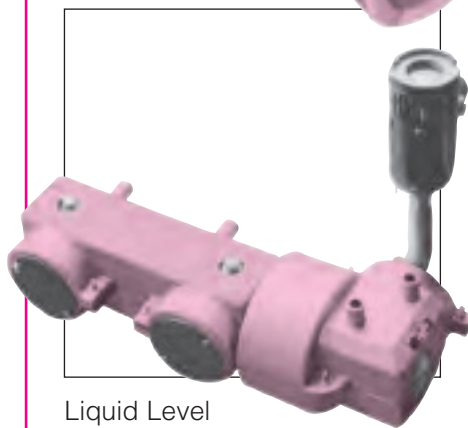
ControHeat Jackets for Meters & Instruments

Accurate process data and process performance often depend on instruments, meters and safety devices operating at elevated process temperatures. CSI makes jackets for many types of meters, instruments and related equipment: DP cells, vortex shedding meters, rupture discs, coriolis flow meters, viscometers, tank vents, level indicators

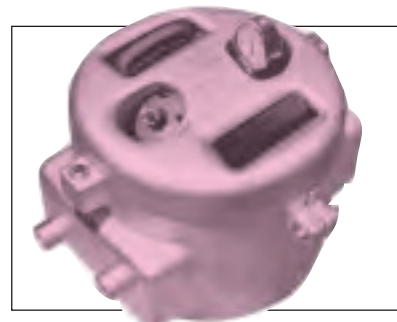
and chemical tees. Few of these components are available with integral jackets. The ControHeat Jacket has a history of successful service with these components. In fact, several manufacturers of these products have standardized on the ControHeat Jacket to complement their product lines.



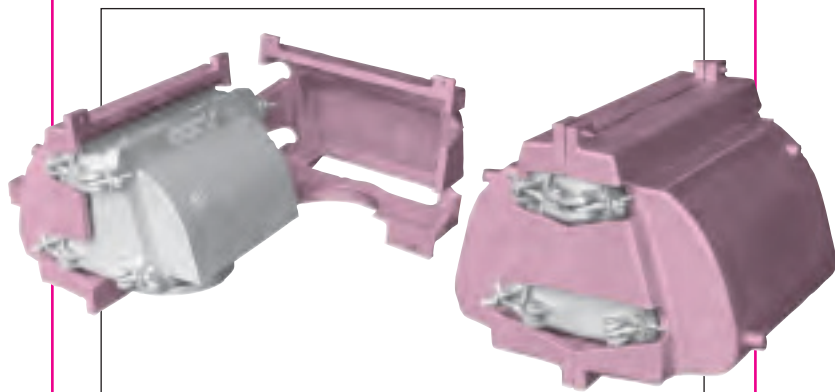
Coriolis Meter used in high temperature service of pre-polymer process. Jacket is hot-oil heated and maintains meter at 600° F.



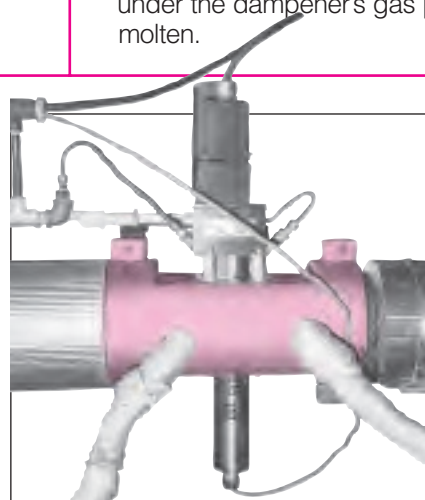
Liquid Level Indicator used in palm oil storage application. Jacket completely covers all process-wetted surfaces.



Pulsation Dampeners with ControHeat Jackets in high-temperature applications provide critical service for downstream instruments and meters. The jacket keeps the stagnant process fluid under the dampener's gas pad molten.



Condensables in gas streams can collect and choke the flow in flame arrestor passages. ControHeat Jackets keep the passages clear.

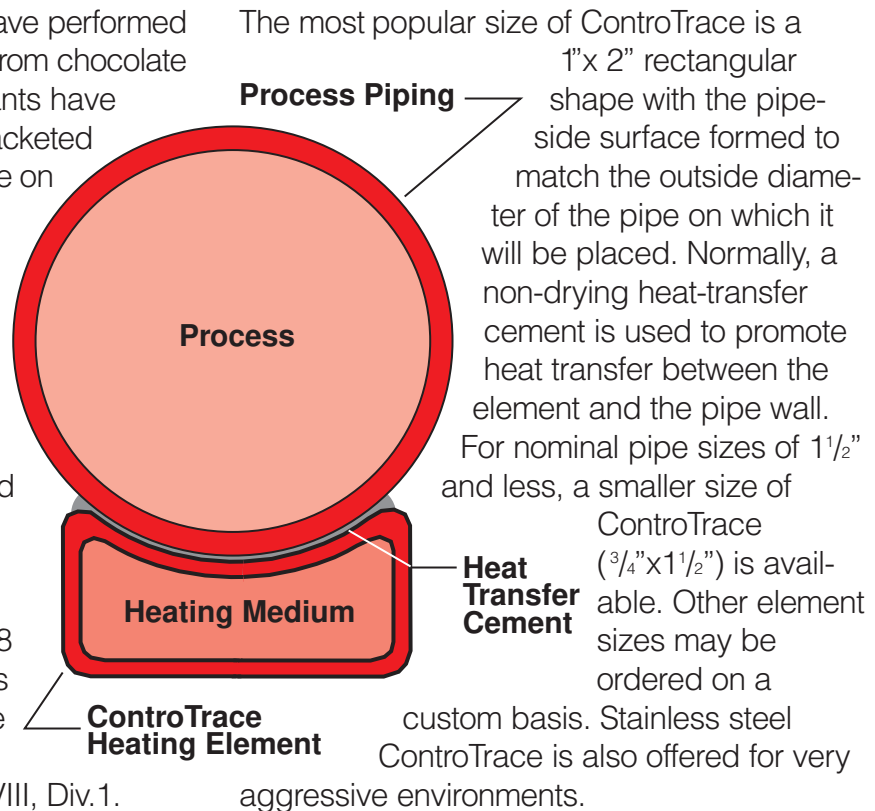


ControHeat Jacket on a Brookfield Viscometer increases the instrument's operating range and longevity, as well as improving accuracy of data collected.

ControTrace Elements Heat Pipe

ControTrace Heating Elements have performed very well in diverse applications from chocolate to polyester resin. Numerous plants have drastically curtailed their use of jacketed pipe, preferring to use ControTrace on process piping for DMT, rosins, sulfur, cyanuric chloride, acrylic acid, hot melts and numerous bottoms recirculating lines. Some of these plants fabricate the elements in the field. Others depend on CSI for the complete service of design, fabrication and installation of the bolt-on heating system.

ControTrace Elements are formed from carbon steel, SA178 Gr. A boiler tubing. The elements are pressure rated in accordance with the ASME Boiler and Pressure Vessel Code, Section VIII, Div.1.

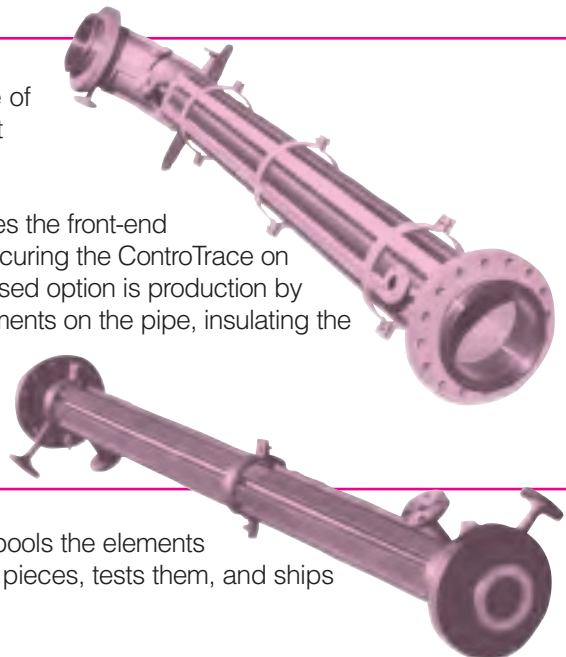


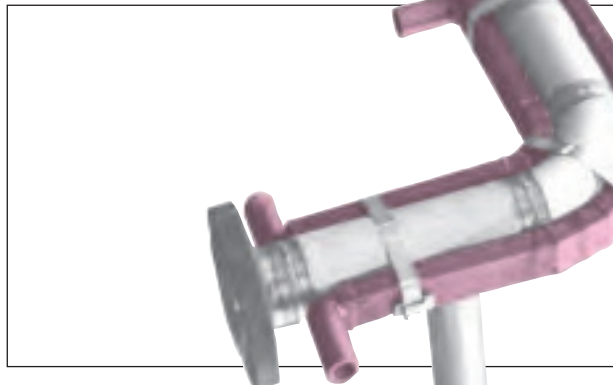
Custom Fabrication Options: Customers may opt for one of three methods to use when installing a heated piping system that utilizes ControTrace Elements.

1. CSI can turnkey the complete heated piping system. CSI provides the front-end engineering and drawings, fabricates the pipe and ControTrace (securing the ControTrace on the pipe), and installs the system in your plant. Another frequently used option is production by CSI of both the piping and ControTrace Elements, installing the elements on the pipe, insulating the finished assemblies, and shipping the system to the field for installation by others. We have the flexibility, of course, to provide only specified portions of the project.

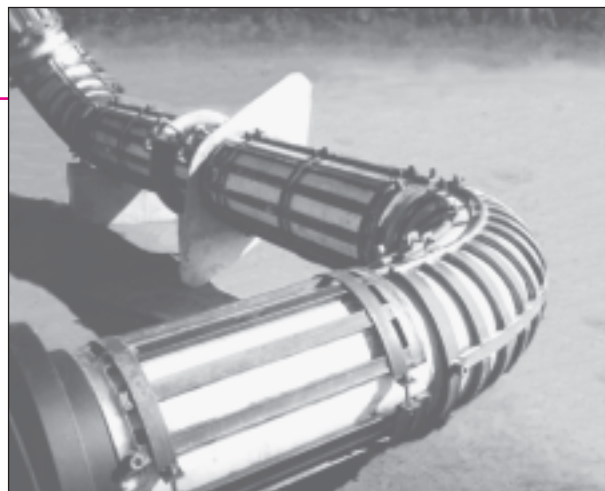
2. Based on isometric drawings provided by the customer, CSI spools the elements and, with the customer's approval, fabricates finished ControTrace pieces, tests them, and ships them to the field, ready for installation on the pipe by others.

3. CSI provides individual components that owners use to fabricate on site their own bolt-on heating systems.

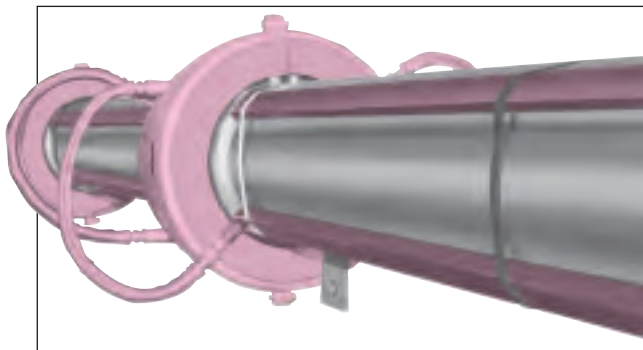




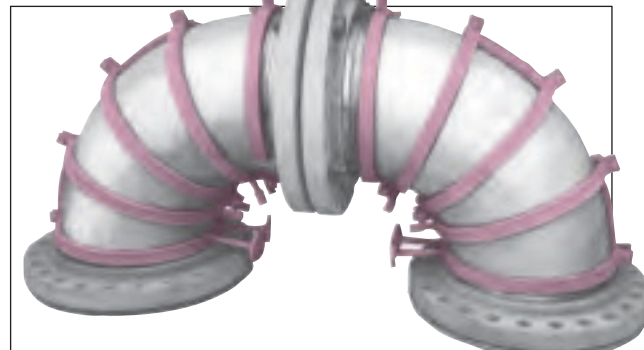
ControTrace coverage of elbows, even in smaller pipe diameters, as shown here, can be accomplished on both the throat and the heel. Side coverage of elbows also is frequently used.



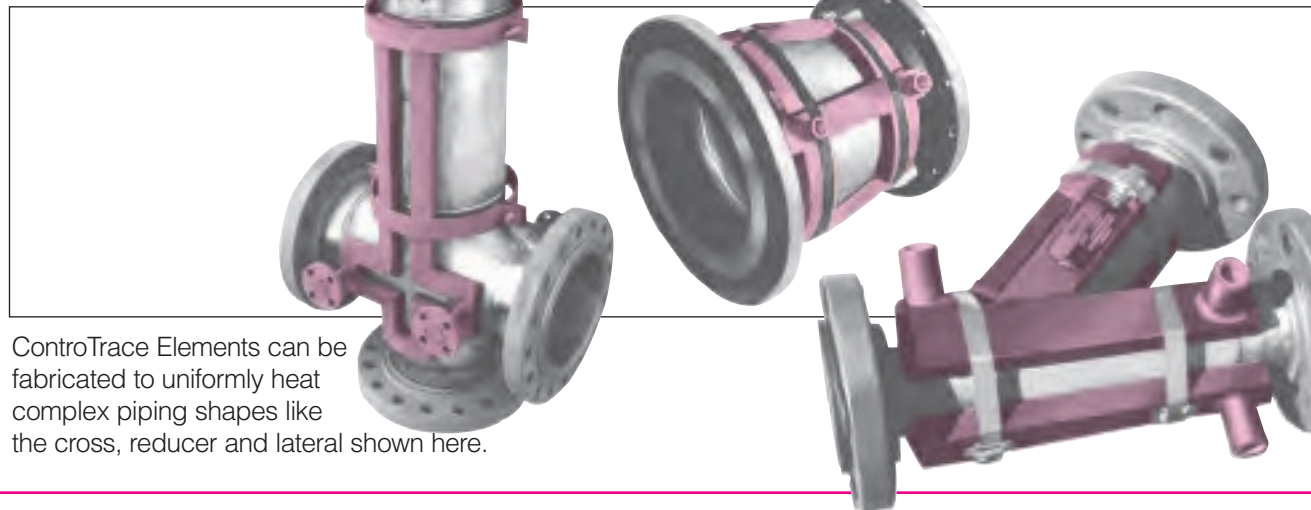
In the application depicted in the accompanying photo, ControTrace Elements proved to be a cost saving alternative to all-stainless steel jacketed pipe. With no external pressure, core piping was selected based on internal process requirements. This allowed a thinner pipe wall and saved money.



ControTrace is used successfully on piping in refineries, terminals, barges and acid plants. Combined with ControHeat jackets, as on the ball joints in this application, uniform heat can be provided to the the entire system very economically.



The design of the ControTrace coverage on a particular piping run depends on the process thermal requirements, pipe schedules, and the type and thickness of insulation used. In this application CSI designers determined that heating elements placed normal to the process flow would provide the most uniform coverage.



ControTrace Elements can be fabricated to uniformly heat complex piping shapes like the cross, reducer and lateral shown here.

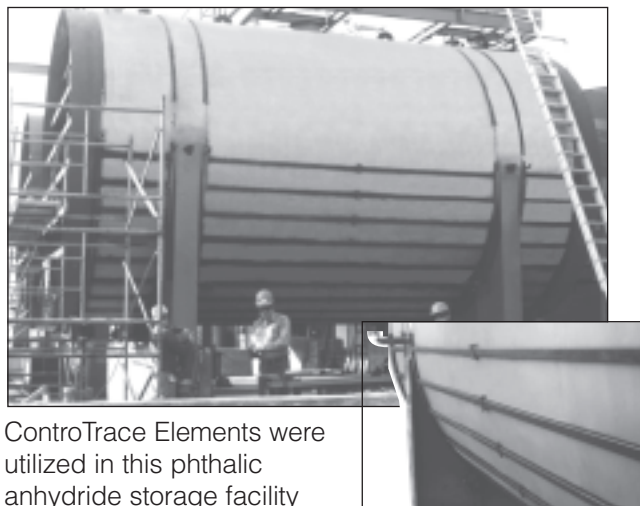
ControTrace Heating Elements for Tanks & Vessels

Storage tanks and vessels up to 25 feet in diameter are in service with ControTrace elements providing uniform heat over their entire surfaces.

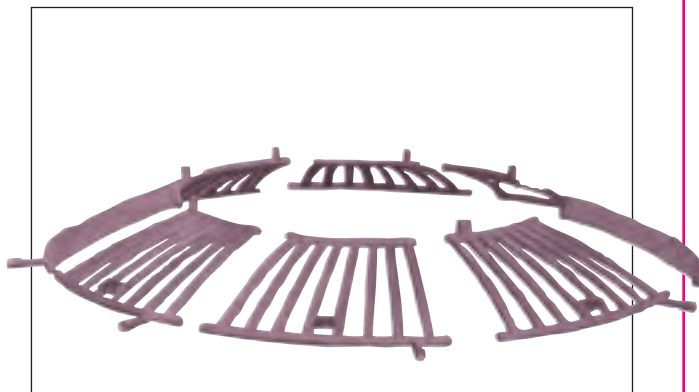
The ControTrace Element configuration can be designed for liquid or vapor heating media. A key benefit of ControTrace is that elements can be dispersed evenly around the vessel, assuring the uniform heat coverage. Jackets can be



fabricated for conic heads as well as elliptical heads. Generally, systems that utilize a liquid heating medium are designed in a serpentine configuration. Systems that use a vapor heating medium are usually constructed for parallel medium flow. When parallel flow must be used on a liquid system, flow diverters can be placed inside the ControTrace assemblies to channel the liquid.



ControTrace Elements were utilized in this phthalic anhydride storage facility because the product could provide economical, uniform temperature maintenance in critical service.

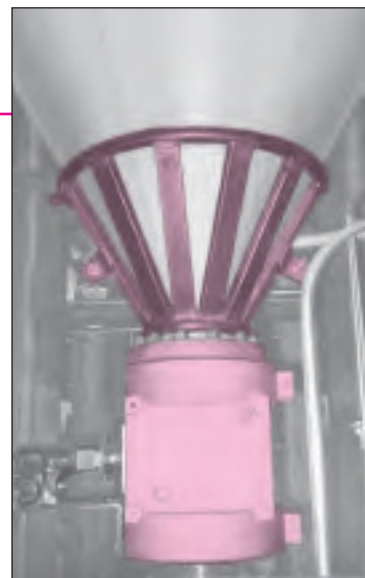


CSI has developed special fabrication techniques to achieve uniform heat coverage of vessel heads, allowing for various sizes of nozzle penetrations.



When liquid heating media are used, jacket elements are fabricated in a serpentine design to provide even heat distribution. Where non-condensables may cause vapor locks, bleed vents are added at strategic jacket locations.

Conical vessel bottom with ControTrace.



Engineering Support for Bolt-On Heating Systems

A major segment of CSI's total business is the design and fabrication of jacketed piping systems. The continuing evolution of CSI Bolt-On Heating Systems is linked directly to the knowledge and experience we gain in jacketed piping, because the same



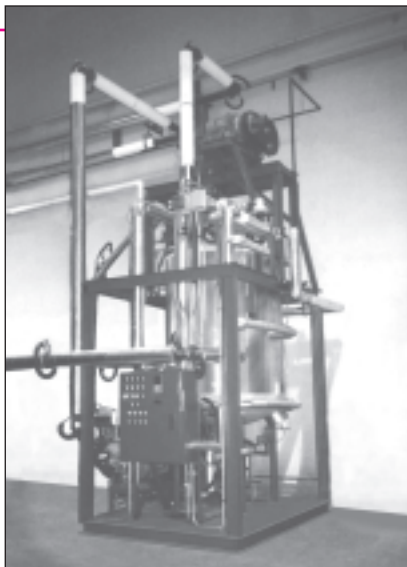
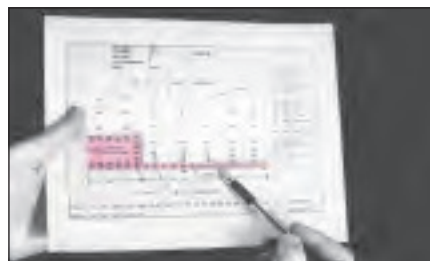
engineers and designers who manage jacketed piping projects also design and manage projects for bolt-on heating systems. The singular focus of this cumulative experience, from initial quotations through process start-up, is a satisfied customer that likes doing business with CSI.

Two Computer Tools

1. To assist customers in determining the right amount of bolt-on heat coverage, CSI has developed a computer program that allows inputs of up to five process variables. These variables are type and thickness of insulation, process temperature, heating medium temperature, ambient design temperature, and nominal pipe or tank sizes. Several values may be selected for each variable. The data produced from these variables is used to determine the optimum system. Results of the program tell designers the number of ControTrace Elements to be used, the energy loss per hour per foot of pipe and the consumption of heating fluid used per hour per foot of pipe.



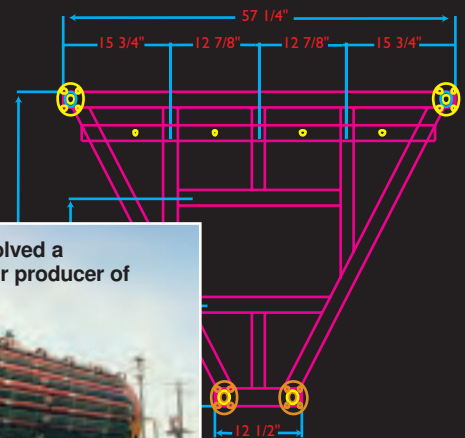
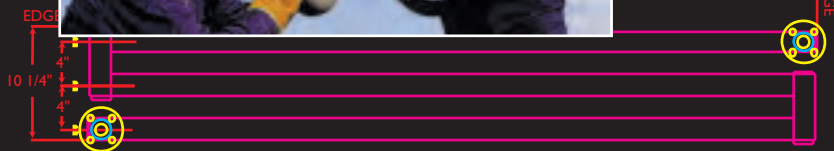
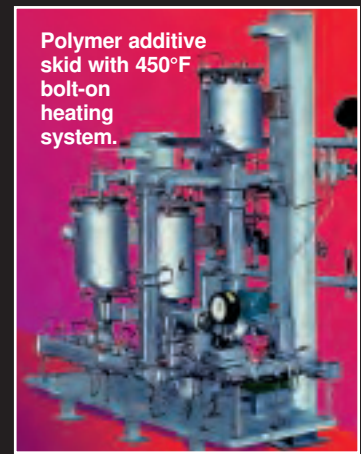
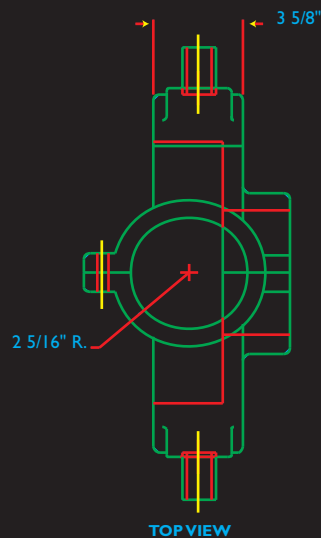
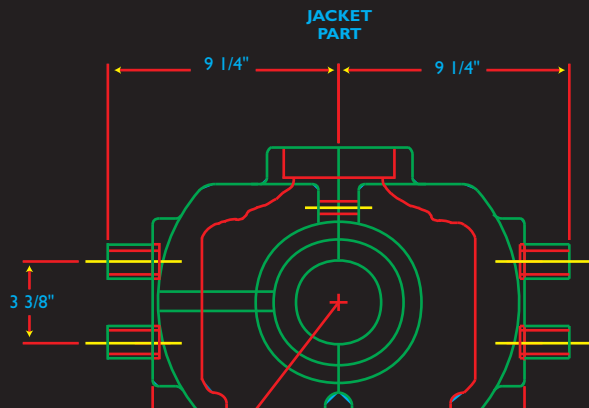
2. The second computer program, more sophisticated than the first, uses finite difference modeling to profile the crosssectional thermal performance of the bolt-on heating system. The results yield a detailed temperature profile of the piping system at equilibrium, the heat lost to the atmosphere through the insulation, and the net heat input to the process. This program considers the thermal conductivities of the system components as well as film coefficients of both the process and the heating fluid.



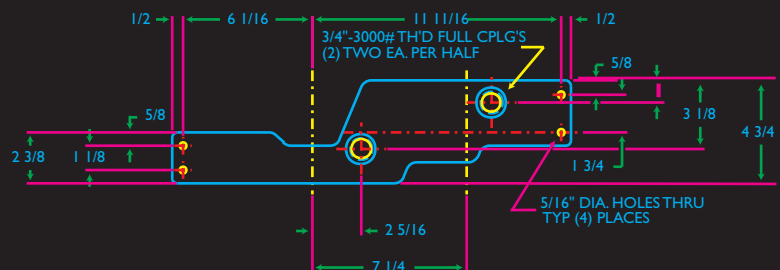
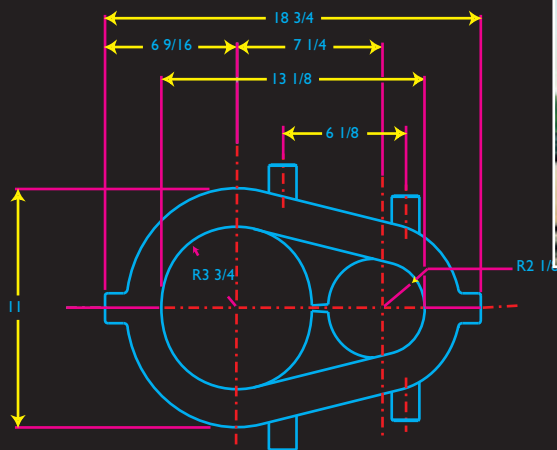
Hot Melt reactor with ControTrace elements on vessel and ControHeat Jackets on valves, pumps and instruments.



CSI-designed Bolt-on Heating System installed in Sulfur Recovery Unit of a large gas plant. Run-down and distribution piping utilize ControTrace Elements. Fittings are heated with ControHeat Jackets.



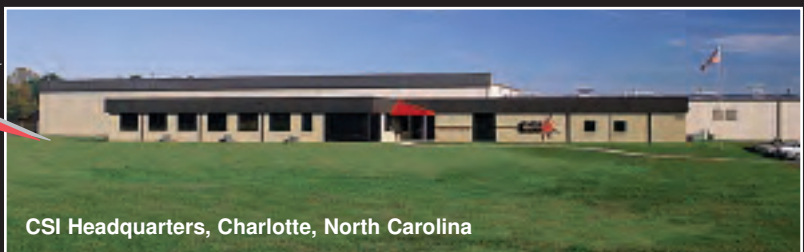
ControTrace elements on this rail car solved a critical maintenance problem for a major producer of caprolactam.

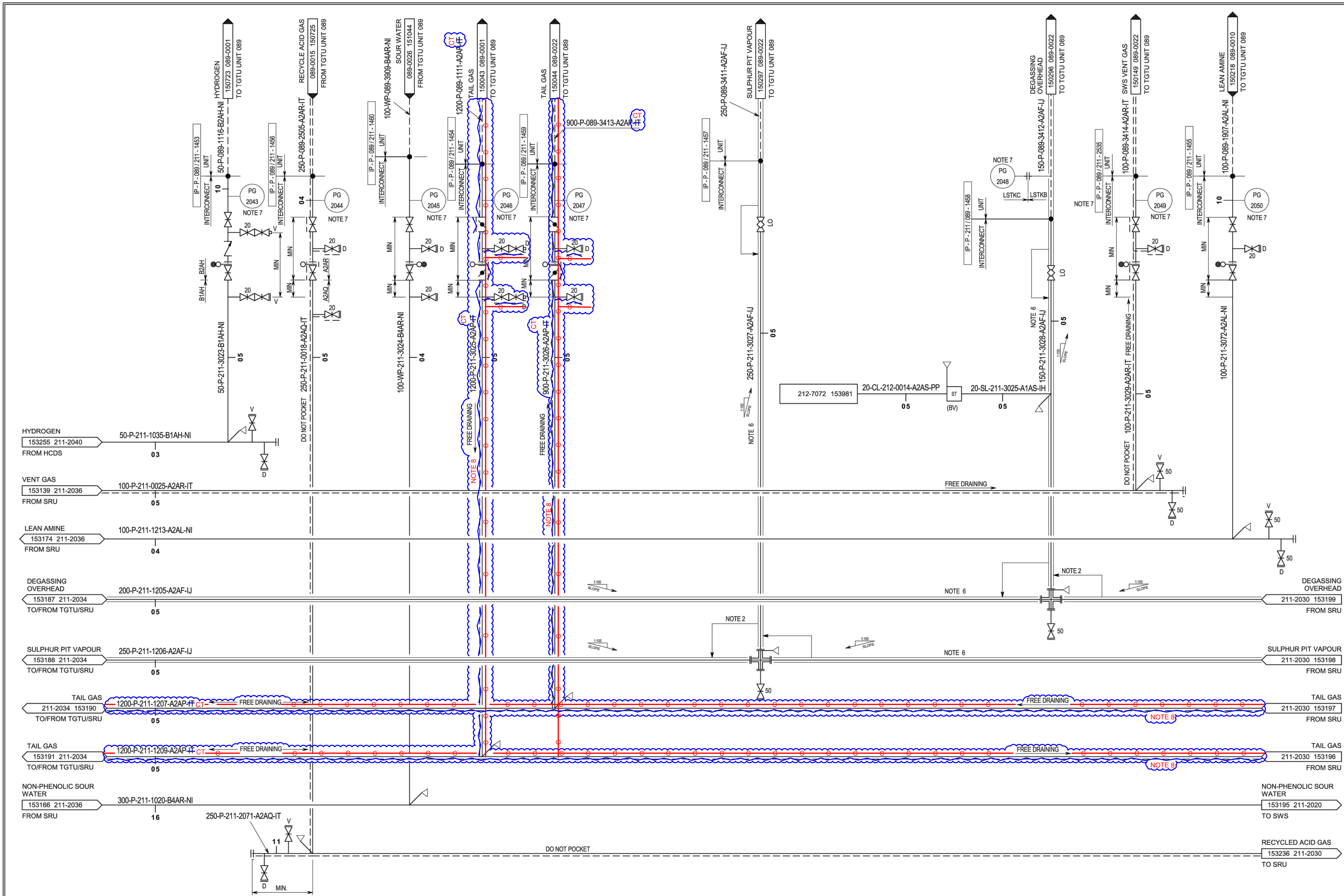


For additional information and quotations, please write or call:



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P.O. Box 7500
Charlotte, NC 28241
Phone: (704) 588-3030
Fax: (704) 588-3039
web: www.csiheat.com
e-mail: sales@csiheat.com





GENERAL

FOR STANDARD SYMBOLS, DETAILS AND LEGEND SHEETS
SEE DRAWINGS PDRP4240-8110-25-600-001 TO
PDRP4240-8110-25-600-008 AND PDRP4240-8110-25-600-0013
TO PDRP4240-8110-25-600-0021.

REFER OVERALL KEYPLAN DRAWING INDICATING NODES
LOCATIONS: PDRP4200-8230-02-600-0001.

NOTES:

- LICENSOR PACKAGE-SRU.
- JUMP OVER SECTIONS FOR STEAM ACROSS JACKETED SECTIONS.
- VENT AND DRAIN VALVES TO BE LOCATED AT HIGH AND LOW POINT OF PIPING RESPECTIVELY. PIPING TO CONFIRM LOCATION.
- PIPERACK STEEL TO BE DEFLECTED PRIOR TO ADDITION OF PIPEWORK. SPECIFICALLY FOR SPANS OF 12M OR GREATER.
- TRACING ON SOLGAS HEADER TO BE CONFIRMED.
- SUPPLY, FABRICATION AND INSTALLATION BY UNIT CONTRACTOR.
- PG TO BE READABLE FROM BL PLATFORM.
- IN BLUE CLOUDED PORTIONS EXISTING LINES STEAM TRACING TO BE REPLACED WITH CONTRA TRACING.

THIS DRAWING HAS BEEN MARKED BY TECHNIPFMC FOR SRU TRAIN 3 & INCINERATOR PROJECT, FROM DRAWING PDRP4220-275-8110-25-211-2032 REV 7.

DISCIPLINE	PROC	EQUIP	INSTR	PIPING	COMM	THSE
SIGNATURE						
DATE						

ENGINEER'S APPROVAL				APPROVED FOR CONST			
REV	DATE	SIGNATURE	OE*	REV	DATE	SIGNATURE	

REV	DATE	DESCRIPTION	BY	CHKD	APPD	
ZX	29/09/15	AS BUILT		VM	ASR	MKV
S3	19/04/13	ISSUED AS MARKED		AK	AMY	CMR
S2	18/07/11	ISSUED FOR CONSTRUCTION		MSR	AKC	AAS
S1	27/06/11	ISSUED FOR CONSTRUCTION		PS	AKC	AAS
S	18/02/11	ISSUED FOR CONSTRUCTION		YAS	SNG	AAS
B	03/06/10	ISSUED FOR DETAILED DESIGN		PR	AS	OP

PARADIP REFINERY PROJECT-LSTK PACKAGE-C
Paradip, Orissa State, India

INDIAN OIL CORPORATION LIMITED

LSTK JSC OGCC KSS ALMATY

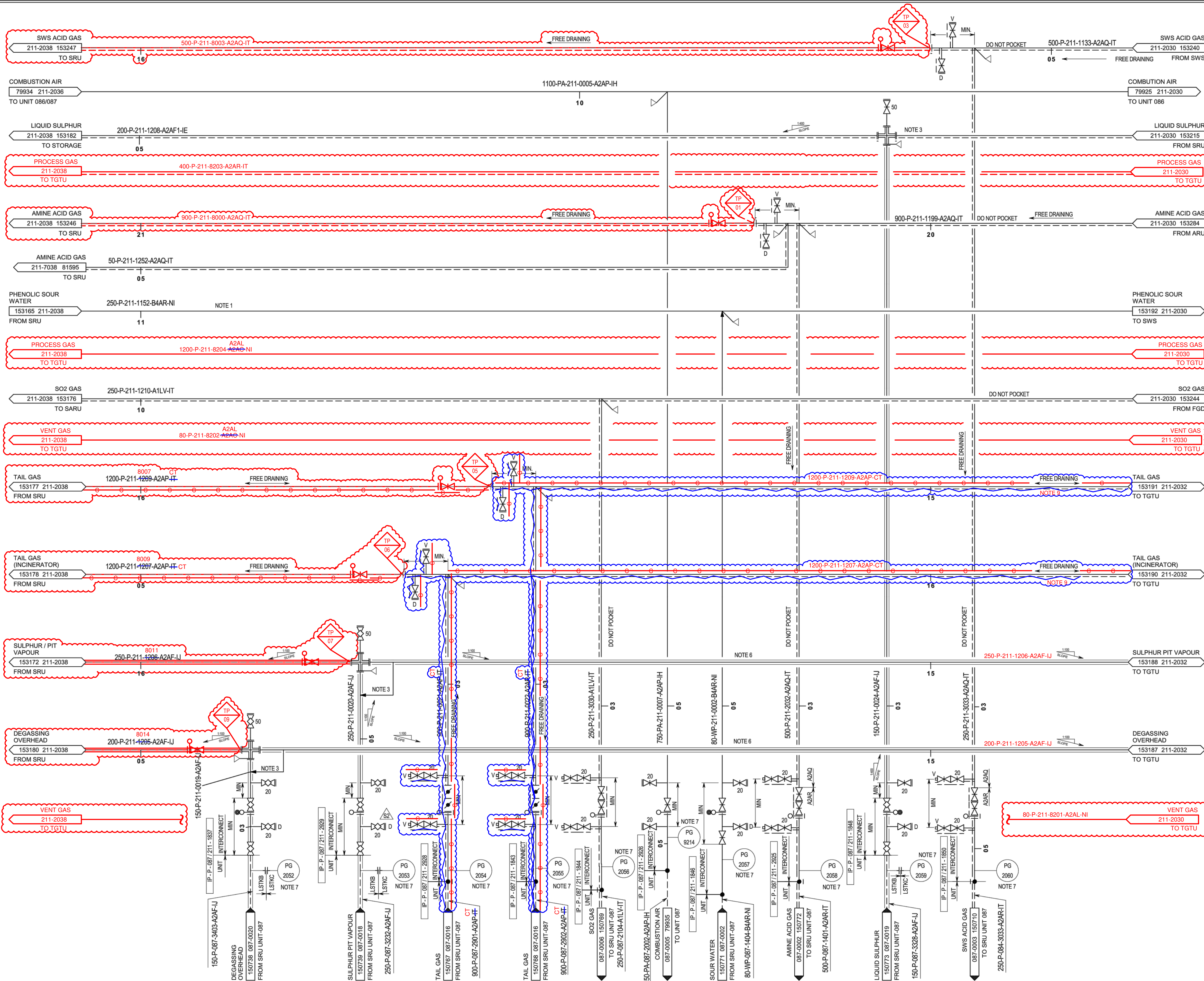
EMDEC KAZSTROY ENGINEERING INDIA VALDEL ENGINEERING & CONSTRUCTION

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TITLE:
PIPING AND INSTRUMENTATION DIAGRAM
INTERCONNECTING PIPE RACK

TGTU NODE 6

SCALE:	DWG NO:	REV
NTS:	PDRP4240-275-8110-25-211-2032	ZX
CONTRACT No.	CLASS	DSN
1-14-4200/0275	2	26559



GENERAL:

FOR STANDARD SYMBOLS, DETAILS AND LEGEND SHEETS SEE DRAWINGS PDRP4240-8110-25-600-0001 TO PDRP4240-8110-25-600-0008 AND PDRP4240-8110-25-600-0013 TO PDRP4240-8110-25-600-0021.

REFER OVERALL KEYPLAN DRAWING INDICATING THE NODE LOCATIONS: PDRP4200-8230-02-600-0001.

NOTES:

1. DELETED.
2. DELETED.
3. JUMP OVER SECTIONS FOR STEAM ACROSS JACKETED SECTIONS.
4. VENT AND DRAIN VALVES TO BE LOCATED AT HIGH AND LOW POINT OF PIPING RESPECTIVELY. PIPING TO CONFIRM LOCATION.
5. PIPERACK STEEL TO BE DEFLECTED PRIOR TO ADDITION OF PIPEWORK. SPECIFICALLY FOR SPANS OF 12M OR GREATER.
6. SUPPLY, FABRICATION AND INSTALLATION BY UNIT CONTRACTOR.
7. PG TO BE READABLE FROM BATTERY LIMIT PLATFORM.
8. ONLY RED CLOUDED ITEMS ARE IN THE SCOPE OF SRU TRAIN 3 PROJECT
9. IN BLUE CLOUDED PORTIONS EXISTING LINES STEAM TRACING TO BE REPLACED WITH CONTRA TRACING.

THIS DRAWING HAS BEEN MARKED BY TECHNIPFMC FOR TIE-IN IDENTIFICATION FOR SRU TRAIN 3 & INCINERATOR PROJECT, FROM DRAWING PDRP4240-275-8110-25-211-2034 REV 2.

KEYPLAN - INTERCON PIPERACKS

APPROVED	
FW	IOCL

DISCIPLINE	PROC	EQUIP	INSTR	PIPING	COMM	THSE
SIGNATURE						
DATE						
ENGINEER'S APPROVAL			APPROVED FOR CONST			
REV	DATE	SIGNATURE	OE*	REV	DATE	SIGNATURE
ZX	29/09/15	AS BUILT		VM	ASR	MKV
S2	19/04/13	ISSUED AS MARKED		AK	AMY	CMR
S1	27/06/11	ISSUED FOR CONSTRUCTION		PS	AKC	AAS
S	18/02/11	ISSUED FOR CONSTRUCTION		YSK	SNG	AAS
B	03/06/10	ISSUED FOR DETAILED DESIGN		PS	AS	OP
A	05/03/10	ISSUED FOR DESIGN		PS	AS	OP
REV	DATE	DESCRIPTION	BY	CHKD	APPD	

PARADIP REFINERY PROJECT-LSTK PACKAGE-C
Paradip, Orissa State, India

INDIAN OIL CORPORATION LIMITED

LSTK JSC OGCC KSS ALMATY

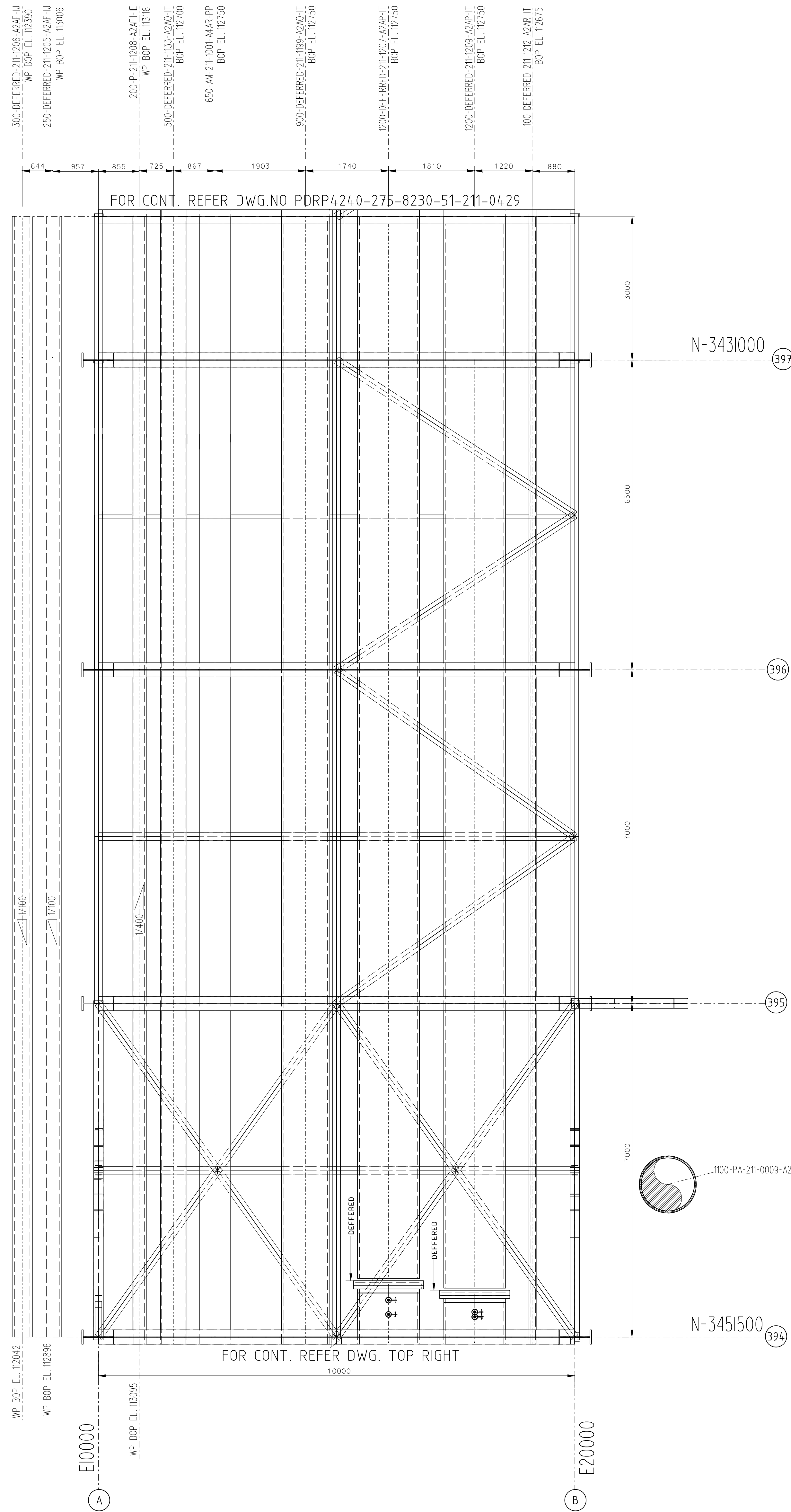
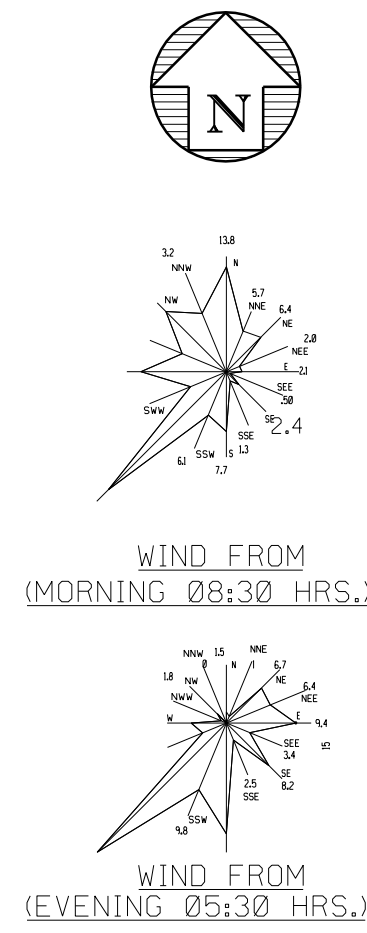
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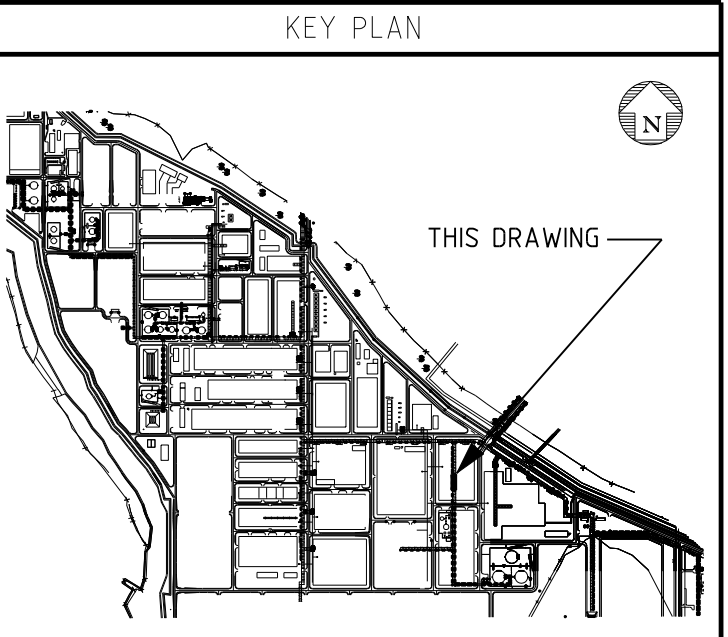
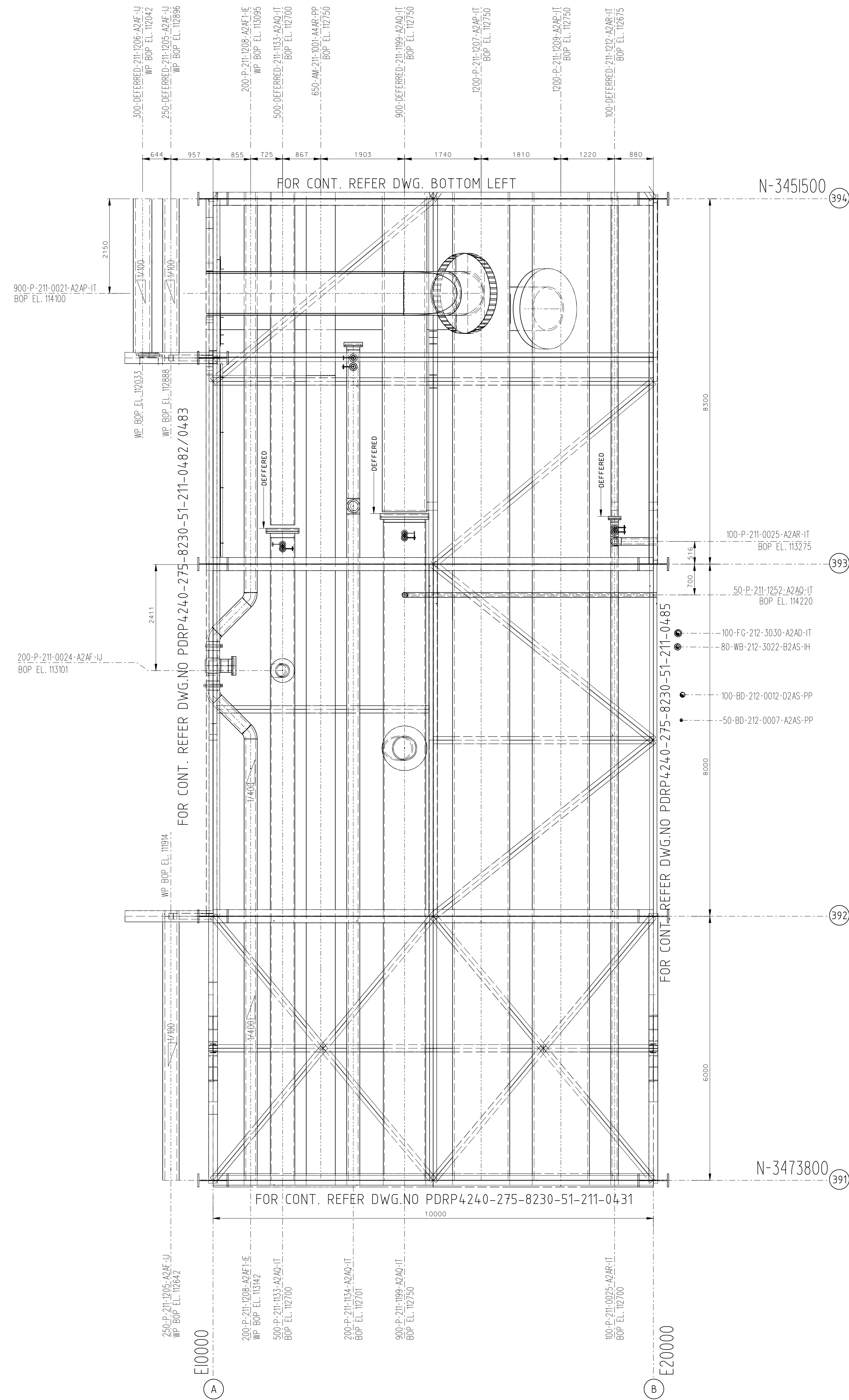
TITLE:
PIPING AND INSTRUMENTATION DIAGRAM
INTERCONNECTING PIPE RACK
UNIT 211 DRAWING 1/2 - SRU
NODE 7

SCALE: DWG NO: PDRP4240-275-8110-25-211-2034
NTS: CONTRACT NO. 1-14-4200/0275 CLASS 2 DSN 26563

PLAN AT EL.112600

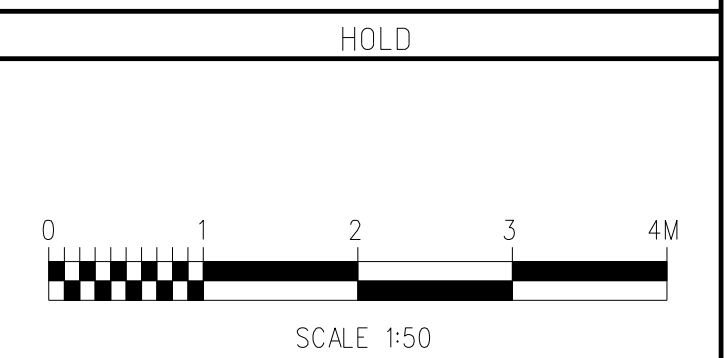


PLAN AT EL.112600



- NOTES
1. ALL DIMENSIONS ARE IN MILLIMETERS UNLESS SPECIFIED OTHERWISE.
 2. REFER ISOMETRICS FOR PIPE SUPPORT LOCATIONS & SUPPORT TAGS.

- LEGEND
- HEAVY DUTY PAVING
 - NORMAL DUTY PAVING
 - LIGHT DUTY PAVING
 - PLATFORM
 - FUTURE REFERENCED FACILITIES
 - ACCESS WAY
 - WITHDRAWAL / LAYDOWN AREA
 - FIRE EQUIPMENT CABINET (FHB) (BY OTHERS)
 - FIRE WATER NOZZLES (BY OTHERS)
 - FIRE HYDRANT (BY OTHERS)
 - TOR
 - TOP OF ROD



DRAWING No.	TITLE
PDRP4240-275-8230-01-211-0012	RACK PLOT PLAN
PDRP4240-8230-02-600-0002	CONSTRUCTION AREA KEY PLAN
PDRP4200-8230-01-600-0005	SOUTH-WEST SITE PLAN

ENGINEER'S APPROVAL	APPROVED FOR CONST.
REV. DATE. SIGNATURE	REV. DATE. SIGNATURE

ST.	DATE	ISSUED FOR CONSTRUCTION	VN	MSR	VGP
01	06/01/12	ISSUED FOR CONSTRUCTION			

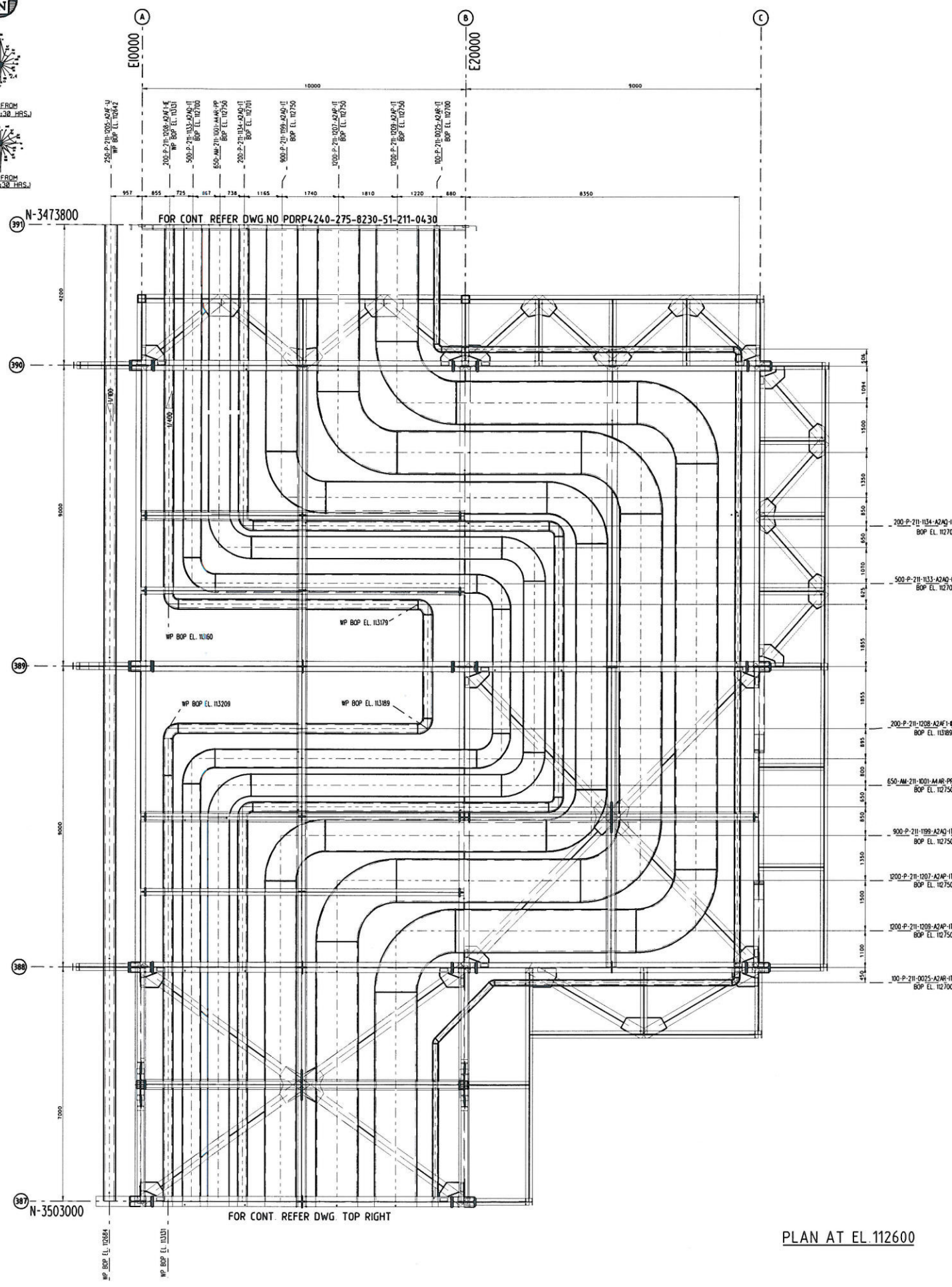
REV.	DATE	DESCRIPTION	BY	CHKD.	APPD.
01	06/01/12	ISSUED FOR CONSTRUCTION			

INDIAN OIL CORPORATION LIMITED	JSC DGCC KSS ALMATY
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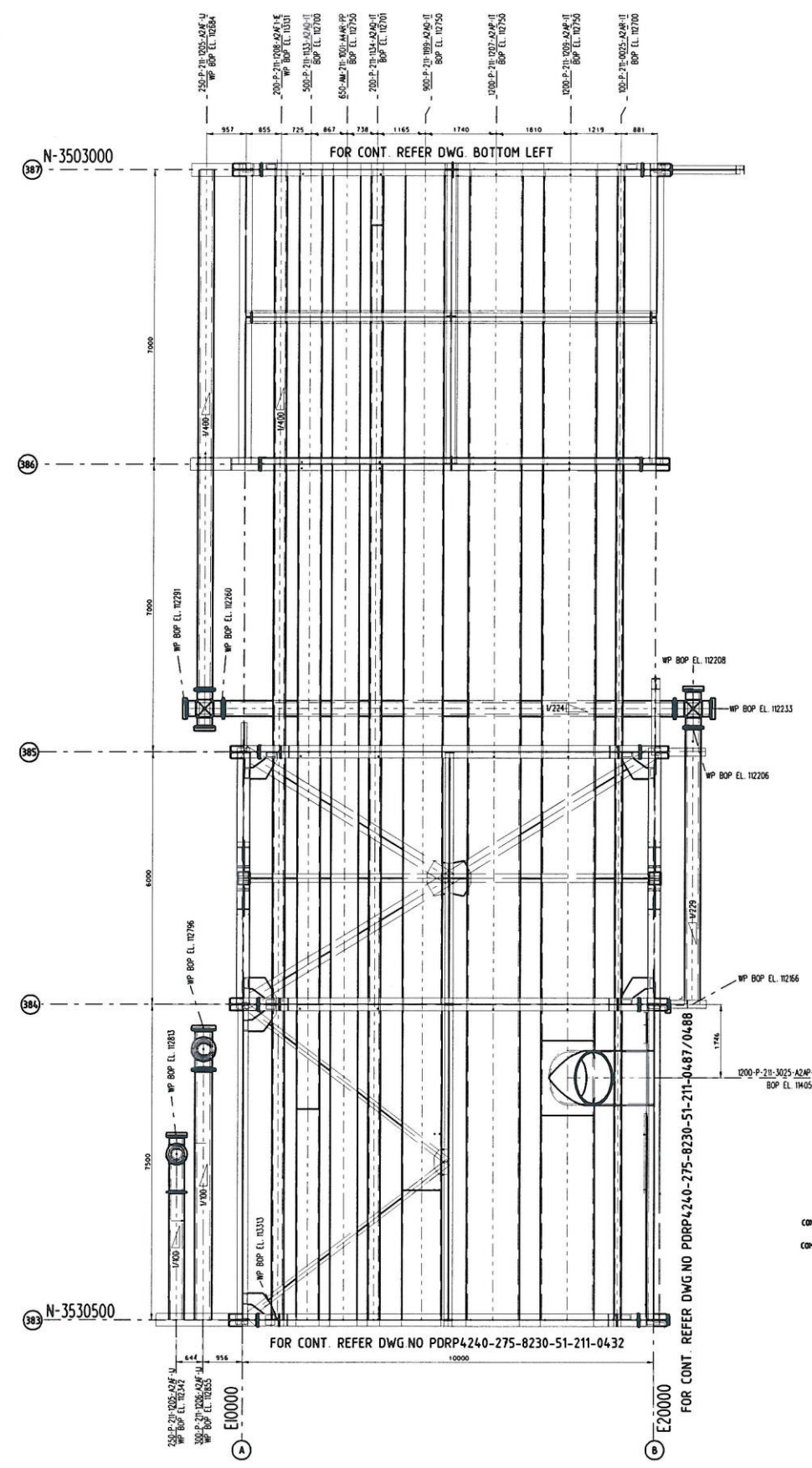
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TITLE	PIPING GENERAL ARRANGEMENT DRAWING
AREA	RSC
PLAN AT EL.112600	
(GRID-391 TO GRID-397)	

SCALE:	DRAWING NO:	SHT NO:	REV.
1:50	PDRP4240-275-8230-51-211-0430	1 OF 1	S1
CONTRACT NO:		CLASS:	DSN:
1-14-4200/4399			



PLAN AT EL 112600



KEY PLAN

NOTES

1. ALL DIMENSIONS ARE IN MILLIMETERS UNLESS SPECIFIED OTHERWISE

2. REFER ISOMETRICS FOR PIPE SUPPORT LOCATIONS & SUPPORT TAGS

LEGEND

- HEAVY DUTY PAVING
- MODIAL DUTY PAVING
- LIGHT DUTY PAVING
- PLATFORM
- FUTURE REFERENCED FACILITIES
- ACCESS WAY
- WITHDRAWAL / LAYDOWN AREA
- FIRE EQUIPMENT CABINET (FIRE BY OTHERS)
- FIRE WATER HOZZLES (BY OTHERS)
- FIRE HYDRANT (BY OTHERS)
- TOP OF ROAD

HOLD

SCALE 1:50

REFERENCE DRAWINGS

DRAWING No.	TITLE
PORP4240-275-8230-51-211-0487	BACK PLOT PLAN
PORP4240-6230-02-600-0002	CONSTRUCTION AREA KEY PLAN
PORP4200-6230-01-600-0005	SOUTH-WEST SITE PLAN

ENGINEER'S APPROVAL

DATE	SIGNATURE	DESIGN	DATE	SIGNATURE	REV	DATE	SIGNATURE

PROCESS PROJECTS

CONSTRUCTION

SAFETY

COMMISSIONING

51 06/06/18 ISSUED FOR CONSTRUCTION

REV	DATE	DESCRIPTION	BY	CHKD	APPR	FOR	WOP
1	06/06/18	PARADIP REFINERY PROJECT - LSTK PACKAGE-C					

INDIAN OIL CORPORATION LIMITED

JSC OGCX KSS ALMATY

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TITLE

PIPING GENERAL

ARRANGEMENT DRAWING

AREA - RSC

PLAN AT EL 112600

(GRID-383 TO GRID-391)

SCALE

DRAWING NO.

150 (PORP4240-275-8230-51-211-0431)

CONTRACT NO.

1-16-4200/4399

REV

NO

1

REV

NO

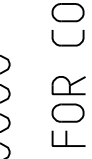
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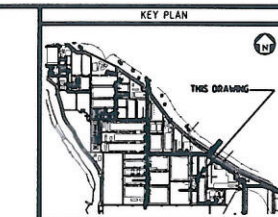
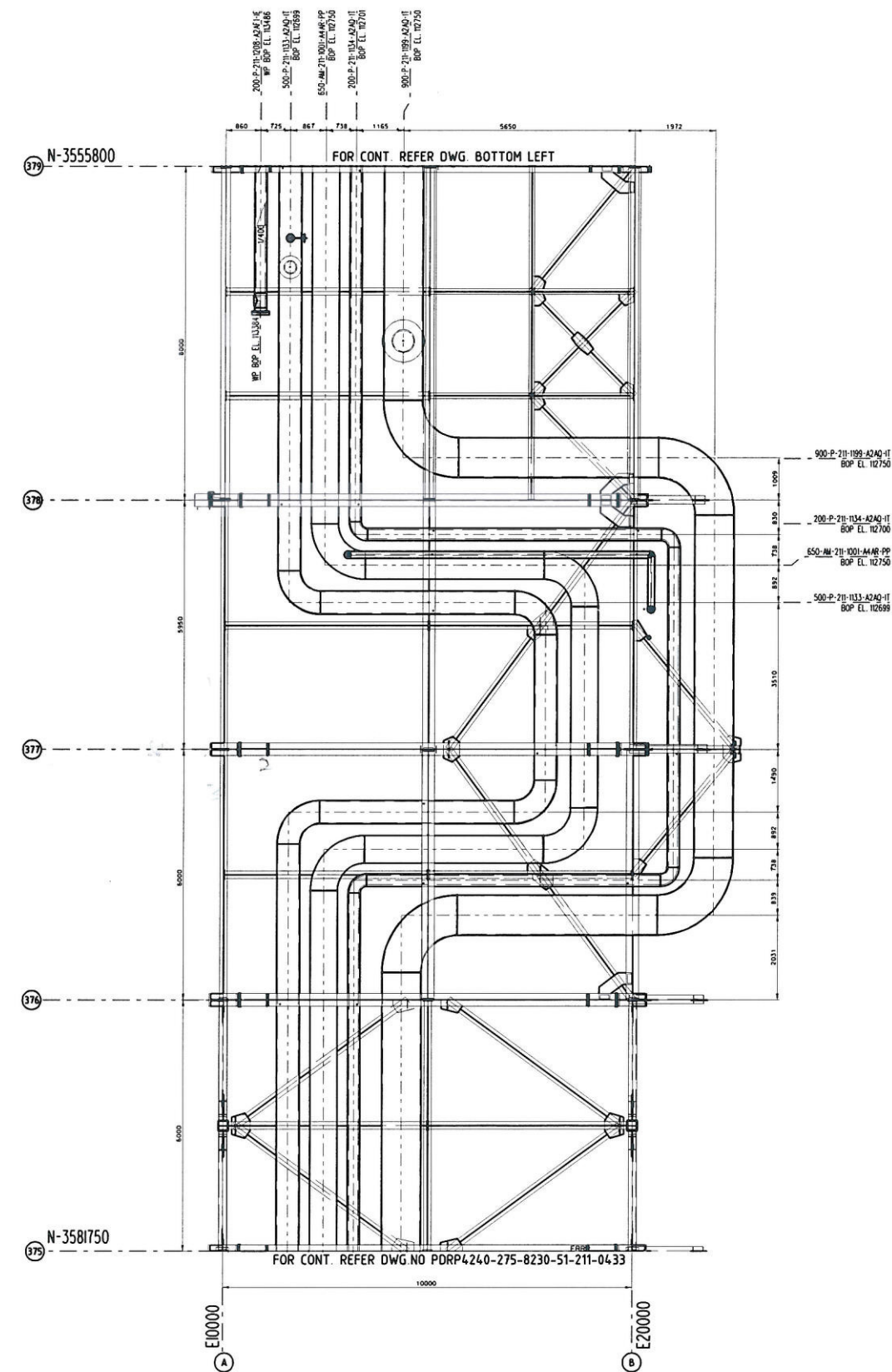
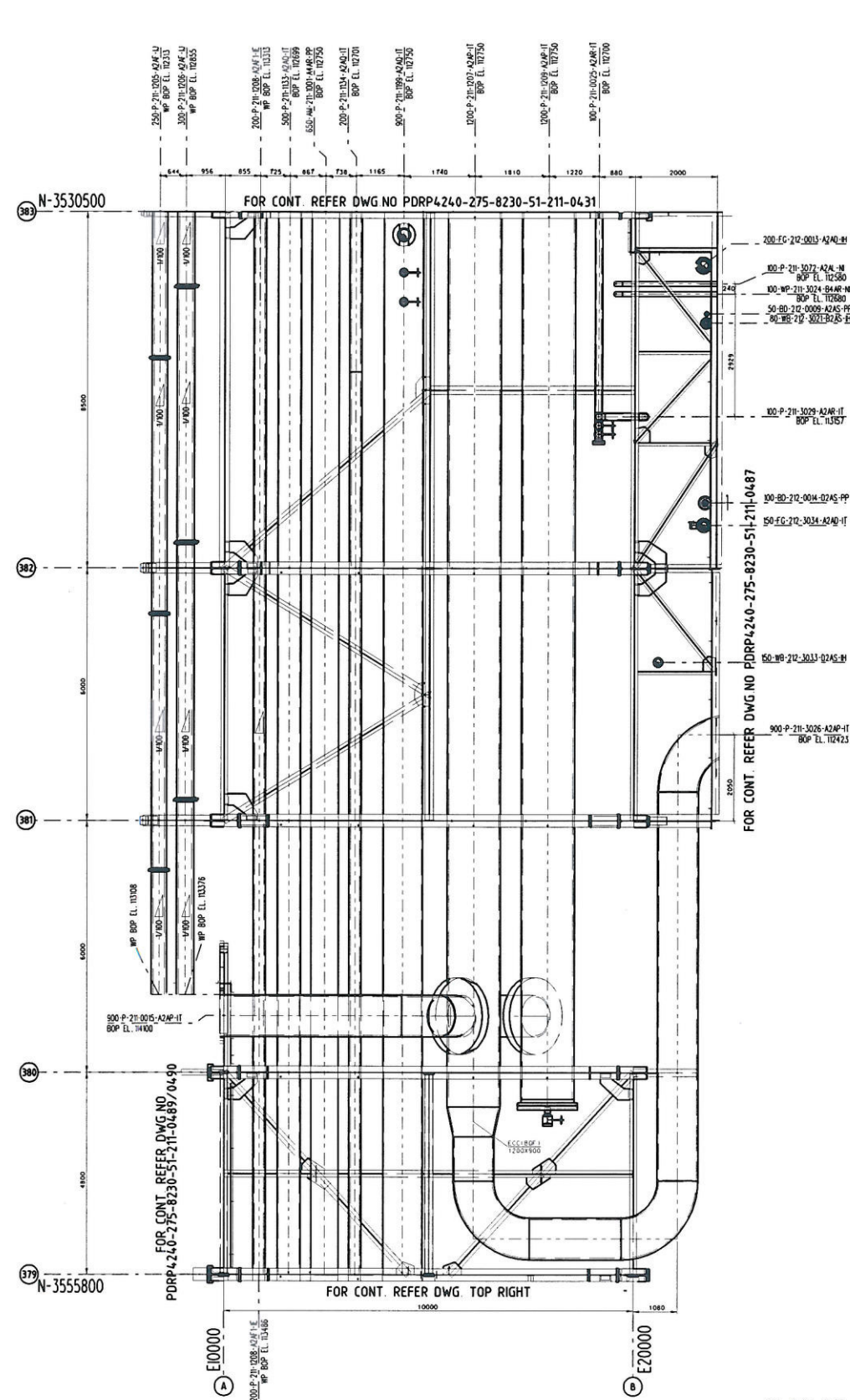
CLASS

CON

DATE

18/06/2018





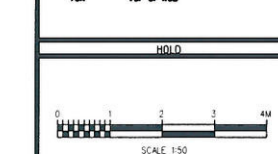
NOTES

1. ALL DIMENSIONS ARE IN MILLIMETERS UNLESS SPECIFIED OTHERWISE.

2. REFER ISOMETRICS FOR PIPE SUPPORT LOCATIONS & SUPPORT TAGS.

LEGEND

////	HEAVY DUTY PAVING
////	NORMAL DUTY PAVING
----	LIGHT DUTY PAVING
----	PLATFORM
----	FUTURE REFERENCED FACILITIES
----	ACCESS WAY
----	WITHDRAWAL / LAYDOWN AREA
----	FIRE EQUIPMENT CABINET (FBI)
----	FIRE WATER NOZZLES (BY OTHERS)
----	FIRE HYDRANT (BY OTHERS)
----	TOP OF ROAD



REFERENCE DRAWINGS

DRAWING No.	TITLE
PDRP4240-275-8230-51-211-0012	RACK PLOT PLAN
PDRP4240-275-8230-51-211-0013	RACK PLOT PLAN
PDRP4240-275-8230-51-211-0014	CONSTRUCTION AREA KEY PLAN
PDRP4240-275-8230-51-211-0015	SOUTH-WEST SITE PLAN

ENGINEER'S APPROVAL

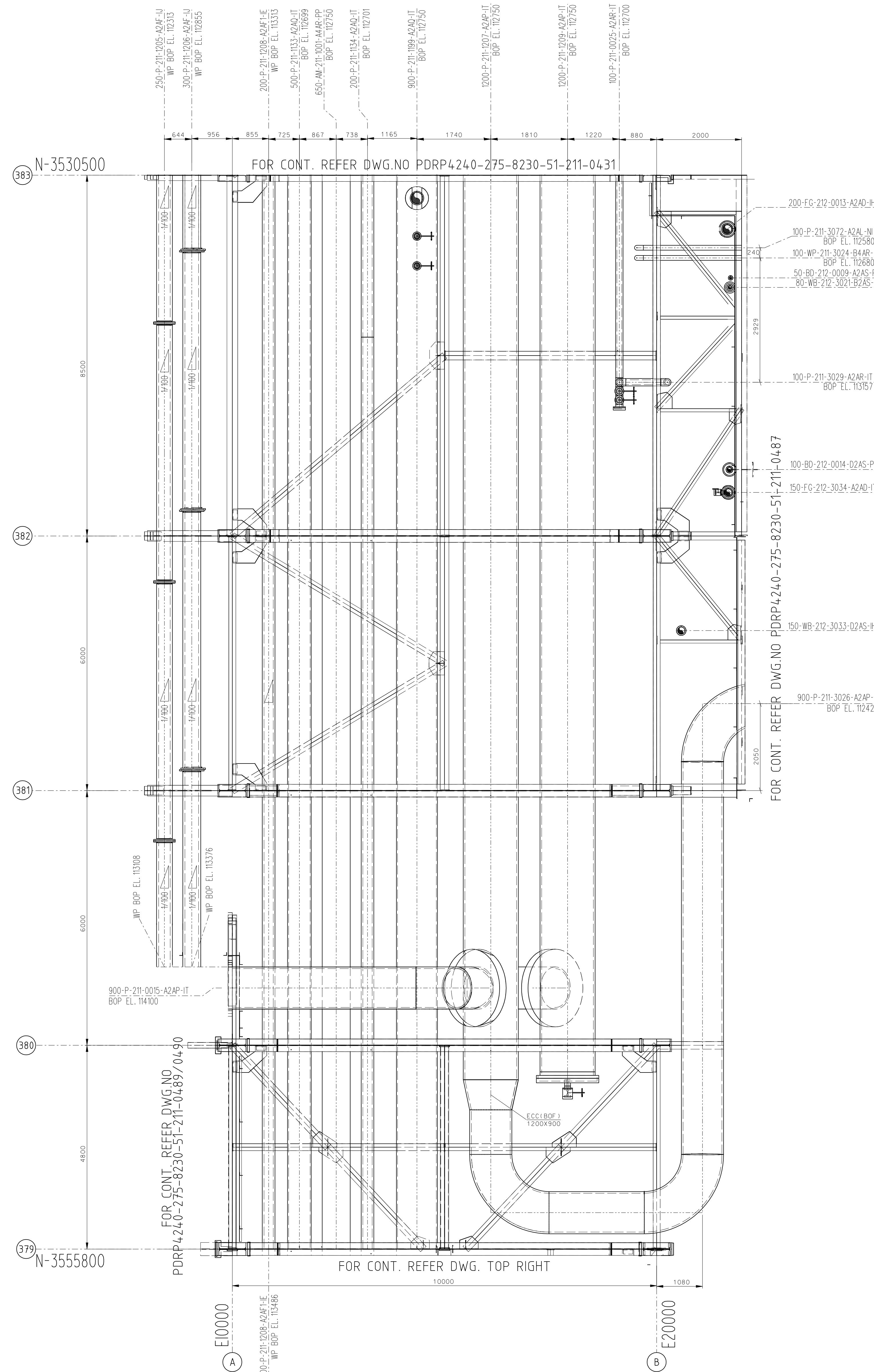
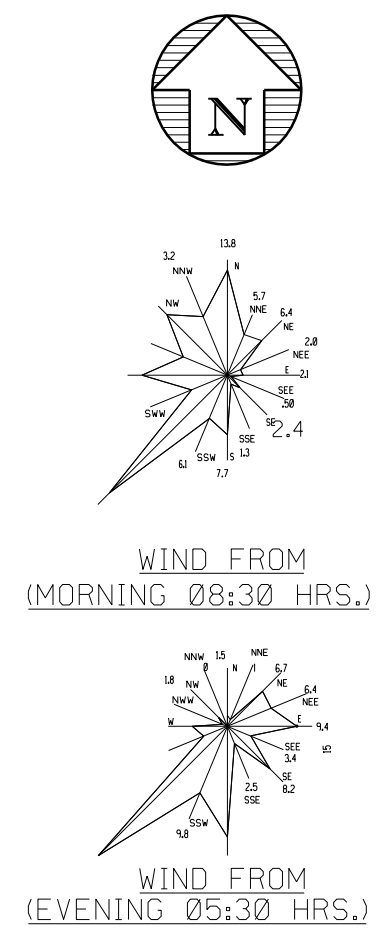
REV	DATE	SIGNATURE	DATE	SIGNATURE
1	06/04/12			

INDIAN OIL CORPORATION LIMITED

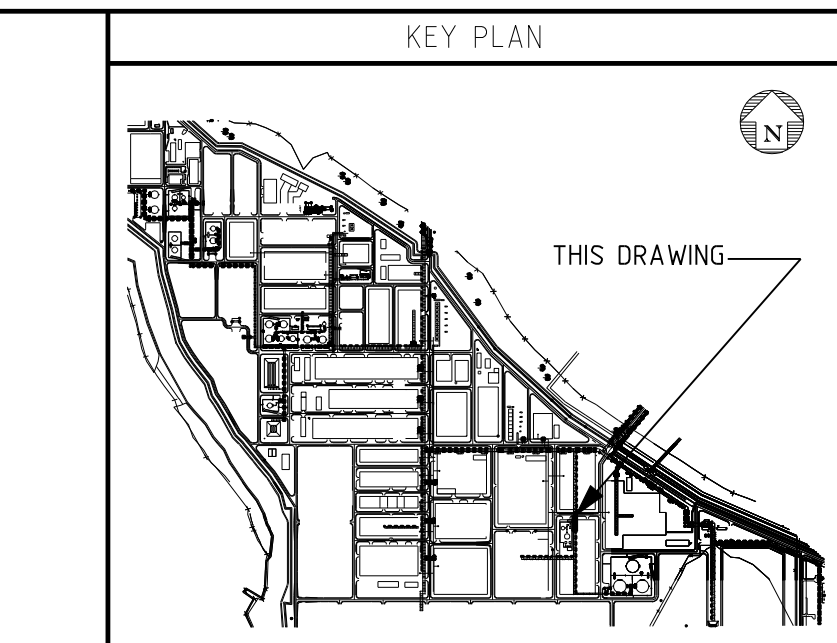
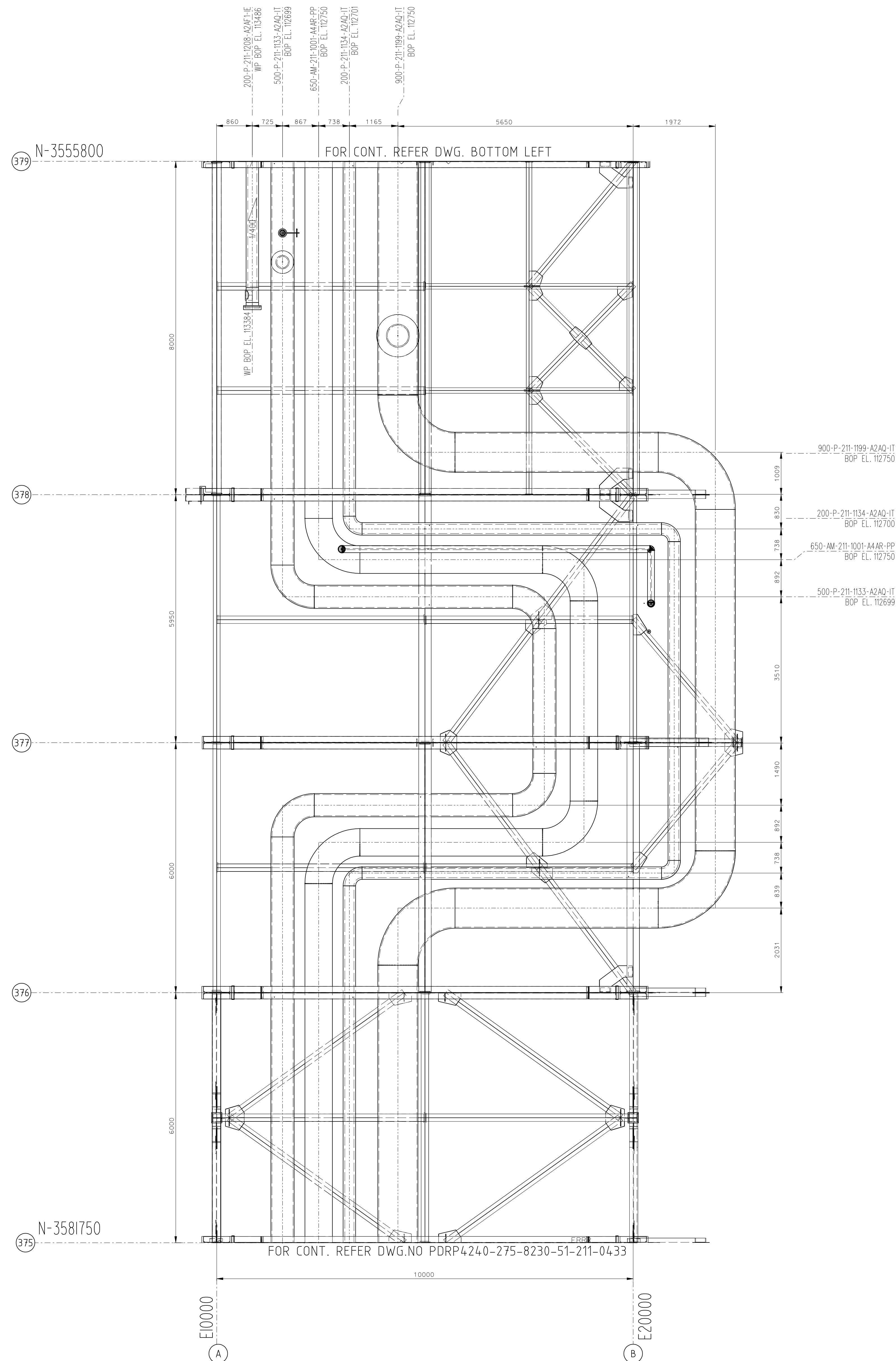
INDIAN OIL CORPORATION LIMITED	JSC OGCSS KSS ALMATY
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INDIAN OIL CORPORATION LIMITED

INDIAN OIL CORPORATION LIMITED	JSC OGCSS KSS ALMATY
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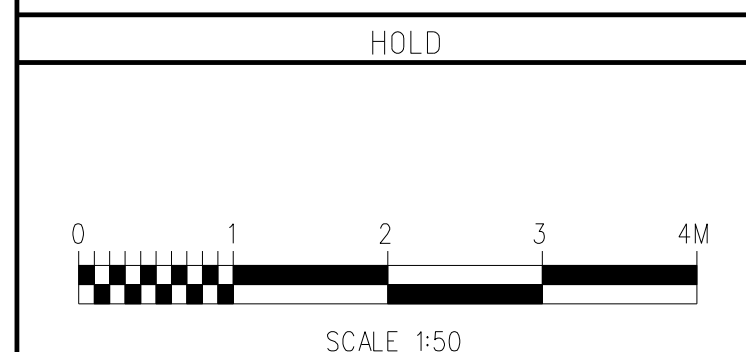
PLAN AT EL.112600



- NOTES
1. ALL DIMENSIONS ARE IN MILLIMETERS UNLESS SPECIFIED OTHERWISE
 2. REFER ISOMETRICS FOR PIPE SUPPORT LOCATIONS & SUPPORT TAGS.

E30000

- LEGEND
- HEAVY DUTY PAVING
 - NORMAL DUTY PAVING
 - LIGHT DUTY PAVING
 - PLATFORM
 - FUTURE REFERENCED FACILITIES
 - ACCESS WAY
 - WITHDRAWAL / LAYDOWN AREA
 - FIRE EQUIPMENT CABINET (FHB) (BY OTHERS)
 - FIRE WATER NOZZLES (BY OTHERS)
 - FIRE HYDRANT (BY OTHERS)
 - TOR
 - TOP OF ROD



REFERENCE DRAWINGS	
DRAWING NO.	TITLE
PDRP4240-275-8230-01-211-0012	RACK PLOT PLAN
PDRP4240-275-8230-01-211-0013	RACK PLOT PLAN
PDRP4240-8230-02-600-0002	CONSTRUCTION AREA KEY PLAN
PDRP4200-8230-01-600-0005	SOUTH-WEST SITE PLAN

ENGINEER'S APPROVAL		APPROVED FOR CONST.	
REV	DATE	SIGNATURE	DATE

SY	DATE	ISSUED FOR CONSTRUCTION	VN	MSR	VOP

PARADIP REFINERY PROJECT - LSTK PACKAGE-C

Paradip, Orissa State, India

INDIAN OIL CORPORATION LIMITED

JSC OGC KSS ALMATY

INDIAN OIL CORPORATION LTD

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TITLE	
PIPING GENERAL ARRANGEMENT DRAWING	
AREA: RSFC	
PLAN AT EL.112600	
(GRID-375 TO GRID-383)	
SCALE	DRAWING NO.
1:50	PDRP4240-275-8230-01-211-0432
CONTRACT NO.	CLASS
114-4200/4399	

1 OF 1

REV. S1

DSN.



FIELD MATERIAL							
PART NO.	REQ ITEM NO.	QTY	SIZE	SCHED.	RATING	END COND	DESCRIPTION
18	1561RXNA00320	1	900	NREOD	CL150	RFTBE	SPACER RING CS TO ASTM A516 GR 70 S5 DIM. GENERALLY IN ACCORDANCE WITH ASME B16.48
19	1574UACB00329	2	900				SPIRAL WOUND GASKET 4.5MM THK SP WOUND GRAPHITE FILLER 316L SS WINDINGS
20	1574UACA00329	3	900				SPIRAL WOUND GASKET 4.5MM THK SP WOUND GRAPHITE FILLER 316L SS WINDINGS
21	1576GAAA00083	1	50				FLAT RING GASKET 1.5MM THK FLEXIBLE GRAPHITE LAMINATE TO ASME B16.21
22	1574SACB00079	2	40				SPIRAL WOUND GASKET 4.5MM THK SP WOUND GRAPHITE FILLER
23	1576GAAA00043	1	20				FLAT RING GASKET 1.5MM THK FLEXIBLE GRAPHITE LAMINATE TO ASME B16.21
24	1572SDDA13079	64	1.5/8				STUDBOLTS ALLOY ST. TO ASTM A193 GR B7, 395.0MM BOLT LENGTH
25	1572SDDA07043	44	7/8				STUDBOLTS ALLOY ST. TO ASTM A193 GR B7, 220.0MM BOLT LENGTH

SEE ISO SHT 2

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TITLE:

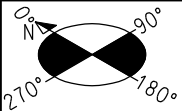
ISOMETRIC PIPING DETAIL - UNIT 086

LINE NO. 900-P-086-2902-A2AP-IT

DRAWING NO. PDRP0271-52-BEAD-P-086-2902

CONTRACT NO.- LSTKB/271	SHT 1 OF 2	REV S2
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LEGEND FOR MATERIAL PART NUMBERS	[1]	[S3]	[F5]	[B6]	[G7 B8]		[F9 G10 B11]			OPERATING CONDITIONS	PRESSURE	0.000	DESIGN CONDITIONS	PRESSURE	0.000	INSULATION	TYPE	IT		
	REFER TO PART "1" IN MATERIAL LISTING	S - SUPPORT 3 - PART 3	F - FLANGE 5 - PART 5	B - BOLTS 6 - PART 6	G - GASKET 7- PART 7	B - BOLT 8 - PART 8	F - FLANGE 9 - PART 9	G - GASKET 10 - PART 10	B - BOLT 11 - PART 11		TEMPERATURE	0.00		TEMPERATURE	0.00		THICKNESS	40.00		
GENERAL NOTES:																				
1. INSULATION IS IN ACCORDANCE WITH THE SPECIFICATION PDRP-8440-SP-0004 & 0005					7. CONTRACTOR TO SUPPLY, FABRICATE & INSTALL ALL STANDARD PIPE SUPPORTS & INSTALL ANY FREE ISSUE SUPPORTS (HANGERS, SLIDE UNITS, ETC.)					12. CONTROL VALVE AND PSV'S HOLD TOBE REMOVED AS PER EXACT DIMENSION AT SITE.										
2. PRESSURE TESTING IS IN ACCORDANCE WITH THE SPECIFICATION PDRP4200-8820-SP-1002					8. FOR PWHT REQUIREMENT SEE PIPING MATERIAL SPECIFICATION & LINE LIST.					13. DIMENSION FOR LINE SIZE 40MM AND BELOW TOBE CHECKED AT SITE BEFORE FABRICATION. DIMENSIONS ARE FOR GUIDANCE ONLY.										
3. PAINTING IS IN ACCORDANCE WITH THE SPECIFICATION PDRP4200-8440-SP-1006					9. FOR DATA RELATING TO LINE CONDITIONS, TEST PRESSURE/MEDIUM ETC.-SEE LINE LIST.					14. LINE SIZE 40MM AND BELOW SHALL BE FIELD SUPPORTED BY CONSTRUCTION CONTRACTOR.										
4. FOR VENTS & DRAINS DETAILS REFER SPECIFICATION PDRP4200-8440-SP-1001					10. ALL SMALL BORE BRANCHES IN STAINLESS STEEL PIPING (AG) ARE TO BE BRACED IN ACCORDANCE WITH PS-69A/B AS PER PIPE SUPPORT STANDARD.					15. ALL LOW SUPPORTED PEDESTAL HEIGHT SHALL BE 150MM FROM HPP. HPP ELEVATION: 100300MM										
5. UNLESS OTHERWISE NOTED, ALL DIMENSIONS ARE TO FACE OF FLANGE OR CL OF PIPE. BOLT HOLES ON FLANGES STRADDLE CENTRE LINE. ALL DIMENSIONS ARE IN MILLIMETERS.					11. FOR ALL T-TYPE STRAINERS TEMPORARY STRAINER MESH ELEMENT SHALL BE REMOVED & PERMANENT STRAINER MESH ELEMENT SHALL BE INSTALLED AFTER PRE-COMMISSIONING.					16. FOR NON CRITICAL FIELD RUN PIPING SYSTEM, CONTRACTOR IS RESPONSIBLE FOR SITE VERIFYING THE ROUTING AND THE SELECTION AND ALLOCATION OF PIPE SUPPORTS.										
6. SPRING LOCK NUTS TO BE RELEASED POST HYDROTEST.																				
REV		DRAWN	CHECKED	STRESS	APPD	APPD	REV		DRAWN	CHECKED	STRESS	APPD	APPD	REV		DRAWN	CHECKED	STRESS	APPD	APPD
S1	SIGN						S2	SIGN						S3	SIGN					
	DATE							DATE							DATE					



PART NO.	REQ ITEM NO.	QTY	SIZE	SCHED.	RATING	END COND	DESCRIPTION
SHT SHT 1							
26	1572SDDA07034	44	7/8				STUDBOLTS ALLOY ST. TO ASTM A193 GR B7, 170.0MM BOLT LENGTH
27	1572SDDA06018	8	3/4				STUDBOLTS ALLOY ST. TO ASTM A193 GR B7, 90.0MM BOLT LENGTH
28	1572SDDA05017	4	5/8				STUDBOLTS ALLOY ST. TO ASTM A193 GR B7, 85.0MM BOLT LENGTH
29	1572SDDA04013	4	1/2				STUDBOLTS ALLOY ST. TO ASTM A193 GR B7, 65.0MM BOLT LENGTH
INSTRUMENTS/SP ITEMS							
30	086-HV-0205	1	900	S-20	CL300	RFFE	INSTRUMENT, REF. TO UNIT INSTRUMENT INDEX
31	086-AT-0101	1	50	NREQD	CL150	RFFE	INSTRUMENT, REF. TO UNIT INSTRUMENT INDEX
32	086-TT-0107	1	40	NREQD	CL300	RFFE	INSTRUMENT, REF. TO UNIT INSTRUMENT INDEX
33	086-TG-0188	1	40	NREQD	CL300	RFFE	INSTRUMENT, REF. TO UNIT INSTRUMENT INDEX
34	086-SP-072	1	20	NREQD	CL150	RFFE	1599VAVW286072 - SAMPLING VALVE
PIPE SUPPORTS							
35	S-16Y	5	900				PIPE SUPPORT, REF. TO PDRP4200-8230-SP-1016
36	AT-70D	5	900				PIPE SUPPORT, REF. TO PDRP4200-8230-SP-1016
37	PG-5	1	900				PIPE SUPPORT, REF. TO PDRP4200-8230-SP-1016
38	PG-33A	1	900				PIPE SUPPORT, REF. TO PDRP4200-8230-SP-1016
MISCELLANEOUS COMPONENTS							
39	1561PXNA00320	1.0	900				PADDLE BLIND CS TO ASTM A516 GR 70 S5 DIM. GENERALLY IN ACCORDANCE WITH ASME B16.48

AS-BUILT

DRAWING NO. PDRP0271-52-BEAD-P-086-2902 SHT 1

PARADIP REFINERY PROJECT
Paradip, Orissa State, India



INDIAN OIL
CORPORATION LIMITED



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subject to obligations of confidentiality.

TITLE:
ISOMETRIC PIPING DETAIL - UNIT 086

LINE NO. 900-P-086-2902-A2AP-IT

DRAWING NO. PDRP0271-52-BEAD-P-086-2902

CONTRACT NO.- LSTKB/271

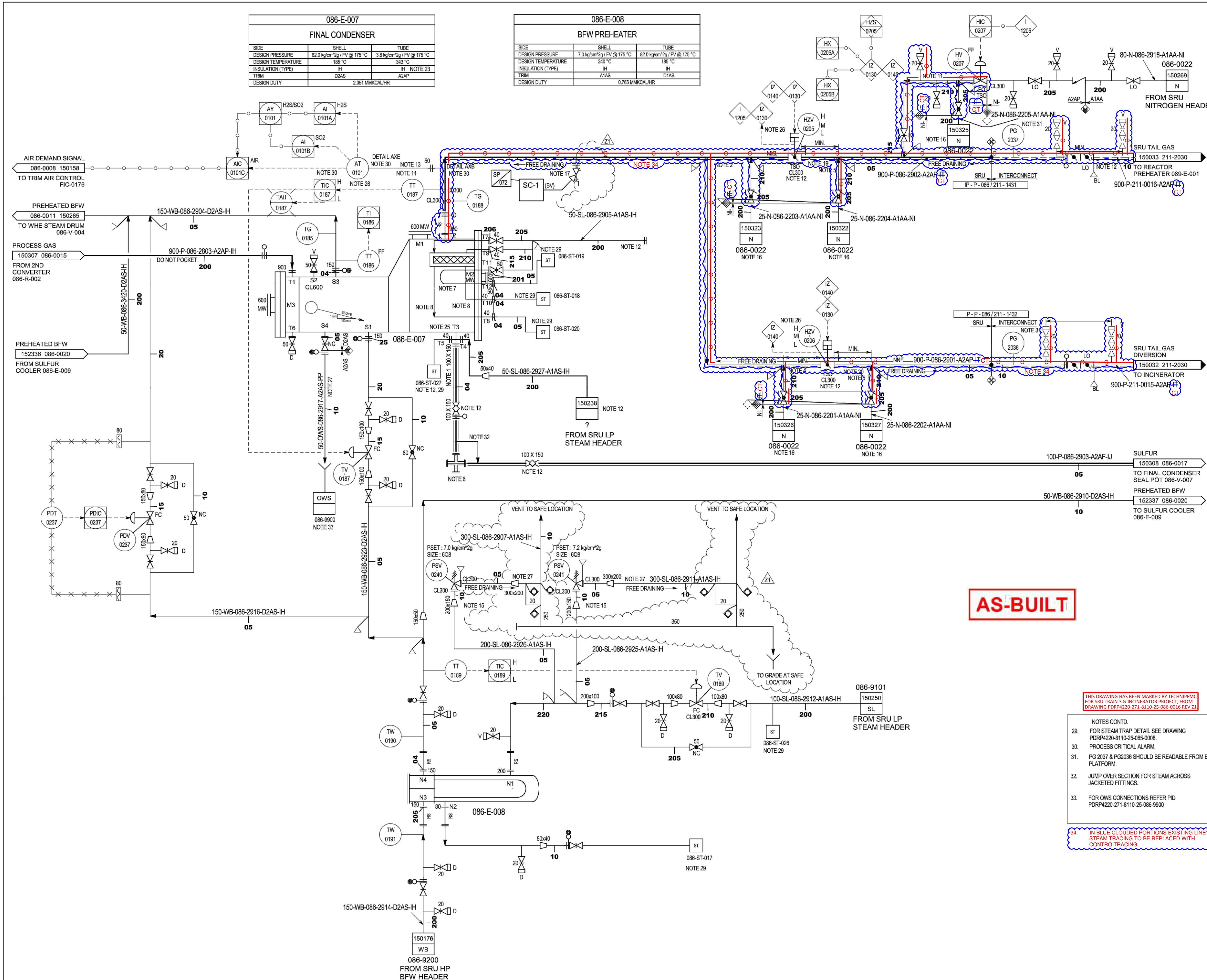
SHT 2 OF 2

REV S2

TRAIN NO.- 1

BEAD086P29021

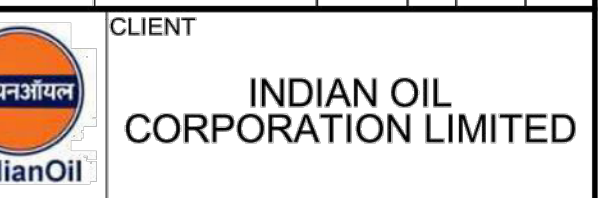
.i02



- GENERAL :
- FOR STANDARD SYMBOLS, DETAILS AND LEGEND SHEETS SEE DRAWINGS PDRP4240-8110-25-600-0001 THROUGH PDRP4240-8110-25-600-0008 AND PDRP4240-8110-25-600-0013.
- FOR SAMPLE STATION DETAILS SEE DRAWING PDRP4220-271-8110-25-085-0001.
- ALL INSTRUMENTS TO BE PREFIXED BY THE UNIT NUMBER.
- THIS DRAWING HAS BEEN DEVELOPED BASED ON LICENSOR P&ID DRG NUMBER D01-1629.
- NOTES:
- STEAM JACKETED SULFUR NOZZLE & VALVE IS HORIZONTAL AND 'TANGENTIAL' TO BOTTOM OF OUTLET CHANNEL.
 - MINIMUM DISTANCE FROM TEE AND HV & HV. DELETED.
 - LOCATE AT HIGH POINT IN LINE.
 - LP STEAM JACKETED VALVE WITH LP STEAM HEATED SHAFT. INSTALL SHAFT IN THE HORIZONTAL.
 - CROSS TO BE CAPABLE OF BEING RODDED OUT IN BOTH DIRECTIONS. EVERY CHANGE IN DIRECTION HAS A CROSS.
 - STEAM AND CONDENSATE TO/FROM INTERNAL STEAM COIL UNDERNEATH MESH PAD.
 - STEAM AND CONDENSATE TO/FROM CHANNEL STEAM JACKET LOCATED AT ENDS OF MESH PAD. DELETED.
 - DELETED.
 - TOP ENTRY.
 - STEAM SUPPLY TO VALVE FROM STEAM MANIFOLD/ CONDENSATE WITH STEAM TRAP TO CONDENSATE MANIFOLD.
 - ANALYZER VENDOR TO SUPPLY SPECIAL PROBE, 50MM NOZZLE.
 - PLATFORM ACCESS REQUIRED TO 3 SIDE SHELTER FOR AIR DEMAND ANALYSER.
 - DELETED.
 - LOCATE MANIFOLD NEAR HZV-0205 AND HZV-0206.
 - PRESSURE TAP/SAMPLE POINT WITH STRAHMAN PISTON TYPE VALVE.
 - DELETED.
 - FAIL LAST DRIFT TO OPEN.
 - FAIL LAST DRIFT TO CLOSE.
 - DELETED.
 - DELETED.
 - INLET CHANNEL SHALL HAVE 90MM OF INSULATION OUTLET CHANNEL SHALL HAVE 50MM OF INSULATION FOR HEAT CONSERVATION.
 - DELETED.
 - NOZZLES T4 & T5 ARE STEAM INLET AND CONDENSATE OUTLET FOR JACKET ON NOZZLE T3.
 - NO LOCAL RESET.
 - TWO PHASE FLOW.
 - FOR ANALYSER TYPICAL DETAIL SEE DRAWINGS PDRP4220-8110-25-085-0009.

REFERENCE DRAWINGS	
DRAWING No.	TITLE

UNIT LICENSED BY M/s BLACK & VEATCH					
Z1	14/07/16	ISSUED AS-BUILT	IAB	MM	SATB RRK
S2	05/09/12	ISSUE FOR CONSTRUCTION	IFC	RKH	AST RRK
S1	26/07/11	ISSUE FOR CONSTRUCTION	IFC	RKH	ALD SKH
B1	28/02/11	ISSUED FOR DET. DESIGN	IFD	LKK	ALD SKH
REV	DATE	DESCRIPTION	STATUS	BY:	CHKD: APPD:



INDIAN OIL CORPORATION LTD
Paradip, Orissa State, India

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LSTK CONTRACTOR
PUNJ LLOYD LTD.
NEW DELHI
DETAIL ENGINEERING SUB CONTRACTOR
Lurgi India Co. Pvt. Ltd.

EPCm-1 REFERENCE. DRAWING NO:
PDRP4220-8110-25-086-0016 REV. A

TITLE:
PARADIP REFINERY PROJECT

SRU TRAIN 1
FINAL CONDENSER & BFW
PREHEATER
PIPING & INSTRUMENTATION DIAGRAM

SCALE: 1:XXXX
DRAWING NO: PDRP4220-271-8110-25-086-0016
SHT NO: 1 OF 1
REV: Z1

Output File Directory: INDLV200550\PIPEVLS\TKB\CAD\ISO-ASBUILT\TZIN\BEAA

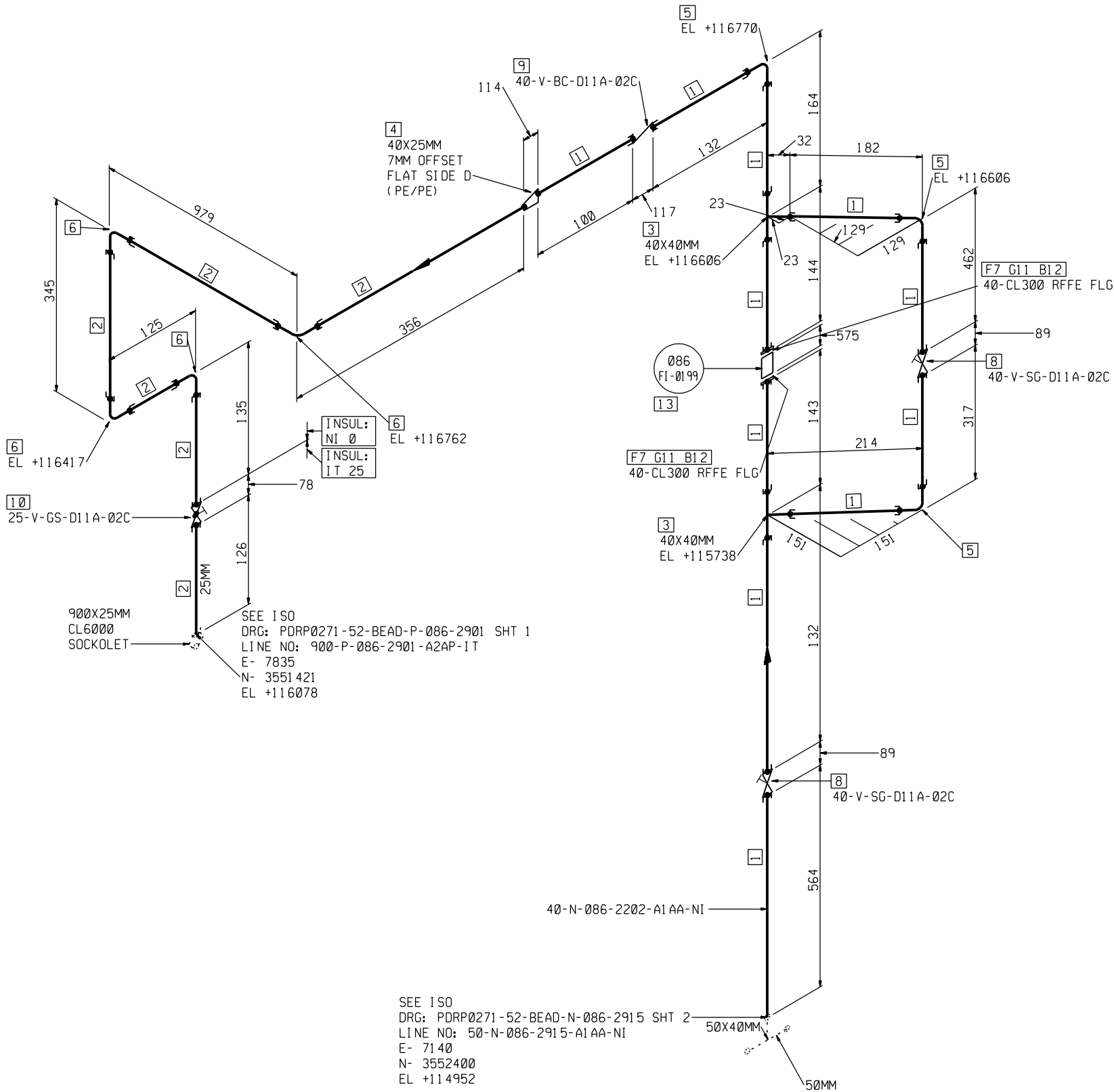
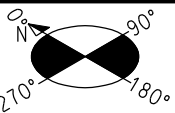
Batch Ref. No. 000001

BEADP01

Piping file:

BEAD

Exctracted from construction area:



SHOP MATERIAL							
PART NO.	REQ ITEM NO.	QTY	SIZE	SCHED.	RATING	END COND	DESCRIPTION
1	1541SAFB10070	2.2 M	40	S-80		PE	PIPE ENDS PLAIN SEAMLESS CS TO ASTM A106 GR.B
2	1541SAFB10050	1.9 M	25	S-80		PE	PIPE ENDS PLAIN SEAMLESS CS TO ASTM A106 GR.B
3	1551HTB810070	2	40X40	NREOD	CL3000	SWE	TEE FORGED CS TO ASTM A105N AND ASME B16.11
4	1551SOBN07072	1	40X25	S-80		PE	ECC. SWAGE NIPPLE FORGED CS TO ASTM A105N & MSS-SP-95
5	1551HLBB10070	3	40	NREOD	CL3000	SWE	90 ELBOW FORGED CS TO ASTM A105N AND ASME B16.11
6	1551HLBB10050	4	25	NREOD	CL3000	SWE	90 ELBOW FORGED CS TO ASTM A105N AND ASME B16.11
7	1561NBAB10070	2	40	S-80	CL300	RFFE	SOCKET WELD FLANGE CS TO ASTM A105N AND ANSI B16.5
8	1512GABG01070	2	40		CL800	SWE	GATE VALVE FORGED CS BODY TO ASTM A105N TRIM 8
9	1512CABG20070	1	40		CL800	SWE	CHECK VALVE FORGED CS BODY TO ASTM A105N TRIM 8
10	1512DABG09050	1	25		CL800	SWE	GLOBE VALVE FORGED CS BODY TO ASTM A105N TRIM 8

FIELD MATERIAL							
PART NO.	REQ ITEM NO.	QTY	SIZE	SCHED.	RATING	END COND	DESCRIPTION
11	1574SACB00079	2	40				SPIRAL WOUND GASKET 4.5MM THK SP WOUND GRAPHITE FILLER
12	1572SDDA06018	8	3/4				STUDBOLTS ALLOY ST. TO ASTM A193 GR B7, 90.0MM BOLT LENGTH
INSTRUMENTS/SP ITEMS							
13	086-FI-0199	1	40	S-80	CL300	RFFE	INSTRUMENT, REF. TO UNIT INSTRUMENT INDEX

AS-BUILT

DRAWING NO. PDRP0271-52-BEAD-N-086-2202 SHT 1

PARADIP REFINERY PROJECT
Paradip, Orissa State, India

INDIAN OIL CORPORATION LIMITED

Punj Lloyd

AIR LIQUIDE Lurgi

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TITLE:
ISOMETRIC PIPING DETAIL - UNIT 086

LINE NO. 40-N-086-2202-A1AA-NI

DRAWING NO. PDRP0271-52-BEAD-N-086-2202

CONTRACT NO.- LSTKB/271 SHT 1 OF 1 REV Z1

REV	DATE	DRAWN	CHECKED	STRESS	APPD	APPD	REV	DATE	DRAWN	CHECKED	STRESS	APPD	APPD	REV	DATE	DRAWN	CHECKED	STRESS	APPD	APPD
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LINE ID - BEAD-086-N-2202-1

TRAIN NO.- 1

BEAD086N22021

01



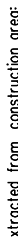
AS-BUILT

TRAIN NO.- 1

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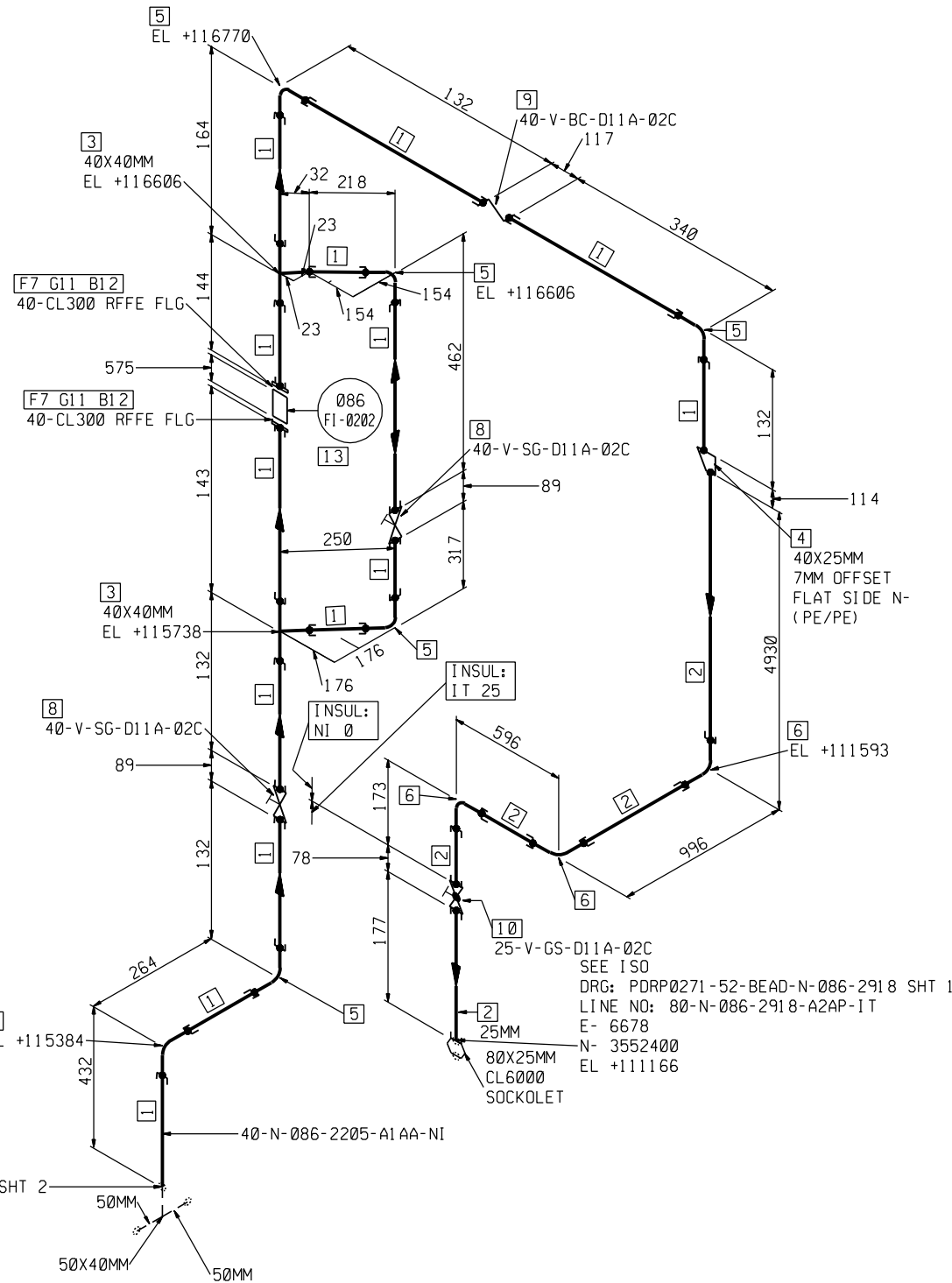
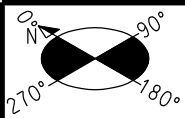
TRAIN NO.- 1	BEAD086N22031	.i0
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LEGEND FOR MATERIAL PART NUMBERS		[1]	[S3]	[F5]	[B6]	[G7 B8]		[F9 G10 B11]			OPERATING CONDITIONS	PRESSURE	0.000	DESIGN CONDITIONS	PRESSURE	0.000	INSULATION	TYPE	NI	
		REFER TO PART "1" IN MATERIAL LISTING	S - SUPPORT 3 - PART 3	F - FLANGE 5 - PART 5	B - BOLTS 6 - PART 6	G - GASKET 7- PART 7	B - BOLT 8 - PART 8	F - FLANGE 9 - PART 9	G - GASKET 10 - PART 10	B - BOLT 11- PART 11		TEMPERATURE	0.00		TEMPERATURE	0.00		THICKNESS	0.000	
GENERAL NOTES: 1. INSULATION IS IN ACCORDANCE WITH THE SPECIFICATION PDRP-8440-SP-0004 & 0005 2. PRESSURE TESTING IS IN ACCORDANCE WITH THE SPECIFICATION PDRP4200-8820-SP-1002 3. PAINTING IS IN ACCORDANCE WITH THE SPECIFICATION PDRP4200-8440-SP-1006 4. FOR VENTS & DRAINS DETAILS REFER SPECIFICATION PDRP4200-8440-SP-1001 5. UNLESS OTHERWISE NOTED, ALL DIMENSIONS ARE TO FACE OF FLANGE OR CL OF PIPE. BOLT HOLES ON FLANGES STRADDLE CENTRE LINE. ALL DIMENSIONS ARE IN MILLIMETERS. 6. SPRING LOCK NUTS TO BE RELEASED POST HYDROTEST. 7. CONTRACTOR TO SUPPLY, FABRICATE & INSTALL ALL STANDARD PIPE SUPPORTS & INSTALL ANY FREE ISSUE SUPPORTS (HANGERS, SLIDE UNITS, ETC.) 8. FOR PWHT REQUIREMENT SEE PIPING MATERIAL SPECIFICATION & LINE LIST. 9. FOR DATA RELATING TO LINE CONDITIONS, TEST PRESSURE/MEDIUM ETC.-SEE LINE LIST. 10. ALL SMALL BORE BRANCHES IN STAINLESS STEEL PIPING (AG) ARE TO BE BRACED IN ACCORDANCE WITH PS-69A/B AS PER PIPE SUPPORT STANDARD. 11. FOR ALL T-TYPE STRAINERS TEMPORARY STRAINER MESH ELEMENT SHALL BE REMOVED & PERMANENT STRAINER MESH ELEMENT SHALL BE INSTALLED AFTER PRE-COMMISSIONING. 12. CONTROL VALVE AND PSV'S HOLD TOBE REMOVED AS PER EXACT DIMENSION AT SITE. 13. DIMENSION FOR LINE SIZE 40MM AND BELOW TOBE CHECKED AT SITE BEFORE FABRICATION. DIMENSIONS ARE FOR GUIDANCE ONLY. 14. LINE SIZE 40MM AND BELOW SHALL BE FIELD SUPPORTED BY CONSTRUCTION CONTRACTOR. 15. ALL LOW SUPPORTED PEDESTAL HEIGHT SHALL BE 150MM FROM HPP. HPP ELEVATION: 100300MM 16. FOR NON CRITICAL FIELD RUN PIPING SYSTEM, CONTRACTOR IS RESPONSIBLE FOR SITE VERIFYING THE ROUTING AND THE SELECTION AND ALLOCATION OF PIPE SUPPORTS.																				
REV		DRAWN	CHECKED	STRESS	APPD	APPD	REV		DRAWN	CHECKED	STRESS	APPD	APPD	REV		DRAWN	CHECKED	STRESS	APPD	APPD
S1	SIGN					///	S2	SIGN					///	S3	SIGN					///
	DATE					///		DATE					///		DATE					///



DRAWING NO. PURP0271-52-BEAD-N-086-2204	
LINE ID - BEAD-086-N-2204-1	CONTRACT NO.- LSTKB/271 SHT 1 OF 1 REV S2

EXTRACTION NUMBER: 2 DATED: 04/01/12



SEE ISO
DRG: PDRP0271-52-BEAD-N-086-2915 SHT 2
LINE NO: 50-N-086-2915-A1AA-NI
E- 5946
N- 3552400
EL +114952

SHOP MATERIAL

PART NO.	REQ ITEM NO.	QTY	SIZE	SCHED.	RATING	END COND	DESCRIPTION
1	1541SAFB10070	2.7 M	40	S-80		PE	PIPE ENDS PLAIN SEAMLESS CS TO ASTM A106 GR.B
2	1541SAFB10050	6.8 M	25	S-80		PE	PIPE ENDS PLAIN SEAMLESS CS TO ASTM A106 GR.B
3	1551HTB810070	2	40X40	NREOD	CL3000	SWE	TEE FORGED CS TO ASTM A105N AND ASME B16.11
4	1551SOBN07072	1	40X25	S-80		PE	ECC. SWAGE NIPPLE FORGED CS TO ASTM A105N & MSS-SP-95
5	1551HLB810070	6	40	NREOD	CL3000	SWE	90 ELBOW FORGED CS TO ASTM A105N AND ASME B16.11
6	1551HLB810050	3	25	NREOD	CL3000	SWE	90 ELBOW FORGED CS TO ASTM A105N AND ASME B16.11
7	1561NBAB10070	2	40	S-80	CL300	RFFE	SOCKET WELD FLANGE CS TO ASTM A105N AND ANSI B16.5
8	1512GABG01070	2	40		CL800	SWE	GATE VALVE FORGED CS BODY TO ASTM A105N TRIM 8
9	1512CABG20070	1	40		CL800	SWE	CHECK VALVE FORGED CS BODY TO ASTM A105N TRIM 8
10	1512DABG09050	1	25		CL800	SWE	GLOBE VALVE FORGED CS BODY TO ASTM A105N TRIM 8

FIELD MATERIAL

PART NO.	REQ ITEM NO.	QTY	SIZE	SCHED.	RATING	END COND	DESCRIPTION
11	1574SAC800079	2	40				SPIRAL WOUND GASKET 4.5MM THK SP WOUND GRAPHITE FILLER
12	1572SDDA06018	8	3/4				STUDBOLTS ALLOY ST. TO ASTM A193 GR B7, 90.0MM BOLT LENGTH

INSTRUMENTS/SP ITEMS

PART NO.	REQ ITEM NO.	QTY	SIZE	SCHED.	RATING	END COND	DESCRIPTION
13	086-F1-0202	1	40	S-80	CL300	RFFE	INSTRUMENT, REF. TO UNIT INSTRUMENT INDEX

AS-BUILT

DRAWING NO. PDRP0271-52-BEAD-N-086-2205 SHT 1

PARADIP REFINERY PROJECT
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TITLE:
ISOMETRIC PIPING DETAIL - UNIT 086

LINE NO. 40-N-086-2205-A1AA-NI

DRAWING NO. PDRP0271-52-BEAD-N-086-2205

CONTRACT NO.- LSTKB/271

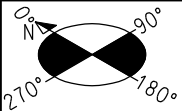
SHT 1 OF 1

REV S1

TRAIN NO.- 1

BEAD086N22051

.j01



PART NO.	REQ ITEM NO.	QTY	SIZE	SCHED.	RATING	END COND	DESCRIPTION
							SHT SHT 1
INSTRUMENTS/SP ITEMS							
28	086-HV-0207	1	80	NREOD	CL300	RFFE	INSTRUMENT, REF. TO UNIT INSTRUMENT INDEX
PIPE SUPPORTS							
29	TR-3E	1	80				PIPE SUPPORT, REF. TO PDRP4200-8230-SP-1016
30	PS-99A	1	80				PIPE SUPPORT, REF. TO PDRP4200-8230-SP-1016
31	PS-7A	1	80				PIPE SUPPORT, REF. TO PDRP4200-8230-SP-1016
32	PS-10B	1	80				PIPE SUPPORT, REF. TO PDRP4200-8230-SP-1016
33	PG-3A	1	80				PIPE SUPPORT, REF. TO PDRP4200-8230-SP-1016
34	PS-1A	1	80				PIPE SUPPORT, REF. TO PDRP4200-8230-SP-1016
35	REST	1	80				PIPE SUPPORT, REF. TO PDRP4200-8230-SP-1016

AS-BUILT

DRAWING NO. PDRP0271-52-BEAD-N-086-2918 SHT 1

PARADIP REFINERY PROJECT
Paradip, Orissa State, India



INDIAN OIL
CORPORATION LIMITED



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TITLE:
ISOMETRIC PIPING DETAIL - UNIT 086

LINE NO. 80-N-086-2918-A2AP-IT

DRAWING NO. PDRP0271-52-BEAD-N-086-2918

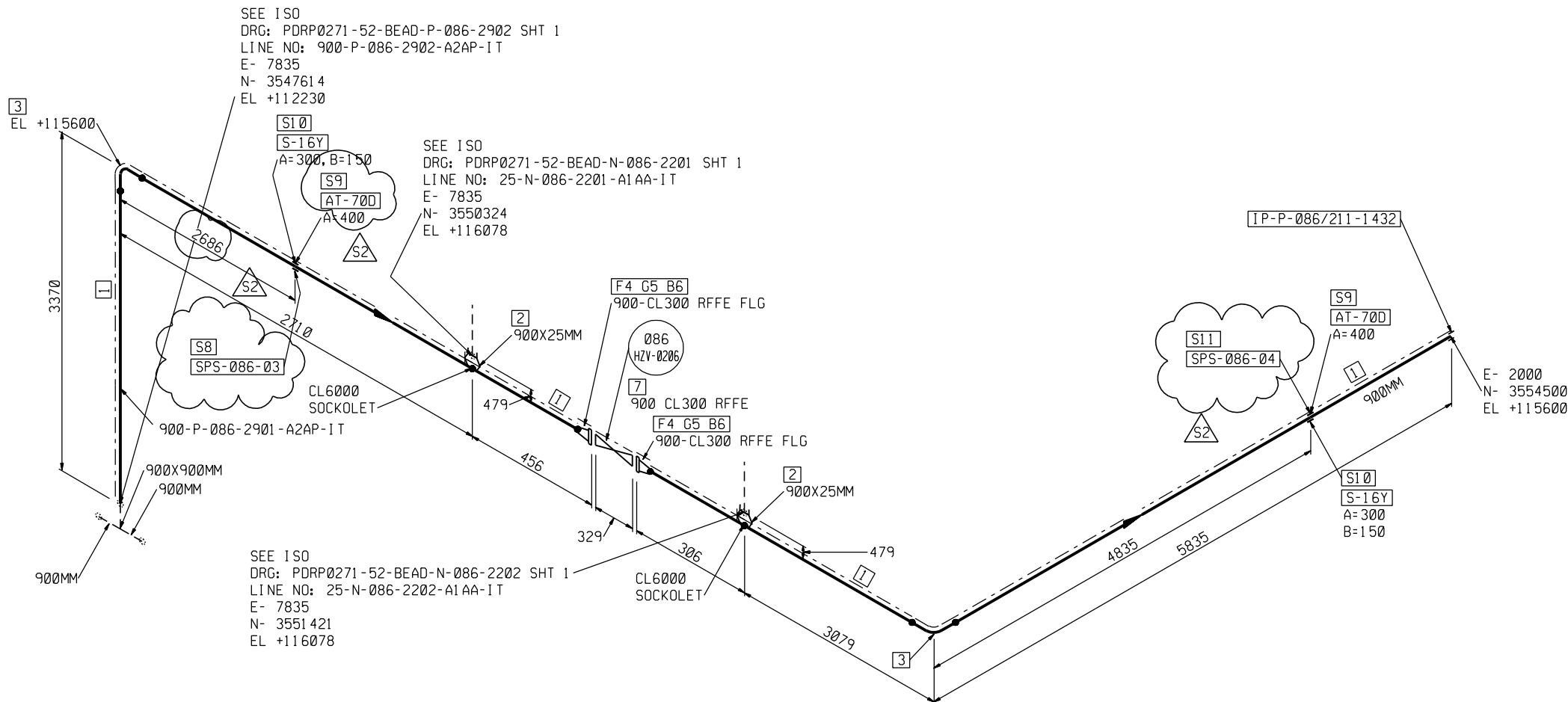
CONTRACT NO.- LSTKB/271

SHT 2 OF 2 REV S2

TRAIN NO.- 1

BEAD086N29181

.i02



AS-BUILT

SHOP MATERIAL							
PART NO.	REQ ITEM NO.	QTY	SIZE	SCHED.	RATING	END COND	DESCRIPTION
1	W541WGCA04320	10.0 M	900	S-20		BE	PIPE ENDS BEVELLED EFW CS TO ASTM A672 GR. B60 CLASS 32
2	1551LKBB57810	2	900X25	NREOD		BE	SOCKET FORGED CS TO ASTM A105N & MSS SP 97
3	W551ELWA04320	2	900	S-20		BE	90 LR ELBOW WELDED CS TO ASTM A234 GR. WPBW AND ASME B16.9
4	1561WBCB04320	2	900	S-20	CL300	RFPE	WELD NECK FLANGE CS TO ASTM A105N AND ASME B16.47 SERIES R.

FIELD MATERIAL							
PART NO.	REQ ITEM NO.	QTY	SIZE	SCHED.	RATING	END COND	DESCRIPTION
5	1574UACB00329	2	900				SPIRAL WOUND GASKET 4.5MM THK SP WOUND GRAPHITE FILLER 316L SS
6	1572SDDA13079	64	1.5/8				WINDINGS STUDBOLTS ALLOY ST. TO ASTM A193 GR B7, 395.0MM BOLT LENGTH

INSTRUMENTS/SP ITEMS							
7	086-HZV-0206	1	900	S-20	CL300	RFFE	INSTRUMENT, REF. TO UNIT INSTRUMENT INDEX

<u>PIPE SUPPORTS</u>				
8	SPS-086-03	1	900	PIPE SUPPORT, REF. TO PDRP4200-8230-SP-1016
9	AT-700	2	900	PIPE SUPPORT, REF. TO PDRP4200-8230-SP-1016
10	S-16Y	2	900	PIPE SUPPORT, REF. TO PDRP4200-8230-SP-1016
11	SPS-086-04	1	900	PIPE SUPPORT, REF. TO PDRP4200-8230-SP-1016

DRAWING NO. PDRP0271-52-BEAD-P-086-2901 SHT 1

<div> <div>PARADIP REFINERY PROJECT</div> <div>Paradip, Orissa State, India</div> </div>				<div> <div> <div> <div>इंडियन ऑयल</div> <div>IndianOil</div> </div> <div> <div>INDIAN OIL CORPORATION LIMITED</div> <div> <div> <div>Punj Lloyd</div> <div>AIR LIQUIDE</div> <div>Lurgi</div> </div> </div> </div> <div> <div> <div>This Drawing is the Property of</div> <div>INDIAN OIL CORPORATION LTD</div> <div>and is lent without consideration other than the</div> <div>Borrower's agreement that it shall not be</div> <div>reproduced, copied lent or disposed of directly or</div> <div>indirectly, nor used for any purpose other than that</div> <div>for which it is specifically furnished. The apparatus</div> <div>shown in the drawing is covered by patents.</div> <div>Information contained in this drawing may be proprietary</div> <div>to Indian Oil Corporation Ltd and/or licensors, and is</div> <div>subject to obligations of confidentiality.</div> </div> </div> </div></div>			
S2	02/03/12	REVISED AS MARKED	VPR				
S1	17/10/11	ISSUED FOR CONSTRUCTION	VPR				
REV.	DATE	DESCRIPTION	APPD.				
REFERENCE STDs / DRGS							
PIPING MATERIAL SPEC. PDRP4200-8230-SP-1001							
PIPE SUPPORT STD. PDRP4200-8230-SP-1016							
PIPING STD. HOOK-UPS PDRP4200-8230-SP-1008							
P&ID No. 086-0016							
LINE ID - BEAD-086-P-2901-1				<div> <div>TITLE:</div> <div>ISOMETRIC PIPING DETAIL - UNIT 086</div> <div>LINE NO. 900-P-086-2901-A2AP-IT</div> <div>DRAWING NO. PDRP0271-52-BEAD-P-086-2901</div> <div>CONTRACT NO.- LSTKB/271</div> <div>SHT 1 OF 1</div> <div>REV S2</div> </div>			

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INVENTORY NO. SIGN. AND DATE REF. DRG. NO. COMPUTER FILE NAME

GENERAL DIMENSIONAL LIMITS, FITS & TOLERANCES AS PER HY0230261

FIRST ANGLE PROJECTION

(ALL DIMENSIONS ARE IN mm)

ESP-001-11A

GENERAL NOTES :

- FOR STANDARD SYMBOLS, DETAILS AND LEGEND SHEETS SEE DRAWINGS B366-02-42-0090-0001 THROUGH B366-02-42-0090-0005.
- FOR SAMPLE STATION DETAILS SEE DRAWING B366-02-42-0021-0001.
- FOR PUMP SEAL PLAN DETAILS SEE DRAWING B366-02-42-0021-0002.
- REFER OVERALL KEY PLAN DRAWING INDICATING THE NODE LOCATIONS. PDRP4200-8230-02-600-0001.
- ALL INSTRUMENTS TAGS TO BE PREFIXED BY UNIT NUMBER '211'.

NOTES :

- EXISTING LINES STEAM TRACING TO BE REPLACED WITH CONTROL TRACING.
- VENT AND DRAIN VALVES TO BE LOCATED AT HIGH AND LOW POINT OF PIPING RESPECTIVELY. PIPING TO CONFIRM LOCATION.
- PIPE RACK STEEL TO BE DEFLECTED PRIOR TO ADDITION OF PIPE WORK. SPECIFICALLY FOR SPANS OF 12 M OR GREATER.
- JUMP OVER SECTIONS FOR STEAM ACROSS JACKETED SECTIONS.

LEGEND :

--- EXISTING
— NEW

COMMENTS:
1. EXISTING LINES, MODIFIED LINES AND NEW LINES AS WELL AS EXISTING, MODIFIED AND NEW INSTRUMENTS AND SIGNALS SHALL BE SHOWN IN PID. THESE PIDS SHALL BE USED BY IOCL IN FUTURE AS AREA-WISE PIDS AND ALL ITEMS IN THIS GEOGRAPHIC AREA TO BE SHOWN IN THIS DRAWING.
2. EXISTING ITEMS ALONG WITH RELEVANT NOTES ALSO TO BE REPRODUCED FROM TENDER PIDS.
3. SYMBOL FOR CONTROL TRACING TO BE REPLACED BY BROKEN LINE WITH C IN BETWEEN THE BROKEN LINES AS SHOWN IN TENDER PIDS. SOFT SIGNAL SYMBOL SHALL NOT BE USED FOR CONTROL TRACING.
4. NEW ITEMS IN PID BEING ADDED AS PART OF THIS PROJECT SHALL BE SHOWN WITHIN CLOUDS.

FIX CONTROL TRACING SYMBOL

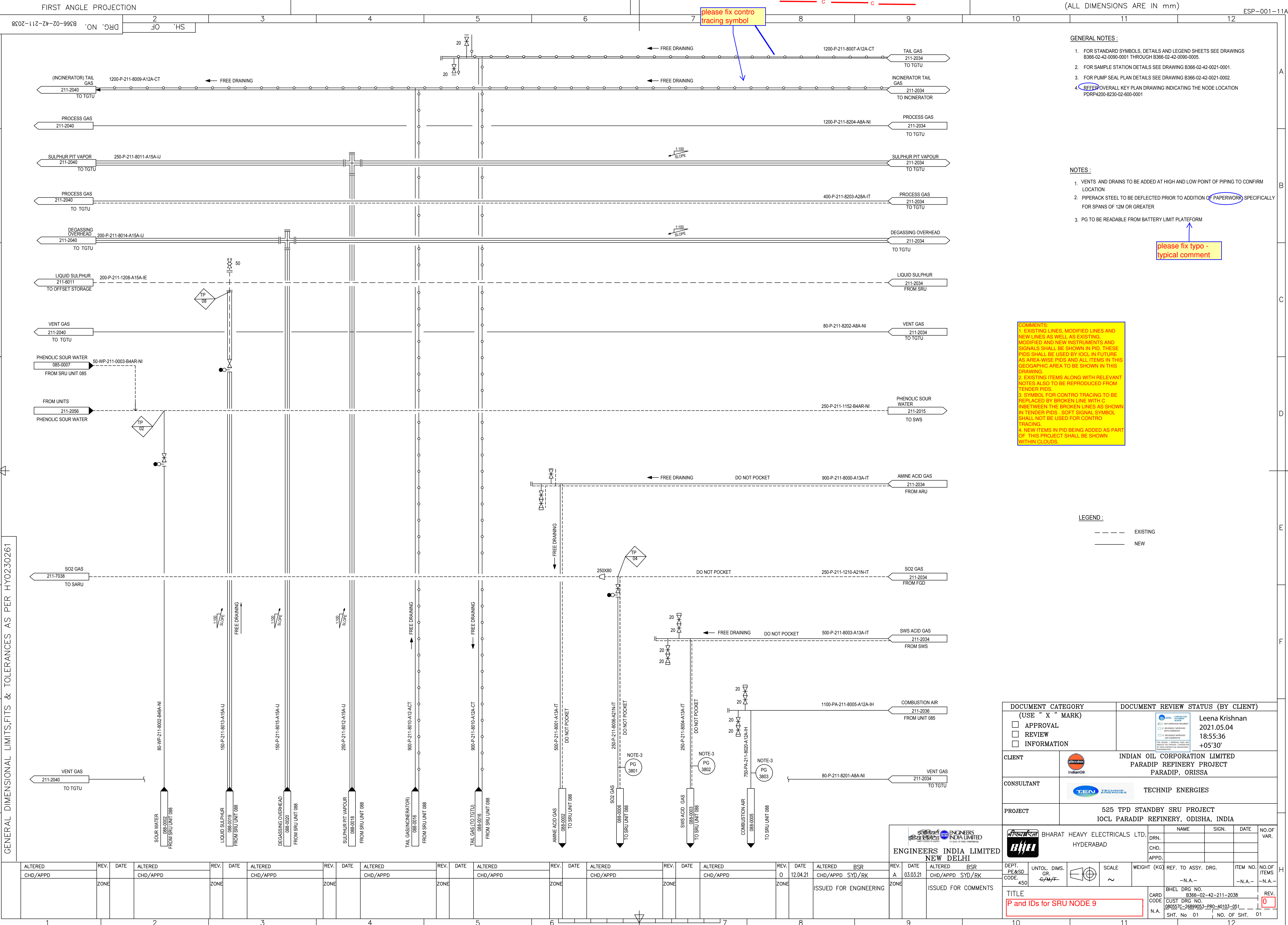
TIE-IN VALVE ALONG WITH SPACER BLIND MISSING

DOCUMENT CATEGORY (USE "X" MARK) <input type="checkbox"/> APPROVAL <input type="checkbox"/> REVIEW <input type="checkbox"/> INFORMATION		DOCUMENT	<div>CONTRACTOR DOCUMENT 1. NOT APPROVED / PRESUMPT 2. REVIEWED / APPROVED WITH COMMENTS 3. REVIEWED / APPROVED AND COMMENTS</div> <div>THIS REVIEW / APPROVAL DOES NOT ABOVE THE SUPERIOR / CONTRACTOR OF THEIR CONTRACTUAL OBLIGATIONS / RESPONSIBILITIES.</div>																	
CLIENT	INDIAN OIL CORPORATION LIMITED PARADIP REFINERY PROJECT PARADIP, ORISSA																			
CONSULTANT	TECHNIP ENERGIES																			
PROJECT	525 TPD STANDBY SRU PROJECT IOCL PARADIP REFINERY, ODISHA, INDIA																			
ENGINEERS INDIA LIMITED NEW DELHI		BHARAT HEAVY ELECTRICALS LTD. HYDERABAD		<table><tr><td>NAME</td><td>SIGN.</td><td>DATE</td><td>NO. OF VAR.</td></tr><tr><td>DRN.</td><td></td><td></td><td></td></tr><tr><td>CHD.</td><td></td><td></td><td></td></tr><tr><td>APPD.</td><td></td><td></td><td></td></tr></table>	NAME	SIGN.	DATE	NO. OF VAR.	DRN.				CHD.				APPD.			
NAME	SIGN.	DATE	NO. OF VAR.																	
DRN.																				
CHD.																				
APPD.																				
DEPT. PE&SD CODE: 450		UNTO. DIMS. OR: 5/16" F	SCALE: ~	WEIGHT (KG):																
TITLE P and IDs for SRU NODE 7		REF. TO ASSY. DRG. -N.A.- ITEM NO. -N.A.- NO. OF ITEMS -N.A.-																		
CARD CODE: N.A.		BHEL DRG. NO. B366-02-42-211-2034 CUST DRG. NO. 080557C-26899053-PR0-A0103-049 SHT. No. 01 NO. OF SHT. 01																		

ESP-001-11A

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INVENTORY NO. SIGN. AND DATE REF. DRG. NO. COMPUTER FILE NAME



- GENERAL NOTES:**
- FOR STANDARD SYMBOLS, DETAILS AND LEGEND SHEETS SEE DRAWINGS B366-02-42-0090-0001 THROUGH B366-02-42-0090-0005.
 - FOR SAMPLE STATION DETAILS SEE DRAWING B366-02-42-0021-0001.
 - FOR PUMP SEAL PLAN DETAILS SEE DRAWING B366-02-42-0021-0002.
 - REFER OVERALL KEY PLAN DRAWING INDICATING THE NODE LOCATION PDRP4200-8230-02-600-0001

- NOTES:**
- VENTS AND DRAINS TO BE ADDED AT HIGH AND LOW POINT OF PIPING TO CONFIRM LOCATION
 - PIPERACK STEEL TO BE DEFLECTED PRIOR TO ADDITION OF PAPERWORK SPECIFICALLY FOR SPANS OF 12M OR GREATER
 - PG TO BE READABLE FROM BATTERY LIMIT PLATFORM





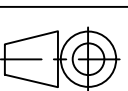
COMMENTS:

- EXISTING LINES, MODIFIED LINES AND NEW LINES AS WELL AS EXISTING, MODIFIED AND NEW INSTRUMENTS AND SIGNALS SHALL BE SHOWN IN PID. THESE PIDS SHALL BE USED BY IOCL IN FUTURE AS AREA-WISE PIDS AND ALL ITEMS IN THIS GEOGRAPHIC AREA TO BE SHOWN IN THIS DRAWING.
- EXISTING ITEMS ALONG WITH RELEVANT NOTES ALSO TO BE REPRODUCED FROM TENDER PIDS.
- SYMBOL FOR CONTRO TRACING TO BE REPLACED BY BROKEN LINE WITH C IN BETWEEN THE BROKEN LINES AS SHOWN IN TENDER PIDS. SOFT SIGNAL SYMBOL SHALL NOT BE USED FOR CONTRO TRACING.
- NEW ITEMS IN PID BEING ADDED AS PART OF THIS PROJECT SHALL BE SHOWN WITHIN CLOUDS.

LEGEND:

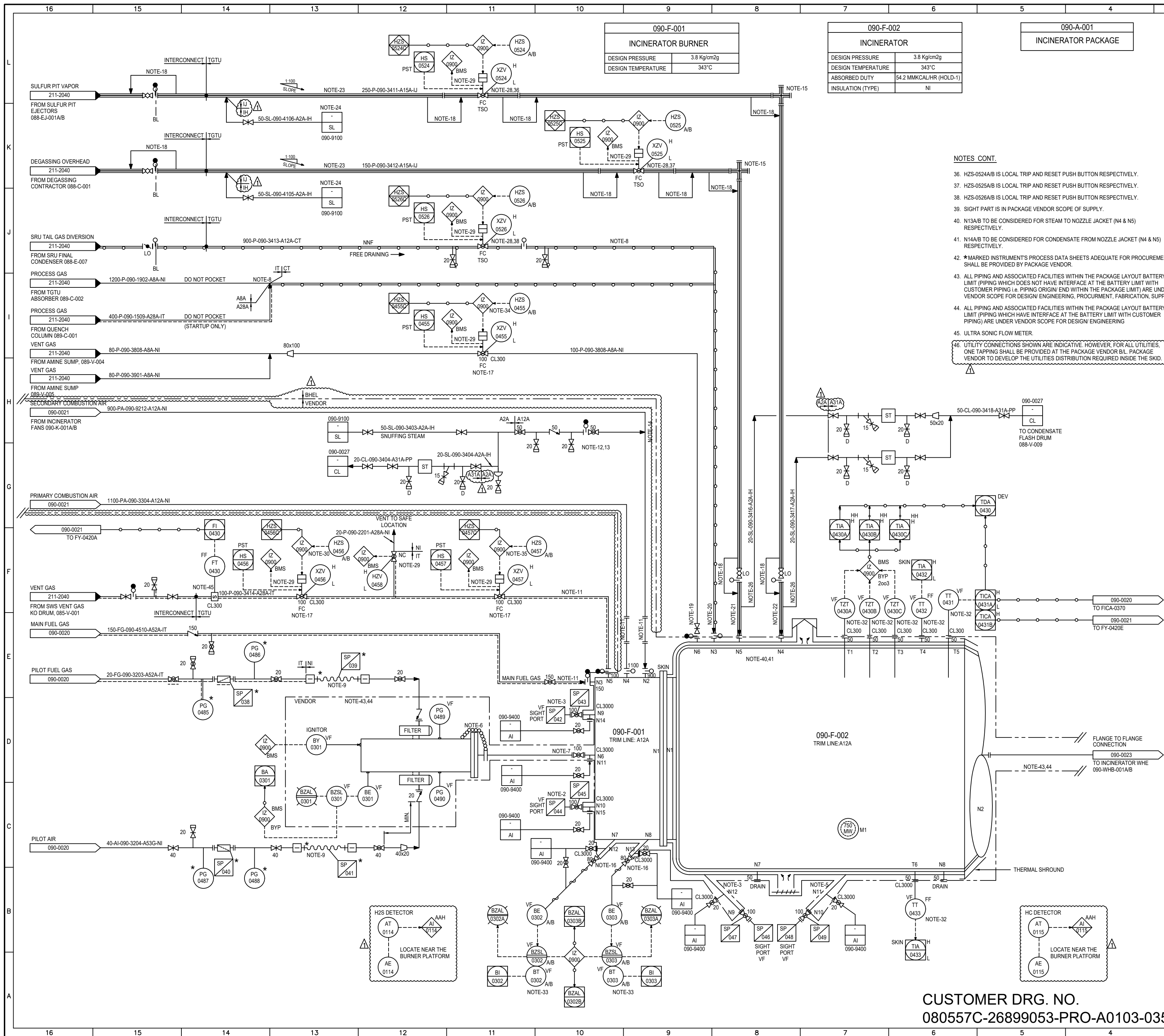
--- EXISTING

— NEW

DOCUMENT CATEGORY (USE " X " MARK)		DOCUMENT REVIEW STATUS (BY CLIENT)					
<input type="checkbox"/> APPROVAL <input type="checkbox"/> REVIEW <input type="checkbox"/> INFORMATION				Leena Krishnan 2021.05.04 18:55:36 +05'30'			
CLIENT 		INDIAN OIL CORPORATION LIMITED PARADIP REFINERY PROJECT PARADIP, ORISSA					
CONSULTANT 		TECHNIP ENERGIES					
PROJECT		525 TPD STANDBY SRU PROJECT IOCL PARADIP REFINERY, ODISHA, INDIA					
 BHARAT HEAVY ELECTRICALS LTD. HYDERABAD		DRN.	NAME	SIGN.	DATE	NO.OF VAR.	
		CHD.					
		APPD.					
DEPT. PE&SD CODE.	UNTO. DIMS. GR. S/M/F		SCALE	WEIGHT (KG)	REF. TO ASSY. DRG.	ITEM NO.	NO.OF ITEMS
450		~			-N.A.-	-N.A.-	-N.A.-
TITLE P and IDs for SRU NODE 9				CARD CODE N.A.	BHEIL DRG NO. R.356-02-42-211-2038 CUST DRG NO. 0905570-26899053-PRO-40103-051		REV. 0
				N.A.	No	01	01



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NOTES CONT.

36. HZS-0524A/B IS LOCAL TRIP AND RESET PUSH BUTTON RESPECTIVELY.
37. HZS-0525A/B IS LOCAL TRIP AND RESET PUSH BUTTON RESPECTIVELY.
38. HZS-0526A/B IS LOCAL TRIP AND RESET PUSH BUTTON RESPECTIVELY.
39. SIGHT PART IS IN PACKAGE VENDOR SCOPE OF SUPPLY.
40. N13A/B TO BE CONSIDERED FOR STEAM TO NOZZLE JACKET (N4 & N5) RESPECTIVELY.
41. N14A/B TO BE CONSIDERED FOR CONDENSATE FROM NOZZLE JACKET (N4 & N5) RESPECTIVELY.
42. * MARKED INSTRUMENTS PROCESS DATA SHEETS ADEQUATE FOR PROCUREMENT SHALL BE PROVIDED BY PACKAGE VENDOR.
43. ALL PIPING AND ASSOCIATED FACILITIES WITHIN THE PACKAGE LAYOUT BATTERY LIMIT (PIPING WHICH DOES NOT HAVE INTERFACE AT THE BATTERY LIMIT WITH CUSTOMER PIPING I.e. PIPING ORIGIN/ END WITHIN THE PACKAGE LIMIT) ARE UNDER VENDOR SCOPE FOR DESIGN/ ENGINEERING, PROCUREMENT, FABRICATION, SUPPLY.
44. ALL PIPING AND ASSOCIATED FACILITIES WITHIN THE PACKAGE LAYOUT BATTERY LIMIT (PIPING WHICH HAVE INTERFACE AT THE BATTERY LIMIT WITH CUSTOMER PIPING) ARE UNDER VENDOR SCOPE FOR DESIGN/ ENGINEERING
45. ULTRA SONIC FLOW METER.
46. UTILITY CONNECTIONS SHOWN ARE INDICATIVE. HOWEVER, FOR ALL UTILITIES, ONE TAPPING SHALL BE PROVIDED AT THE PACKAGE VENDOR BIL. PACKAGE VENDOR TO DEVELOP THE UTILITIES DISTRIBUTION REQUIRED INSIDE THE SKID.

GENERAL NOTES :

1. FOR STANDARD SYMBOLS, DETAILS AND LEGEND SHEETS SEE DRAWINGS B366-02-42-0090-0001 THROUGH B366-02-42-0090-0005.
2. FOR SAMPLE STATION DETAILS SEE DRAWING B366-02-42-0021-0001.
3. FOR PUMP SEAL PLAN DETAILS SEE DRAWING B366-02-42-0021-0002.
4. THIS DRAWING HAS BEEN DEVELOPED BASED ON REFERENCE DRAWING NO. PDRP4220-8110-25-090-0022, REV AX.

NOTES :

1. ALL INSTRUMENT TAG NUMBER SHALL BE PREFIXED BY UNIT NUMBER '090'.
2. SIGHT PORT TO BE AIMED AT PILOT FLAME.
3. SIGHT PORT TO BE AIMED AT MAIN FLAME.
4. FURNACE VENDOR SHALL SUPPLY THE INSTRUMENTS FOR PILOT AND MAIN FLAME DETECTION ZONE TEMPERATURE MEASUREMENTS AND SKIN TEMPERATURE MEASUREMENTS.
5. SIGHT PORT TO BE AIMED AT TUBE OF WASTE HEAT EXCHANGER, 090-WHB-001A/B.
6. PACKING GLAND, RETAINING CHAIN XX MM DIA, XX MM LONG PIPE SPOOL AND FULL PORT VALVE PROVIDED BY PILOT VENDOR.
7. XXMM PILOT IS INSERTED THROUGH XXMM FULL PORT VALVE TO INCINERATOR (PILOT IS AUTO-RETRACTABLE).
8. PIPING TO ENSURE THE SRU TAIL GAS LINE IS THE CLOSEST CONNECTION TO THE INCINERATOR. ABSORBER AND QUENCH LINE WILL TIE INTO THE TOP OF THE SRU TAIL GAS LINE.
9. PROVIDE HOSES AND ELECTRIC CONNECTION LONG ENOUGH TO ALLOW REMOVAL OF PILOT WITHOUT THE NEED FOR DISCONNECTING ANY CONNECTIONS.
10. ~~DELETED~~
11. REMOVABLE SPOOL DESIGNED TO ALLOW REMOVAL OF BURNER.
12. LOCATE VALVE A MINIMUM OF 17M FROM INCINERATOR BURNER.
13. DO NOT POCKET FROM STEAM TRAP TO COMBUSTION AIR LINE. STEAM TRAP SHOULD BE LOWEST POINT IN THIS LINE.
14. TOP ENTRY.
15. CROSSES TO BE USED AT ALL CHANGES IN DIRECTION ON JACKETED PIPING. ALLOW CLEARANCE AT ALL JACKETED CROSSES FOR RODOUT IN BOTH DIRECTIONS.
16. 4 NOS. OF FLAME SCANNERS WILL BE SIGHTED TO OBSERVE THE MAIN FLAME ONLY AND PILOT IF POSSIBLE. MAIN FLAME DETECTION HAS A HIGHER PRIORITY THAN PILOT FLAME DETECTION. A SEPARATE INTERNAL FLAME DETECTOR IS PROVIDED WITH THE PILOT TO OBSERVE THE PILOT FLAME. ALL THE SCANNERS ARE TO BE FITTED WITH SWIVEL MOUNTS. BURNER VENDOR AND FLAME SCANNER VENDOR MUST COMMUNICATE TO MINIMIZE EACH FLAME SCANNER NOZZLE LENGTH AND INSTALLATION TO PROVIDE OPTIMUM VIEWING.
17. DESIGN FOR TSO.
18. JUMP OVER SECTION FOR STEAM ACROSS JACKETED FITTINGS.
19. INLET NOZZLE IS 250MM WITH INTERNAL REFRACTORY LINING 75MM THICK. 100MM INTERNAL DIAMETER.
20. INLET NOZZLE IS 1350MM WITH INTERNAL REFRACTORY LINING 75MM THICK. 1200MM INTERNAL DIAMETER.
21. INLET NOZZLE IS 300 X 350MM (JACKETED) WITH INTERNAL REFRACTORY LINING 75MM THICK. 150 X 200MM (JACKETED) INTERNAL DIAMETER.
22. INLET NOZZLE IS 400 X 450MM (JACKETED) WITH INTERNAL REFRACTORY LINING 75MM THICK. 250 X 300MM (JACKETED) INTERNAL DIAMETER.
23. REMOVABLE SPOOL.
24. NUMBER OF STEAM CONNECTION FOR JACKETED PIPE WORK TO BE CONFIRMED.
25. NOZZLE NUMBER N13 - STEAM TO NOZZLE JACKET N4 & N5.
26. NOZZLE NUMBER N14 - CONDENSATE FROM NOZZLE JACKET N4 & N5.
27. ~~DELETED~~
28. SPOOL FOR FUTURE AUTOMATED VALVE.
29. CLOSED LIMIT SWITCH HAS BMS. FUNCTION OPEN & CLOSE LIMIT SWITCHES TO BE CONNECTED DIRECT TO THE ESD(BMS) SYSTEM WITH SERIAL REPEAT TO DCS.
30. HZS-0456A/B IS LOCAL TRIP AND RESET PUSH BUTTON RESPECTIVELY.
31. ADDITIONAL INSTRUMENTS AND NOZZLES SHALL BE INCLUDED IN P&ID AS PER EQUIPMENT SPECIFICATION
32. T'S OF TT'S ONLY WILL BE IN VENDOR SCOPE. IT WILL BE IN PURCHASER SCOPE.
33. INSTRUMENT AIR PURGING CONNECTION SHALL BE PROVIDED INDIVIDUALLY FOR EACH FLAME SCANNERS/NOZZLE (BE/BZS/BT-0302A, BE/BZS/BT-0302B, BE/BZS/BT-0303A, BE/BZS/BT-0303B).
34. HZS-0455A/B IS LOCAL TRIP AND RESET PUSH BUTTON RESPECTIVELY.
35. HZS-0457A/B IS LOCAL TRIP AND RESET PUSH BUTTON RESPECTIVELY.

HOLD LIST			
S. NO.	HOLD	DUE TO	
1.	INCINERATOR ABSORBED DUTY	TO BE CONFIRMED BY PACKAGE VENDOR.	

Sl. No.	DATE	REVISIONS	BY	CHKD	APPD.
1	09.03.21	REVISED AS MARKED	BSR	SYD	RK
0	26.02.21	ISSUED FOR ENGG.	BSR	SYD	RK
1	15.02.21	ISSUED FOR COMMENTS	BSR	SYD	RK

ENGINEERS INDIA LIMITED		INDIA LIMITED	
(A Govt. of India Undertaking)		(A Govt. of India Undertaking)	

Bharat Heavy Electricals Limited		Powering Progress, Brightening Lives Touching Every Indian Home	
BHEL			

BLACK & VEATCH CORPORATION			
B&V			

INDIAN OIL CORPORATION LIMITED		PARADIP REFINERY PROJECT	
PARADIP, ORISSA			

पाइपिंग रण्ड इंस्ट्रुमेंटेशन डायग्राम		PIPING AND INSTRUMENTATION DIAGRAM	
TGTU TRAIN-2			
INCINERATOR AND BURNER			

अनुमाप SCALE	कार्य संख्या JOB NO.	विभाग DEPT.	अनुभाग SECTN.	इकाई UNIT	आरेख संख्या DWG. No.	रैंको REV.
B366	02	42	090	0022	1	

CUSTOMER DRG. NO.
080557C-26899053-PRO-A0103-035

 		PROJECT	Standby SRU & Additional Tanks IOCL Paradip Refinery		
		CLIENT	INDIAN OIL CORPORATION LIMITED		
MATERIAL MANAGEMENT AND WAREHOUSE	Project No. 080557C001	Document No. 080557C-000-QCP-0000-001		Rev. No. A	Page 1 of 3
QUALITY CONTROL PLAN MATERIAL MANAGEMENT AND WAREHOUSE					





TYPE OF QUALITY CONTROL REPORT	CERTIFICATION EXTENT
RK 0018, RK 0019, RK 0025, RK 0027	MATERIAL RECEIPT REPORTS & IRREGULARITY / DAMAGE REPORTS
QC 08 – QC 09	FOR EACH SHIPPING
QC 04 & QC 05	FOR EACH ITEM
QC 22	LOGBOOK
LB F004	SUPPLY LOGBOOK

REFERENCE DOCUMENTS:

- 080557C-000-PP-805
 - 080557C-000-PP-807
 - 080557C-000-PP-804
 -
 - DRAWINGS
- SITE CO-ORDINATION & COMMUNICATION PROCEDURE
JOB SPECIFICATION FOR MATERIAL RECEIVING, INSPECTION, HANDLING, STORAGE& RESERVATION
STANDARD SPECIFICATION FOR POSITIVE MATERIAL IDENTIFICATION AT CONSTRUCTION SITES



LEGENDA

H	=	HOLD (RFI required - Work stop for inspection)
W	=	WITNESS (RFI required)
WC	=	100 % SUPERVISION AND EXAMINATION BY CONTRACTOR.
P	=	PREPARATION
S	=	SURVEILLANCE (No RFI)
R	=	REVIEW OF REPORTS
N.A.	=	NOT APPLICABLE
A	=	AUTHORIZATION / APPROVAL
IFA	=	ISSUED FOR AUTHORIZATION/APPROVAL
INFO	=	FOR INFORMATION
!	=	WARNING (control of document revision status)

						
A	19/10/2019	ISSUED FOR INFROMATION	SMP	PKP	LA/ANJ	JMC
REV	DATE	DESCRIPTION	PREPARED	CHECKED	APPROVED	AUTHORIZED

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CONFIDENTIAL – Not to disclose without Authorization

 	PROJECT	Standby SRU & Additional Tanks IOCL Paradip Refinery		
	CLIENT	INDIAN OIL CORPORATION LIMITED		
MATERIAL MANAGEMENT AND WAREHOUSE	Project No. 080557C001	Document No. 080557C-000-QCP-0000-001	Rev. No. A	Page 2 of 3

QUALITY CONTROL PLAN



MATERIAL MANAGEMENT AND WAREHOUSE

QUALITY CONTROL ACTIVITIES

Nr.	CHECK AND INSPECTION ITEM	QUALITY CONTROL REPORT	ACTION		NOTES
			CONTRACT.	TECHNIP	
A)	BEFORE MATERIAL ARRIVAL				
A.1	ISSUE OF FORECAST MATERIAL LIST TO ENGINEERING IN CHARGE	By Contractor	P	R	(1)
A.2	EXPEDITING OF NEEDED MATERIAL ACCORDING TO CONSTRUCTION SCHEDULE	N.A.	WC	S	(1)
B)	AT MATERIAL ARRIVAL				
B.1	ISSUE OF A DAILY MATERIALS RECEIVING REPORT	RK 0019	P	R	
B.2	MATERIAL RECEIVING CHECKING	QC 08 & QC 09	WC	W / R	(2)
	- DOCUMENT VERIFICATION - DIMENSIONAL CHECK -SIZE, RATING, PRESSURE RAING, TYPE, ETC - SHIPPING DATA - MATERIAL IDENTIFICATION - GENERAL APPEARANCE				(5)
B.3	JOB-SITE RECEIVING REPORT	RK 0018	P	W/R	
B.4	IRREGULAR MATERIAL				
B.4.1	IRREGULAR MATERIAL SUPPLY REPORT	RK 0025	P	R	(2)
B.4.2	MATERIAL SEGREGATION	N.A.	WC	S	
B.4.3	IRREGULAR MATERIAL SUPPLY LOGBOOK	LB F004	P	R	(1)
B.4.4	NON-CONFORMITY REPORT ISSUED & RESOLUTION	NC FE	WC	R	(3)
B.5	PIPING MATERIAL TRACEABILITY	QC 22	WC	S	
B.6	WAREHOUSE DOCUMENTATION FILE	N.A.	P	R	
C)	WAREHOUSING				
C.1	INDOOR/OUTDOOR STORAGE SELECTION & RECOMMENDATION AS PER SPECIFICATION & APPROVED PROCEDURE	N.A.	P	R	
C.2	VENDOR STORAGE RECOMMENDATION	N.A.	WC	R	
C.3	ACCESSORIES DESCRIPTION & WAREHOUSE LOCATION	QC 05	WC	S	
C.4	ON-OFF VALVES WAREHOUSING	N.A.	WC	S	
D)	MATERIALS PROTECTION / MAINTENANCE DURING STORAGE & CONSTRUCTION	QC 04	WC	S	(4)

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	CLIENT	INDIAN OIL CORPORATION LIMITED		
MATERIAL MANAGEMENT AND WAREHOUSE	Project No. 080557C001	Document No. 080557C-000-QCP-0000-001	Rev. No. A	Page 3 of 3

- NOTES:
- (1) AT CARE OF THE MATERIAL MANAGER
 - (2) CONTRACTOR SITE QC MANAGER OR DISCIPLINE SUPERVISOR AND OWNER INSPECTOR WILL BE CALLED FOR CRITICAL ITEMS ONLY
 - (3) AT CARE OF THE SITE QC MANAGER
 - (4) FIRST ON SITE PRESERVATION SHALL BE WITNESS INSPECTION FOR PMC AND OWNER.
 - (5) 10% DIMENSIONAL CHECKS OF EACH SIZE, PRESSURE RATING AND TYPE OF PIPE FITTINGS AT SITE BY THE CONSULTANT AND SURPRISE CHECKS BY THE OWNER

GENERAL NOTES

- 1 THE ENCLOSED ITP'S ARE INDICATIVE AND SHALL BE FOLLOWED FOR DEVELOPING THE JOB SPECIFIC ITP'S FOR THE WORKS TO BE PERFORMED BY THE CONTRACTOR. THE PROVISIONS INDICATED FOR STAGE WISE INSPECTION BY TECHNIP AND OWNER (FOR SPECIFIC ACTIVITIES) ARE THE MINIMUM AND THE ENGINEER-IN- CHARGE MAY DECIDE TO INCREASE HOLD POINTS/ WITNESS POINTS, WHILE APPROVING THE JOB SPECIFIC ITP'S. ACTIVITIES FOR WHICH ITP'S ARE NOT PROVIDED IN THIS SPECIFICATION. CONTRACTOR TO DEVELOP AND GET THE SAME APPROVED BY TECHNIP/OWNER BEFORE START OF THE WORK. IN GENERAL ROLE OF TECHNIP HAS BEEN SPECIFIED IN THE DOCUMENT THE ROLE OF OWNER TO BE SPECIFIED DURING PREPARATION OF SITE SPECIFIC ITP'S.
- 2 CONTRACTOR TO SUBMIT JOB SPECIFIC REPORTING FORMATS AND JOB PROCEDURES FOR THE JOBS FOR EACH ACTIVITY LISTED IN THE ITP'S AND SUBMIT TO TECHNIP/OWNER FOR APPROVAL. BEFORE COMMENCEMENT OF THE ACTIVITY. IF THE CONTRACTOR HAS TO DEVIATE FROM THE GIVEN ITP FOR A VALID REASON, HE SHALL OBTAIN PRIOR WRITTEN APPROVAL OF TECHNIP/OWNER. CONTRACTOR TO CARRY OUT 100% EXAMINATION OF ALL ACTIVITIES.



**OWNER:****LB F004****PROJ. No.:**

REV. A



SH. 1 OF 1



[illegible]



[illegible]



 		PROJECT:		
		OWNER:		
QUALITY CONTROL FORM RK 0019		PROJ. No.:	REV. A	SH. 1 OF 1
SITE RECEIPT REPORT				
Shipping Agent	Date of materials reception	N° of RK0019	Report issue date	N. of Report
Vendor		Carrier		
Means of transport	Port	Shipping document		
Order	MR	Delivery		Vendor Documents
		Partial	Complete	Disptach bill
Date		<input type="checkbox"/>	<input type="checkbox"/>	Date
DESCRIPTION OF MATERIALS		MATERIALS QUANTITY		
		UNIT OF MEASURE	STATED ON DOCUMENTS	RECEIVED
Shipping contract ref. Parking fee for means of transport Condition of materials received <input type="checkbox"/> Good <input type="checkbox"/> Damaged Quantity of materials received <input type="checkbox"/> Excess <input type="checkbox"/> Missing Quality Control Manufacturing Dossier present <input type="checkbox"/> Yes <input type="checkbox"/> No				Irregular Material supply report N. _____ Date _____
The following sentence applies to all people signing this document: I declare to have received the above materials in the aforementioned quantities, to have inspected same and found them in compliance with the Packing List and in good order. <hr/>				
PREPARED BY (name and signature)	CHECKED BY (name and signature)	APPROVED BY (name and signature)	REVIEWED / ACKNOWLEDGED BY (name and signature)	
CONTRACTOR WAREHOUSE SUPERVISOR	CONTRACTOR MATERIAL MANAGER	CONTRACTOR SITE MANAGER	NAME : OWNER /PMC REPRESENTATIVE	

		PROJECT:	
		OWNER:	
QUALITY CONTROL FORM	RK 0027	PROJ. No.:	REV. A
DAMAGE REPORT (MATERIAL / EQUIPMENT)		NUMBER _____	DATE _____
REF. FIELD WAREHOUSE IRREGULAR MATERIAL SUPPLY REPORT Nr. _____ ISSUED ON _____			
MR/ITEM _____			
DESCRIPTION OF DAMAGE <div style="border-bottom: 1px solid black; height: 10px; margin-bottom: 5px;"></div> <div style="border-bottom: 1px solid black; height: 10px; margin-bottom: 5px;"></div> <div style="border-bottom: 1px solid black; height: 10px; margin-bottom: 5px;"></div> <div style="border-bottom: 1px solid black; height: 10px; margin-bottom: 5px;"></div> <div style="border-bottom: 1px solid black; height: 10px; margin-bottom: 5px;"></div> <div style="border-bottom: 1px solid black; height: 10px; margin-bottom: 5px;"></div>			
PACKING LIST INCLUDED WITH SHIPMENT: YES NO PACKAGE BROKEN: YES NO DAMAGE WAS: Obvious concealed At Factory During Transport During Handling			
REQUIRED ACTIONS DAMAGE CAN BE REPAIRED: YES NO Don't Know Mfrs. Guarantee Affected: YES NO Don't Know DAMAGE CAN BE REPAIRED BY FIELD: YES NO MAT'L REQUIRED FOR REPAIR: YES NO Est. Direct Costs for Repair: Mat'l Labor Replacement Mat'l to be Purchased by Field H.O. Repair must be made immediately to maintain const. schedule: YES NO If repair not urgent must be completed by (date): Vendor contacted: YES NO Name Location If Yes, By Phone Wire Telex Telefax Letter DO NOT PROCEED WITH REPAIRS UNTIL AUTHORIZED BY HEAD OFFICE OTHER COMMENTS: ATTACH TO THIS REPORT PHOTOGRAPHS OF DAMAGED MATERIALS			
PREPARED BY (Name and Signature) CONTRACTOR DISCIPLINE SUPERVISOR	CHECKED BY (Name and Signature) CONTRACTOR MATERIAL MANAGER	APPROVED BY (Name and Signature) CONTRACTOR SITE MANAGER	REVIEWED ? ACKNOWLEDGED BY (Name and Signature) NAME : OWNER / PMC REPRESENTATIVE



 		PROJECT:				
QUALITY CONTROL FORM		QC 04a		OWNER:		
MATERIAL MAINTENANCE CARD (INSPECTION RECORD – PAGE 1)		PROJ. No.:		REV. A	SH. 1 OF 2	
		INSPECTION REPORT - MMC				
GENERAL DATA						
ITEM	_____	TYPE	_____	_____		
MR	_____	MFR	_____	_____		
P.L.	_____	OPEN PACK	_____	_____		
LUBRICANTS						
LUBE PART	LUBRICANT		CHARGE/QUANTITY		REPLACE	
	TYPE	BRAND	1ST	BEFORE PRECOM.	INTERVAL	QUANTITY
ROUTINE INSPECTION LIST			INSPECTION TIME		REMARKS	
INSPECTORS	CONTRATOR	TECHNIP	OWNER			
NAME						
SIGNATURE						
DATE						

 		PROJECT:			
QUALITY CONTROL FORM QC 04b		OWNER:			
MATERIAL MAINTENANCE CARD (INSPECTION RECORD – PAGE 2)		PROJ. No.:		REV. A	SH. 2 OF 2
		INSPECTION REPORT - MMC			
GENERAL DATA					
ITEM _____		TYPE _____			
POS	DESCRIPTION	MAINTENANCE INSPECTION ACTIVITY			REMARKS
		DATE	SUB- CONTRACTOR	CONTRACTOR DISCIPLINE SUPERVISOR	
1.					
2.					
3.					
4.					
5.					
6.					
7.					
8.					
9.					
10.					
11.					
12.					

 			PROJECT:		
QUALITY CONTROL FORM QC 05			OWNER:		
ITEM ACCESSORIES LIST (WAREHOUSING ACTIVITY)			PROJ. No.:		REV. A
			IAL _____		SH. 1 OF 1
GENERAL DATA					
ITEM _____ TYPE _____ MR/MFR _____ P.L. _____ OPEN PACKAGE DATE: _____ P.L. _____ _____ OPEN PACKAGE DATE: _____ WAREHOUSE _____ LOCATION _____					
POS.	DESCRIPTION	QUANTITY	POS.	DESCRIPTION	QUANTITY
1.			14.		
2.			15.		
3.			16.		
4.			17.		
5.			18.		
6.			19.		
7.			20.		
8.			21.		
9.			22.		
10.			23.		
11.			24.		
12.			25.		
13.			26.		
INSPECTORS		CONTRATOR		TECHNIP	
NAME					
SIGNATURE					
DATE					

 		PROJECT:	
		OWNER:	
QUALITY CONTROL FORM	QC 08	PROJ. No.:	REV. A
MATERIAL RECEIVING CHECKLIST			
DESCRIPTION			
P.LIST _____		JRR _____	
01. SHIPPING DATA: <ul style="list-style-type: none"> COMPONENTS/LOOSE COMPONENTS QUANTITY/DESCRIPTION MATCH WITH P.O./M.R. <input type="checkbox"/> PACKAGES /LOOSE COMPONENTS PHYSICAL ASSESSMENT OF QUANTITY/DESCRIPTION MATCH WITH PACKING LIST <input type="checkbox"/> SPECIAL WAREHOUSING AND HANDLING INSTRUCTIONS ARE ATTACHED <input type="checkbox"/> 			
02. DOCUMENTS VERIFICATION: <ul style="list-style-type: none"> REVIEW AND ENDORSEMENT W.R.T IRN / MTC / TC / LAB TESTS REPORTS <input type="checkbox"/> TC VERIFICATION W.R.T IRN / SPEC. / QAP, ETC., <input type="checkbox"/> CHECK FOR VENDOR / SOURCE APPROVAL <input type="checkbox"/> REVIEW OF FIELD TEST REPORTS / TEST REPORTS IF APPLICABLE <input type="checkbox"/> ENDORSEMENT ON IMIR <input type="checkbox"/> 			
03. MATERIAL IDENTIFICATION: <ul style="list-style-type: none"> SAMPLING FOR FIELD TESTS / TESTS FROM APPROVED LABORATORIES, IF APPLICABLE <input type="checkbox"/> COMPONENTS/LOOSE COMPONENTS ARE PROPERLY IDENTIFIED/ STAMPED /TAGGED <input type="checkbox"/> EQUIPMENT/MACHINERY ACCESSORIES/INTERNALS ARE PROPERLY IDENTIFIED <input type="checkbox"/> HEAT / BATCH / TAG NO. MENTIONED ON THE MATERAILS <input type="checkbox"/> PIPING: RATING/SIZE/ CODE <input type="checkbox"/> PIPING: COLOUR CODE APPLIED <input type="checkbox"/> MOTORS/TRANSFORMER PANEL: PROPERLY TAGGED <input type="checkbox"/> SITE IDENTIFICATION MARK ON MATERIAL <input type="checkbox"/> CORRECTION OF M.C.T. W.R.T. HEAT NOS. / BATCH NO. / LOT NO. <input type="checkbox"/> 			
04. GENERAL & APPEARANCE: <ul style="list-style-type: none"> SHIPPING PROTECTION/PACKAGE INTEGRITY <input type="checkbox"/> VISUAL INSPECTION & CERTIFICATION FOR PHYSICAL DAMAGE OR CONTAMINATION <input type="checkbox"/> MACHINED SURFACES ARE NOT DAMAGED AND ARE PROPERLY COATED <input type="checkbox"/> FLANGE FACES ARE NOT DAMAGED AND ARE PROPERLY COATED <input type="checkbox"/> INERT GAS PURGED EQUIPMENT - PRESSURE IS STILL APPLIED <input type="checkbox"/> DESSICANTS ARE LOST OR DAMAGED <input type="checkbox"/> WET PROOF CONDITION <input type="checkbox"/> PLUG/CAPS ARE IN PLACE <input type="checkbox"/> EXTERNAL PAINTING: SCRATCHES OR RUSTED AREA <input type="checkbox"/> LUBRICATED EQUIPMENTS: CHECK LUBRICANT AND LEVEL <input type="checkbox"/> ROTARY MACHINED: TAPPED OPENINGS IN STUFFING BOXES AND GLAND PLATES ARE SEALED <input type="checkbox"/> FILLER MATERIAL: PACKAGE INTEGRITY <input type="checkbox"/> PAINTING: EXPIRING DATE <input type="checkbox"/> SPECIAL REQUIREMENT IF ANY <input type="checkbox"/> 			
NOTE: This checklist is only for warehouse-keeper reference. Discipline Supervisor and QC Inspector shall inspect the material according to MR/Drawings & Job Specifications.			

[illegible]

 	PROJECT		Standby SRU & Additional Tanks IOCL Paradip Refinery	
	CLIENT		INDIAN OIL CORPORATION LIMITED	
QCP-PRE-COMMISSIONING & COMMISSIONING	Project No. 080557C001	Document No. 080557C-000-QCP-1300-051	Rev. No. A	Page 1 of 3

**PRECOMMISSIONING/COMMISSIONING – QUALITY CONTROL
PLAN**





PIPING

QC REPORT CODE	DESCRIPTION	NOTES
QCR 1300.P51	LINES CLEANING	
QCR 1300.P52	LINES SPECIAL CLEANING	
QCR 1300.P53	REINSTATEMENT	
QCR 1300.P54	DRYING	
QCR 1300.P55	GROSS LEAK TEST	
QCR 1300.P56	BLINDS INSTALLATION	
QCR 1300.P57	LOCK OPEN /CAR SEALS INSTALLATION	
QCR 1300.P58	SPRING SUPPORTS COLD SETTING	
QCR 1300.P59	FLOW ELEMENTS AND RESTRICTION ORIFICES INSTALLATION	
QCR 1300.P60	PRESSURE SAFETY VALVES INSTALLATION	
QCR 1300.P61	TEMPORARY STRAINERS INSTALLATION	
QCR 1300.P62	BOLT TORQUING/TENSIONING CHECK REPORT	(1)
QCR 1300.C51	PURGING	
QCR 1300.C52	TIGHTNESS TEST	
QCR 1300.C53	SPRING SUPPORTS HOT SETTING	
W12	MISCELLANEA - INSPECTION REPORT	

(1): Single certificate for each item



GENERAL NOTES

- THE ENCLOSED ITP'S ARE INDICATIVE AND SHALL BE FOLLOWED FOR DEVELOPING THEJOB SPECIFIC ITP'S FOR THE WORKS TO BE PERFORMED BY THE CONTRACTOR. THE PROVISIONS INDICATED FOR STAGE WISE INSPECTION BY TECHNIP AND OWNER (FOR SPECIFIC ACTIVITIES) ARE THE MINIMUM AND THE ENGINEER-IN- CHARGE MAY DECIDE TO INCREASE HOLD POINTS/ WITNESS POINTS, WHILE APPROVING THE JOB SPECIFIC ITP'S. ACTIVITIES FOR WHICH ITP'S ARE NOT PROVIDED IN THIS SPECIFICATION. CONTRACTOR TO DEVELOP AND GET THE SAME APPROVED BY TECHNIP/OWNER BEFORE START OF THE WORK. IN GENERAL ROLE OF TECHNIP HAS BEEN SPECIFIED IN THE DOCUMENT THE ROLE OF OWNER TO BE SPECIFIED DURING PREPARATION OF SITE SPECIFIC ITP'S.
- CONTRACTOR TO SUBMIT JOB SPECIFIC REPORTING FORMATS AND JOB PROCEDURES FOR THE JOBS FOR EACH ACTIVITY LISTED IN THE ITP'S AND SUBMIT TO TECHNIP/OWNER FOR APPROVAL. BEFORE COMMENCEMENT OF THE ACTIVITY. IF THE CONTRACTOR HAS TO DEVIATE FROM THE GIVEN ITP FOR A VALID REASON, HE SHALL OBTAIN PRIOR WRITTEN APPROVAL OF TECHNIP/OWNER. CONTRACTOR TO CARRY OUT 100% EXAMINATION OF ALL ACTIVITIES.

A	21/10/2019	ISSUED FOR INFORMATION	 SMP 2019.10.21 17:58:21 +05'30'	 Signed By 2019.10.21 17:58:21 +05'30'	 Approved By 2019.11.06 16:54:55 +05'30'	 Authorized By 2019.11.06 22:24:49 +05'30'
			PREPARED	CHECKED	APPROVED	AUTHORIZED

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 	PROJECT		Standby SRU & Additional Tanks	
	CLIENT		IOCL Paradip Refinery	
QCP-PRE-COMMISSIONING & COMMISSIONING	Project No. 080557C001	Document No. 080557C-000-QCP-1300-051	Rev. No. A	Page 2 of 3



PRECOMMISSIONING/COMMISSIONING – QUALITY CONTROL PLAN

PIPING

S.No	CHECK AND TEST DESCRIPTION	QCR CODE	ACTION		NOTES
			CONTRACTOR	TECHNIP	
A	CLEANING				
1	LINES CLEANING	1300.P51	WC	W	
2	LINES SPECIAL CLEANING	1300.P52	WC	H/W	(1)
3	REINSTATEMENT	1300.P53	WC	W/R	
4	DRYING	1300.P54	WC	W/R	
5	GROSS LEAK TEST	1300.P55	WC	H/W	
B	BLINDS INSTALLATION	1300.P56	WC	W/R	
C	LOCK CLOSE/CAR SEALS INSTALLATION	1300.P57	WC	W/R	(2)
D	SPRING SUPPORTS COLD SETTING	1300.P58	WC	W/R	
E	FLOW ELEMENTS AND RESTRICTION ORIFICES INSTALLATION	1300.P59	WC	W/R	
F	PRESSURE SAFETY VALVES INSTALLATION	1300.P60	WC	W/R	
G	TEMPORARY STRAINERS INSTALLATION	1300.P61	WC	W/R	
H	BOLT TORQUING/TENSIONING CHECK REPORT	1300.P62	WC	W/R	
I	PURGING	1300.C51	WC	W/R	
J	TIGHTNESS TEST	1300.C52	WC	W	

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 		PROJECT	Standby SRU & Additional Tanks IOCL Paradip Refinery		
		CLIENT	INDIAN OIL CORPORATION LIMITED		
QCP-PRE-COMMISSIONING & COMMISSIONING	Project No. 080557C001	Document No. 080557C-000-QCP-1300-051		Rev. No. A	Page 3 of 3

S.NO	CHECK AND TEST DESCRIPTION	QCR CODE	CONTRACTOR	TECHNIP	NOTES.
K	SPRING SUPPORTS HOT SETTING	1300.C53	WC	W/R	
L	MISCELLANEA - INSPECTION REPORT	W12			(3)

(1): The relevant result summary will be attached according to the cleaning method performed.

(2): To be performed during pre-commissioning or commissioning phase

(3) Split of site inspection responsibilities depends from the type of the inspection performed and the Contract requirements

SITE INSPECTION EXTENT LEGENDA

H = HOLD (Stop Work for Inspection - RFI required)
 W = WITNESS (RFI required)
 S = SURVEILLANCE (NO RFI)
 R = REVIEW of QC REPORTS
 N.A. = NOT APPLICABLE
 A = DOCUMENT APPROVAL
 WC = 100 % SUPERVISION AND EXAMINATION BY CONTRACTOR.

 	PROJECT:		
	COMPANY:		
QUALITY CONTROL REPORT	1300.P51	PROJ. No.:	REV. 0 SH. _1_ OF _1_
		CONTRACTOR:	

PRECOMMISSIONING – QUALITY CONTROL REPORT
PIPING
LINES CLEANING

MC PACKAGE:		UNIT:		SYSTEM:			
Cleaning method	W : WATER FLUSHING		S : STEAM BLOWING		M : MECHANICAL		
	A : AIR BLOWING		H : HYDROJETTING		CLEANING		
					O :		
LINE No.	P&ID No.	CLEANING METHOD	REMARKS	DATE	WITNESSING		
					CONTRACTOR	TECHNIP	OWNER

NOTE:

INSPECTORS	CONTRACTOR	TECHNIP	OWNER
NAME			
SIGNATURE			
DATE			


 	PROJECT:		
	COMPANY:		
QUALITY CONTROL REPORT	1300.P52	PROJ. No.:	REV. 0 SH. _1_ OF _
		CONTRACTOR:	

PRECOMMISSIONING – QUALITY CONTROL REPORT
PIPING
LINES SPECIAL CLEANING

MC PACKAGE:		UNIT:		SYSTEM:				
Cleaning method		D : DEGREASING C : CHEMICAL CLEANING		L : LUBE OIL FLUSHING O :				
LINE No.	P&ID No.	CLEANING METHOD	REMARKS	DATE	WITNESSING			
					CONTRACTOR	TECHNIP	OWNER	THIRD PARTY

NOTE:

INSPECTORS	CONTRACTOR	TECHNIP	OWNER
NAME			
SIGNATURE			
DATE			



 	PROJECT:		
	COMPANY:		
QUALITY CONTROL REPORT	1300.P52A	PROJ. No.:	REV. 0 SH. ____ OF ____
		CONTRACTOR:	

PRECOMMISSIONING – QUALITY CONTROL REPORT
PIPING
DEGREASING RESULT SUMMARY

MC PACKAGE:		UNIT:		SYSTEM:				
SPECIAL CLEANING CIRCUIT DESCRIPTION: _____ SPECIAL CLEANING PROCEDURE: _____								
DEGREASING FINAL RESULT								
DATE	TIME	TEMP (°C)	pH	ALKALINITY	PHOSPHATE (%)	OIL & GREASE (ppm)	TSS (ppm)	REMARKS

NOTE:

INSPECTORS	CONTRACTOR	TECHNIP	OWNER
NAME			
SIGNATURE			
DATE			

 	PROJECT:
	COMPANY:
QUALITY CONTROL REPORT	1300.P52B
PROJ. No.: REV. 0 SH. ____ OF ____	
CONTRACTOR:	

PRECOMMISSIONING – QUALITY CONTROL REPORT
PIPING
ACID CLEANING RESULT SUMMARY

MC PACKAGE:	UNIT:	SYSTEM:					
SPECIAL CLEANING CIRCUIT DESCRIPTION: _____ SPECIAL CLEANING PROCEDURE: _____							
ACID CLEANING FINAL RESULT							
DATE	TIME	TEMP (°C)	pH	CITRIC ACID (%)	IRON (ppm)	CORROSION RATE (mpy)	REMARKS

NOTE:

INSPECTORS	CONTRACTOR	TECHNIP	OWNER
NAME			
SIGNATURE			
DATE			



 	PROJECT:
	COMPANY:
QUALITY CONTROL REPORT	1300.P52C PROJ. No.: REV. 0 SH. ____ OF ____ CONTRACTOR:

PRECOMMISSIONING – QUALITY CONTROL REPORT
PIPING
PASSIVATION RESULT SUMMARY

MC PACKAGE:	UNIT:	SYSTEM:		
SPECIAL CLEANING CIRCUIT DESCRIPTION: _____ SPECIAL CLEANING PROCEDURE: _____				
PASSIVATION FINAL RESULT				
DATE	TIME	TEMP (°C)	pH	REMARKS

NOTE:

INSPECTORS	CONTRACTOR	TECHNIP	OWNER
NAME			
SIGNATURE			
DATE			

 	PROJECT :		
	COMPANY:		
QUALITY CONTROL REPORT	1300.P52D	PROJ. No.:	REV. 0 SH. ____ OF ____
		CONTRACTOR:	

PRECOMMISSIONING – QUALITY CONTROL REPORT

PIPING

LUBE OIL FLUSHING RESULT SUMMARY

MC PACKAGE:		UNIT:		SYSTEM:			
SPECIAL CLEANING CIRCUIT DESCRIPTION: _____ SPECIAL CLEANING PROCEDURE: _____							
LUBE OIL FLUSHING FINAL RESULT							
DATE	TIME	FLOWRATE (lpm)	TEMP (°C)	PIPE SIZE AND SCHEDULE	PARTICLE COUNT	ACCEPTED Y / N	REMARKS

NOTE:

INSPECTORS	CONTRACTOR	TECHNIP	OWNER
NAME			
SIGNATURE			
DATE			

 	PROJECT:
	COMPANY:
QUALITY CONTROL REPORT 1300.P53	PROJ. No.: REV. 0 SH. ____ OF ____
	CONTRACTOR:

<p align="center"> PRECOMMISSIONING – QUALITY CONTROL REPORT PIPING REINSTATEMENT </p>

<i>MC PACKAGE:</i>		<i>UNIT:</i>	<i>SYSTEM:</i>				
LINE No.	P&ID No.	REMARKS	DATE	WITNESSING			
				CONTRACTOR	TECHNIP	OWNER	THIRD PARTY

NOTE:

INSPECTORS	CONTRACTOR	TECHNIP	OWNER
NAME			
SIGNATURE			
DATE			

 	PROJECT:
	COMPANY:
QUALITY CONTROL REPORT 1300.P54	PROJ. No.: REV. 0 SH. _1_ OF _2_
	CONTRACTOR:

<p align="center"> PRECOMMISSIONING – QUALITY CONTROL REPORT PIPING DRYING </p>
--

MC PACKAGE:		UNIT:		SYSTEM:			
LINE No.	P&ID No.	REMARKS	DATE	WITNESSING			
				CONTRACTOR	TECHNIP	OWNER	THIRD PARTY

NOTE:

INSPECTORS	CONTRACTOR	TECHNIP	OWNER
NAME			
SIGNATURE			
DATE			

 	PROJECT:
	COMPANY:
QUALITY CONTROL REPORT	1300.P54 PROJ. No.: REV. 0 SH. _2_ OF _2_ CONTRACTOR:

PRECOMMISSIONING – QUALITY CONTROL REPORT
PIPING
DRYING RESULT SUMMARY

MC PACKAGE:	UNIT:	SYSTEM:
DRIED CIRCUIT DESCRIPTION: _____ DRYING PROCEDURE: _____		
DRYING FLUID:	<input type="checkbox"/> AIR <input type="checkbox"/> NITROGEN <input type="checkbox"/> OTHER _____	
DRYING CONDITION:	DRYING GAS PRESSURE _____ Kg/cm ² g DRYING GAS TEMPERATURE _____ °C DRYING PERIOD _____ Hours	
DRYING FINAL RESULT:		
SAMPLE POINT NUMBER		
<input type="checkbox"/> VISIBLE FREE WATER (Y/N)		
<input type="checkbox"/> MOISTURE (ppm)		
<input type="checkbox"/> DEW POINT (°C)		

NOTE:

INSPECTORS	CONTRACTOR	TECHNIP	OWNER
NAME			
SIGNATURE			
DATE			

 	PROJECT:		
	COMPANY:		
QUALITY CONTROL REPORT	1300.P55	PROJ. No.:	REV. 0 SH. _1_ OF _2_
		CONTRACTOR:	

PRECOMMISSIONING – QUALITY CONTROL REPORT
PIPING
GROSS LEAK TEST

MC PACKAGE:		UNIT:		SYSTEM:			
LINE No.	P&ID No.	REMARKS	DATE	WITNESSING			
				CONTRACTOR	TECHNIP	OWNER	THIRD PARTY

NOTE:

INSPECTORS	CONTRACTOR	TECHNIP	OWNER
NAME			
SIGNATURE			
DATE			


 	PROJECT:
	COMPANY:
QUALITY CONTROL REPORT 1300.P55	PROJ. No.: REV. 0 SH. <u> 2 </u> OF <u> 2 </u>
	CONTRACTOR:

PRECOMMISSIONING – QUALITY CONTROL REPORT
PIPING
GROSS LEAK TEST RESULT SUMMARY

MC PACKAGE:	UNIT:	SYSTEM:
TEST CIRCUIT DESCRIPTION: _____ TEST PROCEDURE: _____		
TESTING FLUID:	<input type="checkbox"/> AIR <input type="checkbox"/> NITROGEN <input type="checkbox"/> WATER <input type="checkbox"/> OTHER _____	
TESTING CONDITION:	CIRCUIT NORMAL OPERATING PRESSURE _____ Kg/cm ² g LEAK TEST PRESSURE _____ Kg/cm ² g TEST DURATION _____ Hours PRESSURE DROP _____ Kg/cm ²	

NOTE:

INSPECTORS	CONTRACTOR	TECHNIP	OWNER
NAME			
SIGNATURE			
DATE			

 	PROJECT:		
	COMPANY:		
QUALITY CONTROL REPORT	1300.P56	PROJ. No.:	REV. 0 SH. _1_ OF _1_
		CONTRACTOR:	

PRECOMMISSIONING – QUALITY CONTROL REPORT
PIPING
BLINDS INSTALLATION

<i>MC PACKAGE:</i>		<i>UNIT:</i>		<i>SYSTEM:</i>					
TAG No.	LINE No.	P&ID No.	POSITION (O/C)	REMARKS	DATE	WITNESSING			
						CONTRACTOR	TECHNIP	OWNER	THIRD PARTY

NOTE:

INSPECTORS	CONTRACTOR	TECHNIP	OWNER
NAME			
SIGNATURE			
DATE			



 	PROJECT:		
	COMPANY:		
QUALITY CONTROL REPORT	1300.P57	PROJ. No.:	REV. 0 SH. _1_ OF _1_
		CONTRACTOR:	

PRECOMMISSIONING – QUALITY CONTROL REPORT
PIPING
LOCK OPEN /CLOSE //CAR SEALS INSTALLATION

MC PACKAGE:		UNIT:		SYSTEM:					
TAG No.	LINE No.	P&ID No.	POSITION (O/C)	REMARKS	DATE	WITNESSING			
						CONTRACTOR	TECHNIP	OWNER	THIRD PARTY

NOTE:

INSPECTORS	CONTRACTOR	TECHNIP	OWNER
NAME			
SIGNATURE			
DATE			



 	PROJECT :		
	COMPANY:		
QUALITY CONTROL REPORT	1300.P59	PROJ. No.:	REV. 0 SH. _1_ OF _1_
		CONTRACTOR:	

PRECOMMISSIONING – QUALITY CONTROL REPORT
PIPING
FLOW ELEMENTS AND RESTRICTION ORIFICES INSTALLATION

<i>MC PACKAGE:</i>			<i>UNIT:</i>		<i>SYSTEM:</i>			
TAG No.	LINE No.	P&ID No.	REMARKS	DATE	WITNESSING			
					CONTRACTOR	TECHNIP	OWNER	THIRD PARTY

NOTE:

INSPECTORS	CONTRACTOR	TECHNIP	OWNER
NAME			
SIGNATURE			
DATE			



 	PROJECT:		
	COMPANY:		
QUALITY CONTROL REPORT	1300.P60	PROJ. No.:	REV. 0 SH. _1_ OF _1_
		CONTRACTOR:	

PRECOMMISSIONING – QUALITY CONTROL REPORT
PIPING
PRESSURE SAFETY VALVES INSTALLATION

<i>MC PACKAGE:</i>		<i>UNIT:</i>		<i>SYSTEM:</i>			
TAG No.	P&ID No.	REMARKS	DATE	WITNESSING			
				CONTRACTOR	TECHNIP	OWNER	THIRD PARTY

NOTE:

INSPECTORS	CONTRACTOR	TECHNIP	OWNER
NAME			
SIGNATURE			
DATE			

 	PROJECT:		
	COMPANY:		
QUALITY CONTROL REPORT	1300.P62	PROJ. No.:	REV. 0 SH. _1_ OF _1_
		CONTRACTOR:	



PRECOMMISSIONING – QUALITY CONTROL REPORT
PIPING
BOLT TORQUING/TENSIONING CHECK REPORT

SYSTEM NUMBER:				FLANGED JOINT NUMBER:			
AREA:				TARGET TORQUE/TENSION VALUE (Nm):			
ISO No.:				LINE:			
Torque/Tension Tool Type:				Pump/Gauge Serial Number:			
Torque/Tension Tool Serial No's:				Pump Pressure Target (bar):			
Coverage (number of tensioners/number of bolts):							
Flange Material	YES	NO	Joint Size (inch)	YES	NO		
Bolt Material:	YES	NO	Joint Rating:	YES	NO		
Bolt Dia (inch):	YES	NO	Gasket Type:	YES	NO		
Bolt Qty:	YES	NO	Lubricated Bolt	YES	NO		
Torquing/Tensioning Values (Nm)							
<u>Torque/Tension</u> 30%	<u>Pump Pressure</u> applied (bar)	<u>Done</u>	<u>Torque/Tension</u> 60%	<u>Pump Pressure</u> applied (bar)	<u>Done</u>	<u>Torque/Tension</u> 100%	<u>Pump Pressure</u> applied (bar)
		<input type="checkbox"/>			<input type="checkbox"/>		<input type="checkbox"/>
Is the gasket outer ring visual check acceptable?			YES	NO			

NOTE:

ID No. Performer:

INSPECTORS	CONTRACTOR	TECHNIP	OWNER
NAME			
SIGNATURE			
DATE			

 	PROJECT:		
	COMPANY:		
QUALITY CONTROL REPORT	1300.C51	PROJ. No.:	REV. 0 SH. _1_ OF _2_
		CONTRACTOR:	

<p align="center">COMMISSIONING – QUALITY CONTROL REPORT</p> <p align="center"><i>PIPING</i></p> <p align="center">PURGING</p>

MC PACKAGE:		UNIT:		SYSTEM:			
LINE No.	P&ID No.	REMARKS	DATE	WITNESSING			
				CONTRACTOR	TECHNIP	OWNER	THIRD PARTY

NOTE:

INSPECTORS	CONTRACTOR	TECHNIP	OWNER
NAME			
SIGNATURE			
DATE			



PROJECT:

COMPANY:

QUALITY CONTROL REPORT

1300.C51

PROJ. No.: REV. 0 SH. _2_ OF _2_



CONTRACTOR:

COMMISSIONING – QUALITY CONTROL REPORT***PIPING*****PURGING RESULT SUMMARY**

MC PACKAGE:	UNIT:	SYSTEM:								
PURGED CIRCUIT DESCRIPTION: _____										
PURGING PROCEDURE: _____										
PURGING FLUID:	<input type="checkbox"/> STEAM <input type="checkbox"/> NITROGEN <input type="checkbox"/> OTHER									
PURGING CONDITION:	<input type="checkbox"/> PURGE OUT DURATION _____ Hours <input type="checkbox"/> CONTINUOUS PURGING DURATION _____ Hours <input type="checkbox"/> PRESSURE CYCLES No. ____ PRESSURE _____ Kg/cm ² g									
PURGING FINAL RESULT:										
SAMPLE POINT NUMBER										
RESIDUAL O₂ CONTENT (%)										

NOTE:

INSPECTORS	CONTRACTOR	TECHNIP	OWNER
NAME			
SIGNATURE			
DATE			



 	PROJECT:		
	COMPANY:		
QUALITY CONTROL REPORT	1300.C52	PROJ. No.:	REV. 0 SH. _1_ OF _2_
		CONTRACTOR:	

COMMISSIONING – QUALITY CONTROL REPORT
PIPING
TIGHTNESS TEST

MC PACKAGE:		UNIT:		SYSTEM:			
LINE No.	P&ID No.	REMARKS	DATE	WITNESSING			
				CONTRACTOR	TECHNIP	OWNER	THIRD PARTY

NOTE:

INSPECTORS	CONTRACTOR	TECHNIP	OWNER
NAME			
SIGNATURE			
DATE			



 	PROJECT:
	COMPANY:
QUALITY CONTROL REPORT	1300.C52
PROJ. No.: REV. 0 SH. <u>2</u> OF <u>2</u>	
CONTRACTOR:	

<p align="center">COMMISSIONING – QUALITY CONTROL REPORT</p> <p align="center"><i>PIPING</i></p> <p align="center">TIGHTNESS TEST RESULT SUMMARY</p>

MC PACKAGE:	UNIT:	SYSTEM:
TEST CIRCUIT DESCRIPTION: _____		
TEST PROCEDURE: _____		
TESTING FLUID:	<input type="checkbox"/> AIR <input type="checkbox"/> NITROGEN <input type="checkbox"/> WATER <input type="checkbox"/> OTHER _____	
TESTING CONDITION:	CIRCUIT NORMAL OPERATING PRESSURE _____ Kg/cm ² g TIGHTNESS TEST PRESSURE _____ Kg/cm ² g TEST DURATION _____ Hours PRESSURE DROP _____ Kg/cm ²	

NOTE:

INSPECTORS	CONTRACTOR	TECHNIP	OWNER
NAME			
SIGNATURE			
DATE			



 	PROJECT:
	COMPANY:
QUALITY CONTROL REPORT 1300.C53	PROJ. No.: REV. 0 SH. _1_ OF _1_
	CONTRACTOR:

<p align="center"> COMMISSIONING – QUALITY CONTROL REPORT PIPING SPRING SUPPORTS HOT SETTING </p>
--

MC PACKAGE:		UNIT:		SYSTEM:					
TAG No.	LINE No.	P&ID No.	HOT SET OK (Y/N)	REMARKS	DATE	WITNESSING			
						CONTRACTOR	TECHNIP	OWNER	THIRD PARTY

NOTE:

INSPECTORS	CONTRACTOR	TECHNIP	OWNER
NAME			
SIGNATURE			
DATE			

 	PROJECT:
	COMPANY:
QUALITY CONTROL REPORT W 12	PROJ. No.: REV. 0 SH. _1_ OF _1_
	CONTRACTOR:

INSPECTION REPORT			
1. PURPOSE OF INSPECTION _____			
QCP _____	CHECK STEP _____	AREA _____	
2. ITEM IDENTIFICATION	_____	_____	_____
	_____	_____	_____
	_____	_____	_____
	_____	_____	_____
3. TYPE OF INSPECTION _____	TEST EXAMINATION CHECK		
4. INSPECTION RESULT: CONFORMING			
NOT CONFORMING			
WITH REMARKS			

INSPECTORS	CONTRACTOR	TECHNIP	OWNER
NAME			
SIGNATURE			
DATE			

 TechnipFMC 	PROJECT		Standby SRU & Additional Tanks	
	CLIENT		IOCL Paradip Refinery	
QCP-PIPING PREFABRICATION	Project No. 080557C001	Document No. 080557C-000-QCP-1310-001	Rev. No. A	Page 1 of 4

QUALITY CONTROL PLAN

PIPING PREFABRICATION

TYPE OF QUALITY CONTROL REPORT	CERTIFICATION EXTENT
W 12/A	SINGLE REPORT PER EACH MATERIAL
W 31A – W 31B – QC 13	SUMMARY
QC 15	SINGLE REPORT PER EACH SHIPPING RELEASE
W 10 – W 50	SINGLE REPORT PER EACH ISOMETRIC
W 01 – W 02 – W03 – W04 – W 24 – QC 21	SINGLE REPORT PER EACH EXAMINATION




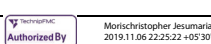
REFERENCE DOCUMENTS:

- 080557C-PP-805 Site Coordination & Communication Procedure.
- 080557C-PP-814 Welding Specification for Fabrication of Piping
- 080557C-PP-807 Material Receiving, Handling & Storage procedure
- 080557C-PP-804 Positive Material Identification at Site

- QCP 1399.02 Piping Welding Activities Management (NDE / PWHT / HT / PMI Included)
- QCP 1399.01 Welders Management
- 080557C-000-JSC-1300-001 Standard Specification for Fabrication and Erection of Piping
- 080557C-000-JSD-2300-001 Specification for Painting



- 080557C-000-JSD-2200-001 Job Specification for Hot Insulation of Vessels, Piping and Equipment
- 080557C-000-JSD-2200-002 Job Specification for Cold Insulation of Vessels, Piping and Equipment
- 080557C-PP-820 Standard specification for inspection, flushing and testing of piping systems.
- 080557C-PP-821 Equipment Construction specification for Welder Management

- Drawings

						
A	21.10.2019	ISSUED FOR INFORMATION	SMP	PKP	LA/ANJ	JMC
REV	DATE	DESCRIPTION	PREPARED	CHECKED	APPROVED	AUTHORIZED



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 		PROJECT	Standby SRU & Additional Tanks	
		CLIENT	IOCL Paradip Refinery	
QCP-PIPING PREFABRICATION		Project No. 080557C001	Document No. 080557C-000-QCP-1310-001	Rev. No. A
				Page 2 of 4

LEGENDA

H	=	HOLD (RFI required - Work stop for inspection)
W	=	WITNESS (RFI required)
WC	=	100 % SUPERVISION AND EXAMINATION BY CONTRACTOR.
S	=	SURVEILLANCE (No RFI)
R	=	REVIEW OF REPORTS
N.A.	=	NOT APPLICABLE
A	=	AUTHORIZATION / APPROVAL
IFA	=	ISSUED FOR AUTHORIZATION/APPROVAL
INFO	=	FOR INFORMATION
RFI	=	REQUEST FOR INSPECTION
!	=	WARNING (control of document revision status)

 	PROJECT		Standby SRU & Additional Tanks		
	CLIENT		IOCL Paradip Refinery		
QCP-PIPING PREFABRICATION	Project No. 080557C001	Document No. 080557C-000-QCP-1310-001		Rev. No. A	Page 3 of 4

S.No.	CHECK AND INSPECTION ITEM	QUALITY CONTROL REPORT	ACTION		NOTES
			CONTR.	TECHNIP	
A)	PRELIMINARY ACTIVITIES				
A.1	CONTRACTOR DRAWINGS CHECK REVISION STATUS	N.A.	!	!	
A.2	CONTRACTOR TECHNICAL SPECIFICATION AND PROCEDURE	N.A.	!	!	
B)	BEFORE PREFABRICATION				
B.1	INCOMING MATERIAL		WC	W/S	
B.2	SHOP APPROVAL	N.A.	WC	R	
B.3	WELDERS MANAGEMENT	Use QCP 1399.01			(2)
B.4	WELDING, NDT/ PMI/PWHT/HT MANAGEMENT	Use QCP 1399.02			(2)
B.5	MATERIALS APPROVAL	W 12/A	WC	A	(1)
B.6	ISOMETRIC SPOOLING	W 50	WC	R	
B.7	MATERIAL RELEASED AND CONSERVATION STATUS	W 50	WC	W/R	
C)	PREFABRICATION				
C.1	PIPES SECTIONING & MATERIAL MARKING / STAMP TRANSFERING	W 50	WC	S	
C.2	ASSEMBLY & TACK WELDS(FIT UP)	W 50	WC	S	
C.3	WELDING	W 10 – W 50	WC	S	
C.4	GRINDING OF ORIFICE FLANGES ROOT WELDS	W 31A – W 50	WC	S	
C.5	PNEUMATIC TEST FOR REINFORCING PADS	W 31B – W 50	WC	W	
C.6	MATERIAL TRACEABILITY	W 10 – W 50	WC	R	
C.7	DIMENSIONAL CHECK	QC 13 – W 50	WC	R/S	
C.8	NDE / PMI / PWHT / HT EXECUTION & TRACEABILITY				
C.8.1	WELDING DAILY PROGRESS & VISUAL EXAMINATION	W24 - W50	WC	R	
C.8.2	PMI EXECUTION (where required)	QC21 - W50	WC	W/R	
C.8.3	PWHT CHART RECORDS (where required)	W 50	WC	R	

 	PROJECT		Standby SRU & Additional Tanks	
	CLIENT		IOCL Paradip Refinery	
QCP-PIPING PREFABRICATION	Project No. 080557C001	Document No. 080557C-000-QCP-1310-001	Rev. No. A	Page 4 of 4



S.No.	CHECK AND INSPECTION ITEM	QUALITY CONTROL REPORT	ACTION		NOTES
			CONTR.	TECHNIP	
C.8.4	HARDNESS TEST EXECUT. (where required)	W 50	WC	W/R	
C.8.5	LIQUID PENETRANT EXAM. (where required)	W03 - W50	WC	W/R	
C.8.6	MAGNETIC PARTIC. EXAM. (where required)	W04 - W50	WC	W/R	
C.8.7	RAD. EXAM. FILM REVIEW (where required)	W01 - W50	WC	R	
C.8.8	ULTRASONIC EXAM. (where required)	W02 - W50	WC	W	
C.8.9	NDE / PMI / PWHT / HT TRACEABILITY	W 10 - W 50	WC	R	
C.9	SHOTBLAST & PAINTING (IF REQUESTED TO PIPING PREFABRICATOR ONLY)				(2)
C.10	SPOOLS IDENTIFICATION AND SHIPPING RELEASE	QC 15 - W 50	WC	R/S	
C.11	FINAL DOCUMENTATION REVIEW	W 50			



NOTES: (1) A COPY OF THE DOCUMENT WILL BE DELIVERED TO COMPANY FOR INFORMATION.

(2) FORMS, INSPECTIONS AND ATTENDANCE SHALL BE IN ACCORDANCE WITH REFERRED QCP.

GENERAL NOTES

- THE ENCLOSED ITP'S ARE INDICATIVE AND SHALL BE FOLLOWED FOR DEVELOPING THE JOB SPECIFIC ITP'S FOR THE WORKS TO BE PERFORMED BY THE CONTRACTOR. THE PROVISIONS INDICATED FOR STAGE WISE INSPECTION BY TECHNIP AND OWNER (FOR SPECIFIC ACTIVITIES) ARE THE MINIMUM AND THE ENGINEER-IN-CHARGE MAY DECIDE TO INCREASE HOLD POINTS/ WITNESS POINTS, WHILE APPROVING THE JOB SPECIFIC ITP'S. ACTIVITIES FOR WHICH ITP'S ARE NOT PROVIDED IN THIS SPECIFICATION. CONTRACTOR TO DEVELOP AND GET THE SAME APPROVED BY TECHNIP/OWNER BEFORE START OF THE WORK. IN GENERAL ROLE OF TECHNIP HAS BEEN SPECIFIED IN THE DOCUMENT THE ROLE OF OWNER TO BE SPECIFIED DURING PREPARATION OF SITE SPECIFIC ITP'S.
- CONTRACTOR TO SUBMIT JOB SPECIFIC REPORTING FORMATS AND JOB PROCEDURES FOR THE JOBS FOR EACH ACTIVITY LISTED IN THE ITP'S AND SUBMIT TO TECHNIP/OWNER FOR APPROVAL. BEFORE COMMENCEMENT OF THE ACTIVITY. IF THE CONTRACTOR HAS TO DEVIATE FROM THE GIVEN ITP FOR A VALID REASON, HE SHALL OBTAIN PRIOR WRITTEN APPROVAL OF TECHNIP/OWNER. CONTRACTOR TO CARRY OUT 100% EXAMINATION OF ALL ACTIVITIES.

 					PROJECT:					
					COMPANY:					
QUALITY CONTROL FORM QC 13					PROJ. No.:		QCF REV. A		SH. ___ OF ___	
PREFABRICATION DIMENSIONAL CHECK REPORT					CONTRACTOR:				QC 13 N° _____	
N°	REFERENCE DRAWING				SPOOL		DIMENSIONAL CHECK		NOTES	
	ISOMETRIC	SH.	REV.	AREA	N°	TOTAL N° x ISO	ACCEP.	EXTRA LENGTH (Y / N)		
1										
2										
3										
4										
5										
6										
7										
8										
9										
10										
11										
12										
13										
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15										
16										
17										
18										
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21										
22										
23										
24										
25										
26										
27										
28										
REMARKS:										
INSPECTORS		CONTRACTOR			PMC			OWNER		
NAME										
SIGNATURE										
DATE										

 					PROJECT:				
					COMPANY:				
QUALITY CONTROL FORM QC 15					PROJ. No.:		QCF REV. A		SH. ___ OF ___
SPOOLS SHIPPING RELEASE					CONTRACTOR:				QC 15 N° ____
N°	REFERENCE DRAWING				SPOOLS EXPEDITING DATA				NOTES
	ISOMETRIC	SH	REV.	AREA	TO BE SHIPPED NR. (1)	MISSING NR. (2)	COMPLETE SHIPMENT	PARTIAL SHIPMENT	
1									
2									
3									
4									
5									
6									
7									
8									
9									
10									
11									
12									
13									
14									
15									
16									
17									
18									
19									
20									
21									
SHIPPING: AUTHORIZED <input type="checkbox"/>					REMARKS:				
NOTE (1) = IDENTIFIED SPOOLS TO BE SHIPPED NOTE (2) = IDENTIFIED MISSING SPOOLS									
INSPECTORS		CONTRACTOR			PMC			OWNER	
NAME									
SIGNATURE									
DATE									



PROJECT:

COMPANY:

QUALITY CONTROL FORM

QC 21

PROJ. No.:

QCF REV. A

SH. 2 OF

POSITIVE MATERIAL IDENTIFICATION REPORT

CONTRACTOR:

QC 21 N° _____

[illegible]

TEST RESULT:

ACCEPTABLE

□

NOT ACCEPTABLE

☐

REMARKS:

INSPECTORS

CONTRACTOR



PMC

OWNER

NAME _____

SIGNATURE

DATE _____



 		PROJECT:		
		COMPANY:		
QUALITY CONTROL FORM (NDE-01) W 01		PROJ. No.:	QCF REV. A	SH. 1 OF 2
RADIOGRAPHIC TEST REPORT (REQUIREMENTS)		CONTRACTOR:		W 01 N° _____
APPLICABLE CODES/SPEC'S • ASME V ART 2 <input type="checkbox"/> • <input type="checkbox"/>		ACCEPTANCE CRITERIA • <input type="checkbox"/> • <input type="checkbox"/>		
FIELD OF APPLICATION		MATERIAL	SURFACE FINISH	
• PIPING <input type="checkbox"/> • TANKS/ SILOS <input type="checkbox"/> • EQUIPMENT <input type="checkbox"/>		• WELDING <input type="checkbox"/> • RAW MATERIAL <input type="checkbox"/> • <input type="checkbox"/>	• C.S/LOW ALLOY <input type="checkbox"/> • S.S/NI ALLOY <input type="checkbox"/> • TI <input type="checkbox"/>	
• BEFORE PWHT <input type="checkbox"/> • AFTER PWHT <input type="checkbox"/> • AFTER HYDR. TEST <input type="checkbox"/>				
SOURCE		FILMS	PENETRAMEters	
• X-RAY <input type="checkbox"/> • γ-RAY: • Ir 192 <input type="checkbox"/> • Co. 60 <input type="checkbox"/>		• TYPE _____ • BRAND _____ • 10 X 48 <input type="checkbox"/> 10 X 24 <input type="checkbox"/> • SINGLE <input type="checkbox"/> • DOUBLE <input type="checkbox"/>	• DIN <input type="checkbox"/> • ASME <input type="checkbox"/> • TYPE _____ • QUANTITY _____ • SOURCE SIDE <input type="checkbox"/> • FILM SIDE <input type="checkbox"/>	
• TYPE _____ • BRAND _____ • SINGLE SPOT <input type="checkbox"/> • 360° EMISSION <input type="checkbox"/> KV _____				
SENSITIVITY		DENSITY	UNSHARPNESS	PARAMETERS
• DIN _____ % • ASME _____ • SINGLE WALL <input type="checkbox"/> • DOUBLE WALL <input type="checkbox"/>		• REQUIRED _____ • RANGE _____ • SINGLE FILM <input type="checkbox"/> • DOUBLE FILM <input type="checkbox"/>	• GEOM UNSHARP _____ MAX • FOCAL SPOT _____ • MINIMUM FOCUS/ FILM DIST.	VOLTAGE _____KV MIN.EXPOSURE _____ MAX MIN DEVELOP TIME _____MIN DEVELOP TEMP _____ °C
EXPOSURE ARRANGMENT		TECHNIQUE	REMARKS:	
• SOURCE INSIDE <input type="checkbox"/> OUTSIDE <input type="checkbox"/> • FILM INSIDE <input type="checkbox"/> OUTSIDE <input type="checkbox"/>		• WALL SINGLE <input type="checkbox"/> DOUBLE <input type="checkbox"/> • IMAGE SINGLE <input type="checkbox"/> DOUBLE <input type="checkbox"/>		
INSPECTORS		CONTRACTOR	PMC	OWNER
NAME				
SIGNATURE				
DATE				





COMPANY:

CM = CUT TO MODIFY

[illegible]

 		PROJECT:	
		COMPANY:	
QUALITY CONTROL FORM (NDE-02) W 02		PROJ. No.:	QCF REV. A
ULTRASONIC TEST REPORT		CONTRACTOR:	W 02 N° _____
APPLICABLE CODES/SPEC'S • ASME V ART 4 <input type="checkbox"/> • <input type="checkbox"/>		ACCEPTANCE CRITERIA • <input type="checkbox"/> • <input type="checkbox"/>	
FIELD OF APPLICATION			
• PIPING <input type="checkbox"/> • TANKS/ SILOS <input type="checkbox"/> • EQUIPMENT <input type="checkbox"/>	• BEVEL <input type="checkbox"/> • 1 ST PASS <input type="checkbox"/> • BACK GOUGING <input type="checkbox"/>	• FINAL PASS <input type="checkbox"/> • OVERLAY <input type="checkbox"/> • RAW MATERIAL <input type="checkbox"/>	• <input type="checkbox"/> • <input type="checkbox"/> • <input type="checkbox"/>
MATERIAL		INSPECTION STAGE	
• C.S. <input type="checkbox"/> • TI <input type="checkbox"/> • S.S. <input type="checkbox"/>	• LOW ALLOY <input type="checkbox"/> • HASTELLOY <input type="checkbox"/> • <input type="checkbox"/>	• BEFORE PWHT <input type="checkbox"/> • AFTER PWHT <input type="checkbox"/> • AFTER HYD. TEST <input type="checkbox"/>	• <input type="checkbox"/> • <input type="checkbox"/> • <input type="checkbox"/>
SURFACE CONDITION			
• AS WELDED <input type="checkbox"/> • AS GROUND <input type="checkbox"/> • AS ROLLED <input type="checkbox"/> • AS CAST <input type="checkbox"/>	• BRUSHED <input type="checkbox"/> • AS FORGED <input type="checkbox"/> • AS MACHINED <input type="checkbox"/> • AS BENT <input type="checkbox"/>	• <input type="checkbox"/> • <input type="checkbox"/> • <input type="checkbox"/> • <input type="checkbox"/>	TEMPERATURE _____ STEP _____
INSPECTION METHOD			
• STRAIGHT BEAM <input type="checkbox"/> • ANGLE BEAM SEARCH UNIT <input type="checkbox"/> • SINGLE TRANSDUCER <input type="checkbox"/> • LONGITUDINAL WAVES <input type="checkbox"/>	• TRANSVERSE WAVES <input type="checkbox"/> • TANDEM METHOD <input type="checkbox"/> • SEARCH UNIT (TR) DUAL TRANSDUCER <input type="checkbox"/> • <input type="checkbox"/>	• BACK REFLECTION mm _____ <input type="checkbox"/> • SIDE DRILLED HOLE mm _____ Ø mm _____ <input type="checkbox"/> • FLAT BOTTOM HOLE mm _____ Ø mm _____ <input type="checkbox"/> • <input type="checkbox"/>	
COUPLANT			
• OIL <input type="checkbox"/>	• TYLOSE PASTE <input type="checkbox"/>	• WATER <input type="checkbox"/>	
REF. CALIBRATION EQUIPMENT BLOCKS METHOD		SCANNING DIRECTION & RESULTS	
INSPECTORS	CONTRACTOR	PMC	OWNER
NAME			
SIGNATURE			
DATE			

 		PROJECT:		
		COMPANY:		
QUALITY CONTROL FORM (NDE-03) W 03		PROJ. No.:	QCF REV. A	SH. 1 OF 2
LIQUID PENETRANT TEST REPORT (REQUIREMENTS)		CONTRACTOR:		W 03 N° _____
APPLICABLE CODES/SPEC'S • ASME V ART 6 <input type="checkbox"/> • <input type="checkbox"/>		ACCEPTANCE CRITERIA • <input type="checkbox"/> • <input type="checkbox"/>		
FIELD OF APPLICATION				
• PIPING <input type="checkbox"/> • TANKS/ SILOS <input type="checkbox"/> • EQUIPMENT <input type="checkbox"/>	• BEVEL <input type="checkbox"/> • 1 ST PASS <input type="checkbox"/> • BACK GOUGING <input type="checkbox"/>	• FINAL PASS <input type="checkbox"/> • OVERLAY <input type="checkbox"/> • RAW MATERIAL <input type="checkbox"/>	• <input type="checkbox"/> • <input type="checkbox"/> • <input type="checkbox"/>	
MATERIAL		INSPECTION STAGE		
• C.S. <input type="checkbox"/> • TI <input type="checkbox"/> • S.S. <input type="checkbox"/>	• LOW ALLOY <input type="checkbox"/> • HASTELLOY <input type="checkbox"/> • <input type="checkbox"/>	• BEFORE PWHT <input type="checkbox"/> • AFTER PWHT <input type="checkbox"/> • AFTER HYD. TEST <input type="checkbox"/>	• <input type="checkbox"/> • <input type="checkbox"/> • <input type="checkbox"/>	
INSPECTION METHOD				
TYPE	PENETRANT	DEVELOPPER	LIGHTING	
• COLOUR CONTRAST <input type="checkbox"/> • FLUORESCENT <input type="checkbox"/>	• WATER WASHABLE <input type="checkbox"/> • POST EMUL. <input type="checkbox"/> • SOLVENT <input type="checkbox"/> • TYPE <input type="checkbox"/> • BRAND _____	• DRY <input type="checkbox"/> • WET <input type="checkbox"/> • BRAND _____	NATURAL <input type="checkbox"/> ARTIFICIAL <input type="checkbox"/> ULTRAVIOLET <input type="checkbox"/>	
PRECLEANING	REMOVABLE	CLEANER	TIME	
• GRINDING <input type="checkbox"/> • MACHINING <input type="checkbox"/> • SOLVENT <input type="checkbox"/>	• BRUSH <input type="checkbox"/> • SPRAY. <input type="checkbox"/>	• TYPE <input type="checkbox"/> • CLOTHS <input type="checkbox"/> • BRUSHY <input type="checkbox"/>	PENETRATION _____ DEVELOPPING _____ MAX READING _____	
PRECLEANING	REMOVABLE			
• WATER <input type="checkbox"/> • ALCOHOL <input type="checkbox"/>	• DIPPING <input type="checkbox"/> • SPRAY. <input type="checkbox"/>	• SPRAY <input type="checkbox"/> • BRAND _____		
INSPECTORS	CONTRACTOR	PMC	OWNER	
NAME				
SIGNATURE				
DATE				



COMPANY:

SH. 2 OF 2

W 03 N° _____

☐ POST EMULSIFYING

☐

[illegible]

		PROJECT:	
		COMPANY:	
QUALITY CONTROL FORM (NDE-04) W 04		PROJ. No.:	QCF REV. A
MAGNETIC PARTICLE TEST REPORT		CONTRACTOR:	W 04 N° _____
APPLICABLE CODES/SPEC'S • ASME V ART 7 <input type="checkbox"/> • OTHER <input type="checkbox"/>		ACCEPTANCE CRITERIA • <input type="checkbox"/> • <input type="checkbox"/>	
FIELD OF APPLICATION			
• PIPING <input type="checkbox"/> • TANKS/SILOS <input type="checkbox"/> • EQUIPMENT <input type="checkbox"/>	• BEVEL <input type="checkbox"/> • 1ST PASS <input type="checkbox"/> • BACK GOUGING <input type="checkbox"/>	• FINAL PASS <input type="checkbox"/> • OVERLAY <input type="checkbox"/> • RAW MATERIAL <input type="checkbox"/>	• <input type="checkbox"/> • <input type="checkbox"/> • <input type="checkbox"/>
MATERIAL		INSPECTION STAGE	
• C.S. <input type="checkbox"/> • <input type="checkbox"/> • <input type="checkbox"/>	• LOW ALLOY <input type="checkbox"/> • <input type="checkbox"/> • <input type="checkbox"/>	• BEFORE PWHT <input type="checkbox"/> • AFTER PWHT <input type="checkbox"/> • AFTER HYD. TEST <input type="checkbox"/>	• <input type="checkbox"/> • <input type="checkbox"/> • <input type="checkbox"/>
INSPECTION METHOD			
MAGNETIZATION	PARTICLE	COLOUR	SUSPENSION
• PRODS CONTACTS Cu <input type="checkbox"/> Sb <input type="checkbox"/> MAX DIST. _____	• DRY <input type="checkbox"/> • WET <input type="checkbox"/> • BRAND _____	• GRAY <input type="checkbox"/> • FLUORESCENT <input type="checkbox"/> • <input type="checkbox"/>	• OIL <input type="checkbox"/> • WATER <input type="checkbox"/>
	CURRENT TYPE	LIGHTING	METHOD
• YOKE FIXED LEGS <input type="checkbox"/> ARTICULAT.LEGS <input type="checkbox"/> MAX DIST. _____	• HALF WAVE RECTIFIED <input type="checkbox"/> • ALTERNATING <input type="checkbox"/>	• NATURAL <input type="checkbox"/> • ARTIFICIAL <input type="checkbox"/> • ULTRAVIOLET <input type="checkbox"/>	• CONTINUOUS <input type="checkbox"/> • RESIDUAL <input type="checkbox"/> • PULSES <input type="checkbox"/>
	AMPERAGE FIELD	DEMAGNETIZATION	PRECLEANING
• COIL <input type="checkbox"/> BRAND _____	AMP _____ FIELD _____	YES <input type="checkbox"/> NO <input type="checkbox"/> RESIDUAL	• BRUSHING <input type="checkbox"/> • <input type="checkbox"/>
REMARKS:			
INSPECTORS	CONTRACTOR	PMC	OWNER
NAME			
SIGNATURE			
DATE			



PROJECT:

COMPANY:

QUALITY CONTROL FORM (NDE-04)

W 04

PROJ. No.:

QCF REV. A

SH. 2 OF 2

MAGNETIC PARTICLE TEST REPORT

CONTRACTOR:

W 04 N° _____

9

PRODS

1

☐ POWDER

1

DRY

1

WET

1

FLUORESCENT

[illegible]



COMPANY:

W 10



SH. OF

W 10 N° (SEE ISO N°)

PMI Y ☐ N ☐

(1) **B** = BUTTWELD; **S** = SOCKET WELD; **EW** = EXTERNAL WELD
(2) **P** = PREBRICATION; **E** = ERECTION
(3) **A** = ACCEPTED; **R** = TO BE REPAIRED; **C** = TO BE CUT; **CM** = CUT TO MODIFY

[illegible]

 		PROJECT:	
		COMPANY:	
QUALITY CONTROL FORM W 12/A		PROJ. No.:	QCF REV. A
CONSTRUCTION MATERIALS APPROVAL		CONTRACTOR:	SH. ____ OF ____
		W 12/A N° ____	
CIVIL <input type="checkbox"/>	PIPING <input type="checkbox"/>	MACHINERY <input type="checkbox"/>	INSULATION <input type="checkbox"/>
BLDG. <input type="checkbox"/>	MECHANIC. <input type="checkbox"/>	ELECTRICAL <input type="checkbox"/>	STEEL STR. <input type="checkbox"/>
NDT <input type="checkbox"/>	SUPPORT PRF. <input type="checkbox"/>	_____ <input type="checkbox"/>	_____ <input type="checkbox"/>
1. MATERIALS			
2. SUPPLIER			
3. PURPOSE			
4. ATTACHMENT DATA			
5. TYPE OF TEST PERFORMED			
6. TEST STANDARD UTILIZED			
REMARKS:			
RESULT:		ACCEPTED <input type="checkbox"/>	NOT ACCEPTED <input type="checkbox"/>
INSPECTORS	CONTRACTOR	PMC	OWNER
NAME			
SIGNATURE			
DATE			



COMPANY:

PROJ. No.:	QCF REV. A	SH. ____ OF ____
------------	------------	------------------

CONTRACTOR: **W 24 N°** _____

[illegible]

<i>INSPECTORS</i>	<i>CONTRACTOR</i>	<i>PMC</i>	<i>OWNER</i>
NAME			
SIGNATURE			
DATE			



COMPANY:

W 31A

SH. OF

W 31A N° _____

REFERENCE

REV.

ORIFICE FLANGES IDENTIFICATION



NOTES

☐

REMARKS:

OWNER

DATE _____

 		PROJECT:		
		COMPANY:		
QUALITY CONTROL FORM W 31B		PROJ. No.:	QCF REV. A	
REINFORCING PADS PNEUMATIC TEST REPORT		CONTRACTOR:	SH. ____ OF ____ W 31B N° ____	
<p align="center">REINFORCING PADS – PNEUMATIC TEST</p> <p>TEST MEDIUM _____ TEST PRESSURE _____ barg</p>				
REFERENCE			REINFORCING PAD IDENTIFICATION	NOTES
LINE / ISO N°	SH.	REV.		
TEST RESULT: ACCEPTED <input type="checkbox"/>				
REMARKS:				
INSPECTORS	CONTRACTOR	PMC	OWNER	
NAME				
SIGNATURE				
DATE				




		PROJECT:					
		COMPANY:					
QUALITY CONTROL FORM W 50		PROJ. No.:	QCF REV. A	SH. ____ OF ____			
PIPING PREFABRICATION SUMMARY REPORT		CONTRACTOR:		W 50 N° ____			
ISOMETRIC/DRAWING N° _____ SH. ____ OF ____ REV. _____ AREA _____ SYSTEM _____							
INSPECTIONS (REF. TO QCP 1310.01)		N.A.	ACC.	REMARKS/ REFERENCES	INSPECTORS SIGNATURE & DATE		
					CONTR.	TECHNIP	OWNER
B.6	ISOMETRIC SPOOLING	<input type="checkbox"/>	<input type="checkbox"/>				
B.7	MATERIAL RELEASED AND CONSERVATION STATUS	<input type="checkbox"/>	<input type="checkbox"/>				
C.1	PIPES SECTIONING & MATERIAL MARKING / STAMP TRANSFERING	<input type="checkbox"/>	<input type="checkbox"/>				
C.2	ASSEMBLY & TACK WELDS	<input type="checkbox"/>	<input type="checkbox"/>				
C.3	WELDING	<input type="checkbox"/>	<input type="checkbox"/>	W 10 (*)			
C.4	GRINDING OF ORIFICE FLANGES ROOT WELD	<input type="checkbox"/>	<input type="checkbox"/>	W 31A (**)			
C.5	PNEUMATIC TEST FOR REINFORCING PADS	<input type="checkbox"/>	<input type="checkbox"/>	W 31B (**)			
C.6	MATERIAL TRACEABILITY	<input type="checkbox"/>	<input type="checkbox"/>	W 10 (*)			
C.7	DIMENSIONAL CHECK	<input type="checkbox"/>	<input type="checkbox"/>	QC 13 (**)			
C.8.1	WELDING DAILY PROGRESS & VISUAL EXAMINATION	<input type="checkbox"/>	<input type="checkbox"/>	W 24 (**)			
C.8.2	PMI EXECUTION	<input type="checkbox"/>	<input type="checkbox"/>	QC 21 (**)			
C.8.3	PWHT CHART RECORDS	<input type="checkbox"/>	<input type="checkbox"/>	Subcontractor Report (**)			
C.8.4	HARDNESS TEST EXECUTION	<input type="checkbox"/>	<input type="checkbox"/>	Subcontractor Report (**)			
C.8.5	LIQUID PENETRANT EXAMINATION	<input type="checkbox"/>	<input type="checkbox"/>	W 03 (**)			
C.8.6	MAGNETIC PARTICLE EXAMINATION	<input type="checkbox"/>	<input type="checkbox"/>	W 04 (**)			
C.8.7	RADIOGRAPHIC EXAM. FILM REVIEW	<input type="checkbox"/>	<input type="checkbox"/>	W 01 (**)			
C.8.8	ULTRASONIC EXAMINATION	<input type="checkbox"/>	<input type="checkbox"/>	W 02 (**)			
C.8.9	NDE / PMI / PWHT / HT TRACEABILITY	<input type="checkbox"/>	<input type="checkbox"/>	W 10 (*)			
C.10	SPOOLS IDENTIFICATION AND SHIPPING RELEASE	<input type="checkbox"/>	<input type="checkbox"/>	QC 15 (**)			
NOTES: (*) W 10 HAS THE SAME N° OF THE ISOMETRIC (**) THE QC REPORTS N° SHALL BE INDICATED IN THE RELEVANT HERE BELOW SPACES : W31A N° ____ W31B N° ____ QC13 N° ____ W24 N° ____ QC21 N° ____ W03 N° ____ W04 N° ____ W01 N° ____ W02 N° ____ QC15 N° ____ PWHT Subcontractor Report N° ____ HT Subcontractor Report N° ____							
C.11) FINAL DOC. REVIEW	INSPECTORS	CONTRACTOR		PMC	OWNER		
	NAME						
	SIGNATURE						
	DATE						

 	PROJECT	Standby SRU & Additional Tanks IOCL Paradip Refinery		
	CLIENT	INDIAN OIL CORPORATION LIMITED		
QCP-PIPING ERECTION (ABOVE & UNDERGROUND)	Project No. 080557C001	Document No. 080557C-000-QCP-1320-001	Rev. No. A	Page 1 of 6
QUALITY CONTROL PLAN PIPING ERECTION (ABOVE & UNDERGROUND)				

TYPE OF QUALITY CONTROL REPORT	CERTIFICATION EXTENT
W 12/A	SINGLE REPORT PER EACH MATERIAL
W 10 - W 16 - W 51AG – W 51UG – V 01 - VE 01	SINGLE REPORT PER EACH ISOMETRIC
W 13 – MC 01 - W 14B - IC 01 - W 51T – LU 01 – PL 10	SINGLE REPORT PER EACH TESTING CIRCUIT
W 31B - W 31C - W 18 – RT 01 – BT 01 – BCS 01 – SS 01	SUMMARY
W 01 – W02 - W03 – W04 – W 24 – QC 21 – BTC 01	SINGLE REPORT PER EACH EXAMINATION



REFERENCE DOCUMENTS:

- 080557C-000-PP-805
 - 080557C-000-PP-807
 - 080557C-000-PP-804
 -
 - QCP 1399.02
 - 080557C-000-JSC-1300-001
 - 080557C-000-JSD-2300-001
 - 080557C-000-JSD-2200-001
 - 080557C-000-JSD-2200-002
 - 0805579C-000-PP-820
 - DRAWINGS
- Site Coordination & Communication Procedure.
Material Receiving, Handling & Storage procedure
Specification for Positive Material Identification at Construcion site
- Piping Welding Activities Management (NDE / PWHT / HT / PMI Included)
Standard Specification for Fabrication and Erection of Piping
Specification for Surface Preparation and Protective Coating
Job Specification for Hot Insulation of Vessels, Piping and Equipment
Job Specification for Cold Insulation of Vessels, Piping and Equipment
Standard specification for inspection, flushing and testing of piping systems.

				 Digitally signed by Samir Paul 2019.10.21 17:58:57 +05'30'	 Digitally signed by Atkappan I 2019.11.06 16:56:24 +05'30'	 Digitally signed by Morischristopher Jesumarian 2019.11.06 22:25:51 +05'30'
A	19/10/2019	ISSUED FOR INFROMATION	SMP	PKP	LA/ANJ	JMC
REV.	DATE	DESCRIPTION	PREPARED	CHECKED	APPROVED	AUTHORIZED



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 	PROJECT	Standby SRU & Additional Tanks IOCL Paradip Refinery		
	CLIENT	INDIAN OIL CORPORATION LIMITED		
QCP-PIPING ERECTION (ABOVE & UNDERGROUND)	Project No. 080557C001	Document No. 080557C-000-QCP-1320-001	Rev. No. A	Page 2 of 6

LEGENDA

H	=	HOLD (RFI required - Work stop for inspection)
W	=	WITNESS (RFI required)
WC	=	100 % SUPERVISION AND EXAMINATION BY CONTRACTOR.
S	=	SURVEILLANCE (No RFI)
P	=	PREPARATION
R	=	REVIEW OF REPORTS
N.A.	=	NOT APPLICABLE
A	=	AUTHORIZATION / APPROVAL
IFA	=	ISSUED FOR AUTHORIZATION/APPROVAL
INFO	=	FOR INFORMATION
RFI	=	REQUEST FOR INSPECTION
!	=	WARNING (control of document revision status)

			PROJECT	Standby SRU & Additional Tanks IOCL Paradip Refinery	
			CLIENT	INDIAN OIL CORPORATION LIMITED	
QCP-PIPING ERECTION (ABOVE & UNDERGROUND)	Project No. 080557C001	Document No. 080557C-000-QCP-1320-001		Rev. No. A	Page 3 of 6



S.NO	CHECK AND INSPECTION ITEM	QUALITY CONTROL REPORT	ACTION		NOTES
			CONTR.	TECHNIP	
A)	PRELIMINARY ACTIVITIES				
A.1	CONTRACTOR DRAWINGS CHECK REVISION STATUS	N.A.	!	!	
A.2	CONTRACTOR TECHNICAL SPECIFICATION AND PROCEDURE	N.A.	!	!	
A.3	CONTRACTOR METHOD STATEMENTS (IF REQUIRED)	N.A.	P	R	
B)	BEFORE ERECTION				
B.1	WELDERS MANAGEMENT	Use QCP 1399.01			(2)
B.2	WELDING, NDE/PMI/PWHT/HT MANAGEMENT	Use QCP 1399.02			(2)
B.3	MATERIALS APPROVAL	W 12/A	WC	R	(1) (3)
C)	EXCAVATION & BACKFILLING (FOR UNDERGROUND PIPING)	QCP 1440.01 (Civil Work)			(2)
D)	ERECTION (PER ISO)				
D.1	PREASSEMBLY	W 10 / W 51 xy	WC	R/S	(4) (5)
D.2	DELIVERED MATERIAL READY AT SITE (MATERIALS & SPOOLS IDENTIFICATION AND CONSERVATION STATUS)	W 51 xy	WC	R/S	(5)
D.3	PIPE / SPOOL INTERNAL CLEANING	IC 01 / W 51 xy	WC	W/R	(5)
D.4	PIPE / SPOOL ERECTION AND ALIGNMENT (inclusive pipe identification transfer if required)	W 51 xy	WC	R/S	(5)
D.5	PIPE / SPOOL TACK WELDS (if any)- FIT UP	W 51 xy	WC	S	(5)
D.6	GAP CONTROL FOR SOCKET WELDS (if any)	W24 / W51 AG	WC	S	
D.7	WELDING	W 10 / W 51 xy	WC	S	(5)
D.8	ORIFICE FLANGES AND VENTURI INSTALLATION	W 31C / W 51 xy	WC	S	(5)
D.9	PNEUMATIC TEST FOR REINFORCING PADS	W 31B / W 51 xy	WC	W/R	(5)
D.10	MATERIAL FULL TRACEABILITY (AS APPLICABLE)	W 10 / W 51 xy	WC	S	(5)
D.11	RT JOINT SELECTION REQUEST	RT 01 / W 51xy	WC	R	(5)
D.12	NDE / PMI / PWHT / HT EXECUTION & TRACEABILITY				
D.12.1	WELDING DAILY PROGRESS & VISUAL EXAMINATION	W24 / W51 xy	WC	R	(5)
D.12.2	PMI EXECUTION (where required)	QC21/ W51 xy	WC	W/R	(5)
D.12.3	PWHT CHART RECORDS (where required)	W51 xy	WC	R	(5)
D.12.4	HARDNESS TEST EXECUT. (where required)	W51 xy	WC	W/R	(5)
D.12.5	LIQUID PENETRANT EXAM. (where required)	W03 / W51 xy	WC	W/R	(5)
D.12.6	MAGNETIC PARTIC. EXAM. (where required)	W04 / W51 xy	WC	W/R	(5)

 	PROJECT	Standby SRU & Additional Tanks IOCL Paradip Refinery		
	CLIENT	INDIAN OIL CORPORATION LIMITED		
QCP-PIPING ERECTION (ABOVE & UNDERGROUND)	Project No. 080557C001	Document No. 080557C-000-QCP-1320-001	Rev. No. A	Page 4 of 6

S.NO	CHECK AND INSPECTION ITEM	QUALITY CONTROL REPORT	ACTION		NOTES
			CONTR.	TECHNIP	
D.12.7	RAD. EXAM. FILM REVIEW (where required)	W01 / W51 xy	WC	R	(5)
D.12.8	ULTRASONIC EXAMINATION (where required)	W02 / W51 xy	WC	W/R	(5)
D.12.9	NDE / PMI / PWHT / HT TRACEABILITY	W 10 / W 51 xy	WC	R	(5)
D.13	JOINT REPAIR EXECUTION (if any)	W 10 / W 51 xy	WC	S	(5)
D.14	REPAIRS RAD. FILM REVIEW (if any)	W 01 or equivalent	WC	R	(5)
D.15	JOINT CUT OUT FOR MODIFICATION (if any)	W 10 / W 51 xy	WC	W/R	(5) (6)
D.16	PIPING SUPPORT INSTALLATION	W 51 xy	WC	R/S	(5)
D.17	VALVE INSTALLATION	V 01 / W 51 xy	WC	R/S	(5) (7)
D.18	FLANGE FACES INSPECTION	W 51 xy	WC	R/S	(5)
D.19	FLANGES PARALLELISM / ALIGNMENT & GASKET INSTALLATION	BT 01 / W 51 xy	WC	R/S	(5)
D.20	TORQUE WRENCHES CALIBRATION	W 51 xy	WC	R	(5)
D.21	JOINT BOLTS TIGHTENING EXECUTION	BTC 01 / W 51 xy	WC	W/R	(5)
D.22	SLOPE CHECK	SS 01 / W 51 xy	WC	W/R	(5)
D.23	PRESSURE TEST (ONLY FOR UNDERGROUND PIPING)	W 51T / W 51 UG	WC	W	(8)
D.24	HOLIDAY TEST AFTER PRESSURE TEST (ONLY FOR UNDERGROUND PIPING)	W 18 / W 51 UG	WC	W/R	
D.25	FINAL DOCUMENTATION REVIEW	W 51 xy			(5)
E)	PRESSURE TEST PREPARATION / EXECUTION (PER TESTING CIRCUIT)				
E.1	TEST PACK CREATION	W 51 T	P	R	
E.2	MECHANICAL CLEARANCE	MC 01 / W 51T	WC	W/R	
E.3	PUNCH LIST BEFORE PRESSURE TEST	PL 10 / W51T	WC	W	
E.4	NDE VERIFICATION (Check of relative QCF W10 issued for ISO's)	W10 / W 51T	WC	R	
E.5	PUNCH "A" CLEARANCE AND RELEASE FOR TEST	PL 10 / W 51T	WC	W/R	
E.6	INTERNAL CLEANLINESS VERIFICATION (Check of relative QCF IC01 issued for spools/ISO)	W 51T	WC	W/R	
E.7	BLIND FLANGES INSTALLATION	BCS 01 / W 51T	WC	W/R	
E.8	BOLT TORQUING REPORT	BTC 01 / W 51T	WC	R	
E.9	PRESSURE TEST EXECUTION	W13 / W 51T	WC	W	
E.10	WATER DRY-OUT EXECUTION	LU 01 / W 51T	WC	W	
E.11	BLIND FLANGES REMOVAL	BCS 01 / W 51T	W	W/R	
E.12	WORK ACCEPTANCE OF "PUNCH LIST AFTER PRESSURE TEST" (LINE REINSTATEMENT)	PL 10 / W 51T	WC	W/R	
F)	MODIFICATION AFTER HYDROTEST (IF ANY)	W 16	WC	W/R	
G)	CONTROL & SAFETY VALVE AND IN-LINE				

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 	PROJECT	Standby SRU & Additional Tanks IOCL Paradip Refinery		
	CLIENT	INDIAN OIL CORPORATION LIMITED		
QCP-PIPING ERECTION (ABOVE & UNDERGROUND)	Project No. 080557C001	Document No. 080557C-000-QCP-1320-001	Rev. No. A	Page 5 of 6

S.NO	CHECK AND INSPECTION ITEM	QUALITY CONTROL REPORT	ACTION		NOTES
			CONTR.	TECHNIP	
	INSTRUMENTS ERECTION				
G.1	MATERIAL AVAILABLE AT SITE	VE 01	WC	W/R	
G.2	CHECK REPORT OF VISUAL INSPECTION / CALIBRATION	VE 01	WC	W/R	
G.3	VALVE/INSTRUMENT INSTALLATION	VE 01	WC	W/R	
G.4	VALVE/INSTRUMENT DISMANTLING (AS APPLICABLE)	VE 01	WC	W/R	
G.5	FINAL DOCUMENTATION REVIEW	VE 01			

- NOTES:
- (1) A COPY OF THE DOCUMENT WILL BE DELIVERED TO OWNER FOR INFORMATION.
 - (2) FORMS, INSPECTION AND ATTENDANCE SHALL BE IN ACCORDANCE WITH REFERRED QCP.
 - (3) MATERIAL APPROVAL WILL BE EXECUTED ONLY FOR MATERIAL SUPPLIED BY CONTRACTOR.
 - (4) VALID ONLY FOR PIPERACK ISOs.
 - (5) THE W51 XY FORM REFERS TO W51 AG & W51 UG AND MUST BE APPLIED AS:
W51 AG: FOR ABOVE GROUND PIPING ERECTION
W51 UG: FOR UNDERGROUND PIPING ERECTION.
 - (6) RFI SHALL BE ISSUED FOR INFORMATION/TRACKING PURPOSE ONLY.
 - (7) FOR CHECK VALVE ONLY.
 - (8) STEP VALID ONLY FOR UG PIPING, BECAUSE A DEDICATED SUB-WORK CLASS EXISTS FOR AG PIPING.

GENERAL NOTES

- 1 THE ENCLOSED ITP'S ARE INDICATIVE AND SHALL BE FOLLOWED FOR DEVELOPING THE JOB SPECIFIC ITP'S FOR THE WORKS TO BE PERFORMED BY THE CONTRACTOR. THE PROVISIONS INDICATED FOR STAGE WISE INSPECTION BY TECHNIP AND OWNER (FOR SPECIFIC ACTIVITIES) ARE THE MINIMUM AND THE ENGINEER-IN- CHARGE MAY DECIDE TO INCREASE HOLD POINTS/ WITNESS POINTS, WHILE APPROVING THE JOB SPECIFIC ITP'S. ACTIVITIES FOR WHICH ITP'S ARE NOT PROVIDED IN THIS SPECIFICATION. CONTRACTOR TO DEVELOP AND GET THE SAME APPROVED BY TECHNIP/OWNER BEFORE START OF THE WORK. IN GENERAL ROLE OF TECHNIP HAS BEEN SPECIFIED IN THE DOCUMENT THE ROLE OF OWNER TO BE SPECIFIED DURING PREPARATION OF SITE SPECIFIC ITP'S.
- 2 CONTRACTOR TO SUBMIT JOB SPECIFIC REPORTING FORMATS AND JOB PROCEDURES FOR THE JOBS FOR EACH ACTIVITY LISTED IN THE ITP'S AND SUBMIT TO TECHNIP/OWNER FOR APPROVAL. BEFORE COMMENCEMENT OF THE ACTIVITY. IF THE CONTRACTOR HAS TO DEVIATE FROM THE GIVEN ITP FOR A VALID REASON, HE SHALL OBTAIN PRIOR WRITTEN APPROVAL OF TECHNIP/OWNER. CONTRACTOR TO CARRY OUT 100% EXAMINATION OF ALL ACTIVITIES.

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PRESSURE TEST PACKAGE

For each piping pressure test circuit CONTRACTOR shall prepare one “test package” collecting at least the following documents:

QCF W 13	: Piping Pressure Test Report - when test circuits shall be splitted in two or more subtest circuits a progressive letter (a, b, c...) shall be added to subtest circuit numbering.
Pressure test gages calibration	: Copy of applicable test gage calibration
QCF PL 10	: Punch list before and after pressure test. All outstanding activities shall be cleared and countersigned by PMC before test.
QCF MC 01	: Mechanical clearance for hydrotest
QCF W 10	: NDE / PWHT / HT / PMI and material Traceability Summary per each isometric
QCF BTC 01	Bolt torqueing check report
Isometrics	: As built isometrics with identified welds, as per W 10, and blind flanges positioning & Numbering
P&ID	: With identified & marked up circuit and blind flanges positioning & Numbering

Each pressure test package shall have a Front-Page with the following information:

- Test Pressure Circuit N°;
- Progressive Test Package N°;
- List of Lines / ISOs;
- List of collected documents

GENERAL NOTES

- 1) All the other reports (shop prefabrication reports included) will be filed per ISO in different files.
- 2) The test packages will be filed per “System”.
- 3) If any welding activity is necessary to apply at one or more circuit's isometrics after pressure test, these will be authorized by PMC and recorded with W 16 Form.
W 16 Form filled and countersigned by PMC will be included into the test package.



PROJECT:

COMPANY:

QUALITY CONTROL FORM

BCS 01

PROJ. No.:

QCF REV. A

SH. ____ OF ____

BLIND CONTROL SHEET

CONTRACTOR:

BCS 01 N° _____

No.	Drawing / Line No.	Blind No.	Size	Rating	Blind Thickness		Gasket	Inserted			Removed			Remarks
					Required	Actual		Contr.	Technip QC team	OWNER	Contr.	Technip QC team	OWNER	
								Name / Date	Name / Date	Name / Date	Name / Date	Name / Date	Name / Date	

NOTES:

INSPECTORS

CONTRACTOR

TECHNIP

OWNER

NAME

SIGNATURE

DATE



PROJECT:

COMPANY:

QUALITY CONTROL FORM

BT 01

PROJ. No.:

QCF REV. A

SH. 1 OF 2

FLANGES PARALLELISM / ALIGNMENT & STUD BOLTS TIGHTENING

CONTRACTOR:

BT 01 N° ____

EQUIPMENT ID NUMBER:

EQUIPMENT DESCRIPTION:

EQPT CODE



SYSTEM ID.

LAYOUT DRAWING NUMBER:

REV N° :

PURCHASE ORDER NUMBER:

ITEM N°	ACCEPTANCE CRITERIA	REFERENCE	N.A.	V.ED
A	General Information: Line Class: _____ Pipe Wall Thickness/Pipe Sch.: _____ Fluid Service: _____ Service Temperature: _____			
A1	Pressure rating of mating flanges conforms with the line specification noted in piping.		<input type="checkbox"/>	<input type="checkbox"/>
A2	The flange facing, particularly the seating area, is clean and no damage (such as scratches) in excess.		<input type="checkbox"/>	<input type="checkbox"/>
A3	The gasket contact areas of the flanges are not coated (to ensure proper contact surface for sealing purpose).		<input type="checkbox"/>	<input type="checkbox"/>
B	Flange alignment (pipe to pipe) tolerances			
B1	Rotation of flanges, measured as the offset between elevations of bolt holes on opposite sides of a flange centerline, shall not exceed ± 2.4 mm		<input type="checkbox"/>	<input type="checkbox"/>
B2	The tilt of a flange measured at the periphery across any diameter shall not exceed 1.6 mm from the square position.		<input type="checkbox"/>	<input type="checkbox"/>
C	Alignment for flanges over 3-inch NPS connected to machinery/equipment is within the following tolerances			
C1	Vertical bolt hole offset: ± 2.4 mm		<input type="checkbox"/>	<input type="checkbox"/>
C2	Horizontal bolt hole offset: ± 2.4 mm		<input type="checkbox"/>	<input type="checkbox"/>
C3	Rotational offset: ± 2.4 mm		<input type="checkbox"/>	<input type="checkbox"/>
C4	Flange face tilt across diameter: 0.025mm per 25 mm (0.001 inch per inch) of flange outside diameter up to a maximum of 0.672 mm (0.030 inch), and 0.254mm (0.010 inch) for all flanges with an outside diameter less than 10 inches.		<input type="checkbox"/>	<input type="checkbox"/>
C5	Flange face separation: gasket thickness ± 1.6 mm		<input type="checkbox"/>	<input type="checkbox"/>
C6	Combination of vertical, horizontal and rotational offset: ± 3.2 mm		<input type="checkbox"/>	<input type="checkbox"/>
D	Alignment of Flange Joints with spectacle plate is within the following tolerances			
D1	Vertical bolt hole offset: $\pm (2.4 \text{ mm} + 30\%) = \pm 3.12\text{mm}$		<input type="checkbox"/>	<input type="checkbox"/>
D2	Horizontal bolt hole offset: $\pm (2.4 \text{ mm} + 30\%) = \pm 3.12\text{mm}$		<input type="checkbox"/>	<input type="checkbox"/>
D3	Rotational offset: $\pm (2.4 \text{ mm} + 30\%) = \pm 3.12\text{mm}$		<input type="checkbox"/>	<input type="checkbox"/>
D4	Combination of vertical, horizontal and rotational offset: ± 3.2 mm		<input type="checkbox"/>	<input type="checkbox"/>
E	Gasket Verification			
E1	Gasket type was verified to be compatible with the flange facing		<input type="checkbox"/>	<input type="checkbox"/>
E2	Gaskets are free from any damage particularly in the seating element. (NOTE: Ensure that spiral wound gaskets are stored flat especially for large sizes, 24 inches and larger.)		<input type="checkbox"/>	<input type="checkbox"/>

 		PROJECT:		
		COMPANY:		
QUALITY CONTROL FORM BT 01		PROJ. No.:	QCF REV. A	SH. 2 OF 2
FLANGES PARALLELISM / ALIGNMENT & STUD BOLTS TIGHTENING		CONTRACTOR:		BT 01 N° _____

ITEM N°	ACCEPTANCE CRITERIA	REFERENCE	N.A.	V.ED
E3	PIKOTEK gaskets, or approved equal, with isolating sleeves and washers are used for isolating dissimilar metal flanged joints (i.e. electrical isolation), and insulating joints for cathodic protection.		<input type="checkbox"/>	<input type="checkbox"/>
E4	Not more than one gasket is used between mating surfaces of flanges.		<input type="checkbox"/>	<input type="checkbox"/>
E5	The ring gaskets have the following identification: a. manufacturer's name or identification trademark. b. gasket number prefixed by the letters R,RX,or BX followed by the gasket material identification. c. The gasket is marked with an ASME B 16.20 designation.		<input type="checkbox"/>	<input type="checkbox"/>
E6	The dimension of the ring-joint gasket indicated by letter designation (R, RX, or BX) stamped on the ring gasket was verified to conform with the flange size and flange standard where it will be used.		<input type="checkbox"/>	<input type="checkbox"/>
E7	The identification markings on the spiral wound gaskets (flange size (NPS), pressure class and the appropriate flange standard (ASME B16.5 or ASME B16.47) were verified to conform with the flange size and flange standard and as specified in the IFC Drawing.		<input type="checkbox"/>	<input type="checkbox"/>
E8	The spiral wound gasket has the filler flush with the metal windings, not below the metal windings. (ASME B16.20, Para. 3.2.2)		<input type="checkbox"/>	<input type="checkbox"/>
E9	All spiral-wound gaskets are furnished with a centering ring.		<input type="checkbox"/>	<input type="checkbox"/>
E10	Inner rings are provided on all spiral-wound gaskets having PTFE (polytetra-fluoroethylene)filler material.		<input type="checkbox"/>	<input type="checkbox"/>
E11	Spiral Wound gasket for use in operating temperatures below minus 45°C has guide rings made of type 304 stainless steel material.		<input type="checkbox"/>	<input type="checkbox"/>
E12	Components of spiral wound gasket (filler, inner and outer rings) are verified to conform with the gasket material		<input type="checkbox"/>	<input type="checkbox"/>
E13	Spiral-wound gaskets are marked with a color code.		<input type="checkbox"/>	<input type="checkbox"/>
F	Bolting			
F1	Bolts and nuts have no physical damage to shanks or threads.		<input type="checkbox"/>	<input type="checkbox"/>
F2	Stud bolts and nuts have identification markings and verified to be suitable to the service temperature		<input type="checkbox"/>	<input type="checkbox"/>
F3	Bolt and nut materials are verified to conform with the approved material.		<input type="checkbox"/>	<input type="checkbox"/>
F4	Bolt Length: Bolts extend completely through their nuts (full thread engagement.). (NOTE: Thread engagement is adequate if the lack of complete engagement is not more than one thread.) (ASME B31.3, Para. 335.2.3)		<input type="checkbox"/>	<input type="checkbox"/>
F5	Method of bolt tightening was reviewed and approved by COMPANY		<input type="checkbox"/>	<input type="checkbox"/>

REMARKS:

INSPECTORS	CONTRACTOR	TECHNIP	OWNER
NAME			
SIGNATURE			
DATE			

PROJECT:

QUALITY CONTROL FORM

BTC 01

COMPANY:

BOLT TORQUING CHECK REPORT

PROJ. N°:

QCF REV. A

SH. 1 OF 1

CONTRACTOR:

BTC 01 N° _____

SUB-SYSTEM NUMBER
FLANGED JOINT NUMBER
AREA - LINE
TARGET TORQUE VALUE (Nm)

Torque Tool Type:

Pump/Gauge Serial Number:

Torque Tool Serial No's:

Pump Pressure Target (bar)

Flange Material:

YES

NO

Joint Size (inch):

YES

NO

Bolt Material:

YES

NO

Joint Rating:

YES

NO

Bolt Dia (inch):

YES

NO

Gasket Type:

Spiral wound

YES

NO

Bolt Qty:

YES

NO

Lubricated Bolt

YES

NO

Is the gasket outer ring visual check acceptable?

YES

NO

Torquing Values (Nm)

<u>Torque 30%</u>	<i>Pump Pressure applied (bar)</i>	<i>Done</i>	<u>Torque 60 %</u>	<i>Pump Pressure applied (bar)</i>	<i>Done</i>	<u>Torque 100%</u>	<i>Pump Pressure applied (bar)</i>	<i>Done</i>
		<input type="checkbox"/>			<input type="checkbox"/>			<input type="checkbox"/>

Remarks:

ID N° Performer _____

The underline values shall be prefilled by contractor

INSPECTORS
CONTRACTOR
TECHNIP
OWNER

NAME

SIGNATURE

DATE



TechnipFMC



PROJECT:

COMPANY:

QUALITY CONTROL FORM

IC 01

PROJ. No.:

QCF REV. A

SH. ____ OF ____

**PIPING / EQUIPMENT INTERNAL CLEANING
INSPECTION**

CONTRACTOR:

IC 01 N° _____

EQUIPMENT ID N° _____

EQUIPMENT DESCRIPTION

P&ID / LINE / ISO N° _____

SH. N° _____

TEST SYSTEM No. _____

LOCATION _____

SYSTEM DESCRIPTION:

Service Fluid: _____

Internal Cleanliness Report for On-plot Piping & Equipment

Method of Internal Cleaning	
Limits of Internal Cleaning (state partial or full and terminating ends)	
Type of Debris (sand, mill scale, electrodes, animals, etc.)	

REMARKS:

INSPECTORS

CONTRACTOR

TECHNIP

OWNER

NAME

SIGNATURE

DATE



PROJECT:

COMPANY:

QUALITY CONTROL FORM

LU 01

PROJ. No.:

QCF REV. A

SH. 1 OF 2

LAY-UP INSPECTION

CONTRACTOR:

LU 01 N° _____

EQUIPMENT ID NUMBER:

EQUIPMENT DESCRIPTION:

EQPT CODE



SYSTEM ID.



LAYOUT DRAWING NUMBER:



REV N° :

PURCHASE ORDER NEMBER:

ITEM N°	ACCEPTANCE CRITERIA	REFERENCE	N.A.	V.ED
A	Wet Lay-Up			
A1	A minimum residual oxygen scavenger concentration of 20 ppm in the water and a maximum oxygen concentration of 10 ppb throughout the system including the dead legs (Note: Analyze water sample(s) for residual levels of oxygen scavenger at the location most remote from the oxygen scavenger inlet).		<input type="checkbox"/>	<input type="checkbox"/>
A2	Once minimum residuals are verified, the system is kept tightly closed to prevent air entry.		<input type="checkbox"/>	<input type="checkbox"/>
A3	The system is maintained under positive pressure between 210 to 350 kPa (30 to 50 psig) using nitrogen, a sweet hydrocarbon gas, or hydraulic pressure of the treated water.		<input type="checkbox"/>	<input type="checkbox"/>
A4	Thermal relief is installed for systems that are to be laid up with hydraulic pressure.		<input type="checkbox"/>	<input type="checkbox"/>
A5	If the design pressure is lower than 350 kPa (50 psig), the pressure shall be adjusted accordingly.		<input type="checkbox"/>	<input type="checkbox"/>
A6	Gauges with a scale range not exceeding three times the target pressure are used to monitor the positive pressure in the system during lay-up.		<input type="checkbox"/>	<input type="checkbox"/>
A7	If a leak occurs or air enters the system, lay-up process is repeated after completing repairs.		<input type="checkbox"/>	<input type="checkbox"/>
B	Dry Lay-Up			
B1	Water from the system is drained and complete removal of water is performed either by sweeping, mopping or scraping.		<input type="checkbox"/>	<input type="checkbox"/>
B2	If sea water was used for testing pipeline, remove salt deposits by scraping with slugs of water containing less than 4500 ppm total dissolved solids.		<input type="checkbox"/>	<input type="checkbox"/>
B3	The system is dried immediately to a dew point of -1 °C or less at all exit points, by blowing dry air or nitrogen through the system.		<input type="checkbox"/>	<input type="checkbox"/>
B4	After blowing, the system is shut in with a positive pressure for not less than 12 hours to allow any remaining moisture to come to equilibrium with the dry air.		<input type="checkbox"/>	<input type="checkbox"/>
B5	After the shut-in period of 12 hours, the exit dew points measured are at below -1 °C.		<input type="checkbox"/>	<input type="checkbox"/>
B6	When the required dew point is reached at -1 °C after shut-in period, pressurize the system to the final lay-up pressure with dry air or nitrogen having a dew point lower than -1 °C. Shut in the system, maintain and monitor the positive pressure of at least 30 psig, but not exceeding the design pressure during the lay-up period using pressure gauges.		<input type="checkbox"/>	<input type="checkbox"/>
C	Inert gas Lay-Up			
C1	Upon completion of a successful final hydrostatic test, the test water is displaced with nitrogen or sweet gas until no water drains out of the system.		<input type="checkbox"/>	<input type="checkbox"/>
C2	After water is drained, shut in the system under positive pressure using nitrogen or sweet hydrocarbon gas until commissioning and start-up.		<input type="checkbox"/>	<input type="checkbox"/>

 		PROJECT:		
		COMPANY:		
QUALITY CONTROL FORM LU 01		PROJ. No.:	QCF REV. A	SH. 2 OF 2
LAY-UP INSPECTION		CONTRACTOR:		LU 01 N° _____
ITEM N°	ACCEPTANCE CRITERIA	REFERENCE	N.A.	V.ED
D	Ambient Lay-Up			
D1	Ambient Lay-up is used only if the following conditions exists: 1) drains are available at all low points to ensure complete removal of water; 2) the corrosion allowable has been provided; 3) the pitting can be tolerated; 4) particulate rust can be tolerated.		<input type="checkbox"/>	<input type="checkbox"/>
D2	After removal of all visible water by sweeping, mopping and/or scraping, close the system to prevent the entry of sand or rainwater.		<input type="checkbox"/>	<input type="checkbox"/>
D3	Install a vacuum breaker unless it is demonstrated that the system will not collapse under vacuum.		<input type="checkbox"/>	<input type="checkbox"/>
E	Vapor – Phase Corrosion Inhibitors (VCI) & Other Lay-Up Methode			
E1	Use of vapour phase corrosion inhibit or other Lay-up are accepted with prior approval by Company.		<input type="checkbox"/>	<input type="checkbox"/>
F	Stainless Steel Equipment			
F1	At the end of the Lay-up, commissioning and start-up the stainless steel equipment within 14 days.		<input type="checkbox"/>	<input type="checkbox"/>
Remarks:				
INSPECTORS	CONTRACTOR	TECHNIP	OWNER	
NAME				
SIGNATURE				
DATE				

 		PROJECT:					
		COMPANY:					
QUALITY CONTROL FORM MC 01		PROJ. No.:		QCF REV. A		SH. 1 OF 3	
MECHANICAL CLEARANCE FOR PRESSURE TESTING		CONTRACTOR:			MC 01		
ISOMETRIC / DRAWING N° _____ SH. ___ OF _____ REV. ____ _____ AREA _____ SYSTEM N° _____							
INSPECTIONS (REF. TO QCP 1320.01)		N.A.	ACC.	REMARKS/ REFERENCES	INSPECTORS SIGNATURE & DATE		
					CONT.	TECHNIP.	OWNER
1 Installation checked as per Isometric							
a	Configuration : Route, elevation, clearance for thermal expansion /insulation	<input type="checkbox"/>	<input type="checkbox"/>				
b	Branch : Location , angle , orientation , type , RF Pad etc.	<input type="checkbox"/>	<input type="checkbox"/>				
c	Steam Trap : Direction	<input type="checkbox"/>	<input type="checkbox"/>				
2 Installation checked as per GAD							
a	Configuration : Route, clearance for thermal expansion / insulation	<input type="checkbox"/>	<input type="checkbox"/>				
3 Installation checked as per P & ID							
4 Completed Isometric for							
a	Joint Numbering (Shop & Field Welds)	<input type="checkbox"/>	<input type="checkbox"/>				
b	Spool Numbering	<input type="checkbox"/>	<input type="checkbox"/>				
c	As built routing & dimensions	<input type="checkbox"/>	<input type="checkbox"/>				
5 Valves (Check Rating , Gaskets, Flow Direction, Sheet No , Tag No, Spindle Direction , Locks, Damage etc.)							
a	Gate Valves	<input type="checkbox"/>	<input type="checkbox"/>				
b	Globe Valves	<input type="checkbox"/>	<input type="checkbox"/>				
c	Check Valves	<input type="checkbox"/>	<input type="checkbox"/>				
d	Control Valves Tag Nos	<input type="checkbox"/>	<input type="checkbox"/>				
e	Safety Valves Tag Nos	<input type="checkbox"/>	<input type="checkbox"/>				
f	Any other Valves (Ball & Plug)	<input type="checkbox"/>	<input type="checkbox"/>				
6 Strainers : Check for flow direction & element							
7 Flanged Joint Details							
a	Total Nos	<input type="checkbox"/>	<input type="checkbox"/>				
b	Check for Size	<input type="checkbox"/>	<input type="checkbox"/>				
c	Check for Rating	<input type="checkbox"/>	<input type="checkbox"/>				
d	Check for Alignment	<input type="checkbox"/>	<input type="checkbox"/>				
e	Check for correct studs & nuts dia , Length Material, uniform protrusion of Studs , Anti corrosive compound :	<input type="checkbox"/>	<input type="checkbox"/>				
f	Check for correct gasket (type, size, specification, thickness etc)	<input type="checkbox"/>	<input type="checkbox"/>				
g	Torque values used for tightening (If require)	<input type="checkbox"/>	<input type="checkbox"/>				

 		PROJECT:					
		COMPANY:					
QUALITY CONTROL FORM MC 01		PROJ. No.:		QCF REV. A		SH. 2 OF 3	
MECHANICAL CLEARANCE FOR PRESSURE TESTING		CONTRACTOR:				MC 01	
INSPECTIONS (REF. TO QCP 1320.01)		N.A.	ACC.	REMARKS/ REFERENCES	INSPECTORS SIGNATURE & DATE		
					CONT.	TECHNIP	OWNER
8 Seal welding of screwed connection (If require)		<input type="checkbox"/>	<input type="checkbox"/>				
9 Orifice Flanges							
a	Check for Tag No tapping orientation , tap valve, Jack screw, straight run length of upstream & downstream	<input type="checkbox"/>	<input type="checkbox"/>				
1 Reinforcement pad as per Piping Class		<input type="checkbox"/>	<input type="checkbox"/>				
1 Location of gauges : Check for accessibility		<input type="checkbox"/>	<input type="checkbox"/>				
1 Check slope (when applicable)		<input type="checkbox"/>	<input type="checkbox"/>				
1 Supports Details							
i) Guides, Cross guide , Trunion etc							
a	Check for correct type, material & dimensions	<input type="checkbox"/>	<input type="checkbox"/>				
b	Check welding	<input type="checkbox"/>	<input type="checkbox"/>				
c	Check for vent hole on pads	<input type="checkbox"/>	<input type="checkbox"/>				
d	Check offset for thermal expansion	<input type="checkbox"/>	<input type="checkbox"/>				
e	Check clearance for guide	<input type="checkbox"/>	<input type="checkbox"/>				
f	Check U bolt for slide supports	<input type="checkbox"/>	<input type="checkbox"/>				
ii) Spring Supports							
a	Verify Tag No and check details as per Data Sheet / Spring Set	<input type="checkbox"/>	<input type="checkbox"/>				
b	Check for locking arrangement and any damage during transits etc.	<input type="checkbox"/>	<input type="checkbox"/>				
c	Check for completeness of installation as per Drg including welding of mounting cleat / bracket	<input type="checkbox"/>	<input type="checkbox"/>				
d	Check for locking during installation	<input type="checkbox"/>	<input type="checkbox"/>				
Bracket Supports & Inserts with Anchor Fasteners							
a	Check members dimensions and materials	<input type="checkbox"/>	<input type="checkbox"/>				
b	Check welding	<input type="checkbox"/>	<input type="checkbox"/>				
c	Check bolting	<input type="checkbox"/>	<input type="checkbox"/>				
d	Check for appearance / damage	<input type="checkbox"/>	<input type="checkbox"/>				
1 Vents / Drains Details							
a	Vents / Drains as per Drg and provision of additional high point vents and / or low point drains (If require)	<input type="checkbox"/>	<input type="checkbox"/>				
b	Check as per Drawings	<input type="checkbox"/>	<input type="checkbox"/>				
c	Orientation of valve handles	<input type="checkbox"/>	<input type="checkbox"/>				
d	Clearance for hose	<input type="checkbox"/>	<input type="checkbox"/>				
15 Earthing's							
a	Check for location	<input type="checkbox"/>	<input type="checkbox"/>				
b	Check for dimension of lug welding	<input type="checkbox"/>	<input type="checkbox"/>				

		PROJECT:					
		COMPANY:					
QUALITY CONTROL FORM MC 01		PROJ. No.:		QCF REV. A		SH. 3 OF 3	
MECHANICAL CLEARANCE FOR PRESSURE TESTING		CONTRACTOR:				MC 01	
16	Check for Removal / Blinding off						
a	Control , safety and check valves	<input type="checkbox"/>	<input type="checkbox"/>				
b	In line instruments	<input type="checkbox"/>	<input type="checkbox"/>				
c	Rupture Discs	<input type="checkbox"/>	<input type="checkbox"/>				
d	Equipment Nozzles	<input type="checkbox"/>	<input type="checkbox"/>				
e	Others	<input type="checkbox"/>	<input type="checkbox"/>				
17	Supports and weld / flanged / screwed connections free from insulation of other coverage	<input type="checkbox"/>	<input type="checkbox"/>				
18	Expansion Bellows Details						
i)	Check for prior to installations						
a	Physical damages	<input type="checkbox"/>	<input type="checkbox"/>				
b	Transits locks are interact	<input type="checkbox"/>	<input type="checkbox"/>				
c	Dimensions as per drawings	<input type="checkbox"/>	<input type="checkbox"/>				
ii)	Check during installation						
a	Parallelity of mating flanges	<input type="checkbox"/>	<input type="checkbox"/>				
b	Face to face dimension of mating flanges	<input type="checkbox"/>	<input type="checkbox"/>				
c	Concentricity of mating flanges	<input type="checkbox"/>	<input type="checkbox"/>				
d	No stress on expansion bellows	<input type="checkbox"/>	<input type="checkbox"/>				
e	Record	<input type="checkbox"/>	<input type="checkbox"/>				
iii)	Isolation during pressure test						
a	Bellows manufacturer recommendations on isolation bellows during pressure test to be followed	<input type="checkbox"/>	<input type="checkbox"/>				
b	If recommended expansion bellow to be dropped during pressure test	<input type="checkbox"/>	<input type="checkbox"/>				
19	System completion						
a	Tie in Joints	<input type="checkbox"/>	<input type="checkbox"/>				
b	Scrutiny of test packs for system testing	<input type="checkbox"/>	<input type="checkbox"/>				
c	System testing	<input type="checkbox"/>	<input type="checkbox"/>				
d	Review Test and Inspection documents	<input type="checkbox"/>	<input type="checkbox"/>				
20	Other general checks						
a	Physical walks through carried out	<input type="checkbox"/>	<input type="checkbox"/>				
b	Removal of unwanted construction supports	<input type="checkbox"/>	<input type="checkbox"/>				
c	Check that all pressure connections are installed correctly	<input type="checkbox"/>	<input type="checkbox"/>				
INSPECTORS		CONTRACTOR		TECHNIP		OWNER	
NAME							
SIGNATURE							
DATE							



PROJECT:

COMPANY:

QUALITY CONTROL FORM

PL 10

PROJ. No.:

QCF REV. A

SH. ____ OF ____

PUNCH LIST

CONTRACTOR:

PL 10 N° _____

TEST PACK N° _____

SYSTEM N° _____

ITEMS TO BE CHECKED	N.A.	YES	ITEMS TO BE CHECKED	N.A.	YES	ITEMS TO BE CHECKED	N.A.	YES
WELDING COMPLETE	<input type="checkbox"/>	<input type="checkbox"/>	RADIOGRAPHY / ULTRASONIC (W10)	<input type="checkbox"/>	<input type="checkbox"/>	PMI (W10)	<input type="checkbox"/>	<input type="checkbox"/>
PT / MT (W10)	<input type="checkbox"/>	<input type="checkbox"/>	PWHT / HT (W10)	<input type="checkbox"/>	<input type="checkbox"/>	MATERIALS TRACEABILITY (W10)	<input type="checkbox"/>	<input type="checkbox"/>
THK CHECK BY UT	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>

Item N°	Drawing / Line N°	Description	Category (1)	Discipline (2)	Issued by	Cleare d by	Verified (CONTRACTOR)		Verified (TECHNIP)		Verified (OWNER)	
							Name	Date	Name	Date	Name	Date

NOTES:

1) Category A: To be resolved before hydrotest B: To be resolved after hydrotest

2) Discipline P: Piping M: Mechanical I: Instrument PA: Painting C: Civil O: Other

INSPECTORS	CONTRACTOR	TECHNIP	OWNER
NAME			
SIGNATURE			
DATE			



PROJECT:

COMPANY:

QUALITY CONTROL FORM

QC 21

PROJ. No.:

QCF REV. A

SH. 1 OF__

POSITIVE MATERIAL IDENTIFICATION REPORT

CONTRACTOR:

QC 21 N° _____

PMI CARRIED OUT:

SHOP

☐

FIELD

☐

BEFORE INSTALLATION

☐

AFTER INSTALLATION

☐

EQUIPMENT:

ITEM DESCRIPTION

PIPING COMPONENT:

SUPPLIER:

MR/PO:

REV:

LINE/DRAWING Nr:

PIPING SUPPORT:

FILLER METAL:

Ø

AWS:

ALLOY ELEMENTS TO BE CHECKED:

PMI EQUIPMENT:

ANALYTICAL LABORATORY METHODS:

CALIBRATION:

YES

☐

NO

☐

SAMPLING:

10%

☐

100%

☐

___%

☐

ITEM TO BE TESTED	IDENT CODE	ALLOY ELEMENTS													DATE & INITIALS
		Cr	Ni	Mo	Cb/ Nb	Ti	V	Cu	Al	C	Co	W	FE		

TEST RESULT:

ACCEPTABLE

☐

NOT ACCEPTABLE

☐

REMARKS:

INSPECTORS

CONTRACTOR

TECHNIP

OWNER

NAME

SIGNATURE

DATE

[illegible]



PROJECT:

COMPANY:

QUALITY CONTROL FORM

RT 01

PROJ. No.:

QCF REV. A

SH. ____ OF ____

RADIOGRAPHY (RT) JOINT SELECTION REQUEST

CONTRACTOR:

RT 01 N° ____

AREA _____

UNIT _____

No.	Drawing / ISO No.	Piping class	Material	Joint No.	Joint Type	Size	Sch.	Thick	Welder	Welding Process	Request Date	Prod. Joint No.	Reshot remarks	Penalty	Request / Remarks

NOTES:

INSPECTORS

CONTRACTOR

TECHNIP

OWNER

NAME

SIGNATURE

DATE



PROJECT:

COMPANY:

QUALITY CONTROL FORM

SS 01

PROJ. No.:

QCF REV. A

SH. ____ OF ____

**SLOPE SURVEY
REPORT**

CONTRACTOR:

SS 01 N° ____

AREA _____

UNIT _____

SYSTEM _____

No.	Drawing / Line No.	Check Point	Elevation / Coordinates		Remarks
			Drawing	Actual	

NOTES:

INSPECTORS	CONTRACTOR	TECHNIP	OWNER	
NAME				
SIGNATURE				
DATE				



PROJECT:

COMPANY:

QUALITY CONTROL FORM

V 01

PROJ. No.:

QCF REV. A

SH. 1 OF 3

VALVE INSTALLATION INSPECTION

CONTRACTOR:

V 01 N° _____

EQUIPMENT ID NUMBER:

EQUIPMENT DESCRIPTION:

EQPT CODE



SYSTEM ID.

LAYOUT DRAWING NUMBER:

REV N° :

PURCHASE ORDER NUMBER:

ITEM N°	ACCEPTANCE CRITERIA	REFERENCE	N.A.	V.ED
A	Gate Valve			
A1	Inside-screw-rising-stem (ISRS) and non-rising-stem (NRS) valves NPS 2 inch and smaller shall not be used in hydrocarbon services.		<input type="checkbox"/>	<input type="checkbox"/>
A2	A gate valve used as isolation valves in flare system piping shall be installed with the stem in or below the horizontal position.		<input type="checkbox"/>	<input type="checkbox"/>
B	Butterfly Valves			
B1	Concentric butterfly valves, such as the API STD 609 Category A type (typically with internal rubber linings), are permitted only in nonhydrocarbon applications.		<input type="checkbox"/>	<input type="checkbox"/>
B2	The use of high performance butterfly valves in hydrocarbon service shall be limited to a maximum rating of Class 900.		<input type="checkbox"/>	<input type="checkbox"/>
B3	Butterfly Valves in hydrocarbon services are designed in accordance with API STD 609 Category B valves with offset-seat type construction.		<input type="checkbox"/>	<input type="checkbox"/>
B4	Butterfly Valves in hydrocarbon services are qualified fire-safe to either API SPEC 6FA, API STD 607, or BS EN ISO 10947		<input type="checkbox"/>	<input type="checkbox"/>
B5	The body of butterfly valve are of the lug-type design with tapped bolt holes, unless the (double) flanged type has been specified. Use of the wafer-type body is not permitted.		<input type="checkbox"/>	<input type="checkbox"/>
B6	Butterfly Valves are installed in the "preferred" direction indicated on the valve.		<input type="checkbox"/>	<input type="checkbox"/>
C	Globe Valve			
C1	Globe valve installed in the preferred direction of flow as indicated on the valve body	Best Practice	<input type="checkbox"/>	<input type="checkbox"/>
D	Plug Valve			
D1	Flanged plug valves in hydrocarbon service are of the inverted lubricated pressure balanced design.		<input type="checkbox"/>	<input type="checkbox"/>
D2	A plug position indicator is installed on the plug valves		<input type="checkbox"/>	<input type="checkbox"/>
D3	Manual bleed to atmosphere with automatic thermal relief to upstream piping are installed.		<input type="checkbox"/>	<input type="checkbox"/>
D4	Manual bleed to atmosphere with automatic thermal relief to upstream piping are installed.		<input type="checkbox"/>	<input type="checkbox"/>

 		PROJECT:		
		COMPANY:		
QUALITY CONTROL FORM V 01		PROJ. No.:	QCF REV. A	SH. 2 OF 3
VALVE INSTALLATION INSPECTION		CONTRACTOR:		V 01 N° _____
ITEM N°	ACCEPTANCE CRITERIA	REFERENCE	N.A.	V.ED
E	CHECK VALVE			
E1	Straight-thru union body check valves shall be used only in portions of piping systems where pipe unions are permissible.		<input type="checkbox"/>	<input type="checkbox"/>
E2	Dual and single plate wafer check and swing check valves are not used in reciprocating pump and compressor suction and discharge services or similar pulsating services.		<input type="checkbox"/>	<input type="checkbox"/>
E3	A non-slam internal-spring-assisted type check valve are installed at the discharge of pumps and compressors, where un-acceptable level of slamming is anticipated.		<input type="checkbox"/>	<input type="checkbox"/>
E4	For all sizes NPS 4 inch and above, a turbulence-free minimum distance of 5 pipe diameters upstream and 2 pipe diameters downstream of every check valve shall be maintained. No pipe fittings such as elbows, reducers, tees, etc., or flow restricting devices such as orifices, control valves, etc., shall be installed in these zones. (NOTE: Exempted are check valves in intermittent service and valves in skid-mounted systems are exempt from these requirements .)		<input type="checkbox"/>	<input type="checkbox"/>
E5	Check valves in sizes NPS 3 inch and above are not installed in vertical lines, unless specifically approved by PMC / Owner. (NOTE: Valves in skid-mounted systems are exempt from this requirement.)		<input type="checkbox"/>	<input type="checkbox"/>
E6	Wafer-type check valves are not permitted in any hydrocarbon service.		<input type="checkbox"/>	<input type="checkbox"/>
F	CONTROL VALVE			
F1	Control valves shall not be used as emergency shutdown (ESD) valves (ZVs), nor as emergency isolation valves (EIVs)		<input type="checkbox"/>	<input type="checkbox"/>
F2	Handwheel is provided on control valves when local manual control is required by the Proponent. Handwheel installations shall meet the following requirements: a) Neutral position shall be clearly indicated. b) Handwheel mechanism shall not add friction to the actuator. c) Handwheel shall not be used as travel stops. d) Handwheel shall be fully accessible for operation.		<input type="checkbox"/>	<input type="checkbox"/>
F3	Volume tank is provided for the pneumatic actuator and conforms with the following: a. designed to a maximum pressure of 930 kPag (135 psig) at 82°C. b. manufactured in accordance with ASME VIII D1 (stamped UM) requirements, or equivalent. c. Volume tanks shall have a minimum capacity for one complete stroke operation of the control valve at the minimum available instrument air pressure of 415 kPag (60 psig).		<input type="checkbox"/>	<input type="checkbox"/>
F4	The Control valve is installed in the direction of flow casted or steelstamped on the valve body.		<input type="checkbox"/>	<input type="checkbox"/>
F5	Control valves are installed in horizontal lines.		<input type="checkbox"/>	<input type="checkbox"/>
F6	Control valves and their actuating systems are mounted such that all adjustments are accessible (and all indicators/gauges are readable) from grade, permanent platform, walkway or fixed ladder.		<input type="checkbox"/>	<input type="checkbox"/>
F7	Access space for lifting equipment shall be provided for valve and actuator assemblies weighing over 50 kg.		<input type="checkbox"/>	<input type="checkbox"/>

 		PROJECT:		
		COMPANY:		
QUALITY CONTROL FORM V 01		PROJ. No.:	QCF REV. A	SH. 3 OF 3
VALVE INSTALLATION INSPECTION		CONTRACTOR:		V 01 N° _____
ITEM N°	ACCEPTANCE CRITERIA	REFERENCE	N.A.	V.ED
F8	<p>Block and bypass valves shall be provided as standard for each control valve installation, except for the following conditions :</p> <ul style="list-style-type: none"> identical pieces of equipment installed in parallel enabling on-line maintenance of any one control valve at any one time. identical process systems installed in parallel with one process system used for spare or redundant capacity. process or equipment which is only intermittently operated in association with a continuous process (e.g., during start-up, regeneration, etc.) non-critical equipment which may be shut down without affecting the operation of the main process applications where, for safety reasons, a block and bypass valves arrangement is not desirable (e.g., to reduce leakage sources of hazardous fluids, such as hydrogen, phenol, hydrofluoric acid, etc.) applications where, for safety reasons, manual operation by means of the bypass valve is not desirable (e.g., anti-surge control, turbine speed control, fuel control to boilers and process heaters, etc.) applications, for which the proponent specifically does not require block and bypass valves to be installed 		<input type="checkbox"/>	<input type="checkbox"/>
F9	The piping around control valves are self-supporting or shall be permanently supported so that when the control valve is removed, the lines will remain in place without the need for temporary supports.		<input type="checkbox"/>	<input type="checkbox"/>
F10	The bypass valve are manually operable and have a correct trim and control characteristic and have a capacity at least equal to the required Cv of the control valve, but not greater than twice the selected Cv of the control valve.		<input type="checkbox"/>	<input type="checkbox"/>
F11	Block valves shall generally be the same size as the line size and shall be full capacity type valves.		<input type="checkbox"/>	<input type="checkbox"/>
F12	Drain valves are installed, (unless otherwise specified by the porponent) on the bottom of each spool piece or reducer between the control valve and the block valves.		<input type="checkbox"/>	<input type="checkbox"/>
F13	Control valve installations without block and bypass valves are provided with a drain valve on each side of the control valve		<input type="checkbox"/>	<input type="checkbox"/>
F14	The size of drain valve are not less than ¾" .		<input type="checkbox"/>	<input type="checkbox"/>
F15	Protective shields, to prevent injury to personnel, shall be installed on valves handling dangerous or flammable liquids		<input type="checkbox"/>	<input type="checkbox"/>
G	FLARE SYSTEM			
G1	Isolation valves in flare system piping are gate, ball, high performance butterfly or plug valves.		<input type="checkbox"/>	<input type="checkbox"/>
G2	A gate valve in this service are installed with the stem in or below the horizontal position.		<input type="checkbox"/>	<input type="checkbox"/>
H	VALVE STROKING			
H1	Prior to installation ensure valve is easily opening and closing full stroke.	Best Practice	<input type="checkbox"/>	<input type="checkbox"/>
INSPECTORS		CONTRACTOR	TECHNIP	OWNER
NAME				
SIGNATURE				
DATE				

		PROJECT:		
		COMPANY:		
QUALITY CONTROL FORM VE 01		PROJ. No.:	QCF REV. A	SH. ____ OF ____
CONTROL & SAFETY VALVE AND IN-LINE INSTRUMENTS ERECTION SUMMARY REPORT		CONTRACTOR:		VE 01 N° ____
ISOMETRIC / DRAWING N° _____ SH. _____ OF _____ REV. _____ AREA _____ EQUIPMENT ID N° _____ EQUIPMENT DESCRIPTION _____ EQUIPMENT CODE _____				
INSPECTIONS (REF. TO QCP 1320.01)		N.A.	ACC.	REMARKS/ REFERENCES
		INSPECTORS SIGNATURE & DATE		
		CONTR. TECHNIP OWNER		
G.1	MATERIAL AVAILABLE AT SITE	<input type="checkbox"/>	<input type="checkbox"/>	
G.2	CHECK REPORT OF VISUAL INSPECTION / CALIBRATION	<input type="checkbox"/>	<input type="checkbox"/>	
G.3	VALVE/INSTRUMENT INSTALLATION	<input type="checkbox"/>	<input type="checkbox"/>	
G.4	VALVE/INSTRUMENT DISMANTLING	<input type="checkbox"/>	<input type="checkbox"/>	
NOTES:				
G.5) FINAL DOC. REVIEW	INSPECTORS	CONTRACTOR		TECHNIP
	NAME			
	SIGNATURE			
	DATE			
		OWNER		

QCF STANDARD REV.0



TechnipFMC



PROJECT:

COMPANY:

QUALITY CONTROL FORM (NDE-01) **W 01**

PROJ. No

QCF REV. A

SH. 1 OF 2

**RADIOGRAPHIC TEST REPORT
(REQUIREMENTS)**

CONTRACTOR:

W 01 N° _____

APPLICABLE CODES/SPEC'S

• ASME V ART 2 ☐• ☐

ACCEPTANCE CRITERIA

• ☐• ☐

FIELD OF APPLICATION

- PIPING ☐
- TANKS/
SILOS ☐
- EQUIPMENT ☐

- WELDING ☐
- RAW MATERIAL ☐
- ☐

MATERIAL

- C.S/LOW ALLOY ☐
- S.S/NI ALLOY ☐
- TI ☐

SURFACE FINISH

- BEFORE PWHT ☐
- AFTER PWHT ☐
- AFTER HYDR.
TEST ☐

SOURCE

- X-RAY ☐
- γ -RAY: ☐
- Ir 192 ☐
- Co. 60 ☐

- TYPE _____
- BRAND _____
- SINGLE SPOT ☐
- 360° EMISSION ☐
- KV _____

FILMS

- TYPE _____
- BRAND _____
- 10 X 48 ☐ 10 X 24 ☐
- SINGLE ☐
- DOUBLE ☐

PENETRIMETERS

- DIN ☐
- ASME ☐
- TYPE _____
- QUANTITY _____
- SOURCE SIDE ☐
- FILM SIDE ☐

SENSITIVITY

- DIN _____ %
- ASME _____
- SINGLE WALL ☐
- DOUBLE WALL ☐

DENSITY

- REQUIRED _____
- RANGE _____
- SINGLE FILM ☐
- DOUBLE FILM ☐

UNSHARPNESS

- GEOM UNSHARP _____
- MAX
- FOCAL SPOT _____
- MINIMUM FOCUS/
FILM DIST.

PARAMETERS

- VOLTAGE _____ KV
- MIN.EXPOSURE _____
- MAX
- MIN
- DEVELOP TIME _____ MIN
- DEVELOP TEMP _____ °C

EXPOSURE ARRANGMENT

- SOURCE
 - INSIDE ☐
 - OUTSIDE ☐
- FILM
 - INSIDE ☐
 - OUTSIDE ☐

TECHNIQUE

- WALL
 - SINGLE ☐
 - DOUBLE ☐
- IMAGE
 - SINGLE ☐
 - DOUBLE ☐

REMARKS:

INSPECTORS**CONTRACTOR****TECHNIP****OWNER**

NAME

SIGNATURE

DATE

TECHNIP INDIA LTD



PROJECT:

COMPANY:

QUALITY CONTROL FORM (NDE-01) **W 01**

PROJ. No.:

QCF REV. A

SH. 2 OF 2

RADIOGRAPHIC TEST REPORT

CONTRACTOR:

W 01 N° _____

EXTENT _____%

A = ACCEPTANCE

R = REPAIR

DF = DEFECTIVE FILM

RS = RESHOOT

C = TO BE CUT

CM = CUT TO MODIFY

[illegible]

TECHNIP INDIA LTD



PROJECT:

COMPANY:

QUALITY CONTROL FORM (NDE-02)

W 02

PROJ. No.:

QCF REV. A

SH. ____ OF ____

**ULTRASONIC
TEST REPORT**

CONTRACTOR:

W 02 N° ____

APPLICABLE CODES/SPEC'S

• ASME V ART 4

☐

•

☐

ACCEPTANCE CRITERIA

•

☐

•

☐

FIELD OF APPLICATION

• PIPING

☐

• BEVEL

☐

• FINAL PASS

☐• ☐• TANKS/
SILOS☐• 1ST PASS☐

• OVERLAY

☐• ☐

• EQUIPMENT

☐

• BACK GOUGING

☐• RAW MATERIAL ☐• ☐• ☐

MATERIAL

• C.S.

☐

• LOW ALLOY

☐

• BEFORE PWHT

☐• ☐

• TI

☐

• HASTELLOY

☐

• AFTER PWHT

☐• ☐

• S.S.

☐

•

☐

• AFTER HYD. TEST

☐• ☐• ☐

SURFACE CONDITION

• AS WELDED

☐

• BRUSHED

☐

•

☐

TEMPERATURE _____

• AS GROUND

☐

• AS FORGED

☐

•

☐

• AS ROLLED

☐

• AS MACHINED

☐

•

☐

STEP _____

• AS CAST

☐

• AS BENT

☐

•

☐

INSPECTION METHOD

• STRAIGHT BEAM

☐

• TRANSVERSE WAVES

☐• BACK REFLECTION mm _____ ☐

• ANGLE BEAM SEARCH UNIT

☐

• TANDEM METHOD

☐• SIDE DRILLED HOLE mm _____
Ø mm _____ ☐

• SINGLE TRANSDUCER

☐• SEARCH UNIT (TR) DUAL
TRANSDUCER☐• FLAT BOTTOM HOLE mm _____
Ø mm _____ ☐

• LONGITUDINAL WAVES

☐

•

☐• ☐

COUPLANT

• OIL

☐

• TYLOSE PASTE

☐

• WATER

☐

REF. CALIBRATION EQUIPMENT BLOCKS METHOD

SCANNING DIRECTION & RESULTS

INSPECTORS**CONTRACTOR****TECHNIP****OWNER**

NAME

SIGNATURE

DATE

TECHNIP INDIA LTD



PROJECT:

COMPANY:

QUALITY CONTROL FORM (NDE-03) **W 03**

PROJ. No.:

QCF REV. A

SH. 1 OF 2

**LIQUID PENETRANT TEST REPORT
(REQUIREMENTS)**

CONTRACTOR:

W 03 N° _____

APPLICABLE CODES/SPEC'S

• ASME V ART 6 ☐• ☐

ACCEPTANCE CRITERIA

• ☐• ☐

FIELD OF APPLICATION

• PIPING ☐
• TANKS/
SILOS ☐
• EQUIPMENT ☐

• BEVEL ☐
• 1ST PASS ☐
• BACK GOUGING ☐

• FINAL PASS ☐
• OVERLAY ☐
• RAW MATERIAL ☐

• ☐
• ☐
• ☐

MATERIAL

• C.S. ☐
• TI ☐
• S.S. ☐

• LOW ALLOY ☐
• HASTELLOY ☐
• ☐

INSPECTION STAGE

• BEFORE PWHT ☐
• AFTER PWHT ☐
• AFTER HYD. TEST ☐

• ☐
• ☐
• ☐

INSPECTION METHOD

TYPE

• COLOUR CONTRAST
☐
• FLUORESCENT ☐

PENETRANT

• WATER WASHABLE ☐
• POST EMUL. ☐
• SOLVENT ☐
• TYPE ☐
• BRAND _____

DEVELOPPER

• DRY ☐
• WET ☐
• BRAND _____

LIGHTING

NATURAL ☐
ARTIFICIAL ☐
ULTRAVIOLET ☐

PRECLEANING

• GRINDING ☐
• MACHINING ☐
• SOLVENT ☐

REMOVABLE

• BRUSH ☐
• SPRAY. ☐

CLEANER

• TYPE ☐
• CLOTHS ☐
• BRUSHY ☐

TIME

PENETRATION _____
DEVELOPPING _____
MAX READING _____

PRECLEANING

• WATER ☐
• ALCOHOL ☐

REMOVABLE

• DIPPING ☐
• SPRAY. ☐

• SPRAY ☐
• BRAND _____

INSPECTORS**CONTRACTOR****TECHNIP****OWNER**

NAME

SIGNATURE

DATE

QCF STANDARD REV.0

TECHNIP INDIA LTD



COMPANY:

SH. 2 OF 2

W 03 N°

- ☐ WATER WASHABLE ☐ POST EMULSIFYING
- ☐ SOLVENT REMOVABLE ☐

[illegible]



PROJECT:

COMPANY:

QUALITY CONTROL FORM (NDE-04)

W 04

PROJ. No.:

QCF REV. A

SH. 1 OF 2

**MAGNETIC PARTICLE
TEST REPORT**

CONTRACTOR:

W 04 N° _____

APPLICABLE CODES/SPEC'S

- ASME V ART 7 ☐
- OTHER ☐

ACCEPTANCE CRITERIA

- ☐
- ☐

FIELD OF APPLICATION

- | | | | |
|--|---|---|----------------------------|
| • PIPING <input type="checkbox"/> | • BEVEL <input type="checkbox"/> | • FINAL PASS <input type="checkbox"/> | • <input type="checkbox"/> |
| • TANKS/SILOS <input type="checkbox"/> | • 1ST PASS <input type="checkbox"/> | • OVERLAY <input type="checkbox"/> | • <input type="checkbox"/> |
| • EQUIPMENT <input type="checkbox"/> | • BACK GOUGING <input type="checkbox"/> | • RAW MATERIAL <input type="checkbox"/> | • <input type="checkbox"/> |

MATERIAL

INSPECTION STAGE

- | | | | |
|---------------------------------|--------------------------------------|--|----------------------------|
| • C.S. <input type="checkbox"/> | • LOW ALLOY <input type="checkbox"/> | • BEFORE PWHT <input type="checkbox"/> | • <input type="checkbox"/> |
| • <input type="checkbox"/> | • <input type="checkbox"/> | • AFTER PWHT <input type="checkbox"/> | • <input type="checkbox"/> |
| • <input type="checkbox"/> | • <input type="checkbox"/> | • AFTER HYD. TEST <input type="checkbox"/> | • <input type="checkbox"/> |

INSPECTION METHOD

MAGNETIZATION	PARTICLE	COLOUR	SUSPENSION
• PRODS	• DRY <input type="checkbox"/>	• GRAY <input type="checkbox"/>	• OIL <input type="checkbox"/>
CONTACTS	• WET <input type="checkbox"/>	• FLUORESCENT <input type="checkbox"/>	• WATER <input type="checkbox"/>
Cu <input type="checkbox"/> Sb <input type="checkbox"/>	• BRAND _____	• <input type="checkbox"/>	
MAX DIST. _____	CURRENT TYPE	LIGHTING	METHOD
• YOKE	• HALF WAVE RECTIFIED <input type="checkbox"/>	• NATURAL <input type="checkbox"/>	• CONTINUOUS <input type="checkbox"/>
FIXED LEGS <input type="checkbox"/>	• ALTERNATING <input type="checkbox"/>	• ARTIFICIAL <input type="checkbox"/>	• RESIDUAL <input type="checkbox"/>
ARTICULAT.LEGS <input type="checkbox"/>		• ULTRAVIOLET <input type="checkbox"/>	• PULSES <input type="checkbox"/>
MAX DIST. _____	AMPERAGE FIELD	DEMAGNETIZATION	PRECLEANING
• COIL <input type="checkbox"/>	AMP _____	YES <input type="checkbox"/> NO <input type="checkbox"/>	• BRUSHING <input type="checkbox"/>
BRAND _____	FIELD _____	RESIDUAL	• <input type="checkbox"/>

REMARKS:

INSPECTORS

CONTRACTOR

TECHNIP

OWNER

NAME

SIGNATURE

DATE

TECHNIP INDIA LTD



COMPANY:

SH. 2 OF 2

W 04 N°

☐ FLUORESCENT

NOTES



PROJECT:

COMPANY:

QUALITY CONTROL FORM

W 10

PROJ. No.:

QCF REV. A

SH. ____ OF ____

NDE / PWHT / HT / PMI AND MATERIAL TRACEABILITY SUMMARY

CONTRACTOR:

W 10 N° (SEE ISO N°)

ISO N° _____ SH. ____ OF ____ NDE (Ref to W 09) _____ HEAT TREAT. REQUIR. Y ☐ N ☐
PIPING CLASS _____ MATERIAL _____ PMI Y ☐ N ☐

LEGEND

RTR = RADIOG. REPORT N°
UTR = UT REPORT N°
REP = REPAIR REPORT N°



PTR = PT REPORT N°
MTR = MT REPORT N°

(1) B = BUTTWELD; S = SOCKET WELD; EW = EXTERNAL WELD
(2) P = PREBRICATION; E = ERECTION
(3) A = ACCEPTED; R = TO BE REPAIRED; C = TO BE CUT; CM = CUT TO MODIFY

JOINTS			BASE MATERIAL TRACEABILITY				PMI	WELDER IDENTIF.	WPS N°	CONTROL AND EVALUATION CERTIFICATION									
N°	Type (1)	P/E (2)	HEAT NUMBER	MANUFACTURER	IDENT CODE	SHORT DESCR.	REPORT N°			VISUAL (3)	RADIOGRAPHIC / ULTRASONIC TEST			PT / MT			PMI	PWHT	HT
											RTR / UTR	(3)	REP	PTR / MTR	(3)	REP	REPORT N°	REPORT N°	REPORT N°
1																			
2																			
3																			
4																			
5																			
6																			
7																			
8																			
9																			
10																			
11																			
12																			
13																			
14																			

INSPECTORS		CONTRACTOR		TECHNIP		OWNER			
PHASE		PREFA.	ERECT.	PREFA.	ERECT.	PREFA.	ERECT.	PREFA.	ERECT.
NAME									
SIGNATURE									
DATE									

TECHNIP INDIA LTD

 		PROJECT:		
		COMPANY:		
QUALITY CONTROL FORM W 12/A		PROJ. No.:	QCF REV. A	SH. ___ OF ___
CONSTRUCTION MATERIALS APPROVAL		CONTRACTOR:		W 12/A N° ____
CIVIL <input type="checkbox"/>	PIPING <input type="checkbox"/>	MACHINERY <input type="checkbox"/>	INSTRUMENT <input type="checkbox"/>	INSULATION <input type="checkbox"/>
BLDG. <input type="checkbox"/>	MECHANIC. <input type="checkbox"/>	ELECTRICAL <input type="checkbox"/>	PAINTING <input type="checkbox"/>	STEEL STR. <input type="checkbox"/>
NDT <input type="checkbox"/>	SUPPORT PRF. <input type="checkbox"/>	_____ <input type="checkbox"/>	_____ <input type="checkbox"/>	_____ <input type="checkbox"/>
1. MATERIALS				
2. SUPPLIER				
3. PURPOSE				
4. ATTACHMENT DATA				
5. TYPE OF TEST PERFORMED				
6. TEST STANDARD UTILIZED				
REMARKS:				
RESULT: ACCEPTED <input type="checkbox"/> NOT ACCEPTED <input type="checkbox"/>				
INSPECTORS	CONTRACTOR	TECHNIP	OWNER	
NAME				
SIGNATURE				
DATE				

QCF STANDARTD REV.0

PROJECT:

COMPANY:

QUALITY CONTROL FORM

W 14A

PROJ. No.:

QCF REV. A

SH. ___ OF ___

DIMENSIONAL CHECK

CONTRACTOR:

W 14A⁽¹⁾ N°
LINE / ISOMETRICS N°
TEST CIRCUIT
SYSTEM

CHECK LIST	N.A.	V. ED	CHECK LIST	N.A.	V. ED
1 GENERAL			4. GASKETS – BOLTS		
Check per P&ID	<input type="checkbox"/>	<input type="checkbox"/>	Correct type	<input type="checkbox"/>	<input type="checkbox"/>
Line routing & size	<input type="checkbox"/>	<input type="checkbox"/>	Correct bolts or studs	<input type="checkbox"/>	<input type="checkbox"/>
Materials	<input type="checkbox"/>	<input type="checkbox"/>	Bolt lubrication	<input type="checkbox"/>	<input type="checkbox"/>
Flange rating	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Installation level & plumb	<input type="checkbox"/>	<input type="checkbox"/>			
Line slopes per drawing	<input type="checkbox"/>	<input type="checkbox"/>	5. PIPE SUPPORTS		
Branches located correctly	<input type="checkbox"/>	<input type="checkbox"/>	Field supports installed	<input type="checkbox"/>	<input type="checkbox"/>
Branches reinforced	<input type="checkbox"/>	<input type="checkbox"/>	Sufficient supports	<input type="checkbox"/>	<input type="checkbox"/>
Weepholes in reinforcing pads	<input type="checkbox"/>	<input type="checkbox"/>	Anchors installed	<input type="checkbox"/>	<input type="checkbox"/>
High point vents installed	<input type="checkbox"/>	<input type="checkbox"/>	Guides installed & aligned	<input type="checkbox"/>	<input type="checkbox"/>
Low point drains installed	<input type="checkbox"/>	<input type="checkbox"/>	Proper shoes installed and welded	<input type="checkbox"/>	<input type="checkbox"/>
Reducers located correctly / orientation	<input type="checkbox"/>	<input type="checkbox"/>	Spring supports per drawing, stopped	<input type="checkbox"/>	<input type="checkbox"/>
Reducer type correct	<input type="checkbox"/>	<input type="checkbox"/>	Piping sits on	<input type="checkbox"/>	<input type="checkbox"/>
Sample connections installed	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Clearances for expansion	<input type="checkbox"/>	<input type="checkbox"/>			
Orifice flanges properly oriented	<input type="checkbox"/>	<input type="checkbox"/>	6. INSULATING		
.....	<input type="checkbox"/>	<input type="checkbox"/>	Welded insulation supports installed	<input type="checkbox"/>	<input type="checkbox"/>
			Clearances adequate for insulation	<input type="checkbox"/>	<input type="checkbox"/>
2 VALVES			<input type="checkbox"/>	<input type="checkbox"/>
Identification code	<input type="checkbox"/>	<input type="checkbox"/>			
Flow direction	<input type="checkbox"/>	<input type="checkbox"/>	7. INSTRUMENTS		
Bypass installed	<input type="checkbox"/>	<input type="checkbox"/>	Correct control valves installed	<input type="checkbox"/>	<input type="checkbox"/>
Chain wheel installed	<input type="checkbox"/>	<input type="checkbox"/>	Meter runs properly installed	<input type="checkbox"/>	<input type="checkbox"/>
Extension installed	<input type="checkbox"/>	<input type="checkbox"/>	Valves at meter run installed	<input type="checkbox"/>	<input type="checkbox"/>
Steam oriented properly	<input type="checkbox"/>	<input type="checkbox"/>	Pressure gauge valves installed	<input type="checkbox"/>	<input type="checkbox"/>
Suitable access to operate & to maintain	<input type="checkbox"/>	<input type="checkbox"/>	Pressure gauges properly oriented	<input type="checkbox"/>	<input type="checkbox"/>
.....	<input type="checkbox"/>	<input type="checkbox"/>	Temp. connections properly oriented	<input type="checkbox"/>	<input type="checkbox"/>
			<input type="checkbox"/>	<input type="checkbox"/>
3 CONNECTION TO MACHINERY / EQUIPMENT					
Flanges parallelism / Alignment	<input type="checkbox"/>	<input type="checkbox"/>	8. TEST CIRCUIT PREPARATION		
.....	<input type="checkbox"/>	<input type="checkbox"/>	Blinds installed	<input type="checkbox"/>	<input type="checkbox"/>
			Vents and drains installed	<input type="checkbox"/>	<input type="checkbox"/>

V.ED = VERIFIED

N.A. = NOT APPLICABLE

(1) SAME TEST CIRCUIT NUMBER

INSPECTORS
CONTRACTOR
TECHNIP
OWNER

NAME

SIGNATURE

DATE



PROJECT:

COMPANY:

QUALITY CONTROL FORM

W 16

PROJ. No.:

QCF REV. A

SH. ___ OF ___

**MODIFICATIONS AFTER PRESSURE TEST
LINE/ISO CHECK REPORT**

CONTRACTOR:

W 16⁽¹⁾ N° _____

CIRCUIT N°

SYSTEM N°

LINE / ISO N°

SH. N°

MODIFICATION AS PER ATTACHED

**TEST TO BE CARRIED OUT****REPORT REFERENCE**

1)

NDE

RADIOGR. TEST

☐ YES

NO

SEE REPORT

ULTRASONIC TEST

☒ YES

NO

SEE REPORT

PENETR. TEST

☐ YES

NO

SEE REPORT

MAGNETIC TEST

YES



NO



SEE REPORT

2)

POST WELD HEAT TREATMENT

YES



NO



SEE REPORT

3)

HARDNESS TEST

YES



NO



SEE REPORT

4)

PMI

BASE MATERIAL

☐ YES

NO

SEE REPORT

WELDING

YES



NO



SEE REPORT

5)

PRESSURE TEST

YES



NO



SEE REPORT

6)

COATING / BITUMIZING CHECK

YES



NO



SEE REPORT

WELDERS IDENTIFICATION: _____

WPS N°: _____

REMARKS: (1) SAME LINE/ISO NUMBER

INSPECTORS**CONTRACTOR****TECHNIP****OWNER**

NAME

SIGNATURE

DATE



COMPANY:



W 18

SH. ____ OF ____



W 18 N° _____

DATE:



<i>INSPECTORS</i>	<i>CONTRACTOR</i>	TECHNIP	<i>OWNER</i>
NAME			
SIGNATURE			
DATE			



 		PROJECT:																																																																																																								
		COMPANY:																																																																																																								
QUALITY CONTROL FORM W 31B		PROJ. No.:	QCF REV. A																																																																																																							
REINFORCING PADS PNEUMATIC TEST REPORT		CONTRACTOR:	SH. __ OF __ W 31B N° ____																																																																																																							
<p align="center">REINFORCING PADS – PNEUMATIC TEST</p> <p>TEST MEDIUM _____ TEST PRESSURE _____ barg</p>																																																																																																										
<table border="1"> <thead> <tr> <th colspan="3">REFERENCE</th> <th rowspan="2">REINFORCING PAD IDENTIFICATION</th> <th rowspan="2">NOTES</th> </tr> <tr> <th>LINE / ISO N°</th> <th>SH.</th> <th>REV.</th> </tr> </thead> <tbody> <tr><td> </td><td> </td><td> </td><td> </td><td> </td></tr> <tr><td> </td><td> </td><td> </td><td> </td><td> </td></tr> <tr><td> </td><td> </td><td> </td><td> </td><td> </td></tr> <tr><td> </td><td> </td><td> </td><td> </td><td> </td></tr> <tr><td> </td><td> </td><td> </td><td> </td><td> </td></tr> <tr><td> </td><td> </td><td> </td><td> </td><td> </td></tr> <tr><td> </td><td> </td><td> </td><td> </td><td> </td></tr> <tr><td> </td><td> </td><td> </td><td> </td><td> </td></tr> <tr><td> </td><td> </td><td> </td><td> </td><td> </td></tr> <tr><td> </td><td> </td><td> </td><td> </td><td> </td></tr> <tr><td> </td><td> </td><td> </td><td> </td><td> </td></tr> <tr><td> </td><td> </td><td> </td><td> </td><td> </td></tr> <tr><td> </td><td> </td><td> </td><td> </td><td> </td></tr> <tr><td> </td><td> </td><td> </td><td> </td><td> </td></tr> <tr><td> </td><td> </td><td> </td><td> </td><td> </td></tr> <tr><td> </td><td> </td><td> </td><td> </td><td> </td></tr> <tr><td> </td><td> </td><td> </td><td> </td><td> </td></tr> <tr><td> </td><td> </td><td> </td><td> </td><td> </td></tr> <tr><td> </td><td> </td><td> </td><td> </td><td> </td></tr> </tbody> </table>			REFERENCE			REINFORCING PAD IDENTIFICATION	NOTES	LINE / ISO N°	SH.	REV.																																																																																																
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LINE / ISO N°	SH.	REV.																																																																																																								
TEST RESULT: ACCEPTED <input type="checkbox"/>																																																																																																										
REMARKS:																																																																																																										
INSPECTORS		CONTRACTOR		OWNER																																																																																																						
NAME																																																																																																										
SIGNATURE																																																																																																										
DATE																																																																																																										

QCF STANDARD REV:0

 		PROJECT:		
		COMPANY:		
QUALITY CONTROL FORM W 31C		PROJ. No.:	QCF REV. A	SH. 1 OF 2
INSPECTION OF VENTURI, RESTRICTION ORIFICE AND FLOW ORIFICE		CONTRACTOR:		W 31C N° _____
EQUIPMENT ID NUMBER:	EQUIPMENT DESCRIPTION:	EQPT CODE	SYSTEM ID.	
LAYOUT DRAWING NUMBER:	REV N° :	PURCHASE ORDER NUMBER:		

ITEM N°	ACCEPTANCE CRITERIA	REFERENCE	N.A.	V.ED
A	General Installation Requirements			
A1	Standard Orifice Plate Installation checked together for accuracy and data completion on installation: <ul style="list-style-type: none"> • Orifice bore is sharp upstream, 45 degree bevelled downstream; • Orifice bore is sharp, restrictive and shaped like a semi-circle; • Orifice bore is not bevelled and has sharp honed corners; • Upstream edges honed round/smooth have no nicks or flat spots downstream is bevelled 45 degrees. 		<input type="checkbox"/>	<input type="checkbox"/>
A2	Orifice Plates checked: A) Material is A240 Type 316 SS (max 217 HB) or per P.O. B) Plates have a fine finish (honed, lapped, polished or buffed). C) Plates are free of surface defects and bore edges are smooth. D) Downstream bevelled edges have no grooves, ridges or pits. E) Plates are flat, bores are centered and outside edges deburred. F) Plates are free from mechanical damage and welding distortion. G) Welded handles are parallel to plates with welds ground flush.		<input type="checkbox"/>	<input type="checkbox"/>
A3	Visually ID markings and orientation.		<input type="checkbox"/>	<input type="checkbox"/>
A4	Visually check orientation against Standard drawing.		<input type="checkbox"/>	<input type="checkbox"/>
A5	Orifice plates and holders. Check installation meets Standard Drawing dimensions.		<input type="checkbox"/>	<input type="checkbox"/>
A6	Ring Joint Orifice Assemblies. Visually Check ID markings and orientation.		<input type="checkbox"/>	<input type="checkbox"/>
A7	Straight minimum piping run lengths for Orifice Runs are acceptable. Measure and ensure installation spacings are acceptable. Noting correct direction of flow, the "A" Upstream and "B" Downstream Dimensions are within stated tolerances.		<input type="checkbox"/>	<input type="checkbox"/>
A8	Verify installation spacings as applicable on lines.		<input type="checkbox"/>	<input type="checkbox"/>
A9	Visually check flange class meets installed with taps/jackscrews. Internal welds are smooth, NDE complete.		<input type="checkbox"/>	<input type="checkbox"/>
A10	Visually check flanges for ring joint orifice assemblies.		<input type="checkbox"/>	<input type="checkbox"/>
A11	Orifice Flange Taps. Check tap dimensions and ensure clearances and spacing.		<input type="checkbox"/>	<input type="checkbox"/>
A12	Venturi Cylindrical Inlet sections are examined and accepted.		<input type="checkbox"/>	<input type="checkbox"/>

 		PROJECT:		
		COMPANY:		
QUALITY CONTROL FORM W 31C		PROJ. No.:	QCF REV. A	SH. 2 OF 2
INSPECTION OF VENTURI, RESTRICTION ORIFICE AND FLOW ORIFICE		CONTRACTOR:		W 31C N° _____
ITEM N°	ACCEPTANCE CRITERIA	REFERENCE	N.A.	V.ED
A13	Venturi Convergent entrances are examined and accepted.		<input type="checkbox"/>	<input type="checkbox"/>
A14	Venturi Throat sections are examined and accepted.		<input type="checkbox"/>	<input type="checkbox"/>
A15	Venturi Divergent outlet sections are examined and accepted.		<input type="checkbox"/>	<input type="checkbox"/>
A16	Venturi items for inspection and acceptance are as follows: A) Throat linings, as applicable, are secure and undamaged. B) Pressure Taps (if applicable) meet Engineering Drawing dimensions.		<input type="checkbox"/>	<input type="checkbox"/>
A17	Measure/ensure installation spacings are acceptable and direction of flow is correct.		<input type="checkbox"/>	<input type="checkbox"/>
A18	SS materials and plates are kept wrapped and protected from damage and are handled with extreme care during installation.		<input type="checkbox"/>	<input type="checkbox"/>
A19	Installation of venturis and orifice plates are not permanently installed until after piping systems have been flushed clean and hydrotested. Installed venturis and orifice plates (to ensure proper pipefitting) are removed, blocked off or isolated prior to commencing flushing/cleaning as they are sensitive to damage. Venturis and orifice plates go in last on line reinstatement.		<input type="checkbox"/>	<input type="checkbox"/>
Remarks:				
INSPECTORS		CONTRACTOR	TECHNIP	OWNER
NAME				
SIGNATURE				
DATE				

 		PROJECT:					
		COMPANY:					
QUALITY CONTROL FORM W 51AG				PROJ. No.:	QCF REV. A	SH. 1 OF 2	
PIPING ERECTION (PER ISO) SUMMARY REPORT				CONTRACTOR:			W 51AG N° _____
ISOMETRIC / DRAWING N° _____				SH. _____ OF _____		REV. _____	
AREA _____				SYSTEM N° _____			
INSPECTIONS (REF. TO QCP 1320.01)		N.A.	ACC.	REMARKS/ REFERENCES	INSPECTORS SIGNATURE & DATE		
					CONTR.	TECHNIP.	OWNER
D.1	PREASSEMBLY	<input type="checkbox"/>	<input type="checkbox"/>	W 10 (*)			
D.2	DELIVERED MATERIAL READY AT SITE (MATERIALS & SPOOLS IDENTIFICATION AND CONSERVATION STATUS)	<input type="checkbox"/>	<input type="checkbox"/>				
D.3	PIPE / SPOOL INTERNAL CLEANING	<input type="checkbox"/>	<input type="checkbox"/>	IC 01 (**)			
D.4	PIPE / SPOOL ERECTION AND ALIGNMENT (inclusive pipe identification transfer if required)	<input type="checkbox"/>	<input type="checkbox"/>				
D.5	PIPE / SPOOL TACK WELDS	<input type="checkbox"/>	<input type="checkbox"/>				
D.6	GAP CONTROL FOR SOCKET WELDS	<input type="checkbox"/>	<input type="checkbox"/>	W 24 (**)			
D.7	WELDING	<input type="checkbox"/>	<input type="checkbox"/>	W 10 (*)			
D.8	ORIFICE FLANGES AND VENTURI INSTALLATION	<input type="checkbox"/>	<input type="checkbox"/>	W 31C (**)			
D.9	PNEUMATIC TEST FOR REINFORCING PADS	<input type="checkbox"/>	<input type="checkbox"/>	W 31B (**)			
D.10	MATERIAL FULL TRACEABILITY	<input type="checkbox"/>	<input type="checkbox"/>	W 10 (*)			
D.11	RT JOINT SELECTION REQUEST	<input type="checkbox"/>	<input type="checkbox"/>	RT 01 (**)			
D.12	NDE / PMI / PWHT / HT EXECUTION & TRACEABILITY						
D.12.1	WELDING DAILY PROGRESS & VISUAL EXAMINATION	<input type="checkbox"/>	<input type="checkbox"/>	W 24 (**)			
D.12.2	PMI EXECUTION	<input type="checkbox"/>	<input type="checkbox"/>	QC 21 (**)			
D.12.3	PWHT CHART RECORDS	<input type="checkbox"/>	<input type="checkbox"/>	contractor Report (**)			
D.12.4	HARDNESS TEST EXECUTION	<input type="checkbox"/>	<input type="checkbox"/>	contractor Report (**)			
D.12.5	LIQUID PENETRANT EXAMINATION	<input type="checkbox"/>	<input type="checkbox"/>	W 03 (**)			
D.12.6	MAGNETIC PARTICLE EXAMINATION	<input type="checkbox"/>	<input type="checkbox"/>	W 04 (**)			
D.12.7	RADIOGRAPHIC EXAM. FILM REVIEW	<input type="checkbox"/>	<input type="checkbox"/>	W 01 (**)			
D.12.8	ULTRASONIC EXAMINATION	<input type="checkbox"/>	<input type="checkbox"/>	W 02 (**)			
D.12.9	NDE / PMI / PWHT / HT TRACEABILITY	<input type="checkbox"/>	<input type="checkbox"/>	W 10 (*)			
D.13	JOINT REPAIR EXECUTION	<input type="checkbox"/>	<input type="checkbox"/>	W 10 (*)			
D.14	REPAIRS RAD. FILM REVIEW	<input type="checkbox"/>	<input type="checkbox"/>	W 01 (**)			
D.15	JOINT CUT OUT FOR MODIFICATION	<input type="checkbox"/>	<input type="checkbox"/>	W 10 (*)			
D.16	PIPING SUPPORT INSTALLATION	<input type="checkbox"/>	<input type="checkbox"/>				
D.17	VALVE INSTALLATION	<input type="checkbox"/>	<input type="checkbox"/>	V 01 (**)			
D.18	FLANGE FACES INSPECTION	<input type="checkbox"/>	<input type="checkbox"/>				

				PROJECT:			
				COMPANY:			
QUALITY CONTROL FORM W 51AG				PROJ. No.:	QCF REV. A	SH. 2 OF 2	
PIPING ERECTION (PER ISO) SUMMARY REPORT				CONTRACTOR:		W 51AG N° _____	
INSPECTIONS (REF. TO QCP 1320.01)		N.A.	ACC.	REMARKS/ REFERENCES	INSPECTORS SIGNATURE & DATE		
					CONTR.	TECHNIP	OWNER
D.19	FLANGES PARALLELISM / ALIGNMENT & GASKET INSTALLATION	<input type="checkbox"/>	<input type="checkbox"/>	BT 01 (**)			
D.20	TORQUE WRENCHES CALIBRATION	<input type="checkbox"/>	<input type="checkbox"/>	Contractor Report (**)			
D.21	JOINT BOLTS TIGHTENING EXECUTION	<input type="checkbox"/>	<input type="checkbox"/>	BTC 01 (**)			
D.22	SLOPE CHECK	<input type="checkbox"/>	<input type="checkbox"/>	SS 01 (**)			

NOTES: (*) W 10 HAVE THE SAME N° OF THE ISOMETRIC

(**) THE QC REPORTS N° SHALL BE INDICATED IN THE RELEVANT HERE BELOW SPACES :

IC 01 N° _____ W31B N° _____ W31C N° _____ W24 N° _____ RT 01 N° _____ QC21 N° _____ W01 N° _____ W02 N° _____

W03 N° _____ W04 N° _____ V 01 N° _____ BT01 N° _____ BTC01 N° _____ SS 01 N° _____

PWHT contractor Report N° _____ HT contractor Report N° _____ CALIBRATION contractor Report N° _____

D.25) FINAL DOC. REVIEW	INSPECTORS	CONTRACTOR	TECHNIP	OWNER
	NAME			
	SIGNATURE			
	DATE			



TechnipFMC



PROJECT:

COMPANY:

QUALITY CONTROL FORM

W 51T

PROJ. No.:

QCF REV. A

SH. ___ OF ___

**PRESSURE TEST PREPARATION / EXECUTION
(PER TESTING CIRCUIT)
SUMMARY REPORT**

CONTRACTOR:

W 51T N° ____

TEST CIRCUIT N° _____ SYSTEM N° _____

LINES / ISOs N° _____

INSPECTIONS (REF. TO QCF 1320.01)		N.A.	ACC.	REMARKS/ REFERENCES	INSPECTORS SIGNATURE & DATE		
					CONTRACT.	TECHNIP	OWNER
E.1	TEST PACK CREATION	<input type="checkbox"/>	<input type="checkbox"/>				
E.2	PUNCH LIST BEFORE PRESSURE TEST	<input type="checkbox"/>	<input type="checkbox"/>	PL 10 (*)			
E.3	NDE VERIFICATION (Check of relative QCF W10 issued for ISO's)	<input type="checkbox"/>	<input type="checkbox"/>				
E.4	DIMENSIONAL CHECK	<input type="checkbox"/>	<input type="checkbox"/>	W 14A (*)			
E.5	PUNCH "A" CLEARANCE AND RELEASE FOR TEST	<input type="checkbox"/>	<input type="checkbox"/>	PL 10 (*)			
E.6	INTERNAL CLEANLINESS VERIFICATION (Check of relative QCF IC01 issued for spools/ISO)	<input type="checkbox"/>	<input type="checkbox"/>				
E.7	BLIND FLANGES INSTALLATION	<input type="checkbox"/>	<input type="checkbox"/>	BCS 01 (*)			
E.8	PRESSURE TEST EXECUTION	<input type="checkbox"/>	<input type="checkbox"/>	W 13 (*)			
E.9	WATER DRY-OUT EXECUTION	<input type="checkbox"/>	<input type="checkbox"/>	LU 01 (*)			
E.10	BLIND FLANGES REMOVAL	<input type="checkbox"/>	<input type="checkbox"/>	BCS 01 (*)			
E.11	WORK ACCEPTANCE OF "PUNCH LIST AFTER PRESSURE TEST" (LINE REINSTATEMENT)	<input type="checkbox"/>	<input type="checkbox"/>	W 14B (*)			

NOTES: (*) W 14A HAVE THE SAME N° OF THE TEST CIRCUIT

(**) THE QC REPORTS N° SHALL BE INDICATED IN THE RELEVANT HERE BELOW SPACES :

PL 10 N° _____ W14A N° _____ W14B N° _____ BCS 01 N° _____ W13 N° _____ LU 01 N° _____

QCF STANDARD REV.1

E.12) FINAL DOC.
REVIEW

INSPECTORS	CONTRACTOR	TECHNIP	OWNER
NAME			
SIGNATURE			
DATE			

TECHNIP INDIA LTD



TechnipFMC



PROJECT:

COMPANY:

QUALITY CONTROL FORM

W 51T

PROJ. No.:

QCF REV. A

SH. ___ OF ___

**PRESSURE TEST PREPARATION / EXECUTION
(PER TESTING CIRCUIT)
SUMMARY REPORT**

CONTRACTOR:

W 51T N° _____

TEST CIRCUIT N° _____ SYSTEM N° _____

LINES / ISOs N° _____

INSPECTIONS (REF. TO QCP 1320.01)		N.A.	ACC.	REMARKS/ REFERENCES	INSPECTORS SIGNATURE & DATE		
					CONTRACT.	TECHNIP	OWNER
E.1	TEST PACK CREATION	<input type="checkbox"/>	<input type="checkbox"/>				
E.2	MECHANICAL CLEARANCE FOR PRESSURE TESTING	<input type="checkbox"/>	<input type="checkbox"/>	MC 01 (*)			
E.3	PUNCH LIST BEFORE PRESSURE TEST	<input type="checkbox"/>	<input type="checkbox"/>	PL 10 (**)			
E.4	NDE VERIFICATION (Check of relative QCF W10 issued for ISO's)	<input type="checkbox"/>	<input type="checkbox"/>	W 10			
E.5	PUNCH "A" CLEARANCE AND RELEASE FOR TEST	<input type="checkbox"/>	<input type="checkbox"/>	PL 10 (**)			
E.6	INTERNAL CLEANLINESS VERIFICATION (Check of relative QCF IC01 issued for spools/ISO)	<input type="checkbox"/>	<input type="checkbox"/>				
E.7	BLIND FLANGES INSTALLATION	<input type="checkbox"/>	<input type="checkbox"/>	BCS 01 (**)			
E.8	BOLT TORQUING CHECK REPORT	<input type="checkbox"/>	<input type="checkbox"/>	BTC 01 (**)			
E.9	PRESSURE TEST EXECUTION	<input type="checkbox"/>	<input type="checkbox"/>	W 13 (**)			
E.10	WATER DRY-OUT EXECUTION	<input type="checkbox"/>	<input type="checkbox"/>	LU 01 (**)			
E.11	BLIND FLANGES REMOVAL	<input type="checkbox"/>	<input type="checkbox"/>	BCS 01 (**)			
E.12	WORK ACCEPTANCE OF "PUNCH LIST AFTER PRESSURE TEST" (LINE REINSTATEMENT)	<input type="checkbox"/>	<input type="checkbox"/>	PL 10 (**)			

NOTES: (*) MC 01 HAVE THE SAME N° OF THE TEST CIRCUIT

(**) THE QC REPORTS N° SHALL BE INDICATED IN THE RELEVANT HERE BELOW SPACES :

PL 10 N° _____ W14A N° _____ BCS 01 N° _____ W13 N° _____ LU 01 N° _____ BTC 01 N° _____

QCF STANDARD REV.1

E.12) FINAL DOC. REVIEW	INSPECTORS	CONTRACTOR	TECHNIP	OWNER
	NAME			
	SIGNATURE			
	DATE			

TECHNIP INDIA LTD



TechnipFMC



PROJECT:

COMPANY:

QUALITY CONTROL FORM

W 51UG

PROJ. No.:

QCF REV. A

SH. 1 OF 2

**PIPING ERECTION (PER ISO)
SUMMARY REPORT**

CONTRACTOR:

W 51UG N° ____

ISOMETRIC / DRAWING N° _____

SH. ____ OF ____ REV. _____

AREA _____

SYSTEM N° _____

INSPECTIONS (REF. TO QCP 1320.01)		N.A.	ACC.	REMARKS/ REFERENCES	INSPECTORS SIGNATURE & DATE		
					CONTR.	TECHNIP.	OWNER
D.1	PREASSEMBLY	<input type="checkbox"/>	<input type="checkbox"/>	W 10 (*)			
D.2	DELIVERED MATERIAL READY AT SITE (MATERIALS & SPOOLS IDENTIFICATION AND CONSERVATION STATUS)	<input type="checkbox"/>	<input type="checkbox"/>				
D.3	PIPE / SPOOL INTERNAL CLEANING	<input type="checkbox"/>	<input type="checkbox"/>	IC 01 (**)			
D.4	PIPE / SPOOL ERECTION AND ALIGNMENT (inclusive pipe identification transfer if required)	<input type="checkbox"/>	<input type="checkbox"/>				
D.5	PIPE / SPOOL TACK WELDS	<input type="checkbox"/>	<input type="checkbox"/>				
D.7	WELDING	<input type="checkbox"/>	<input type="checkbox"/>	W 10 (*)			
D.8	ORIFICE FLANGES AND VENTURI INSTALLATION	<input type="checkbox"/>	<input type="checkbox"/>	W 31C (**)			
D.9	PNEUMATIC TEST FOR REINFORCING PADS	<input type="checkbox"/>	<input type="checkbox"/>	W 31B (**)			
D.10	MATERIAL FULL TRACEABILITY	<input type="checkbox"/>	<input type="checkbox"/>	W 10 (*)			
D.11	RT JOINT SELECTION REQUEST	<input type="checkbox"/>	<input type="checkbox"/>	RT 01 (**)			
D.12	NDE / PMI / PWHT / HT EXECUTION & TRACEABILITY						
D.12.1	WELDING DAILY PROGRESS & VISUAL EXAMINATION	<input type="checkbox"/>	<input type="checkbox"/>	W 24 (**)			
D.12.2	PMI EXECUTION	<input type="checkbox"/>	<input type="checkbox"/>	QC 21 (**)			
D.12.3	PWHT CHART RECORDS	<input type="checkbox"/>	<input type="checkbox"/>	Contractor Report (**)			
D.12.4	HARDNESS TEST EXECUTION	<input type="checkbox"/>	<input type="checkbox"/>	Contractor Report (**)			
D.12.5	LIQUID PENETRANT EXAMINATION	<input type="checkbox"/>	<input type="checkbox"/>	W 03 (**)			
D.12.6	MAGNETIC PARTICLE EXAMINATION	<input type="checkbox"/>	<input type="checkbox"/>	W 04 (**)			
D.12.7	RADIOGRAPHIC EXAM. FILM REVIEW	<input type="checkbox"/>	<input type="checkbox"/>	W 01 (**)			
D.12.8	ULTRASONIC EXAMINATION	<input type="checkbox"/>	<input type="checkbox"/>	W 02 (**)			
D.12.9	NDE / PMI / PWHT / HT TRACEABILITY	<input type="checkbox"/>	<input type="checkbox"/>	W 10 (*)			
D.13	JOINT REPAIR EXECUTION	<input type="checkbox"/>	<input type="checkbox"/>	W 10 (*)			
D.14	REPAIRS RAD. FILM REVIEW	<input type="checkbox"/>	<input type="checkbox"/>	W 01 (**)			
D.15	JOINT CUT OUT FOR MODIFICATION	<input type="checkbox"/>	<input type="checkbox"/>	W 10 (*)			
D.16	PIPING SUPPORT INSTALLATION	<input type="checkbox"/>	<input type="checkbox"/>				
D.17	VALVE INSTALLATION	<input type="checkbox"/>	<input type="checkbox"/>	V 01 (**)			
D.18	FLANGE FACES INSPECTION	<input type="checkbox"/>	<input type="checkbox"/>				

				PROJECT:			
				COMPANY:			
QUALITY CONTROL FORM W 51UG				PROJ. No.:	QCF REV. A	SH. 2 OF 2	
PIPING ERECTION (PER ISO) SUMMARY REPORT				CONTRACTCTOR:		W 51UG N° ____	
INSPECTIONS (REF. TO QCP 1320.01)		N.A.	ACC.	REMARKS/ REFERENCES	INSPECTORS SIGNATURE & DATE		
					CONTR.	TECHNIP	OWNER
D.19	FLANGES PARALLELISM / ALIGNMENT & GASKET INSTALLATION	<input type="checkbox"/>	<input type="checkbox"/>	BT 01 (**)			
D.20	TORQUE WRENCHES CALIBRATION	<input type="checkbox"/>	<input type="checkbox"/>	Contractctor Report (**)			
D.21	JOINT BOLTS TIGHTENING EXECUTION	<input type="checkbox"/>	<input type="checkbox"/>	BTC 01 (**)			
D.22	SLOPE CHECK	<input type="checkbox"/>	<input type="checkbox"/>	SS 01 (**)			
D.23	PRESSURE TEST	<input type="checkbox"/>	<input type="checkbox"/>	W 51T (**)			
D.24	HOLIDAY TEST AFTER PRESSURE TEST	<input type="checkbox"/>	<input type="checkbox"/>	W 18 (**)			

NOTES: (*) W 10 HAVE THE SAME N° OF THE ISOMETRIC



(**) THE QC REPORTS N° SHALL BE INDICATED IN THE RELEVANT HERE BELOW SPACES :

IC 01 N° ____ W31B N° ____ W31C N° ____ W24 N° ____ RT 01 N° ____ QC21 N° ____ W01 N° ____ W02 N° ____
W03 N° ____ W04 N° ____ V 01 N° ____ BT01 N° ____ BTC01 N° ____ SS 01 N° ____ W 18 N° ____ W 51T

N° ____

PWHT Contractctor Report N° ____ HT Contractctor Report N° ____ CALIBRATION Contractctor Report N° ____

D.25) FINAL DOC. REVIEW	INSPECTORS	CONTRACTCTOR	TECHNIP	OWNER
	NAME			
	SIGNATURE			
	DATE			

 	PROJECT	Standby SRU & Additional Tanks		
	CLIENT	INDIAN OIL CORPORATION LIMITED		
QCP-STEAM TRACING SYSTEM	Project No. 080557C001	Document No. 080557C-000-QCP-1330-001	Rev. No. A	Page 1 of 5





QUALITY CONTROL PLAN

STEAM TRACING SYSTEM

TYPE OF QUALITY CONTROL REPORT	CERTIFICATION EXTENT
W 12/A	SINGLE REPORT PER EACH MATERIAL
W 03 – W 04	SINGLE REPORT PER EACH EXAMINATION
HT01a - HT02a - HT02b	SINGLE REPORT PER EACH ITEM
HT01 – HT02 – HT03	SUMMARY
W13 - W14A - W14B - PL10	SINGLE REPORT PER EACH TESTING CIRCUIT



REFERENCE DOCUMENTS:

- 080557C-000-PP-805
 - 080557C-000-PP-814
 - 080557C-000-PP-807
 - 080557C-000-PP-804
 - QCP 1399.02
 - QCP 1399.01
 - 080557C-000-JSC-1300-001
 - 080557C-000-JSD-2300-001
 - 080557C-000-JSD-2200-001
 - 080557C-000-JSD-2200-002
 - 080557C-000-PP-820
 - 080557C-000-PP-821
 - DRAWINGS
- Site Coordination & Communication Procedure.
Welding Specification for Fabrication of Piping
Material Receiving Handling & Storage procedure
Specification for Positive Material Identification at Construction Site.
Piping Welding Activities Management (NDE / PWHT / HT / PMI Included)
Welders Management
Standard Specification for Fabrication and Erection of Piping
Specification for Surface Preparation and Protective Coating
Job Specification for Hot Insulation of Vessels, Piping and Equipment
Job Specification for Cold Insulation of Vessels, Piping and Equipment
Standard specification for inspection, flushing and testing of piping systems.
Equipment
Job Construction specification for Welder Management

		 Samit Paul 2019.10.21 17:48:59 +05'30'		 Digitally signed by samit.paul@technipfmc.com DN: cn=samit.paul, o=technipfmc.com Date: 2019.10.21 19:34:52 +05'30'	 Approved By 16:57:13 +05'30'	 Authorized By Morischristopher Jesumarian 2019.11.06 22:27:21 +05'30'
A	19/10/2019	ISSUED FOR INFORMATION	SMP	PKP	LA/ANJ	JMC
REV.	DATE	DESCRIPTION	PREPARED	CHECKED	APPROVED	AUTHORIZED



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 	PROJECT	Standby SRU & Additional Tanks		
	CLIENT	INDIAN OIL CORPORATION LIMITED		
QCP-STEAM TRACING SYSTEM	Project No. 080557C001	Document No. 080557C-000-QCP-1330-001	Rev. No. A	Page 2 of 5



LEGENDA

H	=	HOLD (RFI required - Work stop for inspection)
W	=	WITNESS (RFI required)
WC	=	100 % SUPERVISION AND EXAMINATION BY CONTRACTOR.
S	=	SURVEILLANCE (No RFI)
R	=	REVIEW OF REPORTS
N.A.	=	NOT APPLICABLE
A	=	AUTHORIZATION / APPROVAL (RFI required)
IFA	=	ISSUED FOR AUTHORIZATION/APPROVAL
INFO	=	FOR INFORMATION
RFI	=	REQUEST FOR INSPECTION
!	=	WARNING (control of document revision status)

 	PROJECT	Standby SRU & Additional Tanks		
	CLIENT	INDIAN OIL CORPORATION LIMITED		
QCP-STEAM TRACING SYSTEM	Project No. 080557C001	Document No. 080557C-000-QCP-1330-001	Rev. No. A	Page 3 of 5

<h2 style="margin: 0;">QUALITY CONTROL PLAN</h2> <h3 style="margin: 0;">STEAM TRACING SYSTEM</h3>

S.NO	CHECK AND INSPECTION ITEM	QUALITY CONTROL REPORT	ACTION		NOTES
			CONTR.	COMPANY	
A)	PRELIMINARY ACTIVITIES				
A.1	CONTRACTOR DRAWINGS CHECK REVISION STATUS	N.A.	!	!	
A.2	CONTRACTOR TECHNICAL SPECIFICATION AND PROCEDURE	N.A.	!	!	
A.3	CONTRACTOR METHOD STATEMENTS	N.A.	WC	A	
B)	BEFORE ERECTION				
B.1	WELDERS MANAGEMENT	Use QCP 1399.01			(1)
B.2	WELDING, NDE/PMI/PWHT/HT MANAGEMENT	Use QCP 1399.02			(1)
B.3	MATERIALS APPROVAL AND RECEIVING INSPECTION	W 12/A	WC	W/R	
B.4	LINE SURFACE INSPECTION BEFORE TRACER INSTALLATION	Use QCP 2200.01			(1)
C)	ERECTION				
C.1	<u>STEAM AND CONDENSATE MANIFOLDS INSTALLATION</u>				
C.1.1	IDENTIFICATION	HT01a - HT01	WC	R/S	
C.1.2	POSITIONING	HT 01	WC	R/S	
C.1.3	MANIFOLDS INSPECTION	HT 01	WC	R/S	
C.1.4	FINAL DOCUMENTATION REVIEW	HT 01			
C.2	<u>TRACER FEED & DISCHARGE LINES INSTALLATION</u>				
C.2.1	IDENTIFICATION	HT02a - HT02	WC	R/S	
C.2.2	POSITIONING	HT 02	WC	R/S	
C.2.3	COMPRESSION JOINT (IF TUBING)	HT 02	WC	R/S	
C.2.4	WELDING (IF PIPING)	HT 02	WC	R/S	
C.2.5	SUPPORTS	HT 02	WC	R/S	
C.2.6	NDE EXECUTION (IF PIPING)				
C.2.6a	VISUAL EXAMINATION	HT 02	WC	R/S	
C.2.6b	LIQUID PENETRANT EXAM. (where required)	W 03 - HT 02	WC	R/S	
C.2.6c	MAGNETIC PARTIC. EXAM. (where required)	W 04 - HT	WC	R/S	

 	PROJECT	Standby SRU & Additional Tanks		
	CLIENT	INDIAN OIL CORPORATION LIMITED		
QCP-STEAM TRACING SYSTEM	Project No. 080557C001	Document No. 080557C-000-QCP-1330-001	Rev. No. A	Page 4 of 5



S.NO	CHECK AND INSPECTION ITEM	QUALITY CONTROL REPORT	ACTION		NOTES
			CONTR.	COMPANY	
		02			
C.2.7	TRACER FEED & DISCHARGE LINES INSPECTION	HT 02	WC	W/R	
C.3	<u>TRACER LINES INSTALLATION</u>				
C.3.1	IDENTIFICATION	HT02b - HT02	WC	R/S	
C.3.2	POSITIONING	HT 02	WC	R/S	
C.3.3	COMPRESSION JOINT (IF TUBING)	HT 02	WC	R/S	
C.3.4	WELDING (IF PIPING)	HT 02	WC	R/S	
C.3.5	FIXING TO TRACED LINE SUPPORT	HT 02	WC	R/S	
C.3.6	EXPANSION LOOP (where required)	HT 02	WC	R/S	
C.3.7	NDE EXECUTION (IF PIPING)	HT 02	WC	R	
C.3.7a	VISUAL EXAMINATION	HT 02	WC	R	
C.3.7b	LIQUID PENETRANT EXAM. (where required)	W 03 - HT 02	WC	R	
C.3.7c	MAGNETIC PARTIC. EXAM. (where required)	W 04 - HT 02	WC	R	
C.3.8	TRACER LINES INSPECTION	HT 02	WC	W/R	
C.4	FINAL DOCUMENTATION REVIEW	HT 02			
C.5	<u>PRESSURE TEST</u>				
C.5.1	TEST PACK CREATION	HT 03	WC	R	
C.5.2	PUNCH LIST BEFORE PRESSURE TEST	PL10 – HT 03	WC	W	
C.5.3	DIMENSIONAL CHECK	W14A - HT 03	WC	W/R	
C.5.4	TEST PREPARATION (INCLUDING TESTING EQUIPMENT) & PRESSURE TEST EXECUTION	W13 - HT 03	WC	W/R	
C.5.5	WORK ACCEPTANCE OF "PUNCH LIST AFTER PRESSURE TEST" (LINE REINSTATEMENT)	W14B - HT 03	WC	W/R	
C.5.6	FINAL DOCUMENTATION REVIEW	HT 03			

NOTES:

- (1) FORMS, INSPECTION AND ATTENDANCE SHALL BE IN ACCORDANCE WITH REFERRED QCP.

GENERAL NOTES

- THE ENCLOSED ITP'S ARE INDICATIVE AND SHALL BE FOLLOWED FOR DEVELOPING THE JOB SPECIFIC ITP'S FOR THE WORKS TO BE PERFORMED BY THE CONTRACTOR. THE PROVISIONS INDICATED FOR STAGE WISE INSPECTION BY TECHNIP AND OWNER (FOR SPECIFIC ACTIVITIES) ARE THE MINIMUM AND THE ENGINEER-IN-CHARGE MAY DECIDE TO INCREASE HOLD POINTS/ WITNESS POINTS, WHILE APPROVING THE JOB SPECIFIC ITP'S. ACTIVITIES FOR WHICH ITP'S ARE NOT PROVIDED IN THIS SPECIFICATION. CONTRACTOR TO DEVELOP AND GET THE SAME APPROVED BY TECHNIP/OWNER BEFORE START OF THE WORK. IN

 	PROJECT	Standby SRU & Additional Tanks		
	CLIENT	INDIAN OIL CORPORATION LIMITED		
QCP-STEAM TRACING SYSTEM	Project No. 080557C001	Document No. 080557C-000-QCP-1330-001	Rev. No. A	Page 5 of 5

GENERAL ROLE OF TECHNIP HAS BEEN SPECIFIED IN THE DOCUMENT THE ROLE OF OWNER TO BE SPECIFIED DURING PREPARATION OF SITE SPECIFIC ITP'S.

- 2 CONTRACTOR TO SUBMIT JOB SPECIFIC REPORTING FORMATS AND JOB PROCEDURES FOR THE JOBS FOR EACH ACTIVITY LISTED IN THE ITP'S AND SUBMIT TO TECHNIP/OWNER FOR APPROVAL. BEFORE COMMENCEMENT OF THE ACTIVITY. IF THE CONTRACTOR HAS TO DEVIATE FROM THE GIVEN ITP FOR A VALID REASON, HE SHALL OBTAIN PRIOR WRITTEN APPROVAL OF TECHNIP/OWNER. CONTRACTOR TO CARRY OUT 100% EXAMINATION OF ALL ACTIVITIES.



TechnipFMC



PROJECT:

COMPANY:

QUALITY CONTROL FORM

HT 02a

PROJ. No.:

QCF REV. A

SH. ____ OF ____

**TRACER FEED & DISCHARGE LINES INSTALL.
REPORT**

CONTRACTOR:

HT 02a N° _____

TRACER FEED LINES

ITEM

TRACER DISCHARGE LINES

ITEM

NOTES:

INSPECTORS

CONTRACTOR



TECHNIP



OWNER

NAME

SIGNATURE

DATE

 				PROJECT:			
				COMPANY:			
QUALITY CONTROL FORM HT03				PROJ. No.:	QCF REV. A	SH. ____ OF ____	
PRESSURE TEST SUMMARY REPORT				CONTRACTOR:			HT 03 N° _____
INSPECTIONS (REF. TO QCP 1330.01)			N.A.	ACC	REMARKS/ REFERENCES	INSPECTORS SIGNATURE & DATE	
						CONTR.	TECHNIP
						OWNER	
C.5	PRESSURE TEST						
C.5.1	TEST PACK CREATION	<input type="checkbox"/>	<input type="checkbox"/>				
C.5.2	PUNCH LIST BEFORE PRESSURE TEST	<input type="checkbox"/>	<input type="checkbox"/>	PL 10 (*)			
C.5.3	DIMENSIONAL CHECK	<input type="checkbox"/>	<input type="checkbox"/>	W 14A (*)			
C.5.4	TEST PREPARATION (INCLUDING TESTING EQUIPMENT) & PRESSURE TEST EXECUTION	<input type="checkbox"/>	<input type="checkbox"/>	W 13 (*)			
C.5.5	WORK ACCEPTANCE OF "PUNCH LIST AFTER PRESSURE TEST" (LINE REINSTATEMENT)	<input type="checkbox"/>	<input type="checkbox"/>	W 14B (*)			
NOTES: (*) THE QC REPORTS N° SHALL BE INDICATED IN THE RELEVANT HERE BELOW SPACES : PL10 N° _____ W14A N° _____ W14B N° _____ W13 N° _____							
C.5.6 - FINAL DOC. REVIEW	INSPECTORS		CONTRACTOR		PMC		OWNER
	NAME						
	SIGNATURE						
	DATE						

 				PROJECT:			
				COMPANY:			
QUALITY CONTROL FORM HT 01				PROJ. No.:	QCF REV. A	SH. ____ OF ____	
MANIFOLDS INSTALLATION SUMMARY REPORT				CONTRACTOR:			HT 01 N° ____
INSPECTIONS (REF. TO QCP 1330.01)			N.A.	ACC.	REMARKS/ REFERENCES	INSPECTORS SIGNATURE & DATE	
						CONTR.	TECHNIP
						OWNER	
C.1	STEAM AND CONDENSATE MANIFOLD INSTALLATION						
C.1.1	IDENTIFICATION	<input type="checkbox"/>	<input type="checkbox"/>	HT 01a (*)			
C.1.2	POSITIONING	<input type="checkbox"/>	<input type="checkbox"/>				
C.1.3	MANIFOLDS INSPECTION	<input type="checkbox"/>	<input type="checkbox"/>				
NOTES: (*) THE QC REPORT N° SHALL BE INDICATED IN THE RELEVANT HERE BELOW SPACES : HT 01a N° _____							
C.1.4 - FINAL DOC. REVIEW	INSPECTORS	CONTRACTOR		PMC		OWNER	
	NAME						
	SIGNATURE						
	DATE						



TechnipFMC



PROJECT:

COMPANY:

QUALITY CONTROL FORM

HT 01a

PROJ. No.:

QCF REV. A

SH. ____ OF ____

**STEAM & CONDENS. MANIFOLD INSTALLATION
REPORT**

CONTRACTOR:

HT 01a N° _____

STEAM MANIFOLD

ITEM

CONDENSATE MANIFOLD

ITEM

NOTES:

INSPECTORS

CONTRACTOR

PMC

OWNER

NAME

SIGNATURE

DATE

				PROJECT:			
				COMPANY:			
QUALITY CONTROL FORM HT 02				PROJ. No.:	QCF REV. A	SH. ____ OF ____	
FEEDER/DISCHARGE AND TRACER LINES INSTALL. SUMMARY REPORT				CONTRACTOR:		HT 02 N° ____	
INSPECTIONS (REF. TO QCP 1330.01)			N.A.	ACC.	REMARKS/ REFERENCES	INSPECTORS SIGNATURE & DATE	
						CONTR.	TECHNIP
						OWNER	
C.2	TRACER FEED & DISCHARGE LINES INSTALLATION						
C.2.1	IDENTIFICATION	<input type="checkbox"/>	<input type="checkbox"/>	HT 02a (*)			
C.2.2	POSITIONING	<input type="checkbox"/>	<input type="checkbox"/>				
C.2.3	COMPRESSION JOINT (IF TUBING)	<input type="checkbox"/>	<input type="checkbox"/>				
C.2.4	WELDING (IF PIPING)	<input type="checkbox"/>	<input type="checkbox"/>				
C.2.5	SUPPORTS	<input type="checkbox"/>	<input type="checkbox"/>				
C.2.6	NDT EXECUTION (IF PIPING)						
C.2.6a	VISUAL EXAMINATION	<input type="checkbox"/>	<input type="checkbox"/>				
C.2.6b	LIQUID PENETRANT EXAMINATION	<input type="checkbox"/>	<input type="checkbox"/>	W 03 (*)			
C.2.6c	MAGNETIC PARTIC. EXAMINATION	<input type="checkbox"/>	<input type="checkbox"/>	W 04 (*)			
C.2.7	TRACER FEED & DISCHARGE LINES INSPECTION	<input type="checkbox"/>	<input type="checkbox"/>				
C.3	TRACER LINES INSTALLATION						
C.3.1	IDENTIFICATION	<input type="checkbox"/>	<input type="checkbox"/>	HT 02b (*)			
C.3.2	POSITIONING	<input type="checkbox"/>	<input type="checkbox"/>				
C.3.3	COMPRESSION JOINT (IF TUBING)	<input type="checkbox"/>	<input type="checkbox"/>				
C.3.4	WELDING (IF PIPING)	<input type="checkbox"/>	<input type="checkbox"/>				
C.3.5	FIXING TO TRACED LINE SUPPORT	<input type="checkbox"/>	<input type="checkbox"/>				
C.3.6	EXPANSION LOOP	<input type="checkbox"/>	<input type="checkbox"/>				
C.3.7	NDT EXECUTION (IF PIPING)						
C.3.7a	VISUAL EXAMINATION	<input type="checkbox"/>	<input type="checkbox"/>				
C.3.7b	LIQUID PENETRANT EXAMINATION	<input type="checkbox"/>	<input type="checkbox"/>	W 03 (*)			
C.3.7c	MAGNETIC PARTIC. EXAMINATION	<input type="checkbox"/>	<input type="checkbox"/>	W 04 (*)			
C.3.8	TRACER LINES INSPECTION	<input type="checkbox"/>	<input type="checkbox"/>				
NOTES: (*) THE QC REPORTS N° SHALL BE INDICATED IN THE RELEVANT HERE BELOW SPACES : <div style="display: flex; justify-content: space-around; margin-top: 5px;"> HT 02a N° _____ HT 02b N° _____ W 03 N° _____ W 04 N° _____ </div>							
C.4 - FINAL DOC. REVIEW	INSPECTORS	CONTRACTOR		PMC		OWNER	
	NAME						
	SIGNATURE						
	DATE						

[illegible]



PROJECT:

COMPANY:

QUALITY CONTROL FORM

PL 10

PROJ. No.:

QCF REV. A

SH. ____ OF ____

PUNCH LIST

CONTRACTOR:

PL 10 N° _____

TEST PACK N° _____

SYSTEM N° _____

ITEMS TO BE CHECKED	N.A.	YES	ITEMS TO BE CHECKED	N.A.	YES	ITEMS TO BE CHECKED	N.A.	YES
WELDING COMPLETE	<input type="checkbox"/>	<input type="checkbox"/>	RADIOGRAPHY / ULTRASONIC (W10)	<input type="checkbox"/>	<input type="checkbox"/>	PMI (W10)	<input type="checkbox"/>	<input type="checkbox"/>
PT / MT (W10)	<input type="checkbox"/>	<input type="checkbox"/>	PWHT / HT (W10)	<input type="checkbox"/>	<input type="checkbox"/>	MATERIALS TRACEABILITY (W10)	<input type="checkbox"/>	<input type="checkbox"/>
THK CHECK BY UT	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>

Item N°	Drawing / Line N°	Description	Category (1)	Discipline (2)	Issued by	Cleare d by	Verified (CONTRACTOR)		Verified (TECHNIP)		Verified (OWNER)	
							Name	Date	Name	Date	Name	Date

NOTES:

1) Category A: To be resolved before hydrotest B: To be resolved after hydrotest

2) Discipline P: Piping M: Mechanical I: Instrument PA: Painting C: Civil O: Other

INSPECTORS	CONTRACTOR	PMC	OWNER
NAME			
SIGNATURE			
DATE			



PROJECT:

COMPANY:

QUALITY CONTROL FORM (NDE-03) **W 03**

PROJ. No.:

QCF REV. A

SH. 1 OF 2

**LIQUID PENETRANT TEST REPORT
(REQUIREMENTS)**

CONTRACTOR:

W 03 N° _____

APPLICABLE CODES/SPEC'S

- ASME V ART 6 ☐
- ☐

ACCEPTANCE CRITERIA

- ☐
- ☐

FIELD OF APPLICATION

- | | | | |
|--|---|---|----------------------------|
| • PIPING <input type="checkbox"/> | • BEVEL <input type="checkbox"/> | • FINAL PASS <input type="checkbox"/> | • <input type="checkbox"/> |
| • TANKS/
SILOS <input type="checkbox"/> | • 1 ST PASS <input type="checkbox"/> | • OVERLAY <input type="checkbox"/> | • <input type="checkbox"/> |
| • EQUIPMENT <input type="checkbox"/> | • BACK GOUGING <input type="checkbox"/> | • RAW MATERIAL <input type="checkbox"/> | • <input type="checkbox"/> |

MATERIAL

INSPECTION STAGE

- | | | | |
|---------------------------------|--------------------------------------|--|----------------------------|
| • C.S. <input type="checkbox"/> | • LOW ALLOY <input type="checkbox"/> | • BEFORE PWHT <input type="checkbox"/> | • <input type="checkbox"/> |
| • TI <input type="checkbox"/> | • HASTELLOY <input type="checkbox"/> | • AFTER PWHT <input type="checkbox"/> | • <input type="checkbox"/> |
| • S.S. <input type="checkbox"/> | • <input type="checkbox"/> | • AFTER HYD. TEST <input type="checkbox"/> | • <input type="checkbox"/> |

INSPECTION METHOD

- | TYPE | PENETRANT | DEVELOPPER | LIGHTING |
|--|---|--------------------------------|--------------------------------------|
| • COLOUR CONTRAST <input type="checkbox"/> | • WATER WASHABLE <input type="checkbox"/> | • DRY <input type="checkbox"/> | NATURAL <input type="checkbox"/> |
| • FLUORESCENT <input type="checkbox"/> | • POST EMUL. <input type="checkbox"/> | • WET <input type="checkbox"/> | ARTIFICIAL <input type="checkbox"/> |
| | • SOLVENT <input type="checkbox"/> | • BRAND _____ | ULTRAVIOLET <input type="checkbox"/> |
| | • TYPE <input type="checkbox"/> | | |
| | • BRAND _____ | | |

PRECLEANING

REMOVABLE

CLEANER

TIME

- | | | | |
|--------------------------------------|-----------------------------------|-----------------------------------|-------------------|
| • GRINDING <input type="checkbox"/> | • BRUSH <input type="checkbox"/> | • TYPE <input type="checkbox"/> | PENETRATION _____ |
| • MACHINING <input type="checkbox"/> | • SPRAY. <input type="checkbox"/> | • CLOTHS <input type="checkbox"/> | DEVELOPPING _____ |
| • SOLVENT <input type="checkbox"/> | | • BRUSHY <input type="checkbox"/> | MAX READING _____ |

PRECLEANING

REMOVABLE

- | | | |
|------------------------------------|------------------------------------|----------------------------------|
| • WATER <input type="checkbox"/> | • DIPPING <input type="checkbox"/> | • SPRAY <input type="checkbox"/> |
| • ALCOHOL <input type="checkbox"/> | • SPRAY. <input type="checkbox"/> | • BRAND _____ |

INSPECTORS

CONTRACTOR

PMC

OWNER

NAME

SIGNATURE

DATE



COMPANY:

SH. 2 OF 2

W 03 N°

- ☐ WATER WASHABLE ☐ POST EMULSIFYING
- ☐ SOLVENT REMOVABLE ☐

[illegible]



PROJECT:

COMPANY:

QUALITY CONTROL FORM (NDE-04)

W 04

PROJ. No.:

QCF REV. A

SH. 1 OF 2

**MAGNETIC PARTICLE
TEST REPORT**

CONTRACTOR:

W 04 N° _____

APPLICABLE CODES/SPEC'S

- ASME V ART 7 ☐
- OTHER ☐

ACCEPTANCE CRITERIA

- ☐
- ☐

FIELD OF APPLICATION

- | | | | |
|--|---|---|----------------------------|
| • PIPING <input type="checkbox"/> | • BEVEL <input type="checkbox"/> | • FINAL PASS <input type="checkbox"/> | • <input type="checkbox"/> |
| • TANKS/SILOS <input type="checkbox"/> | • 1ST PASS <input type="checkbox"/> | • OVERLAY <input type="checkbox"/> | • <input type="checkbox"/> |
| • EQUIPMENT <input type="checkbox"/> | • BACK GOUGING <input type="checkbox"/> | • RAW MATERIAL <input type="checkbox"/> | • <input type="checkbox"/> |

MATERIAL

INSPECTION STAGE

- | | | | |
|---------------------------------|--------------------------------------|--|----------------------------|
| • C.S. <input type="checkbox"/> | • LOW ALLOY <input type="checkbox"/> | • BEFORE PWHT <input type="checkbox"/> | • <input type="checkbox"/> |
| • <input type="checkbox"/> | • <input type="checkbox"/> | • AFTER PWHT <input type="checkbox"/> | • <input type="checkbox"/> |
| • <input type="checkbox"/> | • <input type="checkbox"/> | • AFTER HYD. TEST <input type="checkbox"/> | • <input type="checkbox"/> |

INSPECTION METHOD

MAGNETIZATION	PARTICLE	COLOUR	SUSPENSION
• PRODS CONTACTS Cu <input type="checkbox"/> Sb <input type="checkbox"/> MAX DIST. _____	• DRY <input type="checkbox"/> • WET <input type="checkbox"/> • BRAND _____	• GRAY <input type="checkbox"/> • FLUORESCENT <input type="checkbox"/> • <input type="checkbox"/>	• OIL <input type="checkbox"/> • WATER <input type="checkbox"/>
• YOKE FIXED LEGS <input type="checkbox"/> ARTICULAT.LEGS <input type="checkbox"/> MAX DIST. _____	CURRENT TYPE • HALF WAVE RECTIFIED <input type="checkbox"/> • ALTERNATING <input type="checkbox"/>	LIGHTING • NATURAL <input type="checkbox"/> • ARTIFICIAL <input type="checkbox"/> • ULTRAVIOLET <input type="checkbox"/>	METHOD • CONTINUOUS <input type="checkbox"/> • RESIDUAL <input type="checkbox"/> • PULSES <input type="checkbox"/>
• COIL <input type="checkbox"/> BRAND _____	AMPERAGE FIELD AMP _____ FIELD _____	DEMAGNETIZATION YES <input type="checkbox"/> NO <input type="checkbox"/> RESIDUAL	PRECLEANING • BRUSHING <input type="checkbox"/> • <input type="checkbox"/>

REMARKS:

INSPECTORS

CONTRACTOR

PMC

OWNER

NAME

SIGNATURE

DATE



COMPANY:

W 04

SH. 2 OF 2

CONTRACTOR:

W 04 N°

☐ PRODS ☐ POWDER ☐ DRY
☐ WET
☐ FLUORESCENT

[illegible]



PROJECT:

COMPANY:

QUALITY CONTROL FORM

W 12/A

PROJ. No

QCF REV. A

SH. ____ OF ____

**CONSTRUCTION MATERIALS
APPROVAL**

CONTRACTOR:

W 12/A N° ____

CIVIL	<input type="checkbox"/>	PIPING	<input type="checkbox"/>	MACHINERY	<input type="checkbox"/>	INSTRUMENT	<input type="checkbox"/>	INSULATION	<input type="checkbox"/>
BLDG.	<input type="checkbox"/>	MECHANIC.	<input type="checkbox"/>	ELECTRICAL	<input type="checkbox"/>	PAINTING	<input type="checkbox"/>	STEEL STR.	<input type="checkbox"/>
NDT	<input type="checkbox"/>	SUPPORT PRF.	<input type="checkbox"/>	_____	<input type="checkbox"/>	_____	<input type="checkbox"/>	_____	<input type="checkbox"/>

1. MATERIALS

2. SUPPLIER

3. PURPOSE

4. ATTACHMENT DATA

5. TYPE OF TEST PERFORMED

6. TEST STANDARD UTILIZED

REMARKS:

RESULT:

ACCEPTED

☐

NOT ACCEPTED

☐**INSPECTORS****CONTRACTOR****PMC****OWNER**

NAME

SIGNATURE

DATE



PROJECT:

COMPANY:

QUALITY CONTROL FORM

W 14A

PROJ. No.:

QCF REV. A

SH. ____ OF ____

DIMENSIONAL CHECK

CONTRACTOR:

W 14A⁽¹⁾ N° ____

LINE / ISOMETRICS N° _____

TEST CIRCUIT

SYSTEM

CHECK LIST	N.A.	V. ED	CHECK LIST	N.A.	V. ED
1 GENERAL			4. GASKETS – BOLTS		
Check per P&ID	<input type="checkbox"/>	<input type="checkbox"/>	Correct type	<input type="checkbox"/>	<input type="checkbox"/>
Line routing & size	<input type="checkbox"/>	<input type="checkbox"/>	Correct bolts or studs	<input type="checkbox"/>	<input type="checkbox"/>
Materials	<input type="checkbox"/>	<input type="checkbox"/>	Bolt lubrication	<input type="checkbox"/>	<input type="checkbox"/>
Flange rating	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Installation level & plumb	<input type="checkbox"/>	<input type="checkbox"/>			
Line slopes per drawing	<input type="checkbox"/>	<input type="checkbox"/>	5. PIPE SUPPORTS		
Branches located correctly	<input type="checkbox"/>	<input type="checkbox"/>	Field supports installed	<input type="checkbox"/>	<input type="checkbox"/>
Branches reinforced	<input type="checkbox"/>	<input type="checkbox"/>	Sufficient supports	<input type="checkbox"/>	<input type="checkbox"/>
Weep holes in reinforcing pads	<input type="checkbox"/>	<input type="checkbox"/>	Anchors installed	<input type="checkbox"/>	<input type="checkbox"/>
High point vents installed	<input type="checkbox"/>	<input type="checkbox"/>	Guides installed & aligned	<input type="checkbox"/>	<input type="checkbox"/>
Low point drains installed	<input type="checkbox"/>	<input type="checkbox"/>	Proper shoes installed and welded	<input type="checkbox"/>	<input type="checkbox"/>
Reducers located correctly / orientation	<input type="checkbox"/>	<input type="checkbox"/>	Spring supports per drawing, stopped	<input type="checkbox"/>	<input type="checkbox"/>
Reducer type correct	<input type="checkbox"/>	<input type="checkbox"/>	Piping sits on	<input type="checkbox"/>	<input type="checkbox"/>
Sample connections installed	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Clearances for expansion	<input type="checkbox"/>	<input type="checkbox"/>			
Orifice flanges properly oriented	<input type="checkbox"/>	<input type="checkbox"/>	6. INSULATING		
.....	<input type="checkbox"/>	<input type="checkbox"/>	Welded insulation supports installed	<input type="checkbox"/>	<input type="checkbox"/>
			Clearances adequate for insulation	<input type="checkbox"/>	<input type="checkbox"/>
2 VALVES			<input type="checkbox"/>	<input type="checkbox"/>
Identification code	<input type="checkbox"/>	<input type="checkbox"/>			
Flow direction	<input type="checkbox"/>	<input type="checkbox"/>	7. INSTRUMENTS		
Bypass installed	<input type="checkbox"/>	<input type="checkbox"/>	Correct control valves installed	<input type="checkbox"/>	<input type="checkbox"/>
Chain wheel installed	<input type="checkbox"/>	<input type="checkbox"/>	Meter runs properly installed	<input type="checkbox"/>	<input type="checkbox"/>
Extension installed	<input type="checkbox"/>	<input type="checkbox"/>	Valves at meter run installed	<input type="checkbox"/>	<input type="checkbox"/>
Steam oriented properly	<input type="checkbox"/>	<input type="checkbox"/>	Pressure gauge valves installed	<input type="checkbox"/>	<input type="checkbox"/>
Suitable access to operate & to maintain	<input type="checkbox"/>	<input type="checkbox"/>	Pressure gauges properly oriented	<input type="checkbox"/>	<input type="checkbox"/>
.....	<input type="checkbox"/>	<input type="checkbox"/>	Temp. connections properly oriented	<input type="checkbox"/>	<input type="checkbox"/>
			<input type="checkbox"/>	<input type="checkbox"/>
3 CONNECTION TO MACHINERY / EQUIPMENT					
Flanges parallelism / Alignment	<input type="checkbox"/>	<input type="checkbox"/>	8. TEST CIRCUIT PREPARATION		
.....	<input type="checkbox"/>	<input type="checkbox"/>	Blinds installed	<input type="checkbox"/>	<input type="checkbox"/>
			Vents and drains installed	<input type="checkbox"/>	<input type="checkbox"/>

V.ED = VERIFIED

N.A. = NOT APPLICABLE

(1) SAME TEST CIRCUIT NUMBER

INSPECTORS

CONTRACTOR

PMC

OWNER

NAME

SIGNATURE

DATE



COMPANY:

W 14B



SH. ____ OF ____

W 14B N°

SYSTEM N°

REMARKS:			
INSPECTORS	CONTRACTOR	PMC	OWNER
NAME			
SIGNATURE			
DATE			

QCF STANDARD REV.0

 	PROJECT		Standby SRU & Additional Tanks	
	CLIENT		IOCL Paradip Refinery	
QCP-PIPING SUPPORT PREFABRICATION	Project No. 080557C001	Document No. 080557C-000-QCP-1380-001	Rev. No. A	Page 1 of 4



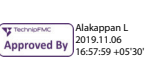

QUALITY CONTROL PLAN

PIPING SUPPORT PREFABRICATION

TYPE OF QUALITY CONTROL REPORT	CERTIFICATION EXTENT
W 12/A	SINGLE REPORT PER EACH MATERIAL
W 24S	DAILY REPORT
W 10S – W 50S	SINGLE REPORT PER EACH ISOMETRIC



REFERENCE DOCUMENTS:

- 080557C-000-PP-805
 - 080557C-000-PP-814
 - 080557C-000-PP-807
 - 080557C-000-PP-804
 - QCP 1399.02
 - QCP 1399.01
 - 080557C-000-JSC-1300-001
 - 080557C-000-JSD-2300-001
 - 080557C-000-JSD-2200-001
 - 080557C-000-JSD-2200-002
 - 080557C-000-PP-820
 - 080557C-000-PP-821
 - DRAWINGS
- Site Coordination & Communication Procedure.
Welding Specification for Fabrication of Piping
Material Receiving, Handling & Storage procedure
Specification for Positive Material Identification at Construction Site.
Piping Welding Activities Management (NDE / PWHT / HT / PMI Included)
Welders Management
Standard Specification for Fabrication and Erection of Piping
Specification for Surface Preparation and Protective Coating
Job Specification for Hot Insulation of Vessels, Piping and Equipment
Job Specification for Cold Insulation of Vessels, Piping and Equipment
Standard specification for inspection, flushing and testing of piping systems.
Equipment
Job Construction specification for Welder Management

			 Samit Paul 2019.10.21 18:28:47 +05'30'	 Digitally signed by jaykajaputhi@technipfmc.com DN: cn=jaykajaputhi@technipfmc.com, Date: 2019.10.21 18:38:13 +05'30'	 Approved By Alakapann L 2019.11.06 16:57:59 +05'30'	 Authorized By Morischristopher Jesumarian 2019.11.06 22:27:42 +05'30'
A	19/10/2019	ISSUED FOR INFORMATION	SMP	PKP	LA/ANJ	JMC
REV.	DATE	DESCRIPTION	PREPARED	CHECKED	APPROVED	AUTHORIZED



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 	PROJECT		Standby SRU & Additional Tanks	
	CLIENT		IOCL Paradip Refinery	
QCP-PIPING SUPPORT PREFABRICATION	Project No. 080557C001	Document No. 080557C-000-QCP-1380-001	Rev. No. A	Page 2 of 4

LEGENDA

H	=	HOLD (RFI required - Work stop for inspection)
W	=	WITNESS (RFI required)
WC	=	100 % SUPERVISION AND EXAMINATION BY CONTRACTOR.
S	=	SURVEILLANCE (No RFI)
R	=	REVIEW OF REPORTS
N.A.	=	NOT APPLICABLE
A	=	AUTHORIZATION / APPROVAL
IFA	=	ISSUED FOR AUTHORIZATION/APPROVAL
INFO	=	FOR INFORMATION
RFI	=	REQUEST FOR INSPECTION
!	=	WARNING (control of document revision status)



 	PROJECT	Standby SRU & Additional Tanks IOCL Paradip Refinery		
	CLIENT	INDIAN OIL CORPORATION LIMITED		
QCP-PIPING SUPPORT PREFABRICATION	Project No. 080557C001	Document No. 080557C-000-QCP-1380-001	Rev. No. A	Page 3 of 4

S.No.	CHECK AND INSPECTION ITEM	QUALITY CONTROL REPORT	ACTION		NOTES
			CONTR.	COMPANY	
A)	PRELIMINARY ACTIVITIES				
A.1	CONTRACTOR DRAWINGS CHECK REVISION STATUS	N.A.	!	!	
A.2	CONTRACTOR TECHNICAL SPECIFICATION AND PROCEDURE	N.A.	!	!	
B)	BEFORE PREFABRICATION				
B.1	SHOP APPROVAL (if any)	N.A. Use	WC	S	
B.2	WELDERS MANAGEMENT	QCP 1399.01			(1)
B.3	WELDING, NDE/PWHT/HT/PMI MANAGEMENT	Use QCP 1399.02			(1)
B.4	MATERIALS APPROVAL	W 12/A	WC	W/R	(2)
B.5	MATERIAL RELEASED AND CONSERVATION STATUS	W 50S	WC	R/S	
C)	PREFABRICATION				
C.1	WELDING	W 24S – W 50S	WC	R/S	
C.2	SUPPORT MARKING	W 10S – W 50S	WC	R/S	
C.3	DIMENSIONAL CHECK	W 10S – W 50S	WC	R/S	
C.4	PAINTING	Use QCP 2300.01			(1)
C.5	SHIPPING RELEASE	W 10S – W 50S	WC	R/S	
C.6	FINAL DOCUMENTATION REVIEW	W 50S			

NOTES: (1) FORMS, INSPECTIONS AND ATTENDANCE SHALL BE IN ACCORDANCE WITH REFERRED QCP.
(2) MATERIAL APPROVAL WILL BE EXECUTED ONLY FOR MATERIAL SUPPLIED BY CONTRACTOR.

GENERAL NOTES



- THE ENCLOSED ITP'S ARE INDICATIVE AND SHALL BE FOLLOWED FOR DEVELOPING THEJOB SPECIFIC ITP'S FOR THE WORKS TO BE PERFORMED BY THE CONTRACTOR. THE PROVISIONS INDICATED FOR STAGE WISE INSPECTION BY TECHNIP AND OWNER (FOR SPECIFIC ACTIVITIES) ARE THE MINIMUM AND THE ENGINEER-IN- CHARGE MAY DECIDE TO INCREASE HOLD POINTS/ WITNESS

 		PROJECT	Standby SRU & Additional Tanks IOCL Paradip Refinery		
		CLIENT	INDIAN OIL CORPORATION LIMITED		
QCP-PIPING SUPPORT PREFABRICATION	Project No. 080557C001	Document No. 080557C-000-QCP-1380-001		Rev. No. A	Page 4 of 4

POINTS, WHILE APPROVING THE JOB SPECIFIC ITP'S. ACTIVITIES FOR WHICH ITP'S ARE NOT PROVIDED IN THIS SPECIFICATION. CONTRACTOR TO DEVELOP AND GET THE SAME APPROVED BY TECHNIP/OWNER BEFORE START OF THE WORK. IN GENERAL ROLE OF TECHNIP HAS BEEN SPECIFIED IN THE DOCUMENT THE ROLE OF OWNER TO BE SPECIFIED DURING PREPARATION OF SITE SPECIFIC ITP'S.

- 2 CONTRACTOR TO SUBMIT JOB SPECIFIC REPORTING FORMATS AND JOB PROCEDURES FOR THE JOBS FOR EACH ACTIVITY LISTED IN THE ITP'S AND SUBMIT TO TECHNIP/OWNER FOR APPROVAL. BEFORE COMMENCEMENT OF THE ACTIVITY. IF THE CONTRACTOR HAS TO DEVIATE FROM THE GIVEN ITP FOR A VALID REASON, HE SHALL OBTAIN PRIOR WRITTEN APPROVAL OF TECHNIP/OWNER. CONTRACTOR TO CARRY OUT 100% EXAMINATION OF ALL ACTIVITIES.

		PROJECT:					
		COMPANY:					
QUALITY CONTROL FORM W 50S		PROJ. No.:	QCF REV. A	SH. ____ OF ____			
PIPING SUPPORT PREFABRICATION SUMMARY REPORT		CONTRACTOR:		W 50S N° ____			
DRAWING N° _____ SH. ____ OF ____ REV. _____ SUPPORT MARK _____ AREA _____							
INSPECTIONS		N.A.	ACC.	REMARKS/ REFERENCES	INSPECTORS SIGNATURE & DATE		
					CONT.	TECHNIP.	OWNER
B.5	MATERIAL RELEASED AND CONSERVATION STATUS	<input type="checkbox"/>	<input type="checkbox"/>				
C.1	WELDING	<input type="checkbox"/>	<input type="checkbox"/>	W 24S (*)			
C.2	SUPPORT MARKING	<input type="checkbox"/>	<input type="checkbox"/>	W 10S (*)			
C.3	DIMENSIONAL CHECK	<input type="checkbox"/>	<input type="checkbox"/>	W 10S (*)			
C.5	SHIPPING RELEASE	<input type="checkbox"/>	<input type="checkbox"/>	W 10S (*)			
NOTES: (*) THE QC REPORTS N° SHALL BE INDICATED IN THE RELEVANT HERE BELOW SPACES : W 10S N° _____ W 24S N° _____							
C.6) FINAL DOC. REVIEW	INSPECTORS	CONTRACTOR		PMC		OWNER	
	NAME						
	SIGNATURE						
	DATE						

 	PROJECT		Standby SRU & Additional Tanks	
	CLIENT		IOCL Paradip Refinery	
QCP-PIPING SUPPORT PREFABRICATION	Project No. 080557C001	Document No. 080557C-000-QCP-1380-01	Rev. No. A	Page 1 of 4


QUALITY CONTROL PLAN



PIPING SUPPORT PREFABRICATION

TYPE OF QUALITY CONTROL REPORT	CERTIFICATION EXTENT
W 12/A	SINGLE REPORT PER EACH MATERIAL
W 24S	DAILY REPORT
W 10S – W 50S	SINGLE REPORT PER EACH ISOMETRIC

REFERENCE DOCUMENTS:



- 080557C-000-PP-502 Inspection Methodology & Co-ordination Procedures
- 080557C-000-JSC-1390-001 Welding Specification for Fabrication of Piping
- 080557C-000-CSG-0000-002 Material Handling & Storage procedure
- 080557C-000-JSC-0000-001 Specification for Positive Material Identification at Construction Site.
- QCP 1399.02 Piping Welding Activities Management (NDE / PWHT / HT / PMI Included)
- QCP 1399.01 Welders Management
- 080557C-000-JSD-1300-001 Standard Specification for Fabrication and Erection of Piping
- 080557C-000-JSD-2300-001 Specification for Surface Preparation and Protective Coating
- 080557C-000-JSD-2200-001 Job Specification for Hot Insulation of Vessels, Piping and Equipment
- 080557C-000-JSD-2200-002 Job Specification for Cold Insulation of Vessels, Piping and Equipment
- 080557C-000-JSC-0000-002 Standard specification for inspection, flushing and testing of piping systems.
- 080557C-000-JSC-0000-005 Equipment
- 080557C-000-JSC-0000-005 Job Construction specification for Welder Management
- DRAWINGS

						
A	19/10/2019	ISSUED FOR INFORMATION	SMP	PKP	LA/ANJ	MP
REV.	DATE	DESCRIPTION	PREPARED	CHECKED	APPROVED	AUTHORIZED

 	PROJECT	Standby SRU & Additional Tanks		
	CLIENT	IOCL Paradip Refinery		
QCP-PIPING SUPPORT PREFABRICATION	Project No. 080557C001	Document No. 080557C-000-QCP-1380-01	Rev. No. A	Page 2 of 4

LEGENDA

H	=	HOLD (RFI required - Work stop for inspection)
W	=	WITNESS (RFI required)
WC	=	100 % SUPERVISION AND EXAMINATION BY CONTRACTOR.
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R	=	REVIEW OF REPORTS
N.A.	=	NOT APPLICABLE
A	=	AUTHORIZATION / APPROVAL
IFA	=	ISSUED FOR AUTHORIZATION/APPROVAL
INFO	=	FOR INFORMATION
!	=	WARNING (control of document revision status)



 	PROJECT	Standby SRU & Additional Tanks IOCL Paradip Refinery		
	CLIENT	INDIAN OIL CORPORATION LIMITED		
QCP-PIPING SUPPORT PREFABRICATION	Project No. 080557C001	Document No. 080557C-000-QCP-1380-01	Rev. No. A	Page 3 of 4

S.No.	CHECK AND INSPECTION ITEM	QUALITY CONTROL REPORT	ACTION		NOTES
			CONTR.	COMPANY	
A)	PRELIMINARY ACTIVITIES				
A.1	CONTRACTOR DRAWINGS CHECK REVISION STATUS	N.A.	!	!	
A.2	CONTRACTOR TECHNICAL SPECIFICATION AND PROCEDURE	N.A.	!	!	
B)	BEFORE PREFABRICATION				
B.1	SHOP APPROVAL (if any)	N.A. Use	WC	S	
B.2	WELDERS MANAGEMENT	QCP 1399.01			(1)
B.3	WELDING, NDE/PWHT/HT/PMI MANAGEMENT	Use QCP 1399.02			(1)
B.4	MATERIALS APPROVAL	W 12/A	WC	W/R	(2)
B.5	MATERIAL RELEASED AND CONSERVATION STATUS	W 50S	WC	R/S	
C)	PREFABRICATION				
C.1	WELDING	W 24S – W 50S	WC	R/S	
C.2	SUPPORT MARKING	W 10S – W 50S	WC	R/S	
C.3	DIMENSIONAL CHECK	W 10S – W 50S	WC	R/S	
C.4	PAINTING	Use QCP 2300.01			(1)
C.5	SHIPPING RELEASE	W 10S – W 50S	WC	R/S	
C.6	FINAL DOCUMENTATION REVIEW	W 50S			

NOTES: (1) FORMS, INSPECTIONS AND ATTENDANCE SHALL BE IN ACCORDANCE WITH REFERRED QCP.
(2) MATERIAL APPROVAL WILL BE EXECUTED ONLY FOR MATERIAL SUPPLIED BY CONTRACTOR.

GENERAL NOTES

- THE ENCLOSED ITP'S ARE INDICATIVE AND SHALL BE FOLLOWED FOR DEVELOPING THE JOB SPECIFIC ITP'S FOR THE WORKS TO BE PERFORMED BY THE CONTRACTOR. THE PROVISIONS INDICATED FOR STAGE WISE INSPECTION BY TECHNIP AND OWNER (FOR SPECIFIC ACTIVITIES) ARE THE MINIMUM AND THE ENGINEER-IN- CHARGE MAY DECIDE TO INCREASE HOLD POINTS/ WITNESS POINTS, WHILE APPROVING THE JOB SPECIFIC ITP'S. ACTIVITIES FOR WHICH ITP'S ARE NOT PROVIDED IN THIS SPECIFICATION. CONTRACTOR TO DEVELOP AND GET THE SAME APPROVED BY

 		PROJECT	Standby SRU & Additional Tanks IOCL Paradip Refinery		
		CLIENT	INDIAN OIL CORPORATION LIMITED		
QCP-PIPING SUPPORT PREFABRICATION	Project No. 080557C001	Document No. 080557C-000-QCP-1380-01		Rev. No. A	Page 4 of 4

TECHNIP/OWNER BEFORE START OF THE WORK. IN GENERAL ROLE OF TECHNIP HAS BEEN SPECIFIED IN THE DOCUMENT THE ROLE OF OWNER TO BE SPECIFIED DURING PREPARATION OF SITE SPECIFIC ITP'S.

- 2 CONTRACTOR TO SUBMIT JOB SPECIFIC REPORTING FORMATS AND JOB PROCEDURES FOR THE JOBS FOR EACH ACTIVITY LISTED IN THE ITP'S AND SUBMIT TO TECHNIP/OWNER FOR APPROVAL. BEFORE COMMENCEMENT OF THE ACTIVITY. IF THE CONTRACTOR HAS TO DEVIATE FROM THE GIVEN ITP FOR A VALID REASON, HE SHALL OBTAIN PRIOR WRITTEN APPROVAL OF TECHNIP/OWNER. CONTRACTOR TO CARRY OUT 100% EXAMINATION OF ALL ACTIVITIES.

		PROJECT:					
		COMPANY:					
QUALITY CONTROL FORM W 50S		PROJ. No.:	QCF REV. A	SH. ____ OF ____			
PIPING SUPPORT PREFABRICATION SUMMARY REPORT		CONTRACTOR:		W 50S N° ____			
DRAWING N° _____ SH. ____ OF ____ REV. _____ SUPPORT MARK _____ AREA _____							
INSPECTIONS		N.A.	ACC.	REMARKS/ REFERENCES	INSPECTORS SIGNATURE & DATE		
					CONT.	TECHNIP.	OWNER
B.5	MATERIAL RELEASED AND CONSERVATION STATUS	<input type="checkbox"/>	<input type="checkbox"/>				
C.1	WELDING	<input type="checkbox"/>	<input type="checkbox"/>	W 24S (*)			
C.2	SUPPORT MARKING	<input type="checkbox"/>	<input type="checkbox"/>	W 10S (*)			
C.3	DIMENSIONAL CHECK	<input type="checkbox"/>	<input type="checkbox"/>	W 10S (*)			
C.5	SHIPPING RELEASE	<input type="checkbox"/>	<input type="checkbox"/>	W 10S (*)			
NOTES: (*) THE QC REPORTS N° SHALL BE INDICATED IN THE RELEVANT HERE BELOW SPACES : W 10S N° _____ W 24S N° _____							
C.6) FINAL DOC. REVIEW	INSPECTORS	CONTRACTOR		PMC		OWNER	
	NAME						
	SIGNATURE						
	DATE						



PROJECT:

COMPANY:

QUALITY CONTROL FORM

W 10S

PROJ. No.:

QCF REV. A

SH. ____ OF ____

PIPING SUPPORT PREFABRICATION & RELEASE

CONTRACTOR:

W 10S N°

IDENTIFICATION AND REFERENCES

CONTROL AND EVALUATION

LOT	DRAWING				IDENTIFICATION		WELDING			SUPPORT MARKING		DIMENSIONAL CHECK		RELEASE FOR PAINTING		DATA & SIGNATURE		
S.NO	DW	SH	REV	AREA	SUPPORT MARK	QTY	W 24S N°	ACC	N.A.	ACC	N.A.	ACC	N.A.	ACC	N.A.	CONT.	TECHNIP	OWNER
1								<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>			
2								<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>			
3								<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>			
4								<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>			
5								<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>			
6								<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>			
7								<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>			
8								<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>			
9								<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>			
10								<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>			
11								<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>			
12								<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>			
13								<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>			
14								<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>			
15								<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>			
INSPECTORS		CONTRACTOR				PMC				OWNER								
NAME																		
SIGNATURE																		
DATE																		



TechnipFMC



PROJECT:

COMPANY:

QUALITY CONTROL FORM

W 12/A

PROJ. No.:

QCF REV. A

SH. ___ OF ___

**CONSTRUCTION MATERIALS
APPROVAL**

CONTRACTOR:

W 12/A N° ____

CIVIL	<input type="checkbox"/>	PIPING	<input type="checkbox"/>	MACHINERY	<input type="checkbox"/>	INSTRUMENT	<input type="checkbox"/>	INSULATION	<input type="checkbox"/>
BLDG.	<input type="checkbox"/>	MECHANIC.	<input type="checkbox"/>	ELECTRICAL	<input type="checkbox"/>	PAINTING	<input type="checkbox"/>	STEEL STR.	<input type="checkbox"/>
NDT	<input type="checkbox"/>	SUPPORT PRF.	<input type="checkbox"/>	_____	<input type="checkbox"/>	_____	<input type="checkbox"/>	_____	<input type="checkbox"/>

1. MATERIALS

2. SUPPLIER

3. PURPOSE

4. ATTACHMENT DATA

5. TYPE OF TEST PERFORMED

6. TEST STANDARD UTILIZED

REMARKS:

RESULT:

ACCEPTED

☐

NOT ACCEPTED

☐

INSPECTORS

CONTRACTOR

PMC

OWNER

NAME

SIGNATURE

DATE



COMPANY:

SH. ____ OF ____

W 24S N° _____

PREPARED BY:

JOINT VISUAL INSPECTION RESULT

OWNER

DATE _____



PROJECT:

COMPANY:

QUALITY CONTROL FORM

W 10S

PROJ. No.:

QCF REV. A

SH. ____ OF ____

PIPING SUPPORT PREFABRICATION & RELEASE

CONTRACTOR:

W 10S N°

IDENTIFICATION AND REFERENCES

CONTROL AND EVALUATION

LOT	DRAWING				IDENTIFICATION		WELDING			SUPPORT MARKING		DIMENSIONAL CHECK		RELEASE FOR PAINTING		DATA & SIGNATURE		
S.NO	DW	SH	REV	AREA	SUPPORT MARK	QTY	W 24S N°	ACC	N.A.	ACC	N.A.	ACC	N.A.	ACC	N.A.	CONT.	TECHNIP	OWNER
1								<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>			
2								<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>			
3								<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>			
4								<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>			
5								<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>			
6								<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>			
7								<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>			
8								<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>			
9								<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>			
10								<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>			
11								<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>			
12								<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>			
13								<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>			
14								<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>			
15								<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>			
INSPECTORS		CONTRACTOR				PMC				OWNER								
NAME																		
SIGNATURE																		
DATE																		



TechnipFMC



PROJECT:

COMPANY:

QUALITY CONTROL FORM

W 12/A

PROJ. No.:

QCF REV. A

SH. ___ OF ___

**CONSTRUCTION MATERIALS
APPROVAL**

CONTRACTOR:

W 12/A N° ____

CIVIL	<input type="checkbox"/>	PIPING	<input type="checkbox"/>	MACHINERY	<input type="checkbox"/>	INSTRUMENT	<input type="checkbox"/>	INSULATION	<input type="checkbox"/>
BLDG.	<input type="checkbox"/>	MECHANIC.	<input type="checkbox"/>	ELECTRICAL	<input type="checkbox"/>	PAINTING	<input type="checkbox"/>	STEEL STR.	<input type="checkbox"/>
NDT	<input type="checkbox"/>	SUPPORT PRF.	<input type="checkbox"/>	_____	<input type="checkbox"/>	_____	<input type="checkbox"/>	_____	<input type="checkbox"/>

1. MATERIALS

2. SUPPLIER

3. PURPOSE

4. ATTACHMENT DATA

5. TYPE OF TEST PERFORMED

6. TEST STANDARD UTILIZED

REMARKS:

RESULT:

ACCEPTED

☐

NOT ACCEPTED

☐

INSPECTORS

CONTRACTOR

PMC

OWNER

NAME

SIGNATURE

DATE

 		PROJECT Standby SRU & Additional Tanks IOCL Paradip Refinery
		CLIENT INDIAN OIL CORPORATION LIMITED
QCP-WELDERS MANAGEMENT	Project No. 080557C001	Document No. 080557C-000-QCP-1399-001
	Rev. No. A	Page 1 of 2
QUALITY CONTROL PLAN WELDERS MANAGEMENT		





TYPE OF QUALITY CONTROL REPORT	CERTIFICATION EXTENT
W 07	SINGLE LIST PER EACH WORK SHOP / SITE
W 19	SUMMARY
W 21	SINGLE REPORT PER EACH WELDER
W 22	WEEKLY REPORT

REFERENCE DOCUMENTS:



- 080557C-000-PP-805 Site Coordination & Communicaiton Procedure.
- 080557C-000-PP-814 Welding Specification for Fabrication of Piping
- 080557C-000-PP-807 Material Receiving Handling & Storage procedure
- 080557C-000-PP-804 Specification for Positive Material Identification at Construction Site
- QCP 1399.002 Piping Welding Activities Management (NDE / PWHT / HT / PMI Included)
- 080557C-000-JSC-1300-001 Standard Specification for Fabrication and Erection of Piping
- 080557C-000-PP-821 Job Construction Specification for Welders Management
- DRAWINGS

LEGENDA

- H = HOLD (RFI required - Work stop for inspection)
 W = WITNESS (RFI required)
 WC = 100 % SUPERVISION AND EXAMINATION BY CONTRACTOR.
 S = SURVEILLANCE (No RFI)
 R = REVIEW OF REPORTS
 N.A. = NOT APPLICABLE
 A = AUTHORIZATION / APPROVAL
 IFA = ISSUED FOR AUTHORIZATION/APPROVAL
 INFO = FOR INFORMATION
 RFI = REQUEST FOR INSPECTION
 ! = WARNING (control of document revision status)

			 Samit Paul 2019.10.21 18:24:35 +05'30'	 Signed By 2019.11.06 16:58:23 +05'30'	 Approved By 2019.11.06 16:58:23 +05'30'	 Authorized By 2019.11.06 22:28:06 +05'30'
A	19/10/2019	ISSUED FOR INFROMATION	SMP	PKP	LA/ANJ	JMC
REV.	DATE	DESCRIPTION	PREPARED	CHECKED	APPROVED	AUTHORIZED

This document is developed by TECHNIP India Limited and the information it contains is property of Indian Oil Corporation Ltd. It shall not be used for any purpose other than that for which it is supplied.

 	PROJECT		Standby SRU & Additional Tanks	
	CLIENT		IOCL Paradip Refinery	
QCP-WELDERS MANAGEMENT	Project No. 080557C001	Document No. 080557C-000-QCP-1399-001	Rev. No. A	Page 2 of 2



S.No	CHECK AND INSPECTION ITEM	QUALITY CONTROL REPORT	ACTION		NOTES
			CONTR.	TECHNIP	
A) PRELIMINARY ACTIVITIES					
A.1	CONTRACTOR DRAWINGS CHECK REVISION STATUS	N.A.	!	!	
A.2	CONTRACTOR TECHNICAL SPECIFICATIONS AND PROCEDURES	N.A.	!	!	
A.3	SITE SHOP FOR WELDER'S TESTING IS INSPECTED AND APPROVED	N.A.	WC	A	
B) WELDER'S QUALIFICATION AT PREFABRIC. SHOP					
B.1	WELDERS' QUALIFICATION BY INDEPENDENT RECOGNIZED THIRD PARTY ORGANIZATION	ASME or Equiv.	R	R	
B.2	WELDER QUALIFICATION WITH "TEST COUPON" & APPROVAL	W 19	WC	W/A	(1)
B.3	WELDERS IDENTIFICATION (STAMP) AND CARDS ASSIGNMENT	W 07	WC	A	
B.4	SHOP WELDERS LIST UP-TO-DATE	W 07	WC	R	
B.5	"PERIODICAL EVALUATION" (WEEKLY REPORT - AT SHOP)	W 22	WC	R	(1)
C) TRANSFER OF WELDERS FROM "PREFABR. SHOP" TO "SITE"					
C.1	SITE WELDERS LIST UP-TO-DATE	W 07	WC	R	
C.2	"CONTROL EVALUATION" AT SITE WORK STARTING	First 2 joints	WC	R/S	
C.3	"PERIODICAL EVALUATION" (WEEKLY REPORT - AT SITE)	W 22	WC	R	(1)
D) WELDER'S QUALIFICATION AT SITE					
D.1	WELDERS' QUALIFICATION BY INDEPENDENT RECOGNIZED THIRD PARTY ORGANIZATION	ASME or Equiv.	R	R	
D.2	WELDER QUALIFICATION WITH "TEST COUPON"	W 19	WC	W	(1)
D.3	WELDERS IDENTIFICATION (STAMP) AND CARDS ASSIGNMENT	W 07	WC	A R	
D.4	SITE WELDERS LIST UP-TO-DATE	W 07	WC	R/S	
D.5	"CONTROL EVALUATION" AT SITE WORK STARTING	First 2 joints	WC	R	
D.6	"PERIODICAL EVALUATION" (WEEKLY REPORT - AT SITE)	W 22	WC	R	(1)
E) WELDERS HISTORY		W 21	WC	W	(1)
F) TACK WELDERS QUALIFICATION (AT SHOP & AT SITE)		Subc. Form	WC		

REMARKS: (*) FOR THIS QCP "WELDER" HAS THE MEANING OF **WELDER & WELDING OPERATOR**

NOTES: (1) THESE REPORTS WILL BE ALWAYS AVAILABLE DURING PREFABRICATION/ERECTION BUT NOT INCLUDED IN THE SHOP/CONSTRUCTION QUALITY DOSSIER.

GENERAL NOTES

- THE ENCLOSED ITP'S ARE INDICATIVE AND SHALL BE FOLLOWED FOR DEVELOPING THE JOB SPECIFIC ITP'S FOR THE WORKS TO BE PERFORMED BY THE CONTRACTOR. THE PROVISIONS INDICATED FOR STAGE WISE INSPECTION BY TECHNIP AND OWNER (FOR SPECIFIC ACTIVITIES) ARE THE MINIMUM AND THE ENGINEER-IN- CHARGE MAY DECIDE TO INCREASE HOLD POINTS/ WITNESS POINTS, WHILE APPROVING THE JOB SPECIFIC ITP'S. ACTIVITIES FOR WHICH ITP'S ARE NOT PROVIDED IN THIS SPECIFICATION. CONTRACTOR TO DEVELOP AND GET THE SAME APPROVED BY TECHNIP/OWNER BEFORE START OF THE WORK. IN GENERAL ROLE OF TECHNIP HAS BEEN SPECIFIED IN THE DOCUMENT THE ROLE OF OWNER TO BE SPECIFIED DURING PREPARATION OF SITE SPECIFIC ITP'S.
- CONTRACTOR TO SUBMIT JOB SPECIFIC REPORTING FORMATS AND JOB PROCEDURES FOR THE JOBS FOR EACH ACTIVITY LISTED IN THE ITP'S AND SUBMIT TO TECHNIP/OWNER FOR APPROVAL. BEFORE COMMENCEMENT OF THE ACTIVITY. IF THE CONTRACTOR HAS TO DEVIATE FROM THE GIVEN ITP FOR A VALID REASON, HE SHALL OBTAIN PRIOR WRITTEN APPROVAL OF TECHNIP/OWNER. CONTRACTOR TO CARRY OUT 100% EXAMINATION OF ALL ACTIVITIES.

 		PROJECT:											
		COMPANY:											
QUALITY CONTROL FORM						W 07		PROJ. No :		QCF REV. A		SH. ____ OF ____	
WELDERS LIST						SUBCONTRACTOR:				W 07 N° _____			
WELDERS DATA						QUALIFICATION DATA							
NAME		WELDER STAMP No.	WORK CATEGORY			WQR		PROCESS	MTL (PN)	POS.	DIA Inch	THK mm	
FAMILY	FIRST		PIPING	PRESS. VESSEL	STRUCT.	No.	DATE						
			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>								
			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>								
			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>								
			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>								
			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>								
			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>								
			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>								
			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>								
			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>								
			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>								
			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>								
			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>								
			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>								
			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>								
			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>								
			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>								
			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>								
			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>								
			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>								
INSPECTORS		CONTRACTOR				PMC			OWNER				
NAME													
SIGNATURE													
DATE													



COMPANY:

W 19

SH. _ OF _

W 19 N°

[illegible]

NOTE: (1) YES MEANS APPROVAL FOR RADIOGRAPHIC EXAMINATION



COMPANY:

QUALITY CONTROL FORM

W 21

PROJ. No.:

QCF REV. A

SH. 1 OF 1

WELDER HISTORICAL REPORT

CONTRACTOR:

W 21 N°

WELDER NAME _____ WELDER STAMP _____ WELDER PERFORMANCE QUALIFICATION (WPQ) N° _____

[illegible]



COMPANY:

W 22

SH. ____ OF ____

W 22 N° _____



MATERIAL : _____ PIPING CLASSES: _____ RT% _____

WEEK N° _____ FROM _____ TO _____

CUMULATIVE DATA

[illegible]

Date:

 	PROJECT		Standby SRU & Additional Tanks IOCL Paradip Refinery	
	CLIENT		INDIAN OIL CORPORATION LIMITED	
QCP-PIPING WELDING ACTIVITIES MANAGEMENT	Project No. 080557C001	Document No. 080557C-000-QCP-1399-002	Rev. No. A	Page 1 of 3

QUALITY CONTROL PLAN
PIPING WELDING ACTIVITIES MANAGEMENT
(NDE / PWHT / HT / PMI INCLUDED)





TYPE OF QUALITY CONTROL REPORT	CERTIFICATION EXTENT
W 11	SUMMARY
W 25	MONTHLY REPORT



REFERENCE DOCUMENTS:

- 080557C-000-PP-805 Site Coordination & Communication Procedure.
- 080557C-000-PP-814 Welding Specification for Fabrication of Piping
- 080557C-000-PP-807 Material Receiving Handling & Storage procedure
- 080557C-000-PP-804 Specification for Positive Material Identification at Construction Sites
- 080557C-000-JSC-1300-001 Standard Specification for Fabrication and Erection of Piping
- QCP 1399.01 Welders Management
- DRAWINGS

LEGENDA

H	=	HOLD (RFI required - Work stop for inspection)
W	=	WITNESS (RFI required)
WC	=	100 % SUPERVISION AND EXAMINATION BY CONTRACTOR.
S	=	SURVEILLANCE (No RFI)
R	=	REVIEW OF REPORTS
N.A.	=	NOT APPLICABLE
A	=	AUTHORIZATION / APPROVAL
IFA	=	ISSUED FOR AUTHORIZATION/APPROVAL
INFO	=	FOR INFORMATION
RFI	=	REQUEST FOR INSPECTION
!	=	WARNING (control of document revision status)

			 Samit Paul 2019.10.21 18:23:09 +05'30'	 Signed By Digitally signed by samit.paul@technipfmc.com DN: c=IN, o=TechnipFMC, ou=TechnipFMC, email=samit.paul@technipfmc.com Date: 2019.10.21 18:40:12 +05'30'	 Approved By Alakapann L 2019.11.06 16:58:50 +05'30'	 Authorized By Morischristopher Jesumarian 2019.11.06 22:28:38 +05'30'
A	19/10/2019	ISSUED FOR INFORMATION	SMP	PKP	LA/ANJ	JMC
REV.	DATE	DESCRIPTION	PREPARED	CHECKED	APPROVED	AUTHORIZED

 	PROJECT	Standby SRU & Additional Tanks IOCL Paradip Refinery		
	CLIENT	INDIAN OIL CORPORATION LIMITED		
QCP-PIPING WELDING ACTIVITIES MANAGEMENT	Project No. 080557C001	Document No. 080557C-000-QCP-1399-002	Rev. No. A	Page 2 of 3



S.No	CHECK AND INSPECTION ITEM	QUALITY CONTROL REPORT	ACTION		NOTES
			CONTR.	TECHNIP	
A) PRELIMINARY ACTIVITIES					
A.1	CONTRACTOR DRAWINGS CHECK REVISION STATUS	N.A.	!	!	
A.2	CONTRACTOR / COMPANY TECHNICAL SPECIFICATIONS AND PROCEDURES	N.A.	!	!	
B) WELDING					
B.1	REVIEW OF PROPOSED (WPS) WELDING PROCEDURE SPECIFICATION.		A / R	A / R	
B.2	WELDING OF TEST COUPONS & SUBSEQUENT TESTING IF APPLICABLE		WC	H	
B.3	APPROVAL OF WPS & PQR		WC	H	
B.4	WELDING BOOK (PIPING WELDING KEY FORM)	W11	A	R	
B.5	LOG OF WELDING EQUIPMENT CALIBRATION VERIFICATION	Subc. Log	A	R	
C) WELDING CONSUMABLES					
C.1	PROCEDURE OF FILLER MATERIAL MANAGEMENT	Subc. Log	A	R	
C.2	STORAGE / HANDLING	Subc. Log	S	S	
C.3	MATERIAL CERTIFICATES	Subc. Log	R	S	
D) ISOMETRICS					
D.1	PIPE SPOOLS IDENTIFICATION	N.A.	S	S	
D.2	WELDS IDENTIFICATION	N.A.	S	S	
E) POSITIVE MATERIAL IDENTIFICATION (PMI)					
E.1	PMI PROCEDURE	N.A.	A	R	
E.2	PMI OPERATORS QUALIFICATION	N.A.	A	R	
F) NON DESTRUCTIVE EXAMINATION (NDE)					
F.1	VISUAL EXAMINATION (VT) PROCEDURE	N.A.	A	A	
F.2	LIQUID PENETRANT (PT) EXAM. PROCEDURE	N.A.	A	A	
F.3	MAGNETIC PARTICLE (MT) EXAM. PROCEDURE	N.A.	A	A	
F.4	RADIOGRAPHIC EXAM. (RT) PROCEDURE	N.A.	A	A	
F.5	ULTRASONIC EXAMINATION (UT) PROCEDURE	N.A.	A	A	
F.6	NDE MONTHLY STATUS	W 25	R	R	(1)
F.7	NDE PERSONNEL	N.A.	H	R	(2)
G) POST WELD HEAT TREATMENT (PWHT) & HARDNESS TEST (HT)					
G.1	PWHT PROCEDURE	N.A.	A	R	
G.2	LIST OF JOINTS REQUIRING PWHT	N.A.	R	R	
G.3	HT PROCEDURE	N.A.	A	R	
H) REPAIRS PROCEDURE		N.A.	A	R	

NOTES:

- (1) THESE REPORTS WILL BE ALWAYS AVAILABLE AS HARD COPY DURING PREFABRICATION/ERECTION BUT NOT INCLUDED IN THE FINAL CONSTRUCTION QUALITY DOSSIER.
- (2) NDE PERSONNEL AND RELEVANT PROCEDURES SHALL BE APPROVED BY AN INDEPENDENT RECOGNIZED THIRD PARTY ORGANIZATION.

GENERAL NOTES

- 1 THE ENCLOSED ITP'S ARE INDICATIVE AND SHALL BE FOLLOWED FOR DEVELOPING THEJOB SPECIFIC ITP'S FOR THE WORKS TO BE PERFORMED BY THE CONTRACTOR. THE PROVISIONS INDICATED FOR STAGE WISE INSPECTION BY TECHNIP AND OWNER (FOR SPECIFIC ACTIVITIES) ARE THE MINIMUM AND THE ENGINEER-IN-CHARGE MAY DECIDE TO INCREASE HOLD POINTS/ WITNESS POINTS, WHILE APPROVING THE JOB SPECIFIC

 	PROJECT	Standby SRU & Additional Tanks IOCL Paradip Refinery		
	CLIENT	INDIAN OIL CORPORATION LIMITED		
QCP-PIPING WELDING ACTIVITIES MANAGEMENT	Project No. 080557C001	Document No. 080557C-000-QCP-1399-002	Rev. No. A	Page 3 of 3

ITP'S. ACTIVITIES FOR WHICH ITP'S ARE NOT PROVIDED IN THIS SPECIFICATION. CONTRACTOR TO DEVELOP AND GET THE SAME APPROVED BY TECHNIP/OWNER BEFORE START OF THE WORK. IN GENERAL ROLE OF TECHNIP HAS BEEN SPECIFIED IN THE DOCUMENT THE ROLE OF OWNER TO BE SPECIFIED DURING PREPARATION OF SITE SPECIFIC ITP'S.

- 2 CONTRACTOR TO SUBMIT JOB SPECIFIC REPORTING FORMATS AND JOB PROCEDURES FOR THE JOBS FOR EACH ACTIVITY LISTED IN THE ITP'S AND SUBMIT TO TECHNIP/OWNER FOR APPROVAL. BEFORE COMMENCEMENT OF THE ACTIVITY. IF THE CONTRACTOR HAS TO DEVIATE FROM THE GIVEN ITP FOR A VALID REASON, HE SHALL OBTAIN PRIOR WRITTEN APPROVAL OF TECHNIP/OWNER. CONTRACTOR TO CARRY OUT 100% EXAMINATION OF ALL ACTIVITIES.



PROJECT:

COMPANY:

QUALITY CONTROL FORM

W 11

PROJ. No.:

QCF REV.0

SH. 1 OF 2

PIPING WELDING KEY FORM

SUBCONTRACTOR:

W 11 N°

PIPING CLASS (REF TO W 09)	BASE MATERIAL (P-N° OR GRADE)	WPS N°	WELDING DETAIL N° (SEE SH. 2)	WELDING PROCESS			PREHEAT. (Y/N)	HARDNESS (Y/N)	CHARPY IMPACT (Y/N)	PWHT (Y/N)	WALL THK RANGE	PIPE SIZE RANGE	PQR N°	REMARKS
				GTAW	SMAW									

INSPECTORS

CONTRACTOR

PMC

OWNER

NAME

SIGNATURE

DATE

TechnipFMC



PROJECT:

COMPANY:

QUALITY CONTROL FORM

W 11

PROJ.No.:

QCF REV. A

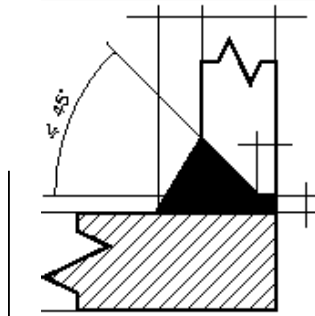
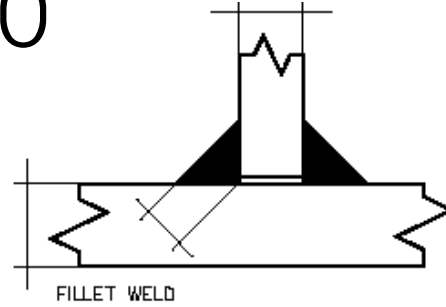
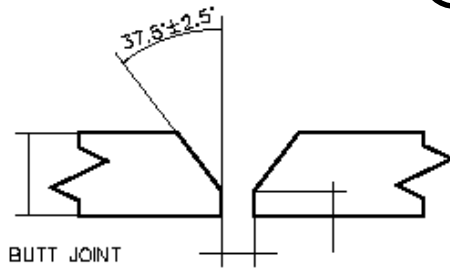
SH. 2 OF 2

PIPING WELDING KEY FORM
ELDING DETAIL

SUBCONTRACTOR:

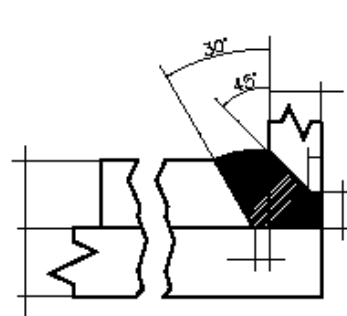
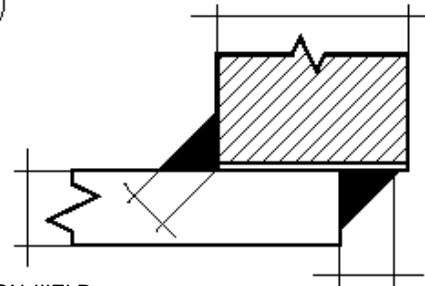
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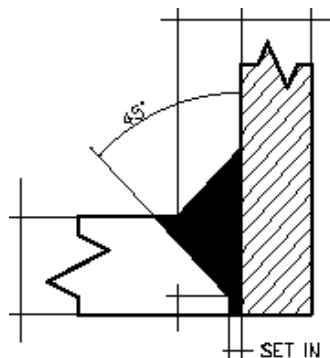
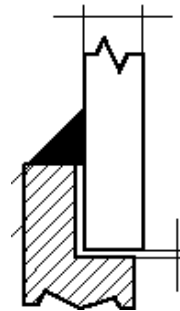


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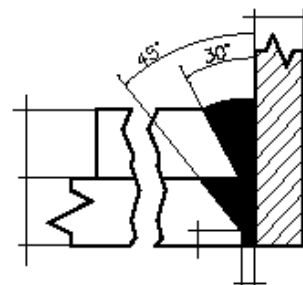
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PROJECT:

COMPANY:

QUALITY CONTROL FORM

W 25

PROJ. No.:

QCF REV. 0

SH. ____ OF ____

MONTHLY RADIOGRAPHIC AND REPAIRING STATUS

CONTRACTOR:

W 25 N° ____

UP-TO-DATE TO:

PROGR	ITEM OR DESCRIPTION	MATERIAL	A (1)	B	C = A x B	NDE TYPE	No CHECKS		EXTENSIONS		H = (E+G) / (D+F)	NOTES
			No JOINTS/m	REQUIRED % age	No. CHECKS		D	E	F	G	%	
							PERFORMED	DEFECTIVE	PERFORMED	DEFECTIVE	DEFECTS	
1												
2												
3												
4												
5												
6												
7												
8												
9												
10												
11												
12												
13												

(1) JOINTS NUMBER TO BE CHECKED (PIPING) OR WELDING METERS TO BE CHECKED (TANKS, VESSELS,)

ISSUED By:

CONTRACTOR INSPECTOR

DATE

CHECKED BY:

PMC INSPECTOR DATE

 		PROJECT	Standby SRU & Additional Tanks IOCL Paradip Refinery	
		CLIENT	INDIAN OIL CORPORATION LIMITED	
QCP-INSULATION	Project No. 080557C001	Document No. 080557C-000-QCP-2200-001	Rev. No. A	Page 1 of 3
QUALITY CONTROL PLAN INSULATION				




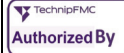
TYPE OF QUALITY CONTROL REPORT	CERTIFICATION EXTENT
W 12/A	SINGLE REPORT PER EACH MATERIAL
CL 1	SINGLE REPORT PER EACH TYPE OF MATERIAL
CL 2 – CL3	SINGLE REPORT PER EACH ITEM



REFERENCE DOCUMENTS:

- 080557C-000-PP-805 Site Coordination & Communication Procedure.
- 080557C-000-PP-807 Material Receiving , Handling & Storage procedure
- 080557C-000-JSD-2300-001 Specification for Surface Preparation and Protective Coating
- 080557C-000-JSD-2200-001 Job Specification for Hot Insulation of Vessels, Piping and Equipment
- 080557C-000-JSD-2200-002 Job Specification for Cold Insulation of Vessels, Piping and Equipment
- DRAWINGS

LEGENDA

- H = HOLD (RFI required - Work stop for inspection)
 W = WITNESS (RFI required)
 WC = 100 % SUPERVISION AND EXAMINATION BY CONTRACTOR.
 S = SURVEILLANCE (No RFI)
 R = REVIEW OF REPORTS
 N.A. = NOT APPLICABLE
 A = AUTHORIZATION / APPROVAL
 IFA = ISSUED FOR AUTHORIZATION/APPROVAL
 INFO = FOR INFORMATION
 RFI = REQUEST FOR INSPECTION
 ! = WARNING (control of document revision status)



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A	21.10.2019	ISSUED FOR INFORMATION	SMP	PKP	LA/ANJ	JMC
REV.	DATE	DESCRIPTION	PREPARED	CHECKED	APPROVED	AUTHORIZED

 	PROJECT		Standby SRU & Additional Tanks IOCL Paradip Refinery	
	CLIENT		INDIAN OIL CORPORATION LIMITED	
QCP-INSULATION	Project No. 080557C001	Document No. 080557C-000-QCP-2200-001	Rev. No. A	Page 2 of 3

S. NO	CHECK AND INSPECTION ITEM	QUALITY CONTROL REPORT	ACTION		NOTES
			CONTR	TECHNIP	
A)	PRELIMINARY ACTIVITIES				
A.1	CONTRACTOR DRAWINGS CHECK REVISION STATUS	N.A.	!	!	
A.2	CONTRACTOR TECHNICAL SPECIFICATION AND PROCEDURE	N.A.	!	!	
A.3	CONTRACTOR METHOD STATEMENT (if required)	N.A.	WC	A	
B)	BEFORE ERECTION				
B.1	MATERIALS APPROVAL	W 12A	WC	A	
B.2	MATERIALS CHECK IN CONTRACTOR WAREHOUSE	CL 1	WC	R/S	(1)
	- STORAGE				
	- INTEGRITY				
	- APPEARANCE				
	- DIMENSION				
C)	INSTALLATION OF HOT INSULATION				
C.1	JACKETING PREFABRICATION	CL 2	WC	R/S	
C.2	SURFACE APPEARANCE OF COMPONENTS TO INSULATE	CL 2	WC	R/S	
C.3	HEATING CHAMBER (for traced components only)	CL 2	WC	R/S	
C.4	INSULATING MATERIAL INSTALLATION	CL 2	WC	W/R	
C.5	JACKETING INSTALLATION	CL 2	WC	R/S	
C.6	MISCELLANEOUS FINISHING WORKS	CL 2	WC	R/S	
	- REMOVABLE INSPECTION WINDOWS (where required)				
	- EXPANSION JOINT (where required)				
	- JACKET OVERLAP				
	- SEALING				
C.7	FINAL DOCUMENTATION REVIEW	CL 2			
D)	INSTALLATION OF COLD INSULATION				
D.1	JACKETING PREFABRICATION	CL 3	WC	R/S	
D.2	SURFACE APPEARANCE OF COMPONENTS TO INSULATE	CL 3	WC	R/S	
D.3	INSULATING MATERIAL INSTALLATION	CL 3	WC	W/R	
	- APPLICATION OF PREFORMED INSULATION				
	- JOINTS SEALING				
	- METAL STRAPS APPLICATION				

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 		PROJECT	Standby SRU & Additional Tanks IOCL Paradip Refinery		
		CLIENT	INDIAN OIL CORPORATION LIMITED		
QCP-INSULATION	Project No. 080557C001	Document No. 080557C-000-QCP-2200-001		Rev. No. A	Page 3 of 3



S. NO	CHECK AND INSPECTION ITEM	QUALITY CONTROL REPORT	ACTION		NOTES
			CONTR	TECHNIP	
D.4	VAPOR BARRIERS AND GLASS CLOTH INSTALLATION	CL 3	WC	W/R	
D.5	JACKETING INSTALLATION	CL 3	WC	W/R	
D.6	MISCELLANEOUS FINISHING WORKS - REMOVABLE INSPECTION WINDOWS (where required) - CONTRACTION JOINT (where required) - JACKET OVERLAP - SEALING	CL 3	WC	S	
D.7	FINAL DOCUMENTATION REVIEW	CL 3			



NOTES: (1) CONTRACTOR SHALL ISSUE AN RFI FOR EACH NEW DELIVERY.



GENERAL NOTES



- THE ENCLOSED ITP'S ARE INDICATIVE AND SHALL BE FOLLOWED FOR DEVELOPING THE JOB SPECIFIC ITP'S FOR THE WORKS TO BE PERFORMED BY THE CONTRACTOR. THE PROVISIONS INDICATED FOR STAGE WISE INSPECTION BY TECHNIP AND OWNER (FOR SPECIFIC ACTIVITIES) ARE THE MINIMUM AND THE ENGINEER-IN- CHARGE MAY DECIDE TO INCREASE HOLD POINTS/ WITNESS POINTS, WHILE APPROVING THE JOB SPECIFIC ITP'S. ACTIVITIES FOR WHICH ITP'S ARE NOT PROVIDED IN THIS SPECIFICATION. CONTRACTOR TO DEVELOP AND GET THE SAME APPROVED BY TECHNIP/OWNER BEFORE START OF THE WORK. IN GENERAL ROLE OF TECHNIP HAS BEEN SPECIFIED IN THE DOCUMENT THE ROLE OF OWNER TO BE SPECIFIED DURING PREPARATION OF SITE SPECIFIC ITP'S.
- CONTRACTOR TO SUBMIT JOB SPECIFIC REPORTING FORMATS AND JOB PROCEDURES FOR THE JOBS FOR EACH ACTIVITY LISTED IN THE ITP'S AND SUBMIT TO TECHNIP/OWNER FOR APPROVAL. BEFORE COMMENCEMENT OF THE ACTIVITY. IF THE CONTRACTOR HAS TO DEVIATE FROM THE GIVEN ITP FOR A VALID REASON, HE SHALL OBTAIN PRIOR WRITTEN APPROVAL OF TECHNIP/OWNER. CONTRACTOR TO CARRY OUT 100% EXAMINATION OF ALL ACTIVITIES.

		PROJECT:					
		COMPANY:					
QUALITY CONTROL FORM CL 3		PROJ. No.:	QCF REV. A	SH. ___ OF ___			
COLD INSULATION SUMMARY REPORT		CONTRACTOR:		CL 3 N° ____			
ITEM / TAG N° _____		ITEM / TAG DESCRIPTION _____					
AREA _____		INSULATION CODE _____					
INSPECTIONS (REF. TO QCP 2200.01)		N.A.	ACC.	REMARKS/ REFERENCES	INSPECTORS SIGNATURE & DATE		
					CONTR.	TECHNIP	OWNER
D.1	JACKETING PREFABRICATION	<input type="checkbox"/>	<input type="checkbox"/>				
D.2	SURFACE APPEARANCE OF COMPONENTS TO INSULATE	<input type="checkbox"/>	<input type="checkbox"/>				
D.3	INSULATING MATERIAL INSTALLATION - APPLICATION OF PREFORMED INSULATION - JOINTS SEALING - METAL STRAPS INSTALL.	 <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	 <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>				
D.4	VAPOR BARRIERS AND GLASS CLOTH INSTALLATION	<input type="checkbox"/>	<input type="checkbox"/>				
D.5	JACKETING INSTALLATION	<input type="checkbox"/>	<input type="checkbox"/>				
D.6	MISCELLANEOUS FINISHING WORKS - REMOVABLE INSPECTION WINDOWS - CONTRACTION JOINT - JACKET OVERLAP - SEALING	 <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	 <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>				
NOTES:							
D.7) FINAL DOC. REVIEW	INSPECTORS	CONTRACTOR		PMC	OWNER		
	NAME						
	SIGNATURE						
	DATE						

 		PROJECT:				
		COMPANY:				
QUALITY CONTROL FORM CL 1		PROJ. No.:	QCF REV. A	SH. ____ OF ____		
INSULATION MATERIAL CHECK		CONTRACTOR:		CL 1 N° _____		
CHECK LIST	N.A.	ACC.	REMARKS/ REFERENCES	INSPECTORS SIGNATURE & DATE		
				CONTR.	TECHNIP	OWNER
1 PACKING - STORAGE - INTEGRITY - APPEARANCE	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>				
2 JACKETING - DIMENSION - APPEARANCE	<input type="checkbox"/> <input type="checkbox"/>	<input type="checkbox"/> <input type="checkbox"/>				
3 BAND OR WIRE - DIMENSION - APPEARANCE	<input type="checkbox"/> <input type="checkbox"/>	<input type="checkbox"/> <input type="checkbox"/>				
4 SCREW/SEALANT/WIRE MESCH - DIMENSION - APPEARANCE	<input type="checkbox"/> <input type="checkbox"/>	<input type="checkbox"/> <input type="checkbox"/>				
NOTES: 						
INSPECTORS		CONTRACTOR		PMC		OWNER
NAME						
SIGNATURE						
DATE						

 		PROJECT:					
		COMPANY:					
QUALITY CONTROL FORM CL 2		PROJ. No.:	QCF REV. A	SH. ___ OF ___			
HOT INSULATION SUMMARY REPORT		CONTRACTOR:		CL 2 N° ____			
ITEM / TAG N° _____		ITEM / TAG DESCRIPTION _____					
AREA _____		INSULATION CODE _____					
INSPECTIONS (REF. TO QCP 2200.01)		N.A.	ACC.	REMARKS/ REFERENCES	INSPECTORS SIGNATURE & DATE		
					CONTR.	TECHNIP	OWNER
C.1	JACKETING PREFABRICATION	<input type="checkbox"/>	<input type="checkbox"/>				
C.2	SURFACE APPEARANCE OF COMPONENTS TO INSULATE	<input type="checkbox"/>	<input type="checkbox"/>				
C.3	HEATING CHAMBER	<input type="checkbox"/>	<input type="checkbox"/>				
C.4	INSULATING MATERIAL INSTALLATION	<input type="checkbox"/>	<input type="checkbox"/>				
C.5	JACKETING INSTALLATION	<input type="checkbox"/>	<input type="checkbox"/>				
C.6	MISCELLANEOUS FINISHING WORKS - REMOVABLE INSPECTION WINDOWS - EXPANSION JOINT - JACKET OVERLAP - SEALING	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>				
NOTES:							
C.7) FINAL DOC. REVIEW	INSPECTORS	CONTRACTOR		PMC	OWNER		
	NAME						
	SIGNATURE						
	DATE						

 		PROJECT:	
		COMPANY:	
QUALITY CONTROL FORM W 12/A		PROJ. No.:	QCF REV. A
CONSTRUCTION MATERIALS APPROVAL		CONTRACTOR:	W 12/A N° _____
CIVIL <input type="checkbox"/>	PIPING <input type="checkbox"/>	MACHINERY <input type="checkbox"/>	INSULATION <input type="checkbox"/>
BLDG. <input type="checkbox"/>	MECHANIC. <input type="checkbox"/>	ELECTRICAL <input type="checkbox"/>	STEEL STR. <input type="checkbox"/>
NDT <input type="checkbox"/>	SUPPORT PRF. <input type="checkbox"/>	_____ <input type="checkbox"/>	_____ <input type="checkbox"/>
1. MATERIALS			
2. SUPPLIER			
3. PURPOSE			
4. ATTACHMENT DATA			
5. TYPE OF TEST PERFORMED			
6. TEST STANDARD UTILIZED			
REMARKS:			
RESULT:		ACCEPTED <input type="checkbox"/>	NOT ACCEPTED <input type="checkbox"/>
INSPECTORS	CONTRACTOR	PMC	OWNER
NAME			
SIGNATURE			
DATE			

 	PROJECT		Standby SRU & Additional Tanks IOCL Paradip Refinery	
	CLIENT		INDIAN OIL CORPORATION	
QCP-PAINTING	Project No. 080557C001	Document No. 080557C-000-QCP-2300-001	Rev. No. A	Page 1 of 3

QUALITY CONTROL PLAN

PAINTING





TYPE OF QUALITY CONTROL REPORT	CERTIFICATION EXTENT
W 12/A	SINGLE REPORT PER EACH MATERIAL
CP 1	SINGLE REPORT PER EACH WAREHOUSE INSPECTION
CP 2	SINGLE REPORT PER EACH ITEM



REFERENCE DOCUMENTS:

- 080557C-000-PP-805 Site Coordination & Communication Procedure.
- 080557C-000-PP-807 Material Receiving, Handling & Storage procedure
- 080557C-000-JSC-1300-001 Standard Specification for Fabrication and Erection of Piping
- 080557C-000-JSD-2300-001 Specification for Surface Preparation and Protective Coating
- 080557C-000-JSD-2200-001 Job Specification for Hot Insulation of Vessels, Piping and Equipment
- 080557C-000-JSD-2200-002 Job Specification for Cold Insulation of Vessels, Piping and Equipment
- DRAWINGS



LEGENDA

- H = HOLD (RFI required - Work stop for inspection)
 W = WITNESS (RFI required)
 S = SURVEILLANCE (No RFI)
 R = REVIEW OF REPORTS
 N.A. = NOT APPLICABLE
 A = AUTHORIZATION / APPROVAL
 IFA = ISSUED FOR AUTHORIZATION/APPROVAL
 INFO = FOR INFORMATION
 ! = WARNING (control of document revision status)

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A	21.10.2019	ISSUED FOR INFORMATION	SMP	LA	LA/ANJ	JMC
REV.	DATE	DESCRIPTION	PREPARED	CHECKED	APPROVED	AUTHORIZED

 	PROJECT	Standby SRU & Additional Tanks IOCL Paradip Refinery		
	CLIENT	INDIAN OIL CORPORATION		
QCP-PAINTING	Project No. 080557C001	Document No. 080557C-000-QCP-2300-001	Rev. No. A	Page 2 of 3

S.NO	CHECK AND INSPECTION ITEM	QUALITY CONTROL REPORT	ACTION		NOTES
			CONTR.	TECHNIP	
A)	PRELIMINARY ACTIVITIES				
A.1	CONTRACTOR DRAWINGS CHECK REVISION STATUS	N.A.	!	!	
A.2	CONTRACTOR TECHNICAL SPECIFICATION AND PROCEDURE	N.A.	!	!	
A.3	SUB CONTRACTOR METHOD STATEMENT (if required)	N.A.	WC	A	
B)	BEFORE APPLICATION				
B.1	MATERIALS APPROVAL	W 12A	WC	A	
B.2	MATERIALS CHECK IN CONTRACTOR WAREHOUSE:				
B.2.1	MATERIAL IDENTIFICATION AND CONSERV. STATUS & EXPIRING DATE CHECK	CP 1	WC	S	(1)
B.2.2	COATING EQUIPMENT, CONTROL & TEST INSTRUMENTS	CP 1	WC	S	
B.3	PAINTERS IDENTIFICATION & CARD ASSIGNMENT (IF ANY)	N.A.	WC	A	
C)	PAINTING APPLICATION				(2)
C.1	<u>SURFACE PREPARATION</u>				
C.1.1	ENVIROMENTAL CONDITIONS & SOLUBLE SALT CONTAMINATION	CP 2	WC	W/R	(3)
C.1.2	ABRASIVE BLASTING EXECUTION; SURFACE PROFILE CHECK; VISUAL EXAMINATION;	CP 2	WC	W/R	
C.2	<u>PRIMER</u>				
C.2.1	ENVIRONMENTAL CONDITIONS & PRIMER EXECUTION	CP 2	WC	W/R	
C.2.2	VISUAL EXAMINATION & THICKNESS CHECK (DFT)	CP 2	WC	R	
C.2.3	CURING & ADHESION TEST	CP 2	WC	W/R	
C.3	<u>INTERMEDIATE COATING</u>				
C.3.1	CLEANLINESS, ENVIRONM. CONDITIONS & INTERMEDIATE COATING EXECUTION	CP 2	WC	R	
C.3.2	VISUAL EXAMINATION & THICKNESS CHECK (DFT)	CP 2	WC	R	
C.3.3	CURING & ADHESION TEST	CP 2	WC	W/R	
C.4	<u>FINAL COATING</u>				
C.4.1	CLEANLINESS, ENVIRONM. CONDITIONS & FINAL COATING EXECUTION	CP 2	WC	R	
C.4.2	VISUAL EXAMINATION & THICKNESS CHECK (DFT)	CP 2	WC	W/R	
C.4.3	CURING & ADHESION TEST	CP 2	WC	W/R	
C.4.4	HOLIDAYS TEST (Only for vessels and tanks internal coating)	CP 2	WC	W/R	

 	PROJECT	Standby SRU & Additional Tanks IOCL Paradip Refinery		
	CLIENT	INDIAN OIL CORPORATION		
QCP-PAINTING	Project No. 080557C001	Document No. 080557C-000-QCP-2300-001	Rev. No. A	Page 3 of 3

S.NO	CHECK AND INSPECTION ITEM	QUALITY CONTROL REPORT	ACTION		NOTES
			CONTR.	TECHNIP	
C.5	<u>BRUSHING & TOUCHUP</u>	CP 2	WC	W/R	
C.6	<u>IDENTIFICATION MARKING</u>	CP 2	WC	S	
C.7	<u>FINAL DOCUMENTATION REVIEW</u>	CP 2			



NOTES: (1) CONTRACTORS SHALL ISSUE AN RFI FOR EACH NEW DELIVERY.



(2) CONTRACTORS SHALL RECORD ON A PROPER LOGBOOK THE ENVIRONMENTAL CONDITIONS EACH WORKING DAY.
AT LEAST: TEMPERATURE (°C), RELATIVE MOISTURE (%) AND DEW POINT (°C)
LOGBOOK SHALL BE ALWAYS AVAILABLE AND ANYWAY ATTACHED TO FINAL DOSSIER.



(3) CONTRACTORS SHALL RECORD ON A PROPER LOGBOOK THE SOLUBLE SALT CONTAMINATION TEST ABOUT ALL LOTS OF MATERIALS, BEFORE AND AFTER THE SURFACE PREPARATION.
LOGBOOK SHALL BE ALWAYS AVAILABLE AND ANYWAY ATTACHED TO FINAL DOSSIER.

GENERAL NOTES

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




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		COMPANY:					
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CHECK LIST		N.A.	ACC.	REMARKS/ REFERENCES	INSPECTORS SIGNATURE & DATE		
					CONTRACT.	TECHNIP	OWNER
1	STORAGE						
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	- CATALYST	<input type="checkbox"/>	<input type="checkbox"/>				
	- THINNER	<input type="checkbox"/>	<input type="checkbox"/>				
	- HARDENER	<input type="checkbox"/>	<input type="checkbox"/>				
	-	<input type="checkbox"/>	<input type="checkbox"/>				
2	IDENTIFICATION & EXPIRING DATE						
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	- THINNER	<input type="checkbox"/>	<input type="checkbox"/>				
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	-	<input type="checkbox"/>	<input type="checkbox"/>				
3	PAINTING EQUIPMENT	<input type="checkbox"/>	<input type="checkbox"/>				
4	CONTROL & TEST INSTRUMENTS	<input type="checkbox"/>	<input type="checkbox"/>				
NOTES:							
INSPECTORS		CONTRACTOR		PMC		OWNER	
NAME							
SIGNATURE							
DATE							

 				PROJECT:				
				COMPANY:				
QUALITY CONTROL FORM CP 2				PROJ. No.:	QCF REV. A	SH. ____ OF ____		
PAINTING SUMMARY REPORT				CONTRACTOR:		CP 2 N° _____		
ITEM / TAG N° _____				ITEM / TAG DESCRIPTION _____				
AREA _____				PAINTING CYCLE _____				
INSPECTIONS (REF. TO QCP 2300.01)			N.A.	ACC.	REMARKS/ REFERENCES	INSPECTORS SIGNATURE & DATE		
						CONTRACT.	TECHNIP	OWNER
C.1	SURFACE PREPARATION							
C.1.1	ENVIROMENTAL CONDITIONS & SOLUBLE SALT CONTAMINATION	<input type="checkbox"/>	<input type="checkbox"/>					
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C.2	PRIMER							
C.2.1	ENVIROMENTAL CONDITION & PRIMER EXECUTION	<input type="checkbox"/>	<input type="checkbox"/>					
C.2.2	VISUAL EXAMINATION & THICKNESS CHECK (DFT)	<input type="checkbox"/>	<input type="checkbox"/>					
C.2.3	CURING & ADHESION TEST	<input type="checkbox"/>	<input type="checkbox"/>					
C.3	INTERMEDIATE COATING							
C.3.1	CLEANLINESS, ENVIRONM. COND. & INTERMEDIATE COATING EXECUT.	<input type="checkbox"/>	<input type="checkbox"/>					
C.3.2	VISUAL EXAMINATION & THICKNESS CHECK (DFT)	<input type="checkbox"/>	<input type="checkbox"/>					
C.3.3	CURING & ADHESION TEST	<input type="checkbox"/>	<input type="checkbox"/>					
C.4	FINAL COATING							
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C.6	IDENTIFICATION MARKING	<input type="checkbox"/>	<input type="checkbox"/>					
NOTES:								
C.7) FINAL DOC. REVIEW	INSPECTORS	CONTRACTOR			PMC		OWNER	
	NAME							
	SIGNATURE							
	DATE							

 		PROJECT:	
		COMPANY:	
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NDT <input type="checkbox"/>	SUPPORT PRF. <input type="checkbox"/>	_____ <input type="checkbox"/>	_____ <input type="checkbox"/>
1. MATERIALS			
2. SUPPLIER			
3. PURPOSE			
4. ATTACHMENT DATA			
5. TYPE OF TEST PERFORMED			
6. TEST STANDARD UTILIZED			
REMARKS:			
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INSPECTORS	CONTRACTOR	PMC	OWNER
NAME			
SIGNATURE			
DATE			

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			 <small>Written By</small>  <small>Mayappan Somaasundaram</small> <small>2019.10.11 17:29:26</small> <small>+05'30'</small>	 <small>Checked By</small>  <small>Loganathan Sudarsan</small> <small>2019.10.11 17:29:26</small> <small>+05'30'</small>	 <small>Approved By</small>  <small>Rango Thottakal</small> <small>2019.10.11 18:01:19</small> <small>+05'30'</small>	 <small>Authorized By</small>  <small>Jeevananthan</small> <small>2019.10.15 21:03:47</small> <small>+05'30'</small>
A	11-10--2019	ISSUED FOR EXECUTION	SMM	SL	TI	JMC
REV.	DATE	DESCRIPTION	PREPARED	CHECKED	APPROVED	AUTHORIZED

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1. Introduction:

INDIAN OIL CORPORATION LIMITED (IOCL) has awarded Fax of Acceptance (FOA) dated 29th August 2019 to M/s. Technip India Limited (TPIL) for Consultancy services (PMC/EPCM services) for overall project management, FEED Review / FEED, Detailed Engineering, Procurement & expediting services, Tendering & award, Construction Management & Supervision, Assistance in start-up, Commissioning & performance test runs for installation of a Standby SRU of 525 TPD capacity and execution of Additional tanks for Paradip Refinery, Odisha, India.

2. Definitions & Abbreviations

Wherever used in this procedure, the following words shall have the meaning as given hereunder

Abbreviation	Definition /Expanded form
IOCL/ CLIENT	Indian Oil Corporation Limited
PMC/ CONSULTANT	Technip India Limited
LICENSOR	Party selected by IOCL for process technology ownership for any UNIT
CONTRACTOR	Party whose services are obtained for performing the works specified as part of LSTK / packages.
EPCM	Engineering, Procurement & Construction Management Services.
LSTK	Lump Sum Turn Key portion of the work to be executed by CONTRACTOR
FEED	Front End Engineering Design
AUTHORISED REPRESENTATIVE	IOCL's/ CONSULTANT's representative authorized to act for and on behalf of them.
VENDOR	Any third party supplying the equipment/materials for setting up the Plant
PROJECT	Indicates Standby SRU and Additional tanks Project, Paradip Refinery
UNIT	Indicates any particular portion of the project to be built which can be Process related or Utilities/Offsites related
SRU	Sulphur Recovery Unit
IBR	Indian Boiler Regulations
PMI	Positive Material Identification
A.S	Alloy Steel

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C.I	Cast Iron
S.S	Stainless Steel
C.S	Carbon Steel
LTCS	Low Temperature Carbon Steel
NDT	Non-Destructive Testing
NACE	National Association of Corrosion Engineers
OISD	Oil Industry Safety Directorate
ASME	American Society of Mechanical Engineers
API	American Petroleum Institute
P&ID	Piping and Instrumentation Diagram
A/G	Above Ground
U/G	Under Ground

3. Scope

This specification covers general requirements of fabrication and erection of above ground and in-trench piping systems at fabrication shop & site. The specification covers the scope of work of Contractor, basis of work to be carried out by Contractor and standards, specifications and normal practice to be followed during fabrication and erection by the Contractor.



4. Conflicts, Deviations and Clarifications:

Any conflicts between this specification and other applicable Engineering Standards, Material Specifications, Standard Drawings, Engineering Procedures, Company Forms or Industry standards, specifications, Codes and forms shall be brought to the attention of Authorised Representative by the Contractor for resolution.

Until the resolution is officially made by the Authorized Representative, the most stringent requirement shall govern.

Where a licensor specification is more stringent than those of this standard, the Licensor's specific requirement shall apply.

Where applicable Codes or Standards are not called by this standard or its requirements

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are not clear, it shall be brought to attention of Authorised Representative by Contractor for resolution.

Direct all requests for deviations or clarifications in writing to the Authorised Representative for final resolution.



5. Scope of Work of Contractor

Generally, the scope of work of Contractor regarding “Fabrication & Erection of Piping” shall include the following:

- 5.1 Transportation of required piping materials (as described in 5.1.1), pipe support (material as described in 5.3) and all other necessary piping material from Contractor’s storage point (Contractor’s scope of supply) & Owner’s storage point (Owner’s scope of supply if any) to work site/shop including raising store requisitions for issue of materials in the prescribed format & maintaining an account of the materials received from Contractor’s/Owner’s stores

- 5.1.1 Piping materials include the following but not limited to the same.

- a. Pipes (All sizes and schedule)
- b. Flanges (All sizes, types & Pressure ratings).
- c. Fittings (All sizes, types and schedule)
- d. Valves (All sizes, types and Ratings)
- e. Gaskets (All sizes, types & Ratings)
- f. Bolts, Nuts or M/C Bolts (All types)
- g. Expansion Joint/Bellows (All types)
- h. Specialty items like online filters, ejectors, sample coolers, steam traps, strainers, air traps, springs, silencers, snubbers, steam and condensate manifolds, injection nozzles, MOVs, sight glass, hoses, hose couplings, etc.
- i. On line instruments like control valve, on-off valves, orifice flange, all types of flow measuring instruments, safety valves, restriction orifice, rupture disc, de-super heaters, corrosion probes, Pressure Measuring Instruments, ejectors, static mixers, flame arrestors, thermal flow switches, pre- fabricated hook-ups etc.

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- j. Shut Down Valves with and without fire-proofing box
- k. Safety/Firefighting items connected with piping like Deluge Valves, Spray Nozzles, Hoses, Hydrants, Monitors, Hose reels etc.,
- l. Any other item required for piping fabrication & erection, testing, inspection, cleaning, flushing, marking and painting etc.,
- m. All pipe support materials, structural, hangers, prefabricated items, brackets, sliding plates, or any other material used for supporting purpose.



5.2 Shop & field fabrication and erection of piping in accordance with documents listed under 6.1 i.e. 'BASIS OF WORK' including erection of all piping materials enumerated above.

5.3 Fabrication and erection of pipe supports like shoe, saddle, guide, stops, anchors, clips, cradles, hangers, turn-buckles, supporting fixtures, bracket cantilevers, struts, tee-posts including erection of spring supports, sway braces, trunnions (dummy pipes), corrosion pads/protection shields, low friction pads, clamps, special supports, stiffeners and stiffening rings.



5.4 Fabrication of Piping items

Fabrication of Piping items shall include but not be limited to the following



- 5.4.1 Fabrication of piping specials like special radius bends, reducers, mitres etc.
- 5.4.2 Fabrication of plain and threaded nipples from pipes as required during erection.
- 5.4.3 Fabrication of swage nipples as and when required.
- 5.4.4 Fabrication of odd angle elbow like 60°, 30° or any other angle from 90°/45° elbows as and when required.
- 5.4.5 Fabrication of flange, reducing flange, blind flange, spectacle blinds as and when required.
- 5.4.6 Fabrication of stub-in connection with or without reinforcement. External reinforcing pads shall have a minimum of one ¼" vent hole. Pads for branch connections greater than 16 inch shall have minimum of 2 vent holes. Pads installed in sections shall have at least one vent per section. Vents shall remain open until the completion of pressure testing. Plug material shall be adequate for the operating temperature but shall not be capable of sustaining pressure between the reinforcing plate and pipe.
- 5.4.7 Grinding of edges of pipes, fittings, flanges etc. to match mating edges of uneven/different thickness wherever required.

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- 5.4.8 Fabrication of circular pipe for steam rings, fire water lines, utility lines.
- 5.4.9 Threading of all small-bore piping as per piping material specifications.
- 5.4.10 Drilling on blind flange for inserting/joining small bore lines.
- 5.4.11 Fabrication and welding of reinforcement pads at branch pipe locations wherever required.
- 5.4.12 Equipment nozzle reinforcement with pads, jacket & stiffeners wherever required.
- 5.4.13 Fabrication of injection nozzles as per details provided wherever required.
- 5.4.14 Fabrication of chain operation arrangement for valves, wherever required. All material required for this modification shall be supplied by Contractor.
- 5.4.15 Fabrication and erection in position of funnels required for OWS/ SS/ Condensate blow down system.
- 5.4.16 Grinding/ finishing of uneven surfaces/ joints after welding. Internal grinding of welds of orifice flanges to render smooth surface.
- 5.4.17 Tapping and drilling of holes in flanges, blind flanges, piping connections for jack screw, if required.
- 5.4.18 Providing bird screens at the outlet of lines open to atmosphere.
- 5.4.19 Weep hole to be provided in the PSV exit line if its open to Atmosphere.
- 5.5 Modifications like providing additional cleats, extension of stem of valve, locking arrangement of valves etc. as and when required.
- 5.6 Preparation of miscellaneous small bore isometrics (where engineering Isometrics are not available) with bill of materials for process and utility lines (up to 1.5" size) like instruments & pump flushing / cooling, sample connection, purging, pump casing vents & drains, pump base plate drains, control valve drains / vent to flare, instrument drains & vents, steam tracing (non-IBR) from steam supply stations up to condensate recovery station, and lines specified as field routed within the Unit battery limit as and when required are in Contractor's scope of work. Approval for these isometrics prepared by the Contractor shall be taken from Engineer-In charge before erection.
- 5.7 Obtaining approval for drawings prepared by Contractor from statutory authority, if required like IBR etc.

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- 5.8 Rubber lining inside pipes, fittings, flanges as and when required, in accordance with specification.
- 5.9 Radiography, stress relieving, dye penetration, magnetic particle test etc. as required in specification.
- 5.10 Performing PMI using alloy analyzers as per 'Standard specification for Positive Material Identification at Construction Sites
- 5.11 Casting of concrete pedestals and Fabrication and erection of small structures/ platforms for pipe supports and valve operation / instruments, spectacle blinds etc., providing brackets, modification / extension of platforms, providing additional platforms / ladders for improving accessibility.
- 5.12 Providing insert plates with anchor fasteners in concrete structures/ paved floors and repair of platform gratings around pipe openings and providing suitable members for support under the platform grating.
- 5.13 Preparing material reconciliation statement and return of Owner's supply left over materials to Owner's storage if any.
- 5.14 Flushing and testing of all piping systems as per standard specification for inspection, flushing and testing of piping systems. The accessories required for blinding the line like flange, blind flange, gasket (all sizes, type and rating), stud-bolts, flexible hoses etc. are to be arranged by the Contractor. During flushing the discharged water / air shall be drained / routed as directed by Engineer-In Charge at site.
- 5.15 Contractor shall prepare welding specifications for all weld joints where dissimilar welding will be performed, and obtain approval from Engineer-In Charge at site.
- 5.16 Contractor to ensure meeting all requirements for carrying out work in shutdown/running plant.
- 5.17 Pickling (as and when applicable) as per Job specification(s) for chemical cleaning of suction piping of compressors, SS Piping, Weldments etc., as applicable.
- 5.18 Chemical Cleaning/ Hydro jet cleaning as per marked-up P&IDs with supply of chemicals, consumables, DM water, equipment, boilers, coupons, tools & tackles and other testing equipment as applicable required for the same.

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5.19 Site clearing of piping leftovers and other debris and making the site free and clean thoroughly of any waste and or unused materials.

5.20 Providing steam/electrical tracing wherever specified as per specification.

5.21 Ceramic / refractory or any other inner lining of pipes as specified.

6 Basis For Work

6.1 The complete piping work shall be carried out in accordance with the following:

6.1.1 "Approved for Construction" drawings, GADs, Layout plans, Isometrics and other sketches issued by Contractor.



6.1.2 "Approved for Construction" drawings, GADs, Layout plans, Isometrics and other sketches supplied by package vendor.

6.1.3 Approved Process Licensor's standards and specification

6.1.4 Approved construction job procedures prepared by Contractor as stipulated.

6.1.5 Following drawings/documents/specifications prepared by Contractor duly approved by Authorised Representative:

- a) P & ID
- b) Line List
- c) Piping Material Specification
- d) Piping Support & Construction Standards
- e) Standard Specification for Hot Insulation of Vessels, Piping and Equipment
- f) Standard Specification for Cold Insulation of Vessels, Piping and Equipment
- g) Standard Specification for Painting & Coating
- h) Job Specification for Steam Tracing & Jacketed Piping
- i) Job Specification for Piping Support Design
- j) Standard Specification for Non-Destructive Testing Requirement of Piping
- k) Standard Specification for application of torque & hydraulic bolt tension for flange joints

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- l) Welding specification for the fabrication of Piping including Welding specification chart for piping
- m) Standard specification for pressure testing of erected piping system
- n) Procedure for storage, preservation and positive identification of materials (PMI) at Contractors work / stores
- o) Inspection & Test Plan for Piping
- p) Instrument installation sketches
- q) Structural drawings wherever required



6.1.6 Following codes, standards and regulations

- a) ASME B 31.3 : Process Piping
- b) ASME B 31.1 : Power Piping
- c) ASME Sec. VIII & IX : ASME Boiler and Pressure Vessel Code
- d) IS: 823 : Code of procedure for Manual Metal Arc Welding of Mild Steel
- e) IBR Regulations

Note: All codes referred shall be latest edition, at the time of award of contract.

7 Storage & Handling Materials

- 7.1 All materials, whether loose or prefabricated shall be stored above ground on a flat surface, on platforms or pallets, in a manner that will prevent any deterioration from debris, grease, salts, sea water, paint spray or any other foreign matter.
- 7.2 Stainless steel and duplex stainless steel piping shall be stored on wooden blocks, in segregated areas from carbon, alloy and galvanized carbon steel, to prevent any possibility of cross contamination during cutting and welding.
- 7.3 Stainless steel and duplex stainless steel materials shall not be loaded, unloaded or handled with hoisting devices (e.g. steel ropes and forklift trucks) containing zinc or other harmful materials.

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- 7.4 Materials destined for Indian Boiler Regulation coded systems shall be separated from other materials of equivalent chemistry.

8 FABRICATION

8.1 General

Fabricated metal piping shall meet local authority requirements like IBR, etc for all piping requiring inspection and approval by local authorities.

All other fabricated metal piping shall meet the requirements of ASME B31.1 / B31.3

To prevent corrosion of stainless steel, duplex stainless steel and other high-alloy steels, fabrication of carbon steel, galvanized carbon steel and low-alloy steel shall be done in a separate area. Area means different shops or two areas in one shop separated by suitable (temporary) walls

For the same reason as above, tools used for fabrication of carbon steel, galvanized steel and low-alloy steel may not be used for fabrication of stainless steel, duplex stainless steel and other high-alloy steel. Only tools made of stainless steel are allowed for grinding, brushing, clamping, etc.

These requirements apply to shop and field fabrication.

8.2 Shop Fabrication



Shop fabrication under this specification shall include all the components of the pipeline or parts thereof entering into fabricated assemblies (spools), but shall exclude all piping specialties other than those with welding end constructions such as bolting, gaskets, flanged valves and fittings, blind flanges, orifice plates and similar items.

CONTRACTOR is responsible for selection of piping to be shop fabricated on site or off site.

8.3 Shop Detail Drawings

The CONTRACTOR can use authorized software tools to make shop detail spool drawings for piping fabrication.

Spool piece mark number shall be assigned and shall follow in sequential order, the fabricated spools in a line, ascending in direction of flow.

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Lines covered by several sequential isometric sheets, shall have piece mark numbers following the same sequence for the entire pipe line.

A number, consisting of the plant or unit number, commodity symbol, line number, and spool piece number, shall identify each pipe spool.

Piece mark numbers and location of field welds between shop fabricated spool pieces shall be shown on the CONTRACTOR's spool drawings.

8.4 Spool Identification

Spools shall be identified by a detail number comprising of their line number and spool suffix which must be weather proof and painted or marked in characters at least 50 mm high and bar code identification also to be done.

Numbers must be located, and repeated as necessary, in such a manner that any spool may be easily identified without turning or lifting it.

8.5 Location of Field Welds

The size of spools and location of field welds shall be determined by CONTRACTOR.

Lengths of spools shall not be limited by "match lines" that appear on drawings. A line and its branches which appear on more than one drawing is not intended to mean that a field weld is desired at the continuation point from one drawing to another.



Where piping is shown passing through a wall or floor, the first weld point on either side of the wall or floor shall be made a field weld, provided it is located at least 150 mm away from the end of the pipe sleeve.

Erection conditions shall be considered in determining the size of spool.

8.6 Field Fabrication

Field fabrication under this specification covers, but is not necessarily limited to the following operations:

- 8.6.1 Erection of shop-fabricated piping.
- 8.6.2 Fabrication and erection of all field-fabricated piping.
- 8.6.3 Design, routing, fabrication and erection of all field-fabricated piping for which no piping drawings are available.

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8.6.4 Fabrication and erection of all pipe supports and auxiliary steel as detailed in the pipe support drawings.

8.6.5 Design, fabrication and erection of all pipe supports for small bore piping, which shall be executed in line with the available drawings for supports.

8.7 Verification of Field Dimensions

Fabrication of piping and pipe supports shall be in accordance with the drawings. However, due to equipment location and fabrication tolerances, field verification of overall dimensions shall be made by CONTRACTOR prior to erection, to ensure a proper fit up at all connections to equipment and other piping.

8.8 Longitudinal welding Joints



The longitudinal welds of two (2) adjacent rings or tubes shall be staggered approximately 90°. Longitudinal welds shall not be situated at the bottom of the pipe and positioned at least 45° upwards.

8.9 Piping Material

Pipe, pipe fittings, flanges, valves, gaskets, studs bolts etc. used in a given piping system shall be strictly as per the "Piping Material Specification" for the "Pipe Class" specified for that system. To ensure the above requirement, all piping material supplied by the Contractor / Owner (if any) shall have proper identification marks as per relevant standards / PMC specifications / Licensors specification. Contractor shall provide identification marks on left over pipe lengths wherever marked up pipe lengths have been fabricated/erected. Material-traceability is to be maintained for A.S., S.S., NACE, LTCS, IBR, material for Hydrogen service and other exotic materials by way of transferring heat number, etc. (hard punching) as per approved procedure. This shall be in addition to color coding for all piping materials to avoid mix-up.

Betterment of common understanding, the construction job procedure to be submitted by the Contractor, shall include proposal for

- Maximizing prefabrication, inspection and testing at fabrication shop with minimum field joints.
- Positive material identification, handling, storage & preservation.
- Shop fabrication of piping supports to the maximum extent feasible. All sharp corners of base plate and other plates shall be rounded and ground smooth.

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8.10 Dimensional Tolerances



The Contractor shall be responsible for working to the dimensions shown on the drawings. However, the Contractor shall bear in mind that there may be variations between the dimensions shown in the drawing and those actually existing at site due to minor variations in the location of equipment, inserts, structures etc. To take care of these variations "Field Welds" shall be provided during piping fabrication. An extra pipe length of 100 mm over and above the dimensions indicated in the drawing may be left on one side of the pipe at each of the field welds. During erection, the pipe end with extra length at each field weld, shall be cut to obtain the actual dimension occurring at site. Fabrication tolerances shall be governed by the relevant code and IOCL standard for fabrication tolerances, whichever is more stringent.

8.11 IBR Piping

Contractor shall obtain approval for the piping systems falling under purview of IBR from the statutory Indian Boiler Regulations (IBR) authority of the state where the plant is situated. The Contractor shall carry out the fabrication, erection and testing of this piping as per requirements of Indian Boiler Regulations and to the entire satisfaction of the local Boiler Inspector. The Contractor shall also get the approval of IBR inspector for all fabrication and testing done by him at his own cost. All certificates of approval shall be in proper IBR forms. All IBR approved drawings and certificates to be handed over to Owner through PMC.

Contractor shall perform all the approval related activities which are listed below but not limited to;

- Piping Isometric Dossier Submission to IBR Authority
- Receipt of Drawing Approval from IBR Authority
- Construction Contractor approval from IBR Authority
- IBR Welders Qualification
- Line Registration
- Material Inspection by IBR
- Submission of reports (like Form-III A, III B, III C) to IBR Authority
- Submission of Test Package Dossiers / As-built drawings along with Original IBR Certificates to IBR and obtaining clearance for Pressure Test from IBR Authority
- Obtaining Final Acceptance from IBR Certificate

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IBR Package for residual, field routed and site modified steam lines shall be prepared by the Contractor. IBR approval for the same shall be in Contractor's scope, at his own cost.

8.12 Pipe Joints

The piping class of each line specifies the type of pipe joints to be adopted. In general, joining of lines 2" and above in process and utility piping shall be accomplished by butt-welds.

Joining of lines 1-1/2" and below shall be by socket welding/butt welding/threaded joints as specified in "Piping Material Specifications".

However, in piping 1-1/2" and below where socket welding/ threaded joints are specified butt-welds may be used with the approval of Engineer-In Charge for pipe to pipe joining in long runs of piping. This is only applicable for non-galvanized piping without lining.

Flange joints shall be used at connections to Vessels, Equipment, Valves and where required for ease of erection and maintenance as indicated in drawings.

8.13 Butt Welded and Socket Welded Piping



End preparation, alignment and fit-up of pipe pieces to be welded, welding, pre-heating, post-heating and heat treatment shall be as described in the Job welding specification and NDT specification.

8.14 Screwed Piping

In general, Galvanized piping shall have threads as per IS:554 or ANSI B2.1 NPT as required to match threads on fittings, valves etc. All other piping shall have threads as per ANSI B2.1, tapered unless specified otherwise.

Threads shall be clean cut, without any burrs or stripping and the ends shall be reamed. Threading of pipes shall be done preferably after bending, forging or heat treating operations. If this is not possible, threads shall be gauge checked and chased after welding heat treatment etc.

During assembly of threaded joints, all threads of pipes and fittings shall be thoroughly cleaned of cuttings, dirt, oil or any other foreign matter. The male threads shall be coated with thread sealant and the joint tightened sufficiently for the threads to seal and give a leakproof joint. Threaded joints to be seal-welded shall be cleaned of all foreign matter, including sealant and made up to full thread engagement before seal welding.

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8.15 Flange Connections

All flange facings shall be true and perpendicular to the axis of pipe to which they are attached. Flanged bolt holes shall straddle the normal centerlines unless different orientation is shown in the drawing.

Wherever jack screws are to be provided, drilling and tapping for the jack screws in the flange, shall be done as per Specification/Standard before welding it to the pipe.

8.16 Branch Connections

Branch connections shall be as indicated in the piping material specifications. For end preparation, alignment, spacing, fit-up and welding of branch connections refer welding specifications. Templates shall be used wherever required to ensure accurate cutting and proper fit-up.

Reinforcement pads shall be provided wherever indicated in drawings/ specifications etc. Reinforcing pads shall be the same material as the pipe.

Prior to welding, saddles or rings shall be drilled with one number of 1/4" NPT threaded hole for testing and venting. Threaded hole shall be sealed with compound after testing. No gap larger than 3 mm shall exist between the OD of the pipe and ID of the ring or saddle.

8.17 Bending



Bending shall be as per ASME B31.3 except that corrugated or creased bends shall not be used. Hot bending is not permitted in the field.

Cold bends for lines 1-1/2" and below, with a bend radius of 5 times the nominal diameter shall be used as required in place of elbows wherever allowed by piping specifications. Bending of pipes 2" and above may be required in some cases like that for headers around heaters, reactors etc.

The completed bend shall have a smooth surface, free from cracks, buckles, wrinkles, bulges, flat spots and other serious defects. They shall be true to dimensions. The flattening of a bend, as measured by the difference between the maximum and minimum diameters at any cross-section, shall not exceed 8% and 3% of the nominal outside diameter, for internal and external pressure respectively.

8.18 Forging and Forming

Forging and forming of small bore fittings, like reducing nipples for piping 1-1/2" and below, shall be as per ASME B 31.3.

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8.19 Mitre Bends and Fabricated Reducers

The specific application of welded mitre bends and fabricated reducers shall be governed by the Piping Material Specifications. Reducers shall be fabricated as per directions of Engineer-In charge. The radiographic requirements shall be as per Material Specifications for process and utility systems and NDT Specification for steam piping under IBR, radiographic requirements of IBR shall be complied with.

8.20 Cutting and Trimming of Standard Fittings & Pipes

Components like pipes, elbows, couplings, half-couplings etc. shall be cut / trimmed / edge prepared wherever required to meet fabrication and erection requirements, as per drawings and instructions of Engineer-In charge. Nipples as required shall be prepared from straight length piping.

8.21 Galvanized Piping

Galvanized carbon steel piping shall be completely cold worked, so as not to damage galvanized surfaces. This piping involves only threaded joints and additional external threading on pipes may be required to be done as per requirement.



8.22 Jacketed Piping & Tracing

The Jacketing & Steam Tracing shall be done in accordance with PMC/ Licensor's job specification.

Pre-assembly of jacketed elements to the maximum extent possible shall be accomplished at shop by Contractor. Position of jump-over and nozzles on the jacket pipes, fittings etc. shall be marked according to pipe disposition and those shall be prefabricated to avoid damaging of inner pipe and obstruction of jacket space. However, valves, flow glasses, in line instruments or even fittings shall be supplied as jacketed.

8.23 Shop Fabrication /Prefabrication

The purpose of shop fabrication or pre-fabrication is to minimize work during erection to the extent possible. Piping spool, after fabrication, shall be stacked with proper identification marks, so as facilitate their withdrawal at any time during erection. During this period, all flange (gasket contact faces) and threads shall be adequately fabricated

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by coating with removable rust preventive & all openings are to be covered to prevent entry of foreign materials. Care shall also be taken to avoid any physical damage to flange faces and threads.

8.24 Miscellaneous

Contractor shall fabricate miscellaneous elements like flash pot, seal pot, sample cooler, supporting elements like turn buckles, extension of spindles and interlocking arrangement of valves, operating platforms as required by Engineer-In charge at Site.

9.0 ERECTION

9.1 Cleaning of Piping before Erection

Before erection all pre-fabricated spool pieces, pipes, fittings etc. shall be cleaned inside and outside by suitable means. The cleaning process shall include removal of all foreign matter such as scale, sand, weld spatter chips etc. by wire brushes, cleaning tools etc. and blowing with compressed air/or flushing out with water. Special cleaning requirements for some services, if any, shall be as specified in the piping material specification or isometric or line list. S.S jacketed piping requiring pickling shall be pickled to remove oxidation and discoloring due to welding.

9.2 Piping Routing



No deviations from the piping route indicated in drawings shall be permitted without the consent of Engineer-In charge or Authorised Representative.

Pipe to pipe, pipe to structure / equipment's distances / clearances as shown in the drawings shall be strictly followed as these clearances may be required for the free expansion of piping /equipment. No deviations from these clearances shall be permissible without the approval of Engineer-In charge or Authorised Representative.

In case of fouling of a line with other piping, structure, equipment etc. the matter shall be brought to the notice of Engineer-In charge or Authorised Representative and corrective action shall be taken as per his instructions.

9.3 Slopes

Slopes specified for various lines in the drawings / P&ID shall be maintained by the Contractor. Corrective action shall be taken by the Contractor in consultation with



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Engineer-In charge or Authorised Representative wherever the Contractor is not able to maintain the specified slope.

9.4 Expansion Joints / Bellows

Installation of Expansion Joints/Bellows shall be as follows:

- 9.4.1 All Expansion joints / Bellows shall be installed in accordance with the specification and installation drawings.
- 9.4.2
 - a. Upon receipt, the Contractor shall remove the Expansion Joints/ Bellows from the case(s) and check for any damage occurred during transit.
 - b. The Contractor shall bring to the notice of the Engineer-In charge any damage one to the bellows / corrugations, hinges, tie-rods, flanges/ weld ends etc.
 - c. Each Expansion Joint / Bellow shall be blown free of dust / foreign matter with compressed air or cleaned with a piece of cloth.
- 9.4.3
 - a. For handling and installation of Expansion Joints, great care shall be taken while aligning. An Expansion Joint shall never be slinged from bellows corrugations/ external shrouds, tie / rods, angles.
 - b. An Expansion Joint / Bellow shall preferably be slinged from the end pipes / flanges or on the middle pipe.
- 9.4.4
 - a. All Expansion Joints shall be delivered at "Installation length", maintained by means of shipping rods, angles welded to the flanges or weld ends or by wooden or metallic stops.
 - b. Expansion Joints stop blocks shall be carefully removed after hydrostatic testing. Angles welded to the flanges or weld ends shall be trimmed by saw as per manufacturer's instructions and the flanges or weld ends shall be ground smooth.
- 9.4.5
 - a. The pipe ends in which the Expansion Joint is to be installed shall be perfectly aligned or shall have specified lateral deflection as noted on the relevant drawings.
 - b. The pipe ends / flanges shall be spaced at a distance specified in the drawings.

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- 9.4.6 The Expansion Joint shall be placed between the mating pipe ends / flanges and shall be tack welded/bolted. The mating pipes shall again be checked for correct alignment.
- 9.4.7 Butt-welding shall be carried out at each end of the expansion joint. For flanged Expansion Joint, the mating flanges shall be bolted.
- 9.4.8 After the Expansion Joint is installed the Contractor shall ensure that the mating pipes and Expansion Joint are in correct alignment and that the pipes are well supported and guided.
- 9.4.9 The Expansion Joint shall not have any lateral deflection. The Contractor shall maintain parallelism of restraining rings or bellows convolutions.
- 9.4.10 Precautions
- For carrying out welding, earthing lead shall not be attached with the Expansion Joint.
 - The Expansion bellow shall be protected from arc weld spot and welding spatter.
 - Hydrostatic Testing of the system having Expansion Joint shall be performed with shipping lugs in position. These lugs shall be removed after testing and certification is over.



9.5 Flange Connections

While fitting up mating flanges, care shall be exercised to properly align the pipes and to check the flanges for trueness, so that faces of the flanges can be pulled together, without inducing any stresses in the pipes and the equipment nozzles. Extra care shall be taken for flange connections to pumps, turbines, compressors, cold boxes, air coolers etc. The flange connections to these equipment shall be checked for misalignment, excessive gap etc. after the final alignment of the equipment is over. The joint shall be made up after obtaining approval of Engineer-In charge.

Hydraulic bolt tensioning & torque tensioning shall be performed on flange joints as per the requirements specified in "Standard Specification for application of Torque Bolt Tension for flange joints"

Temporary protective covers shall be retained on all flange connections of pumps, turbines, compressors and other similar equipment until the piping is finally connected, so as to avoid any foreign material from entering these equipment.

The assembly of a flange joint shall be done in such a way that the gasket between these flange faces is uniformly compressed. To achieve this, the bolts shall be tightened in a proper sequence. All bolts shall extend completely through their nuts but

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not more than 1/4".

Steel to C.I. flange joints, if any, shall be made up with extreme care, tightening the bolts uniformly after bringing flange flush with gaskets with accurate pattern and lateral alignment.

9.6 Vents and Drains

High point vents and low point drains shall be provided as per drawings and in case if not shown in the drawings, Vents & Drains shall be added by contractor at site as per piping material specifications / design / construction standards.

9.7 Valves

Valves shall be installed with spindle / actuator orientation / position as shown in the layout/isometric drawings. In case of any difficulty in doing this or if the spindle orientation \ position is not shown in the drawings, the Engineer-In charge shall be consulted and work done as per his instructions. Care shall be exercised to ensure that globe valves, check valves, and other uni-directional valves are installed with the "Flow direction arrow "on the valve body pointing in the correct direction. If the direction of the arrow is not marked on such valves, this shall be done in the presence of Engineer-In charge before installation.



Fabrication of stem extensions, locking arrangements and interlocking arrangements of valves (if called for), shall be carried out as per drawings/ instructions of Engineer-In charge.

9.8 Instruments

Installation of in-line instruments as per 5.1(i) and (j) shall form a part of piping erection work.

Fabrication and erection of piping up to first block valve / nozzle / flange for installation of offline Instruments for measurement of level, pressure, temperature, flow etc. shall also form part of piping construction work. The limits of piping and instrumentation work will be shown in drawings/standards/specifications. Orientations/locations of take-offs for temperature, pressure, flow, level connections etc. shown in drawings shall be maintained.

Flushing and testing of piping systems which include instruments mentioned above and the precautions to be taken are covered in flushing, testing and inspection of piping. Care shall be exercised and adequate precautions to be taken to avoid any damage and entry of foreign matter into instruments during transportation, installation, testing etc.

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9.9 Line Mounted Equipment / Items

Installation of line mounted items like filters, strainers, steam traps, air traps, de-super heaters, ejectors, samples coolers, mixers, flame arrestors, sight glasses etc including their supporting arrangements shall form part of piping erection work.

9.10 Bolts and Nuts

The Contractor shall apply moly coat grease mixed with graphite powder (unless otherwise specified in piping classes) to all bolts and nuts during storage, after erection and wherever flange connections are broken and made-up for any purpose whatsoever.

9.11 Pipe Supports

Contractor shall follow layout/isometric drawings to locate & provide the pipe supports as per piping support standards. In case, when the supports are not shown in the drawing for small bore Isometrics, then contractor shall suitably design and provide the supports at site. Any additional supports & temporary supports also shall be provided by the contractor if requested by the Engineer-In charge or Authorised Representative. For 1" & below sizes of low point drains & high point vents, stiffeners shall be provided in all pumps & compressors suction & discharge lines.

No pipe shoe / cradle shall be offset unless specifically shown in the drawings. Hanger rods shall be installed inclined in a direction opposite to the direction in which the pipe move during expansion.



Preset pins of all spring supports shall be removed only after hydrostatic testing and insulation is over. Springs shall be checked for the range of movement and adjusted if necessary to obtain the correct positioning in cold condition. These shall be subsequently adjusted to hot setting in operating condition. The following points shall be checked after installation, with the Engineer-in-Charge and necessary confirmation in writing obtained certifying that:

- All restraints have been installed correctly.
- Clearances have been maintained as per support drawings.
- Insulation does not restrict thermal expansion.
- All temporary tack welds provided during erection have been fully removed.
- All welded supports have been fully welded.





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- Lines are completely free for movement except where anchored. All tack welds are removed and grounded smooth. All lines resting/sliding supports shall be checked thoroughly by contractor for free movement before hydro testing.

Insulation support ring to be provided on the pipes as per Insulation specifications.

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STANDARD SPECIFICATION FOR BOLT TENSIONING

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REV.	DATE	DESCRIPTION	PREPARED	CHECKED	APPROVED	AUTHORIZED

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1. INTRODUCTION

INDIAN OIL CORPORATION LIMITED (IOCL) has awarded Fax of Acceptance (FOA) dated 29th August 2019 to M/s. Technip India Limited (TPIL) for Consultancy services (PMC/EPCM services) for overall project management, FEED Review / FEED, Detailed Engineering, Procurement & expediting services, Tendering & award, Construction Management & Supervision, Assistance in start-up, Commissioning & performance test runs for installation of a Standby SRU of 525 TPD capacity and execution of Additional tanks for Paradip Refinery, Odisha, India

2. DEFINITIONS & ABBREVIATIONS



Abbreviation	Definition /Expanded form
IOCL/ CLIENT	Indian Oil Corporation Limited
PMC/ CONSULTANT	Technip India Limited
LICENSOR	Party selected by IOCL for process technology ownership for any UNIT
CONTRACTOR	Party whose services are obtained for performing the works specified as part of LSTK / packages.
EPCM	Engineering, Procurement & Construction Management Services.
LSTK	Lump Sum Turn Key portion of the work to be executed by CONTRACTOR
FEED	Front End Engineering Design
AUTHORISED REPRESENTATIVE	IOCL's/ CONSULTANT's representative authorized to act for and on behalf of them.
VENDOR	Any third party supplying the equipment/materials for setting up the Plant
PROJECT	Indicates Standby SRU and Additional tanks Project, Paradip Refinery
UNIT	Indicates any particular portion of the project to be built which can be Process related or Utilities/Offsites related
SRU	Sulphur Recovery Unit

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OISD	Oil Industry Safety Directorate
ASME	American Society of Mechanical Engineers
API	American Petroleum Institute
P&ID	Piping and Instrumentation Diagram
A/G	Above Ground
U/G	Under Ground
B/L	Battery Limit
ISBL	Inside Battery Limit
EOT	Electrically-operated Overhead Travelling
MTO	Material Take Off

3. **SCOPE**



This specification covers the minimum requirements to define the extension for use of “Bolt Tensioning” to be installed on IOCL Paradip Project.

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4. REFERENCE CODES & STANDARDS

This specification conforms to the requirements of, and shall be read in conjunction with, the following codes and standards (most recent edition or revision):.

Code /Std. No	Description
ASME B31.1	Power piping
ASME B31.3	Process Piping
ASME B16.5	Pipe Flanges and Flanged Fittings
ASME B16.21	Nonmetallic Flat gaskets for Pipe Flanges
ASME B16.47	Large Diameter Steel Flanges
ASME B18.2.1	Square, Hex, Heavy Hex, and Askew Head Bolts and Hex, Heavy Hex, Hex Flange, Lobed Head, and Lag Screws (Inch Series)
ASME B18.2.2	Nuts for General Applications: Machine Screw Nuts, Hex, Square, Hex Flange, and Coupling Nuts (Inch Series)
ASME PCC-1	Guidelines for Pressure Boundary Bolted Flange Joint Assembly
ASME VIII Div. 1 & 2	Boiler and Pressure Vessel Code
ASTM A193	Standard Specification for Alloy-Steel and Stainless Steel Bolting Materials for High-Temperature Service
ASTM A194	Standard Specification for Carbon and Alloy Steel Nuts for Bolts for High Pressure or High Temperature Service, or Both
ASTM A307	Standard Specification for Carbon Steel Bolts, Studs, and Threaded 60 000 PSI Tensile Strength
ASTM A320	Standard Specification for Alloy-Steel and Stainless Steel Bolting for Low-Temperature Service
ASTM A453	Standard Specification for High-Temperature Bolting Materials, with Expansion Coefficients Comparable to Austenitic Stainless Steels
ASTM A593	Specification for Charpy V-Notch Testing Requirements for Steel Plates for Pressure Vessel
080557C-000-JSS-1370-001	Job Supply Specification for Fasteners

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5. **GENERAL REQUIREMENTS**

5.1 **General**

- Use of right type of Gasket, Fasteners etc. conforming to the specifications as per Design and drawings should be ensured.
- For special case (i.e. insulation kits) vendor recommendations should be implemented.

5.2 **Examination of Working Surface**

According to ASME PCC-1.

- They shall be free from dirt, scale, remnant gasket and protrusion. Faces with pitting, indentations or radial tool marks, or scratches are not desirable. Surface finish should conform to specifications.
- Visual examination of gaskets should be carried out prior to installation to ensure that these are free of any defects such as bends, crease or loose spiral windings etc.

5.3 **Alignment of Mating Surface**

According to ASME PCC-1.

- Flanges should be aligned properly. Flange faces shall be parallel and bolt holes shall match so that studs can be inserted freely.
- No external load shall be used to align the flanges.

5.4 **Installation of Gaskets**


According to ASME PCC-1.

- The ring joint gaskets should have 30 to 40 Vickers hardness less than that of the mating face of the flange.
- Gasket position should be checked.
- All non-ring joint gaskets shall be replaced with new ones whenever an opened joint is to be re-closed during construction and commissioning stage. Ring joint gaskets normally can be re-used provided they are inspected and are free from any damage.

5.5 **Installation of Bolts**

According to ASME PCC-1.

- Flange connection with bolting of nominal diameter 25 mm and above shall have sufficient clearances and access to allow the use of hydraulic tensioning equipment (wherever hydraulic bolt tensioning is being used).
- Stud bolts shall be longer by one diameter to suit the bolt tensioners for hydraulic bolt tensioning. Excess threads shall be protected by a threaded cap.

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5.6 Corrective measures

- Faces with pitting, indentations or radial tool marks, or scratches that form leakage paths or with the surface finish not in accordance with design requirements shall be replaced or re-machined to specified surface finish.
- If necessary, gasket-seating face should be cleaned using wire brush (SS bristles on alloy components) and /or suitable solvent.
- Damages gaskets shall be replaced.
- If holding gasket in place after installation is a problem, a thin adhesive tape should be used along the outside edge of gasket.

6. METHODLOGIES AND CONTROL

6.1 Identification of Joints for controlled bolt tightening

Controlled bolt tightening can be done by application of calculated bolt tension with hydraulic tensioner or by application of calculated bolt torque with calibrated torque wrenches. The criteria for selection of joints for these two-application procedure are given below.

6.1.1 Hydraulic Bolt tensioning

Hydraulic bolt tensioning shall be applied for all joints where the bolt sizes match the criteria outlined in Table -1, except those in category "D" services, defined in ASME B31.3.





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Table- 1: Criteria for Bolt Tensioning –

Not applicable for flange joints in category “D” services

Nominal Bolt diameter	Condition	Remarks
All	When specified by the process licensor / vendor / project specifications	
50 mm and above	All joints	
38 mm and above but less than 50 mm	Class 600 and above	
	Hydrogen Service	(See Note-1 below)
	Category "M" fluid services	Refer ASME B31.3
	Joints with leakage potential	(See Note-2 below)
	Critical joints with equipment's	(See Note-3 below)
25 mm and above but less than 38 mm	Joints with leakage potential	(See Note-2 below)
	Critical joints with equipment's	(See Note-3 below)
<p>Note-1: Hydrogen Service</p> <p>Hydrogen service is defined as service in contact with Hydrogen or gaseous mixtures containing Hydrogen in which the partial pressure of Hydrogen is 7 bar absolute (100 psi) or more</p> <p>Note-2: Joints with leakage potential shall include</p> <p>a) Joints involving tapped holes.</p> <p>b) Joints not subjected to hydrotest e.g. joints for equipment manholes, equipment mounted temperature, pressure and level instruments, line mounted temperature connections, on line instruments joints like control valves and safety valves, compressor volume bottles.</p> <p>c) Items involving two sets of gaskets with one set of bolt e.g. orifice flange joint, joints with spectacle blind, spacer, flangeless wafer check valve, wafer type butterfly valves.</p> <p>d) Tie-in joints with other contractors and package vendors.</p> <p>e) High temperature (above 371°C) joints in hydrocarbon services.</p> <p>Note-3: Critical joints with the equipment's shall include the inlet and the outlet flanges of pumps, compressors and turbines.</p>		

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6.1.2 Application of torque

Controlled bolt torque, with calculated torque values, shall be applied using calibrated torque wrench. Joints those qualify for hydraulic bolt tensioning per 6.1.1 shall not be considered for torque application. Controlled bolt torque should be applied for the joints meeting the criteria given in Table-2. Joints fulfilling the criteria for Hydraulic bolt tensioning need not be checked for these criteria.

Table- 2: Criteria for Bolt Torque application

Service	Joints
Hydrogen Service	All Joints (Note-1)
Category "M" services	All Joints (Note-1)
Other services	Class 600 and above
Note-1: Joints, those qualify for hydraulic bolt tensioning as per cl.6.1.1 shall not be considered for torque calculation.	

7. EXTENSION OF SUPPLY FOR BOLTS FOR TENSIONING


Taking into account the paragraph 5.2 and 5.3, The bolts for bolt tensioning shall be purchased with an extra-length equal to 1 bolt diameter in order to permit the getting hold of the bolt tensioner.

The nuts shall be furnished with N. 6 Holes for Tensioning Machine.

Contractor shall submit the following documents to PMC / OWNER's approval.

- Bolt torque calculation
- Bolt tensioning procedure
- Catalogue of bolt tensioning machine to be used.

Operators of manual and hydraulic bolt tensioner machines shall be qualified for and on the actual equipment to be used. Certification of competency and also control and certification of all flanges to be tensioned shall be mandatory.

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8. BOLTS PRESTRESS

To cover the minimum bolt load on most of cases, depending of the material the following bolt prestress shall be applied:

- ASTM A193 Gr. B7		50 ksi
- ASTM A193 Gr. B7M		40 ksi
- ASTM A193 Gr. B8 / B8M Cl.1		15 ksi
- ASTM A193 Gr. B8 / B8M Cl.2	≤1"	40 ksi
- ASTM A193 Gr. B8 / B8M Cl.2	>1"	30 ksi
- ASTM A193 Gr. B16		50 ksi
- ASTM A307 Gr.B		15 ksi
- ASTM A320 Gr. L7		50 ksi
- ASTM A453 Gr. 660 Cl.A		40 ksi

9. TORQUE/TENSION CALCULATION

The calculation shall follow the procedure outlined in ASME Section VIII Division 1/Division 2. Torque calculation shall care of friction between bolt threads and nut threads as well as that between nut and back face of flange. Torque/tension employed should be sufficient to withstand hydrotest pressure safely. The approximate μ values of some of the lubricants are as follows:

Type of Lubricant	Co-efficient of friction (μ)
Molybdenum lead oxide + graphite based	0.085
Molykote G-n plus	0.09
Molykote P37	0.10
Molykote HSC Plus / Never Seez nickel special	0.11
API SA2	0.117
Molykote 1000	0.13
Graphite grease / Machine oil	0.15



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10. **DESIGN**





The design calculations for minimum bolt load shall be based on ASME Boiler and Pressure Vessel Code Section VIII (Division I), Pressure Vessels: Appendix - S Design considerations for bolted flange connections and Appendix - 2 Rules for bolted flange connections with ring type gaskets.

Bolt Stresses shall be compared against the design stress value for bolting materials found in ASME B31.3.

If necessary, in accordance with ASME section VIII Div.2 article 4-141, it is possible to apply a factor 2 to the allowable

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Job Specification for Steam Tracing and Jacketed Piping

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B	11-06-2020	ISSUED FOR DESIGN	SMM	SL	TI	JMC
A	16-10-2019	ISSUED FOR DESIGN	SMM	SL	TI	JMC
REV.	DATE	DESCRIPTION	PREPARED	CHECKED	APPROVED	AUTHORIZED

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APPENDIX - A: Typical Installation Drawings Steam Tracing Sketches

APPENDIX - B: Typical Installation Drawings for Steam Jacketed Piping



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1. Introduction:

INDIAN OIL CORPORATION LIMITED (IOCL) has awarded Fax of Acceptance (FOA) dated 29th August 2019 to M/s. Technip India Limited (TPIL) for Consultancy services (PMC/EPCM services) for overall project management, FEED Review / FEED, Detailed Engineering, Procurement & expediting services, Tendering & award, Construction Management & Supervision, Assistance in start-up, Commissioning & performance test runs for installation of a Standby SRU of 525 TPD capacity and execution of Additional tanks for Paradip Refinery, Odisha, India.

2. Definitions & Abbreviations:

Abbreviation	Definition /Expanded form
IOCL/ CLIENT	Indian Oil Corporation Limited
PMC/ CONSULTANT	Technip India Limited
LICENSOR	Party selected by IOCL for process technology ownership for any UNIT
CONTRACTOR	Party whose services are obtained for performing the works specified as part of LSTK / packages
EPCM	Engineering, Procurement & Construction Management Services
LSTK	Lump Sum Turn Key portion of the work to be executed by CONTRACTOR
FEED	Front End Engineering Design
AUTHORISED REPRESENTATIVE	IOCL's/ CONSULTANT's representative authorized to act for and on behalf of them
VENDOR	Any third party supplying the equipment/materials for setting up the Plant
PROJECT	Indicates Standby SRU and Additional tanks Project, Paradip Refinery
UNIT	Indicates any particular portion of the project to be built which can be Process related or Utilities/Offsites related
SRU	Sulphur Recovery Unit
OISD	Oil Industry Safety Directorate
ASME	American Society of Mechanical Engineers
API	American Petroleum Institute
P&ID	Piping and Instrumentation Diagram

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3. **Scope:**

This Specification provides the requirements for heat tracing and Jacketing of piping, piping components and valves for “Standby SRU and Additional tanks Project”, IOCL Paradip Refinery, Odisha, India.

This Standard also covers the design, installation and construction criteria as well as the technical requirements for the heating of piping by means of Steam tracing and external jacketing fed with steam.

4. **Conflicts, Deviations and Clarifications:**

- 4.1 Any conflicts between this standard and other applicable Engineering Standards , Material Specifications , Standard Drawings, Engineering Procedures , Company Forms or Industry standards, specifications, Codes and forms shall be brought to the attention of Authorized Representative by the Contractor for resolution.

Until the resolution is officially made by the Authorized Representative, the most stringent requirement shall govern.



- 4.2 Where a licensor specification is more stringent than those of this standard, the Licensor’s specific requirement shall apply.
- 4.3 Where applicable Codes or Standards are not called by this standard or its requirements are not clear, it shall be brought to attention of Authorized Representative by Contractor for resolution.
- 4.4 Direct all requests for deviations or clarifications in writing to the Authorized Representative for final resolution.

5. **Design Codes & Standards:**



The latest issue of the following major Codes and Standards shall be referred to as a part of the Piping Design Basis. Other codes and standards not listed herein may also be used for any other design purpose.

The design, materials, equipment and related items in all the systems (i.e. gas, oil, steam, water, air etc.) shall be in accordance with the latest edition of ASME B 31.3 and ASME B 31.1, where the provisions of these standards are applicable. American standards and recommended practices, along with other internationally recognised codes as guidelines, shall be used for the design activity.

Govt. / state / Local rules, regulation, OISD Rules and other industry practice shall be complied with and shall govern the piping systems, in addition to these Piping Design Basis.

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ASME B 31.3	Process Piping
ASME B 31.1	Power Piping
ASME Vol. VIII & IX	ASME Boiler and Pressure Vessel Code
ASME B16.5	Pipe Flanges and Flanged Fittings
ASME B16.9	Factory Made Wrought Steel Butt welding Fittings
ASME B16.34	Valves – Flanged, Threaded, and welding End
ASME B16.47	Large Diameter Steel Flanges
ASME B1.20.1	Pipe threads, General Purpose, Inch
ASME B16.10	Dimensions of Ferrous Valves
ASME B16.11	Forged Steel Fittings, Socket welding and Threaded
ASME B16.20	Metallic Gaskets for Pipe Flanges – Ring Joints, Spiral Wound and Jacketed
ASME B16.21	Non-metallic Flat Gaskets for Pipe Flanges
ASME B16.25	Buttwelding Ends
ASME B18.2.1	Square & Hexagonal Bolts & Screws (Inch Series)
ASME B18.2.2	Square & Hexagonal Nuts (Inch Series)
ASME B36.10	Welded and Seamless Wrought Steel Pipe
ASME B36.19M	Stainless steel pipe
ASME B 46.1	Surface texture
API 594	Wafer and Wafer-lug Check Valve
API 598	Valves inspection and testing
API 599	Metal Plug Valves – Flanged, Threaded and Welded Ends
API 600	Steel Gate Valves, Flanged or Buttwelding Ends
API 602	Compact CS gate valves flanged threaded, welded & extended body ends
API 607	Fire test for soft seated quarter turn valves
API 609	Lug and Wafer type Butterfly valves
BS 1868	Spec. for steel check valves (flanged and butt welding ends) for petroleum, petrochemical and allied industries
BS 1873	Steel globe and globe stop and check valves (flanged and butt welding ends) for the petroleum petrochemical and allied
BS 5351	Steel ball valves for petroleum, petrochemical and allied industries

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BS 5352	Steel wedge gate, globe and check valves, 50mm and smaller for petroleum, petrochemical and allied industries
MSS-SP-6	Standard finishes for contact faces of pipe flanges and connected end flanges of valves and fittings
MSS-SP-25	Standard marking system for valves, fittings, flanges and unions
MSS SP43	Wrought Stainless Steel Butt Welding Fittings
MSS SP44	Steel Pipe Line Flanges
MSS SP48	Steel Butt Welding Fittings (26" and larger)
MSS SP75	High Test Wrought Butt Weld Fittings
MSS SP83	Carbon Steel Pipe Unions, Socket Welding and Threaded
NACE MR0103 / ISO17945	Metallic materials resistant to sulfide stress cracking in corrosive petroleum refining environments
TM 0284	Evaluation of Pipeline and Pressure Vessel Steels for Resistance to Hydrogen-Induced Cracking
OISD-118	Layouts for Oil and Gas Installations
IBR	Indian Boiler Regulation

6. Design Rules for Steam Tracing

6.1 General Requirements



The steam tracing system shall be suitable to perform the following tasks:

- To maintain the fluidity of highly viscous products
- To avoid fluid components separation due to low temperature
- To prevent freezing
- To prevent corrosive compounds forming if condensation occurs.

6.2 As regards the steam tracing system, the size, number and length of each tracer shall be calculated and the output data finalized. The tracer pipe size resulting from the calculation can be optimized with the aim to minimize and standardize the tracer sizes for the whole system. The calculation take into consideration the following parameters:

- ambient conditions (external air temperature and velocity)
- diameter of the process pipe to be traced
- temperature to be maintained in the process pipe
- thermodynamic properties of the tracing steam
- insulation material characteristics (thickness, thermal conductivity)

The above reference parameters, together with economic considerations and any special

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project requirements, univocally establish the tracing pipe diameter, number and maximum length, as well as the insulation thickness for the pipe to be traced.

6.3 System Definition

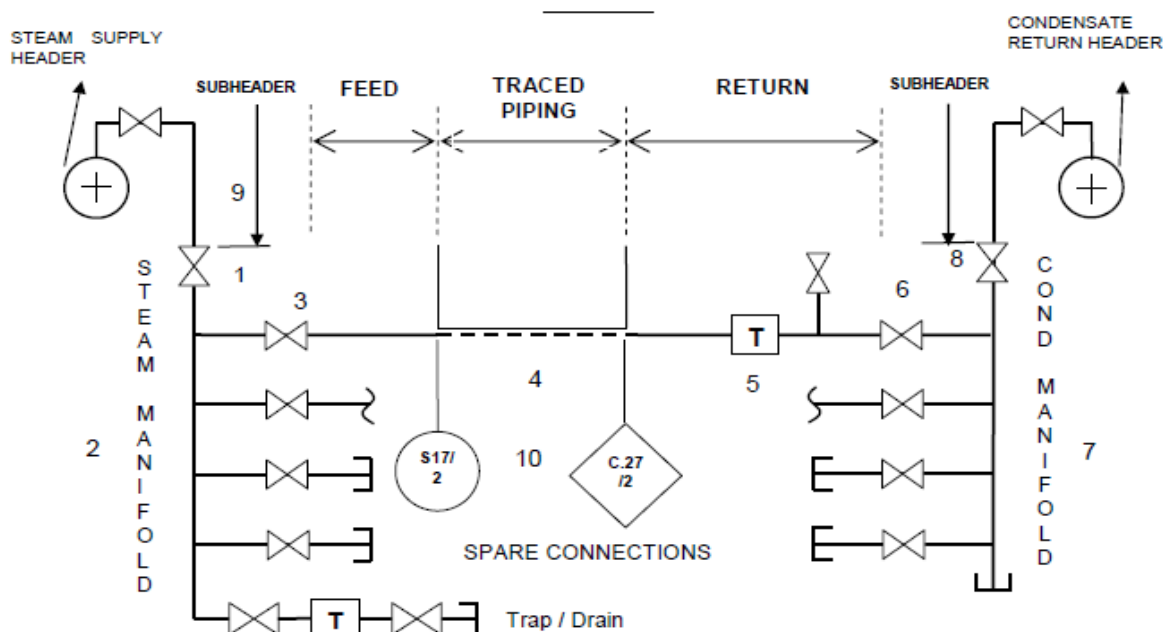
The piping system for steam tracing is defined below:



- Traced lines: the pipeline carrying process or utility fluids which requires steam tracing.
- Steam supply line or condensate recovery line: the pipe connecting the steam supply header with the steam tracing manifold or the pipe connecting the condensate header with the condensate recovery manifold
- Steam, or condensate manifold: typical steam supply or condensate recovery "station".
- Lead tracer or Tail line: the pipe which starts at the "Steam Manifold" or terminates to condensate manifold, from/to tracer line.
- Tracer line: the pipe, or tubing, carrying steam, fastened to the traced line. (Tracer line diameter as indicated on line list or equivalent).

6.4 To define the steam tracing system, the following have to be identified:

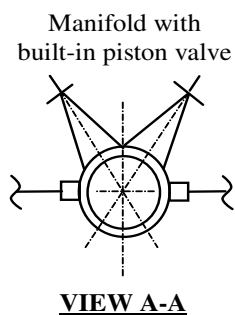
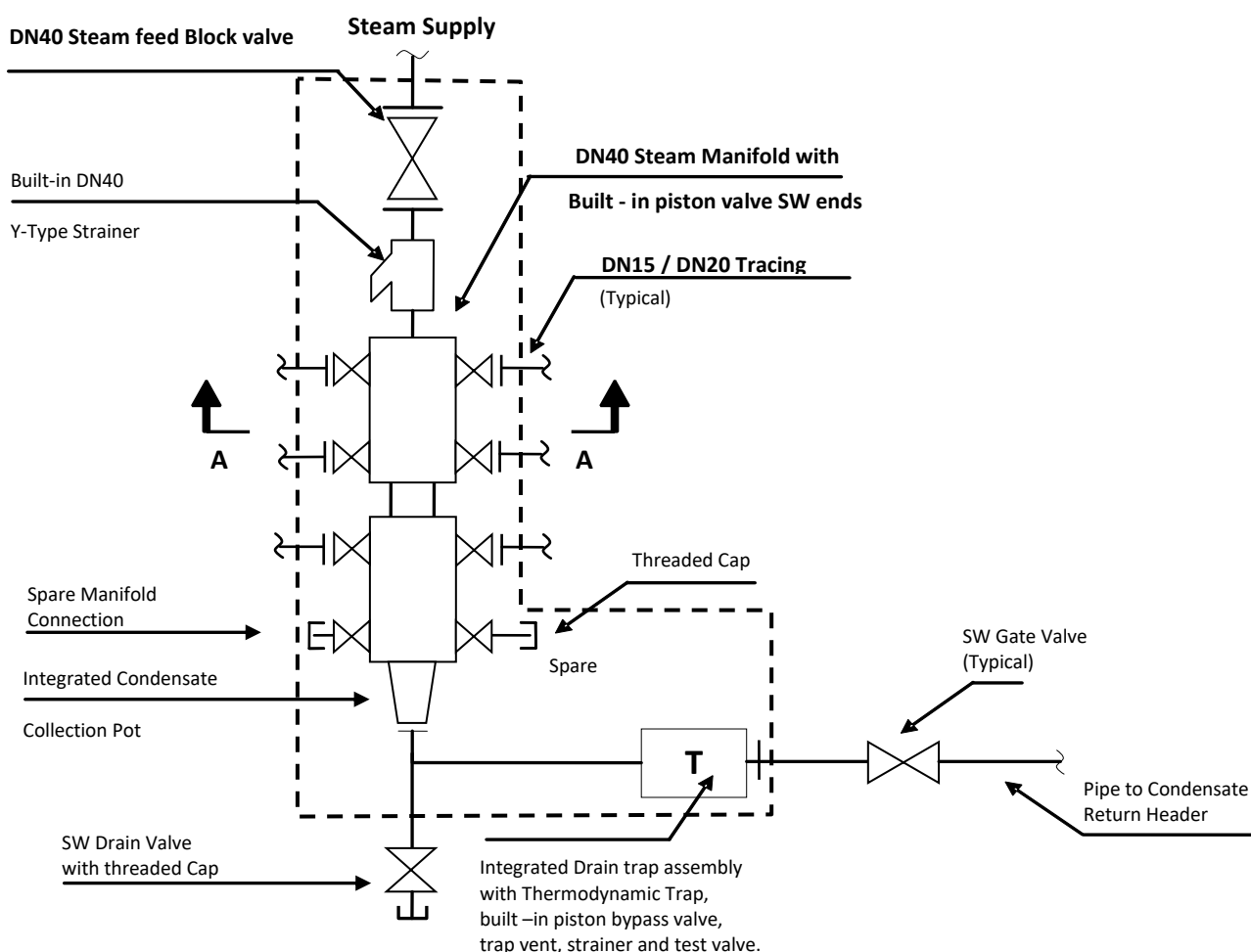
- All feed points on steam-traced pipes
- All recovery points on steam-traced pipes
- Routing of Lead tracer or Tail lines from/to manifolds to define their correct position
- Total number of tracers to define manifold size
- Steam supply and condensate recovery lines from manifolds to headers or sub-headers
- Sub-header size verification according to manifold number.

6.5 Schematic arrangement of Steam Tracing System:





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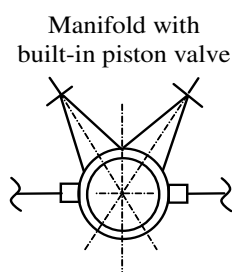
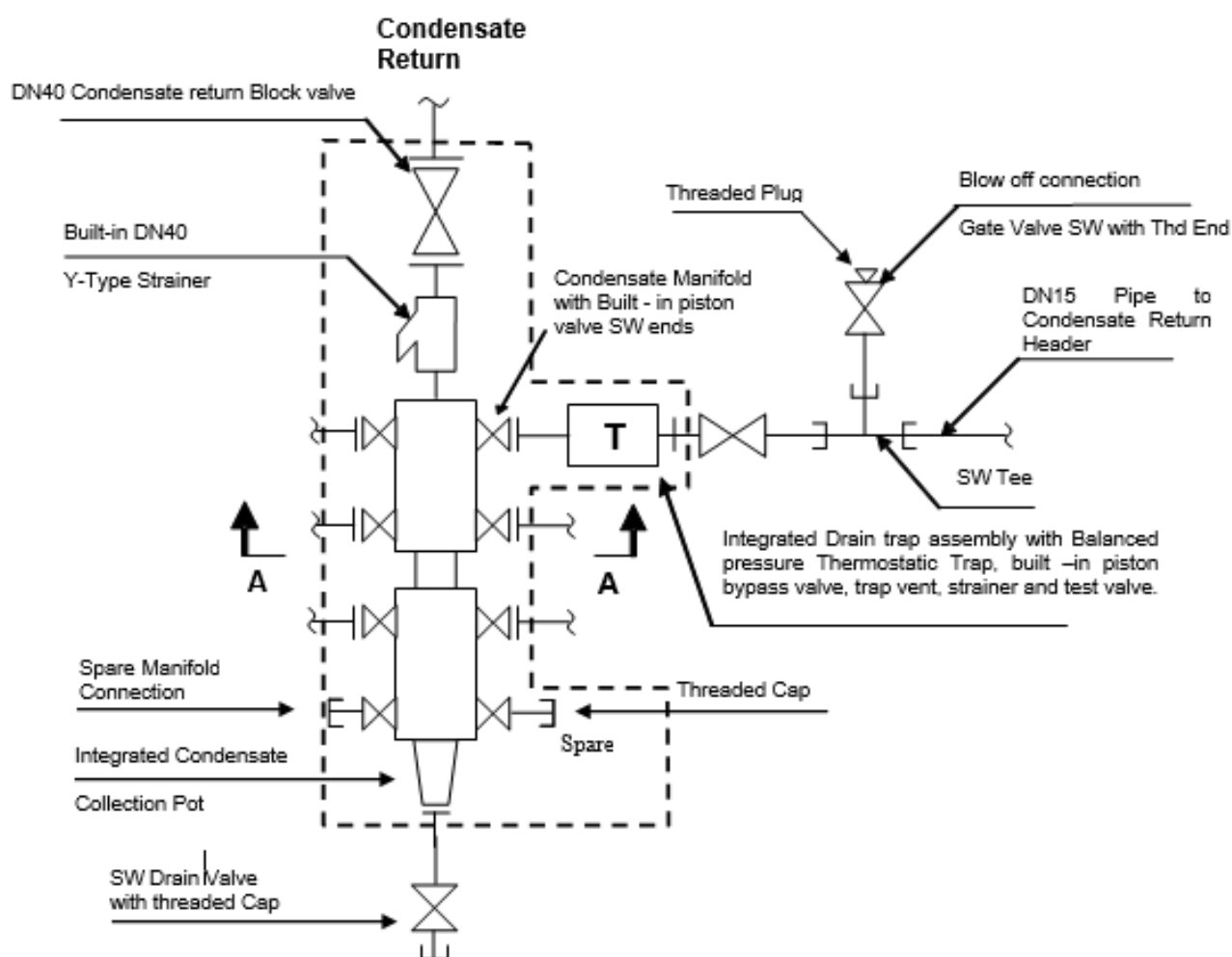
6.6 Typical Steam Supply Manifold Hookups:



NOTE: Where the manifold is located at a higher elevation than the header feeding it, the connection will be at the bottom of the manifold. The block valve will therefore be at the bottom and the SW capped will be relocated to the top to act as a vent. The trap will in this case not be required.



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6.7 Typical Condensate Return Manifold Hookups:



VIEW A-A

NOTE: Where the manifold is located at a higher elevation than the header it feeds, the connection will be at the bottom of the manifold. The block valve will therefore be at the bottom and the SW capped will be relocated to the top to act as a vent.

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6.8 Number of Tracers & Length:

The minimum number of tracers with a heating chamber is a function of the diameter of the piping system to be traced as shown in Table-1:

Table-1: Minimum Number of Tracer per Pipe Size

Nominal Pipe Size to be traced (in)	Minimum number of tracers
Less than or equal to 4"	1
6" to 16"	2
18" to 24"	3
26" & above	To calculate

- a) Maximum tracer run length & No. of tracers shall be determined using the following specific tracer requirements:
 - The number of tracers per line depends predominantly on Minimum Maintained temperature (MMT) of the process fluid extracted from Line list.
 - Line size from line list
 - Steam supply /Condensate return conditions – Normal operating Pressure & Temperature
 - Wind speed
 - Ambient temperature
 - Tracer size DN15 / DN 20
 - Thickness of insulation surrounding the pipe.
 - Spacing of tracers (if applicable).
- b) The number of tracers shown in Table-1 above is minimum quantity only. The MMT vs. No. of tracers w.r.t specific insulation thickness required per process line shall be determined during detail engineering by CONTRACTOR.
- c) Wherever possible LP steam should be used for tracing to maintain process fluid temperature. However if the required temperature cannot be achieved using LP steam tracers, MP steam may be used.
- d) The steam feed and condensate return pipe size shall be sufficient to carry the maximum throughput from all the tracers on the manifold or sub-header. The size shall be determined according to the steam pressure, insulation thickness/type, maximum length of tracer and normal operating temperature.

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- e) The feed line to manifold, manifold to the block valves of individual tracer shall be carbon steel or stainless steel of IBR quality.

6.8.1 Length of the tracers

The length of a tracer is limited by the loss of pressure in the tracer.

The maximum lengths of the tracers, in meters, which are a function of the minimum steam pressure available, are defined in the table below.

Table-2 : Maximum Length for Tracer (excluding lead & tail lines)



Minimum steam operating pressure Kg/cm²	For 0.5" Maximum Tracer Length (meters)
1.5	23
3.5	38
7.0	46
10.5	53
14.0	61

6.9 Design Criteria

The design of the tracing system shall satisfy the following requirements:

Manifolds



- Lead tracer or Tail lines starts from a manifold. For isolated lines or users, the tracer feed line may be fed directly from the header and the condensate discharged from steam trap to the ground.
- Steam feed and condensate recovery manifolds, shall be installed in easily accessible areas (grade or on a platform).
- Depending on the distribution of instruments throughout the various areas of the plant, dedicated manifolds for instruments only, may be installed.
- Number of tracer port shall be 4/8/12 and tracer size DN 15 / DN 20, 20% or minimum 2 nos tracer connections shall be kept spare for future use for both steam supply and condensate collection manifolds.

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- e) Steam & Condensate Manifold size shall be as 40mm unless stated otherwise. Size of the Lead line to steam manifold & tail line from condensate manifold shall be 1.5' unless otherwise specified in the P&ID.
- f) All Manifolds shall be with Compact Type (Complete vendor supplied manifold with insulation jacket) which includes, root isolation glandless piston valve, multiple way steam distribution manifold with built-in piston valves, strainer, spare connections, integrated compact steam trap assembly etc., (as shown in typical sketches / Section 6.6 & 6.7)
- g) Steam manifold at an elevation lower than the feed header shall be provided with a steam trap. Steam manifolds placed highest than the feed header, shall be designed having a free draining toward header and require only a drain valve.
- h) Condensate recovery manifolds shall in all cases be provided with a drain valve.
- i) All manifolds shall be installed in vertical position only.

6.10 Tracers Configuration

- a) As a general rule, the tracer routing shall permit gravity flow of condensate to steam traps. Pockets in steam tracers shall be avoided as far as possible.
- b) Tracers on horizontal pipe shall run parallel to the pipe and be located near bottom center line (to avoid clashing with supports). Tracer loops around flanges and appurtenances shall be in the horizontal plane. Tracer on vertical pipes shall be positioned where they offer the least interference to supports and adjacent piping.
- c) Spiral tracing shall not be used except where continuous free draining is possible, eg., vertical pipes and when specified on PID/line list.
- d) All steam tracer lines shall be TIG welded with minimum of 2 weld runs. Lead and tail Tracer shall be pre-insulated tubing supplied with intermediate patch kit, end patch Kit and bending kit to avoid tubing & insulation damage.
- e) Tracers for single users (e.g. instruments on columns) can be fed from the nearest steam line.
- f) Never flanged and/or threaded joints shall be installed on tracers inside insulation.
- g) Tracer lines shall be provided with break up flanges for main line flange joints and valves.
- h) Differential expansion between pipe and tracer shall be allowed for as follows:
Tracer expansion loops shall be provided on straight runs of pipe over 7.5 metres long. Loop spacing shall not exceed 30 metres. Loops shall be installed in the horizontal plane.

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On straight pipe shorter than 7.5 metres, expansion may be allowed for within the insulation at the bends, for this purpose where piping changes direction from horizontal to vertical the tracer shall be routed to the side of the elbow to prevent breakout and damage to the insulating system, tracer bands shall be prohibited within 1 metre of the bend.

6.10.1 Max allowable pockets height

Sum of tracer risers may not exceed 4 times the differential pressure value, between the steam and the condensate system. In meters the said value is defined as in the following example:

- Steam system pressure = 6.5 Kg/cm²
- Condensate system pressure = 5.0 Kg/cm²
- ΔP = 1.5 Kg/cm²
- H (height) = 4 x 1.5 = 6 meters

6.10.2 Pockets drainage

When the tracer rises vertically 1.5 m or more, a steam trap must also be provided before the vertical rise also. If the rise is less than 1.5 m the additional steam trap is not required.

Tracers for single users (e.g. instruments on columns) can be fed from the nearest steam line.

6.11 Materials



Tracers:

The following materials should be used for steam tracing (as per project piping material specification)

- a) Carbon Steel Pipe / Tubing
- b) Stainless Steel Pipe / Tubing

Material of the steam tracing tubing or piping shall be compatible with the material of the traced equipment or piping. As an example stainless steel piping shall be traced with stainless steel tubing or piping.

Tracer sizes to be used shall be DN15 and DN20 depending on heat transfer duty required. Unless specifically indicated, carbon steel pipe for tracers shall be schedule 40.

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Valves

Steam feed /condensate return block valves, Socket welded Glandless Piston type, Carbon steel body as per ASTM A105N with SS Internals.

Manifold block valves for individual tracers shall be Built-in Glandless Piston type valves, Carbon steel body as per ASTM A105N with SS Internals.

Headers

Materials shall be as specified for the main steam and condensate lines.

Manifolds

General

Forged compact 4Way/8way/12way manifold, Socket welded ends with minimum 2 spare connections, DN40 Inlet & DN20 drain. Manifold Body Carbon steel ASTM A105N.

Steam Supply Manifolds:

Complete proprietary vendor supplied steam supply manifold. Package includes multiple way steam distribution manifold with built-in block valves, strainers, spare connections, integral glandless piston valve for bypass, and integrated Thermodynamic Steam Trap assembly.

Condensate Return Manifolds:

Complete proprietary vendor supplied condensate return manifold. Package includes multiple way steam distribution manifold with built-in block valves, strainers, spare connections, integral glandless piston valve for bypass, and integrated Balanced pressure Thermostatic Steam Trap assembly.

Banding

Stainless Steel AISI 201 or equal 12mm wide x 0.76 mm thick band and compatible buckles.

Tie Wire

Austenitic stainless steel 1.6 mm dia (16 SWG) fully annealed.



Tags

Austenitic stainless steel strip 75mm long 25mm wide 1.0 mm thick.

Spacers

The use of spacers is required where hot spots caused by direct contact of the hot tracer tube with the pipe are to be avoided. Hot spots in the process pipe approaching the temperature of the tracing steam may lead to process fluid degradation for instance polymerising or thermally degrading chemicals or to accelerated corrosion.

Heavy density mineral fibre insulation blocks 40 x 25 x 12 mm thick or glass cloth tape 25 mm wide x 6mm thick (2 thicknesses required).

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Drain trap assembly in Steam supply Manifold

Forged Carbon steel compact drain trapping assembly, SW ends, Assembly complete with Universal Stainless steel thermodynamic steam traps with integral strainer connected to assembly by universal flange with built-in piston valves.

Drain trap assembly in Condensate collection manifold

Forged Carbon steel compact drain trapping assembly, SW ends, Assembly complete with Stainless steel Universal Balanced pressure thermostatic steam traps with integral strainer connected to assembly by universal flange with built-in piston valves.

Heat tracing cement to be used to improve conductivity of heating medium from tracer piping to main piping.

6.12 Project Documentation

6.12.1 Input documentation to define the system:

- the present Project Job Specification.
- the "Line List" identifying the lines to be traced and relative number and diameter of tracers
- the "List of Instruments" to be traced
- the "Equipment List", identifying all equipment to be traced, and relative numbers and diameter of tracers
- the "P&I Diagram", identifying all systems to be traced (piping, instruments, equipment).

6.12.2 Output documentation (Detailed Engineering):



- General Arrangement Drawing: with the installation of manifold and relative connecting pipes with the headers.
- Steam-traced lines isometric sketches with all reference connections from/to manifolds.
- Tracer list (excel) with detail of manifolds, port nos, Tracing line numbers from/To etc

6.12.3 The tracer lead and tail lines arrangement will be defined in field. The lines may be grouped as much as possible and tubing shall be pre-insulated.

7. Installation Rules for Steam Tracing

7.1 Manifold and Steam-trap Installation Arrangements

Typical arrangements schematically define various possibilities for the installation of manifolds

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and steam traps included in a steam tracing system as described in Figures 13 through 16 of Appendix A.

7.2 Typical Tracing Installation Assembly

The typical installations of steam tracing components are described in figure 1 through figure 12 of Appendix – A.

7.3 Fixing of Tracers on Traced Piping

- Fixing of tracers on steam traced lines shall be carried out using metallic bands/straps.
- The following table defines distances for tracer support spacing.

Tracer Diameter	Max. spacing between straps in mm
1/2"	1000

- Any anchor point for thermal expansion required on tracers shall be realized by installing two adjacent fastening straps.
- The installation of single fastening strap shall be considered as a guide for thermal expansion purpose.

8. Jacketed piping system

8.1 General Technical Requirements

Standard jacketed piping provides the most uniform application of heat to the process and maintains the most uniform process temperatures. The core pipe is welded to the front and back of a slip-on flange, and the jacket pipe is welded to the back of the flange.



To meet the above requirements, the system has to be designed taking into account the following parameters:

- Partial or integral jacketing.
- Maintenance temperature of process fluid.
- Temperature of service fluid.
- Thermal exchange capacity between process fluid and service fluid.
- Ambient conditions.
- Type and thickness of thermal insulation.

8.2 System Definition

For system definition, the following is necessary:

- Identification of process lines and/or instruments to be jacketed.

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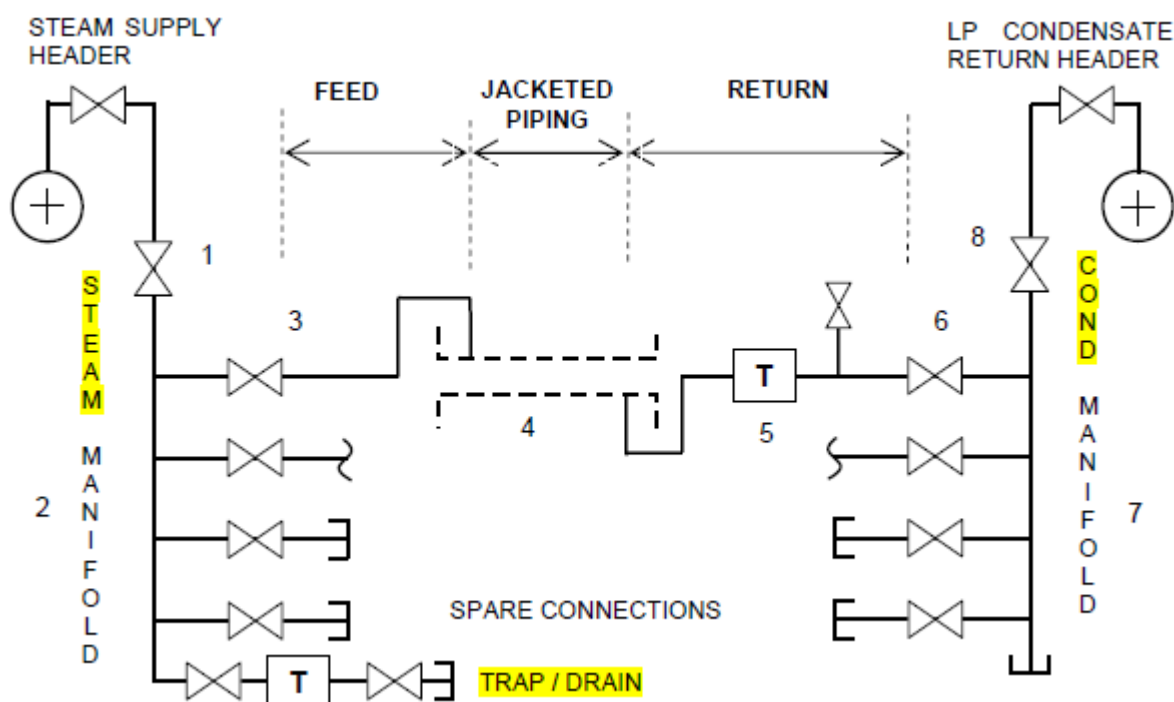
- b) Calculation of max. distance between inlet and outlet of service fluid on Jacketing.
- c) Identification of service fluid inlets and outlets on jacketing for each line.
- d) Location of service fluid feeding and recovery manifolds.
- e) Piping material qualification for process line, jacketing and service line.
- f) Calculation of max. length of straight jacketed piping to be installed without expansion joints.



The above activities shall allow:

- g) Checking of standard size of jacketing in relation to the process line.
- h) Drawing-up of a planimetric flow scheme for all lines relevant to all service fluids included in the system.
- i) Sizing of all service fluid lines.
- j) Sizing of all feeding and recovery manifolds.
- k) Selection of feeding and recovery line routings between manifolds and inlets/outlets on jacketing.
- l) Definition of expansion joints.
- m) Definition of steam trap typology for steam jacketing lines.
- n) Definition of temperature instrument control (thermoregulator valves), on jacketed lines using fluid heating mediums.
- o) Definition of number of jumpers (1 or 2) according to steam condensate flowrate, in horizontal jacketed lines.

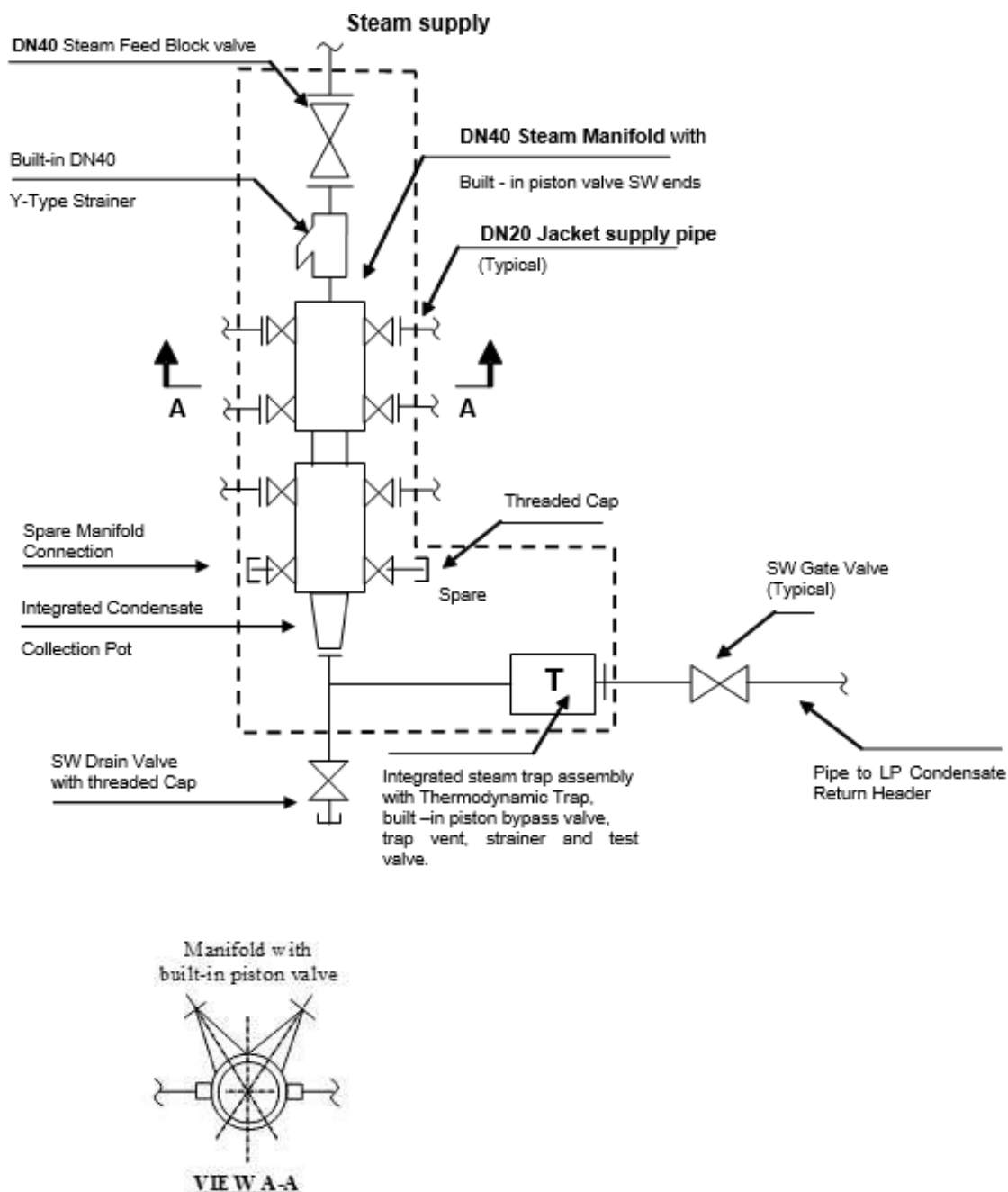
8.3

Schematic Arrangement of Steam Jacketing System:





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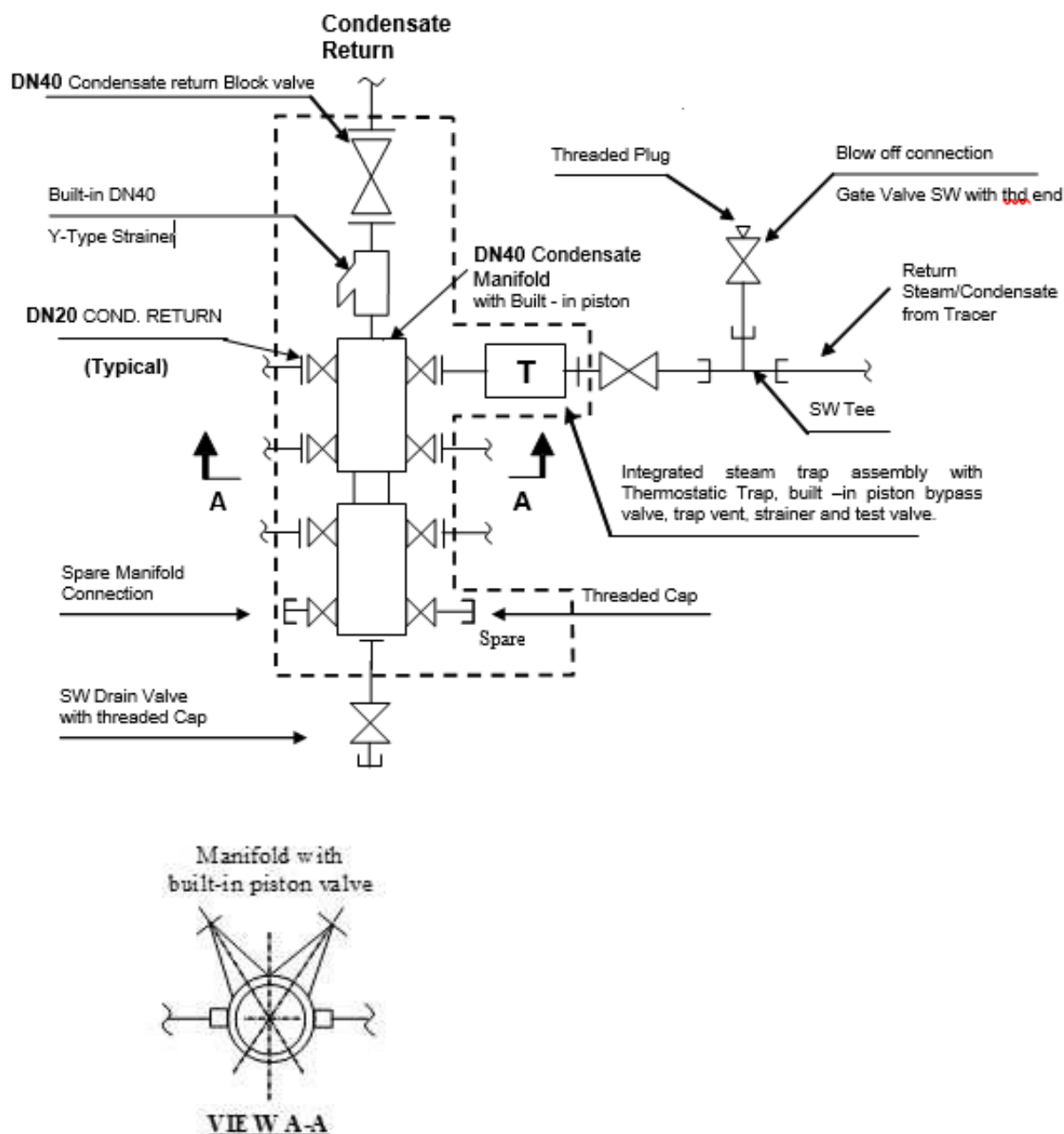
8.4 Typical Steam Supply Manifold Arrangement and Hookup:





NOTE: Where the manifold is located at a higher elevation than the header feeding it, the connection will be at the bottom of the manifold. The block valve will therefore be at the bottom and the SW capped will be relocated to the top to act as a vent. The trap will in this case not be required.

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8.5 Typical Condensate Return Manifold Arrangement and Hookup:



NOTE: Where the manifold is located at a higher elevation than the header it feeds, the connection will be at the bottom of the manifold. The block valve will therefore be at the bottom and the SW capped will be relocated to the top to act as a vent.

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8.6 Steam Supply & Condensate Distribution

Steam jacket block valves shall be manifolded together where practicable, otherwise separate supplies shall be taken direct from the steam supply lines, or from the steam feed line to a jacketing manifold.

Steam Supply / Sub header size shall be DN40 unless stated otherwise. Manifolds and headers supplying jackets shall be positioned such that the feeds and returns are kept as short as practicable.

Manifolds shall have sufficient capacity for instruments and foreseeable future additions to the plant.

Steam manifolds shall preferably be located above the lines and components being jacketed. They shall be positioned on existing platforms or at grade whenever practicable. All jacket block valves shall be accessible without the use of auxiliary equipment. All jacket steam feed lines from manifolds shall be banded together.

Condensate return connections shall be installed at low points.

Steam and condensate manifolds shall be DN40 unless stated otherwise. The steam supply, condensate return and jump-over connections shall be ¾" (DN 20).

Manifolds shall be with Compact Type (Complete vendor supplied manifold with insulation blanket) which includes, multiple way steam distribution manifold with built-in piston valves, strainers, spare connections, glandless piston valve for bypass, integrated compact steam trap assembly etc., (as shown in typical sketches / Section 8.4 & 8.5). Compact Steam trap assemblies shall be with integral glandless piston valve and in-built strainer.

8.7 General Rules



The feeding and discharge lines for jacketing shall be provided with an interception valve.

The jacket shall be provided with non-valved vents and drains for hydraulic testing and operation purposes.

The jackets of line sections in discontinuous service or with removable components for maintenance shall be fed to ensure that the service fluid circulate in the rest of in operation line. 45° elbows shall not be employed due to correct installation difficulties.

Flanged-end cross-branches, shall be utilized instead of jacketed elbows on process fluids subject to solidification that require the mechanical cleaning of lines during maintenance (eg. SULPHUR).

Dead legs and pockets shall be avoided as far as possible on process lines to be jacketed.

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The employment of eccentric reducers shall be avoided as far as possible due to correct installation difficulties.

On horizontal sections with reducers, the jacketing fluid should be fed into the smallest diameter jacketed section.

In case of branches with a change of diameter, the feeding of service fluid should be foreseen on the jacketing run with the smallest diameter.

Process line fittings shall be exclusively B.W. type. (The only exception is the execution of piping branches by means of S.W. half coupling, having verified that this is allowed from a process point of view).

Dismantling joints located on feeding and recovery service fluid lines as well as on jumpers shall be positioned outside the thermal insulation of the jacketed line.

Due consideration shall be given to thermal expansion in order to avoid interference between process lines and jacketing.

In order to permit the welding of the inside process line as well as its inspection during the test phase, the fittings and straight length of jacketed piping shall be provided in two halves.

Internal pipe/jacket spacers shall preferably be placed at piping supports points and should not interfere with feed discharges and jacket vents and drains.

Gate valves on feeding and discharging lines shall be positioned at a minimum distance from manifolds, in an accessible position.

Steam shall be fed into the upper part of the line and, in horizontal sections, in the upper part of the jacket. Jacket steam shall preferably run in counter-flow to the process flow. The discharge shall be provided in the lowest part of the line and, in horizontal sections, at the lowest part of the jacket.

Jumpers on horizontal line sections shall be oriented downward and shall provide a non-valved drain. When two jumpers are foreseen, their orientation shall be one upward and one downward with one vent and one non-valved drain respectively.



Jumpers on vertical line sections shall be alternately oriented one opposite the other in order to avoid preferential circulation areas.

Jacketed carbon steel piping shall be protected with a reinforcing stainless steel plate at steam inlets.

Each condensate discharge line shall have its own steam trap at the outlet from jacket.

Each steam trap shall be dismountable for maintenance or replacement purposes with the steam feed recovery system (if any) in operation. The steam traps shall be compact type.

Steam traps with relative block valves and by-pass shall be preferably positioned as close as possible to the recovery manifold. In any case, the recovery condensate line upstream the steam trap cannot affect any remounts more than two meters.

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On totally jacketed lines, a pad-type flange shall be provided on equipment to which the jacket lines are connected.

8.8 Jacket Piping Size (Outer Pipe Size)

The nominal size of the inner pipe (core) and outer pipe (jacket) in inches shall be as per table below unless otherwise mentioned in P&ID.

Process line (in inches)	Jacket line (in inches)
1 (a)	2
1 1/2 (a)	3
2	3
3	4
4	6
6	8
8	10
10	12
12	16

(a) Process line sizes smaller than DN50 shall not be used. Such sizes shall therefore only be used where required to connect to equipment, Instruments, vent/drain or in-line items.



8.9 Layout

Where slopes are specified on the P&IDs, the centreline elevation of pipe spools shall decrease by at least one hundredth of the developed length of the pipe. All jacketed pipework should drain in the process direction (unless specifically noted) without pockets.

Straight runs of pipe shall be laid out using standard spool pieces as detailed in Appendix-B, Figure 1. The maximum permitted spool length is 6 meters, the minimum varying according to NB as per Fig.1 Table 1. The construction of spool pieces is illustrated in Appendix-B, Figures 1 and 2.

All changes of direction and branching of process flow shall be achieved by using jacketed crosses with rodding points, except where project data indicates otherwise. This enables lines to be steamed or rodded out if they become blocked with solid Sulphur. Line routings shall ensure that adequate clearance is available at rodding points to enable the use of steam hoses and lances.

The construction of a jacketed cross and tee are illustrated in Appendix B, Figures 3, 4 and 5.

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Tees may only be used for the provision of instrument connections as detailed in Appendix B, Figure 6 except where indicated otherwise.

Standardized crosses complying with the dimensions specified in Appendix B, Fig.4 shall be used wherever possible. Shorter leg lengths shall not be used. Longer legs shall be used only where the layout would otherwise require the use of a pipe spool shorter than the minimum specified in Appendix B, Table 1 Fig.1. Note that there is no provision for the fabrication of crosses and tees with flanges set at any angle other than perpendicular to the fitting centreline. Slopes shall not be achieved by adjusting the flange angle on a fitting, but by using a 'field fit spool' as shown in Appendix B, Fig.8.

The presence of small dead legs is a characteristic of the design of a cross, but they shall be avoided elsewhere and shall not be used to support pipe.

Steam and condensate is transferred between jacketed spools using 'jump overs'. These are fabricated from pipe and fittings and shall be flanged adjacent to the jacket flanges to enable the jacketed spools to be taken out of the system if required. For horizontal legs, steam and condensate connections onto the jacket shall be located on the jacket Top Dead Centre and Bottom Dead Centre respectively, hence being evenly straddled by the flange bolt holes. (See Appendix B, Figure 2). The exception to this rule is where a jumpover is made from a vertical cross to a horizontal (or sloping) spool. In this case a single connection is taken from the lowest practical point on the cross to the top of the connecting spool in order to minimize the build-up of condensate in the bottom leg of the cross.

Each steam jacket feed line is to have a dedicated shut-off valve located near the Steam header or Steam manifold, whichever is applicable.

The arrangement of steam feeds, condensate returns, and jumpovers which constitute a steam supply circuit for jacketed pipe work shall be as specified in Appendix B, Figure 7. Special attention shall be given to the additional clearance required between jacketed pipework and other items, particularly in piperacks, to allow space for the jumpovers.



8.10 Detail Design

Valves, fittings, and any in-line devices shall be fully jacketed.

All nozzles should be jacketed to the flange back face where shown on P&IDs. Fresh steam is to be supplied to the nozzle if it is located at the high point in a circuit. The nozzle is to be fed with steam from the pipe if it is located at the low level of a circuit. The condensate can then be drained.

The detail design of standard jacketed system components shall be as specified in the assembly details and sketches in Appendix B.

Information regarding the MMT (minimum maintained temperature), operating and design conditions for jacketed lines is to be taken from the Project Line List.

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Spools shall have continuous jackets which extend to the back faces of the spool flanges except when connecting to equipment nozzles or in-line items with non-jacket size flanges (Appendix B, See Fig.11). The extent of such non-jacketed sections shall be minimized, in order to avoid the need for them to be steam traced. Steam tracing shall be a last resort and subject to agreement with OWNER/PMC.

Detail design shall be such that at all connections, flanges, and reducers, inspection of the process piping shall be possible before installation of the jacket. This is ensured by following the fabrication methods shown in Fig.s 1 to 6, 8, 9 & 11 Appendix B.

Jacket connections for steam & condensate and for jumpovers shall be positioned such that there is a minimum spacing of 75mm between the centre point of the sockolet and any jacket fabrication welds. (See Appendix B, Fig. 2).

The detail design of steam feeds, condensate returns and jumpover connections shall be as specified in Appendix B, Figure 7.

For all flanged connections between jacketed spools, reducing flanges shall be used, sized for the jacket piping with a bore suitable for attachment to the process pipe.

All spades, spacers and Figure 8 blinds shall be specified for the size of the jacket flange but bored to suit the process pipe.

All reducers shall be concentric, as it is not possible to accommodate the offsets generated by eccentric reducers within the spacing between the jacket and inner pipe.

All process and instrument connections to inner pipes shall be fully jacketed up to the Piping/Instrument break as shown on the P&ID. Typically, instrument connections will consist of pre-fabricated flanged units to be bolted directly to a cross or tee. Such units may be removed to accommodate rodding out.



8.10.1 Method of Showing Jacketed Pipework and its services on Drawings

- Piping Isometrics for Process Core Piping
- Piping Isometrics for Jacket piping

Isometrics shall have spool details, support details and with all relevant bill of materials.

The source of steam feeds, destination of condensate returns and type of jumpovers, as per the Steam Jacketing Schedule, will be indicated on the relevant isometric for the jacketed piping by manifold and pin number.

Isometric for Jacket piping shall have separate line number, comprising of jacket size, service and insulation but with the same 4 digit designation as that of process core line shall be used.

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c) Jacketing Schedule including:

- i. Steam Manifold & pin no.
- ii. Condensate Manifold & pin no.
- iii. Relevant Isometric Drawing No. and sheet no.
- iv. Approx. lengths of feed and return pipe to and from jacketed line
- v. Locations of manifolds as co-ordinates and by construction area
- vi. Layout Study: Sketch produced to show location of manifolds

d) General Arrangement Drawings (Erection drawing)

- i. The process line on piping layouts is shown with the same symbol for all plant lines.
- ii. The jacket symbol is shown only at jacket feed and discharge points. Other details are not shown (eg. jumpers, baffles etc.).
- iii. The feed and recovery lines for service fluid between distribution manifold and jacket are not represented on the General Arrangement Drawings. Line routing shall be defined in field by the mechanical contractor with the assistance of the piping supervisor.
- iv. The feed and recovery manifolds for service fluid are represented on layouts using the same symbol for all plant lines.

8.11 FABRICATION, ERECTION, AND TESTING

As much pipework as possible will be shop fabricated on site.

The slope of the rundown pipework will be achieved through the use of Field Fit Spools (see Section 'Fabrication Procedure'), not by adjusting the angle of flanges on shop fabricated fittings. Inaccuracies in fabrication may otherwise result in excessively sloping, or wayward runs which cannot be recovered in the field.



8.11.1 Fabrication Procedure

Welding details and procedures shall conform project specifications. The geometry for standard weld details shall be as specified in Appendix B, Figure 10.

Shop fabricated items shall have flanges set square to the centreline and correctly aligned. Field fit spools shall be fabricated as shown in Appendix B, Figure 8. Note that any pipe run of less than 6m in length should be treated as a field fit spool, in that the required slope is achieved by setting the flanges at an angle to the pipe. Fabrication tolerances are as specified. The use of standard fittings, such as crosses, should be maximized.

The process pipe for all welded assemblies shall be completely fabricated, inspected, hydrotested and radiographically inspected before any welded connection between the jacket pipe and the assembly is made.

The jacket shall then be welded to the assembly, the welds inspected, and the jacket

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hydrotested before erection. All butt welds shall be full penetration, and longitudinal welds shall be completed before circumferential welds.

To accommodate the inspection and testing requirements for the process pipe, the jacket should be fabricated incorporating split sections. This technique is shown in Appendix B, Figures 1 and 3, which illustrates fabrication methods for jacketed spools and crosses.

8.11.2 Erection Procedure

Rundown lines of the jacketed system will achieve a general downward slope by use of field fit spools as shown in Appendix B, Figure 8. The slope will be specified on the Piping isometric drawing.

Adequate compliance with the elevations specified on the isometrics shall subsequently be confirmed by surveying methods to ensure that the minimum required slope has been achieved throughout the system.

8.11.3 Hydraulic Testing

The process pipe and the jacket shall be hydraulically tested in accordance with the project line list and the project specifications.

The process pipe shall be designed such that full hydrostatic test pressure can be applied to the jacket whilst the process pipe is at atmospheric pressure without the line collapsing.

8.12 Jacket Circuit Configuration

A jacket circuit is an arrangement of continuous spools fed from a single steam feed, with steam and condensate passing to subsequent spool jackets via jumpover connections, with condensate return via a single low point.

The following guidance applies to fully jacketed lines with rodding crosses, upstream and downstream of the sulphur pit. Upstream of the pit the sulphur liquid may contain solid particles which can impair drainage of sulphur and increase blockage potential. Downstream of the sulphur pit, sulphur liquid contains far less solid. For these reasons the guidance is more onerous in the sulphur rundown piping.



8.12.1 Maximum jacket Circuit Length

The maximum length of jacket circuits as defined above shall be:

Upstream of the pit:	6m
Downstream of the Pit:	18m

In addition to the limits on jacket circuit length above, the number of fresh steam feeds and condensate return points may be further increased.

Each jumpover type, see Appendix B, Figure 14, provides a location at which condensate flow

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may be restricted and jacket drainage compromised, reducing the jacket heating capability. Within any jacket circuit the number of various types of jumpovers shall be restricted to maximize reliability.

8.12.2 Non-Spool Items

Non-spool elements within a jacket circuit include jacketed control valves, block valves, check valves, equipment nozzles, etc., where steam and condensate feeds connect to jackets designed and/ or fabricated by others do not follow the standard and may not have good jacket clearances or drainage. If possible, the non-spool item should be the first or early item in the jacket circuit order, which especially applies to jacketed items in which there is a pocket of un-drained condensate.

8.12.3 Jacket Circuit Criteria

The following table is a table summarizing the guidance on length and complexity of jacket circuits

Jacket Circuit Criteria	Upstream of Sulphur Pit	Downstream of Sulphur Pit
Maximum number of jumpovers:		
Type 4 (Horizontal)	3	5
Type 4 (vertical)	4	8
Type 3**	1	3
Total	4	8
Max jacket circuit length (m)	6	18
Max non-spool element	1	5 with bottom drain 2 with side drain



** If Type 3 jumpovers are used, the sum of all the lower to upper invert vertical dimensions shall not be more than 3m, to limit potential condensate lift backpressure.

8.12.4 Number of Steam Feeds

Steam from one distribution manifold connection may feed two adjacent circuits if arrangement of the feed points are convenient and economical and the combined length of the two circuits is less than the max jacket circuit length.

8.13 Materials

Jacketed piping materials shall be in accordance with the project Piping Material Specifications. Diaphragm and baffle materials shall be the same as or equivalent to the piping materials to which shall be welded. In any case, if the jacket and process line materials are different, the material plates shall be equivalent to the higher quality material.

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Supply specifications shall be as specified in **Section 6.11** for steam supply and condensate return manifolds with integrated compact drain trap assemblies.

9 Installation Rules for Jacketed Piping

9.1 The installation and construction rules define the shape, size and installation of piping elements in line heating and cooling systems using external jacketing, fed with fluids and/or steam.

9.2 Standard Construction Drawings

The installation and construction rules are shown in Appendix B.

Notes to the Standard Construction Drawings



- All dimensions are in mm. unless otherwise indicated.
- Each weld of inner pipe shall be accessible for x-raying and shall be visible during hydro testing. Therefore, split jackets shall be used to enable inspection of each inner pipe weld (see jacketed piping details)
- When tees are required, the jacket tee shall be split across the horizontal axis. A split at the crotch of tee is not allowed.
- Longitudinal welds from split pipe jackets and split tees or reducers shall be staggered to avoid crossing welds.
- When a jump over or condensate return connection is required on a split jacket, first the connection shall be welded before splitting the jacket pipe or reducer (to avoid deformation of jacket).
- Only external jacket surface of jacketed piping shall be applied with protective paint.

9.3 Pipe Stress and Supports

The annular space between the process and jacket line shall be maintained by centering guides welded to the inner pipe.

Following items shall be checked:



- Stresses caused by thermal expansion and temperature differences between process line and jacket line.
- Position and locations of centering guides or anchors in fully jacketed piping near elbows and branches
- Type of centering guide or anchor shall be specified on isometric drawings.

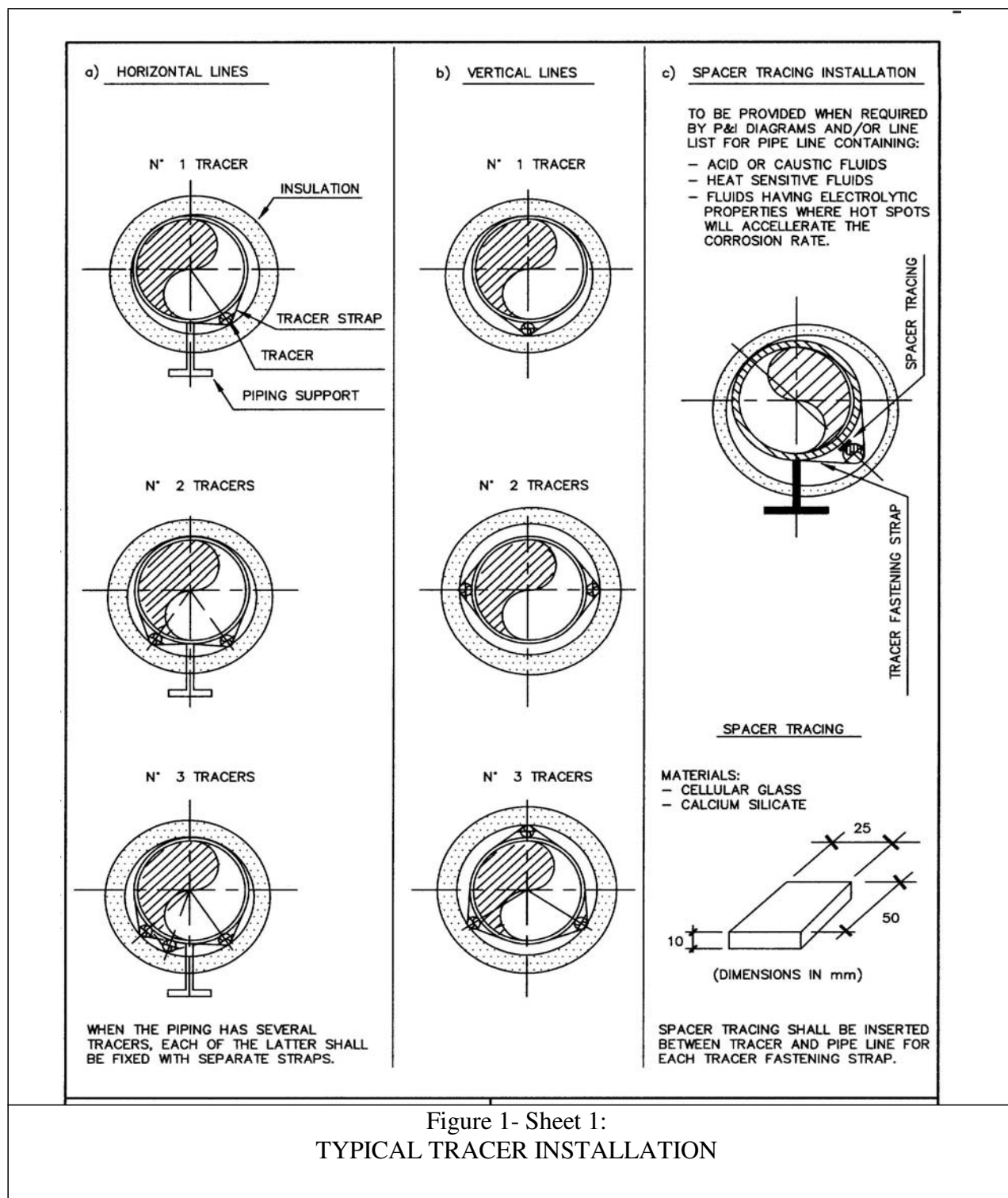
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APPENDIX A: Typical Installation Drawings Steam Tracing Sketches

General Notes:

1. Figures 1 through 16 are applicable for steam tracing.
2. These figures shall be used as general guideline to detail the Issue for Construction Drawings.

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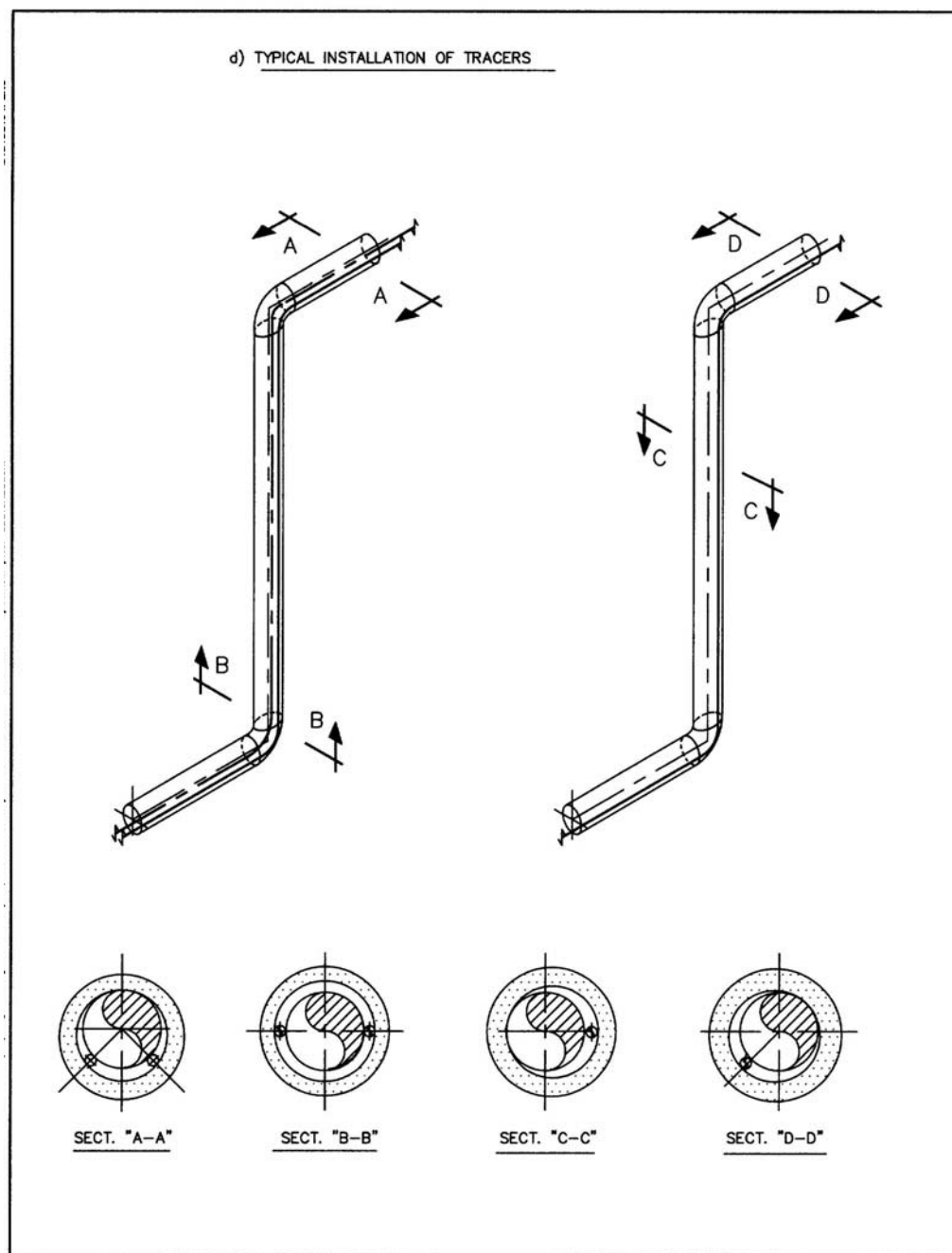




Figure 1-Sheet 2
TYPICAL TRACER INSTALLATION

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a) ON STRAIGHT PIPE EXCEEDING 20 m LENGTH AN EXP. JOINT LOOP SHALL BE PROVIDED TO COMPENSATE DIFFERENTIAL EXPANSION BETWEEN TRACER AND PIPELINE

b) TRACING DETAIL WITHOUT EXPANSION LOOP

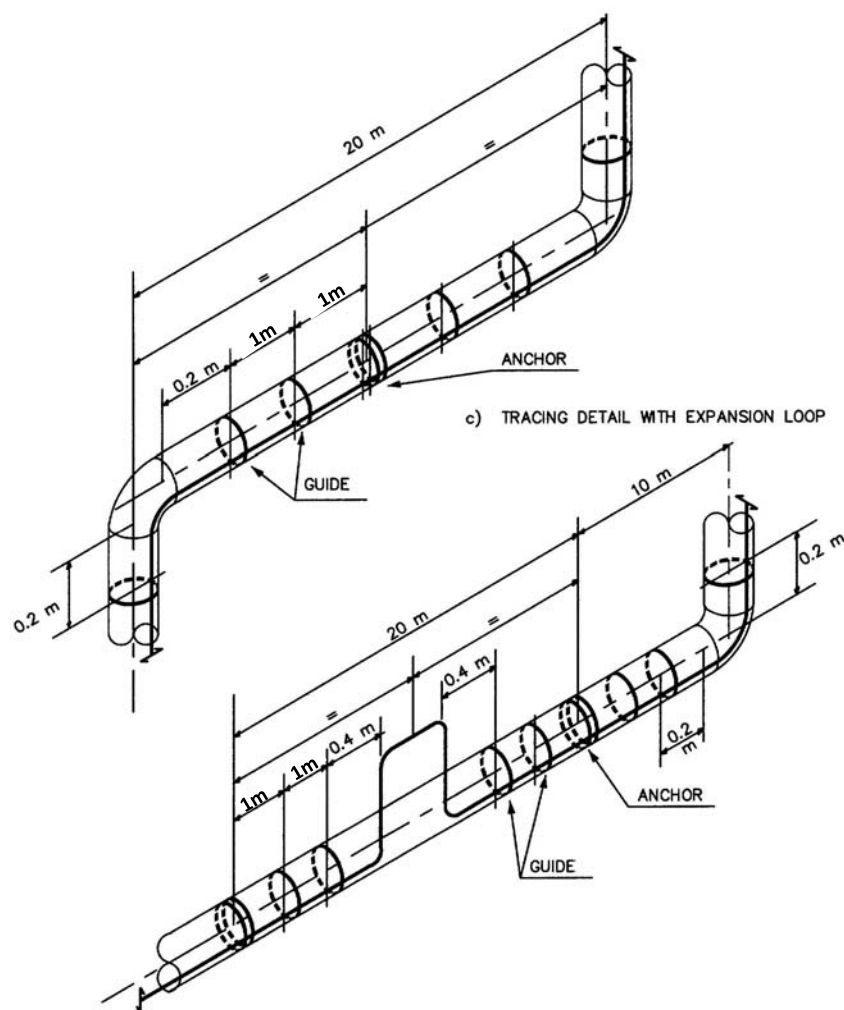
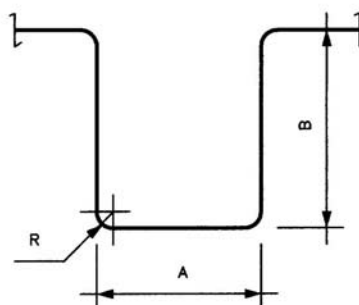


Figure 2 sheet 1
TRACER EXPANSION LOOPS

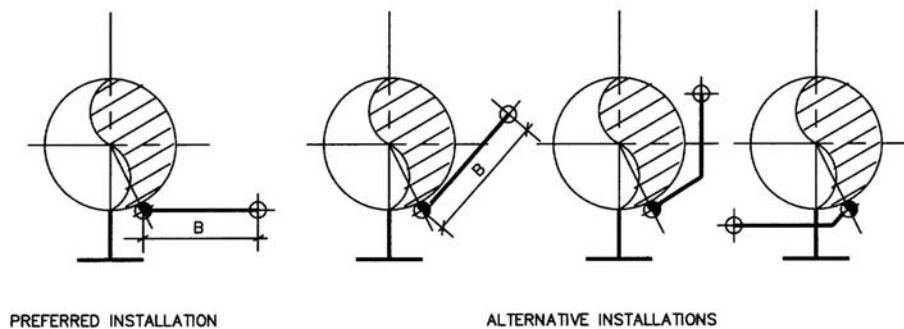
d) DIMENSIONAL TABLE FOR EXPANSION LOOPS ON TUBING AND Sch. 40 PIPE TRACERS.

DIMENSIONS IN mm

TRACER	A	B	R
TUBING 3/8"	150	200	50
TUBING 1/2"	200	200	50
TUBING 3/4"	200	300	75
PIPE 1/2"	200	300	100
PIPE 3/4"	200	400	100
PIPE 1"	300	500	150





e) EXPANSION LOOP INSTALLATION ON TRACERS.



PREFERRED INSTALLATION

ALTERNATIVE INSTALLATIONS

Figure 2 sheet 2
TRACER EXPANSION LOOPS

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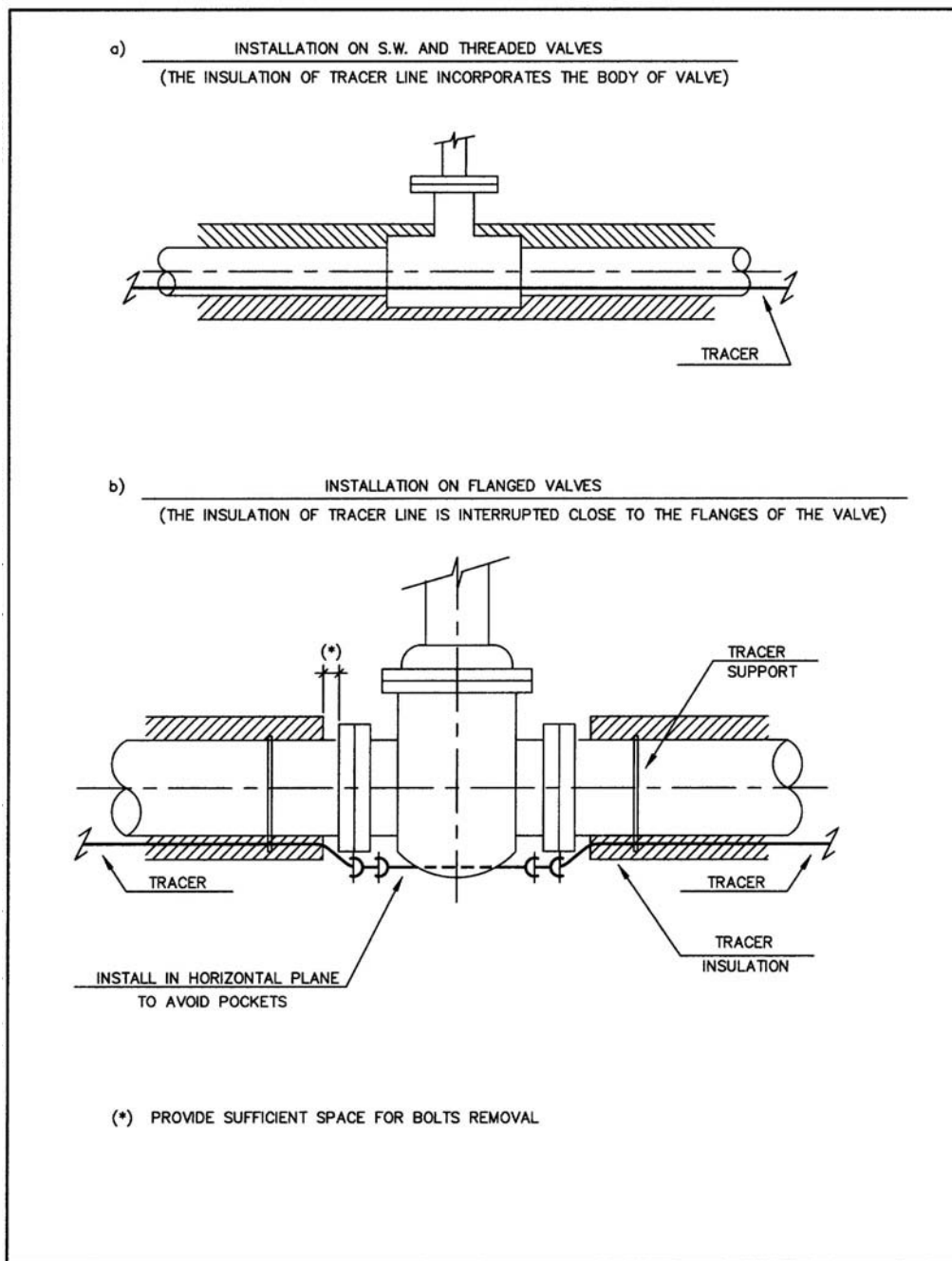


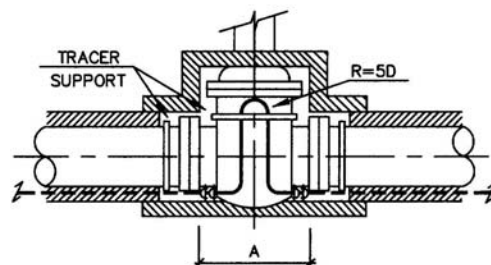


Figure 3
TRACING OF VALVES

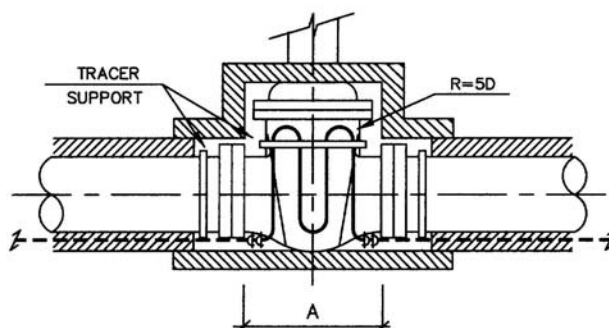
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- a) INSTALLATION ON S.W. AND THREADED VALVES
(THE INSULATION OF TRACER LINE INCORPORATES THE BODY OF VALVE)

- b) INSTALLATION ON FLANGED VALVES AND CONTROL VALVES
(THE INSULATION OF VALVE INCLUDES THE TRACER LINE)



FLANGED VALVES WITH "A" DIMENSION ≤ 400 mm





FLANGED VALVES WITH "A" DIMENSION > 400 mm

NOTES :

- (1) WHEN PROCESS LINE IS TRACED WITH 2 OR MORE TRACERS, PROVIDE VALVE TRACING USING 2 TRACERS ONLY: ONE FOR EACH SIDE OF VALVE, THE OTHERS SHALL BE ROUTED PARALLEL TO THE VALVE.
- (2) TRACERS SHALL ADHERE TO THE VALVE'S BODY LEAVING THE POSSIBILITY TO DISMOUNT THE VALVES.

Figure 4
TRACING OF INSULATED VALVES

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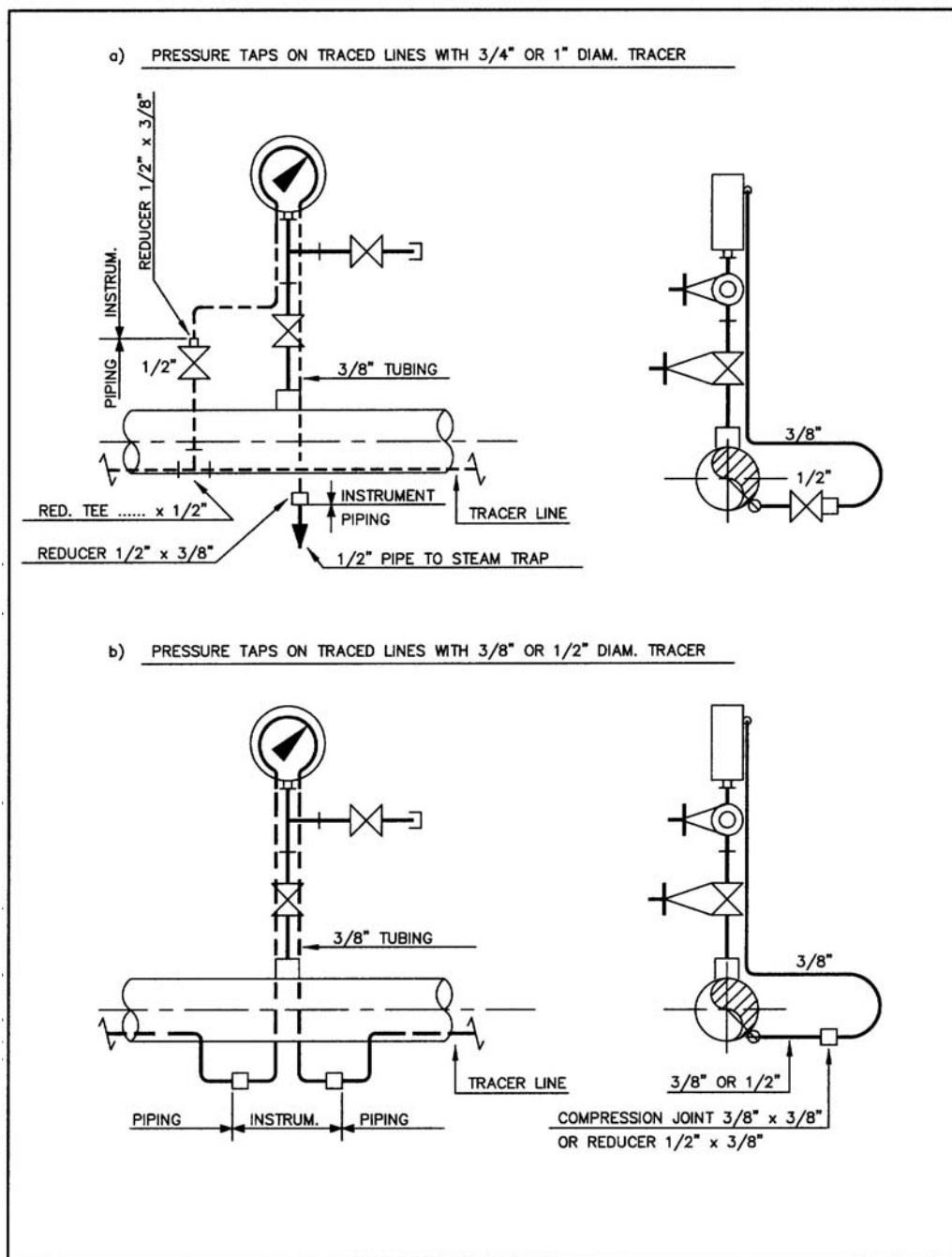


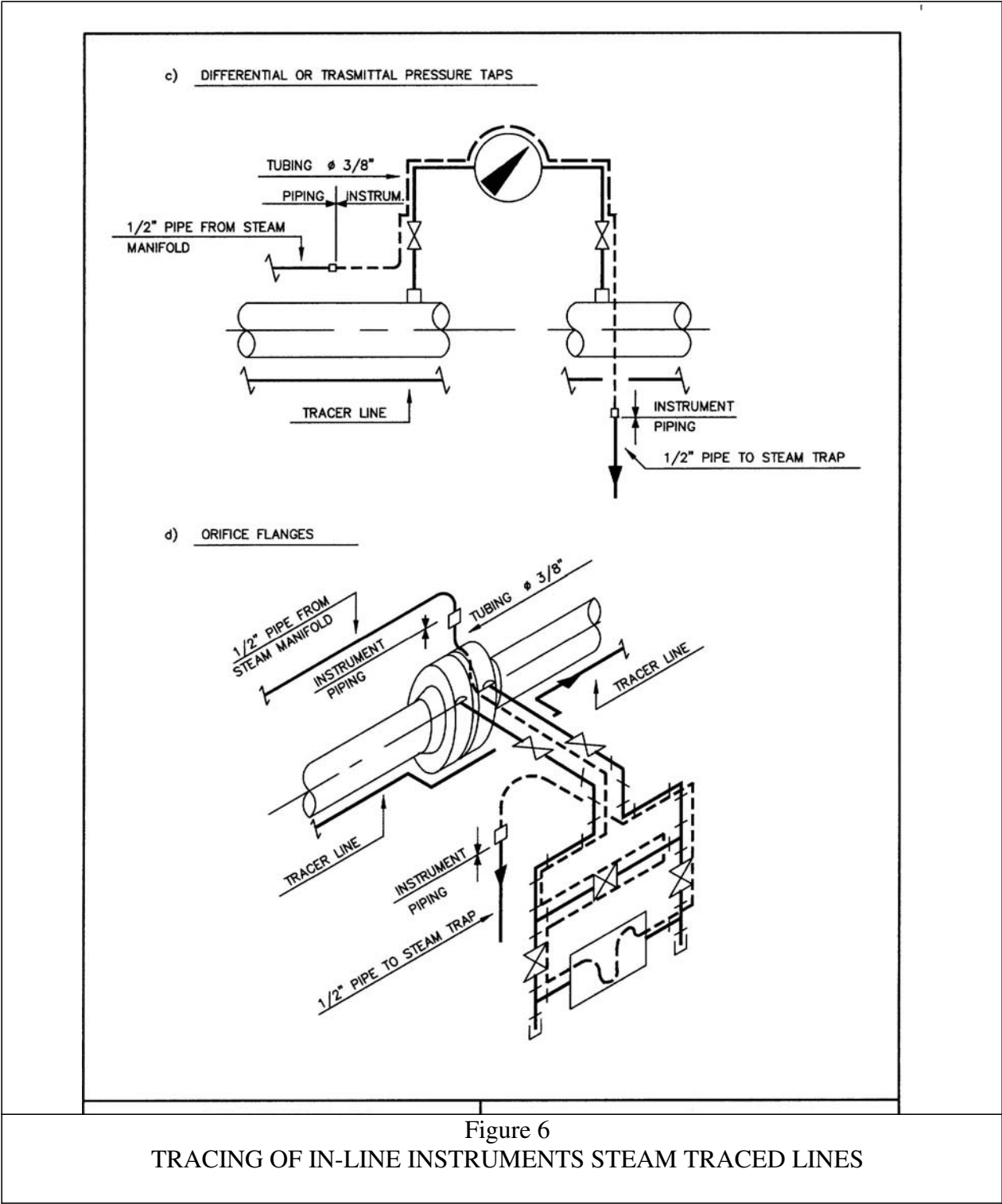


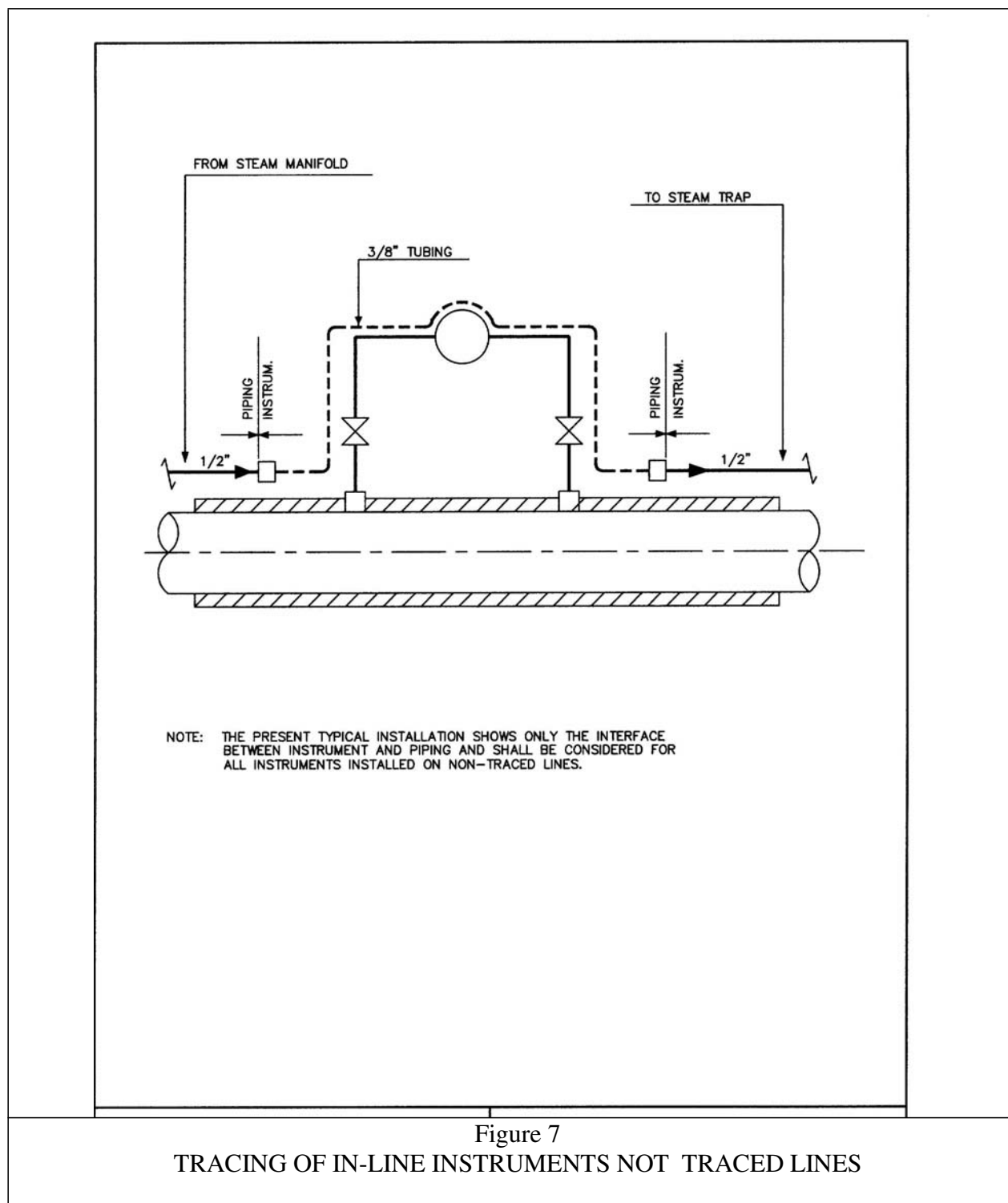




Figure 5
TRACING OF IN-LINE INSTRUMENTS STEAM TRACED LINES

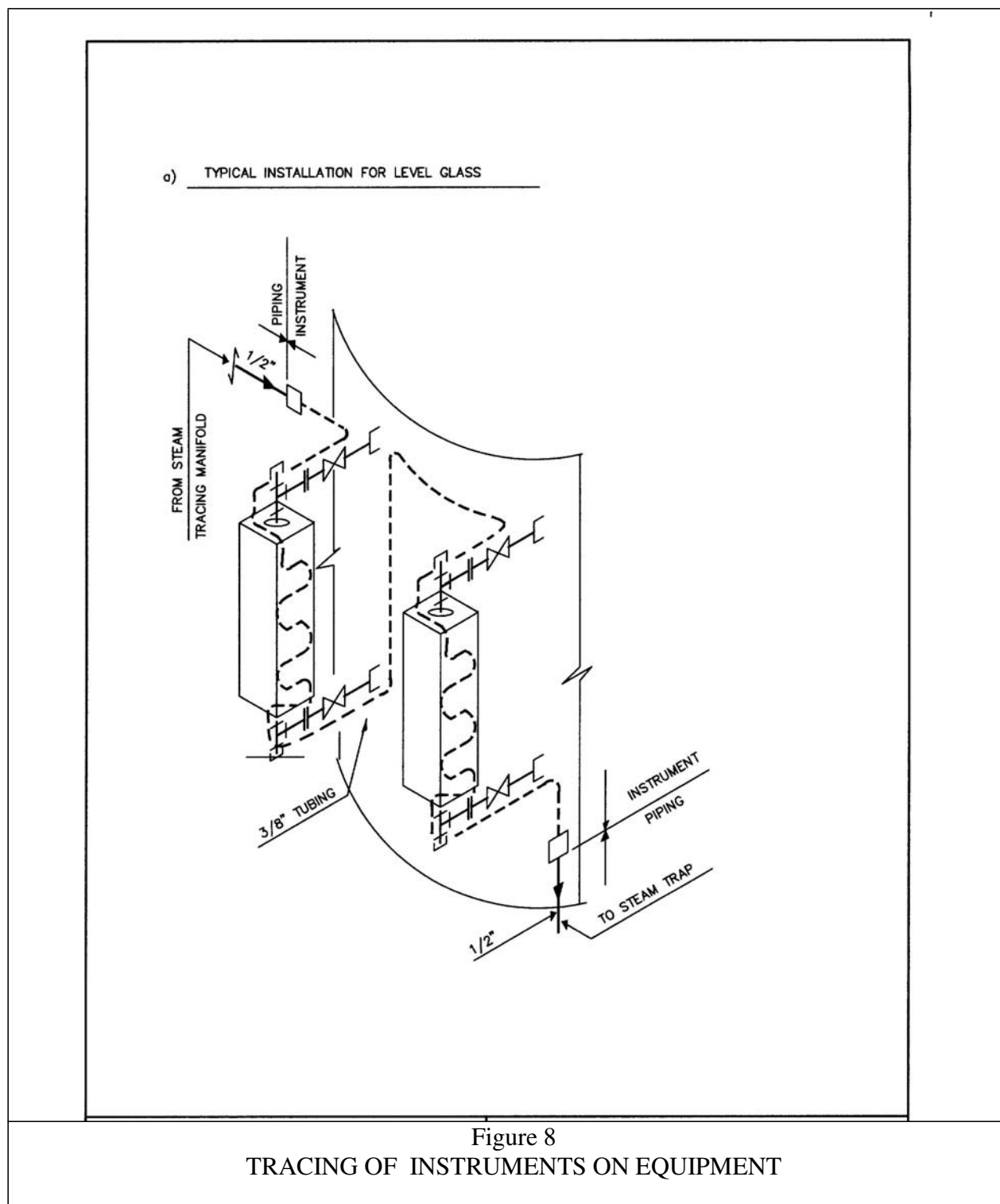
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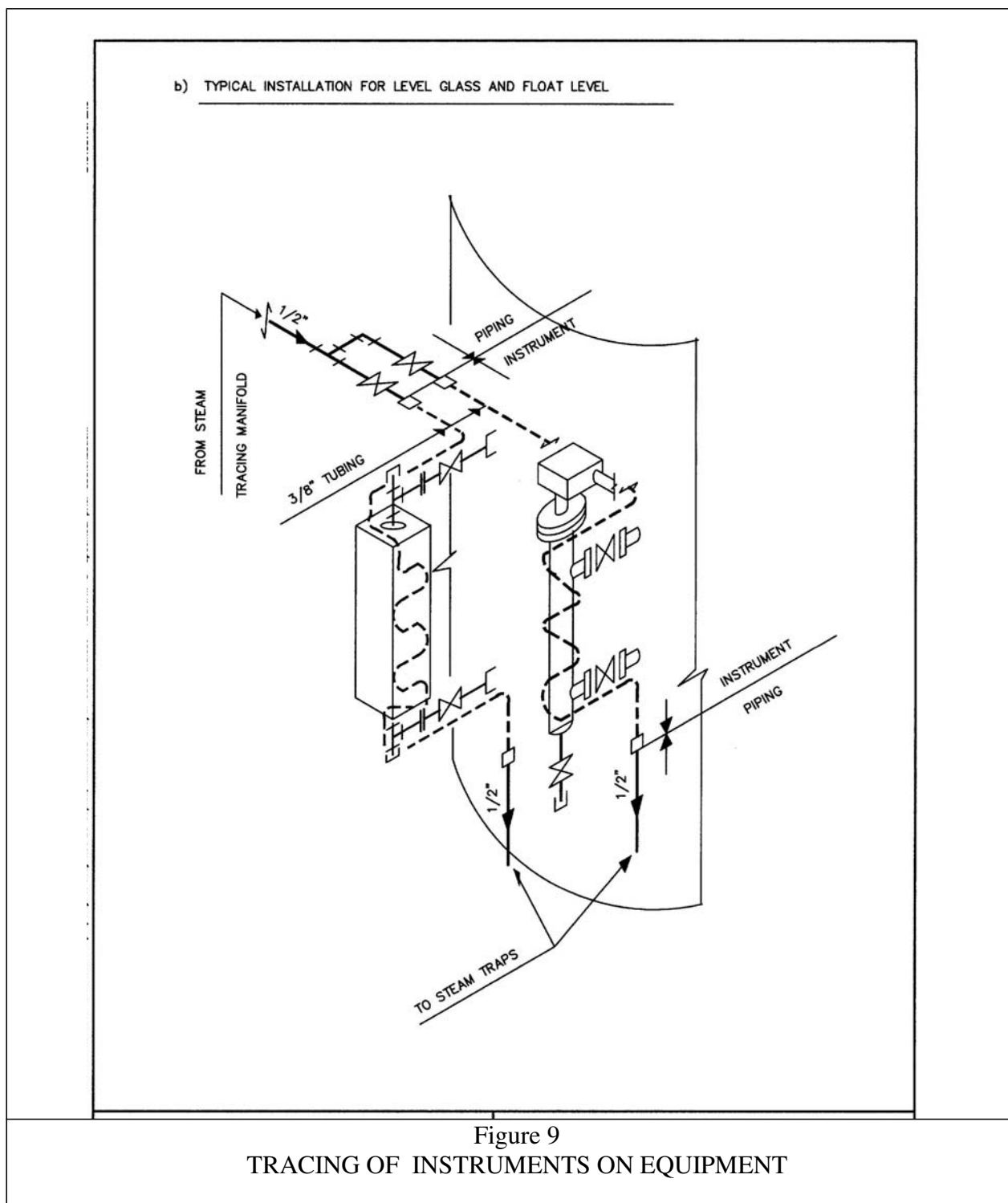
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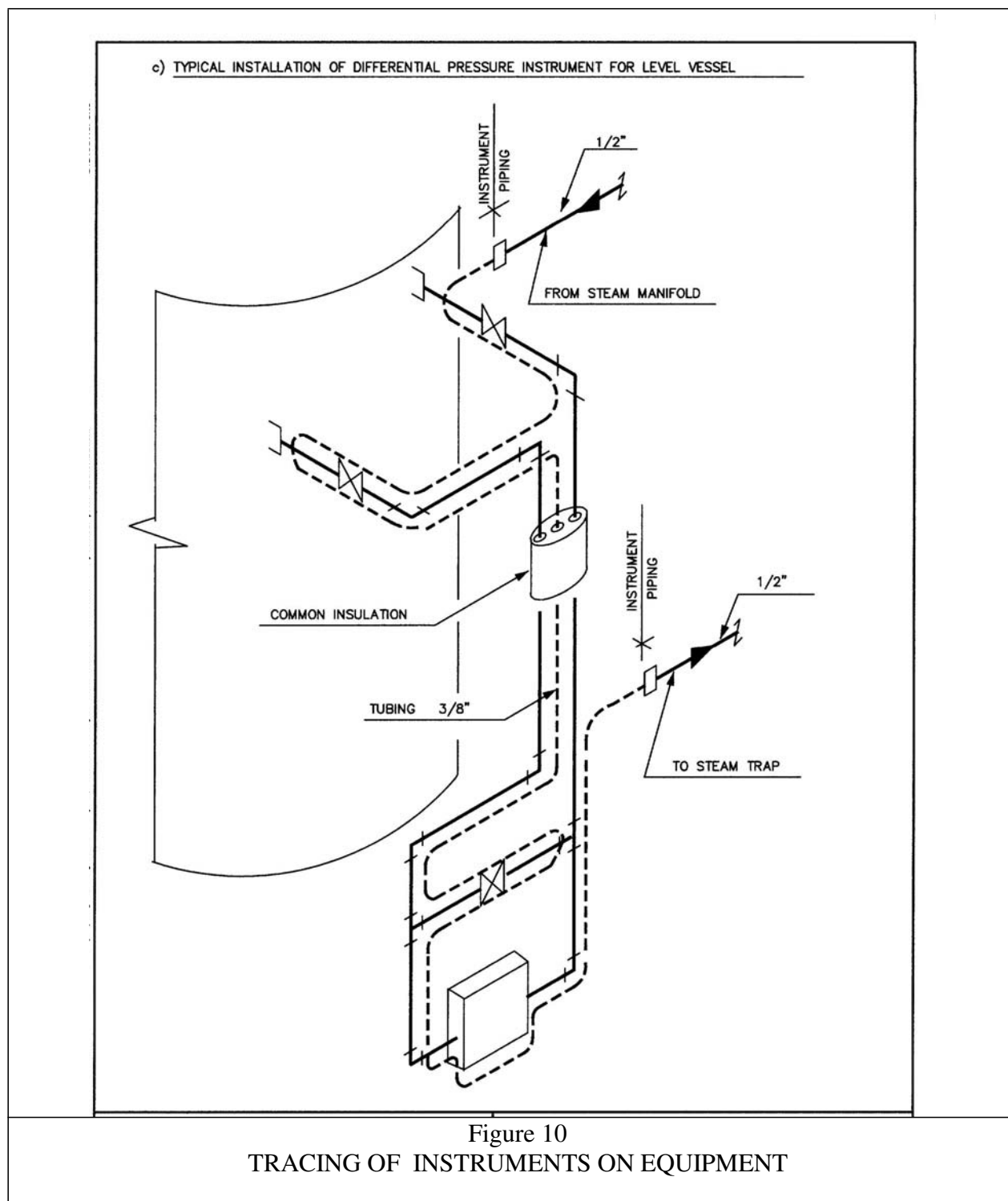
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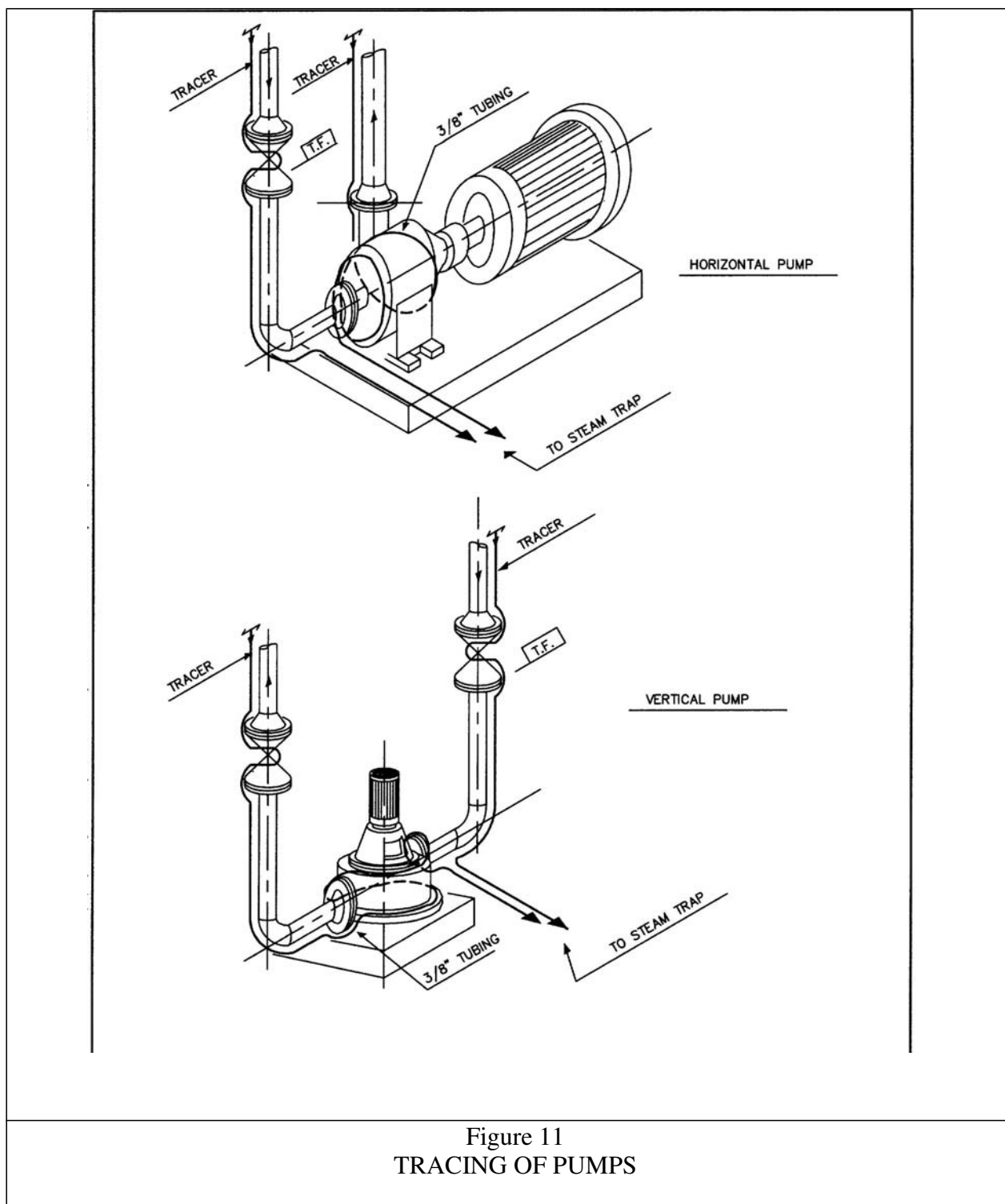
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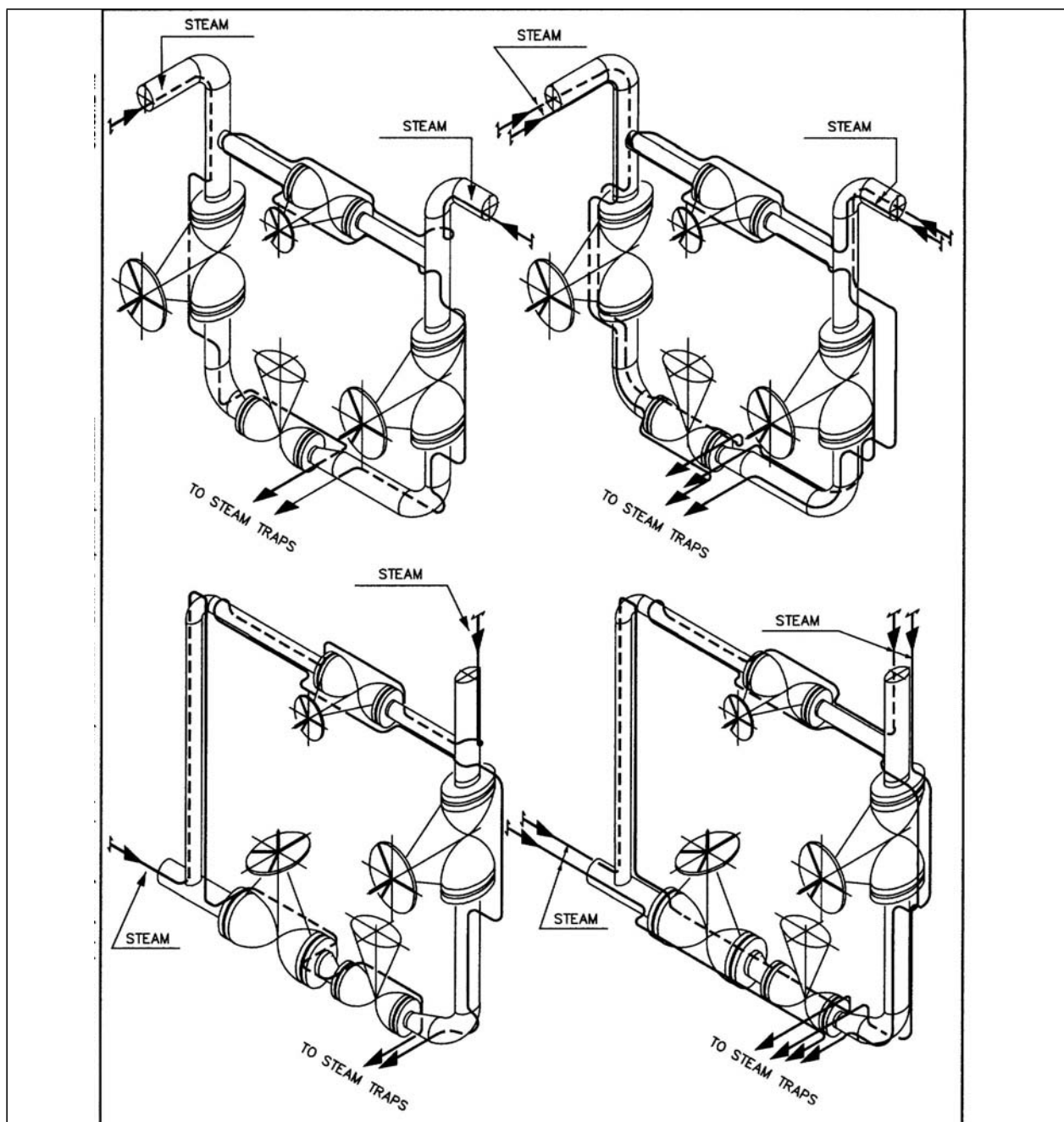


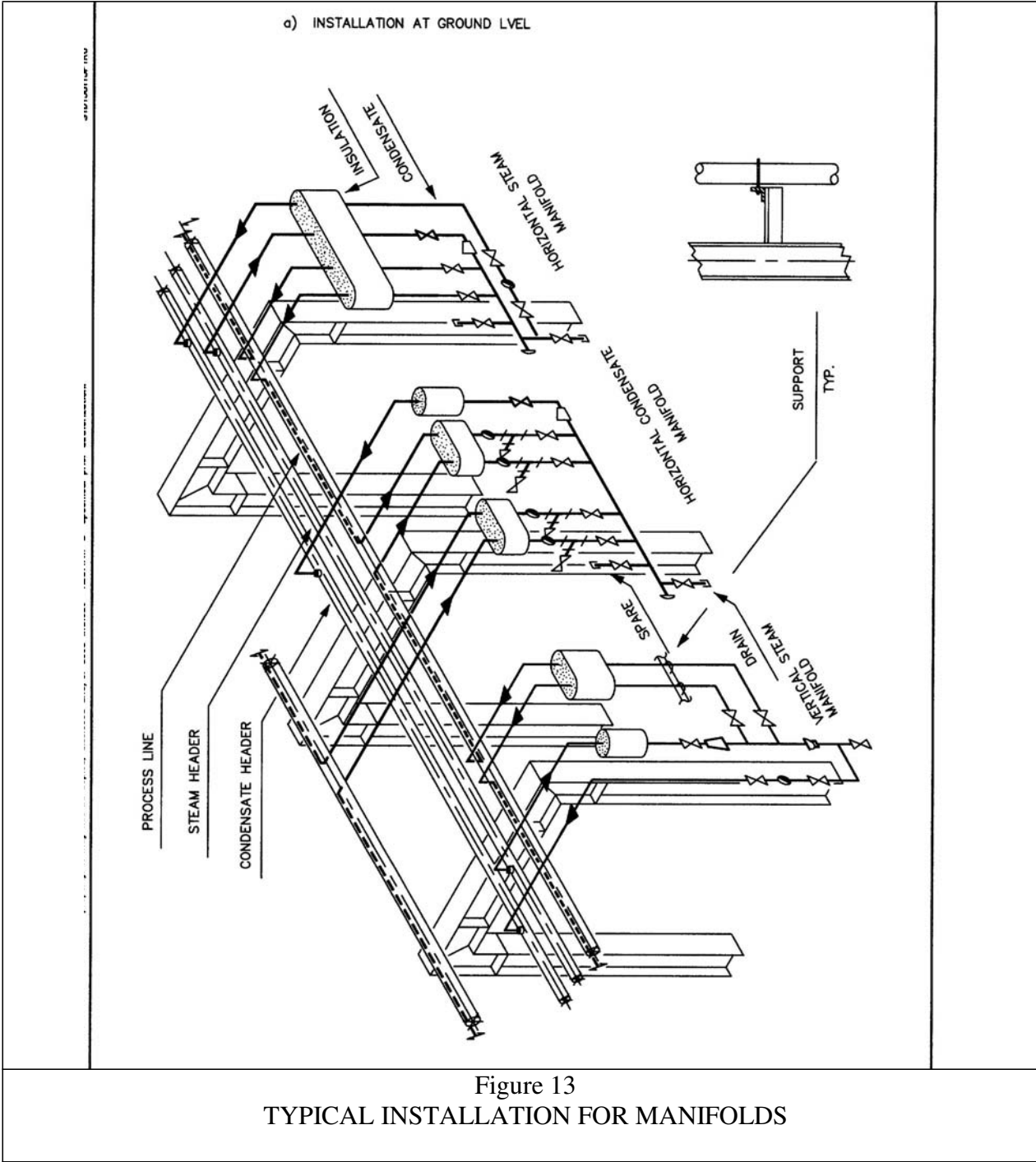


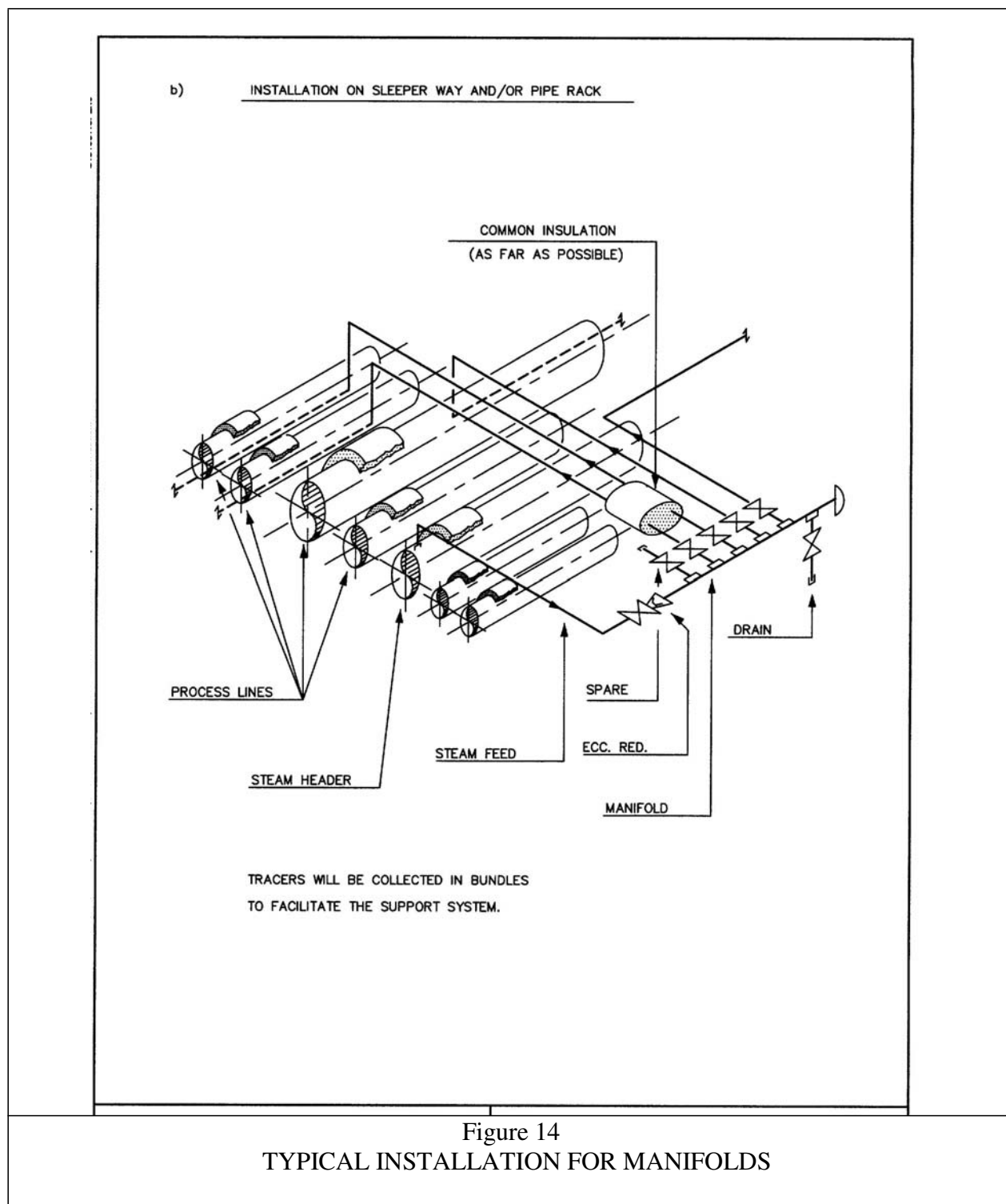




Figure 12
CONTROL SET TRACING

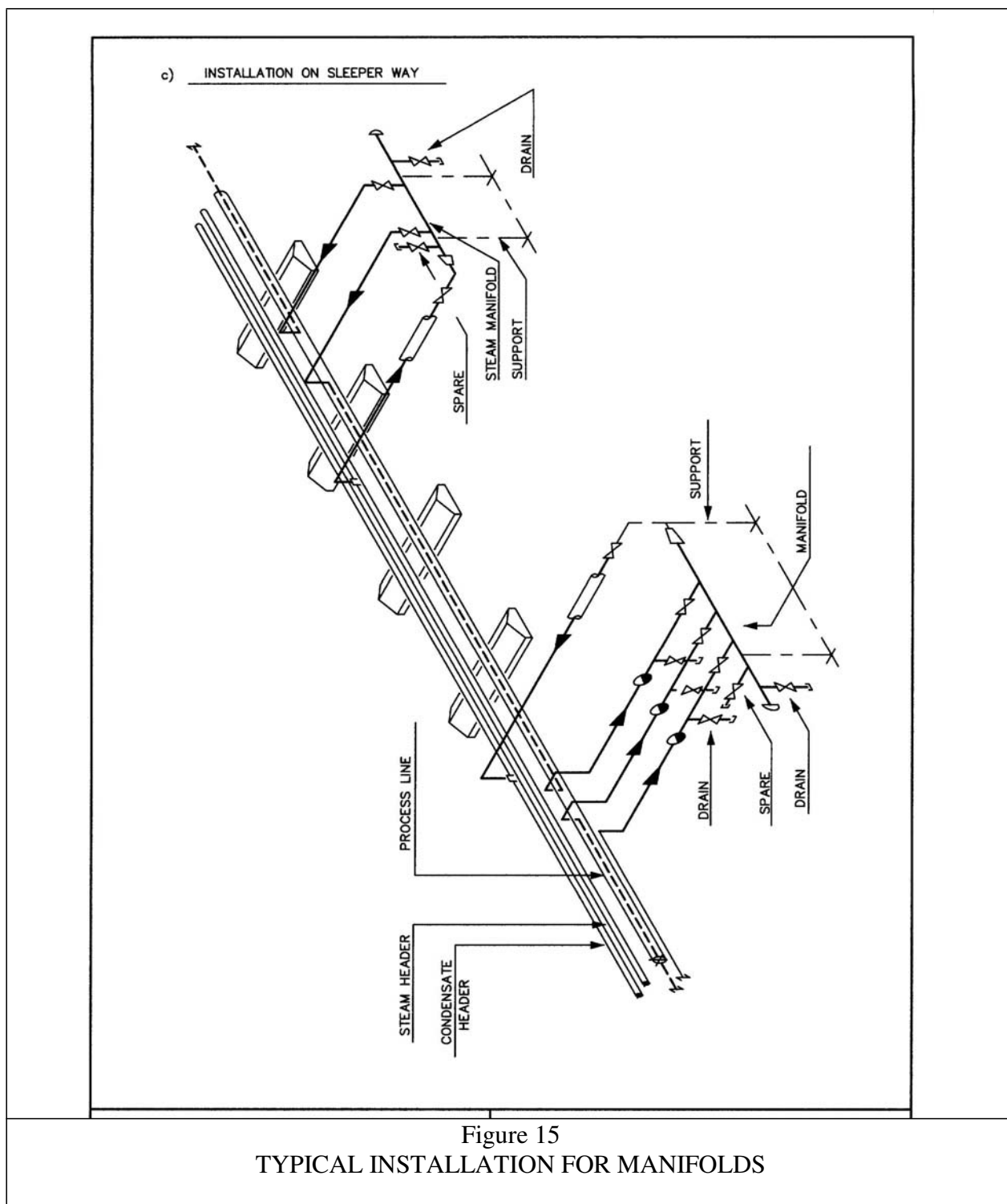
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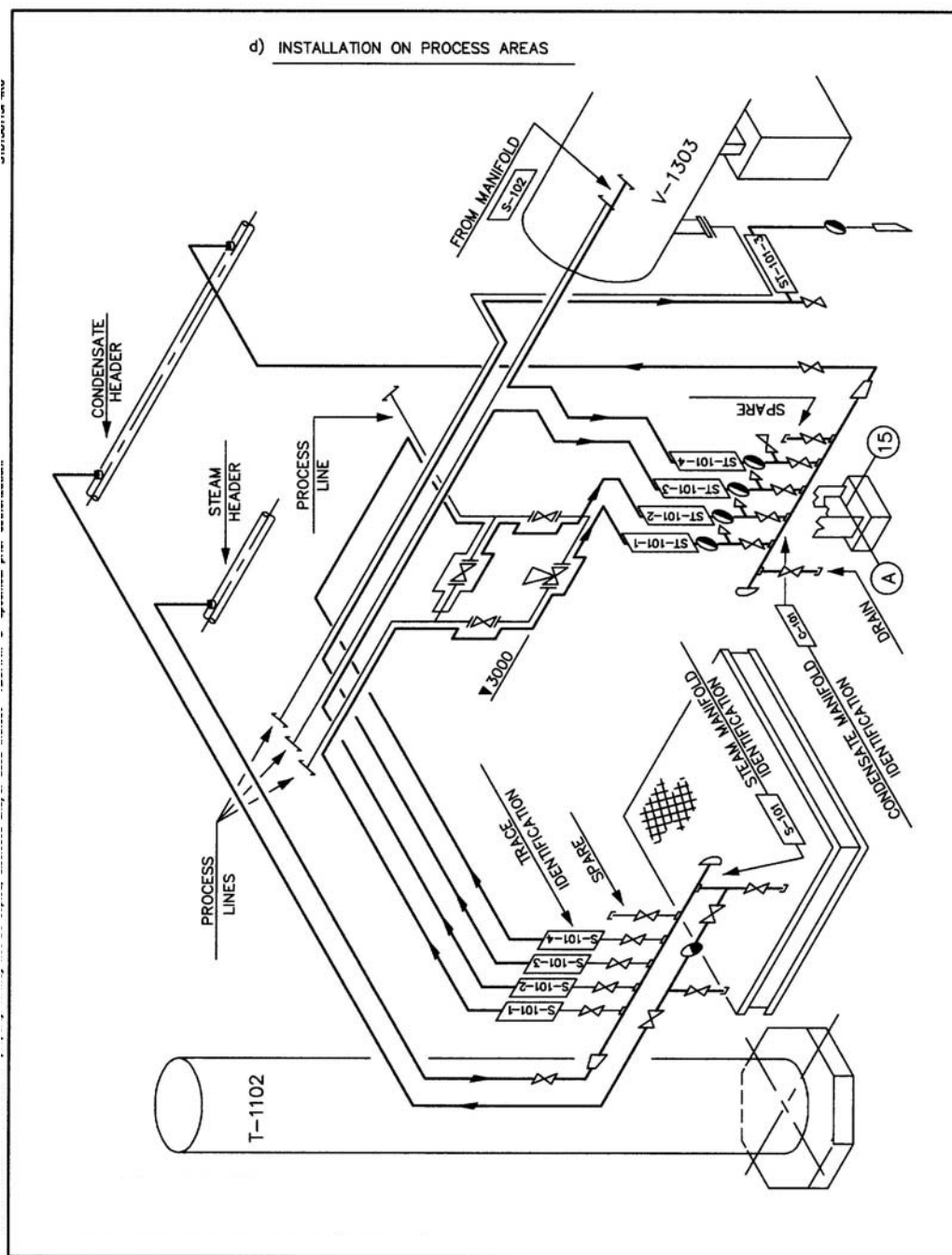




Figure 16
TYPICAL INSTALLATION FOR MANIFOLDS

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APPENDIX B: Typical Installation Drawings for Steam Jacketed Piping

General Notes:

These figures shall be used as general guideline to detail the Issue for Construction Drawings.
Figures:

1. Fabrication Method for Jacketed Spool
2. Jacketed Spool detail
3. Fabrication Method for Jacketed Cross and Tee
4. Jacketed Cross detail
5. Jacketed Tee for Instruments / Drains / Vents
6. Instrument Tee
7. Utility Steam Details
8. Fabrication Procedure for Field Fit Welded spools
9. Standard reducer spool
10. Standard Weld Detail
11. Fabrication Method for Partial Jacketed Spool
12. Seam Weld Orientation for DN80 x DN50 Jacketed Crosses
13. Typical Detail for Jumpover Connections
14. Typical Jumpover Connections



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PROJECT

Standby SRU & Additional Tanks

IOCL Paradip Refinery

CLIENT

INDIAN OIL CORPORATION LIMITED

Job Specification for
Steam Tracing and Jacketed Piping

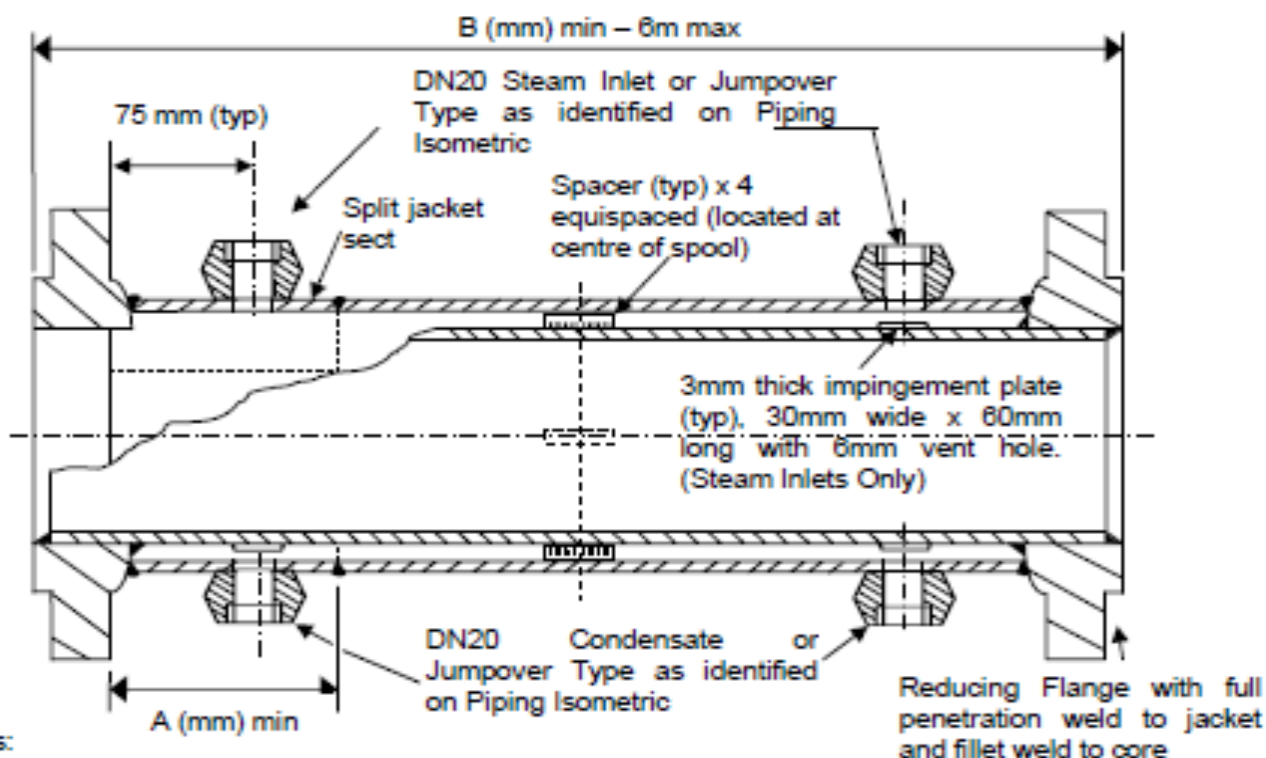
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Figure 1: Fabrication Method for Jacketed Spool



Notes:

- 1.) Complete welding and hydrotesting of inner pipe welds prior to welding of jacket.
- 2.) Summary of Welding Sequences:
 - A: Weld first flange to inner pipe.
 - B: Weld spacers and impingement plate to inner pipe. (Material to ASTM A-36)
 - C: D: Weld second flange to inner pipe.
 - D: NDT / Hydrotest inner pipe.
 - E: Slide jacket length (excluding split jacket section) over inner pipe.
 - F: Weld jacket to first flange
 - G: Weld split jacket halves between jacket and second flange.
 - H: Inspect jacket welds and hydrotest jacket pipe.
- 3.) Utility connections to be DN20 Sockolets in locations as shown on piping isometric.
- 4.) Weld separations to be as defined in Figure 2.
- 5.) If pipework layout results in spool lengths less than specified in Table 1 a non standard cross with an extended leg shall be used.

Table 1. Min Spool Lengths

Jacket DN	A (mm)	B (mm)
80	200	500
100	200	500
150	200	500
200	250	600
250	300	700
300	350	800



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PROJECT

Standby SRU & Additional Tanks

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Figure 2: Jacketed Spool detail

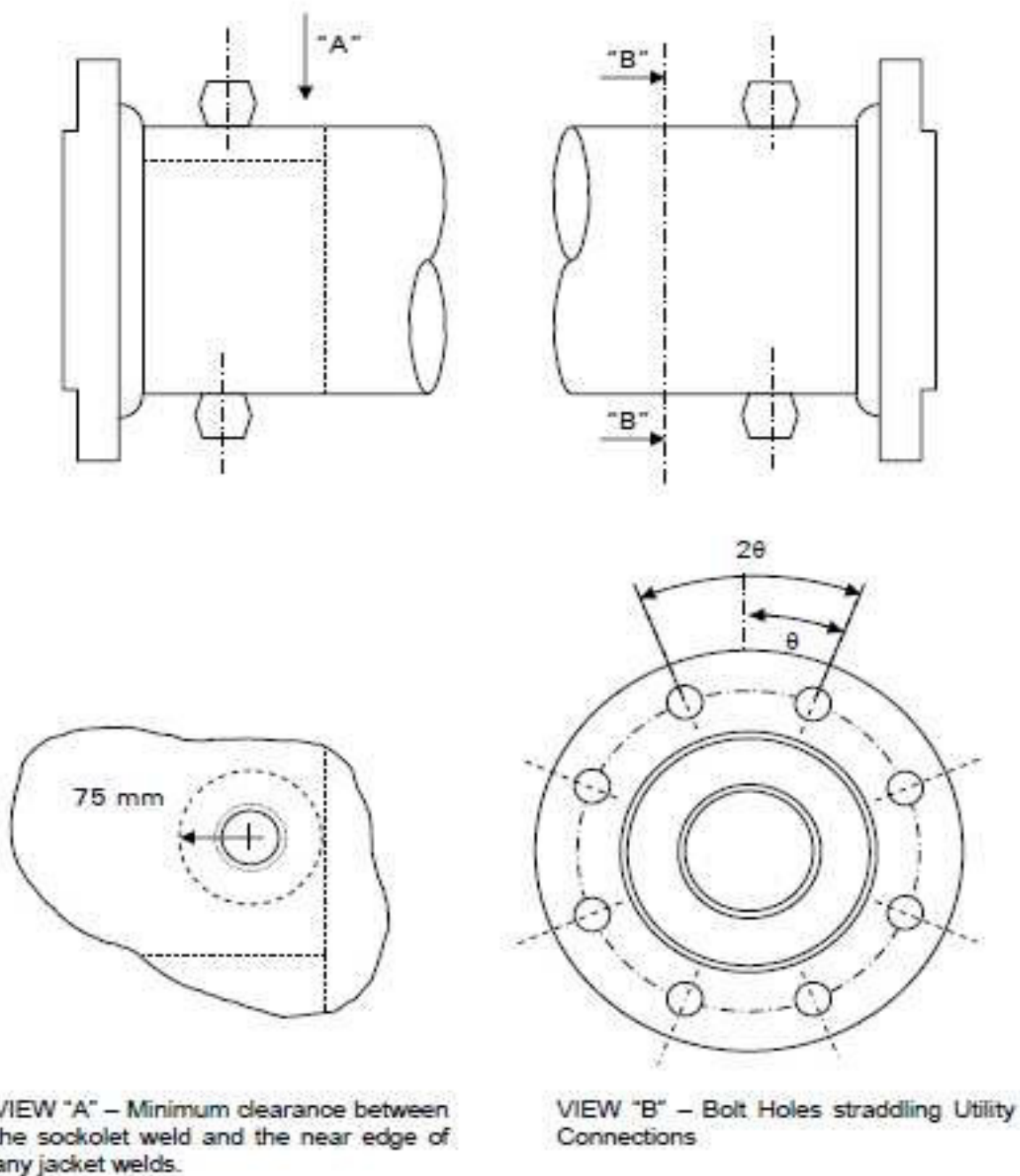
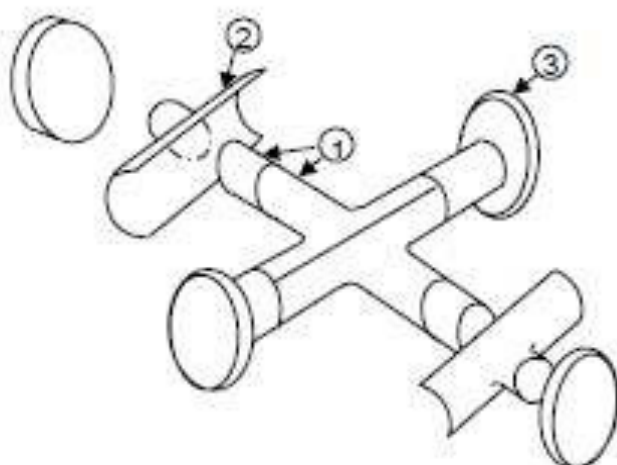
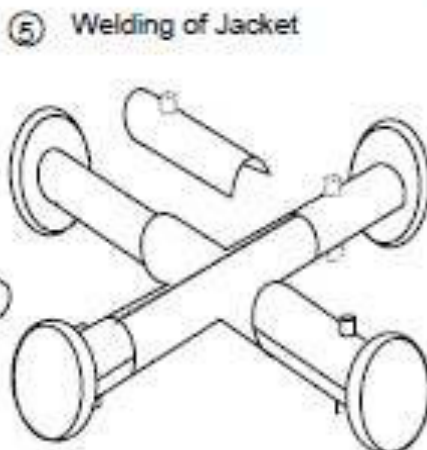


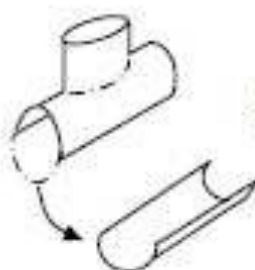
Figure 3: Fabrication Method for Jacketed Cross and Tee
Fabrication


1. Weld straight pipe lengths onto inner (process) split tees NDE (x4).
2. Weld 3 mm thick impingement plate to inner pipe (at steam inlet).
3. NDT and hydrotest inner pipe assembly.
4. Slip unwelded jacket split tees (see detail) over inner cross (x2).
5. Weld flanges onto inner pipe lengths (x4).
6. Complete welding of jacket by welding split jacket tees and split jacket pipe sections.
7. Weld steam and condensate connections and pressure test jacket.

Split jacket pipe sections with DN20 utility connections (socket) at locations as identified on Piping isometric.



Jacket split Tee detail



Separate back from 2 forged tees

NOTE:

The longitudinal seam welds on the jacket pipe must be offset by at least 25 mm from those which join the two split tees. For jacket size DN80 and DN100 this will dictate the orientation of the seam welds with respect to that of the utility connections. See figure 12. Split jacket weld will be at 45 degree orientation from the horizontal for sizes greater than DN100. This allows unrestricted location of utility connections at these sizes.



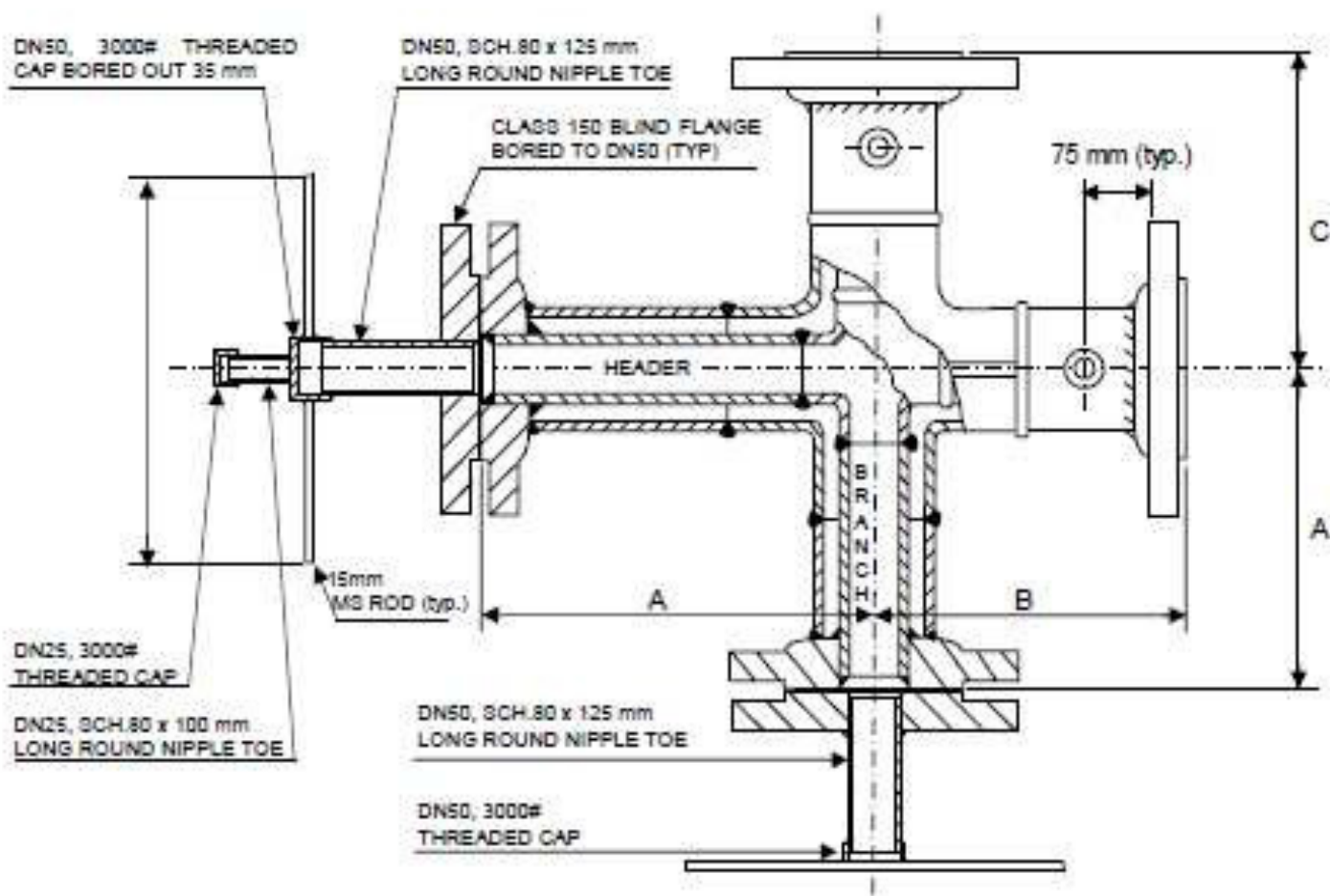
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Figure 4: Jacketed Cross details (with rodding out connections)



Jacket-Core Diameter (DN mm)		Dimension A (mm)
Jacket	Core	
80	50	300
100	80	300
150	100	340
200	150	380
250	200	450
300	250	490

1. Unless otherwise specified, dimensions B & C will be equal to dimension 'A'. If greater than 'A', dimension will be specified on piping isometric.
2. Steam and condensate connections (DN20 socklets) to be located as identified on the Piping isometric.
3. Fabrication sequence as shown in Figure 3.



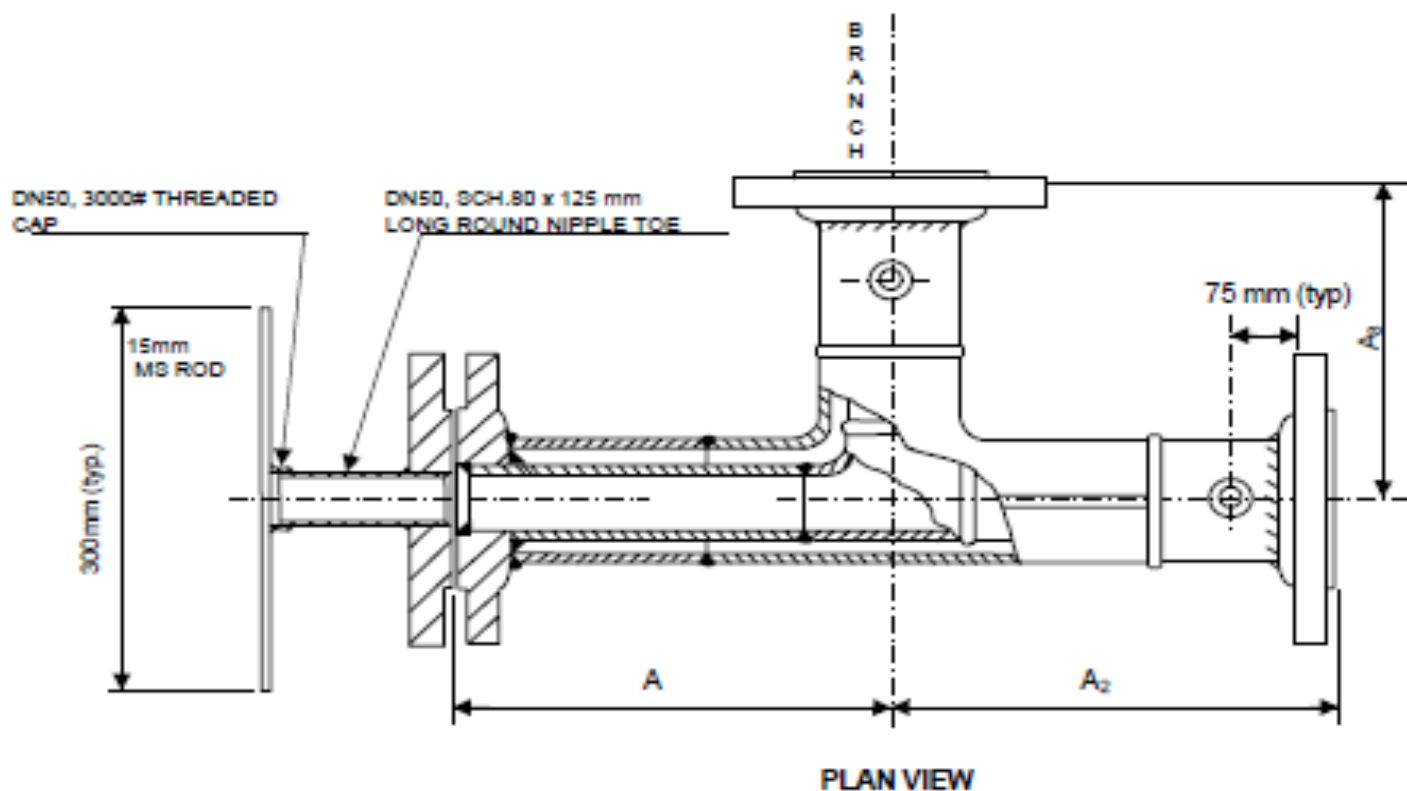
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Figure 5: Jacketed Tee details (with rodding out connections)



Jacket-Core Diameter (DN mm)		Dimension A (mm)
Jacket	Core	
80	50	250
100	80	300
150	100	340
200	150	380
250	200	450
300	250	490

1. Unless otherwise specified, dimensions A_2 & A_3 will be equal to dimension 'A'. If greater than 'A', dimension will be specified on piping isometric.
2. Reducing Tees may be used in order to reduce the instrument connection size to the minimum possible.
3. Deadleg does not require utility connections. The two in line branches shall have connections located as identified on the Piping isometric.
4. For horizontal headers, connections to be on top and bottom dead centre. (May not be possible with jacket sizes less than DN100, due to 25 mm min. jacket weld spacing, so a cross should be used)
5. Fabrication sequence as shown in Figure 3.
6. Rodding crosses shall be used in preference to tees wherever possible. Tees only to be used where space is a constraint.



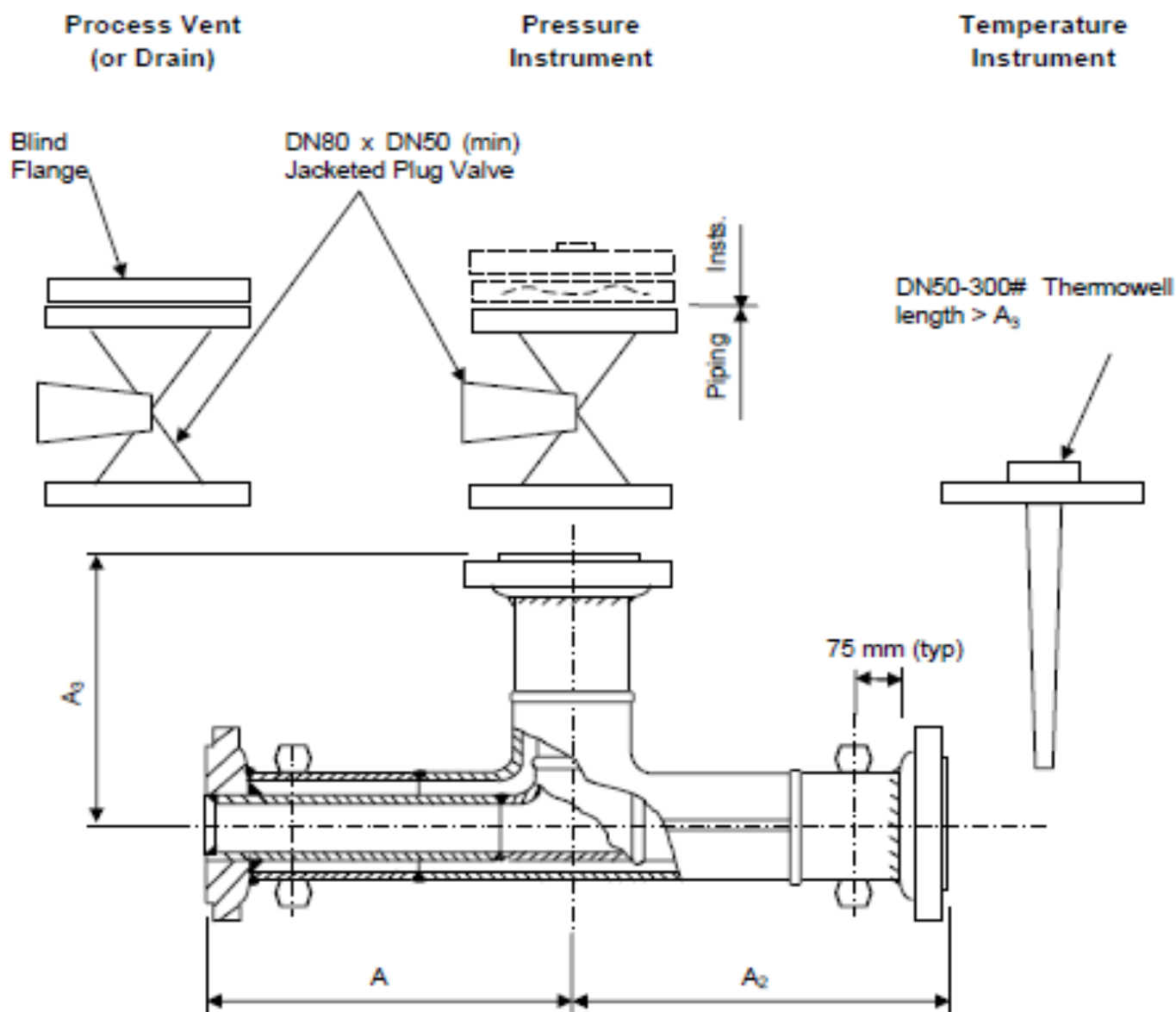
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Figure 6: Jacketed Tee for Instruments / Drains / Vents



Notes:

1. Unless otherwise specified, dimensions A_2 & A_3 will be equal to dimension 'A'. If greater than 'A', dimension will be specified on piping isometric. (For dimensions see table in fig. 5)
2. Thermowell flange shall match the Jacket pipe size.
3. Reducing Tees may be used in order to reduce the instrument connection size to the minimum possible. If not available, stub-ins can be used for both inner and jacket branches.
4. If tee branch size is DN80 x DN50, plug valve shall be directly mounted on it.
5. For horizontal headers, connections to be on top and bottom dead centre.
6. Fabrication sequence as shown in Figure 3
7. Connection to instrument is to be a stub-in if the core size is greater than DN100.

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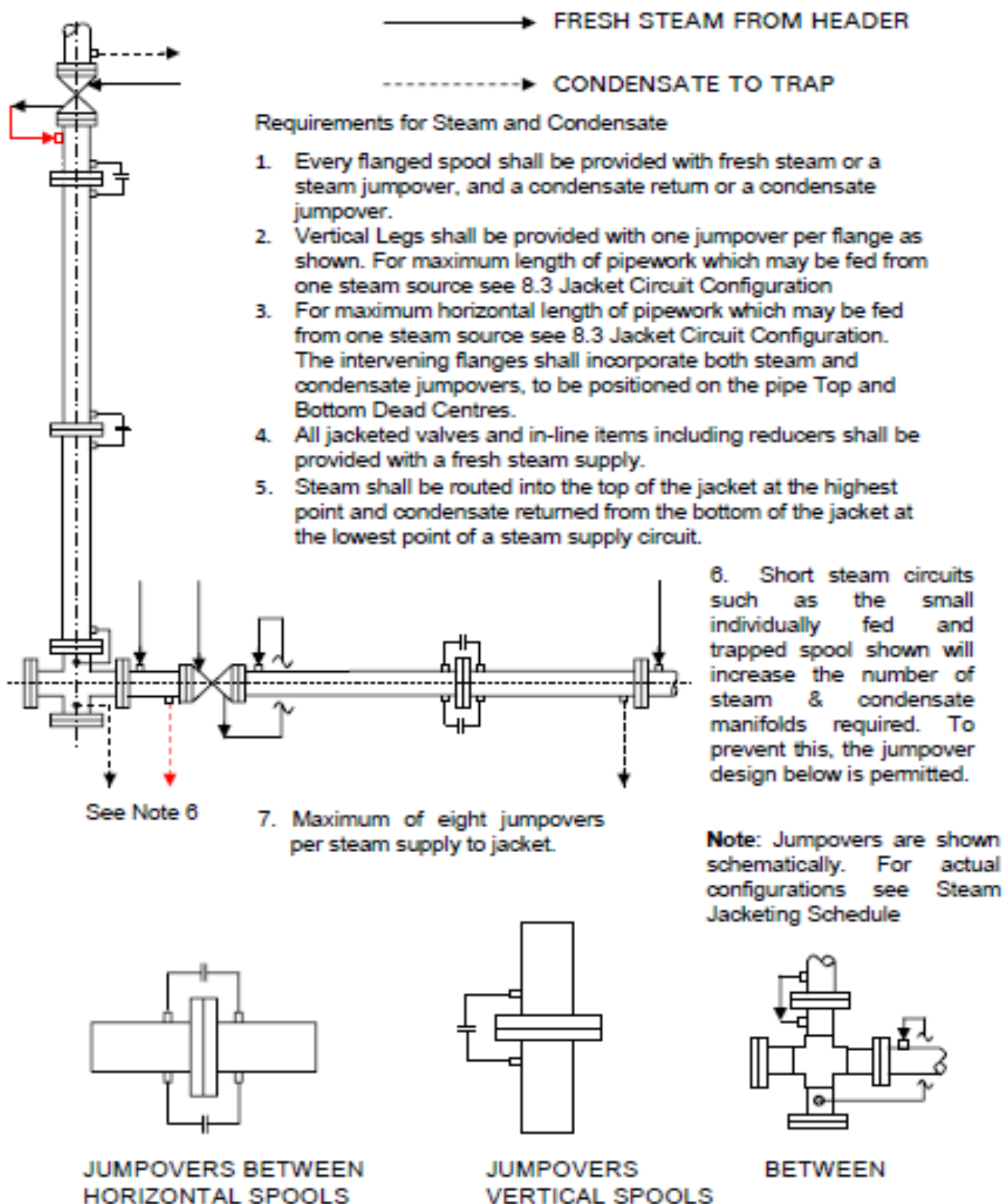
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Figure 7: Utility Steam Details





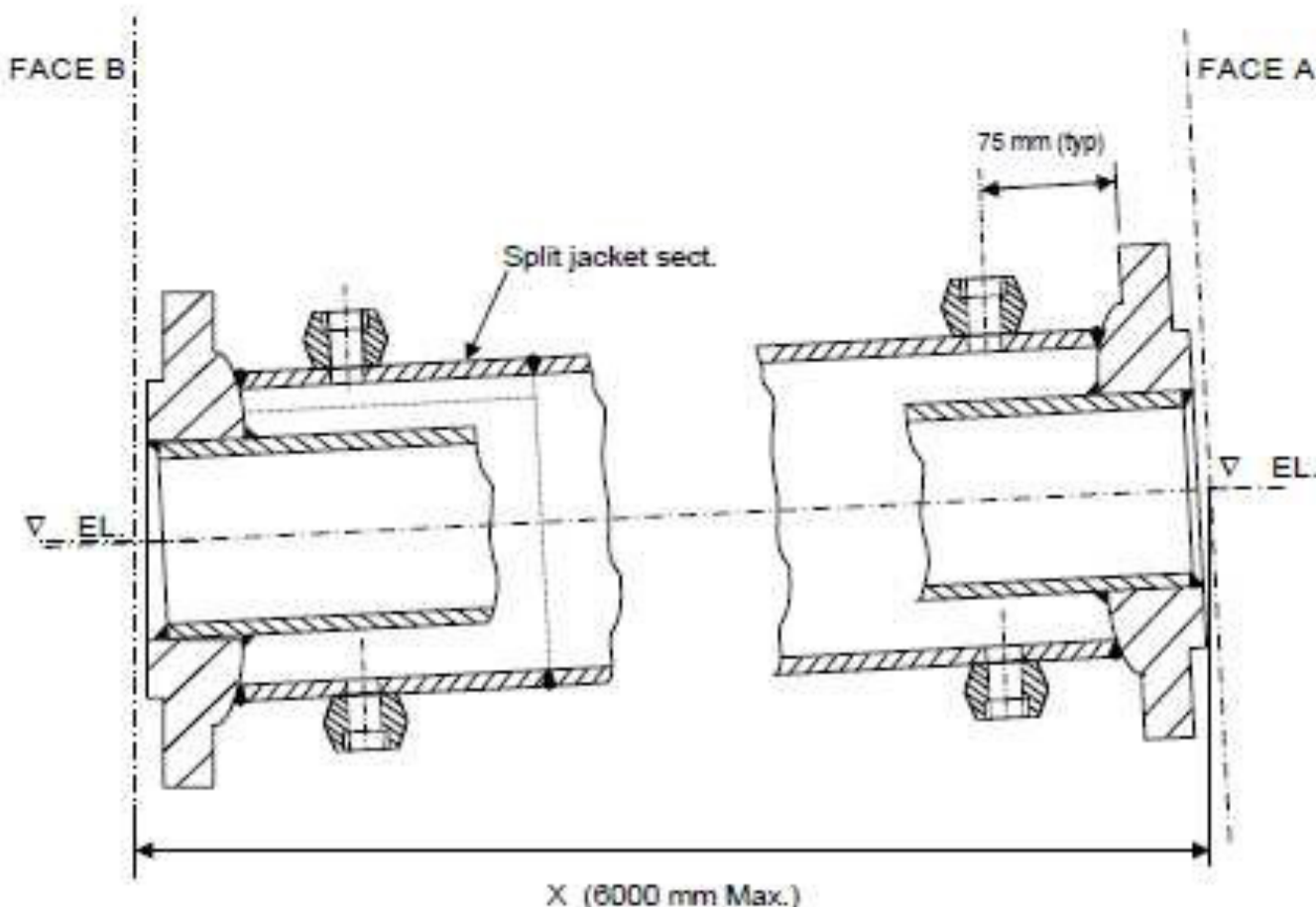
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Figure 8: Fabrication Procedure for Field Fit Welded spools



Fabrication sequence for Field Fit Welded Spools (Details as figure 1)

1. Measure X. (There is not enough space for the steam and condensate connections/jumpovers on a spool shorter than the lengths given in Table 1 Fig.1., so use instead a special cross with one leg increased by the appropriate amount.)
2. Subtract gasket allowance and space for fillet weld detail (see Figure 10). Cut inner pipe to length.
3. Weld 3 mm thick impingement plate (at steam inlet) and 3 off spacers (where required) to inner pipe (see figure 1).
4. Slide main section of jacket over inner pipe, tack weld flanges to inner pipe.
5. Final fit – adjust flange angles / spacing.
6. Complete inner pipe to flange welds.
7. NDT / Hydrotest inner pipe.
8. Tack weld jacket and split jacket sections to flanges.
9. Complete jacket welds and utility connections.
10. NDT / Hydrotest jacket.
11. Note – in the example above, face A would mate with a shop fabricated pipe spool. If it is required to mate with a cross, face A will be set as per face B (i.e. true perpendicular)
12. Note – both faces will be vertical of run < 6m length.



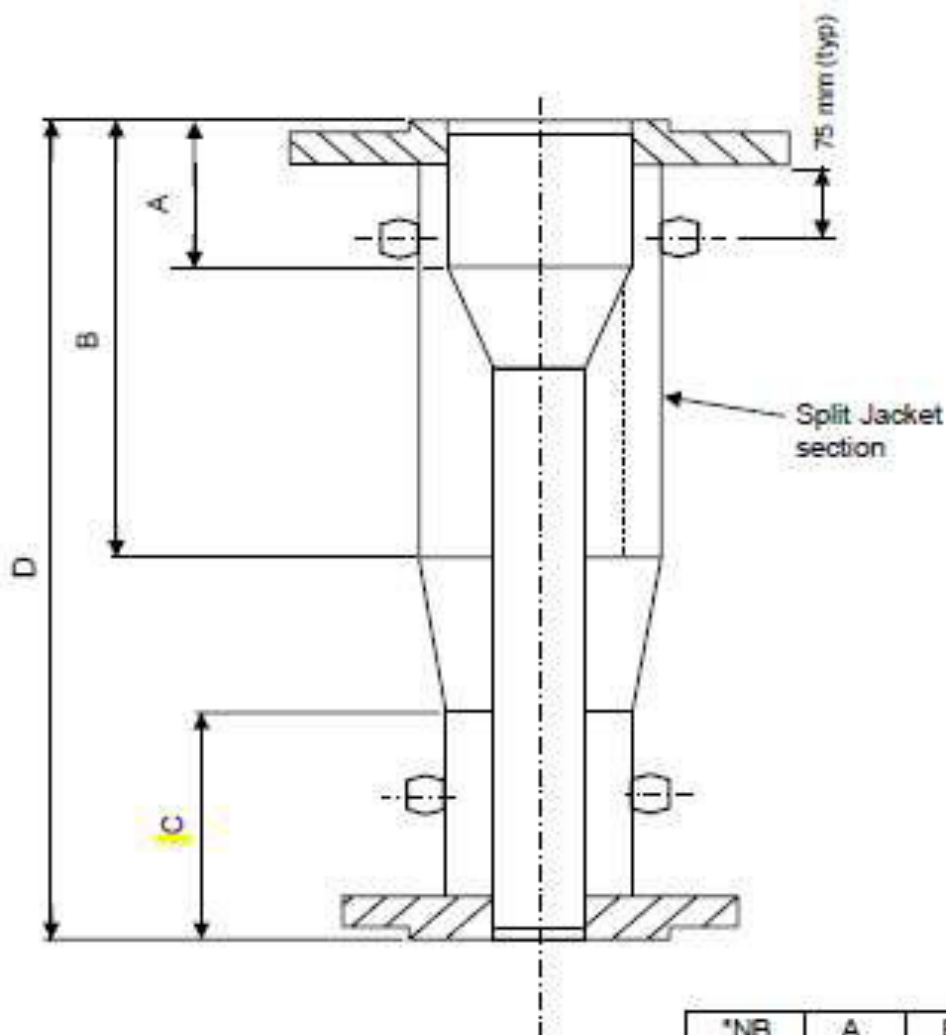
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Figure 9: Standard reducer spool



*NB	A	B	C	D
100	100	300	180	582
150	125	315	200	655
200	150	380	200	732
250	175	415	240	833
300	200	470	240	913

*NB refers to larger jacket flange size

Notes:

1. See table for minimum dimensions.
2. All reducers shall be concentric.
3. 1 fresh steam supply and 1 condensate connection or condensate jumpover is required for each reducer spool. See Figure 7 for positions of connections for vertical and horizontal configurations.



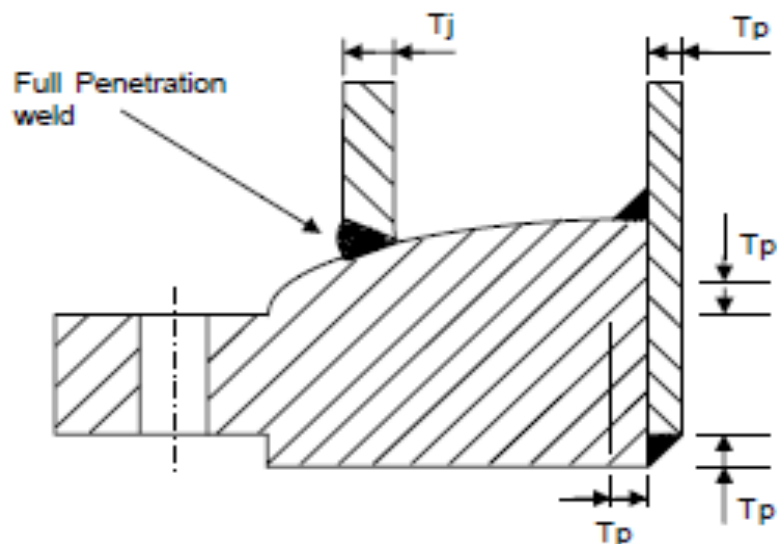
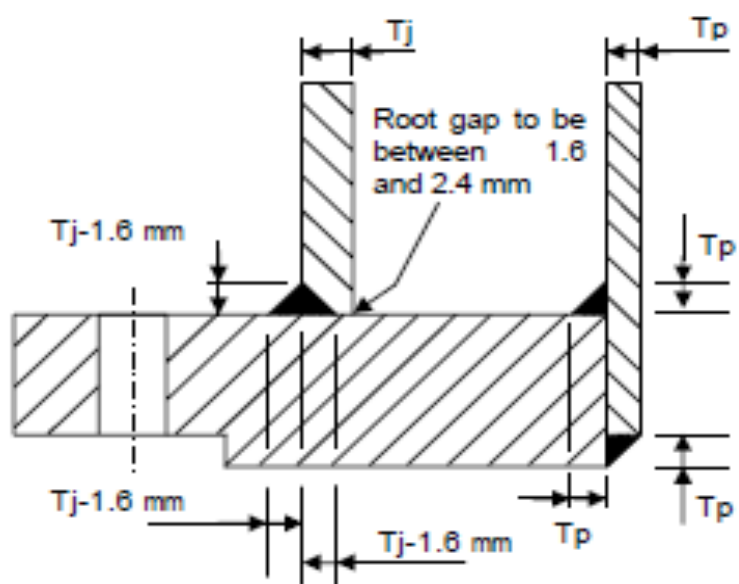
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Figure 10: Standard Weld Details



Reducing Flange Welding details for Jacket and Process Pipe



**Bored Blind Flange Welding details for Jacket and Process Pipe
(where required)**

1. T_p = Thickness of Pressure Pipe (mm)
2. T_j = Thickness of Jacket (mm)
3. Minimum weld dimensions to be in accordance with ASME B31.3 Section 328.5



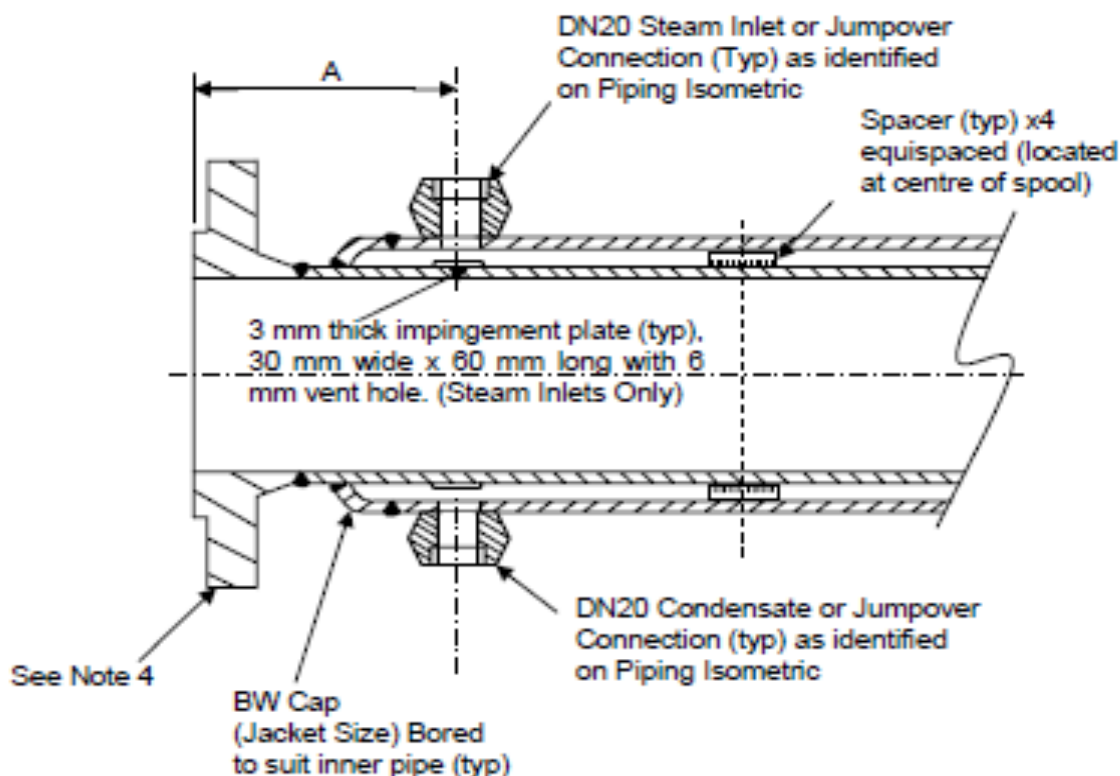
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Figure 11: Fabrication Method for Partial Jacketed Spool
(only to be used when connecting to a Non jacketed Nozzle or Valve*)



Notes:

- Complete welding and hydrotesting of inner pipe welds prior to welding of jacket.
- Summary of Welding Sequences:
 - Weld weldneck flange to inner pipe.
 - Slide cap over inner pipe.
 - Weld spacers and impingement plate to inner pipe.
 - Slide jacket length over inner pipe.
 - Weld reducing slip-on flange to other end of inner pipe.
 - NDT / Hydrotest inner pipe.
 - Weld caps to inner pipe & weld jacket to cap.
 - Complete the jacket by welding the split jacket to the jacket and slip-on flange.
 - Inspect jacket welds.
- Utility connections to be DN20 in locations as shown on piping isometric.
- Where the flange size is less than DN50, use a concentric reducer in the process pipe, boring the cap to suit the reduced size. Note that the jacket size is not reduced.

* Not preferred.

DN (mm)	A mm
50	260
80	285
100	325
150	355
200	395
250	435

To suit 150 and 300 rated flgs.



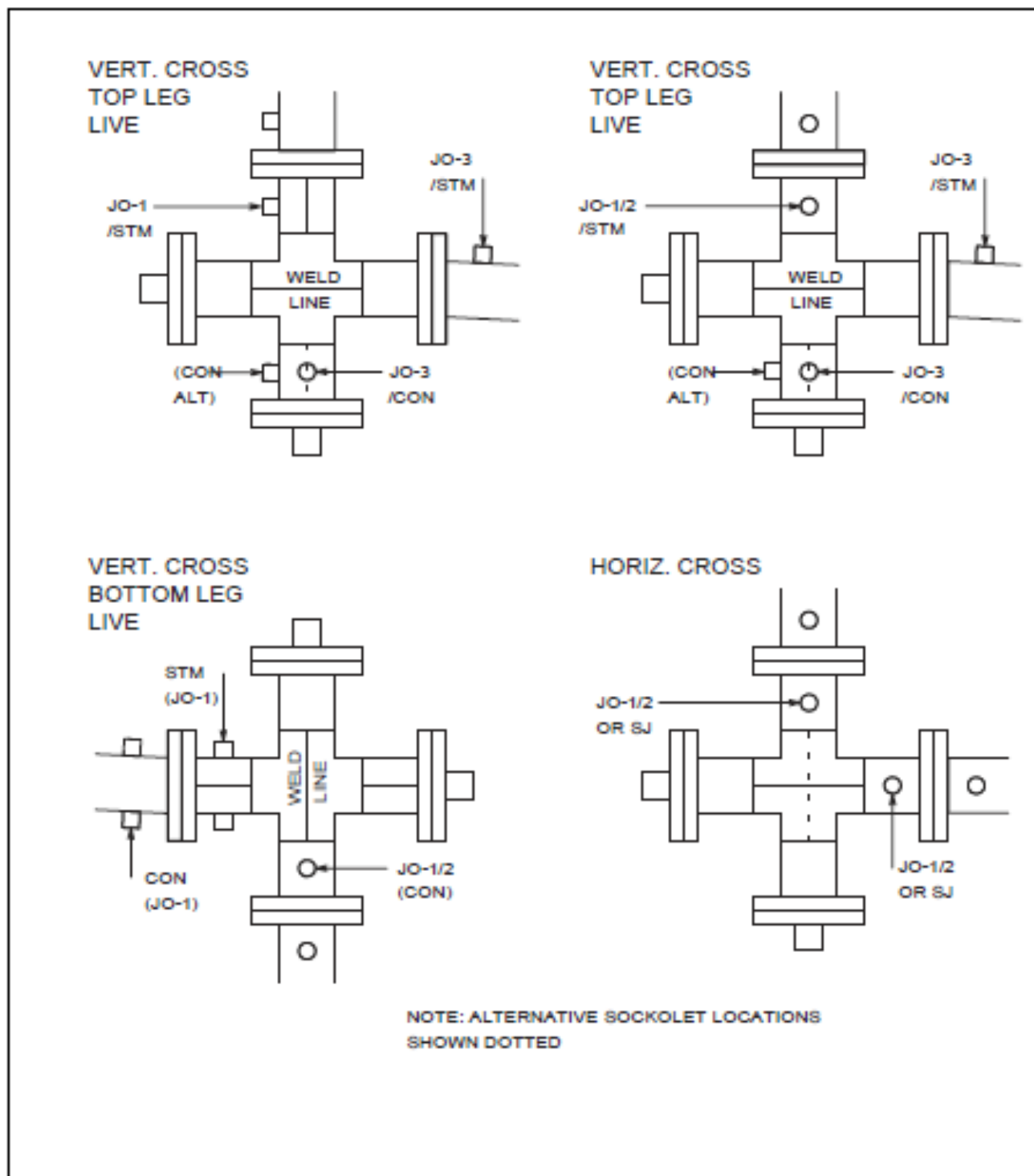
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Figure 12: Seam Weld Orientation for DN100 x DN80 and DN80 x DN50 Jacketed Crosses





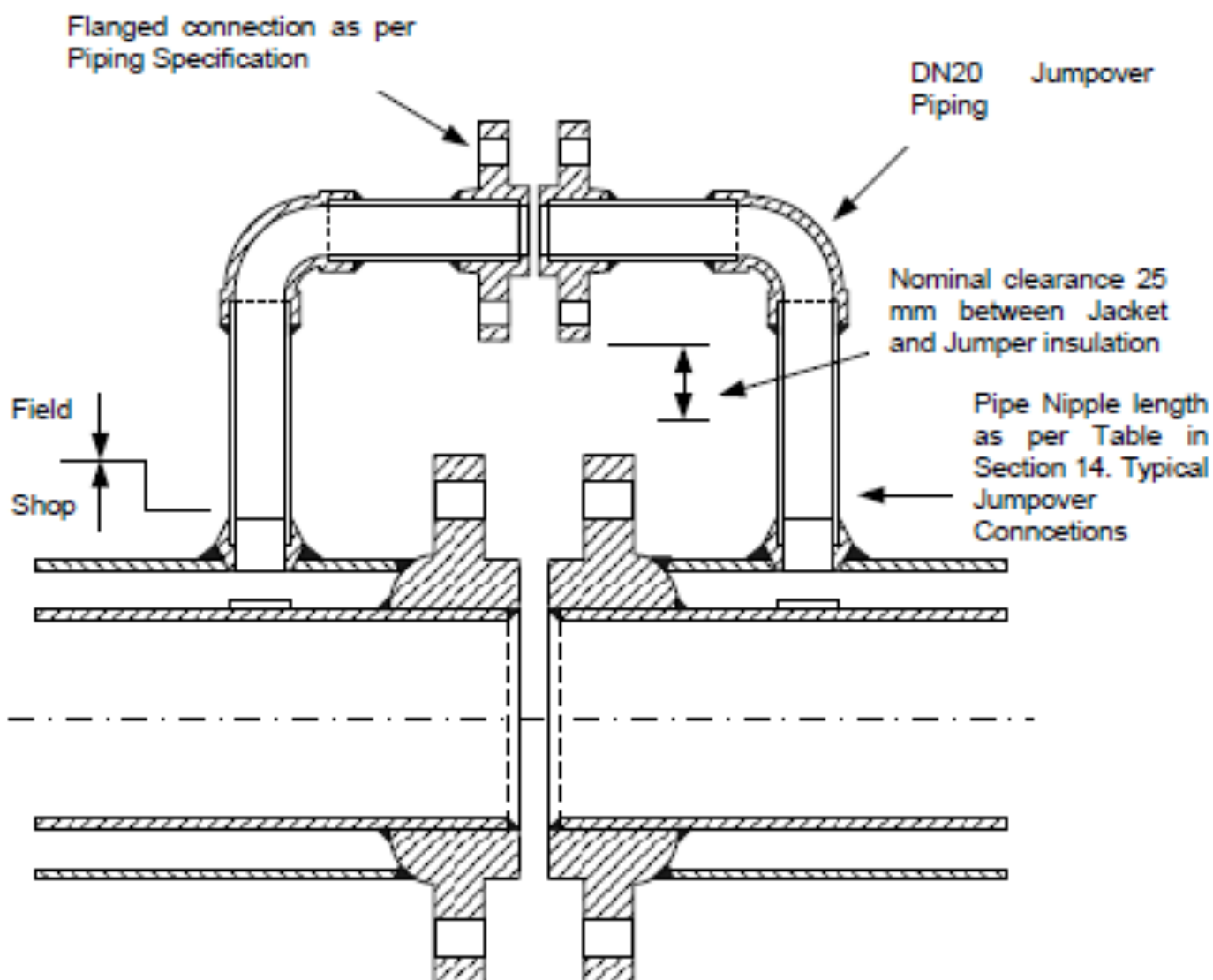
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Figure 13. Typical Detail for Jumpover Connections



Field fabricated components i.e. flanged connections and jumpovers to suit space constraints on site. See Fig 14.



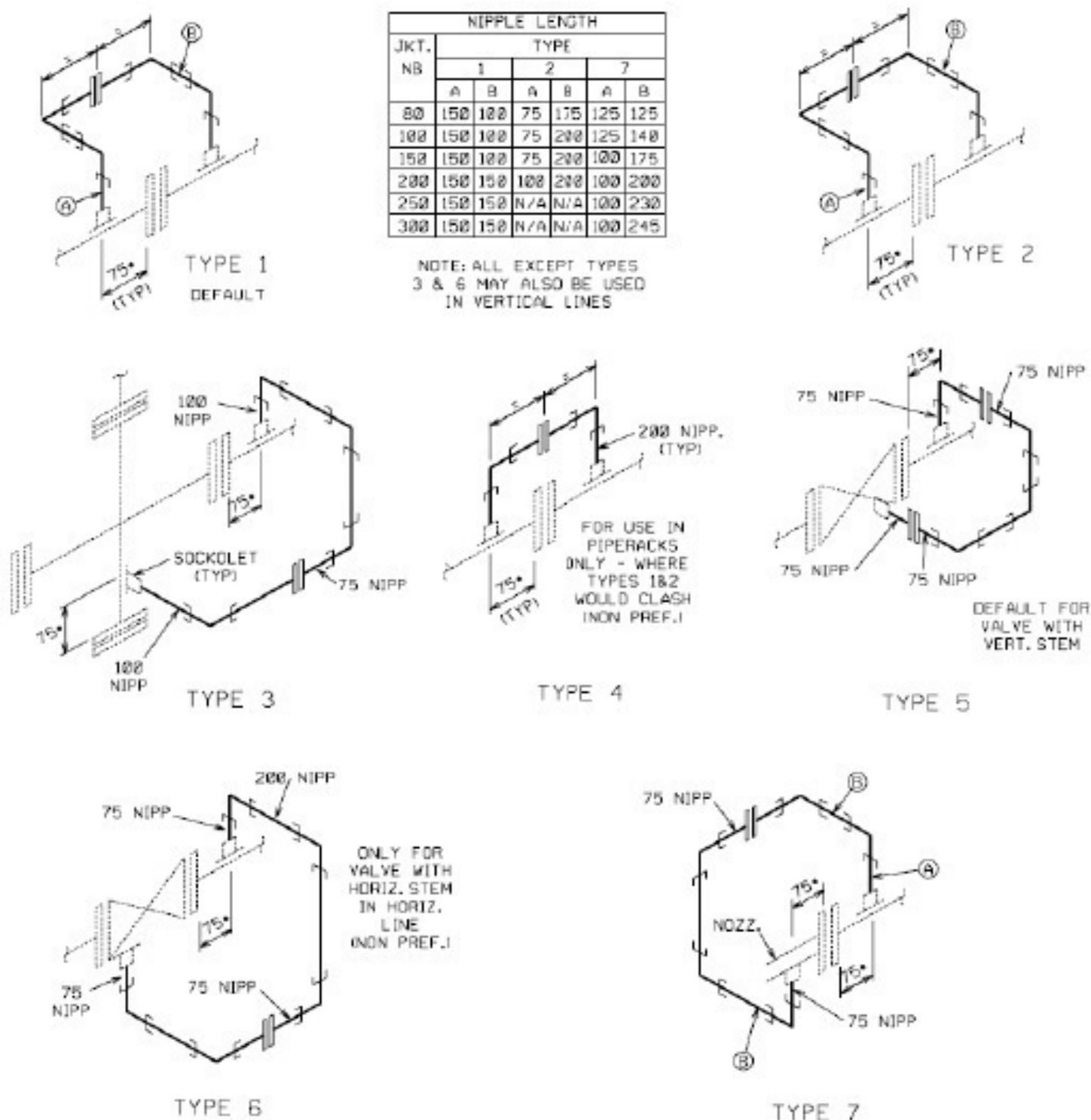


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FIGURE – 14 : TYPICAL JUMPOVER CONNECTIONS







DIMENSIONS MARKED THUS (*) ARE TAKEN FROM BACK OF FLANGE HUB

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1. **INTRODUCTION**

INDIAN OIL CORPORATION LIMITED (IOCL) has awarded Fax of Acceptance (FOA) dated 29th August 2019 to M/s. Technip India Limited (TPIL) for Consultancy services (PMC/EPCM services) for overall project management, FEED Review / FEED, Detailed Engineering, Procurement & expediting services, Tendering & award, Construction Management & Supervision, Assistance in start-up, Commissioning & performance test runs for installation of a Standby SRU of 525 TPD capacity and execution of Additional tanks for Paradip Refinery, Odisha, India.

2. **DEFINITIONS & ABBREVIATIONS**

Abbreviation	Definition /Expanded form
IOCL/ CLIENT	Indian Oil Corporation Limited
PMC/ CONSULTANT	Technip India Limited
LICENSOR	Party selected by IOCL for process technology ownership for any UNIT
CONTRACTOR	Party whose services are obtained for performing the works specified as part of LSTK / packages.
EPCM	Engineering, Procurement & Construction Management Services.
LSTK	Lump Sum Turn Key portion of the work to be executed by CONTRACTOR
FEED	Front End Engineering Design
AUTHORISED REPRESENTATIVE	IOCL's/ CONSULTANT's representative authorized to act for and on behalf of them.
VENDOR	Any third party supplying the equipment/materials for setting up the Plant
PROJECT	Indicates Standby SRU and Additional tanks Project, Paradip Refinery
UNIT	Indicates any particular portion of the project to be built which can be Process related or Utilities/Offsites related
SRU	Sulphur Recovery Unit
OISD	Oil Industry Safety Directorate
ASME	American Society of Mechanical Engineers

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API	American Petroleum Institute
P&ID	Piping and Instrumentation Diagram
A/G	Above Ground
U/G	Under Ground
B/L	Battery Limit
ISBL	Inside Battery Limit
EOT	Electrically-operated Overhead Travelling
MTO	Material Take Off

3. **SCOPE**

This specification covers design and material requirements for above ground, external insulation of piping and equipment operating between ambient temperature and 760°C for the purpose of heat conservation, process stabilization, temperature maintenance, personnel protection and fire protection. Wherever necessary this specification indicates the basis for selecting a criterion.

This specification is suitable for use in normal process plant atmospheres. Alternative designs and materials would be specified if necessary for corrosive atmosphere or potential leaks and spills of chemicals.


All the codes/standards mentioned in this specification shall be of latest issue.

This specification does not cover cold service insulation.

This specification does not cover insulation for boiler or fired heaters and associated air heaters, economizers, flue ducting and air ducting.

Piping, equipment, storage tanks & vessels requiring insulation and the temperatures (operating temperatures) shall normally be specified, as applicable, on the following project documents:

- Piping and Instrument Diagrams (P&IDs) and Line Lists.
- Piping General Arrangement Drawings & Isometrics.
- Instrument Piping Details and Schedules.
- Vessel, Exchanger, Storage Tank and sphere documents and Insulation Schedules.
- Equipment suppliers General Arrangement Drawings for equipment items in Package plant.

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4. **DESIGN BASIS**

4.1 Criteria

Insulation thickness tables are based on heat loss criteria. For various parameters considered for insulation thickness calculations 'Guideline for selecting insulation material & thickness'. Selected 'Insulation thickness tables' for a particular job shall be as per 'Job Process design basis'.

Insulation is required for any of the following purposes, as indicated in P&IDs and line lists:

- Heat conservation
- Process stabilization to assist process control
- Steam tracing
- Electrical tracing
- Hot water or solvent tracing (liquid)
- Hot oil tracing
- Steam jacketing
- Hot water or liquid jacketing
- Hot Oil jacketing
- Fire Protection Personnel

Insulation for 'Personnel protection' is applicable where exposed surface temperatures exceed 60°C in normal or short-term operating conditions. Over internally insulated piping and equipment, provide open mesh metal guards and for surfaces which are not internally insulated, provide insulation on those parts of surfaces with which operating and maintenance personnel may come in contact while performing routine duties. The actual extent of insulation shall be determined by Field Construction Personnel and/or operating personnel using the criteria that the exposed surfaces located within 600mm horizontally or 2100mm vertically of a normal access, walkway or work area are to be insulated.

When heat dissipation is required in high temperature services, insulation shall not be provided. Wire mesh shall be used for high temperature surfaces up to 250°C to avoid the possibility of personnel contact. The minimum distance of mesh installation shall be 100mm. With reference to the Insulation Thickness Table for personal protection (Table 2), for thicknesses greater than 100mm the distance will be equal to the insulation thickness indicated in the table.

Internally refractory lined piping and equipment and any other items for which heat loss is essential shall not be insulated.

Insulation is not desired for piping and equipment for which heat loss is desired - excepting for personnel protection or to avoid thermal stress problems.

Instruments and associated piping (other than impulse piping/tubing) subject to operating flow and/or temperature conditions prevailing in the connected piping or equipment shall be insulated to the same requirements as that of piping or equipment. For impulse piping/tubing refer impulse piping insulation specifications described elsewhere in the document.

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4.2 Extent of Insulation on Piping Systems

Insulated piping systems shall have straight pipe, bends, tees and pipe-fittings completely insulated.

Unless otherwise specified, all valves and flanged joints shall be completely insulated only in steam, condensate service, hot oil lines and in lines which are trace heated or jacketed to maintain temperatures.

For bucket and float type traps the inlet piping and trap shall be insulated.

Insulation on inlet piping to thermostatic and thermodynamic steam traps shall terminate at approximately 500mm before the trap.

Steam trap outlet piping other than closed condensate recovery system shall not be insulated except for personnel protection reasons.

Heat traced instrumentation shall be insulated. The fluid contain sections of such instruments and the associated piping shall be completely insulated. Indication length shall remain visible. Instrumentation other than heat traced shall not be insulated unless otherwise required by Instrumentation department.

Insulation shall not be applied to the following, unless otherwise specified.

- Piping which becomes hot intermittently, such as relief valves, vents, steam-out and snuffing steam systems, flare and blowdown systems.
- Steam condensate lines downstream of steam traps discharging to drainage system, unless otherwise mentioned.
- Supports for piping, excluding pipe hangers to the extent covered by insulation.
- Steam Traps (except as noted in paragraph 4.2).
- Valves, including control valves and flanges in process piping systems (except as noted in paragraph 4.2). However, personnel protection insulation for these items shall be applied, as required.
- Pipe Union fittings.
- Thermowell bosses, temperature and pressure tapings. Expansion joints, hinged joints and hose assemblies Sight flow indicators. Flange joints in Hydrogen service.

4.3 Extent of Insulation on Equipments

Support skirts of insulated vertical vessel greater than 1200mm diameter shall be insulated both internally and externally for a minimum distance of 600mm below the bottom tangent line. The insulation shall terminate not less than 300mm above the anchor chair.

Support skirts of insulated vertical vessels of 1200mm and less shall be insulated externally only, as described in above paragraph.

Bottom heads of insulated vertical vessels enclosed by a support skirt shall be insulated without finishing material and shall be insulated only when the vessel outside diameter is greater than 1200mm.

Turbines shall be insulated for heat conservation.

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Liquid ends of pumps shall be insulated when heat traced and jacketed.

Insulation shall not be applied to the following unless otherwise specified:

- Pumps with operating temperature below 200°C unless pumped fluid has a pour point above minimum design ambient temperature.
- Fans, compressors and blowers.
- Liquid ends of pumps except as noted in the above paragraph.
- Internally insulated or refractory lined equipment unless specially designed for metal temperature control.
- Internal surfaces of insulated vessel support skirts with vessel diameter 1200mm or less.
- Turbine casings to be insulated shall exclude shaft seal caps, shaft bearing housings, throttle valves, governors and supports.
- Expansion Joints of exchanger.
- Nozzles flanges, manholes, hand holes and flanges of equipment.
- Surfaces of coolers and condensers.
- Nameplates of all equipment items.
- Thermowell bosses, temperature and pressure tapings.

5. **MATERIALS**

5.1 **General**

Insulation materials shall be as per specifications described in para 5.2. Selected material

For a particular job shall be as per Process Design Basis.

All materials shall be of high quality and good appearance. Insulation materials shall be of low chloride content, chemically inert, non-sulphurous, rot proof, vermin proof, impervious to hot water and steam, non-injurious to health and non-corrosive to steel and aluminium (even if soaked in water at ambient temperatures for extended periods).

The use of insulation or finishing materials containing ASBESTOS in any form it's not permitted.

No inflammable material shall be attached to the insulation.

Fibrous insulants, calcium silicate, perlite and ceramic fibers can be used for the full temperature range mentioned against the respective material, for all applications except for electrically heated applications.

For electrically heated applications Polyurethane foam (PUR) or Polyisocyanurate (PIR) blocks shall be used in combination, with Rockwool as inner layer.

For low operating temperature (up to 125°C) services a suitable moisture barrier shall be used.

Insulation materials to be used over austenitic stainless steel surfaces shall be zinc free and shall be inhibited with sodium silicate as per ASTM C-795. The amount of leachable chloride in the insulation material (except for calcium silicate) before application shall not exceed 10ppm. In case of calcium silicate it should not exceed 50ppm. For the chemical analysis of insulation materials ASTM C-871

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shall be referred.

Dimensions and dimensional tolerances for pipe sections, mattresses & slabs shall generally be as per respective codes unless otherwise mentioned. The number of pieces to be used shall be as less as possible. When installed the insulation shall fit snugly and shall have a tight joint.

The insulation materials shall be as per ASTM/BS standards/codes for overseas jobs unless otherwise specified.

5.2 Insulation Materials

Fibrous Materials (Rockwool)

Shall be a preformed insulation and shall be of long fibred rock wool material processed from a molten state into fibrous form bonded with a binder and suitable for the intended operational temperature range from ambient to 550°C for Rockwool . Slag wool is not acceptable.

Unless otherwise specified, insulation material shall strictly conform to all the requirements of quality standards listed below:

- **Preformed pipe insulation** IS:9842/ASTM C547 TYPE II or TYPE III
- **Metal-mesh covered bonded mineral fibre blanket and blanket type pipe insulation** IS:8183/ASTM C592 CLASSII for piping & equipt. Blankets shall be faced on one side with 20mm galvanised 22SWG wiremesh stitched through with 22 SWG galvanized lacing wire. For insulation over 'Austenitic SS Piping & Equipment' instead of galvanized wiremesh & lacing wire SS304/316 wiremesh & lacing wire shall be applied.
- **Bonded Mineral fibre slab insulation** IS:8183
- **Mineral fibre block & board thermal insulation** ASTM C612 TYPE IV/ TYPE V

Insulation shall conform to the requirements of respective codes, unless otherwise specified herein and shall be tested and test certificates on representative samples furnished as per IS:8 /83/IS:9842/ASTM:C547/ ASTM:C592 / ASTM:C612.

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• Density(min)	140 & 128 kg/m ³ for resin bonded pipe sections and resin bonded LRB blankets respectively of rockwool; 80 & 64 kg/m ³ for resin bonded pipe sections and resin bonded curved beveled segments or LRB slabs respectively of glasswool. Max resin content at the above mentioned densities shall be 2% and 5% for rockwool and glasswool respectively. 140 kg/m ³ for IS8183 bonded mineral fibre slabs and 240 kg/m ³ /320 kg/m ³ for ASTM C612 TYPEIV /TYPE V respectively.	
• Thermal Conductivity(max)*	**Mean Temperature °C	Thermal Cond. (mW/cm °C)
	50	0.43
	100	0.52
	150	0.62
	200	0.68
	250	0.80
	300	0.90
*The values mentioned are for insulation material as per IS code; For Apparent thermal conductivity for material as per ASTM codes refer respective ASTM code.		
**Mean Temperature = (Hot Face Temperature + Cold Face Temperature) / 2		
• Linear Shrinkage	Not more than 2 percent when subjected to soaking heat at the stated max. temperature of use (550°C), for 24 hours.	
• Compressive Strength (minimum) at 10% deformation	250 kg/m ² for resin bonded pipe sections, curved bevelled segments and LRB slabs; 120 kg/m ² for LRB blankets(mattresses) unless otherwise specified.	
• Chloride Content	For stainless steels, with inhibitors less than 10 PPM, for other materials not to exceed 20 ppm.	

Flame spread Index= 0 (non Combustible)

Low resistance to water vapor Transmission -0.3 mg/h/pa.

Rigid Materials (Calcium Silicate, Moulded Expanded Polyisocyanurate / Polyurethane Foam Blocks and Cellular Glass)

Calcium Silicate

It shall be suitable for temperatures up to 760°C. Insulation shall conform to the requirements of respective codes, unless otherwise specified herein and shall be tested and test certificates on representative samples furnished as per IS 9428/ASTM C533.

• Bulk Density	200 to 280 kg/m ³ .
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• Compressive Strength	Reduction in thickness shall not exceed 10% when tested a) Dry under a load of 415 kN/m ² and b) Wet (after 18 hrs immersion in water) under a load of 170 kN/m ² .	
• Heat Resistance	When tested at increasing temperatures, the material shall be deemed suitable for use under conditions of soaking heat, for 24 hrs, upto a temperature at which the following requirements are met: Max.Linear Shrinkage(length) 2% Max. Loss in Mass 15% Compressive Strength Reduction in thickness not exceeding 10% under a load of 345 kN/m ² .	
• * Thermal Conductivity (max)	**Mean Temperature °C	Thermal Conductivity(W/mk)
	200	0.080
	250	0.088
	300	0.097
	350	0.110
	400	0.121
	450	0.135
	500	0.148
• Chloride content	Not to exceed 50 PPM for CS as well as SS	
*The values mentioned are for insulation material as per IS code; For Apparent thermal conductivity for ASTM code material refer respective ASTM code.		
**Mean Temperature = (Hot Face Temperature + Cold Face Temperature) / 2		

Moulded Expanded Perlite



Insulation shall be block form and pipe sections in accordance with ASTM C610. It shall be compounded from moulded expanded perlite & sodium silicate binder and shall be suitable for temperatures up to 550°C. Insulation shall conform to requirements of respective codes, unless otherwise specified herein and shall be tested and test certificates on representative samples furnished as per ASTM C610. 'Perlite material shall be tested as per C-692 for application over SS surfaces'. This material shall be applied for lines with low ground clearance especially at culvert crossings to avoid loss of heat during water clogging.

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• Bulk Density(min)	192 kg/m ³ . Test as per ASTM C302 (pipe) & ASTM C303(block)	
• Compressive Strength (for blocks only) at 5% deformation	412 kPa(Min). Test as per ASTM C165.	
• Apparent Thermal Conductivity	Shall be as given below: Test method shall be as per ASTM C177/C518 (Block) & ASTM C335 (Pipe)	
	Mean Temp °C	Thermal Conductivity Max. W/mK
	93	0.079
	149	0.086
	204	0.095
	260	0.106
	316	0.111
	371	0.126
• Water Absorption of thermal insulation After heat aging & 48 hr water immersion, moisture gain, % by weight (max)	149	50
	260	50
	371	60
• Linear shrinkage	2%(max) at 649 °C for 24hrs	
• Chloride content	For stainless steels, less than 10 PPM, for other materials not to exceed 20 ppm	

Polyisocyanurate (PIR) / Polyurethane (PUR)

Rigid Polyisocyanurate / Polyurethane foam block, pipe and fitting insulation shall be manufactured with polyester or polyether resins, flammability retarding agents, special catalysts and a blowing agent. This can be used up to a temperature of 125°C. Insulation shall conform to following requirements and shall be tested and test certificates on representative samples furnished for conformance to each of the following requirements:

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• Selection of samples for testing	As per ASTM C390 OR BS:2972 (Frequency of sampling clause IV). Unless otherwise stated, the test specimens shall be conditioned without external stress at 23±1°C and 50±2 percent relative humidity for a minimum of 24 hours before testing.		
• Density	40 to 64 kg/m ³ To be tested as per ASTM C303 for Block-type and ASTM C302 for pipe covering.		
• Thermal Conductivity	Mean Temp. °C	Thermal Conductivity (Maximum) mW/cm deg	
	10	0.238	
	24	0.245	
	38	0.252	
	Thermal conductivity test shall be as per IS:3346 or ASTM C177. Specimen thickness shall be as per IS:3346 or 25mm per ASTM C177.		
• Comp. Strength (Min.)	After drying at 102°C - 120°C for constant mass as per ASTM C165, at 10% deformation or at yield point, whichever occurs first, shall be 205 KPa. Test shall be as per IS:11239 part X.		
• Water-vapour permeability (max)	8.5 & 5.5 ng/(Pa.s.h) for PIR & PUR respectively Test shall be as per BS5608 or IS12436		
• Fire properties	Insulation shall be self extinguishing type and shall satisfy the requirements for maximum extent of burn (less than 25mm for PIR and 125mm for PUR) when tested as per BS:5608 (Horizontal burning characteristics- max. extent of burn) or IS:12436		
• Flexural Strength	This is applicable to preformed pipe coverings only and shall be 275Kpa(min). Test shall be as per ASTM C446.		
• Humid aging	(Max. allowable value after aging at 60°C – 90 to 100% relative humidity)-Maximum percent change in linear dimension shall be 4. This limit applies to each of the three foam direction. Test shall be as per ASTM D2126.		
• Closed cell content	Minimum percent 85. Test as per BS:4370 Part – II (Test for closed cell content)		
• Dimension stability after heating	Test method as per IS:11239 Part – II The max. dimensional change at different temperatures shall be..		
	100°C ± 2°C (24 hr)	2%	
	125°C ± 2°C (24 hr)	2%	
• Standard size and dimensions	<u>Block</u>		
	Length	upto 2400mm	
	Width	upto 1200mm	
	Tolerance	On length	±6mm
		On width	±3mm
		On thickness	±1.6mm
	<u>Pipe Insulation</u>		
	Length	750 to 1000mm	
	Inside diameter	To suit standard steel pipe	
	Shall be supplied as cylindrical shape slit in half lengthwise or as curved segments cut from blocks or moulded segments cut from blocks or moulded to shape. Upto 14" size, only pipe sections slit in half lengthwise shall be used.		
	Dimensional Tolerance:		
	Length	± 6mm	
	Thickness	± 1.6mm	
• Thickness	20, 25, 30, 40, 50, 60 and 75mm		

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Cellular Glass

Cellular Glass formed and fused into unicellular form can be used up to a temperature of 350°C. Insulation shall conform to the requirements of respective codes, unless otherwise specified herein and shall be tested and test certificates on representative samples furnished as per ASTM C552.


• Density		110 to 147 kg/m ³ . Test as per ASTM C303 except that no drying will be necessary. Determine the no. of specimens as per ASTM C390.	
• Thermal conductivity (max)	conductivity	Mean Temp°C	W/m.k
		149	0.078
		93	0.063
		38	0.052
		24	0.050
		10	0.048
		Thermal conductivity shall be tested as per ASTM C240, C177 and C518. Test at least 3 specimens.	
• Compressive (Average min)	Strength	517 kPa Test as per method ASTM C240 and recommended Practice ASTM C165. Test at least four specimens.	

High Temperature Insulation Materials (Above 550°C)

Following types of insulations may be used for high temp insulation applications.

Ceramic Fiber

Ceramic Fiber shall be composed principally of Alumina silica fiber blanket. It should be used in the temperature range of 551°C to 760°C. Ceramic fiber blankets shall be made from fibers having fiber length of about 10 cm or more. It shall normally be of 610mm width, 13mm or 25mm thickness. Unless otherwise specified insulation shall conform to the requirements of ASTM C892 Type III, Grade 8 or to the specifications described in the table below. Insulation shall be tested and test certificates on representative samples furnished. Ceramic fiber blankets shall be sampled for the purpose of test in accordance with ASTM C390.

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Sl No	Chemical & Physical characteristics of Ceramic Fibre Blankets		Test Method
•	Chemical composition(By volume%)		
	Al ₂ O ₃ (Min)	43	IS 1335
	ZrO ₂ (Min)	-	IS-10085
	Fe ₂ O ₃ (Max)	0.1	IS-1527
	TiO ₂ (Max)	0.3	IS1527
	SiO ₂ (Max)	57	-
•	Mean Fibre Dia (Microns)		
	(Upto 3% Standard deviation)	2.5-3.5	BS-2972
•	Dimensional Tolerance		
	Thickness	(-) 0% to (+)40%	-
	Width	(-)2% (Excess is permitted)	-
	Length	(-)0% (Excess is permitted)	-
•	Shot Content(% Max)	20	ASTM C-892
•	Bulk Density(Kg/m ³ Min)	128	ASTM C-167
•	*Bulk Density Tolerance	(+) 30% & (-)0%	-
•	Thermal Conductivity (Kcal/M/Hr°C)**Max (Mean Temp)	0.11(600°C)	ASTM C-177/IS-3346
•	Linear Shrinkage(%) (at max temp) for 24hrs	3(1200°C)	ASTM C-356
•	Tensile Strength(Kg/cm ² g(min)		
	Longitudinal	0.6	BS 1902 part 6
	Transverse	0.5	
* The density shall be calculated on the basis of actual dimensions and actual weight only, as offered by the manufacturer.			
**In case of thermal conductivity, the test certificate from an international laboratory or any laboratory approved by department of Science & Technology could be considered. However, the same shall indicate values for other characteristics of the material. The test certificate shall not be more than 12 months old from the date of offer of material for inspection.			

- 2 **Calcium Silicate**
For material specifications refer clause 3.2.2(1)
- 3 **Combination Insulation of Ceramic Fibre (Inner layer) & Rockwool (Outer layer)**
For material specifications refer clause 3.2.3(1) & 3.2.1
- 4 **Combination Insulation of Cal. Silicate (Inner layer) & Rockwool (Outer layer)**
For material specifications refer clause 3.2.2(1) & 3.2.1

Insulation material for Impulse lines

For impulse lines (Austenitic Stainless Steel), insulation material shall be sodium silicate inhibited Ceramic fibre rope insulation of min density 250 Kg/m³, unless otherwise mentioned. Ceramic Fibre rope shall be made up of Ceramic Fibre insulation. It shall comprise of ceramic fibres laid parallel and finally wrapped with stainless steel wire to reinforce the fibres and holding it in position. Other properties of ceramic fibre shall conform to the specifications as described in paragraph 5.2.

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Additional Tests / Checks for Materials

Additional tests/ checks for density, thickness, shape and size as per the requirements shall be repeated at site at the time of delivery once for each lot. The Contractor shall perform these tests in the presence of Client/Client's representative on the sample selected at random. In case of nonconformance the tests shall be repeated as per norms and frequency decided at site as per the directions of Site-in-Charge. In case of repeated nonconformance, the complete lot of insulation material shall be rejected. Special attention is required for fibrous material as its installed thickness could be reduced due to compaction during transportation & storage and thus affecting performance.

All the codes mentioned shall be the latest issues.

Client/Client's representative/Contractor shall have right to inspect any or all the tests conducted on insulation material by manufacturer at his shop or any laboratory.

Quality Assurance Plan (QAP)

Vendor shall prepare and submit the Quality assurance plan (QAP). The QAP shall include every stage of manufacturing process starting from raw material stage to final stage of manufacturing. The QAP shall also include reference of purchase order number and date, the types of checks, methods of tests followed, frequency of checks, lot size & acceptable criteria with permissible deviations.

5.3 Weather Protection Jacket

Unless otherwise mentioned, aluminium jacketing shall be used as weather protection over insulation except in fire hazardous areas /above 550°C where it should be stainless steel or aluminized steel. Galvanized jacketing shall not be used over insulation on or near austenitic stainless steel and/or austenitic nickel steel Piping & Equipment. Aluminum jacketing shall be as per ASTM B209 Alloy 3003 H16 or IS:737 designation 31000 condition H3 for flat sheets and designation 31500/51300 condition H4 for corrugated sheets. For stainless steel cladding, the materials shall be in accordance with ASTM A167 or A240, type 304 or 316. For aluminized steel cladding, the material shall be in accordance with ASTM A463, type2, coating designation T2-100. Cladding shall be coated on the side in contact with the insulation. All metallic jacketing, except for sound control applications, shall be furnished with a factory laminated moisture barrier of 64µm thick coextrusion of polyethylene and Surlyn. Jacketing for sound control insulation shall be laminated to mass-loaded vinyl and provide a minimum sound transmission class of STC 26 in accordance with ASTM E90.

Thickness of the jacketing shall be as follows:

Item	Size	Thickness	material
PIPE	up to 6"	0.6mm	Flat Aluminium ASTM B209 Alloy 3003 or 5005 - H14 or H24
PIPE	8" up to 18"	0.71mm	Flat Aluminium ASTM B209 Alloy 3003 or 5005 - H14 or H24
PIPE	over 18"	1.0mm	Flat Aluminium ASTM B209 Alloy 3003 or 5005 - H14 or H24
EQUIPMENT	up to 18"	0.8mm	Flat Aluminium ASTM B209 Alloy 3003 or 5005 - H14 or H24
EQUIPMENT	over 18"	1.22mm	Flat Aluminium ASTM B209 Alloy 3003 or 5005 - H14 or H24
PIPE	All sizes	0.56mm	Flat Stainless Steel 304 or 306

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EQUIPMENT	up to 24"	0.56mm	Corrugated Stainless Steel 304 or 306
EQUIPMENT	over 24"	0.91mm	Corrugated Stainless Steel 304 or 306

2 Rigid Material (Calcium Silicate, Moulded Expanded Perlite, Polyisocyanurate, Polyurethane Foam(PUR) Blocks, Cast-in-situ Polyurethane foam and Cellular Glass)

• Application	Thickness for Aluminum jacket / cladding	Thickness for Stainless steel / Aluminized steel jacket/cladding
• Piping, Horizontal Vessel head & Tanks Roof	0.56mm(24 SWG) flat	0.46mm(26 SWG) flat
• Vertical Vessel Shells & vertical portion of storage Tanks.	0.56mm (24 SWG) corrugated. The circular profile of corrugated sheet shall be 32mm 5mm	0.46mm (26 SWG) corrugated. The circular profile of corrugated sheet shall be 32mm 5mm
• Removable covers	1.22mm (18 SWG) Flat	1.22mm (18 SWG) Flat

Jacketing for the acid area and fireproofed insulation systems shall be 304 or 316 stainless steel.

5.4 Ancillary Materials

Securement Bands / Wires

If material is Aluminum, then specification shall be ASTM B209 Alloy 3003 H16 or IS:737 designation 31000 (Old NS3) condition H3; If Stainless Steel, it shall be 18/8.

For securing fibrous insulation

- On Piping Band, 24 SWG thick x 15mm (min) wide up to DN200 to 25mm (DN250 & above), Stainless Steel.
- On Equipment Band, 24 SWG thick x 20mm wide, Stainless Steel.
- On Vertical Storage Tanks Band, Stainless Steel, 25mm wide x 24 SWG thick.
- Horton Sphere 16 SWG SS Wire & Band, Stainless Steel, 25mm wide x 0.8mm (min.) thk.

For Securing Rigid Insulation

- All sizes of Piping, Vertical and Horizontal equipments Band, stainless steel. 20 wide x 24 SWG thick.

For Securing Cladding on Insulation (all types)

- For Piping Band, SS 12mm (min) wide x 24 SWG thick.
- On Equipment Band SS 20mm wide x 24 SWG thick.
- On Vertical Storage Tanks & Spheres Band, Stainless Steel, 25mm wide x 24 SWG thick.

Rivets

Rivets required for metal jacket securement shall be the expanding Aluminium "POP" blind eye type/

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Stainless Steel, 9.8mm long x 5mm diameter.

Screws

Screws required for metal jacket securement shall be Stainless Steel/cadmium plated steel self tapping type A No.8 dia x 12mm long to BS 4176 complete with neoprene washers under the head.

'S.' and 'J' clips

Formed from 25mm wide stainless steel banding.

To ensure perfect water proofing, all the cladding joints shall be packed with sealing materials which may either be in the form of a elastomeric sealing compound or fibre based bituminous felt strips.

5.5 Personal Protection Guards

Guards and their supports shall be manufactured from carbon steel, which may be galvanized or painted or with stainless steel (The mesh may be pointed with yellow stripes, 50 mm wide, and shall include a hazard sign indicating 'Hot surface') The guard mesh shall be of 2mm thick and 12 mm square. Guard shall be designed with end cap of 0.7 to 1 mm thick from galvanized Al-Zn coated or Al coated carbon steel with recommended spacing of 450 mm to 600 mm. Care to be taken that the end caps are filled in an orientation that will allow water drainage. If the metal surface required greater protection, a fibre glass insulation tape can be fitted to area where end caps make contact to protect pipe work and reduce heat transfer. Mesh shall be rolled to share as per normal cladding and shall be provided with 50 mm of overlap, sharp edges of cut mesh to be filed. In case of removable guard the same can be made from toggle clips.

6. APPLICATION

6.1 General

The application methods, given in this Standard are general in nature. The Contractor is responsible for applying an insulating system that will give a satisfactory operational performance and the requirements given herein shall be regarded as the acceptable minimum. The Contractor shall carryout the work in accordance with the best practices of insulation application with the minimum of waste and debris and the final job shall have a neat, efficient and workman like appearance.


The insulation shall be so designed/applied such that ingress of water is prevented, leaked product can drain off and vapor can escape.

All hydrostatic tests on piping and equipment, including steam tracing systems, shall be carried out before insulating material is applied.

The insulation Contractor shall only insulate those sections of the plant that have been specifically released for such work by the engineer in charge. If insulation must be installed before pressure test, then all welds and flanged joints in the pipe shall be left uncovered till successful completion of pressure test. Then insulation shall be completed.

Surfaces to be insulated shall be thoroughly cleaned, dried and made free from loose scale, oil or grease. It shall be the Contractor's responsibility to remove loosely adhering scale and dirt before applying insulation.

Insulation shall be finished, beveled and weatherproofed at all terminal points where it is required to remove bolts etc. without damage to the insulation.

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Equipment nameplates shall remain visible after insulation has been applied by bevelling back the insulating material and carefully sealing the exposed edges to prevent ingress of moisture.

All projections, such as lifting lugs, trunnions and stiffeners on piping, equipment & Tank (i.e. vacuum rings) shall be insulated with the same thickness of insulation as specified for the equipment item or pipeline.

Thermowell bosses, pressure tappings and weep hole nipples shall not be insulated in but left accessible.

For Insulation thicknesses up to 75mm only single layer insulation shall be used. Multi-layer insulation shall be required when the insulation thickness is greater than 75mm with the inner layer being larger. Insulation installed in two or more layers shall be staggered joint construction and each layer shall be secured in place and details of securement shall be the same for each layer.

Wet or Damaged Insulation shall not be used under any circumstances.

Material awaiting its protective cover shall be adequately protected from damage, rain and contamination and shall be covered with cladding at a minimum loss of time.

A minimum clearance of 25mm between outside surface of any insulation finish and adjacent equipment, pipe or structural members shall be maintained.

Insulation supports shall not project out of the insulation outer surface and shall be given sufficient coverage of insulating material to avoid hot spots on the metallic cover at support positions.

Where insulated horizontal piping is supported on steel shoes, the height of the shoe shall be such that the underside of the insulation finishing material is clear of the supporting structure upon which the shoe rests by 25mm minimum.

Pieces of insulation with crushed and damaged ends shall not be used.

Corrosion Prevention

Piping, Equipment, Tanks etc shall be protected against corrosion by painting under insulation as per specifications 080557C-000-JSD-2300-001.

6.2 Piping

Standard Shapes of insulation

Fibrous Material (Rock wool)

Shall be preformed pipe section in 2 halves for sizes upto which manufactured and at least for all pipes with outside diameter over insulation of 500mm. In bigger sizes, multi-segments are preferable if manufactured, otherwise, blankets are acceptable.

Calcium Silicate / Moulded Expanded Perlite

Hollow cylindrical shapes slit in half lengthwise (in a plane including the cylindrical axis) or as curved segments. Up to 14" pipe size, only hollow cylindrical shapes slit in half lengthwise shall be used. Pipe sections bored / machined out of blocks shall not be used.

Polyisocyanurate / Polyurethane

Shall be supplied as cylindrical shape slit in half lengthwise (in a plane including the cylindrical axis)

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or as curved segments cut from blocks or moulded to shape. Up to 14" pipe size, only pipe sections slit in half lengthwise shall be used.

Cellular Glass

Shall be supplied as cylindrical shape slit in half lengthwise (in a plane including the cylindrical axis) or as segments. Up to 14" pipe size, only pipe sections shall be used.

Ceramic Fibre

Shall be supplied in blanket strips in sizes as mentioned in the material spec in paragraph 5.2.

Application

Horizontal Pipe

General

Insulation material shall be applied to fit snugly against the contours and shaped only where necessary to achieve this requirement. The insulation shall be carried out with the least number of material pieces as possible and all unavoidable gaps, cavities, and voids suitably filled up compatible loose fill material.

Pipe Section / Moulded Blocks / Segments

End joints of adjacent blocks shall be staggered one half of the length of the block.

Included angle between segments shall not be less than 30°C for both single and double layer insulation.

Further, minimum arc length of segments should meet following staggering requirements.

When double layer is applied, both longitudinal and circumferential joints shall be staggered. The arc between the longitudinal seam lines of the inside and outside layers of insulation shall have an angle of over 15°C or the longitudinal joints staggered at least by one layer thickness, whichever is more stringent. Circumferential seams of the inside and outside layers shall be at least 100mm apart.

Blankets (Fibrous insulation- Rock wool)

Shall be applied over the surface with joints tightly butted and laced together with 1mm diameter galvanized lacing wire.

Insulation Securement (All insulation materials)

Each layer of insulation shall be secured firmly in place with at least 3 loops of binding wire / band, one loop to be placed not more than 75 from each end and at least one loop to be equally spaced between end loops, for each section. Binding wire shall be drawn about the insulation with ends tightly twisted together, bent under & pressed into the surface of insulation. Bands or wires in no case be spaced more than 200mm apart.

For calcium silicate & Moulded expanded perlite, all joints shall be sealed with insulating cement of same composition as the Moulded block.

For Cellular glass, Polyurethane foam and polyisocyanurate, joints shall be sealed with suitable compatible material.

Each layer of insulation shall be secured by the same method as above.

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Frame work for supporting cladding fibrous insulation (See Fig: 3 and 4)

This is not necessary for rigid materials. This is required only for horizontal pipe runs provided with fibrous insulation, in blanket forms; vertical piping provided with fibrous materials need not be provided with this. Piping provided with fibrous resin bonded pipe sections also need not be provided with this framework.

Spacer rings shall be fabricated out of 25 x 3 M.S. Flats. The outside diameter of these rings shall be equivalent to the outside diameter of the insulation. Spacer rings shall be riveted to 'Z' shaped stays fabricated from the same sized M.S. Flats. These rings shall be suitably painted for corrosion protection. Stays shall be provided at intervals of not more than 300 along the circumference of the insulation, subject to a minimum of 3 stays. Spacer rings shall be provided at every approx. 900mm. To minimize direct heat conduction through the stays, a packing of 2 sheets of 3 thick mill board shall be provided at the joints of the stays and pipes. Joints between M.S. Spacer Ring and stays shall be riveted by 6 dia M.S. Rivets with 2 Sheets of 3 thick mill board interposed.

Vertical Pipe (All insulation materials) (See Fig.5)

Insulation on vertical or near vertical piping (i.e. greater than 45°C angle from horizontal) shall be supported by bolted on metal collars. Metal collars shall be of 6 thick M.S. or Alloy Steel bar (to suit piping material).

Outside diameter of collar shall be around 12 less than O.D. of insulation. Where multi-layer insulation is used, support collar shall be extended to provide for each layer.

Support positions shall be at no greater distance apart than the following:

<u>Pipe operating Temp.(°C)</u>	<u>Support Spacing</u>
Upto 400	4500mm
401 to 500	3500mm
501 to 550	2500mm
551 to 650	2000mm
651 to 760	1500mm

Expansion Joints (Both vertical and horizontal piping. All insulation Materials)

Expansion joint shall be provided at regular intervals as below:

<u>Temp (°C)</u>	<u>Spacing (m)</u>
Upto 200	Not required
201 to 300	10
301 to 350	8
351 to 400	6
401 to 550	5
551 to 650	4
651 to 760	3

Expansion joint shall be formed by a 25mm space between the pipe insulation sections and the space shall be filled by compressed mineral rock fibres. Expansion joints in each layer shall be offset at least 150 from each other in case of multi layer insulation. Expansion joint for first layer for vertical pipe shall preferably be just below insulation support collars.

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Elbows and Bends (All insulation materials) (See Fig.6 and Fig.7)

Insulation material shall be mitred and shall be same as that of pipe. Insulation securement bands/wire shall be same as that for equivalent dia pipe. Each mitred section shall be secured with minimum 2 wires/bands. For bends / elbows of nom. pipe size 6" & below, due to lack of space, for all insulation materials, insulation shall be secured by spirally wound 16 SWG SS wire for hard materials & 10 SWG SS wire for soft materials. Insulation joints of block material shall be suitably sealed with adhesive for isocyanurate /PUR/cellular glass and by insulating cement for calcium silicate/Moulded expanded perlite. Fittings below 50mm nom. dia, if insulated of calcium silicate/Moulded expanded perlite, shall be insulated with insulating cement build up in 6mm layers to the thickness of insulation of the adjacent piping. Each layer of insulation cement shall be reinforced with 25mm No. 20 SWG wire netting.

Tee (All Insulation Materials) (See Fig.8)

Preformed pipe sections or segments shall be carefully cut and shaped around "Tee," junctions and the insulation material of the tangential pipe shall be carefully and neatly cut to mate upto the material applied to the parent pipe without the creation of voids or gaps, at the junction. Insulation shall be adequately secured by wire / bands of same specification as that of same size pipe.

Flanged Joints or Valves (all insulation materials (Fig.9 and 10)

Flanged Joints or Valves, if to be insulated, shall be insulated with prefabricated removable covers, lined with pipe sections / lags / slabs.

Welded valves, if insulated, shall be insulated with oversized pipe sections or lags, cut and shaped to fit around the body of the valve. Insulated valves shall be completely covered, but the insulation shall be cut and shaped around the valve stem and kept clear of the stuffing box gland.

Insulation Flashing (all insulation materials)



Insulation shall be stopped short of flanged joints and unions by a sufficient distance to permit easy removal of the flange nuts and bolts or breaking of the unions to take place without disturbance or damage to the insulating material. At these positions the insulation shall be beveled and sealed with a metal closure which in turn shall be sealed with waterproof sealing material.

Pipe Supports: (All insulation materials) (Fig. 11)

Insulation at solid welded or clamped supports shall be cut and shaped to fit around the support and banded securely to enable the insulation to be carried with the pipe movement. When the pipe hangers pass through insulation on piping outdoors, metal hoods packed with a waterproof sealing material shall be furnished and installed. Upper bolts of the hanger clamps are not to be covered with insulation.

Steam Traced Piping (All insulation materials) (Fig.12)

Steam traced piping and fittings shall be installed with oversized sections to allow accommodation of both parent pipe and tracer without damage or deformation of the insulation. Traced instrument line and fittings shall be totally enclosed by the insulation in a similar manner and the designed warm air annulus maintained throughout the tracer pipe length. Insulation supports for vertical pipe shall have suitable clearance for tracer pipe. Composite box type insulation may be provided on the steam supply lead lines, in case they are routed together similarly this may be provided for the return lines to manifolds after the run of tracers.

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Electrical Traced Piping (Polyisocyanurate / PUR)

Electrical traced piping shall be provided with the same size insulation as would be provided if the piping were not electrically traced, unless otherwise specified.

6.3 Horizontal Equipments

Standard Shapes of insulation

Fibrous Material (Rock wool)

Shells: Preferably preformed pipe or multi pipe segments or slabs cut and shaped to fit. Alternately, blanket may be accepted.

Heads: Preformed blocks and slabs cut and shaped to fit. Alternatively, blanket may be accepted.

Calcium Silicate/ Perlite/ PUR / Polyisocyanurate / Cellular Glass

Curved segments / blocks, mitre cut and shaped to fit.

Ceramic Fibre

Shall be supplied in blanket strips in sizes as mentioned in the material spec in paragraph 5.2.

Application (All Materials)

Following provided by the vessel fabricator for insulator / cladding support / securement, shall be verified for their presence by the insulation contractor, before commencing insulation work:

For vessels of diameter 2000mm and above are provided insulation support at horizontal centre line as also vertically at tangent lines. Ring support at tangent lines are provided with 6mm diameter holes. These are to be used for insulation securement.

At vessel heads above 600mm outside diameter are provided flats having 6mm dia holes. The flats are for insulation support and holes provided in them are to be used for insulation securement. Also provided on either head is a central ring made of 10 dia galvanized steel rod. For vessels which do not have central nozzle, these rings shall not be provided by vessel fabricator. For such vessels, insulation contractor shall provide these rings.


Boot of vessel, if any, is provided with circular support ring with holes, as indicated in sketch.

Blanket shall be applied over the surface with joints tightly butted and laced together with 1mm dia galvanized lacing wire.

Other block insulation shall be applied with the longer dimension parallel to the axis of the vessel or equipment. When blocks are applied in multiple layers, all joints in successive layers shall be parallel to the long axis, shall be staggered and sealed with insulating cement for calcium silicate or suitable adhesive for others. In all cases, the insulation is to fit the contour of the vessel or equipment, so that the use of a leveling coat of insulating cement should not be normally necessary to get an acceptable smooth exterior.

Special considerations for insulating high temperature Vessels (Required only if provided with calcium silicate insulation) (Fig. 15)

This provision is required to take care of the effects of equipment circumferential thermal expansion on insulation. This provision is required only for Vessels and Exchangers provided with calcium

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silicate insulation.

Calcium silicate insulation should be installed in beveled or curved segments only, to avoid voids and provide an efficient insulation system.

For equipment's up to 3000mm in diameter and 200°C, to take care of equipment circumferential expansion, the circumferential block is cut and fitted to be 13mm greater in circumference than the equipment and secured so that tension of the bands produces compression on the butt edges rather than on the surface towards the vessel; the little annular space and the compressiveness of the blocks would suffice to take care of circumferential expansion of equipment.

If the vessel is above 3000mm in diameter or if temperature is above 200°C or both, a 25mm thick Rockwool fiber blanket insulation shall be applied around the equipment prior to the application of calcium silicate. This acts as an expansion area around the equipment to act as mechanical and sometimes thermal cushions. The calcium silicate block must be cut and fitted to the outside radius of the equipment plus the thickness of the Rockwool spacer insulation. The insulation, when installed, should not compress the fibrous blanket.

Above provision to take care of circumferential expansion is required both for shell and head.

Insulation Securement (for all insulation materials) (Refer Fig.13 and 14)

Each layer of insulation on shells of equipment shall be secured by bands at every 225mm centres. Each band shall be machine stretched and tensioned to remove slack only.

Each layer of insulation on vessel heads shall be secured as follows:

Band shall be in radial direction connecting the head central floating ring and shell girth ring. The radial bands shall be placed at not more than 150mm centres for rigid and 300 for fibrous insulation, measured at the girth ring. These bands shall be machine stretched and sealed. Outermost layer of insulation shall also be supported by drawing and securing 16 SWG annealed wire through the 6 diameter holes provided in the shell girth ring as also the flats provided on heads. The wire shall be drawn through every hole and it shall be secured to the ring with a knot.

6.4 Vertical Equipments

Standard Shapes

Shapes for different materials shall be same as specified for horizontal equipment.

Application (For all insulation materials) (Fig 16 & 17)


Application details on shell, top and bottom heads shall be similar to that of horizontal equipment. Insulation shall be laid on insulation support rings provided by the fabricator.

Insulation Securement (For all insulation materials) Fig. 16, 17 & 18)

Bottom and Top Head insulation shall be supported by 16 SWG SS wire drawn through holes in the insulation supports provided by the fabricator.

Top head insulation shall be secured by floating ring/bands provided by vessel fabricator similar to head of horizontal vessel.

Shell insulation shall be supported by bands at every 225mm centres on the cylindrical portion and the bands shall be kept horizontal.

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Insulation Securement for Bottom head for vessel supported on legs shall be identical to that of Top head.

For insulation securement of bottom heads inside skirt no floating rings/bands need be provided; Firm securement should be ensured just by 16 SWG annealed SS wire drawn over insulation tightly and through the holes on support rings provided by the fabricator.

Expansion Joints (All insulation materials)

Expansion joints shall be provided every 4000mm (max.). The joint shall be provided at insulation support rings. It shall be a 25mm space between the top of the insulation and the bottom of the support ring. The space shall be filled up by compressed rockwool fiber.

6.5 Flange, Nozzle, Channel Cover, Manway & Handhole Flanged Cover (For all Insulation Materials)

Where insulation is required, these shall be insulated with lined removable prefabricated covers secured with bands or quick release toggle clips.

Otherwise, insulation shall be stopped short of uninsulated flanges and nozzles etc., a sufficient distance to permit withdrawal of bolts without disturbing the insulation. Insulation shall be weatherproofed and sealed at these locations.

6.6 Irregular Surfaces Such as Pumps, Compressors, Turbines etc.

Application

Fibrous Material: Material, application and insulation securement

This shall be Prefabricated removable covers, lined with pipe sections / lags / slabs / mattresses.

Calcium silicate/Moulded Expanded Perlite

Insulation material shall be loose fill insulating cement/block insulation cut and fitted. Insulation shall be applied in maximum 25mm thick layers until the scheduled thickness is obtained.

Each layer shall be covered with a layer of 25mm hex. 20 SWG galvanized iron wire mesh for other than SS surfaces and with SS wire mesh for SS surfaces. The final layers shall be travelled to a smooth finish with a 6mm thick finishing cement.

Insulation shall be beveled back at 45°C from all casing flanges, shaft seal caps and bearing boxes.

6.7 Vertical Storage Tanks (Carbon Steel)

Standard Shapes of insulation

Fibrous Material (Rock wool) Shall be in slab form.

Polyisocyanurate / Polyurethane foam Shall only be foamed cast in-situ.

Application

Supporting rings / spikes (rods) for supporting insulation / cladding

Shell

Insulation contractor shall check for its presence before insulation application work. Following is

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provided by tank fabricator.

Water Shed

At the junction of shell and roof, a watershed is provided to act as top covering for the shell.

Insulation Support

Insulation support will consist of 5mm dia steel rods provided at 400mm dia diamond pitch. Length of these lugs is 3mm less than insulation thickness.

Cladding Support

From tank top, horizontal rings shall be provided at every 1175mm on tank shell.

Tank Roof

Insulation laying and securement

Shell (Application of fibrous insulation)

Insulation shall be applied between rings in horizontal mode. Mattresses insulation shall be applied with joints tightly butted and laced together with 1mm dia. galvanized lacing wire. Matts shall be impaled to the 5mm rod and speed washers fixed and pressed home for intimate contact of the insulation. In the case of multiple layers, speed washers are necessary only over the final layers, (up to and including 150mms). Rods and speed washers of spring steel should be selected to suit each other. While rods are provided by tank fabricator, speed washers shall be furnished by insulation contractor. Insulation shall be further secured by bands spaced centrally between insulation supports.

Shell (Application of Polyisocyanurate / Polyurethane foam)

Shall be foamed cast in-situ as per vendor's procedure (approved by CONTRACTOR/Client/Client's representative) and to the satisfaction of Site-in-Charge. The minimum requirement for thermal conductivity, density, compressive strength, fire properties and water vapor permeability shall be as per para 5.2. Depending upon the application the thickness of cladding and bands shall be as per para 5.3 & 5.4 respectively. Contractor shall ensure that cladding & band thicknesses are capable of withstanding foaming pressures which are developed at the time of injection of foam. Contractor can use foamed cast in-situ insulation only after getting the approval to material specification and application procedure.

Roof (For all materials)

Application of both fibrous, Polyisocyanurate and Polyurethane foam shall be similar to that as for shell. Insulation support from 5mm dia M.S. lugs shall be exactly same as in shell.

6.8 Horton Spheres

Standard shapes & Material

Shall be only Rockwool blanket.

Application

Structural members provided by spheres fabricator for insulation/cladding securement.

Insulation laying and securement

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Insulation shall be applied between rings. Insulation shall be applied with joints tightly butted and laced together with 1mm dia galvanized lacing wire.

Insulation shall be secured by drawing and securing tightly 16 SWG stainless steel wire through the 6 dia holes, provided every 200mm centres, in the horizontal leg of the insulation support angle ring. The wire shall be rightly drawn over the insulation and the insulation firmly secured. The wire shall be drawn through every single individual hole and it shall be secured with angle with a knot at every fourth hole. For application of bands for securement of insulation and cladding refer figure20.

6.9 Inspection Windows

Piping

Plug type inspection windows of ellipsoidal shape shall be provided on all the insulated pipelines having diameter 2" and above. One inspection window shall be provided at a distance of every 20meters of straight length of pipe. It should be provided at the bottom i.e. At 4-6-8 clock position whichever is convenient. There must be atleast one inspection window between two bends which are minimum 10 meters apart. Atleast 50% of the bends shall be provided with inspection windows. The sheet metal of the inspection windows shall be of same thickness as that of the sheet metal cladding on insulation. The size of the inspection windows shall be as follows:

Pipe dia 2"	35mm minor diameter x 120mm major diameter
Pipe dia 3"	45mm minor diameter x 120mm major diameter
Pipe dia 4"	75mm minor diameter x 120mm major diameter
Pipe dia 6"	100mm minor diameter x 120mm major diameter
Pipe dia 8"	100mm minor diameter x 120mm major diameter
Pipe dia > 8"	120mm minor diameter x 120mm major diameter

Exchangers

All the heads shall be provided with one inspection window each. Minimum two inspection windows shall be provided on the shell side.

Columns & Vessels


Heads shall be provided with one inspection window each. One inspection window shall be provided at every platform. Minimum two inspection windows shall be provided on shell portion.

Tanks

One inspection window shall be provided at each course of the tank and also at the top.

6.10 Impulse Lines

Wrap the impulse lines with insulation (Sodium Silicate inhibited Ceramic rope) of required thickness (refer note below) after cleaning the impulse lines of dust, rust, grease etc. Ensure that the rope(s) have been tightly wrapped without leaving any gaps. Apply two layers of self adhesive Aluminium foil tape of minimum 0.1mm thick spirally bound over the fibre rope surface with the joints in two layers staggered. Ceramic rope shall have minimum density of 250 Kg/m³ with other properties conforming to para 5.2 of the specification for Hot Insulation. A suitable sealant shall be provided to stop the water ingress at the termination points of insulation.

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Note: Impulse line insulation details shall be as follows:

<u>Size</u> (Impulse line)	<u>Temp</u>	<u>No. of Ins layers</u>	<u>Thickness of each layer</u>
1/2"	150degC	2	1/2"
3/4"	150degC	2	1/2"
1/2"	250degC	2	3/4"
3/4"	250degC	2	3/4"

7. **INSULATION FINISH**

7.1 **General**

Moisture Barrier

On all surfaces except horton sphere, provided with fibrous materials, Moulded, Expanded Perlite , Calcium silicate, Polyisocyanurate & Polyurethane foam .

For surfaces upto 125°C & on PIR/PUR in case of electric heat tracing apply a breathing type moisture barrier as below. A 3mm thick coating of mastic shall be applied to the surface of the insulation as soon as possible, after erection, to reduce the time the insulation is exposed to the weather, to a minimum. Whilst this coat is still wet, glass cloth shall be laid over the surface and embedded in the mastic. Care shall be taken to ensure that the glass cloth is laid smooth and free from wrinkles and that no pockets of air are trapped beneath the surface. At junctions in the glass cloth, the overlap shall not be less than 75mm. A second 3mm thick coat of mastic shall be applied after approximately 12 hrs. When dry this coating shall be a minimum of 1.5mm thick. Care must be taken, however, to ensure that the individual coats are not greater than 3mm (especially corners) otherwise some cracking of dried coat may result. The mastic shall not be applied over wet insulation or until the adhesive is dry. During the drying time, the insulation shall be protected from the weather by "Alkathene" film type tarpaulin or similar materials approved by Engineer-in-Charge. Mastic vapour barrier quality shall be Ar-cryl CP-9 of Childers or equivalent.

Insulation Finish

The insulation finish shall provide a weatherproofed and covering over the whole of the insulated areas and be applied and fitted in such a manner as to provide a close-fitting assembly without gaps.

7.2 **Piping (For all Materials)**

Straight pipe shall have metal jacketing cut and machine rolled, (approx. 1 metre long) wrapped around, with 50mm minimum overlap for longitudinal and 75mm overlap for circumferential overlaps. All laps shall be arranged to shed water. All longitudinal overlaps on horizontal pipes shall be arranged weatherside down to the prevailing wind and to shed water and shall be located along the lower half at approximately 135° or 225° positions. Longitudinal overlaps on the vertical

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pipes shall be arranged away from the prevailing site weather conditions and also overlapped circumferentially to shed water.

A single bead shall be made on all overlaps to ensure tight metal to metal water tight arrangement. Self tapping screws, at every 150mm shall be provided at all longitudinal overlaps for both horizontal & vertical piping.

At all operating temperatures the seams at overlap positions shall be rendered watertight as per para 5.4 to ensure that insulation remains dry and unwetted, whether the possible water impingement is from rain, hose or fire sprinklers.

The metal coverings shall be secured tightly around the insulated pipe and held in place with bands on a maximum of 300mm centres. One band shall be located on each circumferential lap and the distance between laps divided at equal band spacings. The band securing seals shall be kept neatly in line and positioned away from viewing angles as much as is possible.

Vertical overlaps on vertical or near vertical piping shall be staggered to provide overlaps at 'North,' and 'South' positions in alternate sections of covering.

Each sections of metal covering on vertical piping with insulation OD's larger than 250mm shall be supported from the next lower section with two 'S' clips, fabricated from banding material. The 'S' clip shall be of sufficient length to allow the minimum overlap of 50mm.

On vertical piping with OD's of 600mm and larger, the securing bands shall be supported by 'J' clips, fabricated from banding material. The 'J' clip spacing shall be a minimum of two per band. All 'J' clips shall be screwed into position and secured.

Insulated bends and elbows in piping 80mm and larger, shall be metalled with 'lobster back' segments using 10mm minimum ball swage to assist shaping. The metal bands shall be screwed with self-tapping screws and metal sealants are to be provided to get a completely waterproofed arrangement.

Insulated bends and elbows in piping smaller than 80mm may use complete pressed and humped back flat metal elbows or fabricated 'stove pipe' elbows.

The practice of locating all joints in the top portion of elevated horizontal pipes for the sake of good appearance when looking up from grade shall be strongly discouraged. The joints shall be located to shed water.

Insulation Supports shall be installed at the following locations:

300mm above an elbow or tee in a vertical run of piping,

Bolt length plus 30mm above flanges of vertical piping,

Every 3.5m of vertical carbon steel pipe elevation and every 2.75m of vertical stainless steel pipe elevation.

7.3 Equipments (For All Materials)

The metal jacket over vertical vessel shells shall be constructed of sheet metal panels with the weight of the panel taken on the equipment insulation support rings, via angle brackets bolted to the panel.

The first insulation support ring from grade shall be 25mm more than the total insulation thickness,

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All other insulation support rings shall be 15mm less than the total insulation thickness.

The panels shall be applied commencing at the bottom of the vessel. Each circumferential ring of panels shall be tensioned by means of tensioning bands until the final joint is screwed tight.

'S' clips shall be used as sheeting support at unscrewed circumferential overlaps.

The panels shall be held tight over the vessel insulation by means of circumferential bands and sealed as per para 5.4. The bands shall be positioned on all horizontal overlaps and at 450mm centres. Bands shall be held in their relative positions with 'J' clips and be machine-stretched and sealed to remove slack only. Those bands which are not supported by 'J' clips, shall be held in position on cladding by providing pop rivets every 2 meter centres.

The panels shall have a minimum overlap of one corrugation on vertical joints and 80mm on horizontal joints. The overlaps shall be arranged to shed water at all times.

The vertical and horizontal overlaps shall be secured with self-tapping screws at 150mm pitch except the horizontal overlaps pre-selected to act as expansion joints, these shall be constructed with a 150mm overlap and shall remain unscrewed and left free to permit expansion. All overlaps shall be rendered watertight as per para 5.4.

All equipment projections such as nozzles, shall have the jacketing sealed using a metal flashing, cut to fit the projection and extending above the jacket at least 80mm. The seal between the flashing and jacket shall be made watertight by use of self-tapping screws and sealing mastic.

Horizontal cylindrical equipment shall be furnished with flat metal jacket arranged in circumferential bands with the edge of the sheets, with the longer dimension applied around the circumference of the equipment insulation.

The panels shall have a minimum of 80mm overlap of both longitudinal and circumferential edges, both overlaps being finished with a simple ball swage and rendered watertight as detailed in para 5.4.

Horizontal overlaps shall be secured with No. 8 x 12mm long self-tapping screws set in the overlap at 150mm intervals and shall be so arranged that staggered bands of panelling encircle the equipment. Vertical overlaps shall not be screwed for horizontal equipment.

The metal finish shall be banded and sealed at 450mm centres.

The insulated heads of vertical and horizontal equipment shall be fabricated from flat metal, an "Orange peel" construction with all radial seams overlapping a minimum of 50mm and secured with self-tapping screws at 150mm centres. All overlaps shall be ball swaged and be rendered water tight as per para 5.4.

Projections from the heads shall be sealed using metal flashings, neatly cut to fit around the projections and extending above the jacket for a minimum of 80mm. The seal between flashing and jacket shall be weatherproofed with self-tapping screws and mastics.

Insulation at bottom heads of fully skirted equipment does not require weatherproofing.

Heads of equipment 24" OD and smaller shall be finished and waterproofed with square ended fabricated covers.

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7.4 Vertical Storage Tanks

Cladding Applications and Securement

Cladding is applied over the system of horizontal rings as follows:

Overlaps in the vertical joints will be one corrugation. Overlaps in the horizontal joints shall be 50mm (min.). Cladding to cladding fastening, at both horizontal and vertical overlaps shall be alternately by "POP" Rivets & self-tapping screws at 150mm pitch.

Cladding shall be secured to support ring by bolting. Bolts are provided by tank fabricator at 300mm centres on angles provided at every 1175mm centres vertically. Felt washer, aluminium washer and nut shall be supplied by insulation contractor for all bolted connections at shell, roof and curb angle.

Insulation shall be tucked into the skirt portion of the curb angle. Shell cladding and extended roof cladding shall be secured to curb angle by bolting at every 1500mm.

Roof

All cladding joints shall be sealed by elastomeric metal sealants. Min. 75mm overlap shall be ensured at all joints. At all joints, cladding-to-cladding securement shall be provided by self tapping screws and pop rivets alternately, every 150mm centres.

Cladding shall be secured by bolting at every 300 provided by tank fabricator.


8. GURANTEE & TEST CERTIFICATES

Insulation contractor shall guarantee all insulation works against the defects due to material and workmanship effecting performance for a period of eighteen months from the date of completion of total insulation works and shall repair /replace promptly, without cost, any part or parts of the material that fails within said period.

All the test certificates required as per this document shall also be furnished along with the supply of materials.


9. REFERENCE CODES AND STANDARDS

The following list includes standards and specifications referenced in this Spec.:

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ASTM STANDARDS AND SPECIFICATIONS

ASTM A167	Specification for stainless and heat-resisting chromium nickel steel plate, sheet and strip
ASTM A240	Specification for heat-resisting chromium and chromium-nickel stainless steel plate, sheet and strip for Pressure Vessels
ASTM A463	Specification for steel sheet, aluminum coated, by hot-dip process
ASTM A526	Specification of steel sheet, zinc coated (galvanized) by the hot-dip process, commercial quality
ASTM B209	Aluminum - Alloy sheet and plate
ASTM C165	Measuring Compressive properties of thermal insulations
ASTM C177	Standard test method for Steady-state heat flux measurements & thermal transmission properties by means of the 'guarded-hot-plate' apparatus
ASTM C240	Standard test methods of testing Cellular glass insulation block
ASTM C302	Standard test method for Density and dimensions of preformed pipe-covering-type thermal insulation
ASTM C303	Standard test method for Density and dimensions of preformed block and board type thermal insulation
ASTM C335	Standard test method for Steady-state heat transfer properties of horizontal pipe insulation
ASTM C356	Standard test method for Linear shrinkage of preformed high-temperature thermal insulation subjected to soaking heat
ASTM C390	Standard criteria for Sampling and acceptance of preformed thermal insulation lots
ASTM C446	Standard test method for Breaking load and calculated modulus of rupture of preformed insulation of pipes
ASTM C518	Standard test method for Steady-state thermal transmission properties by means of the heat flow meter apparatus
ASTM C533	Standard specification for Calcium silicate block and pipe thermal insulation
ASTM C547	Standard specification for Mineral fiber pipe insulation
ASTM C552	Standard specification for Cellular glass thermal insulation
ASTM C591	Standard specification for Unfaced preformed rigid cellular polyisocyanurate thermal insulation
ASTM C592	Standard specification for Mineral fiber blanket insulation and blanket-type pipe insulation (metal-mesh covered) (industrial type)
ASTM C610	Standard specification for block and pipe thermal insulation
ASTM C612	Standard specification for Mineral fiber block and board thermal insulation
ASTM C795	Standard specification for thermal insulation for use in contact with austenitic stainless steel
ASTM C871	Standard test methods for Chemical analysis of thermal insulation materials for leachable chloride, fluoride, silicate and sodium ions
ASTM C892	Standard specification for High temperature fiber blanket thermal insulation
ASTM D1622	Test method for apparent density of rigid cellular plastics
ASTM D2126	Test method for response of rigid cellular plastics to thermal and humid aging
ASTM E96	Standard test methods for Water vapor transmission of materials

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BS STANDARDS AND SPECIFICATIONS

- BS 1902 Prt 6 Ceramic fibre products
BS 2972 Method of test for Inorganic thermal insulating materials
BS 4370 Prt 2 Method of test for rigid cellular materials
BS 5608 Specification for preformed rigid polyurethane (PUR) and polyisocyanurate (PIR) foams for thermal insulation of pipework and equipments

IS STANDARDS AND SPECIFICATIONS

- IS 10085 Method for chemical analysis of zircon flour or sand
IS 11239 Method of test for Rigid cellular thermal insulation materials
IS 12436 Specification for Preformed rigid Polyurethane (PUR) and Polyisocyanurate (PIR) foams of thermal insulation
IS 1335 Method of direct determination of alumina in refractory material
IS 1527 Methods for Chemical analysis of high silica refractory materials
IS 277 Specification for Galvanized steel sheets
IS 3346 Method for determination of Thermal conductivity of thermal insulation materials
IS 737 Specification for wrought aluminum and aluminum alloy sheet and strip for general engineering purposes
IS 8183 Bonded mineral wool-Specification
IS 9428 Calcium silicate insulation blocks and pipe-coverings
IS 9842 Preformed fibrous pipe insulation- Specification

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10. ATTACHMENT DRAWINGS AND TABLES

FIG NO. DESCRIPTION

1. Pipe Insulation Details (Fibrous & Rigid Insulation)
2. Pipe Insulations: Method of staggering of sections Rigid & Fibrous Insulation (Preformed Pipe Sections only)
3. Horizontal Pipe: Fibrous Mattress Insulation; Detail of Spacer Rings for Cladding Support
4. Detail of Spacer Ring Fibrous Insulation (Mattress)
5. Bolted Insulation Support for Vertical Pipe
6. Insulation Details for Bends / Elbows
7. Insulation Details: Pipe Bends & Elbows
8. Insulation Details: Pipe Branched & Reducers
9. Insulated Removable Cover: Valves
10. Insulation Removable Cover: Flanged Joints
11. Insulation Details: Pipe Supports
12. Insulation for Steam Traced Piping
13. Horizontal Equipment Insulation
14. Horizontal Equipment Heads
15. Use of Flexible Insulation in combination with Rigid Insulation to compensate for Vessel Expansion
16. Insulation Details : Vertical Vessel
17. Insulation Details : Vertical Vessel Heads
18. Insulation Details : Vertical Vessels
19. Insulation Details : Vertical Storage Tank

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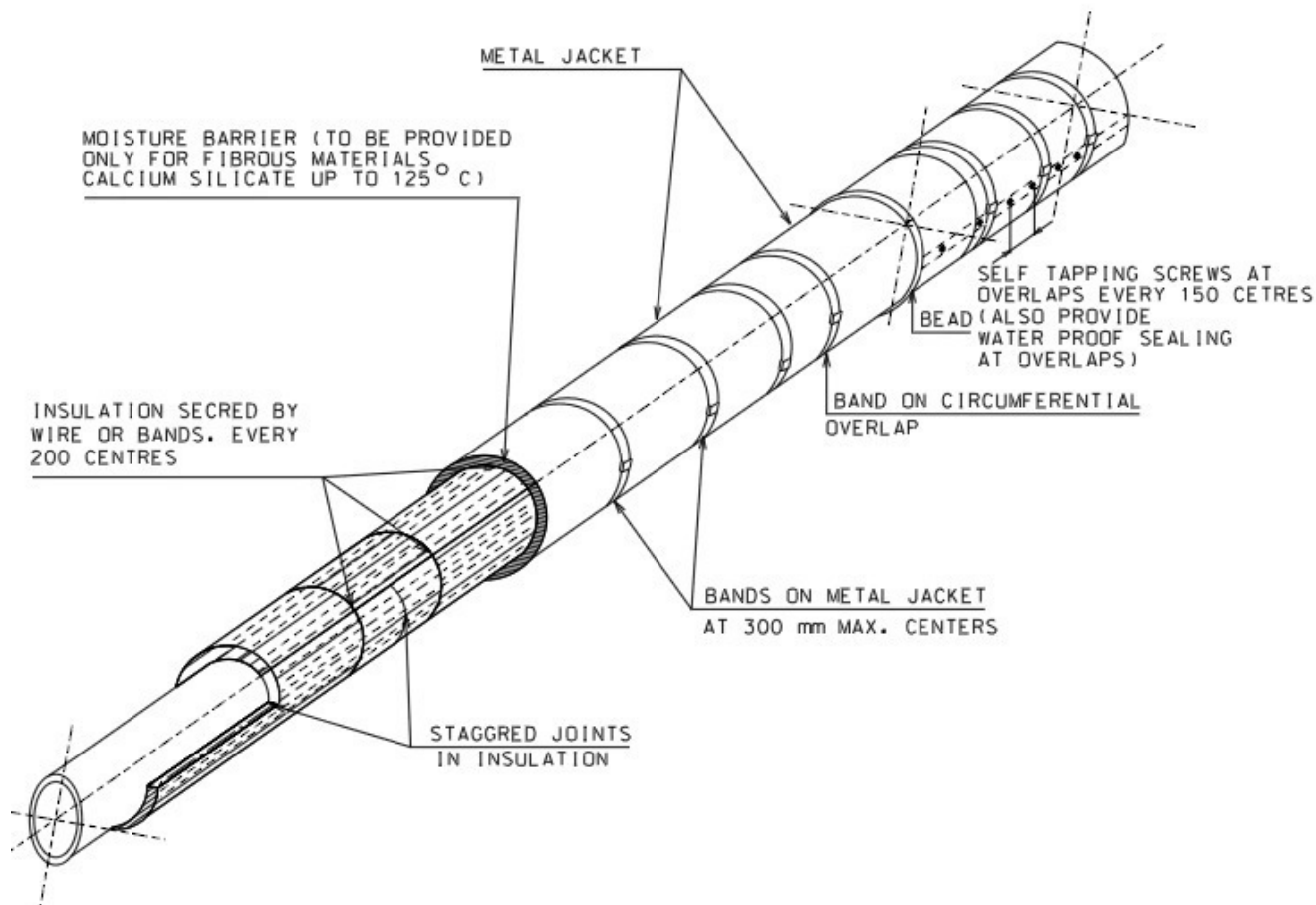


FIGURE 01 – PIPE INSULATION DETAILS (FIBROUS & RIGID INSULATION)

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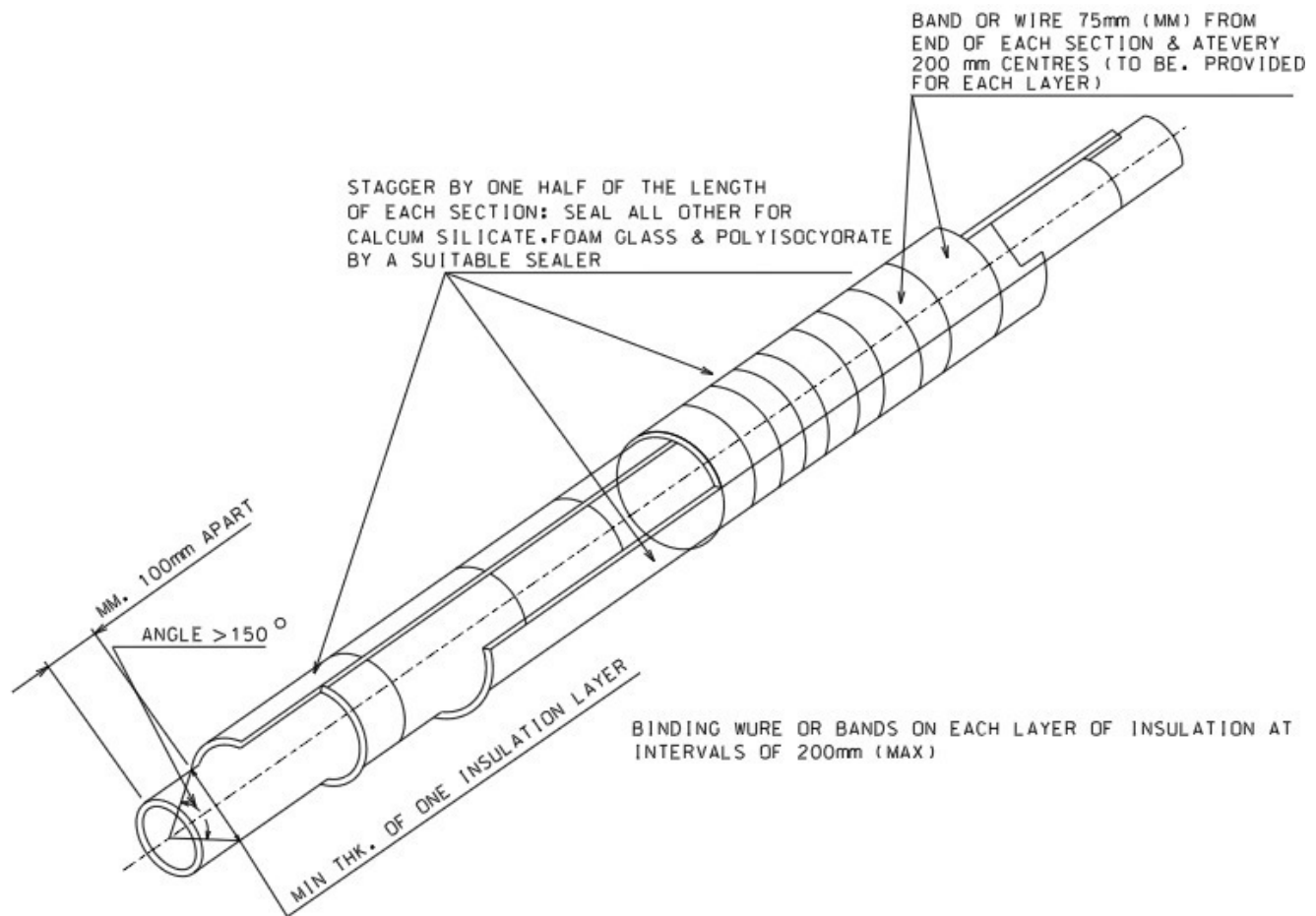
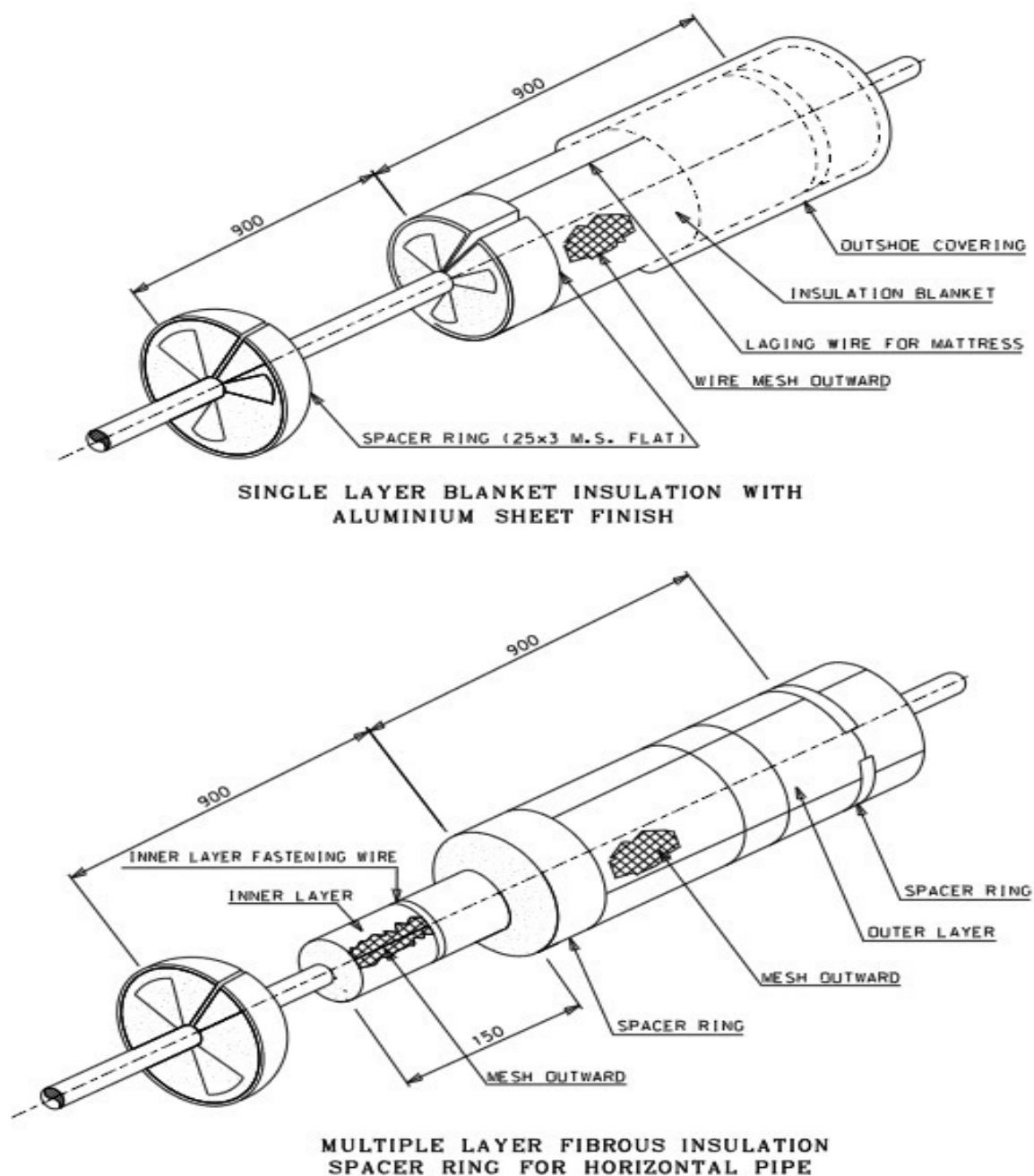


FIGURE-02 – PIPE INSULATION METHOD OF STAGGERING OF SECTIONS RIGID & FIBROUS INSULATION (PREFORMED PIPE SECTIONS ONLY)



**FIGURE -03 HORIZONTAL PIPE FIBROUS MATTERS INSULATION DETAILS OF
SPACER RING FOR CLADDING SUPPORT**

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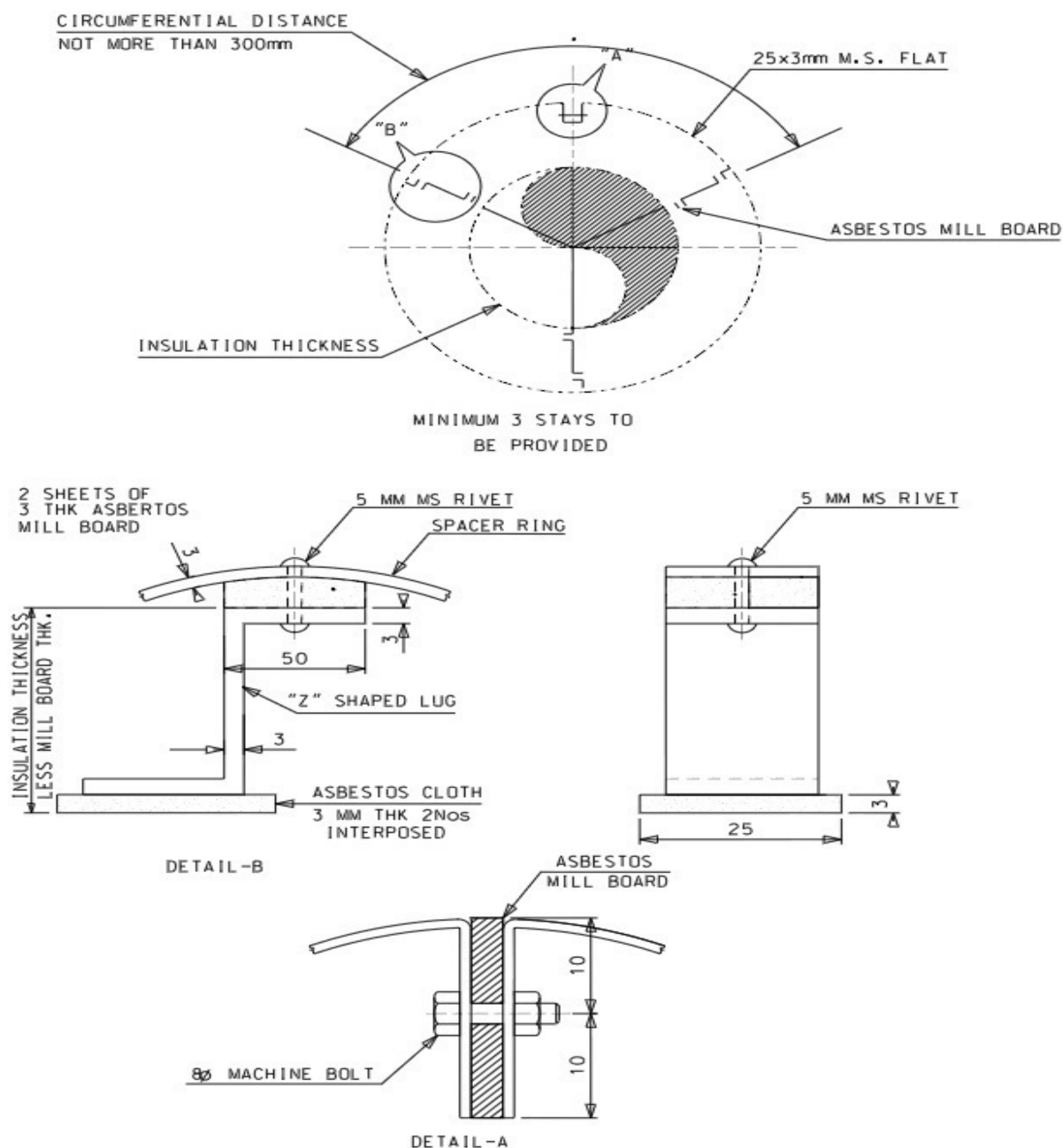
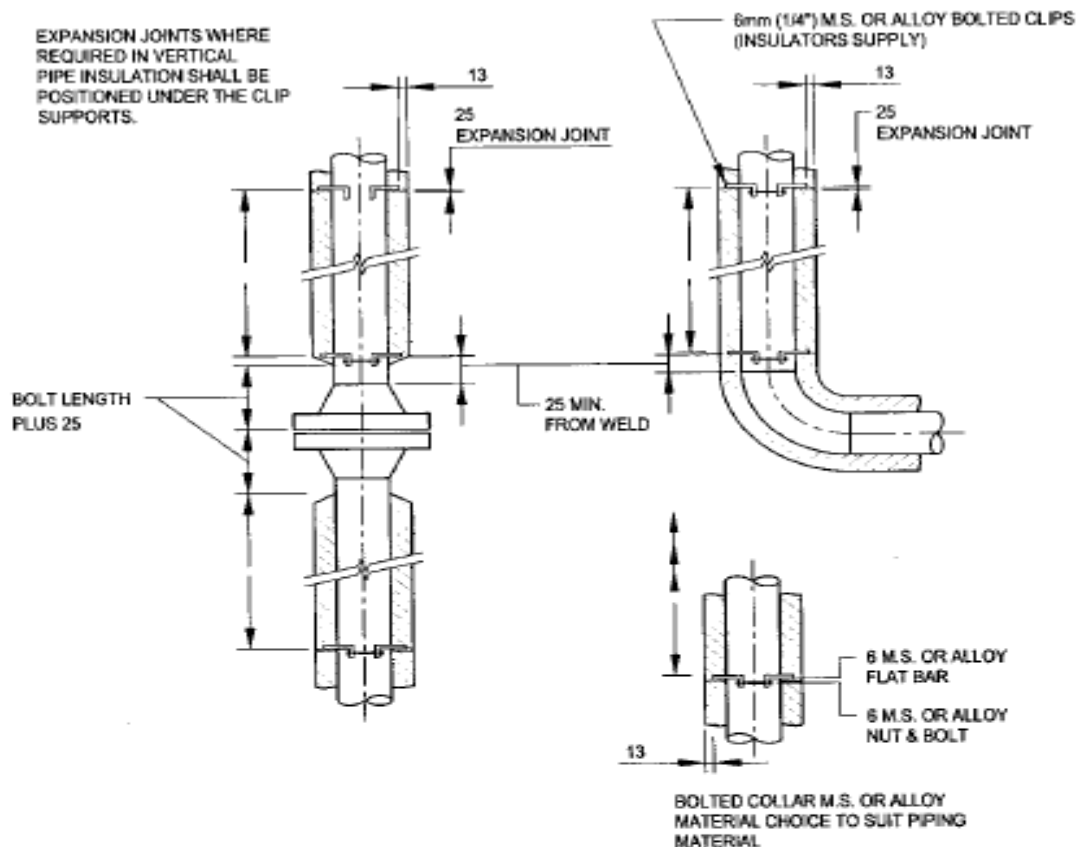



FIGURE -04 – DETAILS OF SPACER RING FIBROUS INSULATION (MATTRESS)


CLIP SPACING

PIPE TEMP.		MAX. SPACING 'D'	
°C		MM	
UPTO 400		4500	
400 TO 500		3500	
500 TO 550		2500	

* CIRCUMFERENTIAL EXPANSION SHALL BE CONSIDERED AT THESE OPERATING TEMPERATURES.

**FIGURE – 05
BOLTED ON INSULATION SUPPORT FOR VERTICAL PIPE**

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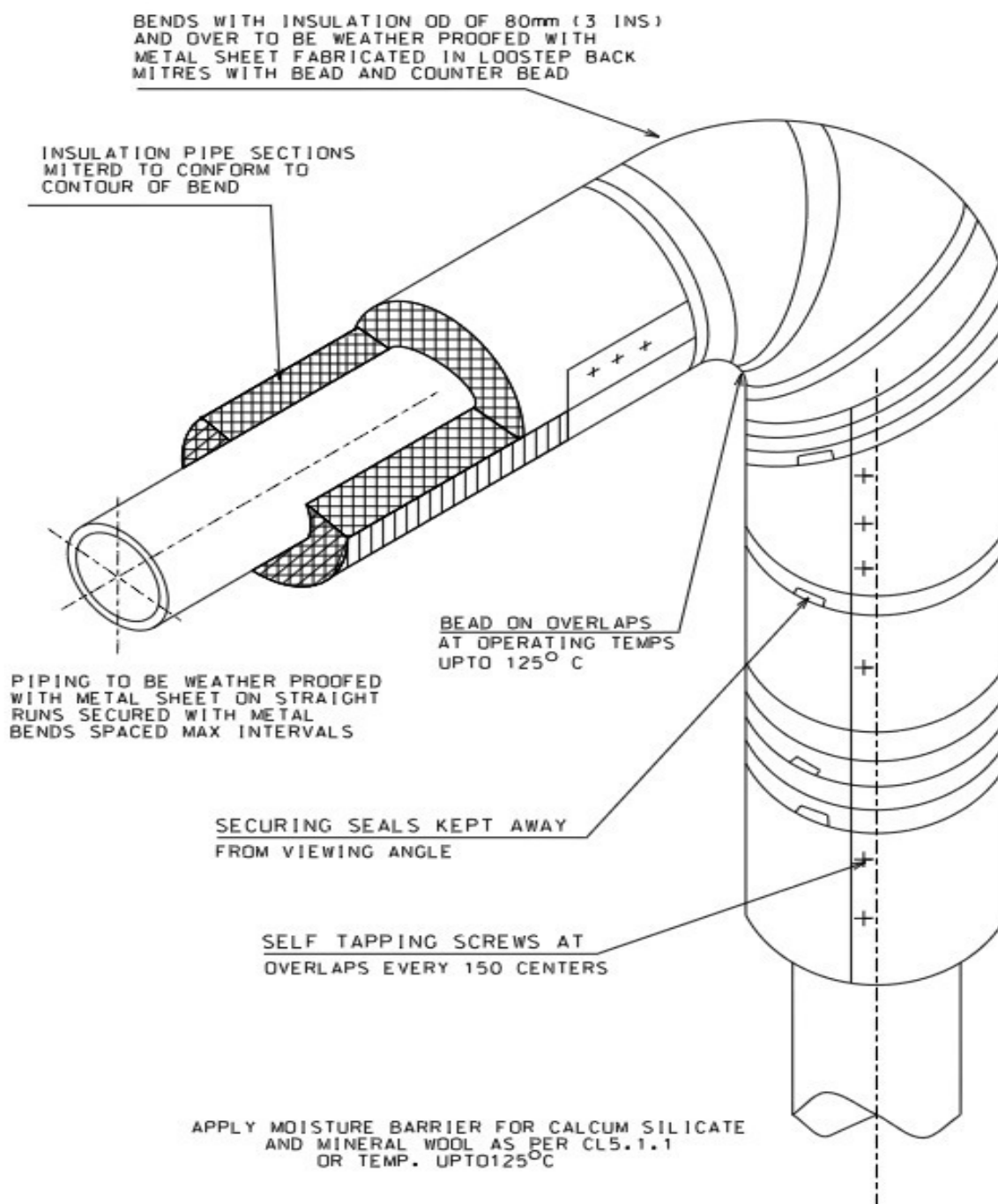
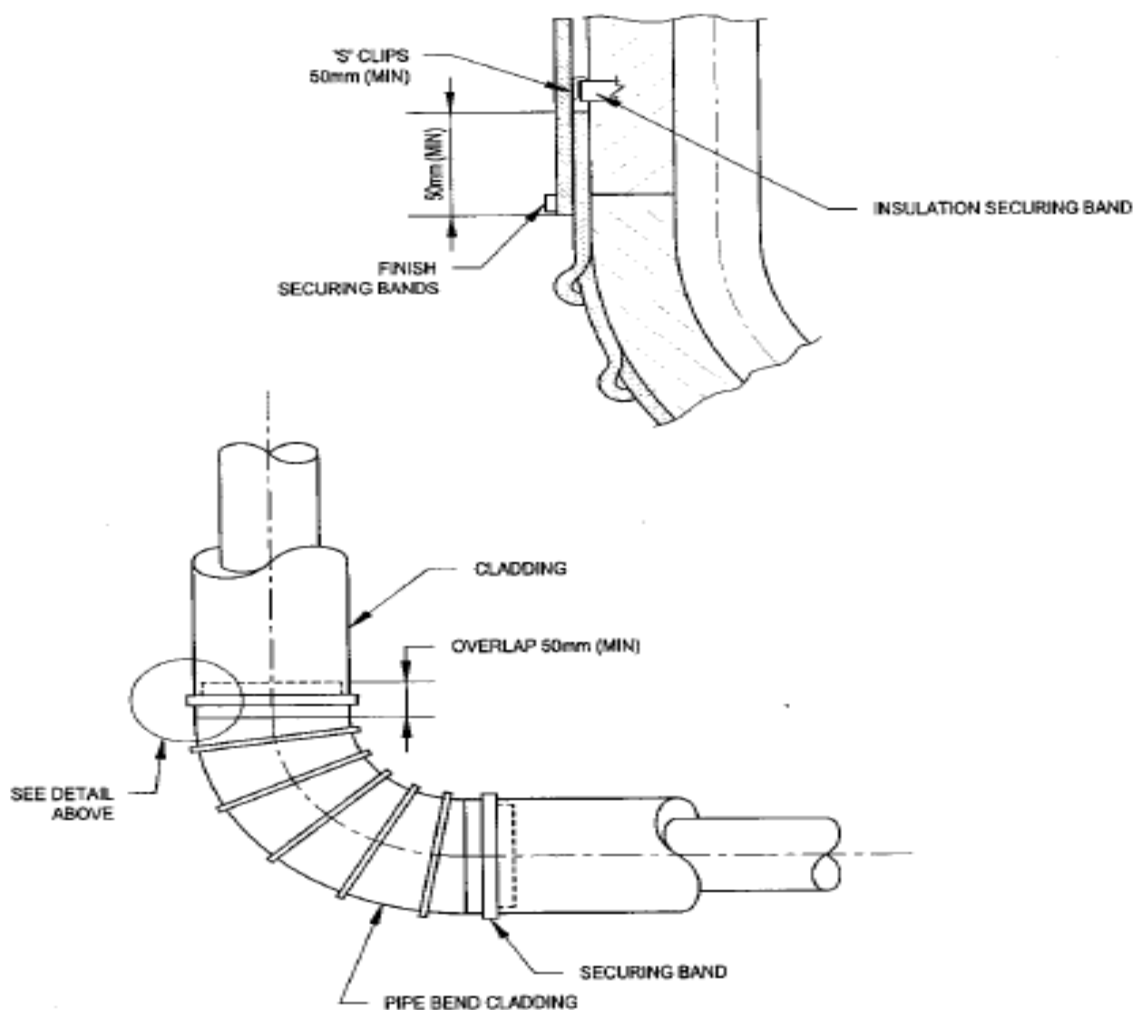


FIGURE 06 – INSULATION DETAILS FOR BENDS / ELBOWS



**FIGURE – 07
INSULATION DETAILS : PIPE BENDS & ELBOWS**

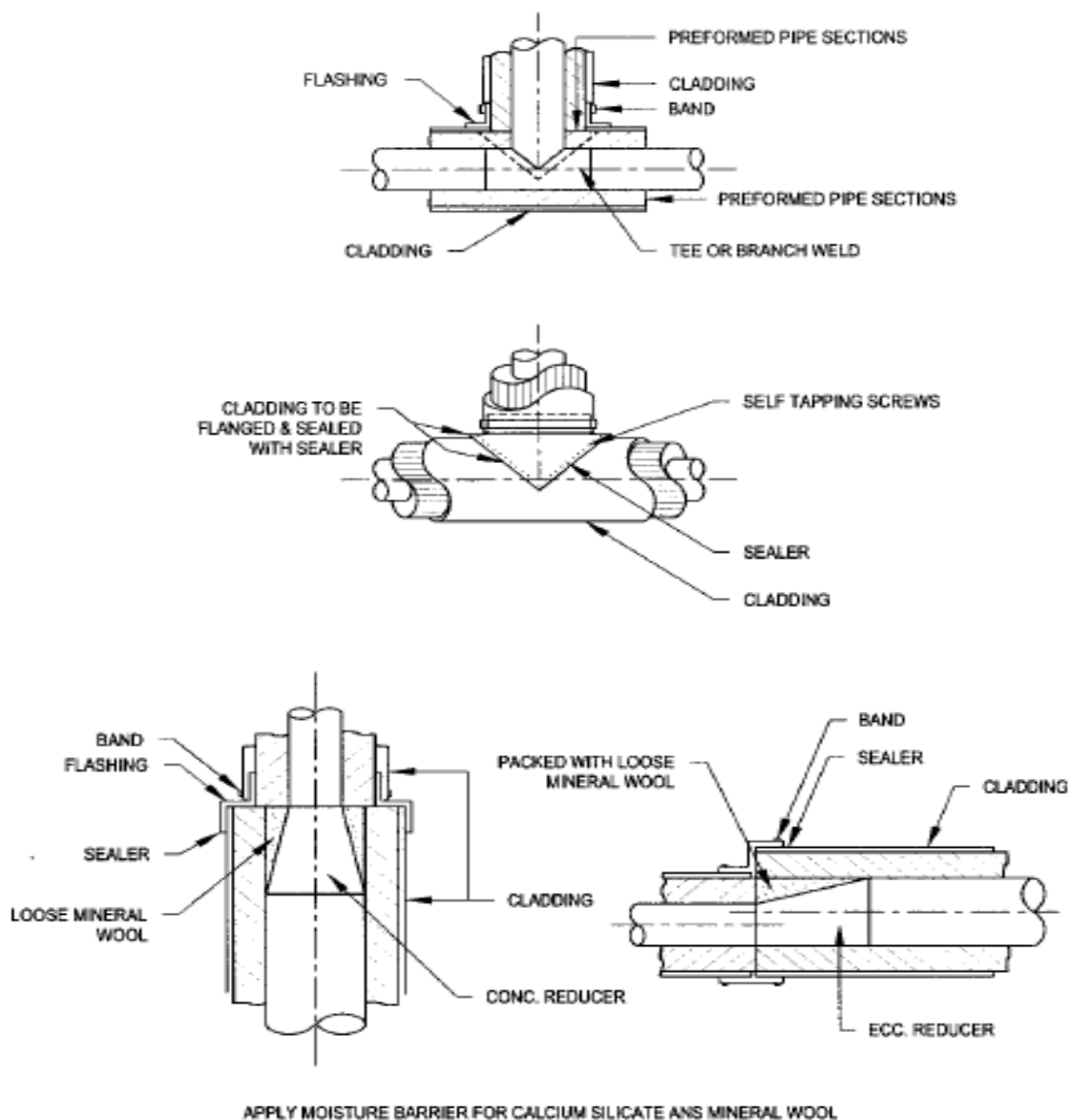
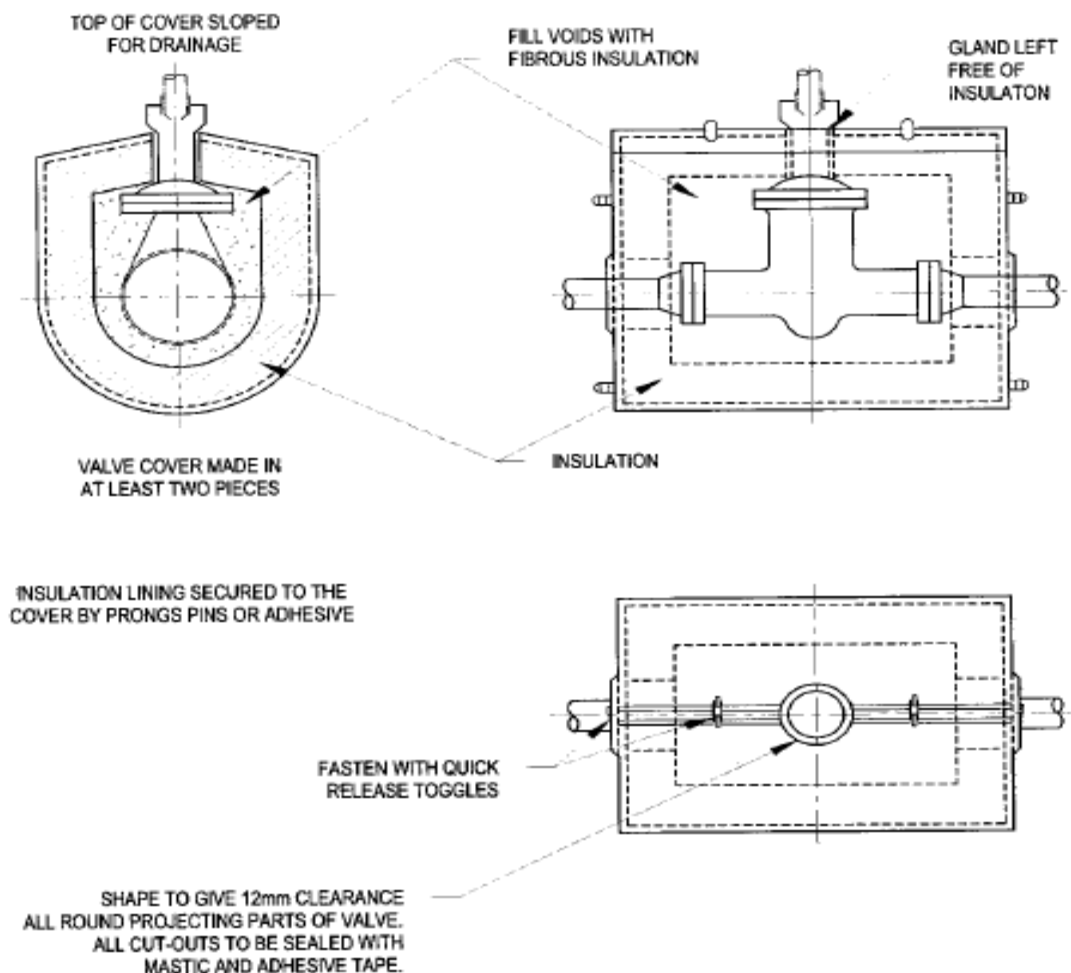


FIGURE – 08
INSULATION DETAILS: PIPE BRANCHED & REDUCER

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**FIGURE – 09
INSULATED REMOVABLE COVER: VALVES**

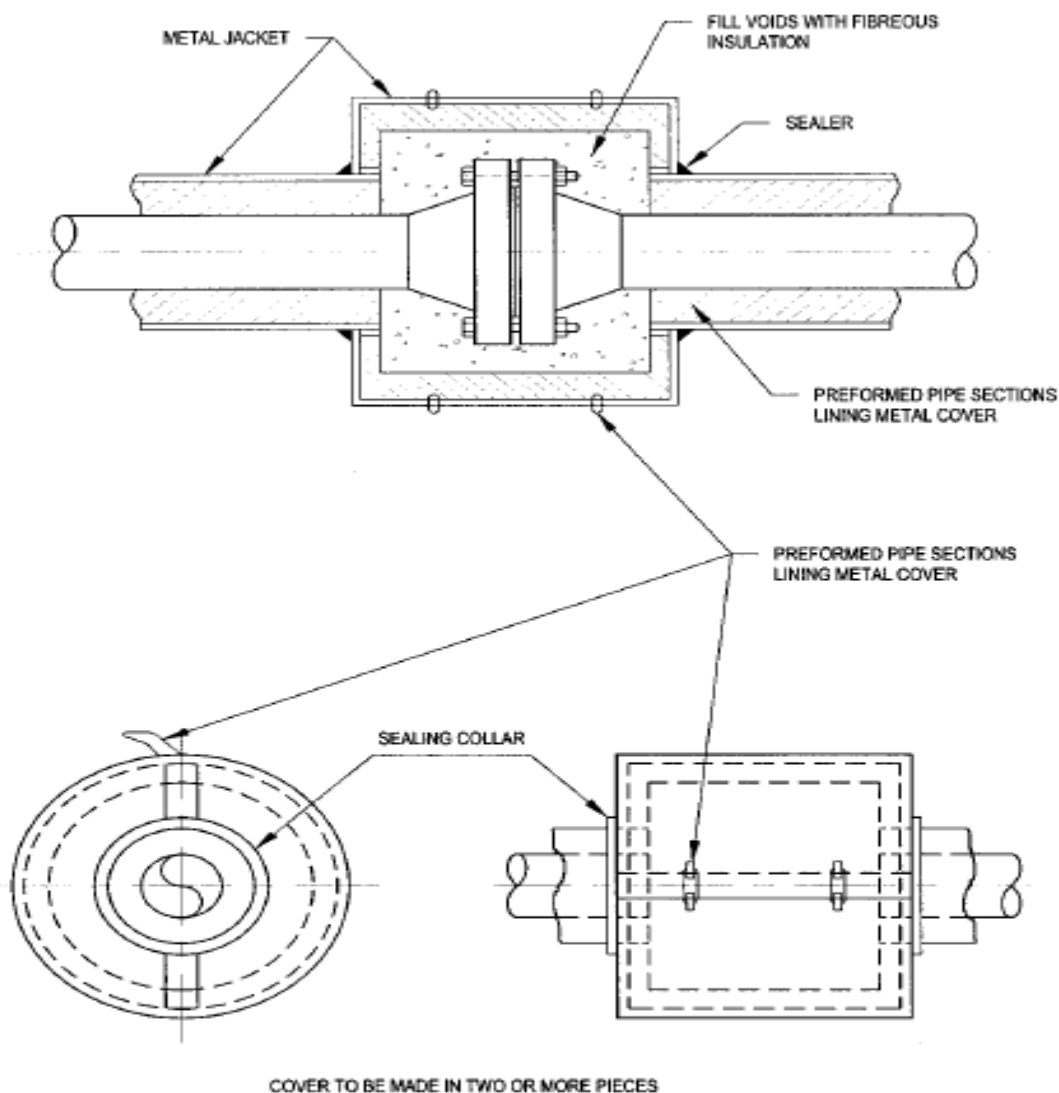
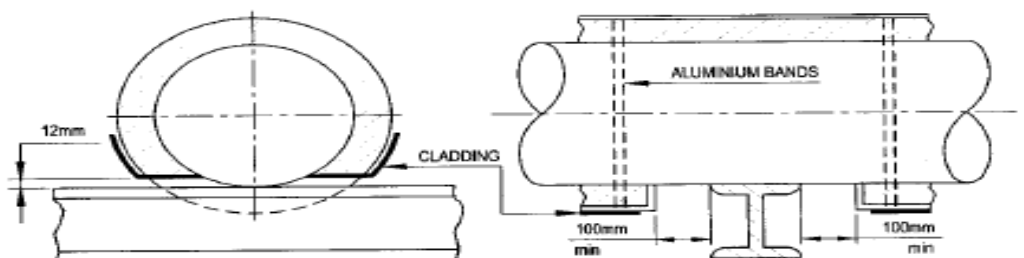
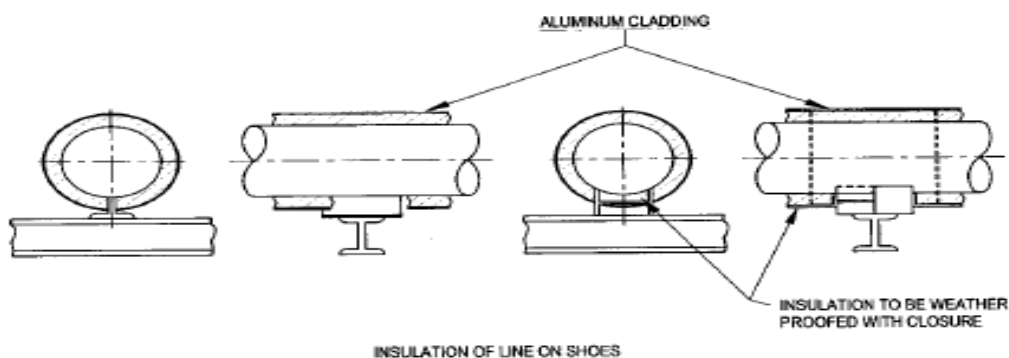


FIGURE – 10
INSULATION REMOVABLE COVER – FLANGED JOINTS



WHERE CLADDING IS TO BE CUT AWAY IT SHALL FIT CLOSELY TO
THE PIPE AND TO BE COMPLETELY WEATHERPROOF

INSULATION DETAIL AT LINES WITHOUT SHOES
(THIS SHOULD ONLY BE REQUIRED IN EXCEPTIONAL CIRCUMSTANCES)



**FIGURE – 11
INSULATION DETAILS PIPE SUPPORTS**

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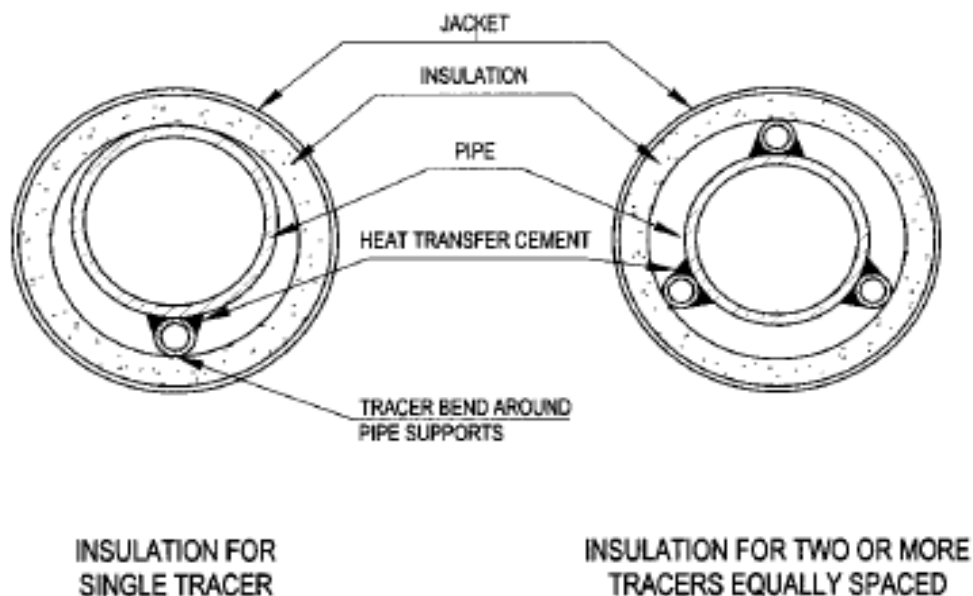
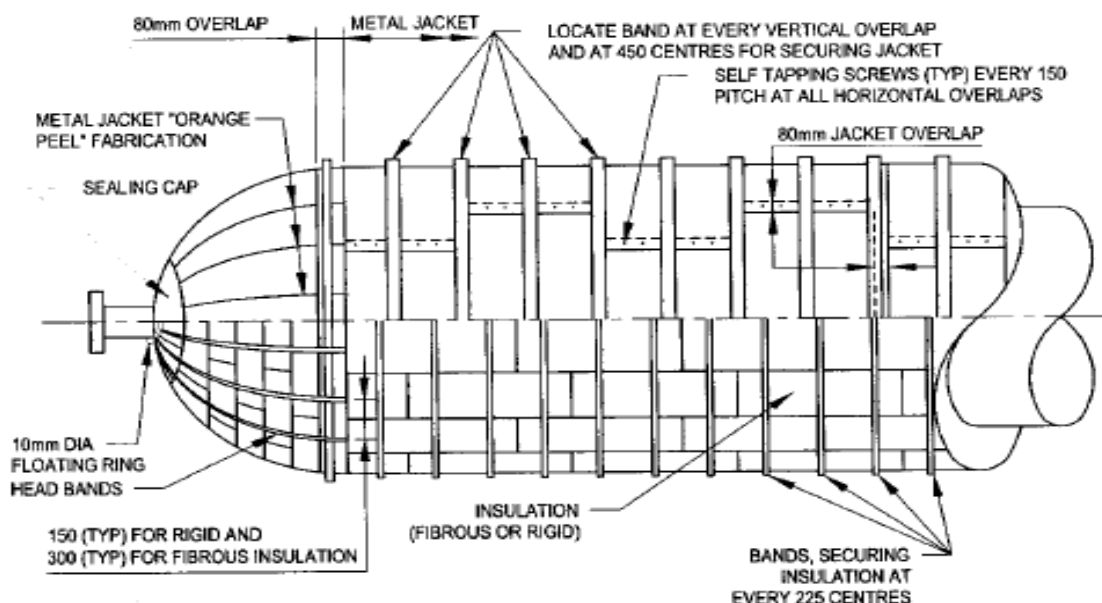


FIGURE – 12
INSULATION OF STEAM TRACED PIPING

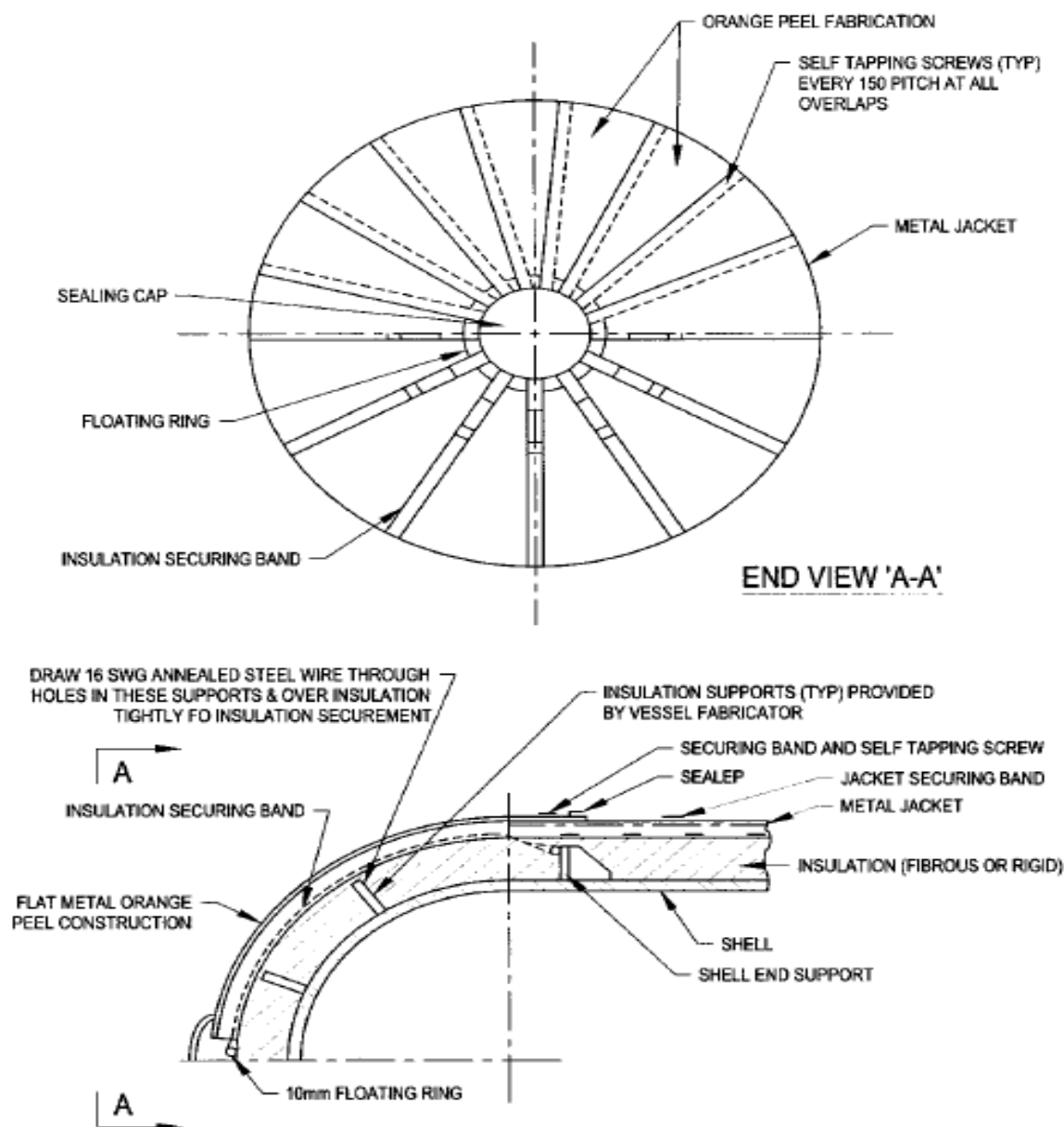
PROJECT	Standby SRU & Additional Tanks IOCL- Paradip Refinery		
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NOTES :-

1. SADDLE SUPPORTS FOR HORIZONTAL EQUIPMENT TOGETHER WITH SHOE AND ANCHOR SUPPORTS FOR HORIZONTAL PIPING SHALL BE DESIGNED TO INCLUDE ELONGATED CUT-OUTS IN THE SUPPORT AT SUCH A DISTANCE FROM THE SUPPORTED EQUIPMENT AND PIPING TO ALLOW THE PASSAGE OF INSULATION SECURING BANDS AND TIES AROUND THE OUTSIDE FACE OF THE INSULATING AND FINISHING MATERIAL.
2. APPLY MOISTURE BARRIER FOR CALCIUM SILICATE AND MINERAL WOOL PER CLAUSE 5.1.1 FOR TEMPERATURES UPTO 125°C.

**FIGURE – 13
HORIZONTAL EQUIPMENT INSULATION**



**FIGURE – 14
HORIZONTAL EQUIPMENT HEADS**

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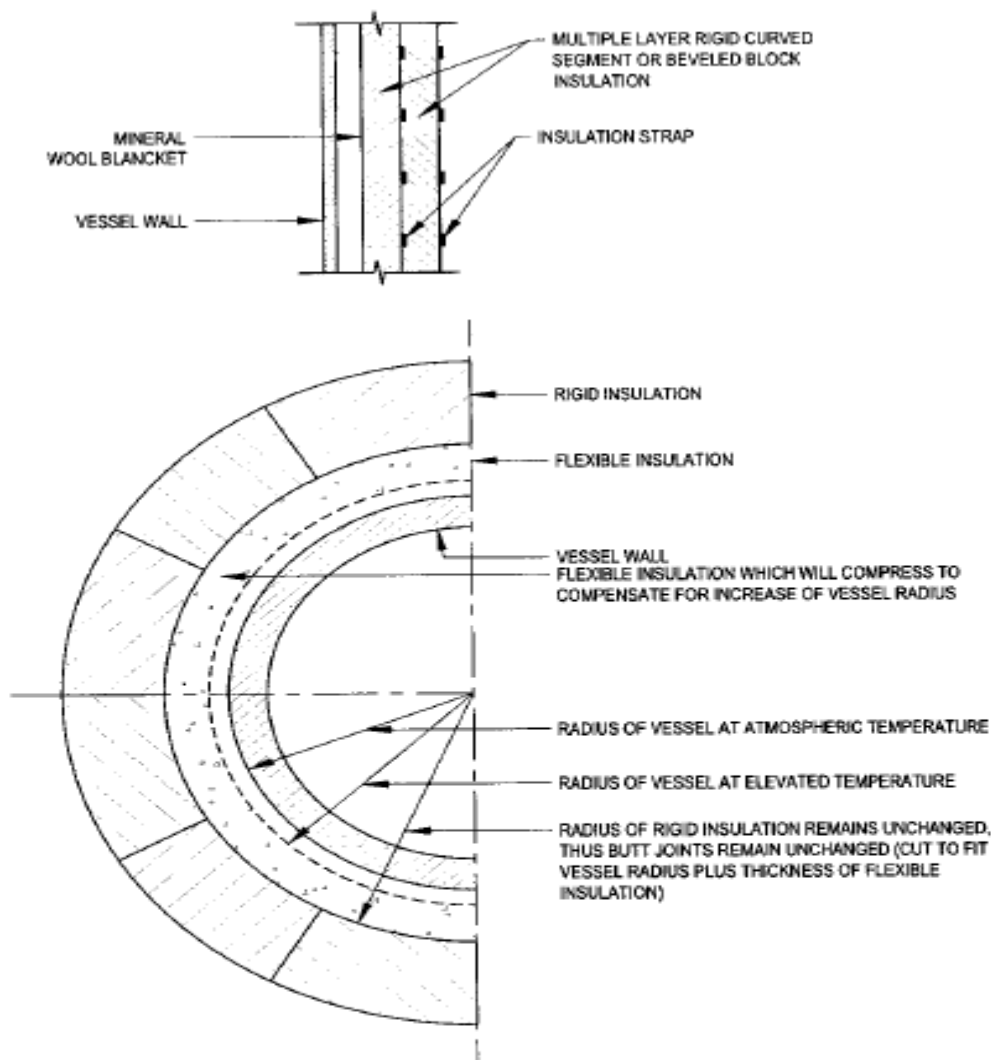
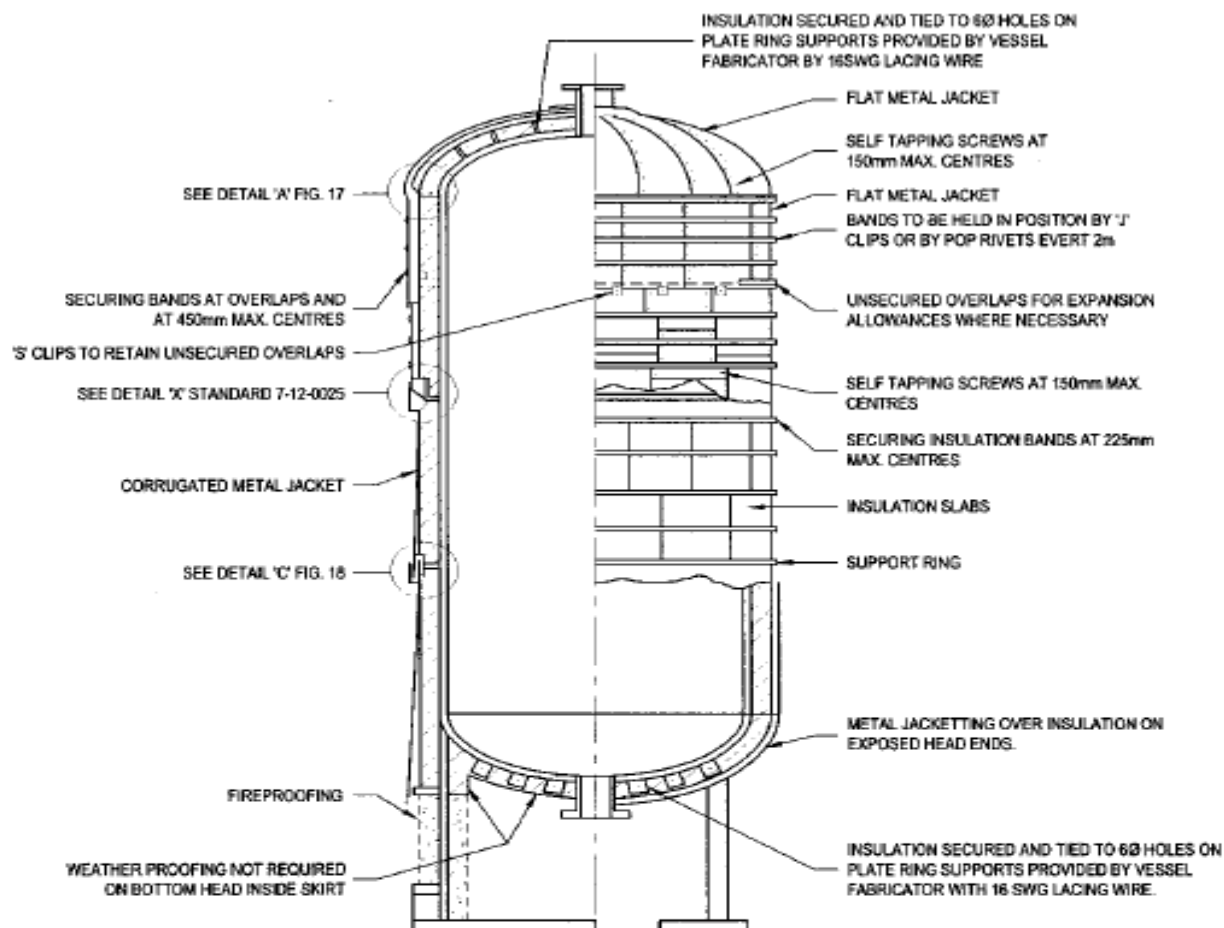


FIGURE – 15
USE OF FLEXIBLE INSULATION IN COMBINATION WITH RIGID INSULATION TO COMPENSATE FOR VESSEL EXPANSION


NOTE:-

APPLY MOISTURE BARRIER FOR CALCIUM SILICATE AND MINERAL WOOL PER CLAUSE 5.1.1 FOR TEMPERATURES UP TO 125°

**FIGURE – 16
INSULATION DETAILS : VERTICAL VESSEL**

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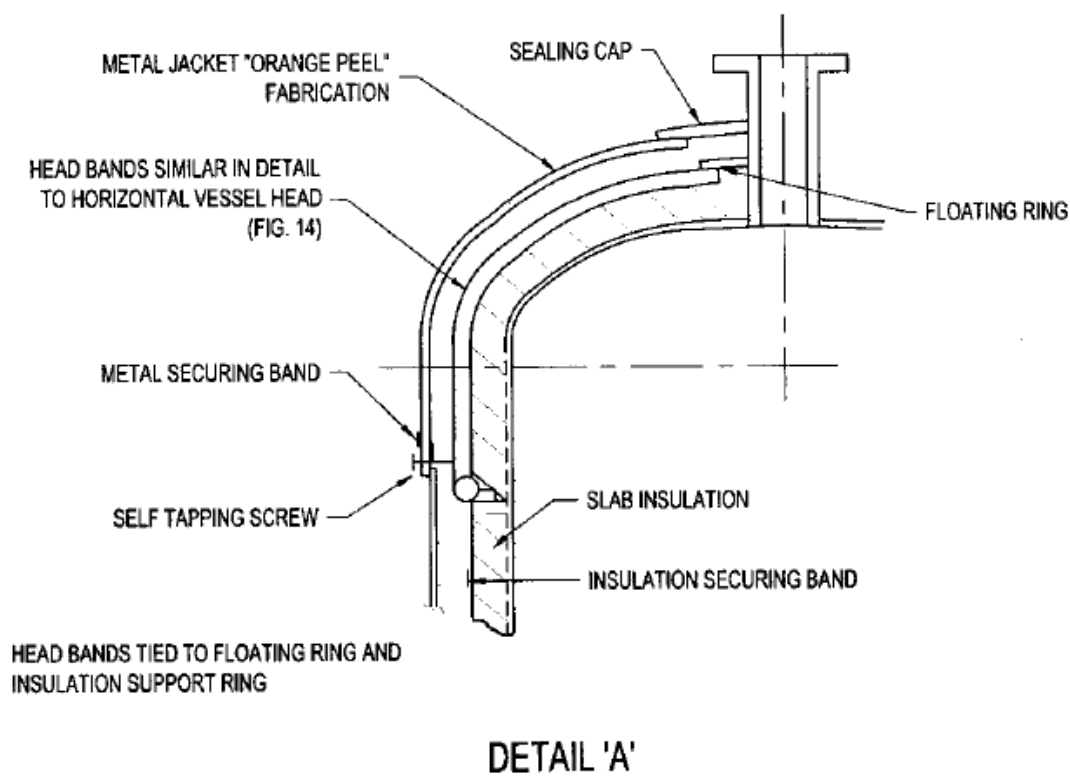
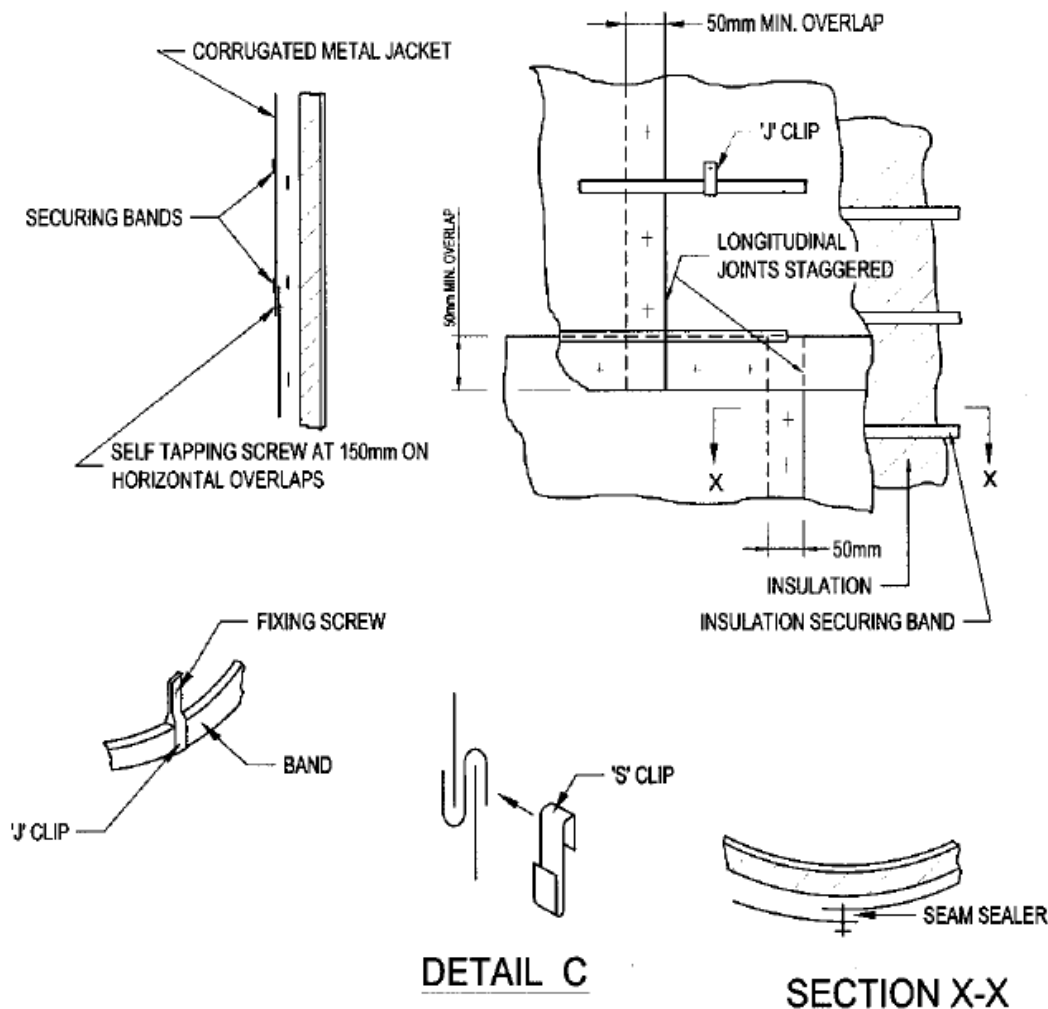
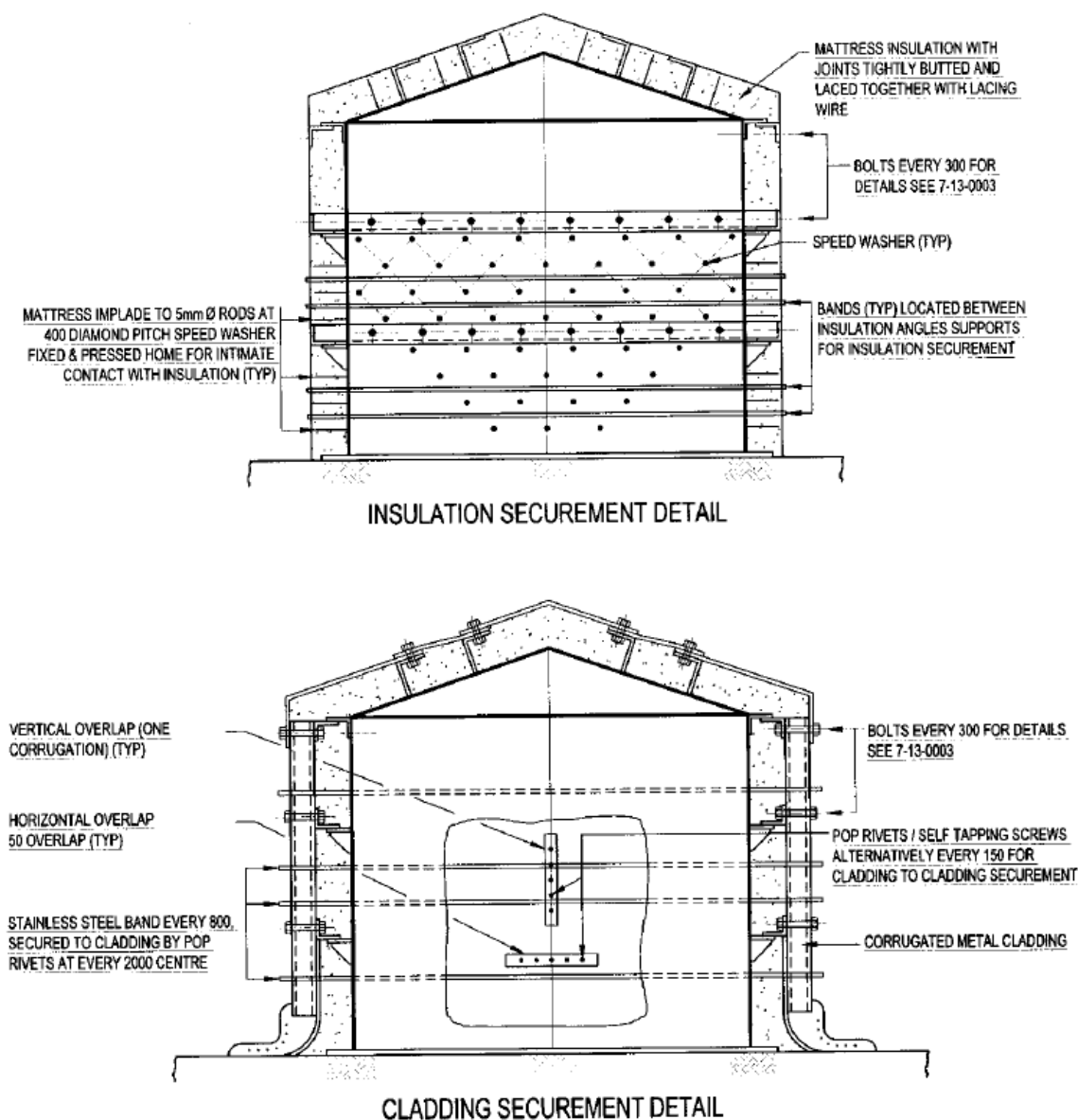


FIGURE – 17
INSULATION DETAILS VERTICAL VESSEL HEADS


NOTE:

FINISHING SHEETING TO BE BANDED AND SCREWED. HORIZONTAL OVERLAPS LEFT UNSCREWED FOR EXPANSION PURPOSES SHALL BE SECURED AND SUPPORTED WITH 'S' CLIPS.

**FIGURE – 18
INSULATION DETAILS : VERTICAL VESSELS**



NOTE :- PROVIDE MASTIC MOISTURE BARRIER ON SHELL & ROOF INSULATION, PER CLAUSE 5.1.1 BEFORE APPLYING CLADDING

FIGURE – 19
INSULATION DETAILS : VERTICAL STORAGE TANK

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11. INSULATION MATERIALS

1.Piping and Equipment Heat Conservation (Process Temp up to 550°C).

Insulation material for heat conservation(IH&IT): Mineral wool(ASTM C 612). For insulation thickness table refer to TABLE-01

2. Piping and Equipment Personnel Protection (Process Temp up to 550°C)

Insulation material for Personal protection (PP): Mineral wool(ASTM C612) for process temperatures up to 550°C. For insulation thickness table refer to TABLE-02

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TABLE-01

INSULATION THICKNESS FOR HEAT CONSERVATION

NOMINAL PIPE SIZE	NORMAL OPERATING TEMPERATURE (°C) AND THICKNESS (mm)										
	Up to 100	101 to 150	151 to 200	201 to 250	251 to 300	301 to 350	351 to 400	401 to 450	451 to 500	501 to 550	551 to 600
MM	THK	THK	THK	THK	THK	THK	THK	THK	THK	THK	THK
15	25	25	30	40	50	55	65	75	90	100	115
20	25	25	30	40	50	60	70	85	95	110	125
25	25	25	30	50	60	70	80	95	100	115	130
40	25	25	40	50	60	70	85	100	110	125	140
50	25	25	40	50	60	70	90	105	115	130	150
65	25	25	40	50	60	75	95	110	120	140	160
80	25	30	40	50	70	80	95	115	125	150	170
100	25	30	40	60	70	80	100	125	140	160	180
150	25	30	50	60	70	90	105	130	150	170	190
200	25	30	50	60	80	95	110	140	160	180	200
250	25	40	50	60	80	95	115	140	160	190	210
300	25	40	50	70	80	100	120	150	170	190	215
350	25	40	50	70	80	100	120	150	170	200	220
400	25	40	50	70	90	100	125	150	170	200	225
450	25	40	50	70	90	105	125	150	175	200	230
500	25	40	50	70	90	105	130	150	180	205	240
OVER 500 & FLAT	25	40	50	70	100	125	160	190	230	270	320
SINGLE LAYER						MULTI LAYER					

Design Basis: Maximum Heat Loss = 150w/m²

Ambient Temp.: 31°C

Wind speed: 11.5 m/sec

Emissivity: 0.15

Mineral wool preformed pipe section: 140kg/m³.

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Multi-Layer Thickness Table:

Multi Layer shall be constructed with layer thickness as follows:

Thickness	1st Layer	2nd Layer	3rd Layer
55	30	25	-
60	30	30	-
65	40	25	-
70	40	30	-
75	50	25	-
80	40	40	-
85	60	25	-
90	60	30	-
95	70	25	-
100	50	50	-
105	80	25	-
110	80	30	-
115	90	25	-
120	90	30	-
125	100	25	-
130	100	30	-
140	100	40	-
150	100	50	-
160	100	30	30
170	100	40	30
175	100	50	25
180	100	50	30
185	100	60	25
190	100	60	30
195	100	70	25
200	100	50	50
205	100	80	25
210	100	80	30
215	100	90	25
220	100	90	30
225	100	100	25
230	100	100	30
240	100	100	40
250	100	100	50
260	100	100	60
270	100	100	70

320 mm thickness shall be constructed with layer thickness: 100 + 100 + 90 + 30 mm.

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TABLE-02

INSULATION THICKNESS FOR PERSONNEL PROTECTION

NORMAL OPERATING TEMPERATURE (0°C) WITH STILL AIR AT 31°C TO GIVE SURFACE TEMPERATURES NO GREATER THAN 60°C.						
NOMINAL PIPE SIZE	60 to 200	201 to 300	301 to 400	401 to 500	501 to 550	550 and Over
mm	Thk	Thk	Thk	Thk	Thk	Thk
15	Personnel protection shall be by guards.	40	55	80	90	Personnel protection at elevated temperatures shal be subject to calculation and special consideration.
20		40	60	90	105	
25		50	65	95	110	
40		50	75	105	120	
50		50	80	110	130	
65		60	85	120	140	
80		60	90	125	150	
100		60	95	140	160	
150		70	105	150	175	
200		80	115	160	190	
250		80	120	180	200	
300		80	125	180	200	
350		90	130	180	200	
400		90	140	180	200	
450		90	140	180	205	
500		90	140	180	210	
OVER 500 & FLAT		90	140	180	210	
SINGLE LAYER			MULTI LAYER			





Design Basis: Maximum Cladding temperature = 60°C
Ambient Temp.: 31°C
Wind speed: 0 m/sec
Emissivity: 0.15
Mineral wool preformed pipe section: 140kg/m³

Multi Layer shall be constructed with layer thickness in accordance with the heat conservation layer thickness as provided above.

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SPECIFICATION FOR PAINTING

Page modified under this revision: Page number 11

			 <small>Written By</small> <small>Karthikeyan Chokkalingam</small> <small>2020.06.11 15:41:51 +05'30'</small>	 <small>Checked By</small> <small>Loganathan Sudarsan</small> <small>2020.06.11 16:14:09</small> <small>+05'30'</small>	 <small>Approved By</small> <small>Vaidyanathan Ramani</small> <small>2020.06.11 16:45:51</small> <small>+05'30'</small>	 <small>Authorized By</small> <small>Jeenukumar</small> <small>2020.06.12 00:39:00</small> <small>+05'30'</small>
C	11-JUNE-2020	ISSUED FOR DESIGN	CK	AS/SL	VV	JMC
B	06-DEC-2019	ISSUED FOR DESIGN	CK	AS	VV	JM
A	14-OCT-2019	ISSUED FOR DESIGN	CK	AS	VV	JM
REV.	DATE	DESCRIPTION	PREPARED	CHECKED	APPROVED	AUTHORIZED

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1. INTRODUCTION

INDIAN OIL CORPORATION LIMITED (IOCL) has awarded Fax of Acceptance (FOA) dated 29th August 2019 to M/s. Technip India Limited (TPIL) for Consultancy services (PMC/EPCM services) for overall project management, FEED Review / FEED, Detailed Engineering, Procurement & expediting services, Tendering & award, Construction Management & Supervision, Assistance in start-up, Commissioning & performance test runs for installation of a Standby SRU of 525 TPD capacity and execution of Additional tanks for Paradip Refinery, Odisha, India.

2. DEFINITIONS & ABBREVIATIONS

Abbreviation	Definition /Expanded form
IOCL/ CLIENT	Indian Oil Corporation Limited
PMC/ CONSULTANT	Technip India Limited
LICENSOR	Party selected by IOCL for process technology ownership for any UNIT
CONTRACTOR	Party whose services are obtained for performing the works specified as part of LSTK / packages.
EPCM	Engineering, Procurement & Construction Management Services.
LSTK	Lump Sum Turn Key portion of the work to be executed by CONTRACTOR
FEED	Front End Engineering Design
AUTHORISED REPRESENTATIVE	IOCL's/ CONSULTANT's representative authorized to act for and on behalf of them.
VENDOR	Any third party supplying the equipment/materials for setting up the Plant
PROJECT	Indicates Standby SRU and Additional tanks Project, Paradip Refinery
UNIT	Indicates any particular portion of the project to be built which can be Process related or Utilities/Offsites related

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SRU	Sulphur Recovery Unit
OISD	Oil Industry Safety Directorate
ASME	American Society of Mechanical Engineers
API	American Petroleum Institute
P&ID	Piping and Instrumentation Diagram
A/G	Above Ground
U/G	Under Ground
B/L	Battery Limit
ISBL	Inside Battery Limit
EOT	Electrically-operated Overhead Travelling
MTO	Material Take Off

3. **SCOPE**

This specification defines the requirements of surface preparation, selection and application of paints and primers for all piping, equipment and structures etc.

The specification is applicable for supply of all paints, coatings, primers and other ancillary items etc. Method of surface preparation, supply and application of paints and primers shall suit given environment, location and temperature. Items requiring painting, field application procedures, inspection and testing of painting shall be governed by this specification.

This specification is suitable for use in normal, corrosive and marine environment of various process, utility and other plants and offsite of refineries, petro-chemicals, onshore terminals and other chemical / industrial plants. Alternative paints / coatings would be specified if necessary for specific or more stringent requirements.

The painting specification covers every type of equipment such as tanks, vessels, drums, heat exchangers/ coolers, air fin coolers, pumps, turbines, compressors, filters, engines, motors, boilers or heaters /furnaces their accessories, fans, stacks / chimney and package units etc.

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The painting specification covers all types of process and utility piping services which can be non-insulated / insulated, jacketed or lined requiring painting. All types of pipe supports, hangers, spring boxes are also covered.

All types of structural steel members, platforms ladders, chequered plates, gratings, walkways, trolleys, monorails, davits, structural steel sheds and buildings are also covered under this painting specification.

The painting of equipment shall conform to equipment data sheets. Painting of piping shall conform to line schedule and piping isometrics etc.

4. **TERMINOLOGY**

MR	Material Requisition
PR	Purchase Requisition
PO	Purchase Order
CS	Carbon steel
LTCS	Low Temp. Carbon Steel
AS	Alloy Steel
SS	Stainless steel
MS	Mild Steel
GI.	Galvanized Iron / steel
ITP	Inspection Test Plan
TPI	Third Party Inspection
DFT	Dry Film Thickness
WFT	Wet Film Thickness
TSAC	Thermally Sprayed Aluminium Coating
Micr.	Micron

5. **EXCLUSIONS**

The following surfaces and materials shall not require painting in general. However, if there is any specific requirement by the owner, the same shall be painted as per the relevant specifications:

- Plastics and or plastic coated surfaces
- Non-ferrous materials like Aluminum, Cu-Ni alloy, Monel, Incoloy
- RCC or cement lined surfaces except those specified
- Gaskets / seals

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- Gauge Glasses
- Meter Faces
- Valve Stem and Threads
- Name Plates
- Insulation or Fireproofing
- Factory Finished Control Panels
- Factory Finished Instrument Cases and Meters

6. REFERENCE CODES & STANDARDS

The following codes shall be applicable, however purchaser may specify any other relevant code for any purpose at any time. The codes latest edition as on date of issue of material requisition shall be applicable.

Code /Std. No	Description
IS: 5	Colours for ready mixed paints and enamels
IS: 101	Methods of test for ready mixed paints and enamels
IS: 2379	Indian Standard for Pipe line identification-colour code
ISO 209	Aluminium and aluminium alloys Chemical composition
ISO 8501-01	Preparation of steel substrates before application of paints and related products - Visual assessment of surface cleanliness
ISO 8502-3 & 9	Preparation of steel substrates before application of paints and related products - Test for assessment of surface cleanliness : Field method for conductometric determination of water soluble salts
ISO12944	Corrosion Protection of steel Structures by Protective Paint System
ASTM E3	Metallographic Examinations
ASTM VOL 6.01 & 6.03	American standard test methods for Paints and Coatings.
ASTM B833	Standard Specification for Zinc and Zinc Alloy Wire for Thermal Spraying (Metallizing) for the Corrosion Protection of Steel , corrosion protection
ASTM C633	Test Method for Adhesive / Cohesive Strength of Flame Sprayed Coatings.

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ASTM D4285	Method for indicating Oil or Water in Compressed Air.
ASTM D4417	Test Method for Field Measurement of Surface Profile of Blasted Steel.
ASTM D4541	Test method for Pull-Off Strength of Coating using Portable Adhesion Testers.
ASTM D4940	Standard Test Method for Conductimetric Analysis of Water Soluble Ionic Contamination of Blasting Abrasives.
ASTM D6677	Standard Test Method for Evaluating Adhesion by Knife1
ANSI A13.1	Scheme for identification of piping systems: American National Standards Institution
ANSI/AWS C2.18	Guide for the Protection of Steel with Thermal Spray Coatings of Aluminium, Zinc and Their Alloys and Composites.
AWS C.2.17	Recommended Practice for Electric Arc Spray.
SSPC-SP	Steel Structures Painting Council
SSPC Publication	The inspection of coatings and linings: A Handbook of Basic practice for Inspectors, Owners, and Specifiers.
SSPC-AB 1	Mineral and Slag Abrasives.
SSPC-AB 3	Ferrous Metallic Abrasives.
SSPC-PA 1	Shop, Field, and Maintenance Painting of Steel.
SSPC-PA 2	Measurement of Dry Coating Thickness with Magnetic Gages.
NACE No. 1 / SSPC-SP 5	White Metal Blast Cleaning.
NACE No. 2 / SSPC-SP 10	Near -White Metal Blast Cleaning.
SSPC-VIS 1	Guide and Reference Photographs for Steel Surfaces Prepared by Dry Abrasive Blast Cleaning.
RAL DUTCH	International Standard for color shade (Dutch Standard)
SIS-05 59 00	Pictorial surface preparation standard for painting of steel surfaces
BS1475	Specification for Wrought Aluminium & Aluminium Alloys for General Engineering Purposes.
BS 2569	Specification for Sprayed Metal Coating.
BS 4232	British Standards (Surface Finish of Blast-cleaned Steel for Painting
NACE Std. RP 0287	Field Measurement of Surface Profile of Abrasive Blast Cleaned Steel Surfaces Using a Replica Tape.

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NACE No.12 / AWS C2.23 M / SSPC-CS 23.00	Specification for the application of thermal spray coatings (Metallizing) of aluminium, zinc, and their alloys and composites for the corrosion protection of steel.
NACE RP 198	The control of corrosion under Thermal Insulation and Fireproofing Materials

ISO 8501-1/ SIS-05 59 00: ISO standard for preparation of steel substrates before application of paints and related products. This standard contains photographs of the various standards on four different degrees of rusted steel and as such is preferable for inspection purpose by the Engineer in charge.

The Contractor shall arrange, at his own cost, to keep a set of latest edition of above standards and codes at site.

The Contractor shall perform the work in accordance with the following reference documents issued to him for execution of painting works.

- Bill of quantities for piping, equipment, machinery and structures etc
- Piping Line List
- Specifications for Painting
- Any Specific requirements from client

7. **GENERAL REQUIREMENTS**

- This specification shall govern all works covered by the contract, and without prejudice to the provisions of various Indian and international codes of practice, standard specifications etc. The Contractor shall carry out the works in all respects with the best quality of materials and workmanship and in accordance with the best engineering practices and instructions of Owner / Engineer in charge.
- All tools, brushes, rollers, spray guns, blast material, hand power tools for cleaning and all equipment, scaffolding materials, shot / sand blasting equipment and air compressors etc. required to be used shall be suitable for the work and all in good order and shall be arranged by the Contractor at site and in sufficient quantity.
- The compressed air supply used for blasting shall be free of water and oil. Adequate separators and traps shall be provided and these shall be drained continuously. Pressure Gauges fitted to compressor shall be calibrated with necessary certificate.
- Blast cleaning equipment shall be in accordance with all applicable regulations. The spraying equipment to be used shall meet the recommendations and instructions set forth by the paint supplier for each specific paint or coating system.
- All mechanical equipment shall be earthed and all necessary precautions shall be taken to prevent the build-up of static electricity. Especially blasting equipment, its operators and the equipment being blasted shall be properly earthed to prevent the occurrence of electro-

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static discharges

- Mechanical mixing shall be used for paint mixing operations in case of two pack systems except that the Engineer in charge may allow the hand mixing of small quantities at his discretion.
- All painting materials and ancillary materials needed for completion of the contract shall conform to the prescribed specifications. Contractor shall procure these materials from specified manufacturers or their stockiest with proper marking and identification as proof of original materials.
- Any sub-standard or duplicate materials or lower grade/ brand materials shall not be used. Owner / Engineer in charge shall have the right to reject all such materials at any stage. Contractor shall seek prior approval from Owner before actual application to avoid rejection of works carried out with such sub-standard materials.
- The Contractor shall bring to the notice of Owner any discrepancy between this specification and codes specified herein. Contractor may request Owner for clarification of any of the applicable clause of this specification or about applicability of a particular painting system for any service / surface. Any deviation from this specification pertaining to supply or application without written permission of Owner shall be rejected by Engineer in charge.
- The items listed in the paint systems is indicative only, however Engineer in charge may decide about the applicability of the paint system for any of the works.
- The Contractor shall ensure all safety and protective apparatus are fully provided to their staffs.
- The contractor shall be fully responsible for carrying out all the necessary painting, coating and lining on external and internal surfaces as per the tender requirement.
- The paint manufacturer's instructions shall be followed as far as practicable at all times for best results. Particular attention shall be paid to the following:
 - Instructions for storage to avoid exposure as well as extremes of temperature.
 - Surface preparation prior to painting shall be followed as per the specification.
 - Mixing and thinning.
- Paint manufacturers shall furnish the characteristics of all paints materials on original printed literature, along with the test certificate for all specified characteristics given in this specification. All the paint materials shall be of first quality and conform to the general characteristics described in various tables.
- Contractor shall fully comply with the client specification for Colour Coding of Piping, Equipment and Structures issued during EPC stage of the project. This specification covers colour codes, identification marking on piping and equipment, recommended colours for paint systems and painting for "Civil Defence" requirements etc.
- Contractor shall ensure that the paint material supplied are fully within the validity period of the product and not exposed to open atmosphere.

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8. EXTENT OF PAINTING

The following surfaces and materials shall require shop, pre-erection and field painting:

- All Non-insulated carbon steel and alloy steel piping as described under scope Including valves, flanges, fittings, specialty items, in line items, and all supports (including painting of identification marks), flare lines ,furnace ducts and stacks.
- Titanium catalyzed inorganic copolymer can be used commonly for all valves.
- All insulated parts of vessels, boilers, chimneys, stacks, piping and steam piping, and any other insulated items present.
- All items contained in a package unit requiring painting.
- All types of structural steel members, platforms ladders, chequered plates, gratings, walkways, trolleys, monorails, davits, structural steel sheds and buildings are also covered under this painting specification.
- External surfaces of MS chimney with or without refractory lining and internal surfaces of MS chimney without refractory lining. (If present)
- Representation of colour bands on all piping including insulated aluminum clad, galvanized, SS and nonferrous piping.
- Identification lettering / numbering on all painted surfaces of equipment / piping insulated aluminum clad, galvanized SS and non-ferrous piping.
- Marking / identification signs on painted surfaces of equipment / piping including hazardous service.
- Supply of all primers, paints and all other materials required for painting (other than Owner supplied materials)
- Metal Area over which insulation surface of equipment and pipes wherever required.
- Painting under insulation for carbon steel, alloy steel and stainless steel as per relevant NACE RP 198 to prevent corrosion.
- Painting of pre-erection / fabrication and Shop primer.
- Repair work of damaged pre-erection / fabrication and shop primer and weld joints in the field / site before and after erection as required.

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- All CS Piping, equipment, storage tanks and internal surfaces of RCC tanks in ETP plant.
- Quality control, testing and inspection during all stages of work (surface preparation, application of coating and testing of furnished coating).

9. **SURFACE PREPARATION**

Any one of following methods of surface preparation shall be followed, depending on condition of surface to be painted and as approved or instructed by Engineer in charge.

- Manual or hand tool cleaning
- Mechanical or power tool cleaning
- Dry abrasive blast cleaning

Before blasting salt contamination test to be carried out for metals & Testing for chloride and soluble salt concentrations and the pH level shall be done using a Bresle Sampler according to ISO 8502-6. The chloride and soluble salt concentrations shall be less than 20 mg/ m² and the pH shall be neutral (between 6 and 8). When these levels are exceeded, the surfaces shall be either steam cleaned or high pressure water washed as per SSPC SP1 or ISO 12944 before abrasive blasting. The cleaned surface shall be retested to verify that the contaminant levels are within the acceptable range. Checks shall be done on each component at least once per 200 m² of blasted surface and a minimum of 3 checks per shift. The test report shall be maintained recording the ambient and substrate temperature, relative humidity, abrasive medium, test obtained valves etc., Measuring device shall be regularly calibrated.

9.1 **Surface Finish Requirements:**

- When surface is exposed to normal atmospheric conditions and where other methods cannot be adopted. May also be used for spot cleaning during maintenance.
 - Solvent Cleaning to SSPC - SP1. Remove oil, grease or wax with a suitable solvent/degreaser (Non-Chloride solvent to be used on SS substrate)
 - Manual or hand tool cleaning to: SSPC-SP-2 or ST.2 Level

Remove loose rust / mill scale / loose paint thoroughly by chipping, scrapping, sanding and or wire brushing. Finished surface shall have a faint metallic

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sheen.

- Mechanical or power tool cleaning to SSPC-SP-3 or ST.3 Level

Remove loose rust / mill scale / loose paint to degree specified by power tool chipping, de-scaling, sanding, wire brushing and grinding, after removal of dust, surface should have a pronounced metallic sheen.

Care to be taken where the welding / riveting portion of the joints.

- **Dry abrasive Blast cleaning:**

There are four different methods of dry abrasive blast cleaning as described below. Each method shall be selected depending on surface finish required for particular paint system. However Engineer in charge may instruct about any of the system to be followed for a particular job / item as deem necessary.

- White metal to SSPC-SP-5 or SA.3 or NACE #1 Level

Remove all visible rust / Mill scale / paint and foreign matter 100% to achieve desired surface profile with blast cleaning to white metal cleanliness in order to achieve extremely clean surface for prolonged life of paint system.

- Near white metal to SSPC-SP-10 or SA.2 ½ or NACE # 2 Level

Blast clean to near white metal cleanliness until at least 95% of each element of surface area is free of all visible residues with desired surface profile in order to have minimum acceptable clean surface. This is the minimum requirement for chemically resistant paint systems such as epoxy, vinyl, polyurethane based and inorganic zinc silicate paints, also for conventional paint systems used under fairly corrosive conditions to obtain desired life of paint system.

- Commercial Blast to SSPC-SP-7 or SA.2 or NACE # 3 Level

Blast clean until at least two-third of each element of surface area is free of all visible residues with desired surface profile. Used for steel required to be painted with conventional paints for exposure to mildly corrosive atmosphere for longer life of the paint systems.

- Brush-off Blast to SSPC-SP-7 or SA.1 or NACE # 4 Level

Blast cleaning to white metal cleanliness, removal of all visible rust, mill scale, paint and foreign matter where surface profile is not so important

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9.2 Equipment surface Preparation:

- All tools, brushes, rollers, spray guns, blast material, hand power tools for cleaning and all equipment, scaffolding materials, shot & grit blasting equipment and air compressors etc. required to be used shall be suitable for the work and all in good order and shall be arranged by the Contractor at site and in sufficient quantity. The manufacturer's test certificates & data sheets for all the above items shall be reviewed by Engineer in charge at site before start of work.
- Mechanical mixer shall be used for paint mixing operations in case of two pack systems except that the Engineer in charge may allow the hand mixing of small quantities at his discretion in case of specific requirement for touch up work only.
- Mill scale, rust, rust scale and foreign matter shall be removed fully to ensure that a clean and dry surface is obtained. The minimum acceptable standard, in case of thermally sprayed metal coatings, in case of mechanical or power tool cleaning it shall be St. 3 or equivalent. In case of blast cleaning it shall be Sa 2-1/2 as per Swedish Standard SIS-055900 or SSPC-SP or ISO 8501-01. Blast cleaning shall be Sa 3 as per Swedish Standard in case thermally sprayed metal coatings.
- Before surface preparation by blast cleaning, the surface shall be degreased by aromatic solvent to remove all grease, oil etc.

9.3 Use of Dehumidifiers:

- Blast cleaning shall not be performed for internal or external surface, where dust can contaminate surfaces undergoing such cleaning or during humid weather conditions having humidity exceed 85%. In case of internal coating of storage tanks, dehumidifier shall be used, to control humidity level below 60%. Dehumidifier should depress the dew point of air in the enclosed space, enough to maintain it 3°C below the metal substrate temperature during entire period of blasting and coating application. During the interval time between application of primer coat and subsequent intermediate and top coats or between blast cleaning completion and start of application of primer coat,

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dehumidifier unit should be in continuous operation to ensure that no condensation occurs on substrate.

- Dehumidifier should be able to maintain grain drop (moisture removal) at the rate of 25 grains per pound of air per hour. Dehumidifier should have capacity of at least 2 air changes per hour of the enclosed space. All necessary psychometric data should be collected by contractor for the given site conditions before starting operation of dehumidifier to ensure that desired values of dew point, moisture content in enclosed scope is achieved.
- Dehumidification shall be maintained round the clock for surface preparation and painting till the total coating application is over.
- Dehumidifier shall not be stopped under any condition till the entire blasted surface is primed to the satisfaction of the technical representative of the paint manufacturer interested with quality assurance for the work. In case the dehumidifier breaks down in middle of the job, the same shall be replaced at the risk and the cost of the contractor and the entire unfinished work shall be repeated.
- The Engineer in charge shall have the right to disallow usage of dehumidifier if the performance is not meeting the specified requirements. Under such circumstances the contractor shall remove the equipment and replace the same with another equipment to provide satisfactory results without any additional cost to the owner.
- Irrespective of the method of surface preparation, the first coat of primer must be applied by airless spray / air assisted conventional spray if recommended by the paint manufacturer on dry surface. This should be done immediately and in any case within 4 hours of cleaning of surface. However, at times of unfavourable weather conditions, the Engineer in charge shall have the liberty to control the time period, at his sole discretion and/or to insist on recleaning, as may be required, before primer application is taken up. In general, during unfavourable weather conditions, blasting and painting shall be avoided as far as practicable.
- The external surface of R.C.C. chimney stack to be painted shall be dry and clean. Any loose particle of sand, cement, aggregate etc. shall be removed by scrubbing with soft wire brush. Acid etching with 10-15% HCL solution for about 15 minutes shall be carried and surface must be thoroughly washed with water to remove acid & loose particles and then dried completely before application of paint.

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9.4 Air Blast Cleaning with abrasives:

- The surfaces shall be blast cleaned using one of the abrasives like angular chilled cast iron or steel grit, copper slag or Nickel slag, Al_2O_3 particles at pressure of 7 kg/cm² at an appropriate distance and angle depending of nozzle size maintaining constant velocity and pressure.
- Chilled cast iron or steel shall be in the form of shot or grit of size in the range of G 16 - G42 conforming to SSPC AB1 and S250 grade size of steel shots (maximum) to obtain a desired surface profile of 35-50 microns trough to peak. For all other abrasives, size shall be in the range of G16 -G24. The combination of steel grits and shots shall be normally in the ratio of 3 : 1 . The quality of abrasives shall be free from contaminants and impurities and shall meet the requirements of SSPC AB1.
- Compressed air shall be free from moisture and oil. The blasting nozzles should be venturi style with tungsten carbide or boron carbide as the materials for liners. Nozzles orifice may vary from 3/16" to 3/4". On completion of blasting operation, the blasted surface shall be clean and free from any scale or rust and must show a grey white metallic luster. Primer / first coat of paint shall be applied within 4 hours of surface preparation. Blast cleaning shall not be done outdoors in bad weather without adequate protection or when there is dew on the metal, which is to be cleaned. Surface profile shall be uniform to provide good key to the paint adhesion (i.e. 35 to 50 microns). If possible vacuum collector shall be installed for collecting the abrasives and recycling.

9.5 Mechanical or Power Tool Cleaning:

Power tool cleaning shall be done by mechanical striking tools, chipping hammers, grinding wheels or rotating steel wire- brushes. Excessive burnish of surface shall be avoided as it can reduce paint adhesion. On completion of cleaning, the detached rust mill scale etc. shall be removed by clean rags and /or washed by water or steam and thoroughly dried with compressed air jet before application of paint.

9.6 Non-Compatible Shop Coat Primer:

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- For equipment on which application of total protective coating (Primer+ Intermediate + top coat) is carried out at shop, compatibility of finish coat with primer should be checked with paint manufacturer. Specific duration mentioned in the manufacturer specification shall be fully If the shop coat is in satisfactory condition showing no major defect upon arrival at site, the shop coat shall not be removed.
- Shop coated equipment (coated with Primer & finishing coat) should not be repainted unless paint is damaged. Repair shall be carried out as per **Table 10.2** of paint systems depending upon compatibility of paint.
- Shop primed equipment and surfaces will only be 'spot cleaned' in damaged areas by means of power tool brush cleaning or hand tool cleaning and then spot primed before applying one coat of field primer unless otherwise specified. If shop primer is not compatible with field primer then shop coated primer should be completely removed before application of selected paint system for particular environment.
- For Package units/equipment, shop primer should be as per the paint system given in this specification. However, manufacturer's standard can be followed after review.
- Coating application at field (field primer, intermediate and top coat) on equipment, structures, piping, etc. shall be carried out only after its erection and all welding, testing, steam purging (wherever carried out) have been completed.

10. **COATING PROCEDURE & APPLICATION**

- All paint coatings shall be applied by airless spray excepting at the following special cases where application can be carried out by brush subject to suitability of the application of the paint product by brush.
 - Spot repair
 - Stripe coating on edges
 - Small bore parts not suitable for spray application
- Irregular surfaces such as sharp edges, welds, small brackets, and interstices may stripe coated to ensure specified DFT is achieved. Paint manufacture's recommendation should be followed before deciding for brush application.

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- Surface shall not be coated in rain, wind or in environment where injurious airborne elements exists, when the steel surface temperature is less than 5°F above dew point when the relative humidity is greater than 85% or when the temperature is below 40°F and when the ambient/substrate temp is below the paint manufacturer's recommended temperature of application and curing. De-humidifier equipment shall be used to control RH and Dew point. The paint application shall not be done when the wind speed exceeds 20 km per hour.
- Blast cleaned surface shall be coated with one complete application of primer as soon as practicable but in no case later than 4 hours the same day.
- To the maximum extent practicable, each coat of material shall be applied as a continuous film uniform thickness free of probes. Any spots or areas missed in application shall be recoated and permitted to dry before the next coat is applied. Applied paint should have the desired wet film thickness.
- Each coat shall be in proper state of cure or dryness before the application of succeeding coat. Material shall be considered dry for recoating when an additional coat can be applied without the development of any detrimental film irregularities, such as lifting or loss of adhesion of the under coat. Manufacturer instruction shall be followed for inter-coat interval.
- When the successive coat of the same colour have been specified, alternate coat shall be tinted, when practical, sufficiently to produce enough contrast to indicate complete coverage of the surface. The tinting material shall be compatible with the material and not detrimental to its service life and shall be recommended by the original paint manufacturer.
- Airless spray application shall be in accordance with the following procedure: as per steel structure paint Manual Vo. 1 & Vol. 2 by SSPC, USA, Air less spray relies on hydraulic pressure rather than air atomization to produce the desired spray. An air compressor or electric motor is used to operate a pump to produce pressures of 1000 to 6000 psi. Paint is delivered to the spray gun at this pressure through a single hose within the gun, a single paint stream is divided into separate streams, which are forced through a small orifice resulting in atomization of paint without the use of air. This results in more rapid coverage with less over spray.

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- Airless spray equipment is mounted on wheels, and paint is aspirated in a hose that sucks paint from any container, including drums. The unit shall have in built agitator that keep the paint uniformly mixed during the spraying. The unit shall consist of in built strainer. Usually very small quantity of thinning is required before spray. In case of high build epoxy coating (two pack). 30:1 pump ratio and 0.020-0.023" tip size will provide a good spray pattern. Ideally fluid hoses should not be less than 3/8" ID and not longer than 50 ft to obtain optimum results. In case of gun choking, de-choking steps shall be followed immediately.
- Brush application of paint shall be in accordance with the following:
 - Brushes shall be of a style and quality that will enable proper application of paint.
 - Round or oval brushes are most suitable for rivets, bolts, irregular surface, and rough or pitted steel. Wide flat brushes are suitable for large flat areas, but they shall not have width over five inches.
 - Paint shall be applied into all corners.
 - Any runs or sags shall be brushed out.
 - There shall be a minimum of brush marks left in the applied paint
 - Surfaces not accessible to brushes shall be painted by spray, doublers, or sheepkin.
- For each coat the painter should know the WFT corresponding to the specified DFT and standardize the paint application technique to achieve the desired WFT. This has to be ensured in the qualification trial.
- No coat shall be applied until the preceding coat has dried. The material shall be considered dry for re-coating when another coat can be applied without the development of any film irregularities such as lifting or loss of adhesion of undercoats. Drying time of the applied coat should not exceed maximum specified for it as a first coat; if it exceeds the paint material has possibly deteriorated or maxing is faulty.
- No paint shall be force dried under conditions which will cause chalking, wrinkling, blistering formation of pores, or detrimentally affect the conditions of the paint.
- No drier shall be added to paint on the job unless specifically called for in the manufacturer's specification for the paint.

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- Paint shall be protected from rain, condensation, contamination, snow and freezing until dry to the fullest extent practicable.

11. SURFACE PREPARATION METHOD

The table below describes the methods for surface preparation and the standards used for cleanliness and surface preparation for painting /coating works.

SURFACE PREPARATION

Sr. No.	Description	International Standards (Equivalent)			Remarks
		ISO 8501-1 / SIS-05 59 00	SSPC-SP, USA	NACE, USA	
1.	- Solvent Cleaning Remove oil, grease or wax with a suitable solvent/degreaser (Non-Chloride solvent to be used on SS substrate)	ST-1	SSPC - SP1		
2.	Manual or hand tool cleaning: Removal of loose rust, loose mill scale and loose paint, chipping, scrapping, standing and wire brushing. Surface shall have a faint metallic sheen.	ST.2	SSPC-SP-2	-	This method is applied when the surface is exposed to normal atmospheric conditions when other methods cannot be adopted and also for spot cleaning during maintenance painting.
3.	Mechanical or power tool cleaning: Removal of loose rust loose mill scale and loose paint to by power tool chipping, de-scaling, sanding, wire brushing and grinding, after removal of dust, surface shall have a pronounced	ST.3	SSPC-SP-3	-	

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	metallic sheen.				
4	Dry abrasive Blast cleaning: There are four common grades of blast cleaning White metal				
4.1	Blast cleaning to white metal cleanliness: Removal of all visible rust. Mill scale, paint & foreign matter 100% cleanliness with desired surface profile	SA 3	SSPC-SP-5	NACE #1	Where extremely clean surface can be expected for prolong life of paint system.
4.2	Near white metal: Blast cleaning to near white metal cleanliness, until at least 95% of each element of surface area is free of all visible residues with desired surface profile.	SA 2 ½	SSPC-SP-10	NACE #2	For chemically resistant paint systems such as epoxy, vinyl, polyurethane based and inorganic zinc silicate paints, and for paint systems used under fairly corrosive conditions to obtain desired life of paint system.
4.3	Commercial Blast: Blast cleaning until at least two-third of each element of surface area is free of all visible residues with desired surface profile.	SA 2	SSPC-SP-6	NO. 3	For steel required to be painted with conventional paints for exposure to mildly corrosive atmosphere for longer life of the paint systems.
4.4	Brush-off Blast: Blast cleaning to white metal cleanliness, removal of all visible rust, mill scale, and paint foreign matter. Surface profile is not so important	SA 1	SSPC-SP-7	NO. 4	

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12. PAINTING / COATING MATERIALS

12.1 List of Primers and Finish Paints used:

A broad list of primers and finish paints to be used for painting and coating works is as given below:

PRIMERS	
PR-1	Chlorinated Rubber Zinc Phosphate Primer
PR-2	Etch Primer / Wash Primer
PR-3	Two component Epoxy Zinc Phosphate Primer cured with polyamine hardener
PR-4	Single pack, cold galvanizing compounds containing minimum 92% Electrolytic Zinc in dry film. make ZINGA, LOCKTITE (of HENKEL) or ZRC
FINISH COATS / PAINTS	
FP-1	Two component Acrylic – Polyurethane finish paint
FP-2	Chlorinated Rubber finish paint
FP-3A	High Build Epoxy finish coating cured with polyamine hardener
FP-3B	High Build Epoxy finish coating cured with polyamide hardener
FP-3C	Solvent less Epoxy Coating cured with polyamine hardener
FP-4	High build Coal Tar Epoxy coating cured with polyamine hardener
FP-5	Self-priming surface Tolerant High Build Epoxy coating. cured with polyamine hardener
FP-6	Two component Inorganic Zinc Silicate coating
FP-7	Heat resistant synthetic medium based Aluminium paint
FP-8	Two component Heat resistant Silicone Aluminium paint.
FP-9	Specially formulated Coal Tar Epoxy coating. cured with polyamine hardener
FP-10	Two component Epoxy Phenolic coating cured with Polyamine adduct hardener system
FP-11	Engineered Epoxy Poly Siloxane Coating or High Build cold applied inorganic Co-polymer based Aluminium coating
FP-12	Two component solvent free type High Build Epoxy Phenolic / Novalac Epoxy Phenolic coating cured with Polyamine adduct hardener system

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12.2 Detailed Specification of Primers and Finish Paints

The following are the various parameters of primers, finish paints and coating materials to be used for carrying out various painting / coating works

PRIMERS

Sr. No.	Description	PR-1	PR-2	PR-3	PR-4
1.	Technical Name	Chlorinated Rubber Zinc Phosphate Primer	Etch Primer / Wash Primer	Epoxy Zinc Phosphate Primer	Zinga, Locktite or ZRC Cold Galvanized
2.	Pack Type	Single Pack	Two Pack	Two Pack	Single Pack
3	Composition	Air Drying Chlorinated, Rubber based medium Plasticized with unsaponifiable Plasticizer, pigmented with zinc phosphate	Polyvinyl butyral resin medium cured with phosphoric acid solution. pigmented with zinc tetroxy chromate	Polyamine cured epoxy resin, medium, pigmented with zinc phosphate	Synthetic resin based zinc galvanizing containing min 92% of electrolytic zinc dust of 99.95% purity.
4.	Vol. Solids %	40±3	10±1	50±1	37%
5.	DFT (Micron) / Coat	40-45	8-10	40-50	40-50fl
6.	Covering M ² / Coat / Litre	8-10	8-10	8-10	4 m ² /kg
7.	Wt. Kg. / Litre	1.3±0.05	1.2±0.05	1.4±0.05	2.67 kg at 15°C
8.	Touch Dry at 30°C Min.	30 minutes	2hrs.	After 30 min.	10 minutes
9.	Hard Dry at 30°C Max.	8 hrs.	24 hrs.	8 hrs.	24 hrs.
11.	Over-coat Interval at 30°C	Min.: 8 hrs.	Min.: 4-6 hrs.	Min.:8hrs.	Min.:4 hrs
12.	Pot Life at 30°C	Not applicable	Not applicable	6-8 hrs.	Unlimited
13.	Temperature. Resistance min	60°C Drv service	NA Dry service	80°C Dry service	50°C Dry service

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FINISH PAINTS

Sr. No.	Description	FP-1	FP-2	FP-3A /B	FP-3C	FP-4
1.	Technical Name	Acrylic Polyurethane finish paint	Chlorinated Rubber based finish paint	Epoxy-High Build coating	Solvent less Epoxy coating	High Build Coal Tar Epoxy coat.
2.	Pack Type	Two pack	Single pack	FP-3A: Two pack	Two pack	Two pack
3	Composition	Aliphatic isocyanate cured acrylic finish paint with Glossy-High Glossy finish	Plasticized chlorinated rubber based medium with chemical and weather resistant pigments.	FP-3A: Aromatic amine cured epoxy resin medium suitably pigmented. FP-3B: polyamide cured epoxy resin medium suitably pigmented	Cured with Amine Adduct; catalyzed epoxy resin suitably pigmented.	Polyamide cured epoxy resin blended with coaltar medium, suitably pigmented
4.	Vol. Solids %	40±3	38±2	60±3	99±1	65±3
5.	DFT (Micron) / Coat	30-40	30-40	100-125	200-500	100-125
6.	Covering M ² / Coat / Litre	11-15	11-15	5-6	2-3	5.2-6.5
7.	Wt. Kg. / Litre	1.15±0.03	1.15±0.03	1.42±0.03	1.40±0.03	1.40±0.03
8.	Touch Dry at 30°C Max.	30 Min.	30 Min.	3 Hrs.	3 Hrs.	4 Hrs..
9.	Hard Dry at 30°C Max. Full Cure at 30°C for Immersion	8 Hrs. NA	8 Hrs.. NA	16 Hrs. 5 days	16 Hrs. NA	48 Hrs. 5 days
10.	Over-coat Interval at 30°C (Min)	12 Hrs.	Overnight.	Overnight. Max.: 5 days	8 Hrs.. Max.: 48 hrs	24 Hrs. Max.:5 days
11.	Pot Life at 30°C for paints -two components	6-8 Hrs.	NA	4-6 Hrs.	30 Min.	4-6 Hrs.
12.	Temperature. Resistance - Dry service - Immersion	80°C -	- 60°C	80°C -	120°C 50°C	- 125°C

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FINISH PAINTS... CONT'D

Sr. No.	Description	FP-5	FP-6	FP-7	FP-8
1.	Technical Name	High Build Epoxy , self-priming type surface tolerant coating (for complete rust control)	Inorganic zinc silicate coating	Aluminum Paint Heat resistant synthetic medium based suitable up to 250°C dry temp	Silicone Aluminum Paint Heat resistant suitable up to 500°C dry temp.
2.	Pack Type	Two pack	Two pack	Two pack	Single pack
3	Composition	Epoxy resin based suitable pigmented and capable of adhering to manually prepared surface and old coating.	Air drying self curing solvent based inorganic zinc silicate coating with minimum 80% zinc content on dry film. The final cure of the dry film shall pass the MEK rub test. Zinc purity shall be Type-II of ASTM D520	Heat resistant synthetic medium based Aluminium paint suitable upto 250°C.	Silicon resin based medium with Aluminum flakes.
4.	Vol. Solids %	78±3	60±3	38±0.03	20±2
5.	DFT (Micron) / Coat	100-125	65-75	15-20	15-20
6.	Covering M ² / Coat / Litre	6.0-7.2	8-9	10-12	8-10
7.	Wt. Kg. / Litre	1.41 ± 0.03	2.3 ± 0.03	0.95 ± 0.03	1.0 ± 0.03
8.	Touch Dry at 30°C Max.	3 Hrs.	30 Min.	3 Hrs.	30 Min.
9.	Hard Dry at 30°C Max. Full Cure 30°C for Immersion	24 Hrs. 5 days	12 Hrs. NA	12 Hrs. NA	24 Hrs. NA
10.	Over-coat Interval Min.	10 hrs.	12 hrs. at 20°C & 50% RH.	24 hrs.	24 hrs.
11.	Pot Life at 30°C	90 Min.	4-6 Hrs.	NA	NA
12.	Temperature. Resistance Min. Dry service	80°C	540°C.	250°C	500°C .

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FINISH PAINTS... CONT'D

Sr. No.	Description	FP-9	FP-10	FP-11	FP-12
1.	Technical Name	Coal Tar Epoxy Polyamine cured	Epoxy Phenolic coating Two-component cured with Polyamine adduct hardner system (primer + intermediate coat + finish paint).	Poly Siloxane Coating - ambient temperature curing / High build inorganic copolymer based Aluminium coating, cold applied suitable for under insulation coating of CS and SS piping for high temperature service	High Build Epoxy phenolic based - Two components solvent free type / Novalac Epoxy Phenolic coating
2.	Pack Type	Single pack	Two pack	Two pack	Single pack
3	Composition	Specially formulated polyamine cured coal tar epoxy suitable for application under insulation	Temperature curing epoxy phenolic coating system suitable for application under insulation of CS/AS/SS piping	Amercoat 738 from PPG Protective & Marine Coatings or Interterm 751 CSA of International (Akzo Nobel). Note: 6	High build epoxy phenolic / Novalac Epoxy phenolic coating cured with Polyamine adduct hardner system
4.	Vol. Solids %	70 ± 3	70 ± 3	60 ± 2	98 -100
5.	DFT (Micron) / Coat	100-125	75-100	75-100	125-150
6.	Covering M ² / Coat / Litre	5-8	4-5	7-9	6.5-8
7.	Wt. Kg. / Litre	1.45 ± 0.03	1.65 ± 0.03	1.3	1.7
8.	Touch Dry at 30°C Min.	4 Hrs.	3 Hrs.	1 Hrs.	2 Hrs.
9.	Hard Dry at 30°C Max.Full Cure 30°C for Immersion	24 Hrs. 168 Hrs.(7days)	24 Hrs. 168 Hrs.(7days)	16 Hrs. -	24 Hrs. 168 Hrs.7days)
10.	Over-coat Interval Min,	6 Hrs. Max.: 5 days	16 Hrs. Max.: 21 days	16 Hrs.. Max.: NA	16 Hrs. Max.: 21 days
11.	Pot Life at 30°C	4 Hrs.	4-6 Hrs.	1 Hr.	1 Hr.

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12.	Temperature. Resistance Min.	-45°C to 125°C under insulation And immersion	-45°C to 150°C under insulation & immersion. (Note: 5)	<ul style="list-style-type: none"> Up to 400 °C for CS & SS for Intertherm 751 CSA Up to 480 °C for CS and up to 600 °C for SS for Amercoat 738 (Note 6) 	-45°C to 150°C for immersion service
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Notes:

- Covering capacity and DFT depends on method of application. Covering capacity specified above is theoretical. Allowing the losses during application, min. specified DFT shall be maintained.
- All primers and finish coats shall be cold cured and air drying unless otherwise specified.
- All paints shall be applied in accordance with manufacturer's instructions for surface preparation, intervals, curing and application. The surface preparation, quality and workmanship shall be ensured. In case of conflict between this specification and manufacturer's recommendation, the same shall be clarified with Engineer in charge.
- Technical data sheets for all paints shall be supplied at the time of submission of quotations.
- FP-10 Two-component Epoxy phenolic coating cured with Polyamine adduct hardner system (primer + intermediate coat + finish paint) suitable upto 225°C (Intertherm 228 from M/s Akzo Nobel Coatings India Pvt Ltd. Bangalore). For all other companies, the temperature resistance shall be a maximum of 150°C.
- FP-11 Ambient temperature curing epoxy poly siloxane Coating or high build cold applied inorganic co-polymer based aluminium coating. Amercoat 738 from PPG Protective & Marine coatings, Mumbai is suitable up to 480°C for CS surfaces and 600°C for SS surfaces. Intertherm 751 from Akzo Nobel Coatings India Pvt Ltd., Bangalore, Inorganic co- polymer cold applied Aluminium spray coating is suitable upto 400°C of CS & SS surfaces.

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13. PAINTING SYSTEM TABLES & SELECTION CRITERIA

13.1 Painting System Tables:

There are 11 painting system tables in this specification covering most of painting and coating works. However, new table may be added based on project requirement for any specific painting works as necessary. The tables are as under:

Table-01	Painting systems for uninsulated piping, equipment and structures in process units, power plant, DM plant, cooling tower, chimney / stack, package units and any other equipment in process units also including offsite in coastal areas
Table-02	Painting system for insulated equipment and piping (under insulation) in process units and off sites (Carbon steel, LTCS, SS & low alloy steel)
Table-03	Painting system for uninsulated storage tanks in process units and off sites (Carbon steel & low alloy steel)
Table-04	Painting system for internal surface of storage tanks in process units and off sites (Carbon steel & low alloy steel)
Table-05	Painting system for external surface of underground piping and vessels in units and off sites (Carbon steel)
Table-06	Painting system for internal protection of components of coolers / condensers in fresh water service in units and off sites (Carbon steel)
Table-07	Painting system for internal protection of components of coolers / condensers in fresh water service in units and off sites (Stainless steel, duplex stainless steel, non-ferrous materials & galvanized steel)
Table-08	Painting system for effluent treatment plants (ETP)
Table-09	Coating systems for gratings, rolling & stationery ladders, spiral stairways and hand rails in all location
Table-10	Repair of pre-erection / pre-fabrication or shop primer after erection / welding of uninsulated piping and equipment in all environments. (CS, LTCS & low allow steel)
Table-11	Painting system for uninsulated Piping, Equipment, Tanks & Package units in Process Units & Off-Sites (Stainless Steel)

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13.2 Table selection Criteria:

The painting Table shall be selected based on following broad parameters given below. The selection criteria shall also be in the order below. All necessary precaution shall be taken in selecting the applicable table. In case of any difficulty Contractor may seek clarification before starting the works from Engineer in charge whose decision shall be final and binding on the Contractor.

Sr. No.	Criteria	Description	Details
1	Plant Location	<ul style="list-style-type: none"> Non Coastal / Inland Coastal / Marine 	More than 50 KM from Sea shore Coastal / Marine Within 50 KM from Sea shore
2	Environment	<ul style="list-style-type: none"> Industrial Industrial Marine 	Use Industrial , if Marine environment is not mentioned
3	Type of facility	<ul style="list-style-type: none"> Units Offsite 	Process Units, Power Plant, Cooling Towers, DM Plant, pipe Rack in units, Package units, chimney/ stack, any other equipment in units Offsite- pipe racks, Piping on Sleepers
4	Temperature Ranges	(-) 180°C to 600°C	Temperature varies for case to case. Selection of painting systems according to the operating temperatures of the line.
5	Material of Const. (MOC)	Carbon Steel (CS) Low Alloy Steel, Stainless Steel (SS)	Aluminium, Copper , Monel, Incoloy, Nickel No painting is required
6	<ul style="list-style-type: none"> Insulated Non Insulated 	Equipment / Piping Equipment / Piping	See Under insulation table

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7	<ul style="list-style-type: none"> Aboveground Underground 	Equipment / Piping Equipment / Piping	Equipment /piping in pit consider underground
8	Surface	<ul style="list-style-type: none"> External Internal 	Equipment /piping Equipment only

NOTES: (For ALL Tables)

1. The list of items specified in tables is not exhaustive. More items may be included for a particular Contract as necessary. The Contractor shall complete painting including prefabrication primer for all the items in his scope of work as per tender documents and instructions of Engineer in charge.
2. If the pre-erection / prefabrication and shop primer has already been completed, the same shall not be repeated again in the field. In case the damages of primer are severe and spread over large areas, the Engineer in charge may decide and advise re-blasting and priming again. Repair of pre- fabrication / pre-erection primer, as instructed, shall be carried out by Contractor.
3. All coating system including surface preparation, primer and finish coat for piping shall be done at site / field only.
4. Finish coating is not permitted at equipment manufacture shop.

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TABLE -01
PAINTING SYSTEMS FOR UNINSULATED PIPING, EQUIPMENT AND STRUCTURES IN
PROCESS UNITS, POWER PLANT, DM PLANT, COOLING TOWER, CHIMNEY / STACK,
PACKAGE UNITS AND ANY OTHER EQUIPMENT IN PROCESS UNITS ALSO INCLUDING
OFFSITES (Carbon Steel, LTCS & Low Alloy Steel)

Sl. No.	Temp.in °C	Surface Preparation & Pre erection / Shop Primer	Painting System (Post-erection / Field)		Total Final DFT in Micr. (min.)	Remarks
			Primer	Finish Coat		
						<ul style="list-style-type: none"> No over coating to be done on FP-6 as it will lead to mud cracking.
1.2	-14 to 100	SSPC-SP-10 FP-6 = 75 µm FP-3A =150 µm FP-1 =35 µm Total DFT at shop = 260 µm	FP-1 =40 µm will apply after pressure water wash & surface rubbing Cumulative DFT = 300		300	<ul style="list-style-type: none"> FP-8 shall be ambient temperature curing type. Finish coat including primer compatible with finish coat. (I.e. field primer) shall be applied at site only.
1.3	101 to 400	SSPC-SP-10; 1 coat of FP-6 @ 65 - 75 micr. DFT / Coat	None	2 Coat of FP-8 @ 20 micr. DFT / Coat 2x20 =40	105 - 115	
1.4	401 to 540	SSPC-SP-10; 1 coat of FP-6 @ 75 micr. DFT / Coat	None	2 Coat of FP-8 @ 25 micr. DFT / Coat (2x25 =50)	125	

➤ For external surface of MS chimney with or without refractory lining and for internal surface without refractory lining, paint system at Sl. No.1.3 of the above table shall be followed.

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- For external surface of RCC Chimney 2 coats of FP-3A @ 100 Micr. DFT/ coat to obtain total DFT of 200 Micr. shall be applied after proper surface preparation as per Clause 9.3.7
- In case of paint systems as per Sl. Nos. 1.3 and 1.4, the colour bands shall be applied over the Aluminum paint as per the Color coding system requirement for specific service of piping.
- For 1.3 & 1.4 finish coat at field may be applied at shop itself and touch-up will be done at field.

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TABLE -02
PAINTING SYSTEM FOR INSULATED EQUIPMENT AND PIPING (UNDER INSULATION) IN
PROCESS UNITS AND OFFSITES (Carbon Steel, LTCS, SS & Low Alloy Steel)

Sl. No.	Temp.in °C	Surface Preparation & Pre erection / Shop Primer	Painting System (Post-erection / Field)		Total Final	Remarks
			Primer / Intermediate	Finish Coat	DFT in Microns (min.)	
2.1	Equipment & Piping - Carbon steel, LTCS and low Alloy steel					
2.1.1	- 45 to 200	SSPC-SP-10 1 coat of FP-10 @ 125 micr. DFT/coat.	None	1 coat of FP-10 @ 75micr. DFT/coat. (1x125=125)	250	
2.1.2	201 to 540	SSPC-SP-10; 1 coat of Titanium catalyzed inorganic ceramic coploymer @ 150 micr. DFT/coat.	None	1 coat of Titanium catalyzed inorganic ceramic coploymer @ 150micr. DFT/coat.	300	
2.2	Piping -Stainless Steel including Alloy-20 (Note:2)					
2.2.1	-180 to 600	For SS SSPC-SP-6 Commercial Blast/ For SS SSPC-SP-1 With non-chloride solvent 1 coat of Titanium catalyzed inorganic ceramic coploymer @ 150 micr. DFT/coat.	None	1 coat of Titanium catalyzed inorganic ceramic coploymer @ 150micr. DFT/coat. (150x1=150)	300	
2.3	No painting is required for insulated Monel, Incoloy and Nickel lines.					

- **"Cyclic Service"** is characterized by rapid temperature fluctuation.
- The blast cleaning abrasives for SS and Alloy steel surfaces shall be Aluminium oxide grits/shots or garnet.
- Surface shall be thoroughly degreased using an appropriate emulsion cleaner and

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abrasive cleaned (sweep blasting) to create a sufficient anchor profile. Abrasive for blast cleaning of stainless steel surfaces shall be performed with a suitable non-metallic abrasive such as aluminum oxide. When hand or power tool cleaning is required on stainless steel, only stainless steel wire brushes that have not been previously used on carbon steel surface must be used. All coatings and solvents for use on stainless steel shall be free of substances such as chlorides and other halides, sulfur, and shall be free of low melting point metals (zinc, aluminum, tin and lead).

- For 2.1.1, 2.1.2 & 2.2.1 finish coat at field may be applied at shop itself and touch-up will be done at field.

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TABLE -03
PAINTING SYSTEM FOR UNINSULATED STORAGE TANKS IN PROCESS UNITS AND
OFFSITES (Carbon Steel & Low Alloy Steel)

Sl. No.	Temp.in °C	Surface Preparation (Field)	Painting System (In field after welding & erection)		Total DFT in Microns (min.)	Remarks
			Primer	Finish Coat		
3.1	All external surfaces of shell, wind girders, appurtenances, roof tops of all above ground tank including top side of external and internal floating roof and associated external structural works.					
3.1.1	-14 to 100	SSPC-SP-10	1 coat of FP-6 @ 65-75 micr. DFT/coat +1 coat of PR-3@ 40 micr. DFT/coat.	2 coats of FP=3A @ 100 micr. DFT/coat + 1 coat of FP-1 @ 70 micr. DFT/coat;	345-355	FP-3A should be suitable for occasional water immersion.
3.1.2	101 to 150	SSPC-SP-10	1 coat of FP-10 @ 80 micr. DFT/coat +1 coat of FP-10 intermediate coat @ 80 micr. DFT/coat.	1 coats of FP-10 @80 micr. DFT/coat + 1 coat of FP-1@ 40 micr. DFT/coat;	280	-
3.1.3	151 to 500	SSPC-SP-10	1 coat of FP-6 @ 65-75 micr. DFT/coat	2 coats of FP-8 @20 micr. DFT/coat (or) 1coat of FP-11 @ 50 micr.	105	-
3.2	External surfaces of bottom plate (soil side) for all storage tanks.					
3.2.1	-14 to 80	SSPC-SP-10	1 coat of FP-6 @ 75 micr. DFT/coat.	2coat of High Glass Flake Epoxy @ 200 micr. DFT/coat.(2x200=400)	475	

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3.2.2	81 to 150	SSPC-SP-10	1 coat of FP-10 @ 80 micr. DFT/ coat +1 coat of FP-10 intermediate coat @ 80 micr. DFT/ coat. (80+80=160)	1 coats of FP-10 finish coat @80 micr. DFT/coat.	240	-
3.2.3	151 to 550	SSPC-SP-10	1 coat of FP-11 @ 125 micr. DFT/coat	1 coats of FP-11 finish coat @80 micr. DFT/coat.	250	-
3.3	For underside of the bottom plate (in case tank is not lifted during PWHT) (see Note 2c)					
3.3.1	-180 to 650	For CS SSPC-SP-6 Commercial Blast For SS SSPC-SP-1 With non-chloride solvent	1 coat of inter polymeric matrix coating @ 125 microns.	2 coat of inter polymeric matrix coating @ 125 microns.	350-400	Products from JOTUN or HI-TEMP coating or SK FOMULATION recommended.

- All paint coating application including primer for tankage shall be carried out at field after erection and completion of all welding.
- For underside of bottom plate, painting shall be carried out before laying of bottom plate for tanks with Non-Post Weld Heat Treatment (PWHT).
- For tanks with PWHT, painting shall be carried out after PWHT.
- In case tank is not lifted during PWHT then painting shall be applied before laying of bottom plate, SI no. 3.3.1 shall be followed.

Caution: PWHT temperature shall not exceed 650°C.

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TABLE -04

PAINTING SYSTEM FOR INTERNAL SURFACE OF STORAGE TANKS IN PROCESS UNITS AND OFFSITES (Carbon Steel & Low Alloy Steel)

Sl. No.	Temp.in °C	Surface Preparation (Field)	Painting System (In field after welding & erection)		Total DFT in Microns (min.)	Remarks
			Primer	Finish Coat		
4.1	Crude oil, ATF, Turpentine oil, Lubricating oil and Vegetable oil Underside of floating roof, internal surface of cone roof, inside of bottom plate, Internal surfaces of Shell - including wetted and free board height, oil side surfaces of deck plates, oil side surfaces of pontoons, roof structures, structural steel, ladders and other carbon steel internals.					
4.1.1	-14 to 90	SSPC-SP-10	1 coat of FP-10 primer@ 80 micr. DFT/coat.	1 coats of FP-10 intermediate coat @80micr. DFT/coat+ 1coat of FP-10 finish coat@ 80 micr.	240 - 300	-
4.2	Petroleum products & Intermediates Like LDO, HSD, Gas oil, Feeds of FCC -PC, FCC-LCO, VGU-HDT, ISOM, DHDT, Reformate, DCU, NHT & Gasoline, Naphtha, Isomerate and Kerosene. Underside of Floating roofs, internal surface of cone roof, inside of bottom plate, internal surfaces of Bare shell for full height, underside of floating roof, oil side surfaces of deck plates, oil side surfaces of pontoons, support structures and ladders etc.					
4.2.1	-14 to 45	SSPC-SP-10	1 coat of FP-6 @ 75 micr. DFT/coat.	-	75	Note-1
4.2.2	46 to 90	SSPC-SP-10	1 coat of FP-10 primer@ 80 micr. DFT/coat+	1 coats of FP-10 intermediate coat @80micr. DFT/coat+ 1coat of FP-10 finish coat@ 80 micr. DFT/coat;	240-300	-
4.3	Raw / Fresh water, Potable water and Fire water All internal surfaces, accessories and roof structures of cone and dome roof tanks					
4.3.1	-14 to 65	SSPC-SP-10	1 coat of PR-3 @ 100 microns. DFT/coat	2 coats of FP3A @ 100 micr. DFT/coat. (2x100=200)	300	Note-2

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4.4	De-mineralized water (DM) All internal surfaces, accessories and roof structures of cone and dome roof tanks					
4.4.1	-14 to 60	SSPC-SP-10	1 coat of PR-3@ 100micr. DFT/coat.	2 coats of FP-3C @ 200 micr. DFT/coat. (2x100=200)	400 - 450	-
4.4.2	61 to 150	SSPC-SP-10	1 coat of FP-10 primer@ 80 micr. DFT/coat.	1 coats of FP-10 intermediate coat @80micr. DFT/coat+ 1coat of FP-10 finish coat@ 80 micr. DFT/coat; (80+80=160)	240 - 300	-
4.5	Hydrochloric Acid (HCl) 10% All internal surfaces, accessories and roof structures of cone and dome roof tanks					
4.5.1	-14 to 60	SSPC-SP-10	None	Natural Rubber Lining	4.5 mm	-
4.6	Aggressive Solvents like Hexane, Hexene, Benzene, Xylene and Toluene All internal surfaces, accessories and roof structures of cone and dome roof tanks.					
4.6.1	-14 to 65	SSPC-SP-10	1 coat of FP-6 @ 75microns. DFT/coat	-	75	-
4.7	Ethylene Glycol (EG) Tanks Internal shell-full height, bottom plate, underside of roof and all accessories					
4.7.1	ALL	SSPC-SP-10	1 coat of FP-10 primer@ 80micr. DFT/coat.	31 coats of Vinyl chloride Co-polymer Amercoat 23 @75micr. DFT/coat (3x75=225)	225	-
4.8	Inside pontoon and inside of double deck of all tanks floating roofs					
4.8.1	-14 to 80	SSPC-SP-3	1 coat of FP-5@ 100micr. DFT/coat.	1 coats of FP-5 coat @100micr. DFT/coat	200	-
4.9	Wet Slops, Amine Solutions, Sour water, Water draw off All internal surfaces, accessories and roof structures of Cone and Dome roof tanks.					

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4.9.1	-14 to 90	SSPC-SP-10	1 coat of Novolac Phenolic Epoxy Primer@ 125micr. DFT/coat.	1coat of Novolac Phenolic Epoxy finish coat@ 125 micr. DFT/coat; (80+80=160)	250	-
4.10	Vacuum Residue, Fuel oil, Dry Slop, Bitumen and other High Temperature Hydrocarbon Liquids. Underside of floating roof, internal surface of cone roof, bottom plate, inside of bare shell - including wetted and non-wetted surfaces, oil side surfaces of deck plates, oil side surfaces of pontoons, roof structures, structural steel and ladders.					
4.10.1	Up to 150	SSPC-SP-10	1 coat of FP-12 Primer@ 125micr. DFT/coat.	1 coats of FP-12 intermediate coat @125micr. DFT/coat+ 1coat of FP-12 finish coat@ 125 micr. DFT/coat; (125+125=250)	375	Note-3
4.11	Alkalis up to 50 % Concentration All internal surfaces accessories and roof structures of cone and dome roof tanks					
4.11.1	Up to 60	SSPC-SP-10	1 coats of Novolac Phenolic Epoxy primer @125micr. DFT/coat.	1coats of Novolac Phenolic Epoxy @100micr. DFT/coat. (1x125=1250)	250	-

Notes:

1. FP-6 shall be suitable and resistant for immersion service for the respective Hydrocarbons.
2. FP-3A shall be suitable for drinking water service and should have competent authority certification.
3. This system can be used where maximum operating temperature is below 150°C and design temperature is up to 200°C. Cases of operating temperature above 150°C are not covered in this spec; such cases shall be covered in the job specifications.

TABLE -05

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PAINTING SYSTEM FOR EXTERNAL SURFACE OF UNDERGROUND PIPING AND VESSELS IN UNITS AND OFFSITES (Carbon Steel)

Sl. No.	Temp.in °C	Surface Preparation & Shop Primer	Coating System (Field)		Total	Remarks
			Surface Preparation & Primer	Finish Coat	Final DFT in Microns (min.)	
5.1	External surface of non-insulated underground piping					
5.1.1	25 to 65	-	SSPC-SP-10; Three layer polyethylene coating, thickness as per JSS for coating.			
5.1.2	66 to 150	-	SSPC-SP-10; 1 coat of FP-12 primer @ 125micr. DFT/coat.	1 coats of FP-12 intermediate coat @125micr. DFT/coat+ 1coat of FP-12 finish coat @ 125 micr. DFT/coat;	375	-
5.1.3	151 to 400	-	SSPC-SP-10; 1 coat of FP-11 primer @ 125micr. DFT/coat.	1 coat of FP-11 finish coat @ 125micr. DFT/coat.	250	-
5.2	External surface of non-insulated underground storage vessels					
5.2.1	-14 to 80	SSPC-SP-10; 1 coat of FP-6 @ 65-75 micr. DFT/coat.	-	3 coat of FP-4 @ 100 micr. DFT/coat.	365-375	-
5.2.2	81 to 150	SSPC-SP-10; 1 coat of FP-6 @ 125 micr. DFT/coat.	-	1 coat of FP-12 Intermediate coat @ 125micr. DFT/coat+ 1coat of FP-12 finish coat @ 125 micr. DFT/coat;	375	-
5.2.3	151 to 400	SSPC-SP-10; 1 coat of FP-11 @ 125 micr. DFT/coat.	-	1 coats of FP-11 finish coat @125micr. DFT/coat	250	-

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TABLE -06
PAINTING SYSTEM FOR INTERNAL PROTECTION OF COMPONENTS OF COOLERS /
CONDENSERS IN FRESH WATER SERVICE IN UNITS AND OFFSITES (Carbon Steel)

Sl. No.	Temp.in °C	Surface Preparation & Shop Primer	Coating System (Field)		Total	Remarks
			Surface Preparation & Primer	Finish Coat	Final DFT in Microns (min.)	
6.1	Fresh water boxes, channels, partition plates, end covers and tube sheets etc.					
6.1.1.	Up to 80	SSPC-SP-10;	1 coat of FP-10 @ 80micr.	2 coat of FP-10@ 80 micr. DFT/coat;	240	-
6.1.2.	80 to 140	SSPC-SP-10;	-	1Coat of glass Fibre Reinforced Novolac epoxy of 1.5mm DFT	1500	-

TABLE -07
PAINTING SYSTEM FOR INTERNAL PROTECTION OF COMPONENTS OF COOLERS /
CONDENSERS IN FRESH WATER SERVICE IN UNITS AND OFFSITES
(Stainless Steel, Duplex Stainless Steel, Non-ferrous materials & Galvanized Steel)

Sl. No.	Temp.in °C	Surface Preparation & Shop Primer	Coating System (Field)		Total Final DFT in Microns (min.)	Remarks
			Surface Preparation & Primer	Finish Coat		
7.1	Up to 80	Sweep Blasting	1 coat of FP-10 @ 80micr. DFT/coat;	1 coat of FP-105@ 80 micr. DFT/coat;	160	-
7.2.	80 to 140	Sweep Blasting	-	1Coat of glass Fibre Reinforced Novolac epoxy of 1.5mm DFT	1500	-

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TABLE -08

PAINTING SYSTEM FOR EFFLUENT TREATMENT PLANTS (ETP)

Sl. No.	Temp.in °C	Surface Preparation	Coating System		Total	Remarks
			Primer	Finish Coat	DFT in Microns	
8.1	External Surface of C.S./ M.S. items screens, walk way, bridges, baffles, dual media filters, Vertical pumps, piping in treated effluent sump, bio sludge pump,					
8.1.1	-14 to 80	SSPC-SP-10	1 coat of FP-6 @ 65-75 micr. DFT/coat	2 coats of FP-3A@100 micr. DFT/coat+ 1coat of FP-1 @ 40 micr. DFT/coat; (2x100+40=240)	305 - 315	
8.2	Internal surfaces of CS/MS Items: Bio-sludge sump, Filter feed sump, Process sump, Sanitary sump, Transfer sump, Sludge, Slop oil tank, scrapping mechanism in Clarifier					
8.2.1	-14 to 80	SSPC-SP-10	1 coat of FP-6 @ 65-75 micr. DFT/ coat.	3 coats of FP-3A @100 micr. DFT/coat (3x100=300)	365 - 375	See * below
8.3	R.C.C./concrete surfaces exposed to effluent water / liquid such as tanks, structures, drains etc. in process sump, TPI separator (Process and oil), Aeration tank and Transfer sump etc.					
8.3.1	-14 to 80	Blast cleaning to SSPC-SP guide lines and Acid etching with 10-15% HCl acid followed by thorough water washing.	Epoxy Screed lining		3mm	Epoxy screed lining shall be applied as per specific manufacturer and Engineer in charge instructions.
8.4	C.S/ M.S Dual media filters (Internal), Chemical dosing tanks(internal) such as Di Ammonium Phosphate (DAP) and Urea					
8.4.1	Up to 60	SSPC-SP-10	Natural Rubber Lining (As per IS 4682, Part I)		4.5mm	Natural Rubber lining shall be applied as per specific manufacturer and Engineer in charge instructions.

- The paint /coating manufacturers shall provide their Quality control test certificate of coating materials (F-3A) for immersion service of the exposed effluent given in 9.2.

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TABLE -09

**COATING SYSTEMS FOR GRATINGS, ROLLING & STATIONERY LADDERS, SPIRAL STAIRWAYS
AND HAND RAILS IN ALL LOCATION**

Sl. No.	Temp.in °C	Coating System	Total DFT in Microns (min,)
9.1	Up to 60	1 coat of High Build Epoxy @ 75 micr. DFT/Coat and 1 coat pf FP-1 @ 50 micr. DFT/Coat	80 microns of finish coat (excluding the thickness of galvanizing) 125

NOTES:

1. No galvanized specimen shall have thickness less than 125 microns.
2. Repair of the damaged area of galvanized coatings due to welding during erection shall be carried out as per recommended practice IS 11759 using cold galvanizing spray process. Organic Paint systems are not acceptable for repair.
3. Approved Cold Galvanizing manufacturers are **ZINGA, LOCKTITE** or **Z.R.C.**

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TABLE -10

**REPAIR OF PRE-ERECTION / PRE-FABRICATION OR SHOP PRIMER AFTER ERECTION /
WELDING OF UNINSULATED PIPING AND EQUIPMENT IN ALL ENVIRONMENTS.
(CS, LTCS & low allow steel)**

Sl. No.	Temp.in °C	Surface Preparation	Coating System	Total DFT in Micr (min.)	Remarks
10.1	-90 to 400	SSPC-SP-3	1coat of FP-6	65-75	See note below and clause 5.9.3
10.2	401 to 550	SSPC-SP-3	1coat of FP-8	20	

- The repair of pre-erection / pre-fabrication or Shop Primer given above shall be done for all items requiring repairs. In case the damages of primer are severe and spread over large area, entire primer shall be removed by blasting to achieve SSPC-SP-10 and surfaces to be primed again with FP-6 or FP-8 as applicable.
- The primer shall be quickly removed from damaged area by mechanical scraping and emery paper conforming to SSPC-SP-3 to expose the white metal. Blast cleans the surface, if possible. Feather the primed surface over the intact adjacent surface(approximately 50mm) surrounding the damaged area by emery paper.

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TABLE -11

**PAINTING SYSTEMS FOR UN-INSULATED PIPING, EQUIPMENT, TANKS & PACKAGE
UNITS IN PROCESS UNITS AND OFFSITES
(STAINLESS STEEL)**

Sl. No.	Temp.in °C	Surface Preparation	Painting System (Post-erection / Field)		Total Final DFT in Micr. (min.)	Remarks
			Primer	Finish Coat		
11.1	0 to 120	SSPC-SP-6 'Sweep blast' using Aluminium Oxide or Garnet abrasive media SSPC-SP-1 With non-chloride solvent	2 Coats of FP-10 @ 125 micr. DFT / Coat 2x125=250	1 Coat of FP-1 @ 75 micr. DFT / Coat 1x75 =75	325	
11.2	121 to 200	SSPC-SP-6 'Sweep blast' using Aluminium Oxide or Garnet abrasive media SSPC-SP-1 With non-chloride solvent	2 Coats of FP-10 @ 125 micr. DFT / Coat 2x125=250	2 Coats of Silicon Acrylic @ 20 micr. DFT / Coat 2x20 =40	290	

- Surface preparation of stainless steel shall be in accordance with IS 8504-2, Sa 1 light blast cleaning to achieve a 25-40µm profile.
- Surface shall be thoroughly degreased using an appropriate emulsion cleaner and abrasive cleaned (sweep blasting) to create a sufficient anchor profile. Abrasive for blast cleaning of stainless steel surfaces shall be performed with a suitable non-metallic abrasive such as aluminum oxide. When hand or power tool cleaning is required on stainless steel, only stainless steel wire brushes that have not been previously used on carbon steel surface must be used. All coatings and solvents for use on stainless steel shall be free of substances such as chlorides and other halides, sulfur, and shall be free of low melting point metals (zinc, aluminum, tin and lead).
- Only air curing heat resistant silicone aluminium paints shall be applied, post heat curing materials are not acceptable
- The colour bands shall be applied over the Aluminum paint as per the Color coding system requirement for specific service of piping.
- Finish coat at field may be applied at shop itself and touch-up will be done at field.

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14. FINISH COLOUR SCHEDULE

14.1 General

This section covers the general colour requirements for structural steelwork and equipment with operating temperatures below 120 deg.C:

Structural Steel, Tanks, Spheres, Electrical Equipment		
Sl. No:	Service	Shade – Shade Number
N/A	Structural Steelwork	Light Grey – RAL 7035
N/A	Spheres and Storage tanks	White – RAL 9003
N/A	Electrical Switch Boards, Cable Conduit and Transformers and all other electrical equipment	Manufacturers Painting standard (including RAL 7035) conforming to relevant code and practices prevailing in the country of manufacture
Un-insulated Equipment, Tanks and Structures		
Sl. No:	Service	Shade – Shade Number
-	Loading Arms (i) Structural Steel (ii) Arms	Light Grey – RAL 7035 Yellow – RAL 1023
96	Heater Structure	Signal Grey – RAL 7004
97	Heater Casing	Aluminium – RAL 9006
98	Vessels and Columns	Aluminium – RAL 9006
99	Hydrogen Bullets	Antique Pink – RAL 3014
100	LPG Vessels	Oxide Red – RAL 3009
101	SO ₂ Vessel	Yellow – RAL 1023
102	Heat Exchangers	Aluminium – RAL 9006
103	FO Tank and Hot Tanks	Black – RAL 9017
104	All Other Tanks	Aluminium – RAL 9006
105	Caustic/Amine/Acid Tanks	Gold/Yellow – RAL 1004
106	Sour Water	Sky Blue – RAL 5015
107	Outer Surface in Boiler House	Aluminium – RAL 9006
108	Steam Turbine	Aluminium – RAL 9006
109	Compressors and Blowers	Dk Grey BS4800 18 B 25
110	Pumps	Cobalt Blue RAL – 5013
111	Motors (Except Fire Motors)	Bluish Green RAL 5021
112	Hand Railing	Red – RAL 3001
113	Staircase, Ladders and Walkways	Black – RAL 9017
114	Load lifting equipment & mono rails etc.	Brown – RAL 8003

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Safety Colour Schemes		
Sl. No:	Service	Shade – Shade Number
115	General Structure	Black – RAL 9017
116	Switchgear (including inside sub- station)	Light Grey RAL 7035
117	Dangerous Obstruction	Alternate Black (RAL 9017) and Orange (RAL 2008) Diagonal Banding
118	Dangerous or Exposed Parts of Machinery	Orange – RAL 2008

14.2 Pipe Colour Bands

This section covers the requirements for a colour scheme identifying the contents of piping carrying products. The colour coding system is based on international specifications such as ASME, ANSI, BS and Indian Standards including IOCL's existing specification for colour coding.

The system of coding consists of a ground/base colour superimposed with secondary colour bands. The ground colour identifies the basic nature of the service and the secondary colour bands distinguish the particular service product contained.

Ground colour shall be applied to the entire length of un-insulated piping.

The ground colours and secondary banding colours are defined in section 14.4.

The frequency of banding on un-insulated pipe shall be as follows:

- Unit Area – Bands at intervals of 6 metres
- Offsite Area – Bands at intervals of 10 metres

Each pipe segment will have a minimum of 1 identification band irrespective of length.

Colour bands of the correct size shall be applied to the pipe, at:

- Both sides of valves, tees and other fittings
- Where pipes enter and emerge through walls
- Where pipes enter and emerge from walkway overpasses and battery limits
- At uniform intervals along long sections of pipe
- Adjacent to tanks, vessels and pumps.

Insulated piping shall received ground colouring and coloured (secondary) identification bands at a minimum of either side of valves, flanges and the like, at each change in flow direction and at no greater than 6 metre intervals, ground colours should be 2 metres long.

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Secondary colours are to be applied using adhesive plastic tapes to the specified colour.

Bands widths are shown below for different pipe diameters and are to be spaced 25mm apart when two bands (or more) are used:

Outside diameter of pipe or covering (inches)	Width of colour bands (mm)
< 2"	200
2" – 4"	300
6" – 8"	600
>= 10"	800

Bands shall also be displayed conspicuously near walkways, both sides of culverts, tanks, dykes, vessels, suction and discharge of pumps/compressors, unit battery limit, near valves of line, etc.,

14.3 Identification Lettering

Name of service and direction of flow, for all lines shall be positioned at the following locations:

- Offsite lines: Both sides of culverts, any one side of walkways, near tank dykes, at tank inlet/outlet points and suction/discharge pumps/compressors.
- Unit lines: At the battery limit, suction/discharge of pumps/compressors, near vessels, columns, tanks, exchangers etc.,

Identification/legend letter sizes on piping shall depend on the pipe diameter. Either white or black letters are to be selected so as to afford maximum contrast with the identification band colour.

Outside diameter of pipe or covering (inches)	Size of legend letters (mm)
< 2"	19
2" – 4"	32
6" – 8"	64
>= 10"	89

Pipe contents and direction of flow is to be identified using legend letters and arrows, any hazard must be identified clearly by the legend.

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Size of letters (stenciled or pre-formed adhesive) for equipment shall be:

Equipment	Size of legend letters
Column and vessel	150 mm (height)
Pump, compressor and other machinery	50 mm (height)

Lettering shall be black on pipes painted with light shade colours and white on pipes painted with dark shade colours to give good contrast.

14.4 IOCL Paint Colour Code and Banding

The following base / ground and secondary colour designation for identification of various important services shall be followed:

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Sl. No:	Service	Base/Ground Colour	Secondary Band Colours
	Hydrocarbon Lines – (Un-insulated)		
1.	Crude Sour	Dk Grey BS4800 18 B 25	(x1) Orange – RAL 2008
2.	Crude Sweet	Dk Grey BS4800 18 B 25	(x1) Red – RAL 3001
3.	Lube Oils	Dk Grey BS4800 18 B 25	(x1) Green – RAL 6002
4.	Flare Line	Aluminium – RAL 9006	Aluminium – RAL 9006
5.	L.P.G.	Orange – RAL 2008	(x1) Oxide Red – RAL 3009
6.	Propylene	Orange – RAL 2008	(x2) Oxford Blue – RAL 5003
7.	Naptha	Orange – RAL 2008	(x1) Green – RAL 6002
8.	M.S.	Orange – RAL 2008	(x1) Dk Grey BS4800 18 B 25
9.	AV. Gasoline (96 RON)	Orange – RAL 2008	(x1) Green – RAL 6002 + (x1) White – RAL 9003 + (x1) Red – RAL 3001
10.	Gasoline (regular, leaded)	Orange – RAL 2008	(x1) Black – RAL 9017
11.	Gasoline (premium, leaded)	Orange – RAL 2008	(x1) Blue – RAL 5017
12.	Gasoline (white)	Orange – RAL 2008	(x1) White – RAL 9003
13.	Gasoline (aviation 100/130)	Orange – RAL 2008	(x1) Red – RAL 3001
14.	Gasoline (aviation 115/145)	Orange – RAL 2008	(x1) Purple – RAL 4006
15.	N-Pentane	Orange – RAL 2008	(x2) Blue – RAL 5017
16.	Diesel Oil (white)	Oxide Red – RAL 3009	(x1) White – RAL 9003
17.	Diesel Oil (black)	Oxide Red – RAL 3009	(x1) Yellow – RAL 1023
18.	Kerosene	Oxide Red – RAL 3009	(x1) Green – RAL 6002
19.	HY. Kero	Oxide Red – RAL 3009	(x2) Green – RAL 6002
20.	Disulfide Oil (Ex-Merox)	Oxide Red – RAL 3009	(x1) Black – RAL 9017
21.	M.T.O.	Oxide Red – RAL 3009	(x3) Green – RAL 6002
22.	DHPPA	Oxide Red – RAL 3009	(x2) White – RAL 9003
23.	Flushing Oil	Oxide Red – RAL 3009	(x2) Black – RAL 9017
24.	Lab FS	Oxide Red – RAL 3009	(x2) Dk Grey BS4800 18 B 25
25.	Lab RS	Oxide Red – RAL 3009	(x3) Dk Grey BS4800 18 B 25
26.	Lab (Off. Spec.)	Oxide Red – RAL 3009	(x1) Lt Grey RAL 7036
27.	N-Paraffin	Oxide Red – RAL 3009	(x1) Blue – RAL 5017
28.	Heavy Alkylate	Oxide Red – RAL 3009	(x1) Red – RAL 3001
29.	Blow Down, Vapour Line	Aluminium – RAL 9006	(x1) Brown – RAL 8003
30.	Blow Down	Aluminium – RAL 9006	(x2) Brown – RAL 8003

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Sl. No:	Service	Base/Ground Colour	Secondary Band Colours
31.	A.T.F.	Brown – RAL 8003	(x1) White – RAL 9003
32.	Toluene	Brown – RAL 8003	(x1) Yellow – RAL 1023
33.	Benzene	Brown – RAL 8003	(x1) Green – RAL 6002
34.	Lab Product	Brown – RAL 8003	(x1) Blue – RAL 5017
35.	Fuel Oil	Black – RAL 9017	(x1) Yellow – RAL 1023
36.	Fuel Oil (aromatic rich)	Black – RAL 9017	(x2) Yellow – RAL 1023
37.	Asphalt	Black – RAL 9017	(x1) White – RAL 9003
38.	Slop and Waste Oils	Black – RAL 9017	(x1) Orange – RAL 2008
39.	Slop Aromatic	Black – RAL 9017	(x2) Orange – RAL 2008

Chemical Lines (Un-insulated)			
40.	Tri-Sodium Phosphate	Yellow – RAL 1023	(x1) Violet – RAL 4008
41.	Caustic Soda	Yellow – RAL 1023	(x1) Black – RAL 9017
42.	Sodium Chloride	Yellow – RAL 1023	(x1) White – RAL 9003
43.	Ammonia	Yellow – RAL 1023	(x1) Blue – RAL 5017
44.	Corrosion Inhibitor	Yellow – RAL 1023	(x1) Aluminium – RAL 9006
45.	Hexameta Phosphate	Yellow – RAL 1023	(x2) Black – RAL 9017
46.	Acid Lines	Gold/Yellow – RAL 1004	(x1) Red – RAL 3001
47.	Rich Amine	Yellow – RAL 1023	(x2) Blue – RAL 5017
48.	Lean Amine	Yellow – RAL 1023	(x3) Blue – RAL 5017
49.	Solvent	Yellow – RAL 1023	(x1) Green – RAL 6002
50.	LCS	Yellow – RAL 1023	(x1) Grey – RAL 7001

Water Lines (Un-insulated)			
51.	Raw Water	Sky Blue – RAL 5015	(x1) Black – RAL 9017
52.	Industrial Water	Sky Blue – RAL 5015	(x2) Red – RAL 3001
53.	Treated Water	Sky Blue – RAL 5015	(x1) Oxide Red – RAL 3009
54.	Drinking Water	Sky Blue – RAL 5015	(x1) Green – RAL 6002
55.	Cooling Water	Sky Blue – RAL 5015	(x1) Pale Brown – RAL 8025
56.	Service Water	Sky Blue – RAL 5015	(x1) Red – RAL 3001
57.	Tempered Water	Sky Blue – RAL 5015	(x2) Green – RAL 6002
58.	DM Water	Sky Blue – RAL 5015	(x1) Aluminium – RAL 9006
59.	DM Water above 150°F	Sky Blue – RAL 5015	(x2) Black – RAL 9017
60.	Sour Water	Sky Blue – RAL 5015	(x2) Yellow – RAL 1023

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Sl. No:	Service	Base/Ground Colour	Secondary Band Colours
61.	Stripped Water	Sky Blue – RAL 5015	(x2) Blue – RAL 5017
62.	ETP Treated Water	Sky Blue – RAL 5015	(x2) Oxide Red – RAL 3009

Fire Protection System (Above Ground)			
63.	Fire Water, Foam and Extinguishers	Red – RAL 3001	Red – RAL 3001

Air and Other Gas Lines (Un-insulated)			
64.	Service Air	May Green – RAL 6017	(x1) Red – RAL 3001
65.	Instrument Air	May Green – RAL 6017	(x1) Black – RAL 9017
66.	Nitrogen	May Green – RAL 6017	(x1) Orange – RAL 2008
67.	Freon	May Green – RAL 6017	(x1) Yellow – RAL 1023
68.	Chlorine	Yellow – RAL 1023	(x1) Oxide Red – RAL 3009
69.	SO ₂	Yellow – RAL 1023	(x2) White – RAL 9003
70.	H ₂ S	Orange – RAL 2008	(x2) Oxide Red – RAL 3009
71.	Gas (fuel)	Orange – RAL 2008	(x1) Aluminium – RAL 9006
72.	Gas (sour)	Orange – RAL 2008	(x2) Aluminium – RAL 9006
73.	Gas (sweet)	Orange – RAL 2008	(x1) Red – RAL 3001
74.	Hydrogen	Orange – RAL 2008	(x1) May Green – RAL 6017

Steam and Condensate Lines (Un-insulated)			
75.	HP Steam & VHP Steam Line	Aluminium – RAL 9006	(x1) Yellow – RAL 1023
76.	MP Steam	Aluminium – RAL 9006	(x1) Red – RAL 3001
77.	MLP Steam	Aluminium – RAL 9006	(x1) Orange – RAL 2008
78.	LP Steam	Aluminium – RAL 9006	(x1) Green – RAL 6002
79.	Condensate	Sky Blue – RAL 5015	(x1) White – RAL 9003
80.	Condensate above 150°F	Sky Blue – RAL 5015	(x3) Oxide Red – RAL 3009
81.	BFW	Sky Blue – RAL 5015	(x2) Traffic Red – RAL 3020
Note: For all insulated steam lines, the colour coding shall be followed as given for un-insulated lines with the specified length of colour bands			

Insulated Hydrocarbon Lines			
82.	IFO Supply	Black – RAL 9017	(x1) Yellow – RAL 1023
83.	IFO Return	Black – RAL 9017	(x1) Green – RAL 6002
84.	HPS	Black – RAL 9017	(x1) Red – RAL 3001
85.	Bitumen	Black – RAL 9017	(x2) Red – RAL 3001

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Sl. No:	Service	Base/Ground Colour	Secondary Band Colours
86.	CLO	Black – RAL 9017	(x1) Brown – RAL 8003
87.	VB Tar	Black – RAL 9017	(x2) Brown – RAL 8003
88.	VR AM (Bitumen/VBU Feed)	Black – RAL 9017	(x1) Blue – RAL 5017
89.	VR BH	Black – RAL 9017	(x2) Blue – RAL 5017
90.	VAC. Slop	Black – RAL 9017	(x1) White – RAL 9003
91.	Slop	Black – RAL 9017	(x1) Orange – RAL 2008
92.	Crude Sweet	Dk Grey BS4800 18 B 25	(x1) Red – RAL 3001
93.	Crude Sour	Dk Grey BS4800 18 B 25	(x1) Orange – RAL 2008
94.	VGO/HCU Feed	Oxide Red – RAL 3009	(x1) Signal Grey – RAL 7004
95.	OVCU Bottom/FCCU Feed	Oxide Red – RAL 3009	(x2) Signal Grey – RAL 7004

15. STORAGE

All paints and painting materials shall be stored only in rooms to be arranged by contractor and approved by Engineer in charge for the purpose. All necessary precautions shall be taken to prevent fire. The storage building shall preferably be separate from adjacent building. A signboard bearing the word **"Paint Storage – No Naked Light - Highly Inflammable"** shall be clearly displayed outside. Manufacturer's recommendation shall be followed for storage of paint materials.

16. QUALITY CONTROL, INSPECTION & TESTING

- All painting materials including primers and thinners brought to site by contractor for application shall be procured directly from manufactures as per specifications and shall be accompanied by manufacturer's test certificates. Paint formulations without certificates are not acceptable
- The contractor must produce Test Certificate from Pre-Qualified Paint Manufacturer for various tests as specified in this document, for each batch and for each category of product. The Engineer in charge shall have the right to test wet samples of paint from each batch at random for verifying quality of paint supplied. Contractor shall arrange to have such tests, when called for by Engineer in charge, performed at his cost any one of the independent laboratories listed in this document.

Samples for the test will be drawn at random in presence of Engineer in charge or his

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representations. Following tests to be carried out if called for by Engineer in charge:

- Specific Gravity
- % solids by weight (% zinc content in case of inorganic or organic zinc primer)
- Drying time (touch dry & full curing)
- Adhesion
- Flexibility
- Hardness
- Storage stability (pot life)

Test methods for above tests shall be as per relevant ASTM or ISO Standard.

- The painting work shall be subject to inspection by Engineer in charge at all times. In particular, following stage-wise inspection will be performed and contractor shall offer the work for inspection and approval of every stage before proceeding with the next stage. The record of inspection shall be maintained in the registers. Stages of inspection are as follows:
 - Surface preparation
 - Primer application
 - Each coat of paint

During surface preparation, following tests are to be carried out:

- Test for absence oil and grease after degreasing before blasting.
- Tests for surface finish of blasted surface shall be done by visual inspection using SSPC-VIS1. Clear cellophane tape test as per ISO 8502-9 shall be used to confirm absence of dust on blasted surface. Checks shall be done on each component at least once per 200 m² of blasted surface and minimum of 3 checks per shift.
- Test for presence of soluble salt as per method ISO 8502-9. Maximum allowable salt content shall be considered 20 mg /m². Checks shall be done on each component at least once per 200 m² of blasted surface and minimum of 3 checks per shift. In case salt exceeds specified limit, the contaminated surface shall be cleaned by method as per Annexure-C of ISO: 12944-4 (water cleaning). After cleaning surface shall be retested for salt after drying.
- Blast profile measurement
- Test for blasting Media and Blasting air- In addition to above, record should include type of shop primer already applied on equipment e.g. zinc silicate, or zinc rich epoxy, or zinc phosphate.

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Any defect noticed during the various stages of inspection shall be rectified by the contractor to the entire satisfaction of Engineer in charge before proceeding further. Irrespective of the inspection, repair and approval at intermediate stages of work, contractor shall be responsible for making good any defects found during final inspection/guarantee period/defect liability period as defined in general condition of contract. Dry film thickness (DFT) shall be checked and recorded after application of each coat and extra coat of paint should be applied to make- up the DFT specified without any extra cost to owner, the extra coat should have prior approval of Engineer in charge.

- **Primer Application:** After surface preparation, the primer should be applied to cover the crevices, comers, sharp edges etc. in the presence of inspector nominated by Engineer in charge.
- The shades of successive coats should be slightly different in colour in order to ensure application of individual coats, the thickness of each coat and complete coverage should be checked as per provision of this specification. This should be approved by Engineer in charge before application of successive coats.
- The contractor shall provide standard thickness measurement instrument with appropriate range(s) for measuring.
 - Dry film thickness of each coat,
 - Surface profile gauge for checking of surface profile in case of sand blasting.
 - Holiday detectors and pinhole detector and protector whenever required for checking in case of immersion conditions.
- Prior to application of paints on surfaces of chimneys, the thickness of the individual coat shall be checked by application of each coat of same paint on M.S.test panel. The thickness of Paint on test panels shall be determined by using gauge such as 'Elkometer'. The thickness of each coat shall be checked as per provision of this specification. This shall be approved by Engineer in charge before application of paints on surface of chimney.
- At the discretion of Engineer in charge, the paint manufacturer must provide the expert technical service at site as and when required. This service should be free of cost and without any obligation to the owner, as it would be in the interest of the manufacturer to ensure that both surface preparation and application are carried out as per their recommendations. The contractor is responsible to arrange the same.
- Final inspection of finished coating shall consist of measurement of:
 - Paint dry film thickness (DFT),

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- Adhesion, and,
- Holiday detection check as well as for finish and workmanship.

- Coating DFT measurement shall be as per ISO: 2808. Type II electromagnetic gauges should be used for ferrous substrates. DFT gauge calibration, number of measurement shall be as per SSPC-PA 2. Measured DFT shall be within + 10% of the dry film thickness, specified in the specifications.
- Adhesion of the primer to the steel substrate and intercoat adhesion of the subsequent coat(s) after curing for at least a week after application of the topcoat shall be examined by a knife-test in accordance with ASTM D6677. For the knife test, if the rating is better than 8, the adhesion is considered acceptable. The adhesion is defective and:-tested areas shall be repaired afterward using the spot repair procedure. Alternatively, the applicator may perform the adhesion test on a steel coupon coated using the same surface preparation and coating application procedure as the work piece. Adhesion testing shall be carried out for each component at least once per 200 m² (2000 ft²) of coated surface.
- Holiday testing shall be conducted in accordance with NACE SP0188. For immersion services, 100% of coated area shall be inspected for holidays. For atmospheric exposure, 10% of coated area which must include weld seams, corners and edges to be holiday tested. Voltage at which test is to be carried out will depend upon DFT of coating being tested and shall be as per NACE SP0188. Any holiday is unacceptable and should be marked and repaired immediately.
- The contractor shall arrange for spot checking of paint materials for Specific gravity, glow time (ford cup) and spreading rate.
- **Final Inspection of coating system:**

A final inspection shall be conducted prior to the acceptance of the work. The Contractor and the Owner / Engineer in charge shall both be present and they shall sign an agreed inspection report. Such reports shall include:

 - General
 - Names of the painting Contractor and the responsible personnel
 - Dates when work was performed
 - Painting Materials

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- Information on painting materials being applied
- Condition of painting materials received
- Environmental Conditions
 - Weather and ambient conditions
 - Painting periods
- Surface Preparation
 - Condition of surface before preparation
 - Tools and methods used to prepare surface
 - Condition of surface after preparation
- Painting Application
 - Equipment used
 - Mixing procedure prior to application
 - Coating application techniques used
- Testing
 - Type and calibration of inspection instruments used
 - Type of quality control tests performed, and results

17. **GUARANTEE**

The Contractor shall guarantee that the chemical and physical properties of paint material used are in accordance with the specifications contained herein / to be provided during execution of work.

18. **QUALIFICATION CRITERIA OF PAINTING CONTRACTOR / SUB-CONTRACTOR**

Painting contractor who is awarded the contract for painting by the Owner, must have necessary equipment's, machinery, tools and tackles for surface preparation, paint application and

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inspection. The contractor must have qualified, trained and experienced surface preparator, paint applicator, inspector and supervisors. The Contractor supervisor, inspector, surface preparator and paint applicator must be conversant with the standards referred in this specification.

19. **QUALIFICATION / ACCEPTANCE CRITERIA FOR PAINT COATING SYSTEM**

- Pre-Qualification of Paint Coating Manufacturer and his Products
Paint / coating manufacture meeting the following requirements shall be considered for supply of their products. Contractor is advised to select coating manufacturer. Only after obtaining prequalification from Owner for the manufacturer based on following requirements. Even those manufacturers, whose names are appearing elsewhere in the tender document, under the list of "Owner Recommended or Approved Vendors", will also be required to meet the following prequalification requirements.
 - Manufacturer should have been in continuous business of paint / coating formulation and manufacturer for at least past 5 years.
 - Manufacturer should possess past experience of supplying his products to hydrocarbon processing industry or offshore platforms in the past 5 years.
 - Coating manufacturer should have supplied at least 10000 litre of an individual product to hydrocarbon processing industry or offshore platform.
 - The manufacturer's manufacturing procedure & QA/QC system shall meet ISO 9001 Requirements and preferably should possess ISO 14000 certificate.
 - The Quality control set up should be manned by qualified paint technologists whose bio data should be sent along with quality control organization chart.
- Pre-Qualification Testing:
Manufacturer should have got his products tested at least one time in last 3 years at a reputed independent laboratory for the following test items. Test certificates which are more than 3 years old will not be considered.

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Test	Test Method
Specific gravity	ASTM D1475
Dipping properties	ASTM D823
Film characteristics	-
Solid content by weight	ASTM D2369
Drying Time	ASTM D1640
Flexibility	ASTM D1737 / D522
Hardness	ASTM D3363
Adhesion	ASTM D2197
Abrasion resistance	ASTM D968/ D1044
DFT/coat	As per SSPC guidelines
Storage Stability	ASTM D1849
Resistance to moisture vapour permeability for 2000 hrs	ASTMD2247
Cyclic Test for the duration of 4200 h (25 cycles a 168 hours)	ASTM D5894
% Zn in Dry film for Inorganic Zinc Silicate primer	-
Chemical Resistance test - 10% & 40% NaOH (applicable only for F-6 & F-15) - 10% H ₂ SO ₄ (applicable only for F-6 & F-15) - 10% Nitric Acid test (applicable only for F-6 & F-15) - Benzene / Toluene (applicable only for F-6 & F-15) - Kerosene (applicable only for F-6 & F-15) - Sea water (applicable only for F-6 & F-15) - MIBK test (applicable only for F-6 & F-15)	ASTM D543
Resistance to water using water immersion (applicable only for F6-, F-7, F-8, F-14 & F-15)	ASTM D870
Dry Heat Resistance test (applicable only for F-9, F-6AIB, F-2, F-15, F-16, Polysiloxane, heat;:resistance Al silicone)	ASTM D2485
Thermal shock resistance test (only for F-9, F-6, Polysiloxane)	ASTM D2485 - 91
Cathodic Disbondment Test	ASTM G42 @60 deg C

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- Each coating product to be qualified shall be identified by the following
 - An infrared scan (fingerprint), for Part A and B, each component as per ASTM D2621
 - Specific gravity of Base and curing agent (Ref. ISO 2811)
 - Ash content (ASTM 01650), volatile and non-volatile matters (ISO 3251) of each component
- The identification shall be carried out on the batch, which is used for the Pre-qualification testing. Pre-qualification of the products shall be carried out at an independent laboratory.
- Test shall be carried out at any one of the following laboratories and tests to be witnessed & certified by third party inspection agency (TUV, BY, DNV)
 - IICT, Hyderabad
 - HBTI, Kanpur
 - DMSRDE, Kanpur
 - BIS Laboratories
 - UICT, Matunga, Mumbai
 - UTES, Kolkata
 - PDIL, -Sindri
 - NTH, Kolkata
- Contractor shall furnish to Owner for approval / acceptance of all necessary documents / information including test certificates to prove that the paint manufacturers, from whom he intends to procure paint products, meet the various requirements for fulfilling the pre-qualification criteria as given above. The paint manufacturer shall be qualified and approved for supply after review / assessment of the submission made by the contractor.
- Contractor along with delivery of paint material has to furnish following information from paint manufacturer to Owner for acceptance / approval of products.
 - a) Batch test certificates (Batch Testing)

Contractor has to produce test certificate from paint manufacturer for each batch and for each category of product for the following test items. Test to be witnessed & certified by third party inspection agency. All test results must mention clearly the batch no. and category of product tested. Tests to be conducted for following properties:

 - Infrared scan for Part A and B, each component
 - Specific Gravity
 - % solids by weight (% zinc content in case of inorganic or organic zinc primer)
 - b) Product information sheet Technical data sheet for each category of product.

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20. **METHOD OF SAMPLING & DISPATCH FOR LABORATORY TESTING**

(Pre-Qualification tests, Batch testing and Inspection testing)



Samples of coating materials should be submitted to the Govt. laboratory in sealed containers with batch no. and test certificate on regular format of manufacturer's testing laboratory. The sampling shall be certified and sealed by a certifying agency.

All test panels should be prepared by Govt. testing agency coloured photographs of test panels should be taken before and after the test and should be enclosed along with test report.





Sample batch no. and manufacturer's test certificate should be enclosed along with the report. Test report must contain details of observation and rusting if any, as per the testing code.

Manufacturers should intimate the company, details of sample submitted for testing, name of Govt. testing agency, date, and contact personnel of the govt. testing agency. At the end of the test the manufacturer should submit the test reports to the company for approval.

Coating systems for panel test shall be decided after discussion with Owner.

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**JOB SUPPLY SPECIFICATION FOR
3 LAYER POLYETHYLENE COATING
(Fusion Bonded Epoxy and Polyethylene Tapes)**

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REV.	DATE	DESCRIPTION	PREPARED	CHECKED	APPROVED	AUTHORIZED

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APPENDIX 1

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1. INTRODUCTION

INDIAN OIL CORPORATION LIMITED (IOCL) has awarded Fax of Acceptance (FOA) dated 29th August 2019 to M/s. Technip India Limited (TPIL) for Consultancy services (PMC/EPCM services) for overall project management, FEED Review / FEED, Detailed Engineering, Procurement & expediting services, Tendering & award, Construction Management & Supervision, Assistance in start-up, Commissioning & performance test runs for installation of a Standby SRU of 525 TPD capacity and execution of Additional tanks for Paradip Refinery, Odisha, India.

2. DEFINITIONS & ABBREVIATIONS

Abbreviation	Definition /Expanded form
IOCL/ CLIENT	Indian Oil Corporation Limited
PMC/ CONSULTANT	Technip India Limited
LICENSOR	Party selected by IOCL for process technology ownership for any UNIT
CONTRACTOR	Party whose services are obtained for performing the works specified as part of LSTK / packages.
EPCM	Engineering, Procurement & Construction Management Services.
LSTK	Lump Sum Turn Key portion of the work to be executed by CONTRACTOR
FEED	Front End Engineering Design
AUTHORISED REPRESENTATIVE	IOCL's/ CONSULTANT's representative authorized to act for and on behalf of them.
VENDOR	Any third party supplying the equipment/materials for setting up the Plant
PROJECT	Indicates Standby SRU and Additional tanks Project, Paradip Refinery
UNIT	Indicates any particular portion of the project to be built which can be Process related or Utilities/Offsites related
SRU	Sulphur Recovery Unit

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OISD	Oil Industry Safety Directorate
ASME	American Society of Mechanical Engineers
API	American Petroleum Institute
P&ID	Piping and Instrumentation Diagram
A/G	Above Ground
U/G	Under Ground
B/L	Battery Limit
ISBL	Inside Battery Limit
EOT	Electrically-operated Overhead Travelling
MTO	Material Take Off

3. **SCOPE**

This Technical Specification covers the minimum requirements for surface preparation and the supply, application, inspection and testing of external anti-corrosion coating of pipes using 3 Layer Side Extruded Polyethylene coating (3LPE) conforming to DIN 30670, 2012 Edition, "Polyethylene coatings on steel pipes and fittings – Requirements and testing". The specification specifically relates to the plant application of 3LPE.

The VENDOR shall supply all materials, labour, equipment and plant necessary for the satisfactory completion of the Work under this Specification, including, but not limited to: -

- Taking receipt of bare line pipe from dockyard / rail / road (as the case may be) and its handling, loading and transport to the coating plant(s).
- Handling and storage of pipe before and after coating.
- Supply, handling, transport and storage of coating materials.
- Preheating and pre-cleaning of pipe prior to abrasive cleaning.

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- Surface preparation.
- Application, curing, inspection and repair of all external coatings.
- Handling, temporary storage and loading for transport of coated pipes.
- Supply of repair material and making good all coating damage caused by handling, loading and transport, off-loading and stockpiling.

Information to be supplied by the vendor as detailed in Appendix 1.

3.1 Scope of Work

The Schedule of Specific Requirements lists the specific quantity of pipe that shall be coated with the system detailed herein.

3.2 Design Information

The 3LPE coating shall consist of a three-layer coating system comprising: -

- A layer of fusion bonded epoxy (FBE).
- A layer of chemically modified polyethylene copolymer adhesive.
- A layer of medium-density UV stabilized polyethylene (MDPE).

The 3LPE external coating is the primary part of the corrosion protection system to be provided for a buried high-pressure pipeline. The corrosion protection system will be supplemented with a cathodic protection system to protect the Pipeline for the specified minimum design life with minimum maintenance.

The coating system is required to withstand transport, construction handling and installation in the trench without significant damage, and which, once installed, can withstand the stresses imposed on it by the soil and associated environment, for the required design life. An increased coating thickness will be applied to provide additional gouging and abrasion resistance at long Horizontal Directional Drills.

Bare line pipe may be supplied with a Bar Code label system for pipe identification and tracking purposes. The VENDOR shall obtain and/or utilize such equipment as necessary for the scanning, reading and writing of bar codes.

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4. REFERENCE CODES & STANDARDS

The coating shall comply in all aspects with the DIN 30670 Standard, 2012 Edition, "Polyethylene coatings on steel pipes and fittings – Requirements and testing"

Reference shall also been made to the latest edition of the following Standards, Codes and Specifications. The latest edition shall be applicable and shall be the edition in force at the date of Tender submission.

Code /Std. No	Description
ASTM D149	Standard Test Methods of Dielectric Breakdown Voltage and Dielectric Strength of Solid Electrical Insulating Materials at Commercial Frequencies
ASTM D257	Standard Test Methods for DC Resistance or Conductance of Insulating Materials
ASTM D543	Standard Practices for Evaluating the Resistance of Plastics to Chemical Reagents
ASTM D570	Standard Test Method for Water Absorption of Plastics
ASTM D638	Standard Test Method for Tensile Properties of Plastics
ASTM D792	Standard Test Methods for Density and Specific Gravity (Relative Density) of Plastics by Displacement
ASTM G42	Standard Test Method for Cathodic Disbonding of Pipeline Coatings Subjected to Elevated Temperatures
ASTM G8	Standard Test Methods for Cathodic Disbonding of Pipeline Coatings
ASTM G62	Standard Test Methods for Holiday Detection in Pipeline Coatings
DIN 30670	Polyethylene coatings on steel pipes and fittings - Requirements and testing
DIN 30678	Polypropylene coatings on steel pipes and fittings – Requirements and testing
DIN EN ISO 1133-1	DIN EN ISO 1133-1 - Plastics - Determination of the melt mass-flow rate (MFR) and melt volume-flow rate (MVR) of thermoplastics - Part 1: Standard method
DIN EN ISO 1133-2	Plastics - Determination of the melt mass-flow rate (MFR) and melt volume-flow rate (MVR) of thermoplastics - Part 2: Method for materials sensitive to time-temperature history and/or moisture
ISO 2808	Paints and Varnishes - Determination of Film Thickness

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ISO 8501-1	Preparation of steel substrates before application of paints and related products - Visual assessment of surface cleanliness - Part 1: Rust grades and preparation grades of uncoated steel substrates and of steel substrates after overall removal of previous coatings
ISO 8502-2	Preparation of steel substrates before application of paints and related products - Tests for the assessment of surface cleanliness - Part 2: Laboratory determination of chloride on cleaned surfaces
ISO 8503-2	Preparation of steel substrates before application of paints and related products - Surface roughness characteristics of blast-cleaned steel substrates - Part 2: Method for the grading of surface profile of abrasive blast-cleaned steel - Comparator procedure
ISO 11124-1	Preparation of Steel Substrates Before Application of Paints and Related Products - Specifications for Metallic Blast-Cleaning Abrasives - Part 1: General Introduction and Classification
NACE SP0394	Application, Performance, and Quality Control of Plant-Applied, Single-Layer Fusion-Bonded Epoxy External Pipe Coating – Item No. 21064
SIS 055900	Swedish Standard, Preparation of Steel Substrates Before Application of Paints and Related Products – Visual Assessment of Surface Cleanliness
API 5L	Specification for Line pipe
API RP 5L1	Recommended Practice for Railroad Transportation of Line pipe

5. PLANT SCALE AND INSTALLATION

5.1 Plant Capability

VENDOR shall size the coating plant(s) after evaluating the scale of work and the time schedule required for the works. Coating plant(s) shall be installed into yards whose geometry and dimensions allow the execution of a continuous work schedule. For this purpose the VENDOR shall ensure non-stop work will continue even under severely adverse weather conditions, and when required by the CONTRACTOR. VENDOR shall install equipment and plant in roofed and adequately weather-protected areas.

5.2 Plant Operability

Plant, equipment, machinery and other facilities shall be in first-class operating condition and shall provide coating to the requirements of this Specification, with total reliability.

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5.3 Plant site Approvals

VENDOR shall, at his own responsibility and cost, provide and prepare all necessary areas for the storage of pipe and all other materials, for the coating of pipe, for stock-piling and for other temporary installation. For each area, VENDOR shall arrange servitude agreements as required with the relevant Authorities. On work completion, VENDOR shall clean, restore and pay servitude and claims for damages, as applicable.

VENDOR shall, at its own responsibility and cost, provide water and power supply and other utilities and consumable and obtain authorization regarding access roads and other permits required for the execution of works conforming to all the requirements of the governing Authorities.

5.4 Testing Facilities

VENDOR shall, at its own cost, provide a fully equipped laboratory and test facilities with adequate inventory to carry out tests required for the Coating Procedure Qualification and the Production Coating testing. If tests are to be performed outside the coating plant by third parties, the VENDOR shall state so in its offer, giving details of laboratories/locations where such tests are proposed to be carried out. Only certified testing laboratories shall be used and shall be subject to approval by the CONTRACTOR.

6. MATERIALS

6.1 Materials Approval

The basic materials (i.e. fusion bonded epoxy powder, copolymer adhesive and polyethylene compound) shall have proven compatibility as 3LPE external line pipe coatings. VENDOR shall submit to the CONTRACTOR, or CONTRACTOR's Representative, the proposed material data sheets for approval prior to undertaking the works. The group(s) of compatible materials shall be pre-qualified and approved by the CONTRACTOR in accordance with provision of clause 7.4 of this Specification. VENDOR shall obtain prior approval from CONTRACTOR for the suppliers of all materials.

6.2 Materials Certificates

VENDOR shall obtain from the manufacturer(s) of all materials the relevant certificates of material conformity and test results, and the same shall be submitted to CONTRACTOR for approval prior to their use.

6.3 Materials Identification

All materials to be used shall be suitably marked and identifiable with the following minimum information:-

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- Name of the manufacturer.
- Type of material and product designation.
- Batch Number.
- Date of manufacturing / expiry and storage temperature limits.
- Safety data sheets.
- Relevant manufacturing standards and specification.

All materials noted to be without above identification shall be deemed suspect and shall be rejected by CONTRACTOR. Such materials shall not be used for coating and shall be removed from site and replaced by VENDOR at its cost.

6.4 Batch Information for FBE Material

VENDOR shall obtain from the FBE resin manufacturer the information listed below for each batch of powder produced in a 24-hour interval in one continuous run, designated by a specific batch number assigned by the Coating Manufacturer. Standards for comparison shall be provided for each item. The SUPPLIER to check that no changes have been made in the epoxy formulation will use this information.

- Infra Red scan of powder and typical powder scans for comparison. Infra red spectrograph to be made by using a standard Potassium Bromide (KBr) disc.
- Gel time at recommended application temperature.
- Particle size distribution.

Batch numbers shall segregate coating powder during shipment, storage, and handling. Batches shall be used consecutively during coating application and shall not be mixed except when necessary to keep the coating process continuous.

6.5 Coating Materials Storage

Materials shall be stored, handled and transported in accordance with the Coating Manufacturer's written recommendations. Storage time of materials shall not exceed the shelf life recommended by the Coating Manufacturer.

6.6 Material Substitution

VENDOR shall not substitute alternative materials to those approved by the CONTRACTOR, without the written approval by CONTRACTOR, even though the alternative materials may comply with this Specification.

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6.7 Abrasive Materials

Abrasive materials shall comply with ISO 11124-1:1993 and shall be free from contaminations and shall contain less than 100mg/kg chlorides, and less than 0.3% copper. VENDOR shall maintain records to demonstrate that the levels of chlorides and copper are within the specified limits.

6.8 Materials Sequencing

VENDOR shall be required to use all materials on a date received rotation basis, i.e. first in, first used basis.

7. COATING PROPERTIES AND FUNCTIONAL REQUIREMENTS

7.1 Operating Temperature

The pipe coating shall be suitable for the required duty and service conditions.

The coating must be able to withstand a maximum continuous in-service operating temperature of +60°C and still comply with the performance requirements of this Specification. In open storage finished pipe coating shall be able to withstand exposure in sunlight with a daytime coating temperature of up to 80°C for a period of 12 months without any change detrimental to the performance of the coating.

7.2 Environmental Conditions

The coating materials used shall be fully stabilized against the influence of ultraviolet radiation (i.e. sunlight), oxygen in air and heat (due to environmental temperature as specified above). The material shall fully comply with the performance requirements of this Specification after 12 months exposure at any location in India. In evaluating this condition, particular attention shall be paid to elongation, resistance to peeling, and lack of voids under the coating.

7.3 Properties

7.3.1 Properties of Polyethylene Compound

Sl. No.	Properties	Unit	Requirement	Test Method
i.	Tensile Strength and Elongation (at break) at +25°C	MPa and %	12.4 min and 600 min	ASTM D 638
ii.	Melt Index	G/10 min	0.15-0.80	ASTM D 1238 or DIN 53735

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Sl. No.	Properties	Unit	Requirement	Test Method
iii.	Specific gravity at +25°C	g/cm ³	0.925-0.95	ASTM D 792
iv.	Hardness at +25°C	Shore D	50 min	ASTM D 2240
v.	Water Absorption, 24 hours, +25°C	%	0.02 max	ASTM D 570
vi.	Volume Resistivity at +25°C	Ohm-cm	10 ¹⁵ min	ASTM D 257
vii.	Dielectric withstand, 100 Volt/sec rise at +25°C	Volts	30,000 min	ASTM D 149
viii.	ESC at 100% Igepal Conc.	Hours	900 min	ASTM D1693 Condition B (F50)
ix.	Thermal stability after 100 days at 100%	% change in Melt Index	35 max	ASTM D1238 or DIN 53735
x.	Resistance to splitting of 50mm cut	Mm	2 max	Section 10

7.3.2 Properties of Epoxy Powder and Adhesive

VENDOR shall select a brand of epoxy powder and adhesive that will achieve the functional requirements and properties of the coating system as specified in section 7.1 and 7.3.3 respectively, of this Specification. At the time of bidding, VENDOR shall furnish a reference list of epoxy powder and adhesive, having such properties, applied by them in similar coating systems.

Sl. No.	Properties	Unit	Requirement	Test Method
i.	Coating porosity	% Coating thickness	33 max total voids at any location	Section 10
ii.	Sieve analysis	%	95 between 10micron and 100micron	ASTM D1921
iii.	Volatile content after 2 hours at 105°C	%	0.5% max	Section 10

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7.3.3 Properties of Coating System

Sl. No.	Properties	Unit	Requirement	Test Method
i.	Resistance to Indentation at $23 \pm 2^{\circ}\text{C}$ at $70 \pm 2^{\circ}\text{C}$	mm	0.1 max 0.3 max	DIN 30670
ii.	Resistance to Impact (Min of 30 impacts. No holiday allowed when tested at 25 KV.)	Nm per mm of coating thickness	8 min (for NB <200mm) 7 min (for NB \geq 200mm)	DIN 30670
iii.	Resistance to Peeling. Test Method at $20 \pm 5^{\circ}\text{C}$ At $50 \pm 5^{\circ}\text{C}$	Kg/cm	5 min 4 min	DIN 30670
iv.	Elongation due to tearing	%	600 minimum	DIN 30670
v.	Resistance to Thermal Aging	-	Retain 65% of Melt Index	DIN 30670
vi.	Resistance to exposure to Light	-	Retain 65% of Melt Index	DIN 30670
vii.	48 hour Cathodic Disbondment Test at 65°C	mm radius of disbondment	8 max	ASTM G42
viii.	Cathodic Disbondment after 28 days, Test method A at $+60^{\circ}\text{C}$	mm radius of disbondment	13 max	ASTM G42

7.4 Materials Compatibility

Candidate coating materials are shown in Appendix 1. VENDOR may propose to use any other coating material or combination of coating material. The materials brands offered by VENDOR for coating (i.e. epoxy powder, adhesive and the polyethylene compound) shall have proven compatibility. VENDOR shall, in support of its offered coating system, submit at the time of Tender adequate track record demonstrating the compatibility of offered materials. Only CONTRACTOR's approved materials/combination of materials shall be used for coating of pipes.

Repair materials shall be approved epoxy primed heat shrink sleeves, such as Raychem HTLP 80 (refer Section 15).

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8. COATING PROCEDURE AND QUALIFICATION

8.1 Project Report

Following award of the ORDER, the VENDOR shall submit for CONTRACTOR approval, in accordance with the SUPPLY Schedule, a detailed report in the form of a bound manual outlining, but not limited to, the following: -

- a.** Details for plant(s), installations, locations, geometry, dimensions, capacity and production rates(s).
- b.** Facilities in the yard for unloading, handling, transport, production, storage, stockpiling, loading of bare and coated pipes and warehouses for storage of other coating materials.
- c.** Details Organogram of coating equipment and manpower.
- d.** Details of utilities/facilities such as water, power, fuel, access roads and communication etc.

8.2 Proposed Work Procedures

Prior to the commencement of the work, VENDOR shall submit a pipe Coating Procedure Specification (CPS) giving full details of all the characteristics of the proposed coating process. The project specific CPS shall be formulated by VENDOR and submitted for CONTRACTOR's approval in the form of a bound manual. No element of pipe coating shall proceed without written approval from CONTRACTOR of the CPS. The CPS shall include, but not limited to, the following information and proposals: -

- a.** Steel surface preparation, including preheating, removal of steel defects, cleanliness, profile, methods of measurements and consumables.
- b.** Pipe heating, temperatures and control.
- c.** Complete details of raw materials together with quality control and manufacturer's data.
- d.** Application of materials, including characteristics, temperature of application, etc.
- e.** Pipe and coating quenching and cooling, including time and temperature.
- f.** Quality assurance system, Inspection and Testing Plan (ITP) and reporting formats, including instrument and equipment types, makes and uses, etc.
- g.** Detailed method of repair of coating defects duly classified depending upon nature and magnitude of defects and repairs thereof.
- h.** Details of instrument and equipment calibration methods including relevant standards and examples of calibration certificates.
- i.** Complete details and inventory of laboratory and equipment.

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- j. Pipe handling and stock piling procedures.
- k. Sample of recording and reporting formats, including laboratory reports, certificates and requirement as per section 8.0 of this specification.
- l. Complete details of test certificates for raw materials including test methods and standards used.
- m. Test certificates from PE compound manufacturer for tests for thermal aging and aging under exposure to light. These test certificates shall not be older than three years.
- n. Environmental provisions for the storage of raw materials.
- o. Procedure for transferring of pipe identification numbers, paper barcode labels, and applying pipe identification marking.

Following submission of the Inspection and Test Plan for approval, the CONTRACTOR will advise VENDOR of the specific inspection review, witness and HOLD points required by the CONTRACTOR or its Representatives by marking up the ITP.

After approval of the CPS and ITP has been given by CONTRACTOR, procedural changes shall not be made. Unavoidable changes may be executed only after obtaining written approval from CONTRACTOR.

8.3 Coating Procedure Qualification (CPQ)

Prior to commencing production, VENDOR shall, at its own expense, carry out a Coating Procedure Qualification (CPQ) trials at each plant for each pipe diameter and pipe wall thickness to verify its plant, materials, and coating procedures can produce a consistent quality of product conforming to the properties stated in Clause 7.3 of this Specification, other relevant Standards and Specifications, and the material manufacturer's recommendations.

- **Tests on Raw Materials**

VENDOR shall furnish test certificates from the coating materials manufacturer(s) for the following properties for each batch of raw materials used in the procedure qualification tests: -

- a. Polyethylene
 - i. Tensile Strength
 - ii. Melt Index
 - iii. Specific Gravity
 - iv. Hardness

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- v. Water Absorption
- vi. Volume Resistivity
- vii. Dielectric withstands.

b. Epoxy Powder

- i. Gel Time
- ii. Specific Gravity
- iii. Sieve Analysis.

c. Adhesive

- i. Specific gravity
- ii. Melt Index.

• **Tests on Coated Pipes:**

At least 5 (five) test pipes per pipe diameter shall be coated in accordance with the approved coating procedure. Trial coated pipes shall be subjected to procedure qualification testing as described below. All tests shall be witnessed by the CONTRACTOR or the CONTRACTOR's Representative. Where test rings are cut from the pipes, additional test rings shall be supplied to the CONTRACTOR for independent testing as required.

i. Coating Thickness

All pipes shall be subject to coating thickness measurements. Acceptance criteria shall be as per Clause 11.4 of this Specification.

ii. Holiday Testing

All the pipes shall be subject to holiday testing at 25kV and shall meet the criteria identified in Clause 11.5.

iii. Resistance to Indentation

Five samples from different pipes shall be taken. If any one of these samples fails to satisfy the requirements of Clause 7.3.3 of this Specification, then the test shall be repeated on ten more samples. In this case, none of the samples shall be permitted to fail.

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iv. Resistance to Impact

Three test pipes shall be selected for impact test and each test on each pipe is required to meet the requirement of Clause 7.3.3 of this Specification.

v. Resistance to Peeling

Three test pipes shall be selected for peel tests. On each of the selected pipes, three peel tests shall be performed; one at each end and one in the middle of the pipe. None of these samples is permitted to fail the criteria identified in Clause 7.3.3 of this Specification.

vi. Elongation due to Tearing (Ultimate Elongation)

Ten samples each from three coated pipes (i.e. 30 samples in all) shall be tested in accordance with Clause 7.3.3 of this Specification. Only one sample per pipe may fail.

vii. Cathodic Disbondment Test

Two tests shall be conducted in accordance with Clause 7.3.3 of this Specification, one test being performed on each of two test pipes. Tests shall only be performed on samples that have been confirmed to be holiday-free in accordance with test (ii) above.

• Testing Report

After completion of the above tests, VENDOR shall prepare and issue to CONTRACTOR for approval a detailed report of the above tests including test reports/certificates of all materials and coatings tested.


Only upon written approval from CONTRACTOR, shall VENDOR commence production coating.

• Test Pipes

On completion of coating qualification tests, coating on all remaining intact test pipes shall be removed at Vendor's cost and the pipes completely recycled as per the approved Coating Procedure Specification.

• Procedure Re-qualification

VENDOR shall re-establish the requirements of the Coating Procedure Qualification to the full Specification requirements, or to the extent considered necessary by CONTRACTOR, in the event of, but not limited to, the following :-

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- Every time there is a change in the previously qualified Coating Procedure Specification.
- Every time there is a change in the manufacturer for the supply of any of the raw materials.
- Every time the coating yard is shifted from one location to another location.
- Any time when, in CONTRACTOR's opinion, the properties are deemed to be suspect during regular production tests.
- Every time there is a change in pipe diameter.

8.4 Independent Testing

CONTRACTOR reserves the right to conduct any or all the tests required for Coating Procedure Qualification through an independent laboratory or agency, at the cost of VENDOR, when in CONTRACTOR's opinion, the test results are deemed suspect. CONTRACTOR's decision shall be final.

9. PIPE SURFACE PREPARATION

9.1 Pre-Treatment

The pipe shall be preheated prior to blast cleaning to a temperature at least 5°C above the dew point or higher if recommended by the Coating Manufacturer. This is to remove moisture and to identify slivers and surface defects for further treatment.

Pipe shall be handled to prevent any damage to bevels. Ends shall be closed to prevent any abrasives and/or foreign material from entering the pipe's interior during blasting. Any abrasive and/or foreign material entering the pipe shall be removed before and after subsequent coating.

9.2 Surface Contaminants

Unless specified otherwise, the pipes shall be supplied free from mill applied oils or coatings.

All pipes shall be monitored for chloride contamination. Three extracts per day shall be taken from a drip line using the soak method and chloride titration or other approved method. VENDOR shall submit a test procedure to ensure that surfaces are free from chloride, oil and grease contaminants. Chloride contamination of the pipe surface shall not exceed 20 mg/m².

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9.3 Pre Inspection

Prior to pipe cleaning operation, each pipe shall be inspected for split seams, dents, gouges, slivers or other imperfections that would make the pipe unsuitable for use. The Supplier shall report all such imperfections to the CONTRACTOR on receipt, during all stages of the coating process and subsequent handling and load out operations, segregate all pipe containing such defects, and arrange for repair as directed by CONTRACTOR. Surface preparation shall not reduce the pipe wall thickness below the minimum specified for the pipe grade.

9.4 Removal of Surface Contaminants

Any oil, grease, salt or other contaminants detrimental to the formation of a good coating bond or coating quality shall be removed prior to coating application.

Organic contaminants may be removed by the use of non-oil solvents. Gasoline or kerosene shall not be used for this purpose. Visible oil and grease spots shall be removed by solvent wiping. Solvent cleaning shall be in accordance with SSPC-SP1.

Prior to blast cleaning, pipe shall be cleaned to remove residual surface contamination using high-pressure fresh water. Where necessary, and subject to prior approval from CONTRACTOR, if the surface chloride contamination level exceeds 200 mg/m² the pipe may given a phosphate pre-treatment to remove all residual chloride and ferrous salt contamination. VENDOR shall submit a detailed Specification and Phosphate Cleaning Procedure for prior approval of the CONTRACTOR. Excess treatment chemical shall be removed by thorough rinsing with fresh water and the residual chloride monitored in accordance with the CONTRACTOR approved procedure. Two chloride test per day shall be carried out on phosphate treated pipes and the chloride levels shall not exceed 20 mg/m².

9.5 Pipe Blast Cleaning

In case of the presence of moisture on the pipe, the pipes shall be preheated to a temperature of 65°C to 85°C prior to abrasive blast cleaning. An abrasive blast-cleaning machine shall clean the external surface of the pipe. The standard of finish for cleaned pipe shall conform to white metal finish to Sa 2 ½ of Swedish Standard SIS 055900. The surface of the pipe after abrasive shot/grit blasting shall have an anchor pattern of 50 to 75 microns peak to trough height and an angular and open anchor pattern. This shall be measured for each pipe. At least one pipe at the start and end of each shift shall be measured with Testex Press-O-Film replication tape. Remaining pipes may be measured by a suitable instrument, such as Elcometer, providing that the instrument has been calibrated and the results cross-checked with the replication tape.

At no time shall the blast cleaning be performed when the relative humidity exceeds 90% or when the steel temperature is less than 5°C higher than the dew point, unless the pipes are preheated to a temperature of 65°C to 85°C.

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Abrasives shall contain less than 100mg/kg total water soluble salts, less than 0.3% copper and shall be free of moisture.

9.6 Pipe Surface Imperfections

The blast cleaned surface shall not be contaminated with dirt, dust, metal particles, oil, water or any other foreign material, nor shall the surface or its anchor pattern be scarred or burnished. After blast cleaning, all surfaces shall be thoroughly inspected to determine anchor pattern, quality of blasting and identify any surface defects prior to coating application. All surface defects such as slivers, scab, burns, laminations, welds spatters, gouges, scores, indentations, slugs or any other defects considered injurious to the coating integrity shall be reported to CONTRACTOR's Representative and on permission from CONTRACTOR, such defects shall be removed by filing or grinding. The method employed to remove surface defects shall not burnish or destroy the anchor pattern or contaminate the surface. Pneumatic tools shall not be used unless they are fitted with effective air/oil and water traps. Where burnishing results in destruction of anchor pattern, the anchor pattern shall be restored by suitable means.

9.7 Acceptance of Surface Preparation

Upon Completion of the blasting operations, the Vendor's quality control supervisor shall accept the pipe for coating, or return it for recleaning. Where imperfections are considered detrimental to the coating quality, the same shall be reported to CONTRACTOR's Representative for final decision on rejection or recleaning / removal of defects. Recleaning/removal of defects or returning pipe to the yard shall be at the Vendor's cost.

CONTRACTOR's inspector, reserves the right to initiate any of the above actions during periodic inspections for oil, dust, salt, imperfections, lack of white metal finish and unacceptable surface profile.

9.8 Coating Interval

The total allowable elapsed time between completion of the blasting operations and commencement of the coating and heating operations shall be such that no detectable oxidation of the surface occurs. Relative humidity readings shall be recorded every two hours during the blasting operations in the immediate vicinity of the operations. Blast cleaning shall not be performed when the relative humidity exceeds 90% or when the steel temperature is less than 5°C above the dew point. The maximum elapsed time shall not exceed the maximum time as given below:

Relative Humidity %	Maximum elapsed time
80 to 85	2 hours
61 to 79	3 hours

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60 or below

4 hours

Pipes not brought up to the coating application temperatures within these maximum times shall be returned for complete reblasting. Any pipe showing flash rusting shall be reblasted even if the above conditions have not been exceeded.

10. COATING APPLICATION

10.1 Heating of Line Pipe

An induction heater or gas furnace shall be used for heating the pipe. The method shall be capable of maintaining uniform temperature along the total length of the pipe, and shall be such that it shall not contaminate the surface to be coated. Oxidation of the cleaned pipe surfaces prior to coating (in the form of bluing or other apparent oxide formation) is not acceptable.

10.2 Temperature Monitoring

The specified pipe temperature shall be determined using approved temperature-indicating crayons. The specified temperature shall be maintained as it enters and throughout the coating chamber and shall be carefully monitored. If approved Pyrometers are used for continuous temperature monitoring, the Pyrometer shall be calibrated twice every shift and/or as per CONTRACTOR instruction using approved temperature indicating crayons.

The surface temperature during coating application shall not be lower than that required for complete melt, flow-out, wetting of the pipe surface and fusion; nor shall it be higher than that at which optimum polymerisation occurs without premature gelation before completion of fusion, flow-out and wetting. Post-application cure temperature and time shall not be less than that required for full cure of the applied coating.

The pipe temperature shall not be allowed to exceed 260°C. Any pipe or part of pipe heated in excess of 260°C shall be quarantined and may be rejected, subject to inspection by the CONTRACTOR.

Any pipe heated to a temperature exceeding 375°C or that would cause the steel surface to turn blue shall be totally rejected and not used for any coating purpose. The cost of the rejected pipe shall then be deducted from the Vendor's charges.

10.3 Coating Application

The external surface of the cleaned pipe conforming to section 9.0 of this Specification shall be immediately coated with 3-layer extruded polyethylene coating in accordance with the coating application procedures approved by CONTRACTOR, relevant standards and this Specification. In general the procedure shall be as follows: -

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During application, curing, and handling, the coating shall not be physically damaged, nor shall it be contaminated with any foreign material including (without limitation) dirt, metal particles, oil, water, coating debris, excess powder drips, whether airborne or from application equipment or enclosures, cutback rings or pipe handling mechanisms.

For all pipes between DN250 and DN500, the minimum 3LPE coating thickness shall be 2350 microns anywhere on the pipe. The external surface of the pipe shall be heated to a temperature as recommended by the powder manufacturer followed by application of the following three layers:

- i. Electrostatic application of epoxy powder (minimum 150 microns FBE).
- ii. Crystalline Co-polymer Adhesive applied by extrusion (minimum 200 microns thickness).
- iii. Medium density polyethylene coating by extrusion (minimum 2000 microns MDPE).

The coated pipe shall be subsequently quenched and cooled in water for a period that shall sufficiently lower the temperature of pipe coating to allow handling and inspection.

For pipe that has been identified for use at long horizontal directional drills, the thickness of the outer MDPE layer shall be increased by a minimum of 1500 microns, giving a total coating thickness of 3850 microns.

10.4 Air Entrapment

The copolymer adhesive shall be applied by extrusion within the time recommended by the epoxy powder manufacturer and the copolymer adhesive manufacturer.

While applying the coating, VENDOR shall ensure that there is no entrapment of air or void formation along the seam weld (where applicable). VENDOR shall propose a suitable method for achieving this as part of the Coating Application Procedure and the same shall be witnessed for approval by CONTRACTOR.

10.5 Coating Appearance

The resultant coating shall have a uniform appearance and shall be free from air bubbles, wrinkles, holidays, irregularities, discontinuities and separation between layers of FBE/adhesive/PE.

10.6 End Cut Back

Coating materials shall be cut back to 150 mm (tolerance +10 mm, -15 mm) from the ends of the pipe. The cut back shall be perpendicular to the pipe axis.

The MDPE shall be cut so that it is chamfered at an angle of approximately 30° to the pipe surface to facilitate the later application of heat shrink sleeves without the possibility of a void along the shoulder of the line pipe coating. The adhesive shall seal the end of applied coating.

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The pipe end faces, bevels and uncoated external surface of the pipe at pipe ends shall be essentially free of all coating and foreign material.

10.7 Rejection of Coating

Failure to comply with any of the above applicable requirements and of the approved procedure shall be cause for the rejection of the coating and such coating shall be removed in a manner approved by CONTRACTOR at Vendor's cost.

11. INSPECTION AND TESTING

11.1 General

VENDOR shall establish and maintain a comprehensive Quality Assurance system to ensure that all of the requirements of this Specification are met.

The CONTRACTOR reserves the right to require the inspection or testing of the goods or services during any stage of manufacturing at which the quality of the finished goods may be affected, and to undertake inspection or testing of raw materials or purchased components.

The VENDOR at the frequency as defined herein shall perform the following tests and inspections.

11.2 Visual Inspection

Visual inspection of finished coating for colour, blisters, sags, porosity, burns and handling damage during coating, stacking and loading, for each pipe.

11.3 Gel Time Test

To confirm that the epoxy powder has been manufactured, handled, shipped and stored properly, the VENDOR shall perform Gel time test on each batch of powder one week prior to its use, in accordance with the method and acceptance as recommended by the powder manufacturer.

11.4 Thickness Test

- i. The coating thickness shall be determined by taking at least 10 measurements at locations uniformly distributed over the length and periphery of each pipe. In case of welded pipes, five of the above readings shall be made at the apex of the weld seam, uniformly distributed over the length of the coated pipe. All the readings must meet the minimum requirements. However, localised coating thickness of less than the permissible minimum thickness can be tolerated on the condition that it does not attain a total extent of more than 5 cm² per meter length of coated

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pipe, and the actual coating thickness does not drop more than 10% below the permissible minimum coating thickness at these locations.

The frequency of thickness measurement as stated above shall be initially on every pipe, but may be reduced depending upon consistency of results, at the sole discretion of CONTRACTOR's Representative.

- ii. Coated pipes not meeting the above requirements shall be rejected. The VENDOR shall remove the entire coating and the pipe shall be recycled to the cleaning and coating operations as per the approved procedure and shall be to Vendor's cost.

11.5 Holiday Detection

- i. Each coated pipe length shall be checked over 100% of coated surface by means of a "holiday detector" of a type approved by CONTRACTOR for detecting holidays in the finished coating.
- ii. The holiday detector shall be a low pulse D.C. full circle electronic detector with audible alarm and precise voltage control. The set voltage for inspection shall be minimum 25kV.
- iii. VENDOR shall calibrate the holiday detector at least once every 4 hours of production. VENDOR shall have necessary instruments or devices for calibrating the holiday detector.
- iv. Any coated pipe shall be rejected if there is more than 3 (three) holidays on the pipe, or if the area of the one holiday is more than 100cm² in area. Any pipe so rejected shall have the coating removed, and be recycled through the complete cleaning and coating system in accordance with the approved procedure and shall be to Vendor's cost.
- v. A single holiday on a pipe of an area equal or less than 100cm² shall be repaired in accordance with approved procedure and shall be to Vendor's cost.
- vi. Should more than 10% of coated pipes per shift production (typically eight-hour shift) be rejected, VENDOR shall stop production and make a detailed investigation and report on the

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probable cause(s) of the coating failures. Findings of such an investigation shall be submitted to CONTRACTOR for approval prior to recommencing coating.

11.6 Cathodic Disbondment Tests

48 hour cathodic disbondment tests, in accordance with Clause 7.3.3, shall be performed once per shift (maximum 12 hours) for each pipe diameter and wall thickness.

11.7 Peel Test

- i. VENDOR shall conduct a peel test for composite coating as per Clause 7.3.3(iii) of this Specification.
- ii. The frequency of test shall be initially on one pipe in every twenty five (25) pipes coated which may be further reduced to at least 2 (two) per shift depending upon consistently acceptable results, at the sole discretion of CONTRACTOR's representative.

The system shall fail only in the adhesive layer. Failure either adhesive to steel or adhesive to backing shall not be permitted.

- iii. In case the above tests do not comply with the above requirement, VENDOR shall test all the preceding and succeeding coated pipes until the coating is proved acceptable and/or at the discretion of the CONTRACTOR.

11.8 Indentation Resistance Test

- i. VENDOR shall carry out an indentation resistance test as per Clause 7.3.3(i) of this Specification. The frequency of test shall be initially 2 (two) coated pipes per shift which may be further reduced and/or waived depending upon consistent acceptable results, at the sole discretion of CONTRACTOR's representative.
- ii. The samples shall be taken at five equi-distant points along the length of the coated pipe.
- iii. Where the pipe is rejected for lack of indentation resistance, VENDOR shall test the preceding and succeeding pipes coated until the coating is proved acceptable, and/or at the discretion of the CONTRACTOR.
- iv. Rejected coated pipes shall be removed and shall be recycled through the cleaning and coating process in accordance with the approved procedure, at Vendor's cost.

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11.9 Impact Resistance Test

- i. VENDOR shall carry out impact resistance tests as per Clause 7.3.3(ii) of this Specification. Initially the frequency of test shall be two (2) coated pipes per shift, which may be further reduced and/or waived depending upon consistently acceptable results, at the sole discretion of CONTRACTOR's Representative.
- ii. A minimum of 30 impacts, located equidistant along the length of coated pipe, shall be performed.
- iii. Immediately after testing, the test area shall be subjected to holiday detection at the same voltage as used prior to impact resistance test. The pipe shall be rejected if any holiday is noted in the test area.
- iv. Where any coated pipe is rejected for lack of impact resistance, VENDOR shall test the preceding and succeeding pipes coated until the coating is proved acceptable and/or at the discretion of the CONTRACTOR.
- v. Rejected coated pipes shall be recycled through the cleaning and coating process in accordance with the approved procedure, at Vendor's cost.

11.10 Resistance to Splitting Test

VENDOR shall, within 14 days of coating application, take a coating ring sample of length equal to five times pipe diameter and make three 50 ± 3 mm long cuts in the coating parallel to the pipe axis. The cuts shall be through to the steel substrate. The cuts shall essentially be in the middle of the ring sample but shall be separated by 100mm in the longitudinal direction and 100mm in the circumferential direction. The actual length of the cuts shall be measured to ± 0.1 mm.

The prepared ring sample shall be maintained at ambient temperature for 100 days. After 100 days the length of the cuts shall be re measured to ± 0.1 mm. No cut is permitted to have increased its length by more than 2.0mm.

11.11 Epoxy Coating Porosity Test

Fusion bonded epoxy (FBE) coating porosity tests shall be carried out on coated pipe daily and for each batch of FBE powder. A cross section of coating shall be evaluated under a microscope. The porosity, which includes total voids, porosity and foaming, when added over the cross section of any part of the coating shall not to exceed 33% of the thickness of the coating.

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Where the allowable limit is exceeded, additional porosity tests shall be performed. Should the further tests indicate that excessive areas of the coating, in the CONTRACTOR's opinion, contain excess porosity the coating shall be rejected.

11.12 Volatile Content of Epoxy Powder

The volatile content of the FBE powder shall be determined for each batch of powder. VENDOR shall weigh a sample of approximately 1.5g of powder to $\pm 1\text{mg}$ and place a pan containing the powder in a preheated oven at a temperature of 105°C for a period of 2 hours. The pan shall then be removed and placed in a desiccator for 5 minutes while the sample cools. The sample shall then be reweighed immediately and the volatile content of the FBE recorded.

Duplicate tests shall be performed. If the results vary by more than 10%, then two more tests shall be performed. Where three or more of the tests vary by more than 10%, the CONTRACTOR's approval shall be required to continue using the powder.

11.13 Repair of Test Areas

Damages occurring to pipe coating during the above tests shall be repaired in accordance with the approved coating repair procedure and Section 13 of this Specification. Repairs occurring on account of the production tests are excluded from the limitation of three defects per pipe and the limitation of 100cm^2 area.

11.14 Rate for Pipe Rejection

Any pipe coating shall be rejected if there is more than 3 (three) coating repairs on the pipe, or if the area of the repair is more than 100cm^2 in area. Any pipe so rejected shall have the coating removed and the pipe recycled through the complete cleaning and coating system in accordance with the approved coating application procedure, and shall be to Vendor's cost.

11.15 CONTRACTOR's Approval

CONTRACTOR reserves the right to perform inspection and witness test on all activities concerning the pipe coating operations, starting from bare pipe to finished coated pipe, ready for despatch.

VENDOR shall give reasonable notice of time and shall provide, without charge, reasonable access and facilities required for inspection to the CONTRACTOR's Representative. Inspection and tests performed or witnessed by CONTRACTOR's Representative shall in no way relieve the VENDOR's obligation to perform the required inspection and tests.

Where the rate of defective or rejected pipes and/or samples tests are 10% or more for a single shift (typically 8 hours), VENDOR shall be required to stop production and carry out a full and detailed investigation and shall submit the findings to CONTRACTOR for approval. Vendor's shall recommence the production only after receiving written permission from CONTRACTOR.

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Under no circumstances shall any action or omission of the CONTRACTOR's Representative relieve the VENDOR of its responsibility for material and quality of coating produced.

No pipes shall be transported from the coating plants unless authorised in writing by the CONTRACTOR.

12. HANDLING, TRANSPORTATION AND STORAGE

The Supplier shall submit all details on transport, handling and stockpiling procedures for both coated and un coated, including stockpile location and layout, to CONTRACTOR or CONTRACTOR's Representative for approval at least 3 weeks before commencing the work.

12.1 Responsibility for Pipe

The VENDOR shall be fully responsible for the pipe and for the pipe identification marking from the time of "taking over" of bare pipes from the CONTRACTOR at the ships hook until such time that the coated pipes are "handed over" to CONTRACTOR.

At the time of "taking over" of bare pipes, VENDOR shall inspect and record all the relevant details referred to in Clauses 9.3 and 9.6 above in the presence of CONTRACTOR. Damage to the pipes that occur after the VENDOR has taken delivery, such as dents, flats, or damage to the weld ends shall be cut off, removed or repaired and pipes rebevelled as necessary. The cost of this work, as well as that of the pipe lost in cutting and repair shall be to the Vendor's cost. All such works shall only be carried out after Vendor's proposed repair procedure has written approval of the CONTRACTOR.

Prior to commencing coating, VENDOR shall inspect each bare pipe and record any relevant details as per Clauses 9.3 and 9.6. Damage to the bare pipes which occur due to handling / transportation such as dents, flats, or damage to the weld ends, shall be cut off, removed or repaired and pipes rebevelled as necessary, at Vendor's cost.

12.2 Pipe Handling

The VENDOR shall take receipt of bare line pipe from ships hook and shall load and transport the pipe to the coating plant(s).

The VENDOR shall unload, load, stockpile and transport the bare pipes within the coating plant(s) using suitable means and in a manner to avoid damage to pipes.

The VENDOR shall stockpile the bare pipes at the storage area of the coating plant. The VENDOR shall prepare and furnish to CONTRACTOR a procedure/calculation generally in compliance with API RP-5L1 for pipe stacking, which shall be submitted for approval by CONTRACTOR prior to commencement.

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The VENDOR shall load, unload, transport and stockpile the coated pipes within the coating plant site using approved suitable means and in a manner to avoid damage to the pipe and coating. The Vendor's procedure shall be submitted for approval by CONTRACTOR prior to commencement.

Coated pipe shall only be lifted as single pipes.

12.3 Coated Pipes

Coated pipes may be handled by means of slings and belts of proper width (minimum 60mm) made of non-abrasive/non-metallic materials. Use of vacuum lifting equipment is permitted for lifting and handling coated pipe.

Pipes to be stacked shall be separated row by row to avoid coating damage when removing the slings. Use of round sectional slings is prohibited. Forklifts may be used provided that the arms of the forklift are covered with suitable pads, preferably rubber.

12.4 Stacking of Pipes

Bare/coated pipes at all times shall be stacked completely clear from the ground so that the bottom row of pipes remain free from any surface water. The pipes shall be stacked at a slope so that water cannot collect inside the pipe.

The coated pipes may be stacked by placing them on ridges of clean sand and covered with a plastic film, or on wooden supports provided with suitable cover. The supports shall be spaced in such a manner as to avoid permanent bending of the pipes.

Stacks shall be limited to 8 layers and such that the pressure exercised by the pipe's own weight does not cause damage to the coating. VENDOR shall submit calculations for CONTRACTOR's approval in this regard. Each pipe layer shall be separated by means of padded spacers suitably spaced for this purpose and shall be detailed in the VENDOR's handling procedures to be approved by the CONTRACTOR. Stacks shall be suitably secured against collapsing by use of 150mm wide wooden wedges against the outside pipe of each layer. Stacks shall consist of pipe sections having the same diameter and wall thickness.

The weld seam of pipes shall be positioned always in a manner so as not to touch the adjacent pipes.

The ends of the pipes during handling and stacking shall always be protected with bevel protectors.

12.5 Transport Vehicles

The lorries used for transportation shall be equipped with adequate pipe supports, having round hollow beds for each pipe to be placed on the lorry bed. Total width of the supports shall be at least 10% of the pipe length with maximum spacing of 3 metres. The supports shall be lined with heavy

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rubber and shall be spaced in a manner to support equal load from the pipes. The rubber protection must be free from all nails and staples where pipes are in contact.

The second layer and all following layers shall be separated from the other with adequate number of separating layers of protective material such as heavy rubber strips 200mm wide or equivalent, to avoid direct contact between the coated pipes.

Rubber belts or equivalent shall cover all stanchions. Care shall be exercised to properly cover the top of the stanchions and other positions such as reinforcements of the truck body, rivets, etc., to prevent damage to the coated surface.

Final acceptance of coated pipes shall be conditional upon the following: -

1. All pipes shall receive a complete visual inspection for defects.
2. One pipe per truckload shall be selected at random and holiday tested, plus one other pipe nominated by the CONTRACTOR or CONTRACTOR's Representative's representative. If a defect is detected, a further two (2) pipes shall be selected and holiday tested.
3. Holiday testing will be at 25,000 volts.
4. Every defect discovered shall be repaired or the pipe re coated.
5. No coated pipe shall be accepted which has more than three repairs.

12.6 Storage of Coating Materials

Raw coating materials which are susceptible to deteriorating or suffering from damage especially due to humidity, exposure to high thermal excursions or other adverse weather conditions, shall be suitably stored and protected. Deteriorated materials shall not be used and shall be replaced at Vendor's cost.

The materials mentioned above, during loading, unloading, storage and treating should always be handled so as to prevent any damage, alteration and dispersion. When supplied in containers and envelopes, they shall not be dropped or thrown, or removed by means of hooks, both during the transport and handling operations until their complete use.

During unloading, transport and utilisation, any contact with water, earth, crushed stone and any other foreign material shall be carefully avoided.

VENDOR shall strictly follow Manufacturer's instructions regarding storage temperature and conditions. The VENDOR shall provide a climate controlled air-conditioned environment for epoxy powder storage.

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12.7 Additional UV Protection During Pipe Stockpiling

This specification requires the use of UV stabilised polyethylene such that the coating will pass all of the test requirements after 12 months exposure in India. With the present generation UV stabilisers this can be achieved with any colour of PE. If it is likely that the pipe will be stockpiled for longer than 12 months, then a coating of white water-based PVA may be appropriate. However, it should only be applied at the time of stockpiling as it can be easily removed during transport and handling operations.

13. REPAIR OF COATING

VENDOR shall submit and qualify a comprehensive repair system, its methods and materials proposed to be used for executing a coating repair and shall receive approval from CONTRACTOR prior to use. All repairs shall be performed using epoxy primed heat shrink sleeves.

The repair procedure shall cover application over bare pipe and over the trilaminate coating. The minimum adhesion shall meet or exceed the sleeve manufacturer's requirements. Sleeve installers shall be specially trained and qualified by the sleeve manufacturer, and after qualification, be issued with and carry the manufacturer's certification card.

Only approved sleeve installers shall be allowed to perform production repair. One sleeve per installer per week shall be destructively tested. Method of testing shall be subject to approval by the CONTRACTOR or CONTRACTOR's Representative. The adhesion between sleeve and the epoxy and between epoxy and the steel substrate shall be checked using two peel tests. There shall be less than 5% void or adhesive failure and any one area of loss of adhesion is less than 20 mm².

In open storage the repair coating materials must be able to withstand a temperature of at least +80°C, without impairing its serviceability and properties.

Testing of repairs shall be in the same form as testing production coating. All repairs shall result in a coating thickness no less than the parent coating thickness.

All pipe leaving the coating plant, shall have a sound external coating with no holiday or porosity on 100% of the surface.

Defects, repairs and acceptability criteria shall be as follows:-

- Pipes showing porosities or very small damage not detected during holiday test and having a surface area less than 0.5cm² or linear damage (cut) of less than 3 cm, and does not expose bare steel, shall be repaired by applying heat shrink sleeves.

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- Damage to coating by handling such as scratches, cuts, dents, gouges, not detected during holiday test, having a total reduced thickness on the damaged portion of not less than 2.0mm and an area not exceeding 20cm² shall be repaired by applying a heat shrink sleeve.
- Defects exceeding the above sizes or any holidays or exposed steel, exposing the bare metal surface and applying a heat shrink sleeve shall repair not exceeding 300mm.
- Any production pipe containing defects in excess of 3 (three) per pipe, or if the defect length exceeds 300mm (in any direction), shall be stripped and re coated.
- In case of a coating defect close to the coating cut back, VENDOR shall remove the coating throughout the entire circumference of the pipe down to the steel surface and increase the coating cut back length. If the resulting coating cut back exceeds 300mm length, then the coating shall be repaired by the use of a heat shrink sleeve, thereby making up the coating cut back length to 150mm.
- If the defect is more than 400mm from the original coating cut back length, the entire coating shall be removed and the pipe re coated. Alternatively, the pipe end may be cut back and rebevelled and the cost of the lost pipe reimbursed to the CONTRACTOR.

All repairs carried out to coating for whatever reason shall be to the account of the VENDOR.

Cosmetic damages occurring only in the Polyethylene sheathing need not be repaired by exposing up to steel surface, as deemed fit by the CONTRACTOR's Representative. The VENDOR shall establish its repair procedure qualification by testing and shall receive approval from CONTRACTOR prior to use.


Testing of repairs shall be the same as testing for production coating and shall be subject to approval from CONTRACTOR prior to use.

VENDOR shall also demonstrate tests on repaired coating as and when required by CONTRACTOR.

14. MARKING AND PIPE IDENTIFICATION

The VENDOR shall preserve pipe identity by maintaining the identity of each length of pipe. Final markings shall be applied on the outside wall of the pipe at a maximum distance of 500 mm from the end.

Vendor to have a system of properly transferring the original pipe number/heat number (in addition to bar code system) before application of 3LPE coating so that final marking is having the same information without any error.

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The marking shall indicate, but not be limited to, the following information: -

- i. Pipe number, Heat number.
- ii. Coated pipe number.
- iii. Colour band.
- iv. Diameter, wall thickness, weight and length.
- v. Re attach barcode labels from inside of pipe, or replace labels.
- vi. Any other information considered relevant by CONTRACTOR.

VENDOR shall obtain prior approval from CONTRACTOR for the marking procedure to be adopted.

15. PRODUCTION REPORT

VENDOR shall prepare and maintain a detailed production reporting system, which shall provide a detailed history of each pipe length.


The VENDOR shall obtain from the pipe supplier, as a minimum, the following data :-

- Pipe number
- Heat number
- Pipe grade
- Diameter
- Length
- Wall thickness
- Pipe weight.

Prior to acceptance of the pipe at the wharf, the VENDOR in the presence of the CONTRACTOR shall identify and record any minor defects, such as dents, flats or damaged bevels, found during the acceptance inspection. The VENDOR shall be responsible for any subsequent damage to the pipe.

To the records received from the pipe supplier the VENDOR shall add the following information: -

- Details of defect repairs
- Coating material batch numbers
- Pre-qualification tests for raw materials
- Coating procedure qualification tests

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- Coating material balance
- Coated pipe sampling details
- Coated pipe test results
- Coated pipe weight
- Coating defects
- Coating repairs
- Hold points
- Rejected pipe.

The production report shall be submitted to CONTRACTOR every seven (7) days. The report shall be submitted as a single sheet Excel format on a CD.

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APPENDIX 1

LIST OF ACCEPTABLE COMBINATIONS OF COATING MATERIALS

The following Table provides indicative candidate coating materials. Vendor shall decide their possible options of coating specifications. The OWNER favours the use of FUSABOND 158D adhesive material by DUPONT, since this has proven performance in the field and has been shown to provide good adhesion to a wide range of polyethylene and FBE materials. Alternative resin suppliers for FBE and polyethylene should be approved by DUPONT so that all material suppliers are in agreement with the combinations of coating materials. Notwithstanding this, any combination of materials, including those favoured by the OWNER, shall be subject to the full tender testing and documentation requirements.

Epoxy Powder (Manufacturer)	Adhesive (Manufacturer)	PE Compound (Manufacturer)
EP 971197 (JOTUN) SCOTCHKOTE 226N (3M) HGT 53672343 (BASF)	FUSABOND 158D (DUPONT) FUSABOND E MB 206D(DUPONT) OVERAC 18350 (ATOFINA) ME 0420 (BOREALIS)	SCLAIR 35 BP MDPE (NOVACOR) 2006 PBK 35 (LACQTENE)

The responsibility for suitability for application, performance and compliance to the coating system requirements shall unconditionally lie with the VENDOR whatever combination of coating materials are proposed.



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STANDARD AUXILIARY PIPING SUPPORTS HOT COLLECTION

REV.	DATE	DESCRIPTION	PREPARED	CHECKED	APPROVED	AUTHORIZED
B	12.05.2020	ISSUED FOR DESIGN	HC	PVB	KSJ	JMC
A	17.10.2019	ISSUED FOR DESIGN	SL	KSJ	TI/KSJ	JMC



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1. INTRODUCTION:

INDIAN OIL CORPORATION LIMITED (IOCL) has awarded Fax of Acceptance (FOA) dated 29th August 2019 to M/s. Technip India Limited (TPIL) for Consultancy services (PMC/EPCM services) for overall project management, FEED Review / FEED, Detailed Engineering, Procurement & expediting services, Tendering & award, Construction Management & Supervision, Assistance in start-up, Commissioning & performance test runs for installation of a Standby SRU of 525 TPD capacity and execution of Additional tanks for Paradip Refinery, Odisha, India.

2. DEFINITIONS & ABBREVIATIONS

Abbreviation	Definition /Expanded form
IOCL/ CLIENT	Indian Oil Corporation Limited
PMC/ CONSULTANT	Technip India Limited
LICENSOR	Party selected by IOCL for process technology ownership for any UNIT
CONTRACTOR	Party whose services are obtained for performing the works specified as part of LSTK / packages.
EPCM	Engineering, Procurement & Construction Management Services.
LSTK	Lump Sum Turn Key portion of the work to be executed by CONTRACTOR
FEED	Front End Engineering Design
AUTHORISED REPRESENTATIVE	IOCL's/ CONSULTANT's representative authorized to act for and on behalf of them
VENDOR	Any third party supplying the equipment/materials for setting up the Plant
PROJECT	Indicates Standby SRU and Additional tanks Project, Paradip Refinery
UNIT	Indicates any particular portion of the project to be built which can be Process related or Utilities/Offsites related

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3. SCOPE

This relevant synoptic summary intends to introduce standard supports families' structures and applications. This specification detailed materials and basis technical rules for TECHNIP's standard supports design.

4. REFERENCE DOCUMENTS

- 080557C-000-JSD-1300-0003 : Job Specification for Piping Support Design

5. REFERENCE STANDARD SUPPORT DOCUMENTS

- STC-1391-0010 : WELDED SUPPORTS SERIES
- STC-1392-0010 : CLAMPED SUPPORTS SERIES
- STC-1393-0010 : HANGER&ITEMIZED SUPPORTS SERIES
- STC-1394-0010 : STRUCTURAL SUPPORTS SERIES
- STC-1395-0010 : SMALL BORE SERIES

6. SYMBOLOGY



<u>WELDED</u>	<u>ELEMENTS</u>
STC-1391-00	<u>G</u> UIDE
	<u>R</u> ESTING
	<u>S</u> TOP

<u>CLAMPED</u>	<u>ELEMENTS</u>
STC-1392-00	<u>G</u> UIDE
	<u>R</u> ESTING
	<u>S</u> TOP

<u>H</u> ANGERS & <u>I</u> TEMIZED <u>S</u> UPPORTS	<u>A</u> CCOUSTIC <u>A</u> TENUATION PAD
STC-1393-00	<u>C</u> ONSTANT SPRING
	<u>H</u> IGH TEMP. PAD
	<u>S</u> NUBBER
	<u>R</u> IGID STRUT
	<u>S</u> LIDING PLATE
	<u>T</u> IE-ROD
	<u>V</u> ARIABLE SPRING

<u>S</u> TRUCTURAL	<u>B</u> EAMS
STC-1394-00	
<u>S</u> TRUCTURAL	<u>P</u> lates
STC-1394-00	<u>R</u> ESTING

<u>S</u> MALL BORE	<u>E</u> LEMENTS
STC-1395-00 (Only valid for construction at site)	
	<u>G</u> UIDE
	<u>R</u> ESTING

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7. MATERIALS SPECIFICATIONS FOR SUPPORT MEMBERS



The following chapters are valid for Standard Piping Supports Collection “HOT” lines and “COLD” Lines.

PIPING		SUPPORT MATCL	SUPPORTING ELEMENTS AS PER ASTM SPECIFICATION										
			ELEMENT WELDED TO PIPE (1)			ELEMENT NOT WELDED TO PIPE BUT IN CONTACT WITH PIPING THERMAL FLOW OR INSIDE INSULATION				ELEMENT OUT OF THERMAL FLOW OR COMPLETELY OUTSIDE OF INSULATION (STRUCTURAL & HANGERS SUPPORTS SERIES) (4)			
MATERIAL	TEMP. (°C) (3)		PIPE	SHAPES	PLATES & BARS	PIPES	SHAPES	PLATES & BARS	BOLTING (BOLT & NUT)	PIPES	SHAPES PLATE & BARS	BOLTING (BOLT & NUT)	FORGED
Carbon Steel	-29 TO 342	CS	A106 Gr B (A53 Gr B) or as per piping class	A36 / IS-2062 E250BR		A106 Gr B (A53 Gr B)	A36 / IS-2062 E250BR		A193 Gr B7 A194 Gr 2H	A106 Gr B (A53 Gr B)	A36 / IS-2062 E250BR	A 193 Gr B7 A 194 Gr 2H	A668 Gr D
	343 TO 427	CH		/	A516-60		/	A516-60					
Low Temp Carbon Steel	-45 TO 342	CL	A333 Gr 6 or as per piping class	/	A516-60 S5 (6)	A333 Gr 6	/	A 516-60 S5 (6)	A320 Gr L7 A194 Gr 7				
Carbon Steel Galvanized	10 TO 70	CG	/	/	/	A106 Gr B (A53GrB) (2)	A36 / IS-2062 E250BR (2)		A193 Gr B7 (2) A194 Gr 2H (2)				
Stainless Steel 304/304L 316/316L 321H 347H	-29 TO 342	SS	A312-Tp 304 or as per piping class	/	A240 Gr 304	A106 Gr B (A53 Gr B)	A36 / IS-2062 E250BR (3)		A193 Gr B8 A194 Gr 8				
	343 TO 650	SH				A312-Tp 304	/	A 240 Gr 304	A193 Gr B8 A194 Gr 8				
	-198 TO -30	SL							A320 Gr B8 A194 Gr 8				
Alloy Steel 1.25 Cr – 0.5 Mo	-29 TO 342	AS	A335 P11 or as per piping class	/	A387-11	A106 Gr B (A53 Gr B)	A36 / IS-2062 E250BR		A193 Gr B7 A194 Gr 2H				
	343 TO 650	AH				A335 P11	/	A387-11	A193 Gr B8 A194 Gr 8				
Alloy Steel 2.25 Cr – 1.0 Mo	-29 TO 342	AS	A335 P11 or as per piping class	/	A387-11	A106 Gr B (A53 Gr B)	A36 / IS-2062 E250BR		A193 Gr B7 A194 Gr 2H				
	343 TO 650	AH				A335 P11	/	A387-11	A193 Gr B8 A194 Gr 8				

- 1.The material for the pipe support welded to piping shall be the same as, or material equivalent to the material specified for piping.
- 2.Material to be galvanized
- 3.Sheet of isolating material shall be inserted between clamped support and pipe to avoid any direct contact.
- 4.The temperature is based on the alternate design condition or design condition taken from the line list.
- 5.The material of pipes, shapes, plates and bars are in accordance with structure material.
- 6.S5 denotes the supplementary impact test required at minimum temperature for A516-60

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	CLIENT	INDIAN OIL CORPORATION LIMITED		
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8. HEAT TREATMENT FOR WELDED SUPPORTS



PIPING		SUPPORT MATCL	ELEMENT WELDED TO PIPE			P no°	WELDING HEAT TREATMENT				
MATERIAL	TEMP. (°C)		PIPE	SHAPES	PLATES & BARS		PREHEATING		ADDITIONAL LIMITATIONS REQUIRED FOR EXEMPTION FROM PWHT		
						THICKNESS OF PIPE / SUPPORT	PREHEAT TEMP °C	WELDING THICKNESS	WELDING PROCEDURE (2)	PIPE THICKNESS	
Carbon Steel	-29 TO 342	CS	A106 Gr B (A53 Gr B) or as per piping class	A36 / IS-2062 E250BR		1	>25	95	ALL	For T>5mm multiple layer of welds to be used	>25
	343 TO 427	CH	/	A516-60							
Low Temp Carbon Steel	-45 TO 342	CL	A333 Gr 6 or as per piping	/	A516-60 S5 (6)						
Carbon Steel Galvanized	10 TO 75	CG	/	/	/	-	-	-	-	-	
Stainless Steel 304/304L 316/316L 321H 347H	-29 TO 342	SS	A312-Tp 304 or as per piping class	/	A240 Gr 304	8	ALL	NOT REQUIRED	NOT APPLICABLE	NOT APPLICABLE	NOT APPLICABLE
	343 TO 650	SH									
	-198 TO -30	SL									
Alloy Steel 1.25 Cr – 0.5 Mo	-29 TO 342	AS	A335 P11 or as per piping class	/	A387-11	4	ALL	120	≤13	For T>5mm multiple layer of welds to be used	≤16MM
	343 TO 650	AH									
Alloy Steel 2.25 Cr – 1.0 Mo	-29 TO 342	AS	A335 P11 or as per piping class	/	A387-11						
	343 TO 650	AH									

NOTES:

1. The requirements of this table are in accordance with those of ASME code B31.3(2016) Tables 330.1.1, 331.1.1, 331.1.2 and 331.1.3
2. T= throat thickness of fillet welds
3. The throat of fillet welds shall be 7/10 of the smaller thickness to be welded.
4. Welding operations may not be performed with an ambient temperature of less than 0°C.
5. Whenever PWHT is a process requirement support-piping welds shall be always post weld heat treated. In all events, heat treatment shall be performed for caustic soda service.
6. For ambient temperature of less than 5°C, preheating shall be carried out without considering required conditions indicated in the table

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	CLIENT		IOCL Paradip Refinery	
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9. STANDARD STRUCTURAL ELEMENTS

I-SHAPE		CHANNEL		ANGLE	
INDIAN NORM ISMB	CODE	INDIAN NORM ISMC	CODE	INDIAN NORM ISA	CODE
ISMB 100	MB100	ISMC 100	MC100	ISA 30 X 30 X 5	ISA30
ISMB 150	MB150	ISMC 125	MC125	ISA 50 X 50 X 6	ISA50
ISMB 200	MB200	ISMC 150	MC150	ISA 75 X 75 X 8	ISA75
ISMB 250	MB250	ISMC 200	MC200	ISA 100 X 100 X 10	ISA100
		ISMC 250	MC250	ISA 130 X 130 X 10	ISA130

UK SHAPES

H-SHAPE	
UK NORM	CODE
UC 152 X 152 X 23	UC 152 X 23
UC 152 X 152 X 30	UC 152 X 30
UC 203 X 203 X 46	UC 203 X 46
UC 254 X 254 X 73	UC 254 X 73

NOTES: This TABLE is a restrictive list of shapes use on STD Supports Drawings.

 	PROJECT		Standby SRU & Additional Tanks	
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10. BOLTING AND FORGED PIECES SUPPORT ELEMENTS

BOLTS(1)								NUTS	FORG	RODS
M	LENGTH							M	M	DIAM
8	40*		60*					8*		8*
10	40*			70*				10*	10*	10
12	40	50	60	70	80			12	12	12
16	40	50	60	70	80	100	130	16	16	16
20		50	60	70	80	90	150	20	20	20
24			60	70	100	160	170	24	24	24
30						100	170	30	30	30
33						100	120	33	33	33
36						100	120	36	36	36
42						100	120	42		42
48						100	120	48		48
72						100	120	72		72

11. FLAT BARS AND SHEET STEELS SUPPORT ELEMENTS



FLAT BARS (2)							PLATES
THK	BREADTH						THK
2	30*	50	60	70	80		2
3	30*						3
5	30*	50	60	100			5
10	40*	50	60	70	80	90	10
	100	110	120	140	150	200	
							12
15	100						15
20	100						20

*: SPECIFIC MATERIAL FOR PIPE DIA <2"

(1): BOLTS SHALL BE THREADED TO HEAD

(2): FLAT BAR MAY BE REPLACED BY SHEETS STEEL IF NECESSARY AND CUT ON FIELD

M: BOLT DIAMETER

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12. WELDING

All welds shall be continuous fillet weld type as per AWS A2.4 except specific indication on drawing (Field Weld, Full penetration Weld.....)



Otherwise indicated, throat thickness weld shall be 6mm (refer to AWS A3.OM/A3.0, fig.B.25.)

13. PROTECTION SHIELD

Instead of pipe, rolled plate can be used with equivalent thk as per piping class (with MAX. THK 12.7mm, except contrary indication).

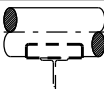

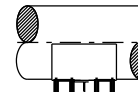
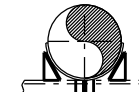
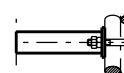
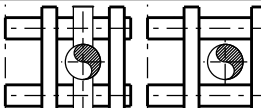
Weld size shall respect requirements specified in codes and project documents.

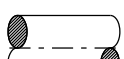
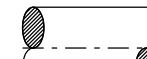

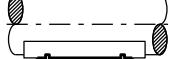

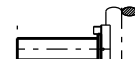

As per ASME Section VIII Div. 1, fig. 13.2 sheet 124, weld throat thickness shall be 0.7 x thinner thickness, but with a minimum of 3mm.

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14. LIST OF PIPING HOT SUPPORT SERIES COLLECTION SYNOPTICS

STANDARD HOT PIPING SUPPORTS COLLECTION SYNOPTICS		
Document Ref. 080557C-000- STC	Description	Rev.
1390-01 GL 01	SYNOPTIC FOR CARBON STEEL LINES WITHOUT PWHT	0
1390-02 GL 02	SYNOPTIC FOR CARBON STEEL LINES GALVANIZED	0
1390-03 GL 03	SYNOPTIC FOR CARBON STEEL LINES WITH PWHT	0
1390-04 GL 04	SYNOPTIC FOR CARBON STEEL LINES WITHOUT PWHT FOR HIGH TEMPERATURE SERVICES	0
1390-05 GL 05	SYNOPTIC FOR ALLOY STEEL LINES WITHOUT PWHT	0
1390-06 GL 06	SYNOPTIC FOR ALLOY STEEL LINES WITH PWHT	0
1390-07 GL 07	SYNOPTIC FOR ALLOY STEEL LINES WITHOUT PWHT FOR HIGH TEMPERATURE SERVICES	0
1390-08 GL 08	SYNOPTIC FOR STAINLESS STEEL LINES	0
1390-09 GL 09	SYNOPTIC FOR ALLOY STEEL LINES WITH PWHT FOR HIGH TEMPERATURE SERVICES	0
1390-10 GL 10	SYNOPTIC FOR STAINLESS STEEL LINES FOR HIGH TEMPERATURE SERVICES	0

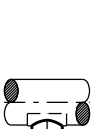
UNINSULATED PIPE	SIMPLE REST	GUIDE	STOP	SEMI-ANCHOR	BRACKET / GUIDE																																		
	<div></div> <div>INDICATIVE SUPPORT ONLY FOR DIAM 2" TO 18"</div> <table><tr><th>DIAM</th><td>50 TO 300 2" TO 12"</td><td>350 TO 600 14" TO 24"</td></tr><tr><th>STD</th><td>WR00</td><td>WE01</td></tr></table>	DIAM	50 TO 300 2" TO 12"	350 TO 600 14" TO 24"	STD	WR00	WE01	<div></div> <table><tr><th>DIAM</th><td>50 TO 600 2" TO 24"</td></tr><tr><th>STD</th><td>WG01</td></tr></table>	DIAM	50 TO 600 2" TO 24"	STD	WG01	<div></div> <table><tr><th>DIAM</th><td>50 TO 600 2" TO 24"</td></tr><tr><th>STD</th><td>WS01</td></tr></table>	DIAM	50 TO 600 2" TO 24"	STD	WS01	<div></div> <table><tr><th>DIAM</th><td>50 TO 600 2" TO 24"</td></tr><tr><th>STD</th><td>GUIDE + STOP</td></tr></table>	DIAM	50 TO 600 2" TO 24"	STD	GUIDE + STOP	<div></div> <table><tr><th>DIAM</th><td>50 TO 150 2" TO 6"</td></tr><tr><th>BRACKET</th><td>SB11 + CS01</td></tr><tr><th>GUIDE</th><td>SB13 + CG01</td></tr><tr><th>STD</th><td></td></tr></table>	DIAM	50 TO 150 2" TO 6"	BRACKET	SB11 + CS01	GUIDE	SB13 + CG01	STD		<div></div> <table><tr><th>DIAM</th><td>200 TO 600 8" TO 24"</td></tr><tr><th>BRACKET</th><td>SB12 + WR07</td></tr><tr><th>GUIDE</th><td>SB14</td></tr><tr><th>STD</th><td></td></tr></table>	DIAM	200 TO 600 8" TO 24"	BRACKET	SB12 + WR07	GUIDE	SB14	STD
DIAM	50 TO 300 2" TO 12"	350 TO 600 14" TO 24"																																					
STD	WR00	WE01																																					
DIAM	50 TO 600 2" TO 24"																																						
STD	WG01																																						
DIAM	50 TO 600 2" TO 24"																																						
STD	WS01																																						
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STD	GUIDE + STOP																																						
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BRACKET	SB11 + CS01																																						
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DIAM	200 TO 600 8" TO 24"																																						
BRACKET	SB12 + WR07																																						
GUIDE	SB14																																						
STD																																							

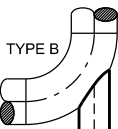
INSULATED PIPE	PIPE SHOE		GUIDE	STOP	SEMI-ANCHOR	BRACKET / GUIDE																																				
																																										
	<table><tr><td>DIAM</td><td>50 TO 600 2" TO 24"</td></tr><tr><td>STD</td><td>WR01</td></tr></table>	DIAM	50 TO 600 2" TO 24"	STD	WR01	<table><tr><td>DIAM</td><td>650 TO 1500 26" TO 60"</td></tr><tr><td>STD</td><td>WR14</td></tr></table>	DIAM	650 TO 1500 26" TO 60"	STD	WR14	<table><tr><td>DIAM</td><td>50 TO 1500 2" TO 60"</td></tr><tr><td>STD</td><td>PIPE SHOE + WG02</td></tr></table>	DIAM	50 TO 1500 2" TO 60"	STD	PIPE SHOE + WG02	<table><tr><td>DIAM</td><td>50 TO 1500 2" TO 60"</td></tr><tr><td>STD</td><td>PIPE SHOE + WS02</td></tr></table>	DIAM	50 TO 1500 2" TO 60"	STD	PIPE SHOE + WS02	<table><tr><td>DIAM</td><td>50 TO 1500 2" TO 60"</td></tr><tr><td>STD</td><td>STOP + GUIDE</td></tr></table>	DIAM	50 TO 1500 2" TO 60"	STD	STOP + GUIDE	<table><tr><td>DIAM</td><td>50 TO 150 2" TO 6"</td></tr><tr><td>BRACKET</td><td>SB11 + PIPE SHOE</td></tr><tr><td>GUIDE</td><td>SB13 + PIPE SHOE</td></tr><tr><td>STD</td><td></td></tr></table>	DIAM	50 TO 150 2" TO 6"	BRACKET	SB11 + PIPE SHOE	GUIDE	SB13 + PIPE SHOE	STD		<table><tr><td>DIAM</td><td>200 TO 600 8" TO 24"</td></tr><tr><td>BRACKET</td><td>SB12 + WR07</td></tr><tr><td>GUIDE</td><td>SB14 + PIPE SHOE</td></tr><tr><td>STD</td><td></td></tr></table>	DIAM	200 TO 600 8" TO 24"	BRACKET	SB12 + WR07	GUIDE	SB14 + PIPE SHOE	STD
DIAM	50 TO 600 2" TO 24"																																									
STD	WR01																																									
DIAM	650 TO 1500 26" TO 60"																																									
STD	WR14																																									
DIAM	50 TO 1500 2" TO 60"																																									
STD	PIPE SHOE + WG02																																									
DIAM	50 TO 1500 2" TO 60"																																									
STD	PIPE SHOE + WS02																																									
DIAM	50 TO 1500 2" TO 60"																																									
STD	STOP + GUIDE																																									
DIAM	50 TO 150 2" TO 6"																																									
BRACKET	SB11 + PIPE SHOE																																									
GUIDE	SB13 + PIPE SHOE																																									
STD																																										
DIAM	200 TO 600 8" TO 24"																																									
BRACKET	SB12 + WR07																																									
GUIDE	SB14 + PIPE SHOE																																									
STD																																										


INSULATED AND UNINSULATED PIPE

VERTICAL STANCHION

STANCHION

TYPE A

TYPE B

TYPE D

DIAM

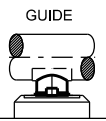
50 TO 1500
2" TO 60"

STD

WR05

BASE RESTRAINT

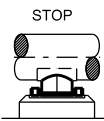
GUIDE



STD

STANCHION
+ WG03


STOP



STANCHION
+ WS03

TYPE A

SEMI-ANCHOR

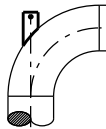


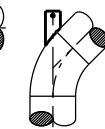
STANCHION
+ WS03

TYPE B

LUG

LUG ON ELBOW

TYPE A

TYPE B

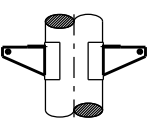
DIAM

50 TO 600
2" TO 24"

STD

WE08

DOUBLE LUGS



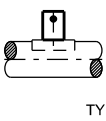
DIAM

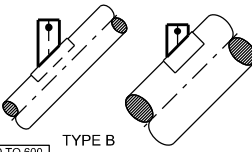
50 TO 600
2" TO 24"

STD

WE06

HORIZONTAL LUGS

TYPE A

TYPE B

DIAM

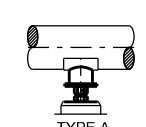
50 TO 600
2" TO 24"

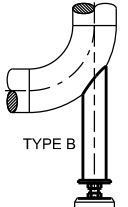
STD

WE07

ADJUSTABLE STANCHION

STANCHION

TYPE A

TYPE B

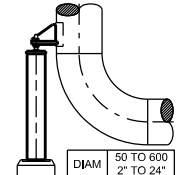
DIAM

50 TO 600
2" TO 24"

STD

WR09

SHAPE STANCHION



DIAM

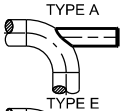
50 TO 600
2" TO 24"

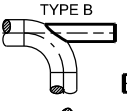
STD

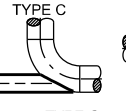
WR10

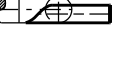
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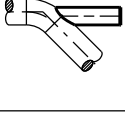
TRUNNION

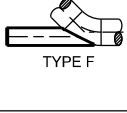
TYPE A

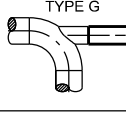
TYPE B

TYPE C

TYPE D

TYPE E

TYPE F

TYPE G

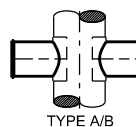
DIAM

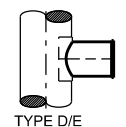
50 TO 600
2" TO 24"

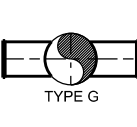
STD

WR06

TRUNNION

TYPE A/B

TYPE D/E

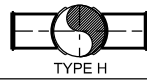
TYPE G

DIAM

50 TO 1500
2" TO 60"

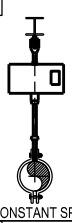
STD

WR07

TYPE H


HANGERS

HC




1 - CONSTANT SPRING

HT



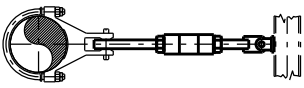
3 - TIE-ROD

HV



4 - VARIABLE SPRING

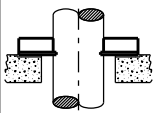
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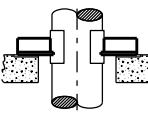


2 - RIGID STRUTS

REST ON PLATFORMS

CONCRETE





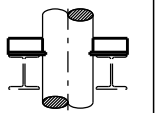
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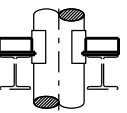
50 TO 200
2" TO 8"

STD

WR11

STEEL





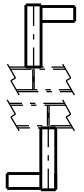
DIAM

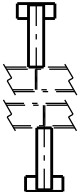
50 TO 200
2" TO 8"

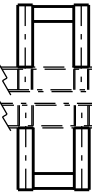
STD

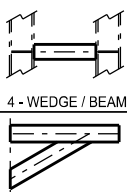
WR11

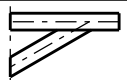
STRUCTURAL BEAM

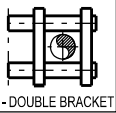
1 - L STRUCT.

2 - T STRUCT.

3 - U STRUCT.

4 - WEDGE / BEAM

5 - SINGLE BRACKET

6 - DOUBLE BRACKET

NOTE

1 : SYNOPTICS ARE ONLY GIVEN AS PRINCIPLE.

IN ALL CASES REFER TO STANDARD DRAWINGS

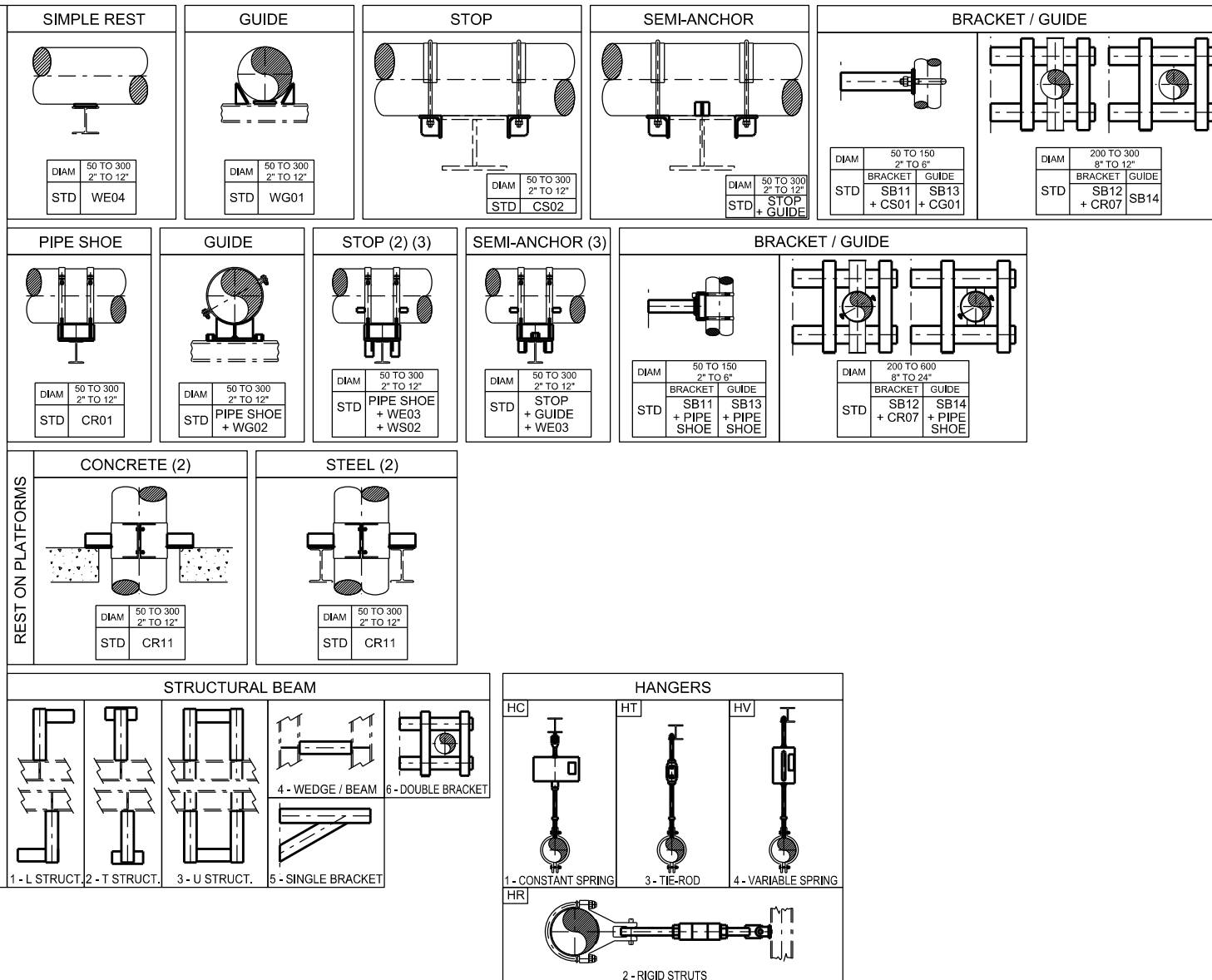
FOR COMPLEMENTARY DETAILS AND SUPPORT MARKS REQUIRED.

APPLICABILITY	
CS	CARBON STEEL

TEMPERATURE RANGE [°C]
-29 TO 342

Technip		CARBON STEEL LINES WITHOUT PWHT			GL01	
STANDARD CONSTRUCTION DRAWING PLANT DESIGN AND PIPING		XXXXXX	000	STC - 1390 - 01	1 of 1	0
Project		Unit		Doc. Code & Serial No.		Page
						Rev.

UNINSULATED PIPE



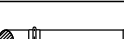
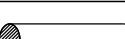




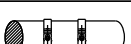



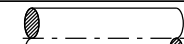
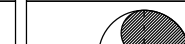




NOTE:
1. SYNOPTICS ARE ONLY GIVEN AS PRINCIPLE.
IN ALL CASES REFER TO STANDARD DRAWINGS
FOR COMPLEMENTARY DETAILS AND SUPPORT MARKS REQUIRED.
2. THIS SUPPORT DESIGN MUST USE A GRIPPED CLAMP.
3. WE03 TO BE WELDED BEFORE GALVANISING.

APPLICABILITY	
CG	GALVANIZED CARBON STEEL

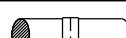
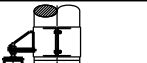


TEMPERATURE RANGE [°C]
-29 TO 75

Technip		CARBON STEEL LINES GALVANIZED			GL 02	
STANDARD CONSTRUCTION DRAWING PLANT DESIGN AND PIPING		XXXXXX	000	STC - 1390 - 02	1 of 1	0
Project		Unit	Doc. Code & Serial No.		Page	Rev.

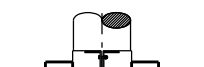
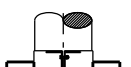



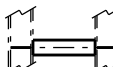
UNINSULATED PIPE	SIMPLE REST		GUIDE		STOP		SEMI-ANCHOR		BRACKET / GUIDE																												
																																					
	INDICATIVE SUPPORT ONLY FOR DIAM 2" TO 18"																																				
	<table><tr><td>DIAM</td><td>50 TO 300 2" TO 12"</td><td>350 TO 600 14" TO 24"</td></tr><tr><td>STD</td><td>WR00</td><td>WE01</td></tr></table>		DIAM	50 TO 300 2" TO 12"	350 TO 600 14" TO 24"	STD	WR00	WE01	<table><tr><td>DIAM</td><td>50 TO 600 2" TO 24"</td></tr><tr><td>STD</td><td>WG01</td></tr></table>		DIAM	50 TO 600 2" TO 24"	STD	WG01	<table><tr><td>DIAM</td><td>50 TO 300 2" TO 12"</td></tr><tr><td>STD</td><td>CS02</td></tr></table>		DIAM	50 TO 300 2" TO 12"	STD	CS02	<table><tr><td>DIAM</td><td>350 TO 600 14" TO 24"</td></tr><tr><td>STD</td><td>WS01</td></tr></table>		DIAM	350 TO 600 14" TO 24"	STD	WS01	<table><tr><td>DIAM</td><td>50 TO 300 2" TO 12"</td></tr><tr><td>STD</td><td>STOP + GUIDE</td></tr></table>		DIAM	50 TO 300 2" TO 12"	STD	STOP + GUIDE	<table><tr><td>DIAM</td><td>350 TO 600 14" TO 24"</td></tr><tr><td>STD</td><td>STOP + GUIDE</td></tr></table>		DIAM	350 TO 600 14" TO 24"	STD
DIAM	50 TO 300 2" TO 12"	350 TO 600 14" TO 24"																																			
STD	WR00	WE01																																			
DIAM	50 TO 600 2" TO 24"																																				
STD	WG01																																				
DIAM	50 TO 300 2" TO 12"																																				
STD	CS02																																				
DIAM	350 TO 600 14" TO 24"																																				
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DIAM	50 TO 300 2" TO 12"																																				
STD	STOP + GUIDE																																				
DIAM	350 TO 600 14" TO 24"																																				
STD	STOP + GUIDE																																				
								<table><tr><td>DIAM</td><td>50 TO 150 2" TO 6"</td></tr><tr><td>STD</td><td>BRACKET SB11 + CS01</td><td>GUIDE SB13 + CG01</td></tr></table>		DIAM	50 TO 150 2" TO 6"	STD	BRACKET SB11 + CS01	GUIDE SB13 + CG01	<table><tr><td>DIAM</td><td>200 TO 600 8" TO 24"</td></tr><tr><td>STD</td><td>BRACKET SB12 + WR07</td><td>GUIDE SB14</td></tr></table>		DIAM	200 TO 600 8" TO 24"	STD	BRACKET SB12 + WR07	GUIDE SB14																
DIAM	50 TO 150 2" TO 6"																																				
STD	BRACKET SB11 + CS01	GUIDE SB13 + CG01																																			
DIAM	200 TO 600 8" TO 24"																																				
STD	BRACKET SB12 + WR07	GUIDE SB14																																			

INSULATED PIPE	PIPE SHOE		GUIDE		STOP		SEMI-ANCHOR		BRACKET / GUIDE																																																	
	 <table><tr><td>DIAM</td><td>50 TO 600 2" TO 24"</td></tr><tr><td>STD</td><td>CR01</td></tr></table>	DIAM	50 TO 600 2" TO 24"	STD	CR01	 <table><tr><td>DIAM</td><td>650 TO 1500 26" TO 60"</td></tr><tr><td>STD</td><td>WR14</td></tr></table>	DIAM	650 TO 1500 26" TO 60"	STD	WR14	 <table><tr><td>DIAM</td><td>50 TO 600 2" TO 24"</td></tr><tr><td>STD</td><td>PIPE SHOE + WG02</td></tr></table>	DIAM	50 TO 600 2" TO 24"	STD	PIPE SHOE + WG02	 <table><tr><td>DIAM</td><td>650 TO 1500 26" TO 60"</td></tr><tr><td>STD</td><td>PIPE SHOE + WG02</td></tr></table>	DIAM	650 TO 1500 26" TO 60"	STD	PIPE SHOE + WG02	 <table><tr><td>DIAM</td><td>50 TO 600 2" TO 24"</td><td>650 TO 1500 26" TO 60"</td></tr><tr><td>STD</td><td>WR01 + WS02</td><td>WR14 + WS02</td></tr></table>	DIAM	50 TO 600 2" TO 24"	650 TO 1500 26" TO 60"	STD	WR01 + WS02	WR14 + WS02	 <table><tr><td>DIAM</td><td>50 TO 600 2" TO 24"</td><td>650 TO 1500 26" TO 60"</td></tr><tr><td>STD</td><td>WR01 + WS02</td><td>WR14 + WS02</td></tr></table>	DIAM	50 TO 600 2" TO 24"	650 TO 1500 26" TO 60"	STD	WR01 + WS02	WR14 + WS02	 <table><tr><td>DIAM</td><td>50 TO 1500 2" TO 60"</td></tr><tr><td>STD</td><td>STOP + GUIDE</td></tr></table>	DIAM	50 TO 1500 2" TO 60"	STD	STOP + GUIDE	 <table><tr><td>DIAM</td><td>50 TO 150 2" TO 6"</td></tr><tr><td>STD</td><td>BRACKET SB11 + PIPE SHOE</td></tr></table>	DIAM	50 TO 150 2" TO 6"	STD	BRACKET SB11 + PIPE SHOE	 <table><tr><td>DIAM</td><td>50 TO 150 2" TO 6"</td></tr><tr><td></td><td>GUIDE SB13 + PIPE SHOE</td></tr></table>	DIAM	50 TO 150 2" TO 6"		GUIDE SB13 + PIPE SHOE	 <table><tr><td>DIAM</td><td>200 TO 600 8" TO 24"</td></tr><tr><td>STD</td><td>BRACKET SB12 + WR07</td></tr></table>	DIAM	200 TO 600 8" TO 24"	STD	BRACKET SB12 + WR07	<table><tr><td>DIAM</td><td>200 TO 600 8" TO 24"</td></tr><tr><td></td><td>GUIDE SB14 + PIPE SHOE</td></tr></table>	DIAM	200 TO 600 8" TO 24"	
DIAM	50 TO 600 2" TO 24"																																																									
STD	CR01																																																									
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STD	WR14																																																									
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	GUIDE SB14 + PIPE SHOE																																																									

PIPE	VERTICAL STANCHION			STANCHION			BASE RESTRAINT			TRUNNION			STANDARD LOAD			STANDARD LOAD		
	 TYPE A 50 TO 600 2" TO 24" STD CR05 TYPE D 650 TO 1500 26" TO 60" STD WR05			 TYPE A 650 TO 1500 26" TO 60" STD WR05 TYPE B TYPE D			 GUIDE STOP SEMI-ANCHOR STD GUIDE CR05 + WG03 STOP WR05 + WS03 TYPE A SEMI-ANCHOR WR05 + WS03 TYPE B			 TYPE A 50 TO 600 2" TO 24" STD CR07 TYPE B			 TYPE A/B TYPE D/E TYPE H TYPE G 650 TO 1500 26" TO 60" STD WR07					

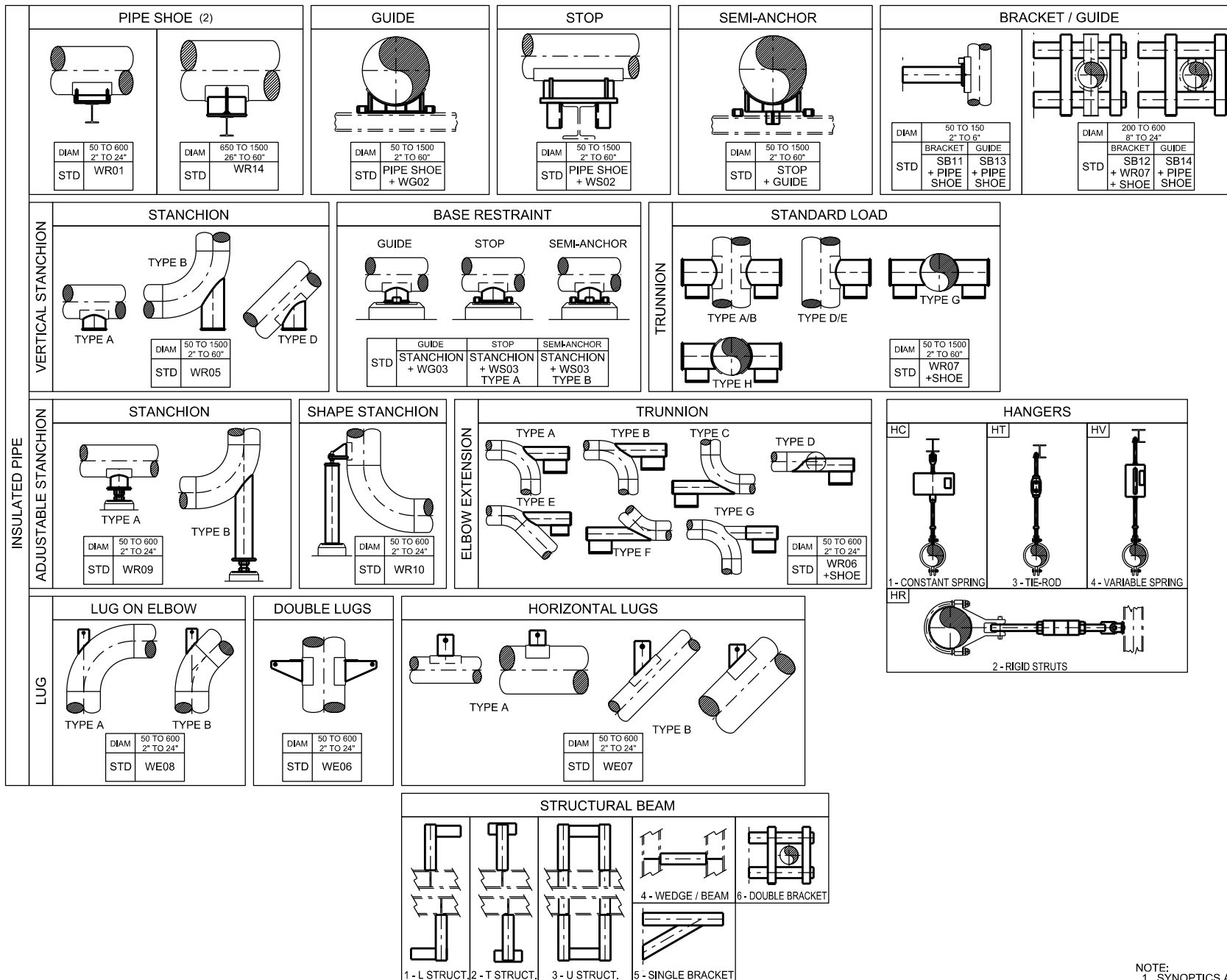
INSULATED AND UNINSULATED PIPE	ADJUSTABLE STANCHION		SHAPE STANCHION (2)		HANGERS				SPECIAL REQUIREMENT						
	 TYPE A <table border="1"><tr><td>DIAM</td><td>50 TO 600 2" TO 24"</td></tr><tr><td>STD</td><td>CR09</td></tr></table>		DIAM	50 TO 600 2" TO 24"	STD	CR09	 <table border="1"><tr><td>DIAM</td><td>50 TO 600 2" TO 24"</td></tr><tr><td>STD</td><td>CR10</td></tr></table>			DIAM	50 TO 600 2" TO 24"	STD	CR10	HC  1 - CONSTANT SPRING	HT  3 - TIE-ROD
DIAM	50 TO 600 2" TO 24"														
STD	CR09														
DIAM	50 TO 600 2" TO 24"														
STD	CR10														

INS

REST ON PLATFORMS	CONCRETE (2)	STEEL (2)	STRUCTURAL BEAM											
	 <table><tr><td>DIAM</td><td>50 TO 600 2" TO 24"</td></tr><tr><td>STD</td><td>CR11</td></tr></table>	DIAM	50 TO 600 2" TO 24"	STD	CR11	 <table><tr><td>DIAM</td><td>50 TO 600 2" TO 24"</td></tr><tr><td>STD</td><td>CR11</td></tr></table>	DIAM	50 TO 600 2" TO 24"	STD	CR11	 1 - L STRUCT.	 2 - T STRUCT.	 3 - U STRUCT.	 4 - WEDGE / BEAM 5 - SINGLE BRACKET
DIAM	50 TO 600 2" TO 24"													
STD	CR11													
DIAM	50 TO 600 2" TO 24"													
STD	CR11													

NOTE:
1. SYNOPTICS ARE ONLY GIVEN AS PRINCIPLE.
IN ALL CASES REFER TO STANDARD DRAWINGS
FOR COMPLEMENTARY DETAILS AND SUPPORT MARKS REQUIRED.
2. SUPPORT WE03 SHALL BE USED FOR THESE SUPPORT TYPES.
3. ALL SUPPORTS WELDED TO PIPE SHALL BE PROVIDED WITH PAD
WE01 AND THIS PAD SHALL BE WELDED AT SHOP BEFORE PWHT.

APPLICABILITY		TEMPERATURE RANGE [°C]		CARBON STEEL LINES WITH PWHT			GL 03		
CS	CARBON STEEL WITH PWHT	-29 TO 342		STANDARD CONSTRUCTION DRAWING PLANT DESIGN AND PIPING	XXXXXX	000	STC - 1390 - 03	1 of 1	0
				Project	Unit	Doc. Code & Serial No.	Page	Rev.	

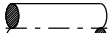


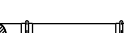




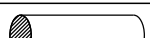


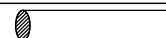

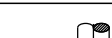
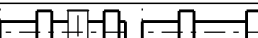
NOTE:
1. SYNOPTICS ARE ONLY GIVEN AS PRINCIPLE.
IN ALL CASES REFER TO STANDARD DRAWINGS
FOR COMPLEMENTARY DETAILS AND SUPPORT MARKS REQUIRED.
2. FOR LINE TEMPERATURE MORE THAN 400C°
HEAT ISOLATION BLOCK (HH01) TO BE PROVIDED.

APPLICABILITY	
CH	CARBON STEEL HIGH TEMPERATURE

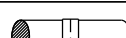




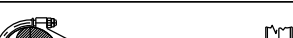



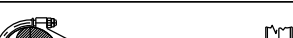
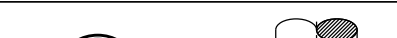



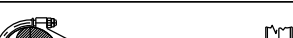
TEMPERATURE RANGE [°C]
343 TO 427

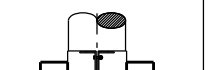
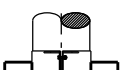



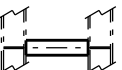


Technip		CARBON STEEL LINES WITHOUT PWHT FOR HIGH TEMPERATURE SERVICES			GL 04	
STANDARD CONSTRUCTION DRAWING PLANT DESIGN AND PIPING		XXXXXX	000	STC - 1390 - 04	1 of 1	0
Project		Unit		Doc. Code & Serial No.		Page
						Rev.

UNINSULATED PIPE	SIMPLE REST		GUIDE		STOP		SEMI-ANCHOR		BRACKET / GUIDE		
											
	INDICATIVE SUPPORT ONLY FOR DIAM 2" TO 18"										
	DIAM	50 TO 300 2" TO 12"	350 TO 600 14" TO 24"	DIAM	50 TO 600 2" TO 24"	DIAM	50 TO 300 2" TO 12"	350 TO 600 14" TO 24"	DIAM	50 TO 150 2" TO 6"	200 TO 600 8" TO 24"
	STD	WR00	WE01	STD	WG01	STD	CS02	WS01	STD	BRACKET + CS01	BRACKET + WR07
										GUIDE + CG01	GUIDE + SB14

INSULATED PIPE	PIPE SHOE		GUIDE		STOP		SEMI-ANCHOR		BRACKET / GUIDE			
												
	DIAM 50 TO 600 2" TO 24"	DIAM 650 TO 1500 26" TO 60"	DIAM 50 TO 600 2" TO 24"	DIAM 650 TO 1500 26" TO 60"	DIAM 50 TO 600 2" TO 24"	DIAM 650 TO 1500 26" TO 60"	DIAM 50 TO 1500 2" TO 60"	DIAM 50 TO 150 2" TO 6"	DIAM 200 TO 600 8" TO 24"	DIAM 200 TO 600 8" TO 24"	DIAM 200 TO 600 8" TO 24"	
	STD CR01	STD WR14	STD PIPE SHOE + WG02	STD PIPE SHOE + WG02	STD WR01 + WS02	STD WR14 + WS02	STD STOP + GUIDE	STD SB11 + PIPE SHOE	STD SB12 + WR07	GUIDE SB13 + PIPE SHOE	GUIDE SB14 + PIPE SHOE	

PIPE	VERTICAL STANCHION	STANCHION		STANCHION		BASE RESTRAINT			TRUNNION	STANDARD LOAD		STANDARD LOAD																	
		<div><p>TYPE A</p><table><tr><td>DIAM</td><td>50 TO 600 2" TO 24"</td></tr><tr><td>STD</td><td>CR05</td></tr></table></div>	DIAM	50 TO 600 2" TO 24"	STD	CR05	<div><p>TYPE D</p></div>	<div><p>TYPE A</p><table><tr><td>DIAM</td><td>650 TO 1500 26" TO 60"</td></tr><tr><td>STD</td><td>WR05</td></tr></table></div>		DIAM	650 TO 1500 26" TO 60"	STD	WR05	<div><p>TYPE B</p></div>	<div><p>TYPE D</p></div>	<div><p>GUIDE</p></div>	<div><p>STOP</p></div>	<div><p>SEMI-ANCHOR</p></div>	<div><p>TYPE A</p><table><tr><td>DIAM</td><td>50 TO 600 2" TO 24"</td></tr><tr><td>STD</td><td>CR07</td></tr></table></div>	DIAM	50 TO 600 2" TO 24"	STD	CR07	<div><p>TYPE B</p></div>	<div><p>TYPE A/B</p></div>	<div><p>TYPE D/E</p></div>	<div><p>TYPE H</p></div>	<div><p>TYPE G</p><table><tr><td>DIAM</td><td>650 TO 1500 26" TO 60"</td></tr><tr><td>STD</td><td>WR07</td></tr></table></div>	DIAM
DIAM	50 TO 600 2" TO 24"																												
STD	CR05																												
DIAM	650 TO 1500 26" TO 60"																												
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DIAM	50 TO 600 2" TO 24"																												
STD	CR07																												
DIAM	650 TO 1500 26" TO 60"																												
STD	WR07																												

INSULATED AND UNINSULATED ADJUSTABLE STANCHION	<div>STANCHION</div> <div></div> <div>TYPE A</div> <table><tr><td>DIAM</td><td>50 TO 600 2" TO 24"</td></tr><tr><td>STD</td><td>CR09</td></tr></table>	DIAM	50 TO 600 2" TO 24"	STD	CR09	<div>SHAPE STANCHION (2)</div> <div></div> <table><tr><td>DIAM</td><td>50 TO 600 2" TO 24"</td></tr><tr><td>STD</td><td>CR10</td></tr></table>	DIAM	50 TO 600 2" TO 24"	STD	CR10	<div>HANGERS</div> <table><tr><td>HC</td><td>HT</td><td>HV</td><td>HR</td></tr><tr><td></td><td></td><td></td><td></td></tr><tr><td>1 - CONSTANT SPRING</td><td>3 - TIE-ROD</td><td>4 - VARIABLE SPRING</td><td>2 - RIGID STRUTS</td></tr></table>	HC	HT	HV	HR					1 - CONSTANT SPRING	3 - TIE-ROD	4 - VARIABLE SPRING	2 - RIGID STRUTS	<div>SPECIAL REQUIREMENT</div> <div></div> <table><tr><td>DIAM</td><td>50 TO 600 2" TO 24"</td></tr><tr><td>STD</td><td>CE06</td></tr></table>	DIAM	50 TO 600 2" TO 24"	STD	CE06
	DIAM	50 TO 600 2" TO 24"																										
STD	CR09																											
DIAM	50 TO 600 2" TO 24"																											
STD	CR10																											
HC	HT	HV	HR																									
																												
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DIAM	50 TO 600 2" TO 24"																											
STD	CE06																											

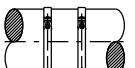



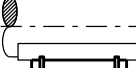

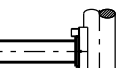

INS	REST ON PLATFORMS	CONCRETE (2)		STEEL (2)		STRUCTURAL BEAM									
															
		DIAM	50 TO 600 2" TO 24"	DIAM	50 TO 600 2" TO 24"	1 - L STRUCT.		2 - T STRUCT.		3 - U STRUCT.		4 - WEDGE / BEAM		6 - DOUBLE BRACKET	
		STD	CR11	STD	CR11										
												5 - SINGLE BRACKET			

APPLICABILITY	
AS	ALLOY STEEL WITH PWHT






TEMPERATURE RANGE [°C]
-29 TO 342

Technip STANDARD CONSTRUCTION DRAWING PLANT DESIGN AND PIPING	ALLOY STEEL LINES WITH PWHT			GL 06	
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NOTE:
1. SYNOPTICS ARE ONLY GIVEN AS PRINCIPLE.
IN ALL CASES REFER TO STANDARD DRAWINGS
FOR COMPLEMENTARY DETAILS AND SUPPORT MARKS REQUIRED.
2. SUPPORT WE03 SHALL BE USED FOR THESE SUPPORT TYPES.
3. ALL SUPPORTS WELDED TO PIPE SHALL BE PROVIDED WITH PAD
WE01 AND THIS PAD SHALL BE WELDED AT SHOP BEFORE PWHT.

INSULATED PIPE	PIPE SHOE (3)		GUIDE		STOP	SEMI-ANCHOR	BRACKET / GUIDE																																				
																																											
	<table><tr><td>DIAM</td><td>50 TO 600 2" TO 24"</td></tr><tr><td>STD</td><td>CR01</td></tr></table>	DIAM	50 TO 600 2" TO 24"	STD	CR01	<table><tr><td>DIAM</td><td>650 TO 1500 26" TO 60"</td></tr><tr><td>STD</td><td>WR14</td></tr></table>	DIAM	650 TO 1500 26" TO 60"	STD	WR14	<table><tr><td>DIAM</td><td>50 TO 600 2" TO 24"</td></tr><tr><td>STD</td><td>PIPE SHOE + WG02</td></tr></table>	DIAM	50 TO 600 2" TO 24"	STD	PIPE SHOE + WG02	<table><tr><td>DIAM</td><td>650 TO 1500 26" TO 60"</td></tr><tr><td>STD</td><td>PIPE SHOE + WG02</td></tr></table>	DIAM	650 TO 1500 26" TO 60"	STD	PIPE SHOE + WG02	<table><tr><td>DIAM</td><td>50 TO 600 2" TO 24"</td><td>650 TO 1500 26" TO 60"</td></tr><tr><td>STD</td><td>WR01 + WS02</td><td>WR14 + WS02</td></tr></table>	DIAM	50 TO 600 2" TO 24"	650 TO 1500 26" TO 60"	STD	WR01 + WS02	WR14 + WS02	<table><tr><td>DIAM</td><td>50 TO 1500 2" TO 60"</td></tr><tr><td>STD</td><td>STOP + GUIDE</td></tr></table>	DIAM	50 TO 1500 2" TO 60"	STD	STOP + GUIDE	<table><tr><td>DIAM</td><td>50 TO 150 2" TO 6"</td></tr><tr><td>STD</td><td>BRACKET + PIPE SHOE</td><td>GUIDE + PIPE SHOE</td></tr></table>	DIAM	50 TO 150 2" TO 6"	STD	BRACKET + PIPE SHOE	GUIDE + PIPE SHOE	<table><tr><td>DIAM</td><td>200 TO 600 8" TO 24"</td></tr><tr><td>STD</td><td>BRACKET + CR07 + WR01</td><td>GUIDE + PIPE SHOE</td></tr></table>	DIAM	200 TO 600 8" TO 24"	STD	BRACKET + CR07 + WR01
DIAM	50 TO 600 2" TO 24"																																										
STD	CR01																																										
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DIAM	200 TO 600 8" TO 24"																																										
STD	BRACKET + CR07 + WR01	GUIDE + PIPE SHOE																																									

INSULATED AND UNINSULATED PIPE	VERTICAL STANCHION	STANCHION		STANCHION		BASE RESTRAINT			TRUNNION	STANDARD LOAD		STANDARD LOAD	
	 TYPE A DIA M 50 TO 600 2" TO 24" STD CR05 TYPE D DIA M 50 TO 600 2" TO 24" STD CR05		 TYPE A DIA M 650 TO 1500 26" TO 60" STD WR05 TYPE B DIA M 650 TO 1500 26" TO 60" STD WR05 TYPE D DIA M 650 TO 1500 26" TO 60" STD WR05		 GUIDE STD CR05 + WG03 STOP STD WR05 + WS03 TYPE A SEMI-ANCHOR STD WR05 + WS03 TYPE B			 TYPE A DIA M 50 TO 600 2" TO 24" STD CR07 +WR01 TYPE B DIA M 50 TO 600 2" TO 24" STD CR07 +WR01		 TYPE A/B DIA M 50 TO 600 2" TO 24" STD CR07 +WR01 TYPE D/E DIA M 50 TO 600 2" TO 24" STD CR07 +WR01			
ADJUSTABLE STANCHION	STANCHION	SHAPE STANCHION (2)		HANGERS				TRUNNION	SPECIAL REQUIREMENT				
	 TYPE A DIA M 50 TO 600 2" TO 24" STD CR09	 DIA M 50 TO 600 2" TO 24" STD CR10		 HC 1 - CONSTANT SPRING HT 3 - TIE-ROD HV 4 - VARIABLE SPRING HR 2 - RIGID STRUTS					 DIA M 50 TO 600 2" TO 24" STD CE06				
STRUCTURAL BEAM													
 1 - L STRUCT. 2 - T STRUCT. 3 - U STRUCT. 4 - WEDGE / BEAM 5 - SINGLE BRACKET 6 - DOUBLE BRACKET													

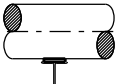
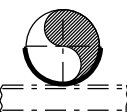

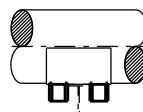
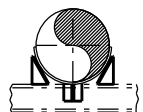
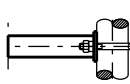
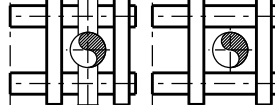
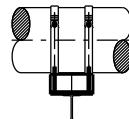
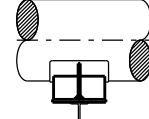
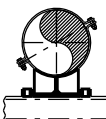
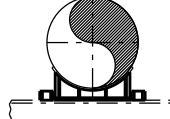
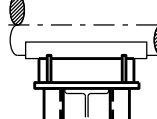

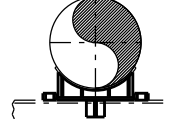
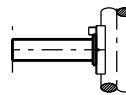
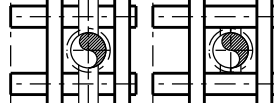
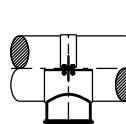
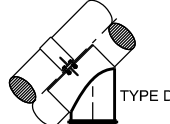

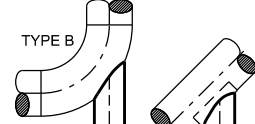
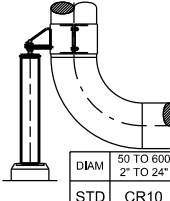
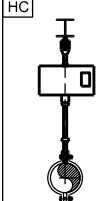

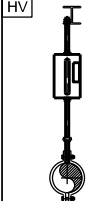
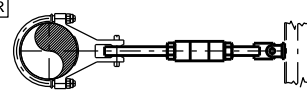
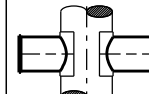
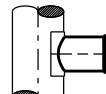
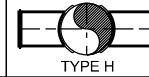
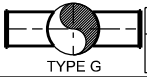
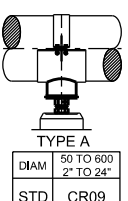
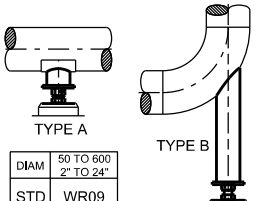
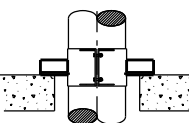
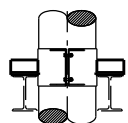
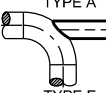
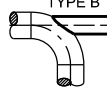
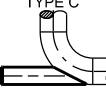
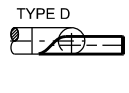
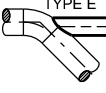
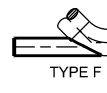
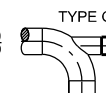
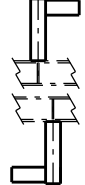
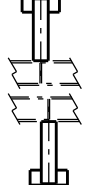


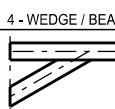
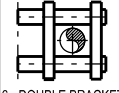
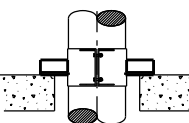
STRUCTURAL BEAM				
				
1 - L STRUCT.	2 - T STRUCT.	3 - U STRUCT.	4 - WEDGE / BEAM	5 - SINGLE BRACKET

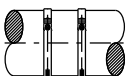



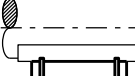

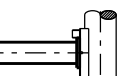
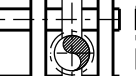
NOTE:
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IN ALL CASES REFER TO STANDARD DRAWINGS
FOR COMPLEMENTARY DETAILS AND SUPPORT MARKS REQUIRED.
2. ALL SUPPORTS WELDED TO PIPE SHALL BE PROVIDED WITH PAD WE01.
3. FOR LINES TEMP MORE THAN 400°C HEAT ISOLATION BLOCK (HH01) TO BE PROVIDED.
4. SUPPORT WE03 SHALL BE USED FOR THESE SUPPORT TYPES.

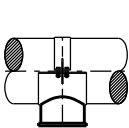
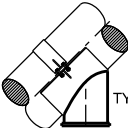

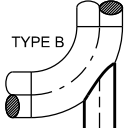
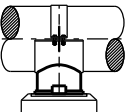
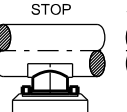
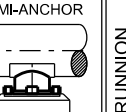
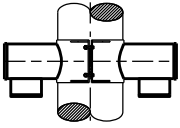
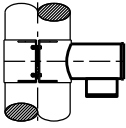
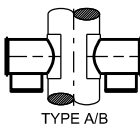
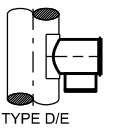
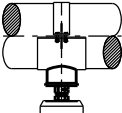
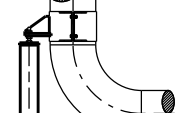
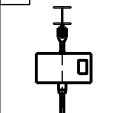
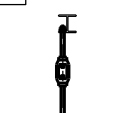
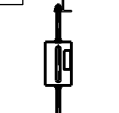
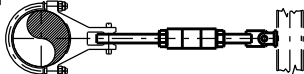
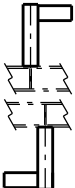
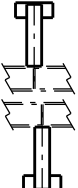
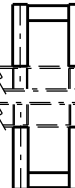
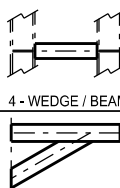
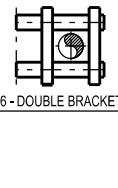
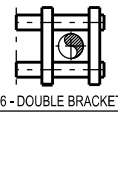

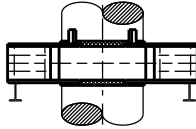




APPLICABILITY	
AH	ALLOY STEEL HIGH TEMPERATURE

TEMPERATURE RANGE [°C]
343 TO 650

Technip		ALLOY STEEL LINES WITHOUT PWHT FOR HIGH TEMPERATURE SERVICES			GL07	
STANDARD CONSTRUCTION DRAWING PLANT DESIGN AND PIPING	XXXXXX	000	STC - 1390 - 07	1 of 1	0	
Project	Unit	Doc. Code & Serial No.	Page	Rev.		

UNINSULATED PIPE	<div>SIMPLE REST</div>  <table><tr><td>DIAM</td><td>50 TO 300 2" TO 12"</td></tr><tr><td>STD</td><td>WE04</td></tr></table>	DIAM	50 TO 300 2" TO 12"	STD	WE04	<div>PROTECTION SHIELD</div>  <table><tr><td>DIAM</td><td>350 TO 600 14" TO 24"</td></tr><tr><td>STD</td><td>WE01</td></tr></table>	DIAM	350 TO 600 14" TO 24"	STD	WE01	<div>GUIDE</div>  <table><tr><td>DIAM</td><td>50 TO 600 2" TO 24"</td></tr><tr><td>STD</td><td>WG01</td></tr></table>	DIAM	50 TO 600 2" TO 24"	STD	WG01	<div>STOP</div>  <table><tr><td>DIAM</td><td>50 TO 600 2" TO 24"</td></tr><tr><td>STD</td><td>WS01</td></tr></table>	DIAM	50 TO 600 2" TO 24"	STD	WS01	<div>SEMI-ANCHOR</div>  <table><tr><td>DIAM</td><td>50 TO 600 2" TO 24"</td></tr><tr><td>STD</td><td>GUIDE +STOP</td></tr></table>	DIAM	50 TO 600 2" TO 24"	STD	GUIDE +STOP	<div>BRACKET / GUIDE</div> <div><table><tr><td>DIAM</td><td>50 TO 150 2" TO 6"</td></tr><tr><td>STD</td><td>BRACKET + CS01</td></tr><tr><td>GUIDE</td><td>SB13 + CG01</td></tr></table></div> <div><table><tr><td>DIAM</td><td>200 TO 600 8" TO 24"</td></tr><tr><td>STD</td><td>BRACKET + WR07</td></tr><tr><td>GUIDE</td><td>SB12 SB14</td></tr></table></div>		DIAM	50 TO 150 2" TO 6"	STD	BRACKET + CS01	GUIDE	SB13 + CG01	DIAM	200 TO 600 8" TO 24"	STD	BRACKET + WR07	GUIDE	SB12 SB14							
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INSULATED PIPE	<div>PIPE SHOE</div>  <table><tr><td>DIAM</td><td>50 TO 600 2" TO 24"</td></tr><tr><td>STD</td><td>CR01</td></tr></table>  <table><tr><td>DIAM</td><td>650 TO 1500 26" TO 60"</td></tr><tr><td>STD</td><td>WR14</td></tr></table>	DIAM	50 TO 600 2" TO 24"	STD	CR01	DIAM	650 TO 1500 26" TO 60"	STD	WR14	<div>GUIDE</div>  <table><tr><td>DIAM</td><td>50 TO 600 2" TO 24"</td></tr><tr><td>STD</td><td>PIPE SHOE + WG02</td></tr></table>  <table><tr><td>DIAM</td><td>650 TO 1500 26" TO 60"</td></tr><tr><td>STD</td><td>PIPE SHOE + WG02</td></tr></table>	DIAM	50 TO 600 2" TO 24"	STD	PIPE SHOE + WG02	DIAM	650 TO 1500 26" TO 60"	STD	PIPE SHOE + WG02	<div>STOP</div>  <table><tr><td>DIAM</td><td>50 TO 600 2" TO 24"</td></tr><tr><td>STD</td><td>WR01 + WS02</td></tr></table>  <table><tr><td>DIAM</td><td>650 TO 1500 26" TO 60"</td></tr><tr><td>STD</td><td>WR14 + WS02</td></tr></table>	DIAM	50 TO 600 2" TO 24"	STD	WR01 + WS02	DIAM	650 TO 1500 26" TO 60"	STD	WR14 + WS02	<div>SEMI-ANCHOR</div>  <table><tr><td>DIAM</td><td>50 TO 1500 2" TO 60"</td></tr><tr><td>STD</td><td>STOP + GUIDE</td></tr></table>	DIAM	50 TO 1500 2" TO 60"	STD	STOP + GUIDE	<div>BRACKET / GUIDE</div> <div><table><tr><td>DIAM</td><td>50 TO 150 2" TO 6"</td></tr><tr><td>STD</td><td>BRACKET + PIPE SHOE</td></tr><tr><td>GUIDE</td><td>SB13 + PIPE SHOE</td></tr></table></div> <div><table><tr><td>DIAM</td><td>200 TO 600 8" TO 24"</td></tr><tr><td>STD</td><td>BRACKET + WR07</td></tr><tr><td>GUIDE</td><td>SB12 SB14 + PIPE SHOE</td></tr></table></div>		DIAM	50 TO 150 2" TO 6"	STD	BRACKET + PIPE SHOE	GUIDE	SB13 + PIPE SHOE	DIAM	200 TO 600 8" TO 24"	STD	BRACKET + WR07	GUIDE	SB12 SB14 + PIPE SHOE
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INSULATED AND UNINSULATED PIPE	<div>VERTICAL STANCHION</div>  <table><tr><td>DIAM</td><td>50 TO 600 2" TO 24"</td></tr><tr><td>STD</td><td>CR05</td></tr></table>  <table><tr><td>DIAM</td><td>650 TO 1500 26" TO 60"</td></tr><tr><td>STD</td><td>WR05</td></tr></table>	DIAM	50 TO 600 2" TO 24"	STD	CR05	DIAM	650 TO 1500 26" TO 60"	STD	WR05	<div>STANCHION</div>  <table><tr><td>DIAM</td><td>50 TO 600 2" TO 24"</td></tr><tr><td>STD</td><td>CR09</td></tr></table>  <table><tr><td>DIAM</td><td>50 TO 600 2" TO 24"</td></tr><tr><td>STD</td><td>WR09</td></tr></table>	DIAM	50 TO 600 2" TO 24"	STD	CR09	DIAM	50 TO 600 2" TO 24"	STD	WR09	<div>SHAPE STANCHION (2)</div>  <table><tr><td>DIAM</td><td>50 TO 600 2" TO 24"</td></tr><tr><td>STD</td><td>CR10</td></tr></table>	DIAM	50 TO 600 2" TO 24"	STD	CR10	<div>HANGERS</div> <div><p>1 - CONSTANT SPRING</p></div> <div><p>3 - TIE-ROD</p></div> <div><p>4 - VARIABLE SPRING</p></div> <div><p>2 - RIGID STRUTS</p></div>	<div>STANDARD LOAD</div> <div><p>TYPE A/B</p></div> <div><p>TYPE D/E</p></div> <div><p>TYPE H</p></div> <div><table><tr><td>DIAM</td><td>650 TO 1500 26" TO 60"</td></tr><tr><td>STD</td><td>WR07</td></tr></table><p>TYPE G</p></div>		DIAM	650 TO 1500 26" TO 60"	STD	WR07																
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XXXXXX	000	STC - 1390 - 08	1 of 1	0																																										
Project	Unit	Doc. Code & Serial No.	Page	Rev																																										

INSULATED PIPE	PIPE SHOE (4)		GUIDE		STOP	SEMI-ANCHOR	BRACKET / GUIDE	
								
	DIAM 50 TO 600 2" TO 24"	DIAM 650 TO 1500 26" TO 60"	DIAM 50 TO 600 2" TO 24"	DIAM 650 TO 1500 26" TO 60"	DIAM 50 TO 600 2" TO 24"	DIAM 50 TO 1500 2" TO 60"	DIAM 50 TO 150 2" TO 6"	DIAM 200 TO 600 8" TO 24"
	STD CR01	STD WR14	STD PIPE SHOE + WG02	STD PIPE SHOE + WG02	STD WR01 + WS02	STD STOP + GUIDE	STD SB11 + PIPE SHOE	STD SB12 + CR07 + WR01
							GUIDE SB13 + PIPE SHOE	GUIDE SB14 + PIPE SHOE

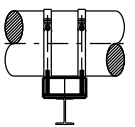
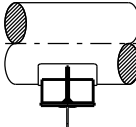

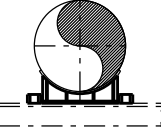
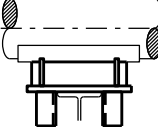
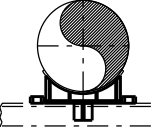
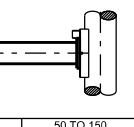
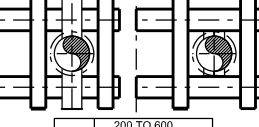
INSULATED AND UNINSULATED PIPE	VERTICAL STANCHION		STANCHION		BASE RESTRAINT			TRUNNION	STANDARD LOAD		STANDARD LOAD																																					
	 TYPE A <table border="1"><tr><td>DIAM</td><td>50 TO 600 2" TO 24"</td></tr><tr><td>STD</td><td>CR05</td></tr></table>	DIAM	50 TO 600 2" TO 24"	STD	CR05	 TYPE D <table border="1"><tr><td>DIAM</td><td>50 TO 600 2" TO 24"</td></tr><tr><td>STD</td><td>CR05</td></tr></table>	DIAM		50 TO 600 2" TO 24"	STD	CR05	 TYPE A <table border="1"><tr><td>DIAM</td><td>650 TO 1500 26" TO 60"</td></tr><tr><td>STD</td><td>WR05</td></tr></table>	DIAM	650 TO 1500 26" TO 60"	STD	WR05	 TYPE B <table border="1"><tr><td>DIAM</td><td>650 TO 1500 26" TO 60"</td></tr><tr><td>STD</td><td>WR05</td></tr></table>	DIAM	650 TO 1500 26" TO 60"	STD	WR05	 GUIDE <table border="1"><tr><td>STD</td><td>GUIDE CR05 + WG03</td></tr></table>	STD	GUIDE CR05 + WG03	 STOP <table border="1"><tr><td>STD</td><td>STOP WR05 + WS03 TYPE A</td></tr></table>	STD	STOP WR05 + WS03 TYPE A	 SEMI-ANCHOR <table border="1"><tr><td>STD</td><td>SEMI-ANCHOR WR05 + WS03 TYPE B</td></tr></table>	STD	SEMI-ANCHOR WR05 + WS03 TYPE B	 TYPE A <table border="1"><tr><td>DIAM</td><td>50 TO 600 2" TO 24"</td></tr><tr><td>STD</td><td>CR07 +WR01</td></tr></table>	DIAM	50 TO 600 2" TO 24"	STD	CR07 +WR01	 TYPE B <table border="1"><tr><td>DIAM</td><td>50 TO 600 2" TO 24"</td></tr><tr><td>STD</td><td>CR07 +WR01</td></tr></table>	DIAM	50 TO 600 2" TO 24"	STD	CR07 +WR01	 TYPE A/B <table border="1"><tr><td>DIAM</td><td>50 TO 600 2" TO 24"</td></tr><tr><td>STD</td><td>CR07 +WR01</td></tr></table>	DIAM	50 TO 600 2" TO 24"	STD	CR07 +WR01	 TYPE D/E <table border="1"><tr><td>DIAM</td><td>650 TO 1500 26" TO 60"</td></tr><tr><td>STD</td><td>WR07 +WR14</td></tr></table>	DIAM	650 TO 1500 26" TO 60"
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DIAM	650 TO 1500 26" TO 60"																																															
STD	WR07 +WR14																																															
INSULATED AND UNINSULATED PIPE	ADJUSTABLE STANCHION		SHAPE STANCHION (2)		HANGERS				STRUCTURAL BEAM																																							
	 TYPE A <table border="1"><tr><td>DIAM</td><td>50 TO 600 2" TO 24"</td></tr><tr><td>STD</td><td>CR09</td></tr></table>	DIAM	50 TO 600 2" TO 24"	STD	CR09	 <table border="1"><tr><td>DIAM</td><td>50 TO 600 2" TO 24"</td></tr><tr><td>STD</td><td>CR10</td></tr></table>	DIAM	50 TO 600 2" TO 24"	STD	CR10	 HC 1 - CONSTANT SPRING	 HT 3 - TIE-ROD	 HV 4 - VARIABLE SPRING	 HR 2 - RIGID STRUTS	 1 - L STRUCT.	 2 - T STRUCT.	 3 - U STRUCT.	 4 - WEDGE / BEAM	 5 - SINGLE BRACKET	 6 - DOUBLE BRACKET																												
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INSULATED AND UNINSULATED PIPE	SPECIAL REQUIREMENT		SPECIAL REQUIREMENT		SPECIAL REQUIREMENT		SPECIAL REQUIREMENT		SPECIAL REQUIREMENT																																							
	 <table border="1"><tr><td>DIAM</td><td>50 TO 600 2" TO 24"</td></tr><tr><td>STD</td><td>CE06</td></tr></table>	DIAM	50 TO 600 2" TO 24"	STD	CE06	 <table border="1"><tr><td>DIAM</td><td>50 TO 600 2" TO 24"</td></tr><tr><td>STD</td><td>CE06</td></tr></table>	DIAM	50 TO 600 2" TO 24"	STD	CE06	 <table border="1"><tr><td>DIAM</td><td>50 TO 600 2" TO 24"</td></tr><tr><td>STD</td><td>CE06</td></tr></table>	DIAM	50 TO 600 2" TO 24"	STD	CE06	 <table border="1"><tr><td>DIAM</td><td>50 TO 600 2" TO 24"</td></tr><tr><td>STD</td><td>CE06</td></tr></table>	DIAM	50 TO 600 2" TO 24"	STD	CE06	 <table border="1"><tr><td>DIAM</td><td>50 TO 600 2" TO 24"</td></tr><tr><td>STD</td><td>CE06</td></tr></table>	DIAM	50 TO 600 2" TO 24"	STD	CE06	 <table border="1"><tr><td>DIAM</td><td>50 TO 600 2" TO 24"</td></tr><tr><td>STD</td><td>CE06</td></tr></table>	DIAM	50 TO 600 2" TO 24"	STD	CE06																		
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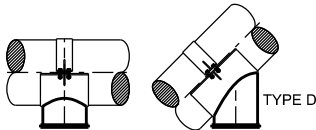
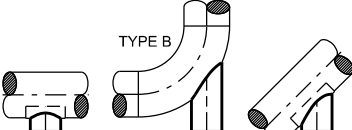
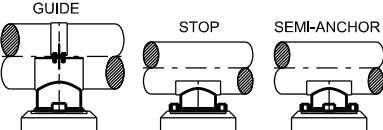
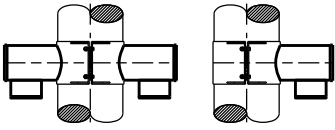
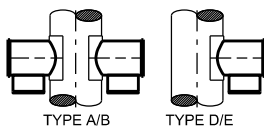
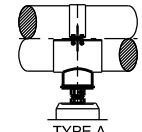
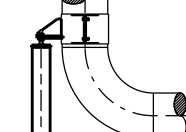
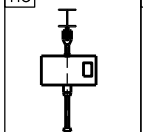
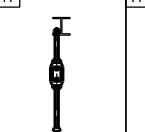
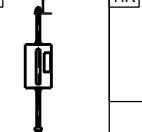
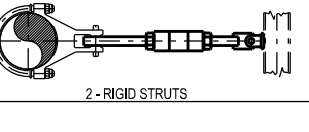
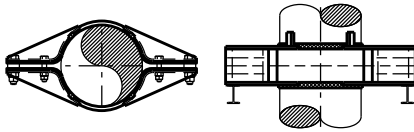
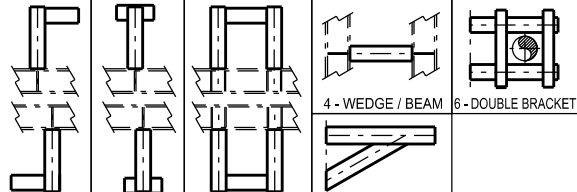
NOTE:
1. SYNOPTICS ARE ONLY GIVEN AS PRINCIPLE.
IN ALL CASES REFER TO STANDARD DRAWINGS
FOR COMPLEMENTARY DETAILS AND SUPPORT MARKS REQUIRED.
2. SUPPORT WE03 SHALL BE USED FOR THESE SUPPORT TYPES.
3. ALL SUPPORTS WELDED TO PIPE SHALL BE PROVIDED WITH PAD
WE01 AND THIS PAD SHALL BE WELDED AT SHOP BEFORE PWHT.
4. FOR LINE TEMP MORE THAN 400°C HEAT ISOLATION BLOCK (HH01) TO BE PROVIDED.

APPLICABILITY	
AH	ALLOY STEEL HIGH TEMPERATURE WITH PWHT

TEMPERATURE RANGE [°C]
343 TO 650

Technip		ALLOY STEEL LINES WITH PWHT FOR HIGH TEMPERATURE SERVICES			GL09	
STANDARD CONSTRUCTION DRAWING PLANT DESIGN AND PIPING	XXXXXX	000	STC - 1390 - 09	1 of 1	0	
Project	Unit	Doc. Code & Serial No.	Page	Rev.		

INSULATED PIPE	PIPE SHOE (3)		GUIDE		STOP		SEMI-ANCHOR		BRACKET / GUIDE																																										
		<table><tr><td>DIAM</td><td>50 TO 600 2" TO 24"</td></tr><tr><td>STD</td><td>CR01</td></tr></table>	DIAM	50 TO 600 2" TO 24"	STD	CR01		<table><tr><td>DIAM</td><td>650 TO 1500 26" TO 60"</td></tr><tr><td>STD</td><td>WR14</td></tr></table>	DIAM	650 TO 1500 26" TO 60"	STD	WR14		<table><tr><td>DIAM</td><td>50 TO 600 2" TO 24"</td></tr><tr><td>STD</td><td>PIPE SHOE + WG02</td></tr></table>	DIAM	50 TO 600 2" TO 24"	STD	PIPE SHOE + WG02		<table><tr><td>DIAM</td><td>650 TO 1500 26" TO 60"</td></tr><tr><td>STD</td><td>PIPE SHOE + WG02</td></tr></table>	DIAM	650 TO 1500 26" TO 60"	STD	PIPE SHOE + WG02		<table><tr><td>DIAM</td><td>50 TO 600 2" TO 24"</td></tr><tr><td>STD</td><td>WR01 + WS02</td></tr></table>	DIAM	50 TO 600 2" TO 24"	STD	WR01 + WS02		<table><tr><td>DIAM</td><td>50 TO 1500 2" TO 60"</td></tr><tr><td>STD</td><td>STOP + GUIDE</td></tr></table>	DIAM	50 TO 1500 2" TO 60"	STD	STOP + GUIDE		<table><tr><td>DIAM</td><td>50 TO 150 2" TO 6"</td></tr><tr><td>STD</td><td>BRACKET + PIPE SHOE</td></tr><tr><td></td><td>GUIDE + PIPE SHOE</td></tr></table>	DIAM	50 TO 150 2" TO 6"	STD	BRACKET + PIPE SHOE		GUIDE + PIPE SHOE		<table><tr><td>DIAM</td><td>200 TO 600 8" TO 24"</td></tr><tr><td>STD</td><td>BRACKET + CR07 + WR01</td></tr><tr><td></td><td>GUIDE + PIPE SHOE</td></tr></table>	DIAM	200 TO 600 8" TO 24"	STD	BRACKET + CR07 + WR01	
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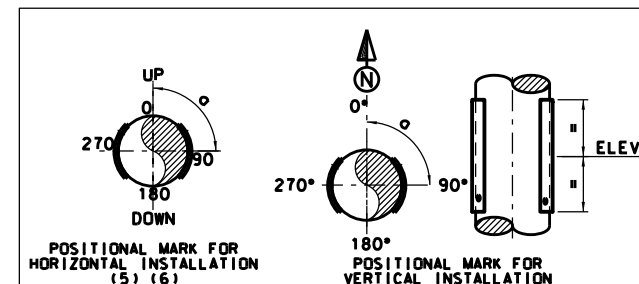
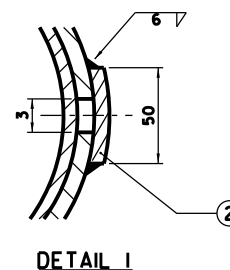
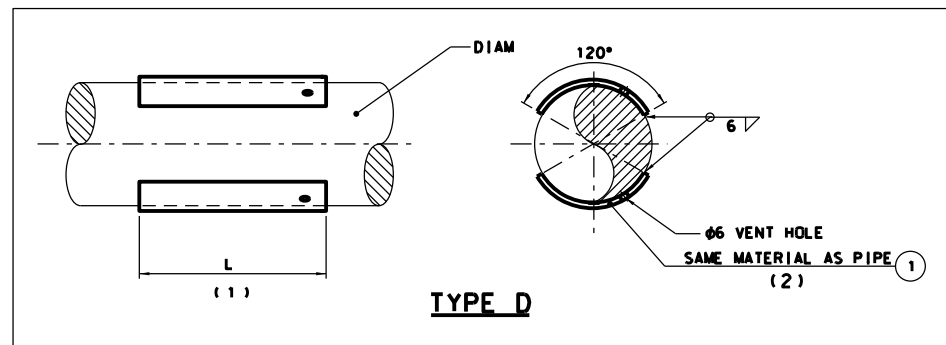
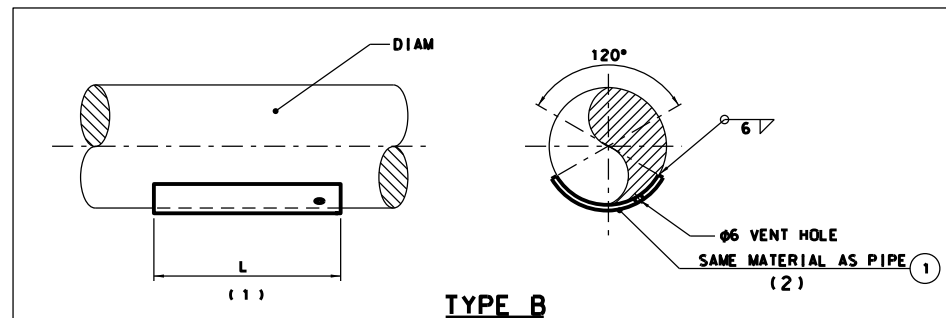
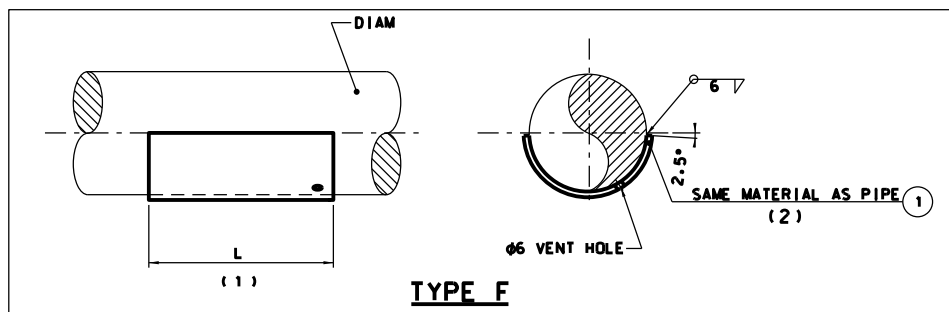
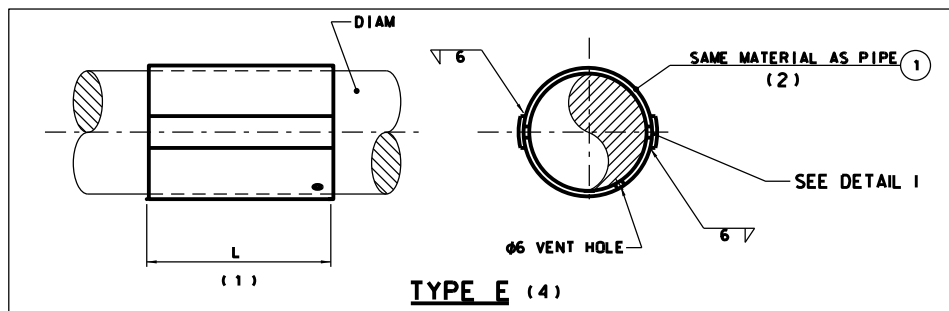
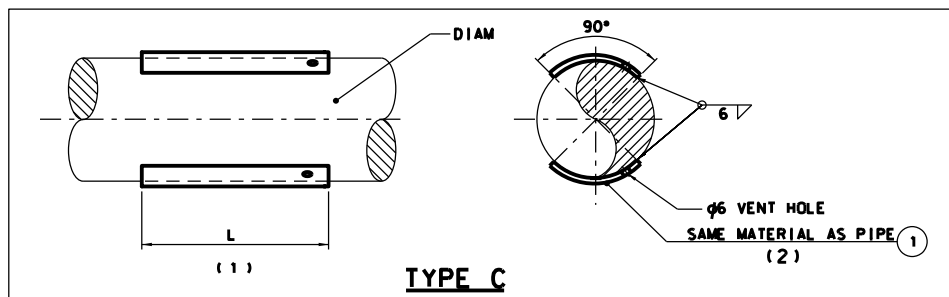
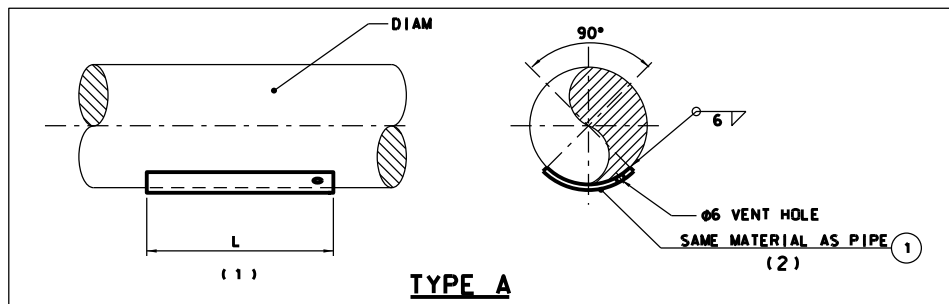
INSULATED AND UNINSULATED PIPE	VERTICAL STANCHION	STANCHION		STANCHION		BASE RESTRAINT			TRUNNION	STANDARD LOAD		STANDARD LOAD	
	 <div><div>TYPE A</div><div>DIAM 50 TO 600 2" TO 24"</div><div>STD CR05</div></div> <div><div>TYPE D</div><div>DIAM 650 TO 1500 26" TO 60"</div><div>STD WR05</div></div>	 <div><div>TYPE A</div><div>DIAM 650 TO 1500 26" TO 60"</div><div>STD WR05</div></div> <div><div>TYPE B</div><div>DIAM 650 TO 1500 26" TO 60"</div><div>STD WR05</div></div> <div><div>TYPE D</div><div>DIAM 650 TO 1500 26" TO 60"</div><div>STD WR05</div></div>	 <div><div>GUIDE</div><div>STD CR05 + WG03</div></div> <div><div>STOP</div><div>STD WR05 + WS03 TYPE A</div></div> <div><div>SEMI-ANCHOR</div><div>STD WR05 + WS03 TYPE B</div></div>	 <div><div>TYPE A</div><div>DIAM 50 TO 600 2" TO 24"</div><div>STD CR07 +WR01</div></div> <div><div>TYPE B</div><div>DIAM 50 TO 600 2" TO 24"</div><div>STD CR07 +WR01</div></div>	 <div><div>TYPE A/B</div><div>DIAM 50 TO 600 2" TO 24"</div><div>STD CR07 +WR01</div></div> <div><div>TYPE D/E</div><div>DIAM 650 TO 1500 26" TO 60"</div><div>STD WR07 +WR14</div></div>								
ADJUSTABLE STANCHION	STANCHION	SHAPE STANCHION (2)		HANGERS				SPECIAL REQUIREMENT					
 <div><div>TYPE A</div><div>DIAM 50 TO 600 2" TO 24"</div><div>STD CR09</div></div>	 <div><div>DIAM 50 TO 600 2" TO 24"</div><div>STD CR10</div></div>	 <div><div>HC</div><div>1 - CONSTANT SPRING</div></div>	 <div><div>HT</div><div>3 - TIE-ROD</div></div>	 <div><div>HV</div><div>4 - VARIABLE SPRING</div></div>	 <div><div>HR</div><div>2 - RIGID STRUTS</div></div>		 <div><div>DIAM 50 TO 600 2" TO 24"</div><div>STD CE06</div></div>						
STRUCTURAL BEAM													
 <div><div>1 - L STRUCT.</div><div>2 - T STRUCT.</div><div>3 - U STRUCT.</div><div>4 - WEDGE / BEAM</div><div>5 - SINGLE BRACKET</div><div>6 - DOUBLE BRACKET</div></div>													

NOTE:
1. SYNOPTICS ARE ONLY GIVEN AS PRINCIPLE.
IN ALL CASES REFER TO STANDARD DRAWINGS
FOR COMPLEMENTARY DETAILS AND SUPPORT MARKS REQUIRED.
2. ALL SUPPORTS WELDED TO PIPE SHALL BE PROVIDED WITH PAD WE01.
3. FOR LINES TEMP MORE THAN 400°C HEAT ISOLATION BLOCK (HH01) TO BE PROVIDED.
4. SUPPORT WE03 SHALL BE USED FOR THESE SUPPORT TYPES.

APPLICABILITY	
SH	STAINLESS STEEL HIGH TEMPERATURE

TEMPERATURE RANGE [°C]
343 TO 650

Technip		STAINLESS STEEL LINES FOR HIGH TEMPERATURE SERVICES			GL 10	
STANDARD CONSTRUCTION DRAWING PLANT DESIGN AND PIPING		XXXXXX	000	STC - 1390 - 10	1 of 1	0
Project		Unit		Doc. Code & Serial No.		Page Rev.



NOTES:

1. L MAX. = 950.
2. MATERIAL AND SCH. AS PER PIPING CLASSES WITH MAX. THK=12.7mm. EXCEPT SPECIAL REQUIREMENT
3. DELETED.
4. USE WHEN REQUIRED BY STRESS CALCULATION.
5. LOOKING TO FLOW FLUID DIRECTION.
6. TO BE INDICATED ONLY IF DIFFERENT OF 180°.

Support Mark						Positional Mark	
WE01	DIAM	TYPE	L	SCH	MATCL	ELEV	a

<i>Technip</i>	PROTECTION SHIELD FOR DIAM 2" TO 60"			WE01	
STANDARD CONSTRUCTION DRAWING PLANT DESIGN AND PIPING	XXXXXXXXXXXX 000	STC1391-01	1 of 1	0	
	Project	Unit	Doc. Code & Serial No.	Page	Rev.

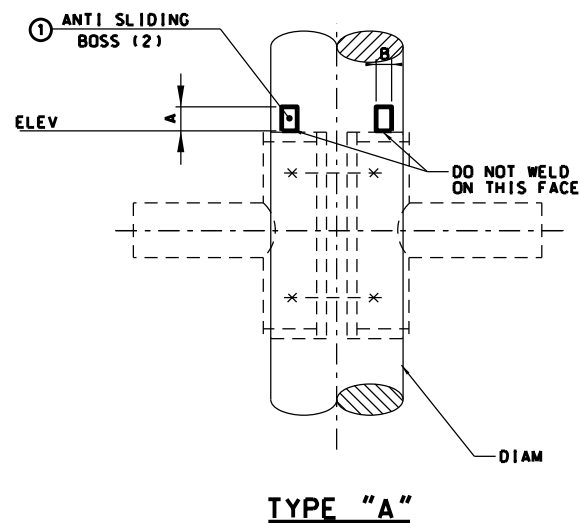
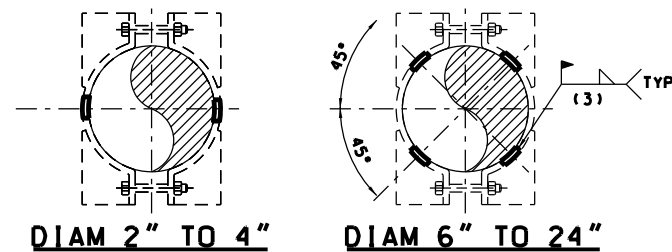
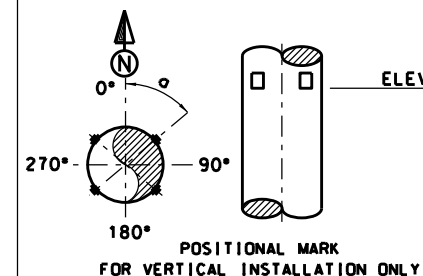
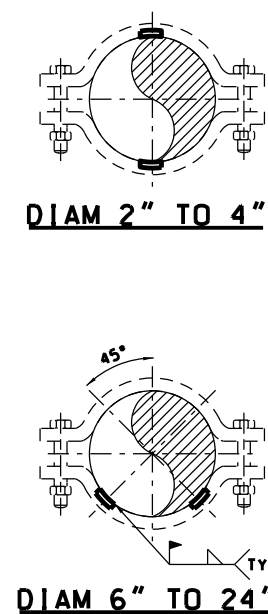
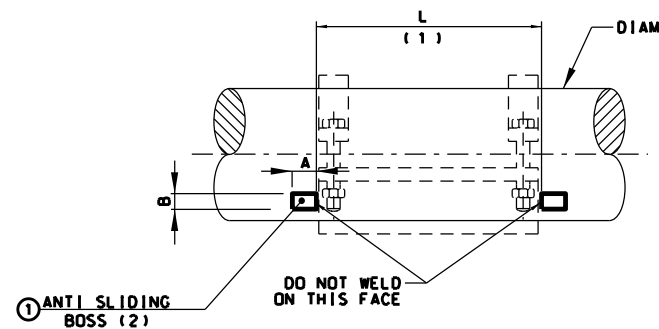


TABLE "1"		
DIAM	A	B
2" TO 6"	50	50
8" TO 14"	80	60
16" TO 20"	100	70
24"	120	80



NOTES:

1. DIMENSIONS L TO BE DEFINED IN FIELD ACCORDING TO CLAMP DIMENSIONS.
2. MATERIAL AND SCH. AS PER PIPING CLASSES WITH MAX. THK = 12.7mm EXCEPT SPECIAL REQUIREMENT
3. DIMENSION OF WELD SHALL BE 0.7 OF PIPE THICKNESS.

Support + Mark

Positional Mark

WE03	DIAM	TYPE	SCH	MATCL
------	------	------	-----	-------

ELEV	a
------	---

Technip

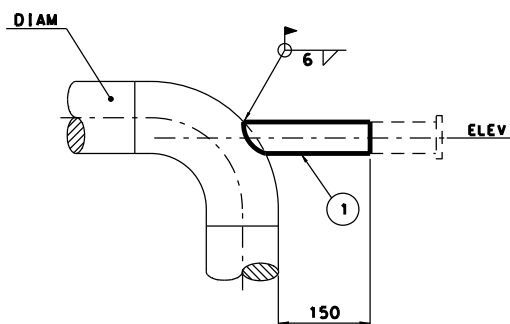
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FOR DIAM 2" TO 24"

WE 03

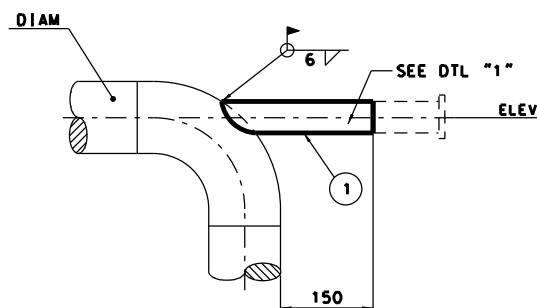
STANDARD CONSTRUCTION DRAWING PLANT DESIGN AND PIPING

G	XXXXXXXXXX	000	STC 1391-03	1 of 1	0
	Project	Unit	Doc. Code & Serial No.	Page	Rev.

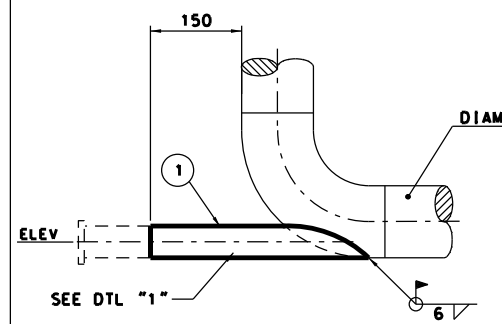
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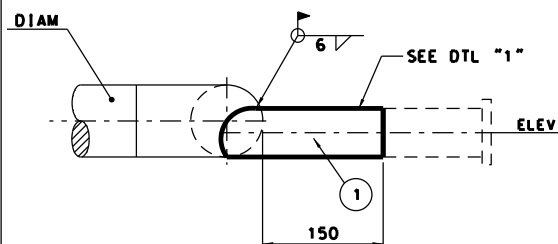
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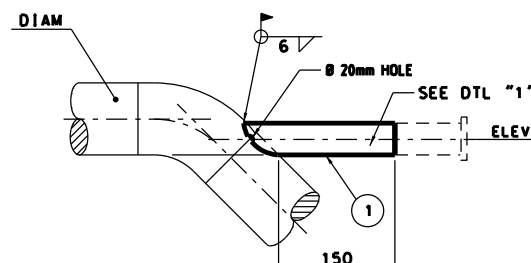
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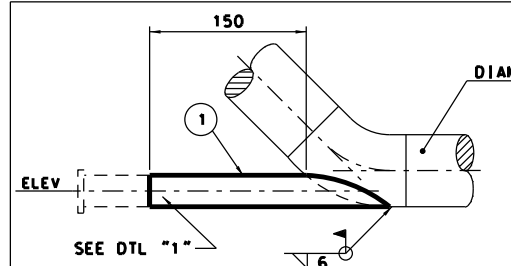
TYPE C
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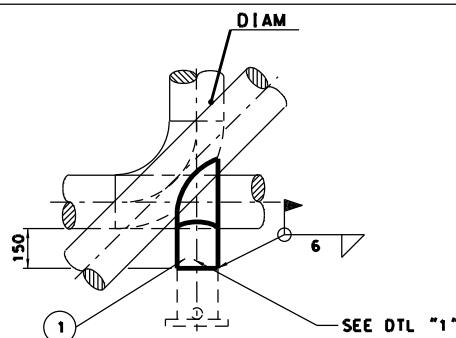
TYPE D
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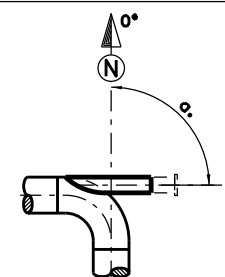
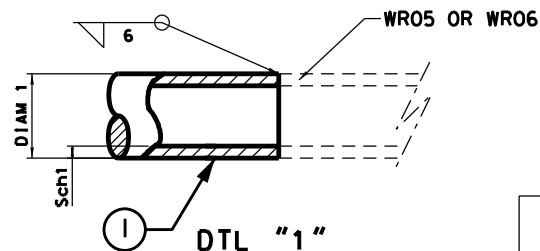
TYPE E
(2)



TYPE F
(2)



TYPE C
(1)



DUMMY ORIENTATION FOR HORIZONTAL INSTALLATION ONLY.

NOTES:

1. SUPPORT TO BE USED IN JUNCTION WITH SUPPORT WR05.
2. SUPPORT TO BE USED IN JUNCTION WITH SUPPORT WR06.
3. MATCH PER PIPING CLASSES EXCEPT SPECIFIC REQUIREMENT.
4. SPECIFY BY NOTE ON ISOMETRIC IN CASE OF WELDING BEFORE TREATMENT OR ANY OTHER REASONS.

Support + Mark

WE05	DIAM	DIAM1	TYPE	SCH	SCH1	MATCL
------	------	-------	------	-----	------	-------

Positional Mark

ELEV	a.
------	----

Technip

SPOOL PIECE FOR DUMMY LEG AND
TRUNNION ON BEND FOR DIAM 2" TO

WE 05

STANDARD CONSTRUCTION DRAWING PLANT DESIGN AND PIPING

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Project	Unit	Doc. Code & Serial No.	Page	Rev.

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<input type="radio"/>												
<input type="radio"/>												
<input checked="" type="radio"/>	SPOOL PIECE	1	PIPE DIAM (3)	/	/	/	/	/	/	/	/	
ITEM DESCRIPTION QTY.	DETAIL			CS	CH	CL	CG	AS	AH	SS	SH	MATCL (3)

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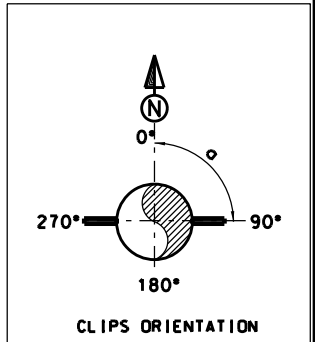
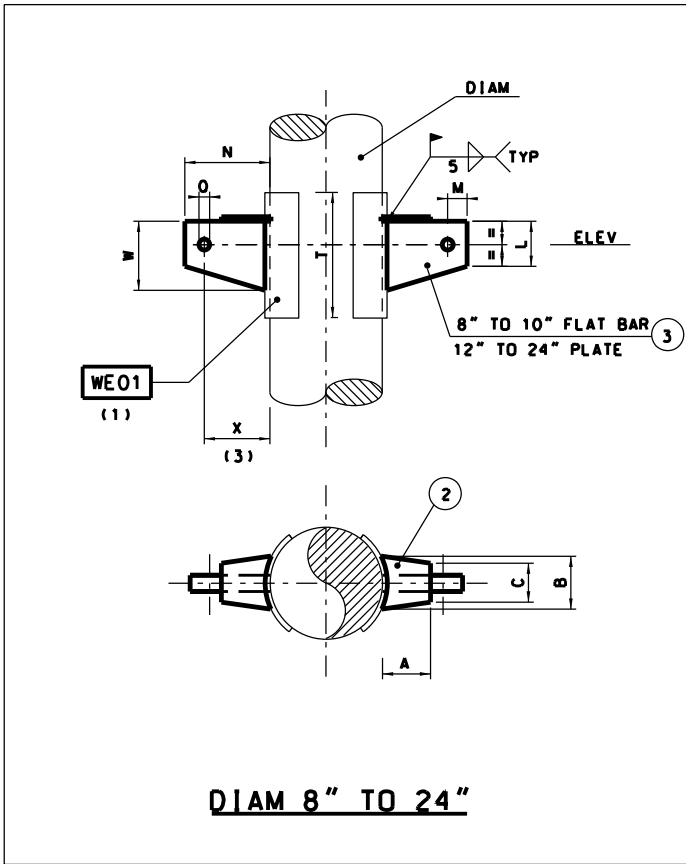
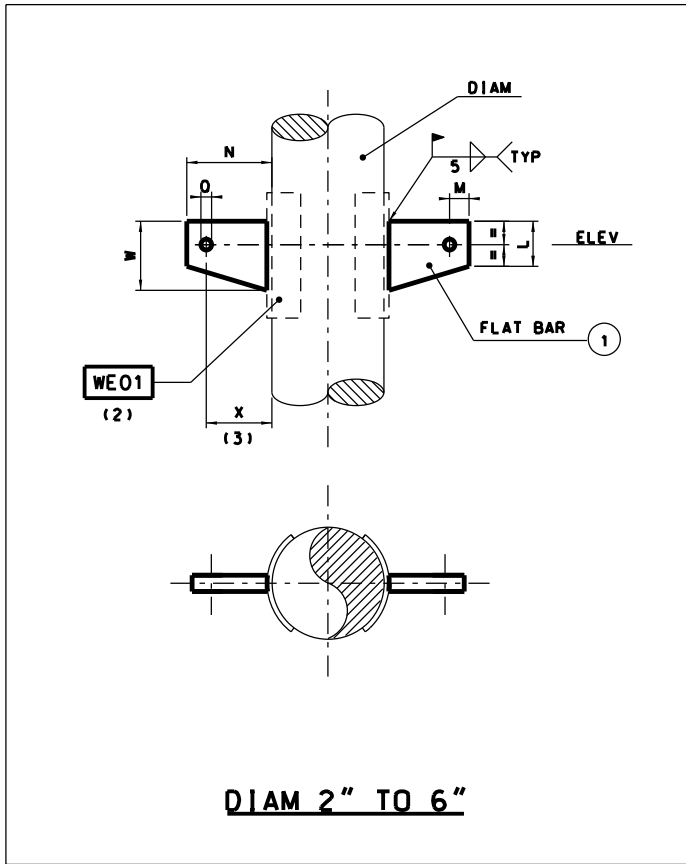


TABLE "1"									
DIAM	CLIP	L	M	O	T	W	A	B	C
2" TO 3"	FLAT BAR 200x10	60	25	14	/	200	/	/	/
4" TO 6"	FLAT BAR 200x10	60	30	18	/	200	/	/	/
8" TO 10"	FLAT BAR 200x10	60	35	22	300	200	175	175	80
12" TO 14"	PLATE THK 20	100	40	27	350	300	200	200	100
16" TO 18"	PLATE THK 20	100	50	33	350	300	200	200	100
20" TO 24"	PLATE THK 20	100	60	39	350	300	200	200	100

NOTES:

- FOR 8" TO 24" PROTECTION SHIELD SHALL BE USED.
- FOR 2" TO 6" PROTECTION SHIELD ONLY IF REQUIRED BY DESIGNER.
- X MAXIMUM = 400

Support Mark

WE06 DIAM X MATCL

Positional Mark

ELEV a

ITEM	DESCRIPTION	QTY.	DETAIL	CS	CH	CL	CG	AS	AH	SS	SH
③	CLIP	2	FLAT BAR OR PLATE	A36	A387-11	A516-60	/	A36	A387-11	A36	A240-304
②	GUSSET	2	PLATE-THK.10	A36	A387-11	A516-60	/	A36	A387-11	A36	A240-304
①	CLIP	2	FLAT BAR	A36	A387-11	A516-60	/	A387-11	A387-11	A240-304	A240-304

MATCL

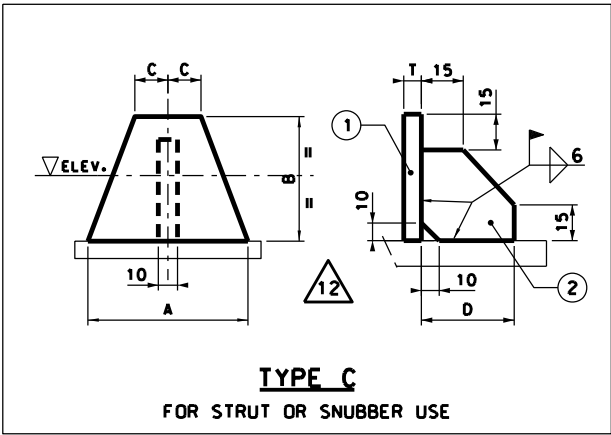
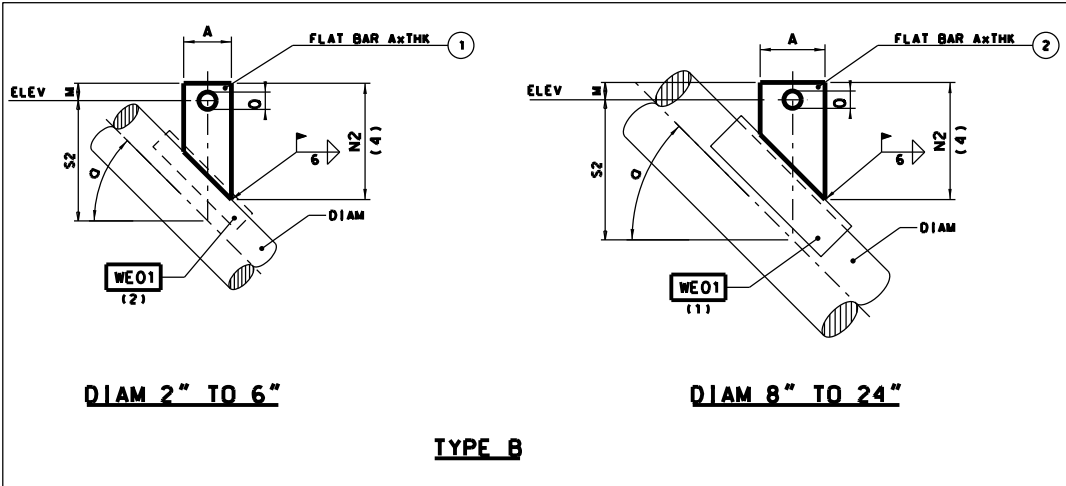
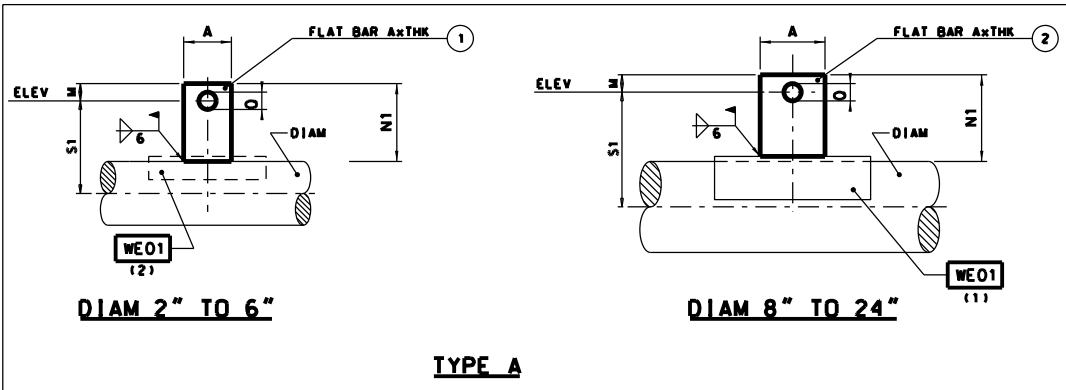
Technip

DOUBLE CLIPS ON VERTICAL PIPE
FOR DIAM 2" TO 24"

WE06

STANDARD CONSTRUCTION DRAWING
PLANT DESIGN AND PIPING

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ITEM	DESCRIPTION	QTY.	DETAIL	CS	CH	CL	CG	AS	AH	SS	SH
②	CLIP	1	FLAT BAR A x THK	A36	A387-11	A516-60	/	A36	A387-11	A36	A240-304
①	CLIP	1	FLAT BAR A x THK	A36	A387-11	A516-60	/	A387-11	A387-11	A240-304	A240-304

MATCL

GUSSETS DIMENSIONS					
DIAM	A	B	C	D	T
2"	70	80	30	30	10
3"	70	100	30	30	10
4"	90	100	30	60	10
6"	120	120	35	60	10
8"	160	120	35	100	10
10"	160	120	35	100	10
12"	210	140	40	110	15
14"	260	160	40	130	15
16"	260	160	40	130	15
18"	260	160	60	160	15
20"	300	160	60	180	15
22"	300	160	60	180	15
24"	300	160	60	180	15

TBL "1"								
DIAM	M	N1	N2 (4)	O	S1	S2	A x THK	MAX. LOADS [KN]
2"	30	120	220	18	120	202	60x10	10.00
3"	30	120	220	18	135	224	60x10	
4"	30	120	220	18	147	241	60x10	
6"	35	140	246	22	189	294	60x10	15.00
8"	35	140	246	22	215	331	100x10	
10"	35	140	246	22	242	369	100x10	
12"	40	160	260	27	282	399	100x15	25.00
14"	40	160	260	27	298	422	100x15	
16"	40	160	260	27	323	457	100x15	
18"	50	180	280	33	359	504	100x20	40.00
20"	50	180	280	33	382	539	100x20	
22"	60	200	300	39	420	585	100x20	
24"	60	200	300	39	445	621	100x20	60.00

NOTES:

1. FOR 8" TO 24" PROTECTION SHIELD SHALL BE USED
2. FOR 2" TO 6" PROTECTION SHIELD ONLY IF REQUIRED BY SUPPORT DESIGNER.
3. DELETED
4. DIM "N2" GIVEN ONLY FOR LINE WITH $\alpha = 45^\circ$

Support Mark

WE07 DIAM TYPE MATCL

Positional Mark

ELEV

Technip

CLIP ON HORIZONTAL PIPE
FOR DIAM 2" TO 24"

WE07

STANDARD CONSTRUCTION DRAWING
PLANT DESIGN AND PIPING

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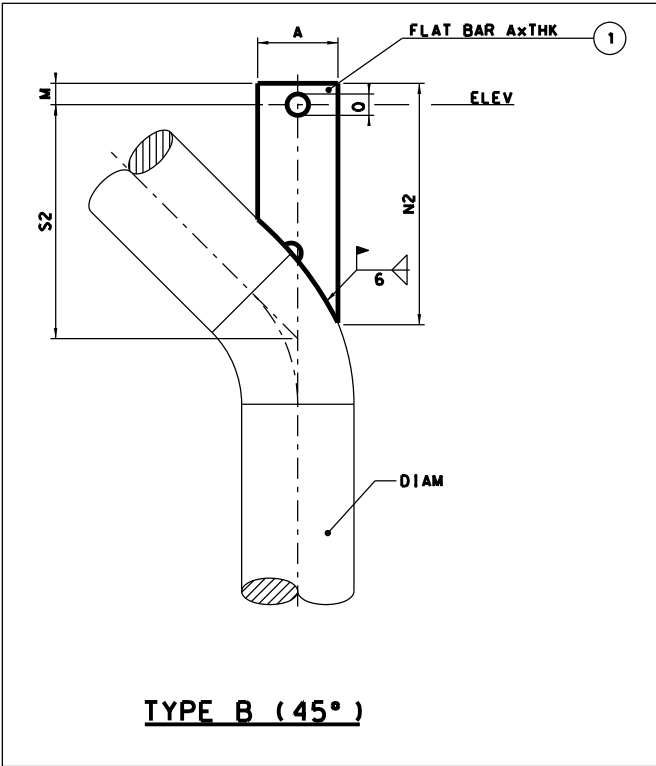
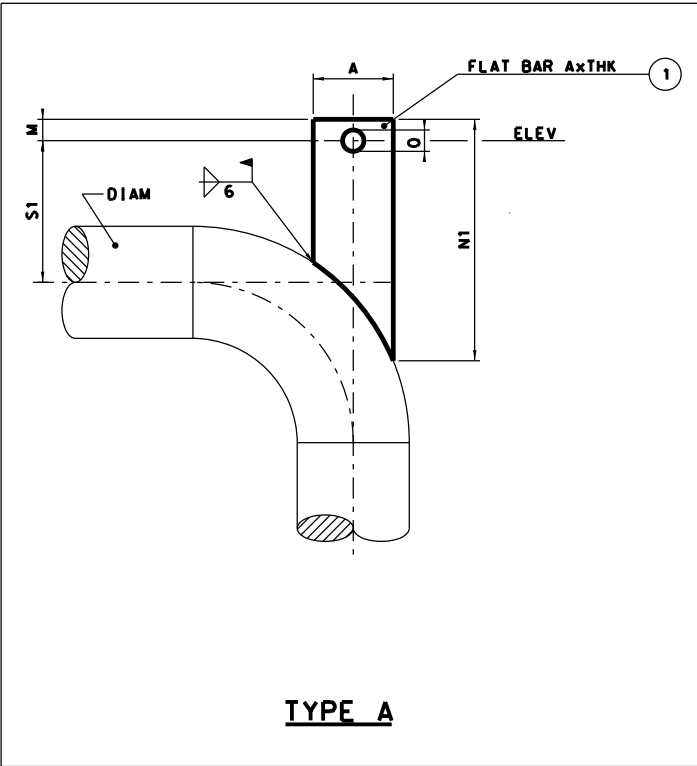


TABLE "1"									
DIAM	M	N1	N2	O	S1	S2	A	THK	MAX. LOADS (KN)
2"	30	121	120	18	60	100	40	10	10.00
3"	30	183	175	18	100	150	70	10	
4"	30	278	240	18	150	200	100	10	
6"	35	272	273	22	150	285	100	10	15.00
8"	35	240	257	22	150	310	100	10	
10"	35	291	299	22	120	350	150	10	
12"	40	301	298	27	120	385	150	15	
14"	40	370	354	27	120	415	200	15	25.00
16"	40	354	348	27	100	450	200	15	
18"	50	368	358	33	100	490	200	20	
20"	50	514	520	33	150	600	300	20	40.00
22"	60	526	530	39	150	650	300	20	
24"	60	529	546	39	150	700	300	20	60.00

○																			
○																			
○																			
①	CLIP	1	FLAT BAR A x THK	A36	A387-11	A516-60	/	A387-11	A387-11	A240-304	A240-304								
ITEM	DESCRIPTION	QTY.	DETAIL	CS	CH	CL	CG	AS	AH	SS	SH								
MATCL																			

NOTES:

Support Mark
WE08 | DIAM | TYPE | MATCL

Positional Mark
ELEV

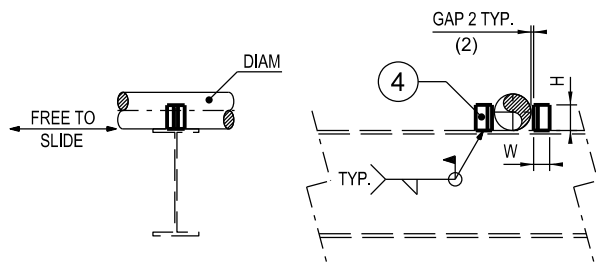
Technip

CLIP ON ELBOWS
FOR DIAM 2" TO 24"

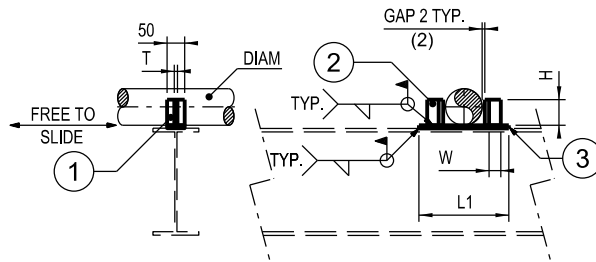
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STANDARD CONSTRUCTION DRAWING
PLANT DESIGN AND PIPING

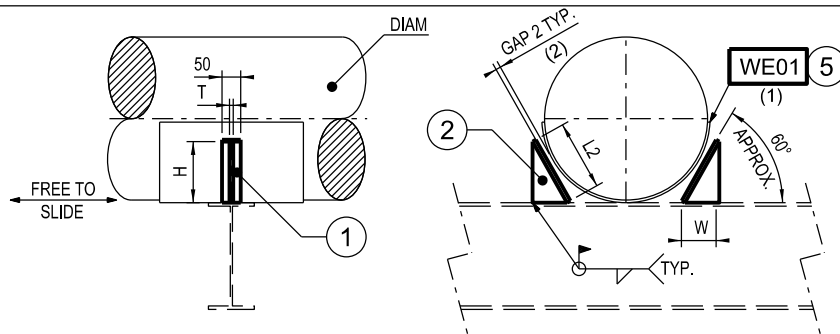
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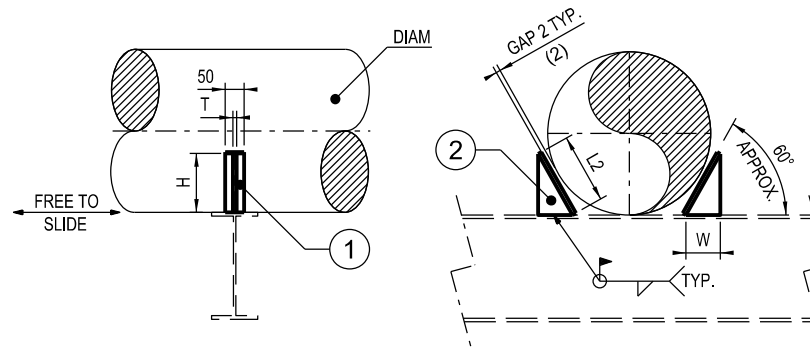
TYPE A
DIAM ND 40 TO 100 - DIAM 1 1/2" TO 4"



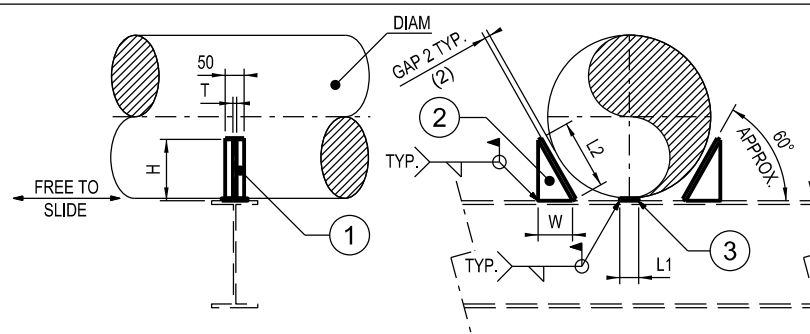
TYPE B
DIAM ND 40 TO 100 - DIAM 1 1/2" TO 4"



TYPE C
DIAM ND 350 TO 600 - DIAM 14" TO 24"



TYPE A
DIAM ND 150 TO 300 - DIAM 6" TO 12"



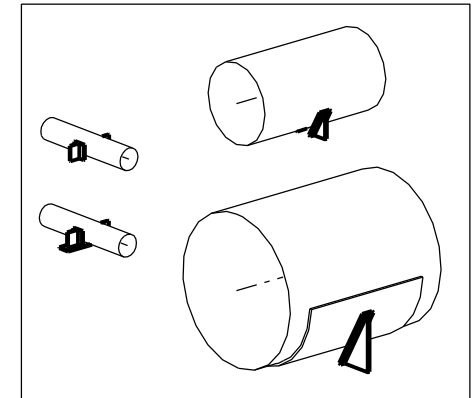
TYPE B
DIAM ND 150 TO 300 - DIAM 6" TO 12"

DIAM	Max.Load (kN)
2"	1
4"	8
6"	15
8"	30
10"	40
12"	50
14"	60
16"	70
18"	80
20"	125
24"	130

NOTES:
1. FOR DIAM ND 350 TO 600 - DIAM 14" TO 24" PROTECTION SHIELD SHALL BE USED.
2. MAXI GAP TO VERIFY AT INSTALLATION.
3. FOR SS WITH WE01, TYPE A SHALL BE USED

TABLE 2	
MATCL	TYPE
CS-CL	A-C
AS	A-C
CG	B
SS(3)	B-C

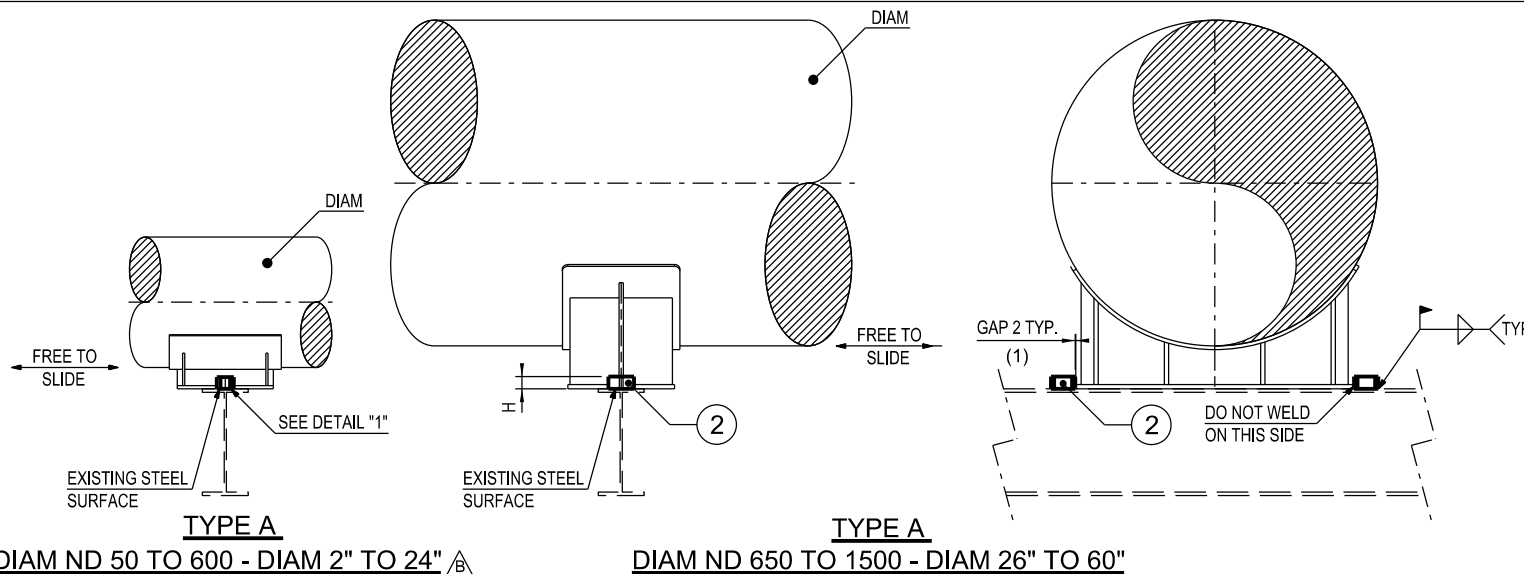
TABLE 1						
DIAM ND	Inch	H	L1	L2	T	W
40	1 1/2"	40	200	/	5	50
50	2"	40	200	/	5	50
80	3"	60	240	/	5	50
100	4"	80	260	/	5	50
150	6"	90	60	100	5	50
200	8"	90	60	100	5	50
250	10"	105	60	120	10	60
300	12"	105	60	120	10	60
350	14"	140	60	160	10	80
400	16"	140	60	160	10	80
450	18"	175	60	200	10	100
500	20"	190	60	220	10	110
550	22"	210	60	240	10	120
600	24"	230	60	260	10	130



ITEM	DESCRIPTION	QTY.	DETAIL	CS	CH	CL	CG	AS	SH
5	PROTECTION SHIELD	1	REFER TO WE01	/	/	/	/	/	/
4	SHAPE	2	HALF MB 100	A36	/	A36	/	A36	/
3	WEDGE	1	FLAT BAR 50 x 5	A36	/	A36	A36 (G)	A36	A240-304
2	STIFFENER	2	FLAT BAR W x T	A36	/	A36	A36 (G)	A36	A240-304
1	GUIDE PLATE	2	FLAT BAR 50 x T	A36	/	A36	A36 (G)	A36	A240-304

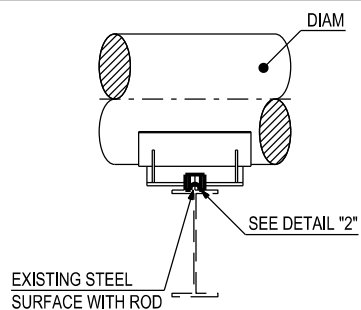
Support Mark			
WG01	DIAM	TYPE	MATCL

Technip		GUIDE ON UNINSULATED PIPE FOR DIAM 1 1/2" TO 24"			WG01	
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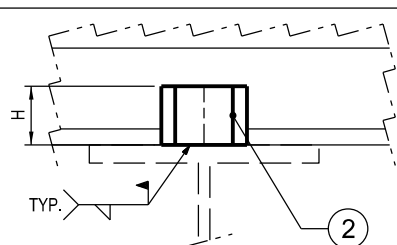


TYPE A
DIAM ND 50 TO 600 - DIAM 2" TO 24" ⚠

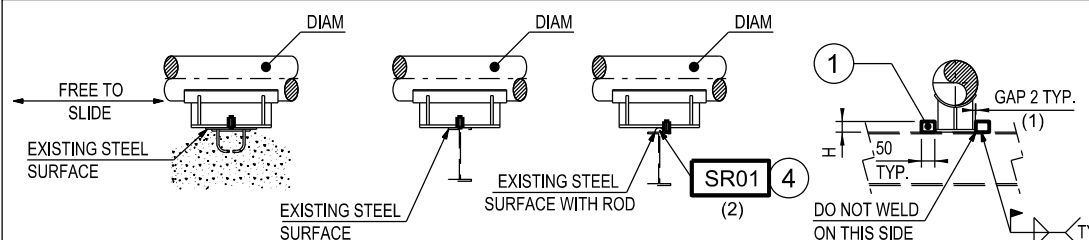
TYPE A
DIAM ND 650 TO 1500 - DIAM 26" TO 60"



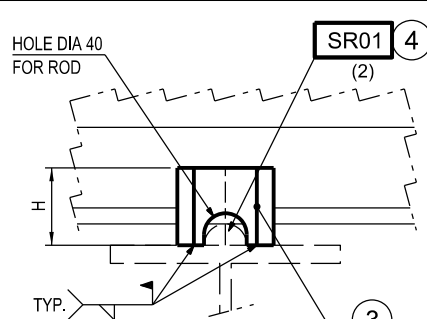
TYPE B
DIAM ND 200 TO 600
DIAM 8" TO 24"



DETAIL 1



TYPE C
DIAM ND 40 TO 150 - DIAM 1 1/2" TO 6"



DETAIL 2

- NOTES:
- 1. MAXI GAP TO VERIFY AT INSTALLATION.
 - 2. REFERENCE TO OTHER SUPPORT. IT WILL BE INDICATED ON ISOMETRIC.
 - 3. FOR TYPE A AND C H MIN = 40
 - 4. FOR TYPE B H MIN = 60

Support Mark

WG02 DIAM TYPE SIZE H

④	ROD	1	REFER TO SR01	/	/	/	/	/	/	/	/	
③	GUIDE	2	SHAPE CHANNEL SEE TABLE	A36	A36	A36	A36	A36	A36	A36	A36	
②	GUIDE	2	SHAPE SEE TABLE	A36	A36	A36	A36	A36	A36	A36	A36	
①	GUIDE	2	FLAT BAR 50 x 10	A36	A36	A36	A36	A36	A36	A36	A36	
ITEM	DESCRIPTION	QTY.	DETAIL	CS	CH	CL	CG	AS	AH	SS	SH	SL

MATCL

STANDARD CONSTRUCTION DRAWING
PLANT DESIGN AND PIPING

Technip

GUIDE ON PIPE SHOES
FOR DIAM 1 1/2" TO 60"

WG02

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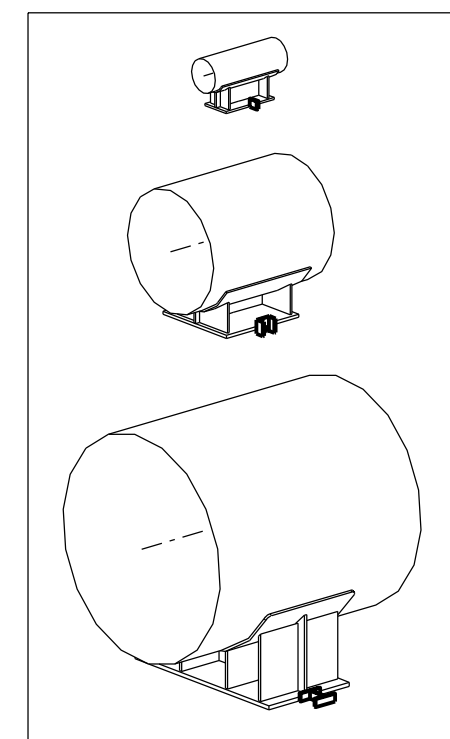
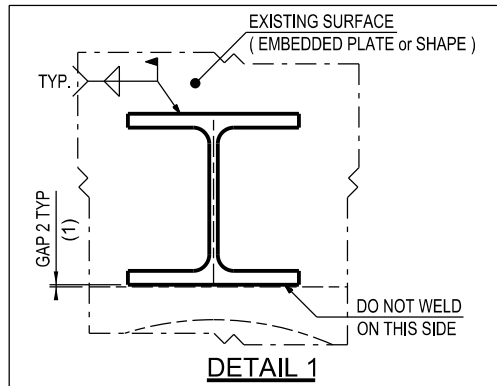
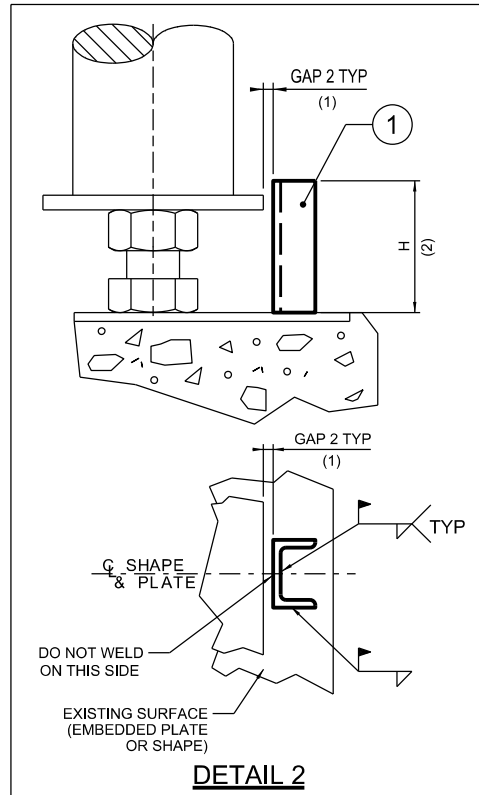
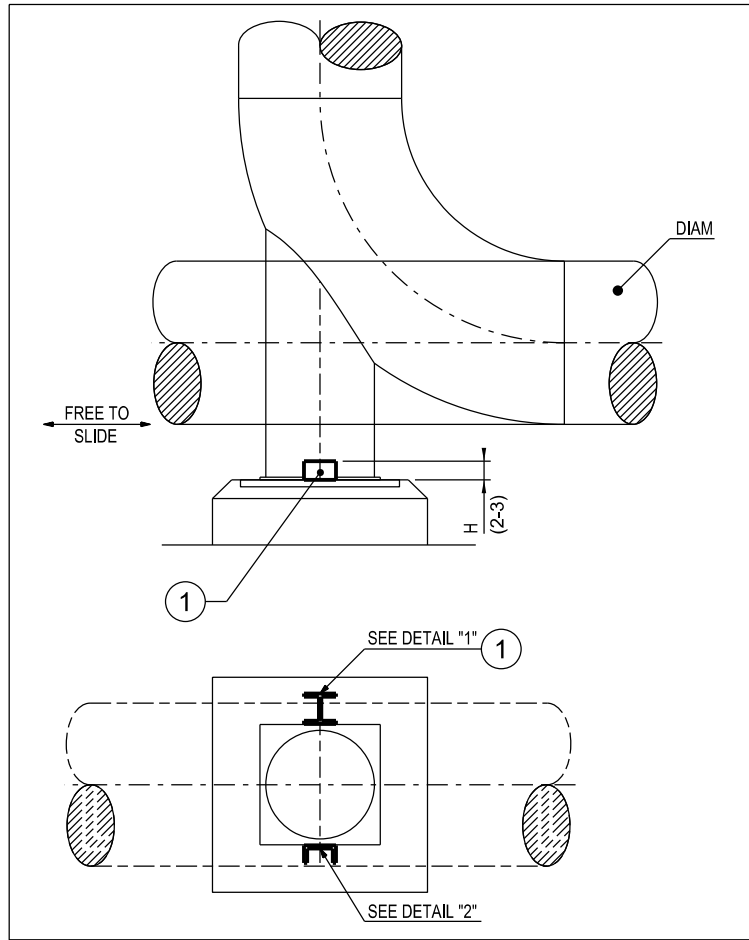


TABLE		
SIZE	SHAPE	load (KN)
1	Flat Bar	1
2	HALF MB100	30
3	MC 100	70
4	MB150	100
5	MB 200	130

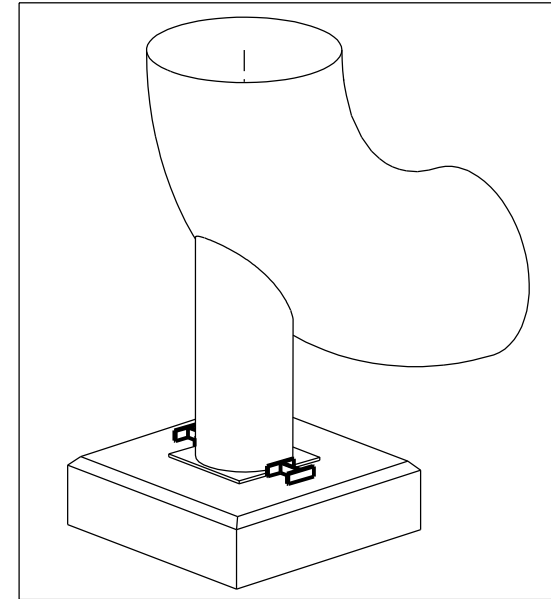


NOTES:
1. MAXI GAP TO VERIFY AT INSTALLATION.
2. H = 50 FOR FIXED STANCHION. TO BE SPECIFIED FOR ADJUSTABLE STANCHIONS.
3. H = 250 MAXI.

Support Mark

WG03 SIZE H

TABLE		
SIZE	SHAPE	load (KN)
1	HALF MB100	30
2	MC 100	70
3	MC150	100
4	MB 200	130



ITEM	DESCRIPTION	QTY.	DETAIL	CS	CH	CL	CG	AS	AH	SS	SH	SL
1	GUIDE	2	SHAPE SEE TABLE	A36	A36	A36	A36	A36	A36	A36	A36	A36
				MATCL								

Technip		GUIDE ON VERTICAL STANCHION FOR DIAM 2" TO 60"			WG03	
STANDARD CONSTRUCTION DRAWING PLANT DESIGN AND PIPING		XXXXXX	000	STC - 1391 - 11	1 of 1	1
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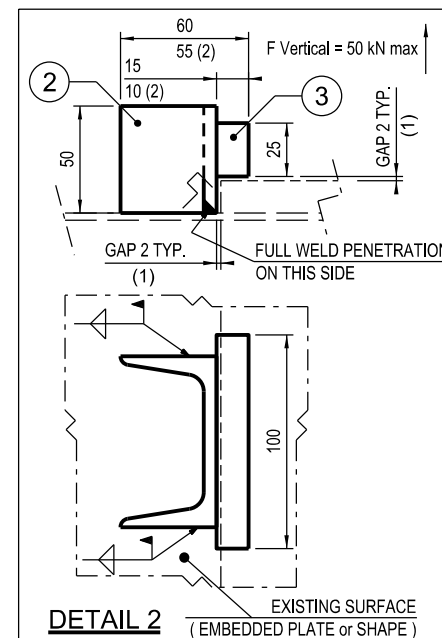
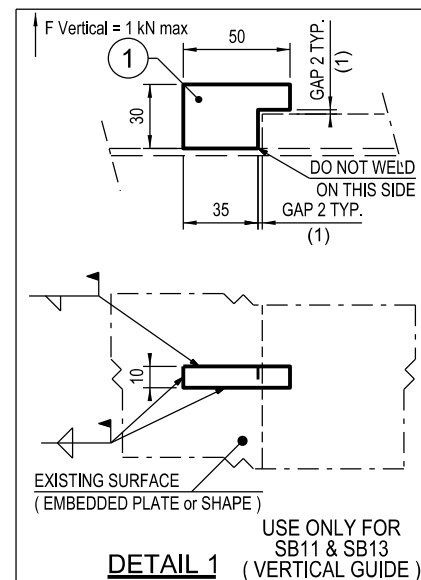
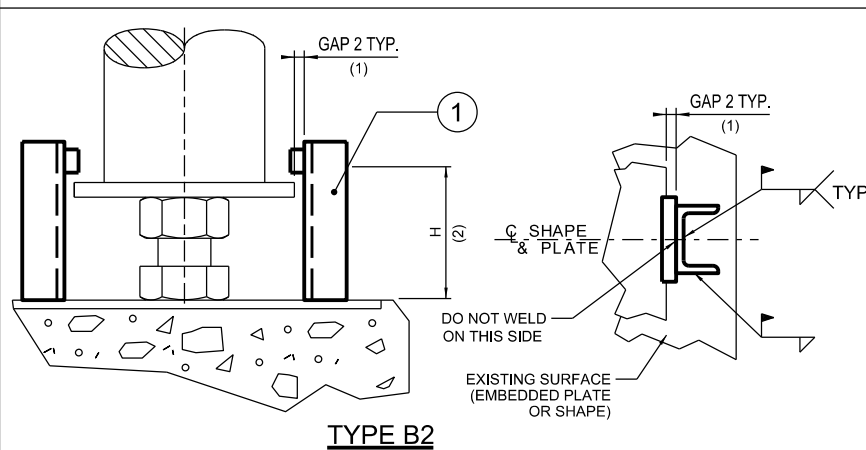
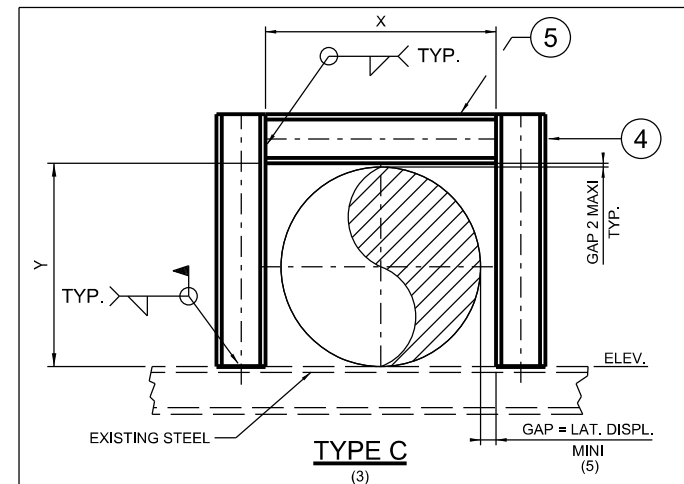
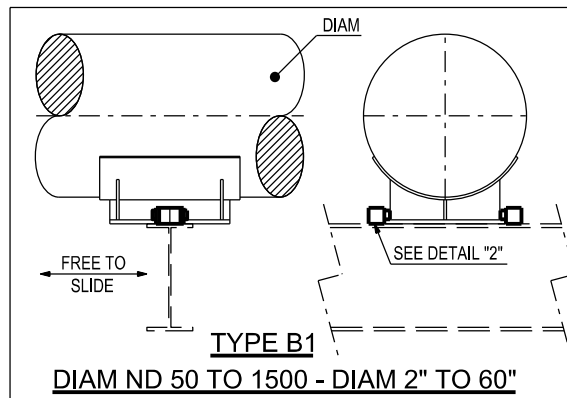
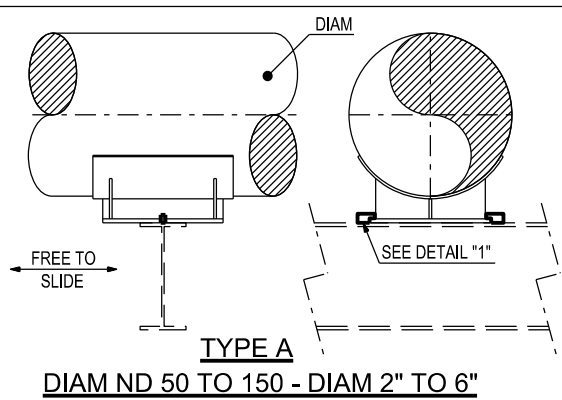
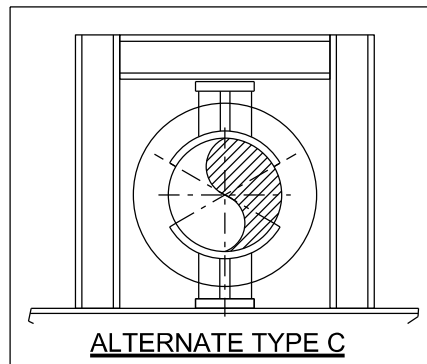
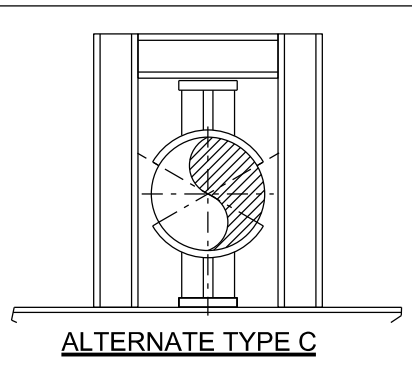
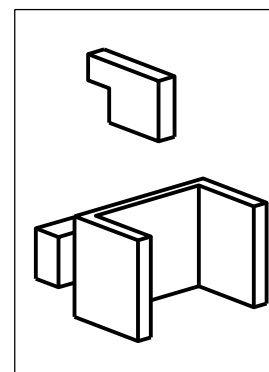


TABLE		
SIZE	SHAPE	load (KN)
1	Flat Bar	1
2	HALF MB100	30
3	MC 100	70
4	MB150	100
5	MB 200	130



NOTES:

1. MAXI GAP TO VERIFY AT INSTALLATION.
2. DIMENSION ONLY REQUIRED FOR TYPE B2.
3. FOR SHAPE SELECTION, REFER TO SB06.
4. DIMENSIONS TO SPECIFY ONLY FOR TYPE C.
5. LATERAL GAP TO SPECIFY ON ISOMETRIC.

5	HOLD DOWN	1	SHAPE (NOTE 3)	A36	A36	A36	A36	A36	A36	A36	A36	A36	
4	GUIDE	2	SHAPE (NOTE 3)	A36	A36	A36	A36	A36	A36	A36	A36	A36	
3	HOLD DOWN	2	PLATE	A36	A36	A36	A36	A36	A36	A36	A36	A36	
2	GUIDE	2	SHAPE SEE TABLE	A36	A36	A36	A36	A36	A36	A36	A36	A36	
1	GUIDE	2	10 mm THK PLATE SEE DETAIL 1	A36	A36	A36	A36	A36	A36	A36	A36	A36	
ITEM	DESCRIPTION	QTY.	DETAIL	CS	CH	CL	CG	AS	AH	SS	SH	SL	
				MATCL									

Support Mark					(2)	(4)	(4)
WG04	DIAM	TYPE	SIZE	H	X	Y	

Technip

**HOLD DOWN GUIDE
FOR DIAM 2" TO 60"**

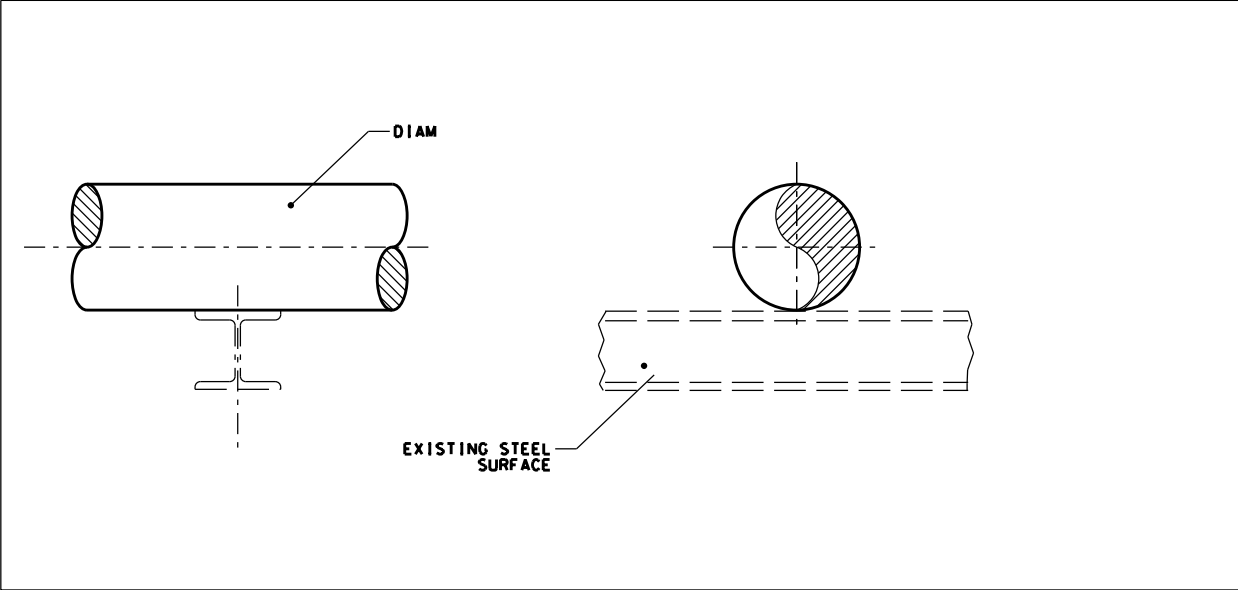
WGO4

STANDARD CONSTRUCTION DRAWING
PLANT DESIGN AND PIPING

XXXXXX
Print

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Unit	Doc. Code & Serial No.

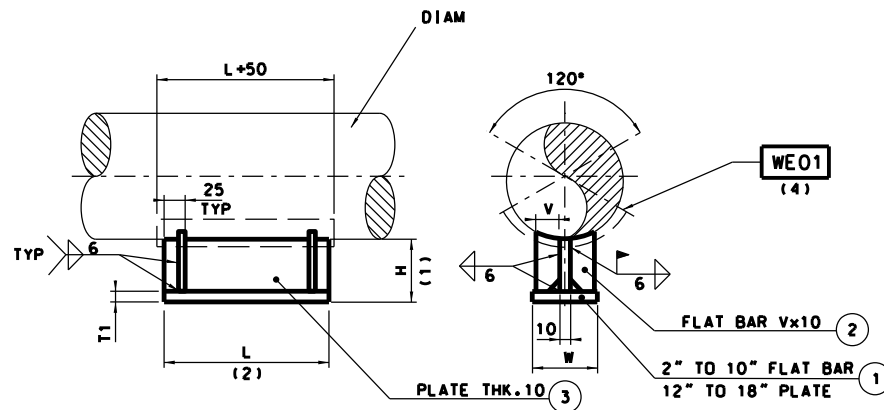
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ONLY REST ON EXISTING BEAM OR PLATE

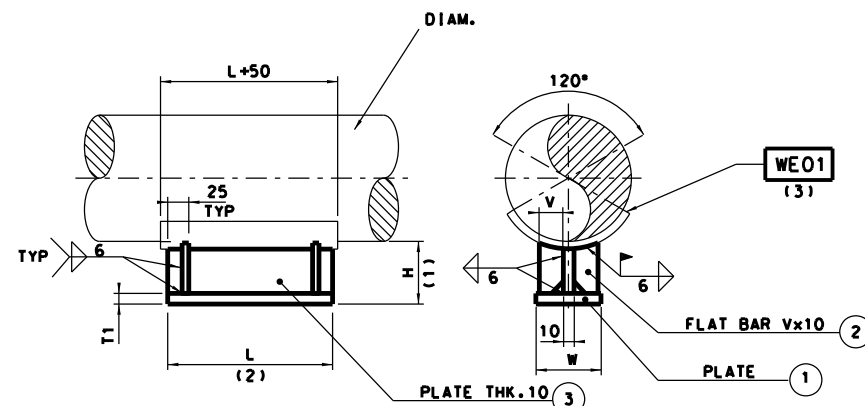
NOTES:
1. THIS STANDARD IS TO INDICATE CONTACT SUPPORT POINT ON ISOMETRIC.

Support Mark				
WROO				
STANDARD CONSTRUCTION DRAWING PLANT DESIGN AND PIPING	ONLY REST ON EXISTING BEAM OR PLATE FOR DIAM. 2" to 18"			WROO
	XXXXXXXXXX	000	STC1391-32	1 of 1
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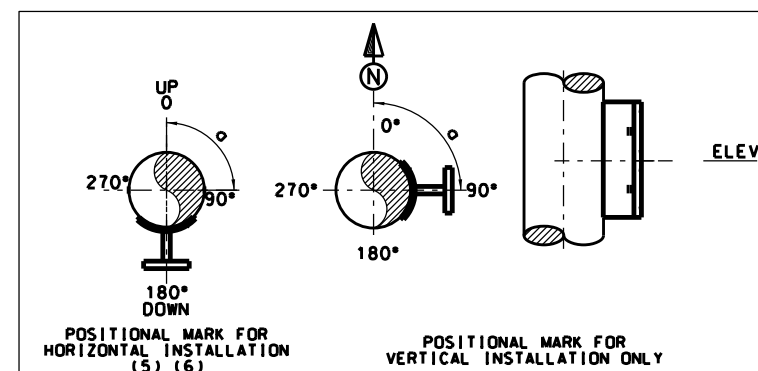
NOTE: ITEM (2) WILL NOT BE USED FOR 2" - 3"

TYPE A - DIAM 2" TO 18"



TYPE B - DIAM 20" TO 24"

TABLE "1"				
DIAM	T1	W	V	
2"	10	100	-	
3"	10	100	-	
4"	10	100	40	
6"	10	150	60	
8" TO 10"	10	200	80	
12" TO 14"	10	250	100	
16" TO 18"	15	350	150	
20" TO 24"	15	450	200	



* GENERAL NOTE
SUPPORT MATCL: AS - SS
FOR LINES CLASSIFIED AS "AS - SS" WHEN THE STANDARD SUPPORT WR01 IS WELDED ON
THE PROTECTION SHIELD WE01 ALL COMPONENTS OF THE WR01 SHALL BE ON CARBON STEEL A36

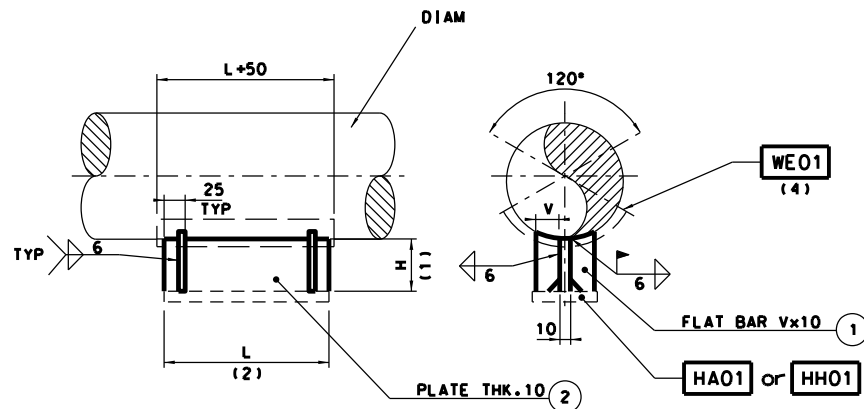
NOTES:

1. H MAX = 300. H DIMENSION SHALL BE ADJUSTED AT ERECTION BEFORE WELDING.
2. L = 300 TO 900, WITH STEP 100.
3. FOR 20" TO 24" PROTECTION SHIELD SHALL BE USED.
4. FOR 2" TO 18" PROTECTION SHIELD ONLY IF REQUIRED BY DESIGNER, WILL BE INDICATED ON ISOMETRIC.
5. LOOKING TO FLOW FLUID DIRECTION.
6. TO BE INDICATED ONLY IF DIFFERENT OF 180°.

ITEM	DESCRIPTION	QTY.	DETAIL	CS	CH	CL	CG	AS *	AH	SS *	SH
(3)	STANCHION	1	PLATE THK. 10	A36	A387-11	A516-60	/	A387-11	A387-11	A240-304	A240-304
(2)	RIB	4	FLAT BAR Vx10	A36	A387-11	A516-60	/	A387-11	A387-11	A240-304	A240-304
(1)	BASE PLATE	1	FLAT BAR OR PLATE	A36	A36	A36	/	A36	A36	A36	A36

Support Mark						Positional Mark	
WR01	DIAM	TYPE	H	L	MATCL	ELEV	α
Technip						VARIABLE HEIGHT SHOES FOR DIAM 2" TO 24"	
STANDARD CONSTRUCTION DRAWING PLANT DESIGN AND PIPING						XXXXXXX	000
						Project	Unit
						Doc. Code & Serial No.	Page
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WR01



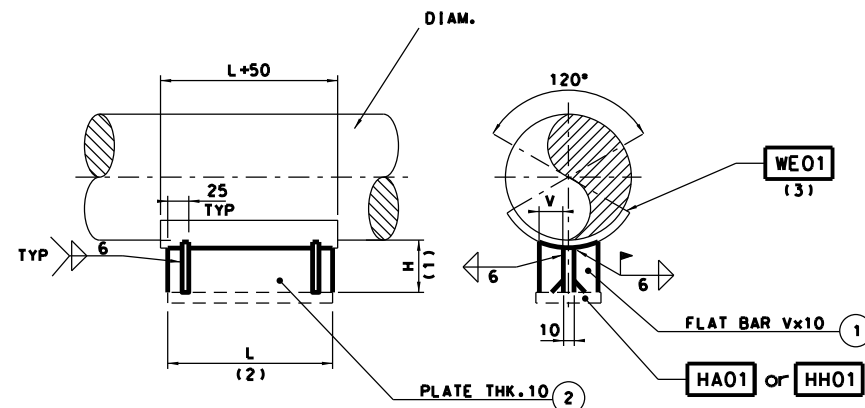
NOTE: ITEM (2) WILL NOT BE USED FOR 2" & 3"

TYPE C - DIAM 2" TO 18"
TO BE USE WITH "HA01" or "HH01"

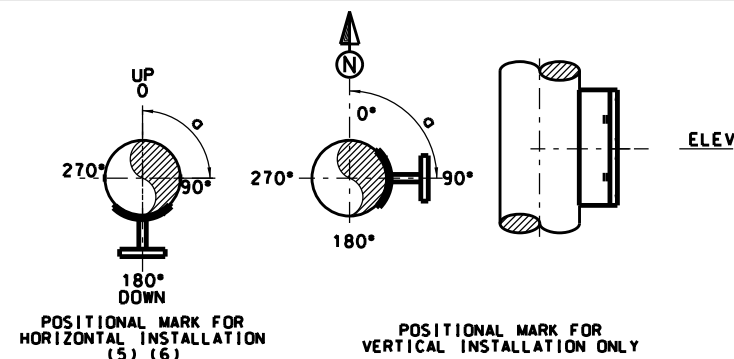
TABLE "1"

DIAM	V
2"	-
3"	-
4"	40
6"	60
8" TO 10"	80
12" TO 14"	100
16" TO 18"	150
20" TO 24"	200

* GENERAL NOTE
SUPPORT MATCL: AS - SS
FOR LINES CLASSIFIED AS "AS - SS" WHEN THE STANDARD SUPPORT WRO1 IS WELDED ON THE PROTECTION SHIELD WE01 ALL COMPONENTS OF THE WRO1 SHALL BE ON CARBON STEEL A36



TYPE D - DIAM 20" TO 24"
TO BE USE WITH "HA01" or "HH01"



- NOTES:
1. H MAX = 300. H DIMENSION SHALL BE ADJUSTED AT ERECTION BEFORE WELDING.
 2. L = 300 TO 900. WITH STEP 100.
 3. FOR 20" TO 24" PROTECTION SHIELD SHALL BE USED.
 4. FOR 2" TO 18" PROTECTION SHIELD ONLY IF REQUIRED BY DESIGNER. WILL BE INDICATED ON ISOMETRIC.
 5. LOOKING TO NORTH OR EAST DIRECTION.
 6. TO BE INDICATED ONLY IF DIFFERENT OF 180°.
 7. DELETED.

Support Mark

Positional Mark

WRO1 DIAM TYPE H L MATCL

ELEV a

Technip

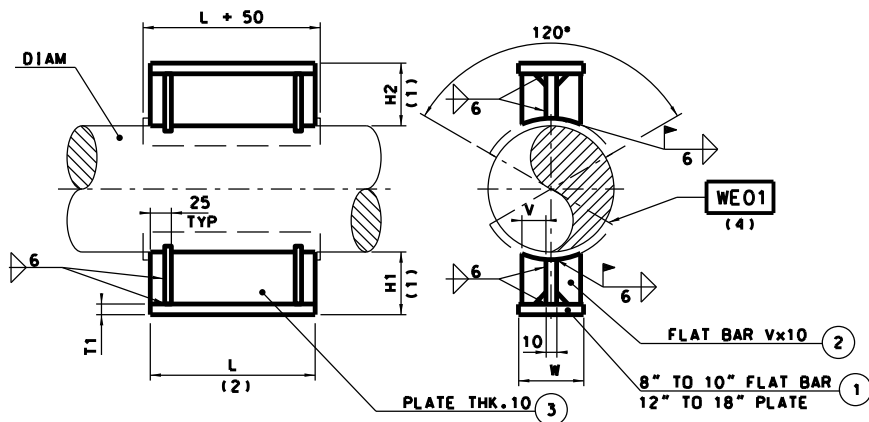
VARIABLE HEIGHT SHOES
FOR DIAM 2" TO 24"

WRO1

STANDARD CONSTRUCTION DRAWING
PLANT DESIGN AND PIPING

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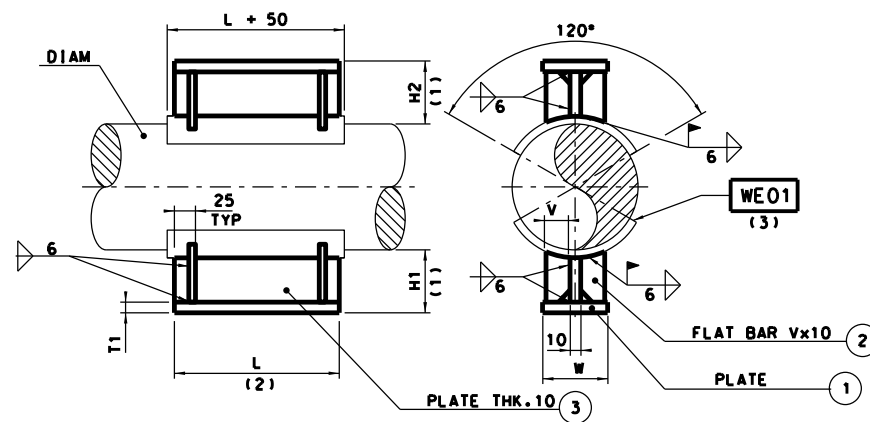
ITEM	DESCRIPTION	QTY.	DETAIL	CS	CH	CL	CG	AS *	AH	SS *	SH
(2)	STANCHION	1	PLATE THK. 10	A36	A387-11	A516-60	/	A387-11	A387-11	A240-304	A240-304
(1)	RIB	4	FLAT BAR Vx10	A36	A387-11	A516-60	/	A387-11	A387-11	A240-304	A240-304



H MAX. = 200 FOR 2" TO 6"
H MAX. = 300 FOR 8" TO 18"

NOTE: ITEM (2) WILL NOT BE USED FOR 2" AND 3"

DIAM 2" TO 18"

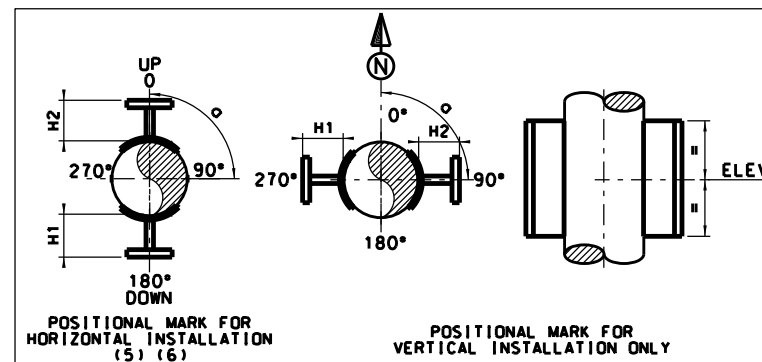


H MAX. = 300

DIAM 20" TO 24"

TABLE "1"				
DIAM	T1	W	V	
2"	10	100	-	
3"	10	100	-	
4"	10	100	40	
6"	10	150	60	
8" TO 10"	10	200	80	
12" TO 14"	10	250	100	
16" TO 18"	15	350	150	
20" TO 24"	15	450	200	

* GENERAL NOTE
SUPPORT MATCH: AS - SS
FOR LINES CLASSIFIED AS "AS - SS" WHEN THE STANDARD SUPPORT WR03 IS WELDED ON
THE PROTECTION SHIELD WE01 ALL COMPONENTS OF THE WR03 SHALL BE ON CARBON STEEL A36



- NOTES:
- H1 AND H2 DIMENSION SHALL BE ADJUSTED AT ERECTION BEFORE WELDING.
 - L = 300 TO 900. WITH STEP 100.
 - FOR 20" TO 24" PROTECTION SHIELD SHALL BE USED.
 - FOR 2" TO 18" PROTECTION SHIELD ONLY IF REQUIRED BY DESIGNER.
WILL BE INDICATED ON ISOMETRIC.
 - LOOKING TO FLOW FLUID DIRECTION.
 - TO BE INDICATED ONLY IF DIFFERENT OF 180 .

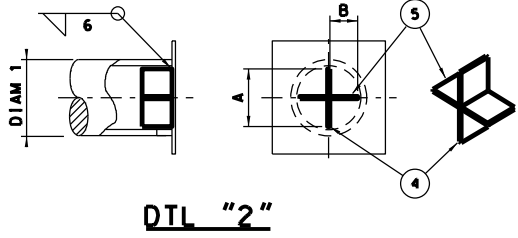
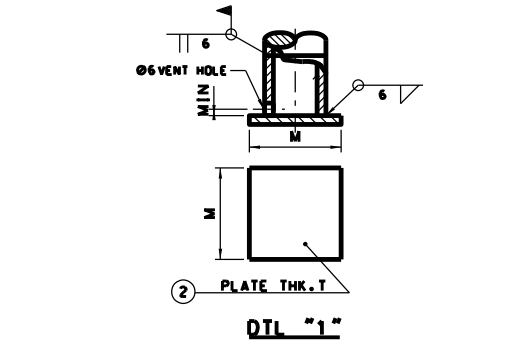
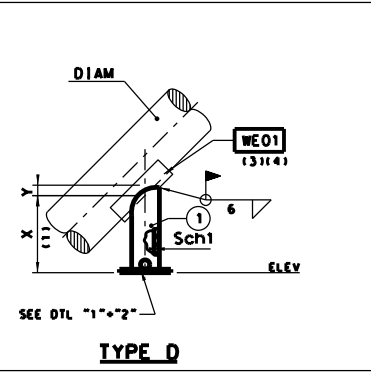
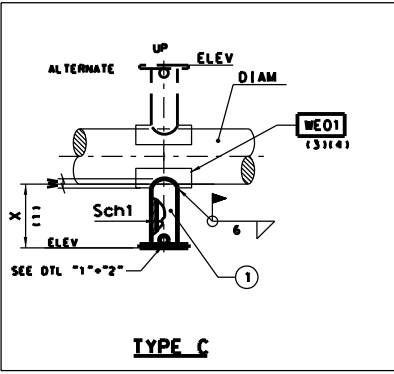
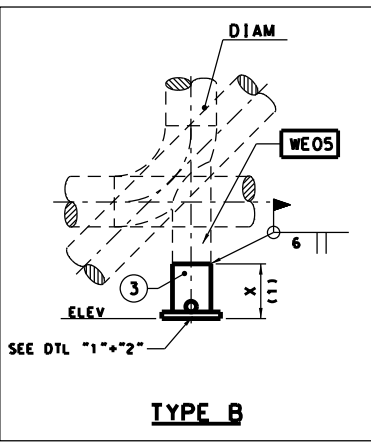
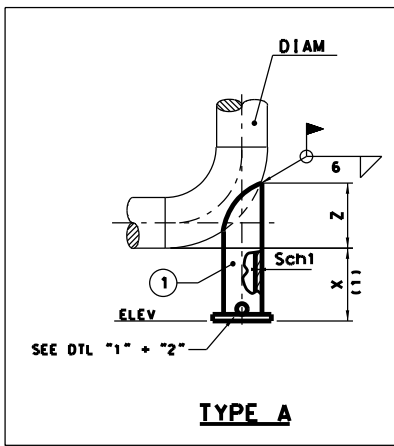
Support Mark	Positional Mark
WR03 DIAM H1 H2 L MATCL	ELEV a

ITEM	DESCRIPTION	QTY.	DETAIL	CS	CH	CL	CG	AS *	AH	SS *	SH	NI	NL
③	STANCHION	2	PLATE THK. 10	A36	A387-11	A516-60	/	A387-11	A387-11	A240-304	A240-304		
②	RIB	8	FLAT BAR Vx10	A36	A387-11	A516-60	/	A387-11	A387-11	A240-304	A240-304		
①	BASE PLATE	2	FLAT BAR OR PLATE	A36	A36	A36	/	A36	A36	A36	A36		
				CS	CH	CL	CG	AS *	AH	SS *	SH	NI	NL
				MATCL									

Technip		DOUBLE VARIABLE HEIGHT SHOES FOR DIAM 2" TO 24"		WR03
STANDARD CONSTRUCTION DRAWING PLANT DESIGN AND PIPING		XXXXXXXXXXXX 000		1 of 1
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TABLE "1"								
DIAM	DIAM ₁	A	B	W (6)	Y (6)	Z (6)	M	T
2"	1½"	/	/	12	48	71	100	10
3"	2"	/	/	12	60	93	100	10
4"	3"	/	/	21	89	137	150	10
6"	4"	/	/	22	114	186	150	10
8"	6"	/	/	39	168	272	210	10
10"	6"	/	/	29	168	291	210	10
12"	8"	/	/	43	219	370	250	10
14"	10"	/	/	60	273	472	350	10
16"	12"	/	/	80	324	557	400	10
18"	14"	/	/	80	356	614	400	10
20"	16"	275	135	96	407	699	450	10
22"	16"	275	135	84	407	712	450	10
24"	16"	275	135	75	407	732	450	10
26"	16"	275	135	75	220	1250	450	10
28"	16"	275	135	75	220	1250	450	10
30"	16"	275	135	75	220	1250	450	10
32"	16"	275	135	75	220	1250	450	10
34"	16"	275	135	75	220	1250	450	15
36"	18"	275	135	75	250	1400	500	15
38"	18"	275	135	75	250	1400	500	15
40"	20"	375	185	75	260	1650	550	15
42"	20"	375	185	75	260	1650	550	15
44"	20"	375	185	75	260	1650	550	15
46"	24"	375	185	90	320	1850	650	15
48"	24"	375	185	90	320	1850	650	15
50"	24"	375	185	90	320	1850	650	20
52"	26"	575	285	100	350	2050	700	20
54"	26"	575	285	100	350	2050	700	20
56"	28"	575	285	110	390	2200	750	20
58"	28"	575	285	110	390	2200	750	20
60"	30"	575	285	120	400	2250	850	20



NOTES:
1.X DIMENSION FROM 200 TO 800 TO BE ADJUSTED AT ERECTION EXCEPT FOR HORIZONTAL RIGID STRUT INSTALLATION WHERE X=300 Max. IN THIS CASE DETAIL "2" SHALL BE USED.
2.DELETED.
3.FOR 20" TO 60" PROTECTION SHIELD SHALL BE USED.
4.FOR 2" TO 18" PROTECTION SHIELD ONLY IF REQUIRED BY DESIGNER. WILL BE INDICATED ON ISOMETRIC.
5.MATCL AND SCH. PER PIPING CLASSES EXCEPT SPECIFIC REQUIREMENT.
6.WILL BE ADJUSTED ON SITE.

⑤	REINFORCEMENT	2	PLATE 150x8 Thk5mm	A36	A36	A36	/	A36	A36	A36	A36		
④	REINFORCEMENT	1	PLATE 150x8 Thk5mm	A36	A36	A36	/	A36	A36	A36	A36		
③	SPOOL	1	PIPE DIAM1 S.STD	/	/	/	/	A106 GrB	A106 GrB	A106 GrB	A106 GrB		
②	BASE	1	PLATE THK.T	A36	A36	A36	/	A36	A36	A36	A36		
①	DUMMY	1	PIPE DIAM1	(S)	(S)	(S)	/	/	/	/	/		
ITEM	DESCRIPTION	QTY.	DETAIL	CS	CH	CL	CG	AS	AH	SS	SH		

Support Mark
WR05 | DIAM | DIAM1 | TYPE | X | SCH | SCH1 | MATCL | ELEV

Positional Mark
WR05

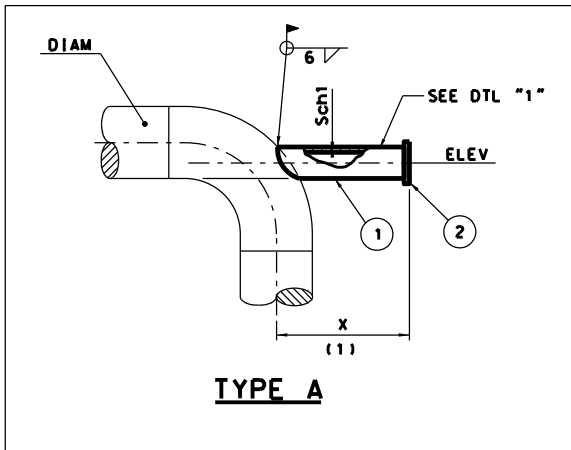
Technip

VERTICAL DUMMY LEG
FOR DIAM 2" TO 60"

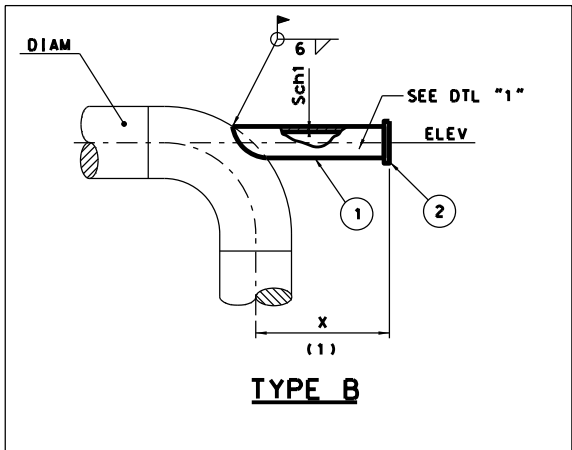
STANDARD CONSTRUCTION DRAWING
PLANT DESIGN AND PIPING

XXXXXXX XXX 000 STC 1391-17 1 of 1 0

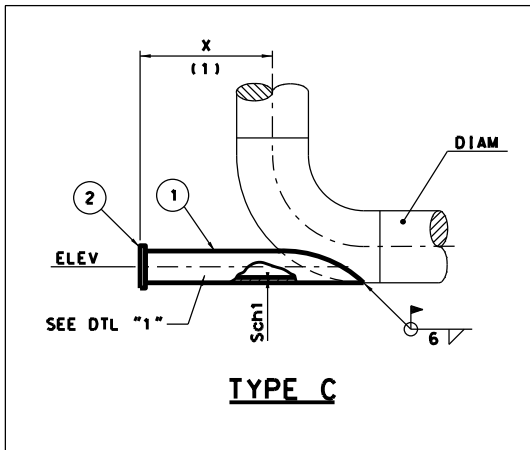
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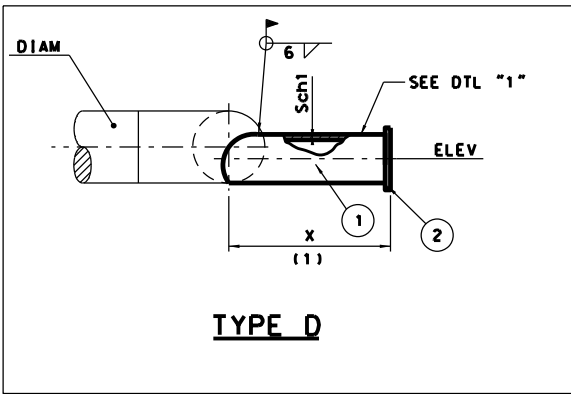
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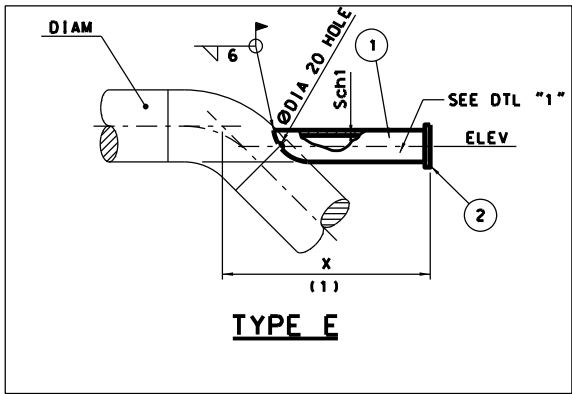
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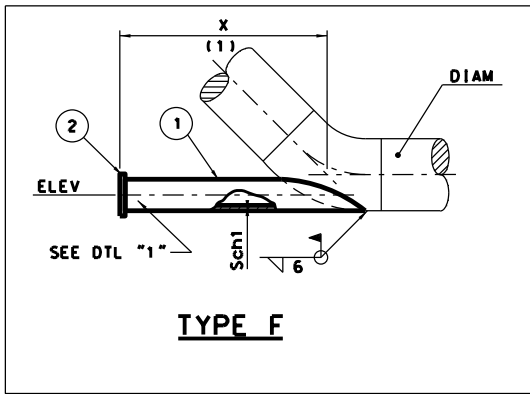
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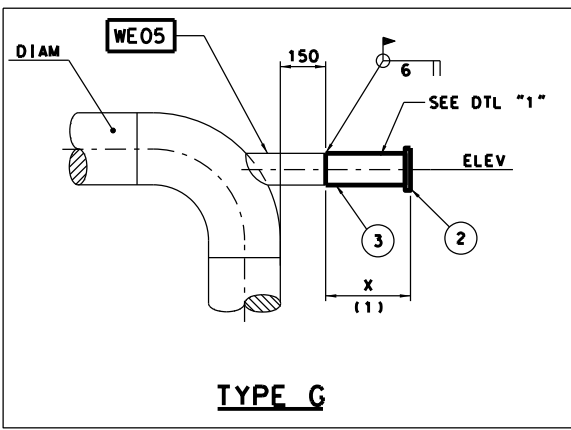
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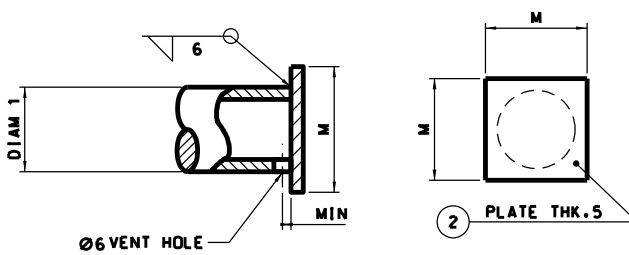
TYPE E



TYPE F

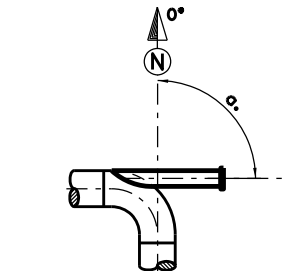


TYPE G



DTL "1"

TABLE "1"		
DIAM	DIAM1	M
2"	1 1/2"	60
3"	2"	70
4"	3"	100
6"	4"	125
8"	6"	180
10"	6"	180
12"	8"	230
14"	10"	300
16"	12"	335
18"	14"	385
20"	16"	440
22"	16"	440
24"	16"	440



ORIENTATION MARK FOR HORIZONTAL INSTALLATION ONLY

NOTES:

1. X DIMENSION SHALL BE FROM 400 TO 800 TO BE ADJUSTED AT ERECTION IF NECESSARY.
2. MATCL AND SCH. PER PIPING CLASSES EXCEPT SPECIFIC REQUIREMENT
3. DELETED.

ITEM	DESCRIPTION	QTY.	DETAIL	CS	CH	CL	CG	AS	AH	SS	SH
3	SPOOL DUMMY	1	PIPE DIAM1 S.STD	/	/	/	/	A106 GrB	A106 GrB	A106 GrB	A106 GrB
2	COVER	1	PLATE THK 5	A36	A36	A36	/	A36	A36	A36	A36
1	DUMMY	1	PIPE DIAM1	(2)	(2)	(2)	/	/	/	/	/

Support Mark

WR06 | DIAM | DIAM1 | TYPE | X | SCH | SCH | MATCL

Positional Mark

ELEV | a

Technip

HORIZONTAL DUMMY LEG ON BEND FOR DIAM 2" TO 24"

WR06

STANDARD CONSTRUCTION DRAWING
PLANT DESIGN AND PIPING

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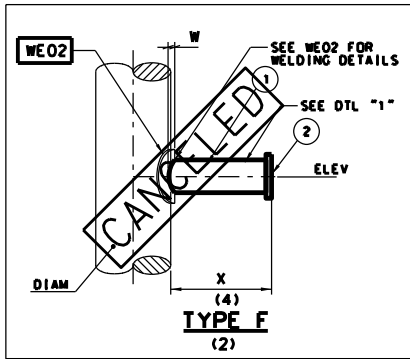
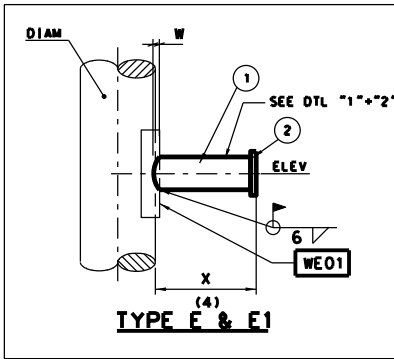
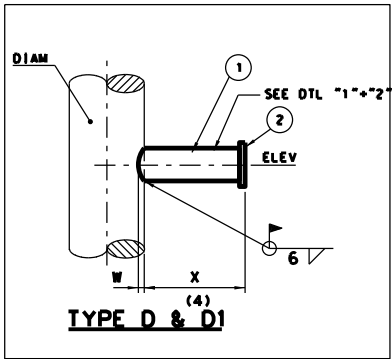
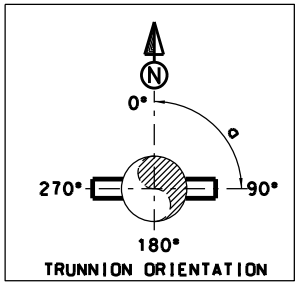
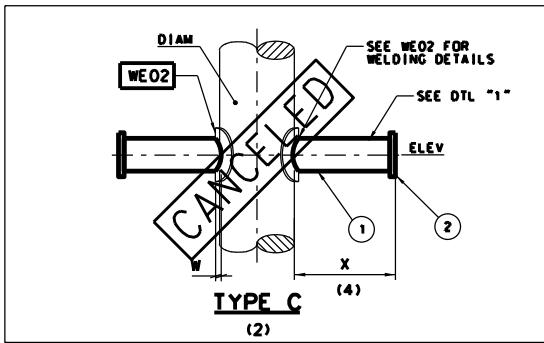
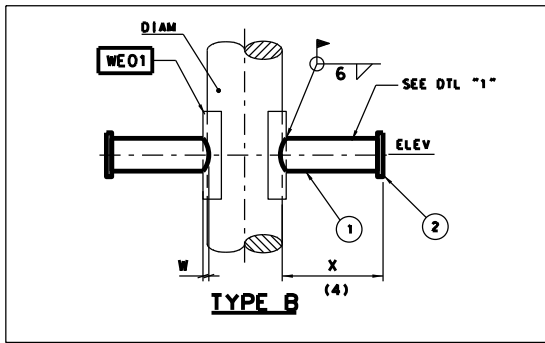
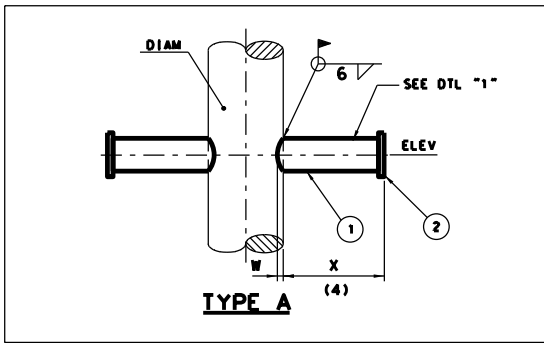
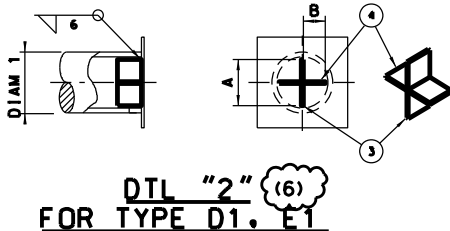
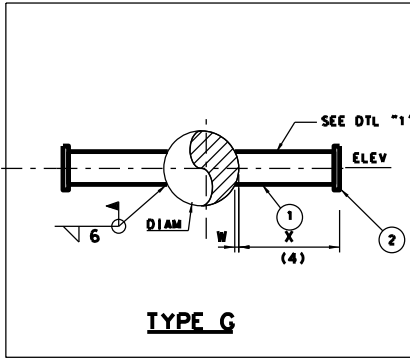
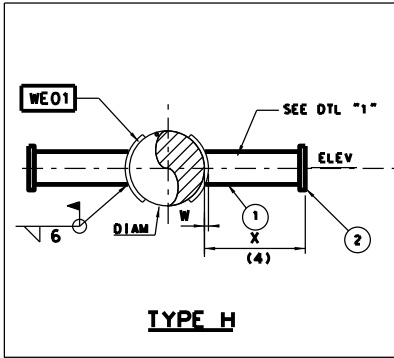
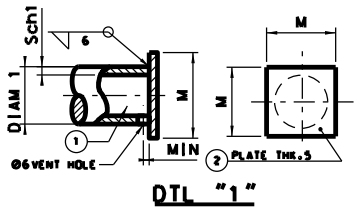


TABLE "1"			
DIAM	DIAM1	M	W
2"	1 1/2"	60	12
3"	2"	70	12
4"	3"	100	21
6"	4"	125	22
8"	6"	180	39
10"	6"	180	29
12"	8"	230	43
14"	10"	300	60
16"	12"	335	80
18"	14"	385	80
20"	16"	440	96
22"	16"	440	84
24"	16"	440	75

TABLE "2"		
DIAM1	A	B
1 1/2"	/	/
2"		
3"		
4"	125	60
6"		
8"		
10"	205	100
12"		
14"		
16"	275	135
16"		



- NOTES:
1. DELETED.
 2. DELETED
 3. DELETED.
 4. X DIMENSIONS FROM 200 TO 800 TO BE ADJUSTED AT ERECTION IF NECESSARY.
 5. MATCL AND SCH. PER PIPING CLASSES EXCEPT SPECIFIC REQUIREMENT.
 6. USED IN CASE OF HORIZONTAL LOADS ON TRUNNION.

ITEM	DESCRIPTION	QTY.	DETAIL	CS	CH	CL	CG	AS	AH	SS	SH
④	REINFORCEMENT	2	PLATE 150x8 THK.5	A36	A36	A36	/	A36	A36	A36	A36
③	REINFORCEMENT	1	PLATE 150x4 THK.5	A36	A36	A36	/	A36	A36	A36	A36
②	COVER	1	PLATE THK. 5	A36	A36	A36	/	A36	A36	A36	A36
①	DUMMY	1	PIPE DIAM1 (5)	/	/	/	/	/	/	/	/

Support Mark

WR07

DIAM

DIAM1

TYPE

X

SCH

SCH1

MATCL

Positional Mark

ELEV

a

Technip

TRUNNION ON PIPE
FOR DIAM 2" TO 60"

WR07

STANDARD CONSTRUCTION DRAWING
PLANT DESIGN AND PIPING

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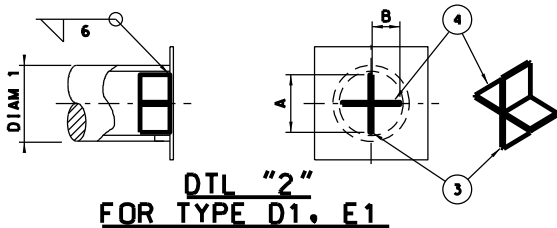
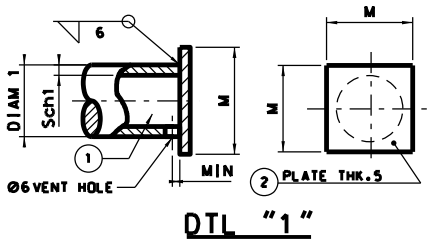
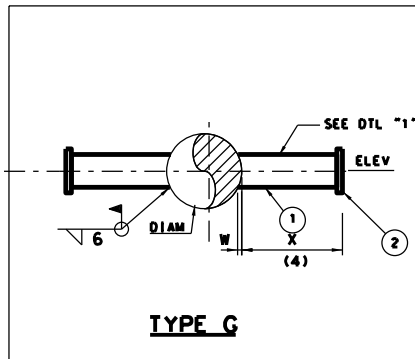
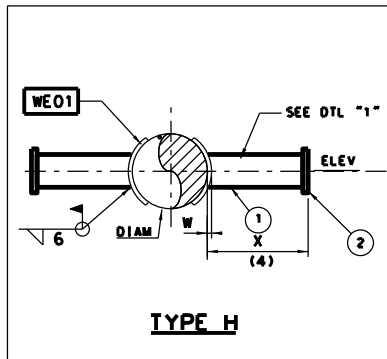
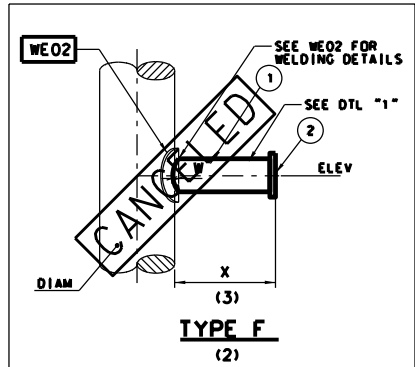
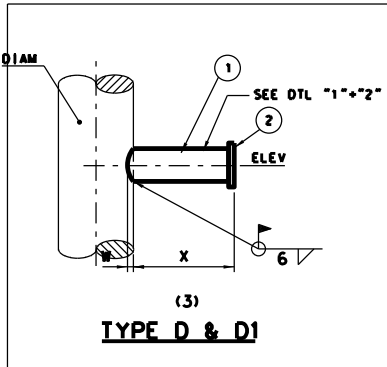
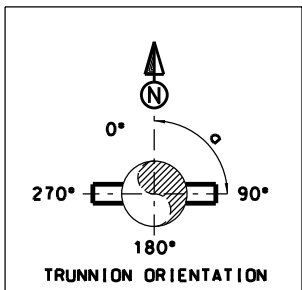
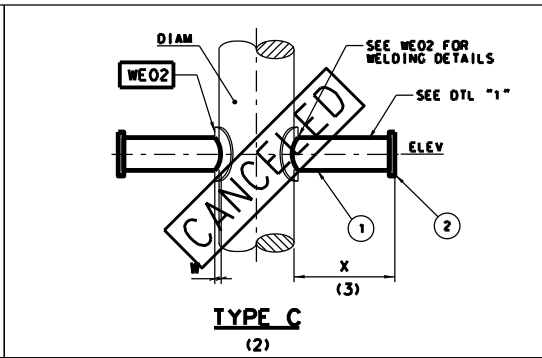
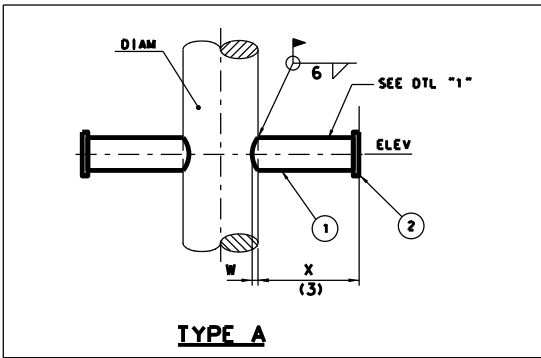
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TABLE "1"			
DIAM	DIAM1 (5)	W	M
26"	16"	75	450
28"	16"	75	450
30"	16"	75	450
32"	16"	75	450
34"	16"	75	450
36"	18"	75	500
38"	18"	75	500
40"	20"	75	550
42"	20"	75	550
44"	20"	75	550
46"	24"	90	650
48"	24"	90	650
50"	24"	90	650
52"	26"	100	700
54"	26"	100	700
56"	28"	110	750
58"	28"	110	750
60"	30"	120	800

TABLE "2"		
DIAM1	A	B
16"	275	135
16"		
16"		
16"		
16"		
18"		
18"		
20"	375	185
20"		
20"		
24"		
24"		
24"		
26"	575	285
26"		
28"		
28"		
28"		
30"		



NOTES:

1. DELETED.
2. DELETED.
3. X DIMENSIONS FROM 200 TO 800 TO BE ADJUSTED AT ERECTION IF NECESSARY
4. MATCL AND SCH. PER PIPING CLASSES EXCEPT SPECIFIC REQUIREMENT.
5. IF DIAM 1 NOT EQUAL TO TABLE A SPECIAL SUPPORT HAS TO BE DESIGNED.

Support Mark

WR07 DIAM DIAM1 TYPE X SCH SCH1 MATCL

Positional Mark

ELEV a

ITEM	DESCRIPTION	QTY.	DETAIL	CS	CH	CL	CG	AS	AH	SS	SH
④	REINFORCEMENT	2	PLATE 150x8 THK.5	A36	A36	A36	/	A36	A36	A36	A36
③	REINFORCEMENT	1	PLATE 150x4 THK.5	A36	A36	A36	/	A36	A36	A36	A36
②	COVER	1	PLATE THK. 5	A36	A36	A36	/	A36	A36	A36	A36
①	DUMMY	1	PIPE DIAM1 (4)	/	/	/	/	/	/	/	/

Technip		TRUNNION ON PIPE FOR DIAM 2" TO 60"		WR07
STANDARD CONSTRUCTION DRAWING PLANT DESIGN AND PIPING		XXXXXXXXXXXX 000		STC1391-19 2 of 2 0
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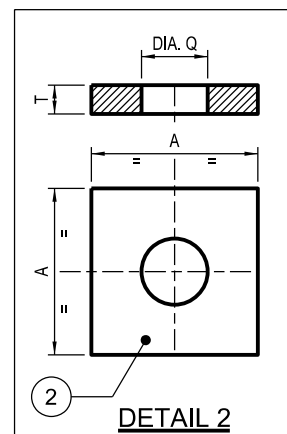
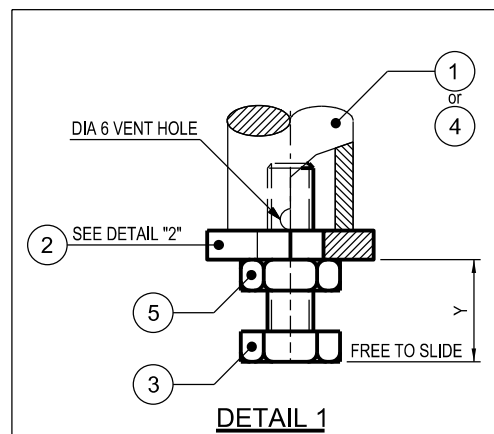
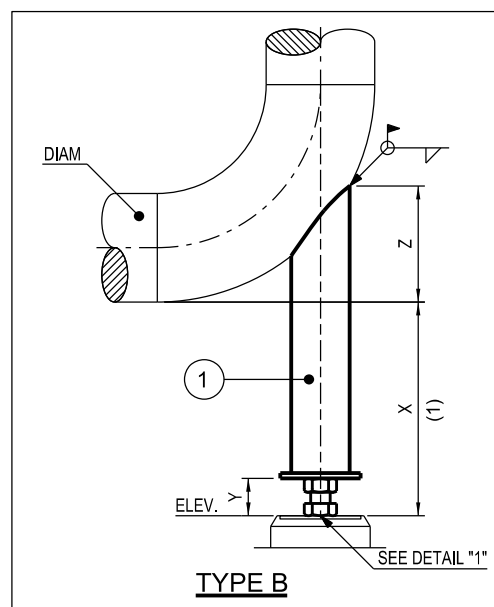
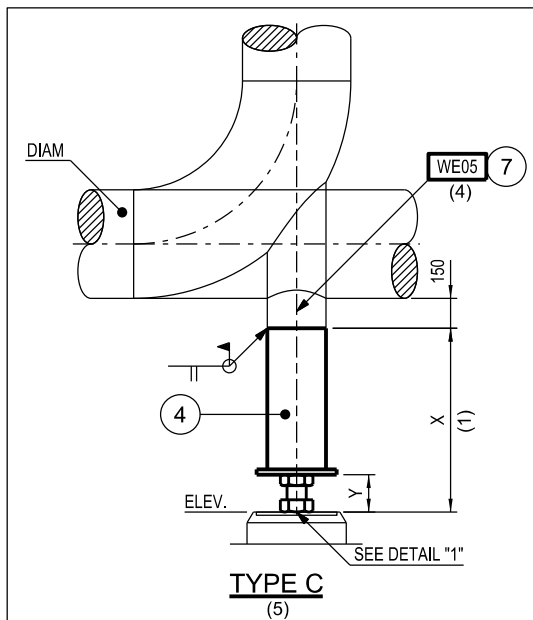
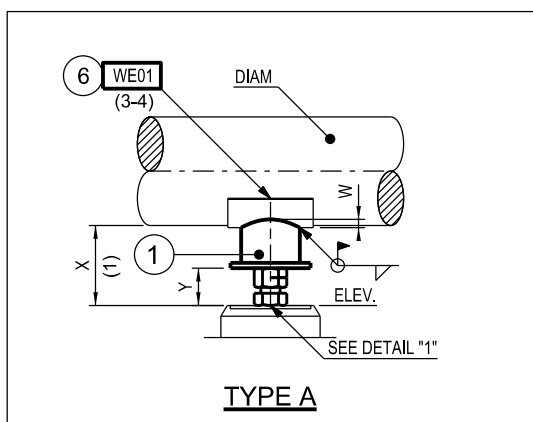
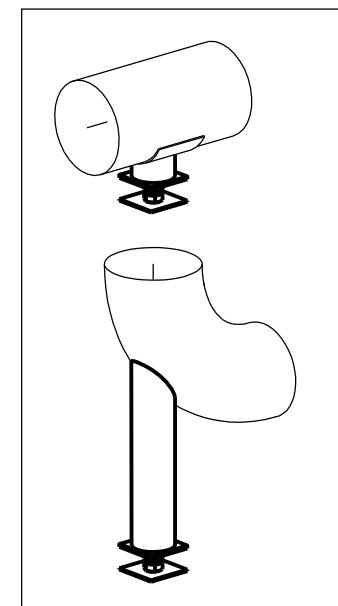


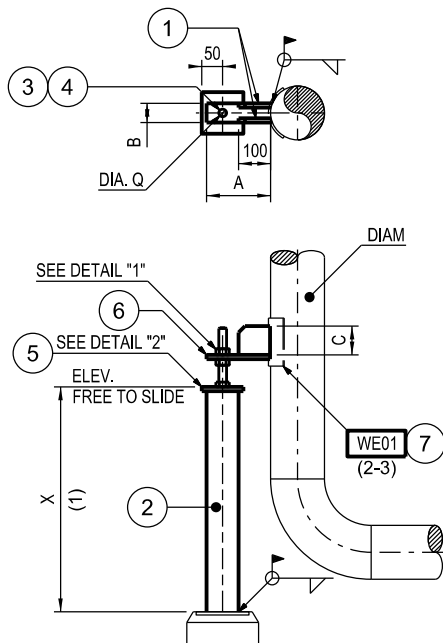
TABLE												
DIAM		DIAM 1		SCREW	Y	A	DIA Q	T	W	Z	X	MAXI
ND	Inch	ND	Inch									
50	2"	40	1 1/2"	M33x170	80	80	40	10	12	71	400	
80	3"	50	2"	M36x170	90	80	40	10	12	93	400	
100	4"	80	3"	M36x170	90	110	50	10	21	137	500	
150	6"	100	4"	M36x170	90	140	50	10	22	186	500	
200	8"	150	6"	M48x170	100	210	60	15	39	272	500	
250	10"	150	6"	M48x170	100	210	60	15	29	298	500	
300	12"	200	8"	M48x170	100	250	60	15	43	370	500	
350	14"	250	10"	M48x170	100	320	60	15	60	472	500	
400	16"	300	12"	M72x170	140	380	80	20	80	557	500	
450	18"	350	14"	M72x170	140	420	80	20	80	614	500	
500	20"	400	16"	M72x170	140	480	80	20	96	699	500	
550	22"	400	16"	M72x170	140	480	80	20	84	712	500	
600	24"	400	16"	M72x170	140	480	80	20	75	732	500	



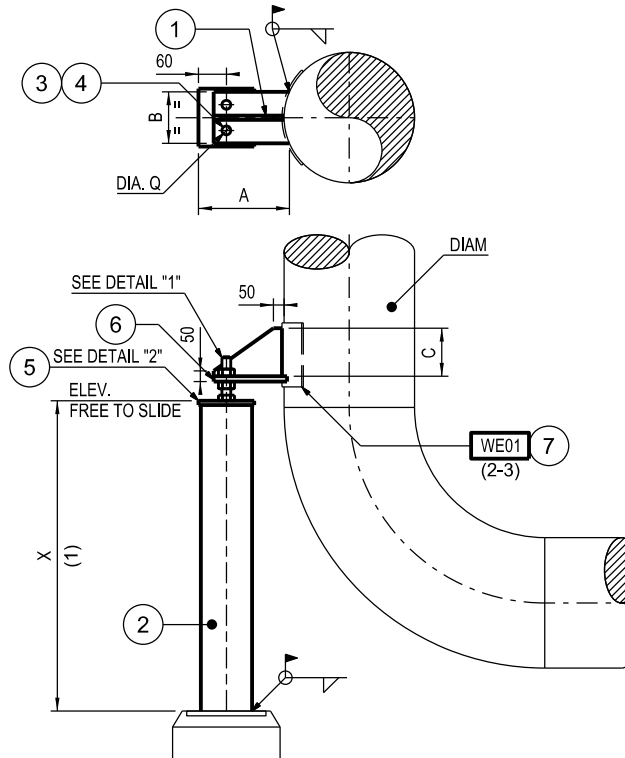
NOTES:
1. X mini = 300 / MAXI SEE TABLE BY STEPS OF 100 TO BE ADJUSTED AT ERECTION IF NECESSARY.
2. MATCL AND SCH. AS PER PIPING CLASSES EXCEPT SPECIFIC REQUIREMENT.
3. PROTECTION SHIELD IS REQUIRED FOR PWHT, AS AND SS LINES. TRUNNION MATERIAL SHALL BE CS WITH STD SCHEDULE.
4. REFERENCE TO OTHER SUPPORT, IT WILL BE INDICATED ON ISOMETRIC.
5. TYPE C SHALL BE USED FOR AH-SH LINES.

7	STANCHION	/	REFER TO WE05	/	/	/	/	/	/	/	/	/	/
6	PROTECTION SHIELD	/	REFER TO WE01	/	/	/	/	/	/	/	/	/	/
5	LOCK NUT	1		A194-2H	A194-2H	A194-2H	A194-2H	A194-2H	A194-2H	A194-2H	A194-2H	A194-2H	A194-2H
4	STANCHION	1	PIPE DIAM 1 SCH. STD	/	/	/	/	/	/	/	/	/	/
3	SCREW	1	SEE TABLE	A193-B7	A193-B7	A193-B7	A193-B7	A193-B7	A193-B7	A193-B7	A193-B7	A193-B7	A193-B7
2	BASE	1	PLATE Thk. T	A36	A36	A36	A36	A36	A36	A36	A36	A36	A36
1	STANCHION	1	PIPE DIAM 1	(NOTE 2)	(NOTE 2)	(NOTE 2)	(NOTE 2)	(NOTE 2)	(NOTE 2)	(NOTE 2)	(NOTE 2)	(NOTE 2)	(NOTE 2)
ITEM	DESCRIPTION	QTY.	DETAIL	CS	CH	CL	CG	AS	AH	SS	SH		

Support Mark							Positional Mark			
WR09	DIAM	DIAM1	TYPE	X	SCH	SCH1	MATCL	ELEV		
<i>Technip</i>					ADJUSTABLE STANCHION FOR DIAM 2" TO 24"				WR09	
STANDARD CONSTRUCTION DRAWING PLANT DESIGN AND PIPING					XXXXXX	000	STC - 1391 - 21		1 of 1	1
					Project	Unit	Doc. Code & Serial No.		Page	Rev.

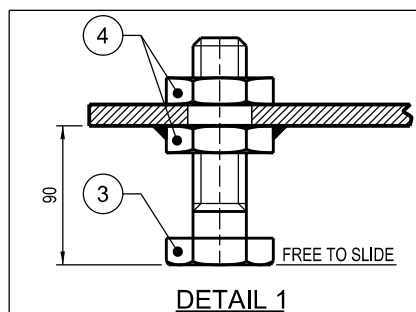
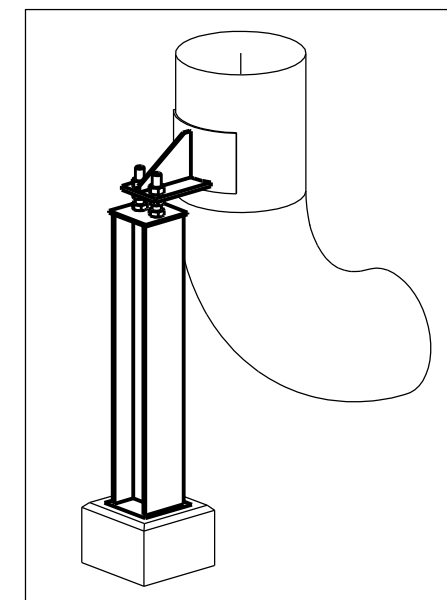
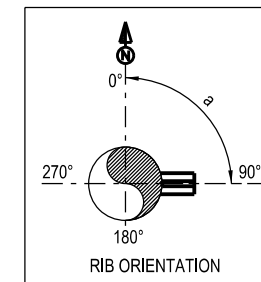


DIAM ND 50 TO 150 - DIAM 2" TO 6"

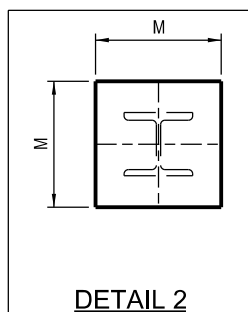


DIAM ND 200 TO 600 - DIAM 8" TO 24"

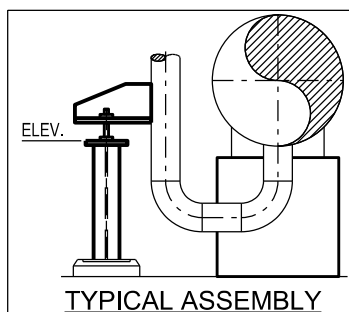
TABLE										
DIAM		SHAPE	A	B	C	M	DIA. Q	SCREW	X MAXI	
ND	Inch									
50 TO 150	2" TO 6"	MB100	200	60	100	130	26	M24x170	1000	
200 TO 300	8" TO 12"	MB150	290	160	150	180	32	M30x170	1250	
350 TO 450	14" TO 18"	MB200	310	200	200	220	38	M36x170	1500	
500 TO 600	20" TO 24"	MB250	330	240	250	260	44	M42x170	1750	



DETAIL 1



DETAIL 2



TYPICAL ASSEMBLY

NOTES:

1. X = MAXI SEE TABLE BY STEPS OF 100 TO BE ADJUSTED AT ERECTION IF NECESSARY.
2. FOR DIAM ND 50 TO 150 - DIAM 2" TO 6" PROTECTION SHIELD ONLY IF REQUIRED BY DESIGNER IT WILL BE INDICATED ON ISOMETRIC.
3. FOR PWHT; AS; AH; SS; SH LINES, PROTECTION SHIELD ALWAYS REQUIRED.

ITEM	DESCRIPTION	QTY.	DETAIL	CS	CH	CL	CG	AS	AH	SS	SH		
7	PROTECTION SHIELD	1	REFER TO WE01	/	/	/	/	/	/	/	/		
6	PLATE	1	PLATE Thk. 10	A36	A387-11	A516-60	/	A36	A387-11	A36	A240-304		
5	BASE	1	PLATE Thk. 10	A36	A36	A36	/	A36	A36	A36	A36		
4	NUT	2/4		A194-2H	A194-2H	A194-2H	/	A194-2H	A194-8	A194-2H	A194-8		
3	SCREW	1/2	SEE TABLE	A193-B7	A193-B7	A193-B7	/	A193-B7	A193-B8	A193-B7	A193-B8		
2	STANCHION	1	SHAPE SEE TABLE	A36	A36	A36	/	A36	A36	A36	A36		
1	RIB	1/2	PLATE C x 10	A36	A387-11	A516-60	/	A36	A387-11	A36	A240-304		
				CS	CH	CL	CG	AS	AH	SS	SH		

MATCL

Support Mark

WR10 DIAM X MATCL

Positional Mark

ELEV a

Technip

**WELDED ADJUSTABLE STANCHION
FOR DIAM 2" TO 24"**

WR10

STANDARD CONSTRUCTION DRAWING
PLANT DESIGN AND PIPING

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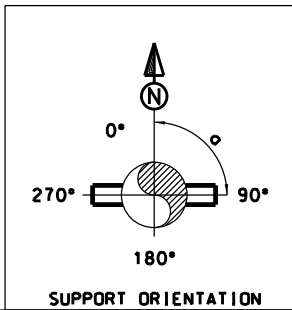
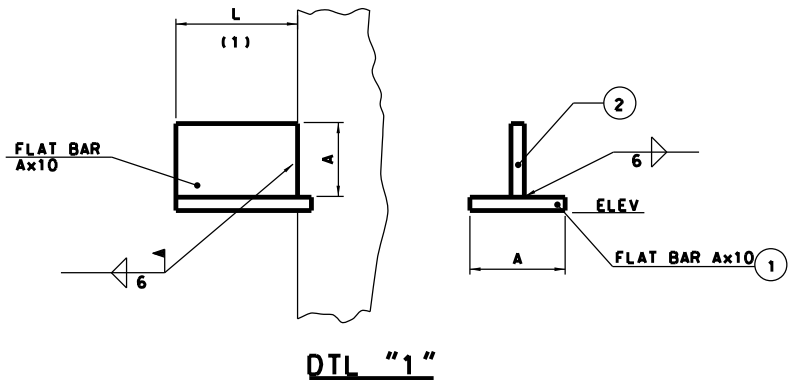
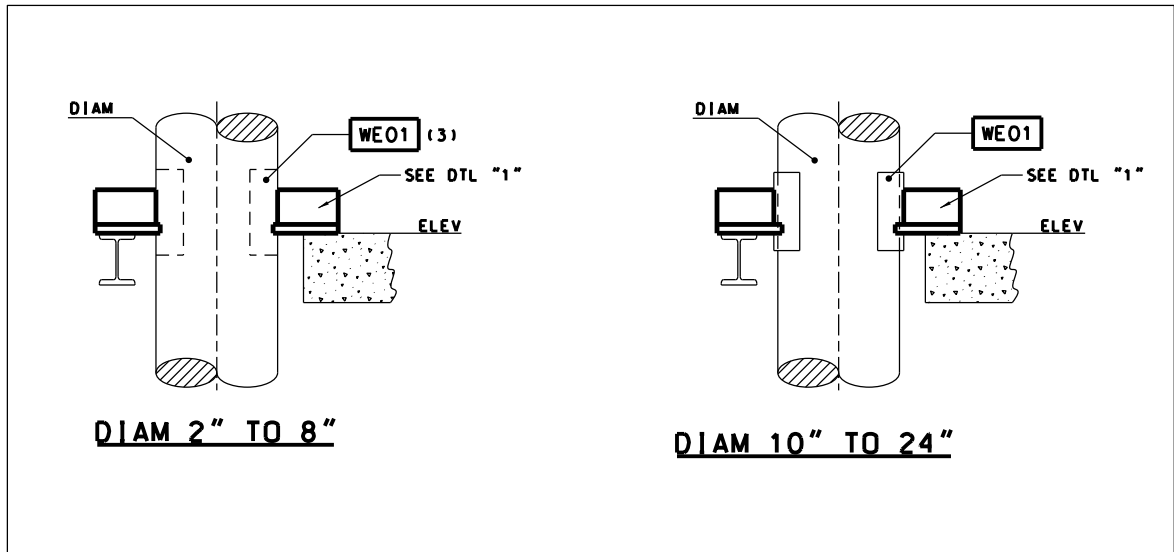



TABLE "1"	
DIAM	FLAT BAR A x 10
2" TO 6"	50 x 10
8" TO 18"	100 x 10
20" TO 24"	150 x 10

NOTES:

1. L DIMENSION FROM 150 TO 300 WITH STEP 50.
2. DELETED.
3. FOR 2" TO 8" PROTECTION SHIELD ONLY IF REQUIRED BY SUPPORT DESIGNER.

Support Mark	Positional Mark
WR11 DIAM L MATCL	ELEV a

ITEM	DESCRIPTION	QTY.	DETAIL	CS	CH	CL	CG	AS	AH	SS	SH
②	STIFFENER	2	FLAT BAR A x 10	A36	A387-11	A516-60	/	A387-11	A387-11	A240-304	A240-304
①	PLATE	2	FLAT BAR A x 10	A36	A387-11	A516-60	/	A387-11	A387-11	A240-304	A240-304



VERTICAL SUPPORT ON PLATFORMS
FOR DIAM 2" TO 24"

STANDARD CONSTRUCTION DRAWING
PLANT DESIGN AND PIPING

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WR11

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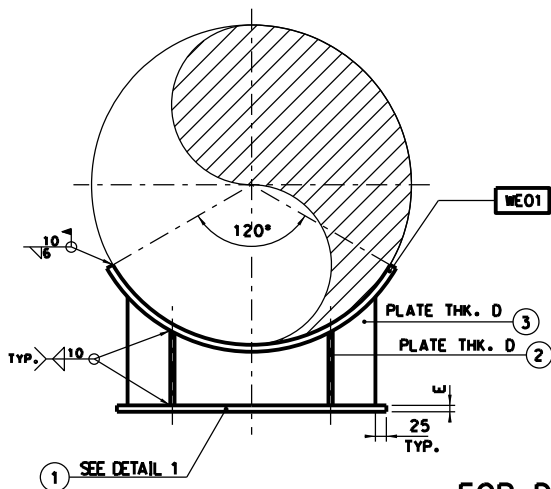


WR13	DIAM	MATCL
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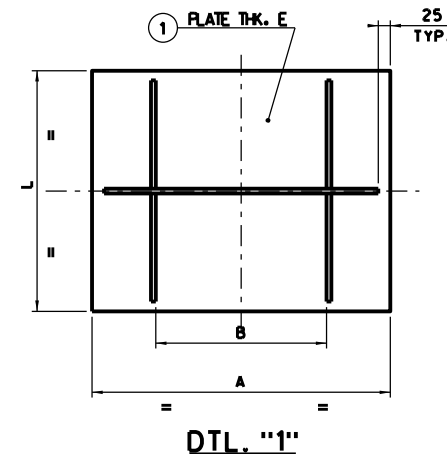
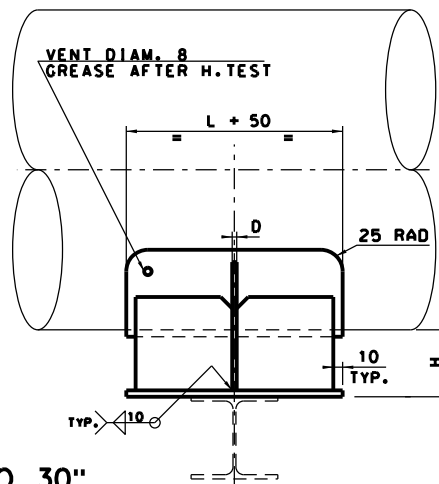
WR 13

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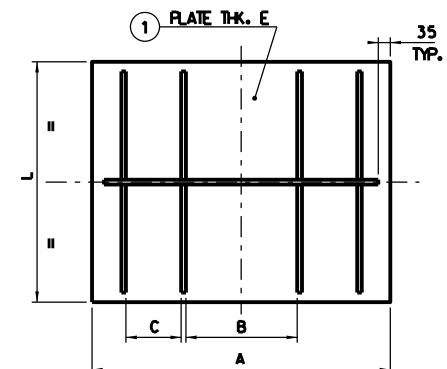
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FOR DIAM 26" TO 30"

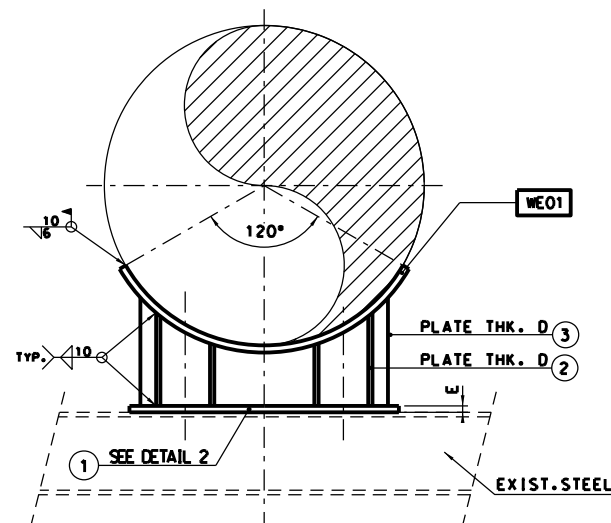


DTL. "1"

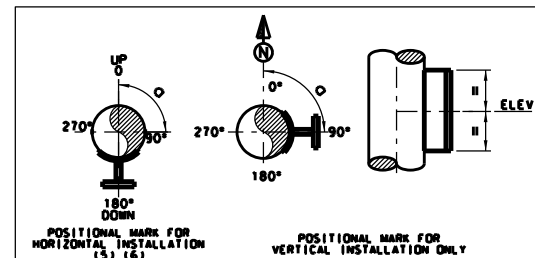
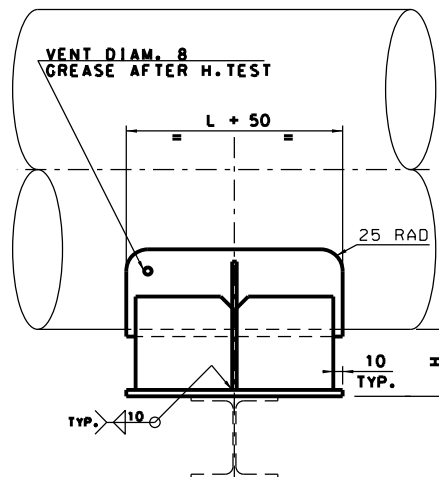


DTL. "2"

DIAM	A	B	C	D	E
26"	550	315	/	15	15
28"	600	340	/	15	15
30"	650	365	/	15	15
32"	750	220	160	15	15
34"	750	240	170	15	15
36"	800	255	180	15	15
38"	850	265	190	15	15
40"	900	280	200	15	15
42"	950	300	210	15	15
44"	950	310	220	15	20
46"	1000	330	230	15	20
48"	1050	345	240	20	20
50"	1100	360	255	20	20
52"	1150	370	265	20	20
54"	1200	385	275	20	20
56"	1250	400	285	20	20
60"	1300	430	310	20	20



FOR DIAM 32" TO 60"



TYPE : A **FOR GAS LINE**

NOTES:

1. L = 300, 500, 700 or 900
2. H = 100 TO 300. FOR LINE WITH SLOPE : H + INDICATING EXACT HEIGHT OF THE SHOE.
3. DELETED.
4. DELETED.
5. LOOKING TO FLOW FLUID DIRECTION.
6. TO BE INDICATED ONLY IF DIFFERENT OF 180°.

ITEM	DESCRIPTION	QTY.	DETAIL	CS	CH	CL	CG	AS	AH	SS	SH
③	RIB	1	PLATE THK. D	A36	A387-11	A516-60	/	A36	A387-11	A36	A240-304
②	RIB	4 or 8	PLATE THK. D	A36	A387-11	A516-60	/	A36	A387-11	A36	A240-304
①	BASE	1	PLATE THK. E	A36	A36	A36	/	A36	A36	A36	A36

Support Mark

WR14 | DIAM | TYPE | H | L | MATCL

Positional Mark

ELEV | a

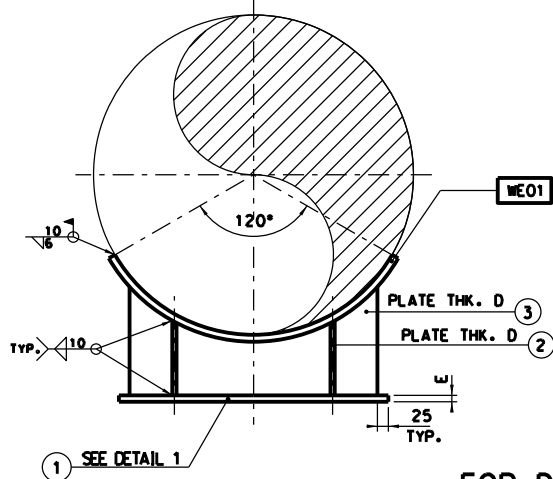
Technip

WELDED SHOES
FOR DIAM 26" TO 60"

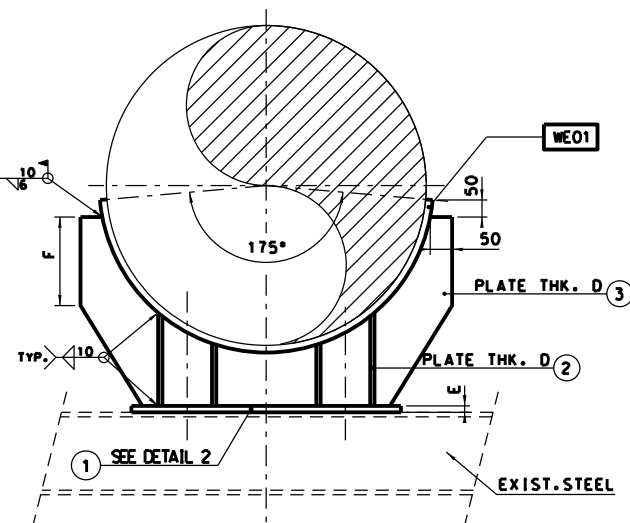
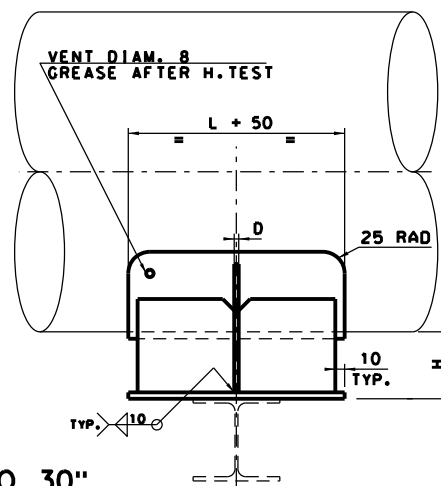
WR14

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PLANT DESIGN AND PIPING

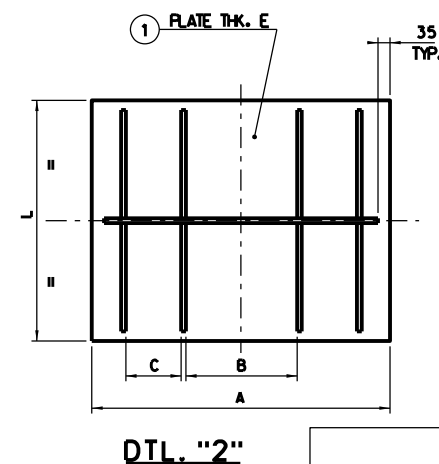
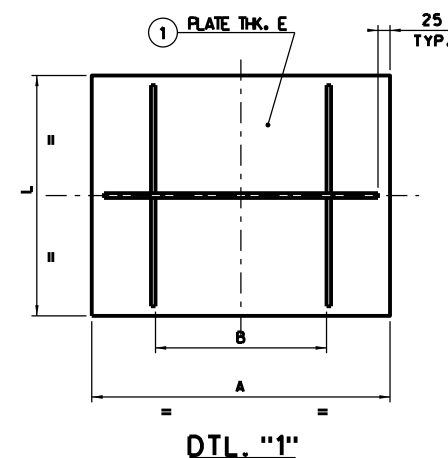
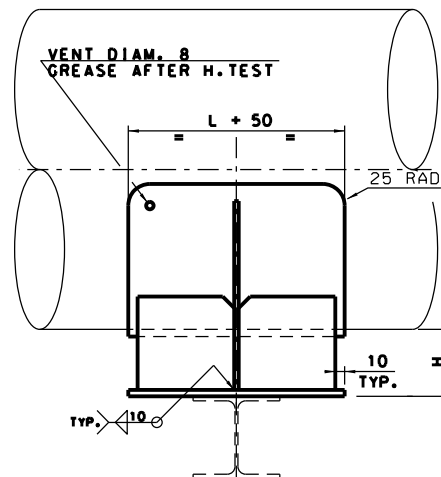
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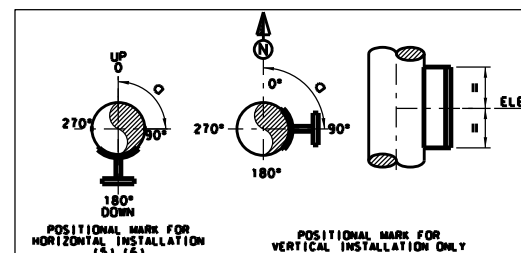
FOR DIAM 26" TO 30"



FOR DIAM 32" TO 60"



DIAM	A	B	C	D	E	F
26"	550	315	/	15	15	/
28"	600	340	/	15	15	/
30"	650	365	/	15	15	/
32"	750	220	160	15	15	200
34"	750	240	170	15	15	200
36"	800	255	180	15	15	200
38"	850	265	190	15	15	250
40"	900	280	200	15	15	250
42"	950	300	210	15	15	250
44"	950	310	220	15	20	300
46"	1000	330	230	15	20	300
48"	1050	345	240	20	20	300
50"	1100	360	255	20	20	300
52"	1150	370	265	20	20	350
54"	1200	385	275	20	20	350
56"	1250	400	285	20	20	350
60"	1300	430	310	20	20	350



TYPE : B FOR LIQUID LINE

NOTES:

1. L = 300, 500, 700 or 900
2. H = 100 TO 300. FOR LINE WITH SLOPE : H + INDICATING EXACT HEIGHT OF THE SHOE.
3. DELETED.
4. FOR 46" TO 60" FULL WRAP MUST BE USED IF PIPE THICKNESS IS LESS THAN 12.7mm.
5. LOOKING TO FLOW FLUID DIRECTION.
6. TO BE INDICATED ONLY IF DIFFERENT OF 180°.

Support Mark

WR14 | DIAM | TYPE | H | L | MATCL

Positional Mark

ELEV | a

ITEM	DESCRIPTION	QTY.	DETAIL	CS	CH	CL	CG	AS	AH	SS	SH
③	RIB	1	PLATE THK. D	A36	A387-11	A516-60	/	A36	A387-11	A36	A240-304
②	RIB	4or8	PLATE THK. D	A36	A387-11	A516-60	/	A36	A387-11	A36	A240-304
①	BASE	1	PLATE THK. E	A36	A36	A36	/	A36	A36	A36	A36

MATCL

Technip

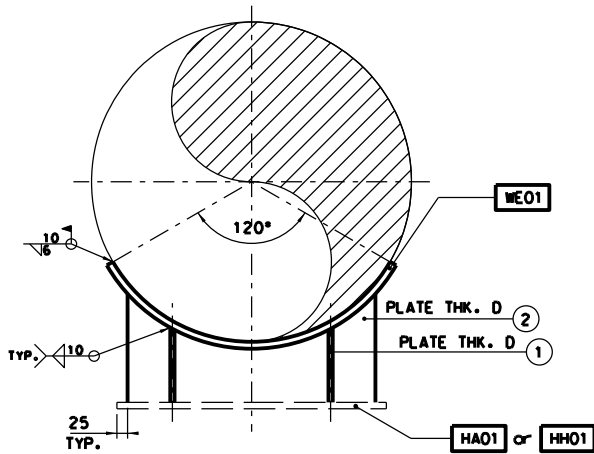
WELDED SHOES
FOR DIAM 26" TO 60"

WR14

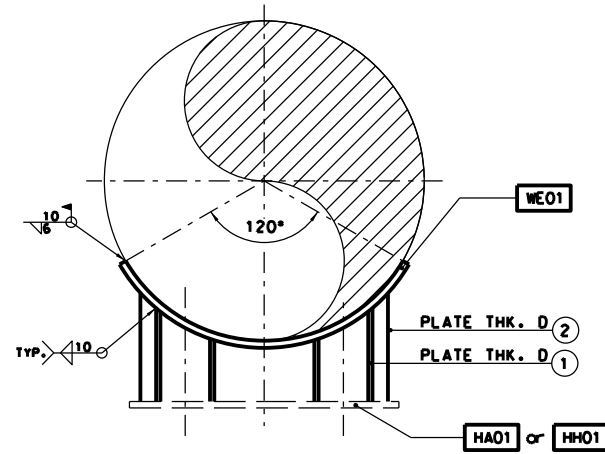
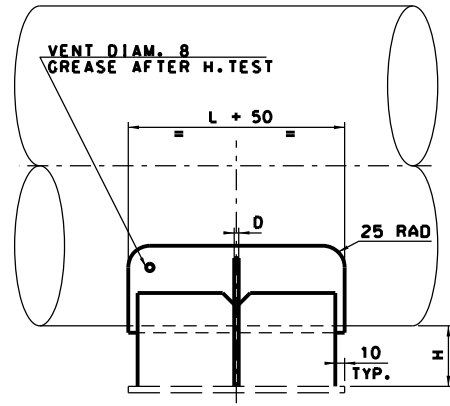
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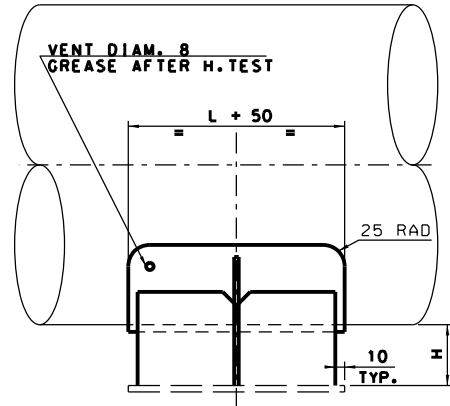
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FOR DIAM 26" TO 30"



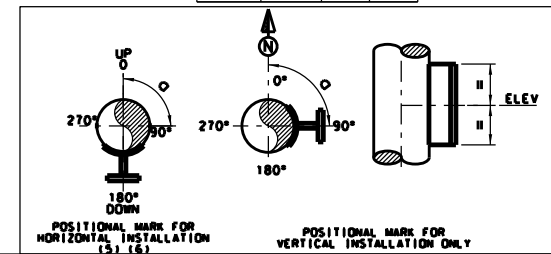
FOR DIAM 32" TO 60"



TYPE : C

FOR GAS LINE
TO BE USE WITH "HA01" or "HH01"

DIAM	B	C	D
26"	315	/	15
28"	340	/	15
30"	365	/	15
32"	220	160	15
34"	240	170	15
36"	255	180	15
38"	265	190	15
40"	280	200	15
42"	300	210	15
44"	310	220	15
46"	330	230	15
48"	345	240	20
50"	360	255	20
52"	370	265	20
54"	385	275	20
56"	400	285	20
60"	430	310	20



- NOTES:
1. L = 300.500.700 or 900
 2. H = 100 TO 300. FOR LINE WITH SLOPE : H + INDICATING EXACT HEIGHT OF THE SHOE.
 3. DELETED.
 5. LOOKING TO FLOW FLUID DIRECTION.
 6. TO BE INDICATED ONLY IF DIFFERENT OF 180°.

Support Mark	Positional Mark
WR14 DIAM TYPE H L MATCL	ELEV a

ITEM	DESCRIPTION	QTY.	DETAIL	CS	CH	CL	CG	AS	AH	SS	SH
②	RIB	1	PLATE THK. D	A36	A387-11	A516-60	/	A36	A387-11	A36	A240-304
①	RIB	4 or 8	PLATE THK. D	A36	A387-11	A516-60	/	A36	A387-11	A36	A240-304

Technip

WELDED SHOES
FOR DIAM 26" TO 60"

WR14

STANDARD CONSTRUCTION DRAWING
PLANT DESIGN AND PIPING

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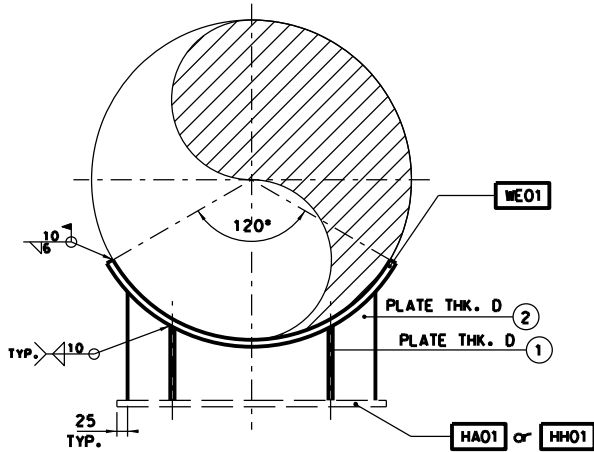
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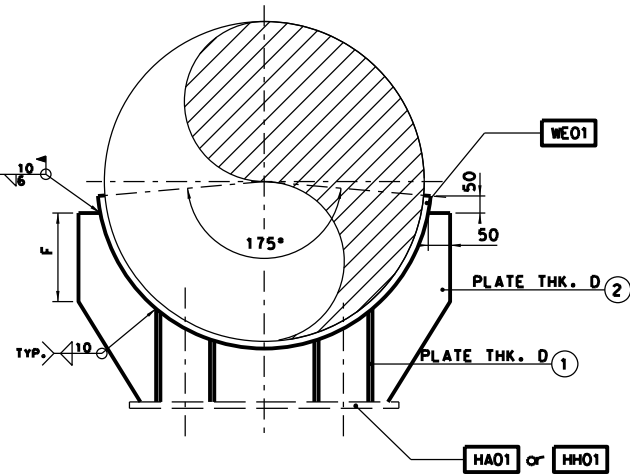
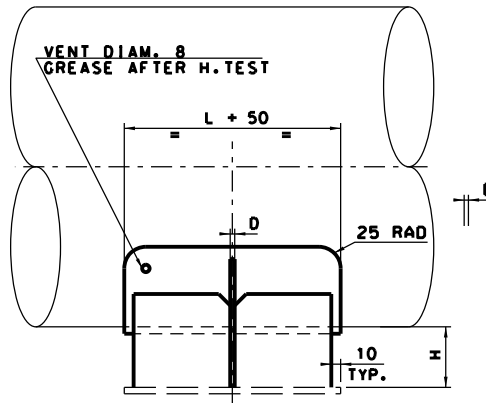
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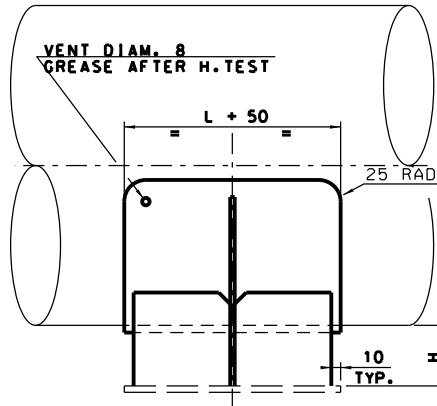
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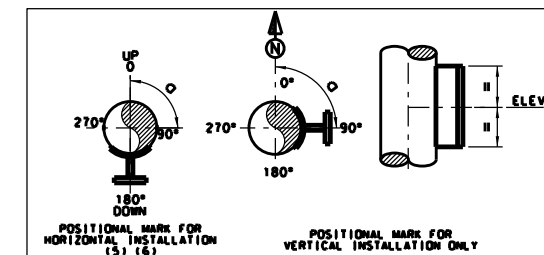
FOR DIAM 26" TO 30"



FOR DIAM 32" TO 60"



DIAM	B	C	D	F
26"	315	/	15	/
28"	340	/	15	/
30"	365	/	15	/
32"	220	160	15	200
34"	240	170	15	200
36"	255	180	15	200
38"	265	190	15	250
40"	280	200	15	250
42"	300	210	15	250
44"	310	220	15	300
46"	330	230	15	300
48"	345	240	20	300
50"	360	255	20	300
52"	370	265	20	350
54"	385	275	20	350
56"	400	285	20	350
60"	430	310	20	350



TYPE : D

**FOR LIQUID LINE
TO BE USE WITH "HA01" or "HH01"**

NOTES:

1. L = 300-500-700 or 900
2. H = 100 TO 300. FOR LINE WITH SLOPE : H + INDICATING EXACT HEIGHT OF THE SHOE.
3. DELETED.
4. FOR 46" TO 60" FULL WRAP MUST BE USED IF PIPE THICKNESS IS LESS THAN 12.7mm.
5. LOOKING TO FLOW FLUID DIRECTION.
6. TO BE INDICATED ONLY IF DIFFERENT OF 180°.

Support Mark

WR14 | DIAM | TYPE | H | L | MATCL

Positional Mark

ELEV | a

ITEM	DESCRIPTION	QTY.	DETAIL	CS	CH	CL	CG	AS	AH	SS	SH
②	RIB	1	PLATE THK. D	A36	A387-11	A516-60	/	A36	A387-11	A36	A240-304
①	RIB	4 or 8	PLATE THK. D	A36	A387-11	A516-60	/	A36	A387-11	A36	A240-304

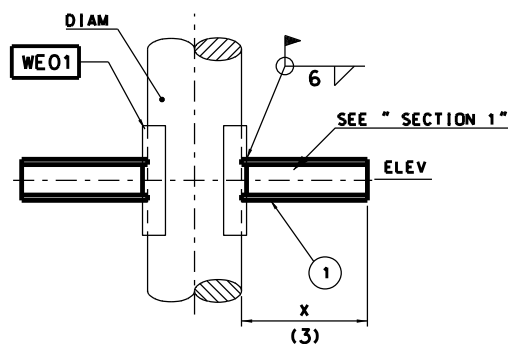
Technip

**WELDED SHOES
FOR DIAM 26" TO 60"**

WR14

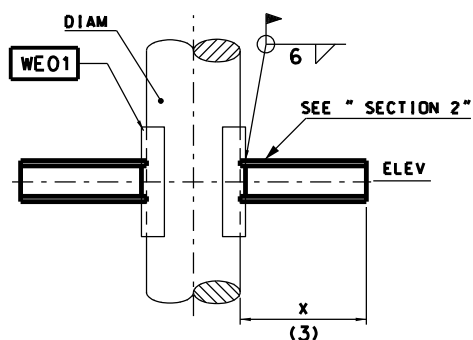
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PLANT DESIGN AND PIPING

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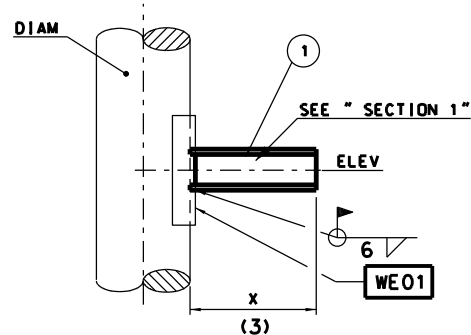
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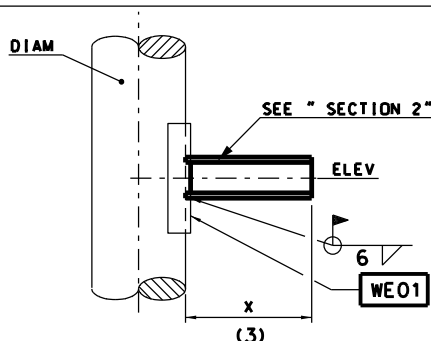
TYPE C

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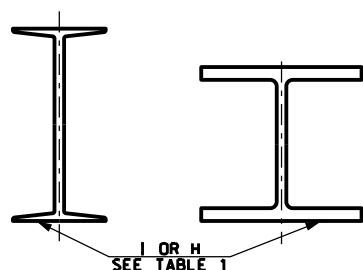
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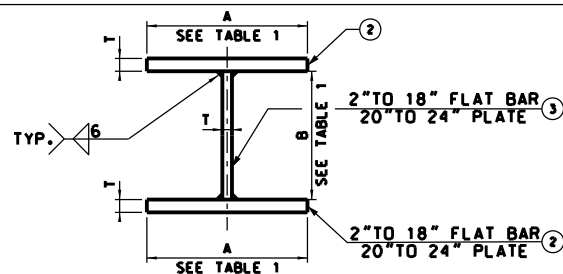


TYPE D

(2)



SECTION 1



SECTION 2

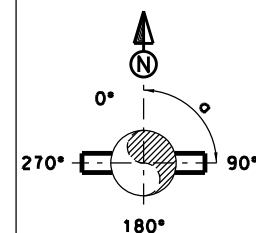
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TABLE "1"

TABLE "1"				
DIAM	SHAPE	A mm	B mm	T mm
2"	I10	50	100	5
3"	I10	50	100	
4"	I12	60	100	
6"	I12	60	100	
8"	H12	120	100	10
10"	H12	120	100	
12"	H16	150	150	
14"	H16	150	150	
16"	H20	200	150	
18"	H20	200	150	
20"	H24	240	200	12
22"	H24	240	200	
24"	H24	240	200	

TABLE "2"

TABLE "2"	
MATCL	TYPE
CS	A OR B
CH. CL. AS AH. SS. SH	C OR D



TRUNNION ORIENTATION

NOTES:

1. DELETED.
2. PROTECTION SHIELD SHALL BE USED FOR ALL DIAMETER.
3. X DIMENSIONS FROM 200 TO 400 AND SHALL BE APPROVED BY A STRESS VALIDATION.

Support + Mark

Positional Mark

WR15	DIAM	TYPE	SHAPE	X	MATCL
------	------	------	-------	---	-------

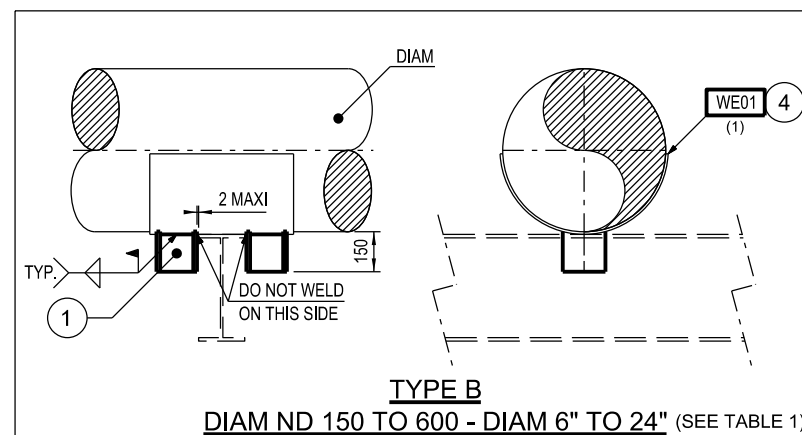
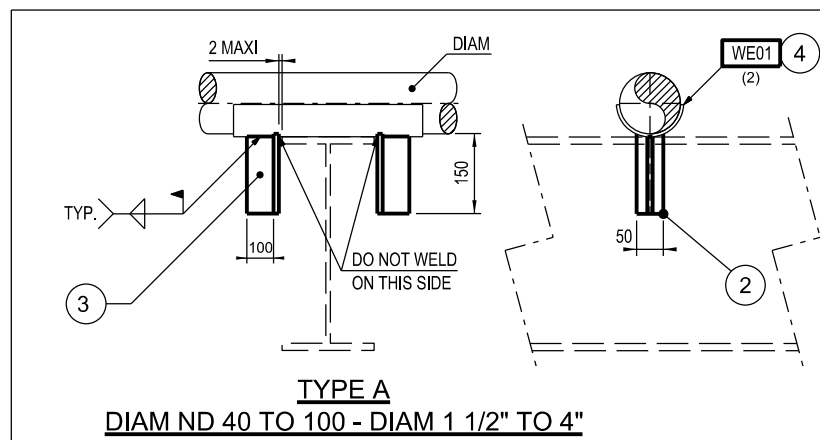
Technip

SHAPE ON VERTICAL PIPE
FOR DIAM 2" TO 24"

WR 15

STANDARD CONSTRUCTION DRAWING PLANT DESIGN AND PIPING

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	Project	Unit	Doc. Code & Serial No.	Page	Rev.



SIZE	SHAPE	Load (KN)
1	PLATE + STIFFNER	30
2	HALF MB200	60
3	MB200	130

NOTES:

1. FOR DIAM ND 350 TO 600 - DIAM 14" TO 24" PROTECTION SHIELD SHALL BE REQUIRED.
2. FOR SS,SH,AS,AH AND PWHT LINES PROTECTION SHIELD SHALL BE REQUIRED FOR ALL DIAMETERS.
3. MAXI GAP TO VERIFY AT ERECTION.

(4)	PROTECTION SHIELD	1	REFER TO WE01	/			/		/				
(3)	STIFFENER	2	PLATE 100 x 10 SEE TABLE 1	A36			A36		A36				
(2)	FLAT BAR	2	PLATE BAR 50 x 10 SEE TABLE 1	A36			A36		A36				
(1)	SHAPE	2	SEE TABLE 1	A36			A36		A36				
ITEM	DESCRIPTION	QTY.	DETAIL	CS	CH	CL	CG	AS	AH	SS	SH		
								MATCL					

Support Mark

WS01	DIAM	TYPE	SIZE
------	------	------	------

Technip

STOP ON UNINSULATED PIPE
FOR DIAM 1½" TO 24"

WS01

STANDARD CONSTRUCTION DRAWING
PLANT DESIGN AND PIPING

XXXXXX	000	STC - 1391 - 29	1 of 1	1
Project	Unit	Doc. Code & Serial No.	Page	Rev

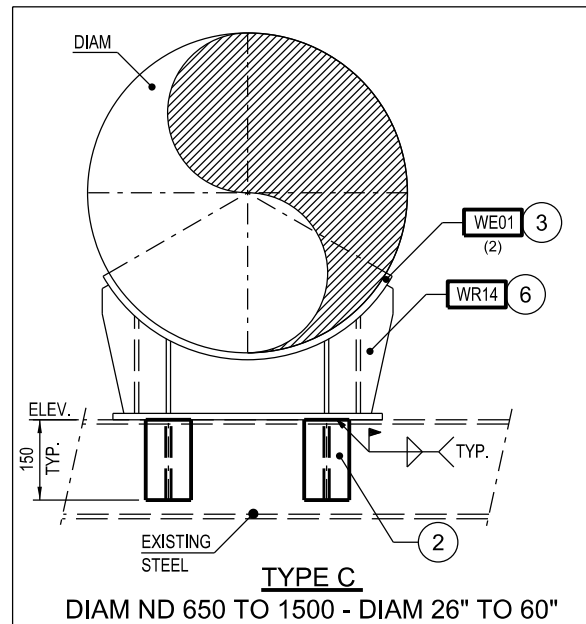
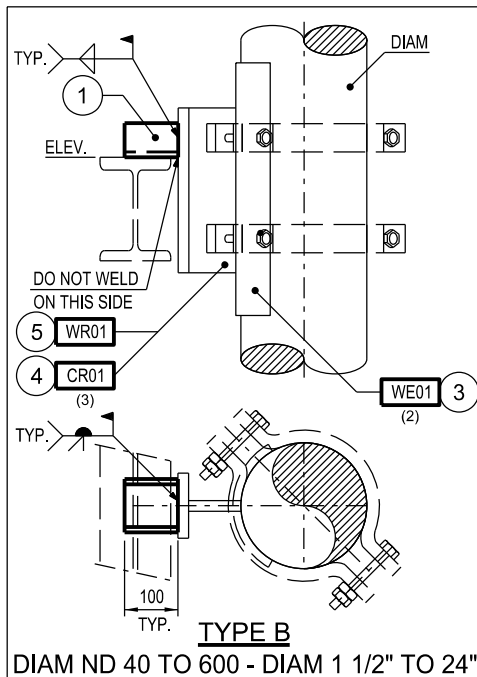
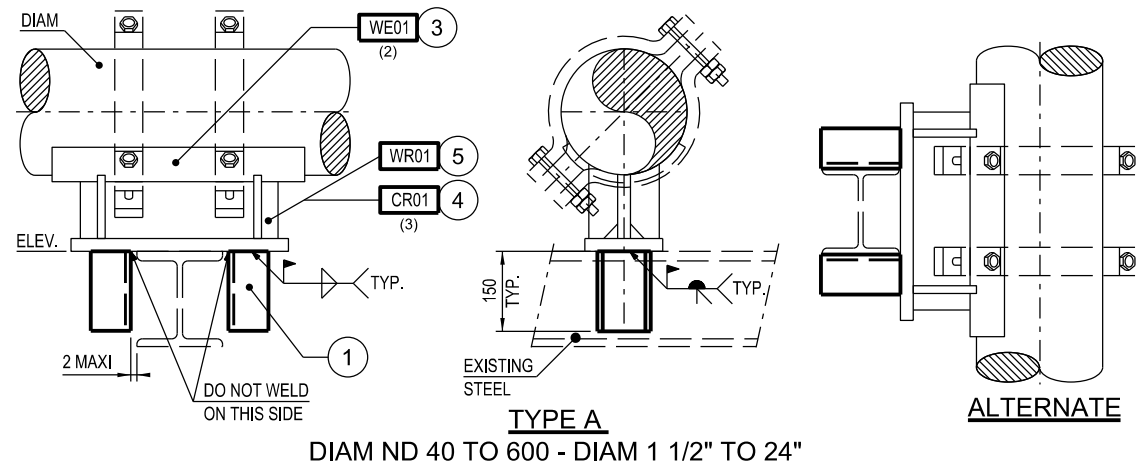
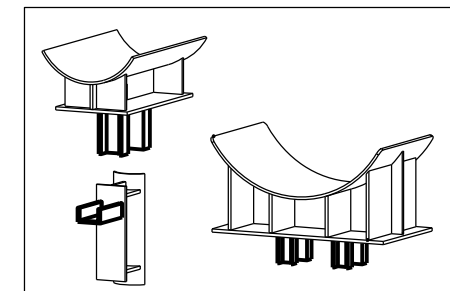
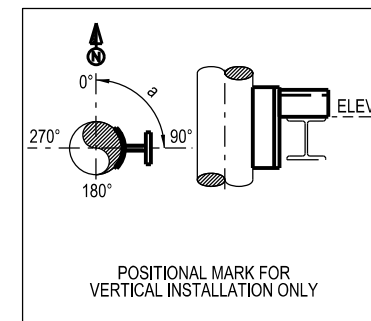


TABLE 1		
SIZE	SHAPE	Load (KN)
1	HALF MB100	30
2	MC 100	70
3	MB 150	100
4	MB 200	130



- NOTES:
1. STOP TO USE IN CONJUNCTION WITH REQUIRED PIPE SHOE.
 2. PROTECTION SHIELD SHALL BE USED FOR PWHT AS, AH, SS, SH AND FOR ALL PIPE DIAM ND 350 TO 1500 - DIAM 14" TO 60" ON OTHER LINES.
 3. WE03 SHALL BE USED FOR PIPE SHOE WITH CLAMP.

6	SHOE	1	REFER TO WR14	/	/	/	/	/	/	/	/	/	/
5	SHOE	1	REFER TO WR01	/	/	/	/	/	/	/	/	/	/
4	SHOE	1	REFER TO CR01	/	/	/	/	/	/	/	/	/	/
3	PROTECTION SHIELD	1	REFER TO WE01	/	/	/	/	/	/	/	/	/	/
2	SHAPE	4	SEE TABLE	A36	A36	A36	A36	A36	A36	A36	A36	A36	A36
1	SHAPE	1/2	SEE TABLE	A36	A36	A36	A36	A36	A36	A36	A36	A36	A36
ITEM	DESCRIPTION	QTY.	DETAIL	CS	CH	CL	CG	AS	AH	SS	SH	SL	

MATCL

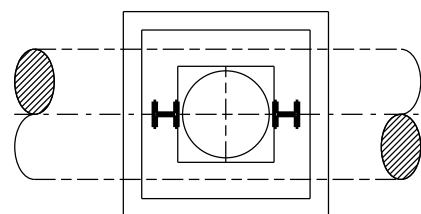
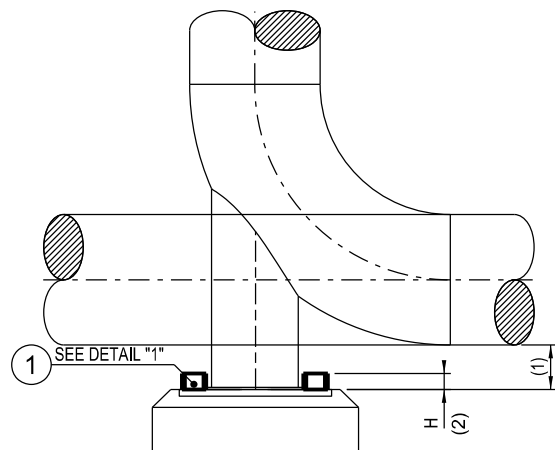
Support Mark

WS02 DIAM TYPE SIZE

Positional Mark

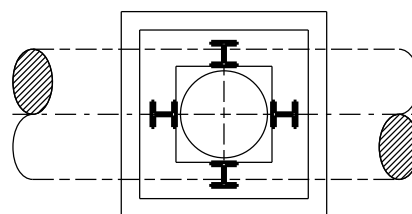
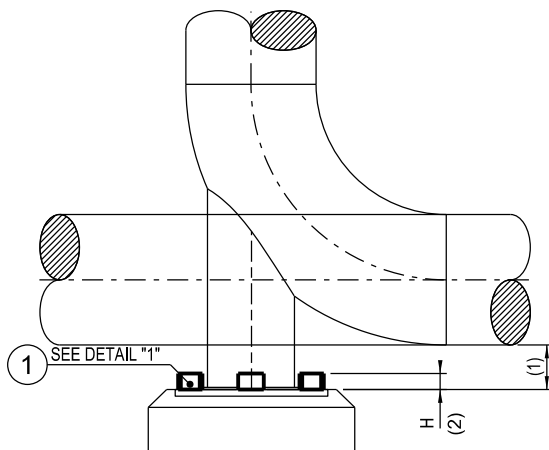
ELEV a

TechnipSTOP ON PIPE SHOES
FOR DIAM 1 1/2" TO 60"**WS02**STANDARD CONSTRUCTION DRAWING
PLANT DESIGN AND PIPINGXXXXXX
Project000
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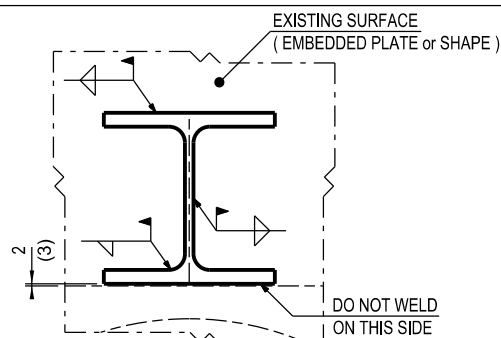


FREE TO
SLIDE

TYPE A
AXIAL STOP



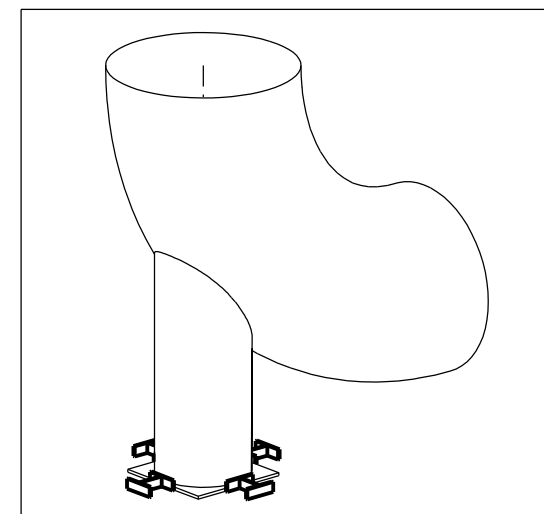
TYPE B
SEMI ANCHOR



DETAIL 1

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<input type="radio"/>														
<input type="radio"/>														
<input checked="" type="radio"/>	SHAPE	2/4	SEE TABLE	A36	A36	A36	A36	A36	A36	A36	A36	A36	A36	
ITEM	DESCRIPTION	QTY.	DETAIL	CS	CH	CL	CG	AS	AH	SS	SH	SL		

TABLE		
SIZE	SHAPE	Load (KN)
1	HALF MB100	30
2	MC 100	70
3	MC 150	100
4	MB 200	130



NOTES:

1. 800 MAXI.
2. H = 50 FOR FIXED STANCHION. TO BE SPECIFIED FOR ADJUSTABLE STANCHION.
3. GAP = 2 MAXI UNLESS SPECIFIED.
4. FOR DIAM ND 50 & 80 - DIAM 2" & 3" HOLD DOWN TO BE USED IN ONLY ONE DIRECTION.

Support Mark

WS03	TYPE	SIZE	H
------	------	------	---

Technip

STOP FOR STANCHION
FOR DIAM 2" TO 60"

WS03

STANDARD CONSTRUCTION DRAWING
PLANT DESIGN AND PIPING

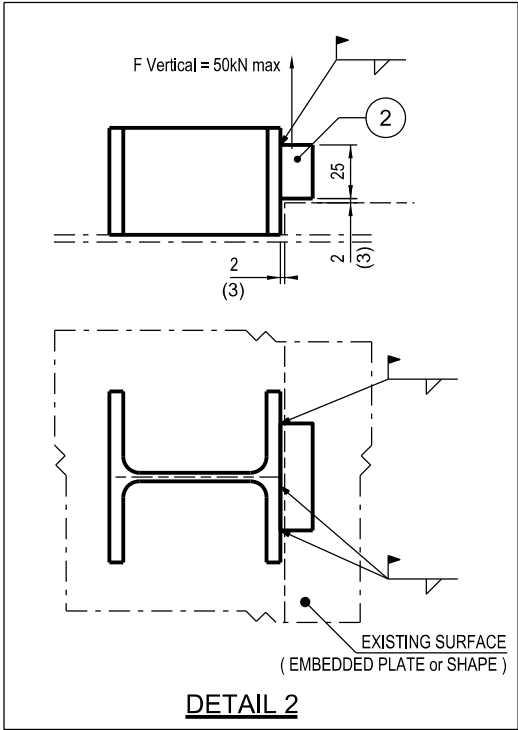
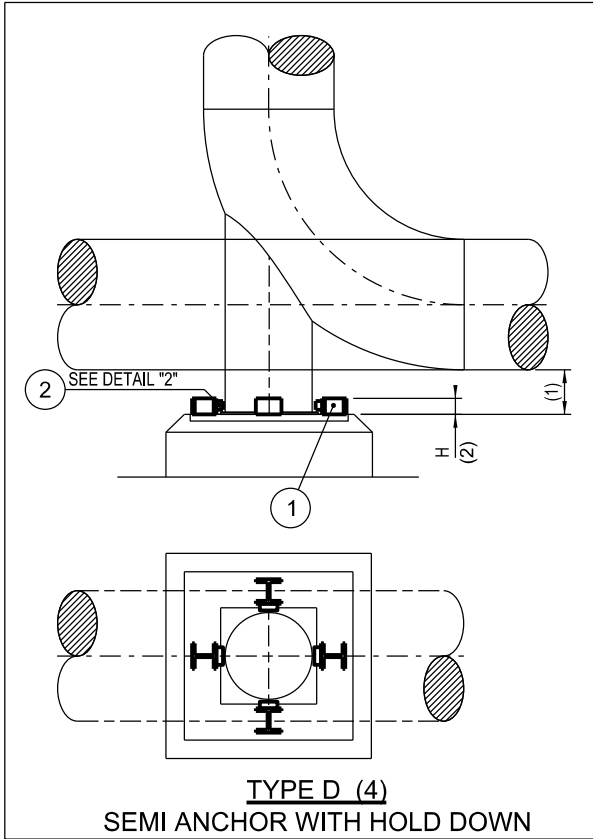
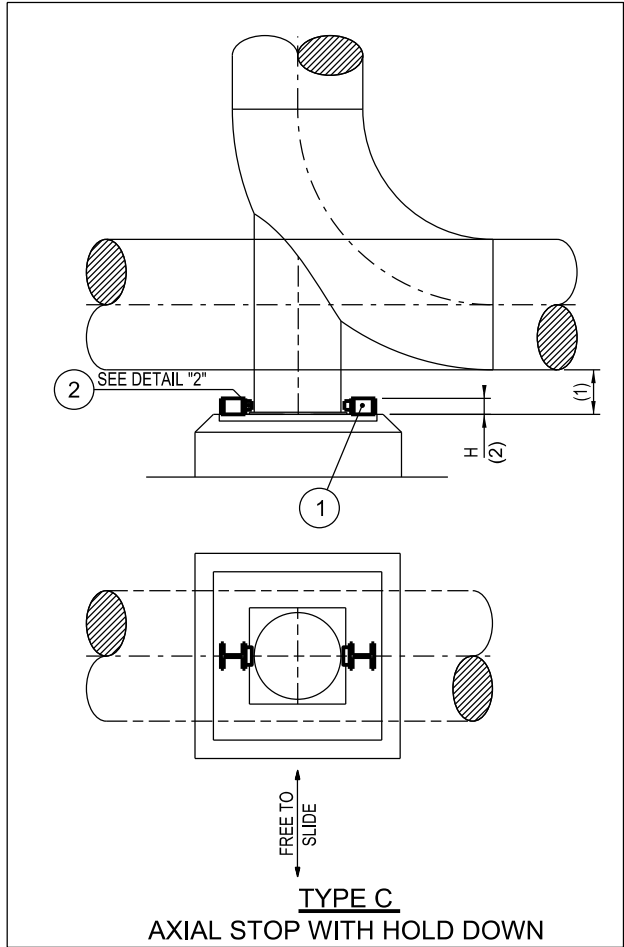
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Print

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1



NOTES:

Support Mark

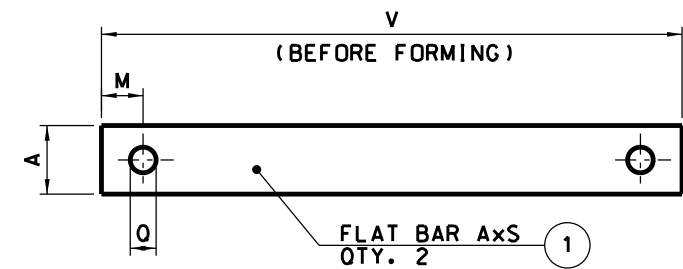
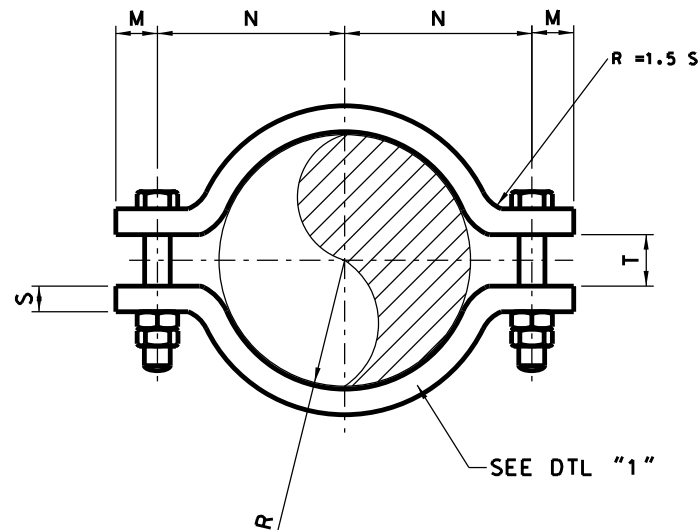
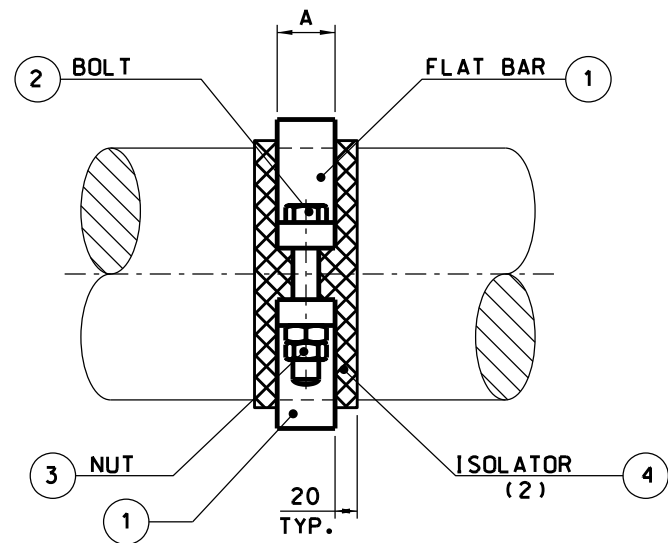
WS03 TYPE SIZE H

ITEM	DESCRIPTION	QTY.	DETAIL	CS	CH	CL	CG	AS	AH	SS	SH	SL
2	HOLD DOWN	2/4	PLATE 100 x 15	A36	A36	A36	A36	A36	A36	A36	A36	A36
1	SHAPE	2/4	SEE TABLE SHEET 1/2	A36	A36	A36	A36	A36	A36	A36	A36	A36

MATCL

Technip		STOP FOR STANCHION FOR DIAM 2" TO 60"		WS03	
STANDARD CONSTRUCTION DRAWING PLANT DESIGN AND PIPING		XXXXXX	000	STC - 1391 - 31	2 of 2
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DTL "1"

TO BE USED IN CONJUNCTION
WITH OTHER SUPPORT
(AS CRO1 AS EXAMPLE).

NOTES:

1. APPROXIMATE LENGHT FOR HALF CLAMP BEFORE FORMING.
2. A SHEET OF ELASTOMERIC ISOLATOR TYPE "CORFLEX" SHALL BE INSERTED BETWEEN CLAMP AND PIPE. LIMITE OF TEMPERATURE IS 210 °C.

Support + Mark

CE01 DIAM MATCL

④	ISOLATOR	1		(2)	/	(2)	NEOPRENE	(2)	/	(2)	(2)		
③	NUT	4	SEE TABLE "1"	A194 2H	A194 2H	A194 2H	A194 2H	A194 2H	A194 8	A194 2H	A194 8		
②	BOLT	2	SEE TABLE "1"	A193 B7	A193 B7	A320 L7	A193 B7	A193 B7	A193 B8	A193 B7	A320 B8		
①	STRIP	2	FLAT BAR A x S	A36	A387-11	A516-60	A36	A36	A387-11	A36	A240-304		
ITEM	DESCRIPTION	QTY.	DETAIL	CS	CH	CL	CG	AS	AH	SS	SH		
MATCL													

Technip

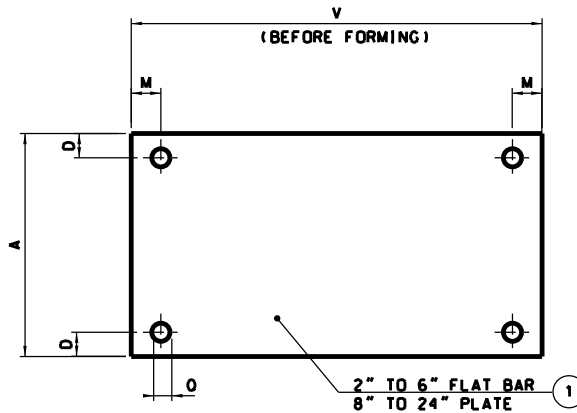
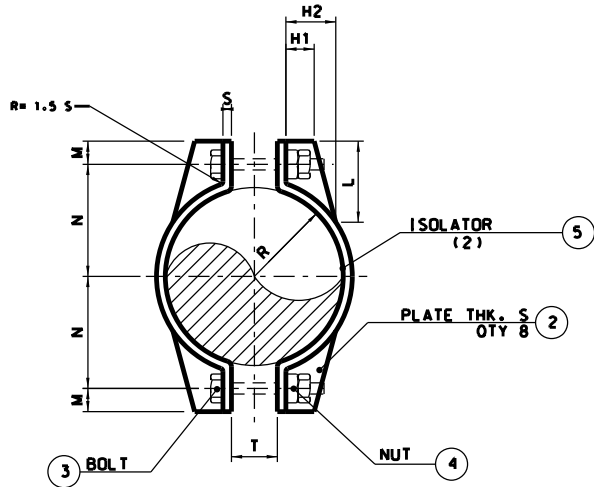
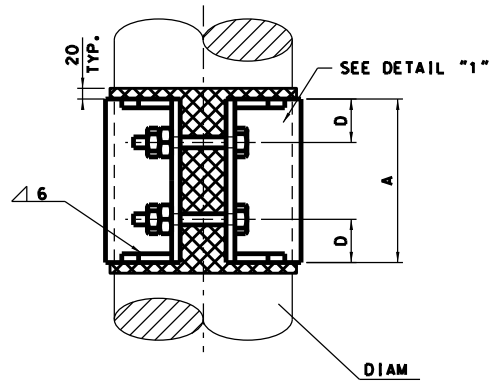
CLAMP FOR HORIZONTAL PIPE
FOR DIAM 2" TO 24"

CE01

STANDARD CONSTRUCTION DRAWING
PLANT DESIGN AND PIPING

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DTL "1"

TABLE "1"

DIAM	BOLT	A	D	H1	H2	L	M	N	O	R WITHOUT ISOLATOR	R WITH ELASTOMERIC BAND	S	T	V (1)
2"	M12x50	200	40	5	15	60	25	60	14	30	32	5	12	205
3"		200	40	5	20	60	25	75	14	45	47	5	12	255
4"		200	40	10	35	60	25	85	14	57	59	5	12	290
6"		200	40	10	50	80	25	115	14	84	86	5	12	375
8"	M16x70	300	55	20	80	100	30	155	18	110	112	10	16	505
10"		300	55	35	95	100	30	185	18	137	139	10	16	590
12"		300	55	45	105	100	30	220	18	162	164	10	16	700
14"		300	60	55	115	100	30	235	18	178	180	10	16	750
16"		350	60	65	125	100	30	275	18	203	205	10	16	860
18"		350	60	75	135	100	30	300	18	229	231	10	16	910
20"	M20x80	400	70	85	150	120	35	330	22	254	256	10	20	1040
22"		400	70	85	155	120	35	355	22	280	282	10	20	1120
24"		400	70	95	165	120	35	380	22	305	307	10	20	1200

NOTES:

1. APPROXIMATE LENGTH FOR HALF CLAMP BEFORE FORMING.
2. A SHEET OF ELASTOMERIC ISOLATOR BAND Type "CORFLEX" SHALL BE INSERTED BETWEEN CLAMP AND PIPE.
LIMIT OF TEMPERATURE IS 210°C

Support Mark

CE02 DIAM MATCL

Technip

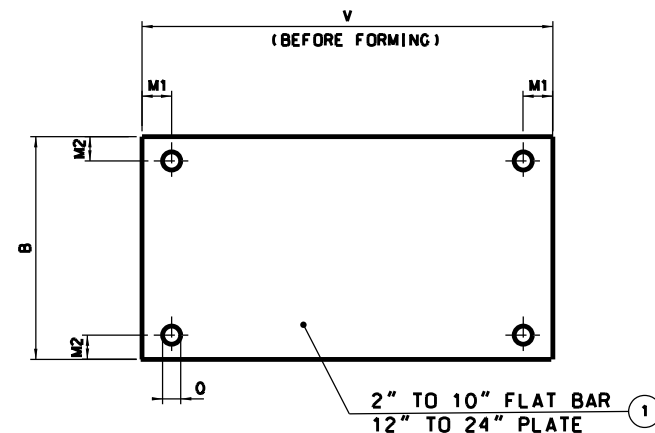
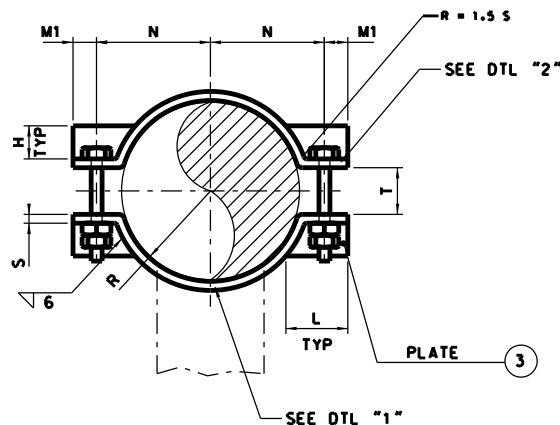
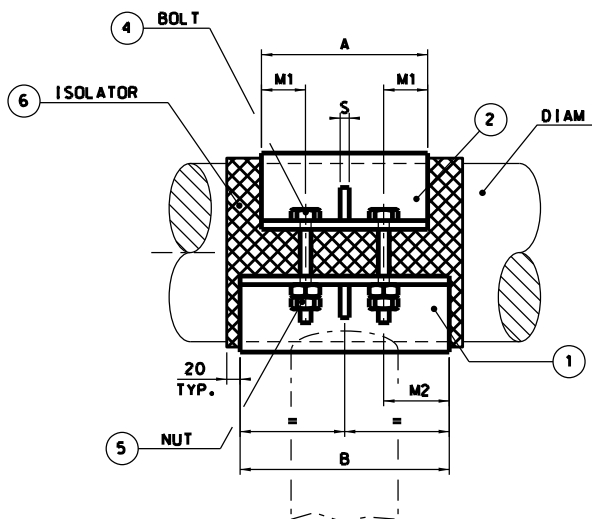
CLAMP FOR TRUNNIONS & CLIPS
FOR DIAM 2" TO 24"

CE02

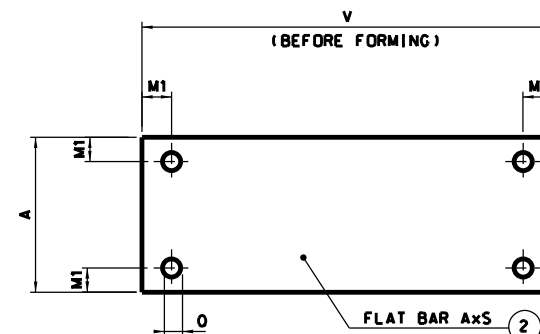
STANDARD CONSTRUCTION DRAWING
PLANT DESIGN AND PIPING

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ITEM	DESCRIPTION	QTY.	DETAIL	CS	CH	CL	CG	AS	AH	SS	SH
5	ISOLATOR	1	(2)	/	(2)	NEOPRENE	(2)	/	(2)	(2)	
4	NUT	8	SEE TABLE "1"	A194 2H	A194 2H	A194 2H	A194 2H	A194 2H	A194 8	A194 2H	A194 8
3	BOLT	4	SEE TABLE "1"	A193 87	A193 87	A320 L7	A193 87	A193 87	A193 88	A193 87	A320 88
2	STIFFENER	8	PLATE THK. S	A36	A387-11	A516-60	A36	A36	A387-11	A36	A240-304
1	STRIP	2	FLAT BAR OR PLATE	A36	A387-11	A516-60	A36	A36	A387-11	A36	A240-304



DTL "1"



DTL "2"

TABLE "1"														
DIAM	BOLT	A	B	H	L	M1	M2	N	O	R WITHOUT ISOLATOR	R WITH ELASTOMERIC BAND	S	T	V
2"	M12x50	100	150	20	55	25	50	60	14	30	32	5	12	205
3"		100	150	20	60	25	50	75	14	45	47	5	12	255
4"		100	200	20	55	25	75	85	14	57	59	5	12	290
6"		150	200	20	57	25	50	115	14	84	86	5	12	375
8"	M16x70	150	200	50	85	30	55	155	18	110	112	10	16	505
10"		150	200	50	85	30	55	185	18	137	139	10	16	590
12"		150	250	50	92	30	85	220	18	162	164	10	16	700
14"		150	250	50	90	30	85	235	18	178	180	10	16	750
16"		150	300	50	103	30	105	275	18	203	205	10	16	860
18"		150	300	50	100	30	105	300	18	229	231	10	16	940
20"	M20x80	150	350	100	130	35	135	330	22	254	256	10	20	1040
22"		150	350	100	127	35	135	355	22	280	282	10	20	1120
24"		150	350	100	125	35	135	380	22	305	307	10	20	1200

- NOTES:
1. APPROXIMATE LENGHT FOR HALF CLAMP BEFORE FORMING.
 2. A SHEET OF ELASTOMERIC ISOLATOR BAND Type "CORFLEX" SHALL BE INSERTED BETWEEN CLAMP AND PIPE.
 3. DELETED
 4. WHEN USED IN CONJUNCTION WITH CRO5 OR CRO9. DIMENSION TO BE ADJUSTED ACCORDINGLY.

6	ISOLATOR	1		(2)	/	(2)	NEOPRENE	(2)	/	(2)	(2)		
5	NUT	8	SEE TABLE "1"	A194 2H	A194 2H	A194 2H	A194 2H	A194 2H	A194 8	A194 2H	A194 8		
4	BOLT	4	SEE TABLE "1"	A193 87	A193 87	A320 L7	A193 87	A193 87	A193 88	A193 87	A320 88		
3	STIFFENER	4	PLATE THK. S	A36	A387-11	A516-60	A36	A36	A387-11	A36	A240-304		
2	STRIP	1	FLAT BAR A x S	A36	A387-11	A516-60	A36	A36	A387-11	A36	A240-304		
1	STRIP	1	FLAT BAR OR PLATE	A36	A387-11	A516-60	A36	A36	A387-11	A36	A240-304		
ITEM	DESCRIPTION	QTY.	DETAIL	CS	CH	CL	CG	AS	AH	SS	SH		

Support Mark
CE03 **DIAM** **MATCL**

Technip

CLAMP FOR DUMMY LEGS
FOR DIAM 2" TO 24"

CE03

STANDARD CONSTRUCTION DRAWING
PLANT DESIGN AND PIPING

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Project Unit Doc. Code & Serial No. Page Rev.

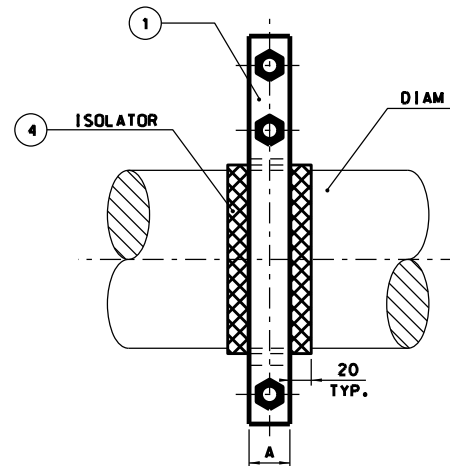
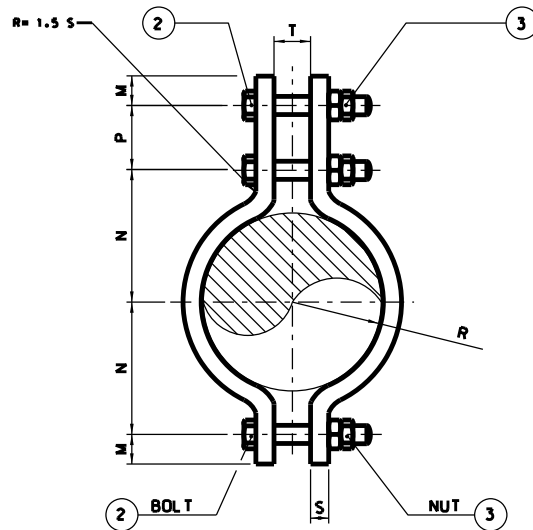
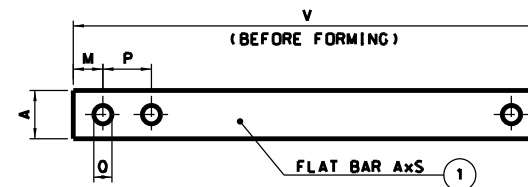


TABLE "1"

DIAM	BOLT	A	M	N	P	Q	R	S	T	V (1)
2"	M12x50	50	25	60	70	14	30	5	12	275
3"		50	25	75	70	14	45	5	12	325
4"		50	25	85	70	14	57	5	12	365
6"		50	25	115	70	14	84	5	12	445
8"	M16x70	60	30	155	70	18	110	10	16	575
10"		60	30	185	80	18	137	10	16	670
12"		60	30	220	80	18	162	10	16	780
14"		60	30	235	80	18	178	10	16	830
16"		60	30	275	80	18	203	10	16	940
18"		60	30	300	80	18	229	10	16	1020
20"	M20x80	70	35	330	90	22	254	10	20	1130
22"		70	35	355	90	22	280	10	20	1210
24"		70	35	380	90	22	305	10	20	1290



DTL "1"

NOTES:

1. APPROXIMATE LENGTH FOR HALF CLAMP BEFORE FORMING.
2. A SHEET OF ELASTOMERIC ISOLATOR BAND Type "CORFLEX" SHALL BE INSERTED BETWEEN CS CLAMP AND SS PIPE. LIMIT OF TEMPERATURE IS 210°C
3. DELETED
4. SUPPLY BY VENDOR.

Support Mark

CE05 DIAM MATCL

④	ISOLATOR	1		(2)	/	(2)	NEOPRENE	(2)	/	(2)	/		
③	NUT	6	SEE TABLE "1"	A194 2H	A194 2H	A194 2H	A194 2H	A194 2H	A194 8	A194 2H	A194 8		
②	BOLT	3	SEE TABLE "1"	A193 87	A193 87	A320 L7	A193 87	A193 87	A193 88	A193 87	A320 88		
①	STRIP	2	FLAT BAR A x S	A36	A387-11	A516-60	A36	A36	A387-11	A36	A240-304		
ITEM	DESCRIPTION	QTY.	DETAIL	CS	CH	CL	CG (3)	AS	AH	SS (2)	SH		

MATCL

Technip

CLAMP ON HORIZONTAL PIPE
FOR DIAM 2" TO 24"

CE05

STANDARD CONSTRUCTION DRAWING
PLANT DESIGN AND PIPING

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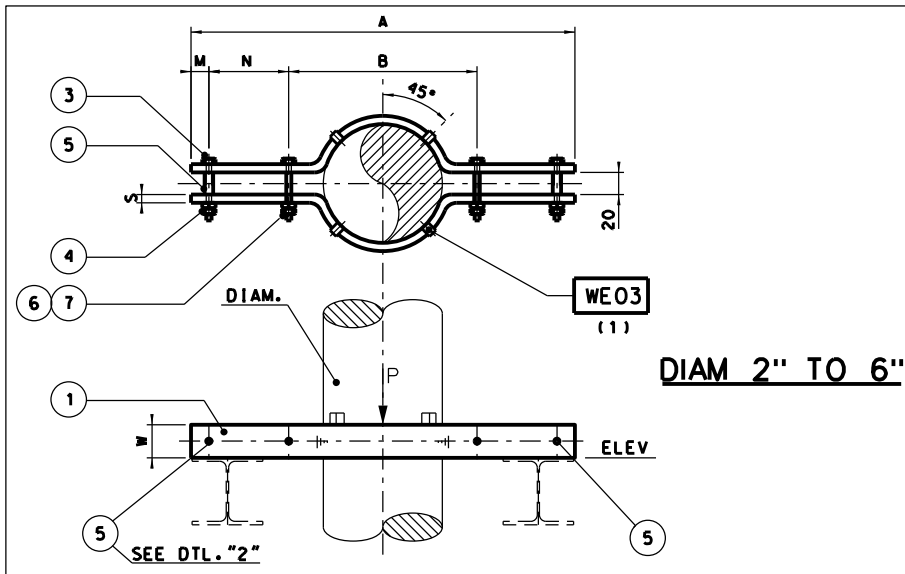
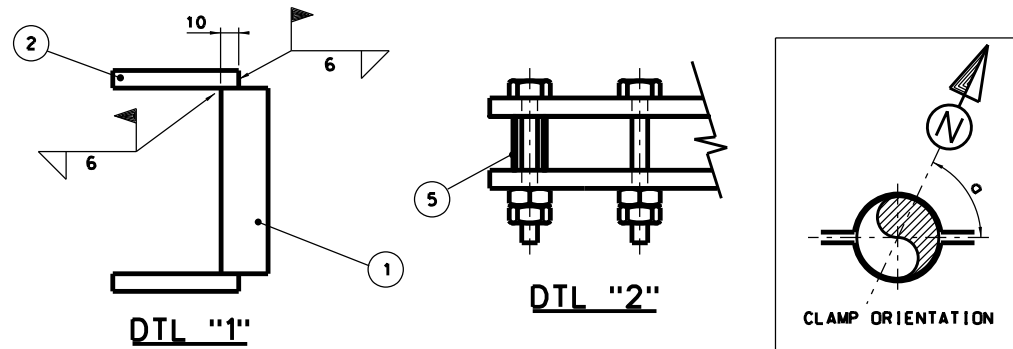
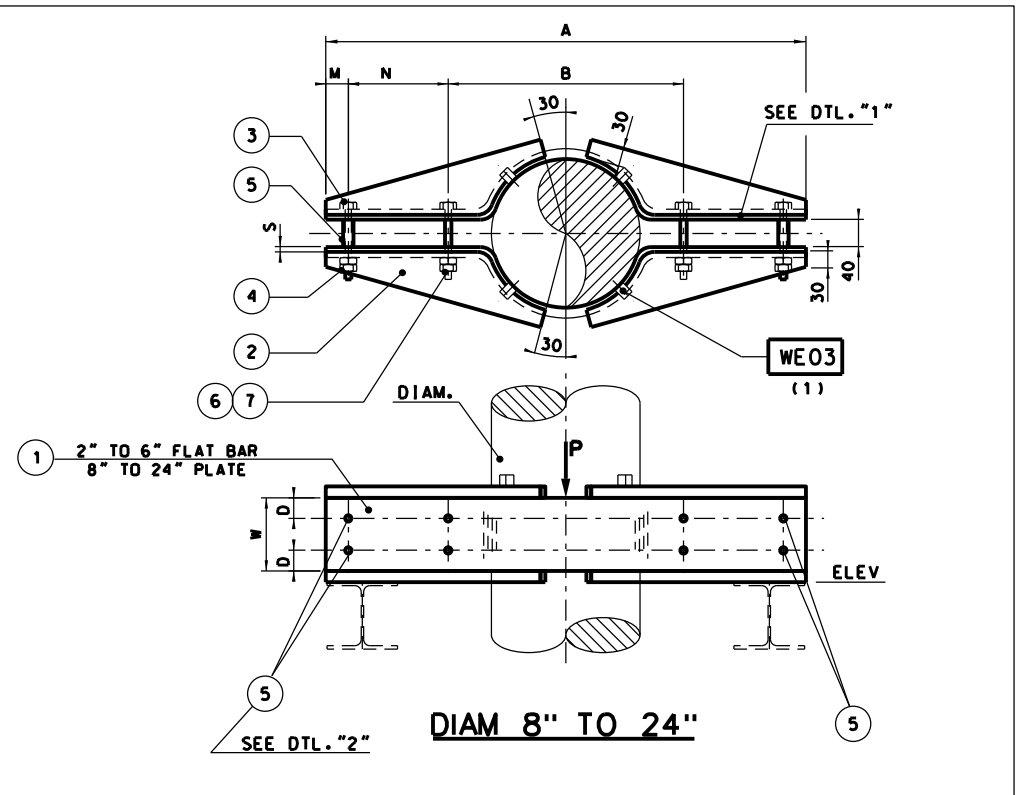


TABLE "1"									
DIAM	BOLT1	BOLT2	A	B	D	M	N	S	W
2"	M12x80	M12x80	380	150	-	40	75	10	70
3"	M12x80	M12x80	415	185	-	40	75	10	70
4"	M12x80	M12x80	440	210	-	40	75	10	100
6"	M20x100	M16x100	520	290	-	40	75	15	100
8"	M24x130	M16x130	970	460	35	50	205	20	130
10"	M24x130	M16x130	1120	510	35	50	255	20	160
12"	M30x150	M20x150	1120	550	45	50	230	25	160
14"	M40x150	M24x150	1120	610	45	50	205	25	160
16"	M40x160	M24x160	1270	660	55	50	255	25	200
18"	M40x180	M24x180	1270	710	55	50	230	35	200
20"	M40x180	M24x180	1420	760	65	50	280	35	220
22"	M40x180	M24x180	1420	810	65	50	255	35	220
24"	M40x180	M24x180	1420	864	65	50	228	35	250

7	NUT2	4/8	SEE TABLE "1"	A194 2H	A194 2H	A194 2H	/	A194 2H	A194 8	A194 2H	A194 8		
6	BOLT2	2/4	SEE TABLE "1"	A193 B7	A193 B7	A320 L7	/	A193 B7	A193 B8	A193 B7	A320 B8		
5	SEPARATOR	2/4	PIPE 1 1/2" SCH. STD	A53-B	A53-B	A53-B	/	A53-B	A53-B	A53-B	A53-B		
4	NUT1	4/8	SEE TABLE "1"	A194 2H	A194 2H	A194 2H	/	A194 2H	A194 2H	A194 2H	A194 2H		
3	BOLT1	2/4	SEE TABLE "1"	A193 B7	A193 B7	A193 B7	/	A193 B7	A193 B7	A193 B7	A193 B7		
2	STIFFENER	4	PLATE THK. 10	A36	A387-11	A516-60	/	A36	A387-11	A240-304	A240-304		
1	STRIP	2	FLAT BAR OR PLATE	A36	A387-11	A516-60	/	A36	A387-11	A240-304	A240-304		
ITEM	DESCRIPTION	QTY.	DETAIL	CS	CH	CL	CG	AS	AH	SS	SH		
MATCL													



NOTES:

1. SHEAR LUG BEARING MUST BE INDICATED ON ISOMETRIC

Support Mark

CE06 DIAM MATCL

Positional Mark

ELEV a

Technip

TIE RISER CLAMP ON VERTICAL PIPE
FOR DIAM 2" TO 24"

CE06

STANDARD CONSTRUCTION DRAWING
PLANT DESIGN AND PIPING

XXXXXXXXXXXX 000 STC1392-06 1 of 1 0
Project Unit Doc. Code & Serial No. Page Rev.

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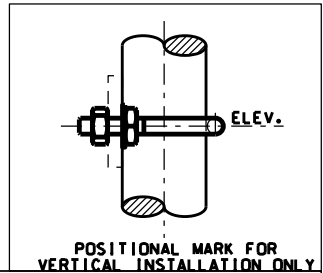
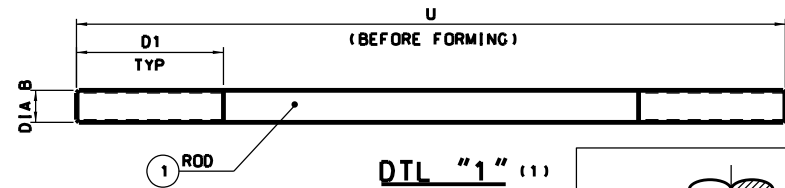
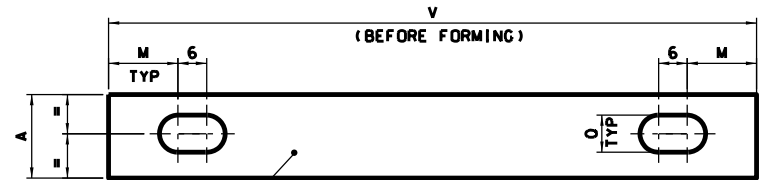
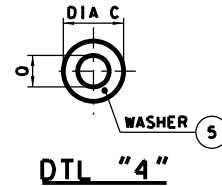
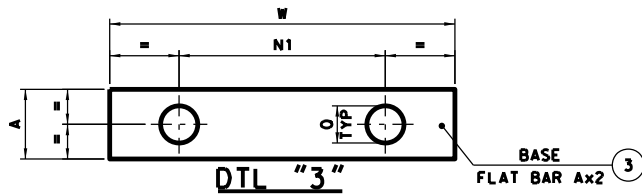
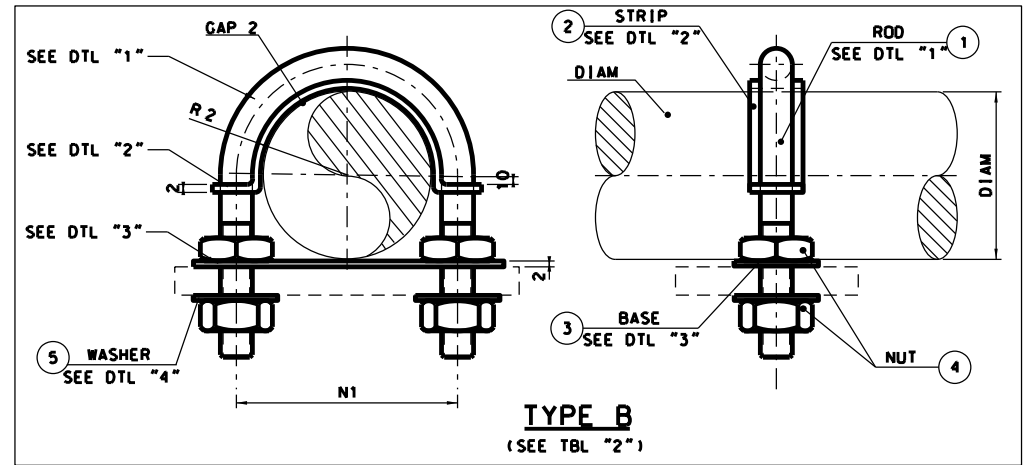
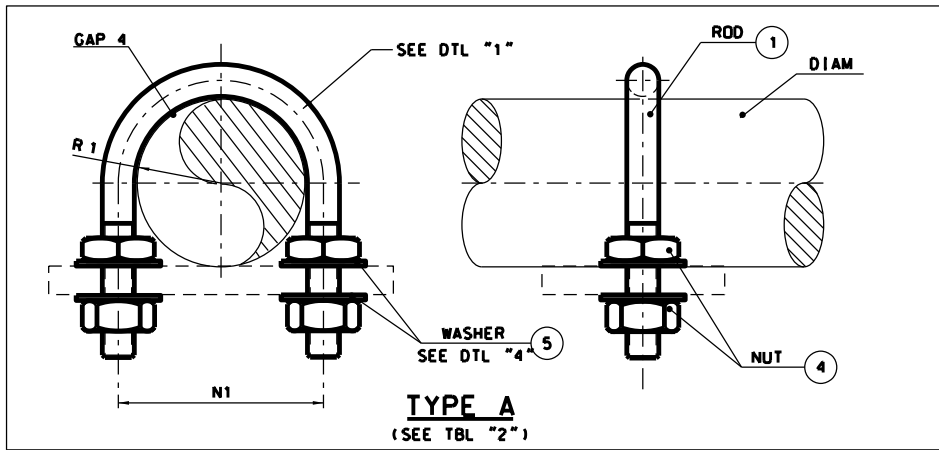


TABLE "1" FOR TYPE A - B													
DIAM	A	D1	DIA B	DIA C	M	N1	NUT	O	R1	R2	U	V	W
2"	50	70	12	24	20	80	M12	14	32	34	280	195	120
3"	50	70	12		20	110	M12	14	47	49	347	242	150
4"	50	70	12		20	134	M12	14	59	61	404	280	175
6"	50	70	12		20	188	M12	14	86	88	549	365	230
8"	60	80	16	30	30	244	M16	18	112	114	697	469	305
10"	60	80	16		30	298	M16	18	139	141	842	553	360
12"	60	80	16		30	348	M16	18	164	166	980	632	410
14"	70	90	20	37	30	384	M20	22	180	182	1077	684	450
16"	70	90	20		30	434	M20	22	205	207	1195	763	495
18"	70	90	20		30	486	M20	22	231	233	1337	844	545
20"	80	110	24	44	35	540	M24	26	256	258	1502	935	610
22"	80	110	24		35	590	M24	26	281	283	1620	1013	660
24"	80	110	24		35	642	M24	26	307	309	1762	1095	710

TBL "2"	
MATCL	TYPE
CS, CH, CL	A
AS, AH	A
SS, SH, CG	B

NOTES:

1. U-BOLT DIMENSIONS ARE ONLY FOR REFERENCE.
DIMENSIONS MAY BE ALSO DEFINED ACCORDING TO MANUFACTURER CATALOGS.

ITEM	DESCRIPTION	QTY.	DETAIL	CS	CH	CL	CG	AS	AH	SS	SH
5	WASHER	2/4	DIA C	A36	A36	A36	/	A36	A36	/	/
4	NUT	4	SEE TABLE "1"	A194 2H	A194 2H	A194 2H	A194 2H	A194 2H	A194 8	A194 2H	A194 8
3	BASE	1	FLAT BAR Ax2	/	/	/	A36 (C)	/	/	A240-304	A240-304
2	STRIP	1	FLAT BAR Ax2	/	/	/	A36 (C)	/	/	A240-304	A240-304
1	U-BOLT	1	ROD DIA B	A193 B7	A193 B7	A320 L7	A193 B7	A193 B7	A193 B8	A193 B7	A320 B8

Support Mark				Positional Mark			
CG01	DIAM	TYPE	MATCL	ELEV			
Technip				NO GRIPPED U-BOLT FOR DIAM 2" TO 24"			
STANDARD CONSTRUCTION DRAWING PLANT DESIGN AND PIPING				XXXXXXXXXXXX 000 STC1392-09 1 of 1 0			
Project				Unit Doc. Code & Serial No. Page Rev.			

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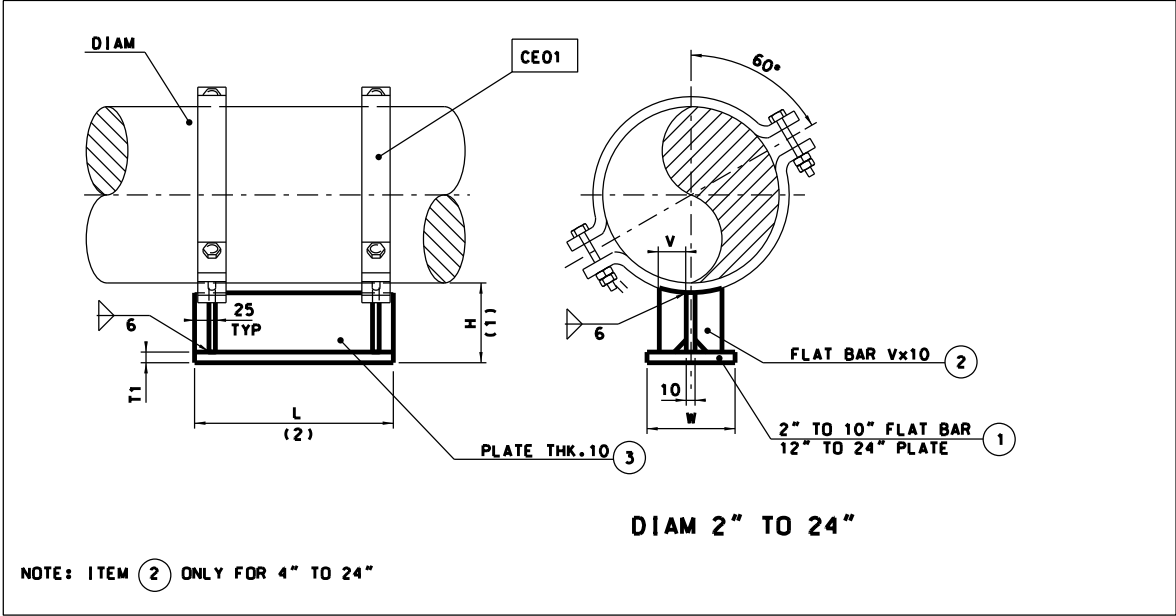
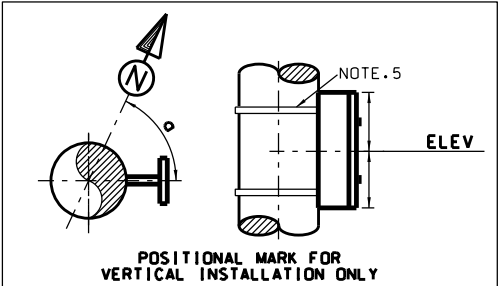


TABLE "1"			
DIAM	T1	W	V
2" TO 3"	10	100	-
4"	10	100	40
6"	10	150	60
8" TO 10"	10	200	80
12" TO 14"	10	250	100
16" TO 18"	15	350	150
20" TO 24"	15	450	200



NOTES:

1. H MAX = 200. H DIMENSION MUST BE CHECKED AFTER CLAMP WELDING.
2. L = 300 TO 900. WITH STEP 100
3. DELETED
4. MAXI OPERATING 210° C.
5. FOR VERTICAL LINE WE03 Type A . SHALL BE USED

ITEM	DESCRIPTION	QTY.	DETAIL	CS	CH	CL	CG	AS	AH	SS(4)	SH
3	STANCHION	1	PLATE THK. 10	A36	A387-11	/	A36	A36	A387-11	A36	A240-304
2	RIB	4	FLAT BAR Vx10	A36	A387-11	/	A36	A36	A387-11	A36	A240-304
1	BASE PLATE	1	FLAT BAR/PLATE	A36	A36	/	A36	A36	A36	A36	

Support Mark

CR01

DIAM

H

L

MATCL

Positional Mark

ELEV

a

Technip

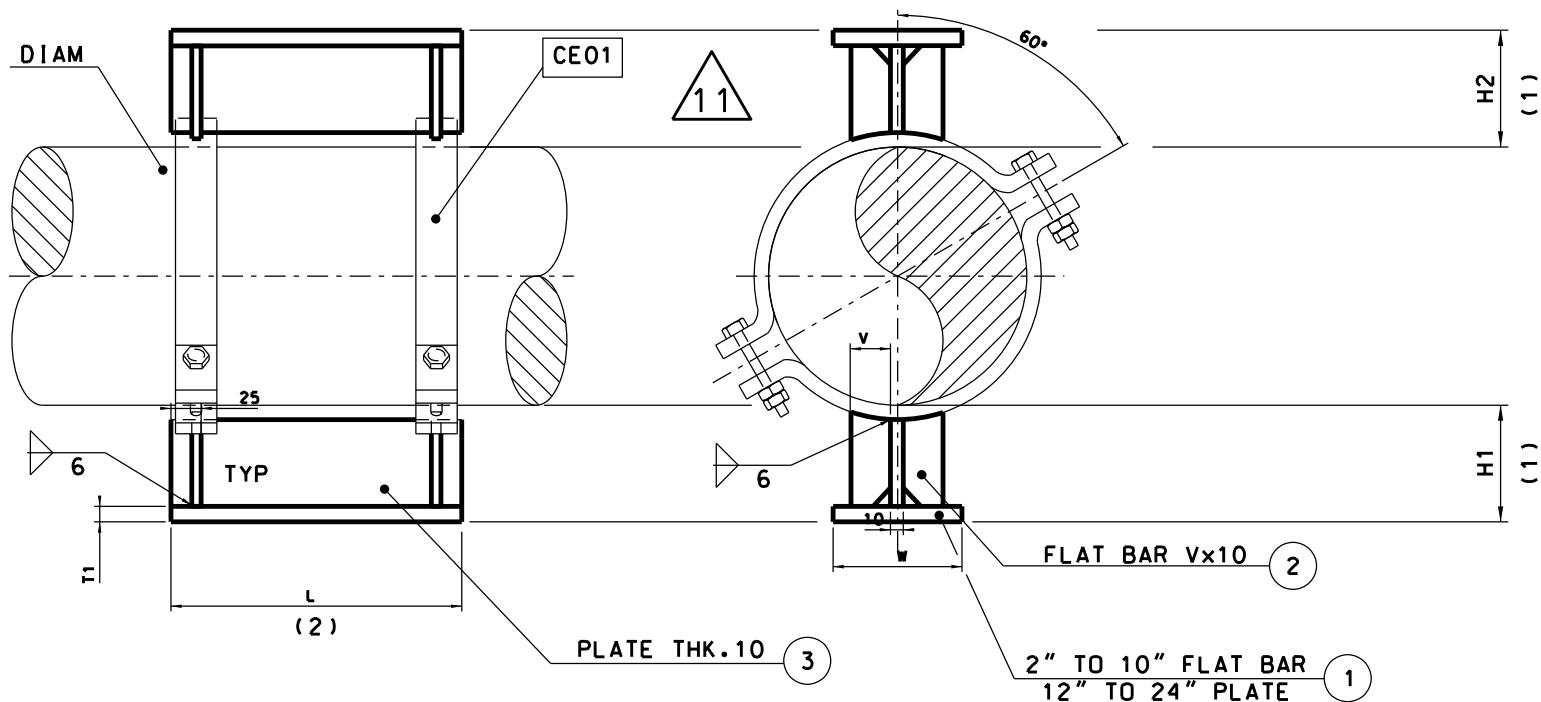
VARIABLE HEIGHT SHOES
FOR DIAM 2" TO 24"

CR01

STANDARD CONSTRUCTION DRAWING
PLANT DESIGN AND PIPING

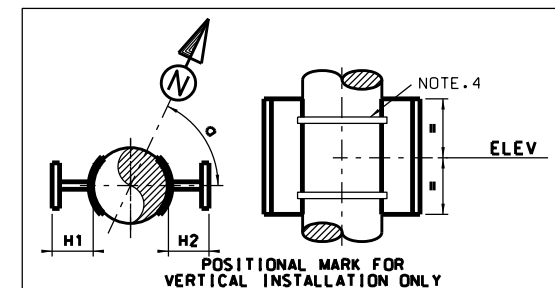
XXXXXXXXXXXX 000 STC 1392-10 1 of 1 0

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DIAM 2" TO 24"

TABLE "1"			
DIAM	T1	W	V
2" TO 3"	10	100	-
4"	10	100	40
6"	10	150	60
8" TO 10"	10	200	80
12" TO 14"	10	250	100
16" TO 18"	15	350	150
20" TO 24"	15	450	200



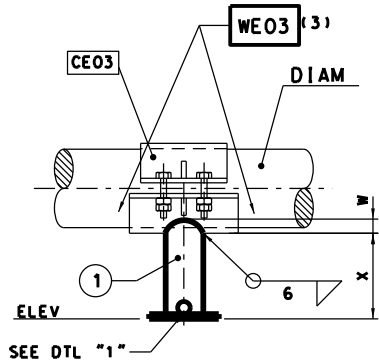
NOTES:

1. H1 AND H2 MAX = 200. H DIMENSION MUST BE CHECKED AFTER CLAMP WELDING.
2. L = 300 TO 900. WITH STEP 100
3. DELETED
4. FOR VERTICAL LINE WE03 Type A . SHALL BF USED

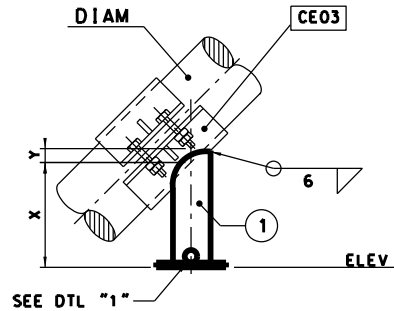
ITEM	DESCRIPTION	QTY.	DETAIL	CS	CH	CL	CG	AS	AH	SS	SH
3	STANCHION	2	PLATE THK. 10	A36	A387-11	A516-60	A36	A36	A387-11	A36	A240-304
2	RIB	8	FLAT BAR Vx10	A36	A387-11	A516-60	A36	A36	A387-11	A36	A240-304
1	BASE PLATE	2	FLAT BAR OR PLATE	A36	A36	A36	A36	A36	A36	A36	A36
ITEM DESCRIPTION QTY. DETAIL				CS	CH	CL	CG	AS	AH	SS	SH

Support Mark				Positional Mark			
CRO3				ELEV a			
TECHNIP				DOUBLE VARIABLE HEIGHT SHOES FOR DIAM 2" TO 24"			
STANDARD CONSTRUCTION DRAWING				XXXXXXX 000 STC 1392-12 1 of 1 0			
PLANT DESIGN AND PIPING				Project Unit Doc. Code & Serial No. Page Rev.			

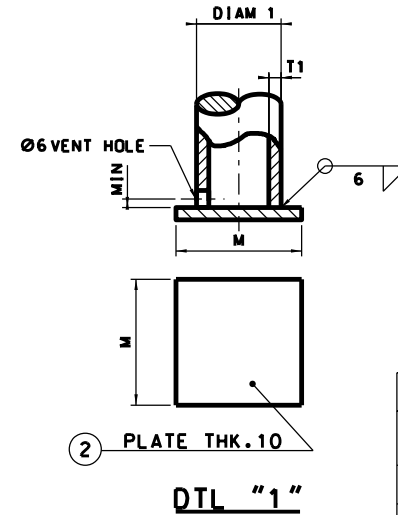
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TYPE A
DIAM 2" TO 24"



TYPE B
DIAM 2" TO 24"



TBL "2"	
MATCL	T1
CG, CS, CH, CL	STD
AS, AH, SS	STD
SH	40S

TBL "1"					
DIAM	DIAM 1	W	Y	Z	M
2"	1 1/2"	12	48	71	100
3"	2"	12	60	93	100
4"	3"	21	89	137	150
6"	4"	22	114	186	150
8"	6"	39	168	272	210
10"	6"	29	168	291	210
12"	8"	43	219	370	250
14"	10"	60	273	472	300
16"	12"	80	324	557	350
18"	14"	80	356	614	400
20"	16"	96	467	699	450
22"	16"	84	407	712	450
24"	16	75	407	732	450

NOTES:

1. X DIMENSION FROM 200 TO 800 ADJUSTED AT ERECTION.
2. DELETED
3. WE03 MUST BE USED FOR STOP AND ANCHOR AND INDICATED ON ISOMETRIC

Support Mark

Positional Mark

CR05 DIAM DIAM1 TYPE X MATCL ELEV

Technip

VERTICAL DUMMY LEG
FOR DIAM 2" TO 24"

CR05

STANDARD CONSTRUCTION DRAWING
PLANT DESIGN AND PIPING

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ITEM	DESCRIPTION	QTY.	DETAIL	CS	CH	CL	CG	AS	AH	SS	SH
2	BASE	1	PLATE THK.10	A36	A36	A36	A36	A36	A36	A36	A36
1	DUMMY	1	PIPE DIAM1 SCH T1	A106 Gr B	A106 Gr B	A333-6	A106 Gr B	A106 Gr B	A335-P11	A106 Gr B	A312-Tp304

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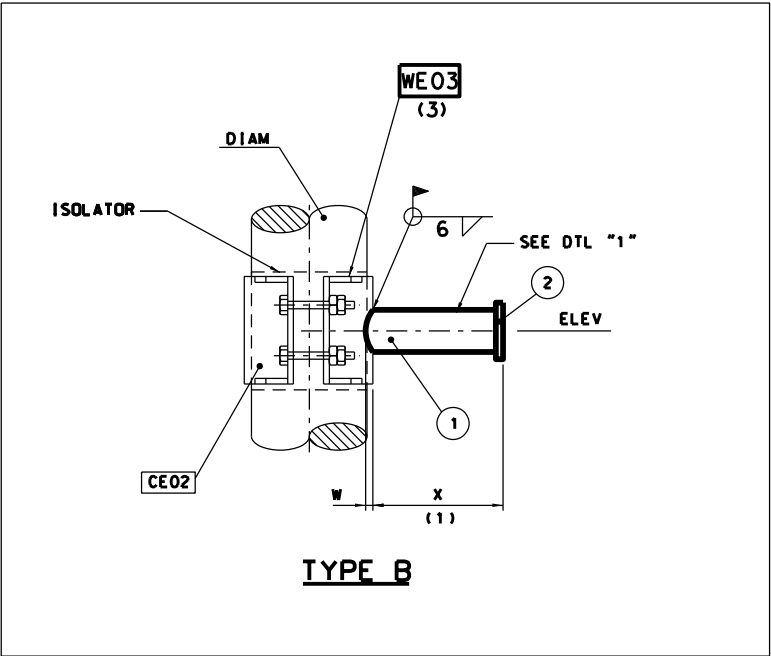
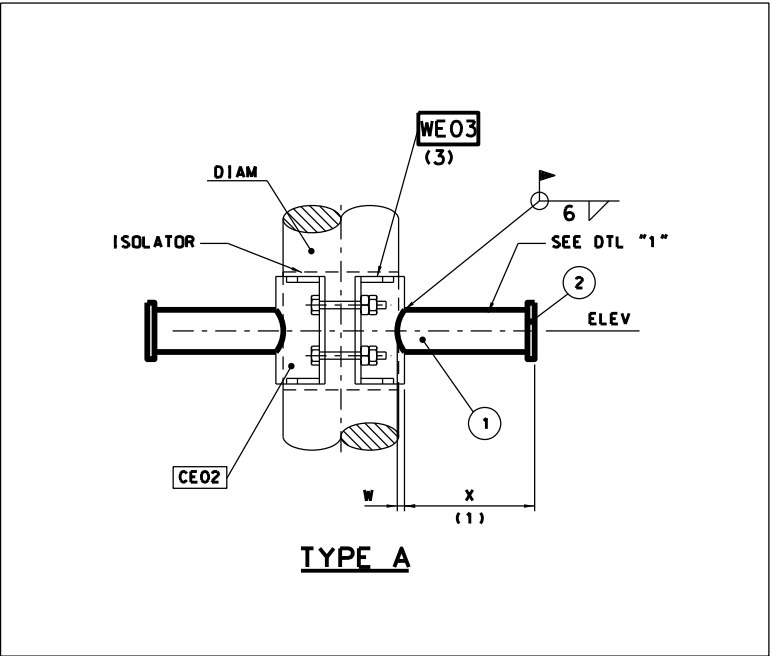
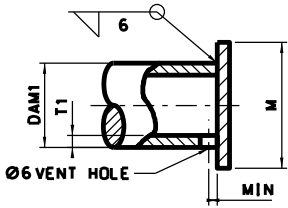
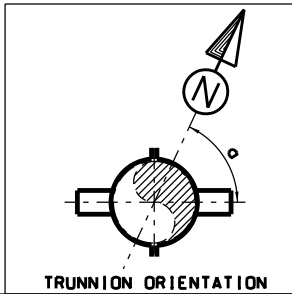
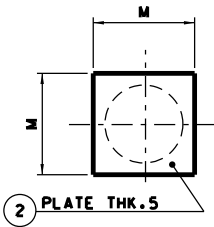


TABLE "1"			
DIAM	DIAM1	M	W
2"	1 1/2"	60	SEE TABLE "1" ON CR05
3"	2"	70	
4"	3"	100	
6"	4"	125	
8" TO 12"	6"	180	
14" TO 18"	10"	285	
20" TO 24"	12"	335	

TBL "2"	
MATCL	T1
CG, CS, CH, CL	STD
AS, AH, SS	STD
SH	40S



DTL "1"



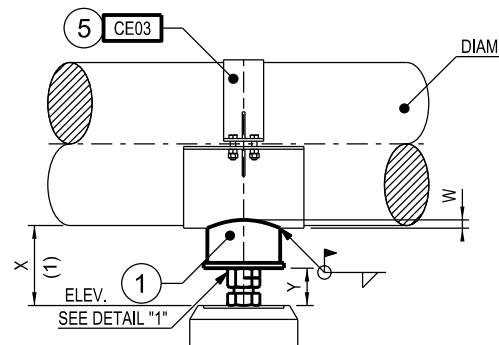
NOTES:

1. X DIMENSION SHALL BE FROM 200 TO 800 ADJUSTED AT ERECTION IF NECESSARY.
2. DELETED.
3. DO NOT USE WE03 ON GALVANIZED CARBON STEEL

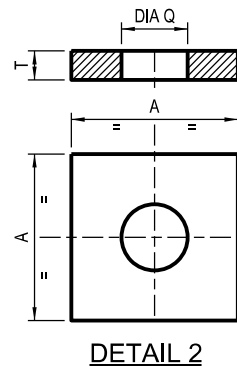
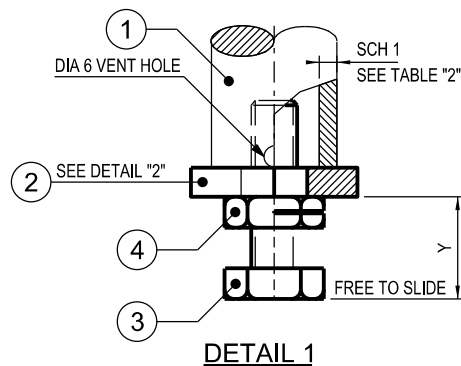
ITEM	DESCRIPTION	QTY.	DETAIL	CS	CH	CL	CG (3)	AS	AH	SS	SH
(2)	COVER	1-2	PLATE THK. 5	A36	A36	A36	A36	A36	A36	A36	A36
(1)	DUMMY	1-2	PIPE DIAM1 SCH. T1	A106 Gr B	A106 Gr B	A333-6	A106 Gr B	A106 Gr B	A335-P11	A106 Gr B	A312-1p304

Support Mark	Positional Mark
CR07	DIAM DIAM1 TYPE X MATCL
ELEV	a

Technip	TRUNNION FOR DIAM 2" TO 24"	CR07
STANDARD CONSTRUCTION DRAWING PLANT DESIGN AND PIPING	XXXXXXXXXXXX 000 STC 1392-16 1 of 1 0	
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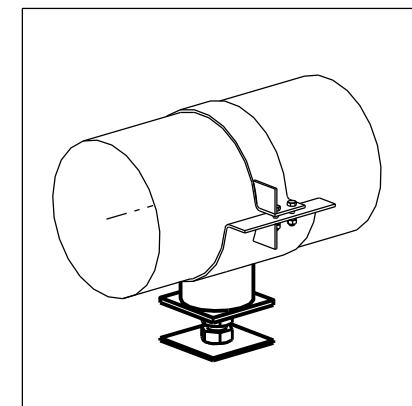


TYPE A
ND 50 TO 600 / DIAM 2" TO 24"



DIAM		DIAM1		SCREW	Y	A	DIA Q	T	W	Z
ND	Inch	ND	Inch							
50	2"	40	1 1/2"	M33x170	80	80	40	10	12	
80	3"	50	2"	M36x170	90	80	40	10	12	
100	4"	80	3"	M36x170	90	110	50	10	21	
150	6"	100	4"	M36x170	90	110	50	10	22	
200	8"	150	6"	M48x170	100	200	60	15	39	
250	10"	150	6"	M48x170	100	200	60	15	29	
300	12"	200	8"	M48x170	100	250	60	15	43	
350	14"	250	10"	M48x170	100	250	60	15	60	
400	16"	300	12"	M72x170	140	300	80	20	80	
450	18"	350	14"	M72x170	140	300	80	20	80	
500	20"	400	16"	M72x170	140	300	80	20	96	
550	22"	400	16"	M72x170	140	300	80	20	84	
600	24"	400	16"	M72x170	140	300	80	20	75	

TABLE 2	
MATCL	SCH.1
CG-CS-CH-CL	STD
AH-AS-SS	STD
SH	40S

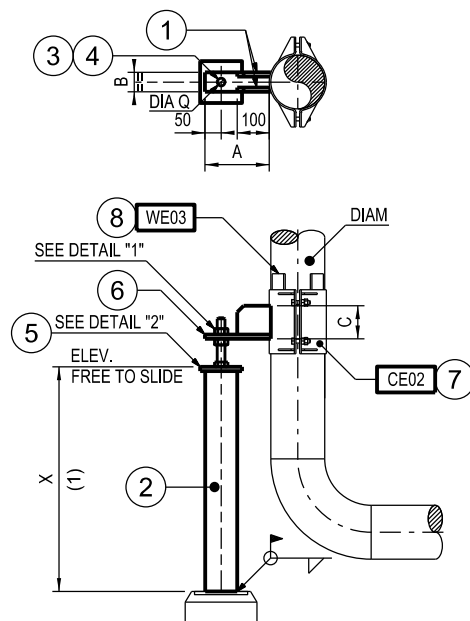


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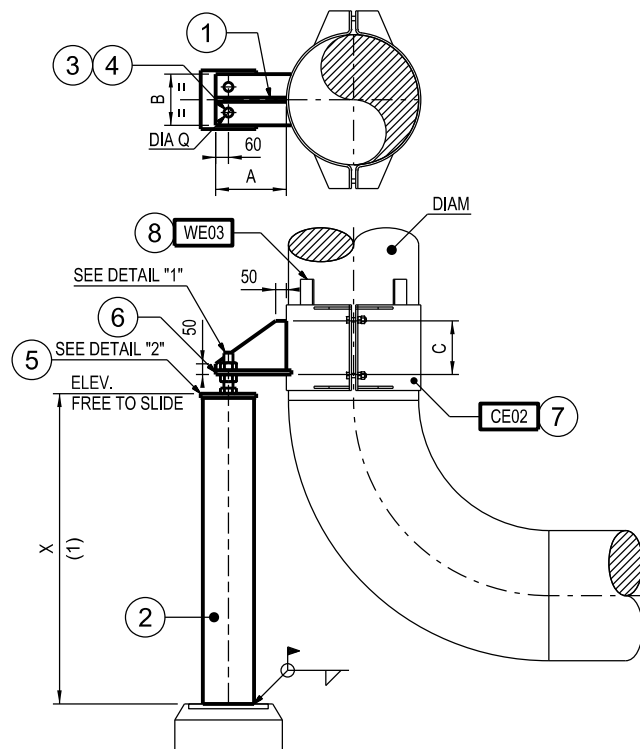
1. X = 300 TO 500 TO BE ADJUSTED AT ERECTION.
2. LIMIT OF TEMPERATURE IS 300°C REFER TO CE03.

(6)														
(5)	CLAMP	1	REFER TO CE03 (2)	/	/	/	/	/	/	/	/			
(4)	LOCK NUT	1	SEE TABLE 1	A194-2H	A194-2H	A194-2H	A194-2H	A194-2H	A194-2H	A194-2H	A194-2H			
(3)	SCREW	1	SEE TABLE 1	A193-B7	A193-B7	A193-B7	A193-B7	A193-B7	A193-B7	A193-B7	A193-B7			
(2)	BASE	1	PLATE Thk. T	A36	A36	A36	A36	A36	A36	A36	A36			
(1)	STANCHION	1	DIAM 1 SCH.1	A106 Gr B	A106 Gr B	A106 Gr B	A106 Gr B	A106 Gr B	A335-P11	A106 Gr B	A312-304			
ITEM	DESCRIPTION	QTY.	DETAIL	CS	CH	CL	CG	AS	AH	SS	SH			
				MATCL										

Support Mark					Positional Mark						
CR09	DIAM	DIAM1	TYPE	X	MATCL	ELEV					
<i>Technip</i>					ADJUSTABLE STANCHION FOR DIAM 2" TO 24"					CR09	
STANDARD CONSTRUCTION DRAWING PLANT DESIGN AND PIPING					XXXXXX	000	STC - 1392 - 18			1 of 1	1
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ND 50 TO 150 / DIAM 2" TO 6"



ND 200 TO 600 / DIAM 8" TO 24"

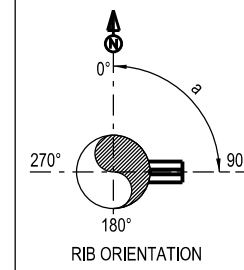
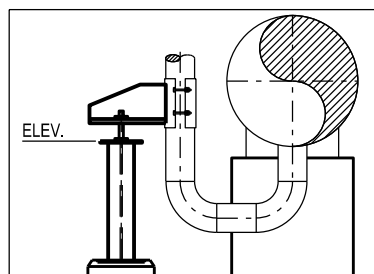
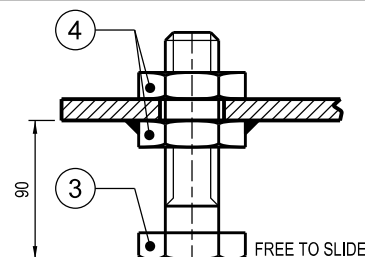


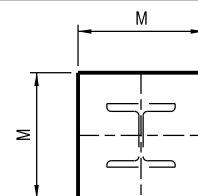
TABLE										
DIAM ND	Inch	LEG	A	B	C	M	DIA Q	SCREW	X MAXI	
50	2"	MB100	200	60	100	130	26	M24x170	1000	
80	3"	MB100	200	60	100	130	26	M24x170	1000	
100	4"	MB100	200	60	100	130	26	M24x170	1000	
150	6"	MB100	200	60	100	130	26	M24x170	1000	
200	8"	MB150	290	160	150	180	32	M30x170	1250	
250	10"	MB150	290	160	150	180	32	M30x170	1250	
300	12"	MB150	290	160	150	180	32	M30x170	1250	
350	14"	MB200	310	200	200	220	38	M36x170	1500	
400	16"	MB200	310	200	200	220	38	M36x170	1500	
450	18"	MB200	310	200	200	220	38	M36x170	1500	
500	20"	MB250	330	240	250	260	44	M42x170	1750	
550	22"	MB250	330	240	250	260	44	M42x170	1750	
600	24"	MB250	330	240	250	260	44	M42x170	1750	



TYPICAL ASSEMBLY

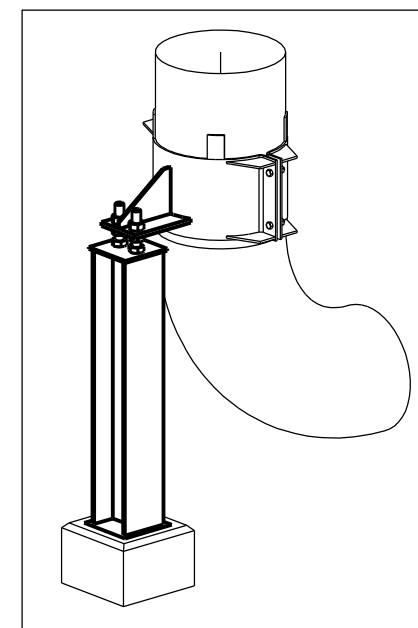


DETAIL 1



DETAIL 2

- NOTES:
1. X = MAXI SEE TABLE BY STEPS OF 100 TO BE ADJUSTED AT ERECTION IF NECESSARY.
2. LIMIT OF TEMPERATURE IS 300°C REFER TO CE02.



8	ANTI SLIDING	1	REFER TO WE03	/	/	/	/	/	/	/	/		
7	CLAMP	1	REFER TO CE02 (2)	/	/	/	/	/	/	/	/		
6	PLATE	1	PLATE Thk. 10	A36	A516-60	A516-60	A36	A36	A387-11	A36	A240-304		
5	BASE	1	PLATE Thk. 10	A36	A36	A36	A36	A36	A36	A36	A36		
4	NUT	2/4	SERIAL H	A194-2H	A194-2H	A194-2H	A194-2H	A194-2H	A194-2H	A194-2H	A194-2H		
3	SCREW	1/2	SEE TABLE	A193-B7	A193-B7	A193-B7	A193-B7	A193-B7	A193-B7	A193-B7	A193-B7		
2	LEG	1	SEE TABLE	A36	A36	A36	A36	A36	A36	A36	A36		
1	RIB	1/2	PLATE C x 10	A36	A516-60	A516-60	A36	A36	A387-11	A36	A240-304		
ITEM	DESCRIPTION	QTY.	DETAIL	CS	CH	CL	CG	AS	AH	SS	SH		

Support Mark

CR10 DIAM X MATCL

Positional Mark

ELEV a

Technip

CLAMPED ADJUSTABLE LEG
FOR DIAM 2" TO 24"

CR10

STANDARD CONSTRUCTION DRAWING
PLANT DESIGN AND PIPING

XXXXXX
Project

000
Unit

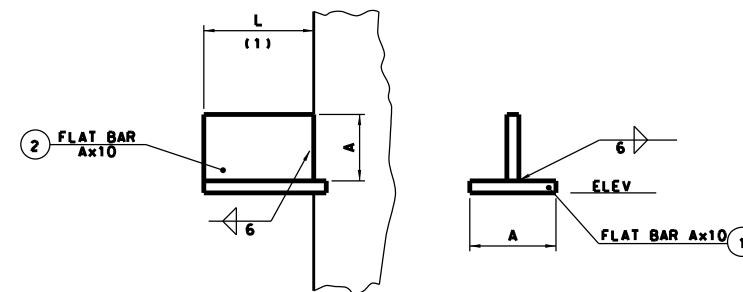
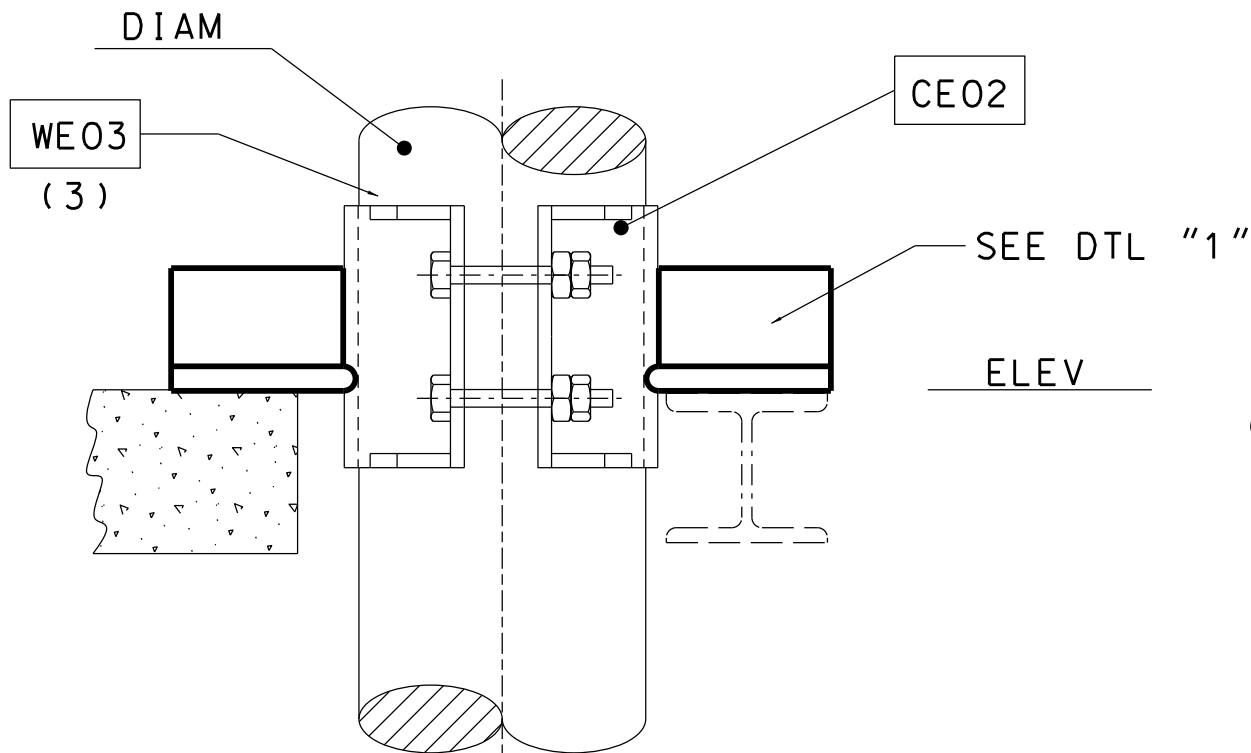
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DTL "1"

DIAM 2" TO 24"

TABLE "1"

DIAM	Ax10
2" TO 6"	50x10
8" TO 18"	100x10
20" TO 24"	150x10

ITEM	DESCRIPTION	QTY.	DETAIL	CS	CH	CL	CG	AS	AH	SS	SH
2	STIFFENER	2	FLAT BAR Ax10	A36	A387-11	A516-60	A36	A36	A387-11	A36	A240-304
1	PLATE	2	FLAT BAR Ax10	A36	A387-11	A516-60	A36	A36	A387-11	A36	A240-304

MATCL

NOTES:

1. L DIMENSION SHALL BE FROM 150 TO 300 WITH STEP 50 ADJUSTED AT ERECTION IF NECESSARY.
2. DELETED
3. DO NOT USE WE03 ON GALVANIZED CARBON STEEL LINES.

Support Mark

CR11 DIAM L MATCL

Positional Mark

ELEV a

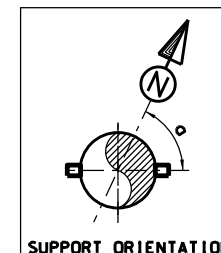
Technip

VERTICAL SUPPORT ON PLATFORMS
FOR DIAM 2" TO 24"

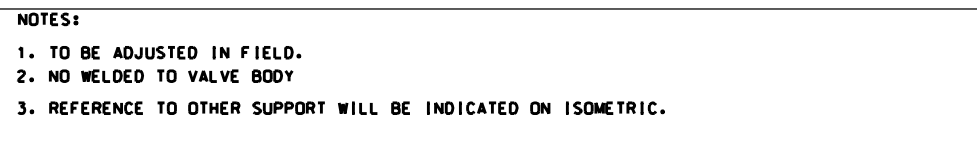
CR11

STANDARD CONSTRUCTION DRAWING
PLANT DESIGN AND PIPING

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SUPPORT ORIENTATION



Support Mark				
CR13	DIAM	MATCL		
<i>Technip</i>		STIFFENERS ON SMALL VALVES FOR DIAM 2" TO 24"		CR13
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		Project	Unit	Doc. Code & Serial No.
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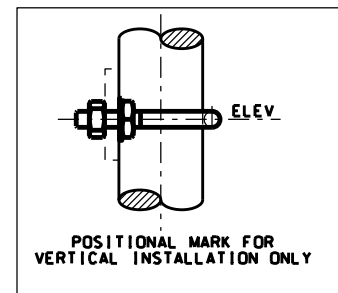
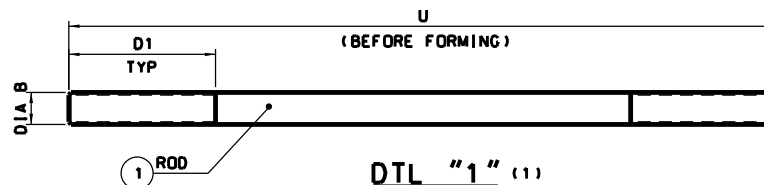
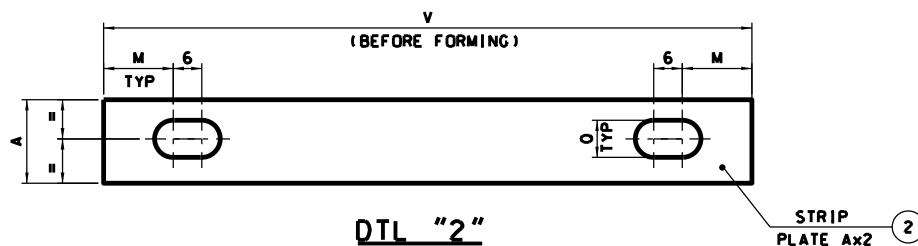
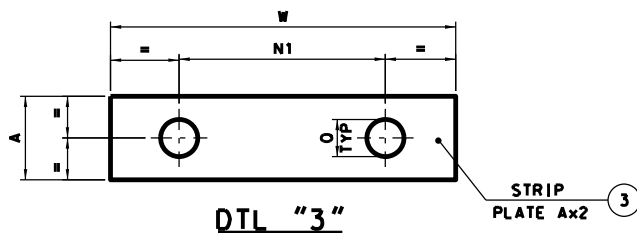
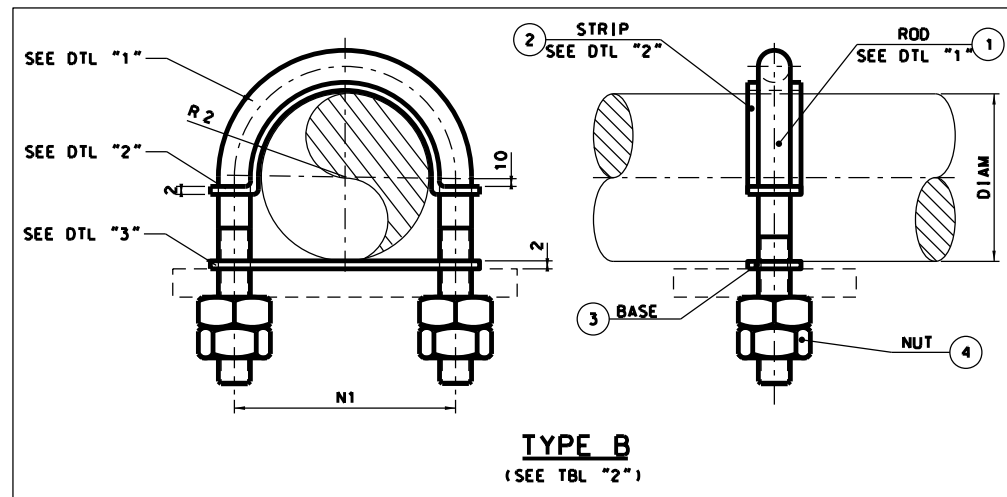
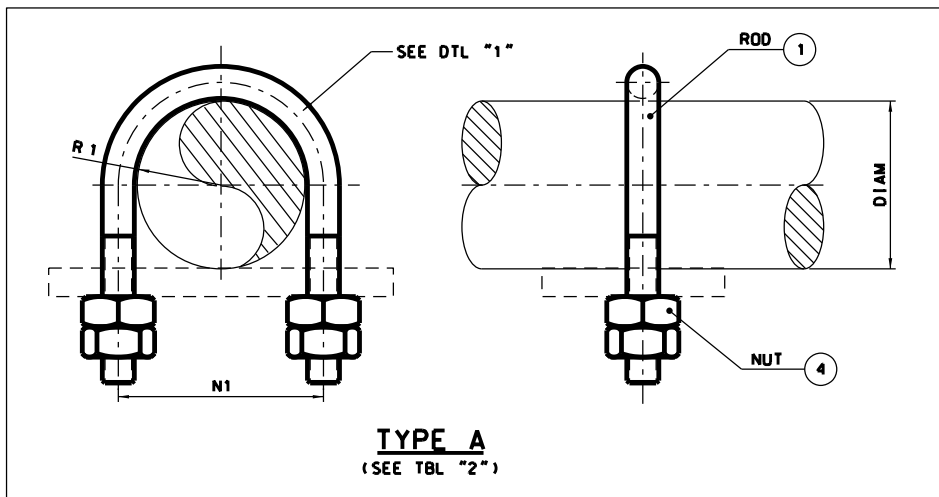


TABLE "1" FOR TYPE A - B												
DIAM	A	D1	DIA B	M	N1	NUT	O	R1	R2	U	V	W
2"	50	70	12	20	80	M12	14	32	34	280	195	120
3"	50	70	12	20	110	M12	14	47	49	347	242	150
4"	50	70	12	20	134	M12	14	59	61	404	280	175
6"	50	70	12	20	188	M12	14	86	88	549	365	230
8"	60	80	16	30	244	M16	18	112	114	697	469	305
10"	60	80	16	30	298	M16	18	139	141	842	553	360
12"	60	80	16	30	348	M16	18	164	166	980	632	410
14"	100	90	20	30	384	M20	22	180	182	1077	684	445
16"	100	90	20	30	434	M20	22	205	207	1195	763	495
18"	100	90	20	30	486	M20	22	231	233	1337	844	545
20"	100	110	24	35	540	M24	26	256	258	1502	935	610
22"	100	110	24	35	590	M24	26	281	283	1620	1013	660
24"	100	110	24	35	642	M24	26	307	309	1762	1095	710

TBL "2"	
MATCL	TYPE
CS, CH, CL	A
AS, AH	A
SS, SH, CG	B

NOTES:

1. U-BOLT DIMENSIONS ARE ONLY FOR REFERENCE DIMENSIONS MAY BE ALSO DEFINED ACCORDING TO MANUFACTURER CATALOGS.

ITEM	DESCRIPTION	QTY.	DETAIL	CS	CH	CL	CG	AS	AH	SS	SH
4	NUT	4	SEE TABLE "1"	A194 2H	A194 2H	A194 2H	A194 2H	A194 2H	A194 8	A194 2H	A194 8
3	BASE	1	PLATE Ax2	-	-	-	A36 (C)	-	-	A240-304	A240-304
2	STRIP	1	PLATE Ax2	-	-	-	A36 (C)	-	-	A240-304	A240-304
1	U-BOLT	1	ROD DIA B	A193 B7	A193 B7	A320 L7	A193 B7	A193 B7	A193 B8	A193 B7	A320 B8

Support Mark				Positional Mark			
CS01	DIAM	TYPE	MATCL	ELEV			
Technip				GRIPPED U-BOLT FOR DIAM 2" TO 24"			CS01
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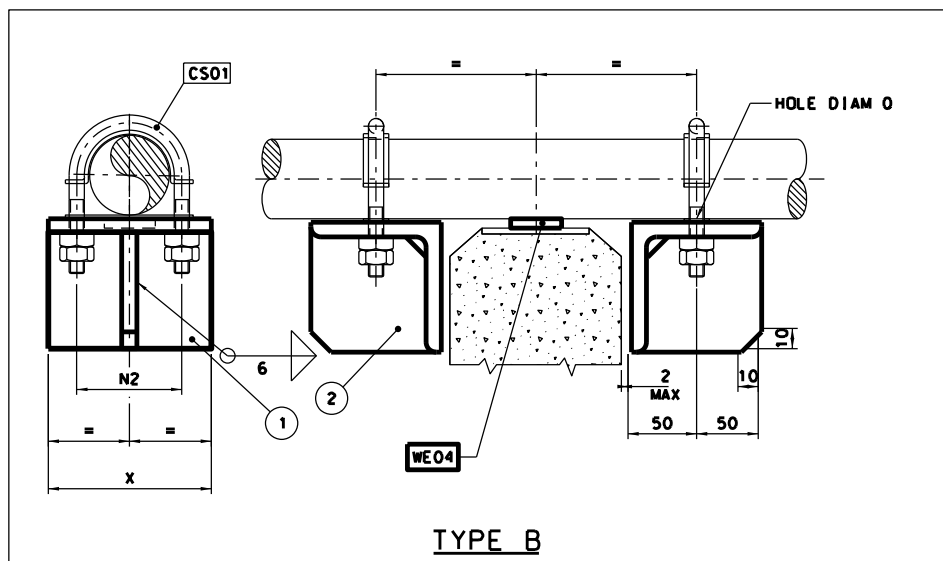
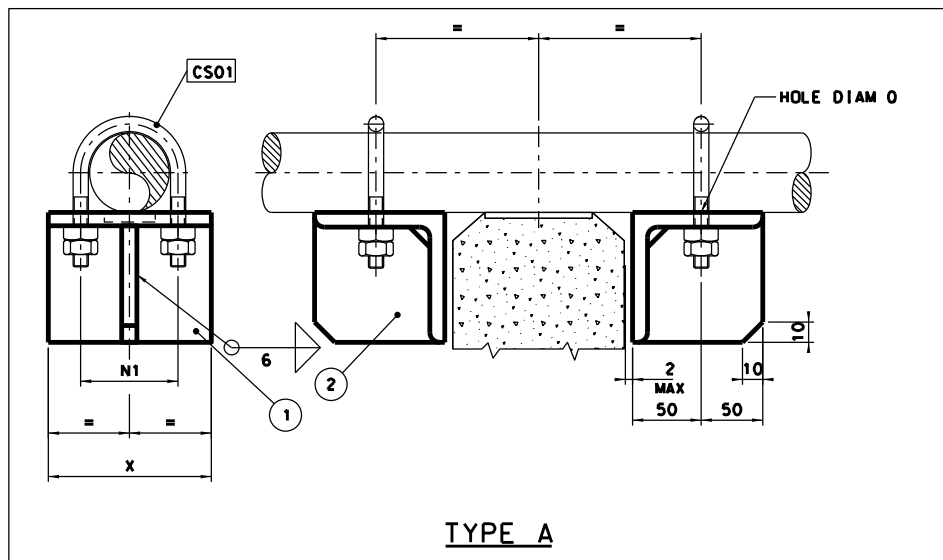


TABLE "1"

TABLE "1"				
DIAM	N1	N2	O	X
2"	76	80	14	135
3"	106	110	14	165
4"	130	134	14	190
6"	184	188	14	245
8"	240	244	18	320
10"	294	298	18	370
12"	344	348	18	420

TBL "2"

TBL "2"	
MATCL	TYPE
CS, AS	A
CG, SS	B

NOTES:

1. DELETED.

Support + Mark

CS02	DIAM	TYPE	MATCL
------	------	------	-------

Technip

STOP ON UNINSULATED PIPE
FOR DIAM 2" TO 12"

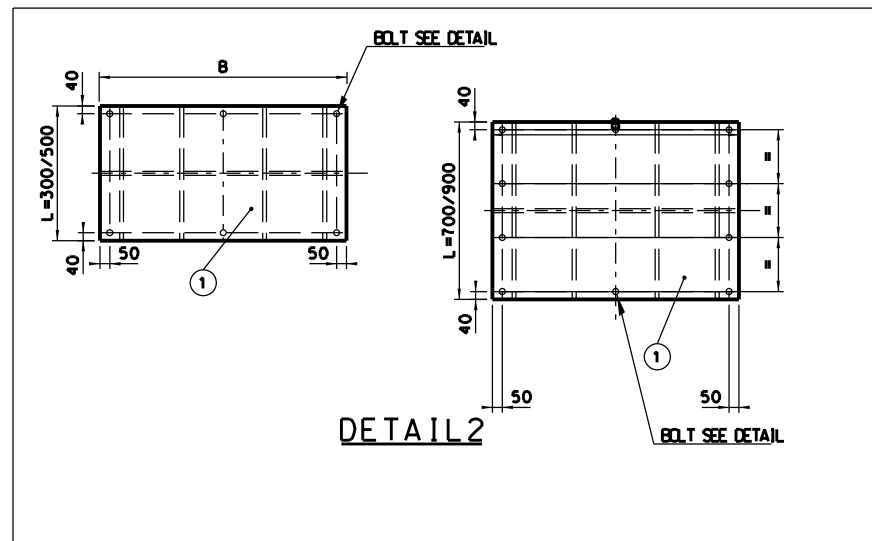
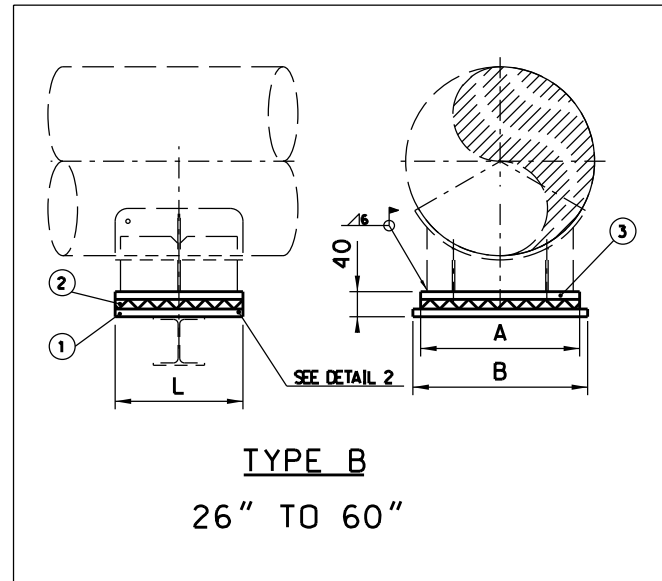
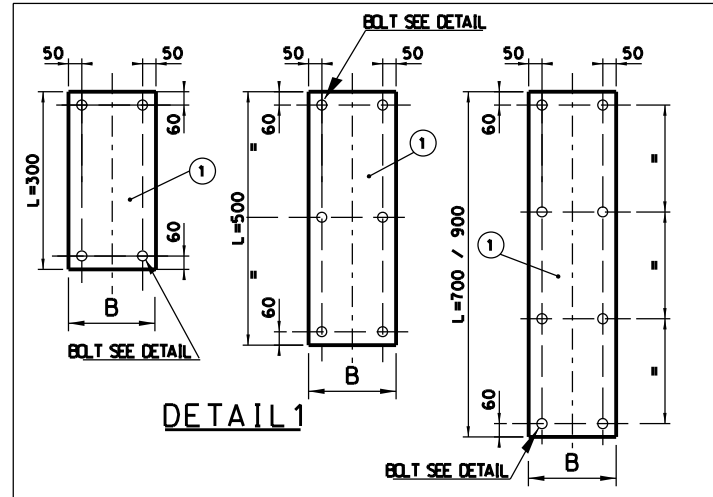
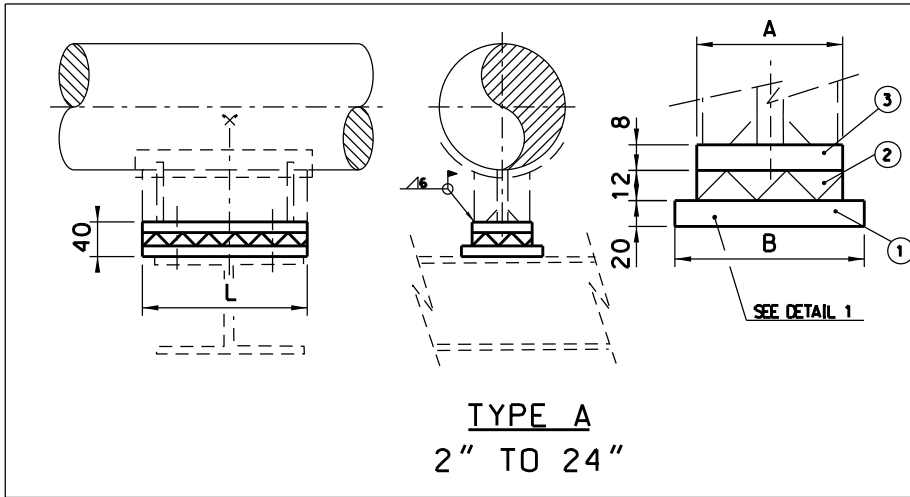
CS02

STANDARD CONSTRUCTION DRAWING PLANT DESIGN AND PIPING

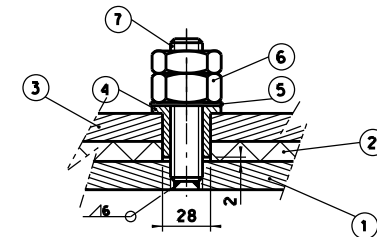
G	XXXXXXXXXX	000	STC 1392-24	1 of 1	0
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(2)	STIFFENER	2	PLATE BAR THK. 10	A36	/	/	A36	A36	/	A36	/			
(1)	STOP	2	L10	A36	/	/	A36	A36	/	A36	/			
ITEM	DESCRIPTION	QTY.	DETAIL	CS	CH	CL	CG	AS	AH	SS	SH			
								MATCL						

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PIPE SIZE	A	B
1/2"-1 1/8"	160	200
2"	160	200
3"	160	200
4"	160	200
6"	160	200
8"	200	240
10"	200	240
12"	250	290
14"	250	290
16"	350	390
18"	350	390
20"	450	490
22"	450	490
24"	450	490



PIPE SIZE	A	B
26"	550	590
28"	600	640
30"	650	690
32"	750	790
34"	750	790
36"	800	840
38"	850	890
40"	900	940
42"	950	990
44"	950	990
46"	1000	1040
48"	1050	1090
50"	1100	1140
52"	1150	1190
54"	1200	1240
56"	1250	1290
60"	1300	1340

7	STUD BOLT	(1)	M24x100	A193 B7	A193 B7	A320 L7	/	A193 B7	A193 B8	A193 B7	A320 B8		
6	NUT H/HM	(1)	M24	A194 2H	A194 2H	A194 2H	/	A194 2H	A194 B	A194 2H	A194 B		
5	WASHER PLATE	(1)	DIA.50x4	A36	A36	A36	/	A36	A36	A36	A36		
4	RED. WASHER	(1)	BY VENDOR (3)	/	/	/	/	/	/	/	/		
3	PLATE	1	PLATE AxL	A36	A36	A36	/	A36	A36	A36	A36		
2	ACOUSTIC PAD	1	BY VENDOR (3)	/	/	/	/	/	/	/	/		
1	BASE PLATE	1	PLATE BxL	A36	A36	A36	/	A36	A36	A36	A36		
ITEM	DESCRIPTION	QTY.	DETAIL	CS	CH	CL	CG	AS	AH	SS	SH		

MATCL

NOTES:

1. QUANTITY DEPENDS OF SIZE. REFER TO DETAILS.
2. DELETED.
3. FABREEKA PAD 12mm OR EQUIVALENT.

Support Mark

HA01 DIAM TYPE L

Technip

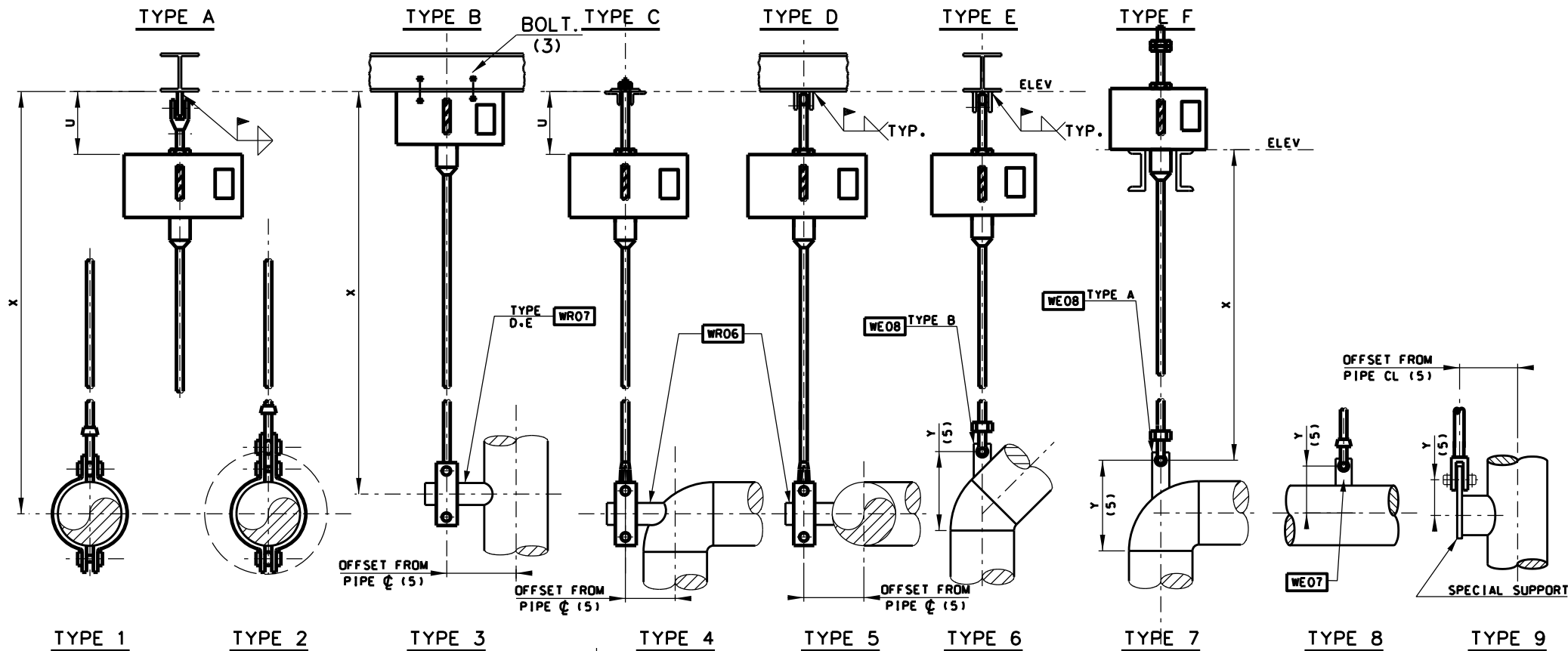
ACOUSTIC ATTENUATION PAD
FOR DIAM 2" TO 60"

HA01

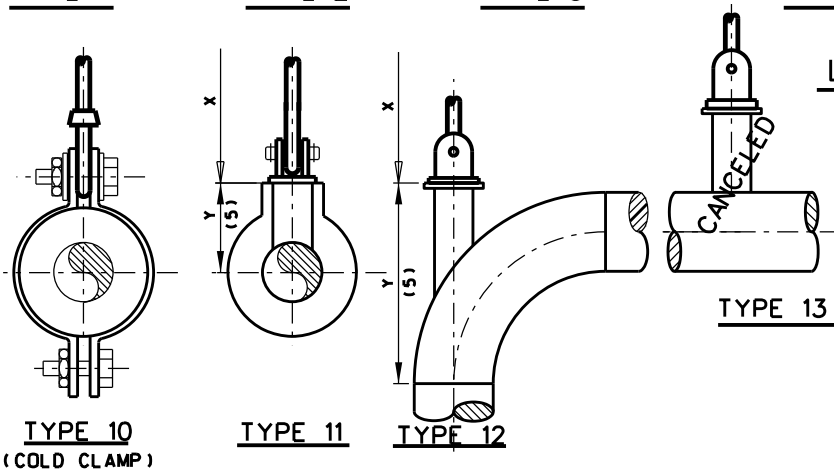
STANDARD CONSTRUCTION DRAWING
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UPPER CONNECTION



LOWER CONNECTION



NOTES:

1. SPRING HANGER ASSEMBLY SUPPLY BY MATERIAL REQUISITION
2. FOR DETAIL SPECIFICATION, SEE SPRING HANGER DATA SHEETS ON MATERIAL REQUISITION
3. BOLT INCLUDED ON THE MATERIAL REQUISITION
4. DELETED.
5. ONLY USEFUL IN SUPPORT MODELER AND SP3D.

Support + Mark

HC01	ITEM	ELEV
------	------	------

Technip

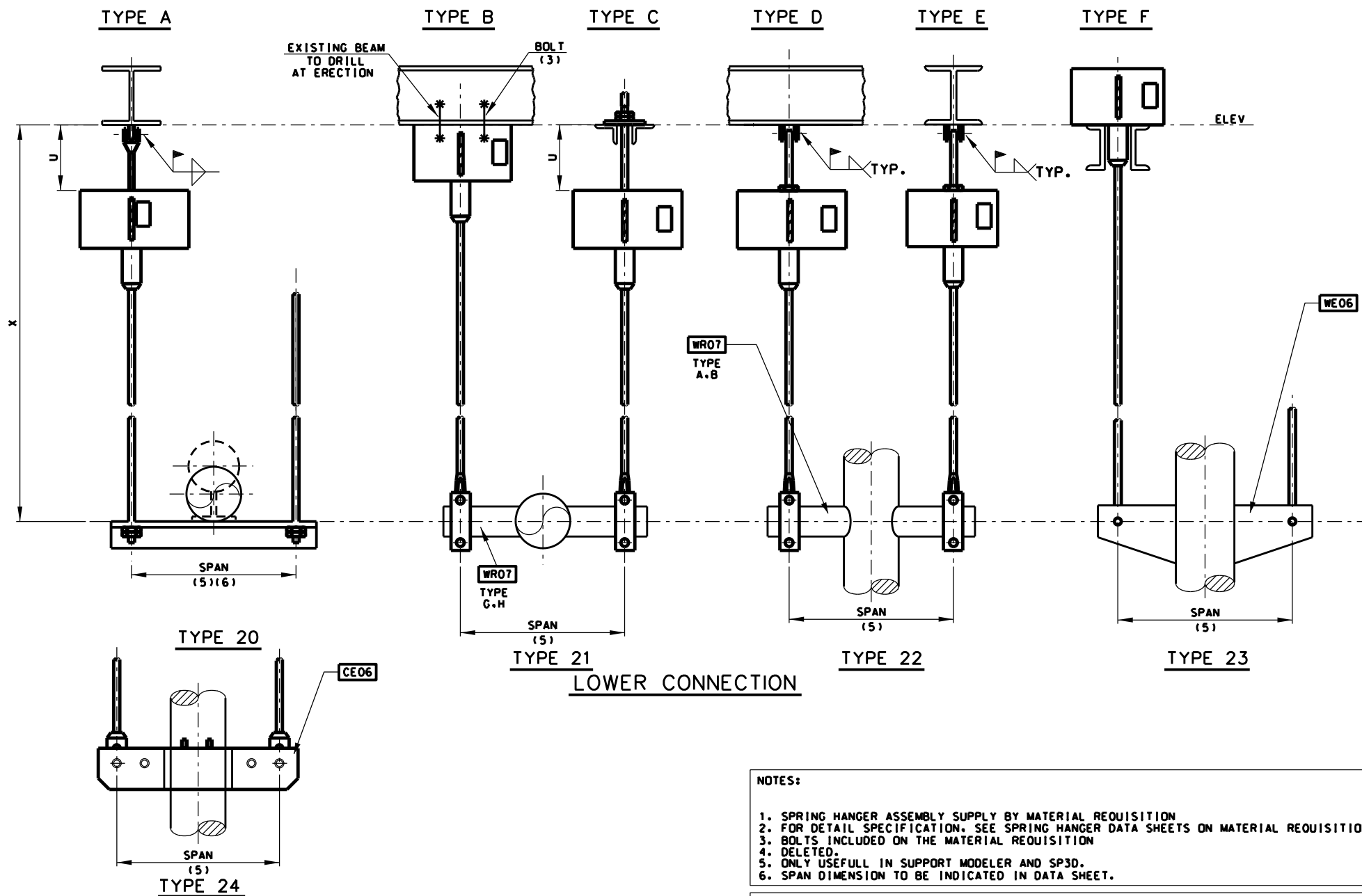
SINGLE CONSTANT SPRING HANGER HC01

STANDARD CONSTRUCTION DRAWING PLANT DESIGN AND PIPING

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①	SPRING HANGER	1	SEE NOTE 2.										
ITEM	DESCRIPTION	QTY.	DETAIL	CS	CH	CL	CG	AS	AH	SS	SH		
				MATCL									

UPPER CONNECTION



NOTES:

1. SPRING HANGER ASSEMBLY SUPPLY BY MATERIAL REQUISITION
2. FOR DETAIL SPECIFICATION, SEE SPRING HANGER DATA SHEETS ON MATERIAL REQUISITION
3. BOLTS INCLUDED ON THE MATERIAL REQUISITION
4. DELETED.
5. ONLY USEFULL IN SUPPORT MODELER AND SP3D.
6. SPAN DIMENSION TO BE INDICATED IN DATA SHEET.

Support + Mark

Positional Mark

HC02	ITEM	ELEV
------	------	------

ELEV

Technip

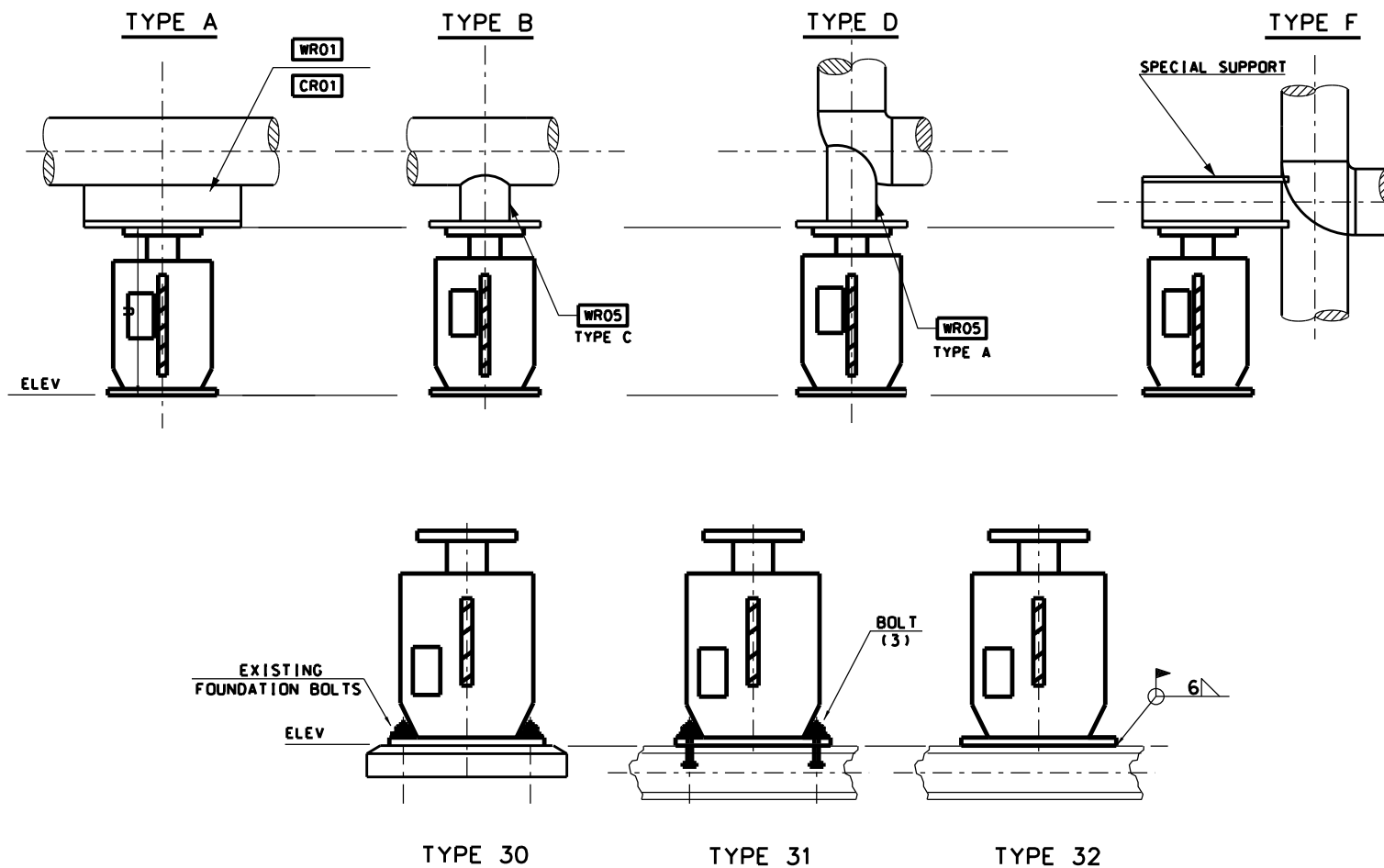
DOUBLE CONSTANT SPRING HANGER HC02

STANDARD CONSTRUCTION DRAWING PLANT DESIGN AND PIPING

G	XXXXXXXXXX	000	STC 1393-02	1 of 1	0
	Project	Unit	Doc. Code & Serial No.	Page	Rev.

○													
○													
○													
①	SPRING HANGER	2	SEE NOTE 2.										
ITEM	DESCRIPTION	QTY.	DETAIL	CS	CH	CL	CG	AS	AH	SS	SH		
				MATCL									

UPPER CONNECTION



LOWER CONNECTION

NOTES:

1. SPRING HANGER ASSEMBLY SUPPLY BY MATERIAL REQUISITION
2. FOR DETAIL SPECIFICATION, SEE SPRING HANGER DATA SHEETS ON MATERIAL REQUISITION
3. BOLT INCLUDED ON THE MATERIAL REQUISITION
4. DELETED.
5. FOR EACH TYPE, PTFE PAD SHALL BE SUPPLIED TOGETHER WITH THE SPRING HANGER AND SPECIFIED IN DATA SHEET.

Support + Mark

Positional Mark

HC03	ITEM	ELEV
------	------	------

ELEV

Technip

SINGLE CONSTANT SPRING BASE

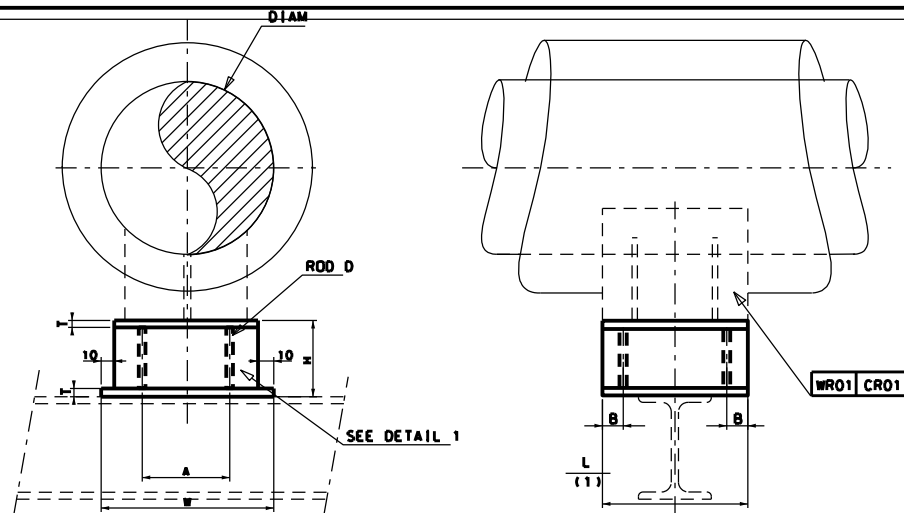
HC03

STANDARD CONSTRUCTION DRAWING PLANT DESIGN AND PIPING

G	XXXXXXXXXX	000	STC 1393-03	1 of 1	0
	Project	Unit	Doc. Code & Serial No.	Page	Rev.

○													
○													
○													
①	SPRING HANGER	1	SEE NOTE 2.										
ITEM	DESCRIPTION	QTY.	DETAIL	CS	CH	CL	CG	AS	AH	SS	SH		
				MATCL									

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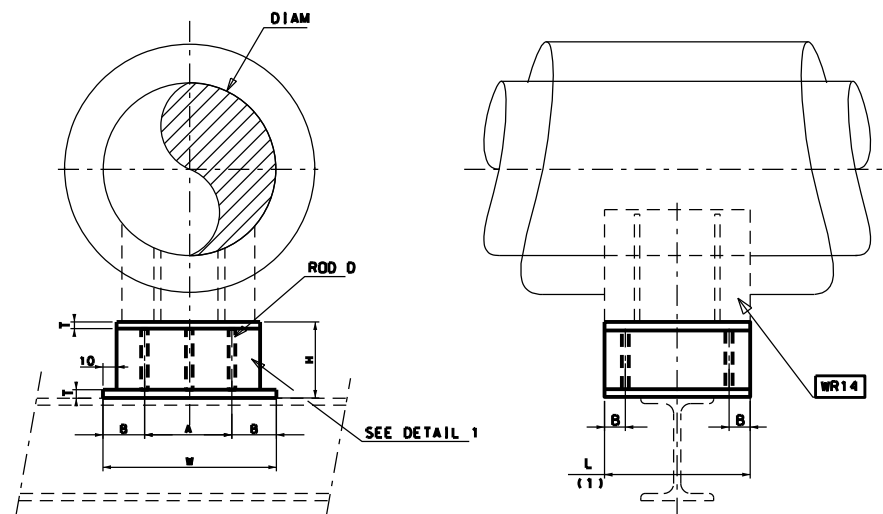


DIAM 2" TO 24"

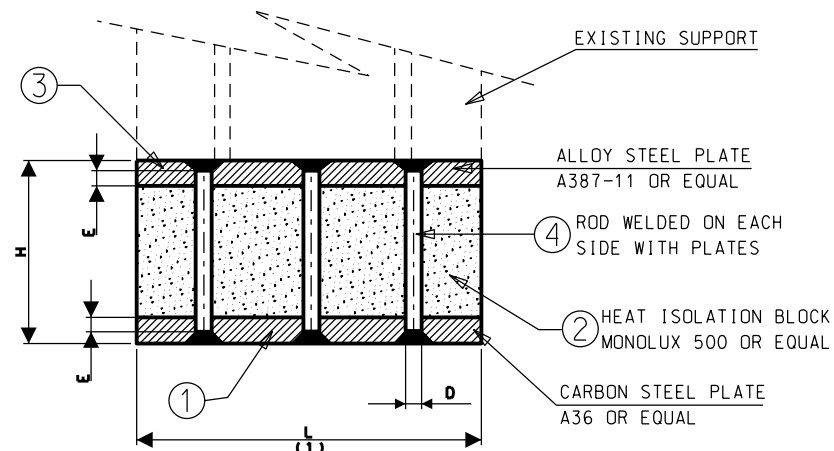
DIAM	A	W	B	H	T	D	E	MAX ALLOW. VERTICAL LOAD (KN)
1"-1 1/2"	60	120	40	70	10	10		54
2"-4"	60	120	40	70	10	10		54
6"	90	170	40	70	10	10	5	54
8"-10"	120	220	40	70	10	16	8	138
12"-14"	150	270	40	70	10	16	8	138
16"-18"	250	370	50	70	10	20	10	173
20"-24"	350	470	50	70	10	20	10	173
26"	450	570	50	80	15	20	10	260
28"	500	620	50	80	15	20	10	260
30"	550	670	50	80	15	20	10	260
32"	600	770	75	80	15	25	12	405
34"	600	770	75	80	15	25	12	405
36"	650	820	75	80	15	25	12	405
38"	700	870	75	80	15	25	12	405
40"	750	920	75	80	15	25	12	405
42"	800	970	75	80	15	25	12	405
44"	800	970	75	80	15	25	12	405
46"	850	1020	75	90	20	25	12	405
48"	900	1070	75	90	20	25	12	405
50"	950	1120	75	90	20	25	12	405
52"	1000	1170	75	90	20	25	12	405
54"	1050	1220	75	90	20	25	12	405
56"	1100	1270	75	90	20	25	12	405
60"	1150	1320	75	90	20	25	12	405

④ ROD	4/6 ROD	/	A193-88	/	/	/	A193-88	/	A193-88		
③ PLATE	1 PLATE THK. T	/	A387-11	/	/	/	A387-11	/	A387-11		
② ISOLATION	1 MONOLUX 500	/	/	/	/	/	/	/	/		
① PLATE	1 PLATE THK. T	/	A36	/	/	/	A36	/	A36		
ITEM DESCRIPTION	QTY.	DETAIL	CS	CH	CL	CG	AS	AH	SS	SH	

MATCL



DIAM 26" TO 60"



DETAIL 1

NOTES:

1. L=300 TO 900 WITH STEP 100
2. HEAT ISOLATION BLOCK SHALL BE USED FOR LINES WITH OPERATING TEMPERATURE OVER 400°C

Support Mark

HH01 DIAM L

Technip

HEAT ISOLATION BLOCK
FOR DIAM 2" TO 60"

HH01

STANDARD CONSTRUCTION DRAWING
PLANT DESIGN AND PIPING

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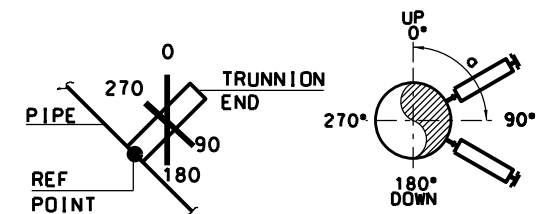
1. SNUBBER ASSEMBLY SUPPLY BY MATERIAL REQUISITION
2. FOR DETAIL SPECIFICATION SEE SNUBBER DATA SHEETS .
3. MINIMUM REQUIRED LENGTH SHALL BE DEFINED PER SUPPLIER CATALOGUE RECOMMENDATIONS AND DATA SHEETS.
4. LIMIT OF USING ON COLD LINES : REFER TO SNUBBER DATA SHEETS
5. CONNECTION DIRECTLY ON PIPE LOOKING TO FLOW FLUIDT DIRECTION.
6. CONNECTION ON TRUNNION LOOKING TO REFERENCE POINT OF TRUNNION.

HN01	ITEM	ELEV.	a
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HNO1

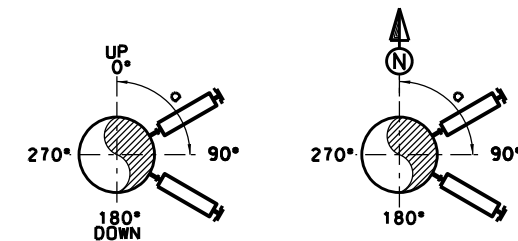
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CONNECTION ON TRUNNION



STRUT ORIENTATION FOR HORIZONTAL TRUNNION (6)

CONNECTION DIRECTLY ON PIPE



STRUT ORIENTATION FOR HORIZONTAL PIPE (5)

STRUT ORIENTATION FOR VERTICAL PIPE OR LEG

1. SNUBBER ASSEMBLY SUPPLY BY MATERIAL REQUISITION
2. FOR DETAIL SPECIFICATION. SEE SNUBBER DATA SHEETS.
3. MINIMUM REQUIRED LENGTH SHALL BE DEFINED PER SUPPLIER CATALOGUE RECOMMENDATIONS AND DATA SHEETS.
4. LIMIT OF USING ON COLD LINES : REFER TO SNUBBER DATA SHEETS.
5. CONNECTION DIRECTLY ON PIPE LOOKING TO FLOW FLUID DIRECTION.
6. CONNECTION ON TRUNNION LOOKING TO REFERENCE POINT OF TRUNNION.

HN02	ITEM	ELEV.	d
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DOUBLE SNUBBERS

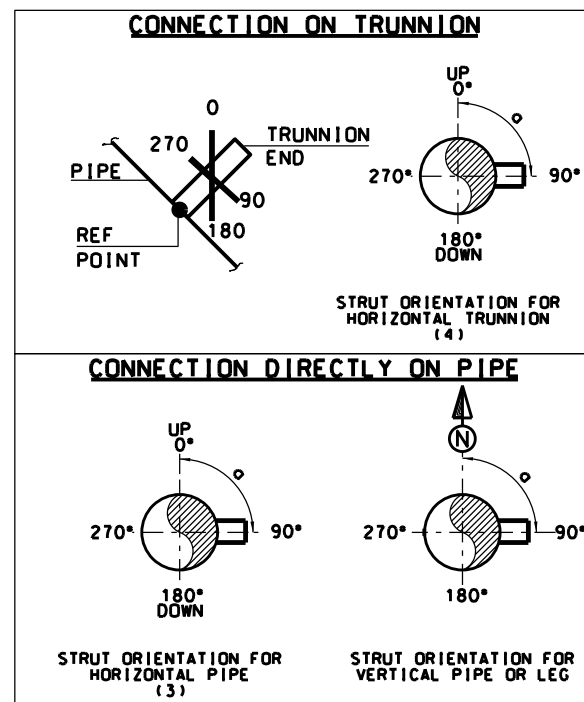
HN02

STANDARD CONSTRUCTION DRAWING
PLANT DESIGN AND PIPING

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<input checked="" type="radio"/>	SNUDDER ASSEMBLY	101	SEE NOTE 2.											
ITEM	DESCRIPTION	QTY.	DETAIL	CS	CH	CL	CG	AS	AH	SS	SH			
				MATCL										

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<input checked="" type="radio"/>	SHUDDER ASSEMBLY	1	SEE NOTE 2.														
ITEM	DESCRIPTION	QTY.	DETAIL	CS	CH	CL	CG	AS	AH	SS	SH						
				MATCL													



- NOTES:
1. RIGID STRUTS ASSEMBLY SUPPLY BY MATERIAL REQUISITION
 2. FOR DETAIL SPECIFICATION, SEE RIGID STRUTS DATA SHEETS ON MATERIAL REQUISITION
 3. CONNECTION DIRECTLY ON PIPE LOOKING TO FLOW FLUID DIRECTION.
 4. CONNECTION ON TRUNNION LOOKING TO REFERENCE POINT OF TRUNNION.

①	STRUTS	1	SEE NOTE 2.										
ITEM	DESCRIPTION	QTY.	DETAIL	CS	CH	CL	CG	AS	AH	SS	SH		
				MATCL									

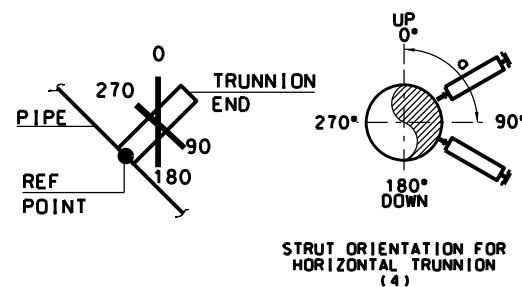
Support Mark	Positional Mark
HR01	ITEM
ELEV	a

<i>Technip</i>	SINGLE RIGID STRUTS	HR01
STANDARD CONSTRUCTION DRAWING PLANT DESIGN AND PIPING	XXXXXXXXXXXX 000	STC 1393-04 1 of 1 0
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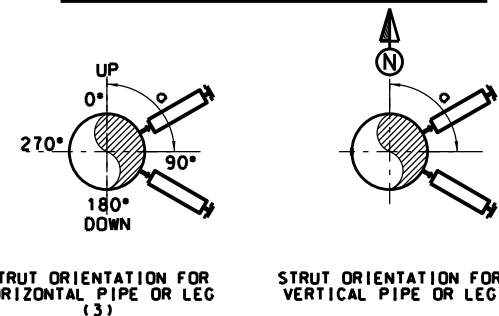


TYPE D

CONNECTION ON TRUNNION



CONNECTION DIRECTLY ON PIPE



1. RIGID STRUTS ASSEMBLY SUPPLY BY MATERIAL REQUISITION
2. FOR DETAIL SPECIFICATION, SEE RIGID STRUTS DATA SHEETS ON MATERIAL REQUISITION
3. CONNECTION DIRECTLY ON PIPE LOOKING TO FLOW FLUID DIRECTION.
4. CONNECTION ON TRUNNION LOOKING TO REFERENCE POINT OF TRUNNION.

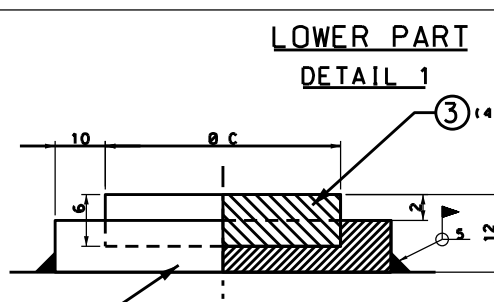
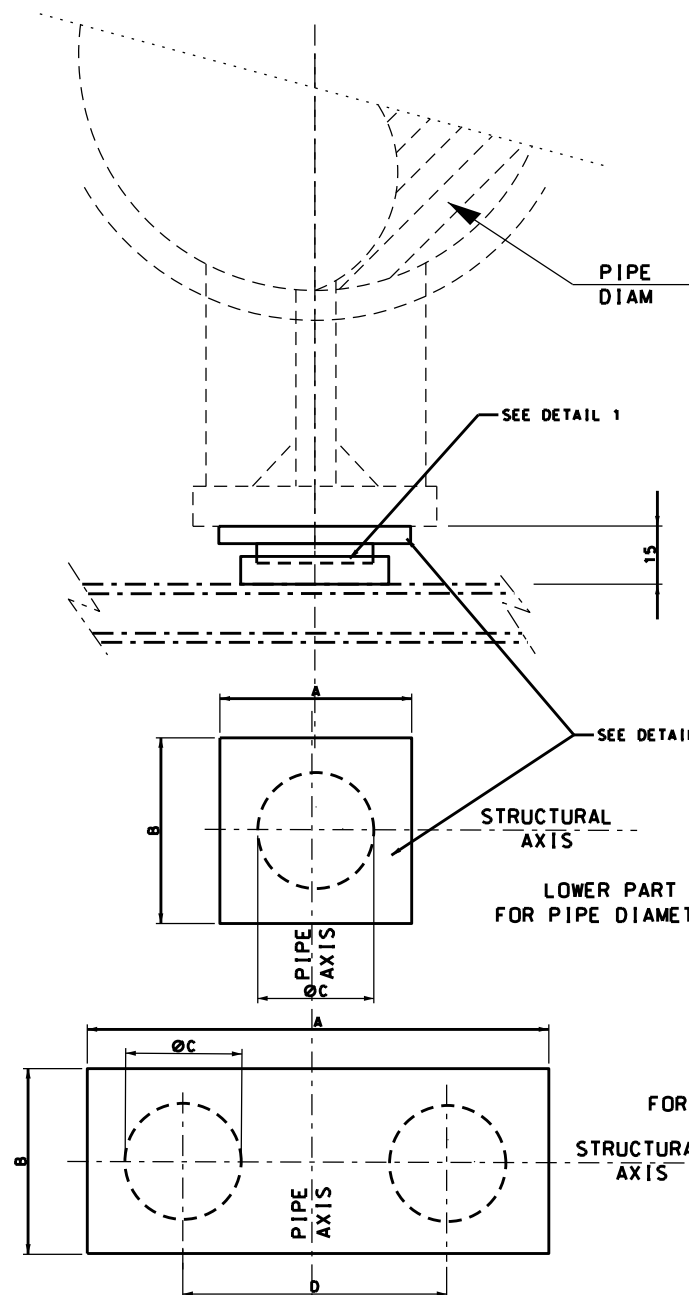
HR02	ITEM
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ELEV	a
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HR02

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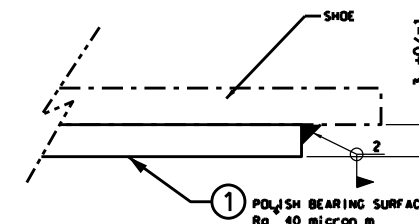
<input type="radio"/>											
<input type="radio"/>											
<input type="radio"/>											
<input checked="" type="radio"/>	STRUTS	1+1	SEE NOTE 2.								
ITEM	DESCRIPTION	QTY.	DETAIL	CS	CH	CL	CG	AS	AH	SS	SH
				MATCL							



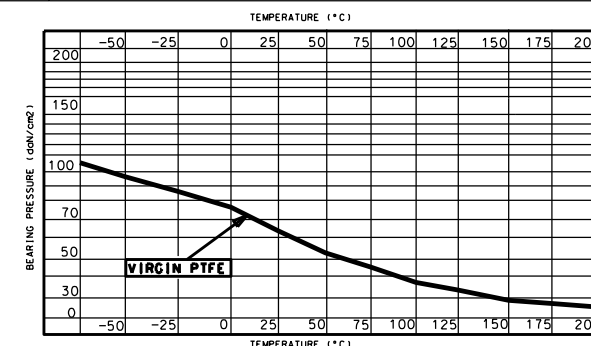
TBL 1	
ØC (mm)	MAX LOAD (KN)
50	14
80	35
120	79
160	140

LOADS AT AMBIENT TEMPERATURE (25° C)

UPPER PART DETAIL 2



STAINLESS STEEL PLATE DIMENSIONS (2)(3)			
PIPE DIA.	STD WRO1 (L=300) (1)		STD WRO5
	A	B	AxB
2"	80	280	80x80
3"	80	280	80x80
4"	80	280	130x130
6"	130	280	130x130
8"	180	280	180x180
10"	180	280	180x180
12"	230	280	230x230
14"	230	280	330x330
16"	330	280	380x380
18"	330	280	380x380
20"	430	280	430x430
22"	430	280	430x430
24"	430	280	430x430



NOTES:

- UPPER PLATE SHALL BE ADJUSTED CONSIDERING THE SUPPORT BASE PLATE.
- FOR OTHER SHOE LENGTH OR LONGIT. PIPE DISPLACEMENT ABOVE 50mm, SS PLATE SHALL BE INCREASED BY STEP 100mm AND SPECIFIED ON DATA SHEET SP 1384 01.
- ALL DIMENSIONS ARE TO BE CHECKED AND SPECIFIED ON DATA SHEET SP 1384 01 ACCORDING TO EFFECTIVE LOADS AND DISPLACEMENTS.
- PTFE TO BE REMOVED BEFORE WELDING
- DELETED
- DELETED
- DELETED

Support Mark

HS01	ITEM	DIAM	A	B	Ø C	D
------	------	------	---	---	-----	---

ITEM	DESCRIPTION	QTY.	DETAIL	CS	CH	CL	CG	AS	AH	SS	SH
3	INSERT. PLATE	1/2		VIRGIN PTFE	VIRGIN PTFE	VIRGIN PTFE	VIRGIN PTFE	VIRGIN PTFE	VIRGIN PTFE	VIRGIN PTFE	VIRGIN PTFE
2	CASING	1/2		A36	A36	A36	A36	A36	A36	A36	A36
1	STAINLESS STEEL PLATE	1		SS	SS	SS	SS	SS	SS	SS	SS

MATCL

Technip

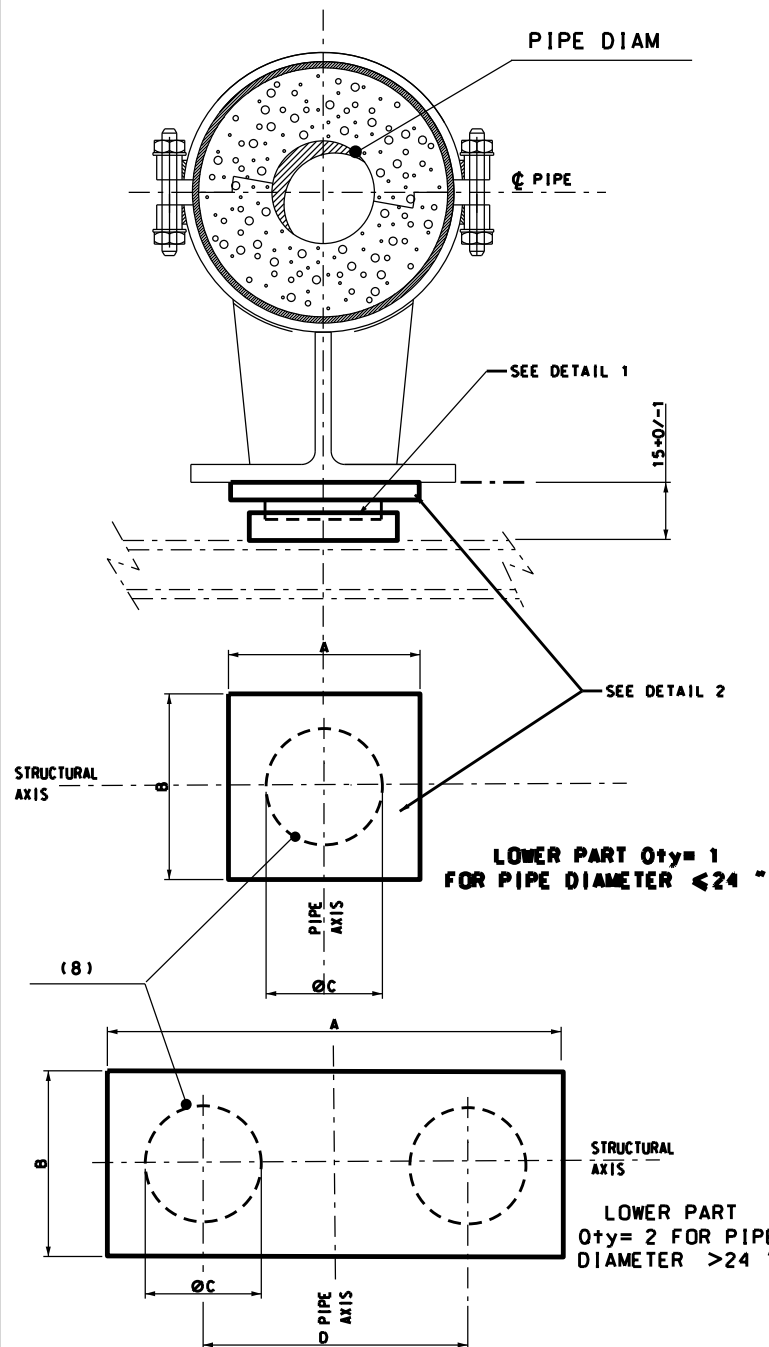
ANTIFRICTION SLIDING PLATES

HS01

STANDARD CONSTRUCTION DRAWING
PLANT DESIGN AND PIPING

XXXXXXXXXX 000 STC1393-181 of 1 0
Project Unit Doc. Code & Serial No. Page Rev.

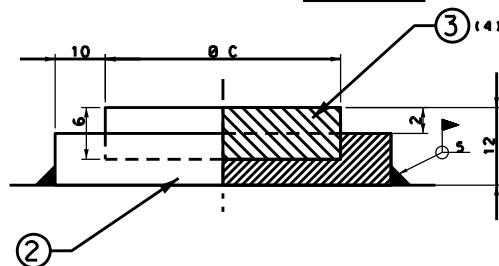
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PIPE DIA.	INSUL. THK	CR61/CR62(3)(5)	
		A	B
14"	< 25	280	380
	< 50	280	380
	< 80	330	380
	< 100	330	380
	< 130	370	380
	< 150	370	380
	< 180	400	380
	< 200	400	380
16"	< 25	280	380
	< 50	280	380
	< 80	280	380
	< 100	370	380
	< 130	400	380
	< 150	400	380
	< 180	430	380
	< 200	430	380
18"	< 25	330	380
	< 50	330	380
	< 80	370	380
	< 100	370	380
	< 130	430	380
	< 150	430	380
	< 180	470	380
	< 200	470	380
20"	< 25	370	380
	< 50	370	380
	< 80	430	380
	< 100	470	380
	< 130	470	380
	< 150	510	380
	< 180	510	380
	< 200	550	380
24"	< 25	430	380
	< 50	430	380
	< 80	430	380
	< 100	470	380
	< 130	470	380
	< 150	510	380
	< 180	510	380
	< 200	550	380

LOWER PART

DETAIL 1

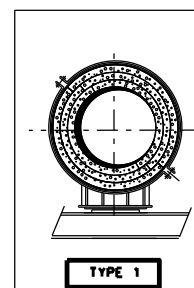
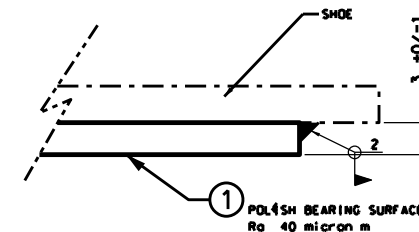


TBL 1	
ØC (mm)	MAX LOAD (KN)
50	14
80	35
120	79
160	140

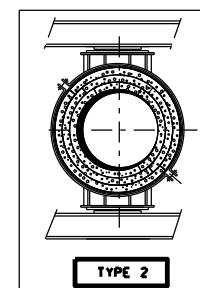
LOADS AT AMBIENT TEMPERATURE (25° C)

UPPER PART

DETAIL 2



TYPE 1



TYPE 2

NOTES:

1. SLIDING PLATES ARE REQUIRED FOR PIPE DIA. 14" AND ABOVE EXCEPT STRESS ANALYSIS REQUEST.
2. STAINLESS STEEL PLATES SHALL BE ADJUSTED CONSIDERING THE SUPPORT BASE PLATE.
3. ALL DIMENSIONS ARE TO BE CHECKED AND SPECIFIED ON DATA SHEET SP 1384 01 ACCORDING TO EFFECTIVE LOADS AND DISPLACEMENTS.
4. PTFE TO BE REMOVED BEFORE WELDING..
5. FOR OTHER SHOE LENGTH OR LONGIT. PIPE DISPLACEMENT ABOVE 50mm, SS PLATE SHALL BE INCREASED BY STEP 100mm AND SPECIFIED ON DATA SHEET SP 1384 01.
6. DELETED
7. DELETED
8. DELETED

Support Mark

HS02	ITEM	DIAM	TYPE	A	B	Ø C	D
------	------	------	------	---	---	-----	---

ITEM	DESCRIPTION	QTY.	DETAIL	CS	CH	CL	CG	AS	AH	SS	SH
3	INSERT. PLATE	1/2		VIRGIN PTFE	VIRGIN PTFE	VIRGIN PTFE	VIRGIN PTFE	VIRGIN PTFE	VIRGIN PTFE	VIRGIN PTFE	
2	CASING	1/2		A36	A36	A36	A36	A36	A36	A36	
1	STAINLESS STEEL PLATE	1		SS	SS	SS	SS	SS	SS	SS	

MATCL

Technip

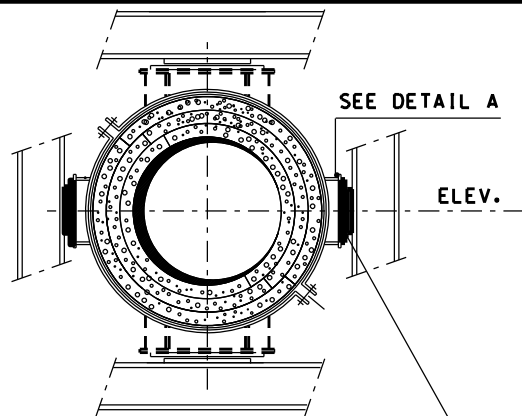
ANTIFRICTION SLIDING PLATES
ON COLD LINES (UNDER/UPPER)

HS02

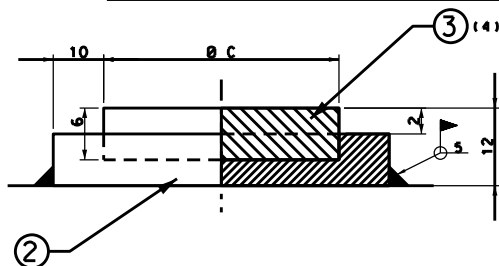
STANDARD CONSTRUCTION DRAWING
PLANT DESIGN AND PIPING

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Project Unit Doc. Code & Serial No. Page Rev.

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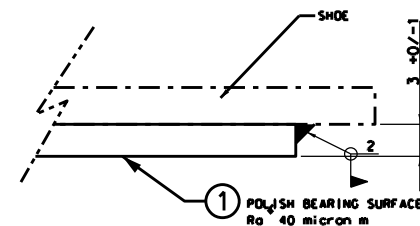
SIDE PART (WELDED ON STRUCTURAL PART)



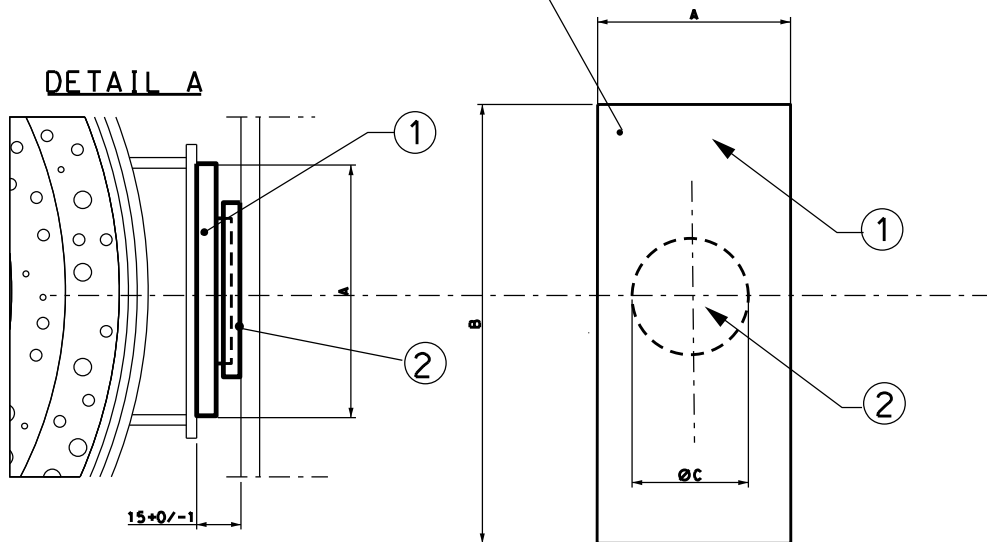
TBL 1 (4)	
ØC (mm)	MAX LOAD (KN)
50	14
80	35
120	79
160	140

LOADS AT AMBIENT
TEMPERATURE (25° C)

SIDE PART (WELDED ON PIPE SHOE)



DETAIL A



STAINLESS STEEL DIMENSIONS (3)
A X B
100 X 300
160 X 300
160 X 400
200 X 500
200 X 600
250 X 500
250 X 600

NOTES:

- SLIDING PLATES ARE REQUIRED FOR PIPE DIA. 14" AND ABOVE EXCEPT STRESS ANALYSIS REQUEST.
- STAINLESS STEEL PLATES SHALL BE ADJUSTED CONSIDERING THE SUPPORT BASE PLATE.
- ALL DIMENSIONS ARE TO BE CHECKED AND SPECIFIED ON DATA SHEET SP 1384 01 ACCORDING TO EFFECTIVE LOADS AND DISPLACEMENTS.
IF OTHER LENGTHS REQUIRED, STEP SHALL BE BY 100.
- PTFE TO BE REMOVED BEFORE WELDING
- DELETED
- DELETED
- DELETED

Support Mark

HS03 ITEM DIAM A B Ø C

Support Mark

ELEV

ITEM	DESCRIPTION	QTY.	DETAIL	CS	CH	CL	CG	AS	AH	SS	SH
3	INSERT PLATE	2		VIRGIN PTFE	VIRGIN PTFE	VIRGIN PTFE	VIRGIN PTFE	VIRGIN PTFE	VIRGIN PTFE	VIRGIN PTFE	VIRGIN PTFE
2	CASING	2		A36	A36	A36	A36	A36	A36	A36	A36
1	STAINLESS STEEL PLATE	2		SS	SS	SS	SS	SS	SS	SS	SS

MATCL

Technip

ANTI FRICTION SLIDING PLATES ON
COLD LINES (FOR HEAVY AXIAL LOADS)

HS03

STANDARD CONSTRUCTION DRAWING
PLANT DESIGN AND PIPING

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1. TIE-ROD ASSEMBLY SUPPLY BY MATERIAL REQUISITION
2. FOR DETAIL SPECIFICATION, SEE TIE-ROD DATA SHEETS ON MATERIAL REQUISITION
3. DELETED
4. ONLY USEFUL IN SUPPORT MODELER AND SP3D

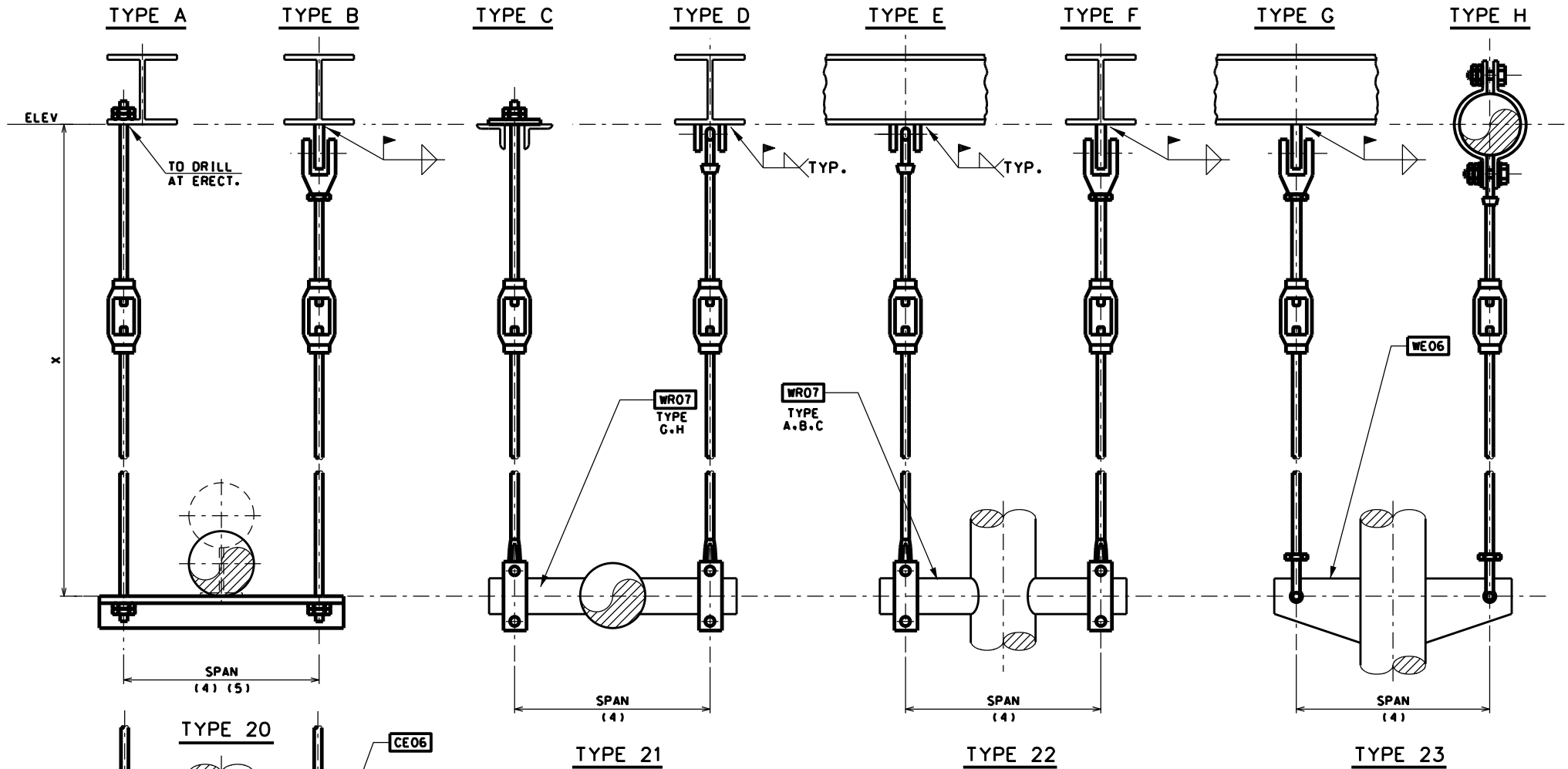
HT01	ITEM	ELEV
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HT01

G	XXXXXXXXXX	000	STC 1393-06	1 of 1	0
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UPPER CONNECTION



LOWER CONNECTION

NOTES:

1. TIE-ROD ASSEMBLY SUPPLY BY MATERIAL REQUISITION
2. FOR DETAIL SPECIFICATION, SEE TIE-ROD DATA SHEETS ON MATERIAL REQUISITION
3. DELETED
4. ONLY USEFUL IN SUPPORT MODELER AND SP3D
- 5-SPAN DIMENSION TO BE INDICATED IN DATA SHEET

Support Mark

Positional Mark

HT02 ITEM ELEV

Technip

DOUBLE TIE-ROD HANGERS

HT02

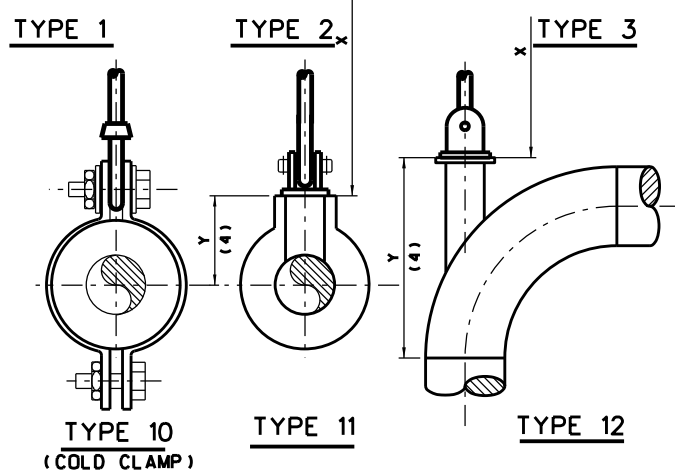
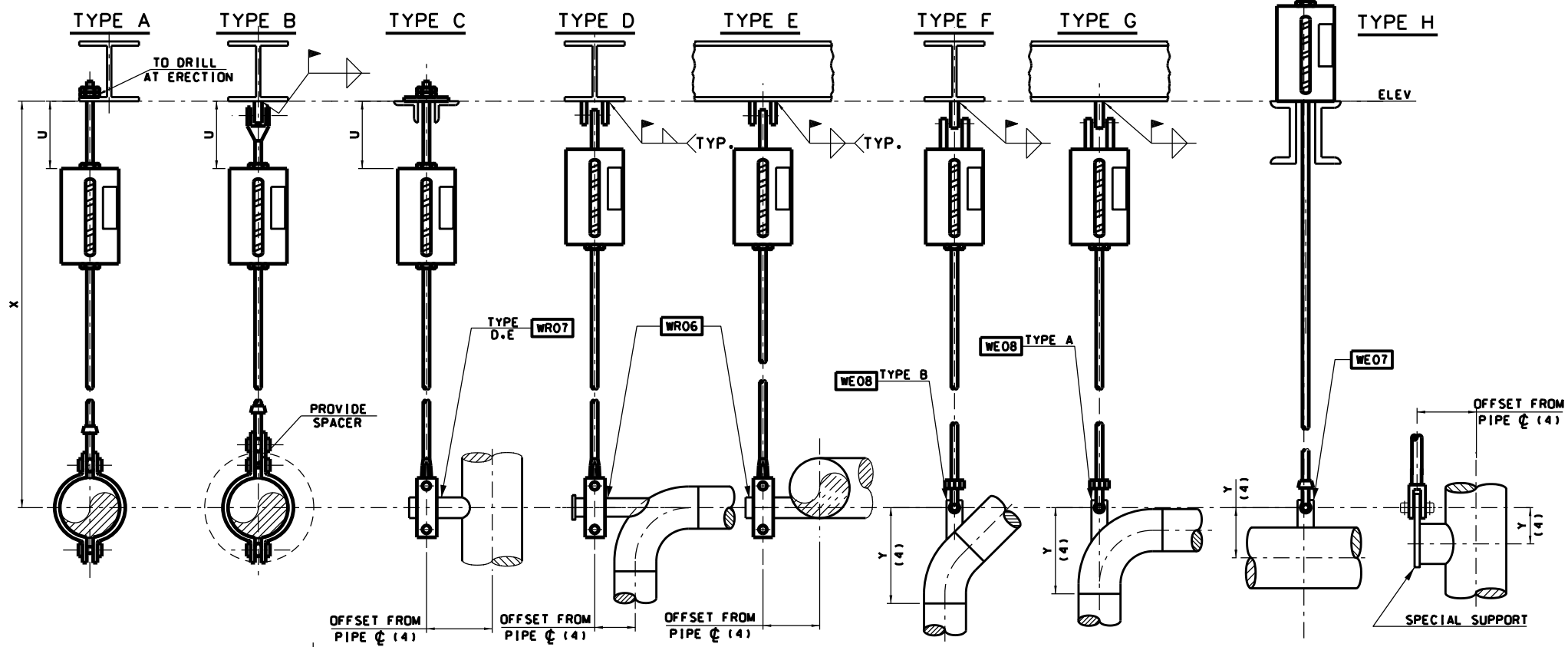
STANDARD CONSTRUCTION DRAWING
PLANT DESIGN AND PIPING

XXXXXXXXXX 000 STC 1393-07 1 of 1 0
Project Unit Doc. Code & Serial No. Page Rev.

ITEM	DESCRIPTION	QTY.	DETAIL	CS	CH	CL	CG	AS	AH	SS	SH
1	TIE - ROD	2	SEE NOTE 2.								

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UPPER CONNECTION



LOWER CONNECTION

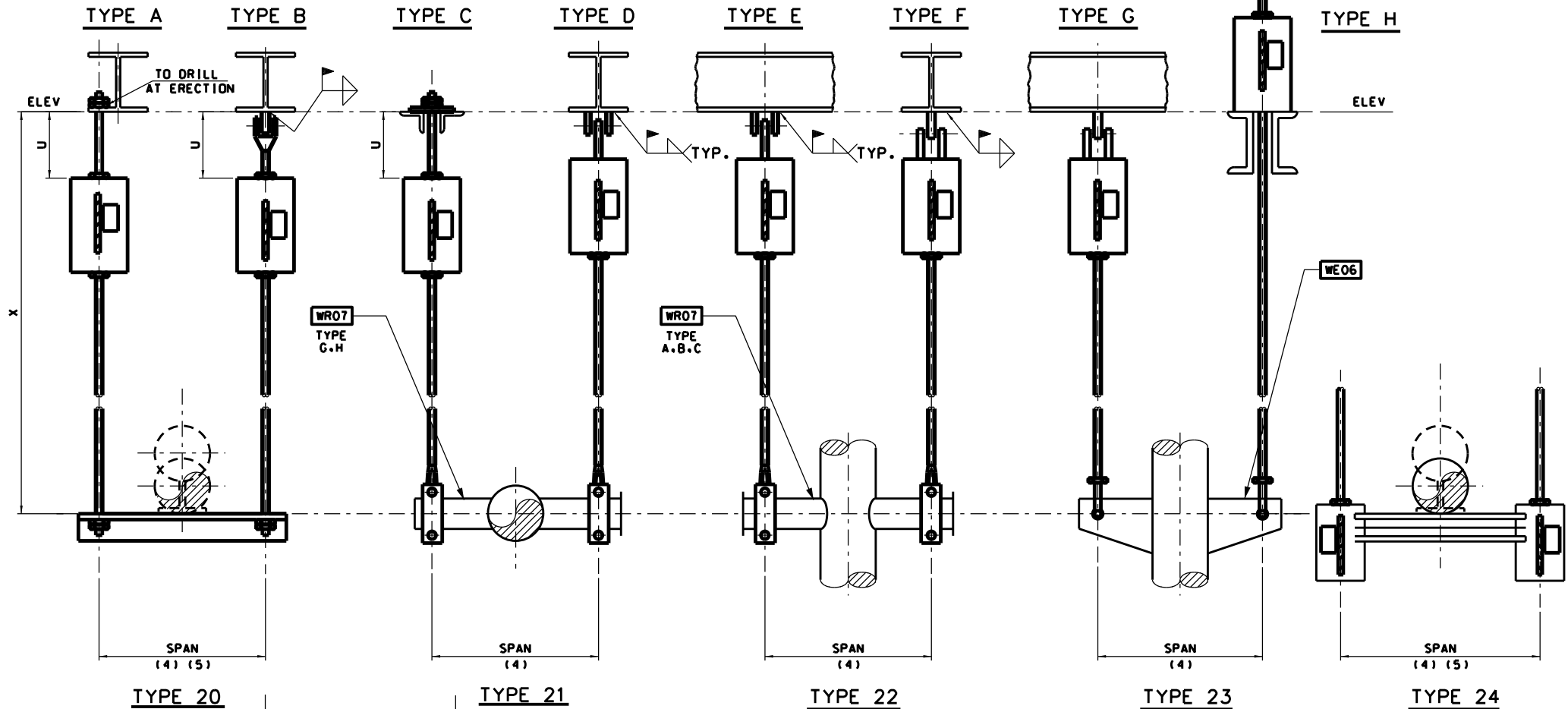
- NOTES:
- 1. SPRING HANGER ASSEMBLY SUPPLY BY MATERIAL REQUISITION
 - 2. FOR DETAIL SPECIFICATION, SEE SPRING HANGER DATA SHEETS ON MATERIAL REQUISITION
 - 3. DELETED
 - 4. ONLY USEFUL IN SUPPORT MODELER AND SP3D

Support Mark	Positional Mark
HV01	ITEM ELEV
Technip	
SINGLE VARIABLE SPRING HANGER HV01	
STANDARD CONSTRUCTION DRAWING PLANT DESIGN AND PIPING	XXXXXXXXXX 000 STC 1393-08 1 of 1 0 Project Unit Doc. Code & Serial No. Page Rev.

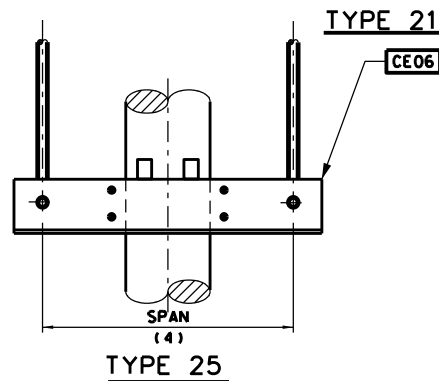
ITEM	DESCRIPTION	QTY.	DETAIL	CS	CH	CL	CG	AS	AH	SS	SH
1	SPRING HANGER	1	SEE NOTE 2.								

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UPPER CONNECTION



LOWER CONNECTION



NOTES:

1. SPRING HANGER ASSEMBLY SUPPLY BY MATERIAL REQUISITION
2. FOR DETAIL SPECIFICATION, SEE SPRING HANGER DATA SHEETS ON MATERIAL REQUISITION
3. DELETED
4. ONLY USEFUL IN SUPPORT MODELER AND SP3D
5. SPAN DIMENSION TO BE INDICATED IN DATA SHEET

Support Mark

Positional Mark

HV02 ITEM ELEV

Technip

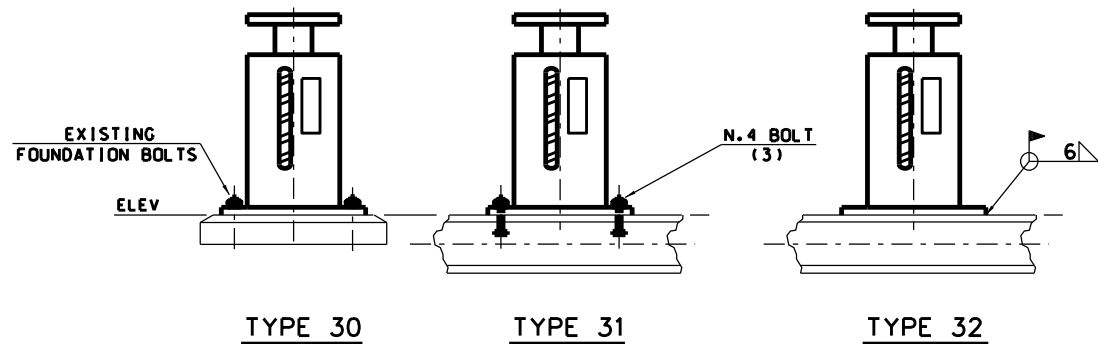
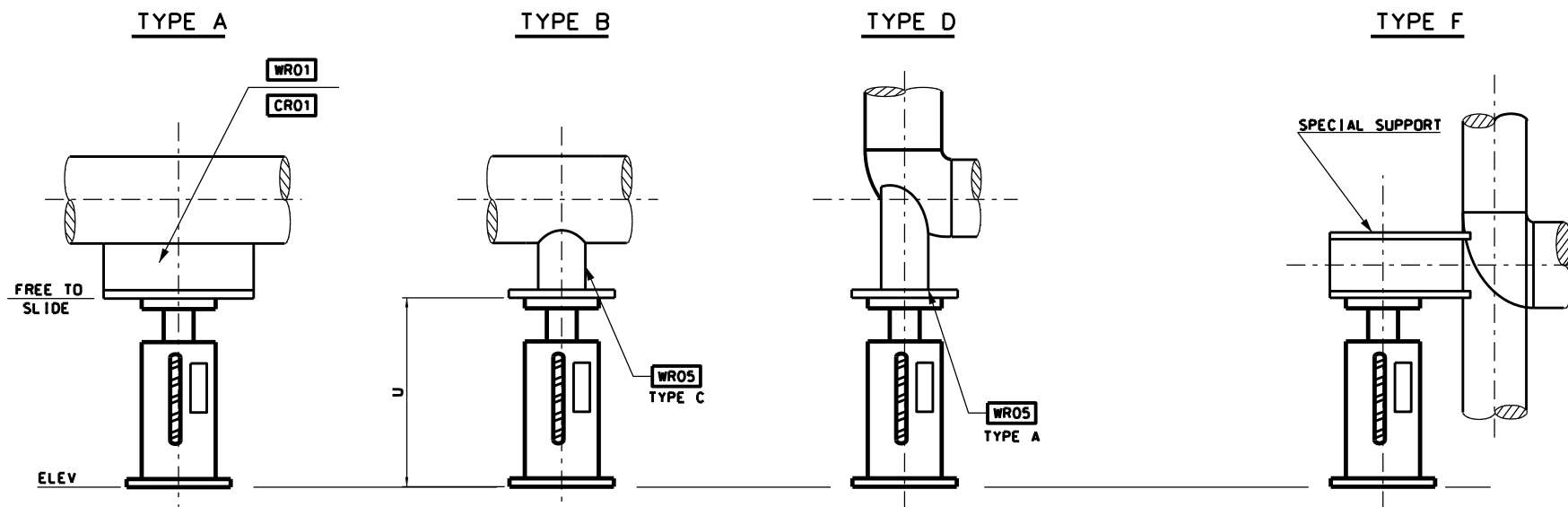
DOUBLE VARIABLE SPRING HANGER HV02

STANDARD CONSTRUCTION DRAWING
PLANT DESIGN AND PIPING

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Project Unit Doc. Code & Serial No. Page Rev.

ITEM	DESCRIPTION	QTY.	DETAIL	CS	CH	CL	CG	AS	AH	SS	SH
1	SPRING HANGER	2	SEE NOTE 2.								

UPPER CONNECTION



LOWER CONNECTION

NOTES:

1. SPRING HANGER ASSEMBLY SUPPLY BY MATERIAL REQUISITION
2. FOR DETAIL SPECIFICATION, SEE SPRING HANGER DATA SHEETS ON MATERIAL REQUISITION
3. BOLTS INCLUDED ON THE MATERIAL REQUISITION
4. DELETED
5. FOR EACH TYPE, PTFE SHALL BE SUPPLIED TOGETHER WITH THE SPRING HANGER AND SPECIFIED IN DATA SHEET

Support + Mark

Positional Mark

HV03	ITEM	ELEV
------	------	------

ELEV

Technip

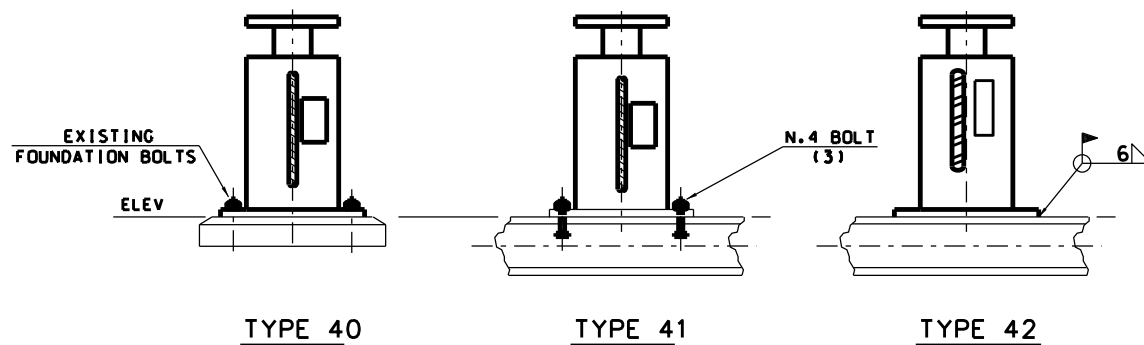
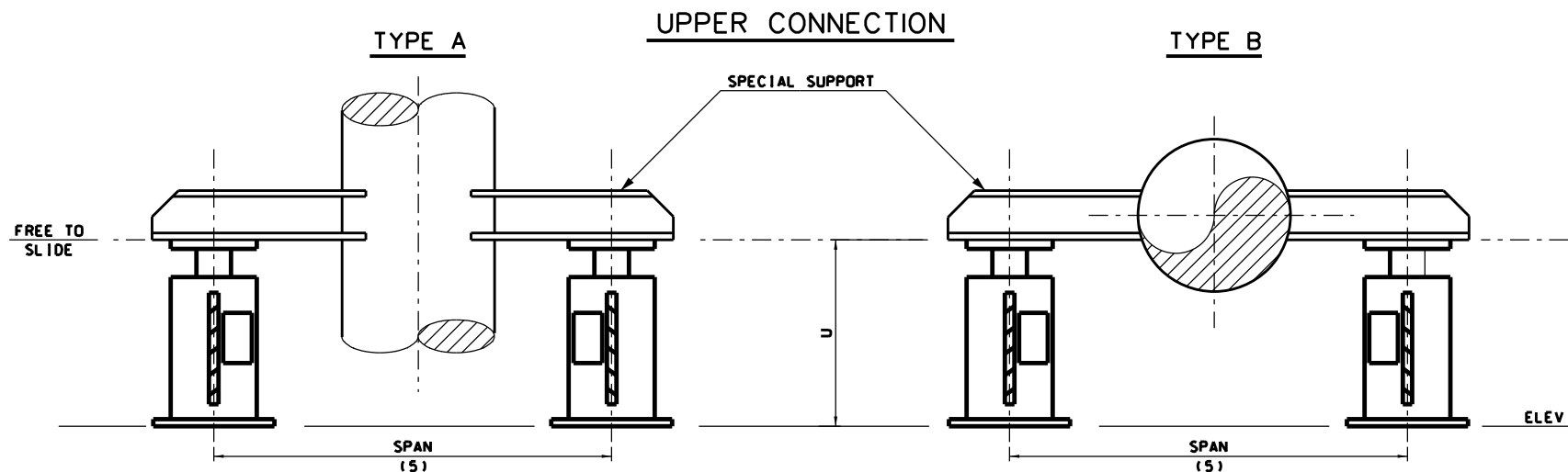
SINGLE VARIABLE SPRING BASE

HV03

**STANDARD CONSTRUCTION DRAWING
PLANT DESIGN AND PIPING**

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	Project	Unit	Doc. Code & Serial No.	Page	Rev.

○													
○													
○													
①	SPRING HANGER	1	SEE NOTE 2.										
ITEM	DESCRIPTION	QTY.	DETAIL	CS	CH	CL	CG	AS	AH	SS	SH		
				MATCL									



LOWER CONNECTION

NOTES:

1. SPRING HANGER ASSEMBLY SUPPLY BY MATERIAL REQUISITION
2. FOR DETAIL SPECIFICATION, SEE SPRING HANGER DATA SHEETS ON MATERIAL REQUISITION
3. BOLTS INCLUDED ON MATERIAL REQUISITION
4. DELETED
5. ONLY USEFULL IN SUPPORT MODELER AND SP3D
6. FOR EACH TYPE,PTFE SHALL BE SUPPLIED TOGETHER WITH THE SPRING HANGER AND SPECIFIED IN DATA SHEET

Support + Mark

Positional Mark

HV04	ITEM	ELEV
------	------	------

ELEV

Technip

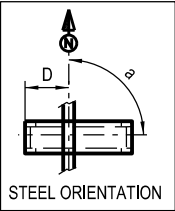
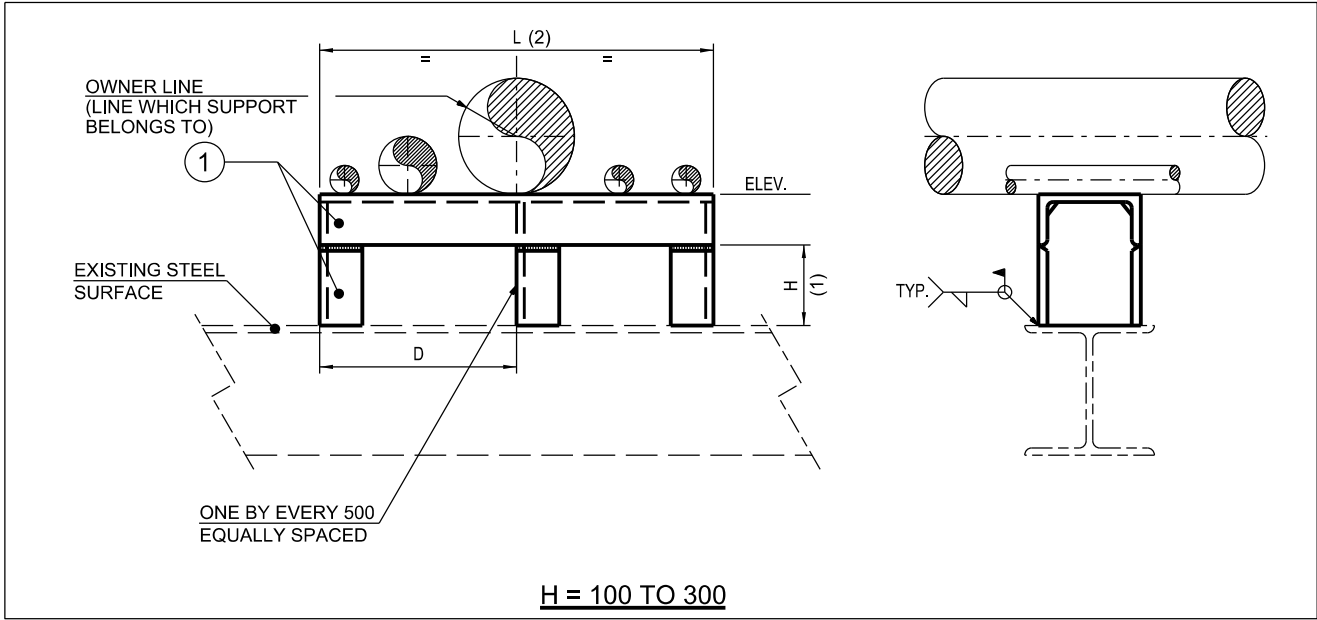
DOUBLE VARIABLE SPRING BASE

HV04

**STANDARD CONSTRUCTION DRAWING
PLANT DESIGN AND PIPING**

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<input type="radio"/>														
<input type="radio"/>														
<input type="radio"/>														
<input checked="" type="radio"/>	SPRING HANGER	2	SEE NOTE 2.											
ITEM	DESCRIPTION	QTY.	DETAIL		CS	CH	CL	CG	AS	AH	SS	SH		
					MATCL									



MAXI ALLOWABLE LOAD - 10 kN

NOTES:
1. H DIMENSION SHALL BE ADJUSTED AT ERECTION BEFORE WELDING IF NECESSARY.
2. L DIMENSION FROM 100 TO 1000 BY STEPS OF 100.

<input type="radio"/>													
<input type="radio"/>													
<input type="radio"/>													
<input checked="" type="radio"/>	STRUCTURE	1	SHAPE MC 100	A36	A36	A36	A36	A36	A36	A36	A36	A36	
ITEM	DESCRIPTION	QTY.	DETAIL	CS	CH	CL	CG	AS	AH	SS	SH	SL	
MATCL													

Support Mark				Positional Mark			
SB01 H L D				ELEV a			
Technip				MULTI COLUMNS FRAME			
STANDARD CONSTRUCTION DRAWING PLANT DESIGN AND PIPING				XXXXXX	000	STC - 1394 - 01	1 of 1
Project		Unit		Doc. Code & Serial No.		Page	Rev.

SB01

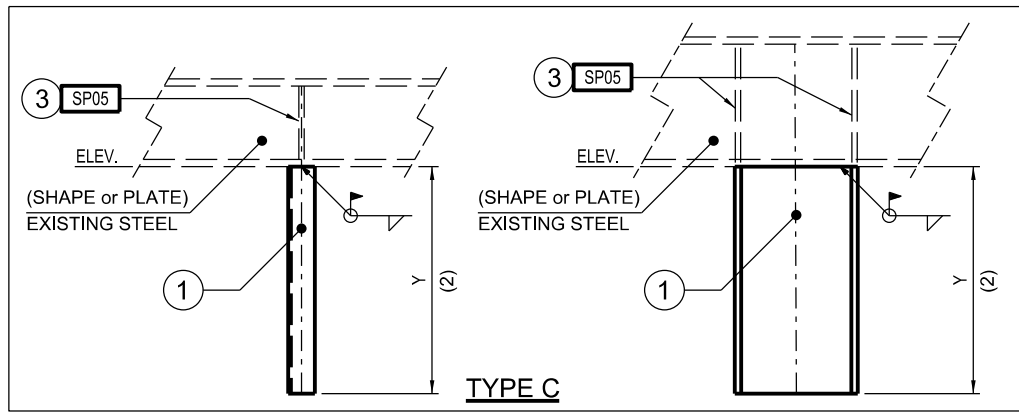
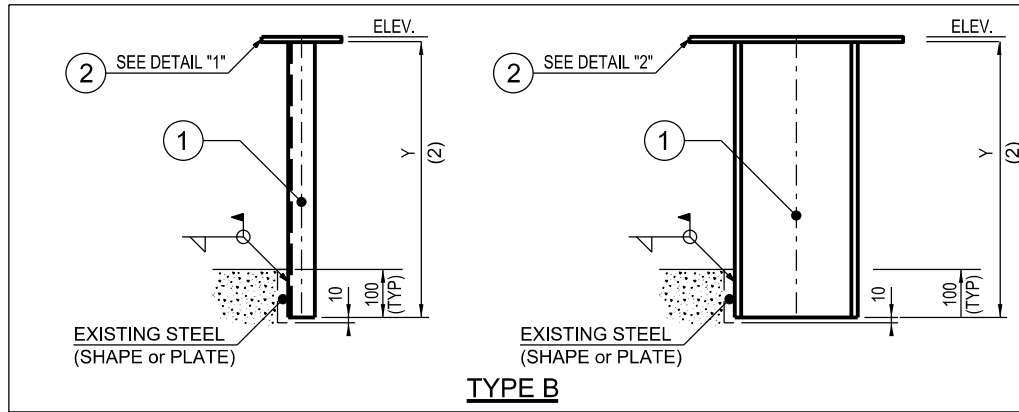
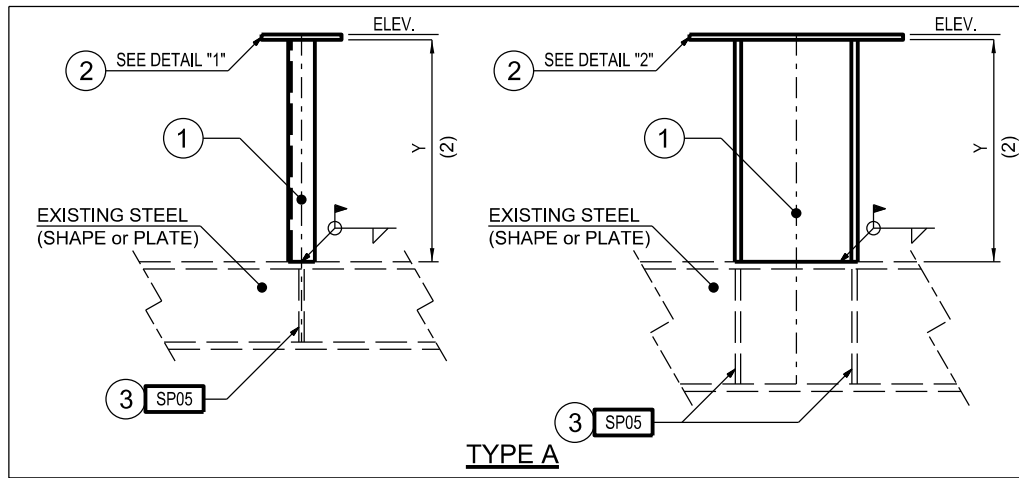
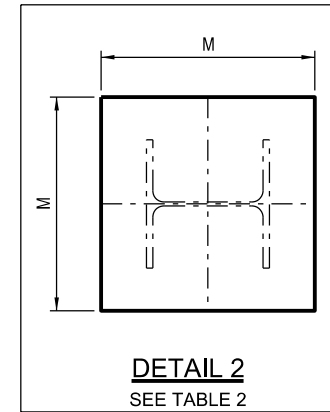
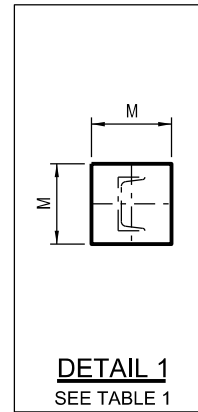
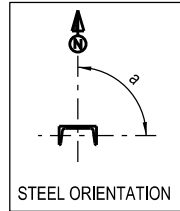


TABLE 1	
SHAPE	M
MC100/MC125	150
MC150/ UC152*23	200
UC152*30	250
UC203*46	300
UC254*73	400

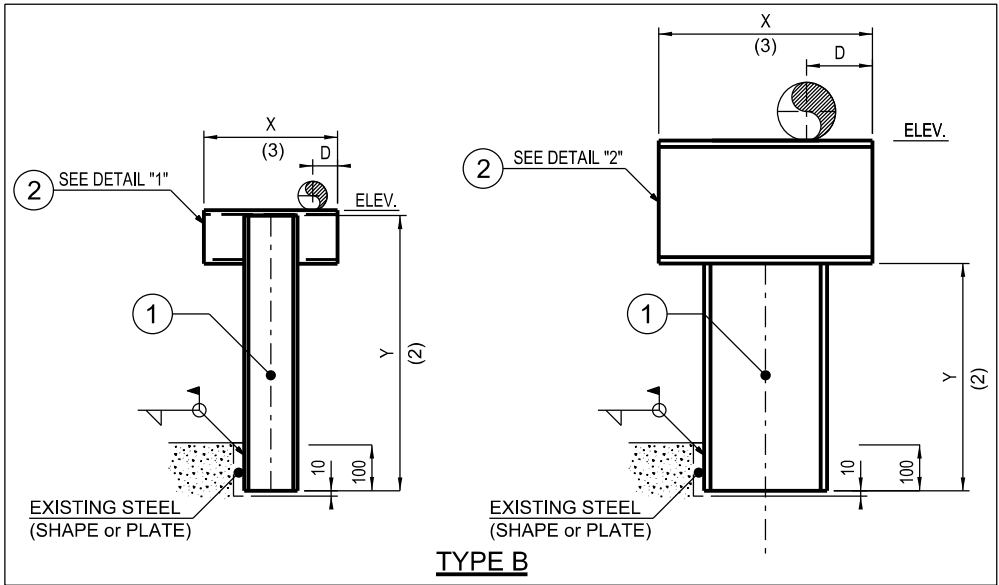
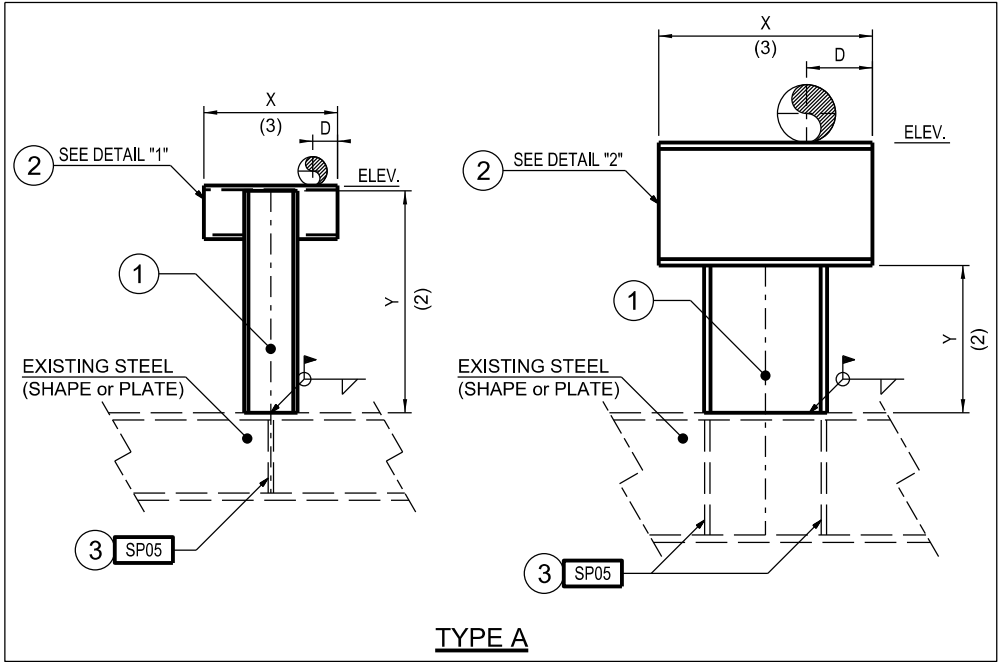
TABLE 2 - P (kN) (1)								
SHAPE Y mm	MC100	MC125	MC150	UC152*23	UC152*30	UC203*46	UC254*73	
500	6.4	8.6	18.6	36.0	-	-	-	
1000	3.3	4.4	9.5	18.7	37.0	-	-	
1500	2.2	2.9	6.4	12.6	25.1	43.3	-	
2000	1.6	2.2	4.8	9.5	19.0	32.8	56.4	



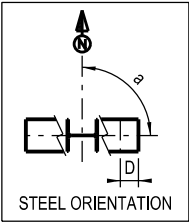
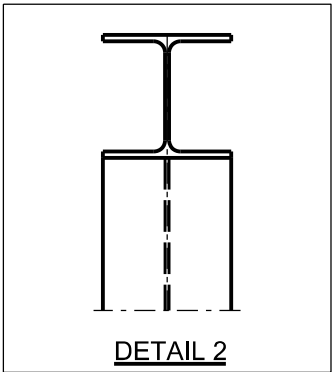
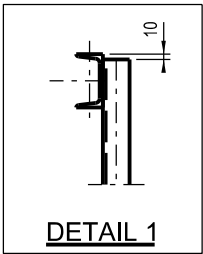
NOTES:
1. MAXI HORIZONTAL LOAD : $F = 0.35 \times P$.
Sadm = 235 MPa x 0.8 = 188 MPa.
LOAD IS SUPPOSED TO BE APPLIED ON THE SECTION'S NEUTRAL AXIS.
2. Y DIMENSION IS LIMITED FROM 200 TO 2000. TO BE ADJUSTED AT ERECTION IF NECESSARY.

ITEM	DESCRIPTION	QTY.	DETAIL	CS	CH	CL	CG	AS	AH	SS	SH	SL
③	STIFFENER	2/4	REFER TO SP05	/	/	/	/	/	/	/	/	/
②	END PLATE	1	PLATE Thk. 10	A36	A36	A36	A36	A36	A36	A36	A36	A36
①	COLUMN	1	SEE TABLE 2	A36	A36	A36	A36	A36	A36	A36	A36	A36

Support Mark				Positional Mark			
SB02				ELEV a			
Technip				POST			
STANDARD CONSTRUCTION DRAWING PLANT DESIGN AND PIPING				SB02			
XXXXXX				000			
Project				Unit			
Doc. Code & Serial No.				Page			
1 of 1				1			



SHAPE Y mm	TABLE - P (kN) (1)							
	MC100	MC125	MC150	UC152*23	UC152*30	UC203*46	UC254*73	
500	0.9	1.8	3.3	8.6	20.8	41.7	-	
1000	0.7	1.3	2.2	4.9	11.2	22.2	42.9	
1500	/	/	/	3.7	8.0	15.5	29.6	
2000	/	/	/	/	6.5	12.1	23.0	



NOTES:
1. MAXI HORIZONTAL LOAD : $F = 0.35 \times P$.
Sadm = 235 MPa x 0.8 = 188 MPa. X = 800 FOR VALUES INDICATED.
2. Y DIMENSION IS LIMITED FROM 200 TO 2000. TO BE ADJUSTED AT ERECTION IF NECESSARY.
3. X DIMENSION IS LIMITED FROM 200 TO 800.

ITEM	DESCRIPTION	QTY.	DETAIL	CS	CH	CL	CG	AS	AH	SS	SH	SL
③	STIFFENER	2/4	REFER TO SP05	/	/	/	/	/	/	/	/	/
②	BEAM	1	SEE TABLE	A36	A36	A36	A36	A36	A36	A36	A36	A36
①	COLUMN	1	SEE TABLE	A36	A36	A36	A36	A36	A36	A36	A36	A36

Support Mark				Positional Mark			
SB03 TYPE SHAPE D X Y				ELEV a			
Technip				T - SHAPE STRUCTURE			
STANDARD CONSTRUCTION DRAWING PLANT DESIGN AND PIPING				XXXXXX	000	STC - 1394 - 03	1 of 1
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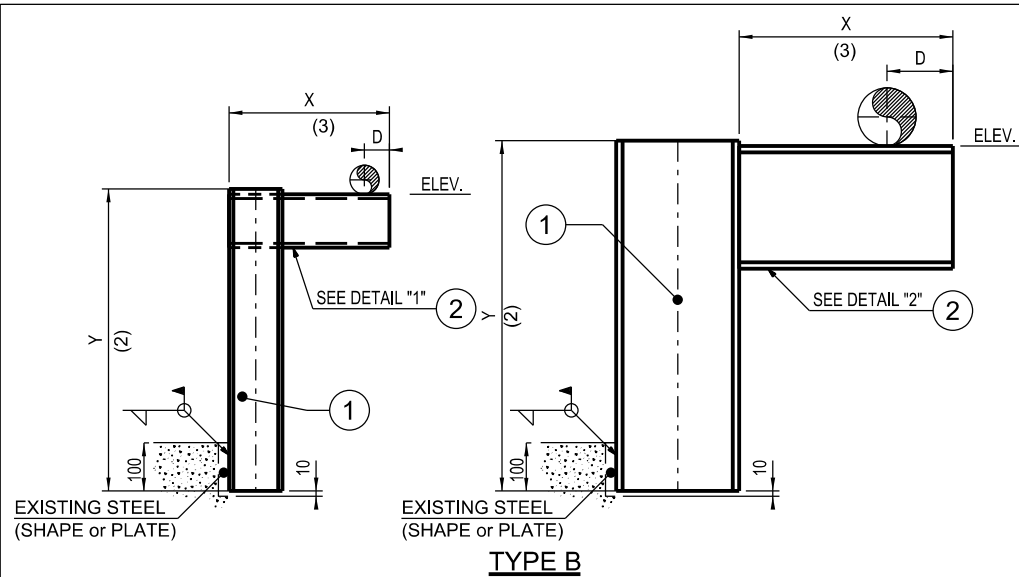
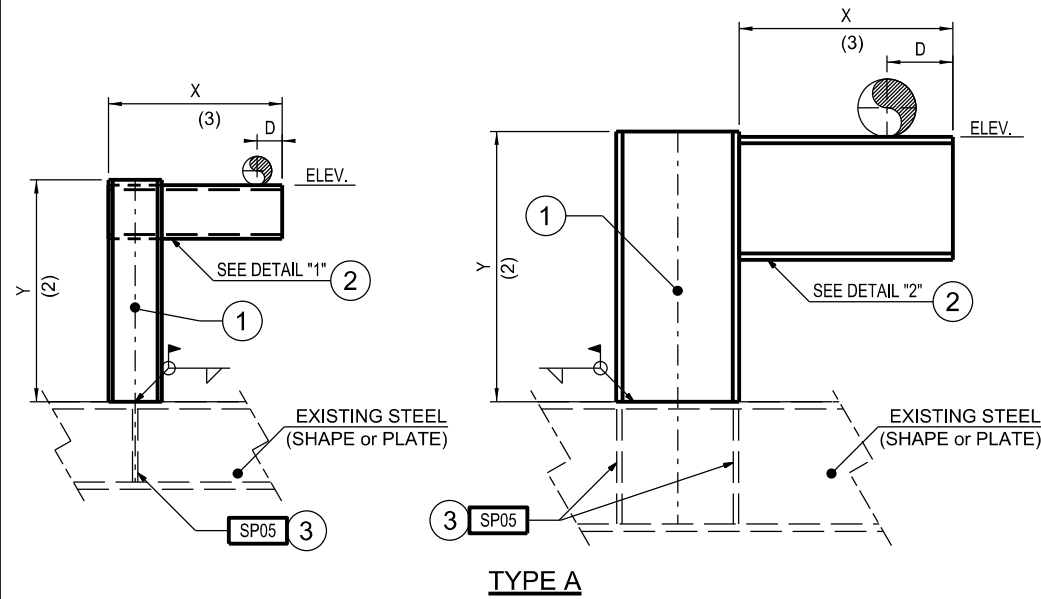
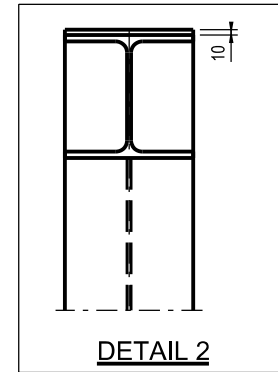
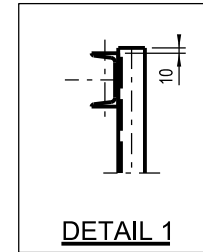


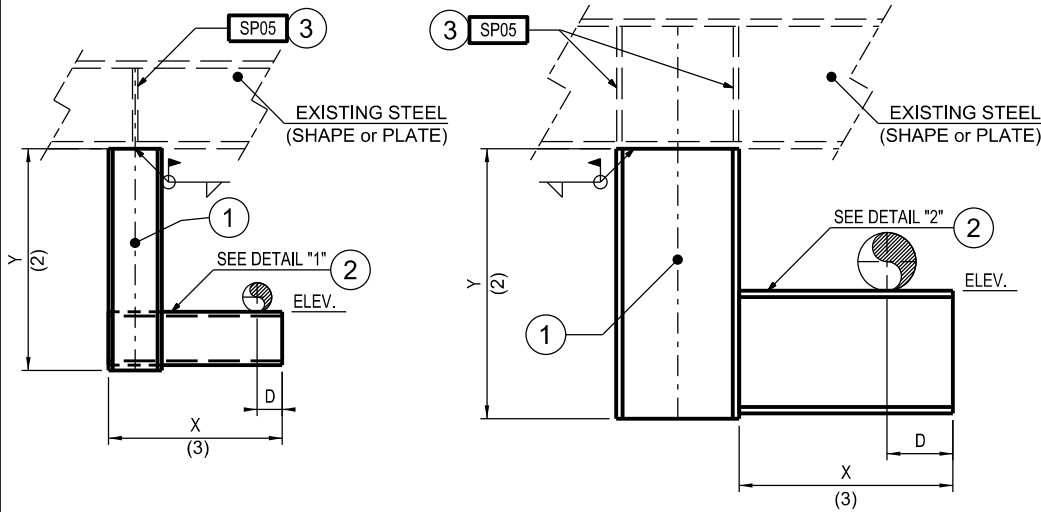
TABLE - P (kN) (1)								
SHAPE Y mm	MC100	MC125	MC150	UC152*23	UC152*30	UC203*46	UC254*73	
500	0.5	1.0	1.8	4.9	12.3	25.1	49.4	
1000	0.4	0.8	1.3	2.9	6.9	14.0	27.8	
1500	/	/	/	2.2	5.0	9.9	19.7	
2000	/	/	/	1.9	4.1	7.9	15.5	



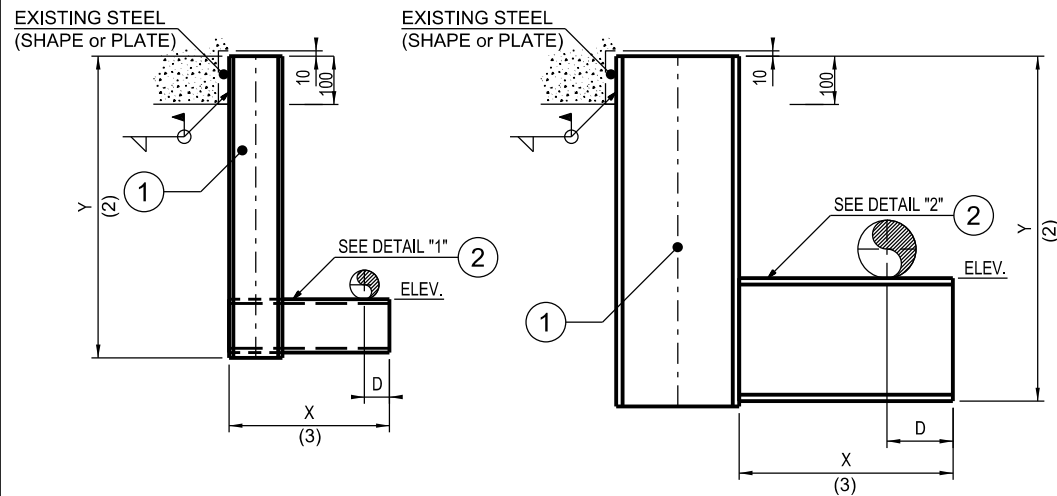
NOTES:
1. MAXI HORIZONTAL LOAD : $F = 0.35 \times P$.
2. $S_{adm} = 235 \text{ MPa} \times 0.8 = 188 \text{ MPa}$. $X = 800$ FOR VALUES INDICATED.
3. Y DIMENSION IS LIMITED FROM 200 TO 2000. TO BE ADJUSTED AT ERECTION IF NECESSARY.
4. THIS SUPPORT SHALL NOT BE USED FOR PIPES WITH LINE STOP.

ITEM	DESCRIPTION	QTY.	DETAIL	CS	CH	CL	CG	AS	AH	SS	SH	SL
3	STIFFENER	2/4	REFER TO SP05	/	/	/	/	/	/	/	/	/
2	BEAM	1	SEE TABLE	A36	A36	A36	A36	A36	A36	A36	A36	A36
1	COLUMN	1	SEE TABLE	A36	A36	A36	A36	A36	A36	A36	A36	A36

Support Mark				Positional Mark			
SB04				ELEV a			
Technip				L - SHAPE STRUCTURE			
STANDARD CONSTRUCTION DRAWING PLANT DESIGN AND PIPING				XXXXXX	000	STC - 1394 - 04	1 of 2
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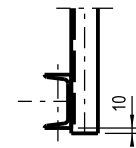
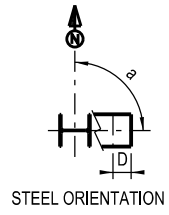
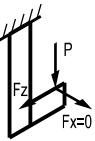


TYPE C

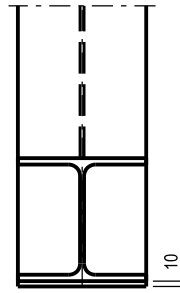


TYPE D

TABLE - P (kN) (1)							
SHAPE Y mm	MC100	MC125	MC150	UC152*23	UC152*30	UC203*46	UC254*73
500	0.5	1.0	1.8	4.9	12.3	25.1	49.4
1000	0.4	0.8	1.3	2.9	6.9	14.0	27.8
1500	/	/	/	2.2	5.0	9.9	19.7
2000	/	/	/	1.9	4.1	7.9	15.5



DETAIL 1



DETAIL 2

- NOTES:
1. MAXI HORIZONTAL LOAD : $F = 0.35 \times P$.
 2. $S_{adm} = 235 \text{ MPa} \times 0.8 = 188 \text{ MPa}$. $X = 800$ FOR VALUES INDICATED.
 3. Y DIMENSION IS LIMITED FROM 200 TO 2000. TO BE ADJUSTED AT ERECTION IF NECESSARY.
 4. THIS SUPPORT SHALL NOT BE USED FOR PIPES WITH LINE STOP.

ITEM	DESCRIPTION	QTY.	DETAIL	CS	CH	CL	CG	AS	AH	SS	SH	SL
3	STIFFENER	2/4	REFER TO SP05	/	/	/	/	/	/	/	/	/
2	BEAM	1	SEE TABLE	A36	A36	A36	A36	A36	A36	A36	A36	A36
1	COLUMN	1	SEE TABLE	A36	A36	A36	A36	A36	A36	A36	A36	A36

MATCL

Support Mark

SB04 TYPE SHAPE D X Y

Positional Mark

ELEV a

Technip

L - SHAPE STRUCTURE

SB04

STANDARD CONSTRUCTION DRAWING
PLANT DESIGN AND PIPING

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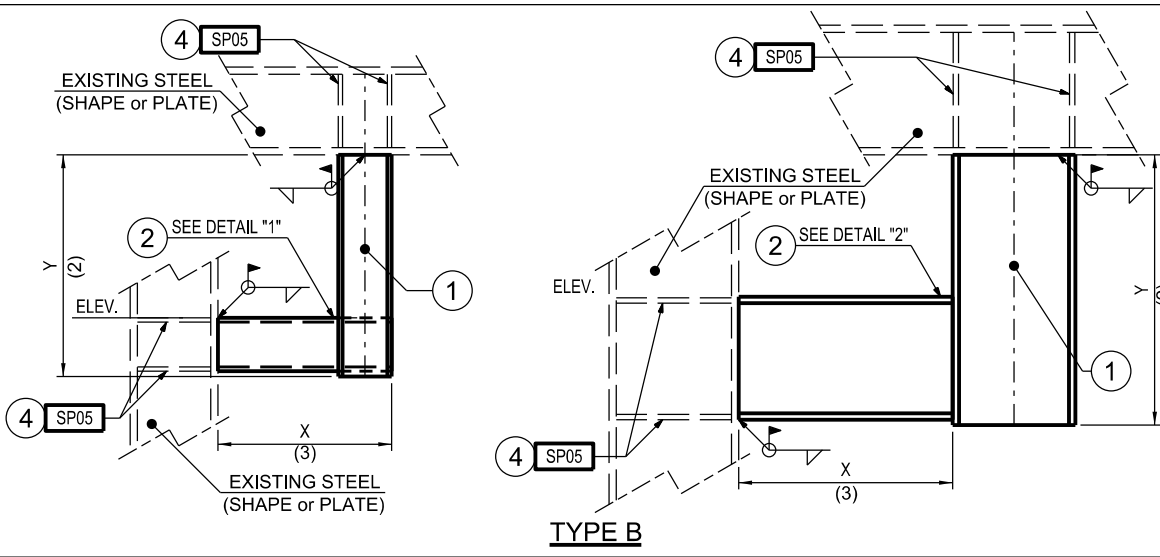
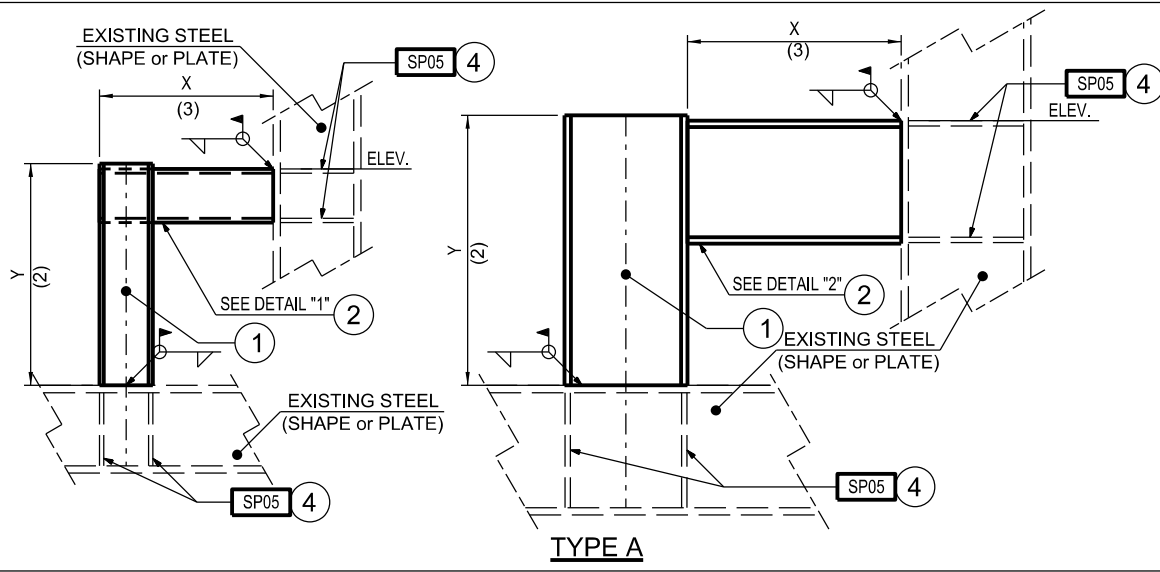
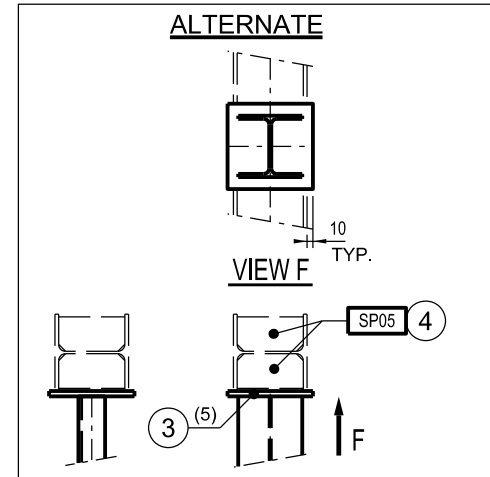
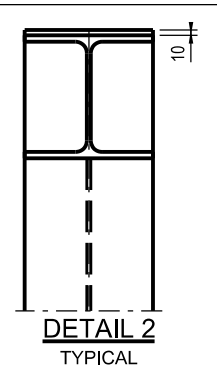
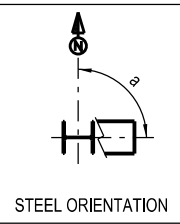
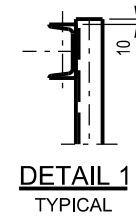
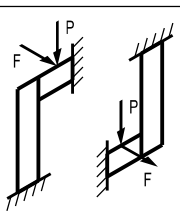


TABLE - P (kN) (1)							
SHAPE Y mm	MC100	MC125	MC150	UC152*23	UC152*30	UC203*46	UC254*73
500	8.3	11.3	26.0	47.5	-	-	-
1000	6.2	8.4	19.4	41.2	-	-	-
1500	4.9	6.6	15.0	28.7	57.6	-	-
2000	4.6	6.2	14.1	25.9	51.3	-	-



- NOTES:
1. MAXI HORIZONTAL LOAD : $F = 0.35 \times P$.
Sadm = 235 MPa x 0.8 = 188 MPa. X = 800 FOR VALUES INDICATED.
LOAD IS SUPPOSED TO BE APPLIED AT THE MOST CRITICAL POINT ON HORIZONTAL BEAM.
 2. Y DIMENSION IS LIMITED FROM 200 TO 2000. TO BE ADJUSTED AT ERECTION IF NECESSARY.
 3. X DIMENSION IS LIMITED FROM 200 TO 800.
 4. THIS SUPPORT SHALL NOT BE USED FOR PIPES WITH LINE STOP.
 5. PLATE DIMENSIONS TO BE ADJUSTED AT ERECTION AS PER EXISTING STEEL SIZE.

ITEM	DESCRIPTION	QTY.	DETAIL	CS	CH	CL	CG	AS	AH	SS	SH	SL
④	STIFFENER	4/8	REFER TO SP05	/	/	/	/	/	/	/	/	/
③	PLATE	1	PLATE Thk. 10	A36	A36	A36	A36	A36	A36	A36	A36	A36
②	BEAM	1	SEE TABLE	A36	A36	A36	A36	A36	A36	A36	A36	A36
①	COLUMN	1	SEE TABLE	A36	A36	A36	A36	A36	A36	A36	A36	A36

Support Mark				Positional Mark			
SB05 TYPE SHAPE X Y				ELEV a			
Technip				CHAIR STRUCTURE			
STANDARD CONSTRUCTION DRAWING PLANT DESIGN AND PIPING				XXXXXX	000	STC - 1394 - 05	1 of 1
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SB05

1

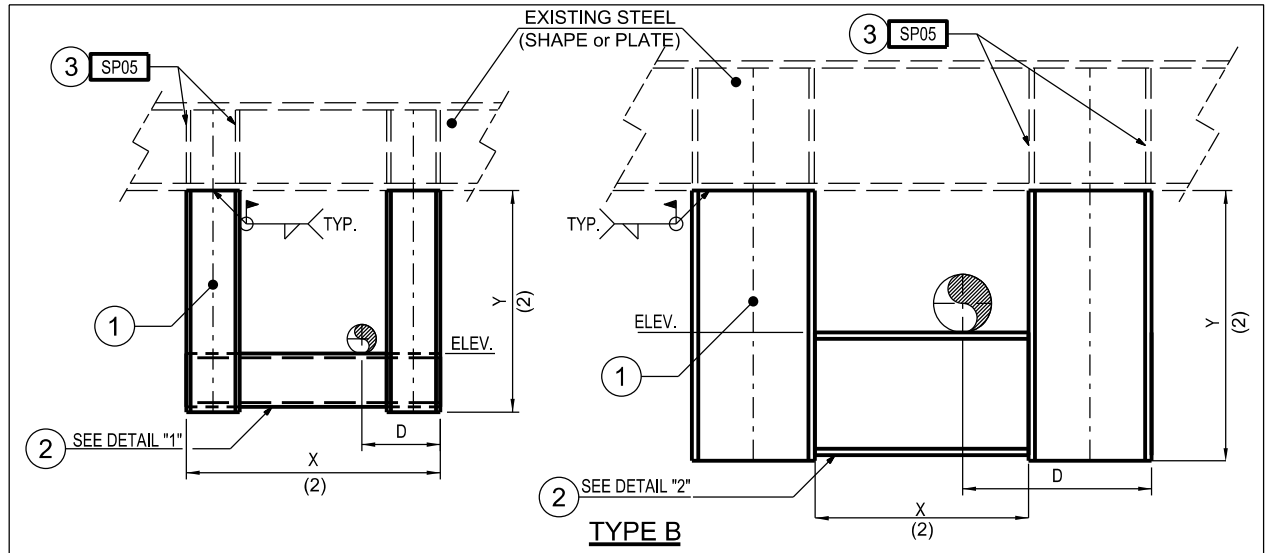
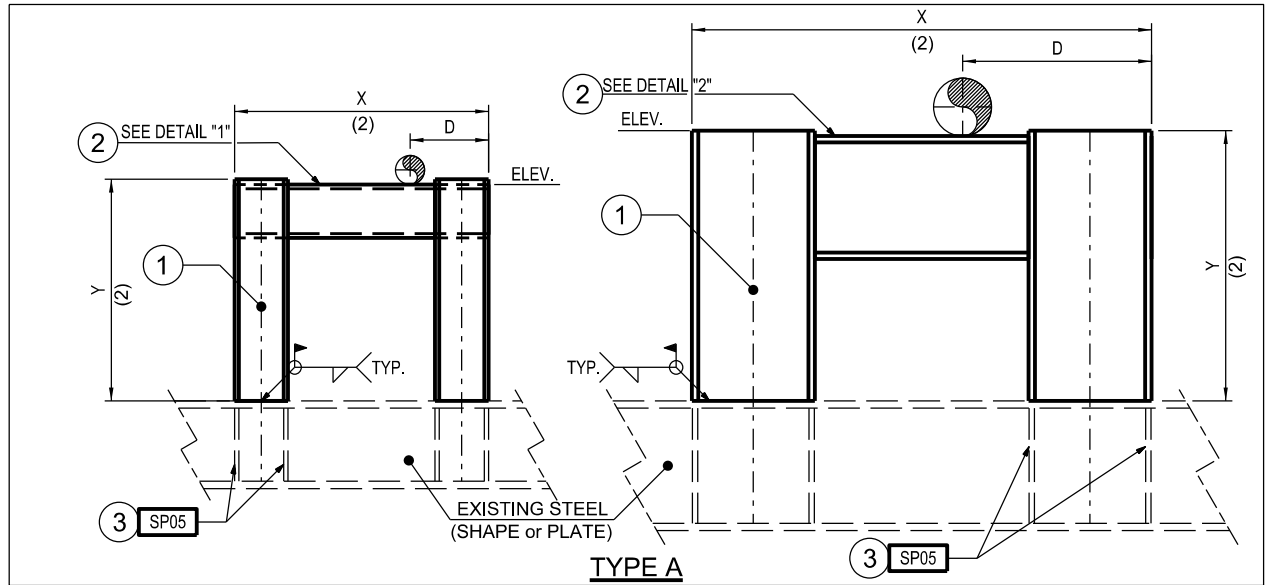
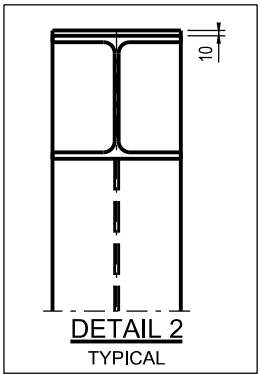
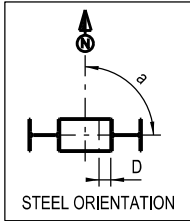
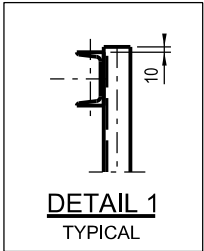
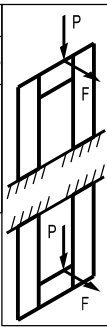


TABLE - P (kN) (1)							
SHAPE Y mm	MC100	MC125	MC150	UC152*23	UC152*30	UC203*46	UC254*73
500	4.8	8.8	14.7	24.1	47.0	-	-
1000	3.4	6.1	10.3	20.8	42.0	-	-
1500	2.2	4.0	6.6	13.7	27.0	48.0	-
2000	1.7	2.9	4.9	10.2	20.0	36.0	-



NOTES:
1. MAXI HORIZONTAL LOAD : $F = 0.35 \times P$.
Sadm = 235 MPa x 0.8 = 188 MPa. X = 800 FOR VALUES INDICATED.
LOAD IS SUPPOSED TO BE APPLIED AT THE MOST CRITICAL POINT ON HORIZONTAL BEAM.
2. X & Y DIMENSIONS ARE LIMITED FROM 200 TO 2000. TO BE ADJUSTED AT ERECTION IF NECESSARY.

ITEM	DESCRIPTION	QTY.	DETAIL	CS	CH	CL	CG	AS	AH	SS	SH	SL
3	STIFFENER	8	REFER TO SP05	/	/	/	/	/	/	/	/	/
2	BEAM	1	SEE TABLE	A36	A36	A36	A36	A36	A36	A36	A36	A36
1	COLUMN	2	SEE TABLE	A36	A36	A36	A36	A36	A36	A36	A36	A36

MATCL

Support Mark

SB06 TYPE SHAPE D X Y

Positional Mark

ELEV a

Technip

U - SHAPE STRUCTURE

SB06

STANDARD CONSTRUCTION DRAWING
PLANT DESIGN AND PIPING

XXXXXX

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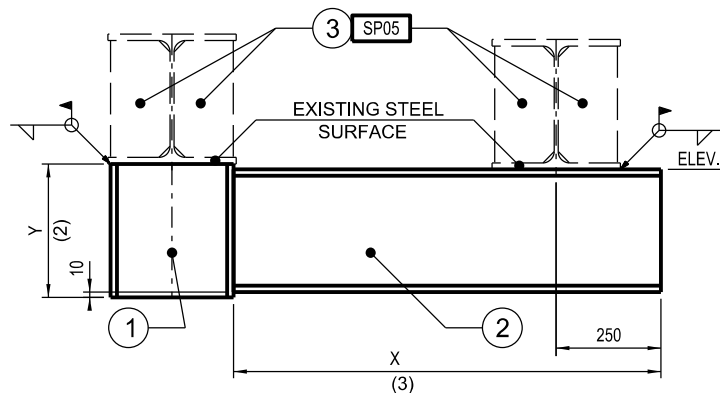
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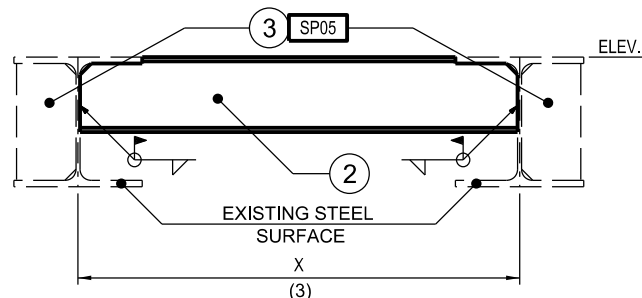
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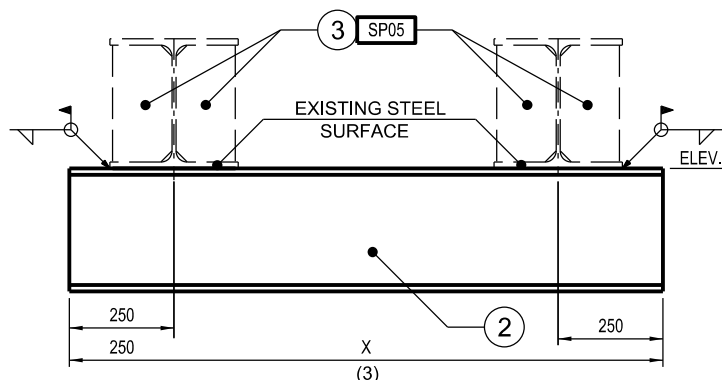
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TYPE A

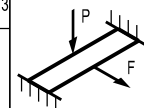


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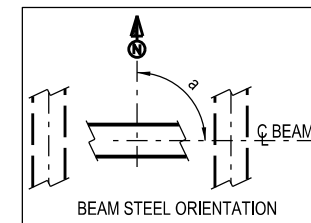


TYPE C

TYPE A / TABLE - P (kN) (1)							
SHAPE Y mm	MC100	MC125	MC150	UC152*23	UC152*30	UC203*46	UC254*73
200	5.8	8.1	18.8	29.0	57.7	-	-
500	5.7	7.9	18.6	29.0	58.8	-	-
1000	3.7	4.9	11.0	22.7	45.7	-	-
1500	2.9	3.9	8.6	18.4	36.8	-	-
2000	2.9	3.9	8.5	18.4	36.0	-	-



TYPE B & C / TABLE - P (kN) (1)							
SHAPE X mm	MC100	MC125	MC150	UC152*23	UC152*30	UC203*46	UC254*73
800	11	28.1	48.6	73.0	-	-	-
1000	9	22.5	39.0	58.4	-	-	-
1500	7.7	15.0	26.0	38.9	-	-	-
2000	5.8	11.2	19.5	29.2	59.4	-	-



NOTES:
1. MAXI HORIZONTAL LOAD : $F = 0.35 \times P$.
2. $S_{adm} = 235 \text{ MPa} \times 0.8 = 188 \text{ MPa}$.
3. Y DIMENSION IS LIMITED FROM 200 TO 2000. TO BE ADJUSTED AT ERECTION IF NECESSARY.
4. X DIMENSION IS LIMITED FROM 800 TO 2000. TO BE ADJUSTED AT ERECTION IF NECESSARY.
5. LOADS ARE DEFINED CONSIDERING $X = 2000$.

Support Mark

SB07 TYPE SHAPE X Y

Positional Mark

ELEV a

ITEM	DESCRIPTION	QTY.	DETAIL	CS	CH	CL	CG	AS	AH	SS	SH	SL
3	STIFFENER	2/4	REFER TO SP05	/	/	/	/	/	/	/	/	/
2	BEAM	1	SEE TABLES	A36	A36	A36	A36	A36	A36	A36	A36	A36
1	COLUMN	1	SEE TABLES	A36	A36	A36	A36	A36	A36	A36	A36	A36

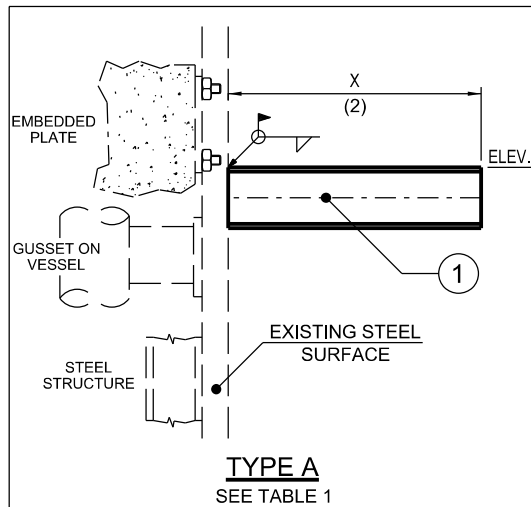
MATCL

STANDARD CONSTRUCTION DRAWING
PLANT DESIGN AND PIPING

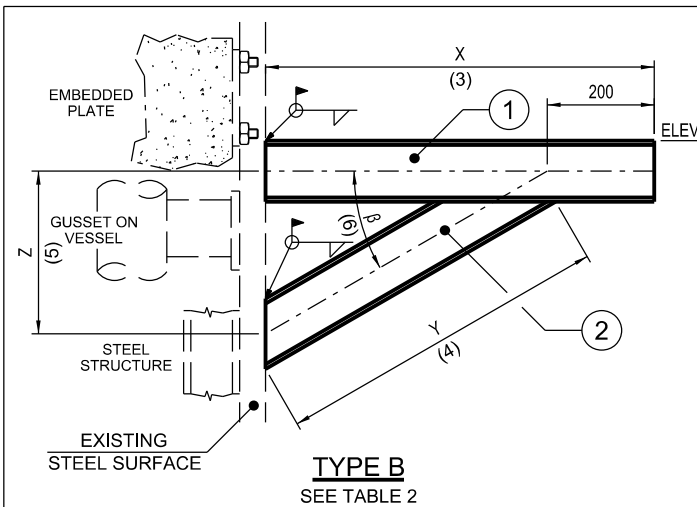
ADDITIONAL INTERMEDIATE BEAM

SB07

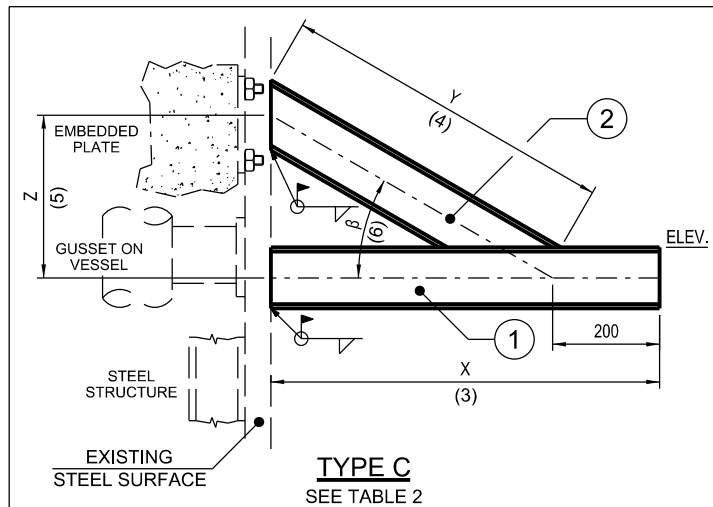
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TYPE A
SEE TABLE 1



TYPE B
SEE TABLE 2



TYPE C
SEE TABLE 2

TABLE 1 - P (kN) (1)							
SHAPE X mm	MC100	MC125	MC150	UC152*23	UC152*30	UC203*46	UC254*73
200	5.8	12.1	21.0	50.8	-	-	-
500	2.6	5.1	8.6	20.3	41.3	-	-
1000	1.5	2.8	4.6	10.0	20.6	36.0	-

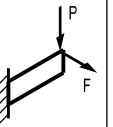
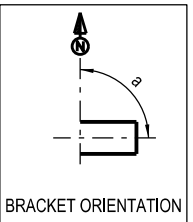
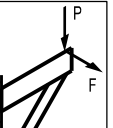
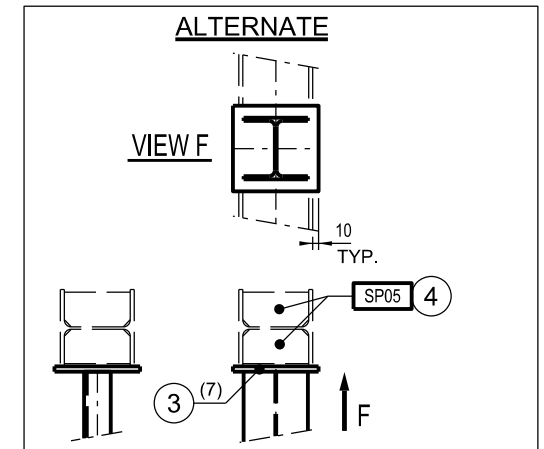


TABLE 2 - P (kN) (1)							
SHAPE X mm	MC100	MC125	MC150	UC152*23	UC152*30	UC203*46	UC254*73
1000	6.3	10.8	17.4	33.4	-	-	-
1500	4.0	7.0	11.4	22.8	43.4	-	-
2000	3.0	5.2	8.4	17.0	33.0	55.6	-



BRACKET ORIENTATION



- NOTES:
1. MAXI HORIZONTAL LOAD : $F = 0.35 \times P$.
2. $S_{adm} = 235 \text{ MPa} \times 0.8 = 188 \text{ MPa}$.
3. X DIMENSION FOR TYPE A IS LIMITED FROM 200 TO 1000.
4. X DIMENSION FOR TYPES B & C ARE LIMITED FROM 1000 TO 2000.
5. Y DIMENSION (APPROX.) IS $X \times 1.15$. TO BE ADJUSTED AT ERECTION.
6. Z DIMENSION IS $(X - 200) \times 0.57$.
7. ANGLE 30° MIN AS DEFAULT. TO BE CHANGED IF NECESSARY FOR VESSEL APPLICATIONS.
8. PLATE DIMENSIONS TO BE ADJUSTED AT ERECTION AS PER EXISTING STEEL SIZE.

ITEM	DESCRIPTION	QTY.	DETAIL	CS	CH	CL	CG	AS	AH	SS	SH	SL
④	STIFFENER	4/8	REFER TO SP05	/	/	/	/	/	/	/	/	/
③	PLATE	1/2	PLATE Thk, 10	A36	A36	A36	A36	A36	A36	A36	A36	A36
②	BRACE	1	SEE TABLE 2	A36	A36	A36	A36	A36	A36	A36	A36	A36
①	BEAM	1	SEE TABLES	A36	A36	A36	A36	A36	A36	A36	A36	A36

MATCL

Support Mark				Positional Mark			
SB08	TYPE	SHAPE	X β	ELEV	a		
Technip				SINGLE BRACKET			SB08
STANDARD CONSTRUCTION DRAWING PLANT DESIGN AND PIPING				XXX XXX	000	STC - 1394 - 08	1 of 1
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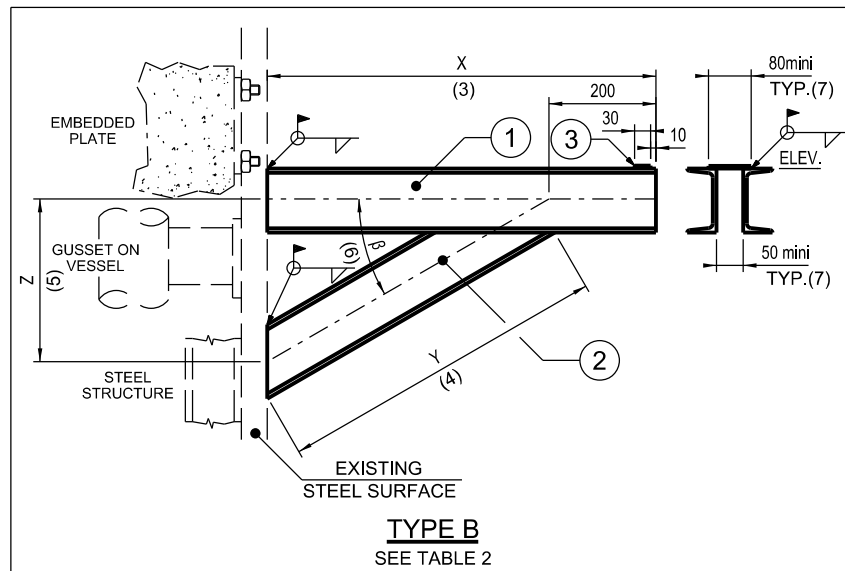
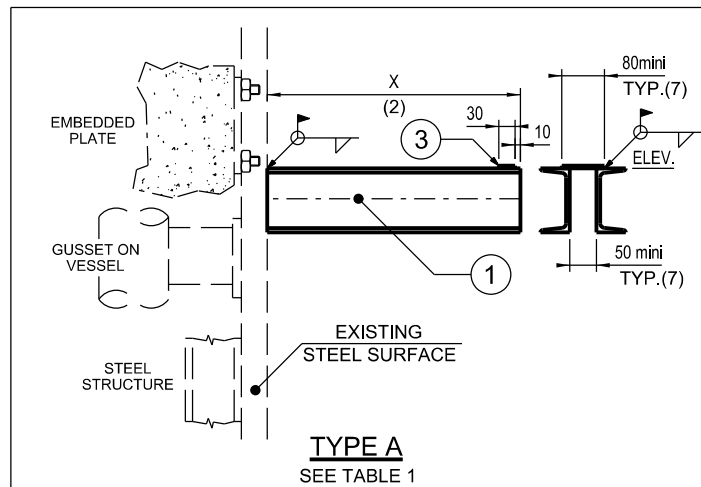


TABLE 1 - P (kN) (1)				
SHAPE X mm	MC100	MC125	MC150	MC 200
500	8.1	15.7	27.0	41.3
1000	4.1	7.8	13.6	20.7

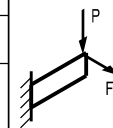
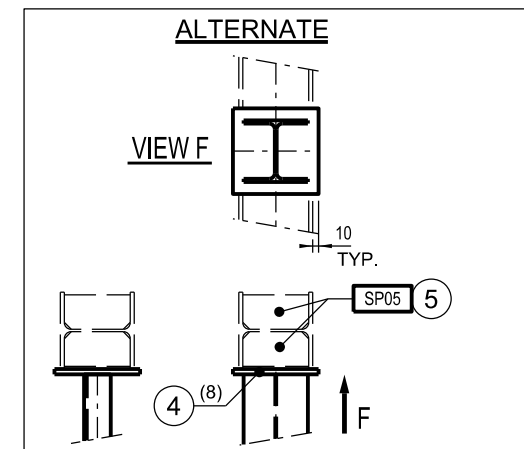
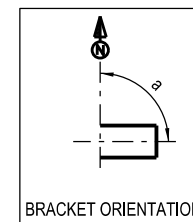
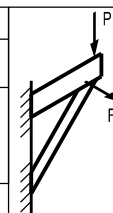


TABLE 2 - P (kN) (1)				
SHAPE X mm	MC100	MC 125	MC 150	MC 200
1000	12.2	21.0	33.8	49.0
1500	7.8	13.4	21.9	32.0
2000	5.7	9.9	16.1	23.7



NOTES:
1. MAXI HORIZONTAL LOAD : $F = 0.35 \times P$.
 $S_{adm} = 235 \text{ MPa} \times 0.8 = 188 \text{ MPa}$.
2. X DIMENSION FOR TYPE A IS LIMITED FROM 200 TO 1000.
3. X DIMENSION FOR TYPE B IS LIMITED FROM 1000 TO 2000.
4. Y DIMENSION (APPROX.) $X \times 1.15$. TO BE ADJUSTED AT ERECTION.
5. Z DIMENSION IS $(X - 200) \times 0.57$.
6. ANGLE 30° MIN AS DEFAULT. TO BE CHANGED IF NECESSARY FOR VESSEL APPLICATIONS.
7. DIMENSIONS TO BE ADAPTED ON SITE AS PER SPRING BOX ROD SIZE.
8. PLATE DIMENSIONS TO BE ADJUSTED AT ERECTION AS PER EXISTING STEEL SIZE.

5	STIFFENER	4/8	REFER TO SP05	/	/	/	/	/	/	/	/	
4	PLATE	1/2	PLATE Thk. 10	A36	A36	A36	A36	A36	A36	A36	A36	
3	STIFFENER	1	FLAT BAR 30 x 5	A36	A36	A36	A36	A36	A36	A36	A36	
2	BRACE	2	SEE TABLE 2	A36	A36	A36	A36	A36	A36	A36	A36	
1	BEAM	2	SEE TABLES	A36	A36	A36	A36	A36	A36	A36	A36	
ITEM	DESCRIPTION	QTY.	DETAIL	CS	CH	CL	CG	AS	AH	SS	SH	SL

MATCL

Support Mark				Positional Mark			
SB09				ELEV a			
Technip				DOUBLE BRACKET FOR SPRING HANGER INSTALLATION			
STANDARD CONSTRUCTION DRAWING				SB09			
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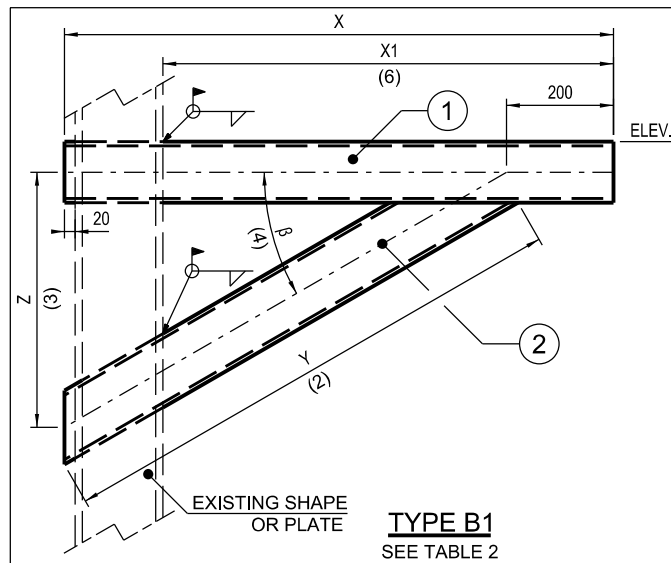
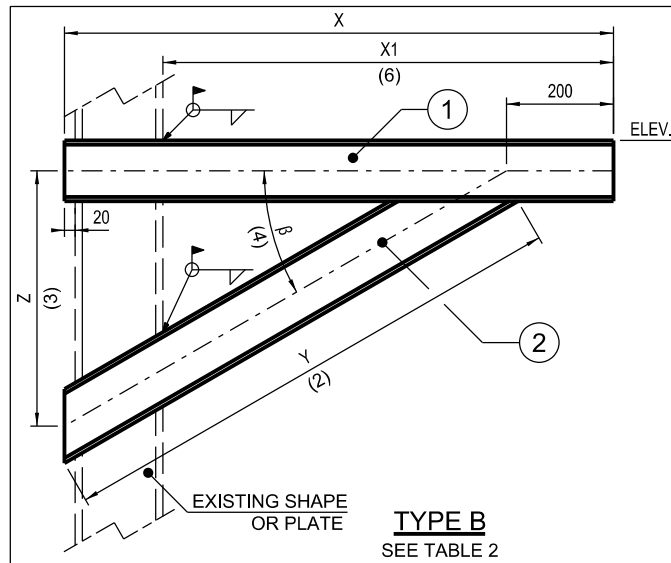
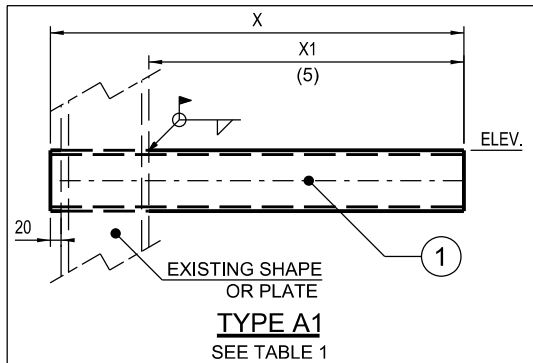
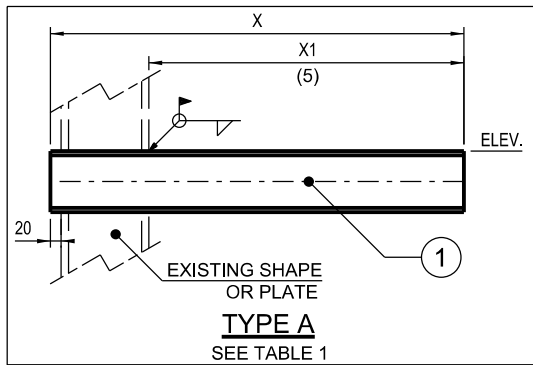
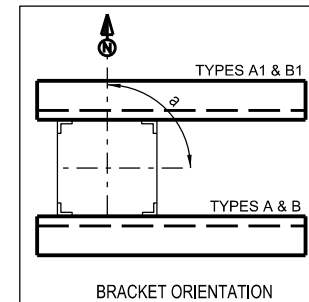


TABLE 1 - P (kN) (1)				
SHAPE X1 mm	MC100	MC125	MC150	
500	2.6	4.9	8.2	
1000	2.0	3.9	6.8	

TABLE 2 - P (kN) (1)				
SHAPE X1 mm	MC 100	MC 125	MC 150	
1000	6.1	10.5	17.0	
1500	3.9	6.7	11.0	
2000	2.8	4.9	8.0	

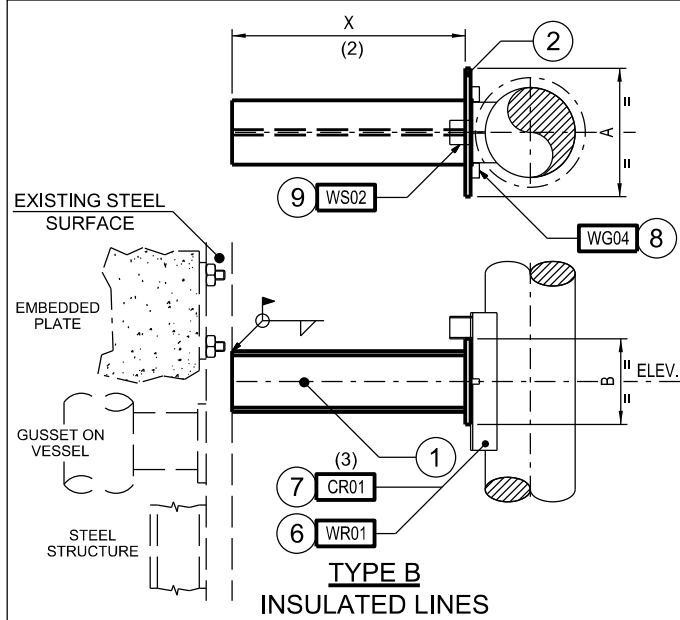
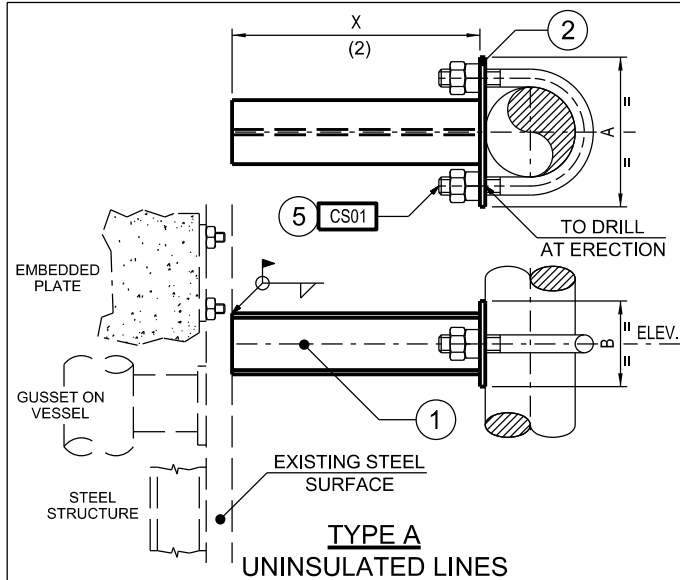


NOTES:
1. MAXI HORIZONTAL LOAD : $F = 0.35 \times P$.
Sadm = 235 MPa x 0.8 = 188 MPa.
2. Y DIMENSION (APPROX.) X x 1.15. TO BE ADJUSTED AT ERECTION.
3. Z DIMENSION IS (X - 200) x 0.57.
4. ANGLE 30° MIN AS DEFAULT. TO BE CHANGED IF NECESSARY FOR VESSEL APPLICATIONS.
5. X1 DIMENSION FOR TYPES A & A1 IS LIMITED FROM 200 TO 1000.
6. X1 DIMENSION FOR TYPES B & B1 IS LIMITED FROM 1000 TO 2000.

ITEM	DESCRIPTION	QTY.	DETAIL	CS	CH	CL	CG	AS	AH	SS	SH	SL
②	BRACE	1	SEE TABLE 2	A36	A36	A36	A36	A36	A36	A36	A36	A36
①	BEAM	1	SEE TABLES	A36	A36	A36	A36	A36	A36	A36	A36	A36

MATCL

Support Mark				Positional Mark			
SB10 TYPE SHAPE X β				ELEV a			
Technip				LATERALLY FIXED BRACKET FOR VERTICAL PIPE			
STANDARD CONSTRUCTION DRAWING PLANT DESIGN AND PIPING				XXXXXX	000	STC - 1394 - 10	1 of 1
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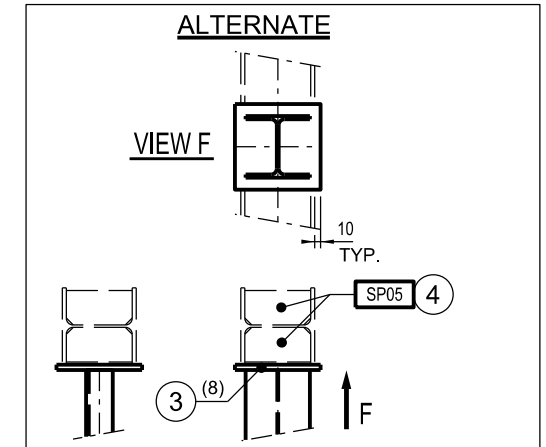
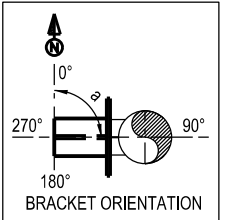
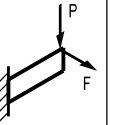


9	STOP	1	REFER TO WS02	/	/	/	/	/	/	/	/	
8	HOLD DOWN	1	REFER TO WG04	/	/	/	/	/	/	/	/	
7	SHOE	1	REFER TO CR01	/	/	/	/	/	/	/	/	
6	SHOE	1	REFER TO WR01	/	/	/	/	/	/	/	/	
5	U-BOLT	1	REFER TO CS01	/	/	/	/	/	/	/	/	
4	STIFFENER	4	REFER TO SP05	/	/	/	/	/	/	/	/	
3	PLATE	1	PLATE Thk, 10	A36	A36	A36	A36	A36	A36	A36	A36	
2	END PLATE	1	PLATE Thk, T	A36	A36	A36	A36	A36	A36	A36	A36	
1	BEAM	1	SEE TABLE 1	A36	A36	A36	A36	A36	A36	A36	A36	
ITEM	DESCRIPTION	QTY.	DETAIL	CS	CH	CL	CG	AS	AH	SS	SH	SL

MATCL

TABLE 2				
DIAM		A	B	T
ND	Inch			
50	2"	200	130	5
80	3"	200	160	5
100	4"	210	160	10
150	6"	250	160	10

TABLE 1 - P (kN) (1)					
SHAPE	MC100	MC125	MC150	UC152*23	UC152*30
X mm					
200	5.8	12.1	21.0	50.8	-
500	2.6	5.1	8.6	20.3	41.3
1000	1.5	2.8	4.6	10.1	20.6



NOTES:
1. MAXI HORIZONTAL LOAD : $F = 0.35 \times P$.
2. $S_{adm} = 235 \text{ MPa} \times 0.8 = 188 \text{ MPa}$.
3. X DIMENSION IS LIMITED FROM 200 TO 1000, TO BE ADJUSTED AT ERECTION.
4. WE03 SHALL BE USED FOR CLAMPED PIPE SHOE.
5. PLATE DIMENSIONS TO BE ADJUSTED AT ERECTION AS PER EXISTING STEEL SIZE.

Support Mark

SB11 DIAM TYPE SHAPE X

Positional Mark

ELEV a

Technip

BRACKET FOR VERTICAL PIPE
FOR DIAM 2" TO 6"

SB11

STANDARD CONSTRUCTION DRAWING
PLANT DESIGN AND PIPING

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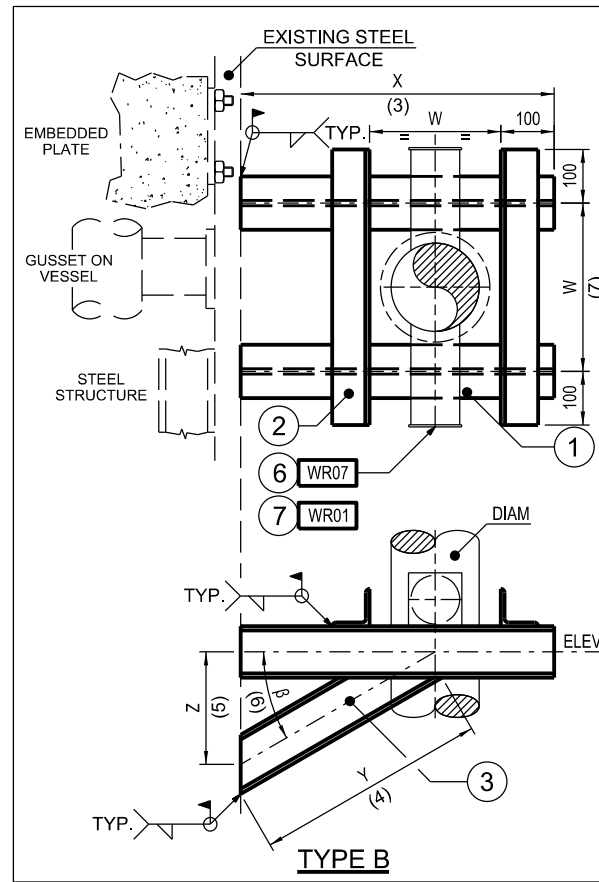
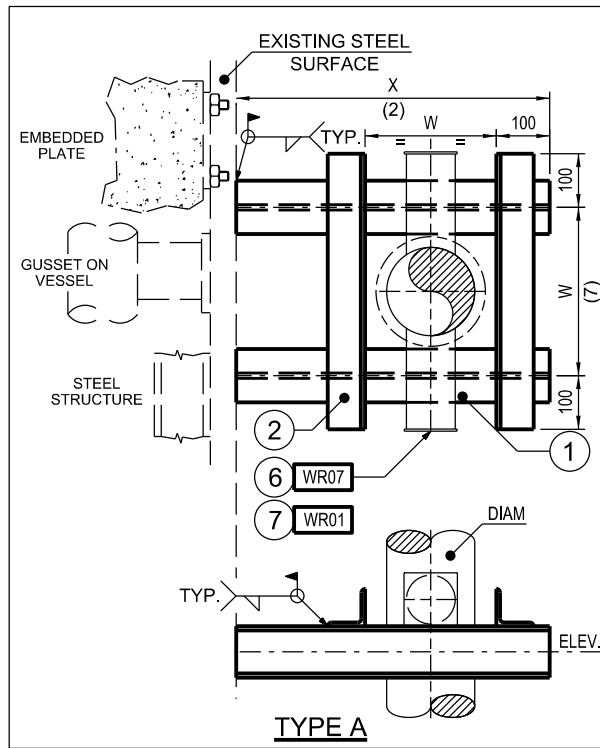
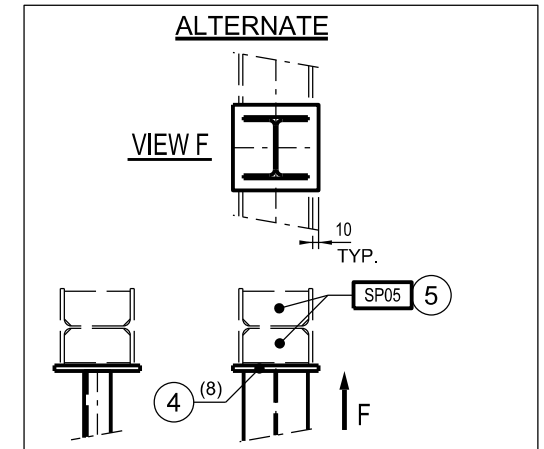
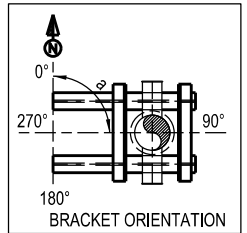


TABLE 1 - P (kN) (1)							
SHAPE	MC100	MC125	MC150	UC152*23	UC152*30	UC203*46	UC254*73
X mm							
200	5.8	12.1	21.0	50.8	-	-	-
500	2.6	5.1	8.6	20.3	41.3	-	-
1000	1.5	2.8	4.6	10.0	20.6	36.0	-

TABLE 2 - P (kN) (1)							
SHAPE	MC100	MC125	MC150	UC152*23	UC152*30	UC203*46	UC254*73
X mm							
1000	6.3	10.8	17.4	33.4	-	-	-
1500	4.0	7.0	11.4	22.8	43.4	-	-
2000	3.0	5.2	8.4	17.0	33.0	55.6	-



NOTES:

1. MAXI HORIZONTAL LOAD : $F = 0.35 \times P$.
 $S_{adm} = 235 \text{ MPa} \times 0.8 = 188 \text{ MPa}$.
2. X DIMENSION FOR TYPE A IS LIMITED FROM 200 TO 1000.
3. X DIMENSION FOR TYPE B IS LIMITED FROM 1000 TO 2000.
4. Y DIMENSION (APPROX.) $X \times 1.15$. TO BE ADJUSTED AT ERECTION.
5. Z DIMENSION IS $(X - W/2 - 100) \times 0.57$.
6. ANGLE 30° MIN AS DEFAULT. TO BE CHANGED IF NECESSARY FOR VESSEL APPLICATIONS.
7. FOR CHANNEL SHAPE, W IS INTERNAL DIMENSION.
8. PLATE DIMENSIONS TO BE ADJUSTED AT ERECTION AS PER EXISTING STEEL SIZE.
9. FOR HIGH TEMPERATURE CH,AH,SH SHOE TO BE PROVIDED ALONG WITH TRUNNION.

7	SHOE	1	REFER TO WR01	/	/	/	/	(9)	/	(9)	/	
6	TRUNNION	1	REFER TO WR07	/	/	/	/	/	/	/	/	
5	STIFFENER	8/16	REFER TO SP05	/	/	/	/	/	/	/	/	
4	PLATE	2/4	PLATE Thk. 10	A36	A36	A36	A36	A36	A36	A36	A36	
3	BRACE	2	SEE TABLE 2	A36	A36	A36	A36	A36	A36	A36	A36	
2	CROSS BEAM	2	ISA 75	A36	A36	A36	A36	A36	A36	A36	A36	
1	BEAM	2	SEE TABLES	A36	A36	A36	A36	A36	A36	A36	A36	
ITEM	DESCRIPTION	QTY.	DETAIL	CS	CH	CL	CG	AS	AH	SS	SH	SL

MATCL

Support Mark

SB12 DIAM TYPE SHAPE X W β

Positional Mark

ELEV a

Technip

**DOUBLE BRACKET FOR VERTICAL PIPE
FOR DIAM 8" TO 24"**

SB12

STANDARD CONSTRUCTION DRAWING
PLANT DESIGN AND PIPING

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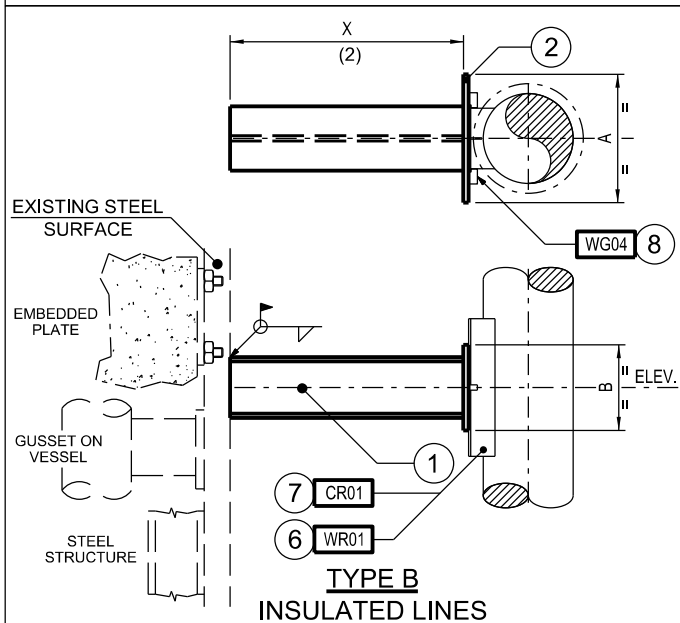
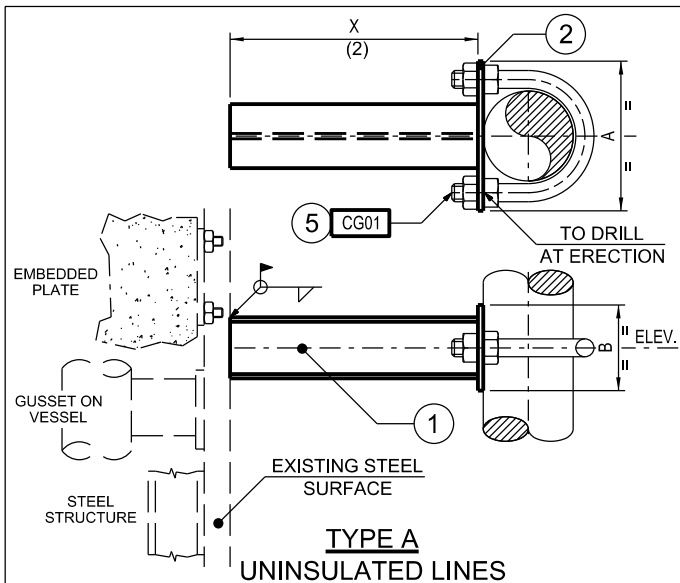
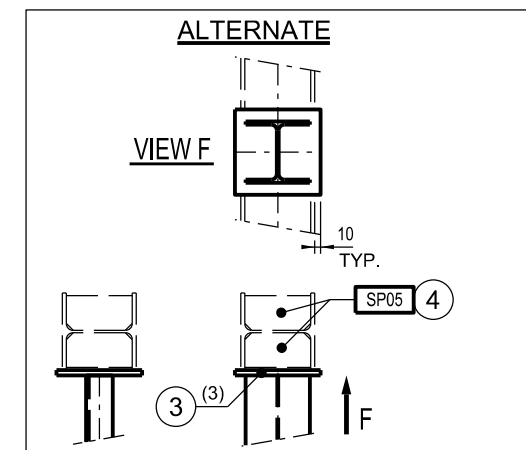
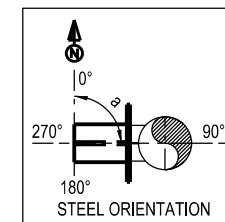


TABLE 1 - F (kN) (1)					
SHAPE	MC100	MC125	MC150	UC152*23	UC152*30
X mm					
200	2.0	4.2	7.35	17.7	36.1
500	0.9	1.7	3.0	7.1	14.4
1000	0.5	0.9	1.6	3.5	7.2

TABLE 2				
DIAM				
	ND	Inch	A	B
50	2"		200	130
80	3"		200	160
100	4"		210	160
150	6"		250	160



NOTES:
1. MAXI HORIZONTAL LOAD : $F = 0.35 \times P$.
2. X DIMENSION IS LIMITED FROM 200 TO 1000, TO BE ADJUSTED AT ERECTION.
3. PLATE DIMENSIONS TO BE ADJUSTED AT ERECTION AS PER EXISTING STEEL SIZE.

8	HOLD DOWN	1	REFER TO WG04	/	/	/	/	/	/	/	/	
7	SHOE	1	REFER TO CR01	/	/	/	/	/	/	/	/	
6	SHOE	1	REFER TO WR01	/	/	/	/	/	/	/	/	
5	U-BOLT	1	REFER TO CG01	/	/	/	/	/	/	/	/	
4	STIFFENER	4	REFER TO SP05	/	/	/	/	/	/	/	/	
3	PLATE	1	PLATE Thk, 10	A36	A36	A36	A36	A36	A36	A36	A36	
2	END PLATE	1	PLATE Thk, T	A36	A36	A36	A36	A36	A36	A36	A36	
1	BEAM	1	SEE TABLE 1	A36	A36	A36	A36	A36	A36	A36	A36	
ITEM	DESCRIPTION	QTY.	DETAIL	CS	CH	CL	CG	AS	AH	SS	SH	SL

MATCL

Support Mark				Positional Mark			
SB13	DIAM	TYPE	SHAPE	X	ELEV	a	
Technip				BIDIRECTIONAL VERTICAL GUIDE FOR DIAM 2" TO 6"			SB13
STANDARD CONSTRUCTION DRAWING PLANT DESIGN AND PIPING				XXXXXX	000	STC - 1394 - 13	1 of 1
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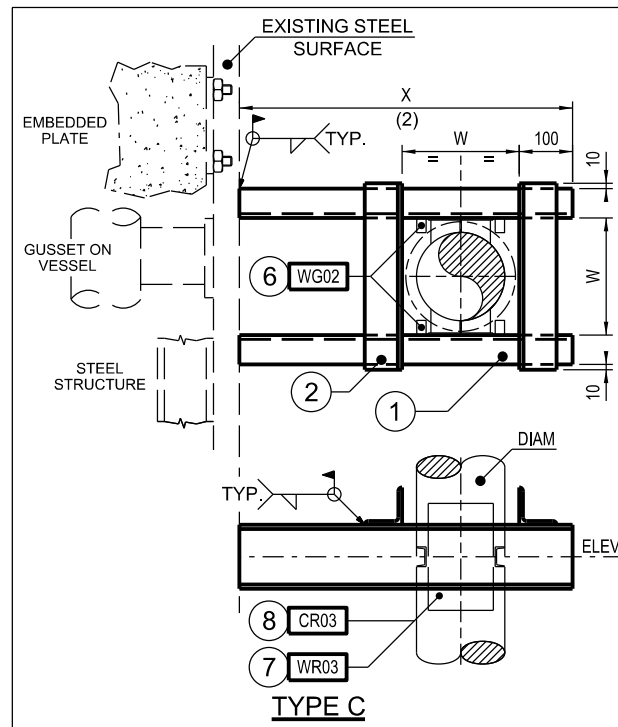
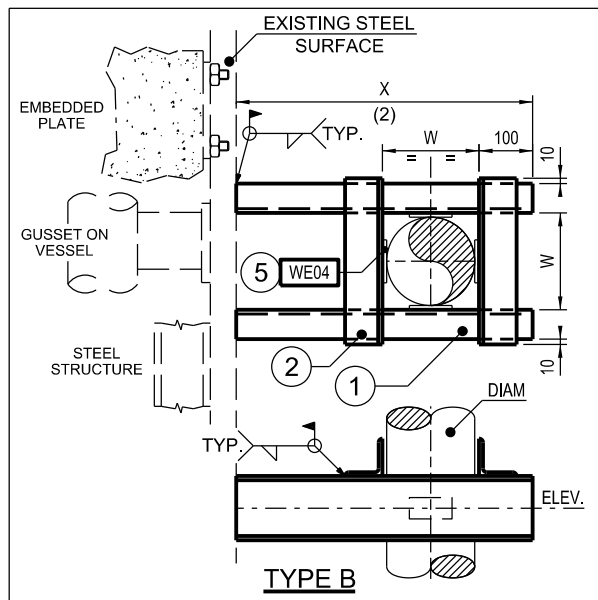
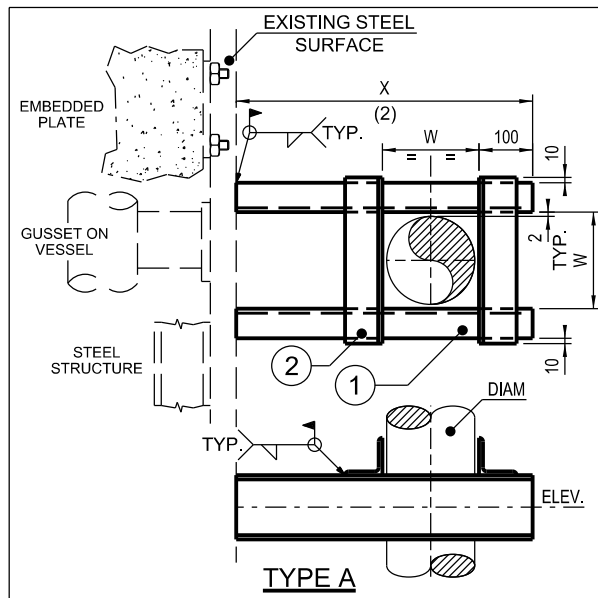
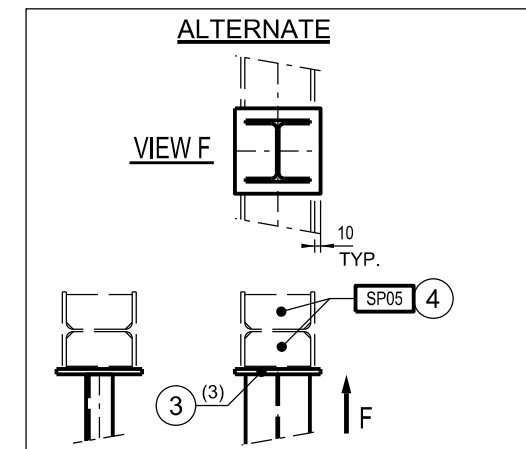
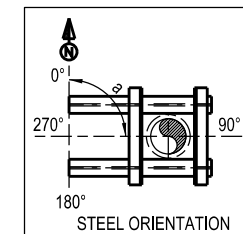


TABLE 1 - LOADS (kN) TYPE A/B/C										
SHAPE		MC100		MC125		MC150		MC 200		
X mm		P	F	P	F	P	F	P		F
500		5.2	1.8	9.8	3.4	16.4	5.7	26		9.1
1000		4.0	1.4	7.8	2.7	13.6	4.7	20	7	

TABLE 2		
DIAM		2
ND	Inch	
200 TO 450	8" TO 18"	
500 TO 600	20" TO 24"	



ITEM	DESCRIPTION	QTY.	DETAIL	CS	CH	CL	CG	AS	AH	SS	SH	SL
8	SHOE	1	REFER TO CR03	/	/	/	/	/	/	/	/	/
7	SHOE	1	REFER TO WR03	/	/	/	/	/	/	/	/	/
6	GUIDE	2	REFER TO WG02	/	/	/	/	/	/	/	/	/
5	WEDGE	4	REFER TO WE04	/	/	/	/	/	/	/	/	/
4	STIFFENER	8	REFER TO SP05	/	/	/	/	/	/	/	/	/
3	PLATE	2	PLATE Thk, 10	A36	A36	A36	A36	A36	A36	A36	A36	A36
2	CROSS BEAM	2	SEE TABLE 2	A36	A36	A36	A36	A36	A36	A36	A36	A36
1	BEAM	2	SEE TABLE 1	A36	A36	A36	A36	A36	A36	A36	A36	A36

NOTES:											
1. DELETED											
2. X DIMENSION FOR TYPES A / B / C IS LIMITED FROM 400 TO 1100. TO BE ADJUSTED AT ERECTION.											
3. PLATE DIMENSIONS TO BE ADJUSTED AT ERECTION AS PER EXISTING STEEL SIZE.											

Support Mark						Positional Mark					
SB14						ELEV a					
Technip						BIDIRECTIONAL VERTICAL GUIDE FOR DIAM 8" TO 24"					
STANDARD CONSTRUCTION DRAWING PLANT DESIGN AND PIPING						SB14					
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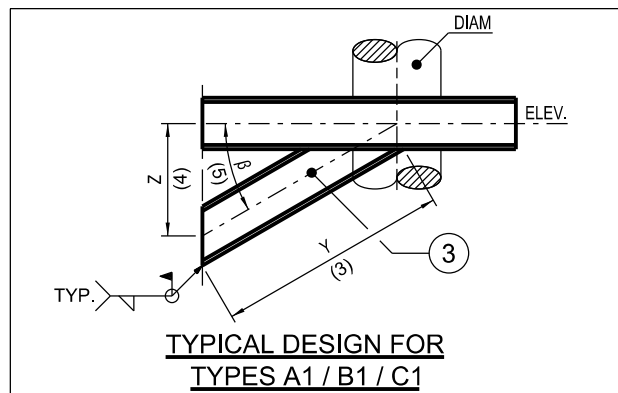
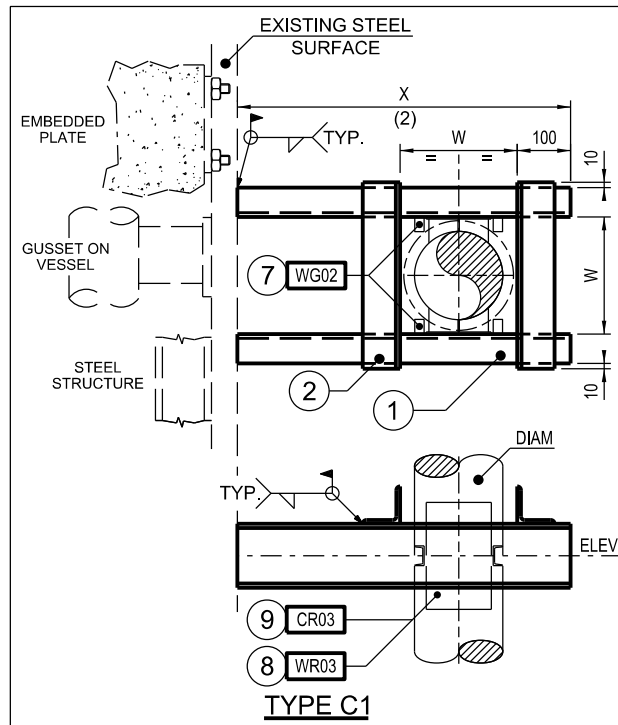
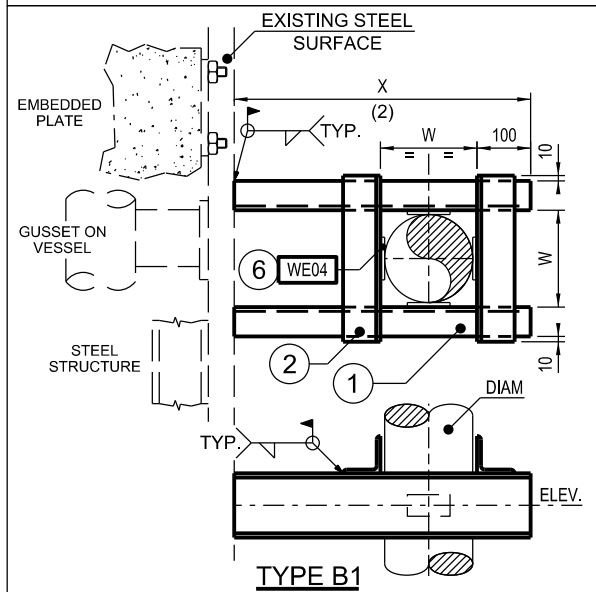
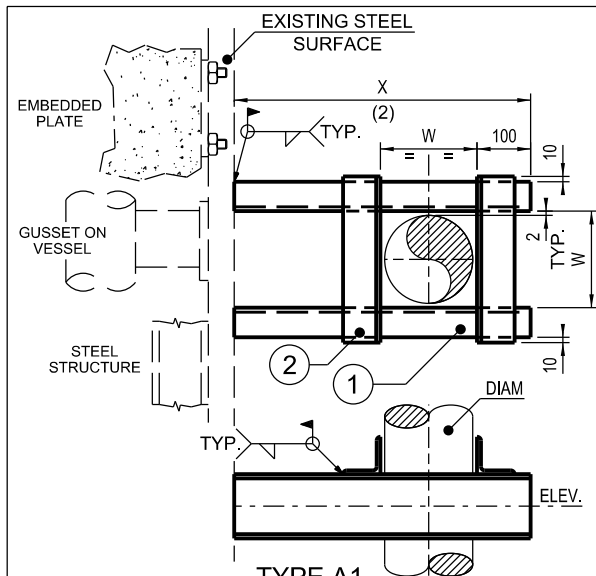


TABLE 1 - LOADS (kN) TYPE A1/B1/C1								
SHAPE X mm	MC100		MC125		MC150		MC 200	
	P	F	P	F	P	F	P	F
1000	24	7.0	30	8.9	38	11.5	50	15
2000	14	4.0	18	4.9	22	6.5	29	8.5

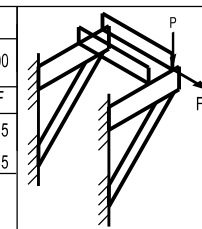
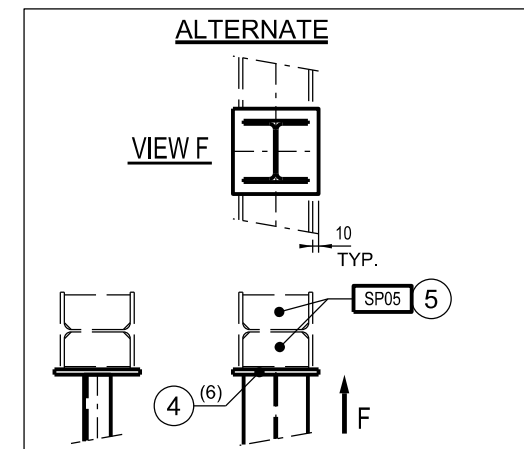
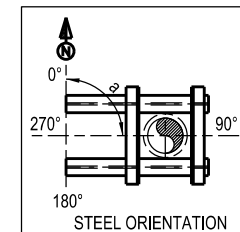


TABLE 2		
DIAM		(2)
ND	Inch	
200 TO 450	8" TO 18"	ISA 75
500 TO 600	20" TO 24"	ISA 100



(9)	SHOE	1	REFER TO CR03	/	/	/	/	/	/	/	/	/	/
(8)	SHOE	1	REFER TO WR03	/	/	/	/	/	/	/	/	/	/
(7)	GUIDE	2	REFER TO WG02	/	/	/	/	/	/	/	/	/	/
(6)	WEDGE	4	REFER TO WE04	/	/	/	/	/	/	/	/	/	/
(5)	STIFFENER	16	REFER TO SP05	/	/	/	/	/	/	/	/	/	/
(4)	PLATE	4	PLATE Thk. 10	A36	A36	A36	A36	A36	A36	A36	A36	A36	A36
(3)	BRACE	2	SAME AS BEAM	A36	A36	A36	A36	A36	A36	A36	A36	A36	A36
(2)	CROSS BEAM	2	SEE TABLE 2	A36	A36	A36	A36	A36	A36	A36	A36	A36	A36
(1)	BEAM	2	SEE TABLE 1	A36	A36	A36	A36	A36	A36	A36	A36	A36	A36
ITEM	DESCRIPTION	QTY.	DETAIL	CS	CH	CL	CG	AS	AH	SS	SH	SL	

MATCL

NOTES:

1. DELETED
2. X DIMENSION FOR TYPES A1 / B1 / C1 IS LIMITED FROM 1100 TO 2000. TO BE ADJUSTED AT ERECTION.
3. Y DIMENSION (APPROX.) X x 1.15. TO BE ADJUSTED AT ERECTION.
4. Z DIMENSION IS (X - W/2 - 100) x 0.57.
5. ANGLE 30° MIN AS DEFAULT. TO BE CHANGED IF NECESSARY FOR VESSEL APPLICATIONS.
6. PLATE DIMENSIONS TO BE ADJUSTED AT ERECTION AS PER EXISTING STEEL SIZE.

Support Mark

SB14 DIAM TYPE SHAPE X W β

Positional Mark

ELEV a

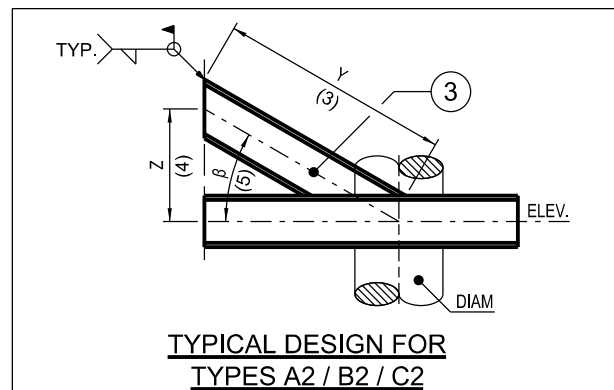
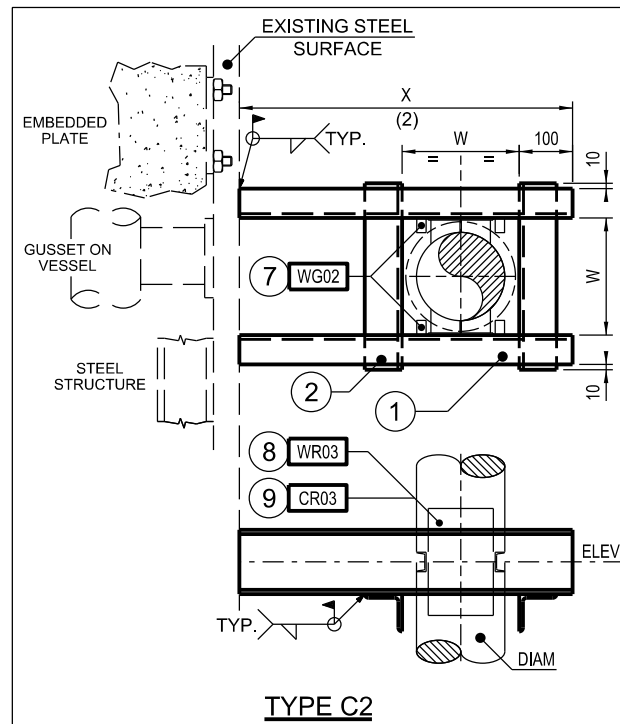
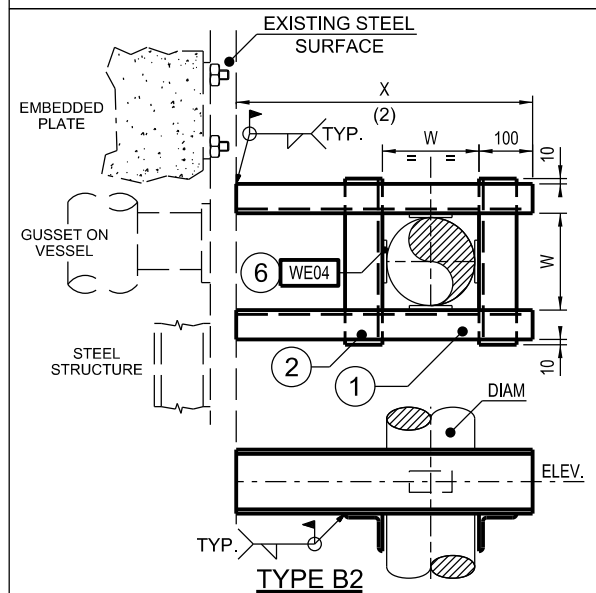
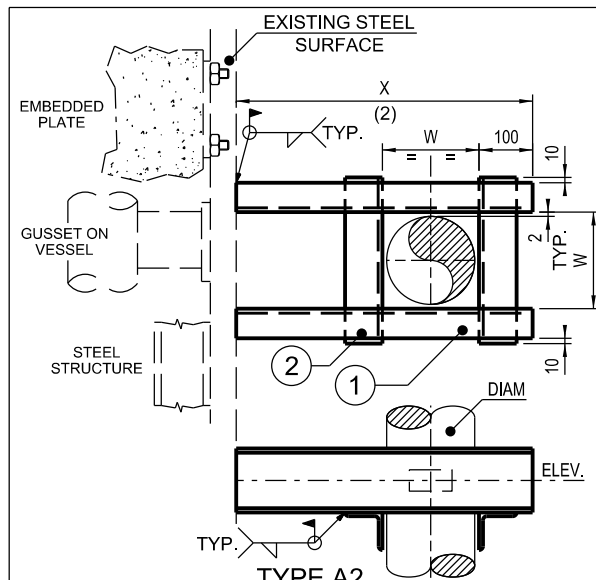
Technip

BIDIRECTIONAL VERTICAL GUIDE
FOR DIAM 8" TO 24"

SB14

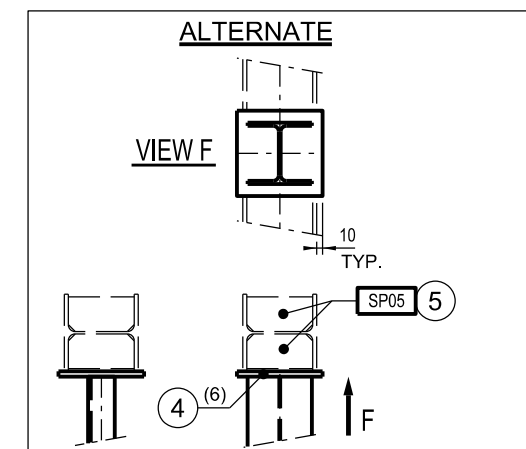
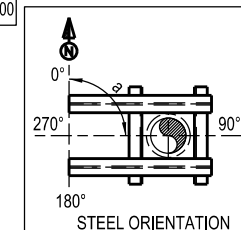
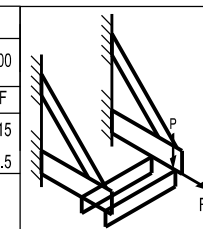
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PLANT DESIGN AND PIPING

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SHAPE X mm	MC100		MC125		MC150		MC 200	
	P	F	P	F	P	F	P	F
1000	24	7.0	30	8.9	38	11.5	50	15
2000	14	4.0	18	4.9	22	6.5	29	8.5

TABLE 2		
DIAM		2
ND	Inch	
200 TO 450	8" TO 18"	ISA 7
500 TO 600	20" TO 24"	ISA 1



	(9)	SHOE	1	REFER TO CR03	/	/	/	/	/	/	/	/	
	(8)	SHOE	1	REFER TO WR03	/	/	/	/	/	/	/	/	
	(7)	GUIDE	2	REFER TO WG02	/	/	/	/	/	/	/	/	
	(6)	WEDGE	4	REFER TO WE04	/	/	/	/	/	/	/	/	
	(5)	STIFFENER	16	REFER TO SP05	/	/	/	/	/	/	/	/	
	(4)	PLATE	4	PLATE THK. 10	A36	A36	A36	A36	A36	A36	A36	A36	
	(3)	BRACE	2	SAME AS BEAM	A36	A36	A36	A36	A36	A36	A36	A36	
	(2)	CROSS BEAM	2	SEE TABLE 2	A36	A36	A36	A36	A36	A36	A36	A36	
	(1)	BEAM	2	SEE TABLE 1	A36	A36	A36	A36	A36	A36	A36	A36	
ITEM DESCRIPTION QTY.				CS	CH	CL	CG	AS	AH	SS	SH	SL	
	DETAIL			MATCH									

NOTES:

1. DELETED
2. X DIMENSION FOR TYPES A2 / B2 / C2 IS LIMITED FROM 1100 TO 2000. TO BE ADJUSTED AT ERECTION.
3. Y DIMENSION (APPROX.) $X \times 1.15$, TO BE ADJUSTED AT ERECTION.
4. Z DIMENSION IS $(X - W/2 - 100) \times 0.67$.
5. ANGLE 30° MIN AS DEFAULT, TO BE CHANGED IF NECESSARY FOR VESSEL APPLICATIONS.
6. PLATE DIMENSIONS TO BE ADJUSTED AT ERECTION AS PER EXISTING STEEL SIZE.

Support Mark

Positional Mark

SB14	DIAM	TYPE	SHAPE	X	W	β
-------------	------	------	-------	---	---	---------

ELEV	a
------	---

Technip

**BIDIRECTIONAL VERTICAL GUIDE
FOR DIAM 8" TO 24"**

SB 14

STANDARD CONSTRUCTION DRAWING
PLANT DESIGN AND PIPING

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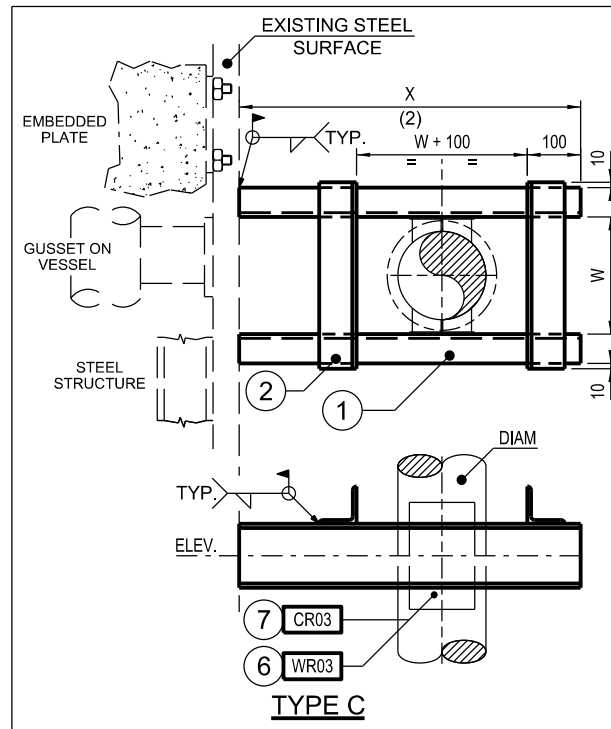
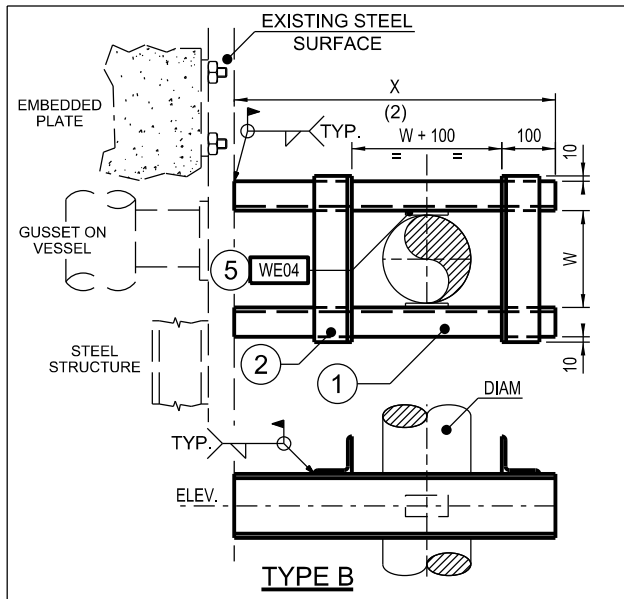
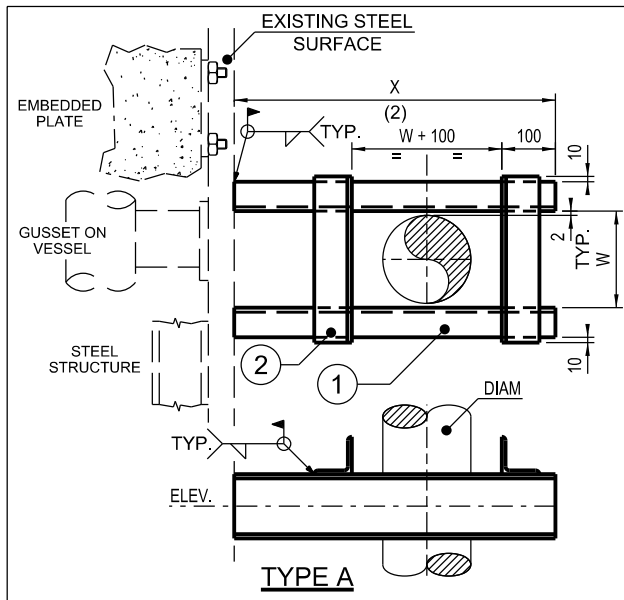


TABLE 1 - LOADS (kN) TYPE A/B/C								
SHAPE X mm	MC100		MC125		MC150		MC 200	
	P	F	P	F	P	F	P	F
500	5.2	1.8	9.8	3.4	16.4	5.7	26	9.1
1000	4.0	1.4	7.8	2.7	13.6	4.7	20	7

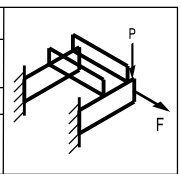
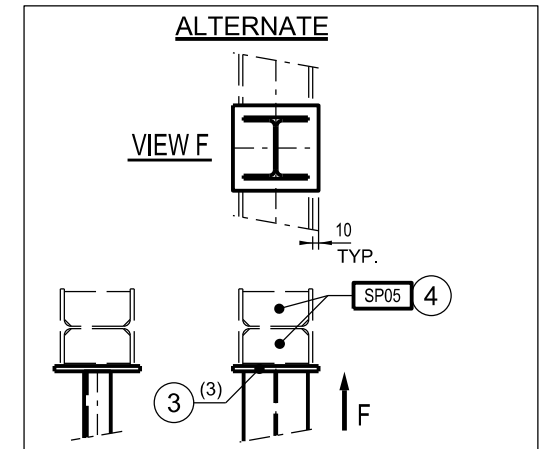
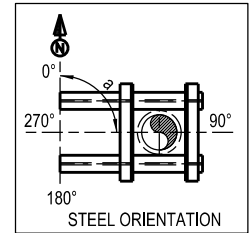


TABLE 2		
DIAM		2
ND	Inch	
50 TO 150	2" TO 6"	ISA 50
200 TO 450	8" TO 18"	ISA 75
500 TO 600	20" TO 24"	ISA 100



NOTES:

1. DELETED
2. X DIMENSION FOR TYPES A / B / C IS LIMITED FROM 400 TO 1100. TO BE ADJUSTED AT ERECTION.
3. PLATE DIMENSIONS TO BE ADJUSTED AT ERECTION AS PER EXISTING STEEL SIZE.

7	SHOE	1	REFER TO CR03	/	/	/	/	/	/	/	/	/	/
6	SHOE	1	REFER TO WR03	/	/	/	/	/	/	/	/	/	/
5	WEDGE	1	REFER TO WE04	/	/	/	/	/	/	/	/	/	/
4	STIFFENER	8	REFER TO SP05	/	/	/	/	/	/	/	/	/	/
3	PLATE	2	PLATE Thk, 10	A36	A36	A36	A36	A36	A36	A36	A36	A36	A36
2	CROSS BEAM	2	SEE TABLE 2	A36	A36	A36	A36	A36	A36	A36	A36	A36	A36
1	BEAM	2	SEE TABLE 1	A36	A36	A36	A36	A36	A36	A36	A36	A36	A36
ITEM	DESCRIPTION	QTY.	DETAIL	CS	CH	CL	CG	AS	AH	SS	SH	SL	

MATCL

Support Mark

SB15 DIAM TYPE SHAPE X W β

Positional Mark

ELEV a

Technip

UNIDIRECTIONAL VERTICAL GUIDE
FOR DIAM 2" TO 24"

SB15

STANDARD CONSTRUCTION DRAWING
PLANT DESIGN AND PIPING

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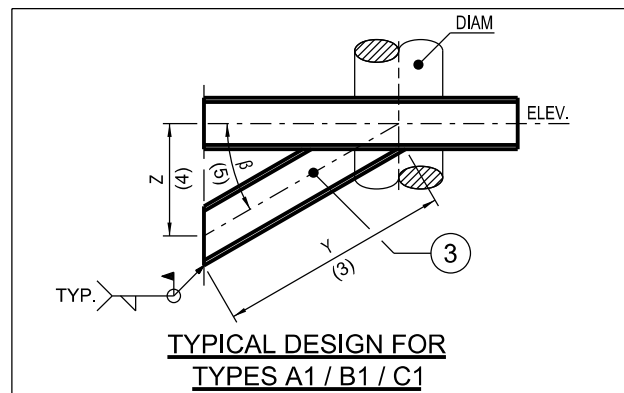
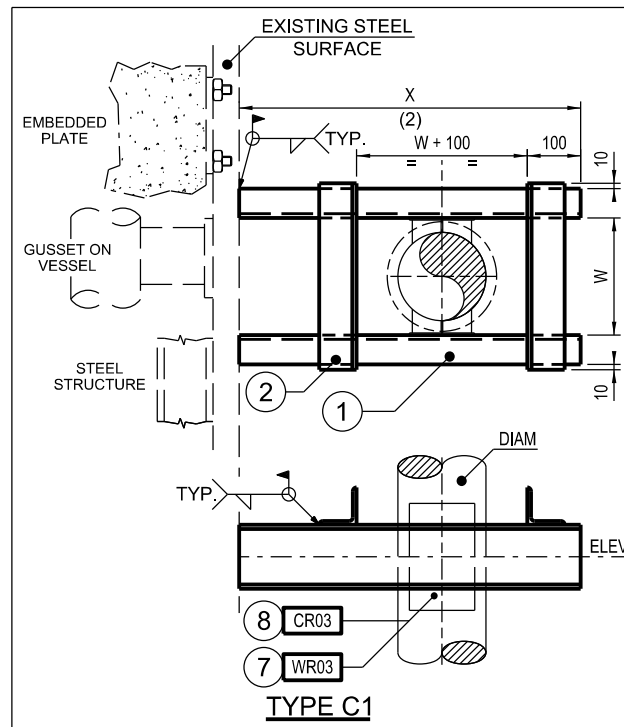
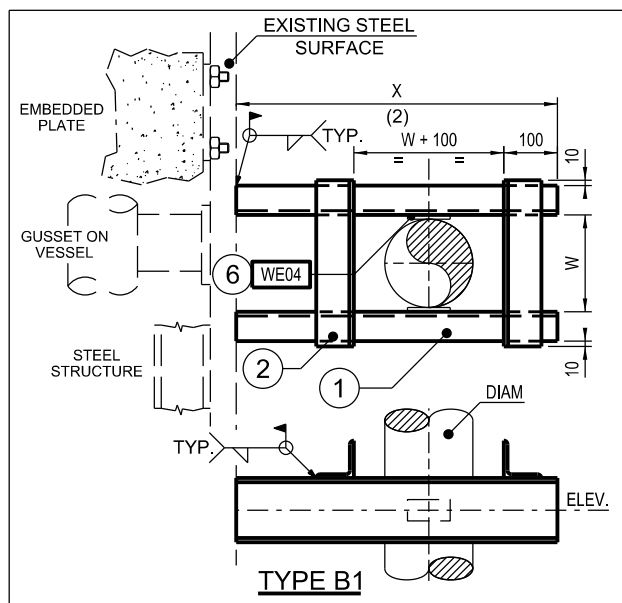
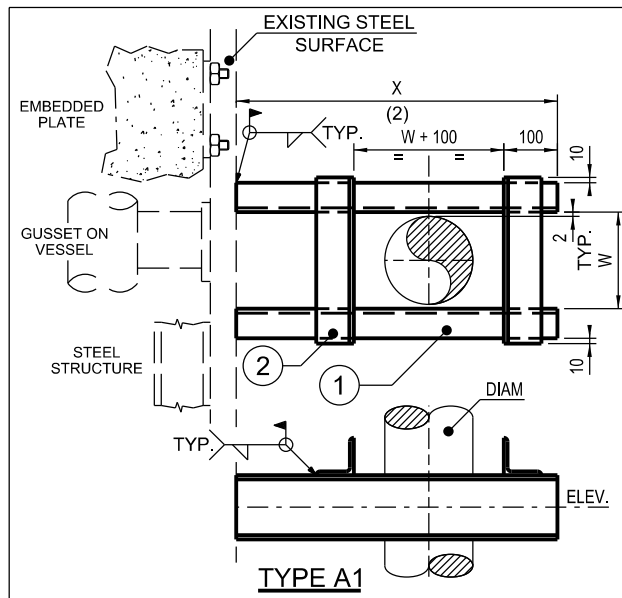


TABLE 1 - LOADS (kN) TYPE A1/B1/C1								
SHAPE X mm	MC100		MC125		MC150		MC 200	
	P	F	P	F	P	F	P	F
1000	24	7.0	30	8.9	38	11.5	50	15
2000	14	4.0	18	4.9	22	6.5	29	8.5

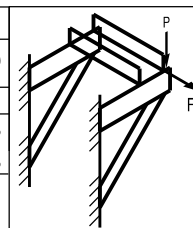
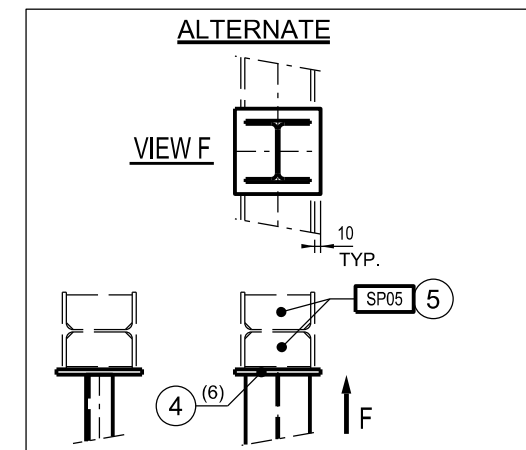
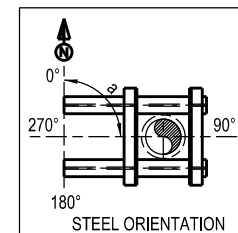


TABLE 2			
DIAM			2
ND	Inch		
50 TO 150	2" TO 6"	ISA 50	
200 TO 450	8" TO 18"	ISA 75	
500 TO 600	20" TO 24"	ISA 100	



NOTES:

1. DELETED
2. X DIMENSION FOR TYPES A1 / B1 / C1 IS LIMITED FROM 1100 TO 2000. TO BE ADJUSTED AT ERECTION.
3. Y DIMENSION (APPROX.) $X \times 1.15$. TO BE ADJUSTED AT ERECTION.
4. Z DIMENSION IS $(X - W/2 - 100) \times 0.57$.
5. ANGLE 30° MIN AS DEFAULT. TO BE CHANGED IF NECESSARY FOR VESSEL APPLICATIONS.
6. PLATE DIMENSIONS TO BE ADJUSTED AT ERECTION AS PER EXISTING STEEL SIZE.

Support Mark

Positional Mark

SB15 DIAM TYPE SHAPE X W β

ELEV a

ITEM	DESCRIPTION	QTY.	DETAIL	CS	CH	CL	CG	AS	AH	SS	SH	SL
8	SHOE	1	REFER TO CR03	/	/	/	/	/	/	/	/	/
7	SHOE	1	REFER TO WR03	/	/	/	/	/	/	/	/	/
6	WEDGE	2	REFER TO WE04	/	/	/	/	/	/	/	/	/
5	STIFFENER	16	REFER TO SP05	/	/	/	/	/	/	/	/	/
4	PLATE	4	PLATE Thk. 10	A36	A36	A36	A36	A36	A36	A36	A36	A36
3	BRACE	2	SAME AS BEAM	A36	A36	A36	A36	A36	A36	A36	A36	A36
2	CROSS BEAM	2	SEE TABLE 2	A36	A36	A36	A36	A36	A36	A36	A36	A36
1	BEAM	2	SEE TABLE 1	A36	A36	A36	A36	A36	A36	A36	A36	A36

MATCL

STANDARD CONSTRUCTION DRAWING
PLANT DESIGN AND PIPING

UNIDIRECTIONAL VERTICAL GUIDE
FOR DIAM 2" TO 24"

SB15

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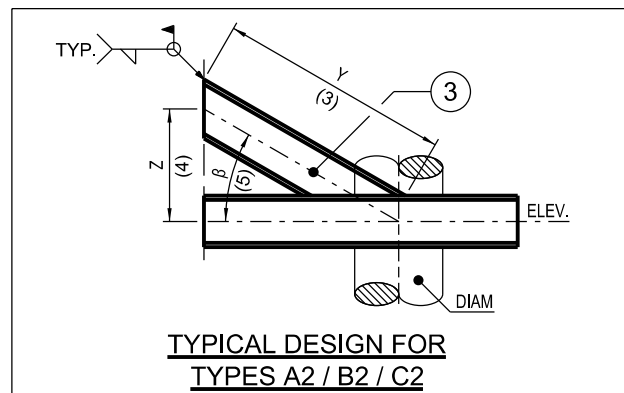
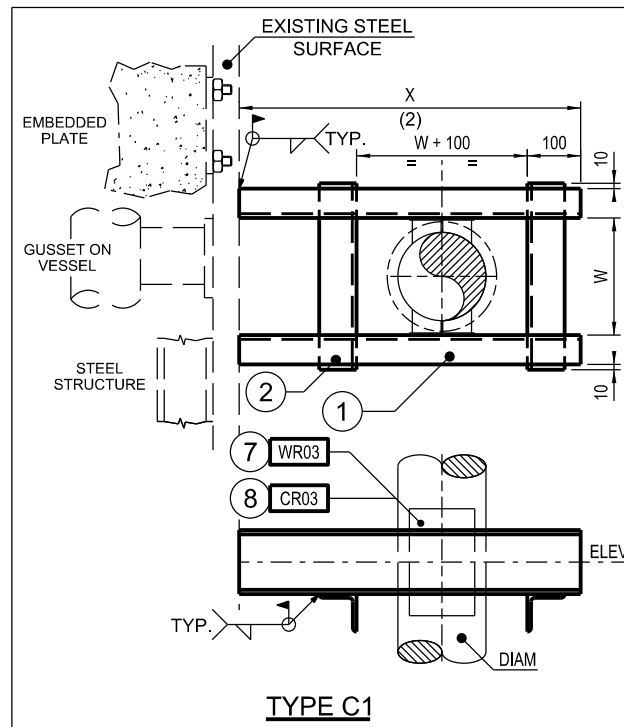
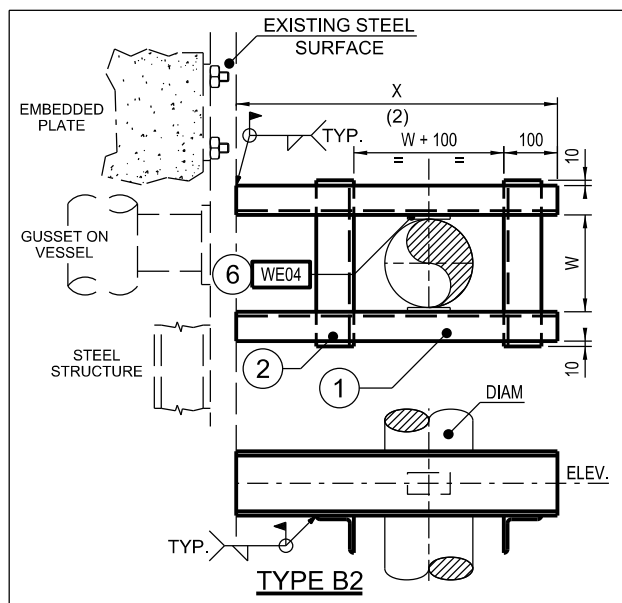
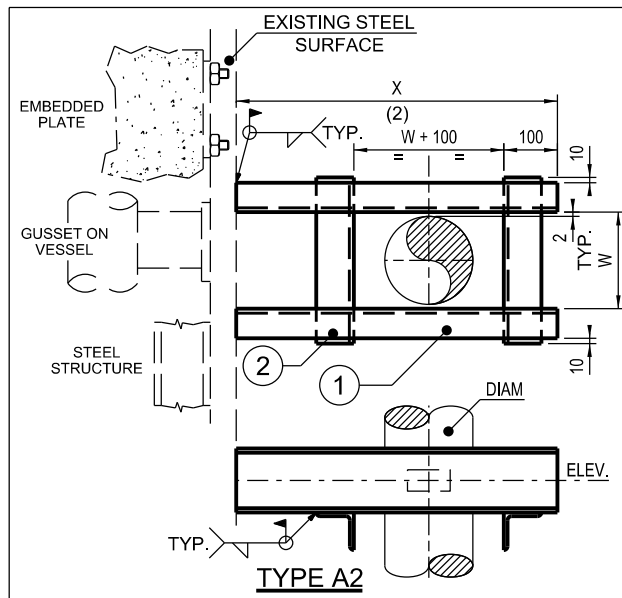


TABLE 1 - LOADS (kN) TYPE A2/B2/C2								
SHAPE X mm	MC100		MC125		MC150		MC 200	
	P	F	P	F	P	F	P	F
1000	24	7.0	30	8.9	38	11.5	50	15
2000	14	4.0	18	4.9	22	6.5	29	8.5

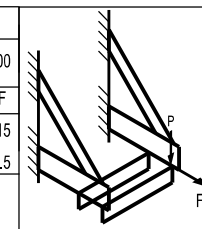
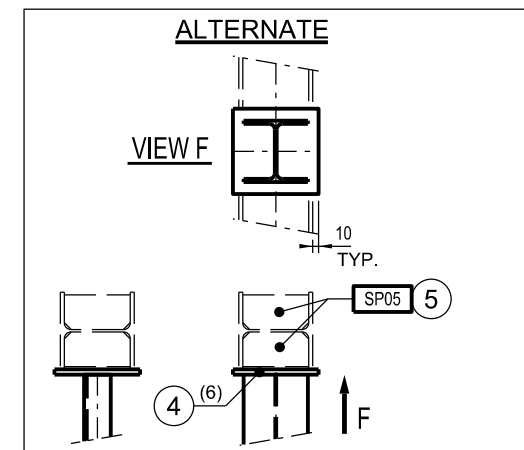
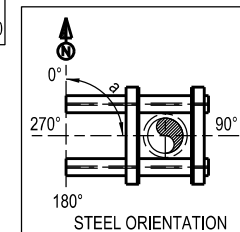


TABLE 2			
DIAM		(2)	
ND	Inch		
50 TO 150	2" TO 6"	ISA 50	
200 TO 450	8" TO 18"	ISA 75	
500 TO 600	20" TO 24"	ISA 100	



NOTES:

1. DELETED
2. X DIMENSION FOR TYPES A2 / B2 / C2 IS LIMITED FROM 1100 TO 2000. TO BE ADJUSTED AT ERECTION.
3. Y DIMENSION (APPROX.) X x 1.15. TO BE ADJUSTED AT ERECTION.
4. Z DIMENSION IS (X - W/2 - 100) x 0.57.
5. ANGLE 30° MIN AS DEFAULT. TO BE CHANGED IF NECESSARY FOR VESSEL APPLICATIONS.
6. PLATE DIMENSIONS TO BE ADJUSTED AT ERECTION AS PER EXISTING STEEL SIZE.

Support Mark

Positional Mark

SB15 DIAM TYPE SHAPE X W β

ELEV a

ITEM	DESCRIPTION	QTY.	DETAIL	CS	CH	CL	CG	AS	AH	SS	SH	SL
8	SHOE	1	REFER TO CR03	/	/	/	/	/	/	/	/	/
7	SHOE	1	REFER TO WR03	/	/	/	/	/	/	/	/	/
6	WEDGE	2	REFER TO WE04	/	/	/	/	/	/	/	/	/
5	STIFFENER	16	REFER TO SP05	/	/	/	/	/	/	/	/	/
4	PLATE	4	PLATE Thk. 10	A36	A36	A36	A36	A36	A36	A36	A36	A36
3	BRACE	2	SAME AS BEAM	A36	A36	A36	A36	A36	A36	A36	A36	A36
2	CROSS BEAM	2	SEE TABLE 2	A36	A36	A36	A36	A36	A36	A36	A36	A36
1	BEAM	2	SEE TABLE 1	A36	A36	A36	A36	A36	A36	A36	A36	A36

MATCL

STANDARD CONSTRUCTION DRAWING
PLANT DESIGN AND PIPING

UNIDIRECTIONAL VERTICAL GUIDE
FOR DIAM 2" TO 24"

SB15

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XXXXXX	000	STC - 1394 - 15	3 of 3	1

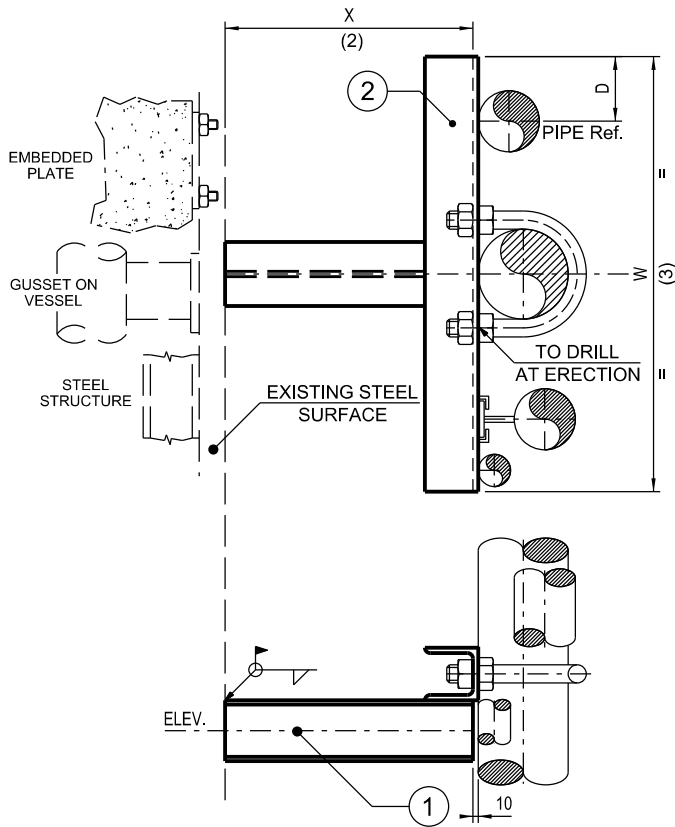
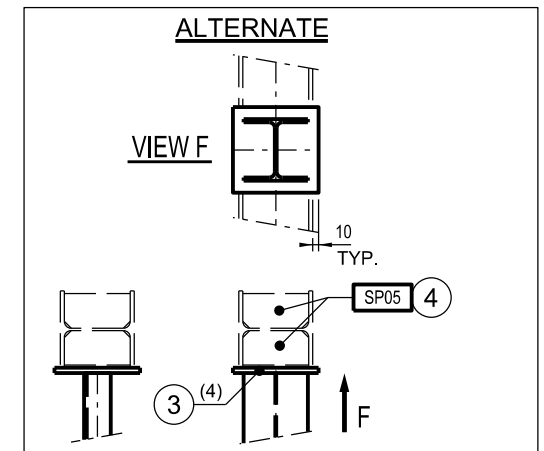
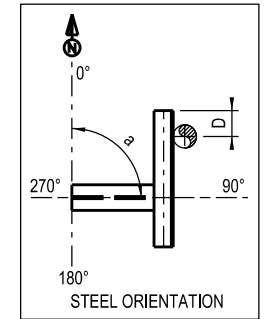


TABLE 1 - F (kN) (1)				
SHAPE	UC152*23	UC152*30		
X mm				
200	17.7	36.1		
500	7.1	14.4		
1000	3.5	7.2		



NOTES:
1. MAXI HORIZONTAL LOAD : $F = 0.35 \times P$.
Sadm = 235 MPa x 0.8 = 188 MPa.
RESULTANT LOAD IS ASSUMED AT THE MIDDLE OF BEAM.
2. X DIMENSION IS LIMITED TO 1000.
3. W DIMENSION IS LIMITED FROM 200 TO 1200.
4. PLATE DIMENSIONS TO BE ADJUSTED AT ERECTION AS PER EXISTING STEEL SIZE.

(4)	STIFFENER	4	REFER TO SP05	/	/	/	/	/	/	/	/	
(3)	PLATE	1	PLATE Thk, 10	A36	A36	A36	A36	A36	A36	A36	A36	
(2)	CROSS BEAM	1	SHAPE MC100	A36	A36	A36	A36	A36	A36	A36	A36	
(1)	BRACKET	1	SEE TABLE 1	A36	A36	A36	A36	A36	A36	A36	A36	
ITEM	DESCRIPTION	QTY.	DETAIL	CS	CH	CL	CG	AS	AH	SS	SH	SL

MATCL

Support Mark				Positional Mark			
SB16				ELEV a			
Technip				COMMON BRACKET GUIDE FOR LINES UP TO DIAM 4"			
STANDARD CONSTRUCTION DRAWING PLANT DESIGN AND PIPING				XXXXXX	000	STC - 1394 - 16	1 of 1
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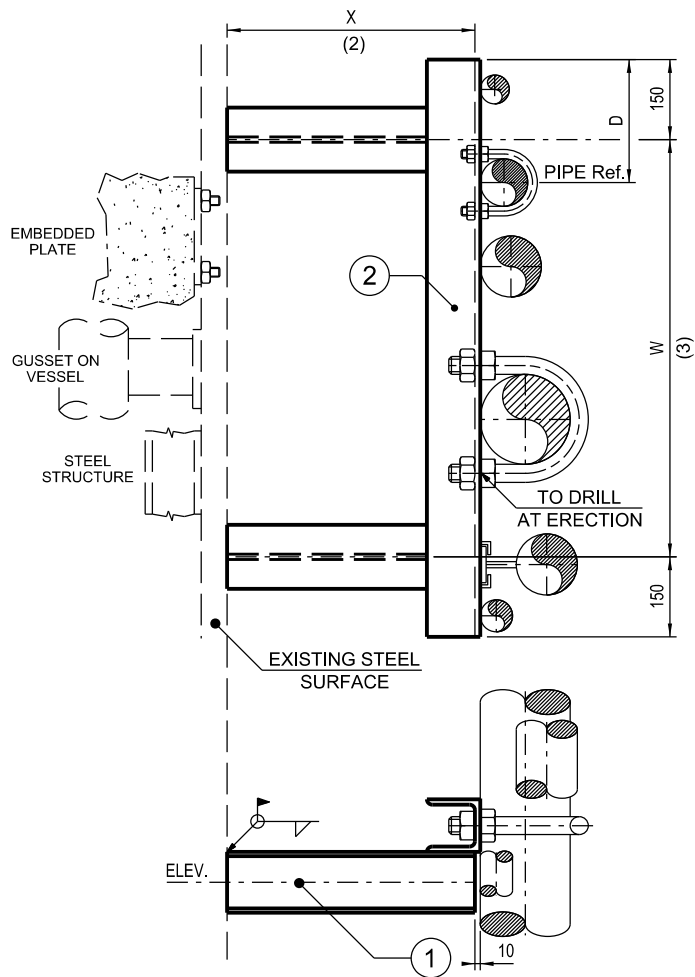
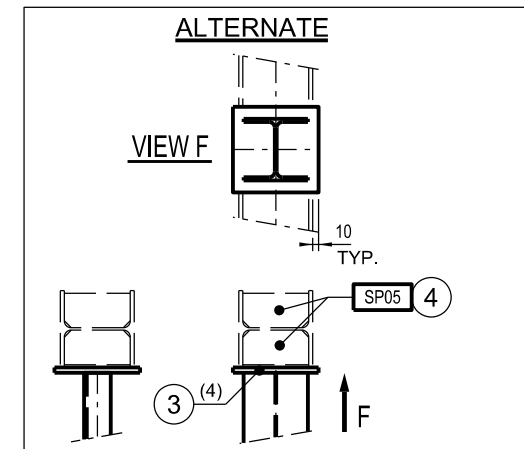
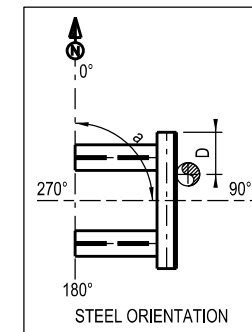
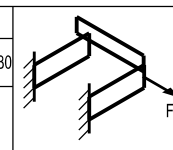


TABLE 2	
W	(2)
200 TO 300	MC100
UP TO 700	MC125
UP TO 1200	MC150

TABLE 1 - F (kN) (1)		
SHAPE	UC152*23	UC152*30
X mm		
500	7.1	14.4
1000	3.5	7.2



NOTES:
1. MAXI HORIZONTAL LOAD : $F = 0.35 \times P$.
Sadm = 235 MPa x 0.8 = 188 MPa.
RESULTANT LOAD IS ASSUMED AT THE MIDDLE OF BEAM.
2. X DIMENSION IS LIMITED TO 1000.
3. W DIMENSION IS LIMITED FROM 200 TO 1200.
4. PLATE DIMENSIONS TO BE ADJUSTED AT ERECTION AS PER EXISTING STEEL SIZE.

(4)	STIFFENER	8	REFER TO SP05	/	/	/	/	/	/	/	/	/	
(3)	PLATE	2	PLATE Thk, 10	A36	A36	A36	A36	A36	A36	A36	A36	A36	
(2)	CROSS BEAM	1	SEE TABLE 2	A36	A36	A36	A36	A36	A36	A36	A36	A36	
(1)	BRACKET	2	SEE TABLE 1	A36	A36	A36	A36	A36	A36	A36	A36	A36	
ITEM	DESCRIPTION	QTY.	DETAIL	CS	CH	CL	CG	AS	AH	SS	SH	SL	

MATCL

Support Mark

SB17 SHAPE D X W

Positional Mark

ELEV a

Technip

COMMON DOUBLE BRACKET GUIDE
FOR LINES UP TO DIAM 4"

SB17

STANDARD CONSTRUCTION DRAWING
PLANT DESIGN AND PIPING

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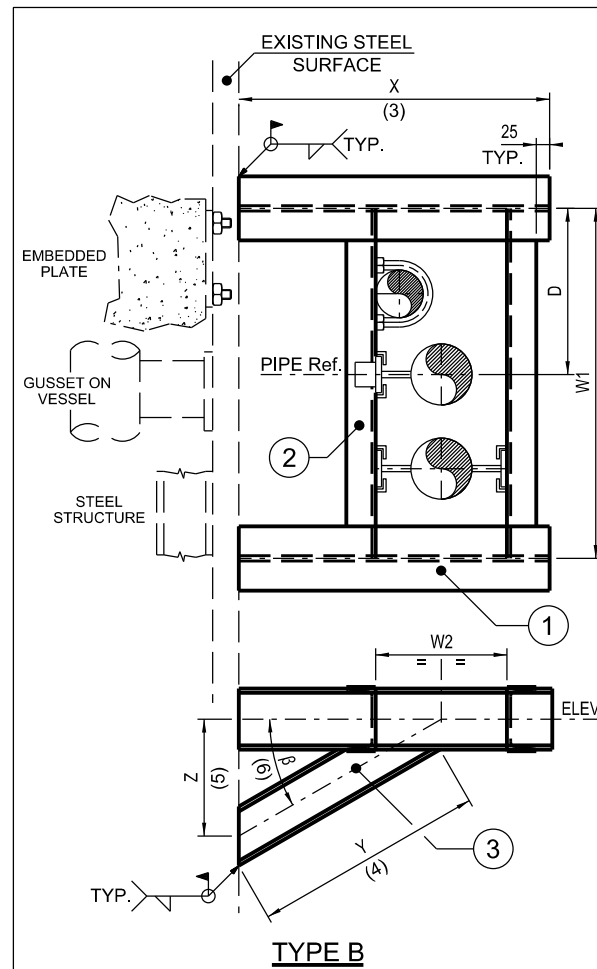
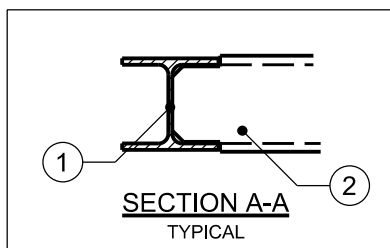
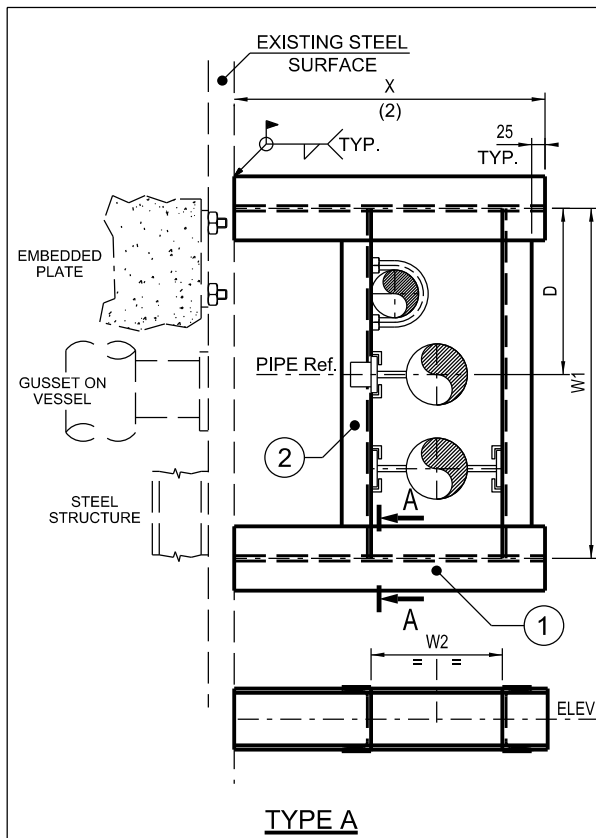
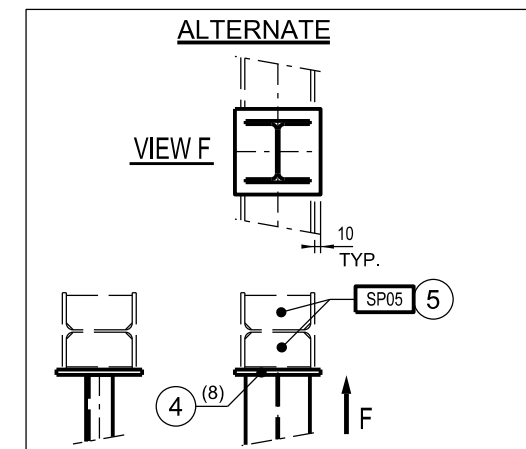
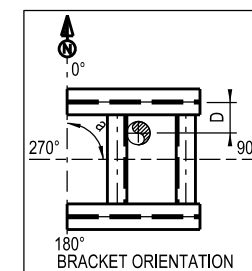


TABLE 1 - P (kN) (1)						
SHAPE X mm	MC100	MC125	MC150	UC152*23	UC152*30	
200	5.8	12.1	21.0	50.8	-	
500	2.6	5.1	8.6	20.3	41.3	
1000	1.5	2.8	4.6	10.0	20.6	

TABLE 2 - P (kN) (1)						
SHAPE X mm	MC100	MC125	MC150	UC152*23	UC152*30	
1000	6.3	10.8	17.4	33.4	61.8	
1500	4.0	7.0	11.4	22.8	43.4	
2000	3.0	5.2	8.4	17.0	33.0	

TABLE 3		
1	3	2
MC100	MC100	
MC125	MC125	
MC150	MC150	
UC152*23	MC150	
UC152*30	MC150	



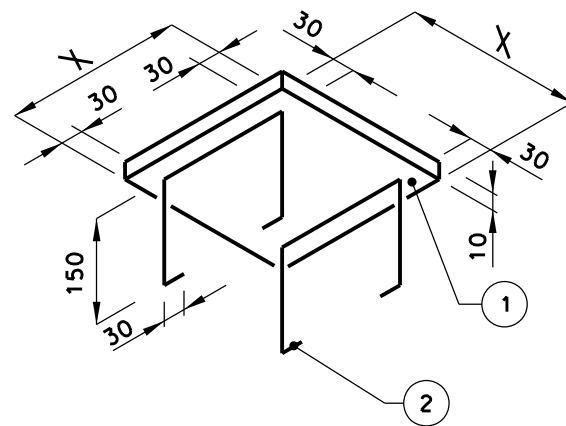
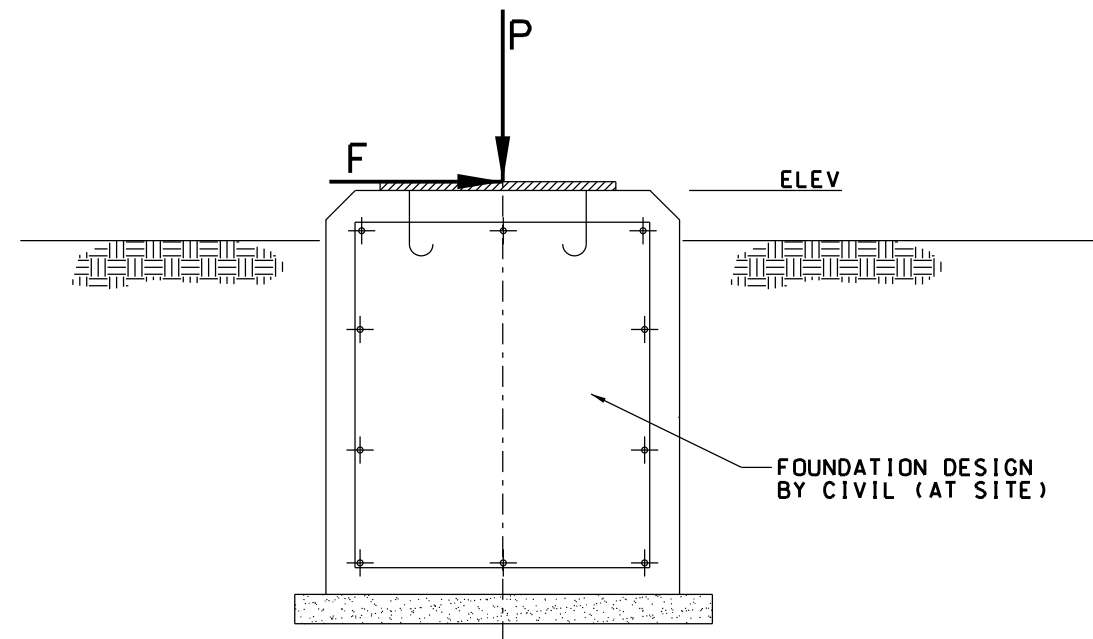
NOTES:
1. MAXIMUM HORIZONTAL LOAD : $F = 0.35 \times P$.
2. $S_{adm} = 235 \text{ MPa} \times 0.8 = 188 \text{ MPa}$.
3. X DIMENSION FOR TYPE A IS LIMITED FROM 200 TO 1000.
4. X DIMENSION FOR TYPE B IS LIMITED FROM 1000 TO 2000.
5. Y DIMENSION (APPROX.) $X \times 1.15$. TO BE ADJUSTED AT ERECTION.
6. Z DIMENSION IS $(X - 200) \times 0.57$.
7. ANGLE 30° MIN AS DEFAULT. TO BE CHANGED IF NECESSARY FOR VESSEL APPLICATIONS.
8. FOR CHANNEL SHAPE, W IS INTERNAL DIMENSION.
9. PLATE DIMENSIONS TO BE ADJUSTED AT ERECTION AS PER EXISTING STEEL SIZE.
10. W1 DIMENSION TO BE LIMITED. MAX = 2000

ITEM	DESCRIPTION	QTY.	DETAIL	CS	CH	CL	CG	AS	AH	SS	SH	SL
5	STIFFENER	8/16	REFER TO SP05	/	/	/	/	/	/	/	/	/
4	PLATE	2/4	PLATE Thk. 10	A36	A36	A36	A36	A36	A36	A36	A36	A36
3	BRACE	2	SEE TABLES	A36	A36	A36	A36	A36	A36	A36	A36	A36
2	CROSS BEAM	2	SEE TABLES	A36	A36	A36	A36	A36	A36	A36	A36	A36
1	BEAM	2	SEE TABLES	A36	A36	A36	A36	A36	A36	A36	A36	A36

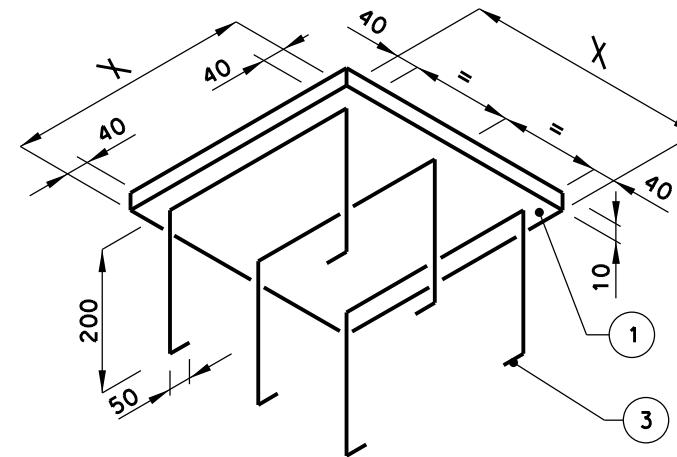
MATCL

Support Mark										Positional Mark			
SB18	DIAM	TYPE	SHAPE	D	X	W1	W2	β		ELEV	a		
Technip				DOUBLE BRACKET FOR MULTIPLE VERTICAL PIPE DIAM 2" TO 24"						SB18			
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FOR X= 200-300



FOR X= 400-500

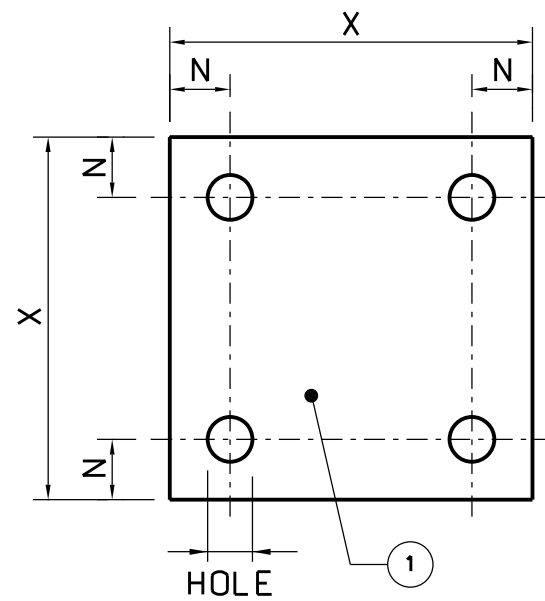
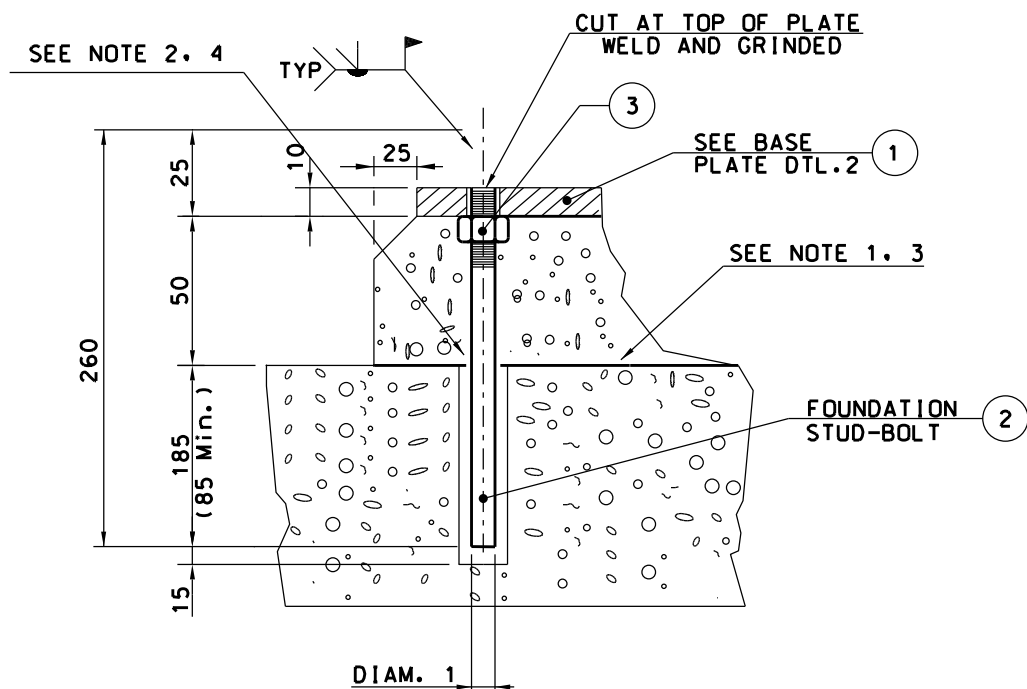
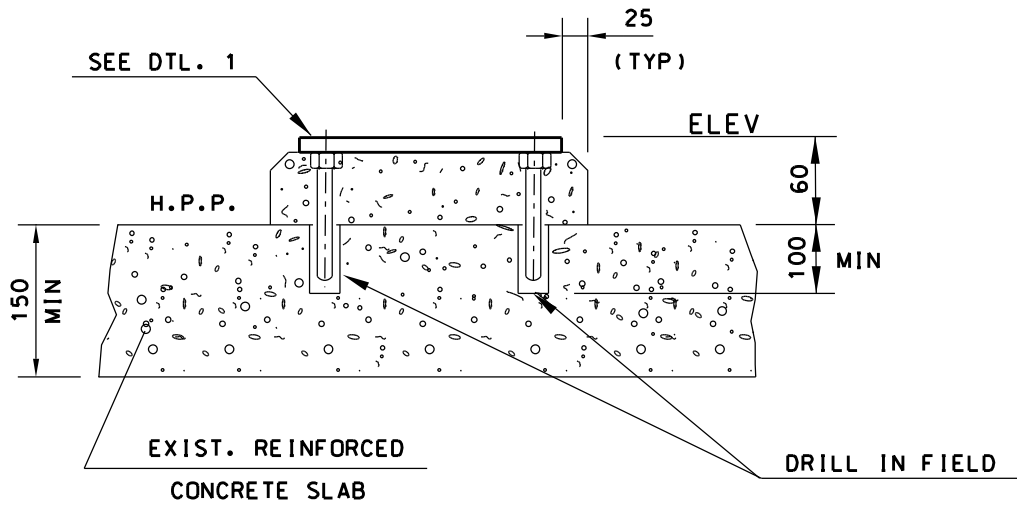
TABLE "1"			
X	P [KN]	F [KN]	HOOK DEVELOP EACH
200	10.00	5.00	500
300	10.00	5.00	600
400	12.00	10.00	820
500	20.00	12.00	920

NOTES:
1. DIMENSION X IS LIMITED FROM 200 TO 500. WITH STEP 100.

Support Mark	Positional Mark
SP01	X ELEV

ITEM	DESCRIPTION	QTY.	DETAIL	MATERIAL
3	HOOK	3	ROD Ø12	A36
2	HOOK	2	ROD Ø10	A36
1	PLATE	1	PLATE THK.10	A36

Technip TECHNIP INDIA LTD.	BASE PLATE FOR UNPAVED AREA		SP01	
STANDARD CONSTRUCTION DRAWING PLANT DESIGN AND PIPING	TPIL DRAWING NO.	XXXXXXXXXX-000-STC-1394-21	SHEET NO. 1 of 1	REV. A



DTL "1"

DTL "2"

TABLE "1"

X	P [KN]	F [KN]	DIAM1	HOLE	N
200	10.00	16.00	10	12	18
300	12.00	16.00	12	14	21
400	15.00	16.00	16	18	27
500	20.00	16.00	20	22	33

NOTES:

1. VERTICAL (P) AND HORIZONTAL (F) ALLOWABLE LOADS DEFINED CONSIDERING THE SLAB AND GROUND FEATURES.
2. DIMENSION X IS LIMITED FROM 200 TO 500, WITH STEP 100.
3. LIGHT CHIPPING SURFACE.
4. PROVIDE MORTER SHRINKING HOLE PREVENT.

Support Mark

Positional Mark

SP02

X

ELEV

ITEM	DESCRIPTION	QTY.	DETAIL	MATERIAL
③	NUT	4	DIAM1	A194-2H
②	STUD-BOLT	4	DIAM1	A193-B7
①	BASE PLATE	1	PLATE THK.10	A36

Technip

TECHNIP INDIA LTD.

BASE PLATE FOR PAVED AREA

SP02

STANDARD CONSTRUCTION DRAWING
PLANT DESIGN AND PIPING

TPIL DRAWING NO.

XXXXXXXXXX-000-STC-1394-22

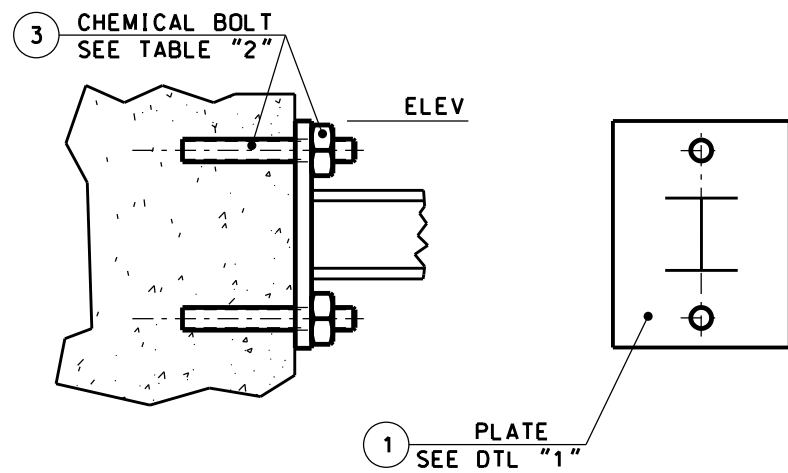
SHEET NO.

1 of 1

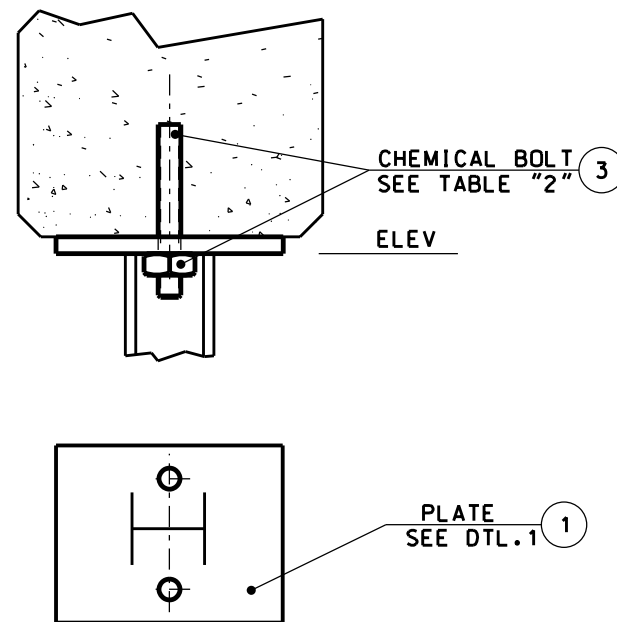
REV.

A

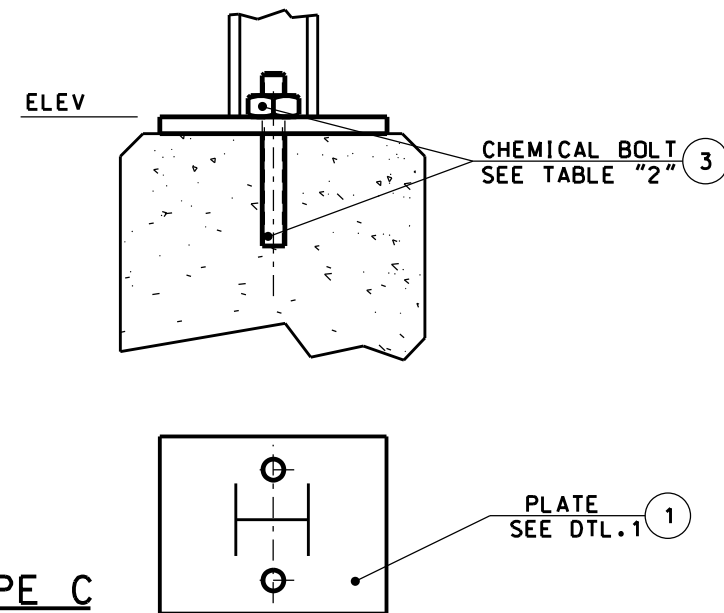
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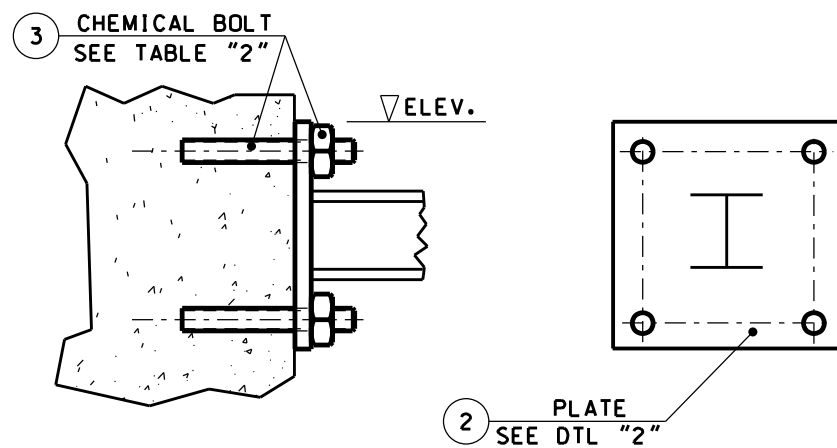
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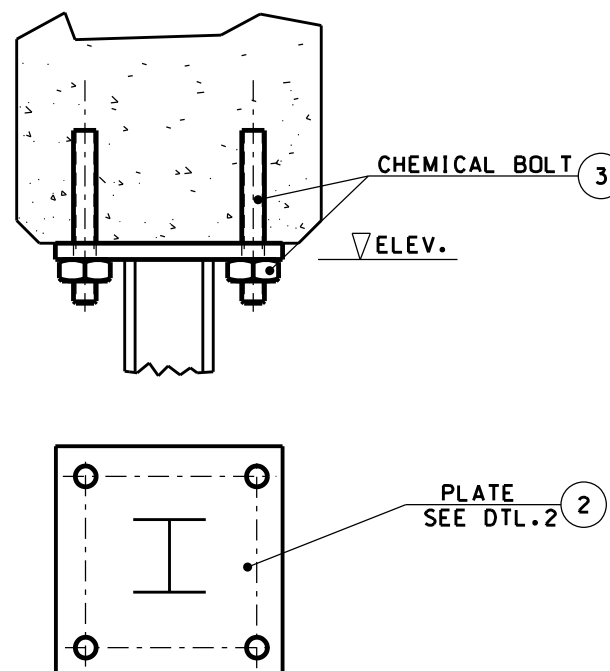
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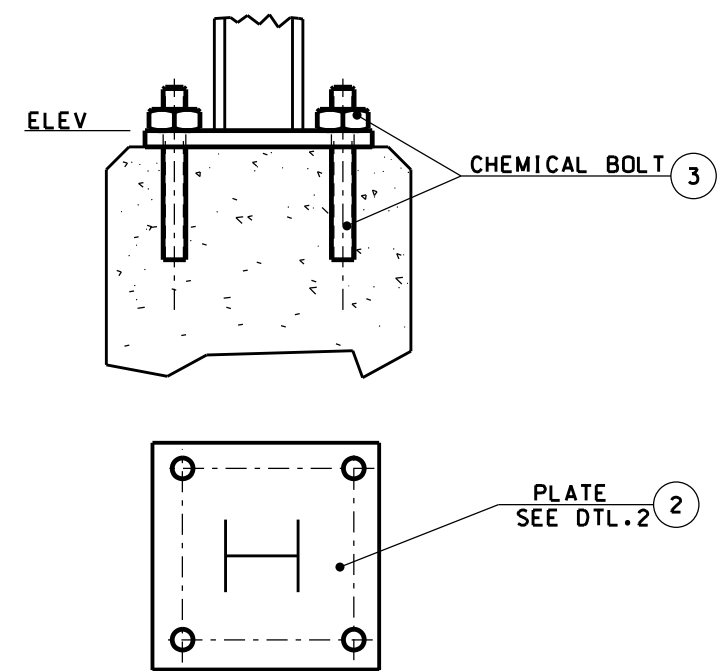
TYPE C



TYPE A1



TYPE B1



TYPE C1

NOTES:

1. CHEMICAL BOLTS LOADS AND DIMENSION AS PER HILTI CATALOGUET ED-2001.

Support Mark

Positional Mark

SP03 TYPE PLATE SIZE BOLT SIZE BOLT MATCL

ELEV

ITEM	DESCRIPTION	QTY.	DETAIL	MATERIAL
3	BOLT	2	CHEM. BOLT	(1)
2	PLATE	1	SEE TABLE "1"	A36
1	PLATE	1	SEE TABLE "1"	A36

Technip TECHNIP INDIA LTD.		BOLTING PLATE ON CONCRETE		SP03	
STANDARD CONSTRUCTION DRAWING PLANT DESIGN AND PIPING		TPIL DRAWING NO.	XXXXXXXXXX-000-STC-1394-23	SHEET NO.	1 of 2
				REV.	A

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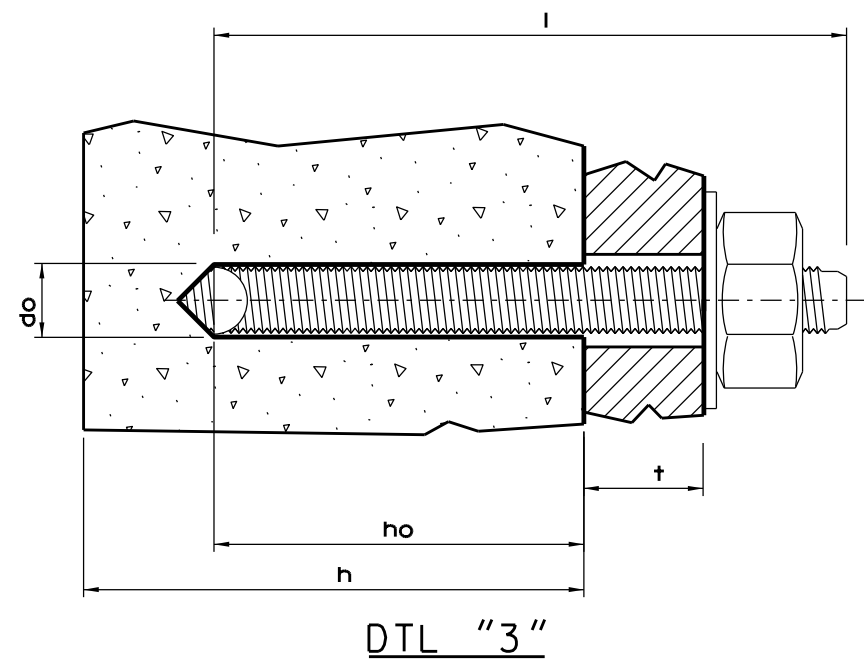
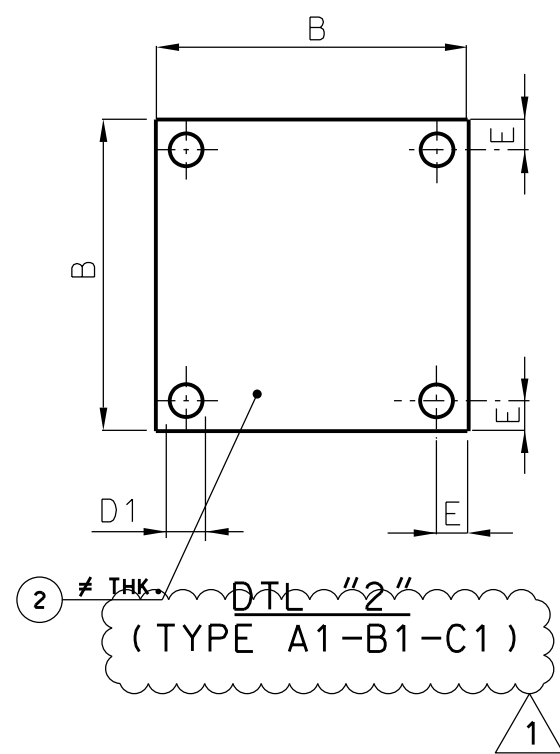
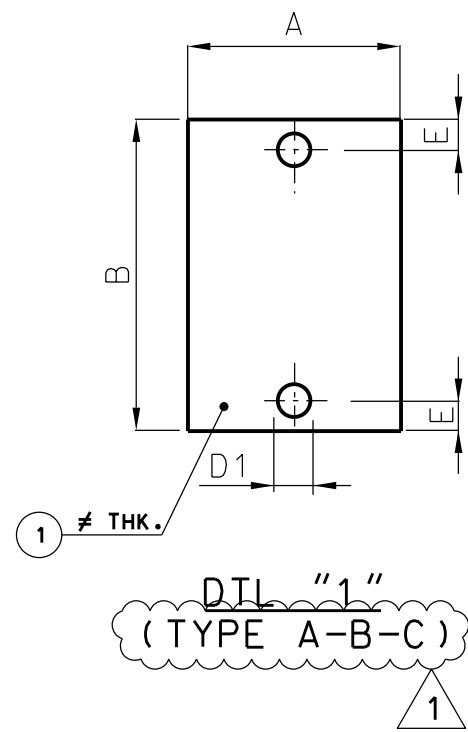
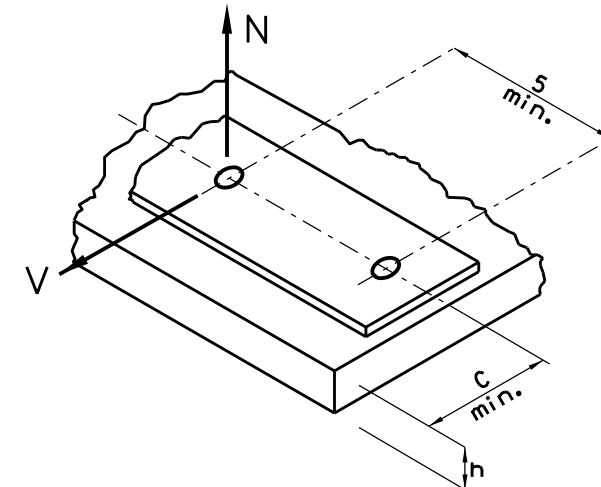


TABLE "1"			
PLATE SIZE	THK	A	B
1	10	150	300
2		200	300
3			350
4	15	250	400
5			450
6	20	300	500
7			550

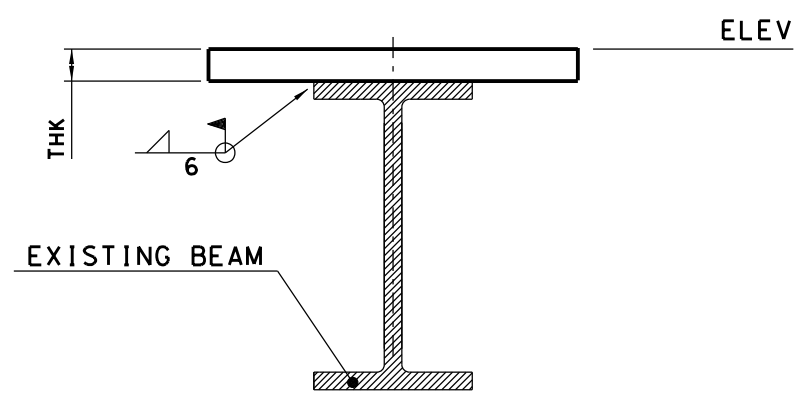
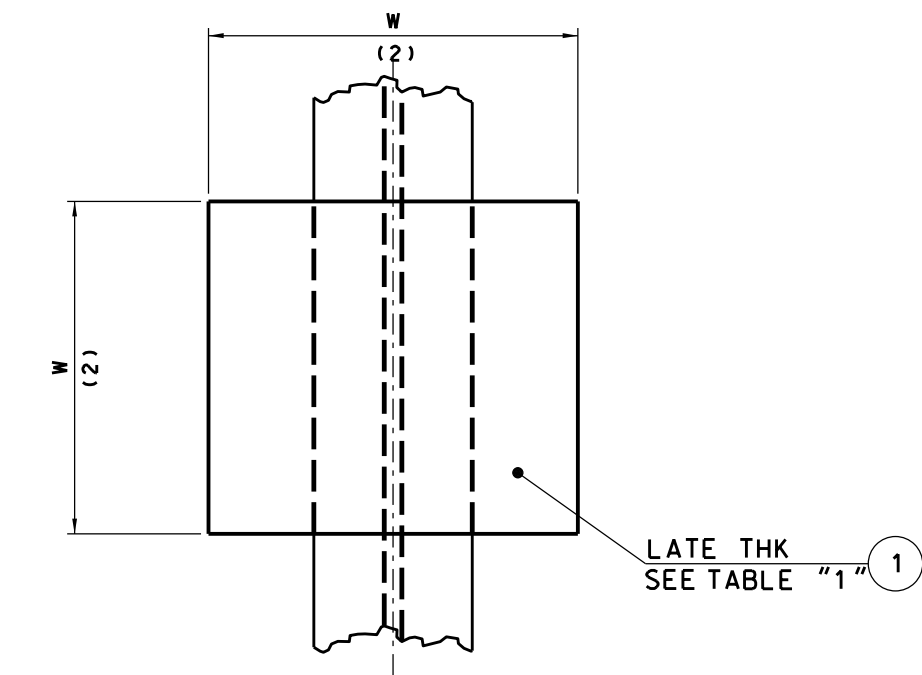
TABLE "3"	
BOLT MATCL	MATERIAL DETAIL
CG	STEEL COLD GALVANIZING 5-10 μ
CGH	STEEL HOT GALVANIZING 45 μ
SS	INOX (316)

TABLE "2"												
BOLT SIZE	BOLT	h	ALLOW. LOADS (KN)		do	D1	E	C	SG	t	l	s
			N	V								
1	M 8	80	7.40	5.60	10	11	25	-	130	14	110	50
2	M 10	90	9.90	9.20	12	13	30	140	140	21	130	55
3	M 12	110	14.10	13.10	14	15	35	170	170	28	160	75
4	M 16	125	20.60	24.70	18	19	40	190	190	38	190	90
5	M 20	170	37.40	38.60	24	26	50	260	260	48	240	105
6	M 24	210	53.90	55.60	28	29	60	320	320	54	290	120
FOR COMBINATED LOADS CONSIDER 65% OF ALLOWABLE												

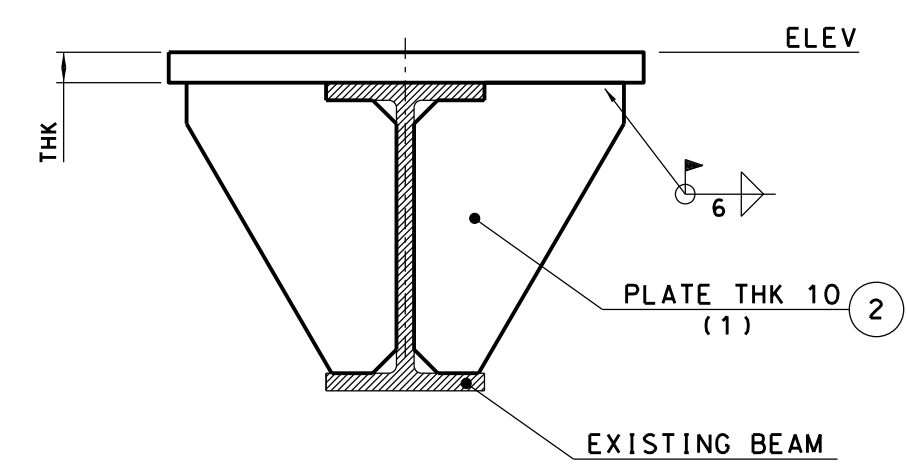
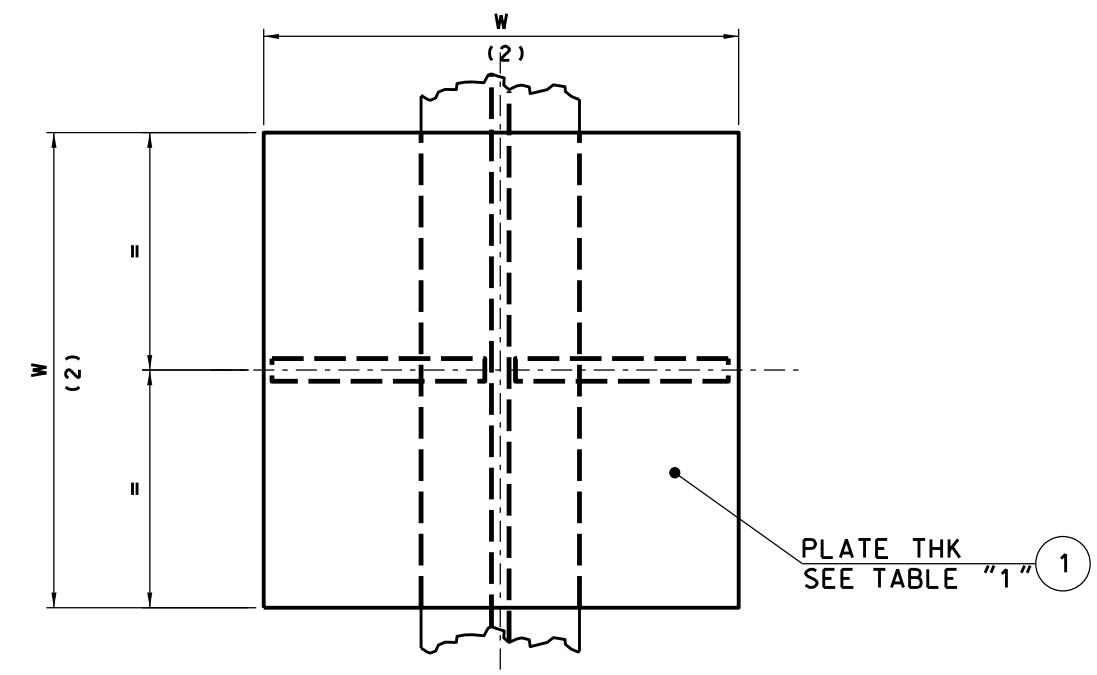
NOTE :
DIMENSION AND LOAD ACCORDING TO CHEMICALS BOLTS HILTI TYPE HVU (HVA WITH THREDED BAR HAS)
VALUE FOR ALL THE DIRECTION OF THE LOADS: CONCRETE $BW \geq 25 \text{ N/mm}^2$,
STATIC LOAD, NO INFLUENCE OF THE EDGE AND THE SPACING.
(HILTI BOLT DESIGNATION FOR ORDER HVU M8x80).



Technip TECHNIP INDIA LTD.		BOLTING PLATE ON CONCRETE		SP03	
STANDARD CONSTRUCTION DRAWING PLANT DESIGN AND PIPING		TPIL DRAWING NO.	XXXXXXXXXX-000-STC-1394-23	SHEET NO.	2 of 2
				REV.	A



WIDTH 150 TO 200



WIDTH 250 TO 400

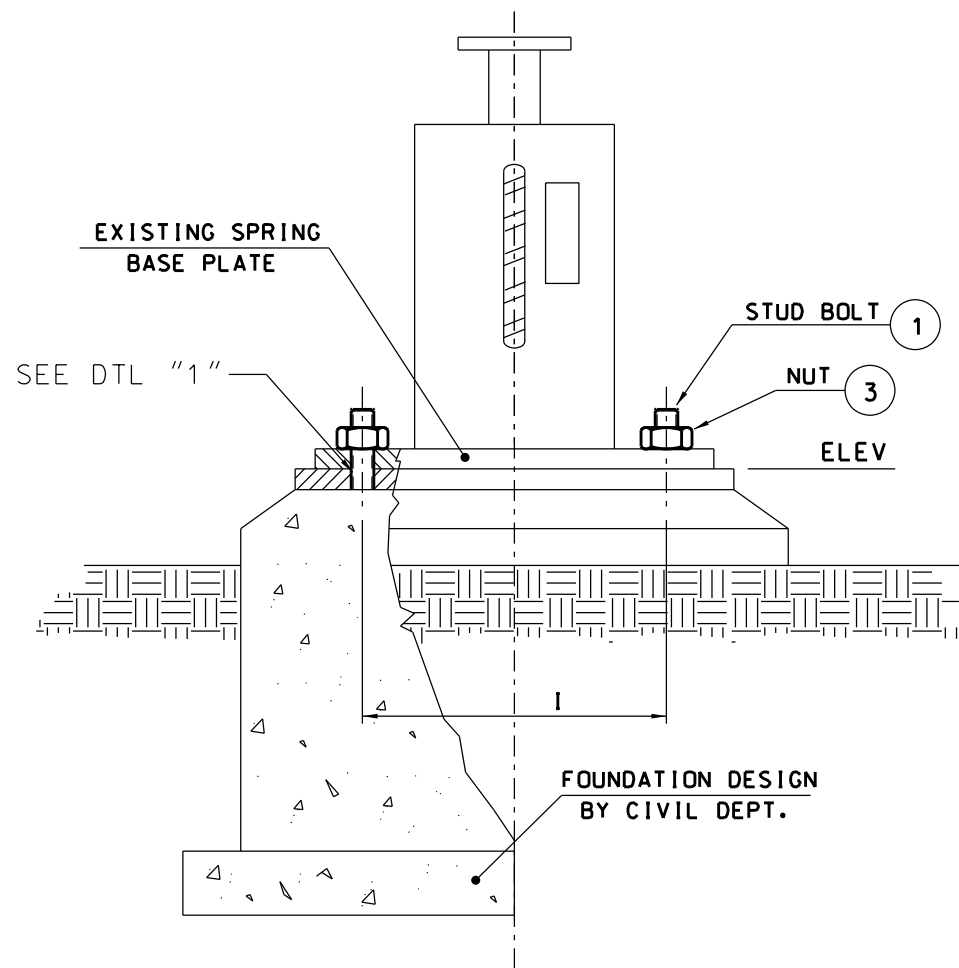
TABLE "1"	
W	THK
150	10
200	10
250	15
300	15
350	15
400	15

○				
○				
②	STIFFENING	2	PLT THK.10	A36
①	BASE PLATE	1	PLT THK.	A36
ITEM	DESCRIPTION	QTY.	DETAIL	MATERIAL

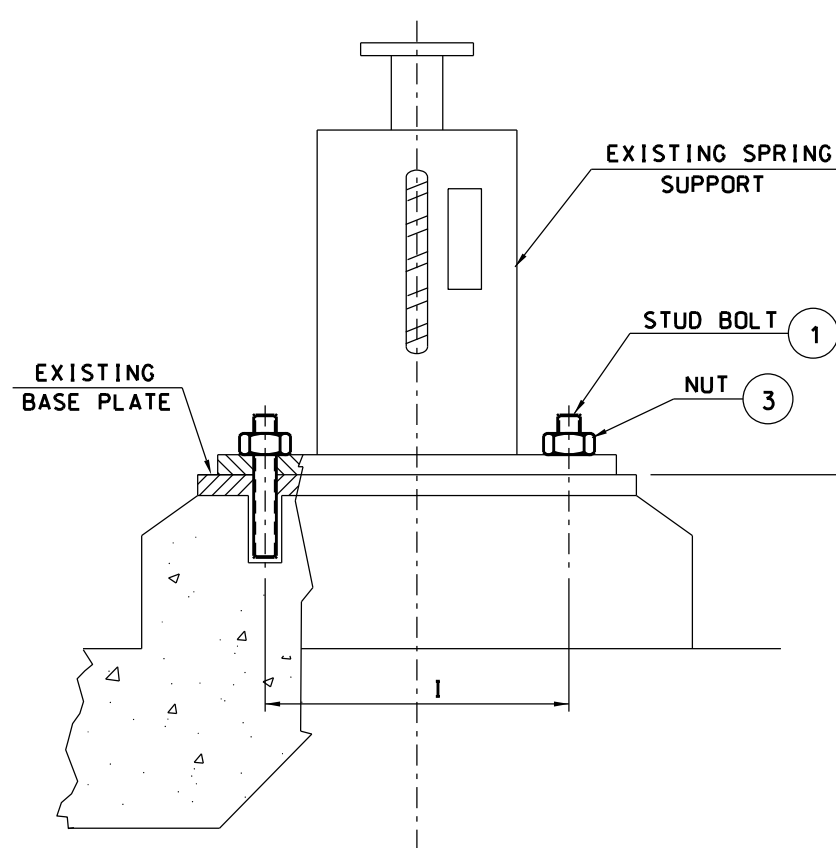
NOTES:
1. STIFFENING PLATE TO BE CUT AND FORM AT ERECTION
2. DIMENSION W IS LIMITED FROM 150 TO 400. WITH STEP 50.

Support Mark	Positional Mark
SP04 W	ELEV

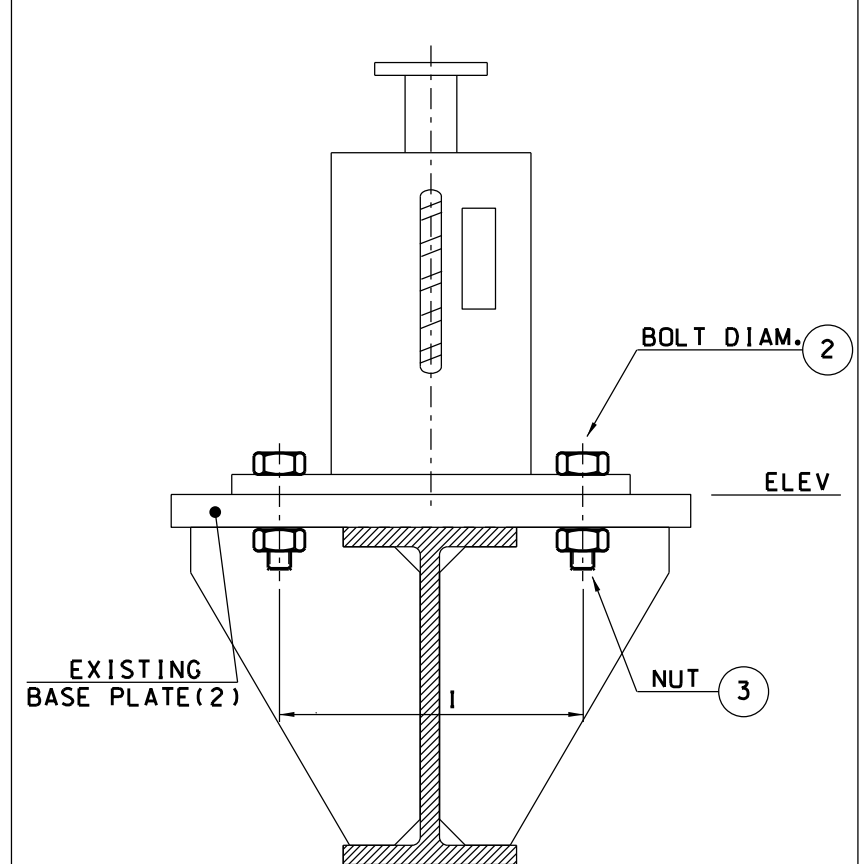
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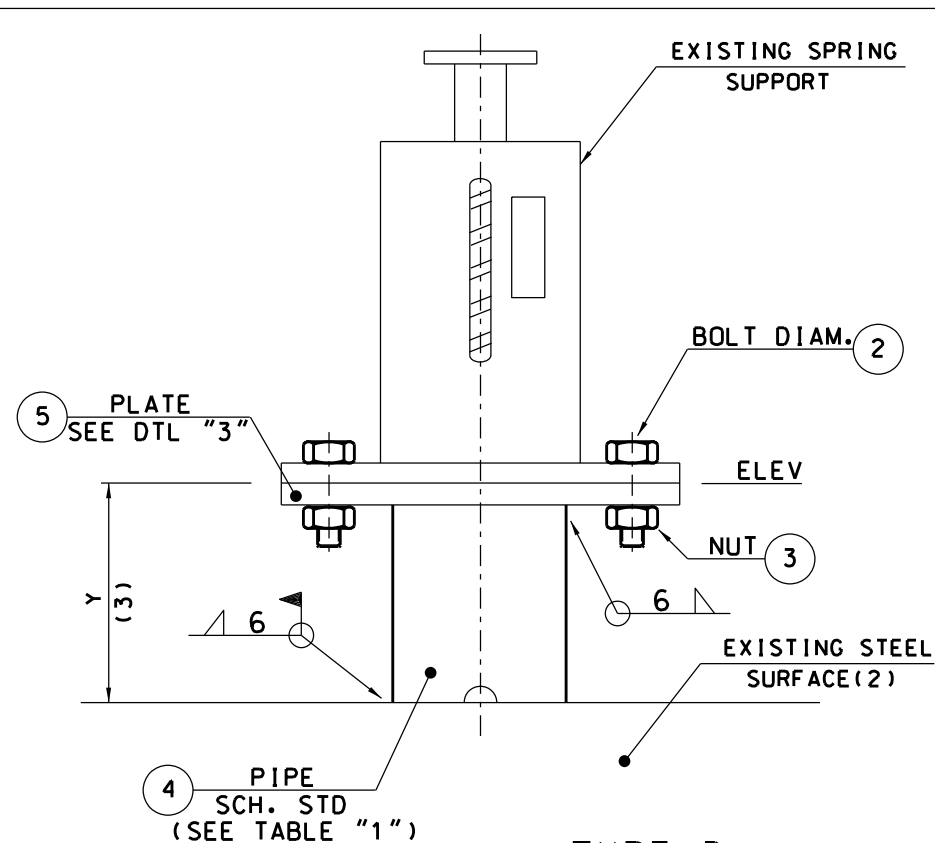
TYPE A
FOR UNPAVED AREA



TYPE B
FOR PAVED AREA



TYPE C
FOR STEEL BEAM



TYPE D

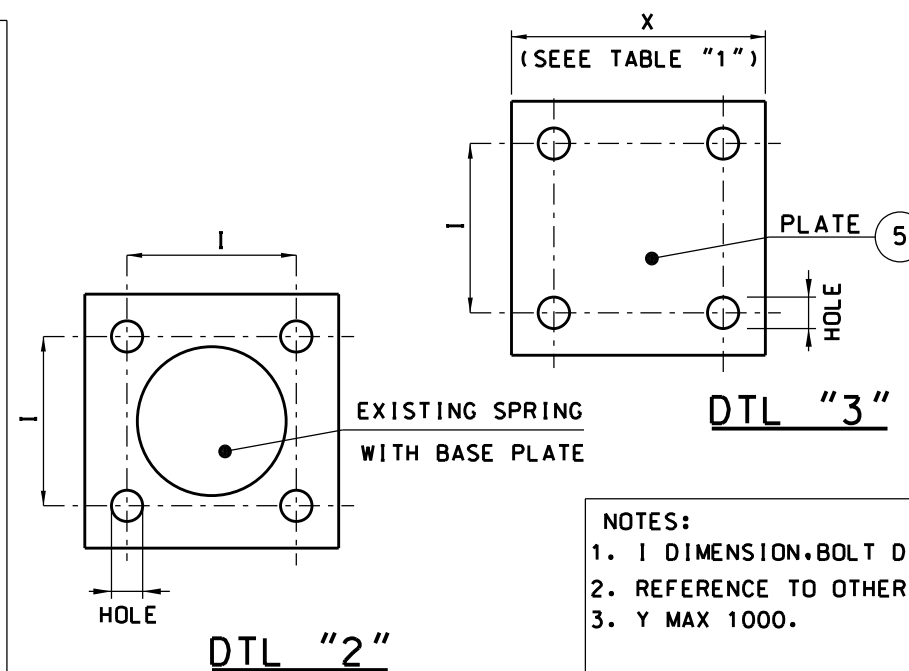
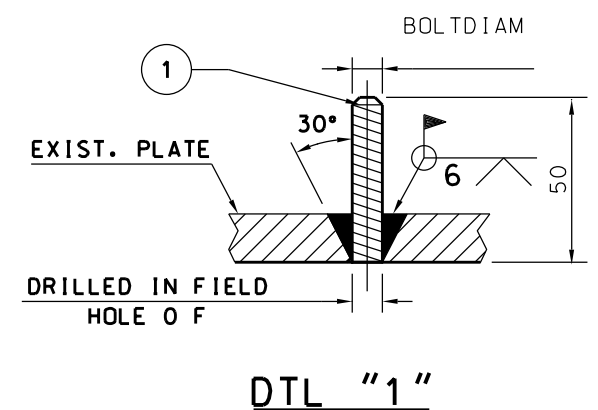


TABLE "1"	
SIZE	X
1	150
2	200
3	250
4	300
5	350



NOTES:

1. I DIMENSION, BOLT DIAMETER AND HOLE DIAMETER SHALL BE ACCORDING TO SPRING VENDOR CATALOGUE.
2. REFERENCE TO OTHER SUPPORT. IT MUST BE INDICATED ON ISOMETRIC.
3. Y MAX 1000.

Support Mark

SP05 TYPE SIZE Y

Positional Mark

ELEV

⑤	PLATE	1	PLATE THK 10	A36
④	COLUMN	1	PIPE SCH. STD	A53 B
③	NUT	4	BOLT DIAM	A194 2H
②	BOLT	4	BOLT DIAM	A193 B7
①	STUD BOLT	4	ROD BOLT DIAM	A36
ITEM	DESCRIPTION	QTY.	DETAIL	MATERIAL

Technip
TECHNIP INDIA LTD.
STANDARD CONSTRUCTION DRAWING
PLANT DESIGN AND PIPING

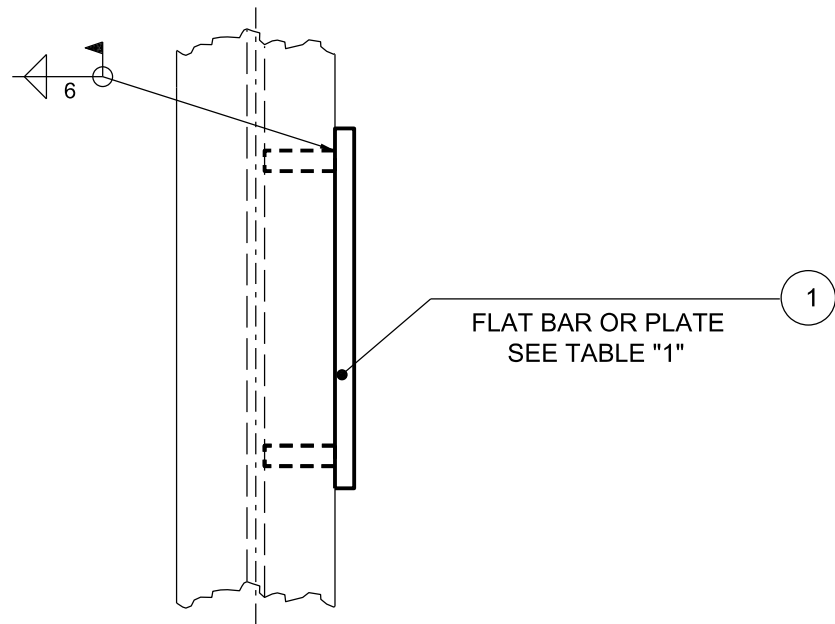
BASE FOR SPRING BASES

SP05

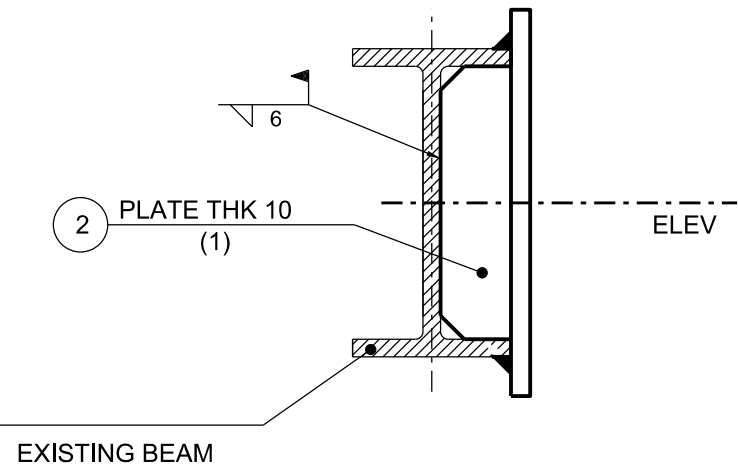
TPIL DRAWING NO.

XXXXXXXXXX-000-STC-1394-25

SHEET NO. 1 of 1
REV. A



TOP VIEW



WIDTH 150 TO 400

ELEVATION VIEW

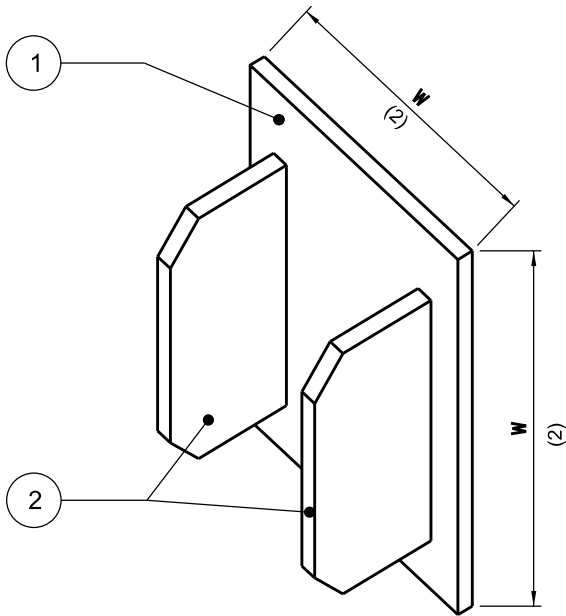


TABLE "1"		
	W	THK
FLAT BAR	150	10
	200	10
PLATE	250	15
	300	15
	350	15
	400	15

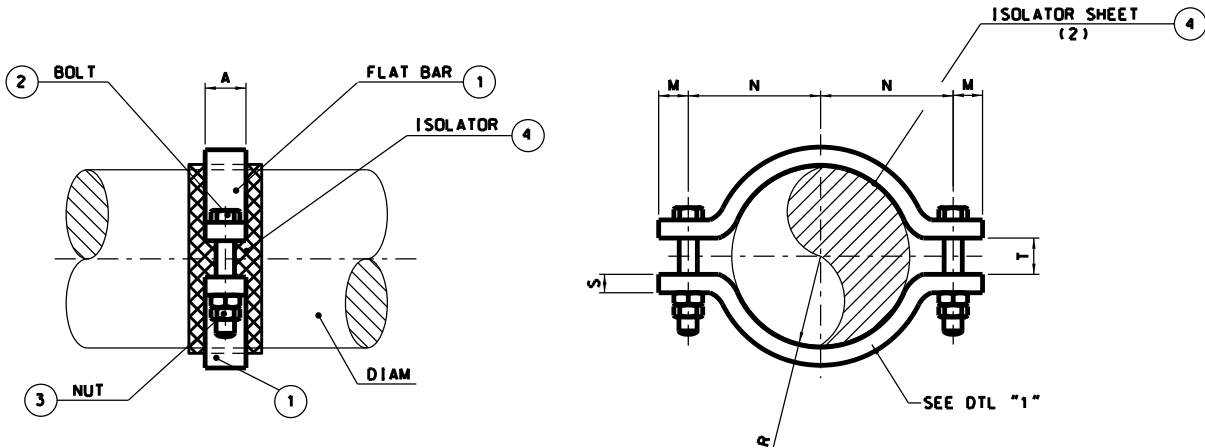
- NOTES:
- 1. STIFFENING PLATE TO BE CUT AND FORM AT ERECTION
 - 2. DIMENSION W IS LIMITED FROM 150 TO 400, WITH STEP 50.

Support Mark

SP06	W	ELEV
------	---	------

○				
○				
②	STIFFENER	2	THK.10	A36
①	BASE	1	SEE TABLE 1	A36
ITEM	DESCRIPTION	QTY.	DETAIL	MATERIAL

Technip TECHNIP INDIA LTD.		VERTICAL PLATE ON STEEL SHAPES		SP06	
STANDARD CONSTRUCTION DRAWING PLANT DESIGN AND PIPING		TPIL DRAWING NO.	XXXXXXXXXX-000-STC- 1394-26	SHEET NO. 1 of 1	REV. A



DTL "1"

TABLE "1" (3)									
DIAM	BOLT	A	M	N	O	R	S	T	V (1)
1/2"	M8x40	30	20	26	10	11	5	8	112
3/4"	M8x40	30	20	28	10	14	5	8	120
1"	M8x40	30	20	32	10	17	5	8	130
1 1/2"	M8x40	30	20	39	10	24	5	8	155

GUIDE DOCUMENT FOR SITE USE ONLY.SITE CONTRACTOR TO DEFINE IN DETAIL EACH SUPPORT

- NOTES:
- APPROXIMATE LENGHT FOR HALF CLAMP BEFORE FORMING.
 - A SHEET OF INSULATING MATERIAL (ELASTOMERIC BAND) SHALL BE INSERTED BETWEEN CARBON STEEL CLAMP AND PIPE
 - CLAMP DIMENSION TO BE ADAPTED ACCORDING TO FABRICATION OR MANUFACTURER SUPPLY

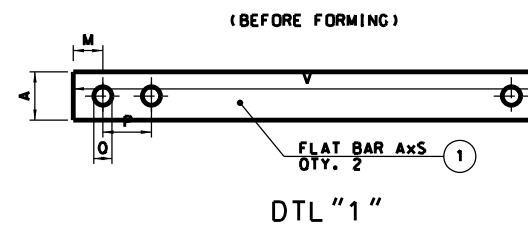
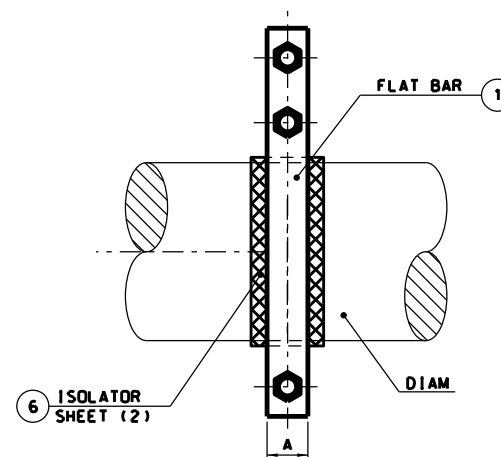
Support Mark

ME01 DIAM MATCL

④	ISOLATOR	1	SHEET THK. 2	/	/	/	NEOPRENE	/	/	ELASTOMER	/
③	NUT	4	SEE TABLE "1"	A194 2H	A194 2H	A194 2H	A194 2H(G)	A194 2H	A194 8	A194 2H	A194 8
②	BOLT	2	SEE TABLE "1"	A193 87	A193 87	A320 L7	A193 87(G)	A193 87	A193 88	A193 87	A320 88
①	STRIP	2	FLAT BAR AxS	A36	A516-60	A516-60	A36 (G)	A36	A387-11	A36	A240-304
ITEM	DESCRIPTION	QTY.	DETAIL	CS		CL	CG	AS	AH	SS(2)	


MATCL

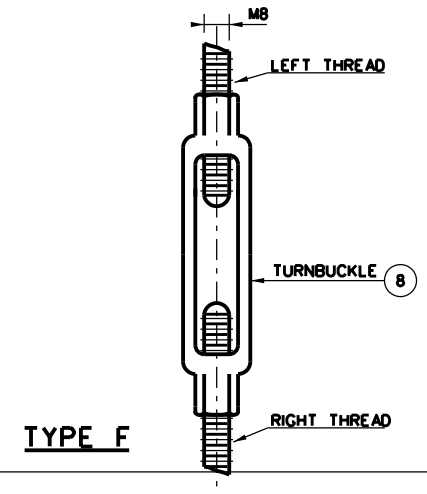
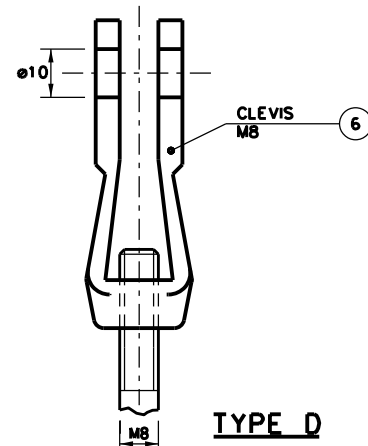
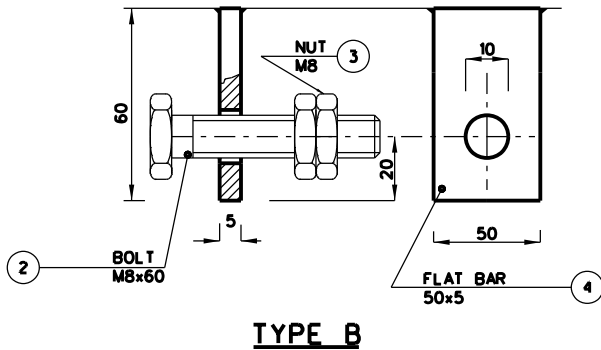
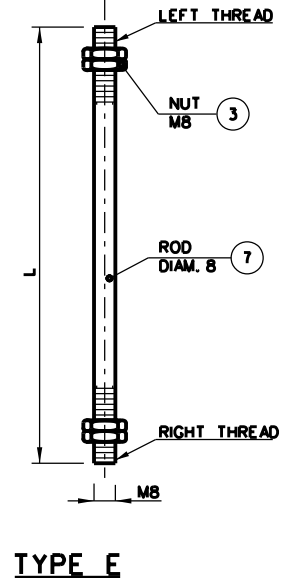
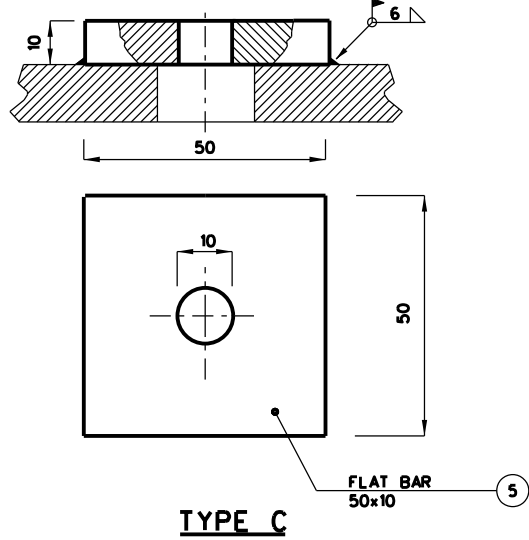
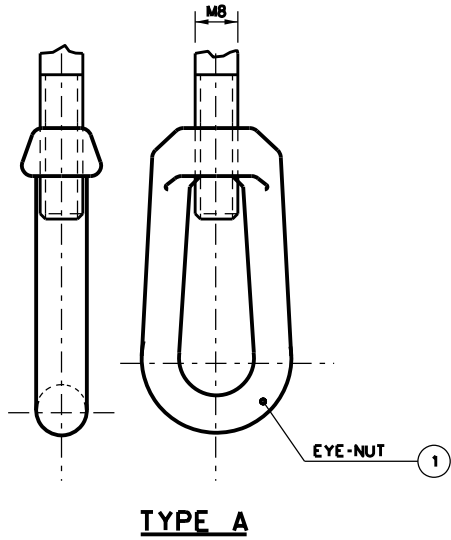
STANDARD CONSTRUCTION DRAWING PLANT DESIGN AND PIPING	CLAMP FOR DIAM 1/2" TO 1 1/2"		ME01	
	XXXXXX	000	STC -1395 - 01	1 of 1
	Project	Unit	Doc. Code & Serial No.	Page



NOTES:

1. APPROXIMATE LENGHT FOR HALF CLAMP BEFORE FORMING.
2. A SHEET OF INSULATING MATERIAL (ELASTOMERIC BAND) SHALL BE INSERTED BETWEEN CARBON STEEL CLAMP AND PIPE
3. CLAMP DIMENSION TO BE ADAPTED ACCORDING TO FABRICATION OR MANUFACTURER SUPPLY

Support Mark						
ME02		DIAM		MATCL		
		CLAMP ON HORIZONTAL PIPE FOR DIAM 1/2" TO 1 1/2"			ME 02	
STANDARD CONSTRUCTION DRAWING PLANT DESIGN AND PIPING		XXXXXX	000	STC - 1395 - 02	1 of 1	0
		Project	Unit	Doc. Code & Serial No.	Page	Rev.



GUIDE DOCUMENT FOR SITE USE ONLY.SITE CONTRACTOR
TO DEFINE IN DETAIL EACH SUPPORT

ITEM	DESCRIPTION	QTY.	DETAIL	CS	CH	CL	CG	AS	AH	SL	SH
8	TURNBUCKLE	1	M8	A668-0	A668-0	A668-0	A668-0	A668-0	A668-0	A668-0	
7	TIE-ROD	1	ROD DIAM. 8	A193-B7	A193-B7	A193-B7	A193-B7	A193-B7	A193-B7	A193-B7	
6	CLEVIS	1	CLEVIS	A668-0	A668-0	A668-0	A668-0	A668-0	A668-0	A668-0	
5	WASHER	1	FLAT BAR 50x10	A36	A36	A36	A36	A36	A36	A36	
4	CLIPS	1	FLAT BAR 50x5	A36	A36	A36	A36	A36	A36	A36	
3	NUT	2/4	M8	A194-2H	A194-2H	A194-2H	A194-2H	A194-2H	A194-2H	A194-2H	
2	BOLT	1	M8x60	A193-B7	A193-B7	A193-B7	A193-B7	A193-B7	A193-B7	A193-B7	
1	EYE-NUT	1	EYE-NUT	A668-0	A668-0	A668-0	A668-0	A668-0	A668-0	A668-0	

NOTES:

1. DIMENSIONS ADAPTED ACCORDING TO MANUFACTURER SUPPLY

Support Mark

ME03 TYPE

Technip

THREADED ANCILLARY
FOR DIAM 1/2" TO 1 1/2"

ME03

STANDARD CONSTRUCTION DRAWING
PLANT DESIGN AND PIPING

XXXXXX	000	STC - 1395 - 03	1 of 1	0
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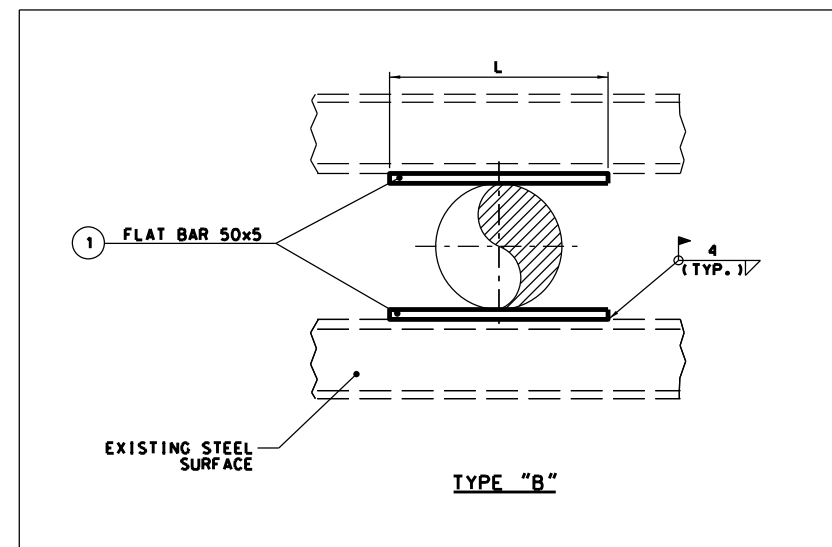
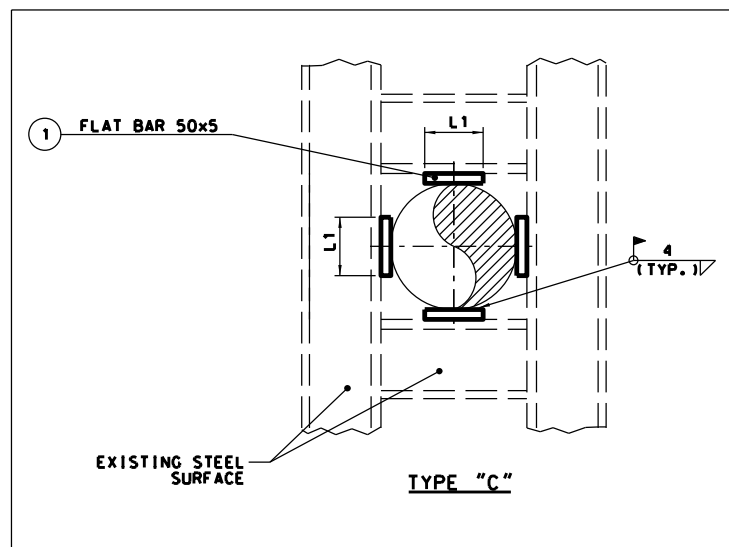
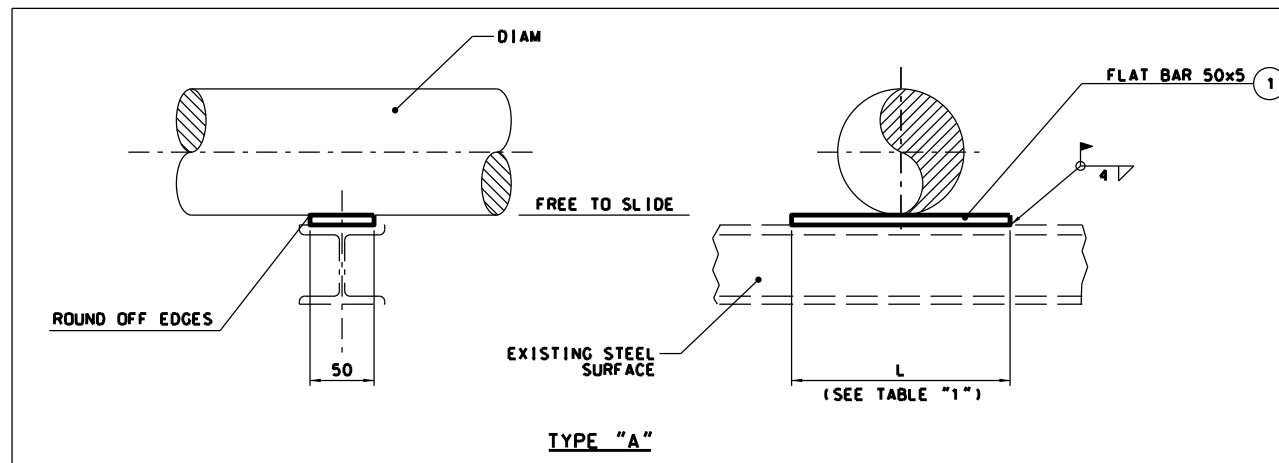


TABLE "1"

TABLE "1"		
DIAM	L	L 1
1 1/2"	50	10
3/4"	50	20
1"	80	20
1 1/2"	80	30

GUIDE DOCUMENT FOR SITE USE ONLY.SITE CONTRACTOR
TO DEFINE IN DETAIL EACH SUPPORT

NOTES:

1. MAY BE USED AS FIELD SHIM.

Support + Mark

ME04	DIAM	TYPE	MATCL
------	------	------	-------

Technip

WEDGE
FOR DIAM $1\frac{1}{2}$ " TO $1\frac{1}{2}$ "

ME 04

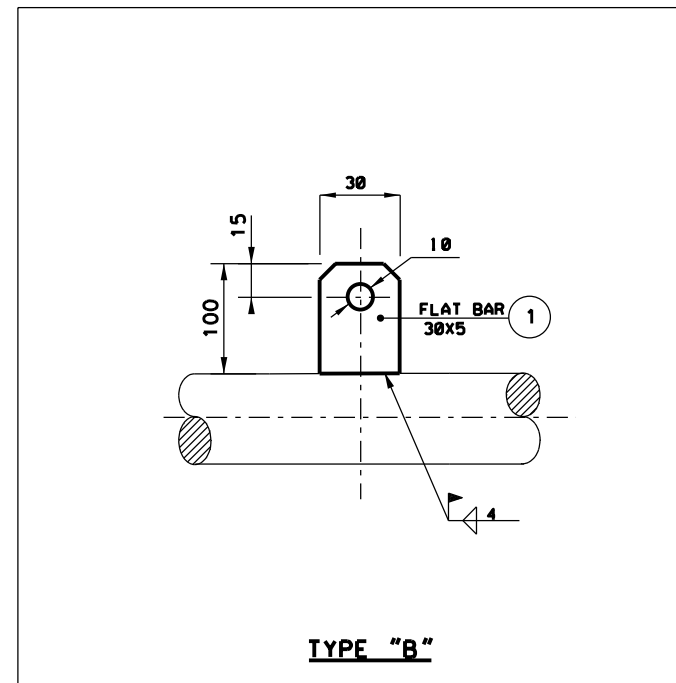
STANDARD CONSTRUCTION DRAWING
PLANT DESIGN AND PIPING

XXXXXX
Project

000	STC - 1395 - 04
Unit	Doc. Code & Serial No.

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Page	Rev

(1)	WEDGE	1	FLAT BAR 50x5	A36	/	/	A36 (G)	A36	/	A240-304	A240-304	
ITEM DESCRIPTION QTY.	DETAIL	(1) CS	CH	CL	CG	AS	AH	SL	SH			
							MATCHL					

[illegible]

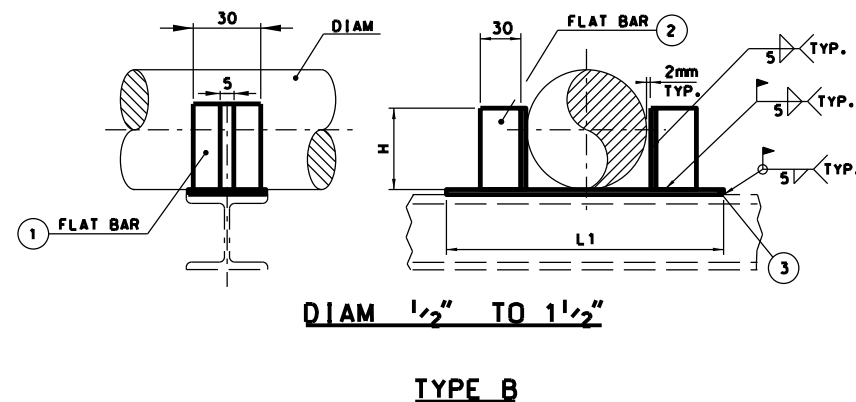


TABLE "2"	
MATCL	TYPE
CS-AS	A
CH-AH	A
CG-SS-SH	B

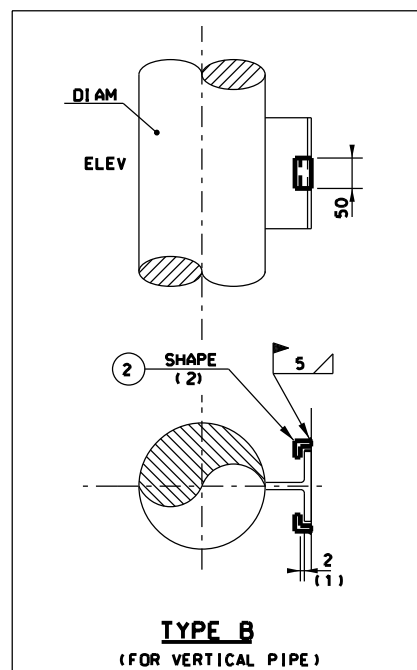
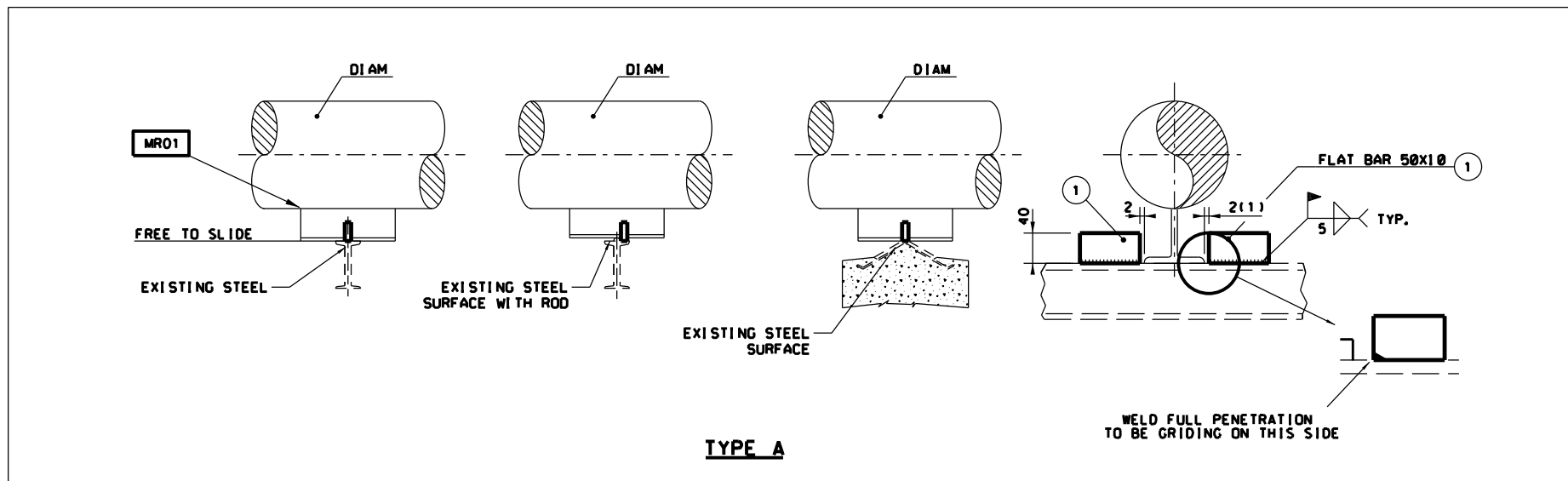
NOTES:

Support + Mark

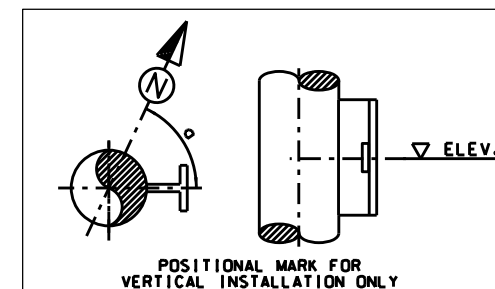
Technip

MG01

XXXXXX	000	STC - 1395 - 06	1 of 1	0
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GUIDE DOCUMENT FOR SITE USE ONLY.SITE CONTRACTOR
TO DEFINE IN DETAIL EACH SUPPORT



NOTES:

1. MAY GAP AT ERECTION
2. CUT AT ERECTION

2	GUIDE	1	SHAPE ISA30	A36	A36	A36	A36	A36	A36	A36	A36		
1	GUIDE	1	FLAT BAR 50x10	A36	A36	A36	A36	A36	A36	A36	A36		
ITEM	DESCRIPTION	QTY.	DETAIL	CS	CH	CL	CG	AS	AH	SL	SH		
				MATCL									

Support Mark		Positional Mark				
MG02 TYPE		ELEV a				
	GUIDE FOR INSULATED PIPE FOR DIAM 1 1/2" TO 1 1/2"			MG02		
	STANDARD CONSTRUCTION DRAWING PLANT DESIGN AND PIPING	XXXXXX	000	STC - 1395 - 07	1 of 1	0
	Project	Unit	Doc. Code & Serial No.		Page	Rev.

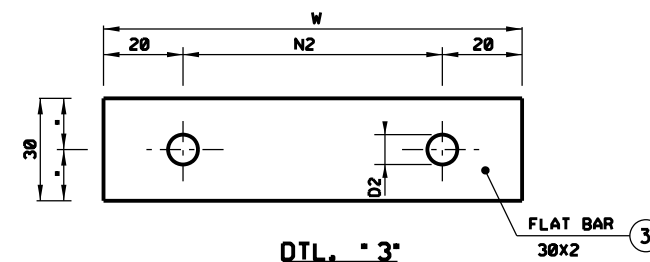
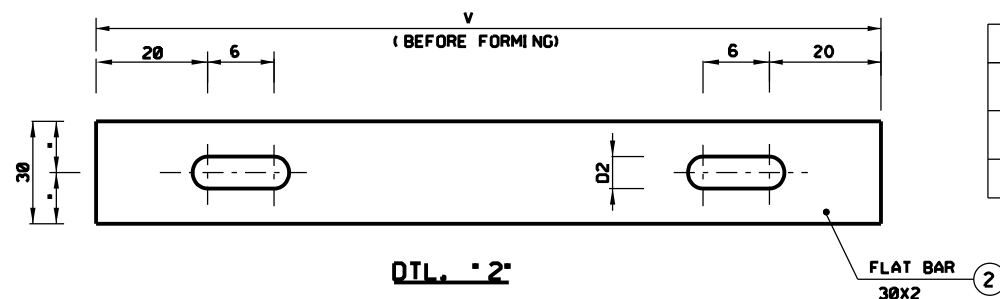
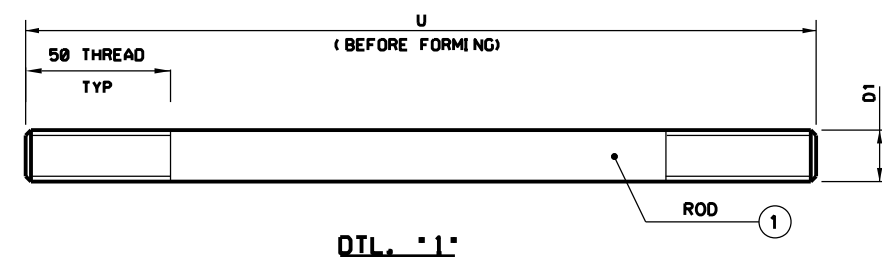
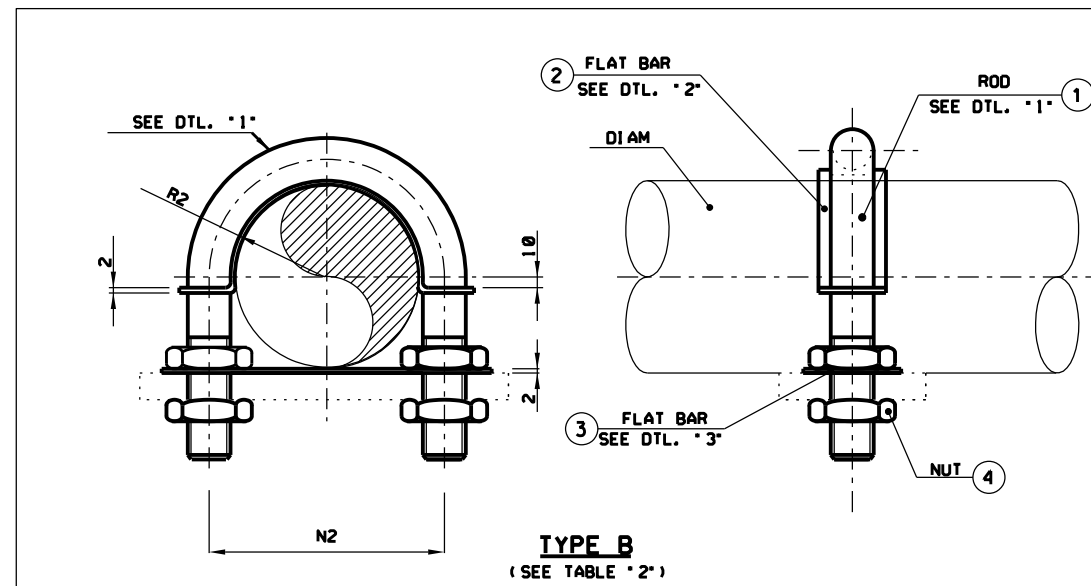
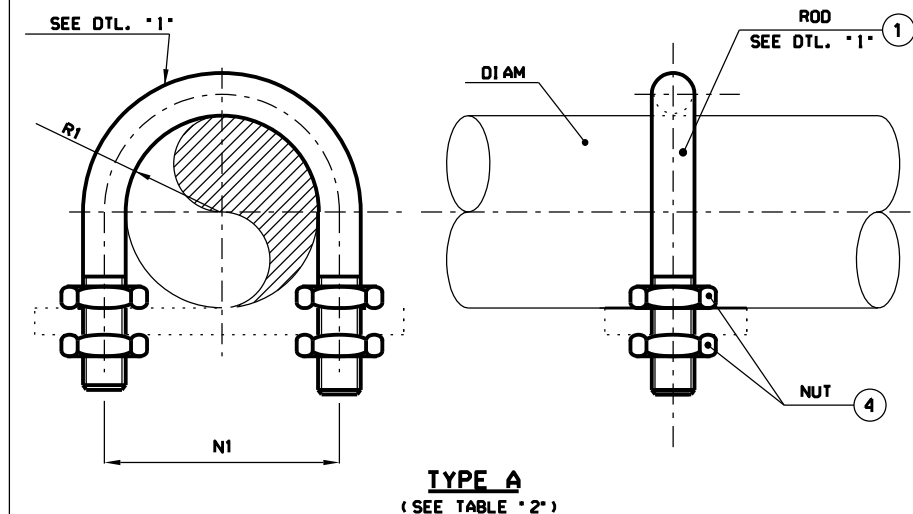


TABLE "2"	
MATCL	TYPE
CS, CH, CL, AS, AH	A
CG, SS, SH	B

TABLE "1" (1)									
DIAM	D1	D2	N1	N2	R1	R2	U	V	W
1/2"	10	12	32	36	11	13	104	83	76
3/4"	10	12	38	42	14	16	114	87	82
1"	10	12	44	48	17	19	126	92	88
1 1/2"	12	14	60	64	25	27	156	114	104

NOTES:

1. U-BOLT DIMENSIONS TO BE ADAPTED ACCORDING TO FABRICATION OR MANUFACTURER SUPPLY

GUIDE DOCUMENT FOR SITE USE ONLY. SITE CONTRACTOR TO DEFINE IN DETAIL EACH SUPPORT

ITEM	DESCRIPTION	QTY.	DETAIL	CS	CH	CL	CG	AS	AH	SL	SH	NI
4	NUT	4	SEE TABLE "1"	A194 2H	A194 2H	A194 2H	A194 2H	A194 2H	A194 2H	A194 2H		
3	BASE	1	FLAT BAR 30x2	/	/	/	A36 (G)	/	/	A240 304		
2	STRIP	1	FLAT BAR 30x2	/	/	/	A36 (G)	/	/	A240 304		
1	U-BOLT	1	ROD SEE TABLE "1"	A193 B7	A193 B7	A320 L7	A193 B7	A193 B7	A193 B7	A193 B7		

Support Mark

MG03 DIAM TYPE MATCL

Technip

U-BOLT NON GRIPPED
FOR DIAM 1/2" TO 1 1/2"

MG03

STANDARD CONSTRUCTION DRAWING
PLANT DESIGN AND PIPING

XXXXXX

000

STC-1395-08

1 of 1

0

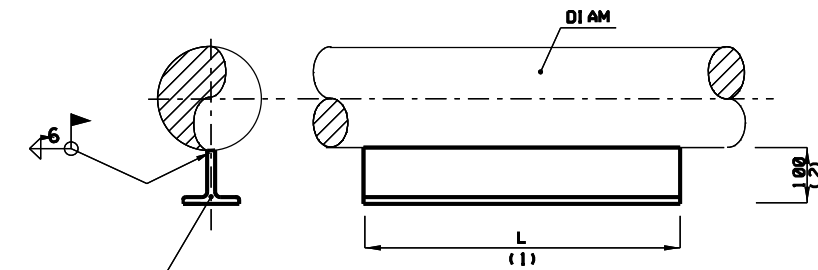
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Unit

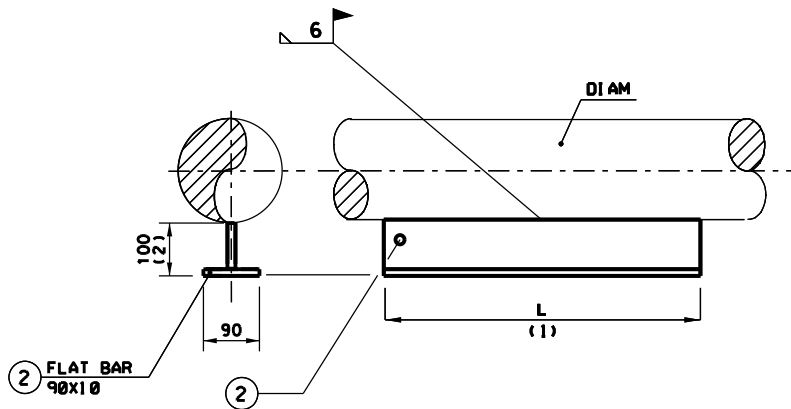
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Page

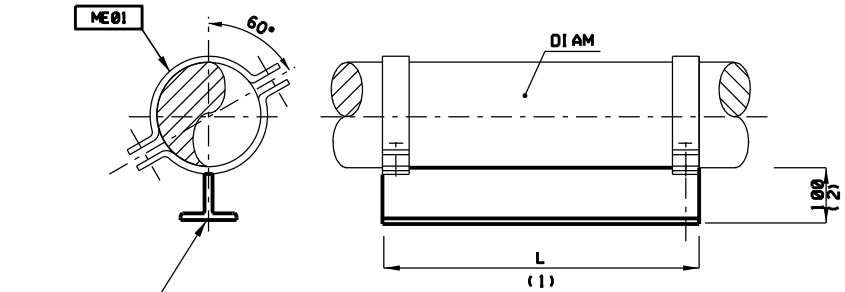
Rev.



TYPE A



TYPE C



TYPE B

TABLE "1"

MATCL	TYPE
CS	A
CG	B
CH+CL+AS AH+SS+SH	B+C

**ONLY FOR
INSULATED LINES.**

GUIDE DOCUMENT FOR SITE USE ONLY.SITE CONTRACTOR
TO DEFINE IN DETAIL EACH SUPPORT

NOTES:

1. L =200. 300. 500 or 700
2. H CAN BE INCREASED UPTO 150

ITEM	DESCRIPTION	QTY.	DETAIL	CS	CH	CL	CG	AS	AH	SL	SH
2	SHOE	2	FLAT BAR 90x10	/	A387-11	A516-60	A36	A387-11	A387-11	A240-304	A240-304
1	SHOE	1	SHAPE HALF MB200	A36	/	/	/	/	/	/	/
				CS	CH	CL	CG	AS	AH	SL	SH
				MATCL							

Support Mark

MR01 **DIAM** **TYPE** **MATCL**

Technip

SHOES
FOR DIAM 1/2" TO 1 1/2"

MR01

STANDARD CONSTRUCTION DRAWING
PLANT DESIGN AND PIPING

XXXXXX	000	STC - 1395 - 09	1 of 1	0
Project	Unit	Doc. Code & Serial No.	Page	Rev.

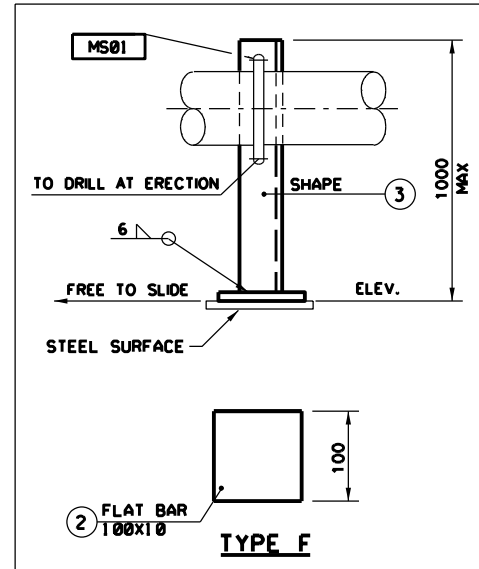
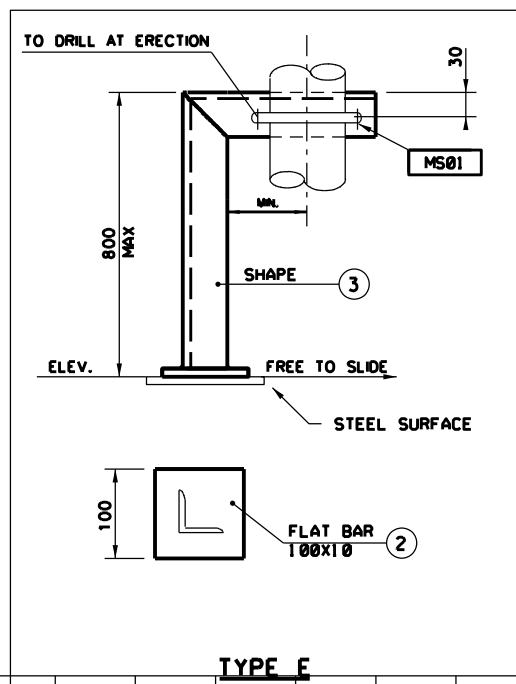
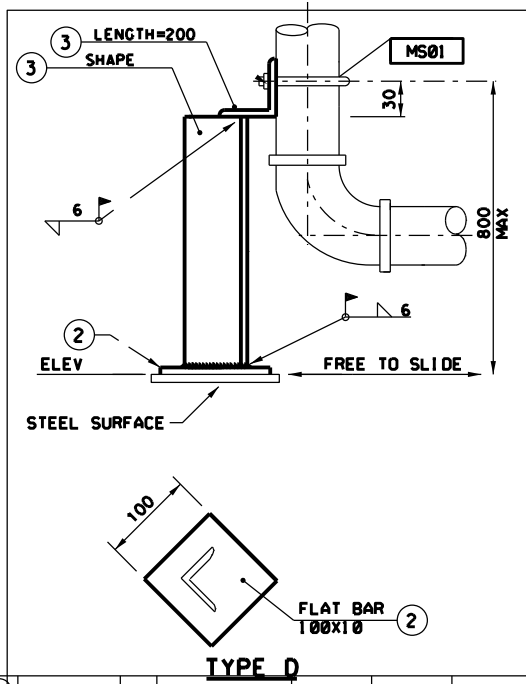
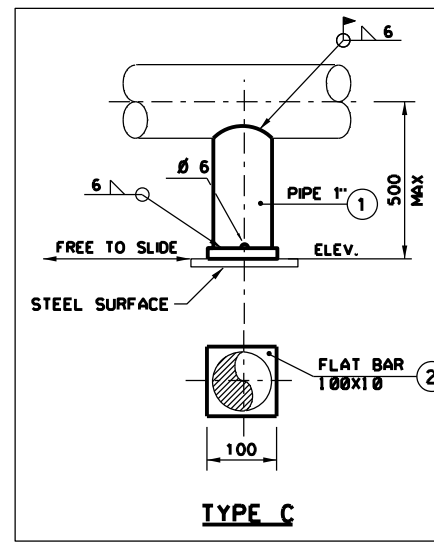
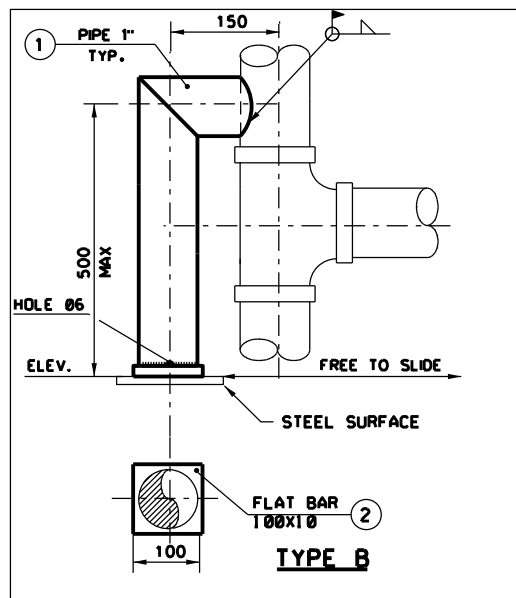
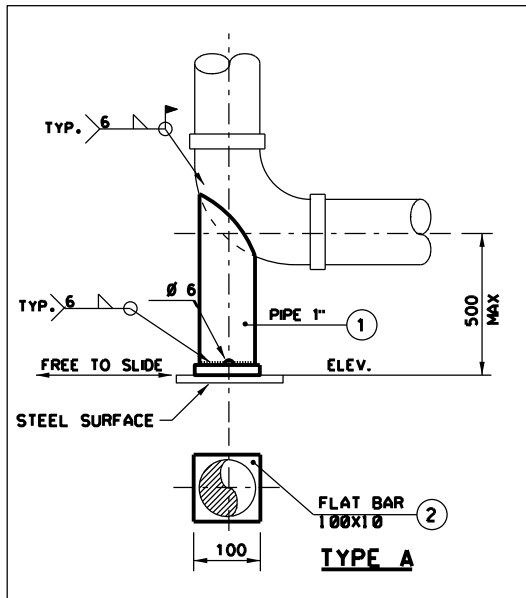


TABLE "1"	
MATCL	TYPE
CS, CH, CL AS, AH, SS, SH	A-B-C
CS, CG, AS, SS	D-E-F

GUIDE DOCUMENT FOR SITE USE ONLY. SITE CONTRACTOR TO DEFINE IN DETAIL EACH SUPPORT

NOTES:

Support Mark

MR02 TYPE MATCL

ITEM	DESCRIPTION	QTY.	DETAIL	CS	CH	CL	CG	AS	AH	SL	SH	NI
3	LEG	1	SHAPE ISA50	A36	/	/	A36C	A36	/	A36	/	
2	BASE	1	FLAT BAR 100x10	A36	A36	A36	A36	A36	A36	A36	A36	
1	DUMMY	1	PIPE 1" SCH. STD	A106 GrB	A106 GrB	A333-6	/	A335-P11	A335-P11	A312-TP304	A312-TP304	

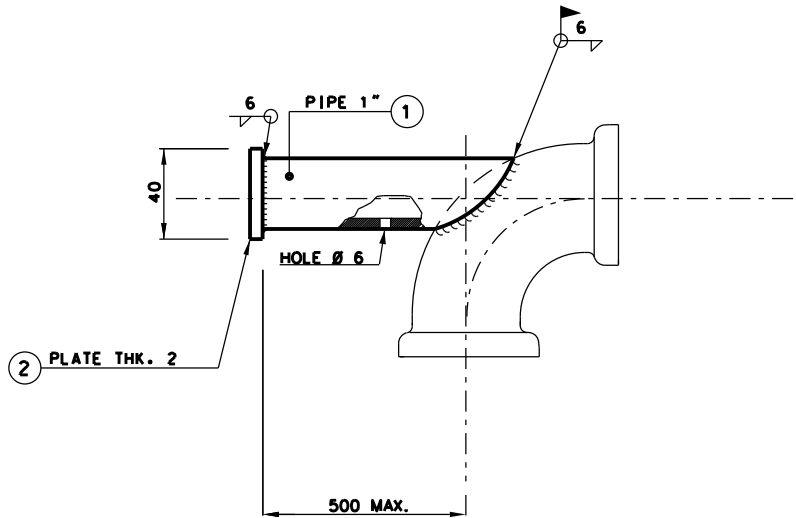
Technip

STANDARD CONSTRUCTION DRAWING
PLANT DESIGN AND PIPING

VERTICAL DUMMY LEG
FOR DIAM 1" TO 1 1/2"

MR02

XXXXXX	000	STC - 1395 - 10	1 of 1	0
Project	Unit	Doc. Code & Serial No.	Page	Rev.

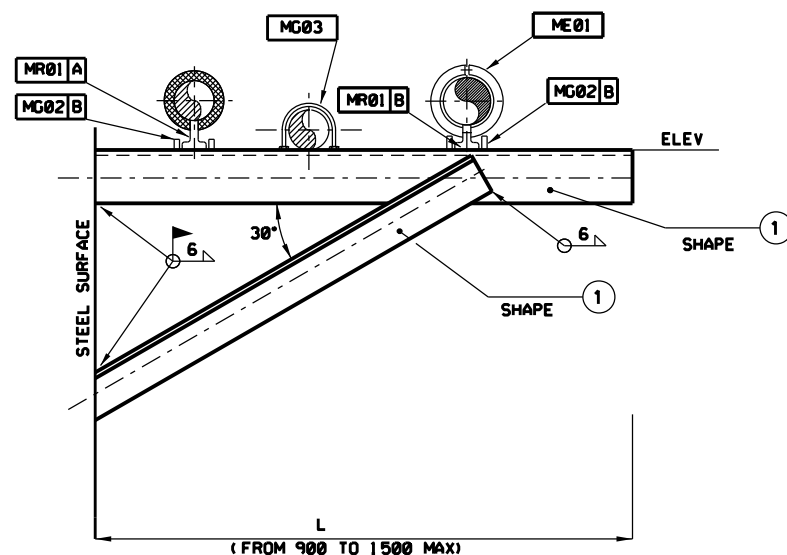


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TO DEFINE IN DETAIL EACH SUPPORT

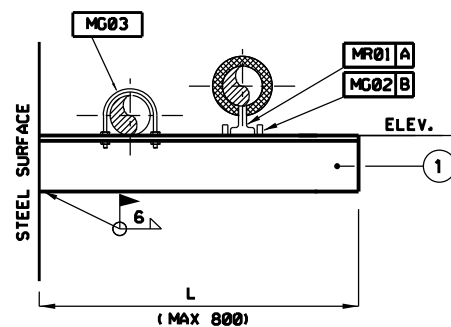
NOTES:.
1. NOT USE FOR PIPE WITH P.W.H.T.

2	COVER	1	PLATE THK.2	A36	A36	A36	/	A36	A36	A36	A36			
1	DUMMY	1	PIPE 1" SCH.STD	A106 GrB	A106 GrB	A333-6	/	A335 P11	A335 P11	A312-TP304	A312-TP304			
ITEM	DESCRIPTION	QTY.	DETAIL	CS	CH	CL	CG	AS	AH	SL	SH			
MATCL														

Support Mark														
MR03 MATCL														
Technip										HORIZONTAL DUMMY LEG ON ELBOW FOR DIAM 1" TO 1½"				
STANDARD CONSTRUCTION DRAWING PLANT DESIGN AND PIPING										XXXXXX	000	STC - 1395 - 11		
Project										Unit		Doc. Code & Serial No.		
												Page		
												Rev.		
												1 of 1		
												0		



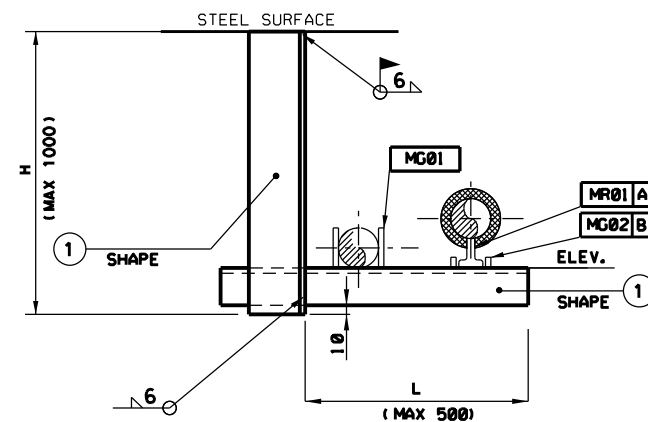
TYPE A



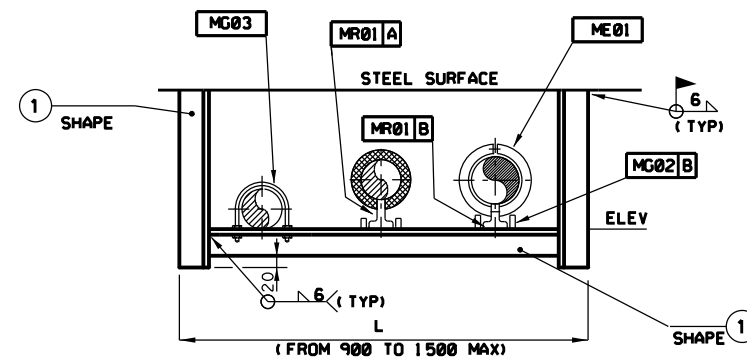
TYPE B

GUIDE DOCUMENT FOR SITE USE ONLY.SITE CONTRACTOR
TO DEFINE IN DETAIL EACH SUPPORT

(1)	BEAM	1	SHAPE ISATS	A36	A36	A36	A36	A36	A36	A36	A36		
ITEM	DESCRIPTION	QTY.	DETAIL	CS	CH	CL	CG	AS	AH	SL	SH		
				MATCL									



TYPE C



TYPE D

NOTES:

Support + Mark

MR04	TYPE
------	------

Technip

BEAM SUPPORT ON HORIZONTAL
PIPE FOR DIAM 1'¹/₂" TO 1'¹/₂"

MR04

STANDARD CONSTRUCTION DRAWING
PLANT DESIGN AND PIPING

XXXXXX

Unit

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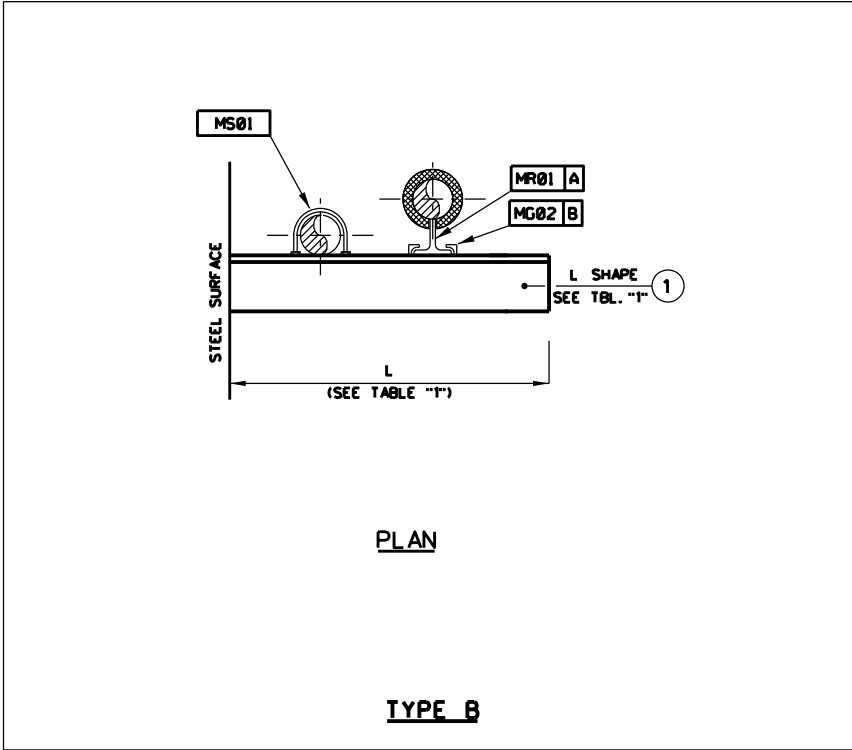
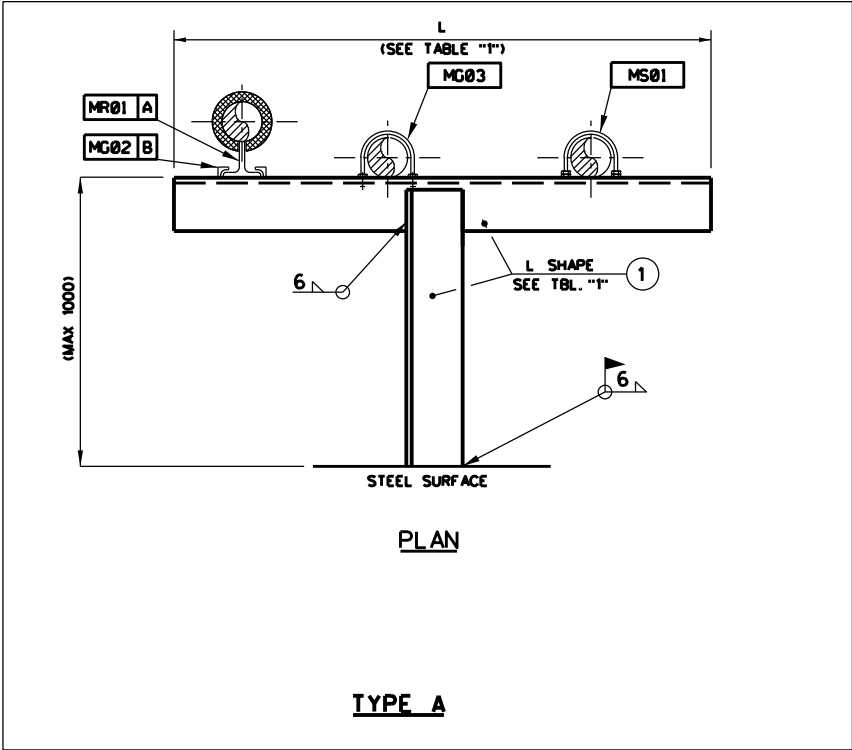


TABLE "1"	
SHAPE	MAX L
ISA50	500
ISA75	800
ISA100	1000

GUIDE DOCUMENT FOR SITE USE ONLY.SITE CONTRACTOR TO DEFINE IN DETAIL EACH SUPPORT

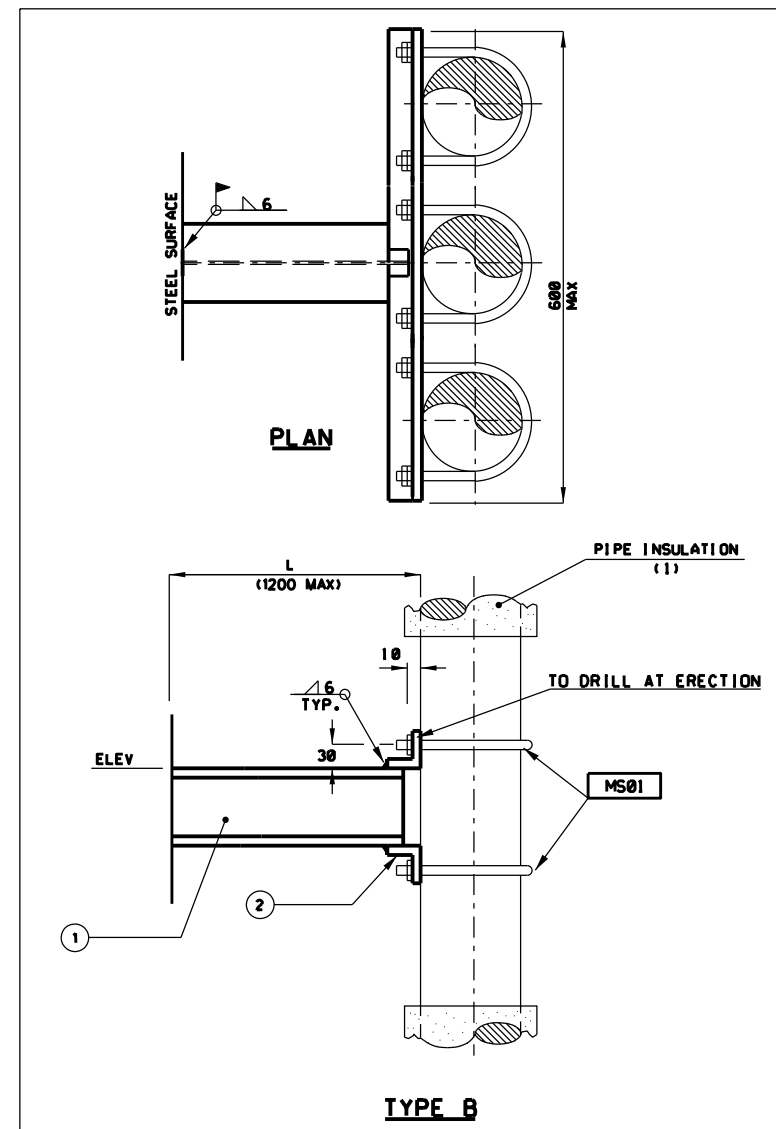
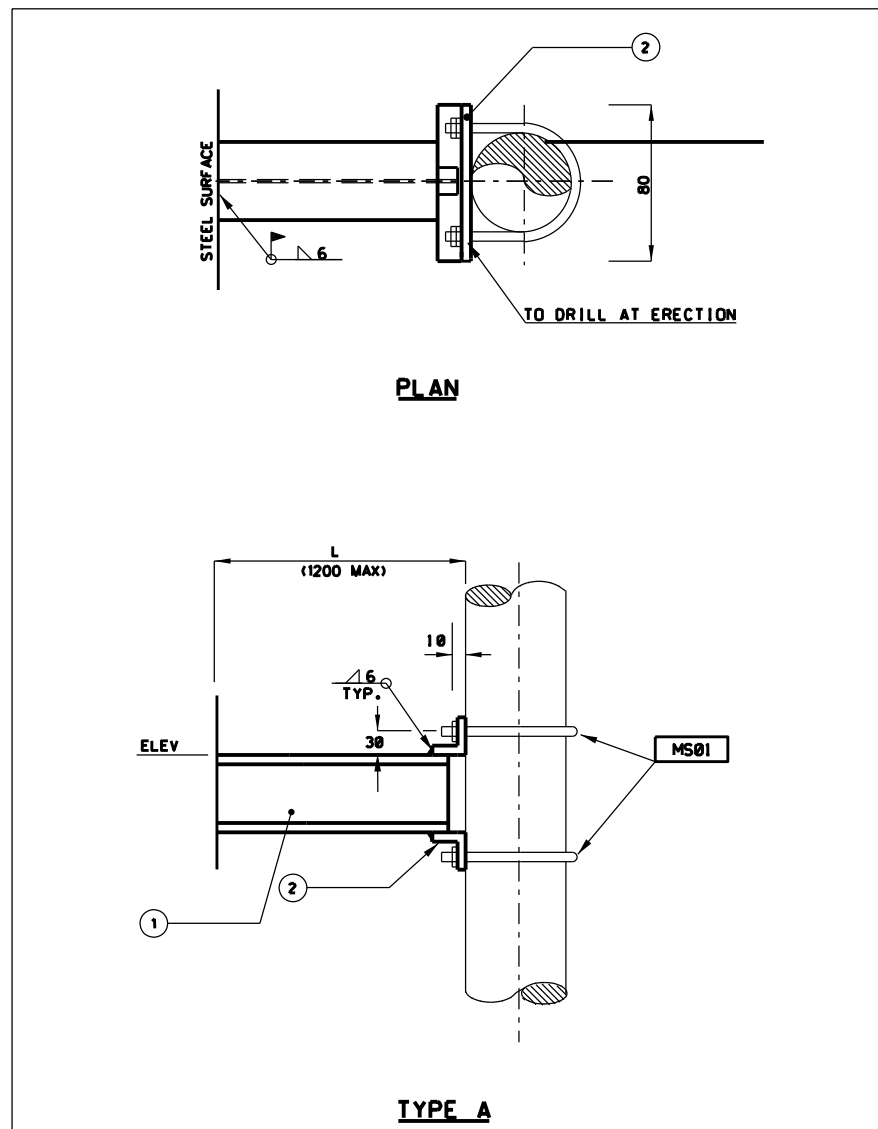
NOTES:

Support Mark

MR05 TYPE

○														
○														
○														
○														
○														
○														
1	BEAM	1	SHAPE SEE TBL. "1"	A36	A36	A36	A36	A36	A36	A36	A36			
ITEM	DESCRIPTION	QTY.	DETAIL	CS	CH	CL	CG	AS	AH	SL	SH			
MATCL														

Technip		BEAM SUPPORT WITH GUIDE ON VERTICAL PIPE DIAM 1/2" TO 1 1/2"			MR05	
STANDARD CONSTRUCTION DRAWING PLANT DESIGN AND PIPING		XXXXXX	000	STC -1395 - 13	1 of 1	0
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NOTES:

1. THE INSULATION OF THE PIPE MUST BE INTERRUPTED.
2. USE THIS SUPPORT FOR LINE WITH TEMPERATURE TO 343°C.

GUIDE DOCUMENT FOR SITE USE ONLY. SITE CONTRACTOR
TO DEFINE IN DETAIL EACH SUPPORT

2	BEAM	2	SHAPE 1SA50	A36	A36	A36	A36	A36	A36	A36	A36			
1	BEAM	1	SHAPE MB100	A36	A36	A36	A36	A36	A36	A36	A36			
ITEM	DESCRIPTION	QTY.	DETAIL	CS	CH	CL	CG	MATCL			AS	AH	SL	SH

Support + Mark

MR06	TYPE
------	------

Technip

**SUPPORT ON VERTICAL PIPING
FOR DIAM 1/2" TO 1 1/2"**

MR06

STANDARD CONSTRUCTION DRAWING
PLANT DESIGN AND PIPING

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TYPE A
(1)

TYPE C

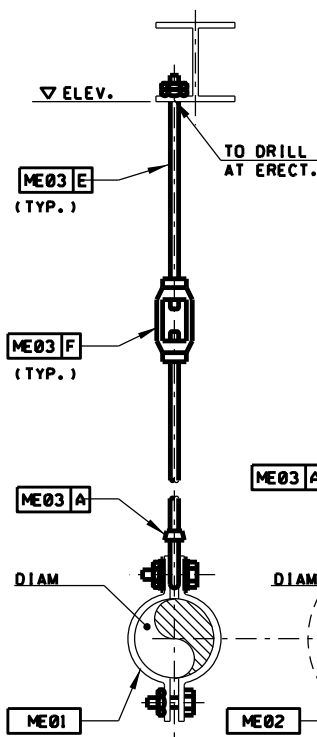
TYPE E
(1)

TYPE B
(1)

TYPE D
(1)

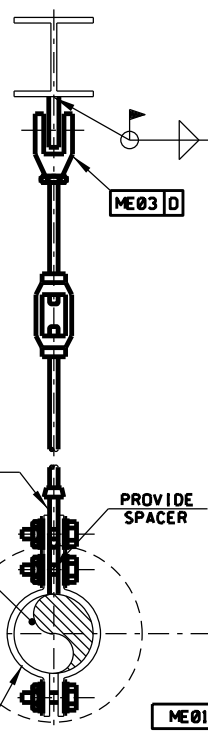
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TYPE A



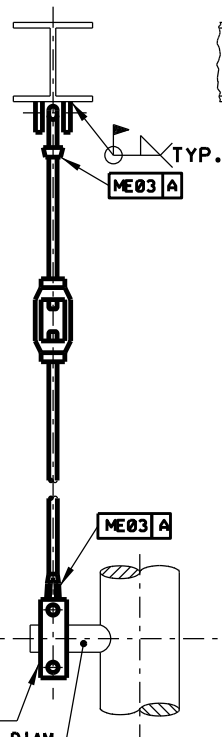
TYPE 1

TYPE B



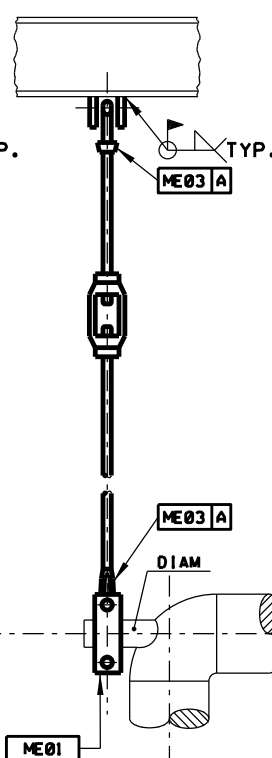
TYPE 2
(HOT INSULATED)

TYPE C



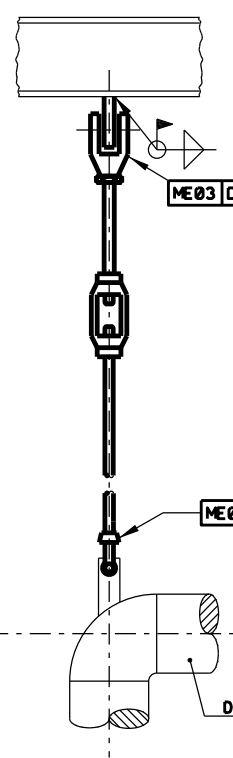
TYPE 3

TYPE D



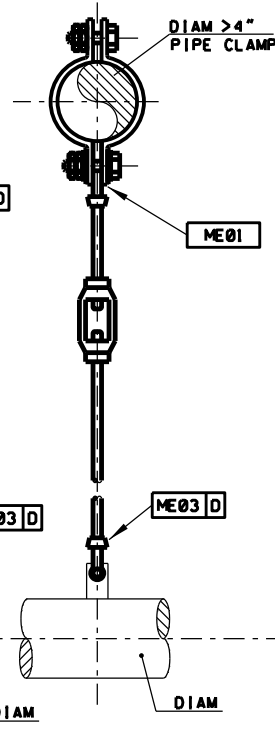
TYPE 4

TYPE E



TYPE 5

TYPE F



TYPE 6

GUIDE DOCUMENT FOR SITE USE ONLY.SITE CONTRACTOR
TO DEFINE IN DETAIL EACH SUPPORT

Support Mark	Positional Mark	Positional Mark
--------------	-----------------	-----------------

MR08	DIAM	UPP.CONN. TYPE	LOWER CONN. TYPE	MATCL
------	------	----------------	------------------	-------

Technip

SINGLE TIE-ROD HANGER
FOR DIAM. $1\frac{1}{2}$ " TO $1\frac{1}{2}$ "

MR08

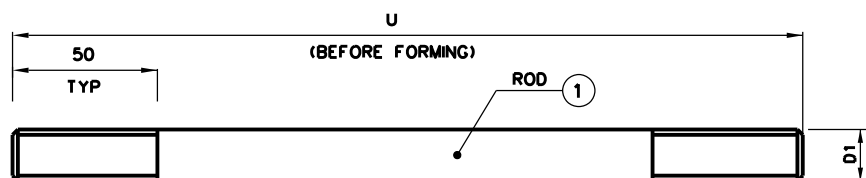
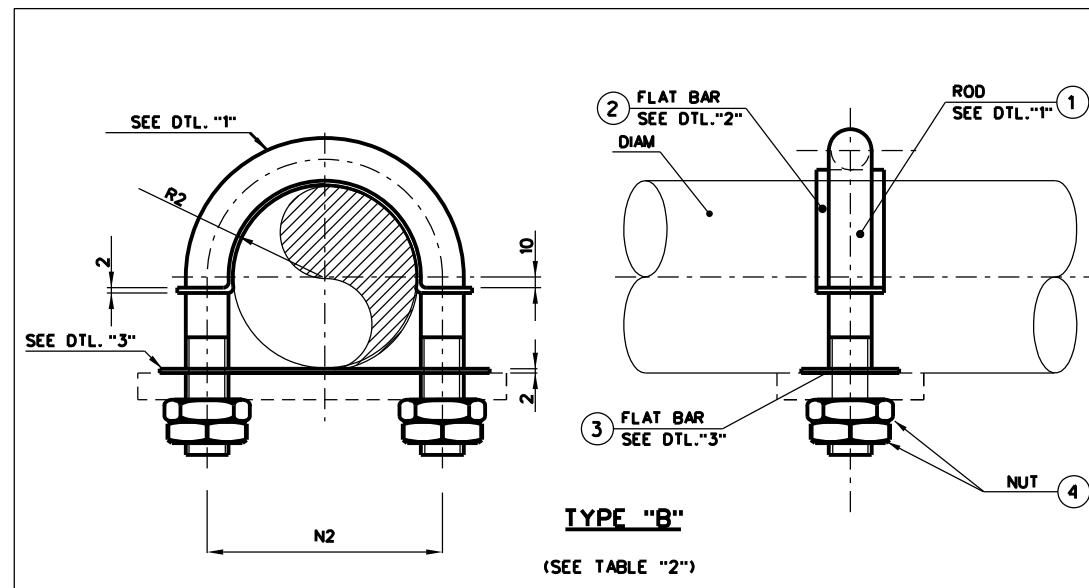
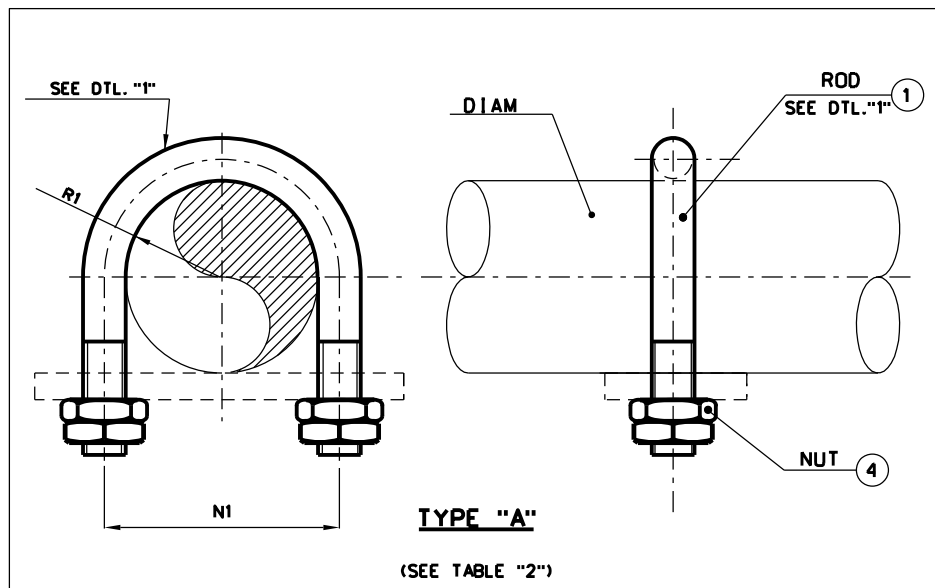
STANDARD CONSTRUCTION DRAWING
PLANT DESIGN AND PIPING

XXXXXX
Project

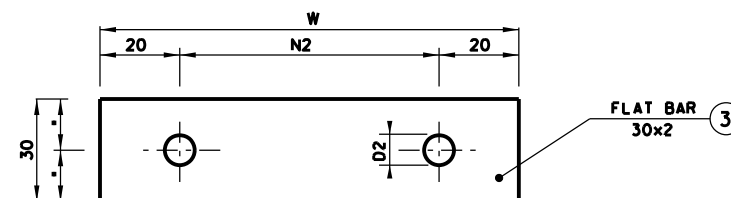
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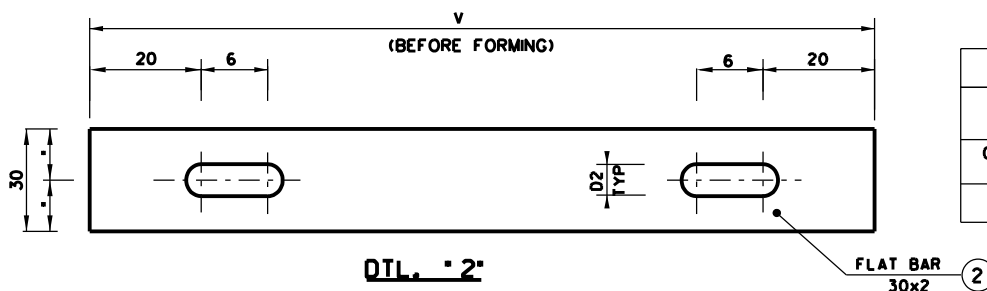
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DTL. "1"



DTL. "3"



DTL. "2"

TABLE "2"	
MATCL	TYPE
CS, CH, CL, AS, AH	A
CG, SS, SH	B

TABLE "1" (1)									
DIAM	D1	D2	N1	N2	R1	R2	U	V	W
1/2"	10	12	32	36	11	13			76
3/4"	10	12	38	42	14	16			82
1"	10	12	44	48	17	19			88
1 1/2"	12	14	60	64	25	27			104

NOTES:

1. U-BOLT DIMENSIONS TO BE ADAPTED ACCORDING TO FABRICATION OR MANUFACTURER SUPPLY

GUIDE DOCUMENT FOR SITE USE ONLY. SITE CONTRACTOR
TO DEFINE IN DETAIL EACH SUPPORT

ITEM	DESCRIPTION	QTY.	DETAIL	CS	CH	CL	CG	AS	AH	SL	SH	N1
④	NUT	4	SEE TABLE 1	A194 2H	A194 2H	A194 2H	A194 2H	A194 2H	A194 2H	A194 2H		
③	BASE	1	FLAT BAR 30x2	/	/	/	A36 (G)	/	/	A240 304		
②	STRIP	1	FLAT BAR 30x2	/	/	/	A36 (G)	/	/	A240 304		
①	U-BOLT	1	ROD SEE TABLE 1	A193 B7	A193 B7	A320 L7	A193 B7	A193 B7	A193 B7	A193 B7		

Support Mark

MS01 DIAM TYPE MATCL

Technip

GRIPPED U-BOLT
FOR DIAM 1/2" TO 1 1/2"

MS01

STANDARD CONSTRUCTION DRAWING
PLANT DESIGN AND PIPING

XXXXXX

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Project

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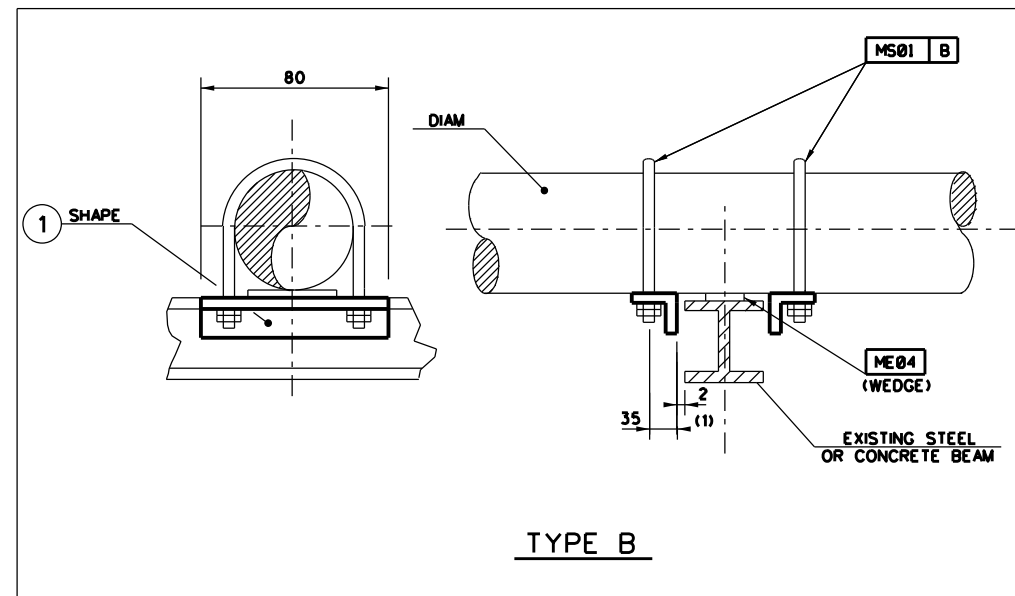
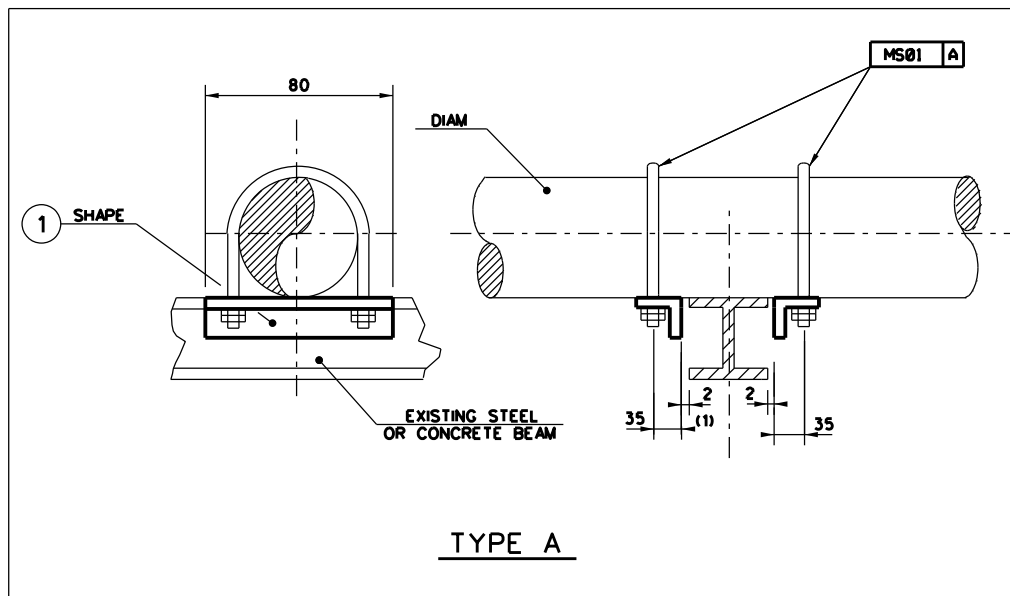


TABLE "1"

TABLE "1"	
MATCL	TYPE
CS,AS	A
CG,SS	B

GUIDE DOCUMENT FOR SITE USE ONLY.SITE CONTRACTOR
TO DEFINE IN DETAIL EACH SUPPORT

NOTES:

1. MAX. GAP AT ERECTION
2. TO DRILL AT ERECTION ACCORDING TO U-BOLT DIMENSION

①	STOP	2	SHAPE 1SA75	A36	/	/	A36	A36	/	A36	/		
ITEM	DESCRIPTION	QTY.	DETAIL	CS	CH	CL	CG	AS	AH	SL	SH		
				MATCL									

Support t Mark

MS02	DIAM	TYPE	MATCL
------	------	------	-------

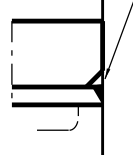
Technip

CLAMPED STOP ON UNINSULATED
LINES FOR DIAM $1\frac{1}{2}$ " TO $1\frac{1}{2}$ "

MS02



STANDARD CONSTRUCTION DRAWING
PLANT DESIGN AND PIPING

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Project	Unit	Doc. Code & Serial No.	Page	Rev.









Rev.

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 TechnipFMC 		PROJECT	Standby SRU & Additional Tanks IOCL Paradip Refinery		
		CLIENT	INDIAN OIL CORPORATION LIMITED		
PIPING STANDARDS – HOOKUP ASSEMBLY DRAWINGS	Project No. 080557C001	Document No. 080557C-088-STD-1380-001		Rev. No. A	Page 1 of 52



PIPING STANDARDS
HOOKUP ASSEMBLY DRAWINGS
(For Standby SRU)

			 Written By <small>Reganathan Sundarajan 2020.03.12 10:52:51 +05'30'</small>	 Checked By <small>Loganathan Sudarshan 2020.03.12 10:52:51 +05'30'</small>	 Approved By <small>Loganathan Sudarshan 2020.03.12 10:54:08 +05'30'</small>	 Authorized By <small>MonteChristopher Jesumathan 2020.03.12 12:20:28 +05'30'</small>
A	12-03-2020	ISSUED FOR DESIGN	SMM	SL	TI / SL	JMC
REV.	DATE	DESCRIPTION	PREPARED	CHECKED	APPROVED	AUTHORIZED

 TechnipFMC		PROJECT	Standby SRU & Additional Tanks IOCL Paradip Refinery		
		CLIENT	INDIAN OIL CORPORATION LIMITED		
PIPING STANDARDS – HOOKUP ASSEMBLY DRAWINGS	Project No. 080557C001	Document No. 080557C-088-STD-1380-001		Rev. No. A	Page 2 of 52

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SECTION	SUBJECT	PAGE
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2.0	CONFLICTS, DEVIATIONS AND CLARIFICATIONS	3
3.0	REFERENCE DOCUMENTS	3
4.0	HOOK-UPS ARRANGEMENT.....	3
	HOOK-UP ASSEMBLY DETAILS ON EQUIPMENTS	5
	HOOK-UP ASSEMBLY DETAILS ON PIPINGS	6

 	PROJECT		Standby SRU & Additional Tanks	
	CLIENT		IOCL Paradip Refinery	
PIPING STANDARDS – HOOKUP ASSEMBLY DRAWINGS	Project No. 080557C001	Document No. 080557C-088-STD-1380-001	Rev. No. A	Page 3 of 52

1.0 SCOPE

This Project Specification covers the standard piping hook-ups for vents & drains, Instrument connections (pressure, temperature & orifice connections) for Standby SRU unit of “Standby SRU & Additional tanks” Project, IOCL Paradip Refinery, Odisha, India. The requirements specified herein shall govern besides the relevant codes and standards specified here.

2.0 CONFLICTS, DEVIATIONS AND CLARIFICATIONS

Any conflicts between this specification and other applicable Engineering Standards, Material Specifications, Standard Drawings, Engineering Procedures, Company Forms or Industry standards, specifications, Codes and forms shall be brought to the attention of Authorized Representative by the Contractor for resolution. Until the resolution is officially made by Authorized Representative, the most stringent requirement shall govern. Where a licensor specification is more stringent than those of this standard, the Licensor's specific requirement shall apply. Where applicable Codes or Standards are not called by this standard or its requirements are not clear, it shall be brought to attention of Authorized Representative by Contractor for resolution.

Direct all requests for deviations or clarifications in writing to the Authorized Representative for final resolution. Technical changes implemented prior to approval by Authorized Representative are subject to rejection.

3.0 REFERENCE DOCUMENTS

- 080557C-000-JSD-1300-002 - Job Specification for Design - Piping Material Specifications
- PDRP4200-8550-SP-1013 - Instrument / Piping Interface Standard

4.0 HOOK-UPS ARRANGEMENT



4.1 PROCESS VENTS AND DRAINS

All process vents and drains shall be fitted with an appropriate valve selected from the pipe class valve list in which it placed. The vent and drain shall be recorded on the relevant P&ID's as per process requirement. The valve outlet shall be fitted with either a flange or cap as appropriate to the valve design.

4.2 HYDROSTATIC VENTS AND DRAINS

All low points in the piping system may require additional drain connections to drain the test fluid which shall be fitted with an appropriate valve selected from the respective pipe class. The valve outlet shall be fitted with either a flange or plug as appropriate to the valve design.

All hydrostatic vents would normally be without valves and shall be fitted with a closure appropriate to vent size and pressure class. The closure would normally be a flange, plug or

 TechnipFMC 		PROJECT	Standby SRU & Additional Tanks IOCL Paradip Refinery		
		CLIENT	INDIAN OIL CORPORATION LIMITED		
PIPING STANDARDS – HOOKUP ASSEMBLY DRAWINGS	Project No. 080557C001	Document No. 080557C-088-STD-1380-001		Rev. No. A	Page 4 of 52

threaded cap. However there may be cases where high point vent require valved process vent which shall be employed as per process vent hook up.

The location of all hydrostatic vents and drains is dependent upon the geometry of the pipe run in order to locate suitable high and low points. High and low points can only realistically be identified on isometric drawings and these drawings will form part of detailed engineering design.

4.3 HOOK-UPS ON PIPING

Applicable Piping Hook-up assemblies for individual pipe class are listed in Table-2.

The connection sizes & block valve sizes are based on the Instrument-Piping Interface standard as referred in section 3, and as per the requirement of Instrument. The sizes indicated on the table shall be updated suitably if any change from Instrument/as per requirement of Instrument discipline / Instrumentation design basis.

The assembly details P33, P34, F13 & F14 shall be referred for diaphragm mounting type instrument connections wherever shown on P&ID.

4.4 HOOK-UPS ON EQUIPMENTS

Equipment Hook-up assembly details for individual pipe class are listed in Table-1.

The connection sizes & block valve sizes are based on the Instrument-Piping Interface standard as referred in section 3, and as per the requirement of Instrument. The sizes indicated on the table shall be updated suitably if any change from Instrument/as per requirement of Instrument discipline / Instrumentation design basis.

The assembly details PE07, LC07 & LC17 shall be referred for diaphragm mounting type instrument connections wherever shown on P&ID.



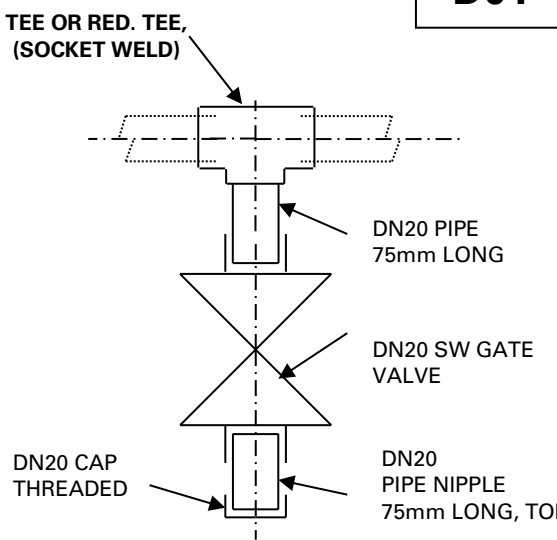
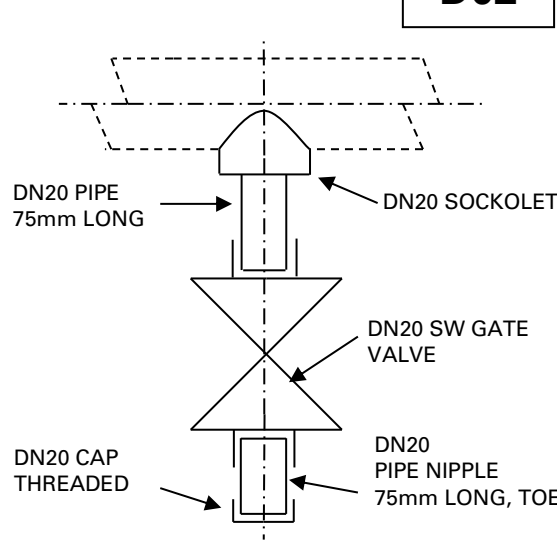
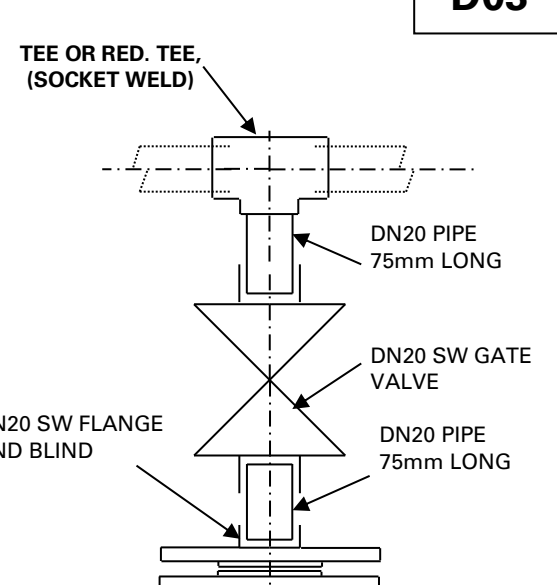
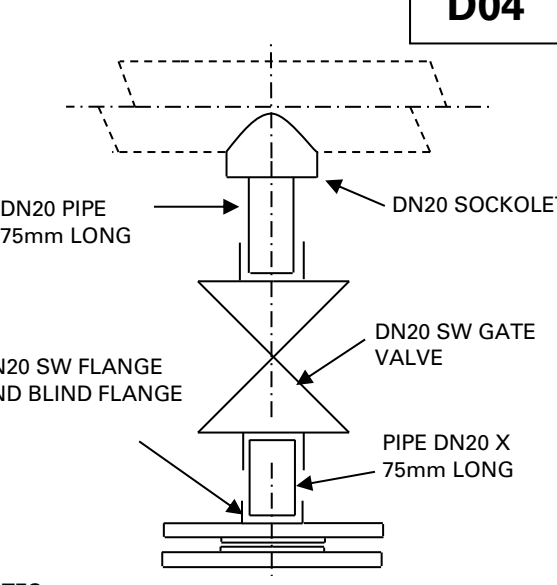
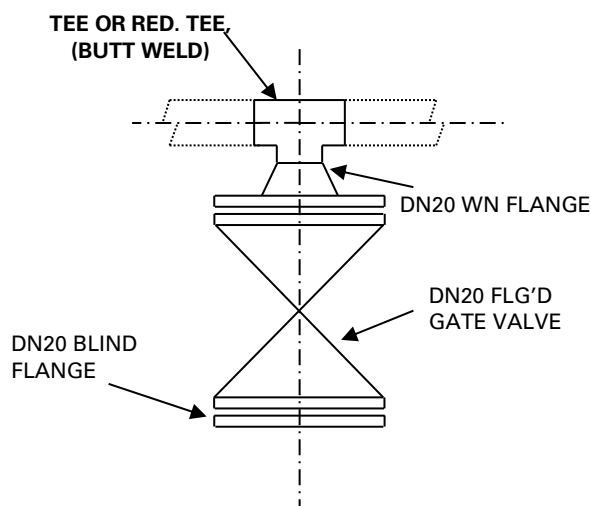
 	PROJECT		Standby SRU & Additional Tanks		
	CLIENT		IOCL Paradip Refinery		
PIPING STANDARDS – HOOKUP ASSEMBLY DRAWINGS	Project No. 080557C001	Document No. 080557C-088-STD-1380-001		Rev. No. A	Page 6 of 52

TABLE-2: STANDARD PIPING ASSEMBLIES

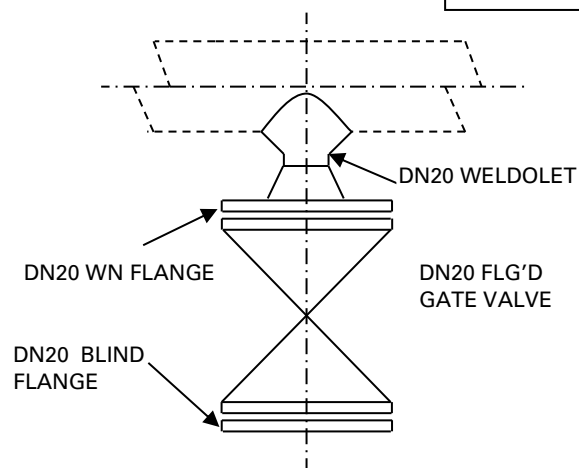
VENTS, DRAINS AND INSTRUMENT CONNECTIONS (REFER FOLLOWING PAGES FOR PIPING STANDARD HOOK-UPS)										
PIPING CLASS	PIPING CLASS (EQUIVALENT EXISTING REFINERY CLASS)	20 – 40 (MM)	50 & ABOVE (MM)	20 – 40 (MM)	50 & ABOVE (MM)	20 – 40 (MM)	50 & ABOVE (MM)	80 MM	100 & ABOVE (MM)	
		VENT / DRAIN VALVED		VENT HYDROSTATIC		PRESSURE CONNECTION		TEMPERATURE CONNECTION		ORIFICE
A1K	A0JV	D01/V01	D02/V02	H03	H04	P01	P02	T01	T02	F01
A23A	A1AA	D01/V01	D02/V02	H01	H02	P01	P02	T01	T02	F01
A1A	A1AP	D01/V01	D02/V02	H03	H04	P01	P02	T01	T02	F01
A2A	A1AS	D01/V01	D02/V02	H09	H10	P01	P02	T03	T04	F01
A21N	A1LV	D01/V01	D02/V02	H03	H04	P01	P02	T01	T02	F01
A52A	A2AD	D09/V09	D10/V10	H03	H04	P05	P06	T01	T02	F03
A13A	A2AQ	D07/V07	D08/V08	H07	H08	P03	P04	T03	T04	F09
A8A	A2AL	D11/V11	D12/V12	H03	H04	P07	P08	T01	T02	F05
A15A	A2AF	Refer Job Specification for Steam Tracing & Jacketing (080557C-000-JSD-1300-006)								
A12A	A2AP	D01/V01	D02/V02	H03	H04	P01	P02	T01	T02	F01
A28A	A2AR	D07/V07	D08/V08	H07	H08	P03	P04	T03	T04	F09
A31A	A2AS	D01/V01	D02/V02	H09	H10	P01	P02	T03	T04	F01
A29A	A2AU	D01	D02	H03	H04	P01	P02	T01	T02	F01
A3A	A2AW	D01/V01	D02/V02	H01	H02	P01	P02	T01	T02	F01
A30A	A2UU, A2UW	Not Applicable (UG)								
A49A	A4AR	D07/V07	D08/V08	H07	H08	P03	P04	T03	T04	F09
A95A	A4AV	D07/V07	D08/V08	H07	H08	P25	P26	T03	T04	F08
A17A	A4UV	Not Applicable (UG)								
B19A	B1AL	D11/V11	D12/V12	H03	H04	P07	P08	T01	T02	F05
B1A	B1AP	D01/V01	D02/V02	H03	H04	P01	P02	T01	T02	F01
B2A	B1AS	D01/V01	D02/V02	H09	H10	P01	P02	T03	T04	F01
B9A	B2AP	D01/V01	D02/V02	H03	H04	P01	P02	T01	T02	F01
B28A	B2AR	D07/V07	D08/V08	H07	H08	P03	P04	T03	T04	F09
B31A	B2AS	D01/V01	D02/V02	H09	H10	P01	P02	T03	T04	F01
B49A	B4AR	D07/V07	D08/V08	H07	H08	P03	P04	T03	T04	F09
D2A	D1AS	D33/V29	D34/V30	H09	H10	P27	P28	T03	T04	F10
D3A	D2A2	D01/V01	D02/V02	H03	H04	P01	P02	T01	T02	F01
D31A	D2AS	D33/V29	D34/V30	H09	H10	P27	P28	T03	T04	F10
D9D	D1DS	D35/V31	D36/V32	H09	H10	P29	P30	T03	T04	F11
D9L	D1ZS	D31/V27	D32/V28	H07	H08	P31	P32	T03	T04	F12
A53G	S0RA, S1RW	D17/V17	D18/V18	H05	H06	P13	P14	T07	T08	F04

HOOKUP ASSEMBLY DETAILS ON PIPING

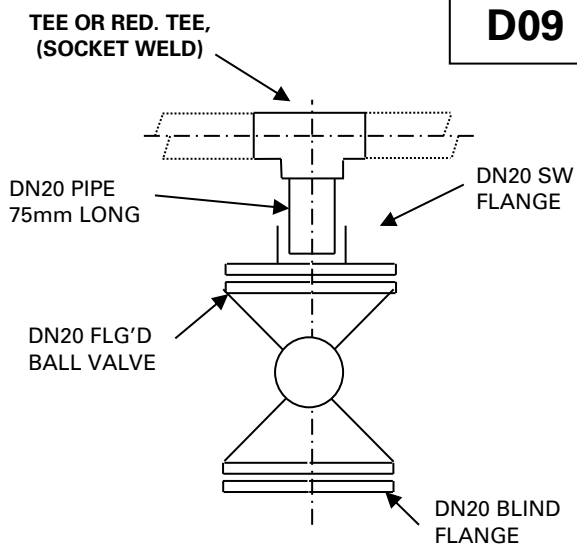
<div> D01 </div>  <p>NOTE: DN20 PIPE 75mm LONG</p> <p>NOTE: DN20 SW GATE VALVE</p> <p>NOTE: DN20 CAP THREADED</p> <p>NOTE: DN20 PIPE NIPPLE 75mm LONG, TOE</p> <p>NOTES:</p> <ol style="list-style-type: none"> FOR RUN SIZE DN20 – DN40 ONLY. FOR INSULATED LINES PIPE LENGTH MAY NEED TO BE INCREASED. 	<div> D02 </div>  <p>NOTE: DN20 PIPE 75mm LONG</p> <p>NOTE: DN20 SOCKOLET</p> <p>NOTE: DN20 SW GATE VALVE</p> <p>NOTE: DN20 CAP THREADED</p> <p>NOTE: DN20 PIPE NIPPLE 75mm LONG, TOE</p> <p>NOTES:</p> <ol style="list-style-type: none"> FOR RUN SIZE DN50 – DN600 ONLY. FOR INSULATED LINES PIPE LENGTH MAY NEED TO BE INCREASED. USE DN25 DRAIN ASSEMBLY FOR RUN SIZES FROM DN650 – DN1200. USE DN40 DRAIN ASSEMBLY FOR RUN SIZES ABOVE DN1200.
<div> D03 </div>  <p>NOTE: TEE OR RED. TEE, (SOCKET WELD)</p> <p>NOTE: DN20 PIPE 75mm LONG</p> <p>NOTE: DN20 SW GATE VALVE</p> <p>NOTE: DN20 SW FLANGE AND BLIND</p> <p>NOTE: DN20 PIPE 75mm LONG</p> <p>NOTES:</p> <ol style="list-style-type: none"> FOR RUN SIZE DN20 - DN40 ONLY. FOR INSULATED LINES PIPE LENGTH MAY NEED TO BE INCREASED. 	<div> D04 </div>  <p>NOTE: DN20 PIPE 75mm LONG</p> <p>NOTE: DN20 SOCKOLET</p> <p>NOTE: DN20 SW GATE VALVE</p> <p>NOTE: DN20 SW FLANGE AND BLIND FLANGE</p> <p>NOTE: PIPE DN20 X 75mm LONG</p> <p>NOTES:</p> <ol style="list-style-type: none"> FOR RUN SIZE DN50 – DN600 ONLY. FOR INSULATED LINES PIPE LENGTH MAY NEED TO BE INCREASED. FOR RUN SIZE DN650 TO DN1200 USE DN25 DRAIN ASSEMBLY.

D07

NOTES:

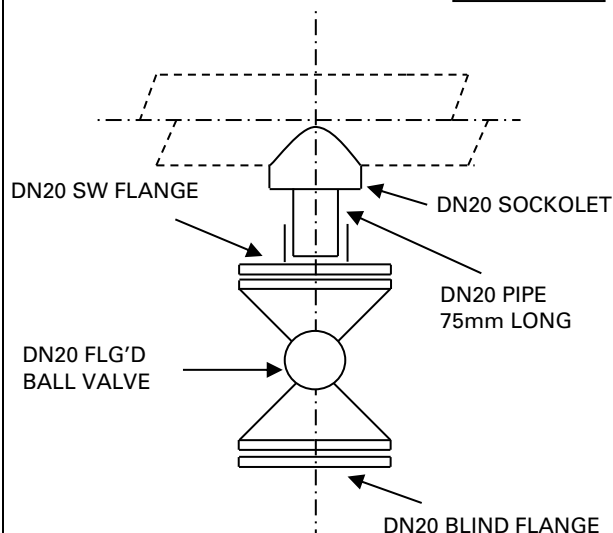
1. FOR RUN SIZE DN20 – DN40 ONLY.
2. FOR INSULATED LINES CHECK VALVE CLEARANCE AND ADD PIPE LENGTH TO SUIT.

D08

NOTES:

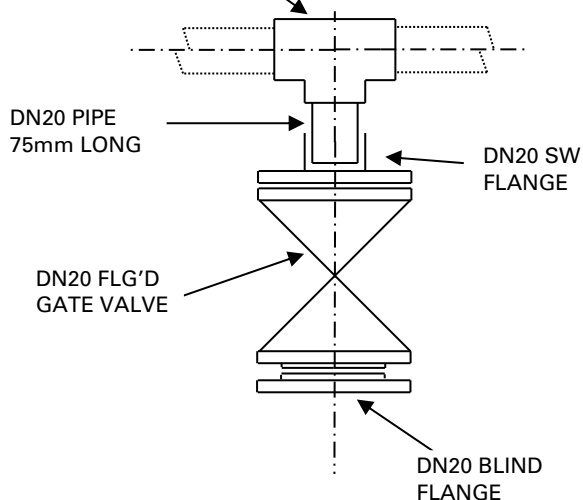
1. FOR RUN SIZE DN50 – DN600 ONLY.
2. FOR INSULATED LINES CHECK VALVE CLEARANCE AND ADD PIPE LENGTH TO SUIT.
3. FOR RUN SIZES DN650-DN1200 USE DN25 DRAIN ASSEMBLY. USE DN40 DRAIN ASSEMBLY FOR RUN SIZES OVER DN1200

D09

NOTES:

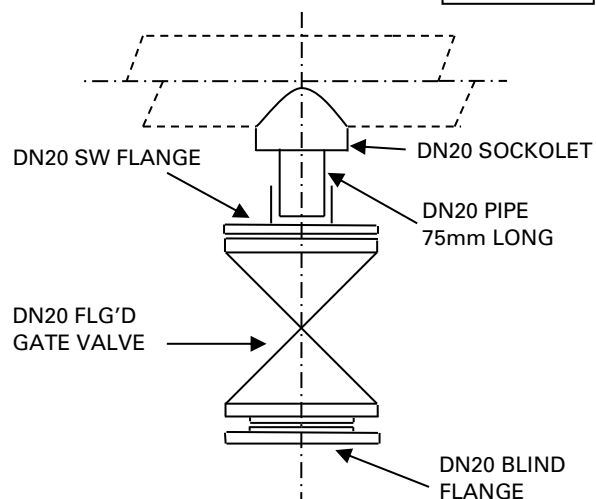
1. FOR RUN SIZE DN20 – DN40 ONLY.
2. FOR INSULATED LINES PIPE LENGTH MAY NEED TO BE INCREASED.

D10

NOTES:

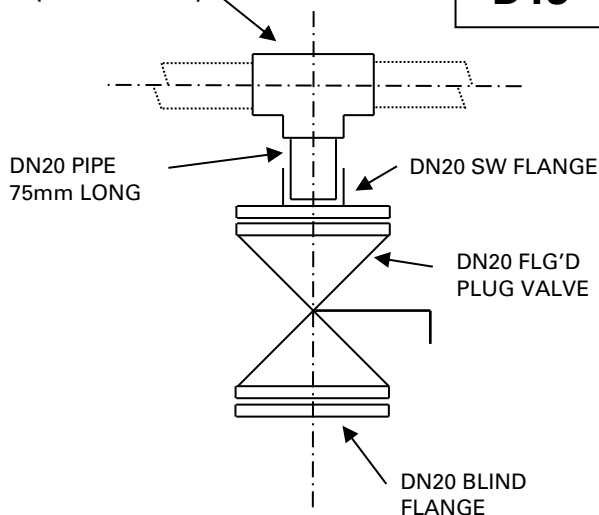
1. FOR RUN SIZE DN50 – DN600 ONLY.
2. FOR INSULATED LINES PIPE LENGTH MAY NEED TO BE INCREASED.
3. FOR RUN SIZE DN650 – DN1200 USE DN25 DRAIN ASSEMBLY.

**TEE OR RED. TEE,
(SOCKET WELD)**
D11

NOTES:

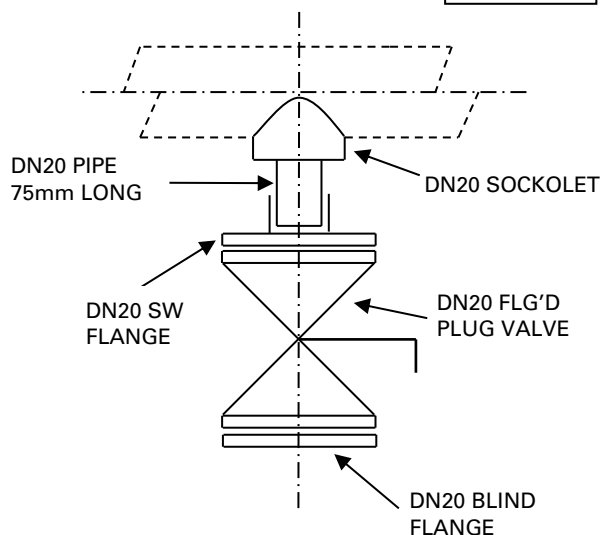
1. FOR RUN SIZE DN20 – DN40 ONLY.
2. FOR INSULATED LINES PIPE LENGTH MAY NEED TO BE INCREASED.

D12

NOTES:

1. FOR RUN SIZE DN50 – DN600 ONLY.
2. FOR INSULATED LINES PIPE LENGTH MAY NEED TO BE INCREASED.
3. FOR RUN SIZE DN650 TO DN1200 USE DN25 DRAIN ASSEMBLY. USE DN40 DRAIN ASSEMBLY FOR RUN SIZE ABOVE DN1200

**TEE OR RED. TEE,
(SOCKET WELD)**
D13

NOTES:

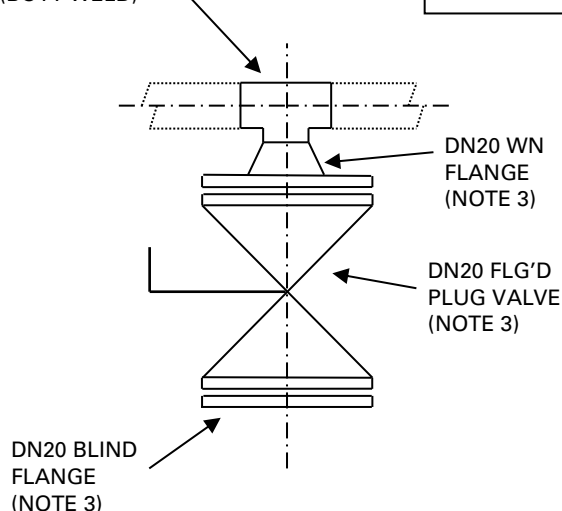
1. FOR RUN SIZE DN20 – DN40 ONLY.
2. FOR INSULATED LINES PIPE LENGTH MAY NEED TO BE INCREASED.

D14

NOTES:

1. FOR RUN SIZE DN50 – DN600 ONLY.
2. FOR INSULATED LINES PIPE LENGTH MAY NEED TO BE INCREASED.
3. FOR RUN SIZE DN650 – DN1200 USE DN25 DRAIN ASSEMBLY.

TEE OR RED. TEE,
(BUTT WELD)

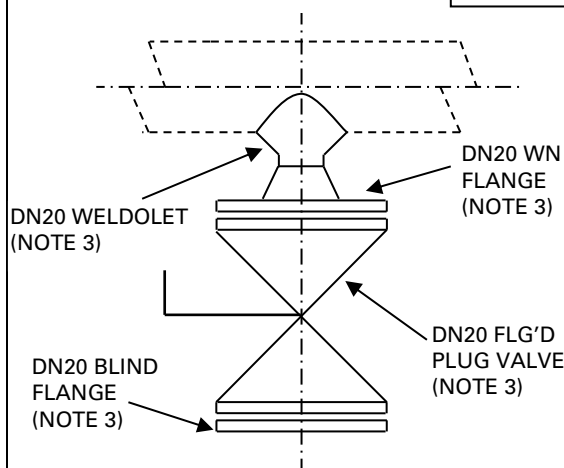
D15



NOTES:

1. FOR RUN SIZE DN20 – DN40 ONLY.
2. FOR INSULATED LINES CHECK VALVE CLEARANCE AND ADD PIPE LENGTH TO SUIT.
3. FOR PTFE LINED PLUG VALVES, MINIMUM DRAIN ASSEMBLY SIZE IS DN25.

D16

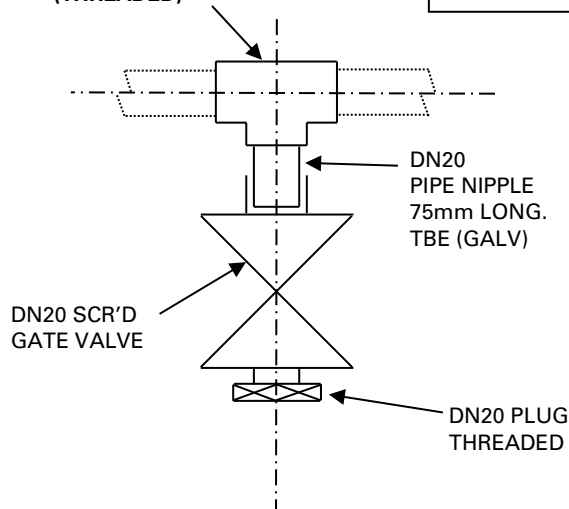


NOTES:

1. FOR RUN SIZE DN50 – DN600 ONLY.
2. FOR INSULATED LINES CHECK VALVE CLEARANCE AND ADD PIPE LENGTH TO SUIT.
3. FOR PTFE LINED PLUG VALVES MINIMUM DRAIN ASSEMBLY SIZE IS DN25.
4. FOR RUN SIZE DN650 – DN1200 USE DN25 DRAIN ASSEMBLY.

TEE OR RED. TEE,
(THREADED)

D17

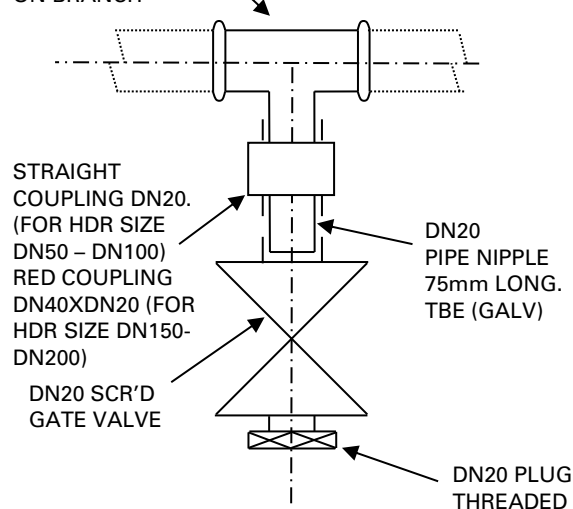


NOTES:

1. FOR RUN SIZE DN20 – DN40 ONLY.
2. PIPE NIPPLE LENGTH MAY BE INCREASED IF NECESSARY.

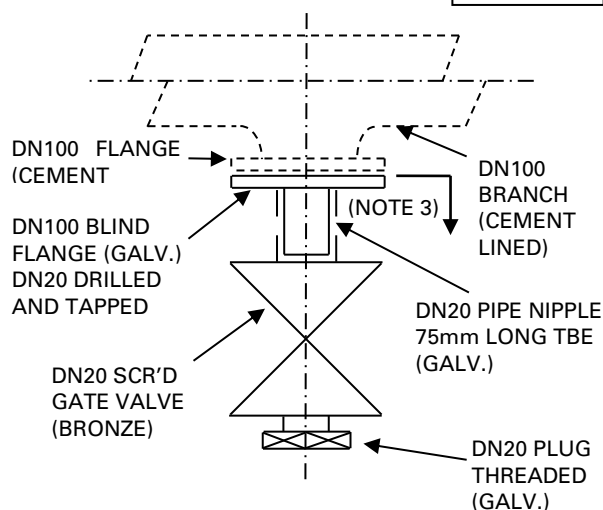
RED. TEE, GROOVED ENDS
ON RUN THRD. NPT(M) END
ON BRANCH

D18

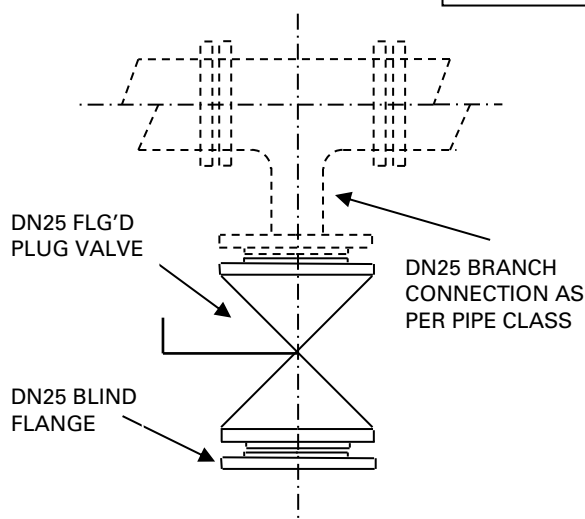


NOTES:

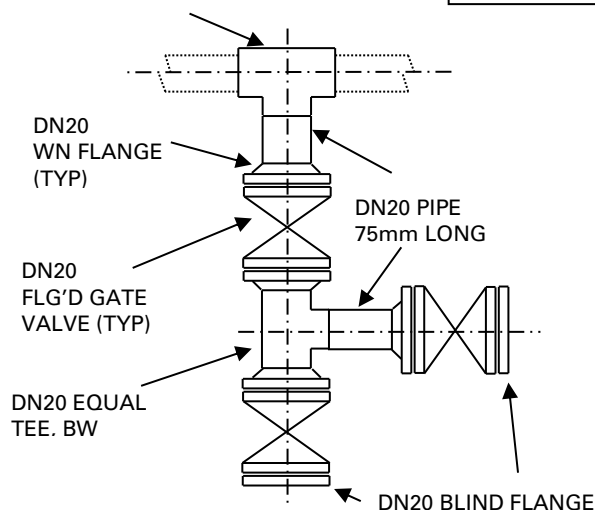
1. FOR RUN SIZE DN50 – DN200 ONLY.

D19

NOTES:

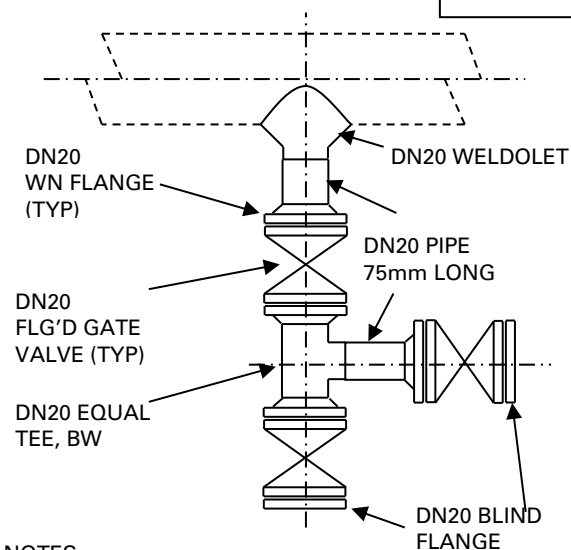
1. FOR RUN SIZE DN100 – DN600 ONLY.
2. FOR RUN SIZE DN650 - DN1200 USE DN25 DRAIN ASSEMBLY. USE DN40 DRAIN ASSEMBLY FOR RUN SIZES OVER DN1200.
3. USE PIPING ITEMS AS PER PIPE CLASS S1RW.

D20

NOTES:

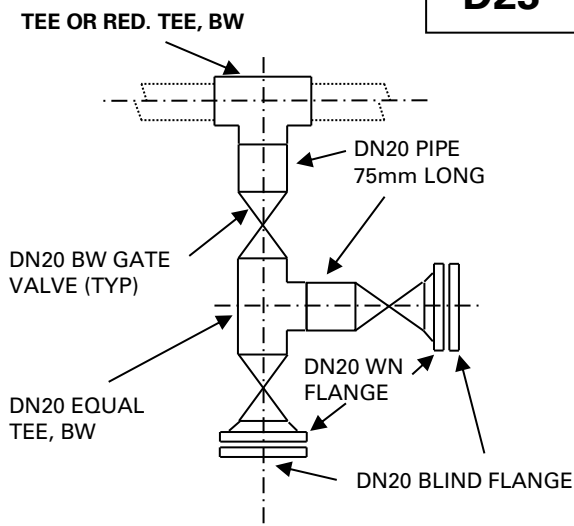
1. FOR RUN SIZE DN25 & ABOVE.
2. FOR INSULATED LINES FLANGED SPOOLS OR SPACERS MAY BE ADDED IF REQUIRED.

TEE OR RED. TEE, BW
D21

NOTES:

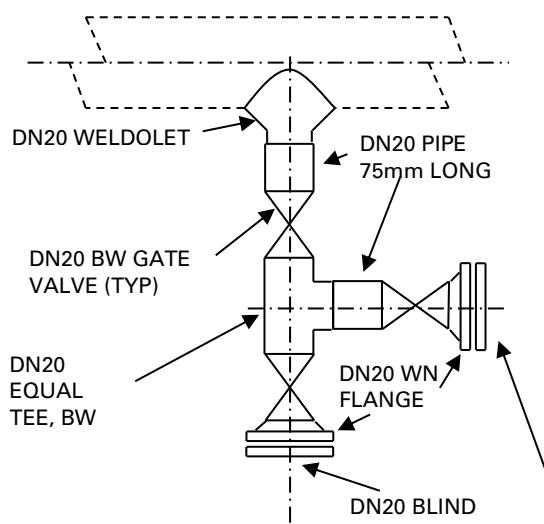
1. FOR RUN SIZE DN20 – DN40 ONLY.
2. FOR INSULATED PIPE LENGTH MAY NEED TO BE INCREASED.

D22

NOTES:

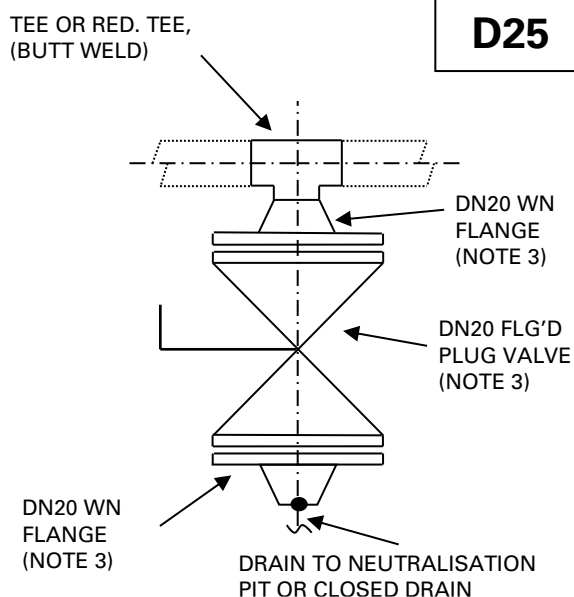
1. FOR RUN SIZE DN50 – DN600 ONLY.
2. FOR INSULATED LINES PIPE LENGTH MAY NEED TO BE INCREASED.
3. FOR RUN SIZE DN650 - DN1200 USE DN25 DRAIN ASSEMBLY.

D23

NOTES:

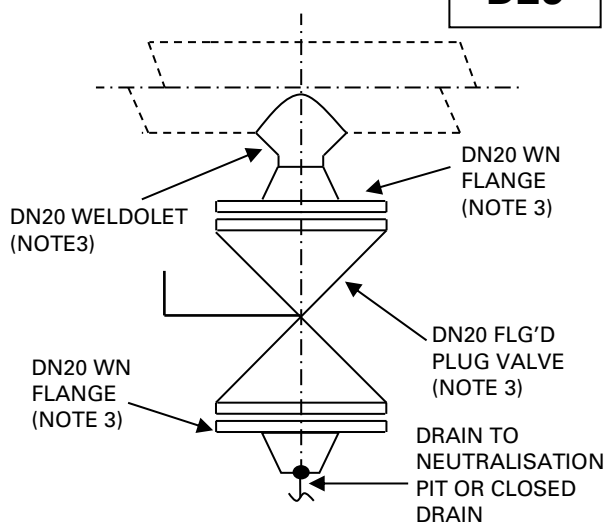
1. FOR RUN SIZE DN20 – DN40 ONLY.
2. FOR INSULATED PIPE LENGTH MAY NEED TO BE INCREASED.

D24

NOTES:

1. FOR RUN SIZE DN50 – DN600 ONLY.
2. FOR INSULATED LINES PIPE LENGTH MAY NEED TO BE INCREASED.
3. FOR RUN SIZE DN650 – DN1200 USE DN25 DRAIN ASSEMBLY.

D25

NOTES:

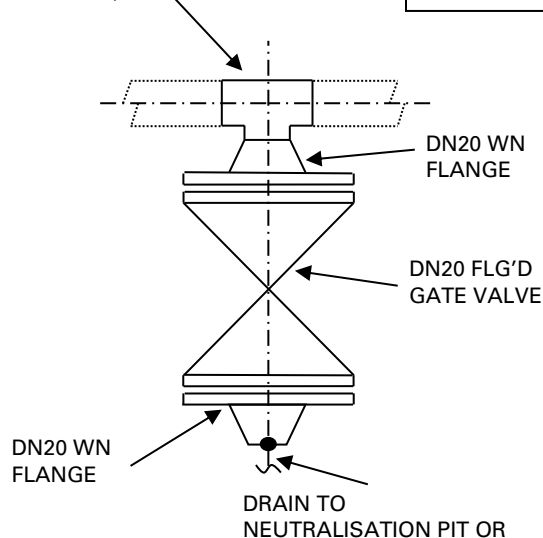
1. FOR RUN SIZE DN20 – DN40 ONLY.
2. FOR INSULATED LINES CHECK VALVE CLEARANCE AND ADD PIPE LENGTH TO SUIT.
3. FOR PTFE LINED PLUG VALVE, MINIMUM DRAIN ASSEMBLY SIZE IS DN25.

D26

NOTES:

1. FOR RUN SIZE DN50 – DN600 ONLY.
2. FOR INSULATED LINES CHECK VALVE CLEARANCE AND ADD PIPE LENGTH TO SUIT.
3. FOR PTFE LINED PLUG VALVE, MINIMUM DRAIN ASSEMBLY SIZE IS DN25.
4. FOR RUN SIZE DN650 – DN1200 USE DN25 DRAIN ASSEMBLY.

TEE OR RED. TEE,
(BUTT WELD)

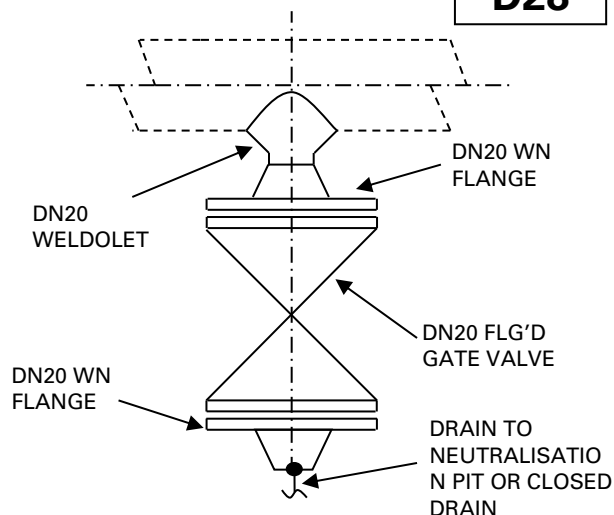
D27



NOTES:

1. FOR RUN SIZE DN20 – DN40 ONLY.
2. FOR INSULATED LINES CHECK VALVE CLEARANCE AND ADD PIPE LENGTH TO SUIT.

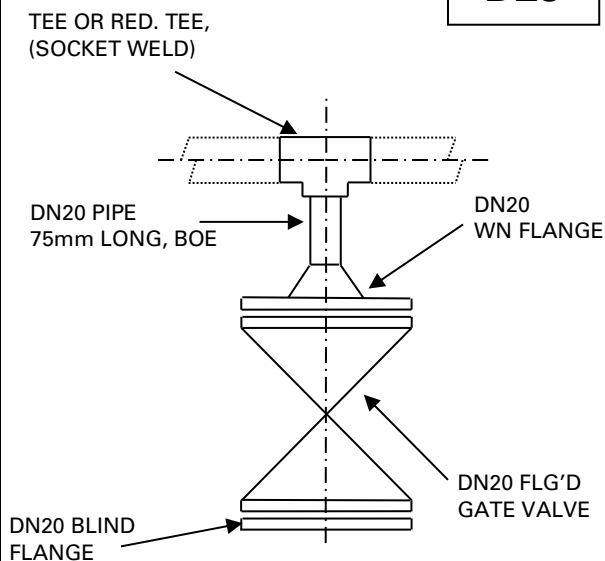
D28



NOTES:

1. FOR RUN SIZE DN50 – DN600 ONLY.
2. FOR INSULATED LINES CHECK VALVE CLEARANCE AND ADD PIPE LENGTH TO SUIT.
3. FOR RUN SIZE DN650 – DN1200 USE DN25 DRAIN ASSEMBLY.

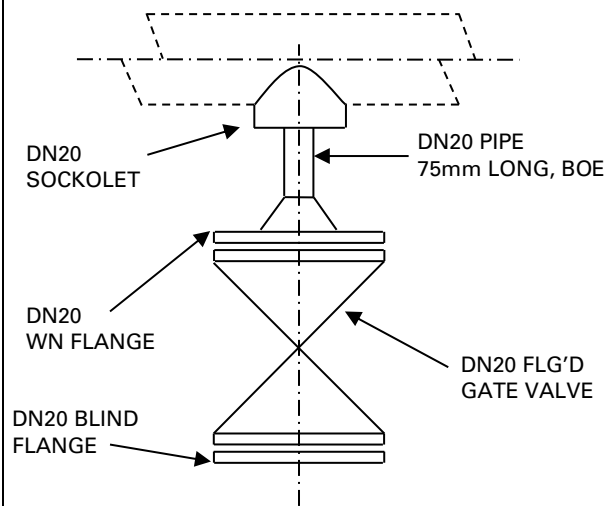
D29



NOTES:

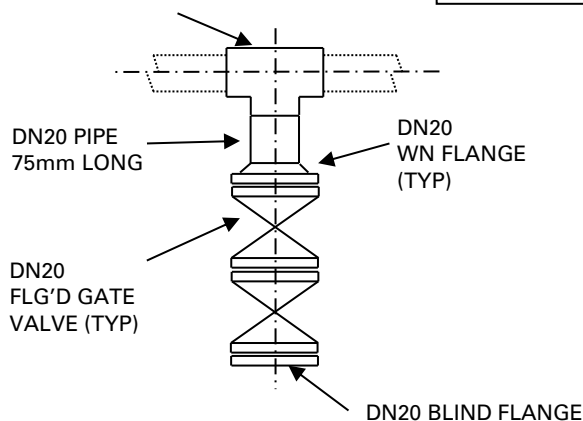
1. FOR RUN SIZE DN20 – DN40 ONLY.
2. FOR INSULATED LINES PIPE LENGTH MAY NEED TO BE INCREASED.

D30

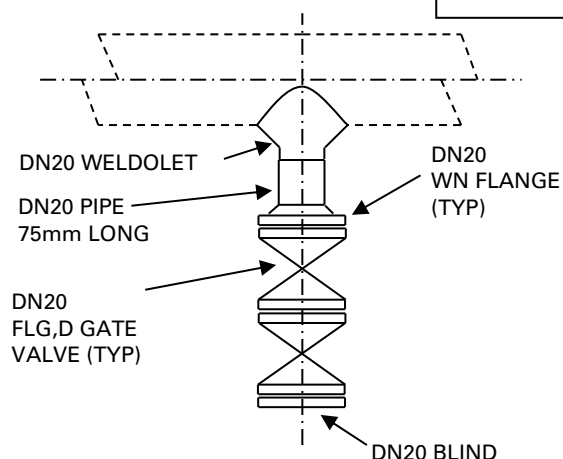


NOTES:

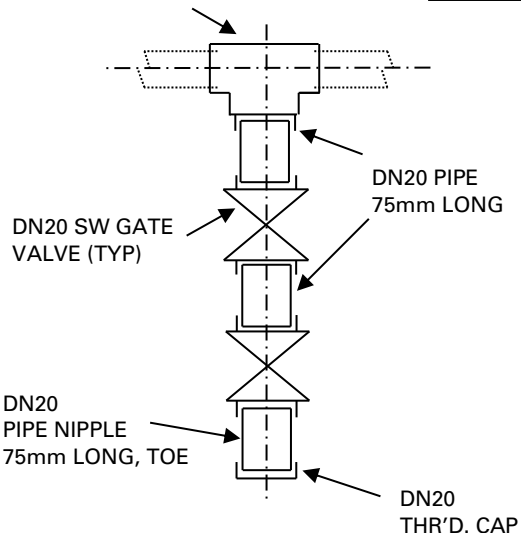
1. FOR RUN SIZE DN50 – DN600 ONLY.
2. FOR INSULATED LINES PIPE LENGTH MAY NEED TO BE INCREASED.
3. FOR RUN SIZES DN650 - DN1200 USE DN25 DRAIN ASSEMBLY.

TEE OR RED. TEE, BW
D31

NOTES:

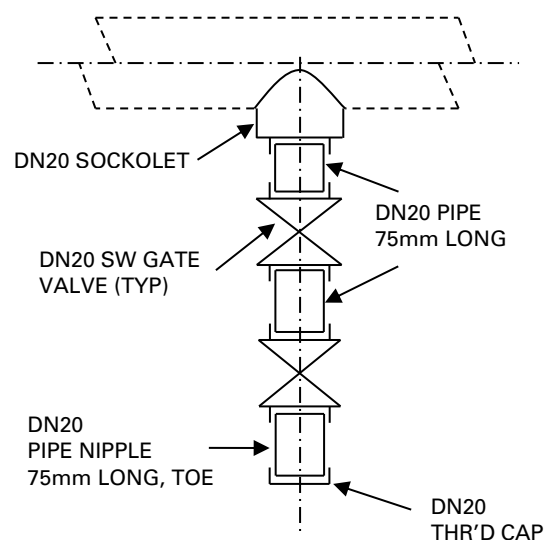
1. FOR RUN SIZE DN20 – DN40 ONLY.
2. FOR INSULATED LINES PIPE LENGTH MAY NEED TO BE INCREASED.

D32

NOTES:

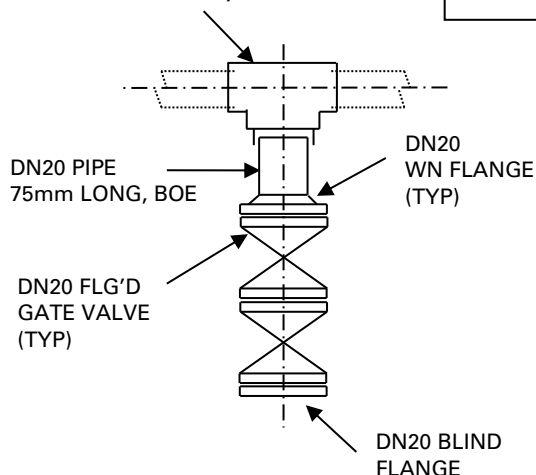
1. FOR RUN SIZE DN50 – DN600 ONLY.
2. FOR INSULATED LINES PIPE LENGTH MAY NEED TO BE INCREASED.
3. FOR RUN SIZE DN650 - DN1200 USE DN25 DRAIN ASSEMBLY.

TEE OR RED. TEE, SW
D33

NOTES:

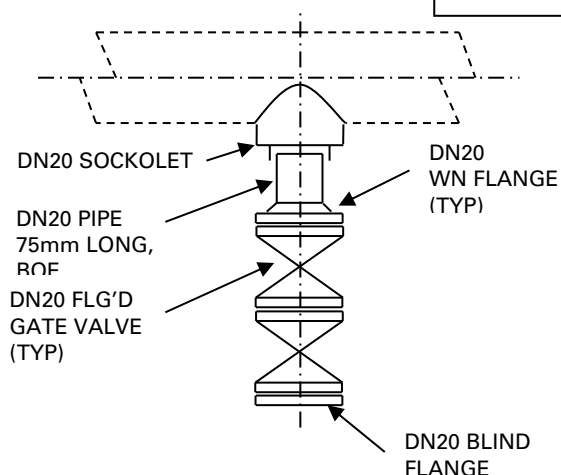
1. FOR RUN SIZE DN20 – DN40 ONLY.
2. FOR INSULATED LINES PIPE LENGTH MAY NEED TO BE INCREASED.

D34

NOTES:

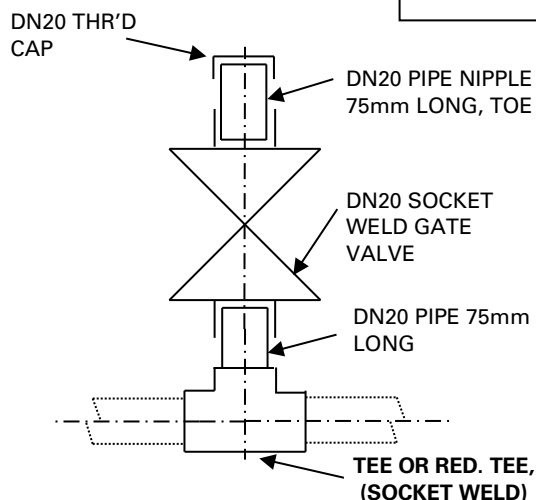
1. FOR RUN SIZE DN50 – DN600 ONLY.
2. FOR INSULATED LINES PIPE LENGTH MAY NEED TO BE INCREASED.
3. FOR RUN SIZE DN650 – DN1200 USE DN25 DRAIN ASSEMBLY.

TEE OR RED. TEE, SW
D35

NOTES:

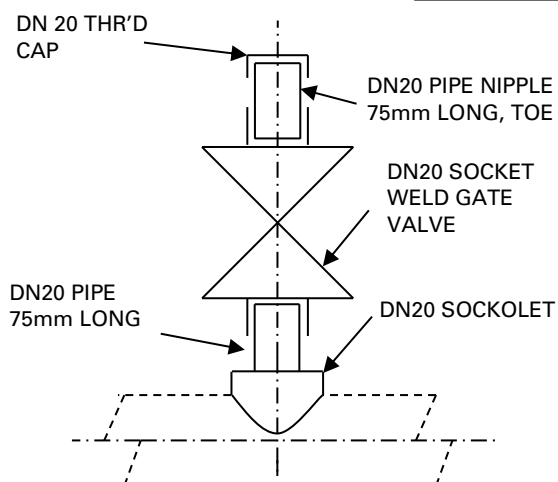
1. FOR RUN SIZE DN20 – DN40 ONLY.
2. FOR INSULATED LINES PIPE LENGTH MAY NEED TO BE INCREASED.

D36

NOTES:

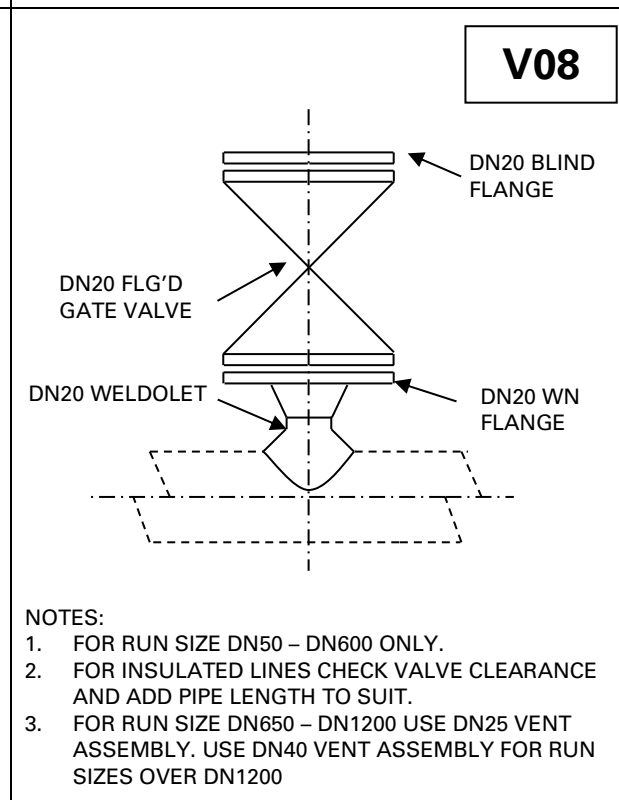
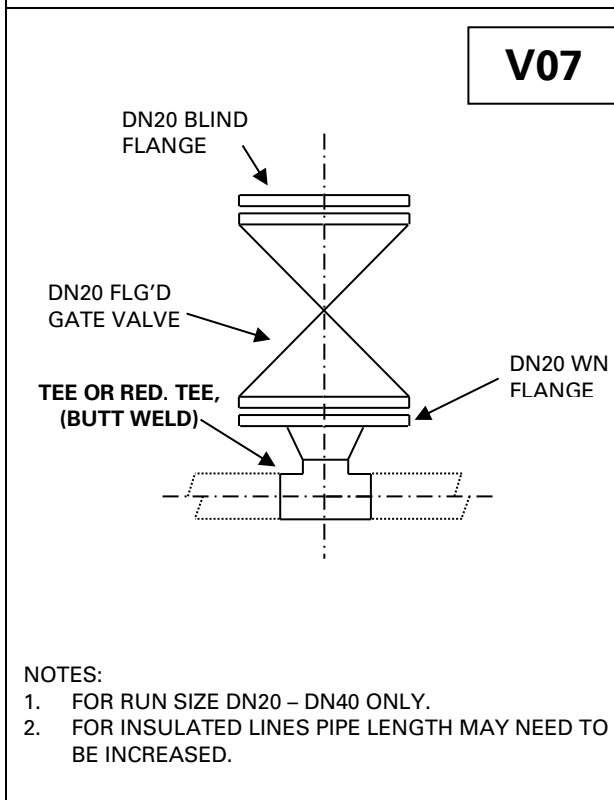
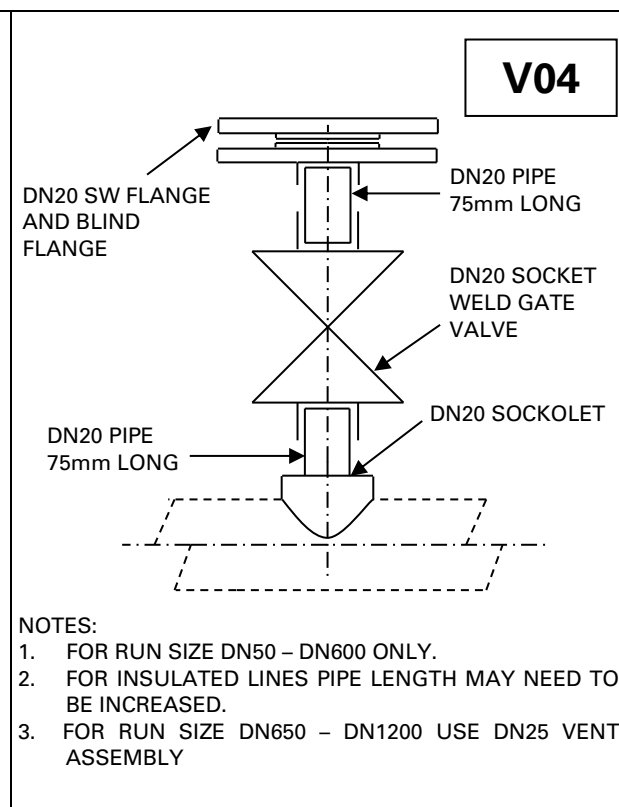
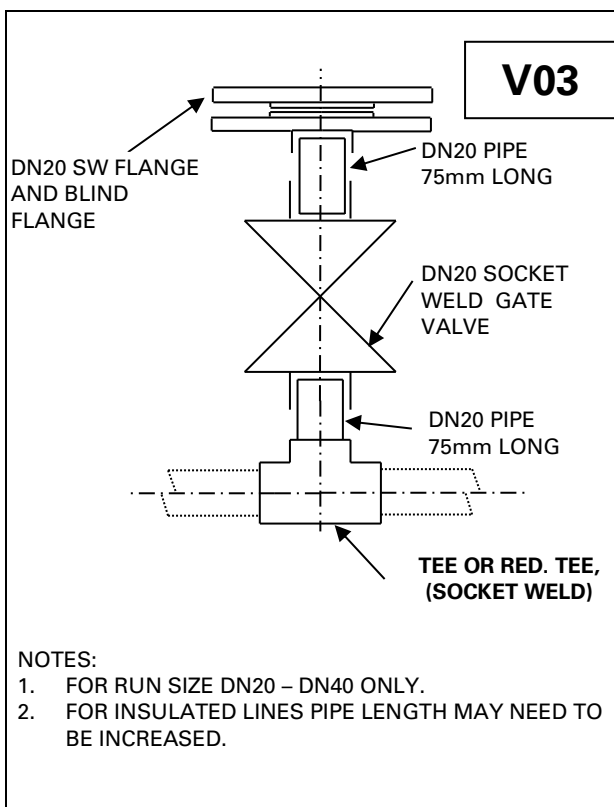
1. FOR RUN SIZE DN50 – DN600 ONLY.
2. FOR INSULATED LINES PIPE LENGTH MAY NEED TO BE INCREASED.
3. FOR RUN SIZE DN650 - DN1200 USE DN25 DRAIN ASSEMBLY.

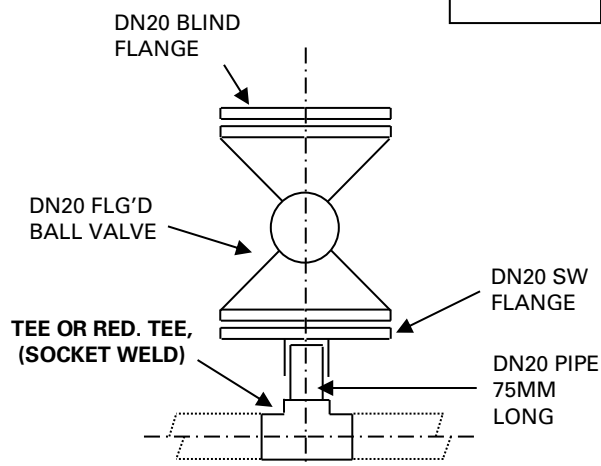
V01

NOTES:

1. FOR RUN SIZE DN20 – DN40 ONLY.
2. FOR INSULATED LINES PIPE LENGTH MAY NEED TO BE INCREASED.

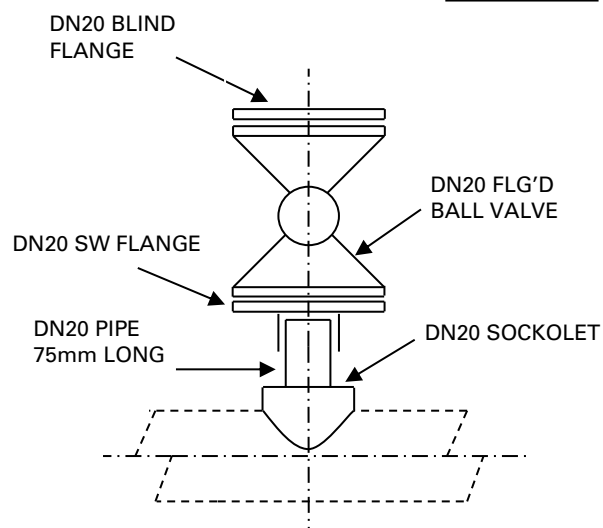
V02

NOTES:

1. FOR RUN SIZE DN50 – DN600 ONLY.
2. FOR INSULATED LINES PIPE LENGTH MAY NEED TO BE INCREASED.
3. FOR RUN SIZE DN650 – DN1200 USE DN25 VENT ASSEMBLY. USE DN40 VENT ASSEMBLY FOR RUN SIZE ABOVE DN1200

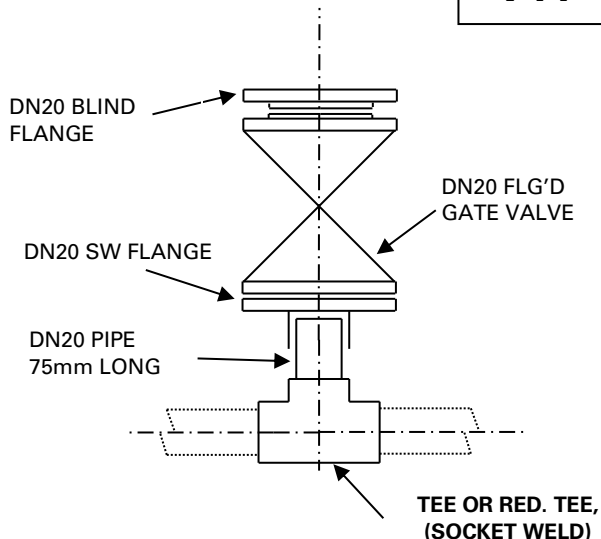


V09

NOTES:

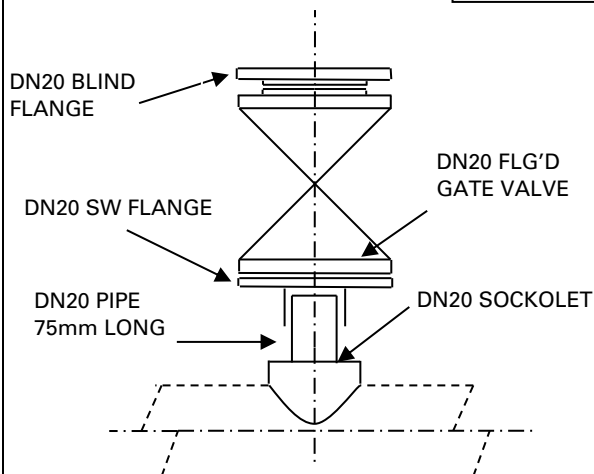
1. FOR RUN SIZE DN20 – DN40 ONLY.
2. FOR INSULATED LINES PIPE LENGTH MAY NEED TO BE INCREASED.

V10

NOTES:

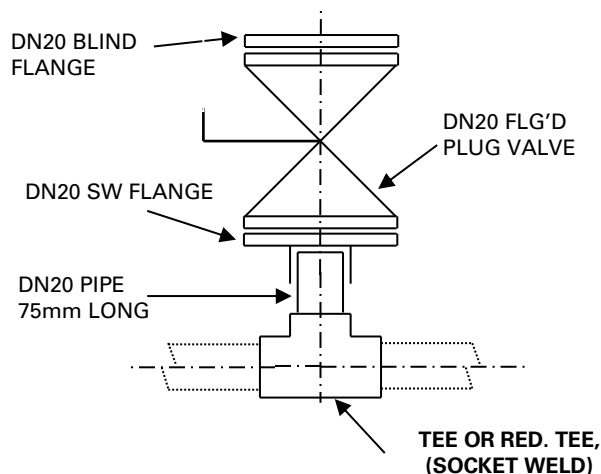
1. FOR RUN SIZE DN50 – DN600 ONLY.
2. FOR INSULATED LINES PIPE LENGTH MAY NEED TO BE INCREASED.
3. FOR RUN SIZE DN650 – DN1200 USE DN25 VENT ASSEMBLY

V11

NOTES:

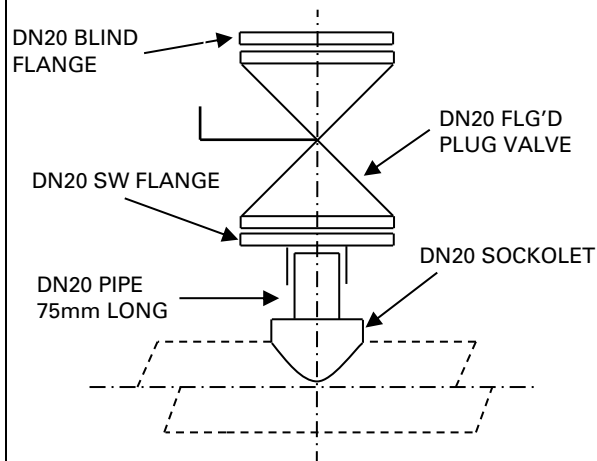
1. FOR RUN SIZE DN20 – DN40 ONLY.
2. FOR INSULATED LINES PIPE LENGTH MAY NEED TO BE INCREASED.

V12


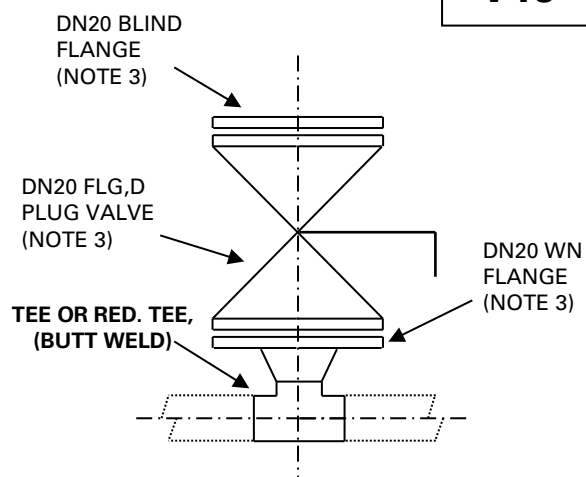
1. FOR RUN SIZE DN50 – DN600 ONLY.
2. FOR INSULATED LINES PIPE LENGTH MAY NEED TO BE INCREASED.
3. FOR SIZES DN650 – DN1200 USE DN25 VENT ASSEMBLY. USE DN40 VENT ASSEMBLY FOR RUN SIZES ABOVE DN1200.

V13

NOTES:

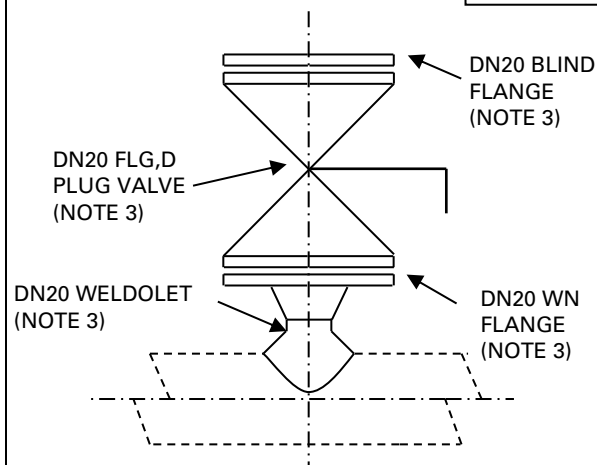
1. FOR RUN SIZE DN20 – DN40 ONLY.
2. FOR INSULATED LINES PIPE LENGTH MAY NEED TO BE INCREASED.

V14

NOTES:

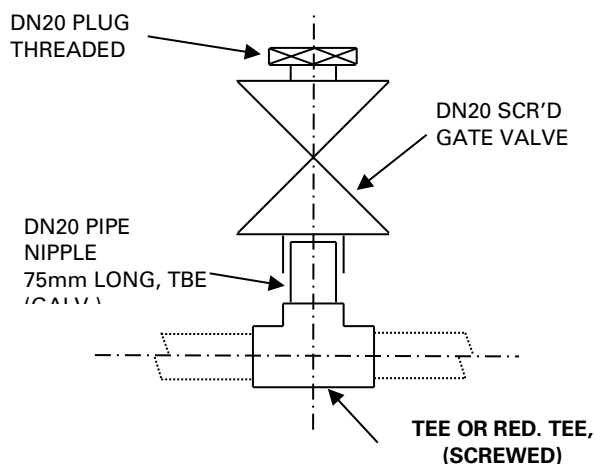
1. FOR RUN SIZE DN50 – DN600 ONLY.
2. FOR INSULATED LINES PIPE LENGTH MAY NEED TO BE INCREASED.
3. FOR RUN SIZE DN650 – DN1200 USE DN25 VENT ASSEMBLY.

V15

NOTES:

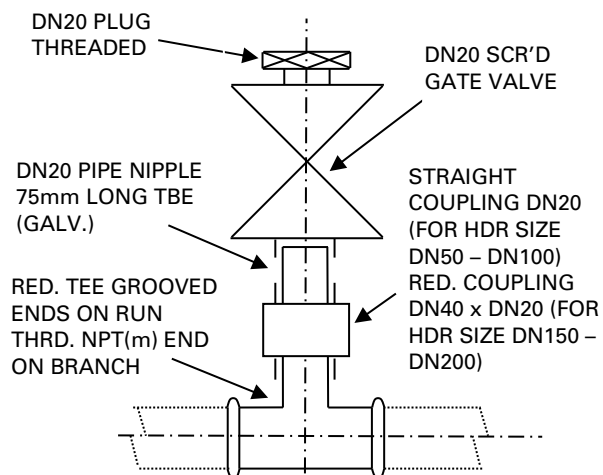
1. FOR RUN SIZE DN20 – DN40 ONLY.
2. FOR INSULATED LINES PIPE LENGTH MAY NEED TO BE INCREASED.
3. FOR PTFE LINED PLUG VALVE, MINIMUM VENT ASSEMBLY SIZE IS DN25

V16

NOTES:

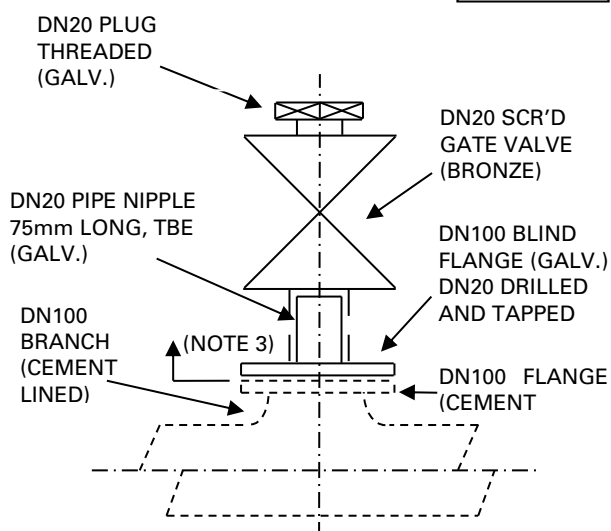
1. FOR RUN SIZE DN50 – DN600 ONLY.
2. FOR INSULATED LINES CHECK VALVE CLEARANCE AND ADD PIPE LENGTH TO SUIT.
3. FOR PTFE LINED PLUG VALVE, MINIMUM VENT ASSEMBLY SIZE IS DN25.
4. FOR RUN SIZE DN650 – DN1200 USE DN25 VENT ASSEMBLY.

V17

NOTES:

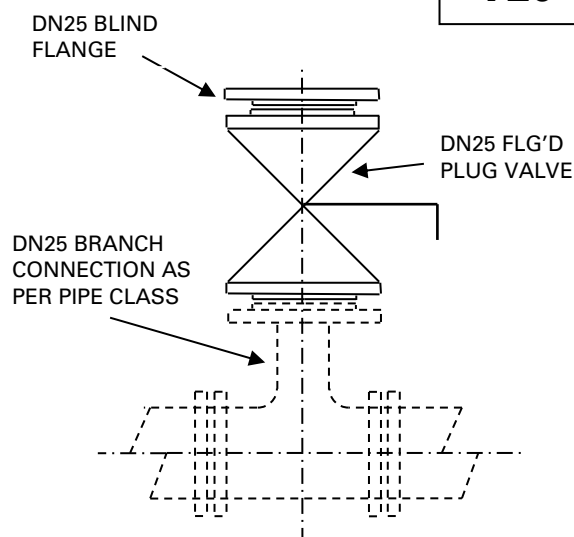
1. FOR RUN SIZE DN20 – DN40 ONLY.
2. PIPE NIPPLE LENGTH MAY NEED TO BE INCREASED IF NECESSARY.

V18

NOTES:

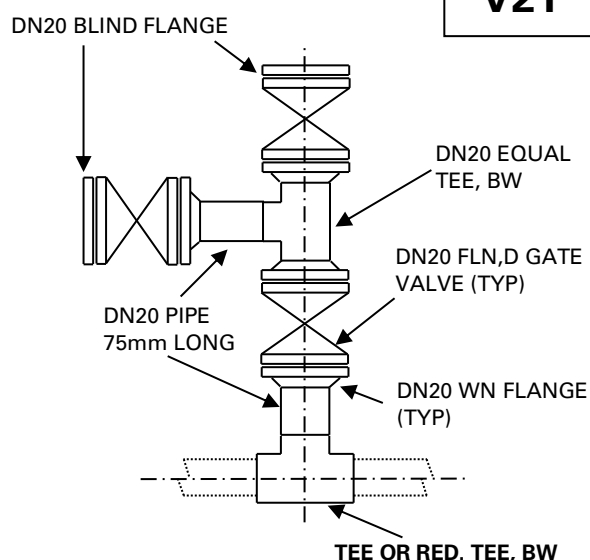
1. FOR RUN SIZE DN50 – DN200 ONLY.

V19

NOTES:

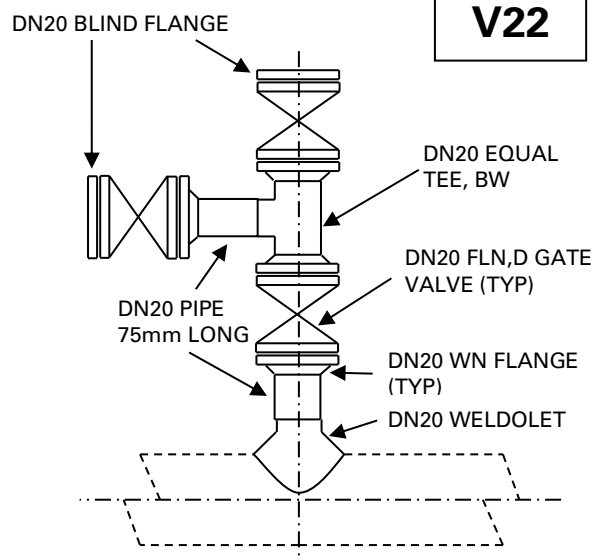
1. FOR RUN SIZE DN50 – DN600 ONLY.
2. FOR RUN SIZE DN650 – DN1200 USE DN25 VENT ASSEMBLY. USE DN40 VENT ASSEMBLY FOR RUN SIZES OVER DN1200.
3. USE PIPING ITEMS AS PER PIPE CLASS S1RW

V20

NOTES:

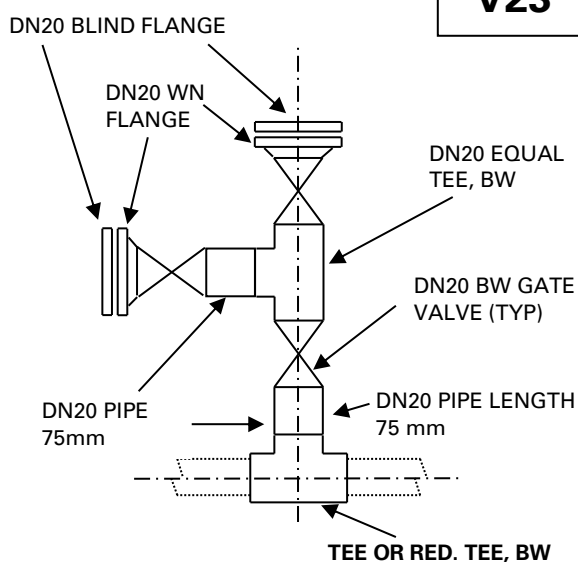
1. FOR RUN SIZE DN25 & ABOVE.
2. FOR INSULATED LINES FLANGED SPOOLS OR SPACERS MAY BE ADDED IF REQUIRED.

V21

NOTES:

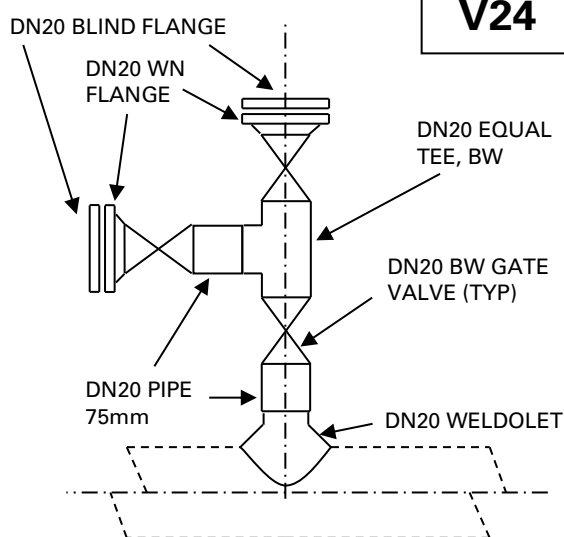
1. FOR RUN SIZE DN20 – DN40 ONLY.
2. FOR INSULATED LINES PIPE LENGTH MAY NEED TO BE INCREASED.

V22

NOTES:

1. FOR RUN SIZE DN50 – DN600 ONLY.
2. FOR INSULATED LINES PIPE LENGTH MAY NEED TO BE INCREASED.
3. FOR RUN SIZE DN650 – DN1200 USE DN25 VENT ASSEMBLY

V23

NOTES:

1. FOR RUN SIZE DN20 – DN40 ONLY.
2. FOR INSULATED LINES PIPE LENGTH MAY NEED TO BE INCREASED.

V24

NOTES:

1. FOR RUN SIZE DN50 – DN600 ONLY.
2. FOR INSULATED LINES CHECK VALVE CLEARANCE AND ADD PIPE LENGTH TO SUIT.
3. FOR RUN SIZE DN650 – DN1200 USE DN25 VENT ASSEMBLY

DN20 BLIND
FLANGE

DN20 FLG'D
GATE VALVE

DN20 PIPE
75MM LONG, BOE

V25

DN20 WN
FLANGE

TEE OR RED. TEE,
(SOCKET WELD)

NOTES:

1. FOR RUN SIZE DN20 – DN40 ONLY.
2. FOR INSULATED LINES PIPE LENGTH MAY NEED TO BE INCREASED.

DN20 BLIND
FLANGE

DN20 FLG'D
GATE VALVE

DN20 WN
FLANGE

V26

DN20 PIPE
75MM LONG, BOE

DN20 SOCKOLET

NOTES:

1. FOR RUN SIZE DN50 – DN600 ONLY.
2. FOR INSULATED LINES PIPE LENGTH MAY NEED TO BE INCREASED.
3. FOR RUN SIZE DN650 – DN1200 USE DN25 VENT ASSEMBLY.

V27

DN20 BLIND FLANGE

DN20 PIPE
75mm LONG

DN20 FLG'D GATE
VALVE (TYP)

DN20 WN FLANGE
(TYP)

TEE OR RED. TEE, BW

NOTES:

1. FOR RUN SIZE DN20 – DN40 ONLY.
2. FOR INSULATED LINES PIPE NIPPLE LENGTH MAY NEED TO BE INCREASED.

V28

DN20 BLIND FLANGE

DN20 PIPE
75mm LONG

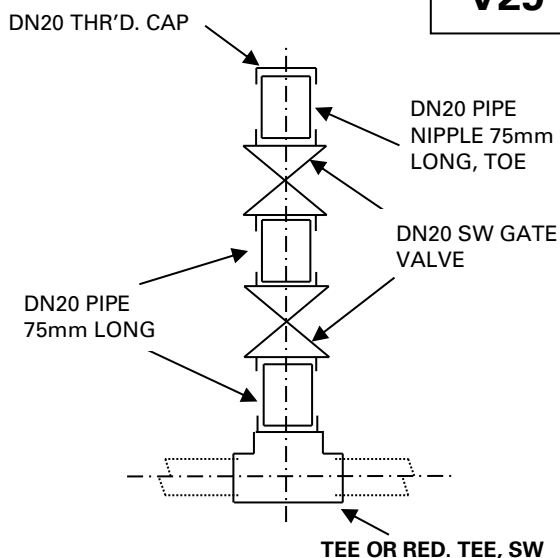
DN20 FLG'D GATE
VALVE (TYP)

DN20 WELDOLET

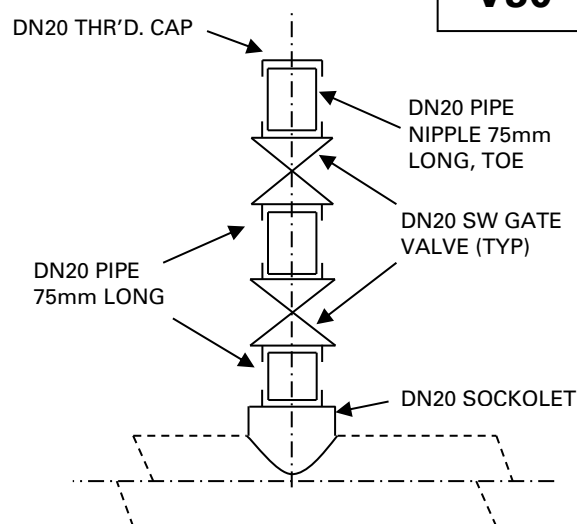
DN20 WN
FLANGE (TYP)

NOTES:

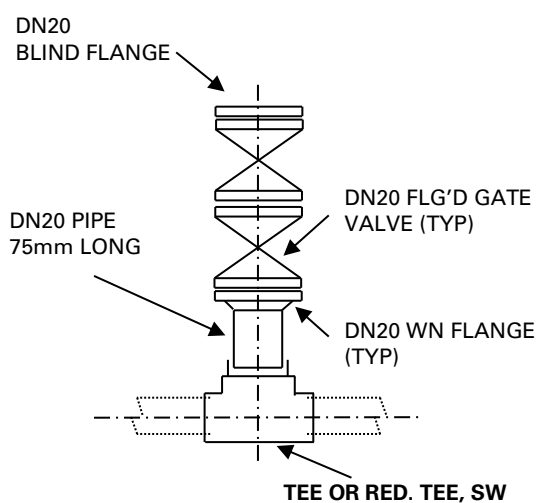
1. FOR RUN SIZE DN50 – DN600 ONLY.
2. FOR INSULATED LINES PIPE NIPPLE LENGTH MAY NEED TO BE INCREASED.
3. FOR RUN SIZE DN650 – DN1200 USE DN25 VENT ASSEMBLY

V29

NOTES:

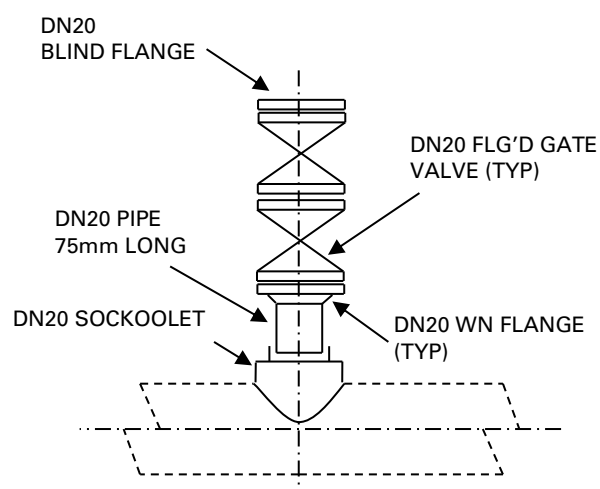
1. FOR RUN SIZE DN20 – DN40 ONLY.
2. FOR INSULATED LINES PIPE LENGTH MAY NEED TO BE INCREASED.

V30

NOTES:

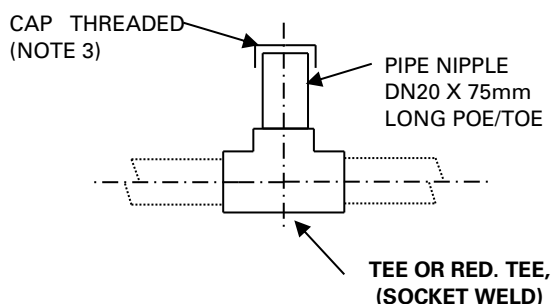
1. FOR RUN SIZE DN50 – DN600 ONLY.
2. FOR INSULATED LINES PIPE LENGTH MAY NEED TO BE INCREASED.
3. FOR RUN SIZE DN650 – DN1200 USE DN25 VENT ASSEMBLY

V31

NOTES:

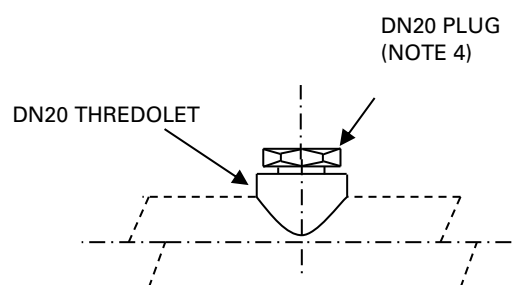
1. FOR RUN SIZE DN20 – DN40 ONLY.
2. FOR INSULATED LINES PIPE LENGTH MAY NEED TO BE INCREASED.

V32

NOTES:

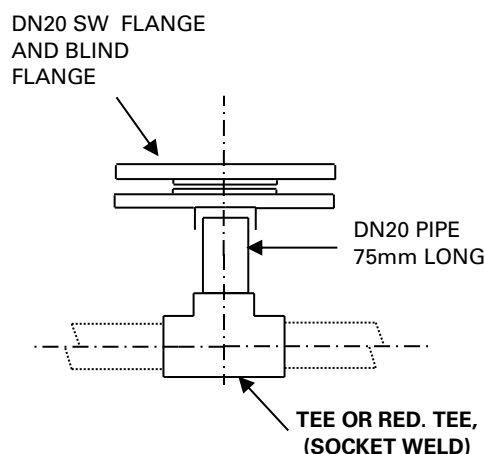
1. FOR RUN SIZE DN50 – DN600 ONLY.
2. FOR INSULATED LINES PIPE LENGTH MAY NEED TO BE INCREASED.
3. FOR RUN SIZE DN650 – DN1200 USE DN25 VENT ASSEMBLY

H01

NOTES:

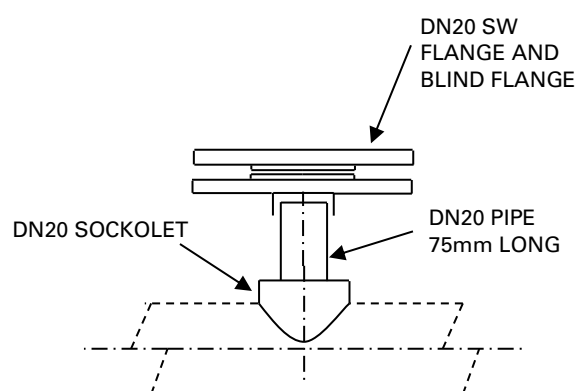
1. FOR RUN SIZE DN20 – DN40 ONLY.
2. FOR INSULATED LINES PIPE NIPPLE LENGTH MAY NEED TO BE INCREASED.
3. USE PTFE JOINTING TAPE OR APPROVED JOINTING COMPOUND.

H02

NOTES:



1. FOR RUN SIZE DN50 – DN600 ONLY.
2. FOR INSULATED LINES USE PIPE NIPPLE AND CAP
3. FOR RUN SIZE OVER DN600 USE DN25 VENT ASSEMBLY.
4. USE PTFE JOINTING TAPE OR APPROVED JOINTING COMPOUND.

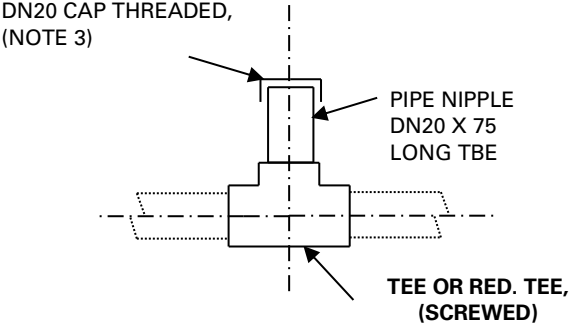
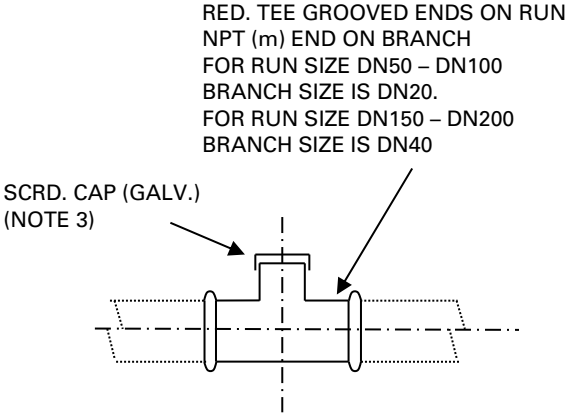
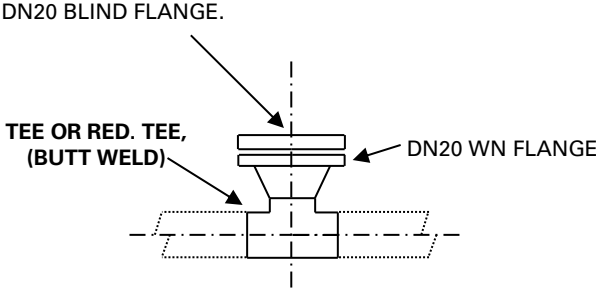
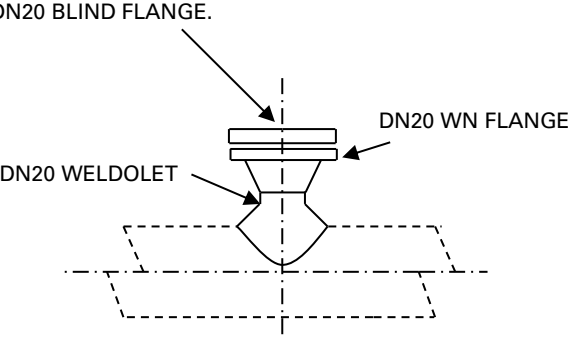
H03

NOTES:

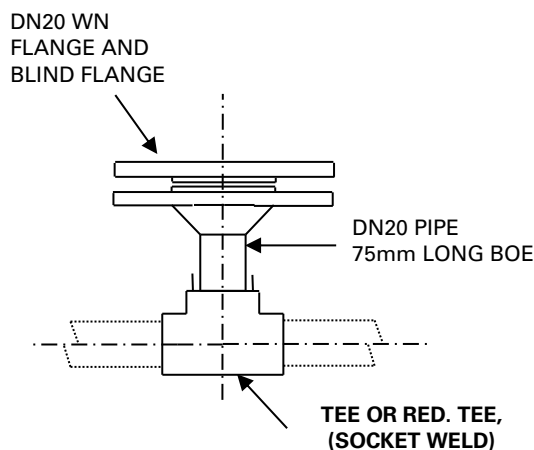
1. FOR RUN SIZE DN20 – DN40 ONLY.
2. FOR INSULATED LINES PIPE LENGTH MAY NEED TO BE INCREASED.

H04

NOTES:

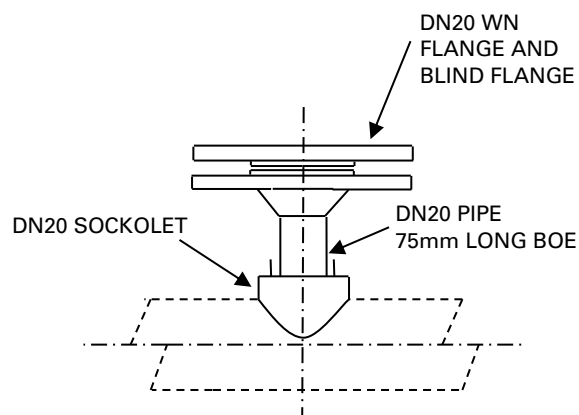
1. FOR RUN SIZE DN50 – DN600 ONLY.
2. FOR INSULATED LINES PIPE LENGTH MAY NEED TO BE INCREASED.
3. FOR RUN SIZE OVER DN600 USE DN25 VENT ASSEMBLY.

 TechnipFMC		PROJECT	Standby SRU & Additional Tanks IOCL Paradip Refinery	
		CLIENT	INDIAN OIL CORPORATION LIMITED	
PIPING STANDARDS – HOOKUP ASSEMBLY DRAWINGS	Project No. 080557C001	Document No. 080557C-088-STD-1380-001	Rev. No. A	Page 24 of 52

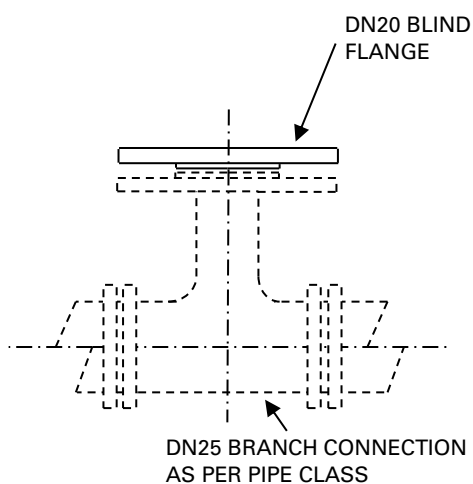
<div style="text-align: right; border: 1px solid black; padding: 5px; width: fit-content; margin: 0 auto;">H05</div> <div style="text-align: center; margin-top: 20px;">  </div> <p>NOTES:</p> <ol style="list-style-type: none"> FOR RUN SIZE DN20 – DN40 ONLY. FOR INSULATED LINES PIPE NIPPLE LENGTH MAY NEED TO BE INCREASED. USE PTFE JOINTING TAPE OR APPROVED JOINTING COMPOUND. 	<div style="text-align: right; border: 1px solid black; padding: 5px; width: fit-content; margin: 0 auto;">H06</div> <div style="text-align: center; margin-top: 20px;">  </div> <p>NOTES:</p> <ol style="list-style-type: none"> FOR RUN SIZE DN50 – DN200 ONLY. FOR INSULATED LINES USE PIPE NIPPLE AND CAP USE PTFE JOINTING TAPE OR APPROVED JOINTING COMPOUND.
<div style="text-align: right; border: 1px solid black; padding: 5px; width: fit-content; margin: 0 auto;">H07</div> <div style="text-align: center; margin-top: 20px;">  </div> <p>NOTES:</p> <ol style="list-style-type: none"> FOR RUN SIZE DN20 – DN40 ONLY. FOR INSULATED LINES USE SUITABLE PIPE LENGTH BETWEEN TEE AND FLANGE 	<div style="text-align: right; border: 1px solid black; padding: 5px; width: fit-content; margin: 0 auto;">H08</div> <div style="text-align: center; margin-top: 20px;">  </div> <p>NOTES:</p> <ol style="list-style-type: none"> FOR RUN SIZE DN50 – DN600 ONLY. FOR INSULATED LINES USE SUITABLE PIPE LENGTH BETWEEN WELDOLET AND FLANGE FOR RUN SIZE OVER DN600 USE DN25 VENT ASSEMBLY.

H09

NOTES:

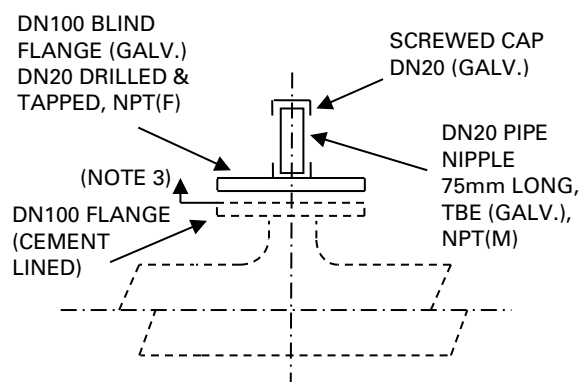
1. FOR RUN SIZE DN20 – DN40 ONLY.
2. FOR INSULATED LINES PIPE LENGTH MAY NEED TO BE INCREASED.

H10

NOTES:

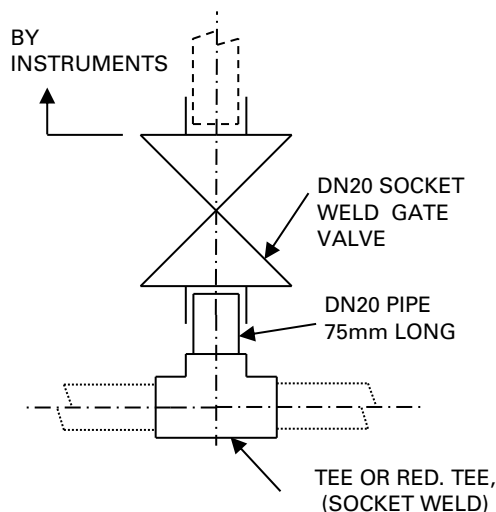
1. FOR RUN SIZE DN50 – DN600 ONLY.
2. FOR INSULATED LINES PIPE LENGTH MAY NEED TO BE INCREASED.
3. FOR RUN SIZE OVER DN600 USE DN25 VENT ASSEMBLY

H11

NOTES:

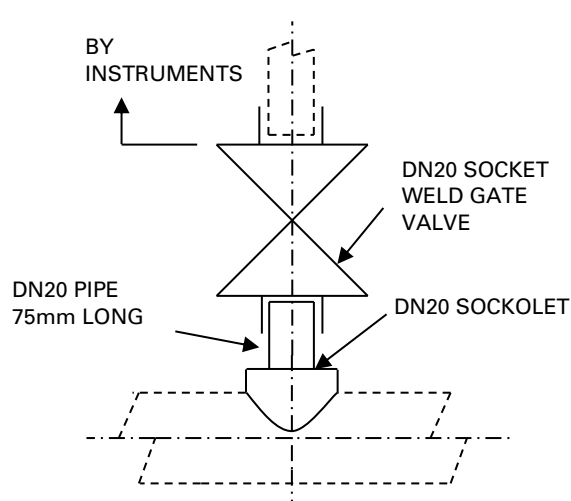
1. FOR RUN SIZE DN25 & ABOVE

H12

NOTES:

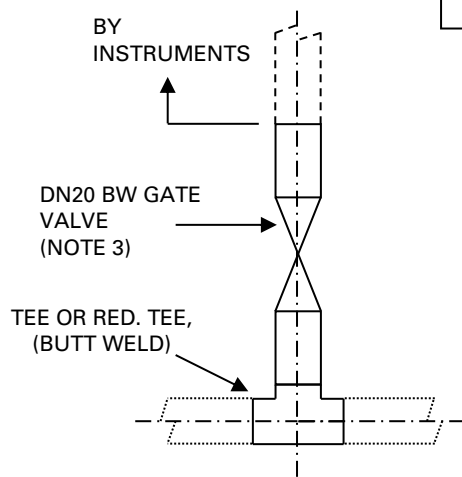
1. FOR RUN SIZE DN100 – DN600 ONLY.
2. FOR RUN SIZE OVER DN600 USE DN25 VENT ASSEMBLY.
3. USE PIPING ITEMS AS PER PIPE CLASS S1RW.

P01

NOTES:

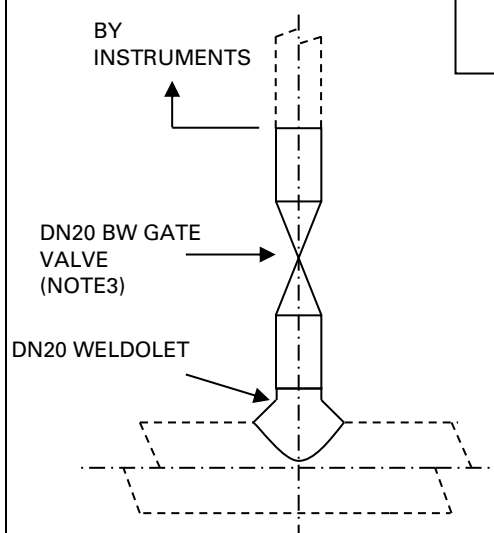
1. FOR RUN SIZE DN20 – DN40 ONLY.
2. FOR INSULATED LINES PIPE LENGTH MAY NEED TO BE INCREASED.

P02

NOTES:

1. FOR RUN SIZE DN50 AND ABOVE.
2. FOR INSULATED LINES PIPE LENGTH MAY NEED TO BE INCREASED.

P03

NOTES:

1. FOR RUN SIZE DN20 – DN40 ONLY.
2. FOR INSULATED LINES PIPE MAY BE ADDED IF NECESSARY ON THE BRANCH OUTLET.
3. GATE VALVES ARE SUPPLIED WITH 150mm PUP PIECES ON BOTH SIDES OF THE VALVE.

P04

NOTES:

1. FOR RUN SIZE DN50 AND ABOVE.
2. FOR INSULATED LINES PIPE MAY BE ADDED IF NECESSARY ON THE BRANCH OUTLET.
3. GATE VALVES ARE SUPPLIED WITH 150mm PUP PIECES ON BOTH SIDES OF THE VALVE.

DN20 COUNTER FLANGE
(BY INSTRUMENTS)

P05

DN20 FLG'D
BALL VALVE

DN20 SW
FLANGE

TEE OR RED. TEE,
(SOCKET WELD)

DN20 PIPE
75mm LONG

NOTES:

1. FOR RUN SIZE DN20 – DN40 ONLY.
2. FOR INSULATED LINES PIPE LENGTH MAY NEED TO BE INCREASED.
3. BOLTS & GASKETS BY PIPING

DN20 COUNTER FLANGE
(BY INSTRUMENTS)

P06

DN20 FLG'D
BALL VALVE

DN20 SW FLANGE

PIPE LENGTH
DN20 X 75mm
LONG

DN20 SOCKOLET

NOTES:

1. FOR RUN SIZE DN50 AND ABOVE.
2. FOR INSULATED LINES PIPE LENGTH MAY NEED TO BE INCREASED.
3. BOLTS & GASKETS BY PIPING

BY
INSTRUMENTS

P07

DN20 SW GATE
VALVE
(NOTE 3)

TEE OR RED. TEE,
(SOCKET WELD)

NOTES:

1. FOR RUN SIZE DN20 – DN40 ONLY.
2. FOR INSULATED LINES PIPE MAY BE ADDED IF NECESSARY.
3. GATE VALVES ARE SUPPLIED WITH 150mm PUP PIECES ON BOTH SIDES OF THE VALVE.

BY
INSTRUMENTS

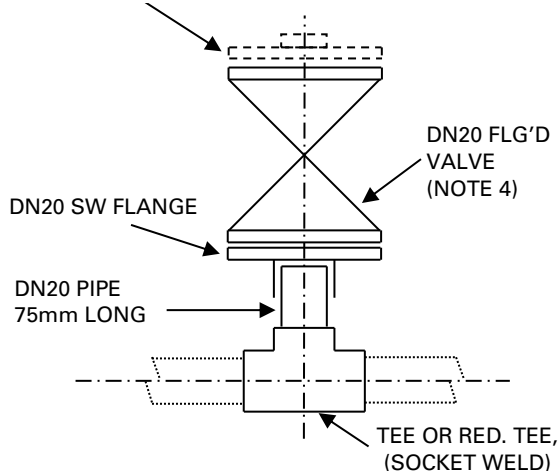
DN20 SW
GATE VALVE
(NOTE 3)

DN20 SOCKOLET

NOTES:

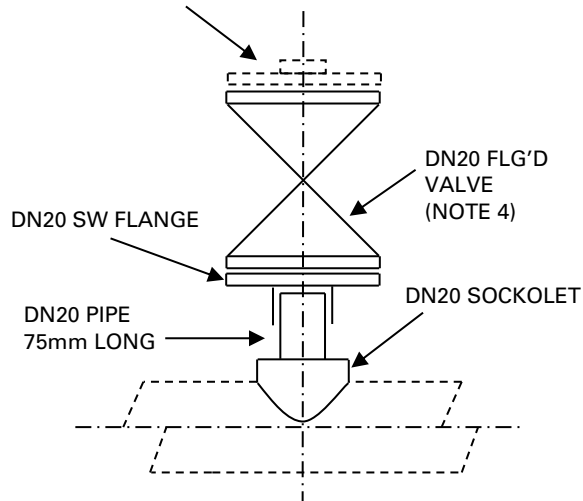
1. FOR RUN SIZE DN50 AND ABOVE.
2. FOR INSULATED LINES PIPE MAY BE ADDED IF NECESSARY.
3. GATE VALVES ARE SUPPLIED WITH 150mm PUP PIECES ON BOTH SIDES OF THE VALVE.

P09

DN20 COUNTER FLANGE
(BY INSTRUMENTS)

NOTES:

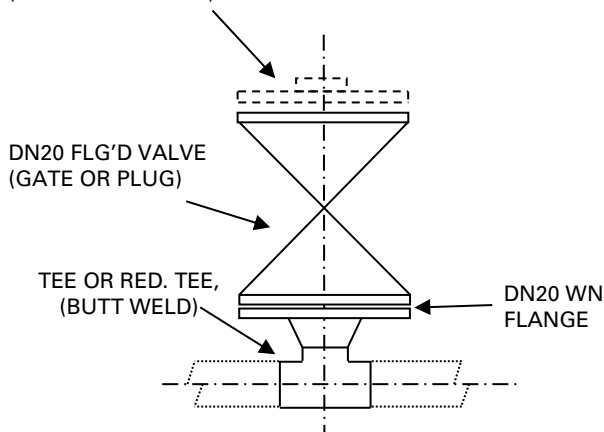
1. FOR RUN SIZE DN20 – DN40 ONLY.
2. FOR INSULATED LINES PIPE LENGTH MAY BE ADDED TO SUIT.
3. BOLTS & GASKETS BY PIPING.
4. GATE / PLUG VALVE AS PER PIPE CLASS.

P10

DN20 COUNTER FLANGE
(BY INSTRUMENTS)

NOTES:

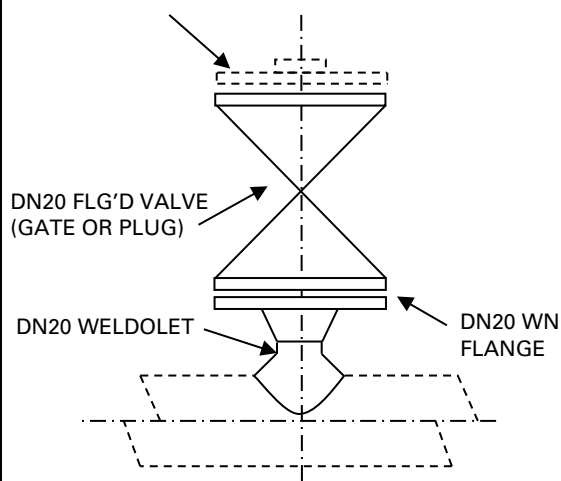
1. FOR RUN SIZE DN50 AND ABOVE.
2. FOR INSULATED LINES PIPE LENGTH MAY BE ADDED TO SUIT.
3. BOLTS & GASKETS BY PIPING.
4. GATE / PLUG VALVE AS PER PIPE CLASS.

P11

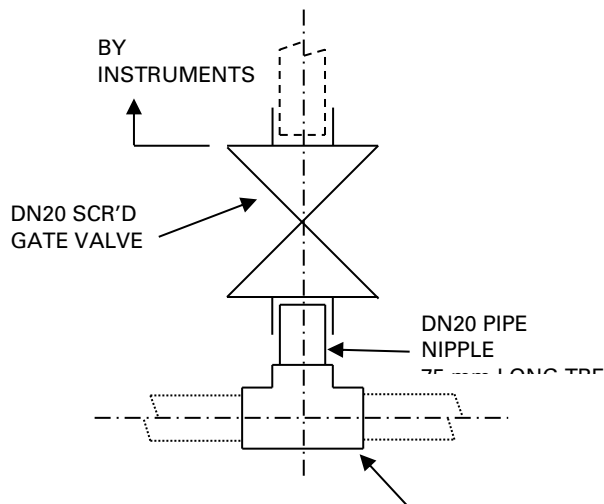
DN20 COUNTER FLANGE
(BY INSTRUMENTS)

NOTES:

1. FOR RUN SIZE DN20 – DN40 ONLY.
2. FOR INSULATED LINES CHECK VALVE CLEARANCE AND ADD PIPE LENGTH TO SUIT.
3. BOLTS & GASKETS BY PIPING.

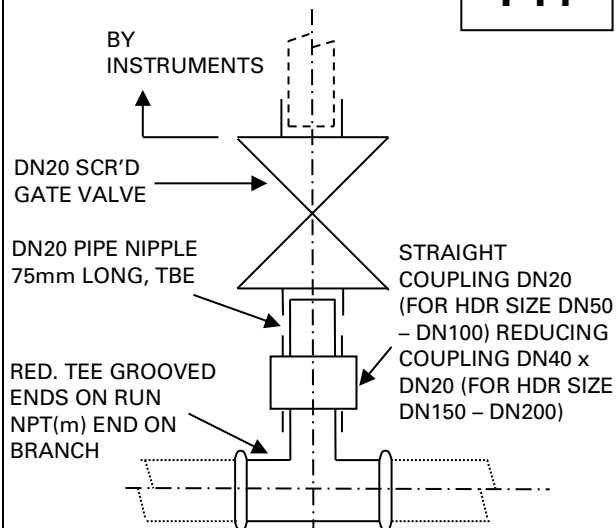
P12

DN20 COUNTER FLANGE
(BY INSTRUMENTS)

NOTES:

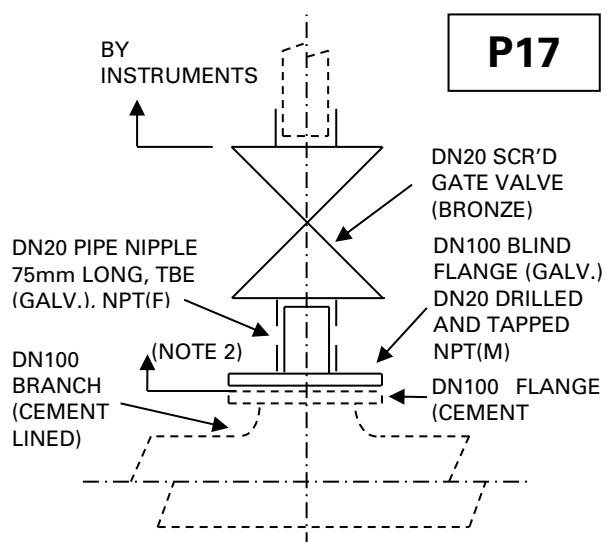
1. FOR RUN SIZE DN50 AND ABOVE.
2. FOR INSULATED LINES CHECK VALVE CLEARANCE AND ADD PIPE LENGTH TO SUIT.
3. BOLTS & GASKETS BY PIPING.

P13

NOTES:

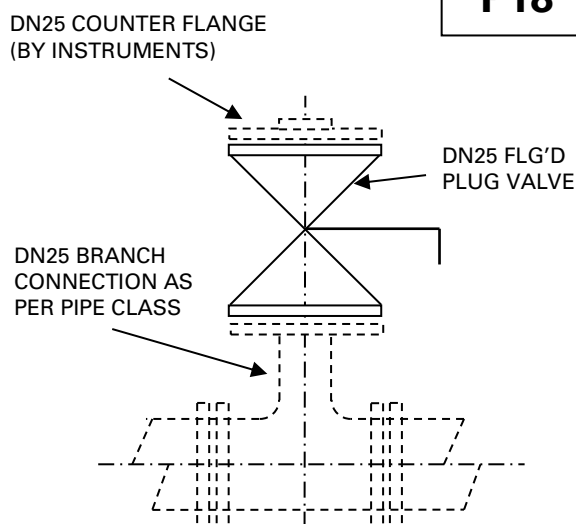
1. FOR RUN SIZE DN20 – DN40 ONLY.
2. PIPE NIPPLE LENGTH MAY NEED TO BE INCREASED
3. BOLTS & GASKETS BY PIPING

P14

NOTES:

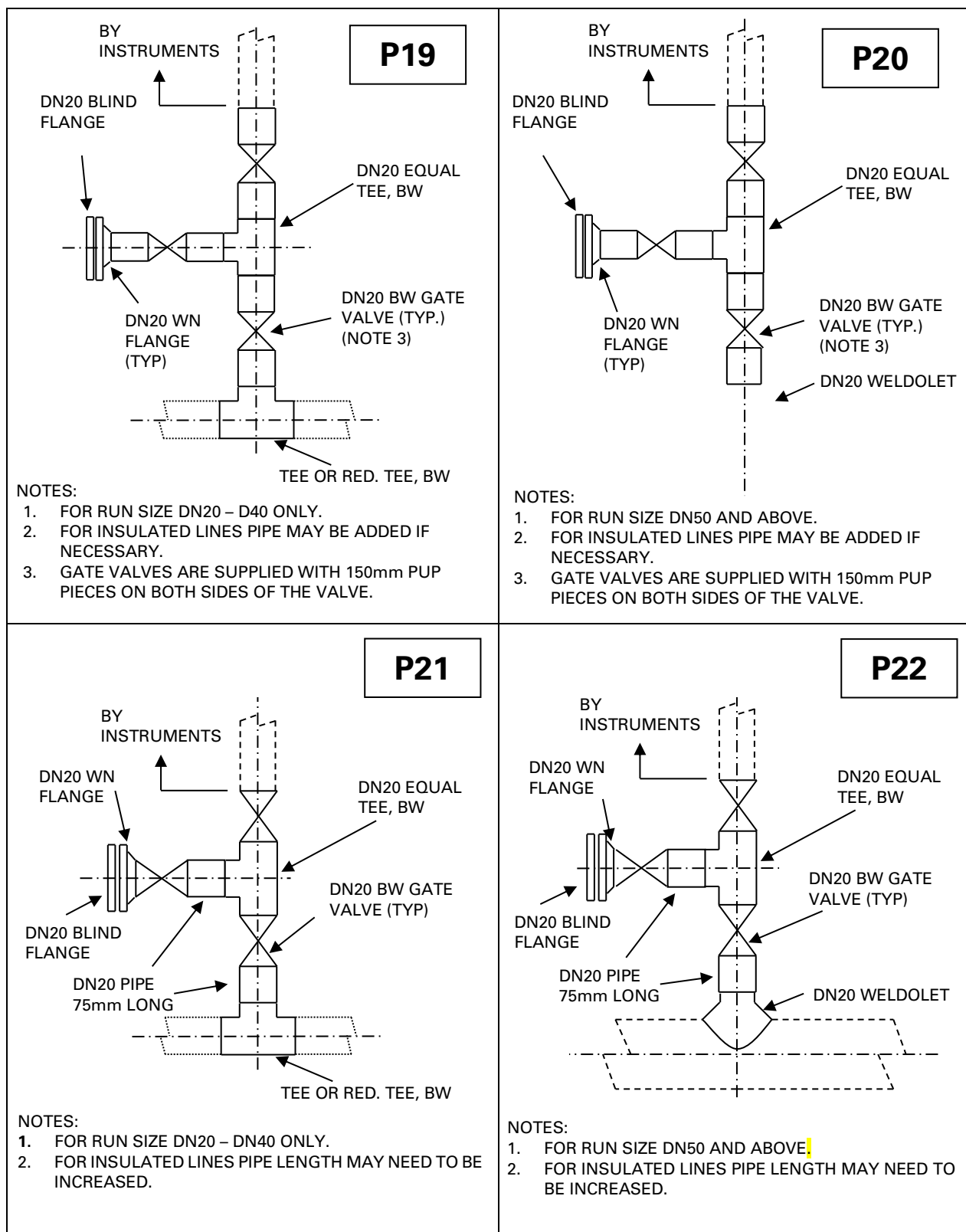
1. FOR RUN SIZE DN50 – DN200.

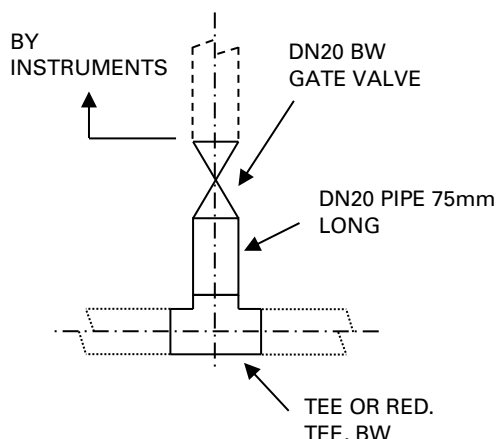
P17

NOTES:

1. FOR RUN SIZE DN100 & ABOVE.
2. USE PIPING ITEMS AS PER PIPE CLASS S1RW

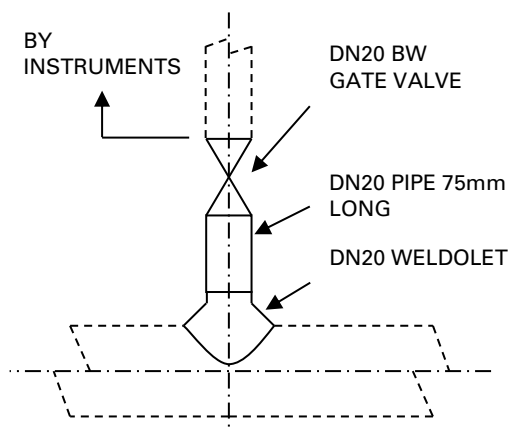
P18

NOTES:

1. FOR RUN SIZE DN25 & ABOVE.
2. FOR INSULATED LINES FLANGED SPOOLS OR SPACERS MAY BE ADDED IF REQUIRED.
3. BOLTS & GASKETS BY PIPING.

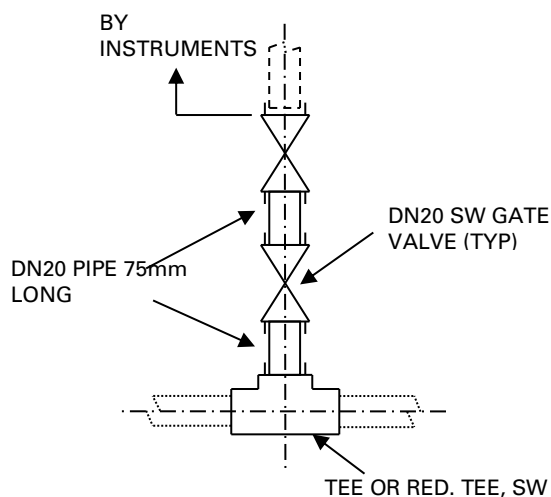


P25

NOTES:

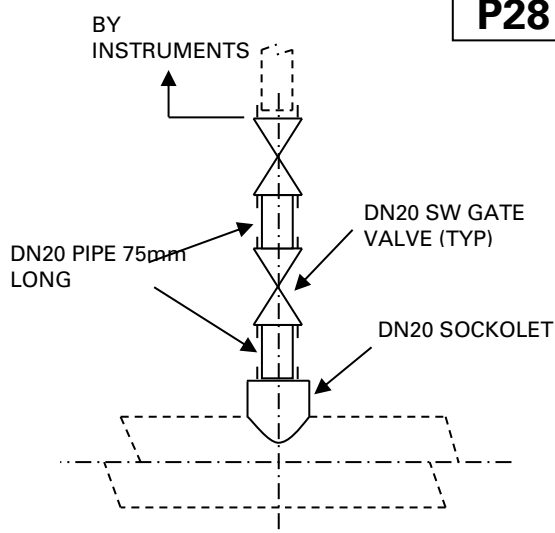
1. FOR RUN SIZE DN20 – DN40 ONLY
2. FOR INSULATED LINES PIPE LENGTH MAY NEED TO BE INCREASED.

P26

NOTES:

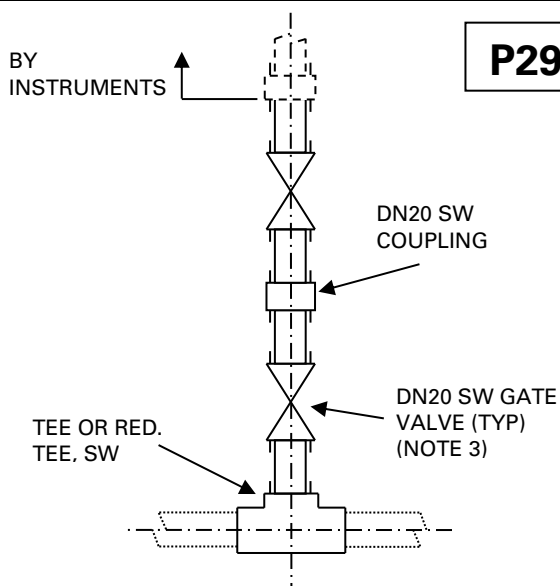
1. FOR RUN SIZE DN50 AND ABOVE
2. FOR INSULATED LINES PIPE LENGTH MAY NEED TO BE INCREASED.

P27

NOTES:

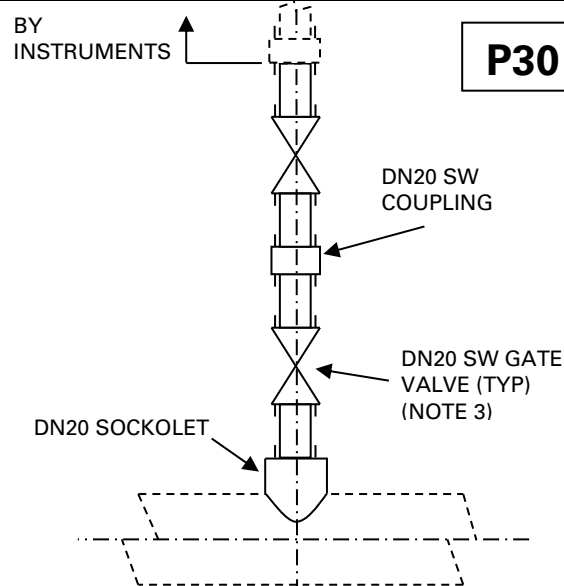
1. FOR RUN SIZE DN20 – DN40 ONLY
2. FOR INSULATED LINES PIPE LENGTH MAY NEED TO BE INCREASED.

P28

NOTES:

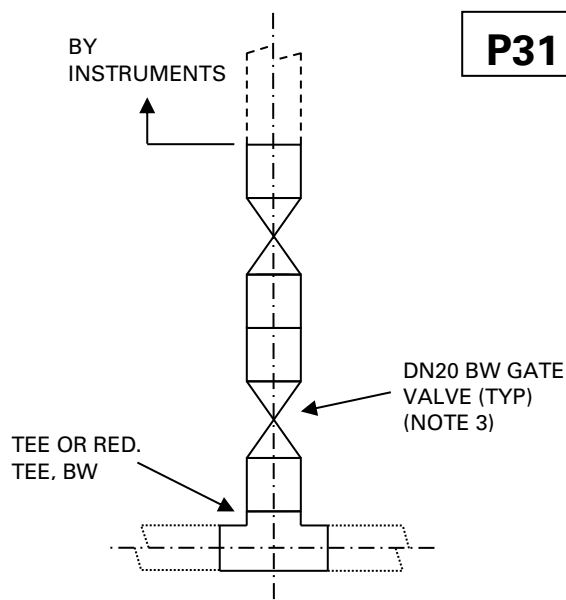
1. FOR RUN SIZE DN50 AND ABOVE
2. FOR INSULATED LINES PIPE LENGTH MAY NEED TO BE INCREASED.


NOTES:

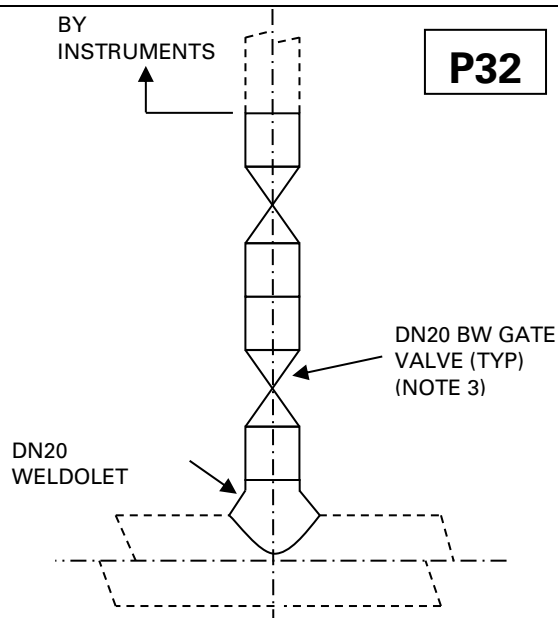
1. FOR RUN SIZE DN20 – DN40 ONLY
2. FOR INSULATED LINES PIPE MAY BE ADDED IF NECESSARY.
3. GATE VALVES ARE SUPPLIED WITH 150mm PUP PIECES ON BOTH ENDS OF THE VALVE


NOTES:

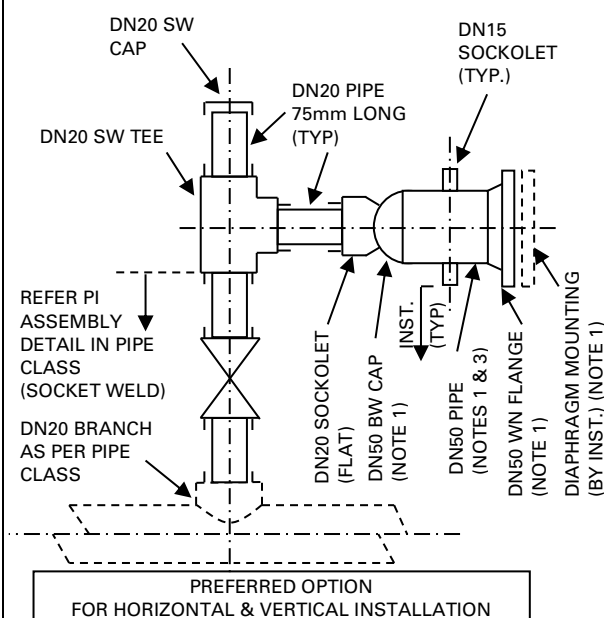
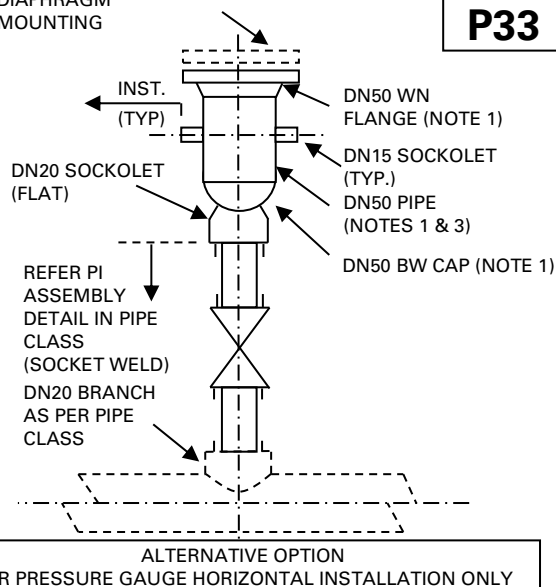
1. FOR RUN SIZE DN20 AND ABOVE
2. FOR INSULATED LINES PIPE MAY BE ADDED IF NECESSARY.
3. GATE VALVES ARE SUPPLIED WITH 150mm PUP PIECES ON BOTH ENDS OF THE VALVE


NOTES:

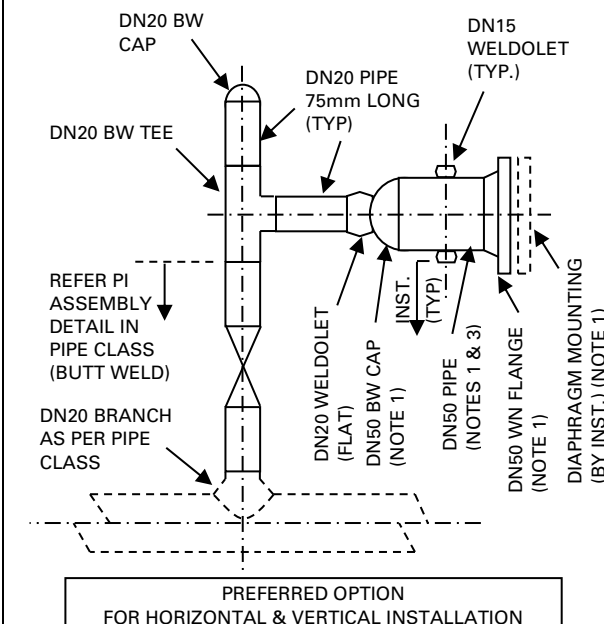
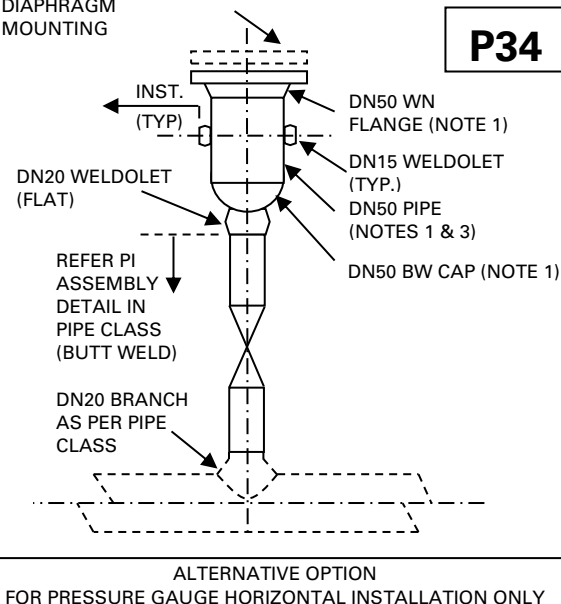
1. FOR RUN SIZE DN20 – DN40 ONLY
2. FOR INSULATED LINES PIPE MAY BE ADDED IF NECESSARY.
3. GATE VALVES ARE SUPPLIED WITH 150mm PUP PIECES ON BOTH ENDS OF THE VALVE


NOTES:

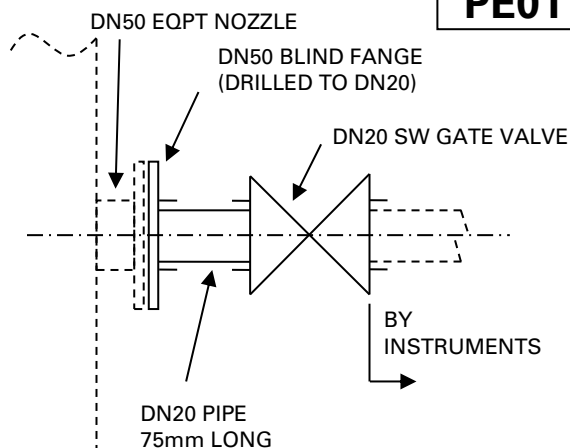
1. FOR RUN SIZE DN50 AND ABOVE
2. FOR INSULATED LINES PIPE MAY BE ADDED IF NECESSARY.
3. GATE VALVES ARE SUPPLIED WITH 150mm PUP PIECES ON BOTH ENDS OF THE VALVE


**DIAPHRAGM
MOUNTING**
P33

NOTES:

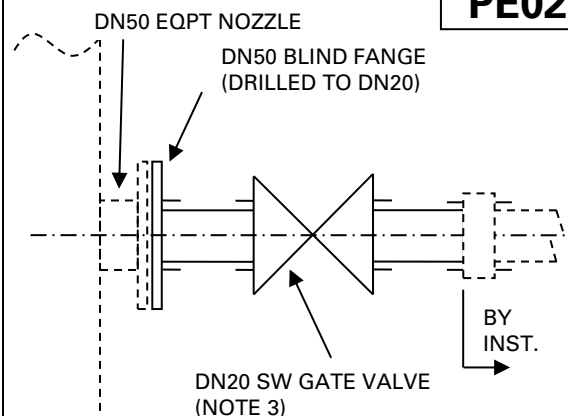
1. DIAPHRAGM MOUNTING SIZE IS CONSIDERED AS DN50. THIS SHALL BE CHECKED WITH INSTRUMENTS AND IF ANY CHANGE IN SIZE REQUIRED, OTHER PIPING ITEM SIZES SHALL BE CHANGED ACCORDINGLY.
2. BOLTS & GASKETS BY PIPING.
3. PIPE LENGTH TO BE KEPT TO A MINIMUM.(RECOMMENDED MIN. LENGTH IS 100mm)


**DIAPHRAGM
MOUNTING**
P34

NOTES:

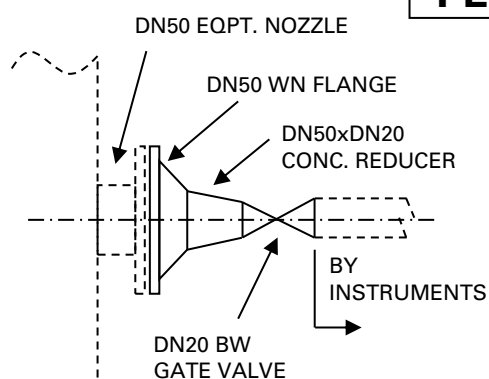
1. DIAPHRAGM MOUNTING SIZE IS CONSIDERED AS DN50. THIS SHALL BE CHECKED WITH INSTRUMENTS AND IF ANY CHANGE IN SIZE REQUIRED, OTHER PIPING ITEM SIZES SHALL BE CHANGED ACCORDINGLY.
2. BOLTS & GASKETS BY PIPING.
3. PIPE LENGTH TO BE KEPT TO A MINIMUM.(RECOMMENDED MIN. LENGTH IS 100mm)

PE01

NOTES:

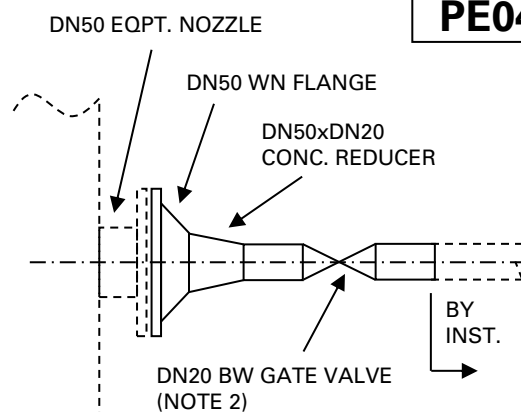
1. MINIMUM RATING FOR FLANGES IS CLASS 300.
2. BOLTS & GASKETS BY PIPING.

PE02

NOTES:

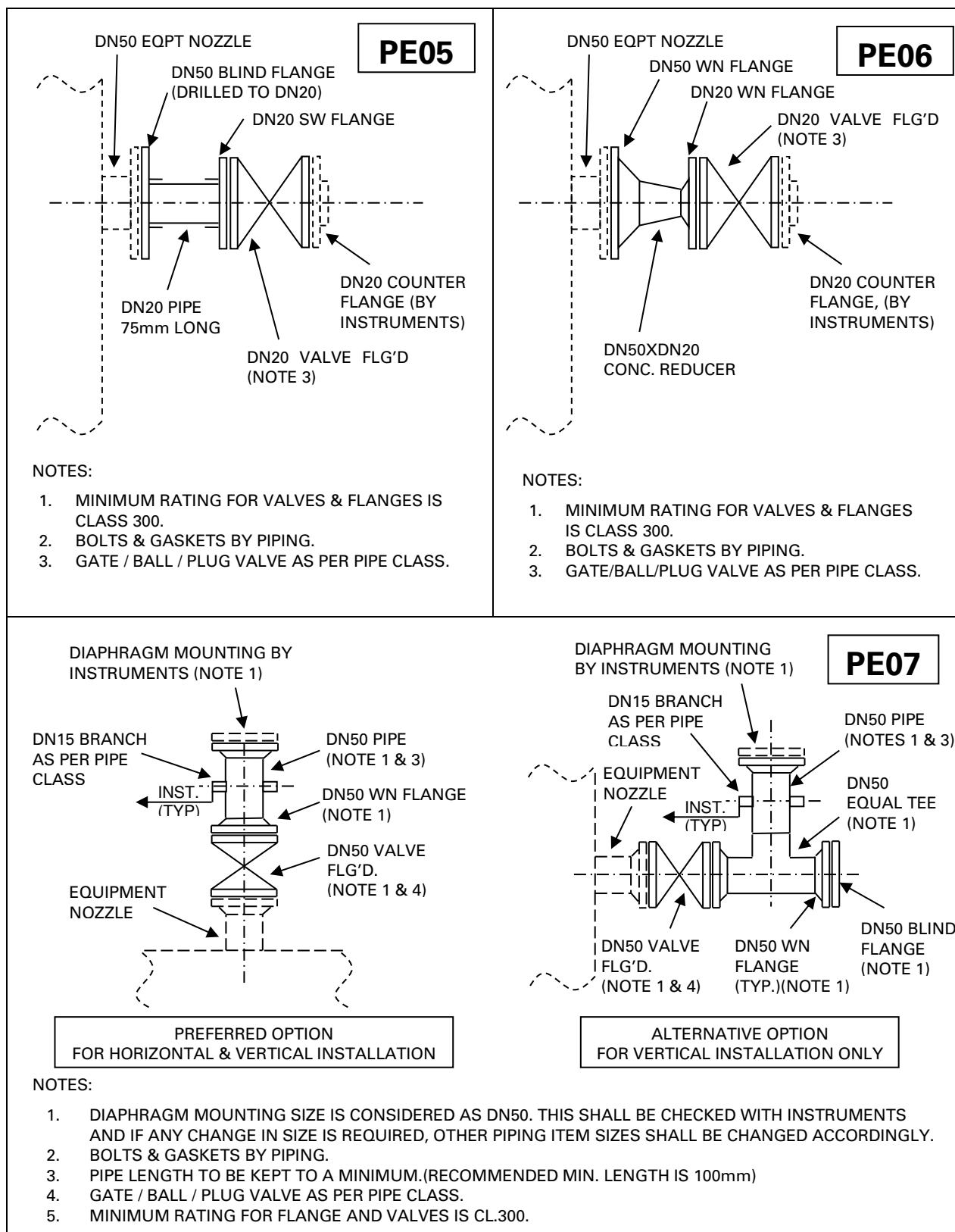
1. MINIMUM RATING FOR FLANGES IS CLASS 300.
2. BOLTS & GASKETS BY PIPING.
3. GATE VALVE IS SUPPLIED WITH 150mm PUP PIECES ON BOTH ENDS OF VALVE.

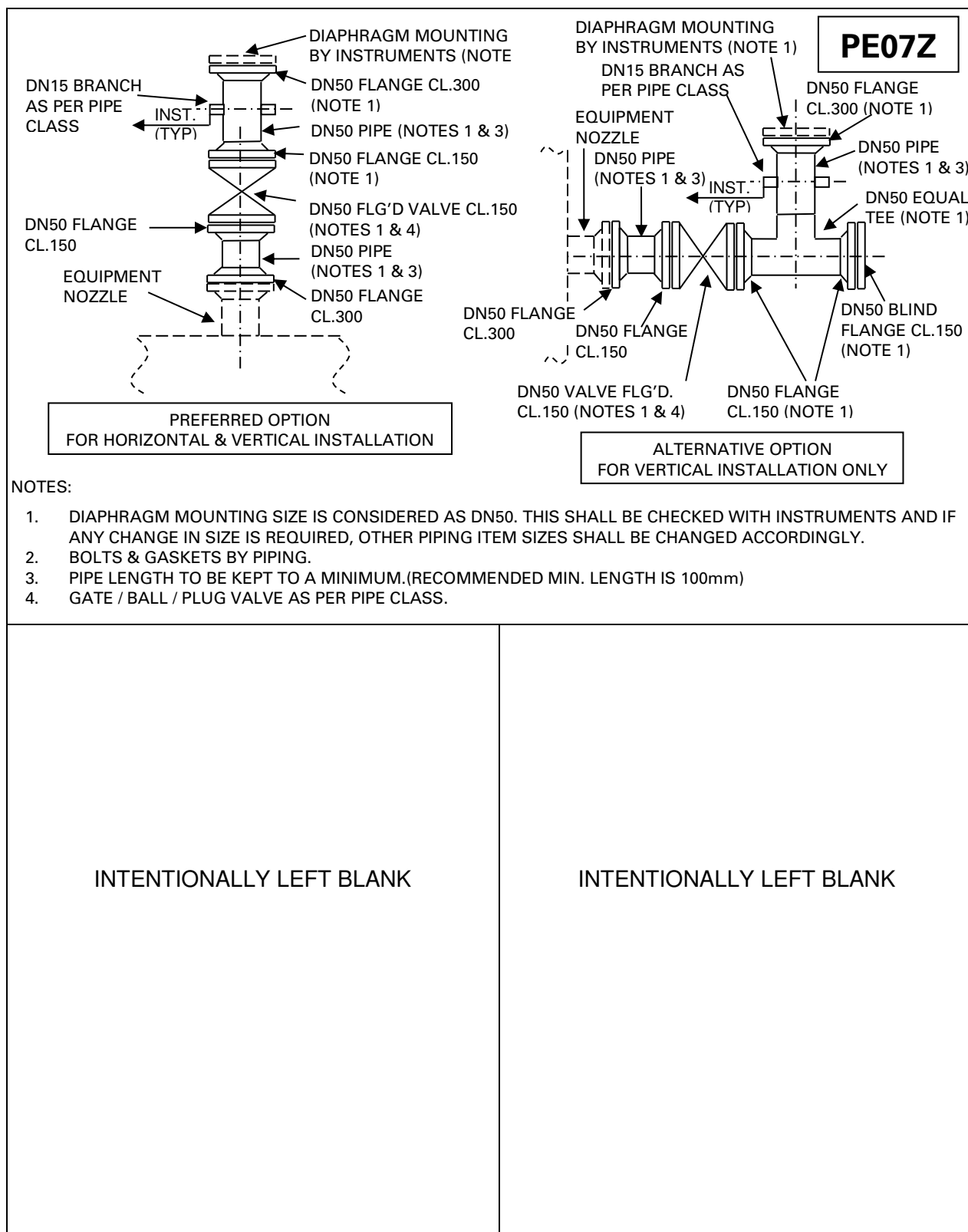
PE03

NOTES:

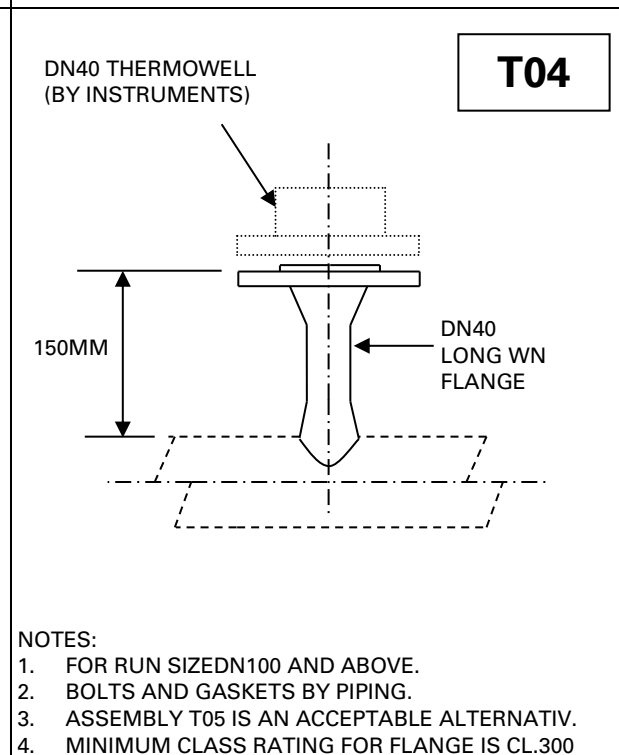
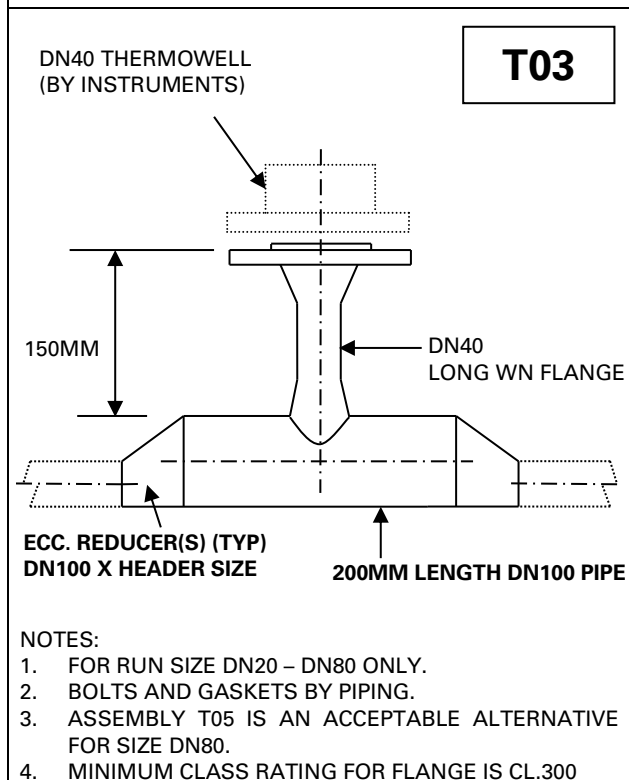
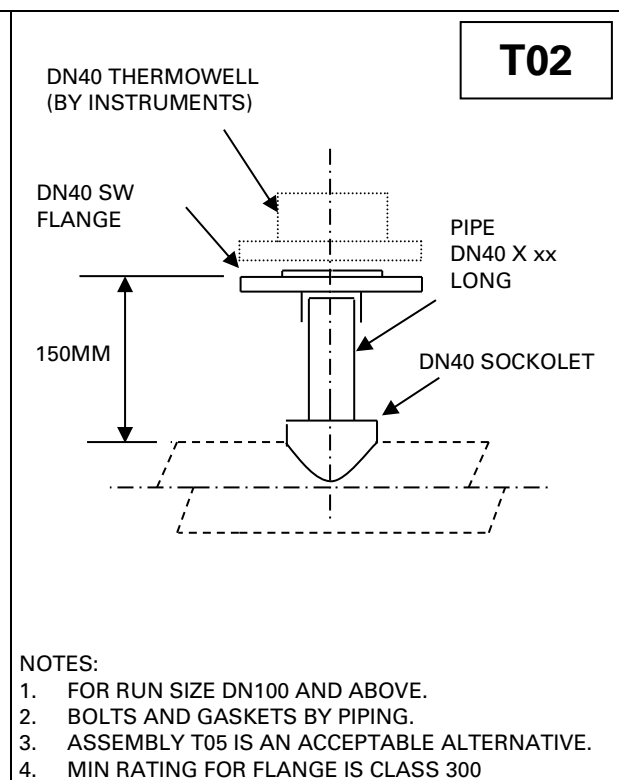
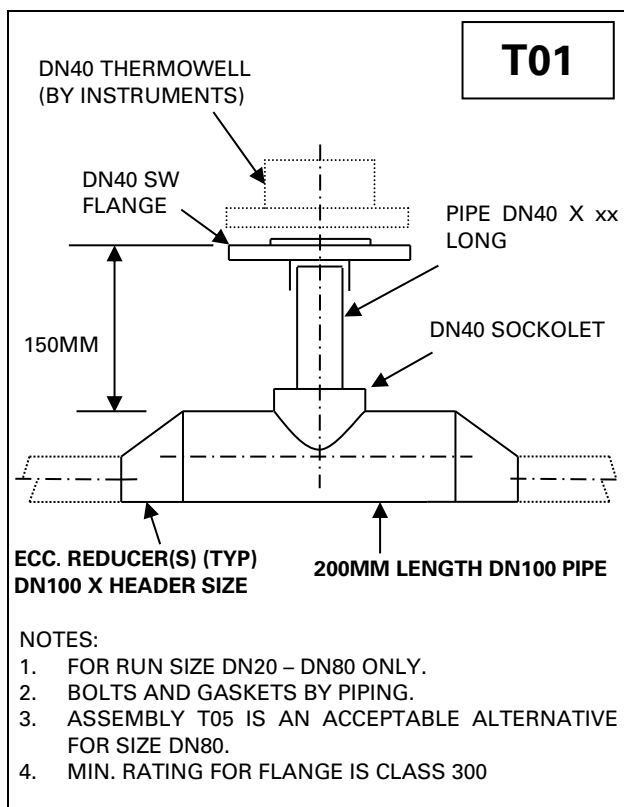
1. MINIMUM RATING FOR FLANGES IS CLASS 300.
2. BOLTS & GASKETS BY PIPING.

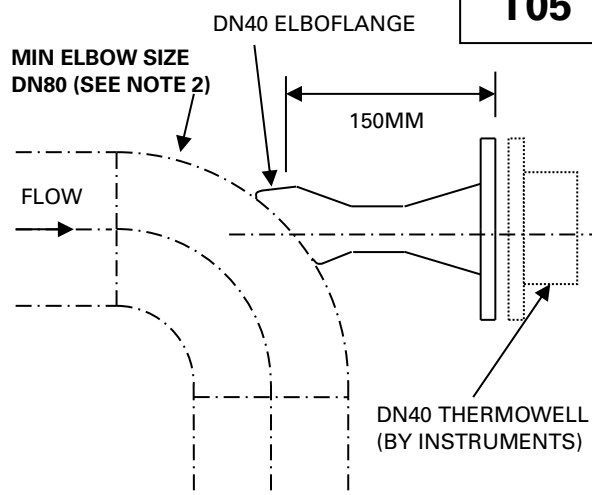
PE04

NOTES:

1. MINIMUM RATING FOR FLANGES IS CLASS 300.
2. BOLTS & GASKETS BY PIPING.
3. GATE VALVE IS SUPPLIED WITH 150mm PUP PIECES ON BOTH ENDS OF VALVE.

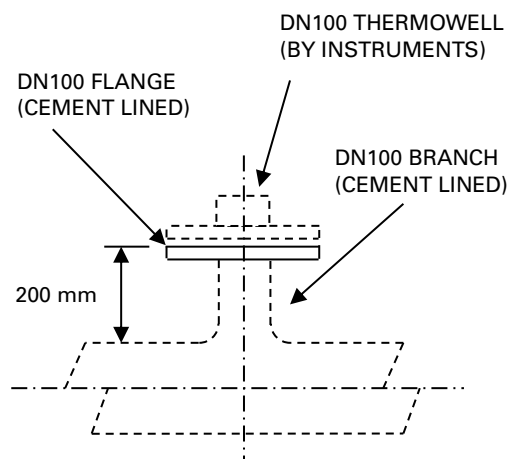




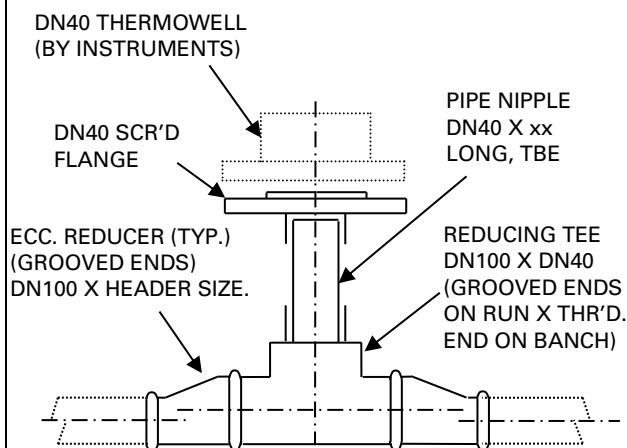


T05

NOTES:

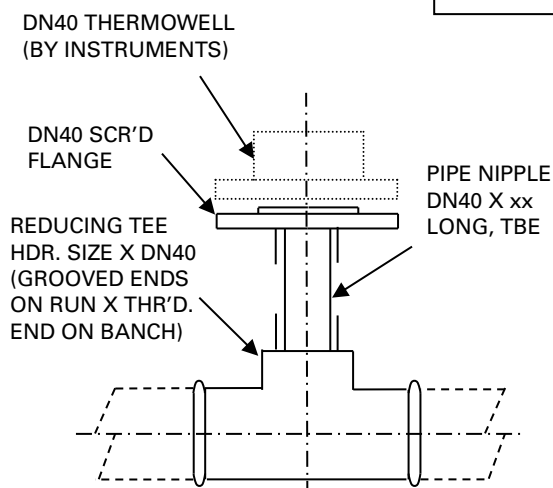
1. BOLTS AND GASKETS BY PIPING.
2. FOR HEADER SIZES DN50 AND BELOW LINE SIZE TO BE INCREASED TO DN80 LOCALLY TO ELBOW USING REDUCERS.
3. MINIMUM CLASS RATING FOR FLANGE IS CL.300

T06

NOTES:

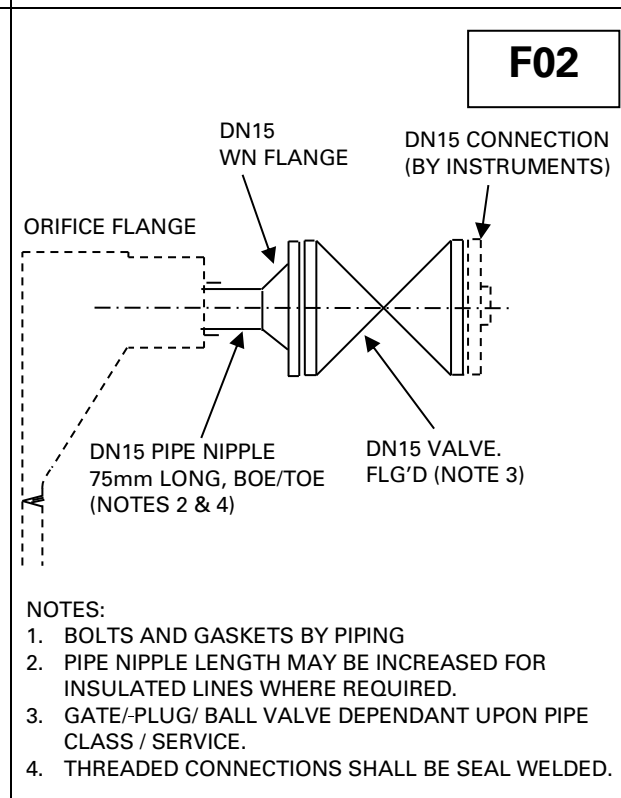
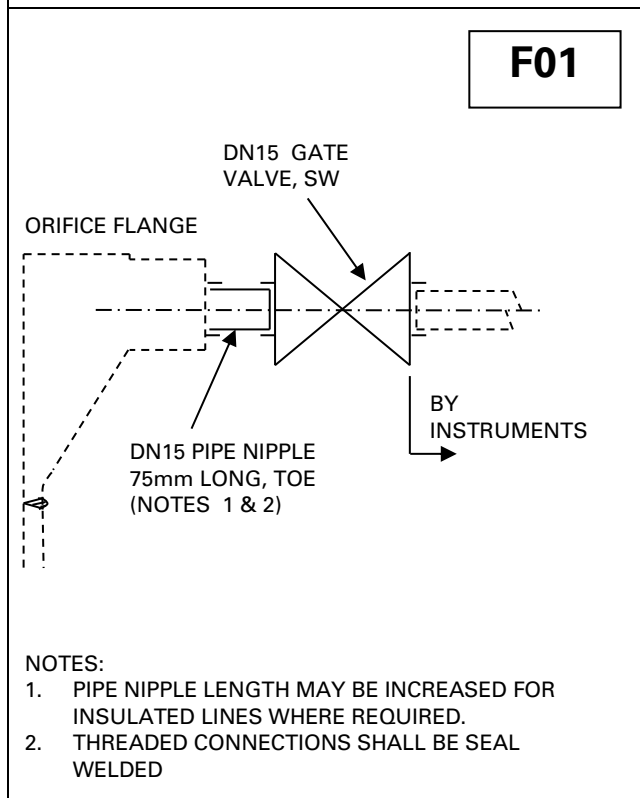
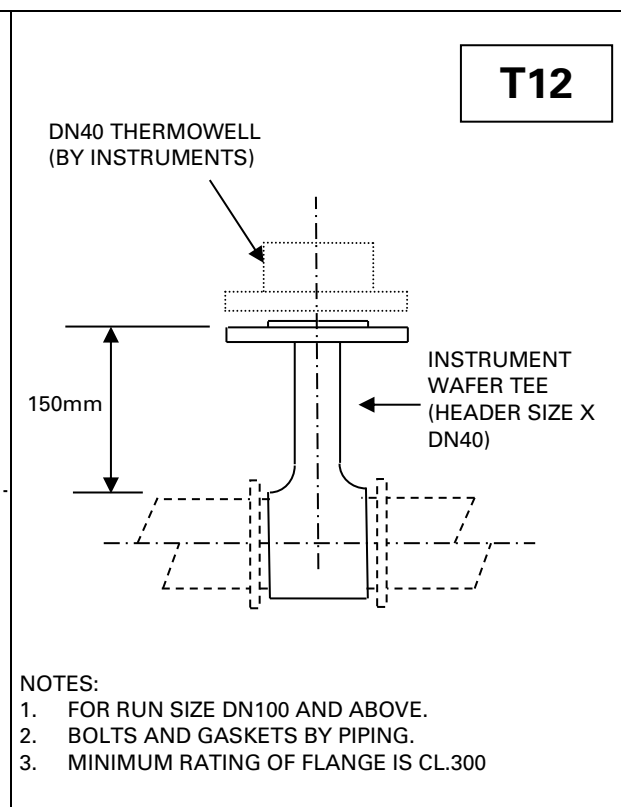
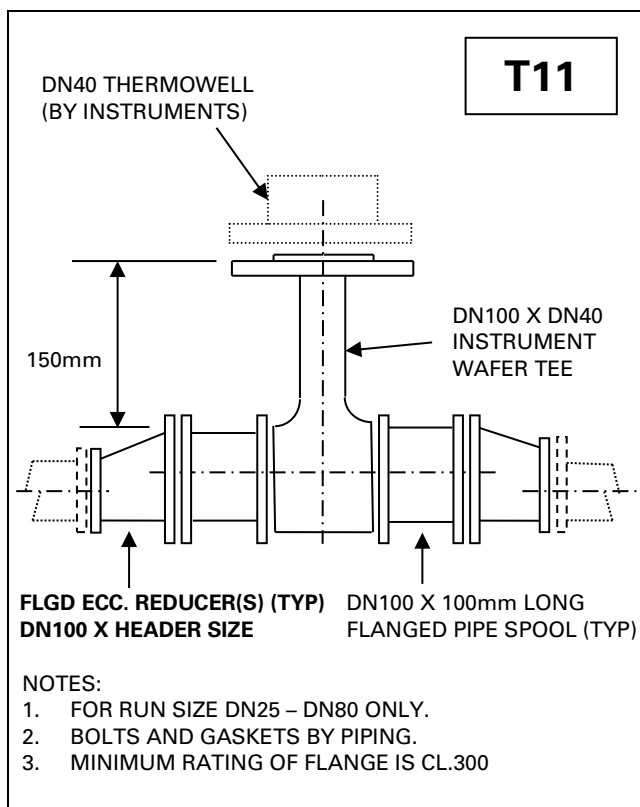
1. FOR RUN SIZE DN100 & ABOVE.
2. BOLTS & GASKETS BY PIPING.
3. MINIMUM CLASS RATING FOR FLANGE IS CL.300

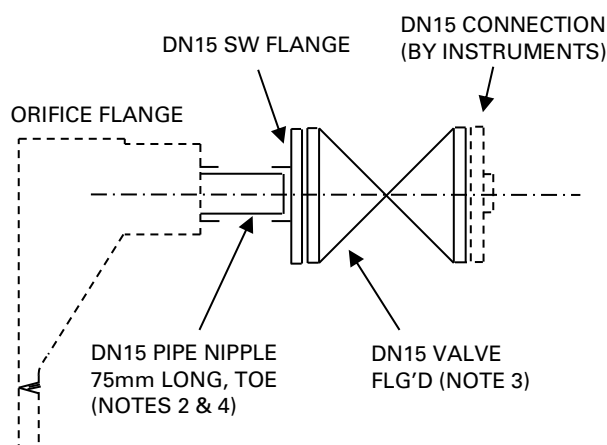
T07

NOTES:

1. FOR RUN SIZE DN50 – DN80 ONLY.
2. BOLTS AND GASKETS BY PIPING.
3. MINIMUM RATING OF FLANGE IS CL.300

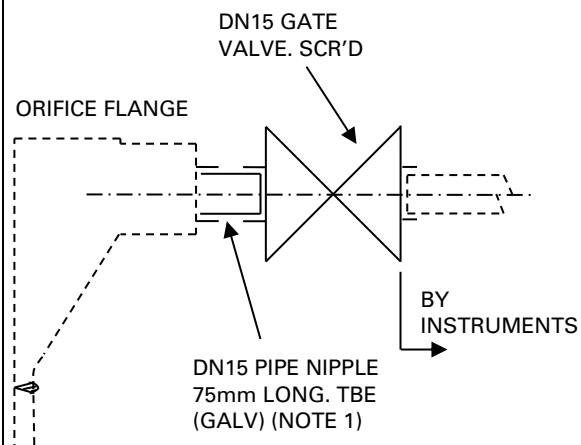
T08

NOTES:

1. FOR RUN SIZE DN100 – DN200.
2. BOLTS AND GASKETS BY PIPING.
3. MINIMUM RATING OF FLANGE IS CL.300

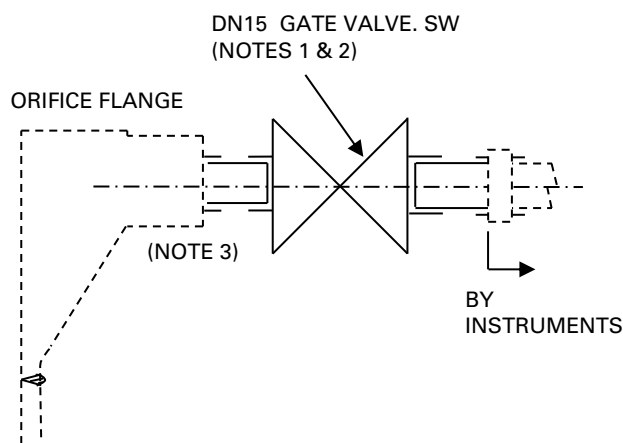


F03

NOTES:

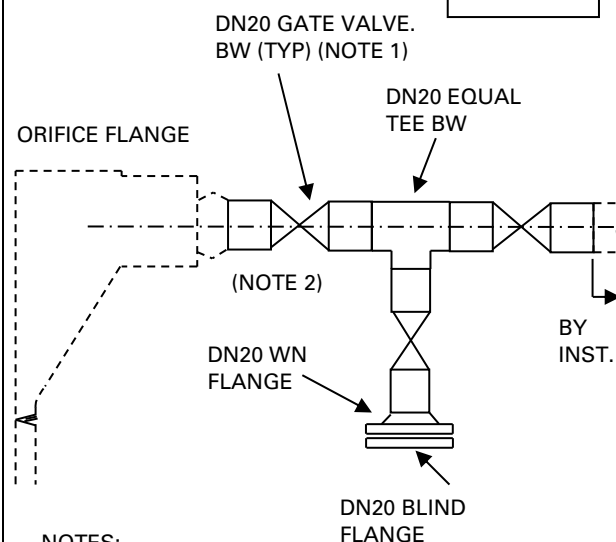
1. BOLTS AND GASKETS BY PIPING
2. PIPE NIPPLE LENGTH MAY BE INCREASED FOR INSULATED LINES WHERE REQUIRED.
3. GATE/PLUG/BALL VALVE DEPENDANT UPON PIPE CLASS / SERVICE.
4. THREADED CONNECTIONS SHALL BE SEAL WELDED.

F04

NOTES:

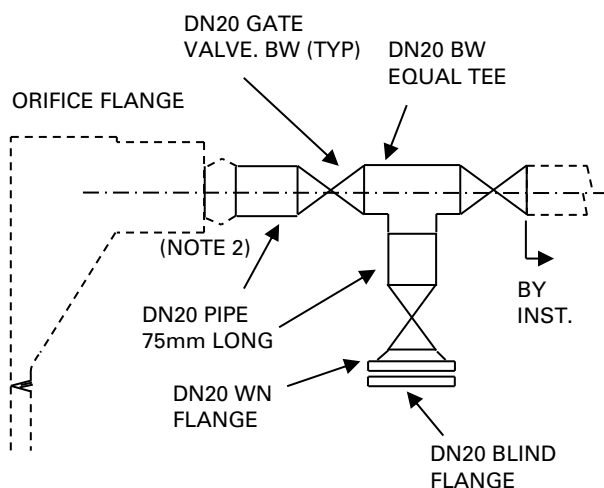
1. PIPE NIPPLE LENGTH MAY BE INCREASED FOR INSULATED LINES WHERE REQUIRED.

F05

NOTES:

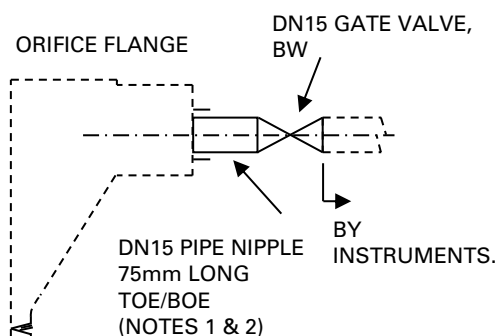
1. GATE VALVE IS SUPPLIED WITH 150mm PUP PIECES ON BOTH ENDS OF THE VALVE
2. ONE END OF THE VALVE WITH PUP PIECE SHALL BE THREADED AT SITE TO NPT(m) TO SUIT ORIFICE TAPPING.
3. THREADED CONNECTION SHALL BE SEAL WELDED.

F06

NOTES:

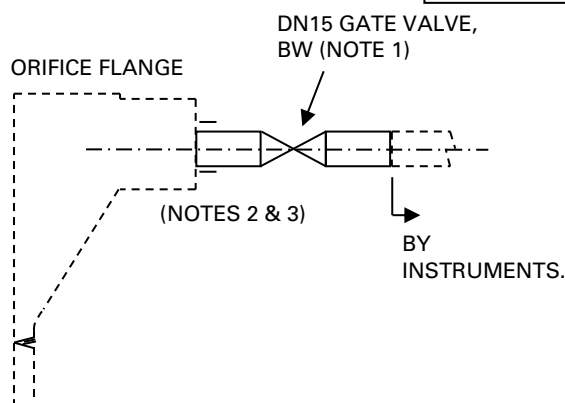
1. GATE VALVE IS SUPPLIED WITH 150mm PUP PIECES ON BOTH ENDS OF THE VALVE.
2. VALVE WITH PUP PIECES SHALL BE DIRECTLY WELDED ON TO THE WELDOLET PROVIDED AS PART OF ORIFICE FLANGE SCOPE.

F07

NOTES:

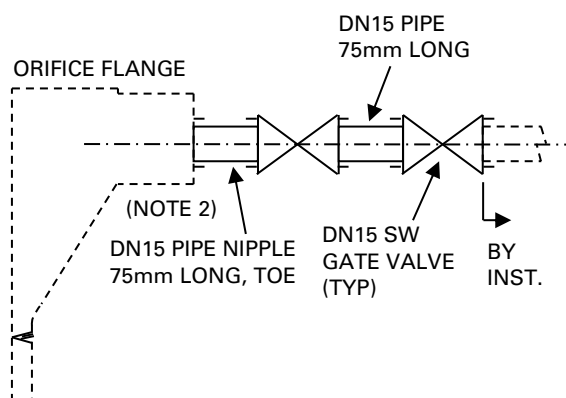
1. PIPE NIPPLE LENGTH MAY BE INCREASED FOR INSULATED LINES WHERE REQUIRED.
2. NIPPLE SHALL BE DIRECTLY BUTT WELDED ONTO THE WELDOLET PROVIDED AS PART OF ORIFICE FLANGE SCOPE.

F08

NOTES:

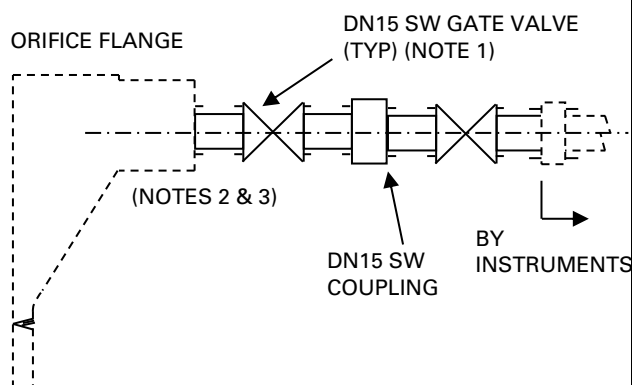
1. PIPE NIPPLE LENGTH MAY BE INCREASED FOR INSULATED LINES WHERE REQUIRED.
2. THREADED CONNECTION SHALL BE SEAL WELDED.

F09

NOTES:

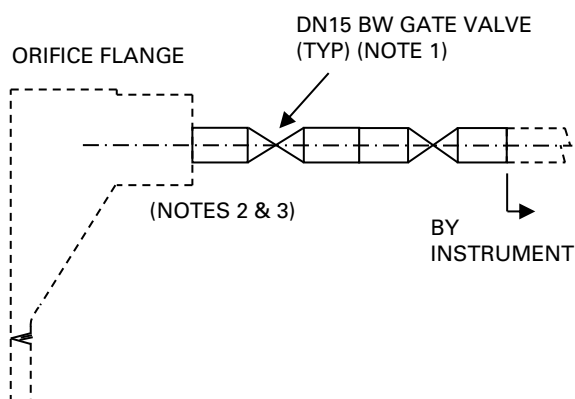
1. GATE VALVE IS SUPPLIED WITH 150mm PUP PIECES ON BOTH ENDS OF VALVE.
2. ONE END OF VALVE WITH PUP PIECE SHALL BE THREADED AT SITE TO NPT(M) TO SUIT ORIFICE TAPPING.
3. THREADED CONNECTION SHALL BE SEAL WELDED.

F10

NOTES:

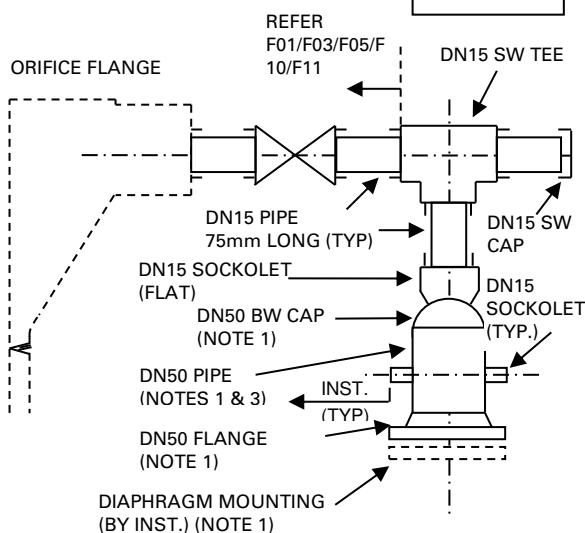
1. PIPE NIPPLE LENGTH MAY BE INCREASED FOR INSULATED LINES WHERE REQUIRED.
2. THREADED CONNECTIONS SHALL BE SEAL WELDED.

F11

NOTES:

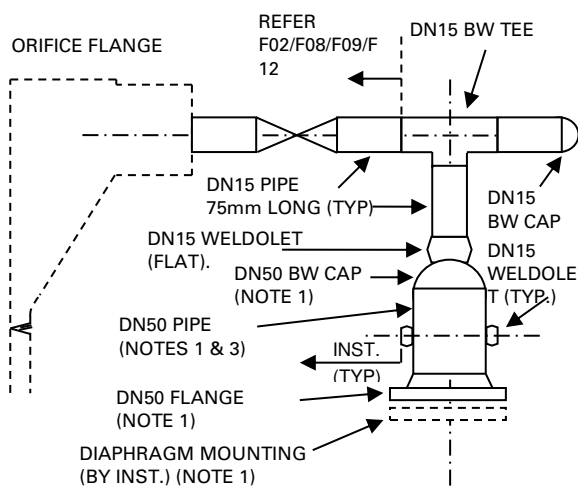
1. GATE VALVE IS SUPPLIED WITH 150mm PUP PIECES ON BOTH ENDS OF VALVE.
2. ONE END OF VALVE WITH PUP PIECE SHALL BE THREADED AT SITE TO NPT(m) TO SUIT ORIFICE TAPPING.
3. THREADED CONNECTION SHALL BE SEAL WELDED.

F12

NOTES:

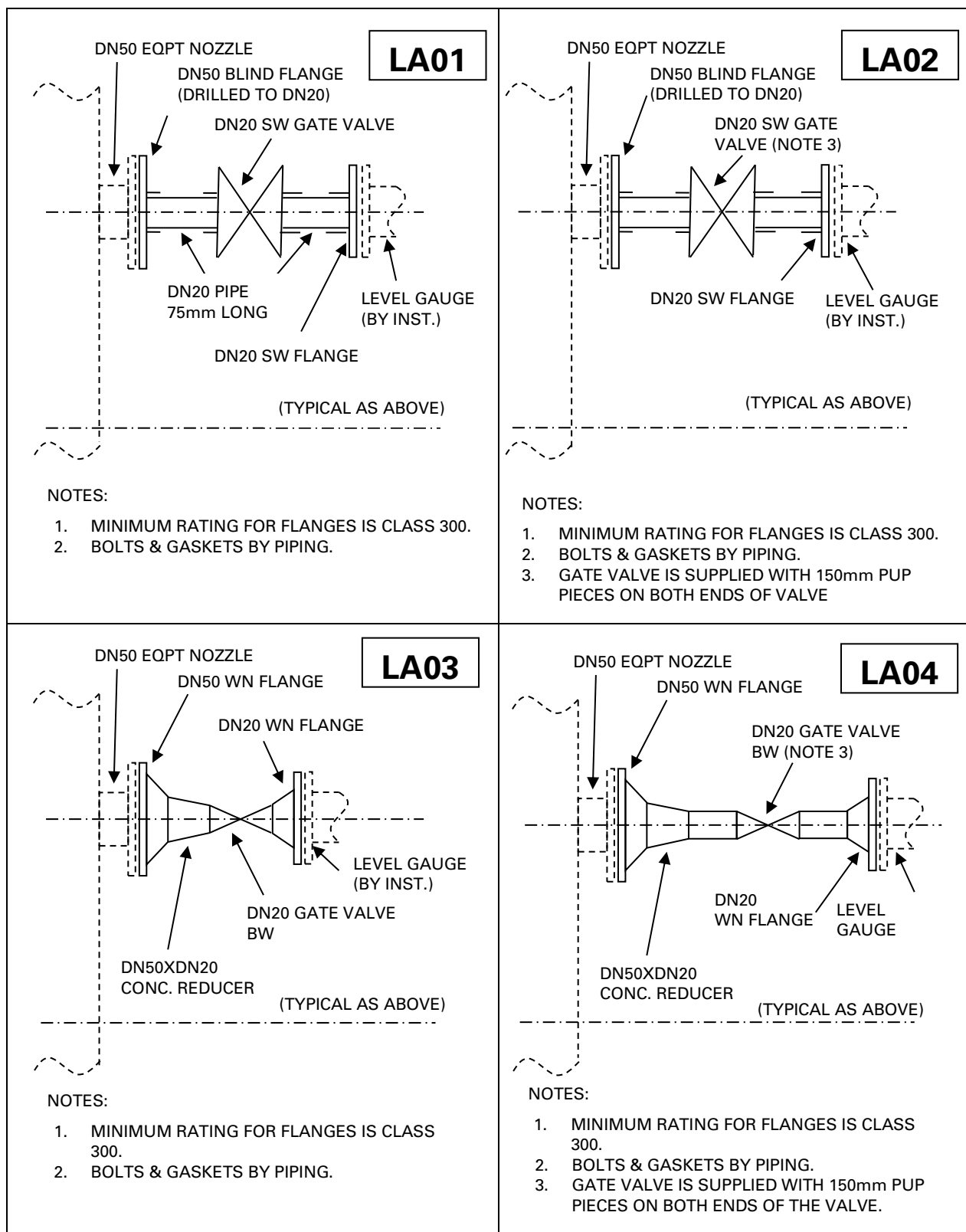
1. GATE VALVE IS SUPPLIED WITH 150mm PUP PIECES ON BOTH ENDS OF VALVE.
2. ONE END OF VALVE WITH PUP PIECE SHALL BE THREADED AT SITE TO NPT(m) TO SUIT ORIFICE TAPPING.
3. THREADED CONNECTION SHALL BE SEALED WELDED.

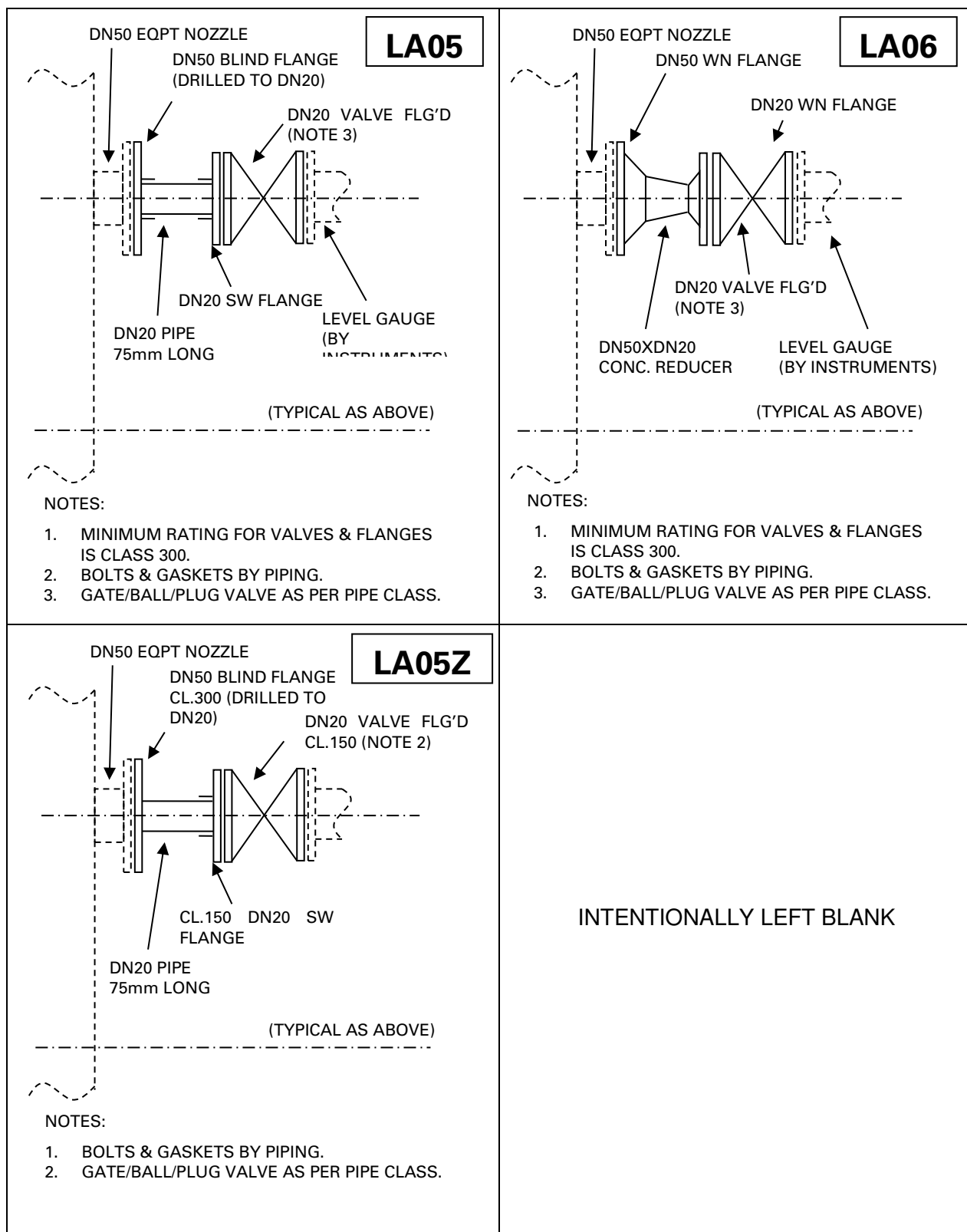
F13

NOTES:

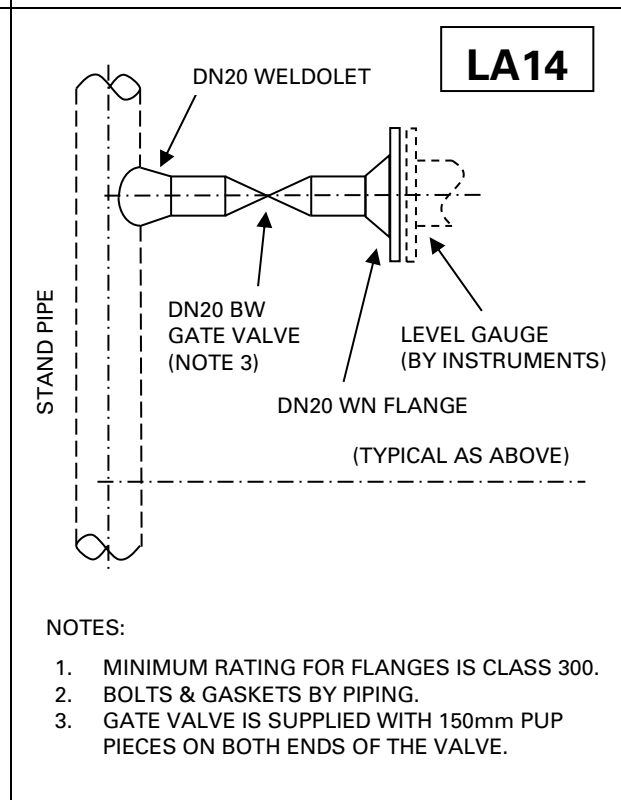
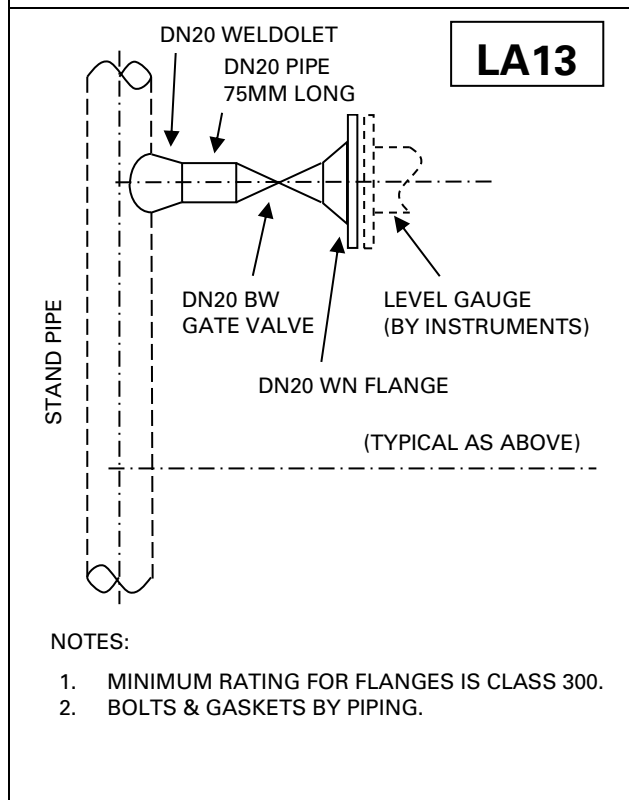
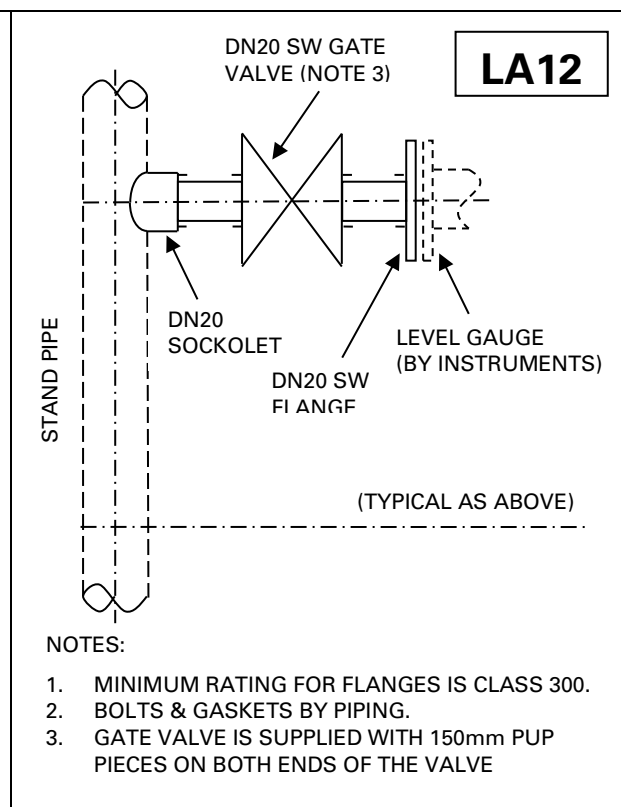
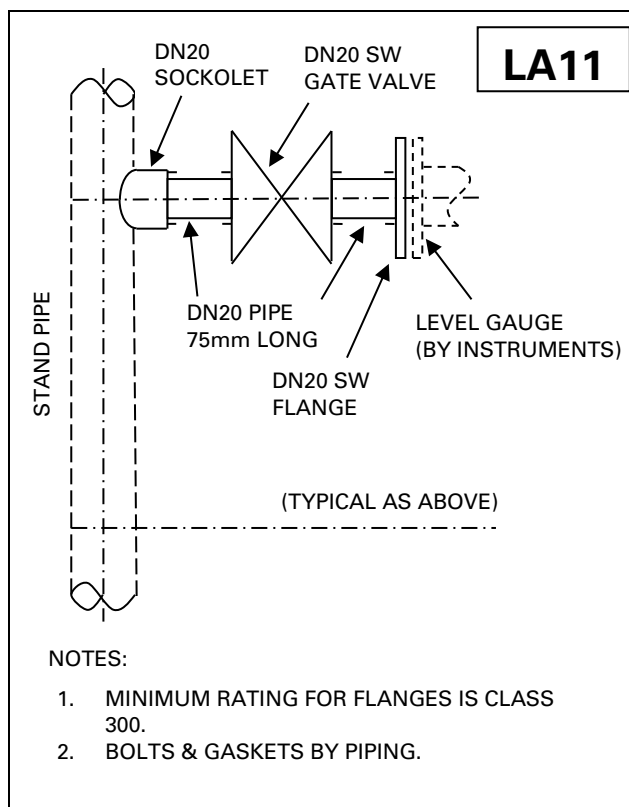
1. DIAPHRAGM MOUNTING SIZE IS CONSIDERED AS DN50. THIS IS TO BE CHECKED WITH INSTRUMENTS AND OTHER PIPING ITEM SIZES TO BE CHANGED IF SIZE CHANGE IS REQUIRED.
2. BOLTS & GASKETS BY PIPING.
3. PIPE LENGTH TO BE KEPT TO MINIMUM. (RECOMMENDED MIN LENGTH IS 100mm)

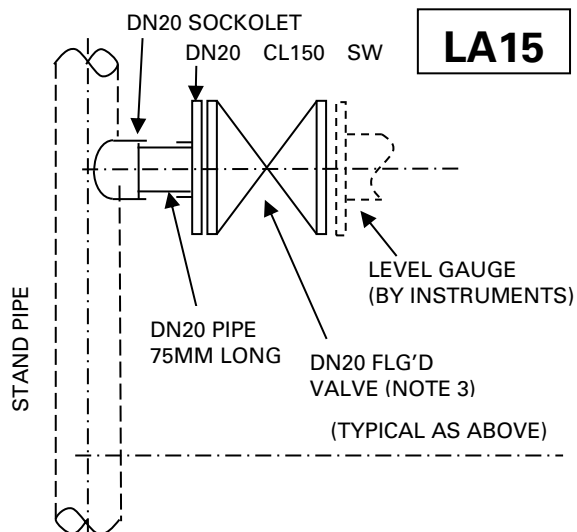
F14

NOTES:

1. DIAPHRAGM MOUNTING SIZE IS CONSIDERED AS DN50. THIS IS TO BE CHECKED WITH INSTRUMENTS AND OTHER PIPING ITEM SIZES TO BE CHANGED IF SIZE CHANGE IS REQUIRED.
2. BOLTS & GASKETS BY PIPING.
3. PIPE LENGTH TO BE KEPT TO MINIMUM. (RECOMMENDED MIN LENGTH IS 100mm)

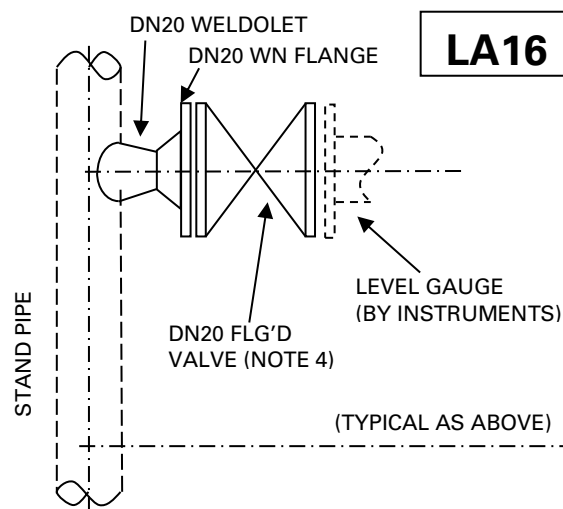




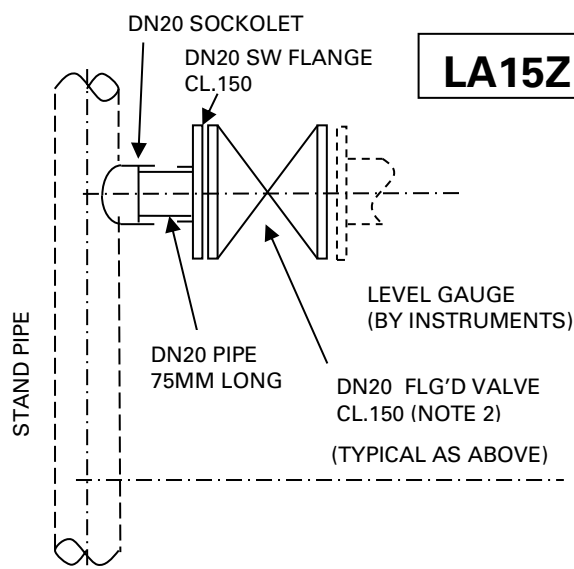



NOTES:

1. MINIMUM RATING FOR VALVES & FLANGES IS CLASS 300.
2. BOLTS & GASKETS BY PIPING.
3. GATE/BALL/PLUG VALVE AS PER PIPE CLASS

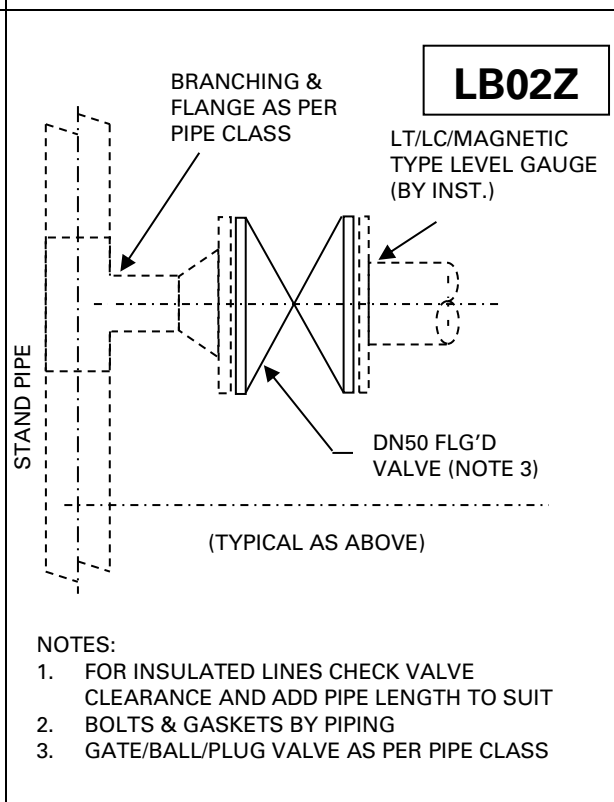
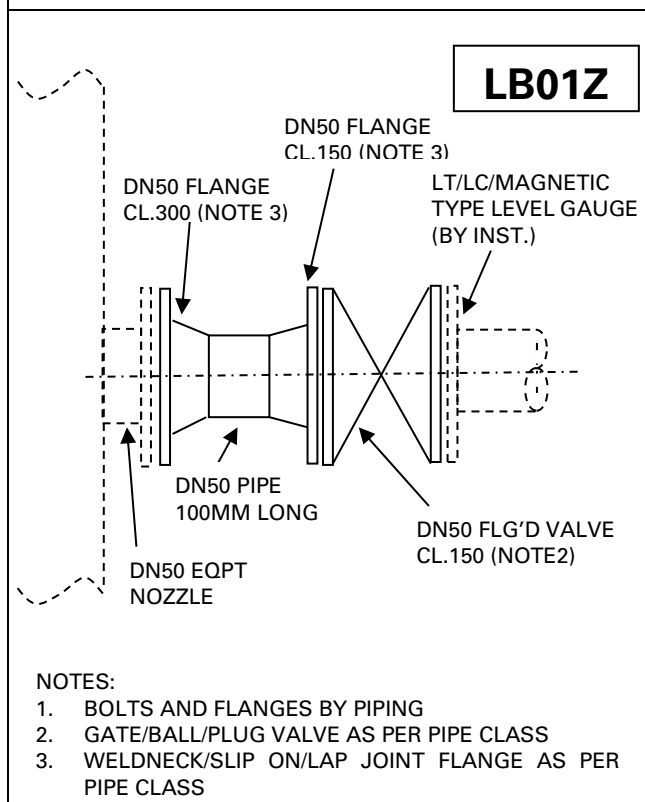
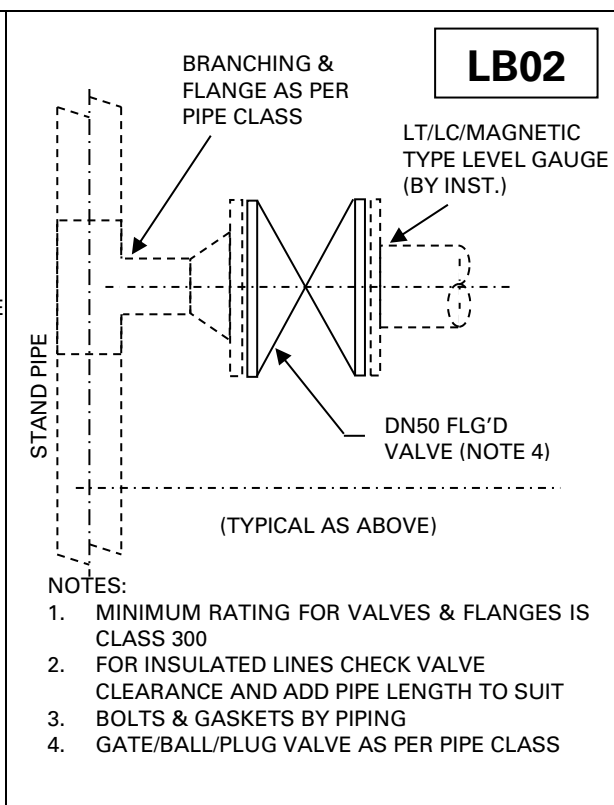
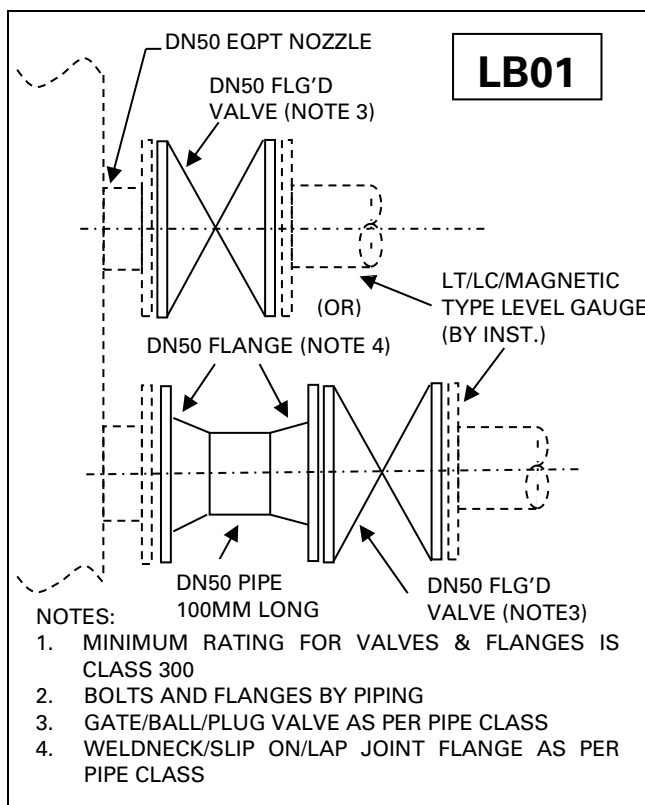

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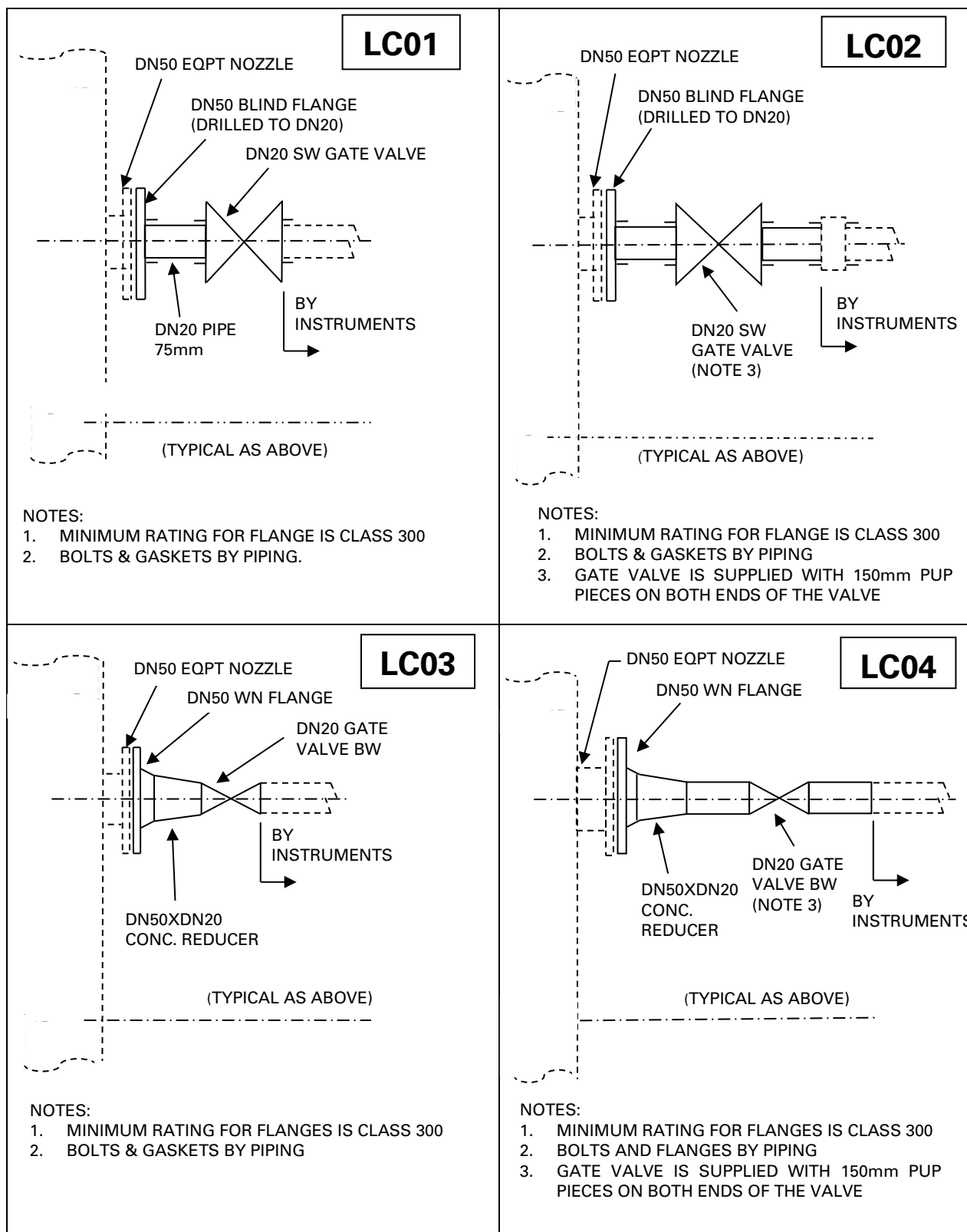
1. MINIMUM RATING FOR VALVES & FLANGES IS CLASS 300.
2. FOR INSULATED LINES CHECK VALVE CLEARANCE AND ADD PIPE LENGTH TO SUIT.
3. BOLTS & GASKETS BY PIPING.
4. GATE/BALL/PLUG VALVE AS PER PIPE CLASS.

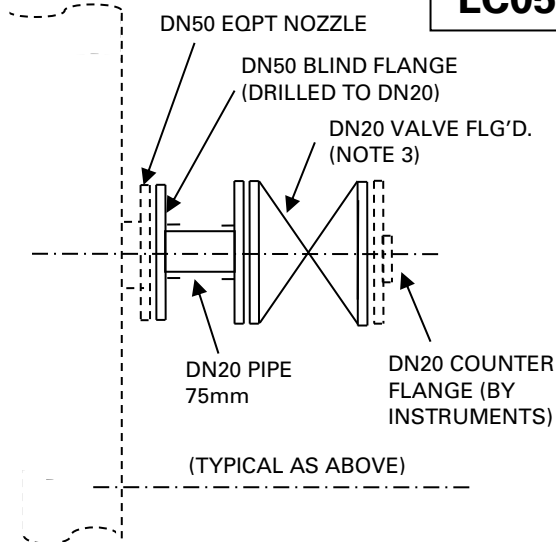

NOTES:

1. BOLTS & GASKETS BY PIPING.
2. GATE/BALL/PLUG VALVE AS PER PIPE CLASS

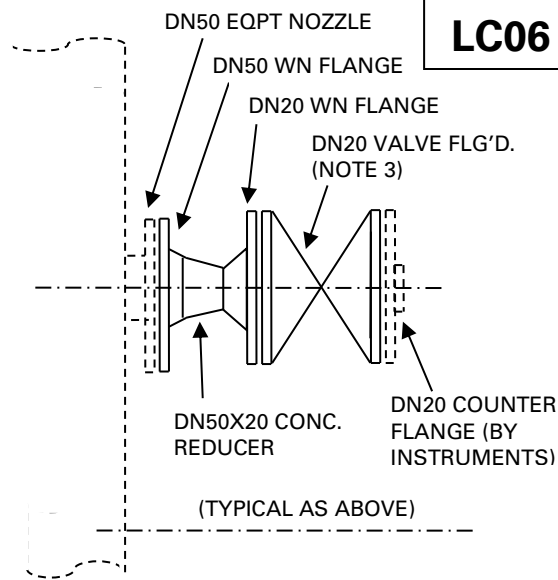
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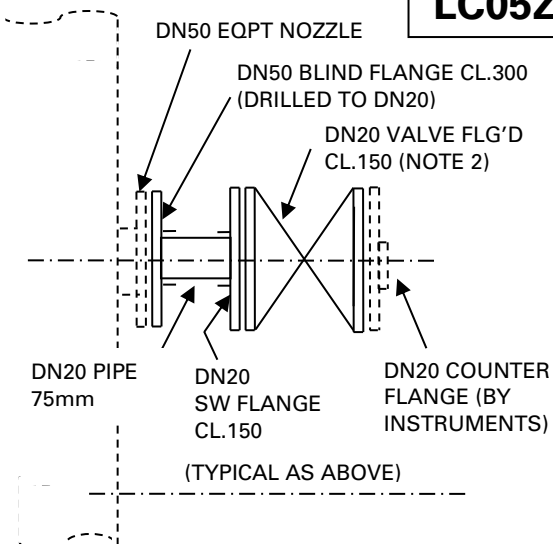


LC05

NOTES:

1. MINIMUM RATING FOR VALVES & FLANGES IS CLASS 300
2. BOLTS & GASKETS BY PIPING
3. GATE/BALL/PLUG VALVE AS PER PIPE CLASS

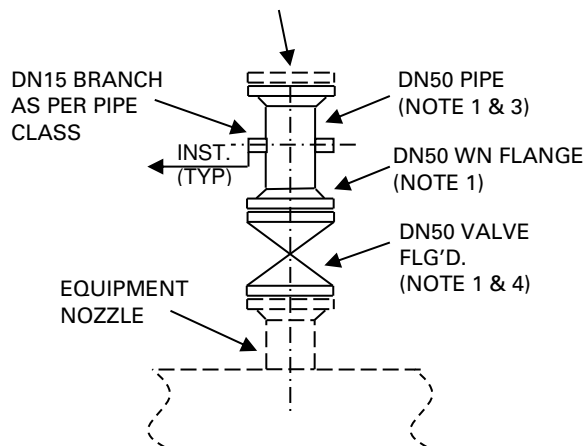
LC06

NOTES:

1. MINIMUM RATING FOR VALVES & FLANGES IS CLASS 300
2. BOLTS & GASKETS BY PIPING
3. GATE/BALL/PLUG VALVE AS PER PIPE CLASS

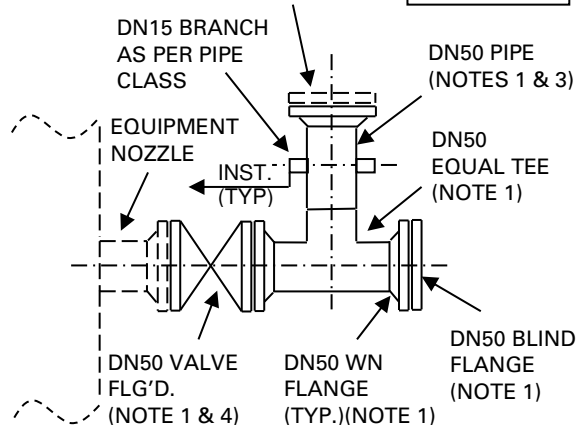
LC05Z

NOTES:

1. BOLTS & GASKETS BY PIPING
2. GATE/BALL/PLUG VALVE AS PER PIPE CLASS

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**DIAPHRAGM MOUNTING BY
INSTRUMENTS (NOTE 1)**


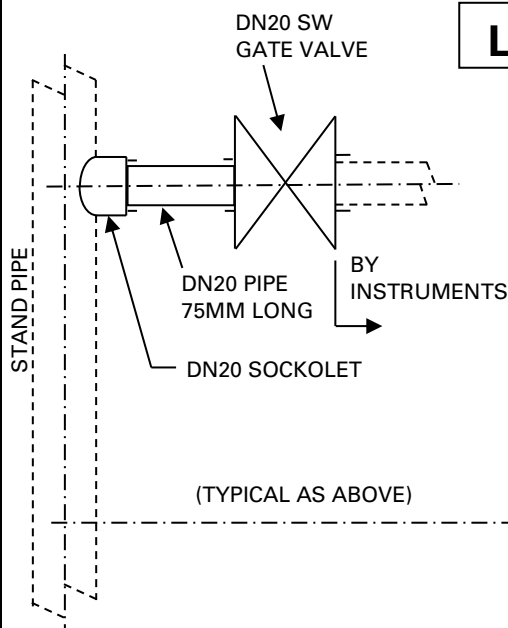
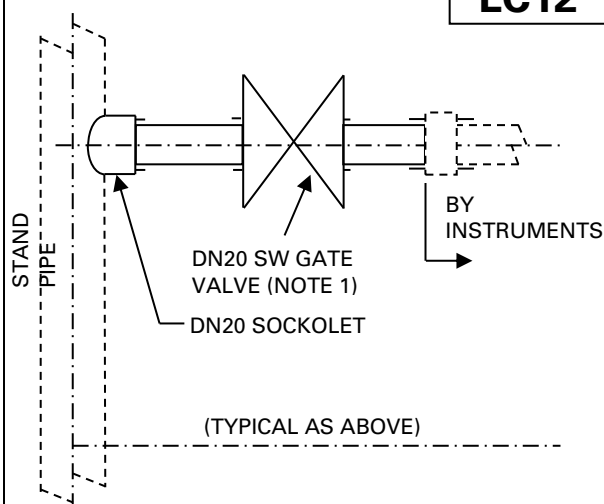
**PREFERRED OPTION
FOR HORIZONTAL & VERTICAL INSTALLATION**

**DIAPHRAGM MOUNTING
BY INSTRUMENTS (NOTE 1)**
LC07


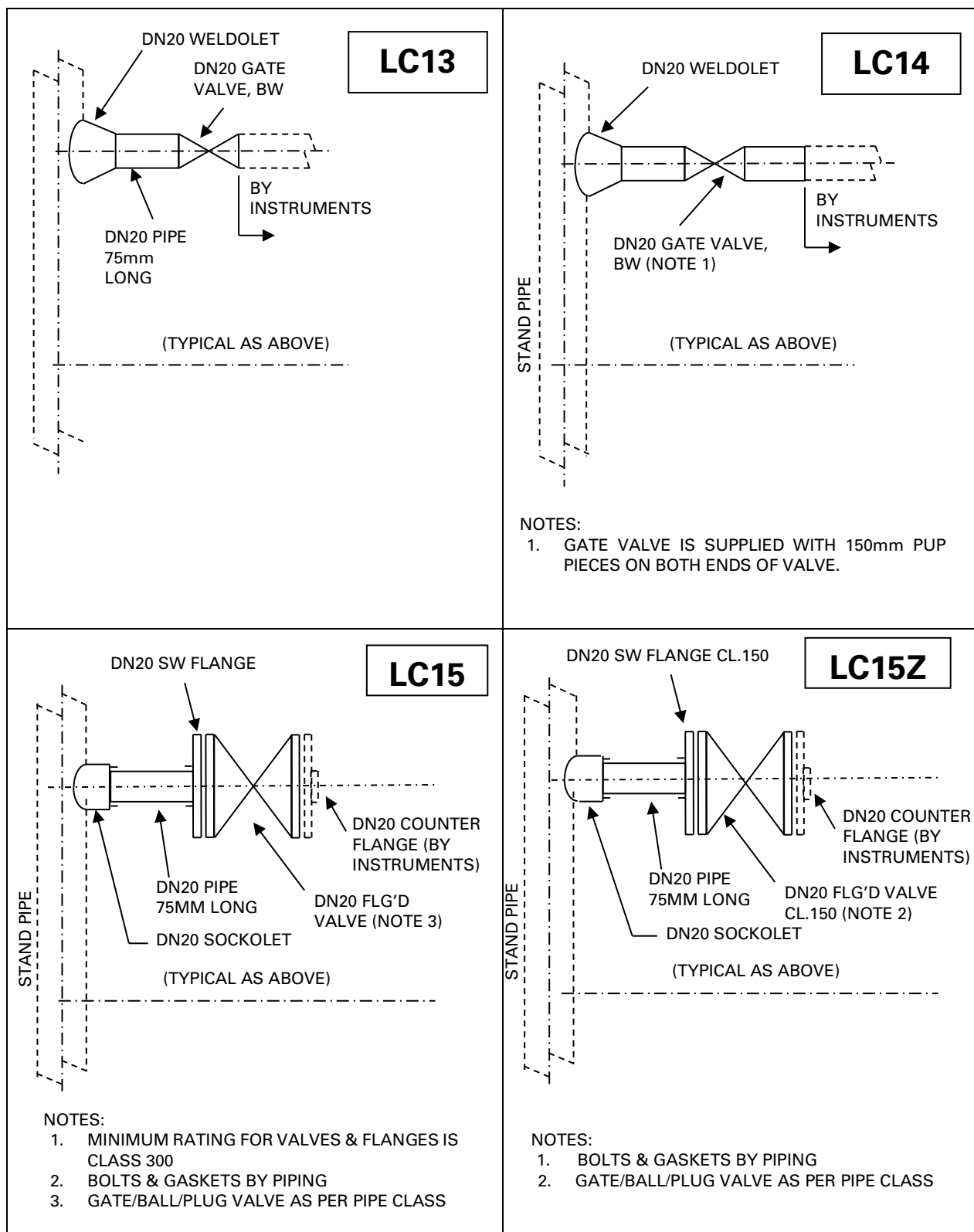
**ALTERNATIVE OPTION
FOR VERTICAL INSTALLATION ONLY**

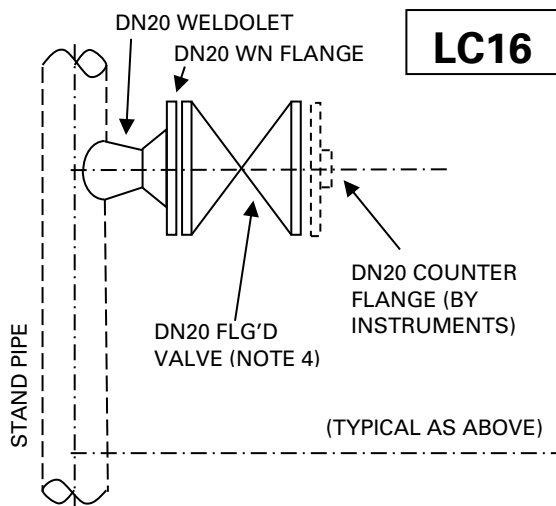
NOTES:

1. DIAPHRAGM MOUNTING SIZE IS CONSIDERED AS DN50. THIS SHALL BE CHECKED WITH INSTRUMENTS AND IF ANY CHANGE IN SIZE IS REQUIRED, OTHER PIPING ITEM SIZES SHALL BE CHANGED ACCORDINGLY.
2. BOLTS & GASKETS BY PIPING.
3. PIPE LENGTH TO BE KEPT TO A MINIMUM. (RECOMMENDED MIN. LENGTH IS 100mm)
4. GATE / BALL / PLUG VALVE AS PER PIPE CLASS.
5. MINIMUM RATING FOR FLANGE AND VALVES IS CL.300.

LC11

LC12


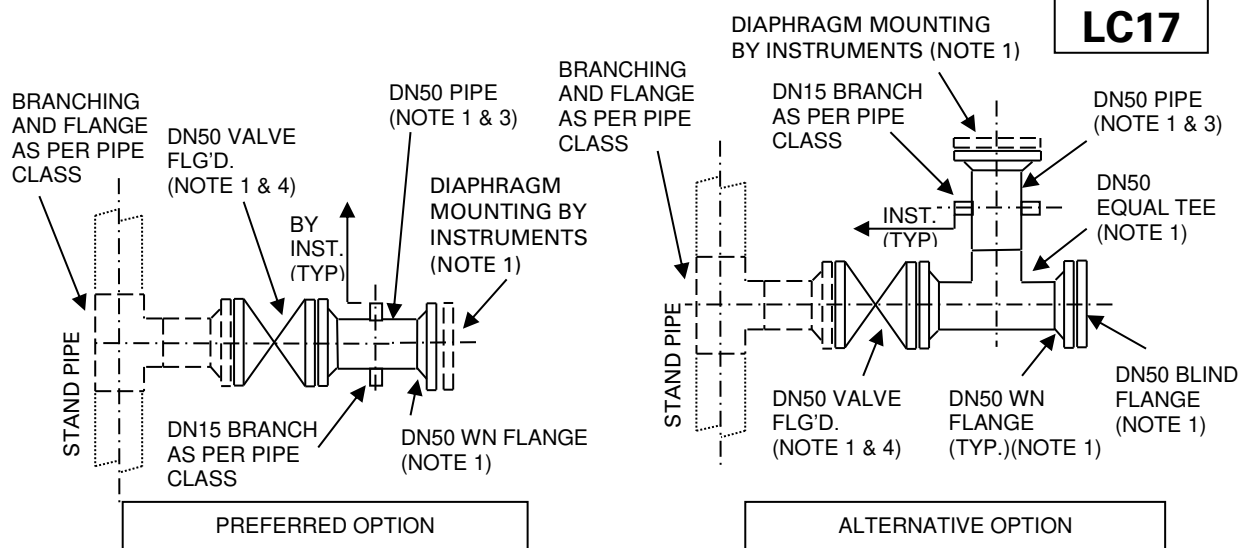
1. GATE VALVE IS SUPPLIED WITH 150mm PUP PIECES ON BOTH ENDS OF THE VALVE




NOTES:

1. MINIMUM RATING FOR VALVES & FLANGES IS CLASS 300.
2. FOR INSULATED LINES CHECK VALVE CLEARANCE AND ADD PIPE LENGTH TO SUIT.
3. BOLTS & GASKETS BY PIPING.
4. GATE/BALL/PLUG VALVE AS PER PIPE CLASS.





INTENTIONALLY LEFT BLANK


NOTES:

1. DIAPHRAGM MOUNTING SIZE IS CONSIDERED AS DN50. THIS SHALL BE CHECKED WITH INSTRUMENTS AND IF ANY CHANGE IN SIZE IS REQUIRED, OTHER PIPING ITEM SIZES SHALL BE CHANGED ACCORDINGLY.
2. BOLTS & GASKETS BY PIPING.
3. PIPE LENGTH TO BE KEPT TO A MINIMUM. (RECOMMENDED MIN. LENGTH IS 100mm)

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	CLIENT		INDIAN OIL CORPORATION LIMITED	
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JOB CONSTRUCTION SPECIFICATION FOR SITE PIPING MATERIAL TRACEABILITY

			 Written By T Balasurugan 2019.12.02 17:41:31 +05'30'	 Signed By Digitally signed by mordischristopher.jesumarian DN: cn=, o=technip.fmc, ou=technip.fmc, email=mordischristopher.jesumarian@technip.fmc, c=IN Date: 2019.12.03 15:07:37 +05'30'	 Approved By Atakappan L. 2019.12.03 15:40:10 +05'30'	 Authorized By Mordischristopher Jesumarian 2019.12.03 17:05:20 +05'30'
0	21.11.2019	ISSUED FOR IMPLEMENTATION	TB	PKP / LA	LA	JMC
REV.	DATE	STATUS	WRITTEN BY	CHECKED BY	APPROVED BY	AUTHOR. BY
DOCUMENT REVISIONS						

 	PROJECT		Standby SRU & Additional Tanks IOCL Paradip Refinery	
	CLIENT		INDIAN OIL CORPORATION LIMITED	
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1. GENERAL

1.1. Scope

This specification covers requirements for the Material Identification of all piping components must be applied from site receiving up to fabrication, erection and final test. by Contractor at site

Contractor to apply the standard traceability and the full traceability (as applicable) to any piping components of the piping class which the components are part of.

This specification establishes the actions to be taken to ensure material Traceability that is the identification of piping materials during any construction phase.

This specification defines:

- the various Traceability methods;
- Traceability instruction work;
- extent of each Traceability;
- roles and responsibilities of personnel involved in Traceability activity.

1.2. Fields of application

This specification must be applied at material receiving and storage in the site warehouse and during site/shop piping prefabrication and erection activity.

This specification is applied to:

- piping loose component;
- piping shop fabricated and field erected;
- piping wholly field fabricated and erected.

The following steps of piping traceability are included:

- receiving at site/shop;
- storage;
- registration;
- identification;
- marking;
- inspection;
- coordination of staff involved and certification request;
- certification records.

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1.3. Exclusions

- 1.3.1. Traceability, among NDE/Heat Treatment records, joints, Isometric drawings, and welders is excluded from this specification.

These activities shall be coordinated and recorded according to the following:

- Job Construction Specification for Welders Management 080557C-000-PP-821

- 1.3.2. No metallic piping components are excluded from this specification.

2. REFERENCE

2.1. Documents

The following documents are correlated with following documents:

- Piping Construction Quality Control Plans
- Specification for Site Coordination & Communication 080557C-000-PP-805
- Job Specification for Material Receiving, Inspection, Handling Storage & Preservation 080557C-000-PP-807
- Specification for Positive Material Identification 080557C-000-PP-804
- Specification for colour Coding of piping materials By Vendors 080557C-000-SP-1390-009

All other documents referenced in this specification shall be applicable.

3. DEFINITIONS

3.1. Traceability

Traceability means a correct identification of original materials and material composition during construction phases and in particular after installation, using “stamping, etching and stencilling” as methods of implementation.

TARGET: Measures intended to prevent the installation of incorrect materials during construction and piping assembling of plant.

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Traceability can be implemented using:

3.1.1. Colour code: STANDARD TRACEABILITY

Colour code, fixed by Engineering, is used only for an easy identification to permit a quick material handling/segregation and visual check/monitoring during construction phases.

3.1.2. Identification code: STANDARD TRACEABILITY

Identification code, fixed by Engineering, is used to establish a correspondence between each piping component and the ISO's bill of material.

This code permits a full material tracking during the all phases:

- Engineering: ISO's bill of material and take-off
- Procurement: material requisitioning/P.O.
- Shipping: Inspection, Shipping release notes and packing list,
- Construction:
 - Warehousing: receiving inspection, segregation and storage, software material management input data and delivery voucher to site.
 - Piping engineering: ISO's prefabrication analysis
 - Erection: piping component tracking versus ISO's drawing.

3.1.3. Tracking code: (TOTAL) FULL TRACEABILITY

Tracking code ensures the identification of installed material by means of the twofold correlation of the heat number and related Material Test Report (MTR) issued by the Manufacturer.

3.1.4. PMI: POSITIVE MATERIAL IDENTIFICATION

PMI ensures a correct installation of materials/weld deposit throughout chemical verification, at any construction phases, of distinctive (s) component (s) of requested alloy steel.

3.2. Definition of the Party

Wherever used in this procedure, the following words shall have the meaning as given hereunder

“OWNER or IOCL or CLIENT” shall mean INDIAN OIL CORPORATION LIMITED

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“CONSULTANT or PMC” shall mean TECHNIP INDIA LIMITED

“CONTRACTOR” shall mean the bidder selected by the OWNER for performing the scope of works specified in the Tender documents.

“AUTHORISED REPRESENTATIVE” shall mean OWNER’s/CONSULTANT’s representative authorized to act for and on behalf of OWNER/CONSULTANT, as the case may be

“VENDOR” shall mean any third party supplying any of the equipment/materials for setting up the Plant.

“PROJECT” shall mean Sulphur Recovery Unit and Additional Tanks Project, Paradip Refinery

“PLANT” shall mean the units and facilities comprised in the project, and if divided into different packages for the award of Contracts.

“UNIT” shall mean a particular process unit etc. which forms a distinct operating system and a part of the plant.

"WORKS" means and includes any and all works and services undertaken by the CONTRACTOR.

"MATERIALS" means equipment, materials, chemicals, spare parts, tools etc. to be provided by the CONTRACTOR in accordance with the CONTRACT, which are for incorporation into the Temporary or Permanent Works.

“SUB-CONTRACTOR” shall mean Sub-Contractor engaged by CONTRACTOR

4. **KICK OFF MEETING**

CONTRACTOR QC Manager and CONSULTANT QC Manager/Personnel shall define and agree working details/instructions to implement this Traceability procedure during a dedicate Kick Off Meeting, before starting of shop/field activities.

5. **STANDARD TRACEABILITY** (Colour and identification code)

5.1. **Fields of application**

Standard Traceability is applied to all piping components.

Standard Traceability is applied/checked during:

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- warehousing
- piping prefabrication;
- piping erection.

The colour coding established for the identification of piping components is mentioned below :

5.2. Colour Coding

The colour code shall be used for material identification. Color coding is intended to supplement standard marking required by ASME, MSS, ASTM, API or other codes and/or specifications. The colour code shall be marked at **Manufacture shop itself**. The main purpose of color coding is to simplify identification of piping elements during storage and after the pipe has been cut for fabrication or returned to stock.

All pieces shall be marked with a stripe of water-proof paint / ink in accordance with the colour code specification. The painted stripe shall be executed as per the relevant detailed supply specification for each piping component category.

Surfaces to be color coded shall be clean, dry and free from oil, grease, rust, scale and other foreign matter. The surface preparation shall be according to manufacturer's paint. Colour coding paint shall not be applied to any machined surface, including welded surfaces, weld bevels, etc., nor on any surface intended for welding.

The paint or ink used for austenitic stainless steel or nickel alloy steel shall not contain any chlorides, nor shall it contain zinc, lead, halogens or other harmful metal or metal salts that may cause a corrosive attack.

One or more stripes of water-proof paint, shall be provided according to the Specification Specification for Color Coding of Piping **Materials 080557C-000-SP-1390-009**

5.3. Identification

Correct identification of material/spool shall be implemented by color coding and/or tagging such as clarified in this table:

IDENTIFICATION TABLE - 5.3.1.

Description	Identification			
	Color code	Tagging codes		
		Identification code ⁽⁵⁾	Material ⁽⁶⁾ Specification	Spool numbering ⁽⁷⁾
Material typology ⁽¹⁾		x	x	
Material dimensions ⁽²⁾		x		

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Description	Identification			
	Color code	Tagging codes		
		Identification code ⁽⁵⁾	Material ⁽⁶⁾ Specification	Spool numbering ⁽⁷⁾
Material grade/std ⁽³⁾	x	x	x	
Material supply status ⁽⁴⁾	x	x	x	
Fabricated spool				x

Notes:

- 1) Pipe, elbow,
- 2) Diameter/thickness
- 3) API 5L Gr B, A53 Gr B,
- 4) Seamless, welded, normalized,
- 5) As defined in Contractor Software
- 6) As defined by applicable ASTM, API, etc.
- 7) As agreed by CONTRACTOR & CONSULTANT.

5.3.1. Warehouse Reception

- Prior to accepting the material, the warehouseman shall check the type and quantity of materials against the packing list and the purchase order.
- Warehouseman shall restore identification colour coding or tagging at site when this is not properly applied or damaged during shipping.

Note: The identification code is usually marked by Manufacture (Contractor has to provide this color code requirement to the Vendor during ordering) .

The warehouseman is responsible for marking the identification code during material acceptance before delivering the same to the piping fabrication

- Materials which cannot be identified shall be stored in a separate “QUARANTINE AREA” and shall be properly identified by the sign “HOLD”.
- Quarantined material may not be utilized as plant erecting material.

5.3.2. Marking

When the warehouse staff or CONTRACTOR'S personnel should restore or apply the identification on piping components, the following methods shall be used:

- “Low stress” punch.
- Paint markers, with insoluble water ink that will not attack or harmfully affect the material at ambient or elevated temperature. Ink shall be free from halogen (bromine, chlorine, fluorine, iodine), lead, sulphur, zinc, cadmium, mercury or other harmful compounds.

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- Punched metal sheet labels fastened with an adequate wire on piping.
- Note:** This method is advisable only for temporary use or for special materials

Marks shall be applied in the following locations:

- pipe: 75mm from one end of the outer surface
- welds: adjacent to the welder's identification marker on the weld.
- fittings, forging, or casting: adjacent to the Manufacturer's marking.

5.3.3. Preservation

Color and identification codes shall be maintained on loose materials and or spools during all fabrication/erection activities, including shot-blasting and priming.

Fabrication activities requiring preservation of identification are:

- cutting
- furnace Post Weld Heat Treatment (PWHT)
- shot blasting and priming

Raw Loose components to be primed

Straight pipes and piping components, with the bevelled ends, shot blasted and primed before fabrication/erection should have their ends, 50 mm at least, protected by tape to avoid any contamination during welding.

CONTRACTOR first of all shall provide to keep full identifications as follow:

- transcribing with paint marker (see point 5.3.2) into the inner part of piping the identification code, and applying a short line with color code (when possible);
- punching the identification code (see point 5.3.2) and applying a short line with color code directly onto the end of piping component and protecting it with adhesive tape;
- using metal labels fastened to the piping part;
- using metal labels tack welded to the piping part. This operation must be authorized by SITE MANAGEMENT.

After primer application CONTRACTOR will restore the identification code and color code.

Prefabricated Spools to be primed

The CONTRACTOR, in charge of piping prefabrication, will take care to keep the identification of spools during the various fabrication phases, as follows:

- Before cutting the pipe (or elbow), the CONTRACTOR will identify each loose part by marking the identification code as per point 5.3.2;

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- After welding each pre-fabricated spool will be identified by the isometric number and a sequential number. The identification will be applied, when possible, with adequate marker and circled, to be more clear, with the same marker;
- The identification of spools to be shot blasted and primed shall be transferred by marking on one end of the spool according to point 5.3.2 and protected by tape. After spool priming primary identification will be restored;
- Other methods may be submitted by CONTRACTOR to CONSULTANT/OWNER for approval;
- Moreover the CONTRACTOR shall protect the bevels with appropriate masking tape before applying the primer.

6. **FULL TRACEABILITY (As applicable)** (Tracking code)

6.1. **Scope**

The scope of Full Traceability is to identify installed material by means of the twofold correlation of the Heat Number and related Material Test Report (MTR) issued by the manufacturer

Full Traceability is performed in addition to standard Traceability and does not replace PMI

6.2. **Fields of Application**

In order to avoid possible mistakes of appraisal and/or interpretation the Full Traceability will be applied to all piping lines with a diameter $\geq 2''$.

The piping lines with a diameter $\leq 1\frac{1}{2}''$ shall be traced by the standard method.

Full Traceability is not applied to the following accessory components: bolting, gaskets, temporary strainers, etc.

These components shall be traced by the standard method.

6.3. **File Number**

6.3.1. **File Number Scope**

The File Number scope is to quickly find in the material certificate archives the Material Test Reports of each material Heat Number relevant to piping materials utilized in the Plant.

6.3.2. **File Number Assignment**

The warehouse team shall assign to each Material Test Report a File Number that univocally identifies the component with Heat Number, Material Test Report, material

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description/dimension, Identification Code and not mandatory but preferable if also MR/PO/Packing List number and supplier name will be mentioned.

The warehouse team will fill the above information in the suggested Form QC22 and will write on the Material Test Report (MTR) the assigned File Number (FN).

Note: If same MTR makes reference to different materials (description or dimensions) different FN for the same certificate shall be assigned for each different material.

As many copies of the MTR should be provided and positioned into the binder, according to FN sequence, as different FN arising for each MTR.

The File Number is a 4-digit number XXYY, in which:

XX = the number of the binder containing the MTR.

YY = the MTR position inside the binder.

6.4. Warehouse Reception

In addition to checking the type and quantity of materials against the packing list and purchase order and prior to accepting the material, the warehouse team shall immediately verify that the MTR matches the Heat Number marked on the pieces.

Materials which cannot be identified by its Heat Number and/or MTR shall be stored in a separate "QUARENTINE AREA" and shall be properly identified and segregated with "HOLD" tag.

Such material shall not be utilized as Plant erecting material.

6.4.1 Marking

Accepted materials shall be stored in warehouse areas only after the warehouse team has checked the Heat Number marking on each loose component.

6.5. Material Delivery

The material as per point 6.4.1 can be delivered to the Site for fabrications.

6.6. Heat Number Preservation

Full Traceability shall be maintained throughout all work phases. Suitable measures shall be taken for the purpose.

The following activities make to lose the Traceability:

- cutting;

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- heat treatment;
- shot-blasting and painting.

Before cutting, the Heat Number - which makes the material traceable - shall be indicated on the portion where it is lacking. Scrap shall be kept separate and traceable by transcribing or punching the Heat Number on them.

Prior to local heat treatment, the Heat Number shall be repeated on an area away from the heat.

Before shot-blasting and priming pipes or loose material, the Heat Number can be preserved through the technique reported in point 5.3.3

Before shot-blasting and priming complete spools, or before heat treatment in furnace, the Heat Number shall be transferred on the (attached) Form W10 produced for each isometric.

6.7. Heat Number Transfer on Site

Prior to the pressure test of any test circuit, the Heat Number marked on loose components, erected directly on site, shall be transferred on Form W10 produced for each isometric.

Any modification to the isometric sketch after pressure test shall be performed using traceable material.

The W10 Form shall also be revised.

6.8. Conversion of Heat Number to File Number on W10 Form

As specified in point 6.6. & 6.7. the Heat Number is recorded in W10 Form therefore by QC22 Form , which include both information Heat Number and relevant File Number, is possible the conversion from Heat Number to File Number on W10 Form.

Remarks:

- The filled W10 Forms and relevant isometrics with welded identified joints, utilized as welding/materials map, will allow the Full Traceability of welding NDE/Materials for installed piping lines.
- W10 Form will be prepared by electronic sheet; it will be possible to split W10 Form in two sections: W10/1 for NDE Traceability and W10/2 for Material Traceability.

In this case CONTRACTOR shall propose new Forms for CONSULTANT examination and approval.

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7. POSITIVE MATERIAL IDENTIFICATION (PMI)

7.1. Scope

PMI checks a correct installation of materials/weld deposit throughout chemical verification of distinctive component(s).

PMI is not a substitute for Material Test Reports, nor vice versa.

PMI does not replace “Standard Traceability” or “Full Traceability”.

7.2. Report

At the end of each inspection, a report shall be issued, signed by the attending inspectors on attached Form QC 21.

Reports Traceability and filing shall be assured according to the following:

- Welding/piping: PMI inspection report (QC21) of welds and base metal shall be recorded on Form W10 (NDE/PWHT/HT/PMI and material traceability summary) and filed for progressive number;
- Instrument: PMI inspection report of instrument shall be filed separately from piping and welding reports;
- Filler metal: PMI inspection report of filler metal shall be filed for progressive number together with welding reports;
- Others: PMI inspection report shall be filed for progressive number together with Piping reports.

8. ATTACHMENTS

ATT. 1 – QCF QC22 – FILE NUMBER RECORD

ATT. 2 – QCF W10 – NDE / PWHT / HT / PMI AND MATERIAL TRACEABILITY SUMMARY

ATT. 3 – QCF QC21 – PMI REPORT



COMPANY:

QC 22

SH. ____ OF ____



QC 22 N° _____

[illegible]

TECHNIP INDIA LIMITED

					PROJECT:														
					COMPANY:														
QUALITY CONTROL FORM W 10					PROJ. No.:			QCF REV. 0			SH. ____ OF ____								
NDE / PWHT / HT / PMI AND MATERIAL TRACEABILITY SUMMARY					CONTRACTOR:					W 10 N° (SEE ISO N°)									
ISO N° _____		SH. ____ OF ____		NDE (Ref to W 09) _____			HEAT TREAT. REQUIR.			Y <input type="checkbox"/> N <input type="checkbox"/>									
PIPING CLASS _____		MATERIAL _____			PMI _____			Y <input type="checkbox"/> N <input type="checkbox"/>											
LEGEND <div style="display: flex; justify-content: space-between;"> <div> RTR = RADIOG. REPORT N° UTR = UT REPORT N° REP = REPAIR REPORT N° </div> <div> PTR = PT REPORT N° MTR = MT REPORT N° </div> <div> (1) B = BUTTWELD; S = SOCKET WELD; EW = EXTERNAL WELD (2) P = PREBRICATION; E = ERECTION (3) A = ACCEPTED; R = TO BE REPAIRED; C = TO BE CUT; CM = CUT TO MODIFY </div> </div>																			
JOINTS			BASE MATERIAL TRACEABILITY				PMI	WELDER IDENTIF.	WPS N°	CONTROL AND EVALUATION CERTIFICATION									
N°	Type (1)	P/E (2)	HEAT NUMBER	MANUFACTURER	IDENT CODE	SHORT DESCR.	REPORT N°			VISUAL (3)	RADIOGRAPHIC / ULTRASONIC TEST			PT / MT			PMI	PWHT	HT
1																			
2																			
3																			
4																			
5																			
6																			
7																			
8																			
9																			
10																			
11																			
12																			
13																			
14																			

INSPECTORS		CONTRACTOR		PMC		OWNER			
PHASE		PREFA.	ERECT.	PREFA.	ERECT.	PREFA.	ERECT.	PREFA.	ERECT.
NAME									
SIGNATURE									
DATE									

 		PROJECT:																			
		COMPANY:																			
QUALITY CONTROL FORM		QC 21		PROJ. No.:					SH. 1 OF__												
POSITIVE MATERIAL IDENTIFICATION REPORT				CONTRACTOR:																	
PMI CARRIED OUT:				SHOP		<input type="checkbox"/>		FIELD		<input type="checkbox"/>		BEFORE INSTALLATION		<input type="checkbox"/>		AFTER INSTALLATION		<input type="checkbox"/>			
EQUIPMENT:				ITEM DESCRIPTION																	
PIPING COMPONENT:				SUPPLIER:																	
				MR/PO:							REV:										
LINE/DRAWING Nr:				PIPING SUPPORT:																	
FILLER METAL:				Ø							AWS:										
ALLOY ELEMENTS TO BE CHECKED:																					
PMI EQUIPMENT:				{																	
				ANALYTICAL LABORATORY METHODS:																	
CALIBRATION:				YES		<input type="checkbox"/>		NO		<input type="checkbox"/>											
SAMPLING:				10%		<input type="checkbox"/>		100%		<input type="checkbox"/>		___%		<input type="checkbox"/>							
ITEM TO BE TESTED		IDENT CODE		ALLOY ELEMENTS														DATE & INITIALS			
				Cr	Ni	Mo	Cb/Nb	Ti	V	Cu	Al	C	Co	W	FE						
TEST RESULT:				ACCEPTABLE		<input type="checkbox"/>		REMARKS:													
				NOT ACCEPTABLE		<input type="checkbox"/>															
INSPECTORS		CONTRACTOR		PMC		OWNER															
NAME																					
SIGNATURE																					
DATE																					



COMPANY:

SH. 2 OF ____

CONTRACTOR:



TEST RESULT:

ACCEPTABLE ☐





NOT ACCEPTABLE ☐

REMARKS:

TECHNIP INDIA LIMITED

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SPECIFICATION FOR PICKLING AND PASSIVATION OF STAINLESS STEEL SURFACES

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0	27.11.2019	ISSUED FOR IMPLEMENTATION	TB	GM	LA	JMC
REV.	DATE	STATUS	WRITTEN BY	CHECKED BY	APPROVED BY	AUTHOR. BY

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1. INTRODUCTION:

INDIAN OIL CORPORATION LIMITED (IOCL) has awarded Fax of Acceptance (FOA) dated 29th August 2019 to M/s. Technip India Limited (TPIL) for Consultancy services (PMC/EPCM services) for overall project management, FEED Review / FEED, Detailed Engineering, Procurement & expediting services, Tendering & award, Construction Management & Supervision, Assistance in start-up, Commissioning & performance test runs for installation of a Standby SRU of 525 TPD capacity and execution of Additional tanks for Paradip Refinery, Odisha, India.

2. DEFINITIONS:

2.1 Wherever used in this procedure, the following words shall have the meaning as given hereunder

“**OWNER** or **IOC** or **IOCL** or **Client**” shall mean INDIAN OIL CORPORATION LIMITED

“**CONSULTANT** or **PMC**” shall mean TECHNIP INDIA LIMITED.

“**CONTRACTOR**” shall mean the bidder selected by the OWNER for performing the scope of works specified in the bid documents.

“**AUTHORISED REPRESENTATIVE**” shall mean OWNER's/PMC's representative authorized to act for and on behalf of OWNER/PMC, as the case may be.

“**VENDOR/SUPPLIER**” shall mean any third party selected by either the OWNER or CONTRACTOR for supplying any of the equipment/materials for the Unit specified in the bid documents.



“**SUBVENDOR/SUBSUPPLIER**” shall mean any party on whom Vendor/Supplier suborders materials and items and whose role is defined in Quality Control Plans.

“**PROJECT**” shall mean Sulphur Recovery Unit and Additional Tanks Project, Paradip Refinery

“**UNIT**” shall mean the totality of the units and facilities comprised in the Scope of work, which forms a distinct operating system.

2.2 ABBREVIATIONS

- a. ITP: Inspection and Test Plan
- b. QA/QC: Quality Assurance / Quality Control

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- c. FQCP: Fabrication Quality Control Plan
- d. TPIA: Third Party Inspection Agency

2.3 **REFERENCE STANDARD**

ASTM A380 - Standard Practice for Cleaning, Descaling, and Passivation of Stainless Steel Parts, Equipment, and Systems

3 **PURPOSE:**

This document describes the Inspection Methodology to be used for inspection of equipment and materials to be supplied for the project to comply with the specifications and Quality Standards laid down in the Tender / Contract. This document details the Inspection Methodology to be adopted for ensuring the quality of the equipment and materials being supplied and defining the roles of various agencies involved and the quality system to be adhered to.

4 **SCOPE:**

Scope of this specification is to give main instructions for pickling and passivation of 300 and 400 series stainless steel surfaces. The specific equipment/piping surfaces and weld joints to be cleaned shall be given in other technical documents.

Head shell forming for vessels shall be guided by a proper procedure, to be submitted by Vendor / Fabricator for Contractor review. The procedure shall indicate how to avoid iron contamination during various stages of fabrication of Vessel.

The Vendor shall deliver a proper procedure for cleaning, pickling and passivation for approval. The procedure shall contain a detailed description of product used, temperatures, duration, safety requirements, etc.



WARNING:

**The test solution and contaminated water can be dangerous to personnel health.
The national regulations concerning dispose industrial dangerous refuse must be respected**

5. **INITIAL SURFACES CONDITION**

All surfaces shall be free from dust, dirt, weld slag etc.

For this purpose, only nylon brushes and stainless tools have to be used. After cleaning, the surfaces shall be washed with clean water.

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6 **OPERATING PRECAUTION**

Adequate precautions relevant to handling of the test solution shall be adopted.

Great care shall be taken in handling hydrofluoric acid, although the actual pickling solutions or pastes are relatively mild. It is essential that the manufacturer's instructions be followed implicitly as burns due to contact with acid may be apparent only after several hours.

Proper personnel protection including face shields, rubber gloves and rubber protective clothing must be provided.

Adequate ventilation and strict personnel access controls must be maintained in areas where such chemicals are being used.

7 **PICKLING**



7.1 All surfaces must be degreased before acid pickling.

Typical cleaning agents which may be used are organic solvents or paint remover (the same solvent approved for cleaning before liquid penetrant examination).

Wash surface with water to remove any residual organic solvent.

7.2 The composition of pickling/passivation solution shall be as per recommendation of ASTM A380

- PICKLE/PASSIVATION PASTES OR JELLS: These are typically proprietary mixture from a supplier and are material specific for the purpose of oxidation removal and shall contain no halogens. Thus, specific pastes should be selected for different materials and the specific manufactures directions followed. Pickling and passivation using pastes or Jells shall only be carried out on the outside of equipment, pipelines, pipes etc. Any residuals of such pastes shall be removed after cleaning by washing with copious quantities of fresh water

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- 7.3 The temperature during the pickling action shall be within 15°C to 30°C, or as per the Manufacturer's recommendation.

Typically, the lower the cleaning temperature the greater shall be the concentration of pickling agent.

- 7.4 The contact time necessary to obtain the desired surface is solution and temperature dependent, but typically between 5 to 30 minutes: Manufacturer's recommendations should be followed. To prevent over pickling, a previous test shall be made to establish the correct procedures for the specific application.

8 **RINSING**

On pickling completion, all the surfaces must be brushed with hot water. The "pH value" of final rinsing water shall be between 6 and 8 (max. Chloride level 50 ppm); manufacturer's recommendation can be followed if necessary.

Note: To minimize staining, surface must not be permitted to dry between successive steps of the pickling and rinsing procedure.

9 **DRYING**

After rinsing, all surfaces shall be dried in open air or with blower and by means of cleaned and dried clothes.





10 **EXAMINATIONS**

Complete area shall be inspected for any visible contamination using proper illumination. All the surface shall be shiny and free of scales. Weld Joint locations shall be free of oxides and any discoloration

"Spot-Testing" for iron contamination shall be performed when there are doubts on cleanliness, using a documented Feroxyl Test as per ASTM A380. Areas to be tested shall be determined by the Engineer-in charge/Appointed Inspector. Successful completion of testing shall also be approved by the Engineer-in charge/Appointed Inspector.

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STANDARD SPECIFICATION FOR POSITIVE MATERIAL IDENTIFICATION AT CONSTRUCTION SITES

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0	16.10.2019	ISSUED FOR INFORMATION	NVK	PKP	LA	JMC
REV	DATE	STATUS	WRITTEN BY	CHECKED BY	APPROVED BY	AUTHOR. BY

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1 SCOPE

- 1.1 This specification applies to metallic alloy materials as well as carbon steel materials as defined in this document used in piping, heater coils, storage tanks, vessels etc. at construction sites. Positive Material Identification (PMI) is to be carried out on Owner supplied material as well on materials purchased by the contractor after installation (before testing). PMI may be carried out at the ware house also for identification /segregation of materials as per instruction of Engineer in Charge

Any deviation from this specification must be approved by Owner/ PMC in the prescribed format.

2 DEFINITIONS

For this specification, the following definitions are applicable:

“OWNER or IOC or IOCL or Client” shall mean INDIAN OIL CORPORATION LIMITED

“CONSULTANT or PMC” shall mean TECHNIP INDIA LIMITED.

“CONTRACTOR” shall mean the bidder selected by the OWNER for performing the scope of works specified in the bid documents.

“AUTHORISED REPRESENTATIVE” shall mean OWNER's/CONSULTANT's representative authorized to act for and on behalf of OWNER/CONSULTANT, as the case may be

“VENDOR” shall mean any third party selected by either the OWNER or CONTRACTOR for supplying any of the equipment/materials for the Unit specified in the bid documents.

“PROJECT” shall mean Sulphur Recovery Unit and Additional Tanks Project, Paradip Refinery

“UNIT” shall mean the totality of the units and facilities comprised in the Scope of work, which forms a distinct operating system.

“TPIA” shall mean Third Party Inspection Agency

Abbreviations:

API : American Petroleum Institute

ASM : American Society for Metals

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	CLIENT	INDIAN OIL CORPORATION LIMITED		
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ASME	:	American Society of Mechanical Engineers
ASTM	:	American Society for Testing and Materials
ITP	:	Inspection Test Plan
PMI	:	Positive Material Identification
RTJ	:	Ring Type Joint
TPI / TPIA	:	Third Party Inspection /Third Party Inspection Agency Carbon Steel
CS	:	Carbon Steel
AS	:	Alloy Steel
SS	:	Stainless Steel

2.1 Positive Material Identification (PMI)

The term Positive Material Identification (PMI) refers primarily for determination/ verification of alloy type or its composition using portable or mobile spectrometer/ alloy analyzer. For the purpose of this specification, some carbon steel materials as defined in clause no 3.1.9 in this document are also included for PMI checking to avoid mix up with Alloy steel during installation.

Chemical spot checking, resistivity testing, eddy current testing, electromagnetic alloy sorting, thermoelectric testing shall not be considered as PMI for this specification.

3 SPECIFIC APPLICABILITY

3.1 The following items (AS/SS from clause 3.1.1 up to 3.1.10 and CS at clause 3.1.11) require PMI unless specifically exempted through a Concession/ Deviation permit by OWNER/CONSULTANT

3.1.1 All pressure containing piping components including, thermowells instrument manifolds, RTJ gaskets, Spiral Wound gaskets other than carbon steel, fasteners etc. All valves installed on line.

3.1.2 Tubular products used in the fabrication of heaters.

3.1.3 Pressure - containing instrument housings (e.g. gauge glass housings, orifice meter tubes).

3.1.4 Internal metallic linings/cladding, and weld overlay, done at site, used for protection against corrosive environments.

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3.1.5 Tubing

3.1.6 Stud, bolts & nuts and anchors used to hold refractory materials.

3.1.7 Plates

3.1.8 All pressure containing welds.

3.1.9 Pipe supports (welded/ bolted) such as pads, saddles, dummy pipes etc.

3.1.10 Any other components or materials specifically designated for PMI on the purchase order/ contract.

3.1.11 a) Pressure containing CS piping components of rating 900# and above

b) Pressure containing CS steel piping items under Hydrogen service.

c) Pressure Containing CS Piping where substitution of hardenable alloy materials in carbon steel piping systems may result to failure and loss of containment in process services like wet hydrogen sulfide (H₂S), hydrofluoric acid (HF), sulfuric acid (H₂SO₄) services etc.

3.2 Exclusions

The following items are exempted unless specifically designated for PMI in the purchase order/contract:

3.2.1 Internal instrument parts.

3.2.2 Internal machinery parts.

3.2.3 Internal non-pressure - containing baffles, trays, tray clips, supports, pall-rings, support rings, etc.

3.2.4 Electrical components.

3.2.5 Internal valve components.

3.2.6 Compression-type ferrules and fittings for use with 3/4 inch (19mm) outside diameter and smaller tubing.

3.2.7 All carbon steel piping components (including carbon steel pipe supports) other than those

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specified at 3. 1.11

3.2.8 All carbon steel Studs/ bolts/ nuts.

3.2.9 Carbon Steel Plates.

4 REFERENCES

American Society of Mechanical Engineers (ASME) BPV Code Section-II Part A, B and C.

ASME B 31 .3

American Society for Testing and Materials (ASTM): As applicable

Material Verification Program for New and Existing Alloy Piping Systems: API RP 578 Any other material specification referenced by the Purchase Order/Contract.

Any other applicable BIS / ISO /EN / BS material Standard /Specification.

5 GENERAL REQUIREMENTS

- 5.1** The test methods outlined in this specification are intended to identify the nominal composition of alloy/ Stainless steel materials. These test methods are not intended to establish the conformance of a material to a particular specification.
- 5.2** PMI shall not be considered as a substitute for required mill test reports listing chemical composition. In addition, mill test reports shall not be considered as confirming alloy/ composition verification.
- 5.3** The PMI activity shall be included in the overall quality plan and Inspection & Test Plan for fabrication/ erection. The contractor shall submit to OWNER/CONSULTANT, a procedure for PMI to comply with the requirements of this specification. Approval of PMI procedure shall be obtained from OWNER/CONSULTANT prior to commencement of fabrication/ erection as the case may be.
- 5.4** Contractor shall engage reputed TPIA specified in the contract to witness inspection at site and accordingly submit ITP for review of owner/ PMC. In case list of approved TPIA is not available in contract, prior approval shall be taken before engagement of TPIA.
- 5.5** A copy of PMI records duly verified by TPIA shall be submitted to Owner/PMC .

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5.6 After installation, but prior to hydrostatic testing/painting/insulation, the contractor shall examine all components requiring PMI for proper compliance to this specification. A record of this final check duly endorsed by TPIA, as specified below, shall be submitted to OWNER/CONSULTANT and made part of the permanent inspection records.

5.7 Owner Supplied Material If any

Records signed by contractor and duly verified by TPIA (engaged by contractor)/ and reviewed by OWNER/CONSULTANT shall be generated as part of the receiving inspection at warehouse.

5.8 Contractor Supplied Material

Records signed by contractor and certified by an approved TPIA and reviewed by OWNER/CONSULTANT.

5.9 After acceptance, all components shall be marked with a suitable and readily visible paint mark. These markings are in addition to markings/color coding required by other codes/specifications/Technical Notes.

5.10 Controls shall be established to keep the non-conforming items identified till proper resolution of non-conformity.

5.11 OWNER/CONSULTANT shall have the right to witness the performance of any PMI test.

6 EXTENT OF PMI

6.1 PMI shall be done on each component (100 percent PMI inspection) including welds (Except carbon steel Piping welds), unless specifically exempted by OWNER/CONSULTANT.

6.2 PMI shall be done on pipe supports (welded/ bolted) such as pads, saddles, dummy pipes etc. (100 percent PMI inspection) in all piping systems of alloy material.

6.3 PMI shall be done on all bolts and nuts (100 percent PMI inspection) of flange joints in all piping systems of alloy material.

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7 PMI OF PIPING AND HEATER COIL COMPONENTS

PMI testing (irrespective of PMI done at earlier stages) shall be carried out when piping loops/ heater coils have been cleared for hydrostatic testing by OWNER/CONSULTANT. Hydrostatic Testing shall be carried out only when non- conforming components have been replaced with conforming components and subsequent Non- Destructive Testing, Post Weld Heat-Treatment, Hardness checking and re- verification by PMI etc., as required by specifications have been completed. PMI records shall form a part of piping /heater inspection records. Contractor shall demonstrate to PMC that each & every component of the piping system and heater coils has been subjected to PMI by providing line wise records of PMI duly endorsed by TPIA.

8 TESTING METHODOLOGY

- 8.1 The method used for PMI examination shall provide a quantitative determination of the alloying elements like chromium, nickel, molybdenum or vanadium in alloy steel items for the characteristic elements specified in clause 9.0
- 8.2 Instruments or methods used for PMI examination shall be able to provide quantitative, recordable, elemental composition results for positive identification of elements.
- 8.3 The acceptable instruments for alloy analyzer shall be either "portable X-ray Fluorescence" or optical Emission type each capable of verifying the percentage of elements within specified range. The instruments must have the printout facility and sensitivity to detect the elements in the specified range.
- 8.4 Chemical spot testing, magnets, alloy sorters and other methods using eddy current or triboelectric testing methods are not acceptable for PMI examination.
- 8.5 All PMI instruments shall have been serviced within a 6 month period of the time of use to verify the suitability of batteries, sources, etc, and the date of the last service shall be stated on the PMI report form.
- 8.6 The surfaces to be examined shall be prepared and cleaned by suitable means before PMI so that surface be free from grease, oil, paint or oxides. Testing shall be done after proper surface cleaning and other requirements as outlined by the manufacturer of the portable alloy analyzer. Modification, if any, of these procedures must be approved by OWNER/CONSULTANT.
- 8.7 Ring type joint gaskets shall be inspected by using portable X-ray fluorescence instrument.

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9 CHARACTERISTIC ELEMENTS

ALLOY	Cr	Ni	Mo	Cb	Ti	Cu	Al	C	Co	W	Fe
1¼ Cr - ½ Mo	x		x								
2¼ Cr -1 Mo	x		x								
5 Cr - ½ Mo	x		x								
9 Cr - 1 Mo	x		x								
304	x	x									
304L	x	x						x*			
304H	x	x						x*			
310	x	x									
316	x	x	x								
316L	x	x	x					x*			
317	x	x	x								
317L	x	x	x					x*			
321	x	x			x			x*			
321H	x	x			x			x*			
347	x	x		x				x*			
347 H	x	x		x							
405	x				x		x				
410	x				x						
410S	x				x			x*			
430	x				x						
Alloy 20	x	x	x	x		x					
Hast C-276	x	x	x							x	
Alloy 600	x	x									
Alloy 601	x	x					x				
Alloy 625	x	x	x	x							
Alloy 800/800H	x	x				x		x*			
Alloy 825	x	x	x		x						
Monel 400		x				x					
9 Ni/3.5 Ni		x									
70/30 CuNi		x				x					
90/10 CuNi		x				x					
Duplex Stainless steel	x	x	x								

*Testing of C is only required when in the Plant exists the same type of material but with L/H carbon content

- 9.1** Carbon Steel materials under clause no 3.1.11 shall be checked to confirm that no mix up has taken place with alloy steel Components.
- 9.2** Characteristic elements for materials not listed above shall be proposed by the Contractor for approval of the OWNER/CONSULTANT

10 CALIBRATION

- 10.1** Instruments used for PMI shall have the sensitivity to detect the alloying elements in the specified

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ranges. Instruments or methods used for examination shall be of the type that will provide quantitative, recordable, elemental composition results for positive identification of the alloy elements present.

- 10.2** Each alloy analyzer shall be calibrated using known alloy standards for intended materials to be checked by PMI. A calibration certification from the Manufacturer or his authorized agency shall be submitted to OWNER/CONSULTANT for records.
- 10.3** PMC/ Owner shall review the procedure and qualification and witness sample alloy/ carbon steel materials verification tests to confirm that the procedures, equipment and personnel are capable of providing consistent and accurate results. Certified samples, with full traceability, of a known alloy materials/ carbon steel materials shall be available for use as a random spot checking on instrument calibration.

11 SITE VERIFICATION OF ANALYZER

Verification using Standard samples supplied by institutes such as ASM (American Society of Metals) for the intended materials type and grade shall be performed each day before using the analyzer. Such verification shall be done again if PMI test is to be performed on different grade or type of material.

12 PERSONNEL QUALIFICATION

The persons performing the PMI test should be knowledgeable about properties of material, all aspects of operation of PMI equipment including the method of testing. Qualification/ experience documents of the person performing the PMI test including his training and experience shall be submitted to OWNER/CONSULTANT for review and approval.

13 ACCEPTANCE CRITERIA

13.1 Base Metal

PMI test results showing presence of characteristic elements up to 8% less than the minimum specified value in the material specification and up to 8% more than the maximum specified value in the material specification shall be acceptable.

13.2 Deposited Weld Metal

For deposited weld metal between base metals of the same specification using matching consumables, the recorded presence of characteristic elements up to 12% less than the minimum

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specified value in the welding consumables specification and up to 12% more than the maximum specified value in the welding consumable specification shall be acceptable.

14 REJECTION CRITERIA

- 14.1** If the PMI test results fall outside the acceptable range as given in 13.0 above, the contractor shall obtain a quantitative check analysis performed by a laboratory acceptable to OWNER/CONSULTANT for a complete chemical analysis. Results of this analysis shall be submitted to OWNER/CONSULTANT, with contractor's recommendation, for final decision.

Decision of OWNER/CONSULTANT shall be final in this regard.

If any material component or weld is found unacceptable, all other represented materials (e.g. in case of fasteners, supports) or welds shall be considered suspect. In such cases, the contractor has the following options:

- 14.2.1** Scrapping all those represented materials or components and replacing with new components or welds.
- 14.2.2** Performing 100% examination of the remainder of the represented materials/ components and replacing each item that fails the PMI check.
- 14.2.3** If the performance of any verification activity is unacceptable to OWNER/CONSULTANT or if any material has been incorrectly identified, continuation of all further tests shall be subject to approval of OWNER/CONSULTANT until the problem is corrected.

15 DOCUMENTATION

- 15.1** PMI report duly verified by PMI agency and Inspection Representative of LSTK Contractor.
- 15.2** PMI report as per format no QC-21 (Attached)
- 15.3** Basis and action for resolving and documenting PMI non-conformances.
- 15.4** Contractor shall demonstrate to OWNER/CONSULTANT that all components requiring PMI have been subjected to PMI testing and accepted.

		PROJECT:		
		COMPANY:		
QUALITY CONTROL FORM QC 21		PROJ. No.:		SH. 1 OF ____
POSITIVE MATERIAL IDENTIFICATION REPORT		CONTRACTOR:		

PMI CARRIED OUT:	SHOP <input type="checkbox"/>	FIELD <input type="checkbox"/>	BEFORE INSTALLATION <input type="checkbox"/>
			AFTER INSTALLATION <input type="checkbox"/>

EQUIPMENT:	_____	ITEM DESCRIPTION	_____
PIPING COMPONENT:	_____	SUPPLIER:	_____
		MR/PO:	_____
		REV:	_____
LINE/DRAWING Nr:	_____	PIPING SUPPORT:	_____
FILLER METAL:	_____ Ø _____	AWS:	_____
ALLOY ELEMENTS TO BE CHECKED: _____			
PMI EQUIPMENT:	_____ :		
	_____ :		
	ANALYTICAL LABORATORY METHODS: _____		
CALIBRATION:	YES <input type="checkbox"/>	NO <input type="checkbox"/>	
SAMPLING:	10% <input type="checkbox"/>	100% <input type="checkbox"/>	____% <input type="checkbox"/>

ITEM TO BE TESTED	IDENT CODE	ALLOY ELEMENTS														DATE & INITIALS
		Cr	Ni	Mo	Cb/Nb	Ti	V	Cu	Al	C	Co	W	FE			

TEST RESULT: ACCEPTABLE <input type="checkbox"/> NOT ACCEPTABLE <input type="checkbox"/>	REMARKS:
--	-----------------

INSPECTORS	CONTRACTOR	TECHNIP	OWNER	
NAME				
SIGNATURE				
DATE				

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WELDING & NDE SPECIFICATION FOR FABRICATION OF PIPING

REV.	DATE	STATUS	WRITTEN BY	CHECKED BY	APPROVED BY	AUTHOR. BY
3	10.03.2020	ISSUED FOR IMPLEMENTATION	TB	GM	GM	JMC
2	04.12.2019	ISSUED FOR IMPLEMENTATION	TB	GM	LA	JMC
1	8.11.2019	ISSUED FOR IMPLEMENTATION	NVK	PKP	LA	JMC
0	16-10-2019	ISSUED FOR INFORMATION	NVK	PKP	LA	JMC

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1. GENERAL

This specification shall be followed for the fabrication of all types to welded joints of piping system within the battery limits of the plant.

The welded pipe joints shall include the following:

- All pipe joints, longitudinal butt welds, circumferential butt welds and socket welds.
- Attachments of forgings, flanges and other supports to pipes.
- Welded manifold headers and other sub-assemblies.
- Welded branch connections with or without reinforcing pads.
- Joints in welded/fabricated piping components.
- The attachments of smaller connections for vents, drain drips and other instrument tapings.

Any approval granted by the Engineer-in-Charge or Owner /PMC's inspector, shall not relieve the CONTRACTOR / VENDOR of his responsibilities and guarantee.

This specification shall not be applicable for welding of pipelines for transportation of liquid petroleum, gas and other similar products in on shore and off shore.

2. ABBREVIATIONS & DEFINITIONS:

“OWNER or IOCL” shall mean INDIAN OIL CORPORATION LIMITED

“CONSULTANT or PMC” shall mean TECHNIP INDIA LIMITED

“CONTRACTOR” shall mean the bidder selected by the OWNER for performing the scope of works specified in the tender documents.

“AUTHORISED REPRESENTATIVE” shall mean OWNER's/ CONSULTANT's representative authorized to act for and on behalf of OWNER/ CONSULTANT, as the case may be

“VENDOR” shall mean any third party supplying any of the equipment/materials for setting up the Plant.

“PROJECT” shall mean Sulphur Recovery Unit and Additional tanks Project, Paradip Refinery

“PLANT” shall mean the units and facilities comprised in the project, and if divided into different packages for the award of Contracts.

“UNIT” shall mean a particular process unit etc. which forms a distinct operating system and a part of the plant.

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“Sub- Contractor” shall mean Sub-Contractor engaged by Contractor

3. APPLICABLE CODES & STANDARDS

All welding work, equipment for welding, heat treatment, other auxiliary functions and the welding personnel shall meet the requirements of the latest editions of the following accepted standards and procedures unless otherwise specified in the Welding Specification Chart and the Technical Notes attached thereof. In the case of conflicting requirements, the requirements mentioned in Welding Specification Chart/Technical Notes shall be applicable.

- a. ASME Code for Pressure Piping ASME B31.3
- b. ASME Code for Power Piping- ASME B31.1
- c. ASME Boiler & Pressure Vessel Code, Sec II Part C, Materials specifications: Welding Rods, Electrodes and Filler metals.
- d. ASME Boiler & Pressure Vessel Code, Section V, Non-destructive examination
- e. ASME Boiler & Pressure Vessel Code, Section VIII, Rules for Construction of Pressure Vessels.
- f. ASME Boiler & Pressure Vessel Code, Section IX, Welding and Brazing Qualifications.
- g. The Indian Boiler Regulations I.B.R.
- h. API 582 - Welding Guidelines for the Chemical, Oil and Gas Industries
- i. ASNT- SNT-TC-1A- Recommended Practice for Nondestructive Testing
- j. ASTM A833- Indentation Hardness of Metallic Materials by Comparison Hardness Testers
- k. ASTM E110- Standard Test Method for Indentation Hardness of Metallic Materials by Portable Hardness Testers.
- l. ASTM E140- Standard Hardness Conversion Tables for Metals
- m. NACE MR0103 - Petroleum, petrochemical and natural gas industries -- Metallic materials resistant to sulfide stress cracking in corrosive petroleum refining environments
- n. NACE SP0472 - Methods and Controls to Prevent In-Service Environmental Cracking of Carbon Steel Weldments in Corrosive Petroleum Refining Environments.

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o. AWS A4.2 - Standard Procedures for Calibrating Magnetic Instruments to Measure the Delta Ferrite Content of Austenitic and Duplex Ferritic-Austenitic Stainless Steel Weld Metal

p. Licensers specifications.

In the event of any differences due to the additional requirements mentioned in this specification, over and above those obligatory as per codes, this specification shall be binding.

4. ORDER OF PRECEDENCE

4.1 In case of conflict between documents, the following order of precedence shall govern:

- Mandatory local regulations and requirements
- Licensor's specifications
- Purchase order, Scope of work and material requisitions, Data sheets
- Project specifications
- Applicable codes and standards

4.2 All exceptions/conflicts to the specifications and purchase specifications, codes, forms and drawings shall be brought to the attention of PMC/Owner in writing and shall requires prior approval before any action is taken by the CONTRACTOR / VENDOR, until a written resolution is issued, most stringent requirements shall apply

5. WELDING PROCEDURE SPECIFICATION (WPS) and PROCEDURE QUALIFICATION RECORD (PQR)

5.1 Welding Procedure Specifications (WPS) and their Procedure Qualification Records (PQR) shall conform to the requirements of ASME Section IX, Licensers requirements and to the requirements of this specification.

5.2 Each WPS shall be identified by a unique number and shall make reference to the applicable piping classes.

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5.3 WPS forms provided by CONTRACTOR / VENDOR shall have complete welding data defines in ASME IX forms QW- 482, and following information are included:

- a. Welding process or processes when more than one is used in making a complete joint.
- b. Parent metal specification and thickness.
- c. Whether shop or field welding.
- d. Joint preparation (sketch).
- e. Cleaning, degreasing, etc.
- f. Welding position (including direction for vertical position).
- g. Brand name, AWS classification and size (diameter) of welding consumables.
- h. Pre-heating and inter pass temperature, including method and control.
- i. Travel speed (automatic welding).
- j. Approximate number and arrangement of runs and weld dimensions (sketch).
- k. Welding sequence.
- l. Back gouging if applicable
- m. Gases, /Shielding/backing to include composition and flow rate.
- n. P.W.H.T. requirements including the detailed cycle of heat treatment, heating rate cooling rate, holding time and temperature.
- o. When welding quenched and tempered steels, steel requiring impact testing, or alloy steels requiring ferrite control, the heat input in conjunction with the maximum inter pass temperatures shall be restricted to the maximum values shown in the supporting PQR. Heat input values shall be specified on WPS and recorded on PQR.
- p. Heat input in Joules / cm =
$$\frac{\text{Amperage} \times \text{Voltage} \times 60}{\text{Travel speed in cm/min}}$$

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5.4 Special requirement for CS with PWHT

Welding Procedure Specification WPS for CS material with PWHT shall include PWHT regardless of construction code requirement. PWHT temperature shall not be less than 620°C (1150°F) and minimum 10 °C preheat temperature should be used for all welding & requires a hardness survey on preproduction welded coupons to be conducted. Test indentations should be taken on the weld deposit, Heat Affected Zone (HAZ) and base metal, in the cap and root of the weld. Welding Procedure Qualification Record (PQR) shall be documented with hardness survey.

Hardness should be limited to the following after PWHT:

- Base metal: 237HBW (22HRC)
- Weld deposit: 200HBW
- Heat Affected Zone: 200 HBW

5.5 Ferrite

When required in paragraph 7.10 of this specification, ferrite content shall be checked and determined by chemical analysis making reference to WRC (Welding Research Council) diagram or by measurement with calibrated magnetic instruments as per AWS A 4.2 or ISO 8249.

6. BASE METAL

In general, use of carbon steel, alloy steel and stainless steel is envisaged. The details of the material specifications are given in the Welding Specification Chart.

The CONTRACTOR / VENDOR shall provide the manufacturer's test certificates for every heat of the materials supplied by him.

7. WELDING CONSUMABLES

7.1 The CONTRACTOR / VENDOR shall provide, at his own expense, all the welding consumables necessary for the execution of the job such as electrodes, filler wires, argon etc. and these should bear the approval of the Engineer-in-Charge.

7.2 The welding electrodes and filler wires supplied by the CONTRACTOR/ VENDOR shall conform to the class specified in the Welding Specification Chart & as per licensors requirement. The materials shall be of the make approved by the Engineer-in-Charge. It

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shall record the minimum test results required for classification of welding consumable as per ASME Section II-part C.

- 7.3 **CONTRACTOR / VENDOR shall submit the list of welding consumable manufacturers for PMC/Client approval. Only PMC/Client approved welding consumable manufacturers shall be used during the entire course of Site construction activities.**
- 7.4 **The CONTRACTOR / VENDOR shall submit batch test certificates, from the electrode manufacturers, giving details of physical and chemical tests carried out by them, for each batch of electrodes to be used.**
- 7.5 All electrodes shall be purchased in sealed containers and stored properly to prevent deterioration. The electrodes removed from the containers shall be kept in baking ovens at temperatures recommended by the electrode manufacturer. "Out of the oven time" of electrodes, before they are consumed, shall not exceed the limits recommended by the electrode manufacturer. The electrodes shall be handled with care to avoid any damage to the flux covering.
- 7.6 In order to have the control over welding consumables, CONTRACTOR / VENDOR shall have proper system for issue and return of unused electrodes, batch test certificates for the welding consumable, baking time and temperature control, control of relative humidity, avoid mix-up through the use of proper documentation. CONTRACTOR / VENDOR shall ensure that drying oven and portable oven are in working condition and the meters/gauges used are in properly calibrated condition.
- 7.7 **All low hydrogen type of electrodes and others, shall be baked as per manufacturers recommendation and stored in holding ovens at temperature recommended by the manufacturer.**
- 7.8 The electrodes, filler wires and flux used shall be free from rust, oil, grease, earth and other foreign matter which affect the quality of welding.
- 7.9 Tungsten electrodes used shall conform to ASME Sec.II C SFA 5.12 specification. **Thoriated Tungsten electrodes shall not be permitted due to possible radiation hazard. Instead, ceriated Tungsten Electrodes (EWCe-2 or equivalent) shall be used for GTA Welding.**
- 7.10 **Electrodes and/or filler metals shall be selected such as:**
- Strength of deposited weld metal is at least equal to the specified minimum mechanical properties of the materials being welded.

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- Chemical composition of the principal elements in deposited weld metal shall match as closely as possible to the nominal composition of the base metal.
- However, this shall not preclude the use of welding materials containing alloying elements of different types or in different amounts than those in the base materials provided there is no evidence that such elements are not harmful or are beneficial from standpoint of achieving desirable weld metal properties, such as adequate tensile strength after post weld heat treatment or adequate impact toughness at low temperatures.
- For weld procedures requiring impact testing, the brand name of welding consumables (electrodes, rods, wire, flux cored, flux) shall be the same as used in the welding procedure qualification test.
- Carbon and low alloy steel electrodes/bare wire that have a non-specific chemistry as indicated by a "G" classification suffix (i.e. EXXXX-G, ERXXX-G, EG, or EXXXTX-G) shall not be assumed acceptable and shall require CONTRACTOR approval. Any authorization shall imply welding procedure qualifications batch wise.
- Contractor has to select the welding electrode Vendors as per "List of approved Welding electrodes for IOCL Refineries" - Attached as Annexure-A

Carbon / Low alloy /Ferritic steels

When using the shielded metal arc welding and process, only **low hydrogen** electrodes shall be used for all pressure retaining welds or attachments to pressure boundaries

Chemistry restriction as per Table 2 of NACE SP0472 & Licenser requirements shall be applied for NACE services.

Austenitic Stainless Steel

Filler metals shall be selected to produce weld deposits that fall within the ferrite number (FN) range of 4 to 8 as determined by the WRC (Welding Research Council) diagram which is included in AWS A-5.4.

When using 300 "H Grade" materials, high carbon electrodes /wires with 0.040 to 0.08% Carbon shall be used.

Type 321 stainless steel shall be joined with Type 347 weld consumables.

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Austenitic/Ferritic Stainless Steel (DUPLEX)

Filler metal shall be selected to produce weld deposits that fall within the ferrite range of 30 to 65. Welding Procedure Qualification shall include Ferrite measurements as defined in paragraph 5.5

7.11 Consumable Storage

Welding consumables shall be stored with care, under dry conditions in their original unopened packing. After opening shipping containers of electrodes, fluxes and other welding materials, storage and handling shall be as specified in the Manufacturer's recommendations and ASME Section II, Part C.

No electrodes, filler wires or fluxes that are damaged, damp, greasy or oxidized may be used.

CONTRACTOR / VENDOR facilities shall include a temperature and humidity controlled welding consumable and flux store, including holding and drying ovens.

Low hydrogen electrodes and fluxes shall be dried at 250°C/300 °C for two hours prior to use, unless otherwise recommended by the electrodes manufacturer. Welding electrodes shall then be stored in ovens at a minimum temperature of 120 °C.

When issued for production they shall be placed in heated quivers capable of maintaining a minimum temperature of 70 °C.

Above drying conditions do not apply to electrodes supplied in vacuum conditioning boxes.

Carbon steel and 0.3-0.5% Mo low hydrogen electrodes shall be used within 8 hours when stored in quivers. Low hydrogen Cr-Mo steel electrodes shall be used within four hours when stored in quivers. Electrodes stored in quivers, but not used within the specified time, shall be restored in ovens. No electrodes shall be left lying about the site or in the shop. Electrodes so left shall be scrapped.

Submerged arc flux shall be clearly identified in moisture-proof containers and shall be stored in a dry location at a temperature above 20°C. Submerged arc, gas metal arc and flux-cored wire shall be clearly identified and shall be stored in a dry location at a temperature above 20°C. The identification shall state manufacturer, grade and batch number. Unidentifiable wire shall not be used.

Submerged arc, gas metal arc and flux-cored arc consumables shall be withdrawn from storage only when required for immediate use. Unused consumables shall be returned to storage on completion of the welding operation. Batch numbers shall be recorded on

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issue

Submerged arc flux may be recycled but shall be free from fused flux, mill scale, dirt or other foreign matter. Before reuse, the flux shall be rebaked in accordance with the manufacturer's instructions.

All electrodes which have been in direct contact with water shall be definitely rejected.

CONTRACTOR / VENDOR shall submit his procedure for the storage and handling of electrodes, filler metals and fluxes to Owner /PMC for review prior to the start of fabrication. The procedure shall include moisture, cleanliness and identification controls.

8. SHIELDING & PURGING GAS

Argon gas used in GTA welding for shielding purposes shall be 99.995% pure. The purity of the gas shall be certified by the manufacturer. The rate of flow for shielding purposes shall be established through procedure qualification tests.

Argon gas with a purity level of 99.995% shall be used for purging.

When GTAW process alone or a combination of GTAW and SMAW processes is recommended for the production of a particular joint, the purging shall be maintained during the root pass and for the first filling pass (SMAW) to minimize oxidation on the inner side of the pipe, unless otherwise specified in Welding Specification Chart.

Initial purging shall be maintained for sufficient period of time so that at least 4-5 times the volume between the dams is displaced, in order to completely remove the entrapped air. In no case should the initial purging period be less than 10 minutes. High gas pressure should be avoided.

After initial purging, the flow of the backing gas should be reduced to a point where only a slight positive pressure prevails. For systems, which have a small volume (up to 1/2 cubic foot) to be purged, a gas flow rate of 6-CFH may adequate. Systems of larger volume may require higher flow rates and these should be established during procedure qualification tests.

Gas backing (purging) is not required for socket type of welded joints.

Dams, used for conserving inert gas during purging, shall be removed after completion of the welding, and shall be accounted for. Wherever, removal of dams is not possible after welding, use of water-soluble dams should be made.

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9. EQUIPMENTS & ACCESSORIES

The CONTRACTOR / VENDOR shall arrange sufficient number of welding & cutting equipment, and accessories of sufficient capacities so as to meet the target /schedule.

All the equipment for performing the heat treatment, including transformers, thermocouples, pyro-meters, automatic temperature recorders (with suitable calibration arrangement etc.) shall be provided by the CONTRACTOR / VENDOR at his own expenses.

CONTRACTOR / VENDOR shall make necessary arrangements at his own expense, for providing the radiographic equipment, radiographic films, processing equipment all other darkroom facilities, pit room and all the equipment/materials required for carrying out the dye-penetrant /magnetic particle test/ultrasonic testing for satisfactory and timely completion of the job.

Redoing of any work, necessitated by faulty equipment or operation used by the CONTRACTOR / VENDOR, will be done at his own expense.

10. WELDING PROCESS

10.1 General

Welding of various materials under this specification shall be carried out using one or more of the following processes with the approval of the Engineer-in-Charge.

- Shielded Metal Arc Welding Process (SMAW).
- Gas Tungsten Arc Welding Process (GTAW)

In addition to SMAW >AW welding of various materials under this specification may be carried out using one or more of the following process with approval of Engineering -in-charge.

- Gas Metal Arc Welding (GMAW)
- Flux Cored Arc Welding (FCAW)
- Submerged Arc Welding (SAW)

The welding processes to be employed are given in the Welding Specification Chart. Any deviation desired by the CONTRACTOR / VENDOR shall be obtained through the express consent of the Engineer-in-Charge.

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Automatic and semi-automatic welding processes shall be employed only with the express approval of the Engineer-in-Charge. The welding procedure adopted and consumables used shall be specifically approved.

The welding processes could be employed for a particular joint only after duly qualifying the welding procedure to be adopted and obtaining the approval of Engineer-in-Charge.

10.2 Requirement for specific welding process

10.2.1 Flux Cored Arc Welding (FCAW)

Application of FCAW process on piping retaining pressure welds shall not be assumed acceptable by the CONTRACTOR / VENDOR during bid preparation and would require Owner /PMC prior approval.

Flux cored welding shall not be used for wet H₂S services

Flux cored arc welding shall not be used if MDMT is lower than -29°C

Flux Cored Arc Welding (FCAW) may be used for piping prefabrication of carbon steel of rating up to 600Lbs provided that following conditions are fulfilled:

- CONTRACTOR / VENDOR can provide evidence of successful previous experience (minimum 5 years) with this process.
- The flux-cored arc welding process is combined with an external shielding gas.
- FCAW shall be used in the globular/spray transfer modes only.
- T-2 & T-5 type wires shall not be used for vertical-up welding.
- Consumable manufacturer and trade name shall be considered essential variables.
- Welding is carried at prefabrication using automatic /semi-automatic machine equipment.

Flux cored arc welding procedures shall be requalified whenever a change is made in filler metal from one manufacturer to another or to a different brand or type from the same manufacturer.

10.2.2 Submerged Arc Welding Process (SAW)

Solid wires for automatic-welding processes shall contain the principal elements required for the deposited weld metal.

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Both fused and bonded fluxes are acceptable. Only neutral fluxes shall be used

Fluxes that the flux Manufacturer recommends for single pass welds shall not be used for multiple pass welds. Active fluxes are not permitted as defined by ASME section II, Part C SFA 5.17 or 5.23.

The brand name and grade of flux and wire used for production of submerged arc welds shall be the same as used in the relevant procedure qualification test.

Welding procedures for submerged arc welding shall be requalified whenever the welding flux or wire is changed from one manufacturer to another or from one grade to another grade from the same manufacturer. Equivalence under ASME section II, Part C shall not be considered adequate for substitution without requalification.

Both fused and bonded fluxes are acceptable. Only neutral fluxes shall be used

10.2.3 Tungsten Arc Welding (GTAW)

Single sided groove welds in P-No.3 and greater materials shall have the root pass made with the GTAW process.

GTAW process shall be used to deposit the root pass in butt welds of NPS 2 and smaller, and for root pass of socket welds NPS 1 and smaller.

The use of consumable inserts shall be subject to Owner /PMC prior approval.

Backing gas purging procedure shall be submitted to Owner/PMC for approval

CONTRACTOR / VENDOR shall submit to the acceptance of Owner/PMC a "Purging procedure" detailing the method of back purging, and associated inspection procedure to be implemented during piping pre-fabrication and field welding including final closing welds and local repairs.

Argon backing gas is required for Base Material P-No.4 and greater.

The use of nitrogen as backing gas for stainless steels shall not allowed.

10.2.4 Shielded Metal Arc Welding (SMAW)

When using low hydrogen electrodes, only uphill progression shall be allowed.

10.2.5 Gas Metal Arc Welding (GMAW)

The use of GMAW shall not be allowed on ferrous piping retaining pressure even on root pass.

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GMAW procedures utilizing the “short circuiting” metal transfer mode shall be limited to groove, fillet, and structural welds in materials 3/8 inch (10mm) maximum thickness. GMAW in the short-circuiting transfer mode may be used for tack welds, temporary attachments or other applications where the weld metal is completely removed. GMAW process shall not be used for socket welds.

11. EDGE PREPARATION

11.1 General

Weld joint preparation details shall be in accordance with ASME B 31.3 Figures 328.4.2 to 4.4 and Figures 328.5 or ASME B 31.1 as applicable.

The edges to be welded shall be prepared to meet the joint design requirements by any of the following methods recommended:

Carbon Steel

Gas cutting, machining or grinding methods shall be used. After gas cutting, oxides shall be removed by chipping or grinding.

Low Alloy Steels (containing up to 5% Chromium):

Gas cutting, machining or grinding methods shall be used. After gas cutting, machining or grinding shall be carried out on the cut surface.

High alloy steel (> 5% Chromium) and stainless steels, nickel alloys:

Plasma cutting, machining or grinding methods shall be used. After plasma cutting, cut surfaces shall be machined or ground smooth.

Permanent backing rings and consumable inserts shall not be used unless specifically approved by Owner/PMC

Branch connection joints shall be prepared so as to permit full penetration welds of a quality comparable to the circumferential welds in the same piping system. When making the opening on the run by plasma arc-cut, care shall be taken for the internal cleanliness of run pipe. For stainless steel piping, internal protection shall be required during plasma-arc cutting of branch opening from arc spatter, slags, etc.

Grinding discs containing sulphur (iron sulphate) or other harmful components shall not be used on stainless steels, 9% nickel steel or non-ferrous materials.

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11.2 Cleaning

The ends to be welded shall be properly cleaned to remove paint, oil, grease, rust, oxides, sand, earth and other foreign matter. The ends shall be completely dry before the welding commences.

On completion of each run, craters, welding irregularities, slag etc., shall be removed by grinding and chiseling. Wire brushes used for cleaning stainless steel joints shall have stainless steel wires and the grinding wheels used for grinding stainless steel shall be of a suitable type. Separate grinding wheels and wire brushes should be used for carbon steels and stainless steels.

12 ALIGNMENT & SPACING

Components to be welded shall be aligned and spaced as per the requirements laid down in applicable code. Special care must be taken to ensure proper fitting and alignment when the welding is performed by GTAW process. Flame heating for adjustment and correction of ends is not permitted unless specifically approved by the Engineer-in-Charge.

A wire spacer of suitable diameter may be used for maintaining the weld root opening while tacking, but it must be removed after tack welding and before laying the root bead.

For pipes of wall thickness 5 mm and above, the ends to be welded shall be secured in position with the aid of couplers, yokes and 'C' clamps, to maintain perfect alignment. Yokes shall be detached after the completion of weld, without causing any surface irregularity. Any irregularity caused on the pipe surface must be suitably repaired to the satisfaction of the Engineer-in-Charge.

Tack welds, for maintaining the alignment, of pipe joints shall be made only by qualified welders using approved WPS. Since the tack welds become part of the final weldment they shall be executed carefully and shall be free from defects. Defective tack welds must be removed prior to the actual welding of the joints

Tacks should be equally spaced. Minimum number of tacks shall be:

- 3 tacks - for 2 1/2" and smaller dia. pipes.
- 4 tacks -for 3" to 12" dia. pipes.
- 6 tacks -for 14" and larger dia. pipes

Welding shall commence only after approval of fit-up by the Engineer-In-Charge.

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13 WEATHER CONDITIONS

The parts being welded and the welding personnel should be adequately protected from rain and strong winds. In the absence of such a protection no welding shall be carried out.

During field welding using GTAW process, particular care shall be exercised to prevent any air current affecting the welding process.

14 WELDING TECHNIQUE

14.1 Root Pass

Root pass shall be made with electrodes/filler wires recommended in the welding specification chart. For fillet welding, root welding shall be done with consumables recommended for filler passes. The preferred size of the electrodes is 2.5 mm diameter (12 S WG) but in any case, not greater than 3.25 mm (10 S WG).

Upward technique shall be adopted for welding pipe held fixed with its axis horizontal.

The root pass of butt joints should be executed so as to achieve full penetration with complete fusion of the root edges. Weld projection inside the pipe shall be as per applicable code. It shall be limited 3mm max. when the applicable code does not place any restriction.

Any deviation desired from the recommended welding technique and electrodes indicated in the welding specification chart should be adopted only after obtaining express approval of the Engineer-in-Charge.

Welding shall be uninterrupted.

While the welding is in progress care should be taken to avoid any kind of movement of the components, shocks, vibrations and stresses to prevent occurrence of weld cracks.

Peening shall not be used.

A gap of 1.5mm shall be maintained on socket weld.

No welding shall be carried out when the parts to be welded are wet.

Where possible, butt welds may be made from both sides, in accordance with approved welding procedures. In that case, the back side of the root pass shall be ground or gouged to sound metal before welding on that side.

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Welding shall not be stopped before the second pass is completed, and until the thickness of the weld is at least equal to one third of the pipe wall thickness & follow the Clause 330.2.2 of ASME B31.3 & 131.6 of ASME B31.1 in case of Welding interruption.

14.2 Joint Completion

Joint shall be completed using the class of electrodes, recommended in the Welding Specification Chart. Size of the electrode shall not exceed 4 mm in diameter for stainless steels and alloy steels used for low temperature applications.

Two weld beads shall not be started at the same point in different layers.

Butt joints shall be completed with a cover layer that would affect good fusion at the joint edges and a gradual notch free surface.

Each weld joint shall have a workmanship like finish. Weld identification work shall be stamped clearly at each joint, just adjacent to the weld. Metal stamping shall not be used on thin pipe having wall thickness less than 3.5mm. Suitable paint shall be used on thin wall pipes for identification.

Rust preventive/protective painting shall be done after the weld joint has been approved.

14.3 Dissimilar Welds

Where welds are to be produced between carbon steels and alloy steels, preheat and post weld heat treatment requirements shall be those specified for corresponding alloy steels and filler wire/electrodes shall correspond to ER 70 S-G or AWS E-7016/7018 type. For welds between two dissimilar Cr-Mo low alloy steels, preheat and post weld heat treatments shall be those specified for higher alloy steel and electrodes used shall correspond to those specified for steel of lower alloy content. For carbon steel or alloy steel to stainless welds, use of filler wire/electrodes E/ER-309/E-310/ENiCrFe-3/ENiCrMo-3 shall be made. The welding procedure, electrodes/filler wires to be used shall be approved by the Engineer-in-Charge.

Dissimilar metal welding shall be avoided in wet sour service

15 HEAT TREATMENT

15.1 Preheating

Preheating temperature shall be in accordance with the applicable requirements or recommendations of section 330 of ASME B31.3 and licensors documents.

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No welding shall be performed without preheating the joint to 10°C (50°F) when the ambient temperature is below 10 degree.

Preheating requirements for the various materials shall be as per the Welding Specification Chart attached.

Preheating shall be performed using resistance or induction heating methods. Preheating by gas burners, utilizing oxy-acetylene or oxy-propane gas mixtures, with neutral flame may also be carried when permitted by the Engineer-in-Charge.

Preheating shall extend uniformly to at least three times the thickness of the joint, but not less than 50 mm, on both sides of the weld.

Preheating temperature shall be maintained over the whole length of the joint during welding. Temperature recorders shall be provided by the CONTRACTOR / VENDOR to record the temperature.

Minimum and Maximum interpass temperature limits shall be in accordance with the approved WPS.

15.2 Post Heating

In case of alloy steel materials such as Cr-Mo steels, if the post weld heat treatment is not performed immediately after welding, the weld joint and adjacent portion of pipe, at least 50 mm on either side of weld, shall be uniformly heated to 300°C. This temperature shall be maintained for half an hour minimum, and then wrapped with mineral wool before allowing it to cool to room temperature. If the Post Heating temperature specified in the Welding Specification Charts exceeds 300°C, the same shall be followed. Similarly, if the welding specification chart specifies post-heat time, the same shall be applicable. Post weld heat treatment as specified in the Welding Specification Chart shall be carried out later on.

15.3 Post Weld Heat Treatment (PWHT)

PWHT shall be in accordance with the requirements of ASME B 31.3 or ASME B 31.1 as applicable & as per licenser requirement and Welding Specification Chart. During PWHT, the metal temperature shall be maintained within the specified temperature ranges and for the minimum holding times specified.

Post weld heat treatment, wherever required for joints between pipes, pipes and fittings, pipe body and supports shall be carried out as per the welding specification chart, applicable codes standards and the instructions of the Engineer-in-Charge. In this regard procedure qualification to be done before carrying out PWHT in production welds

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The CONTRACTOR / VENDOR shall submit for the approval of the Engineer-in-Charge, well before carrying out actual heat treatment, the details of the post weld heat treatment procedure as per Exhibit B attached, that he proposes to adopt for each of the materials/assembly/part involved.

Post weld heat treatment shall be done in a furnace or by using an electric resistance or induction-heating equipment, as decided by the Engineer-in-Charge.

While carrying out local post weld heat treatment, technique of application of heat must ensure uniform temperature attainment at all points of the portion being heat- treated. Care shall be taken to ensure that width of heated band over which specified post weld heat treatment temperature attained is at least that specified in the relevant applicable standards/codes. Control of temperature shall be done using microprocessor/computer controlled system. The desired time-temperature cycle shall be entered into the microprocessor/computer.

Throughout the cycle of heat treatment, the portion outside the heated band shall be suitably wrapped under insulation so as to avoid any harmful temperature gradient at the exposed surface of pipe. For this purpose temperature at the exposed surface should not be allowed to exceed 50% of the peak temperature.

The temperature attained by the portion under heat treatment shall be recorded by means of thermocouple pyrometers. Adequate number of thermocouples should be attached to the pipe directly at equally spaced location along the periphery of the pipe joint. The minimum number of thermocouples attached per joint shall be 1 up to 2" dia., 2 up to 10" dia. and 3 for 20" dia, 4 for pipe diameter above 20 and above. However, the Engineer-in-Charge can increase the required number of thermocouples to be attached if found necessary.

Automatic temperature recorders, which have been suitably calibrated, shall be employed for measuring & recording temperature. Both, the actual time-temperature graph and the designed time temperature graph shall be available on every chart. The time-temp graph shall be submitted to Engineer-in-Charge immediately on completion of Stress Relieving Cycle

The calibration record of each recorder should be submitted to the Engineer-in-Charge prior to starting the heat treatment operations and his approval should be obtained.

Manufacturer's test certificate shall be submitted for the thermocouples materials and record shall be maintained by the CONTRACTOR / VENDOR.

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Immediately on completion of the Heat Treatment, the Post Weld Heat Treatment charts/records along with the hardness test results on the weld points, wherever required as per the Welding Specification Chart, shall be submitted to Engineer-in- Charge for his approval.

Each weld joint shall bear a unique identification number, which shall be maintained in the piping sketch to be prepared by the CONTRACTOR / VENDOR. The weld joint identification number should appear on the corresponding post weld heat treatment charts. The chart containing the identification numbers and piping sketch shall be submitted to the Engineer-in-Charge in suitable folders.

16. CLEANING OF THE WELD JOINT

All weld joints shall be free from adherent weld spatters slag, sward, dirt or foreign matter. This can be achieved by brushing. For stainless steels, brushes with only stainless steel bristles shall be used.

17. INSPECTION AND TESTING

17.1 General

The Owner /PMC's inspector shall have free access to all concerned areas, where the actual work is being performed. The CONTRACTOR / VENDOR shall also accord the Owner /PMC's Inspector all means and facilities necessary to carry out inspection.

The Owner /PMC is entitled to depute his own inspector to the shop or field where prefabrication and erection of pipe lines is in progress for (but not limited to) the following objectives:

- To check the conformance to relevant standards and suitability of various welding equipment and the welding performance.
- To witness the welding procedure qualification.
- To witness the welder performance qualification.
- To check whether shop/field welding being executed is in conformity with the relevant specifications and codes of practice followed in piping construction.

CONTRACTOR / VENDOR shall intimate sufficiently in advance the commencement of qualification tests, welding works and acceptance tests, to enable the Owner /PMC's inspector to be present to supervise them, as decided by the Engineer-In-Charge.

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17.2 Welding Procedure Qualification

Welding procedure qualification shall be carried out in accordance with the applicable requirements of ASME Sec. IX latest edition and/or other applicable codes and the job requirements. The CONTRACTOR / VENDOR shall submit the welding procedure specification in format as per Exhibit-C (attached) immediately after the receipt of the order. Owner /PMC's inspector will review, check and approve the welding procedure submitted and shall release the procedure for qualification tests. The procedure qualification test shall be carried out by the CONTRACTOR / VENDOR at his own expense. A complete set of test results in the format as per Exhibit-D attached) shall be submitted to the Owner /PMC's inspector for his approval immediately after completing the procedure qualification test and at least 2 weeks before the commencement of actual work. Standard test as specified in the code shall be carried out in all cases. In addition to these tests, other tests like macro/micro examination, hardness tests, dye penetrant examination, charpy V- notch, Corrosion tests, impact tests, Ferrite test etc. shall be carried out on specimens depending upon the type of base material, operating conditions and requirements laid down in the detailed drawings and specifications. It shall be the responsibility of the CONTRACTOR / VENDOR to carry out all the tests required to the satisfaction of the Owner /PMC's inspector. Welding procedures shall be qualified in accordance with the requirements of ASME IX. In addition, the PQR's shall include Brinell testing and ferrite measurements as follows:

17.3 Brinell hardness tests

PQR shall always include hardness testing in case of Ferritic and Duplex materials.

In Wet H₂S service also Austenitic materials shall have hardness testing.

One test per PQR/material/range of qualification is required.

All welding procedure qualification subject to Post Weld Heat treatment shall be as well hardness tested by Brinell method after P.W.H.T.

Unless otherwise specified in Welding Specification Chart & licenser specification the maximum hardness shall not exceed:

- 200 HB for P-No.1 material
- 225 HB for P-No.3 and 4 materials
- 241 HB for P-No.5 material

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17.4 Welder's Qualification

Welders shall be qualified in accordance with the ASME Section-IX or other applicable codes. The Owner /PMCs inspector reserves the right to witness the test and certify/approve the qualification of each welder separately. Only those welders who have been approved by the Owner /PMC's Inspector shall be employed for welding. CONTRACTOR / VENDOR shall submit the welder qualification test reports in the format as per Exhibit-E (attached) and obtain express approval before commencement of work. It shall be the responsibility of CONTRACTOR / VENDOR to carry out qualification tests of welders. For welding of the steam piping, falling under the purview of Indian Boiler Regulations, only those welders with IBR Certification, qualified by Boiler Inspectorate, and acceptable to the local Boiler Inspector authority shall be employed.

The welders shall always have in their possession, an identification card containing information contained in Exhibit-G and shall produce it on demand by the Engineer-In-Charge or his representative. It shall be the responsibility of the CONTRACTOR / VENDOR to issue the identify cards after it has been duly certified by the, Owner /PMC's Inspector.

No welder shall be permitted to work without the possession of the identify card.

If a welder is found to perform a type of welding or in a position for which he is not qualified, he shall be debarred from doing any further work. All welds performed by an unqualified welder shall be cut and redone by a qualified welder at the expense of the CONTRACTOR / VENDOR

In addition to ASME qualification, CONTRACTOR / VENDOR shall submit the training and examination program of qualification of all welders and foremen assigned in the welding and repairs of piping Carbon/stainless steel material.

All Welders and welding operators shall be qualified at Site.

All field welders and welding operators shall be requalified on site before beginning the works.

Qualification certificate records shall be submitted to the review of the Owner /PMC Inspector

17.5 Welder Performance Registration.

In order to control and maintain the validation of performance qualification, a welder performance register shall be kept up to date by the CONTRACTOR / VENDOR

This register should at least contain the following data:

- Welder's name and stamp.

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- Data of weld inspection and inspection results.
- Materials (base and consumable).
- Configuration data (diameter, wall thickness, etc.).
- Reference to WPS used.
- Position of welding.
- Purging records including repairs.

18. NON-DESTRUCTIVE EXAMINATION

The extent of NDE shall be as per attached **Table -01**

Where the extent indicated is 10%, this is defined as 100% examination of 1 in 10 of those welds indicated. The welds to be examined shall cover each pipe size and each welder.

18.1 Visual Examination

Visual Examination of all welds shall be carried out as per the latest editions of the applicable codes and specifications. All finished welds shall be visually inspected for parallel and axial alignment of the work, excessive reinforcement, concavity of welds, shrinkage cracks, inadequate penetration, unrepaired burn-through, under cuts, dimensions of the weld, surface porosity and other surface defects. Undercutting adjacent to the completed weld shall not exceed the limits specified in the applicable standard/code.

Visual examination procedures shall be in accordance with ASME Section V, Article 9. Visual examinations shall be performed on accessible surfaces of all completed welds.

The evaluation of indications and the acceptance criteria for visual inspection shall be in accordance with ASME B31.3, Table 341.3.2 or ASME B 31.1 as applicable.

18.2 Radiographic Examination

CONTRACTOR / VENDOR shall appoint agency for carrying out the radiography works at site from the list of agencies enclosed in the bid document or separately supplied by Owner /PMC

Use of digital radiography requires prior approval of Engineer-in charge

The Radiographic Examination procedures to be adopted shall be submitted by the CONTRACTOR / VENDOR as per Exhibit-F and shall be got approved from the Owner /PMC's Inspector prior to employment. A person qualified to ASNT Level-II or ASNT Level-III in Radiographic testing shall prepare the procedure. The Radiography Procedure shall be established to demonstrate that the required sensitivity can be consistently achieved under the most unfavorable parameters (e.g. source to film distance, geometric

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un sharpness, thickness etc.). The radiographic technique and procedure adopted shall conform of the requirements mentioned in Article 2 as well as Article 22 of ASME Sec.V. The IQI sensitivity obtained shall be equal to or better than the requirements mentioned in Article 2 of ASME Sec.V. Source side penetrometer shall be used in establishing radiographic procedure/ technique. The acceptance criteria shall be as per the relevant codes of Fabrication and overriding requirements if mentioned elsewhere in the technical specifications of the contract. The CONTRACTOR / VENDOR shall be responsible for carrying out Radiography; rectification of defects and re-radiography of welds repaired/rectified at his cost.

Unless otherwise specified, the evaluation of indications and the acceptance criteria of radiographs shall be in accordance with ASME B31.3 Table 341.3.2 Normal and category M Fluid Service or ASME B 31.1 as applicable.

The extent of Radiography shall be as per specifications to be supplied to the CONTRACTOR / VENDOR. For welds between dissimilar materials, the extent of Radiographic Examination shall be the more stringent of the two recommended for the materials being welded. Wherever random Radiography is called for, in a particular piping class, the dissimilar materials weld joints shall essentially be included.

Type of Radiation source and film to be used shall be as per Exhibit-F for carrying out radiographic examination. However, if specifications (as given elsewhere in the contract) for some critical material require usage of X-Radiation, then Radiography shall be done using X-Rays only.

The CONTRACTOR / VENDOR shall fulfil all the statutory and Owner /PMC's safety requirements while handling X-ray and Gamma-ray equipment.

In case of random radiography, the joints for Radiography shall be selected by the Owner /PMC's Inspector and the Radiography shall be performed in his presence, if he instructs the CONTRACTOR / VENDOR to do so. The CONTRACTOR/ VENDOR shall furnish all the radiographs, to the Owner /PMC's Inspector immediately after processing along with evaluation by a person qualified to ASNT Level-II in Radiographic testing, in line with Article 2 of ASME Sec.V. The certificate of ASNT/ISNT Level II qualification of the NDE personnel shall be submitted to Owner /PMC's inspector for his approval prior to start of job.

The CONTRACTOR / VENDOR shall provide the Owner /PMC's Inspector, all the necessary facilities at site such as a dark room with controlled temperature, illuminator (viewer) suitable for varying densities, a duly calibrated electronic densitometer with batteries, magnifying glass, tracing papers, ruler, marking pencils etc. to enable him to review the radiographs.

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Where random radiography is specified, the first weld of each welder shall be completely radiographed. In the case of pipe of size 6" and below, the first two welds shall be completely radiographed.

For each weld performed by a welder found unacceptable, two additional checks shall be carried out on welds performed by the same welder. This operation is iterative and the of two additional welds for each weld deemed unsatisfactory shall be continued till such time that two consecutive welds of satisfactory quality are found for every defective weld.

The CONTRACTOR / VENDOR shall carry out these additional radiographic testing at his own expense. To avoid the possibility of too many defective welds by a single welder remaining undetected for a long period to time, the CONTRACTOR shall promptly arrange for Radiographic Examination so that there is no accumulation of defective joints.

All shop examination (Piping) up to and including 25mm total wall thickness shall use X-radiography. Gamma radiography may be used for thicknesses above 25mm. Gamma radiography could be used on thicknesses of 25mm and below when X-radiography is impractical i.e. construction sites. The gamma source shall be Iridium 192. In any event image sensitivity shall be 2% or better based on source side wire type Image Quality Indicators (IQI).

18.3 Check shots

Owner /PMC / Engineer- in- charge or his representative shall select 5% of the total joints radiographed on a day for check shots. CONTRACTOR / VENDOR shall carry out check shots as directed at his own cost.

Weld profiles of check shots shall be compared with weld profile observed in the earlier Radiographs. In the event of any one variation in the check shots and earlier Radiographs, CONTRACTOR / VENDOR shall re-shoot the entire lot of joints radiographed by particular Radiography agency on the particular date. All the re-shot films shall be compared with the originally submitted films.

18.4 Ultrasonic examination (UT)

Ultrasonic examination procedures shall be in accordance with the requirements and methods specified in ASME Section V, Article 5. The evaluation of indications and the acceptance criteria shall be in accordance with ASME B31.3 or B 31.1 as applicable.

For P-No.1 through P-No.5 material, piping of thickness 40 mm and above 100% ultrasonic examination shall be required on butt welds in addition to the specified radiography examination.

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Ultrasonic examination shall be only considered for the detection of “Planar Flaws”.

The UT procedure shall include the following information as minimum:

Scope; equipment; probe type and details; surface preparation, cleaning and couplant; technique sheet for each technique specified (number of techniques to be sufficient to cover all type of joints to be covered by the procedures scope); material; weld material (if different); sketch showing joint configuration, beam coverage; extent of scan; scanning pattern; material thickness and curvature; calibrations and frequency; means of setting and scanning, sensitivity levels and DAC curves; flaw location and size evaluation; acceptance criteria; reporting format; operator qualifications.

18.5 Liquid Penetrant and Magnetic Particle Examination

Whenever such tests are specified, the tests shall be carried out on joints chosen by the Owner /PMC's inspector, as per ASME Section V article 6 and 7 respectively. The tests are to be performed by a person possessing a valid ASNT/ISNT Level-II qualification in the method being used.

For austenitic stainless steels and other nonmagnetic materials, liquid (dye) penetrant test shall be carried out. For carrying out this test, the materials shall be brought within a temperature limit of 15° to 50°C.

Penetrant materials shall meet the requirements of ASME Section V, Article 6 for sulfur and halogen content regardless of the type of material to be examined.

Liquid penetrant examination of welds shall include a band of base metal at least 25 mm wide on each side of the weld.

The evaluation of indications and the acceptance criteria shall be in accordance with ASME VIII Div. 1 Appendix 8.

The PT procedure shall include the following information as minimum:

- Scope; surface preparation; cleaning and drying; temperature limitations; penetrant application method and time; removal of excess penetrant; drying; application of developer; development time; acceptance level; reporting format; operator qualification; stage performed.

CONTRACTOR / VENDOR shall submit the LPT / MPT procedure to Owner/PMC for review & approval.

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Magnetic particle examination procedures shall be in accordance with the requirements and methods specified in ASME Section V, Article 7.

Magnetic particle examination of welds shall include a band of base metal at least 25 mm wide on each side of the weld.

The evaluation of indications and the acceptance criteria shall be in accordance with ASME VIII Div: 1 Appendix 6.

The MT procedure shall include the following minimum information.

Scope; surface preparation; areas to be examined; stage(s) at which examined (i.e. after welding, after heat treatment, after hydrotest, etc.); magnetizing technique (e.g. AC Yoke); equipment used; magnetic ink trade name; frequency of calibration of equipment and test of bath strength; coverage and direction of magnetic field; measurement of field strength; application of examination media; acceptance level; reporting format; operator qualifications.

18.6 Hardness Test

Hardness requirements for welds shall be as per the Welding Specification Chart/Nondestructive Examination Specification attached elsewhere in the contract. Hardness testing shall be carried out by Vickers Hardness Tester during welding procedure qualification and shall be cross sectional. For production welds, hardness testing shall be carried out by portable digital hardness testers. Poldi hardness tester shall not be permitted. CONTRACTOR / VENDOR shall produce documentary evidence/calibration certificate to the Owner /PMC's Inspector and obtain approval of the hardness testing equipment.

18.7 Proof Tests

Hydrostatic and pneumatic tests shall be performed as per the requirements laid down by respective flushing and Testing specification/applicable codes to demonstrate the soundness of the welds. The tests shall be conducted after fulfilling the requirement of visual examinations radiography etc. and after the entire work has been certified by the Owner //PMC's inspector to be fit for being subjected to such tests.

19. REPAIRS OF WELDS

Defects ascertained, through the inspection methods, which are beyond acceptable limits shall be removed after the joint is completely radiographed by the process of chipping and grinding. The repaired welds shall be subjected, as a minimum requirement to the same testing and inspection requirements as the original weld.

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Unacceptable discontinuities shall be completely removed by chipping, gouging, grinding, or other methods (for the type of material being repaired) to clean, sound metal, and the excavated area shall be examined by MT or PT to assure complete removal of defects.

Repairs to correct weld defects shall be made using the same WPS used for the original weld or other previously authorized WPS

One repair attempts will be allowed on any one defective area. No further attempts to repair shall be carried out without the authorization of Owner /PMC

Weld repair procedures shall be submitted to Owner/PMC prior to piping repair. The procedure shall state, as a minimum, the following information:

- Means of excavating defect from weld.
- NDE method (when applicable) used to verify complete defect removal.
- WPS /PQR used to fill excavated area.
- NDE method used to verify repair weld is sound.
- Purging procedure when root pass is made by GTAW process

When the entire joint is judged unacceptable, the welding shall be completely cut and edges suitably prepared as per required alignment tolerances. The re-welded joint shall again be examined following standard practices.

- No repair shall be carried out without prior permission of the Owner /PMC's inspector.
- Repairs and/or work of defective welds shall be done in time to avoid difficulties in meeting the construction schedules.

20. **DOCUMENTS TO BE SUBMITTED BY CONTRACTOR / VENDOR (4 COPIES EACH)**

Batch Test Certificates, for the Electrodes used, obtained from the Electrode Manufacturers.

Proposed Heat Treatment Procedure as per Exhibit-B.

Heat Treatment Charts.

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Weld joint hardness test results.

Welding Procedure Specifications as per Exhibit-C immediately after receipt of the order.

Welding Procedure Qualification records as per Exhibit-D.

Welder Performance Qualification records as per Exhibit-E immediately after conducting Welder Qualification Tests.

Radiography Procedure as per Exhibit-F and other NDE procedures.

Radiographic test Report along with Radiographs and other NDE reports.

Piping Sketch (Isometric) giving all the details regarding the pipe specifications, welded joints, joints radiographed magnetic particle, tested, ultrasonic tested, penetrant tested, joints heat treated, WPS used, welder's identification number, etc.

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EXHIBIT – B

Sheet 1 of 1

STRESS RELIEF HEAT TREATMENT PROCEDURE SPECIFICATION

Contractor : _____

Name of the Heat treater : _____

Name of the Project : _____ Specification

Reference No. _____

1. General Details Other Details

Name of the
Equipment : _____

Type of Heating : Elec. Res./
Induction
(Tick mark applicable method)

Maximum Permissible Temp at
Uncovered Parent Metal _____

Width of heated band _____

Width of Insulation _____

Material : _____

No. of Thermo couples (dia wise)

Type of Thermo couples _____

3. Heat Treatment Cycle Details

Charging Temp °C _____

Rate of heating °C /Hr. _____

Soaking Temperature, °C _____

Soaking Time, Hrs. _____

Rate of Cooling °C /Hr. _____

Method of Cooling _____

4. Other details, if any _____

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FORMAT FOR WELDING PROCEDURE SPECIFICATION (WPS)

Company Name _____ By _____

Welding Procedure Specification No. _____ Date _____ Supporting PQR No. (S) _____

Revision No. _____ Date _____

Welding Process (es) _____ Type (s) _____
(Automatic, Manual, Machines or Semi Auto)

JOINTS

Joint Design _____

Backing (Yes) _____ (No) _____

Backing Material (Type) _____

Sketches Production Drawings. Weld Symbols Written

Description should show the general arrangement of the parts to be welded. Where applicable, the root spacing and the details of weld groove may be specified.

(At the option of the Manufacturer sketches may be attached to illustrate joint design weld layers and bead sequence e.g. for notch toughness procedures, for multiple process procedures, etc.)

BASE METALS

P.No. _____ Group No. _____ to P. No. _____ Group No. _____

OR

Specification type and grade _____

to Specification type and grade _____

OR

Chem. Analysis and Mech. Prop. _____

to Chem. Analysis and Mech. Prop. _____

Thickness Range :

Base Metal : Groove _____ Fillet _____

Deposited Weld Metal : Groove _____ Fillet _____

Pipe Dia Range : Groove : _____ Fillet _____

Other _____

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FILLER METALS

F.No. _____ Other _____
A.No. _____ Other _____
Spec. No. (SFA) _____
AWS No. (Class) _____
Size of filler metals _____
_____ (Electrodes, Cold Wire, Hot Wire etc.)
Electrode-Flux (Class) _____
Flux Trade Name _____
Consumable Inset _____
Each base metal/filler metal combination should be recorded individually.
WPS NO. _____ Rev. _____

POSITIONS: Position (s) of Groove _____ Welding Progression : UP _____ Down _____ Position (s) of Fillet _____	POSTWELDED HEAT TREATMENT Temperature Range _____ Time Range _____
PREHEAT Preheat Temp. Min. _____ Interpass Temp. Max. _____ Preheat Maintenance _____	GAS Shielding Gas (es) _____ Percent Composition (mixtures) _____ Flow Rate _____ Gas Backing _____ Trailing Shielding Gas Composition _____

ELECTRICAL CHARACTERISTICS

Current AC or DC _____ Polarity _____
Amps (Range) _____ Volts (Range) _____
(Amps and volts range should be recorded for each electrode size, position, and thickness, etc. This information may be listed in a tabular form similar to that shown below).
Tungsten Electrode Size and Type _____ (Pure Tungsten, 2% Ceriated, etc.)
Mode of Metal Transfer for GMAW _____ (Spray arc, short circuiting arc, etc.)
Electrode Wire feed speed range _____

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TECHNIQUE

String or Weave Bead _____

Orifice or Gas Cup Size _____

Initial and Interpass Cleaning (Brushing, Grinding, etc.) _____

Method of Back Gouging _____

Oscillation _____

Contact Tube to Work Distance _____

Multiple or Single Pass (per side) _____

Multiple or Single Electrodes _____

Travel Speed (Range) _____

Peening _____

Other _____

Weld Layer(s)	Process	Filler Metal		Current		Volt Range	Travel Speed Range	Others
		Class.	Dia.	Type Polarity	Amp. Range			
								e.g. Remarks, Comments, Hot wire Addition, Technique Torch Angle, etc.

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EXHIBIT-D
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FORMAT FOR PROCEDURE QUALIFICATION RECORD (PQR)

RECORD ACTUAL CONDITIONS USED TO WELD TEST COUPON

Company Name _____
 Procedure Qualification Record No. _____ Date _____
 WPS No. _____
 Welding Process (es) _____
 Types (Manual, Automatic, Semi-Auto) _____

JOINTS

Groove Design of Test Coupon

(For combination qualification the deposited weld metal thickness shall be recorded for each Filler metal or process weld)

BASE METALS Material Spec. _____ Type of Grade _____ P.No. _____ to P.No. _____ Thickness of Test Coupon _____ Diameter of Test Coupon _____ Other _____	POSTWELD HEAT TREATMENT Temperature _____ Time _____ Other _____
FILLER METALS Weld Metal Analysis A No. _____ Size of Filler Metal _____ Filler Metal E.No. _____ SFA Specification _____ AWS Classification _____ Other _____	GAS Type of Gas on Gases _____ Composition of Gas Mixture _____ Other _____
POSITION Position of Groove _____ Weld Progression (Uphill, Downhill) _____ Other _____	ELECTRICAL CHARACTERISTICS Current _____ Polarity _____ Amps. _____ Tungsten Electrode Size _____ Other _____
PREHEAT Preheat Temp. _____ Interpass Temp. _____	TECHNIQUE Travel Speed _____ String or Weave Bead _____ Oscillation _____ Multipass or Single Pass (per side) _____ Single or Multiple Electrodes _____ Other _____

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EXHIBIT-D
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GUIDED BEND TESTS

Type of Figure No.	Result

TOUGHNESS TESTS

Specimen No.	Notch Location	Notch Type	Test Temp.	Impact Value	Lateral Exp.		Drop Weight	
					% Shear	Mils	Break	No Break

FILLET WELD TEST

Result - Satisfactory : Yes ____ No ____ Penetration into Parent Metal : Yes ____ No. ____

Marco - Results _____

OTHER TESTS

Type of Test _____

Deposit Analysis _____

Other _____

Welder's Name _____ Clock No. _____ Stamp No. _____

Test Conducted by _____ Laboratory Test No. _____

We certified that the statements in this record are correct and test welds were prepared, welded and tested in accordance with the requirements of Section IX of the ASME Code.

Date _____

Manufacturer _____

By _____

(Detail of record of tests are illustrative only and may be moulded to conform to the type and number of tests required by codes and specifications).

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EXHIBIT – E
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**FORMAT FOR MANUFACTURER'S RECORD FOR WELDER OR WELDING OPERATOR
QUALIFICATION TESTS**

Welder Name _____ Check No. _____ Stamp. No. _____

Using WPS No. _____ Rev. _____

The above welder is qualified for the following ranges

<u>Variable</u>	<u>Record Actual Values Used in Qualification</u>	<u>Qualification Range</u>
Process	_____	_____
Process Type	_____	_____
Backing (metal, Weld metal, flux, etc)	_____	_____
Material Spec.	_____ to _____	_____ to _____
Thickness		
Groove	_____	_____
Filler	_____	_____
Diameter		
Groove	_____	_____
Filler	_____	_____
Filler Metal		
Spec. No.	_____	_____
Class	_____	_____
F. No.	_____	_____
Position	_____	_____
Weld Progression	_____	_____
Gas Type	_____	_____
Electrical Characteristics		
Current	_____	_____
Polarity	_____	_____

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Guided Bend Test Results

Type and Fig. No.	Result

Radiographic Test Results
For alternative qualification of groove welds by radiography

Radiographic Results _____

Fillet Weld Test Results

Fracture Test (Describe the location, nature and size of any crack or tearing of the specimen) _____

Length and Per Cent of Defects _____ inches _____ %

Macro Test - Fusion _____

Appearance - Fillet Size (ing) _____ x _____ Convexity or Concavity _____

Test Conducted by _____ Laboratory - Test No. _____

We certify that the statements in this record are correct and that the test welds were prepared.
Welded and tested in accordance with the requirements of Section IX of the ASME Code.

Date _____

Organization _____

By _____

(Details of record tests are illustrative only and may be modified to conformation to the type & number of tests required by the Code).

Note: Any essential variables in addition to those above shall be recorded.

 	PROJECT		Standby SRU & Additional Tanks IOCL Paradip Refinery	
	CLIENT		INDIAN OIL CORPORATION LIMITED	
WELDING & NDE SPECIFICATION FOR FABRICATION OF PIPING	Project No. 080557C001	Document No. 080557C-000-PP-814	Rev. No. 3	Page 39 of 40

EXHIBIT - F

**RADIOGRAPHIC PROCEDURE QUALIFICATION RECORD
FOR PIPE WELDING**

1. Location
2. Date of Testing
3. Name of the Contractor/Agency
4. Material: Carbon steel/Alloy Steel/Stainless Steel
- 4 A. Technique: DWSI/SWSI/DWDI
5. Diameter & Thickness:
6. Type of Weld Joint:
7. Radiation Source:
8. Intensifying Screens/Lead Screens:
9. Geometric Relationship:
10. Limit of Film Coverage:
11. Film Type and Make:
12. Exposure Time:
13. Processing:
14. Density:
15. Sensitivity:
- 16.* Type of penetrameter:
(Source side)
- 17.* Type of penetrameter:
(Film side)

Signature of Contractor/Agency with Seal

Approval of EIL's Inspector

- * Ref. Para regarding recommended practice on placement of penetrameters Article 22, SE 142, ASME Sec. V.
- * For "Random Radiography" lines placement of penetrameters as per Article 2, ASME, Sec. V is permitted.

 		PROJECT	Standby SRU & Additional Tanks IOCL Paradip Refinery		
		CLIENT	INDIAN OIL CORPORATION LIMITED		
WELDING & NDE SPECIFICATION FOR FABRICATION OF PIPING	Project No. 080557C001	Document No. 080557C-000-PP-814	Rev. No. 3	Page 40 of 40	

ANNEXURE – A

(List of Approved Welding Electrodes
for IOCL Refineries)



**INDIAN OIL CORPORATION LIMITED
REFINERY HEADQUARTERS
MAINTENANCE & INSPECTION DEPARTMENT**

REF: M&I/ IP/Welding/33

Updated in Dec'2017

Sub: List of Approved welding electrodes for IOCL Refineries

List of approved Welding electrodes for IOCL refineries is updated on the basis of previous recommendations & communications and is tabulated below for reference;

A. Approved Vendor List for Welding Electrodes for Refineries division before year 14.03.2008 (Ref No. M&I/IP/GC/121 dated 14.03.2008)

1. M/s. ADOR Welding Limited
2. M/s. ESSAB India Limited
3. M/s. D&H Secheron Electrodes Limited

B. Approved Welding Electrodes (Ref No: M&I/IP/GC/121 dated 14/03/2008)

1. M/s Honavar Electrodes Pvt. Ltd., Mumbai

Sl. No.	Brand Name	AWS Classification
1.	CELLUMATE	E 6010
2.	REGULAR – S	E 6013
3.	ULTIMATE – 18	E 7018
4.	ULTIMATE – 18 SPL	E 7018-1
5.	ULTIMATE – 18 A1	E 7018 – A1
6.	ULTIMATE – 18 NC	E 7018 (NACE)
7.	ULTIMATE – 18 (SPL) NC	E 7018 – 1 (NACE).
8.	ULTIMATE – 80 B2	E 8018 – B2
9.	ULTIMATE – 90 B3	E 9018 – B3
10.	CROMOMATE 5	E 8018 – B6
11.	CROMOMATE 9	E 8018 – B8
12.	SILVERSHINE - 308	E 308 – 16
13.	SILVERSHINE – 308L	E 308L – 16
14.	SILVERSHINE – 309	E 309 – 16
15.	SILVERSHINE – 309L	E 309L -016
16.	SILVERSHINE – 309 Mo	E 309Mo – 16
17.	SILVERSHINE – 316	E 316 – 16
18.	SILVERSHINE – 316 L	E 316L – 16
19.	SILVERSHINE – 347	E 347 - 16

2. M/s Mailam India Ltd., Pondicherry

Sl. No.	Brand Name	AWS Classification
1.	MAILARC-10	E 6010
2.	MAILARC-13R	E 6013
3.	MAILARC-18	E 7018
4.	MAILARC-18 PLUS	E 7018-1
5.	MAILARC-1CR	E 8018-B2
6.	MAILARC-2CR	E 9018-B3
7.	MAILARC-5CR	E 8018-B6
8.	MAILARC-9CR	E 8018-B8
9.	MAILEX-AL	E 308L-16
10.	MAILEX-AH	E 308H-16
11.	MAILEX-25/12L	E 309L-16
12.	MAILEX-MoL	E316L – 16
13.	MAILEX-ANb	E 347-16

3. M/s EWAC Alloys Ltd. (Associate Company of L&T), Mumbai

Sl. No.	Brand Name	AWS Classification
1.	XUPER FAB E308-16	E 308-16
2.	XUPER FAB E308L-16	E 308L-16
3.	XUPER FAB E309-16	E 309-16
4.	XUPER FAB E309L-16	E 309L-16
5.	XUPER FAB E309Mo-16	E 309Mo-16
6.	XUPER FAB E310-16	E 310-16
7.	XUPER FAB E316-16	E316-16
8.	XUPER FAB E316L-16	E316L-16
9.	XUPER FAB E347-16	E347-16
10.	XUPER 2220	ENiCu-7

4. M/s Fusion Engineering Products Ltd., Jamshedpur

Sl. No.	Brand Name	AWS Classification
1.	Electra-6	E-6013
2.	Electra-9	E-6013
3.	Basicote-6	E-7018

C. Approved Welding Electrodes (List dated 09/04/2010 and M&I/IP/GC-HQ/10 dtd. April 9, 2010)

1. M/s. ADOR Welding Limited

2. M/s. ESSAB India Limited

3. M/s. D&H Secheron Electrodes Limited

4. **M/s. D&H India, Indore** (M&I/IP/Vendor/Registration/WU-4/19 dtd. 10.04.2012)

Sl. No.	Brand Name	AWS Classification
1.	STANDARD	E 6013
2.	SUPER-LH	E 7018
3.	SUPER-LH (SPL)	E 7018-1
4.	SUPER-CR-1	E 8018-B2
5.	SUPER-CR-2	E 9018-B3
6.	CROMALLOY-A	E 308-16
7.	CROMALLOY-B	E 308L-16
8.	CROMALLOY-C	E 316-16
9.	CROMALLOY-2C	E 316-L
10.	CROMALLOY-309	E 309-16
11.	CROMALLOY-309L	E 309L-16
12.	CROMALLOY-A ST	E 347-16
13.	HAST-B	E NiCrFe3

5. **M/s. Honavar Electrodes Pvt. Ltd., Mumbai**

Sl. No.	Brand Name	AWS Classification
1.	CELLUMATE	E 6010
2.	REGULAR – S	E 6013
3.	ULTIMATE – 18	E 7018
4.	ULTIMATE – 18 SPL	E 7018-1
5.	ULTIMATE – 18 A1	E 7018 – A1
6.	ULTIMATE – 18 NC	E 7018 (NACE)
7.	ULTIMATE – 18 (SPL) NC	E 7018 – 1 (NACE).
8.	ULTIMATE – 80 B2	E 8018 – B2
9.	ULTIMATE – 90 B3	E 9018 – B3
10.	CROMOMATE 5	E 8018 – B6
11.	CROMOMATE 9	E 8018 – B8
12.	SILVERSHINE - 308	E 308 – 16
13.	SILVERSHINE – 308L	E 308L – 16
14.	SILVERSHINE – 309	E 309 – 16
15.	SILVERSHINE – 309L	E 309L -016
16.	SILVERSHINE – 309 Mo	E 309Mo – 16
17.	SILVERSHINE – 316	E 316 – 16
18.	SILVERSHINE – 316 L	E 316L – 16
19.	SILVERSHINE – 347	E 347 - 16
20.	Ultimate 80	E 8018G
21.	Ultimate 90	E 9018G
22.	Cromomate-91	E 9018-B9
23.	Cryomate-2NS	ENiCrFe-2
24.	Cryomate-3NS	ENiCrFe-3
25.	Cryomate-5	ENiCrMo-3
26.	DE-1650	ENiCu-7
27.	Silvershine-4462 (spl.)	E-2209-17

28.	Silvershine-4470	E-2594-16
29.	Silvershine-410B	E-410-15
30.	Silvershine-310	E-310-16
31.	Ultimate 70B2L	E-7018-B2L
32.	Ultimate 80B3L	E-8018-B3L
33.	Cromomate 5L	E-8018-B6L
34.	Silvershine 309MoL	E 309MoL

6. M/s Mailam India Ltd. Pondicherry

Sl. No.	Brand Name	AWS Classification
1.	MAILARC-10	E 6010
2.	MAILARC-13R	E 6013
3.	MAILARC-18	E 7018
4.	MAILARC-18 PLUS	E 7018-1
5.	MAILARC-1CR	E 8018-B2
6.	MAILARC-2CR	E 9018-B3
7.	MAILARC-5CR	E 8018-B6
8.	MAILARC-9CR	E 8018-B8
9.	MAILEX-AL	E 308L-16
10.	MAILEX-AH	E 308H-16
11.	MAILEX-25/12L	E 309L-16
12.	MAILEX-MoL	E316L – 16
13.	MAILEX-ANb	E 347-16
14.	MAILARC-18(MOD) NACE	E 7018 - NACE
15.	MAILARC-18 PLUS (MOD) NACE	E 7018-1 NACE
16.	MAILARC-Mo	E 7018 – A1
17.	MAILEX-25/12LMo	E 309LMo
18.	ME-40	ENiCrFe-3
19.	ME-42	ENiCu7
20.	ME-44	ENiCrMo3
21.	MAILEX-410	E 410-15
22.	MAILEX-430	E 430-15

7. M/s. EWAC Alloys Limited (Associate company of L&T), Mumbai

Sl. No.	Brand Name	AWS Classification
1.	XUPER FAB E308-16	E 308-16
2.	XUPER FAB E308L-16	E 308L-16
3.	XUPER FAB E309-16	E 309-16
4.	XUPER FAB E309L-16	E 309L-16
5.	XUPER FAB E309Mo-16	E 309Mo-16
6.	XUPER FAB E310-16	E 310-16
7.	XUPER FAB E316-16	E316-16
8.	XUPER FAB E316L-16	E316L-16
9.	XUPER FAB E347-16	E347-16
10.	XUPER 2220	ENiCu-7

8. M/s Fusion Engineering Products Ltd., Jamshedpur

Sl. No.	Brand Name	AWS Classification
1.	Electra-6	E-6013
2.	Electra-9	E-6013
3.	Basicote-6	E-7018

9. M/s GEE Limited, Thane, Mumbai

(M&I/IP/Vendor/Registration/WU-4/19 dated 24.02.2012)

Sl. No.	Brand Name	AWS Classification
1.	GRICON WHITE	E 6010
2.	GEECON PINK	E 6013
3.	GRICON GREEN	E 7018
4.	GRICON GREEN (SPL)	E 7018-1
5.	GRIDUCT 3	E 8018 B2
6.	GRIDUCT 4	E 9018 B3
7.	GRIDUCT B6	E 8018 - B6
8.	GRIDUCT B8	E 8018 - B8
9.	GRINOX 4	E 308-16
10.	GRINOX 4L	E 308L-16
11.	GRINOX 9	E 309-16
12.	GRINOX 9L	E 309L-16
13.	GRINOX 16	E 316-16
14.	GRINOX 16L	E 316L-16
15.	GRINOX 47	E 347-16
16.	GRINOX 347 H	E 347 H-16 (SP)
17.	GRINOX 2209	E 2209-16
18.	GEMET 821N	E NiCrFe3

10. M/s Modi Arc Electrode Co.

Sl. No.	Brand Name	AWS Classification
1.	STOVE 60 AP	E 6010
2.	SULTRA	E 6013
3.	MODI 7018	E 7018
4.	MODI 7018 SPL	E 7018-1
5.	MODI 7018-A1	E 7018-A1
6.	MODI 8018-B2	E 8018-B2
7.	MODI 9018-B3	E 9018-B3
8.	MODI 9018	E 9018-G
9.	SS 308	E 308-16
10.	SS 308L	E 308L-16
11.	SS 309	E 309-16
12.	SS 309L	E 309L-16
13.	SS 316	E 316-16
14.	SS 316L	E 316L-16
15.	SS 347	E-347-16

11. Royal Electrodes, Mumbai

Sl. No.	Brand Name	AWS Classification
1.	ROYAL 6010	E 6010
2.	ROYAL THERM	E 7018
3.	ROYAL-THERM SPL	E 7018-1

D. **Approved Welding Electrodes** (Ref. No. M&I/ IP/ VENDOR REGISTRATION/ WU-4/ 19 dated 04/05/2012)

1. M/s Modi Arc Electrode Co.

Sl. No.	Brand Name	AWS Classification
1.	Modi 7018 (NACE)	E 7018
2.	Modi 7018 SPL (NACE)	E 7018-1
3.	Modi 8018	E 8018G
4.	Modi 9015 B9	E 9015-B9
5.	Modi 309L Mo	E 309L Mo-16
6.	Modi 410-15	E 410-15
7.	Modi 430-15	E 430-15
8.	Modi Duex 1	E 2209-17
9.	Modi NICU	ENiCuB

2. M/s D&H India, Indore

Sl. No.	Brand Name	AWS Classification
1.	CELLO-10	E 6010
2.	CELLO-10MO	E 7010G
3.	SUPER MO	E 7018 A1
4.	SUPER SGS	E 7018 (NACE)
5.	SUPER SGS SPL	E 7018-1 (NACE)
6.	SUPER CR 5	E 8018 B6
7.	SUPER CR 9	E 8018 B8
8.	SUPER-LH Ni SPL	E 8018 G
9.	SUPER CR 9 MOD	E 9018 B9
10.	ULTRA-65	E 9018 G
11.	SV-CR-13	E 410-16
12.	ARMER 29L	E 2209-16

3. M/s GEE LIMITED

Sl. No.	Brand Name	AWS Classification
1.	GEMET 825 N	E NiCrMo3
2.	GEMET 811	ENiCu 7
3.	GRICON GREEN (SPECIAL) NC	E 7018 (NACE)
4.	GRICON GREEN NC	E 7018-1 (NACE)
5.	GRIDUCT-B2L	E 7018-B2L
6.	GRIDUCT-B3L	E 8018-B3L
7.	GRINOX 9Mo	E 309Mo-16

4. M/s Royal ARC Electrodes Limited



Sl. No.	Brand Name	AWS Classification
1.	ROYAL 7018B2	E 7018B2
2.	ROYAL THERM 2H SPL	E 7018 NACE
3.	ROYAL CHROM-1	E 8018 B2
4.	ROYAL CHROM-2	E 9018 B3
5.	ROYAL CHROM-5	E 8018 B6
6.	ROYAL CHROM-9	E 8018 B8
7.	ROYAL 1C	E 308L 16
8.	ROYAL 1AH	E 308H 16
9.	ROYAL 2C	E 316L 16
10.	ROYAL D2L	E 309L 16
11.	ROYAL 1B	E 347 16
12.	ROYAL CW	E 310 16
13.	ROYAL 2209	E 2209 16



E. M/s D&H India (Ref. No. PDRP/INSP/55 dated 27/01/2012)



Sl. No.	Brand Name	AWS Classification
1.	MIG ARC-WS-6	ER70S-6 (MIG)
2.	Super TIG-70S-2	ER 70S-2
3.	Super TIG-70S-2 (NACE)	ER 70S-2
4.	Super SGS(SPL)	E-7018-1
5.	Super SGS	E-7018



F. M/s Royal ARC Electrodes Limited (Ref. No. M&I/IP/Vendor/Registration /WU-4/19 dated 24/02/2012)



Sl. No.	Brand Name	AWS Classification
1.	Royal-S	E6013
2.	Royal-SS	E6013
3.	Royal-Bond	E6013
4.	Royal 6010	E6010
5.	Royal-Therm	E7018
6.	Royal-Therm SPL	E7018-1

<div> </div>					<div>TABLE-01</div> <div>NDE CHART</div>								Project N°		Unit	Doc. Type	Mat'l Code	Serial N°	Rev.
													080557C001		000	PP	814		3
Sl. No.	PIPING CLASS	LOCATION	RATING in #	BASIC MATERIAL (DESIGN CODE)	CORROSION ALLOWANCE (MM)	DESIGN CONDITIONS		DESCRIPTION	SPECIAL REQUIREMENT			OTHER REQUIREMENT	Visual in %	RT in %	DPT /MPT (Note-3)			Hardness Test	REMARKS
						P (Kg/Cm ² g)	T (Deg C)		NACE	HIC	PWHT (Note-4)				Socket welds	Branch Welds	External Attachment		
1	A12A	A/G	150	CARBON STEEL (ASME B31.3)	3.00	20.04 5.62	-29/38 427	NITROGEN OILY WATER SEWER PROCESS PLANT AIR LOW PRESSURE STEAM			B31.3 (Note-5)		100	10	10	10	10		Note-1
2	A15A	A/G	150	CARBON STEEL (ASME B31.3)	3.00	20.04 14.21	38 200	PROCESS PLANT AIR LOW PRESSURE STEAM			B31.3 (Note-5)	JACKETED	100	100% 10% (Note 6)	10	10	10		Note-1
3	A17A	U/G	150	CARBON STEEL (ASME B31.3)	6.00	ATM(1.03)	65	CONTAMINATED RAIN WATER SEWER OILY WATER SEWER VENT ATMOSPHERIC			B31.3 (Note-5)	3LPE COATED	100	10	10	10	10		Note-1
4	A1A	A/G	150	CARBON STEEL (ASME B31.3)	1.50	20.04 5.62	-29/38 427	LOW PRESSURE CONDENSATE NITROGEN OILY WATER SEWER PROCESS STORM SEWER SERVICE WATER			B31.3 (Note-5)		100	10	10	10	10		Note-1
5	A1K	A/G	150	SS 304L (ASME B31.3)	0.80	16.17 10.55	-29/38 260	VENT ATMOSPHERIC DEMINERALIZED WATER					100	10	10	10	10		Note-1
6	A21N	A/G	150	SS 316L (ASME B31.3)	1.50	16.17 7.71	-29/38 371	PROCESS					100	10	10	10	10		Note-1
7	A23A	A/G	150	CARBON STEEL (ASME B31.3)	1.50	10.5 10.5	-29/38 100	INSTRUMENT AIR PLANT AIR NITROGEN			B31.3 (Note-5)		100	10	10	10	10		Note-1

<div> </div>					TABLE-01 NDE CHART								Project N°		Unit	Doc. Type	Mat'l Code	Serial N°	Rev.
													080557C001		000	PP	814		3
Sl. No.	PIPING CLASS	LOCATION	RATING in #	BASIC MATERIAL (DESIGN CODE)	CORROSION ALLOWANCE (MM)	DESIGN CONDITIONS		DESCRIPTION	SPECIAL REQUIREMENT			OTHER REQUIREMENT	Visual in %	RT in %	DPT /MPT (Note-3)			Hardness Test	REMARKS
						P (Kg/Cm ² g)	T (Deg C)		NACE	HIC	PWHT (Note-4)				Socket welds	Branch Welds	External Attachment		
8	A28A	A/G	150	CARBON STEEL (ASME B31.3)	3.00	20.04 11.95	-29/38 260	NITROGEN PROCESS LOW PRESSURE STEAM	YES	YES	YES		100	100	100	100	100	Note-2	Note-9
9	A29A	A/G	150	CARBON STEEL (INTERNAL PHENOLIC BAKED EPOXY LINED) (ASME B31.3)	3.00	16 16	-29/38 65	COOLING WATER RETURN COOLING WATER SUPPLY FIRE WATER			B31.3 (Note-5)		100	10	10	10	10		Note-1
10	A2A	A/G	150	CARBON STEEL (ASME B31.1)	1.50	20.04 5.62	-29/38 427	BLOW DOWN LOW PRESSURE CONDENSATE HIGH PRESSURE STEAM LOW PRESSURE STEAM			B31.1 (Note-5)	IBR / FV	100	10	10	10	10		Note-1
11	A30A	U/G	150	CARBON STEEL (INTERNAL PHENOLIC BAKED EPOXY LINED & EXTERNAL 3LPE COATED) (ASME B31.3)	3.00	16 16	-29/38 65	COOLING WATER RETURN COOLING WATER SUPPLY FIRE WATER			B31.3 (Note-5)	3LPE COATED	100	10	10	10	10		Note-1
12	A31A	A/G	150	CARBON STEEL (ASME B31.1)	3.00	20.04 5.62 14.8/FV	-29/38 427 175	BLOW DOWN HIGH PRESSURE CONDENSATE LOW PRESSURE CONDENSATE NITROGEN OILY WATER SEWER HIGH PRESSURE STEAM LOW PRESSURE STEAM			B31.1 (Note-5)	IBR / FV	100	10	10	10	10		Note-1
13	A3A	A/G	150	CARBON STEEL (ASME B31.3)	3.00	20.04 5.62	-29/38 427	OILY WATER SEWER VENT ATMOSPHERIC COOLING WATER RETURN COOLING WATER SUPPLY SERVICE WATER			B31.3 (Note-5)		100	10	10	10	10		Note-1
14	A49A	A/G	150	CARBON STEEL (ASME B31.3)	6.00	20.04 5.62	-29/38 427	ACID GAS FLARE FUEL GAS OILY WATER SEWER PROCESS PROCESS WATER	YES	YES	YES		100	100	100	100	100	Note-2	Note-9

<div> </div>					TABLE-01 NDE CHART								Project N°		Unit	Doc. Type	Mat'l Code	Serial N°	Rev.
													080557C001		000	PP	814		3
Sl. No.	PIPING CLASS	LOCATION	RATING in #	BASIC MATERIAL (DESIGN CODE)	CORROSION ALLOWANCE (MM)	DESIGN CONDITIONS		DESCRIPTION	SPECIAL REQUIREMENT			OTHER REQUIREMENT	Visual in %	RT in %	DPT /MPT (Note-3)			Hardness Test	REMARKS
						P (Kg/Cm ² g)	T (Deg C)		NACE	HIC	PWHT (Note-4)				Socket welds	Branch Welds	External Attachment		
15	A52A	A/G	150	CARBON STEEL (ASME B31.3)	3.00	20.04 18.01	-29/38 100	FUEL GAS			B31.3 (Note-5)		100	10	10	10	10		Note-1
16	A53G	A/G	150	CARBON STEEL (Galv.) (ASME B31.3)	1.50	16 16	0/38 65	INSTRUMENT AIR PLANT AIR DRINKING WATER FIRE WATER (AFTER DELUGE)			B31.3 (Note-5)		100	10	10	10	10		Note-1
17	A95A	A/G	150	CARBON STEEL (ASME B31.3)	6.00	20.04 5.62	-29/38 427	PROCESS			B31.3 (Note-5)		100	100	100	100	100		
18	A13A	A/G	150	CARBONSTEEL (ASME B31.3)	3.00	20.04 5.62	-29/38 427	HYDROCARBONS, SOUR WATER, SOUR GAS, SLOPS, ACID GAS FLARE,	YES		YES		100	100	100	100	100	Note-2	Note-1 & Note-10
19	A8A	A/G	150	CARBONSTEEL (ASME B31.3)	3.00	20.04 5.62	-29/38 427	AMINES AND NON NACE MILD SOUR			YES		100	100	100	100	100	Note-2	
20	B12A	A/G	300	CARBON STEEL (ASME B31.3)	3.00	52.03 28.83	-29 427	NITROGEN OILY WATER SEWER PROCESS			B31.3 (Note-5)		100	10	10	10	10		Note-1
21	B19A	A/G	300	CARBON STEEL (ASME B31.3)	1.50	52.03 28.83	-29 427	PROCESS			YES		100	100	100	100	100	Note-2	Note-9

<div> </div>					TABLE-01 NDE CHART								Project N°		Unit	Doc. Type	Mat'l Code	Serial N°	Rev.
													080557C001		000	PP	814		3
Sl. No.	PIPING CLASS	LOCATION	RATING in #	BASIC MATERIAL (DESIGN CODE)	CORROSION ALLOWANCE (MM)	DESIGN CONDITIONS		DESCRIPTION	SPECIAL REQUIREMENT			OTHER REQUIREMENT	Visual in %	RT in %	DPT /MPT (Note-3)			Hardness Test	REMARKS
						P (Kg/Cm ² g)	T (Deg C)		NACE	HIC	PWHT (Note-4)				Socket welds	Branch Welds	External Attachment		
22	B1A	A/G	300	CARBON STEEL (ASME B31.3)	1.50	52.03 28.83	-29 427	PROCESS			B31.3 (Note-5)		100	10	10	10	10	Note-1	
23	B2A	A/G	300	CARBON STEEL	1.50	40 18 FV	150 350 305	MEDIUM PRESSURE STEAM, BLOW DOWN STEAM			B31.1 (Note-5)	IBR / FV	100	10	10	10	10		
24	B28A	A/G	300	CARBON STEEL (ASME B31.3)	3.00	52.03 28.83	0 427	PROCESS	YES	YES	YES		100	100	100	100	100	Note-2 Note-9	
25	B31A	A/G	300	CARBON STEEL (ASME B31.1)	3.00	40 18 FV	150 225 194	BOILER FEED WATER			B31.1 (Note-5)	IBR/FV	100	10	10	10	10	Note-1	
26	B49A	A/G	300	CARBON STEEL (ASME B31.3)	6.00	52.03 28.83	0 427	ACID GAS FLARE OILY WATER SEWER PROCESS WATER	YES	YES	YES		100	100	100	100	100	Note-2 Note-9	
27	D2A	A/G	600	CARBON STEEL (ASME B31.1)	1.50	79 46 FV	150 427 427	LOW PRESSURE CONDENSATE OILY WATER SEWER HIGH PRESSURE STEAM			B31.1 (Note-5)	IBR/FV	100	100	100	100	100		
28	D3A	A/G	600	CARBONSTEEL (ASME B31.3)	3.00	104.05 58/FV	-29/38 427	PROCESS VACUUM - NON SOUR			B31.3 (Note-5)		100	20	20	20	20	Note-1	

<div></div>					<div>TABLE-01</div> <div>NDE CHART</div>								Project N°		Unit	Doc. Type	Mat'l Code	Serial N°	Rev.
													080557C001		000	PP	814		3
Sl. No.	PIPING CLASS	LOCATION	RATING in #	BASIC MATERIAL (DESIGN CODE)	CORROSION ALLOWANCE (MM)	DESIGN CONDITIONS		DESCRIPTION	SPECIAL REQUIREMENT			OTHER REQUIREMENT	Visual in %	RT in %	DPT /MPT (Note-3)			Hardness Test	REMARKS
						P (Kg/Cm ² g)	T (Deg C)		NACE	HIC	PWHT (Note-4)				Socket welds	Branch Welds	External Attachment		
29	D31A	A/G	600	CARBON STEEL (ASME B31.1)	3.00	82.0 46.0 FV	150 280 280	BLOW DOWN HIGH PRESSURE CONDENSATE LOW PRESSURE CONDENSATE OILY WATER SEWER BOILER FEED WATER			B31.1 (Note-5)	IBR/FV	100	100	100	100	100		
30	D9D	A/G	600	ALLOY STEEL 1.25 Cr 0.5 Mo B31.1	1.50	52/FV	435	HIGH PRESSURE STEAM			YES	IBR / FV	100	100	100	100	100		
31	D9L	A/G	600	ALLOY STEEL 9 Cr 1 Mo V B31.1	1..50	46 FV	438 427	HIGH PRESSURE STEAM			YES	IBR /FV	100	100	100	100	100		

- Note 1

Random, 10% or 20% radiography" shall mean examining not less than one from each 10 welds or less in case of "Random 10% radiography", one from each five welds or less in case of "Random 20% radiography" made by the same welding procedure. Irrespective of percentage, no. of welds to be radiographed shall be minimum one. However first two welds made by each welder shall also be radiographed in case of "Random radiography". Welds selected for examination shall not include flange welds and shall be radiographed for their entire length.
- Note 2

100% of those which are locally heat treated shall be hardness tested.
All welds which are given heat treatment shall be hardness tested. Hardness test shall be performed after final heat treatment.
Hardness test where specifically called out in PMS, shall be carried out irrespective of thickness
- Note 3

MPT for CS & LAS and DPT for SS welds
DPT wherever applicable will be carried out at the root of welding and on finished weld both.
For stainless steel welds, the solutions used in DPT will be controlled halide category.
- Note -4

When mentioned "Yes" PWHT is applicable for all thickness and when code is mentioned like B31.3 or B31.1 stringent requirement of IBR/Welding procedure Specification/ Code shall govern.
- Note-5

Stringent requirement to be followed as per Welding Chart no 080557C-000-PP-815 / Code shall govern
- Note-6



100 % RT for Inner Pipes and 10% RT for out side pipes of Jacketing
- Note-7

In case of sour, amine, caustic & LPG services , wherever MPT indicated will be done by using yoke method, not Prod method.In case of other services, Prod method may be used.
- Note-8





Wherever MPT is not possible due to size restriction, PT can be used.
- Note-9

All NDE shall be performed after completion of PWHT, except for RT of carbon steels
- Note-10

100% RT except for Acid gas flare lines which will be in 10% RT category

 	PROJECT	Standby SRU & Additional Tanks IOCL Paradip Refinery		
	CLIENT	INDIAN OIL CORPORATION LIMITED		
WELDING SPECIFICATION CHARTS FOR PIPING CLASSES	Project No. 080557C001	Document No. 080557C-000-PP-815	Rev. No. 2	Page 1 of 5

WELDING SPECIFICATION CHARTS FOR PIPING CLASSES

			 Written By T Balamurugan 2020.03.13 13:18:18 +05'30'	 Mathivanan Ganesan Digitally signed by Mathivanan Ganesan DN: cn=TechnipFMC, o=IndianOil, ou=Paradip Refinery, email=mathivanan.ganesan@iocl.co.in, c=IN Date: 2020.03.13 15:38:08 +05'30'	 Mathivanan Ganesan Digitally signed by Mathivanan Ganesan DN: cn=TechnipFMC, o=IndianOil, ou=Paradip Refinery, email=mathivanan.ganesan@iocl.co.in, c=IN Date: 2020.03.13 15:38:08 +05'30'	 Authorized By Mutschkegheer 2020.03.13 16:16:33 +05'30'
2	10.03.2020	ISSUED FOR IMPLEMENTATION	TB	GM	GM	JMC
1	27.11.2019	ISSUED FOR IMPLEMENTATION	TB	GM	LA	JMC
0	16.10.2019	ISSUED FOR IMPLEMENTATION	NVK	PKP	LA	JMC
REV.	DATE	DESCRIPTION	PREPARED	CHECKED	APPROVED	AUTHORIZED

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 	PROJECT	Standby SRU & Additional Tanks IOCL Paradip Refinery		
	CLIENT	INDIAN OIL CORPORATION LIMITED		
WELDING SPECIFICATION CHARTS FOR PIPING CLASSES	Project No. 080557C001	Document No. 080557C-000-PP-815	Rev. No. 2	Page 2 of 5

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		PROJECT	Standby SRU & Additional Tanks IOCL Paradip Refinery		
		CLIENT	INDIAN OIL CORPORATION LIMITED		
WELDING SPECIFICATION CHARTS FOR PIPING CLASSES	Project No. 080557C001	Document No. 080557C-000-PP-815		Rev. No. 2	Page 3 of 5

1. INTRODUCTION

INDIAN OIL CORPORATION LIMITED (IOCL) has awarded Fax of Acceptance (FOA) dated 29th August 2019 to M/s. Technip India Limited (TPIL) for Consultancy services (PMC/EPCM services) for overall project management, FEED Review / FEED, Detailed Engineering, Procurement & expediting services, Tendering & award, Construction Management & Supervision, Assistance in start-up, Commissioning & performance test runs for installation of a Standby SRU of 525 TPD capacity and execution of Additional tanks for Paradip Refinery, Odisha, India.

2. DEFINITIONS

2.1 Wherever used in this procedure, the following words shall have the meaning as given hereunder

“OWNER or IOCL” shall mean INDIAN OIL CORPORATION LIMITED

“CONSULTANT or PMC” shall mean TECHNIP INDIA LIMITED

“CONTRACTOR” shall mean the bidder selected by the OWNER for performing the scope of works specified in the tender documents.

“AUTHORISED REPRESENTATIVE” shall mean OWNER's/ CONSULTANT's representative authorized to act for and on behalf of OWNER/ CONSULTANT, as the case may be

“VENDOR” shall mean any third party supplying any of the equipment/materials for setting up the Plant.

“PROJECT” shall mean Sulphur Recovery Unit and Additional Tanks Project, Paradip Refinery



“PLANT” shall mean the units and facilities comprised in the project, and if divided into different packages for the award of Contracts.

“UNIT” shall mean a particular process unit etc. which forms a distinct operating system and a part of the plant.

“Sub- Contractor” shall mean Sub-Contractor engaged by Contractor

2.2 ABBREVIATIONS

a. GTAW - Gas Tungstan Arc Welding

		PROJECT	Standby SRU & Additional Tanks IOCL Paradip Refinery		
		CLIENT	INDIAN OIL CORPORATION LIMITED		
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- b. SMAW - Shielded Metal Arc Welding
- c. FCAW – Flux Cored Arc Welding
- d. SAW – Submerged Arc Welding
- e. WPS - Welding Procedure Specification
- f. PQR - Procedure Qualification record.
- g. AWS - American Welding Society
- h. QA/QC - Quality Assurance / Quality Control
- i. QAP - Quality Assurance Plan
- j. QCP - Quality Control Plan
- k. FQCP - Fabrication Quality Control Plan
- l. TPIA - Third Party Inspection Agency

3. SCOPE

This document describes the Welding Specifications for the piping classes covered by the Piping Material Specification issued for this Project. Contractor shall carry out Procedure Qualification under witnessing by PMC and submit the WPS with qualified PQR to OWNER /PMC for approval. Contractor shall consult with PMC for any additional essential variables to be considered or any additional qualification tests required over and above the normal qualification test requirements covered by ASME Section IX. Any deviation from this shall be approved through a deviation request specifically issued by Contractor and approved by PMC.

4. REFERENCES

- a. Indian Boiler Regulations
- b. ASME B31.3 – Refinery Piping
- c. ASME B31.1 – Power Piping
- d. ASME Sec IX – Qualification Standard for Welding, Brazing, and Fusing Procedures
- e. ASME Sec IIC - Specifications for Welding Rods, Electrodes, and Filler Metals



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- f. ASME Sec V – Non Destructive Examination
- g. AWS D 10.8 – Recommended Practices for Welding of Chromium-Molybdenum Steel Piping and Tubing
- h. API RP 582 - Welding Guidelines for the Chemical, Oil, and Gas Industries
- i. NACE MR0103 – Petroleum, petrochemical and natural gas industries — Metallic materials resistant to sulfide stress cracking in corrosive petroleum refining environments
- j. NACE SP0472 - Methods and Controls to Prevent In-Service Environmental Cracking of Carbon Steel Weldments in Corrosive Petroleum Refining Environments
- k. NACE TM0284 -Evaluation of Pipeline and Pressure Vessel Steels for Resistance to Hydrogen-Induced Cracking
- l. 080557C-000-JSD-1300-002 - Piping Material Specification
- m. 080557C-000-JSC-1300-001 - Standard Specification for Fabrication & Erection of Piping
- n. 080557C-000-PP-814 - Welding & NDE Specification for Fabrication of Piping



5. LIST OF SPECIFICATIONS CHARTS (Attached as Annexure-A)

1. WELDING CHART FOR CLASSES A3A, A17A, A23A, A29A, A30A, A53G
2. WELDING CHART FOR CLASSES A1A, A12A, A15A, A52A, A95A, B1A, B12A, D3A
3. WELDING CHART FOR CLASSES A2A, B2A, A31A, B31A, D2A, D31A
4. WELDING CHART FOR CLASSES A13A
5. WELDING CHART FOR CLASSES A8A, B19A
6. WELDING CHART FOR CLASSES A28A, A49A, B28A, B49A
7. WELDING CHART FOR CLASSES A1K
8. WELDING CHART FOR CLASSES A21N
9. WELDING CHART FOR CLASSES D9D
10. WELDING CHART FOR CLASSES D9L



		PROJECT		Standby SRU & Additional Tanks, IOCL Paradip Refinery																																																																	
		CLIENT		INDIAN OIL CORPORATION LIMITED																																																																	
WELDING SPECIFICATION SHEET		NO :		PMS / 1300 / 01		Rev.	2	Date	27-Nov-19																																																												
PIPING CLASS A3A, A17A, A23A, A29A, A30A, A53G																																																																					
MATERIAL SPECIFICATIONS		PIPES		ASTM A106Gr.B, IS - 3589 GR. 330 , GR.410, API 5L GR.B PSL2																																																																	
		FITTINGS		ASTM A 105, ASTM A 234 GR. WPB, ASTM A 234 GR. WPBW																																																																	
		FLANGES		ASTM A105N																																																																	
		OTHERS																																																																			
BASE METAL 'P' NO.		1																																																																			
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GAS COMPOSITION		NA	NA			GAS COMPOSITION	99.995	80% + 20%																																																													
PREHEATING		PREHEAT TEMP		10° C MIN.		POST HEATING		NA																																																													
CONTINUITY OF WELDING AND PREHEAT				YES		INTERPASS		250° C Max.																																																													
POST WELD HEAT TREATMENT		HOLDING TEMP		NA		HOLDING TIME		NA																																																													
		RATE OF HEATING		NA		MIN. HOLDING TIME		NA																																																													
		METHOD OF COOLING		NA		RATE OF COOLING		NA																																																													
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(Prepared By)		(Checked By)		(Approved By)		CLIENT APPROVAL																																																															



 		PROJECT		Standby SRU & Additional Tanks, IOCL Paradip Refinery			
		CLIENT		INDIAN OIL CORPORATION LIMITED			
WELDING SPECIFICATION SHEET		NO	PMS / 1300 / 02		Rev.	2	Date 27-Nov-19
PIPING CLASS A1A, A12A, A15A, A52A, A95A, B1A, B12A, D3A							
MATERIAL SPECIFICATIONS		PIPES	ASTM A106Gr.B, ASTM A672Gr.C65 Cl.12,				
		FITTINGS	ASTM A234 WPB, ASTM A105N				
		FLANGES	ASTM A105N				
		OTHERS					
BASE METAL 'P' NO.		1					
WELDING PROCESS AND CONSUMABLES				GROOVE JOINTS (NOTE 1)			
BUTT				OTHER THAN BUTT			
PROCESS	GTAW	SMAW	FCAW	PROCESS	GTAW	SMAW	FCAW
PASS				PASS			
ROOT PASS (Note 2)	ER 70 S 2	E 6010	NA	ROOT PASS (Note 2)	ER 70S 2	E7018	NA
FILLER PASS	ER 70 S 2	E 7016 / E 7018	E 71 T1	FILLER PASS	ER 70S 2	E 7016 / E 7018	E 71 T1
WELDING PROCESS AND METALS				FILLET JOINTS/SW JOINTS			
PROCESS	GTAW	SMAW	FCAW				
PASS							
ROOT PASS (Note 3)	ER 70S2	E7016/ E7018	NA				
FILLER PASS	ER 70S2	E7016/ E7018	E 71 T1				
JOINT PREPARATION		ASME B 31.3					
GASES		PURGING		SHIELDING			
PROCESS	GTAW	FCAW		PROCESS	GTAW	FCAW	
PURGING	NA	NA		SHIELDING	YES	YES	
PURGING GAS NAME	NA	NA		GAS NAME	ARGON	Ar + CO2	
GAS COMPOSITION	NA	NA		GAS COMPOSITION	99.995	80% + 20%	
PREHEATING (NOTE 3)	PREHEAT TEMP	10° C MIN./ 100° C For thk. >25mm		POST HEATING	NA		
CONTINUITY OF WELDING AND PREHEAT		YES		INTERPASS	250° C Max.		
POST WELD HEAT TREATMENT	HOLDING TEMP	NA		HOLDING TIME	NA		
	RATE OF HEATING	NA		MIN. HOLDING TIME	NA		
(Note 4)	METHOD OF COOLING	NA		RATE OF COOLING	NA		
MECHANICAL PROPERTY REQUIREMENTS				TEMP	MIN	AVERAGE	
CHARPY 'V' NOTCH IMPACT TEST VALUE				NA	NA	NA	
HARDNESS				200 BHN Max , for PWHT Joints			
CODE OF FABRICATION		ASME B 31.3					
TECHNICAL NOTES							
NOTE 1: Any combination of welding process for groove weld can be used subject to qualification of the Welding Procedure							
NOTE 2: Entire welding of small bore piping, 2"NB and smaller shall be performed with GTAW.							
NOTE 3: Preheat Temperature of 50° C Shall be provided for the Root and next passes for thickness greater than 12.7mm and less than 25.4 mm							
NOTE 4 : Post Weld Heat treatment shall be performed as per ASME B31.3 for pipe wall thickness more than 19 mm at 620 +/- 20° C							
SMAW - SHIELDED METAL ARC WELDING				GTAW - GAS TUNGSTEN ARC WELDING			
FCAW - FLUX CORED ARC WELDING							
(Prepared By)	(Checked By)	(Approved By)	CLIENT APPROVAL				



 		PROJECT		Standby SRU & Additional Tanks, IOCL Paradip Refinery			
		CLIENT		INDIAN OIL CORPORATION LIMITED			
WELDING SPECIFICATION SHEET		NO :	PMS / 1300 / 03	Rev.	2	Date	27-Nov-19
PIPING CLASS A2A, A31A, B2A, B31A, D2A, D31A							
MATERIAL SPECIFICATIONS		PIPES	ASTM A106Gr.B, ASTM A672Gr.C65 Cl.12,				
		FITTINGS	ASTM A234 WPB, ASTM A105N				
		FLANGES	ASTM A105N				
		OTHERS					
BASE METAL 'P' NO. 1							
WELDING PROCESS AND MATERIALS				GROOVE JOINTS (NOTE 1)			
BUTT				OTHER THAN BUTT			
PROCESS	GTAW	SMAW		PROCESS	GTAW	SMAW	
PASS				PASS			
ROOT PASS (Note 2)	ER 70 S 2	E 6010		ROOT PASS (Note 2)	ER 70S 2	E7016 / E7018	
FILLER PASS	ER 70 S 2	E 7016 / E 7018		FILLER PASS	ER 70S 2	E 7016 / E 7018	
WELDING PROCESS AND METALS				FILLET JOINTS/SW JOINTS			
PROCESS	GTAW	SMAW					
PASS							
ROOT PASS (Note 2)	ER 70S2	E7016 / E7018					
FILLER PASS	ER 70S2	E7016 / E7018					
JOINT PREPARATION				ASME B 31.1 + IBR			
GASES		PURGING		SHIELDING			
PROCESS	GTAW			PROCESS	GTAW		
PURGING	NA			SHIELDING	YES		
PURGING GAS NAME	NA			GAS NAME	ARGON		
GAS COMPOSITION	NA			GAS COMPOSITION	99.995		
PREHEATING (Note 3)		PREHEAT TEMP	10° C MIN. / 100° C For thk. >25mm	POST HEATING		NA	
CONTINUITY OF WELDING AND PREHEAT		YES		INTERPASS		250° C Max.	
POST WELD HEAT		HOLDING TEMP	595° C to 620° C	HOLDING TIME		1 Hour/ Inch thk.	
TREATMENT (Note 4)		RATE OF HEATING	200° C / Hr Max.	MIN. HOLDING TIME		1 Hour	
		METHOD OF COOLING	Controlled	RATE OF COOLING		200° C / Hr Max.	
MECHANICAL PROPERTY REQUIREMENTS				TEMP MIN AVERAGE			
CHARPY 'V' NOTCH IMPACT TEST VALUE				NA NA NA			
HARDNESS				200 BHN Max , for PWHT Joints			
CODE OF FABRICATION				ASME B 31.1 & IBR			
TECHNICAL NOTES							
NOTE 1: Any combination of welding process for groove weld can be used subject to qualification of the Welding Procedure							
NOTE 2: Entire welding of small bore piping, 2"NB and smaller shall be performed with GTAW.							
NOTE 3: Preheat Temperature of 50° C Shall be provided for the Root and next passes for thickness greater than 12.7mm and less than 25.4 mm							
NOTE 4: For IBR Service, Post Weld Heat treatment shall be performed for pipe wall thickness more than 20mm							
GTAW - GAS TUNGSTEN ARC WELDING				SMAW - SHIELDED METAL ARC WELDING			
(Prepared By)		(Checked By)		(Approved By)		CLIENT APPROVAL	



 		PROJECT Standby SRU & Additional Tanks, IOCL Paradip Refinery																									
		CLIENT INDIAN OIL CORPORATION LIMITED																									
WELDING SPECIFICATION SHEET		NO	PMS / 1300 / 05 Rev. 3 Date 10-Mar-20																								
PIPING CLASS A13A																											
MATERIAL SPECIFICATIONS (NOTE 5)		PIPES ASTM A106Gr.B, ASTM A672Gr.C65 Cl.12, FITTINGS ASTM A234 WPB, ASTM A105N FLANGES ASTM A105N OTHERS																									
BASE METAL 'P' NO. 1																											
WELDING PROCESS AND CONSUMABLES		GROOVE JOINTS (NOTE 1, 3)																									
BUTT		OTHER THAN BUTT																									
<table border="1"> <tr> <th>PROCESS</th> <th>GTAW</th> <th>SMAW</th> </tr> <tr> <td>PASS</td> <td></td> <td></td> </tr> <tr> <td>ROOT PASS (Note 2)</td> <td>ER 70 S 2</td> <td>NA</td> </tr> <tr> <td>FILLER PASS</td> <td>ER 70 S 2</td> <td>E 7016 / E 7018</td> </tr> </table>	PROCESS	GTAW	SMAW	PASS			ROOT PASS (Note 2)	ER 70 S 2	NA	FILLER PASS	ER 70 S 2	E 7016 / E 7018	<table border="1"> <tr> <th>PROCESS</th> <th>GTAW</th> <th>SMAW</th> </tr> <tr> <td>PASS</td> <td></td> <td></td> </tr> <tr> <td>ROOT PASS (Note 2)</td> <td>ER 70S 2</td> <td>NA</td> </tr> <tr> <td>FILLER PASS</td> <td>ER 70S 2</td> <td>E 7016 / E 7018</td> </tr> </table>			PROCESS	GTAW	SMAW	PASS			ROOT PASS (Note 2)	ER 70S 2	NA	FILLER PASS	ER 70S 2	E 7016 / E 7018
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ROOT PASS (Note 2)	ER 70S 2	NA																									
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WELDING PROCESS AND CONSUMABLES		FILLET JOINTS/SW JOINTS (NOTE 1, 3)																									
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PASS																											
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FILLER PASS	ER 70S2	E7016 / E7018																									
JOINT PREPARATION ASME B 31.3																											
GASES		PURGING																									
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PROCESS	GTAW																										
PURGING	NA																										
PURGING GAS NAME	NA																										
GAS COMPOSITION	NA																										
PROCESS	GTAW																										
SHIELDING	YES																										
GAS NAME	ARGON																										
GAS COMPOSITION	99.995																										
PREHEATING		POST HEATING																									
PREHEAT TEMP 10° C MIN 100° C For thk. >25mm		NA																									
CONTINUITY OF WELDING AND PREHEAT YES		INTERPASS 250° C Max.																									
POST WELD HEAT HOLDING TEMP 620 - 650 Deg C		HOLDING TIME 1 Hour/ Inch thk.																									
TREATMENT RATE OF HEATING 200° C / Hr Max.		MIN. HOLDING TIME 1 Hour																									
(Note 4) METHOD OF COOLING Controlled		RATE OF COOLING 200° C / Hr Max.																									
MECHANICAL PROPERTY REQUIREMENTS		TEMP																									
CHARPY 'V' NOTCH IMPACT TEST VALUE		MIN AVERAGE																									
HARDNESS 180 BHN Max for Weld deposit , HAZ & Base Metal 237 BHN (22HRC) Max. after PWHT		NA																									
CODE OF FABRICATION ASME B 31.3 + NACE MR0103+NACE SP0472																											
TECHNICAL NOTES																											
NOTE 1: Any combination of welding process for groove weld can be used subject to qualification of the Welding Procedure NOTE 2: Entire welding of small bore piping, 2"NB and smaller shall be performed with GTAW. NOTE 3 : Electrodes/Filler metal chemical composition shall have the limitations --> Ni<1%,Mn<1.5%, NOTE 4: PWHT is mandatory for all thickness NOTE 5: Material shall meet the Applicable Material specifications and NACE MR 0103																											
GTAW - GAS TUNGSTEN ARC WELDING		SMAW - SHIELDED METAL ARC WELDING																									
(Prepared By)		(Checked By)																									
(Approved By)		CLIENT APPROVAL																									



		PROJECT		Standby SRU & Additional Tanks, IOCL Paradip Refinery			
		CLIENT		INDIAN OIL CORPORATION LIMITED			
WELDING SPECIFICATION SHEET		NO	PMS / 1300 / 04		Rev.	2	Date 10-Mar-20
PIPING CLASS A8A,B19A							
MATERIAL SPECIFICATIONS		PIPES	ASTM A106Gr.B, ASTM A672Gr.C65 Cl.12,				
		FITTINGS	ASTM A234 WPB, ASTM A105N				
		FLANGES	ASTM A105N				
		OTHERS					
BASE METAL 'P' NO.		1					
WELDING PROCESS AND CONSUMABLES		GROOVE JOINTS (NOTE 1)					
		BUTT			OTHER THAN BUTT		
PROCESS	GTAW	SMAW		PROCESS	GTAW	SMAW	
PASS				PASS			
ROOT PASS (Note 2)	ER 70 S 2	NA		ROOT PASS (Note 2)	ER 70S 2	NA	
FILLER PASS	ER 70 S 2	E 7016 / E 7018		FILLER PASS	ER 70S 2	E 7016 / E 7018	
WELDING PROCESS AND CONSUMABLES		FILLET JOINTS/SW JOINTS (NOTE 1)					
PROCESS	GTAW	SMAW					
PASS							
ROOT PASS (Note 2)	ER 70S2	E7016 / E7018					
FILLER PASS	ER 70S2	E7016 / E7018					
JOINT PREPARATION		ASME B 31.3					
GASES		PURGING		SHIELDING			
PROCESS	GTAW			PROCESS	GTAW		
PURGING	NA			SHIELDING	YES		
PURGING GAS NAME	NA			GAS NAME	ARGON		
GAS COMPOSITION	NA			GAS COMPOSITION	99.995		
PREHEATING	PREHEAT TEMP	10° C MIN 100° C For thk. >25mm		POST HEATING	NA		
CONTINUITY OF WELDING AND PREHEAT		YES		INTERPASS	250° C Max.		
POST WELD HEAT TREATMENT	HOLDING TEMP	620 - 650 Deg C		HOLDING TIME	1 Hour/ Inch thk.		
	RATE OF HEATING	200° C / Hr Max.		MIN. HOLDING TIME	1 Hour		
(Note 3)	METHOD OF COOLING	Controlled		RATE OF COOLING	200° C / Hr Max.		
MECHANICAL PROPERTY REQUIREMENTS		TEMP	MIN	AVERAGE			
CHARPY 'V' NOTCH IMPACT TEST VALUE		NA	NA	NA			
		HARDNESS	200 BHN Max for Weld deposit , HAZ & Base Metal 237 BHN (22HRC) Max. after PWHT				
CODE OF FABRICATION		ASME B 31.3					
TECHNICAL NOTES							
NOTE 1: Any combination of welding process for groove weld can be used subject to qualification of the Welding Procedure							
NOTE 2: Entire welding of small bore piping, 2"NB and smaller shall be performed with GTAW.							
NOTE 3: PWHT is mandatory for all thickness							
<div style="display: flex; justify-content: space-between; margin-top: 20px;"> GTAW - GAS TUNGSTEN ARC WELDING SMAW - SHIELDED METAL ARC WELDING </div>							
(Prepared By)		(Checked By)		(Approved By)		CLIENT APPROVAL	



 		PROJECT		Standby SRU & Additional Tanks, IOCL Paradip Refinery			
		CLIENT		INDIAN OIL CORPORATION LIMITED			
WELDING SPECIFICATION SHEET		NO	PMS / 1300 / 05	Rev.	2	Date	27-Nov-19
PIPING CLASS A28A,A49A,B28A,B49A							
MATERIAL SPECIFICATIONS (NOTE 6)		PIPES	ASTM A106Gr.B, ASTM A672Gr.C65 Cl.12,				
		FITTINGS	ASTM A234 WPB, ASTM A105N				
		FLANGES	ASTM A105N				
		OTHERS					
BASE METAL 'P' NO.		1					
WELDING PROCESS AND CONSUMABLES		GROOVE JOINTS (NOTE 1,3 & 4)					
		BUTT			OTHER THAN BUTT		
PROCESS	GTAW	SMAW		PROCESS	GTAW	SMAW	
PASS				PASS			
ROOT PASS (Note 2)	ER 70 S 2	NA		ROOT PASS (Note 2)	ER 70S 2	NA	
FILLER PASS	ER 70 S 2	E 7016 / E 7018		FILLER PASS	ER 70S 2	E 7016 / E 7018	
WELDING PROCESS AND CONSUMABLES		FILLET JOINTS/SW JOINTS (NOTE 1,3 & 4)					
PROCESS	GTAW	SMAW					
PASS							
ROOT PASS (Note 2)	ER 70S2	E7016 / E7018					
FILLER PASS	ER 70S2	E7016 / E7018					
JOINT PREPARATION		ASME B 31.3					
GASES		PURGING		SHIELDING			
PROCESS	GTAW			PROCESS	GTAW		
PURGING	NA			SHIELDING	YES		
PURGING GAS NAME	NA			GAS NAME	ARGON		
GAS COMPOSITION	NA			GAS COMPOSITION	99.995		
PREHEATING	PREHEAT TEMP	10° C MIN 100° C For thk. >25mm		POST HEATING	NA		
CONTINUITY OF WELDING AND PREHEAT	YES			INTERPASS	250° C Max.		
POST WELD HEAT TREATMENT	HOLDING TEMP	620 - 650 Deg C		HOLDING TIME	1 Hour/ Inch thk.		
	RATE OF HEATING	200° C / Hr Max.		MIN. HOLDING TIME	1 Hour		
(NOTE 5)	METHOD OF COOLING	Controlled		RATE OF COOLING	200° C / Hr Max.		
MECHANICAL PROPERTY REQUIREMENTS		TEMP	MIN	AVERAGE			
CHARPY 'V' NOTCH IMPACT TEST VALUE		NA	NA	NA			
		HARDNESS	180 BHN Max for Weld deposit , HAZ & Basemetal 237 BHN (22HRC) Max. after PWHT				
CODE OF FABRICATION		ASME B 31.3 + NACE MR0103 + NACE SP0472+ NACE TM0284					
TECHNICAL NOTES							
NOTE 1: Any combination of welding process for groove weld can be used subject to qualification of the Welding Procedure							
NOTE 2: Entire welding of small bore piping, 2"NB and smaller shall be performed with GTAW.							
NOTE 3 : Electrodes/Fillermetal chemical composition shall have the limitations --> Ni<1%,Mn<1.5%,							
NOTE 4: Welding consumable shall be used with H4 Hydrogen diffusion Designator in order to comply with Licensor requirements							
NOTE 5: PWHT is mandatory for all thickness							
NOTE 6: In addition to compliance to NACE, HIC tested materials shall be used for fabrication.							
SMAW - SHIELDED METAL ARC WELDING				GTAW - GAS TUNGSTEN ARC WELDING			
(Prepared By)	(Checked By)	(Approved By)	CLIENT APPROVAL				

 		PROJECT		Standby SRU & Additional Tanks,IOCL Paradip Refinery			
		CLIENT		INDIAN OIL CORPORATION LIMITED			
WELDING SPECIFICATION SHEET		NO	PMS / 1300 / 08	Rev.	2	Date	10-Mar-20
PIPING CLASS D9D							
MATERIAL SPECIFICATIONS		PIPES	ASTM A335 Gr.P11				
		FITTINGS	ASTM A182 Gr.F11 Cl.2				
		FLANGES	ASTM A182 Gr.F11 Cl.2,				
		OTHERS					
BASE METAL 'P' NO.		4					
WELDING PROCESS AND CONSUMABLES							
BUTT				GROOVE JOINTS (NOTE 1)			
OTHER THAN BUTT							
PROCESS	GTAW	SMAW		PROCESS	GTAW	SMAW	
PASS				PASS			
ROOT PASS (Note 2)	ER 80 S B2	NA		ROOT PASS (Note 2)	ER 80 S B2	NA	
FILLER PASS	ER 80 S B2	E 8018 B2		FILLER PASS	ER 80 S B2	E 8018 B2	
WELDING PROCESS AND CONSUMABLES							
FILLET JOINTS/SW JOINTS (NOTE 1)							
PROCESS	GTAW	SMAW					
PASS							
ROOT PASS (Note 2)	ER 80 S B2	NA					
FILLER PASS	ER 80 S B2	E 8018 B2					
JOINT PREPARATION							
		ASME B 31.3					
GASES							
PURGING				SHIELDING			
PROCESS	GTAW			PROCESS	GTAW		
PURGING				SHIELDING	YES		
PURGING GAS NAME				GAS NAME	ARGON		
GAS COMPOSITION				GAS COMPOSITION	99.995		
PREHEATING							
PREHEAT TEMP	120° C Minimum		POST HEATING		Refer Note 4		
CONTINUITY OF WELDING AND PREHEAT	YES		INTERPASS		315° C Max		
POST WELD HEAT TREATMENT	HOLDING TEMP	650°C to 705°C	HOLDING TIME		1 HOUR / INCH for thickness ≤ 2 Inch		
	RATE OF HEATING	200° C / HOUR MAXIMUM	MIN. HOLDING TIME		120 Minutes		
(NOTE 3)	METHOD OF COOLING	Controlled	RATE OF COOLING		200° C / HOUR MAXIMUM		
MECHANICAL PROPERTY REQUIREMENTS							
CHARPY 'V' NOTCH IMPACT TEST VALUE		TEMP	MIN	AVERAGE			
		NA	NA	NA			
HARDNESS		225 HBW Maximum					
CODE OF FABRICATION							
		ASME B 31.1 +IBR					
TECHNICAL NOTES							
NOTE 1: Any combination of welding process for groove weld can be used subject to qualification of the Welding Procedure							
NOTE 2: Entire welding of small bore piping, 2"NB and smaller shall be performed with GTAW.							
NOTE 3: PWHT is mandatory for all thickness							
NOTE 4: In the event of any interruption during welding, Clause 131.6 of ASME B31.1 shall be complied							
SMAW - SHIELDED METAL ARC WELDING				GTAW - GAS TUNGSTEN ARC WELDING			
(Prepared By)		(Checked By)		(Approved By)		CLIENT APPROVAL	





 		PROJECT		Standby SRU & Additional Tanks, IOCL Paradip Refinery			
		CLIENT		INDIAN OIL CORPORATION LIMITED			
WELDING SPECIFICATION SHEET		NO	PMS / 1300 / 09		Rev.	2	Date 10-Mar-20
PIPING CLASS D9L							
MATERIAL SPECIFICATIONS		PIPES ASTM A335 Gr.P91					
		FITTINGS ASTM A182 Gr.F91					
		FLANGES ASTM A182 Gr.F91					
		OTHERS					
BASE METAL 'P' NO.		P 15E					
WELDING PROCESS AND CONSUMABLES				GROOVE JOINTS (NOTE 1)			
BUTT				OTHER THAN BUTT			
PROCESS	GTAW	SMAW		PROCESS	GTAW	SMAW	
PASS				PASS			
ROOT PASS (Note 2)	ER 90 S B9	NA		ROOT PASS (Note 2)	ER 90 S B9	NA	
FILLER PASS	ER 90 S B9	E9018- B91		FILLER PASS	ER 90 S B9	E9018- B91	
WELDING PROCESS AND CONSUMABLES				FILLET JOINTS/SW JOINTS (NOTE 1)			
PROCESS	GTAW	SMAW					
PASS							
ROOT PASS (Note 2)	ER 90 S B9	E9018- B91					
FILLER PASS	ER 90 S B9						
JOINT PREPARATION		ASME B 31.3					
GASES		PURGING		SHIELDING			
PROCESS	GTAW			PROCESS	GTAW		
PURGING	YES			SHIELDING	YES		
PURGING GAS NAME	ARGON			GAS NAME	ARGON		
GAS COMPOSITION	99.995			GAS COMPOSITION	99.995		
PREHEATING	PREHEAT TEMP	200° C Minimum		POST HEATING	Refer Note 4		
CONTINUITY OF WELDING AND PREHEAT		YES		INTERPASS	315° C Max		
POST WELD HEAT	HOLDING TEMP	750 to 775		HOLDING TIME	1 HOUR / INCH		
TREATMENT	RATE OF HEATING	110° C / HOUR MAXIMUM		MIN. HOLDING TIME	120 Minutes		
(NOTE 3 & 5)	METHOD OF COOLING	Controlled		RATE OF COOLING	110° C / HOUR MAXIMUM		
MECHANICAL PROPERTY REQUIREMENTS		TEMP	MIN	AVERAGE			
CHARPY 'V' NOTCH IMPACT TEST VALUE		NA	NA	NA			
		HARDNESS	190 to 250 HBW				
CODE OF FABRICATION		ASME B 31.1+ IBR					
TECHNICAL NOTES							
NOTE 1: Any combination of welding process for groove weld can be used subject to qualification of the Welding Procedure							
NOTE 2: Entire welding of small bore piping, 2"NB and smaller shall be performed with GTAW.							
NOTE 3: PWHT is mandatory for all thickness							
NOTE 4: In the event of any interruption during welding, Clause 131.6 of ASME B31.1 shall be complied							
NOTE 5: Preheat, Interpass temperature and PWHT shall be done only with Electric coil heating with temperature chart recorder							
NOTE 6: Mn + Ni shall be 1.20% max for E9018-B91							
SMAW - SHIELDED METAL ARC WELDING				GTAW - GAS TUNGSTEN ARC WELDING			
(Prepared By)	(Checked By)	(Approved By)	CLIENT APPROVAL				

 		PROJECT		Standby SRU & Additional Tanks, IOCL Paradip Refinery			
		CLIENT		INDIAN OIL CORPORATION LIMITED			
WELDING SPECIFICATION SHEET		NO :	PMS / 1300 / 06	Rev.	2	Date	27-Nov-19
PIPING CLASS A1K							
MATERIAL SPECIFICATIONS		PIPES	ASTM A312TYP304L, ASTM A358 Gr.304L Cl.1				
		FITTINGS	ASTM A182F304L, ASTM A403Gr.WP304L				
		FLANGES	ASTM A182F304L				
		OTHERS					
BASE METAL 'P' NO. 8							
WELDING PROCESS AND MATERIALS				GROOVE JOINTS (NOTE 1)			
BUTT				OTHER THAN BUTT			
PROCESS	GTAW	SMAW		PROCESS	GTAW	SMAW	
PASS				PASS			
ROOT PASS (Note 1)	ER 308 L	NA		ROOT PASS (Note 1)	ER 308 L	NA	
FILLER PASS	ER 308 L	E 308L 15/16		FILLER PASS	ER 308L	E 308L 15/16	
WELDING PROCESS AND METALS				SOCKET/FILLET JOINTS			
PROCESS	GTAW	SMAW					
PASS							
ROOT PASS (Note 1)	ER 308 L	NA					
FILLER PASS	ER 308 L	E 308L 15/16					
JOINT PREPARATION		ASME B 31.3					
GASES		PURGING (NOTE 2)			SHIELDING		
PROCESS	GTAW			PROCESS	GTAW		
PURGING	YES			SHIELDING	YES		
PURGING GAS NAME	ARGON			GAS NAME	ARGON		
GAS COMPOSITION	99.995%			GAS COMPOSITION	99.995%		
PREHEATING							
PREHEAT TEMP	10° C MIN.	POST HEATING	NA				
CONTINUITY OF WELDING AND PREHEAT		YES	INTERPASS	150° C Max.			
POST WELD HEAT TREATMENT	HOLDING TEMP	NA	HOLDING TIME	NA			
	RATE OF HEATING	NA	MIN. HOLDING TIME	NA			
	METHOD OF COOLING	NA	RATE OF COOLING	NA			
MECHANICAL PROPERTY REQUIREMENTS				TEMP	MIN	AVERAGE	
CHARPY 'V' NOTCH IMPACT TEST VALUE			NA	NA	NA		
		HARDNESS					
CODE OF FABRICATION ASME B 31.3							
TECHNICAL NOTES							
Note 1: Entire welding of small bore piping, 2"NB and smaller shall be performed with GTAW.							
Note 2 - It is generally recommended that back purge gas shall be maintained for the first two fill pass welds							
SMAW - SHIELDED METAL ARC WELDING GTAW - GAS TUNGSTEN ARC WELDING							
(Prepared By)	(Checked By)	(Approved By)	CLIENT APPROVAL				

 		PROJECT		Standby SRU & Additional Tanks, IOCL Paradip Refinery			
		CLIENT		INDIAN OIL CORPORATION LIMITED			
WELDING SPECIFICATION SHEET		NO :	PMS / 1300 / 07	Rev.	2	Date	27-Nov-19
PIPING CLASS A21N							
MATERIAL SPECIFICATIONS		PIPES	ASTM A312TYP316L, ASTM A358 Gr.316L Cl.1				
		FITTINGS	ASTM A182F316L, ASTM A403 Gr.WP316L				
		FLANGES	ASTM A182F316L				
		OTHERS					
BASE METAL 'P' NO.		8					
WELDING PROCESS AND MATERIALS				GROOVE JOINTS (NOTE 1)			
BUTT (NOTE 1)				OTHER THAN BUTT			
PROCESS	GTAW	SMAW		PROCESS	GTAW	SMAW	
PASS				PASS			
ROOT PASS (Note 1)	ER 316 L	NA		ROOT PASS (Note 1)	ER 316 L	NA	
FILLER PASS	ER 316 L 15/16	E 316 L 15/16		FILLER PASS	ER 316 L 15/16	E 316 L 15/16	
WELDING PROCESS AND METALS				SOCKET/FILLET JOINTS			
PROCESS	GTAW	SMAW					
PASS							
ROOT PASS (Note 1)	ER 316 L 15/16	NA					
FILLER PASS	ER 316 L 15/16	E 316 L 15/16					
JOINT PREPARATION		ASME B 31.3					
GASES		PURGING (Note 2)		SHIELDING			
PROCESS	GTAW			PROCESS	GTAW		
PURGING	YES			SHIELDING	YES		
PURGING GAS NAME	ARGON			GAS NAME	ARGON		
GAS COMPOSITION	99.995%			GAS COMPOSITION	99.995%		
PREHEATING		PREHEAT TEMP	10° C MIN.	POST HEATING	NA		
CONTINUITY OF WELDING AND PREHEAT		YES		INTERPASS	150° C Max.		
POST WELD HEAT TREATMENT		HOLDING TEMP	NA	HOLDING TIME	NA		
		RATE OF HEATING	NA	MIN. HOLDING TIME	NA		
		METHOD OF COOLING	NA	RATE OF COOLING	NA		
MECHANICAL PROPERTY REQUIREMENTS				TEMP	MIN	AVERAGE	
CHARPY 'V' NOTCH IMPACT TEST VALUE				NA	NA	NA	
HARDNESS				22 HRC Max. for NACE/H2S Service			
CODE OF FABRICATION		ASME B 31.3					
TECHNICAL NOTES							
NOTE 1: Entire welding of small bore piping, 2"NB and smaller shall be performed with GTAW.							
Note 2 - It is generally recommended that back purge gas shall be maintained for the first two fill pass welds							
<div style="display: flex; justify-content: space-around;"> SMAW - SHIELDED METAL ARC WELDING GTAW - GAS TUNGSTEN ARC WELDING </div>							
(Prepared By)		(Checked By)		(Approved By)		CLIENT APPROVAL	

 		PROJECT	Standby SRU & Additional Tanks IOCL Paradip Refinery		
		CLIENT	INDIAN OIL CORPORATION LIMITED		
CONSTRUCTION OF TANKAGE RELATED PIPING-QCP PLANS	Project No. 080557C001	Document No. 080557C-000-PP-820		Rev. No. 0	Page 1 of 12

PIPING -FLUSHING, TESTING & REINSTATEMENT- PROCEDURE

			 NAVNEET KUMAR	 Signed By	 Authorized By	 Authorized By
0	16/10/2019	ISSUED FOR INFORMATION	NVK	PKP	LA	JMC
REV.	DATE	DESCRIPTION	PREPARED	CHECKED	APPROVED	AUTHORIZED

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 	PROJECT		Standby SRU & Additional Tanks	
	CLIENT		IOCL Paradip Refinery	
CONSTRUCTION OF TANKAGE RELATED PIPING-QAP PLANS		Project No. 080557C001	Document No. 080557C-000-PP-820	Rev. No. 0
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1. INTRODUCTION

INDIAN OIL CORPORATION LIMITED (IOCL) has awarded Fax of Acceptance (FOA) dated 29th August 2019 to M/s. Technip India Limited (TPIL) for Consultancy services (PMC/EPCM services) for overall project management, FEED Review / FEED, Detailed Engineering, Procurement & expediting services, Tendering & award, Construction Management & Supervision, Assistance in start-up, Commissioning & performance test runs for installation of a Standby SRU of 525 TPD capacity and execution of Additional tanks for Paradip Refinery, Odisha, India.

2. DEFINITIONS & ABBREVIATIONS

Abbreviation	Definition /Expanded form
IOCL/ CLIENT	Indian Oil Corporation Limited
PMC/ CONSULTANT	Technip India Limited
LICENSOR	Party selected by IOCL for process technology ownership for any UNIT
CONTRACTOR	Party whose services are obtained for performing the works specified as part of LSTK / packages.
EPCM	Engineering, Procurement & Construction Management Services.
LSTK	Lump Sum Turn Key portion of the work to be executed by CONTRACTOR
FEED	Front End Engineering Design
AUTHORISED REPRESENTATIVE	IOCL's/ CONSULTANT's representative authorized to act for and on behalf of them.
VENDOR	Any third party supplying the equipment/materials for setting up the Plant
PROJECT	Indicates Standby SRU and Additional tanks Project, Paradip Refinery
UNIT	Indicates any particular portion of the project to be built which can be Process related or Utilities/Offsites related
SRU	Sulphur Recovery Unit

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3. **SCOPE**

This specification covers the minimum requirements for flushing, pressure testing, draining, drying and reinstatement of piping systems.

4. **REFERENCE DOCUMENTS**

Contractor shall meet all requirements of federal, state and local laws and regulations, which maybe specified by Owner / TPIL.

4.1 **CODES**

ASME B31.1	Power Piping
ASME B31.3	Process Piping
IBR	Indian Boiler Regulations.

4.2 **STANDARDS**

The version valid on the date of contract award shall be used.

ASME B16.34 Valves Flanged, Threaded and Welding Ends.


4.3 SPECIFICATIONS/DRAWINGS, ETC.

5. **PRESSURE TESTING SCOPE**

- 5.1 Piping systems subject to pressure testing shall be indicated on test diagrams & line list which shall be prepared by CONTRACTOR using the P&ID's as the basis.
- 5.2 Prior to testing, CONTRACTOR shall provide documentation (test packages) in which the test system limits, type of testing and the test pressure are defined.
- 5.3 Test systems shall be divided into:
 - 5.3.1 **Systems, which require pneumatic testing.**

Pneumatic testing always needs approval from OWNER / TPIL and shall be limited to:

 - a. High-pressure Nitrogen lines.
 - b. Flare lines and overhead vapor lines not designed for full of water testing.
 - c. Lines in cryogenic service (cold packs) where freezing of water in cavities may damage piping or valves (e.g. ball valves).
 - d. Lines where introduction of water damages piping systems or product to be conveyed after start-up (oxygen lines, EO lines etc.).

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5.3.2 Systems, which require service testing.

Service test always needs approval from OWNER / TPIL

Service testing shall be limited to piping systems as defined in ASME B31.1 / B31.3. Instrument air, plant air and nitrogen lines shall be service tested to avoid presence of water in the lines.

5.3.3 Systems, which require "full of liquid testing".

"Full of liquid testing" shall be limited to pressure-less sewer systems and all other systems under atmospheric pressure (vent lines etc.).

5.3.4 Systems, which require hydrotesting

All systems except those mentioned under 5.3.1, 5.3.2 and 5.3.3, require hydro-testing

5.4 All testing for piping subject to authority approval as identified in "test packages" shall be in accordance with authority rules and additional requirements of this specification.

In case requirements of this specification are in contradiction with authority requirements, authority requirements are governing.

5.5 Piping not subject to authority approval shall be tested in accordance with this specification and ASME B31.1/B31.3 (depending on selected design code) as a minimum.

5.6 Test pressures listed in test packages shall be determined in accordance with one of the applicable codes, as mentioned above

6. GENERAL REQUIREMENTS

6.1 Prior to testing CONTRACTOR must have inspected the piping system for completeness and conformity to piping drawings and specifications.

6.2 Test packages for piping systems are to be released by Owner / TPIL prior to start of pressure testing and flushing.

6.3 All welds shall be free of painting, coating or insulation to enable visual inspection of all welds.



6.4 Welds of piping spools, which have been pressure tested in the piping prefabrication shop and have been painted afterwards, may remain painted during field pressure testing after erection.

6.5 For stainless steel piping, the duration of the hydrotesting, flushing and draining/drying sequence shall be kept as short as possible, to reduce the possibility of chloride attack.

6.6 Testing against a closed valve is not permitted, unless specifically approved by Owner / TPIL and under the condition that the test pressure is not higher than the maximum allowable pressure at ambient temperature of subject valve as indicated in ASME B16.34.

The pressure test certificate of subject valves must be included in the test package.

6.7 Test systems without equipment or closed valves may be combined when specifically approved by TPIL

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7. SAFETY AND ENVIRONMENTAL CONTROL

- 7.1 Before starting any pressure test or flushing operation, adequate measures for safety and environmental control shall be established. All code requirements, local regulations and recommendations from OWRN and TPIL shall be complied with.

7.2 SAFETY



- 7.2.1 Test pressure shall not be applied until the piping system and its contents are at approximately the same temperature.
- 7.2.2 Pressure testing shall be executed under supervision of an experienced piping supervisor to prevent accidents
- 7.2.3 The testing area shall be marked with signs indicating risk boundaries.
- 7.2.4 It is recommended to limit access to test area to authorized personnel only.
- 7.2.5 All piping systems shall be provided with a protective device to relieve excess pressure due to thermal expansion of the test fluid.
- 7.2.6 Actions, which may cause damage to pipe under pressure, are prohibited.
- 7.2.7 Test pressure shall be increased gradually in steps as shown below providing sufficient time between each step to check for leaks or unacceptable deformation and to allow the piping to equalize strains during testing.

Acceptable steps are:

- Increase to half the intended test pressure with a maximum of twenty-five (25) bars.
 - Increase with one (1) quarter of the intended test pressure with a maximum of twenty- five (25) bars.
 - Repeat step "b" until the intended test pressure has been reached.
- 7.2.8 Test pressure shall be released immediately if piping shows changes in form or size, which are not normal.
- 7.2.9 After completion of the pressure test, the pressure shall be released so as not to endanger personnel or damage equipment.
- 7.2.10 Care shall be taken that as little water as possible is spilled over the paving to prevent muddy and/or wet roads, or damage to equipment, instrumentation or insulation. A hose shall be used to drain water to a gutter or sewer system to avoid any damage to equipment and personnel or contact with electrical systems.
- 7.2.11 Pneumatic Testing
- As pneumatic testing presents special risks, utmost care shall be taken during pressurization and inspection of the systems to prevent any danger to personnel or equipment.
- 7.2.12 Following additional safety measures shall be taken:
- Access to test area shall be limited to test personnel only.
 - Compressor and pressure gauge for checking the test pressure shall be in a sheltered area.
 - Contractor shall prepare a procedure detailing steps to be taken for pneumatic testing.

7.3 ENVIRONMENTAL CONTROL

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- 7.3.1 The use of chemical additives, i.e. wetting agents, biocides, inhibitors, etc., shall only be allowed when an environmentally acceptable disposal has been agreed with OWNER / TPIL and local authorities.
- 7.3.2 A wastewater disposal plan, which will specify the handling of the water used for flushing and pressure testing, shall be prepared and agreed upon between OWNER & TPIL
- 7.3.3 Disposal of flush and test water via the plant sewer system shall only be allowed after written approval from OWNER / TPIL at specified flow rates.
- 7.3.4 Subcontractor shall estimate the expected quantities, flow rate and composition of the wastewater.

8. TEST EQUIPMENT

- 8.1 Equipment used for testing shall be approved by Owner / TPIL and authority inspectors prior to use.
- 8.2 Contractor shall supply hydrostatic testing equipment, including filters, fill pump, pressurizing pump, test gauges, relief devices, storage tanks, and test and flushing medium.
- 8.3 For pneumatic testing, an air compressor suitable to supply dry, clean air at the pneumatic test pressure shall be supplied by contractor.
- 8.4 The test pressure shall be checked by means of gauges having a range from zero up to a minimum of 1.5 and a maximum of 4 times the required maximum test pressure.
- 8.5 All test pressure gauges shall be calibrated within a tolerance of 1% accuracy prior to testing. Calibration certificates shall be available at the work site and all gauges shall be properly identified to enable traceability to the calibration certificates.
- 8.6 Calibration of gauges shall be repeated every 6 months or whenever requested by the inspection team (representatives from the authorities, OWNER & TPIL).
- 8.7 Temperature measuring equipment to measure metal temperature and content temperature shall have a tolerance of + 0.5°C.
- 8.8 CONTRACTOR shall prove by means of calculations that supplied test blanks are suitable for the intended test pressure. Contractor shall supply test blanks test gaskets & water. Design and dimensions shall be in accordance with piping standards.



9. TEST MEDIUM

- 9.1 The test medium for hydrostatic testing shall be clean water (maximum chloride content 20-25 ppm) without foreign matter such as sand, rust or other particles.

A filter shall be provided in the water fill lines.

Prior to use the water shall be analysed and the results shall be reported to TPIL. Testing of the water quality shall be repeated once every week.

- 9.2 Where the test packages indicate that a pneumatic test must be performed, air shall be used for pressure testing.



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9.3 Service tests shall be performed with the intended service medium.

10. TEST PROCEDURE

10.1 PREPARATIONS FOR PRESSURE TESTING

- 10.1.1 Blind flanges, blanks, caps or plugs with adequate pressure rating shall be installed to isolate piping systems and equipment as indicated on the test diagrams.
- 10.1.2 All temporarily installed items (blanks, gaskets, spools, strainers, etc.), shall be adequately marked using paint or tags for easy traceability.
- 10.1.3 Items not to be subjected to the pressure test shall be removed. Items to be removed or blanked off prior to testing/flushing shall include, but shall not be limited to:
 - Equipment not included in the test system.
 - Relief valves and rupture discs.
 - Orifice plates, flow nozzles or other similar restrictions.
 - Venturi type flow meters (flanged).
 - Internals of equipment (trays, demisters, level instrument floats, float cages, etc.), if included in the test system.
 - Flanged control valves (for welded-in type control valve internals shall be removed).
 - Flanged check valves unless internals are removed (for butt-weld check valves internals shall be removed).
 - All in-line instruments (unless otherwise approved by TPIL) .
 - Any items not designed to withstand the test pressure (e.g. pressure gauges).
 - Internals of strainers and filters.
- 10.1.4 Instrument piping shall be tested together with the piping system up to the piping block valve nearest to the instrument.
- 10.1.5 When a union is provided downstream of an instrument block valve, it shall be broken to prevent dirt or foreign matter from being introduced into the instrument.
- 10.1.6 If the test pressure on both sides of flanged control valves is equal and when block valves and bypass are installed, the block and bypass valves shall be left open with the control valve removed and with blinds or a spool piece installed.
- 10.1.7 If test pressures up and downstream of a control valve are not equal, the spool piece between the control valve and the downstream block valve shall be tested in combination with the upstream part.
- 10.1.8 Piping supported by counterweight or spring without "down travel stop" shall be temporarily supported prior to filling of the line with water.
- 10.1.9 A spring with "down travel stop" shall have the "stop" (wedges or block) inserted prior to filling of the line with water.

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- 10.1.10 Piping designed for vapor or gas shall (when necessary) be provided with additional temporary supports, as indicated on isometrics, to support the additional weight of the test liquid.
- 10.1.11 All open valves in the test system, which have a back seat (gate and globe valves) shall be fully opened until the stem seat contacts the back seat and then the hand wheel shall be turned twice in the direction of closing to assure that gland packing is subjected to full line test pressure.
- 10.1.12 Open ends of atmospheric lines to be "full of liquid" tested shall be left open during testing.
- 10.1.13 For pneumatic testing or service testing with air or nitrogen, screwed and flanged joints shall be prepared for soap testing by taping with masking tape and punching a 3 mm diameter hole through the tape.



When electronic leak testing will be applied, taping with masking tape will not be required.

10.2 PRESSURE TESTING

- 10.2.1 After acceptance of the preparations for pressure testing by TPIL, the piping system will be released for pressure testing.
- 10.2.2 All systems shall be properly vented (at the high points) while filling.
- 10.2.3 Test pressure shall be applied by means of a suitable test pump or other pressure source. This pump shall be positively isolated from the system except when being used to pressurize the system (the hose should be disconnected after filling).
- 10.2.4 At least two (2) pressure gauges per test system shall be installed: one (1) at the test pump discharge and one (1) at or near the highest point of the test system. The pressure recorded at the pump is governing (lowest point). Other gauges shall indicate same pressure with a correction for static head. For large systems, more pressure gauges shall be installed at suitable locations, in coordination with TPIL.
- 10.2.5 An authorized person shall constantly attend the test pump during the test. Before the pump is left unattended, it shall be positively disconnected from the system, while the pressure gauge remains connected to the test system.
- 10.2.6 The test pressure shall be as indicated in the Line List as prepared by CONTRACTOR
- 10.2.7 Retesting of a system (when required) shall be performed at the same pressure as originally specified for the test.
- 10.2.8 The outside surface of the test system shall be dry and free from grease and dirt before and during testing. Testing during rain periods can't be performed.
- 10.2.9 The test pressure shall be maintained for at least half an hour prior to start of inspection and long enough to enable a visible inspection of the complete test system by the inspection team.
- 10.2.10 Atmospheric lines to be "full of liquid" tested shall be filled with water for at least 24 hours before visible inspection of the complete test system by the inspection team.
- Water level in the test system shall be checked and marked at the start of the test and rechecked after twenty-four (24) hours during visible inspection of the system.
- 10.2.11 In case hydrotesting through equipment is required, LSTK/EPC Contractor shall provide special instructions & approved by Owner / TPIL (e.g. maximum differential pressures on shell and tube side of heat exchangers) where applicable.

10.3 ADDITIONAL REQUIREMENTS FOR SERVICE TESTS

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10.3.1 A service test shall be performed with the line in service i.e. with the service medium and at service pressure.

10.3.2 Visual inspection, and/or (in case of air or nitrogen lines) soap leakage tests shall be carried out.

10.4 **ADDITIONAL REQUIREMENTS FOR PNEUMATIC TESTING**

10.4.1 For systems being pneumatically tested, a preliminary check of the test system shall be made at a pressure not exceeding 1.7 barg (25 psig).

10.4.2 A visual inspection, and soap leakage tests shall be carried out.

10.4.3 Care shall be taken to avoid a temperature drop which could cause failure of metal and thermoplastics due to embrittlement. The metal temperature during testing shall not be below the minimum allowable temperature indicated in the "test package".

10.5 **FLUSHING**

Requirements described in this paragraph are for construction flushing only. Whenever flushing, cold commissioning and hot commissioning are part of the scope of the CONTRACTOR a separate specification shall be developed to describe flushing methods and cleanliness requirements for the piping systems involved.

10.5.1 After acceptance of testing reports by TPIL, the piping system will be released for flushing.

10.5.2 Flushing will be carried out to remove all trash and construction debris from the piping systems.

10.5.3 Flushing through equipment is not allowed unless specifically approved by TPIL

10.5.4 During flushing of pump suction/discharge lines, the elbow close to the pump shall be turned away and the pump inlet shall be adequately covered to prevent contamination of pumps. This applies also for equipment nozzles, which shall be blinded off during the flushing operation.

10.5.5 Commissioning team representatives from TPIL shall witness each flushing operation.

10.5.6 Flushing shall be performed against open pipe ends. Flushing via small openings like vents, drains, etc., is regarded as insufficient.

10.5.7 Stainless-steel lines shall be flushed with DM water or clean condensate to prevent chloride stress corrosion cracking.

10.5.8 After completion of the flushing operation, equipment which is welded in-line and included in the test system, shall be inspected internally for cleanliness.

10.5.9 For a better flushing effect, it is recommended to use special water/air flushing tools.



10.5.10 Trash and construction debris in air or nitrogen systems, which will not be hydrotested, shall be removed from the piping systems by air blowing.

10.6 **DRAINING AND DRYING**

10.6.1 Immediately after flushing, all lines and systems shall be completely drained.

10.6.2 After draining, all test systems not subject to chemical cleaning shall be dried with air.

Contractor shall provide a suitable air compressor with drier.

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The system shall be pressurized with air up to the system operating pressure with a maximum of 6 barg and expanded abruptly to atmospheric pressure.

10.6.3 After dry out, the systems shall be presented to TPIL for acceptance

10.7 REINSTATEMENT

10.7.1 After completion of testing, chemical cleaning (where applicable) and drying, all systems shall be reinstated as per drawings and specifications.

This also includes but shall not be limited to:

- Removal of all temporary materials such as spades, blinds, gaskets, pipe spools, temporary supports, etc.
- Replacement of all damaged gaskets and all test gaskets.
- Positioning of spectacle blinds to the correct position.
- Reinstallation of all items removed for hydrotesting.
- Reinstallation of unions downstream of instrument block valves.
- Inspection of the completed system for correct flow direction of instruments, check and control valves, etc.

10.7.2 During the activities described above, measures shall be taken to avoid dirt, debris, etc., entering the piping system. Each pipe spool shall be inspected for cleanliness prior to reinstallation.

OWNER, TPIL and CONTRACTOR shall witness this inspection.

10.7.3 After inspection and acceptance by Owner / TPIL, the system shall be released for further activities, e.g. steam tracing, painting, insulation, etc.



10.7.4 The "stop" of pipe support springs with "down travel stop" placed prior to flushing, shall be removed during pre-commissioning or commissioning stage.

11. INSPECTION AND REPORTING



Contractor shall prepare a final report, giving positive documented evidence that subject systems are pressure tested in accordance with the requirements.

Documentation shall be maintained in accordance with the code and/or authority requirements for piping systems. The report will have to include as a minimum:





- All information required by the applicable code and/or authority requirements.
- Reference to documents and specifications.
- Applicable:
- Hydrotest diagrams.
- P&ID's.
- Isometrics, duly marked up with all weld joints.

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- Internal cleaning reports
- Line History Sheets & NDT reports.
- Agreed punch lists.
- Authority approvals.
- All required certificates.
- A continuous log of operation, if applicable.
- Test results and duration.
- Pressure.
- Temperature (metal and content).
- Duration.
- Ambient temperature.
- Signature of local authority (when applicable), OWNER, TPIL and CONTRACTOR.

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JOB CONSTRUCTION SPECIFICATION FOR WELDERS MANAGEMENT

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1. **INTRODUCTION:**

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2. **DEFINITIONS & ABBREVIATIONS**

Abbreviation	Definition /Expanded form
IOCL/ CLIENT	Indian Oil Corporation Limited
PMC/ CONSULTANT	Technip India Limited
LICENSOR	Party selected by IOCL for Process Technology Ownership for any UNIT
CONTRACTOR	Party whose services are obtained for performing the works specified as part of LSTK / packages.
EPCM	Engineering, Procurement & Construction Management Services.
LSTK	Lump Sum Turn Key portion of the work to be executed by CONTRACTOR
SUBCONTRACTOR	Any person/ Company / Person or Body who may be engaged by Contractor / LSTK for works and services connected with construction/ Installation/ Erection /commissioning of the facilities for the project with or without the supply of equipment and material.
FEED	Front End Engineering Design
VENDOR SUPPLIER /	Any third party supplying the equipment/materials for setting up the Plant
LLI	Long Lead Item – Any equipment / Package / Work order taking 16 months or more completion time from the date of award
PROJECT	Indicates Standby SRU & Additional tanks Project,Paradip Refinery
SITE	Indicates ,Paradip Refinery,Odisha

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UNIT	Indicates any particular portion of the project to be built which can be Process related or Utilities/Off sites related
ENGINEER-IN-CHARGE	PMC represented looking over the CONTRACTOR's/ LSTK Job or Part thereof
MR	Material Requisition
PURCHASER	The Party That Issues the Purchase Order for The Package
KOM	Kick Off Meeting
AUTHORISED REPRESENTATIVE	OWNER's/CONSULTANT's representative authorized to act for and on behalf of OWNER/CONSULTANT
PLANT	the units and facilities comprised in the project, and if divided into different packages for the award of LSTK Contracts

3. **SCOPE**

The purpose of this specification is to define:

- the activities and the documents to be adopted to confirm, evaluate and monitor qualification and performance of welders and welder's operator.
- the Q.C. activities to be carried out and forms to be adopted for the welding inspection procedure;
- duties and responsibilities of the parties involved.

For this specification "welder" has the meaning of welder and welder operator.

4. **FIELD OF APPLICATION**



The present specification is prepared to be applied to project IOCL- Paradip Standby SRU & Tankages LSTK packages.

5. **CORRELATION WITH OTHER PROCEDURES/SPECIFICATION**

This specification is to be correlated with the following documents:

- | | |
|---|----------------------------|
| • Welding & NDE Specification for Fabrication of Piping | 080557C-000- PP- 814 |
| • Quality Control Plan for Welders Management | 080557C-000- -QCP-1399.01 |
| • Standard Specification for Fabrication and Erection of Piping | 080557C-000- -JSC-1300-001 |

All other documents referenced in these specifications shall be considered applicable.

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6. ACTIVITIES AND DOCUMENTATION

6.1 WELDER'S QUALIFICATION AT PREFABRICATION SHOP

Before they are proposed to PMC / OWNER all Contractor welders shall already have a qualification certified by an Independent Recognized Third-Party Organization (I.R.T.P.O.) according to ASME IX, AWS D1.1

- For all the other welders is necessary a confirmation with "test coupon" as per para.6.3

During production at Prefabrication Shop, all the welders will be evaluated according the "Periodical Evaluation" procedure (applicable Form W22) as specified in para. 6.5.2 and will be monitored according to para. 6.5.3.

6.2 Transfer of welders from "Prefabrication Shop" to "Site"

All the welders that have worked at Prefabrication Shop having good performances could be transferred for working at Site after a confirmation (Control Evaluation) as specified in para. 6.5.1

6.3 Confirmation of Welder's Qualification at Site

Confirmation of welder's qualification consist of one welding test coupon execution, one per each qualification type (i.e. materials, range of thickness and diameter, processes, positioning, etc.), to be checked by visual and radiographic examination. See APPENDIX "A".

Welding execution on test coupons must be done at CONTRACTOR Welding Inspector presence.

If examination result is acceptable:

- welder's qualification is confirmed;
- welder's identification is assigned;
- welder's list is up-to-date.



If examination result is not-acceptable:

- welder's qualification is not confirmed.

6.3.1 Test Coupons

Welded Test Coupons must be marked by Contractor with the welder name and progressive numbering and made available for visual check and evaluated by PMC/OWNER Welding Inspector (see attached Form W 19).

After visual inspection, the welded test coupons are verified by radiographic examination tests at Contractor care.

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Test results shall be recorded on Form W 19 and submitted to PMC /OWNER Welding Inspector for approval.

6.3.2 Categories

Welders shall be classified into three categories:

- **Piping Welders**

These welders must be qualified according to ASME IX.

These qualified welders are authorized for the butt welding of piping in the selected ASME IX ranges including tack, temporary, repair welds and for any kind of fillet welds for this category.

- **Equipment Welders**

These welders must be qualified according to ASME IX.

These qualified welders are authorized for the butt welding of plates with selected ASME IX ranges including tack, temporary, repair welds and for any kind of fillet welds for this category.

- **Structural Welders**

These welders must be qualified according to AWS D1.1 or ASME IX.

Welders qualified for full penetration welding are authorized to perform repair, fillet and tack welds of structural assemblies and for piping supports.

In addition to piping, equipment and structural welders' categories, it's possible to qualify tack welders as follows:

- **Structural tack welders**

Tack welder's qualification consists of test coupon execution in position 3F and 4F with visual examination and bend (or fracture) test as per ASME IX.



Welding and bend (or fracture) test execution on test coupons must be done at CONTRACTOR welding inspector presence.

These qualified tack welders are authorized for tack welding of structural assemblies and piping supports.

- **Piping tack welders**

Piping tack welder's qualification is applicable for carbon steel material P-Number N° 1 Group 1 & 2 only.

Piping tack welder's qualification follows the same requirements as per structural tack welders.

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REMARK:

Concerning equipment and piping other than carbon steel materials P-Number N°1 Group 1 & 2, tack welds must be done by welders qualified in accordance to ASME IX.

6.4 Identification and Registration

6.4.1 Identification Stamp

Contractor shall assign to each approved welder an identification number (stamp) that will be approved by PMC

Such identification number (stamp) shall be marked or punched by the welder, close to each weld he has carried on. The identification number shall be used to record the welding activities of the related welder

6.4.2 Registration

For all approved welders all data relevant to confirmation examinations (visual and radiographic examination) shall be recorded by Contractor on Form W19.

Contractor shall also fill-in the main data of the welder qualification made by Independent Recognized Third-Party Organization in the attached Form W07 - Welders List.

The Contractor will register all historical information about each welder (i.e. confirmation, penalty, etc.) in the attached Form W21.



For all approved tack welders, visual examination and bend (or fracture) test shall be recorded on a dedicated form like form W19 proposed and fulfilled by Contractor. That form shall be additionally approved by PMC /OWNER welding inspector.

6.5 Inspection and Evaluation on Production

6.5.1 Control Evaluation (at site only)

To check the welders ability at site the initial welding production of piping and equipment welders after their qualification confirmation is controlled by the CONTRACTOR Welding Inspector as below specified: first two production welded joints of each confirmed welder are 100% radiographically examined and evaluated according to the applicable codes; the following criteria of acceptance are applied:

- When the production welds are acceptable, the welder is confirmed.
- If one production weld is rejected, two additional joints, made by the same welder, shall be 100% radiographically examined. If additional joints are acceptable, the welder is confirmed. If any of the penalty joints reveal defects requiring repair, the welder is rejected.
- If both production welds are rejected, the welder is rejected.

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- After a welder passes the initial evaluation, he shall be monitored as per ASME B31.3 by “WELDER’S RT%” weekly report (FORM W22).

6.5.2 Periodical Evaluation

Contractor must continuously control the welder’s production through periodical performance evaluation, as per the percentage explained below.

The welder’s performance evaluation is based on the “Repair Rates” (RR). The Repair Rates shall be calculated on linear basis.

The maximum weekly repair rate for each welder should not exceed 2%.

$$RR(\%) = \frac{L_r}{L_w} \times 100$$

L_r = welder’s total length of repairs in one week, mm

L_w = welder’s total length of weld radiographed in one week, mm

The results of the radiographic examinations relevant to each welder are summarized in the Welder Repair Rates Weekly Report (FORM W22) which is kept by Contractor and delivered to PMC /OWNER Welding Inspector on weekly basis.



Welders are confirmed or disqualified according to the results summarized in the

Welder RR Weekly Report and criteria given below:

RR	ACTIONS TO BE TAKEN
RR ≤ 2%	Welder is confirmed.
2% < RR ≤ 10%	Increase control + 1 penalty shall be registered on Welder Historical Report (Form W 21)
RR > 10%	Welder is rejected.

Note 1: Welders that cumulate two penalties in 10 weeks are rejected or downgraded at PMC / OWNER Welding Inspector decision.

Note 2: Radiographic increase shall be at Contractor expense. PMC/OWNER Welding Inspector will decide the number of the joints to be checked in accordance with the ASME B 31.3/B31.1 and AWS D1.1 requirements.

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6.5.3 Monitoring

Contractor is responsible that the welders are operating according to their qualifications and to the approved welding procedures.

PMC / OWNER Welding Inspector that has found a welder not applying the welding procedure or working outside of his qualification can issue a notice to the Contractor requesting the cut-out of the incorrectly executed joints and the application of penalty note to the welder in his historical data report.

Welders that have two recorded penalties notices in 10 weeks are rejected or downgraded at PMC / OWNER Welding Inspector decision.

6.5.4 Welders Card

Contractor shall provide a Welders Card (to each welder) which shows the welder name, stamp and photo and essential data of welder qualification.

Welders Card shall be coloured to permit an easy identification of the job category and welding process for which welder is qualified.

LABEL COLOUR (*)	JOB CATEGORY
WHITE/material code	PIPING
YELLOW	EQUIPMENT
RED	STEEL STRUCTURES (FULL PENETRATION)
BLUE	TACK WELD – S. STRUCTURES / C. S. PIPING

7. ATTACHMENTS

ATT. 1 - APPENDIX “A” PROCEDURE FOR WELDERS CONFIRMATION



ATT. 2 - FLOW DIAGRAM FOR WELDERS Q.C. ACTIVITY

ATT. 3 - QCF W07 WELDERS LIST

ATT. 4 - QCF W19 TEST COUPONS VISUAL & RADIOGRAPHIC EXAMINATION

ATT. 5 - QCF W21 WELDER HISTORICAL REPORT

ATT. 6 - QCF W22 WELDER'S RT% & WELDER REPAIR RATES - WEEKLY REPORT

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ATTACHMENT 01

APPENDIX "A"

PROCEDURE FOR WELDERS & TACK WELDERS QUALIFICATION

1. PREPARATION OF TEST COUPON

Pipe/Plate test coupon for confirmation of welder and tack welder qualification shall be prepared by Contractor, according to ASME IX, AWS codes standard.

Machining, oxygen-acetylene flame cutting, or proper methods shall bevel test coupons. Test coupon shall be ground after flame cutting to match WPS joint preparation.

Each test coupon shall be marked as follows:

- Progressive test number (+ "TW" for tack welding)
- Coupon identification number (+ "TW" for tack welding)
- Welder Identification / Tack Welder Identification

2. TEST COUPON EXECUTION

Before starting the weld of test coupon Contractor's Welding Inspector shall verify and check the followings:

- Marking of test coupon;
- Material, Position, Range of thickness and diameter, etc. according to the qualification;
- WPS requirements.

All welding requirements as welding rods and shielding shall be in accordance with the applicable approved WPS.



3. TEST ACCEPTANCE CRITERIA

PMC /OWNER Welding Inspector shall witness the welder test.

PMC /OWNER Welding Inspector shall authorize the coupon radiographic examination only after his visual check and approval of welding by Form W19.

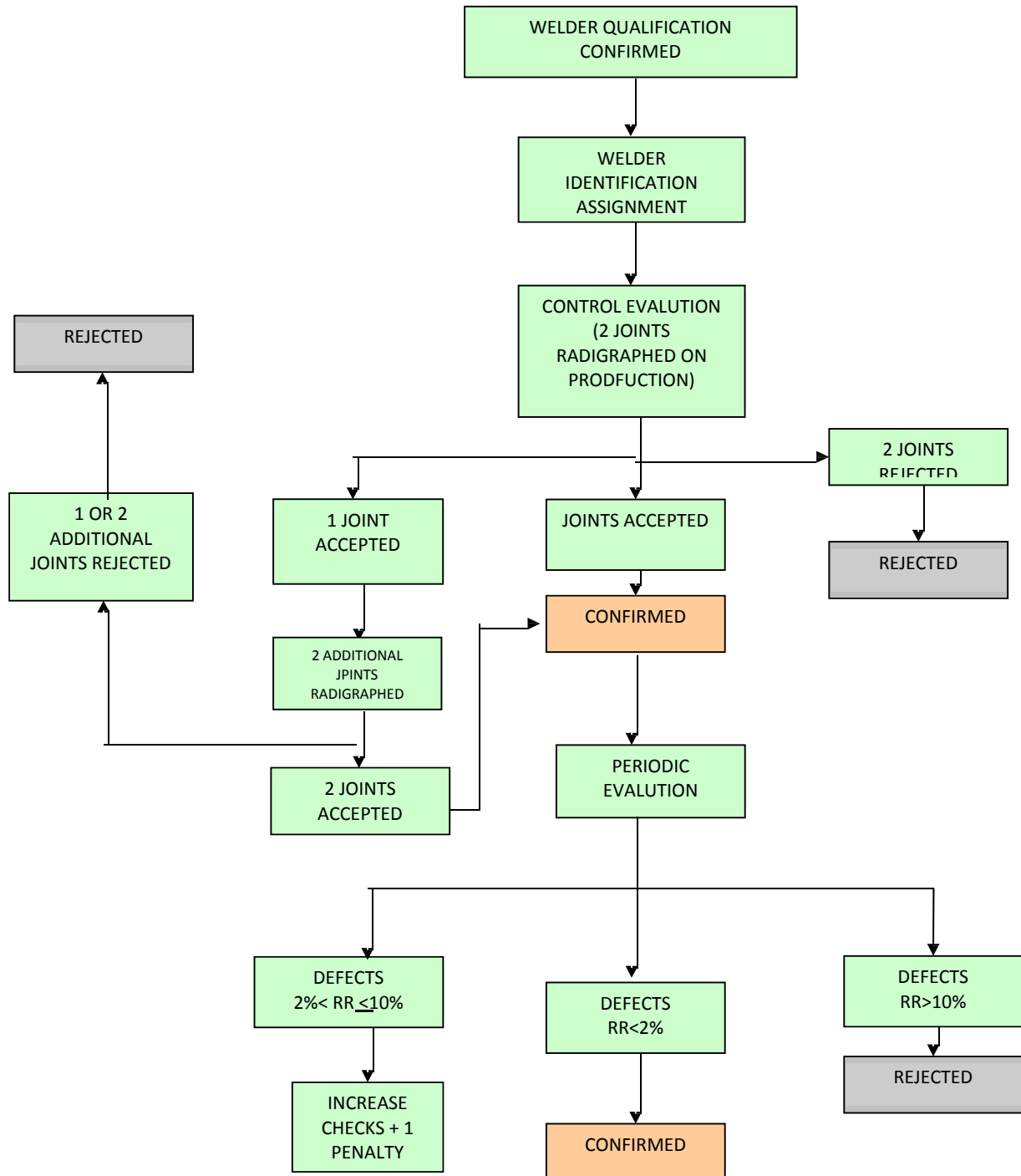
Acceptance criteria for visual inspection and radiographic examination shall be in accordance to ASME IX, ASME VIII, ASME B31.3 and ASME B31.1.

Visual and bend (or fracture) test acceptance criteria for tack welding shall be in accordance to ASME IX.

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ATTACHMENT 02

LOW DIAGRAM FOR WELDERS Q.C. ACTIVITY WELDERS EMPLOYED FOR PRESSURE RETAINING WELDS



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COMPANY:

QUALITY CONTROL FORM

W 19

PROJ. No.:

QCF REV. 0

SH. OF

TEST COUPONS VISUAL & RADIOGRAPHIC EXAMINATION

CONTRACTOR:

W 19 N° _____

[illegible]

NOTE: (1) YES MEANS APPROVAL FOR RADIOGRAPHIC EXAMINATION

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				PROJECT: Standby SRU & Additional Tanks																		
				COMPANY:																		
QUALITY CONTROL FORM W 21				PROJ. No.:		QCF REV. 0		SH. 1 OF 1														
WELDER HISTORICAL REPORT				CONTRACTOR:				W 21 N° _____														
WELDER NAME _____				WELDER STAMP _____		WELDER PERFORMANCE QUALIFICATION (WPQ) N° _____																
AT WORK SHOP AT SITE		WEEKS PERIOD EVALUATION (Note 2)	PENALTIES		PENALTIES				WELDER		REMARKS											
			RR (%) = REPAIR RATES (W 22)		OTHER (MONITORING)				DISQUALIF. DATE	DOWN GRADED DATE												
			DATE	DATE	DATE	(*)	DATE	(*)														
1. TEST COUPON EXAMINATION (W 19 N°) : ____		From Week N° ____ To Week N° ____																				
2. CONTROL EVALUATION ON PRODUCTION																						
<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td colspan="2" style="text-align: center;">FIRST TWO JOINTS</td> <td colspan="2" style="text-align: center;">ADDITIONAL JOINTS</td> </tr> <tr> <td style="text-align: center;">(Note 1)</td> <td style="text-align: center;">DATE</td> <td style="text-align: center;">(Note 1)</td> <td style="text-align: center;">DATE</td> </tr> <tr> <td style="height: 30px;"></td> <td></td> <td></td> <td></td> </tr> </table>		FIRST TWO JOINTS		ADDITIONAL JOINTS		(Note 1)	DATE	(Note 1)	DATE													
FIRST TWO JOINTS		ADDITIONAL JOINTS																				
(Note 1)	DATE	(Note 1)	DATE																			
(*) PENALTY NOTE: W = INCORRECT WPS APPLICATION Q = INCORRECT WPQ APPLICATION																						
(1) ACC = ACCEPTABLE UN-ACC = UNACCEPTABLE A = APPLICABLE N.A. = NOT APPLICABLE (2) From the first welder working week																						



COMPANY:

W 22

QCF REV. 0

SH. OF

SUBCONTRACTOR:

W 22 N° _____

MATERIAL : _____ PIPING CLASSES: _____ RT% _____

WEEK N°	FROM	TO
---------	------	----

CUMULATIVE DATA

Filled up by:	Date:	Recived by:	Date:
---------------	-------	-------------	-------

Client : IOCL			Dept./Sect. : 16/43	
Project : PARADIP REF-S'BY SRU				
Location : PARADIP, ODISHA			Tag No: 513FE	Sheet No. 1 of 1
GATE VALVE SPECIFICATION			MANUF'S OFFER	
TAG NO. :513FE PIPING CLASS : A53G			STANDARD:	
RATING : 150 STANDARD : API-600			MEGRS CAT/FIG:	
SIZE RANGE : 2.0" TO 8.0" ENDS : FLGD TO B-16.5 FF/125AARH			(For category -II MRs only)	
			RATING:	ENDS:
DESCRIPTION	CONSTRUCTION	MATERIAL	CONSTRUCTION	MATERIAL
BODY	CAST	ASTM B62 UNS C83600		
BONNET	BOLTED	ASTM B62 UNS C83600		
STEM	NON RISING	BRONZE		
WEDGE DISC	FLEXIBLE	BRONZE		
BODY SEAT RING	RENEWABLE	BRONZE		
STEM PACKING	RENEWABLE WITH VALVE OPEN ON STREAM	CORROSION INHIBITED DIE FORMED FLEXIBLE GRAPHITE WITH BRAIDED ANTI EXTRUSION RINGS		
HAND WHEEL	NON RISING	MALLEABLE IRON/CAST STEEL/FORGED STEEL/DUCT. IRON		
BONNET BOLTS		ASTM A 193 GR B7 (HDG)		
BONNET NUTS		ASTM A 194 GR 2H (HDG)		
BONNET GASKET		NON ASB. SYNTHETIC FIBER+ RUBBER BINDER		
REQUIREMENT OF GEAR OPERATOR		REFER JOB SUPPLY SPECIFICATION FOR VALVES.		
REQUIREMENT OF RADIOGRAPHY		REFER JOB SUPPLY SPECIFICATION FOR VALVES.		
SPECIAL SERVICE CONDITIONS		MAX. TEMP 70 DEG C		
BACK SEAT & SHOULDER		BRONZE		
OTHERS	OS&Y			
WEDGE FACING RINGS & NUT		BRONZE		
HYDROSTATIC TEST PRESSURE	BODY : 348 PSIG	SEAT : 232 PSIG		
TEST PRESSURE WITH AIR				








NOTES

- THIS VALVE SPEC SHEET SHALL BE READ IN CONJUNCTION WITH TECHNICAL NOTES FOR VALVES.
- ONLY IN THE CASE OF CATEGORY - II MRs,BIDDER SHALL CLEARLY WRITE ALL/ ANY DEVIATION AGAINST EACH PART/ MATERIAL OF VALVE IN THE SPACE PROVIDED FOR AND WHEREVER BIDDER AGREES WITH EIL'S SPEC BIDDER SHALL INDICATE "AGREED".
- NO CUTTING/ OVERWRITING BY BIDDER ON EIL'S SPEC IS ALLOWED.
- TESTING SHALL BE AS PER API-598.
- FLANGE END SHALL BE FLAT FACE DRILLED TO ANSI B16.5, 150#.
- RADIOGRAPHY OF VALVE CASTINGS NOT REQUIRED.

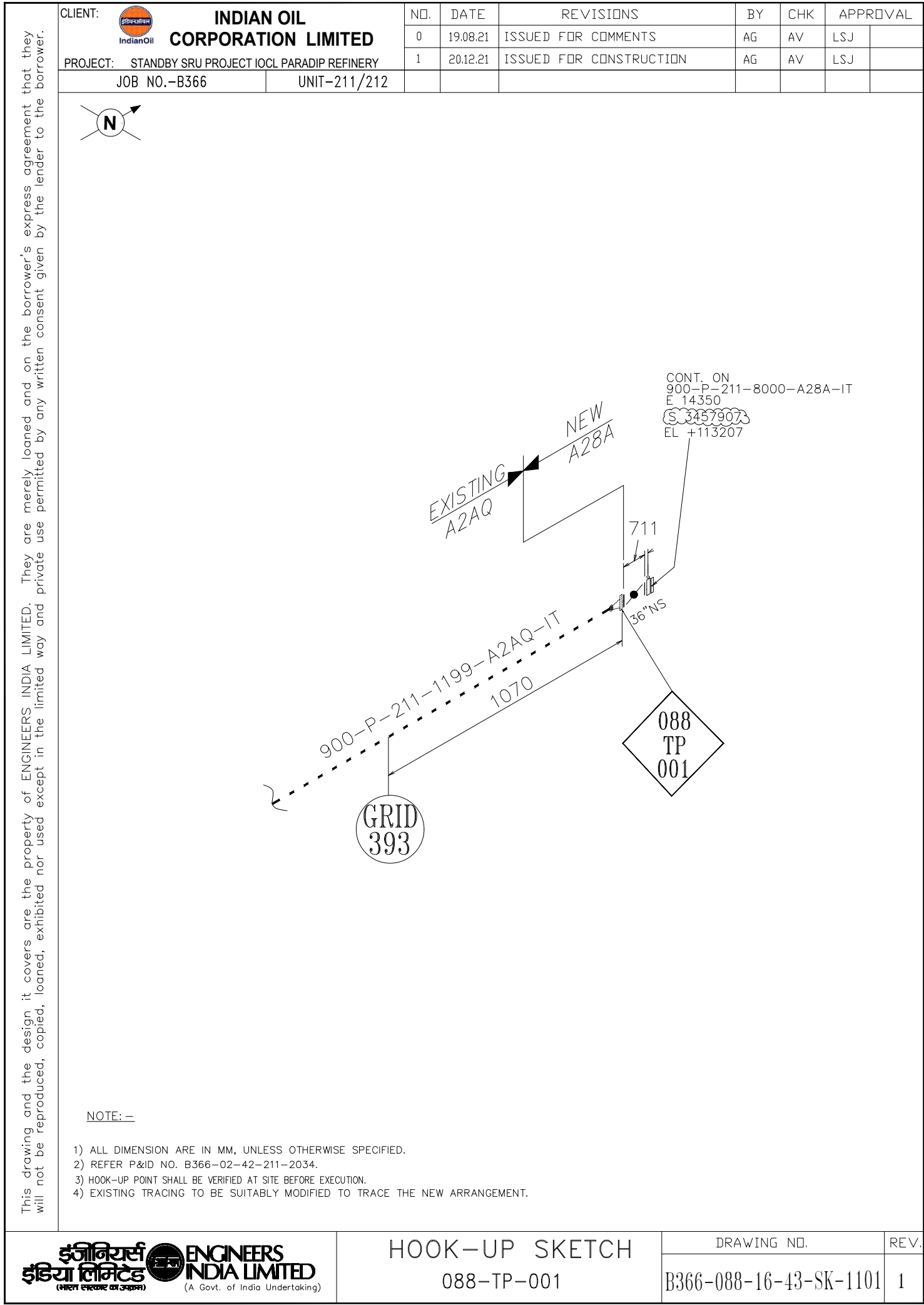
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OF MANUFACTURER

SHEET REV. NO.	0	1
DATE	27/04/2021	18/06/2021


513FE

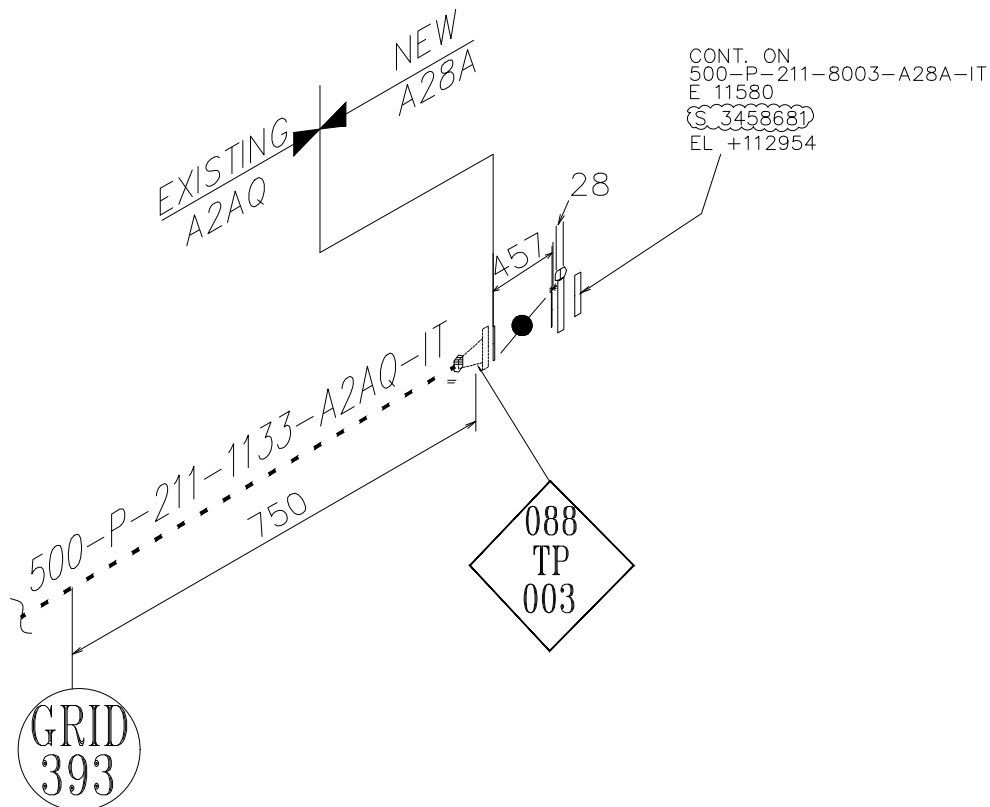
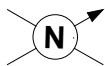
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1	10.12.2021	ISSUED FOR CONSTRUCTION	AG	AV	LSJ	
0	20.08.2021	ISSUED FOR COMMENTS	AG	AV	LSJ	
REV	DATE	DETAILS OF REVISION	PREPARED	CHECKED	APPROVED	
CLIENT	 IndianOil		INDIAN OIL CORPORATION LIMITED PARADIP REFINERY PROJECT PARADIP ODISHA			
CONSULTANT	 TECHNIP ENERGIES		TECHNIP ENERGIES			
PROJECT	525 TPD STANDBY SRU PROJECT IOCL PARADIP REFINERY, ODISHA, INDIA					
ESC	 ENGINEERS INDIA LIMITED					
 DEPT. PE&SD.	BHEL Hyderabad	NAME	SIGN	DATE		
		DRN				
		CHD				
	CODE 450					
<p>The information on this document is the property of BHARAT HEAVY ELECTRICALS LIMITED. It must not be used directly or indirectly in any way detrimental to the interest of the company</p>		TITLE- TIE-IN DRAWINGS				
		BHEL/EIL DRG NO.- B366-088-16-43-SK-1001				REV
		CUST. DRG NO.- 080557C-26899053-PIP-A2301-001				1
		SHT NO.- 1 of 63	NO. OF SHT.- 63			

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3	B366-088-16-43-SK-1103	088-TP-010	
4	B366-088-16-43-SK-1104	088-TP-004	
5	B366-088-16-43-SK-1105	090-TP-027	
6	B366-088-16-43-SK-1106	089-TP-039,053,054	
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34	B366-088-16-43-SK-1316	090-TP-034	
35	B366-088-16-43-SK-1317	090-TP-037	
36	B366-088-16-43-SK-1319	088-TP-XX1	HOLD-DM Water
37	B366-088-16-43-SK-1320	090-TP-XX2	HOLD-DM Water
38	B366-088-16-43-SK-1330	212-TP-101	
39	B366-088-16-43-SK-1331	212-TP-102	
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50	B366-088-16-43-SK-1407	090-TP-036	
51	B366-088-16-43-SK-1408	090-TP-038	
MTO			
1	TIE-IN MTO		
NOTES			
1	Insulation & Painting to be considered as per the P&ID/Specifications/Standards.		
2	For supports, refer support standard.		



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	0	19.08.21	ISSUED FOR COMMENTS	AG	AV	LSJ	
	1	10.12.21	ISSUED FOR CONSTRUCTION	AG	AV	LSJ	
PROJECT: STANDBY SRU PROJECT IOCL PARADIP REFINERY							
JOB NO.-B366		UNIT-211/212					

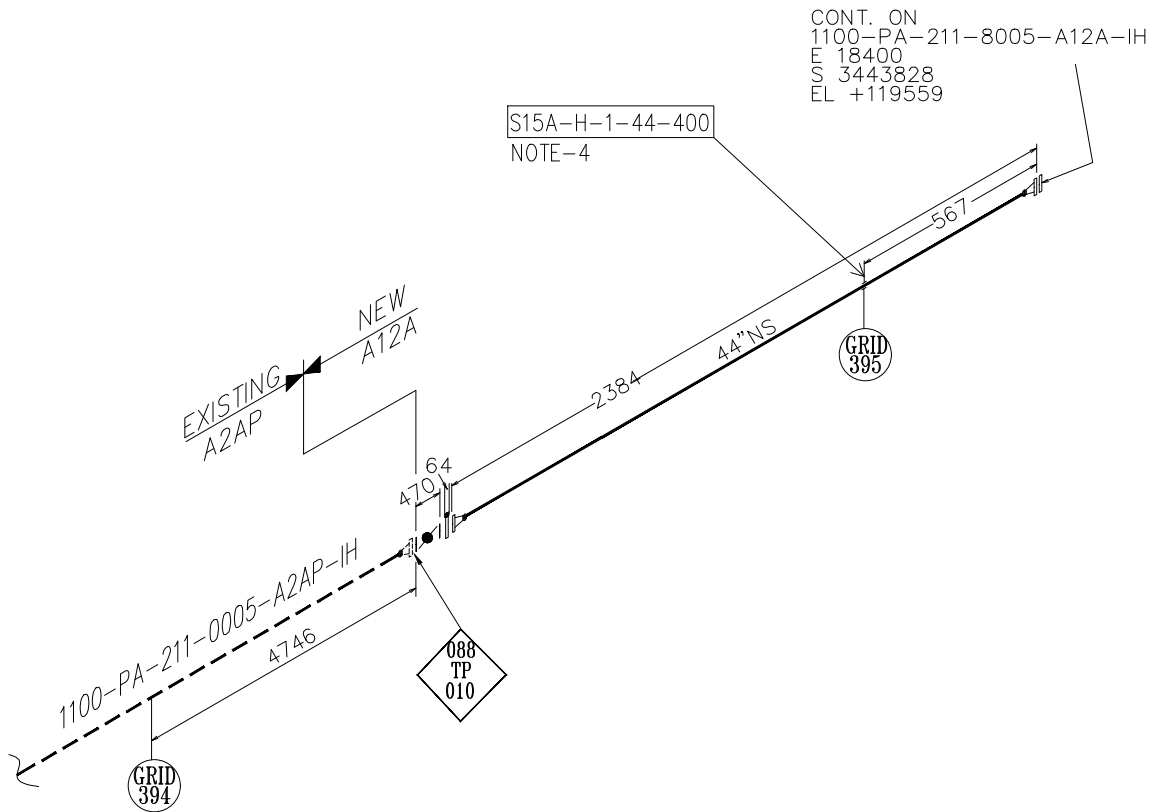
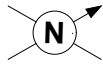


NOTE: -

- 1) ALL DIMENSION ARE IN MM, UNLESS OTHERWISE SPECIFIED.
- 2) REFER P&ID NO. B366-02-42-211-2034.
- 3) HOOK-UP POINT SHALL BE VERIFIED AT SITE BEFORE EXECUTION.
- 4) EXISTING TRACING TO BE SUITABLY MODIFIED TO TRACE THE NEW ARRANGEMENT.

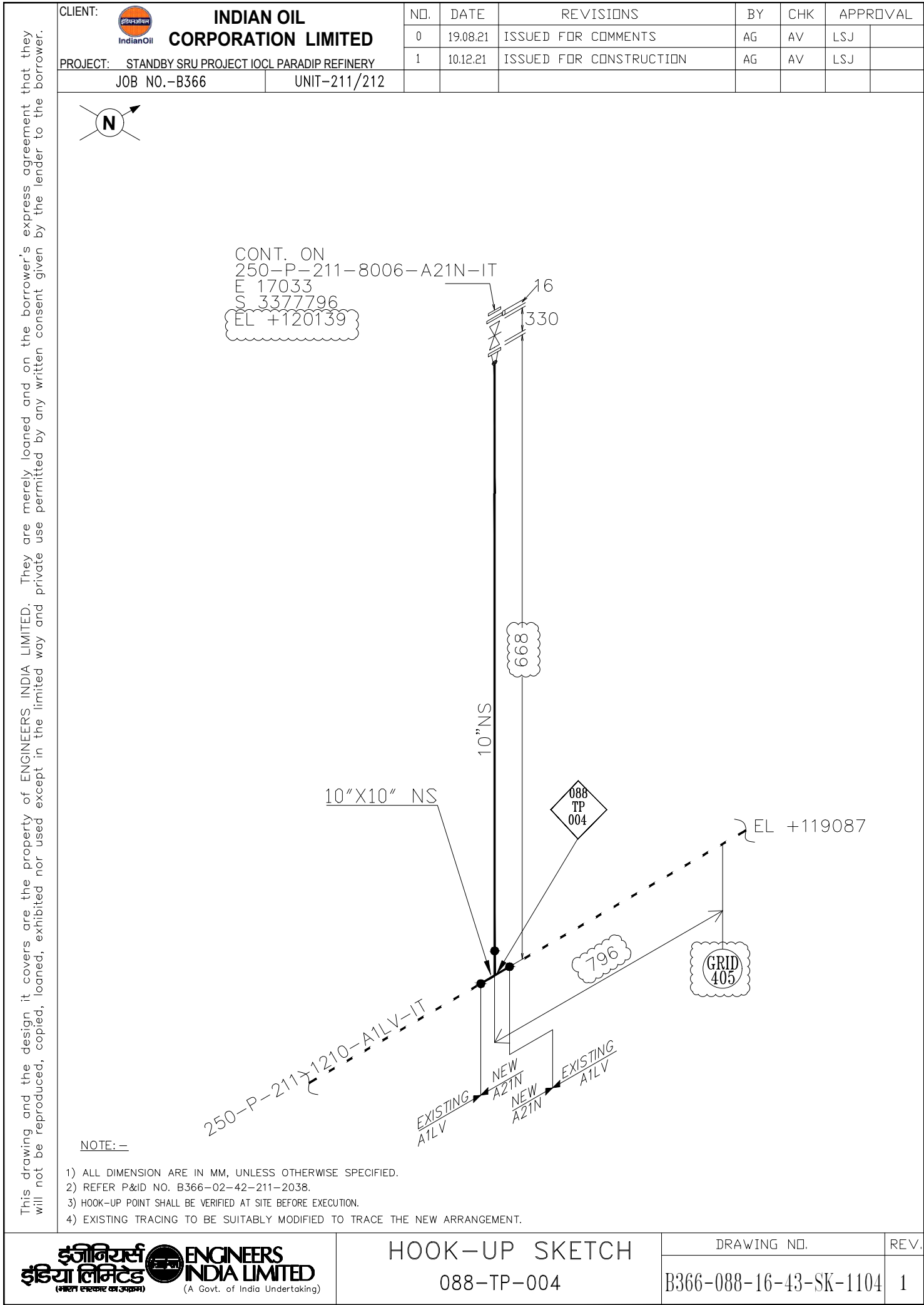
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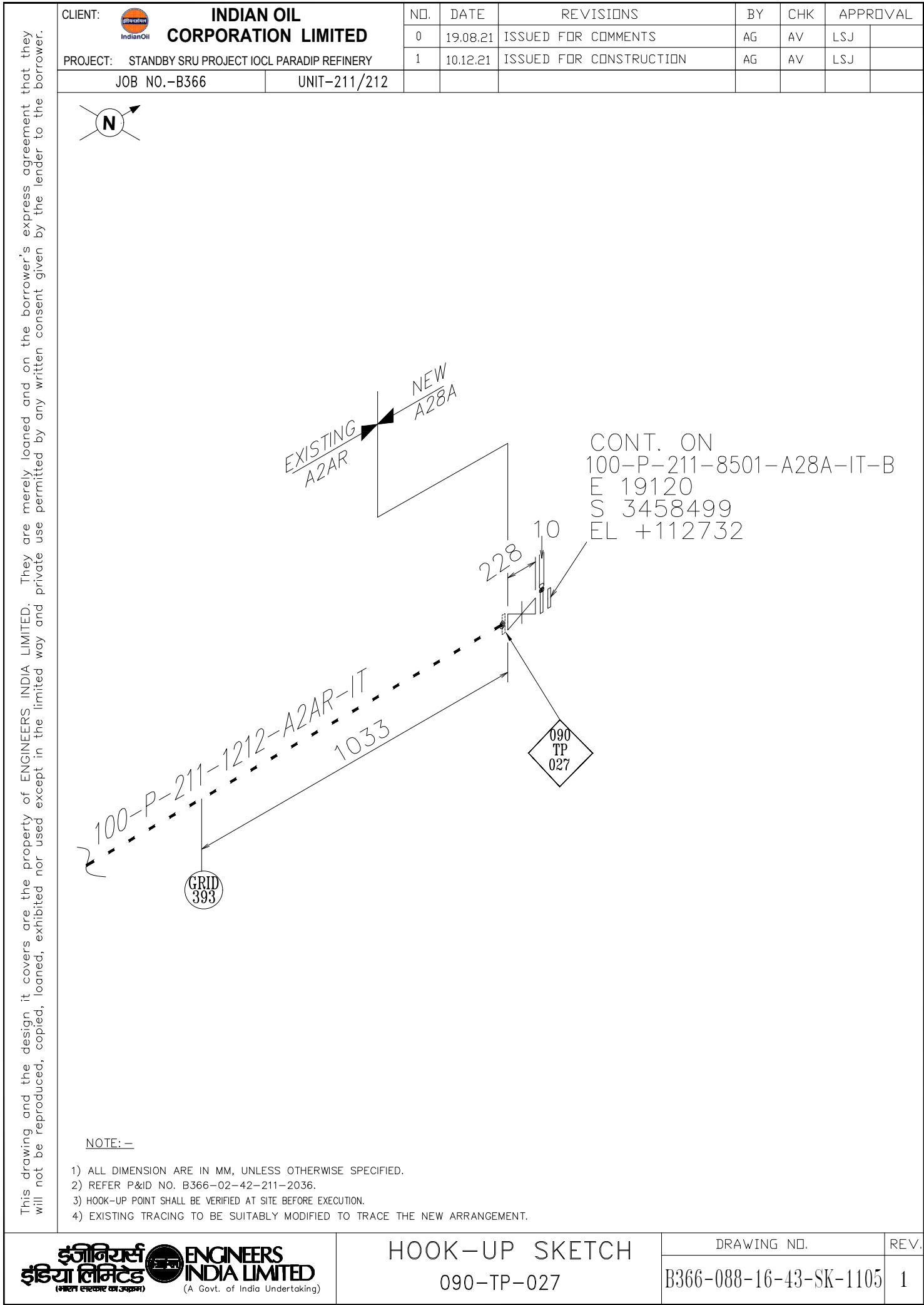
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JOB NO.-B366		UNIT-211/212					




NOTE:—

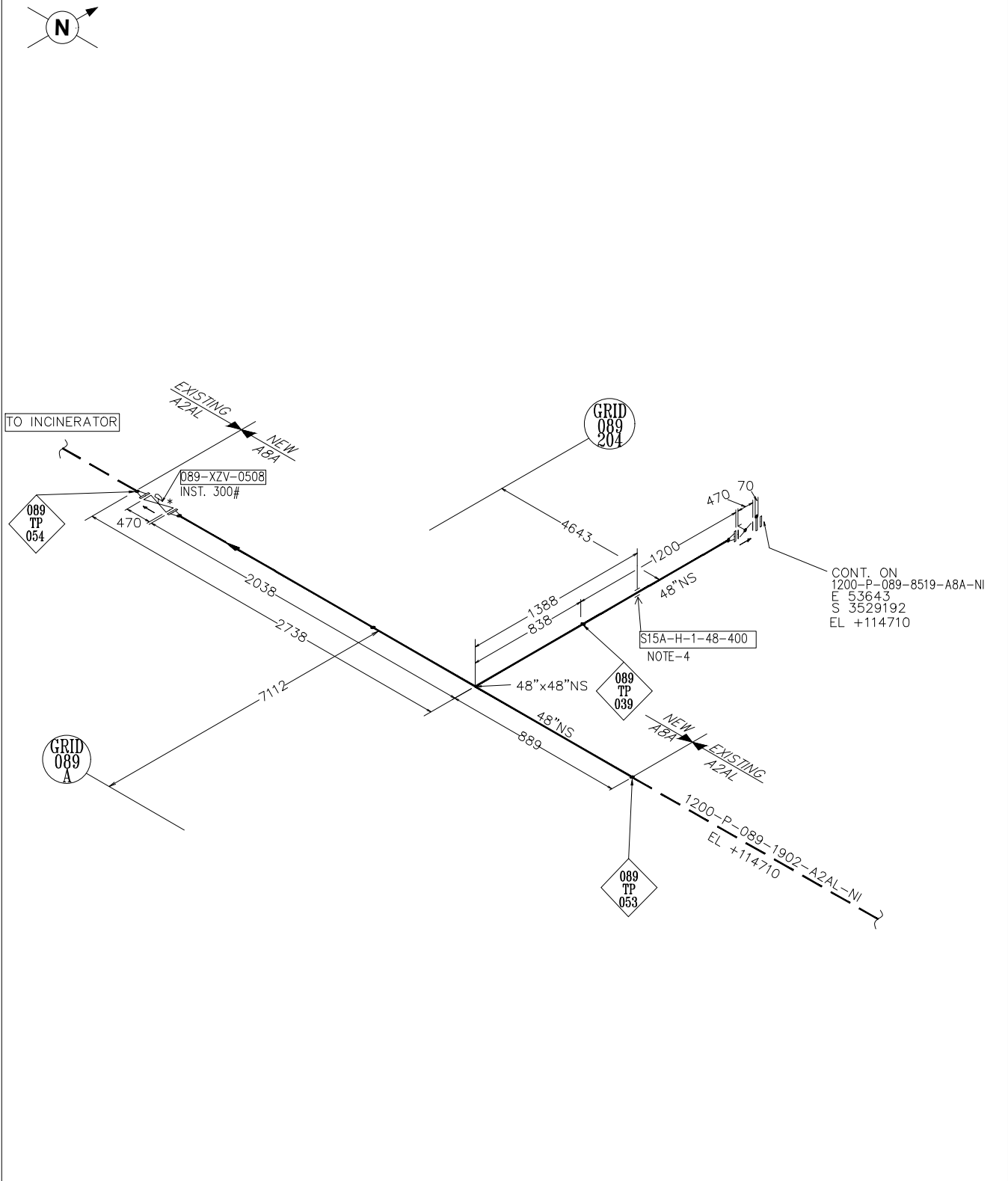
- 1) ALL DIMENSION ARE IN MM, UNLESS OTHERWISE SPECIFIED.
- 2) REFER P&ID NO. B366-02-42-211-2036.
- 3) HOOK-UP POINT SHALL BE VERIFIED AT SITE BEFORE EXECUTION.
- 4) SHOE HEIGHT SHALL BE EQUAL TO EXISTING ADJACENT SHOE HEIGHT.





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CLIENT:	 INDIAN OIL CORPORATION LIMITED	NO.	DATE	REVISIONS	BY	CHK	APPROVAL
PROJECT:	STANDBY SRU PROJECT IOCL PARADIP REFINERY	0	10.12.21	ISSUED FOR CONSTRUCTION	AG	AV	LSJ
JOB NO.-B366	UNIT-089						




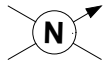
* CONTROL VALVE ALONG WITH MATING FLANGES SHALL BE 300#

NOTE: —

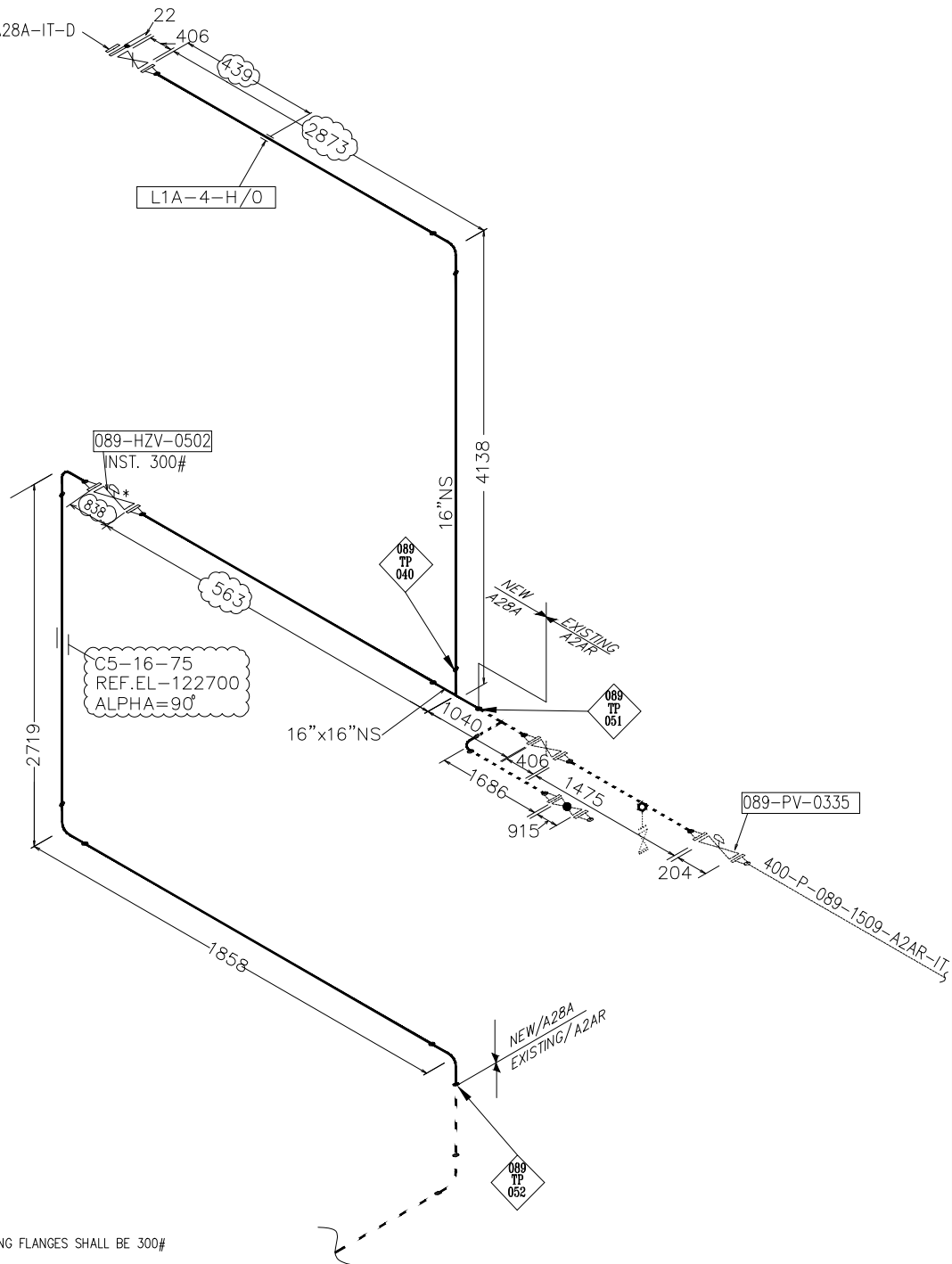
- 1) ALL DIMENSION ARE IN MM, UNLESS OTHERWISE SPECIFIED.
- 2) REFER P&ID NO. B366-02-42-089-0010.
- 3) HOOK-UP POINT SHALL BE VERIFIED AT SITE BEFORE EXECUTION.
- 4) SHOE HEIGHT SHALL BE SUIT TO SITE.

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CLIENT:	 INDIAN OIL CORPORATION LIMITED	NO.	DATE	REVISIONS	BY	CHK	APPROVAL
PROJECT:	STANDBY SRU PROJECT IOCL PARADIP REFINERY	0	19.08.21	ISSUED FOR COMMENTS	AG	AV	LSJ
JOB NO.-B366	UNIT-089	1	29.09.21	ISSUED FOR COMMENTS	AG	AV	LSJ
		2	10.12.21	ISSUED FOR CONSTRUCTION	AG	AV	LSJ



CONT. ON
400-P-089-8520-A28A-IT-D
E 53426
S 3518066
EL +127728

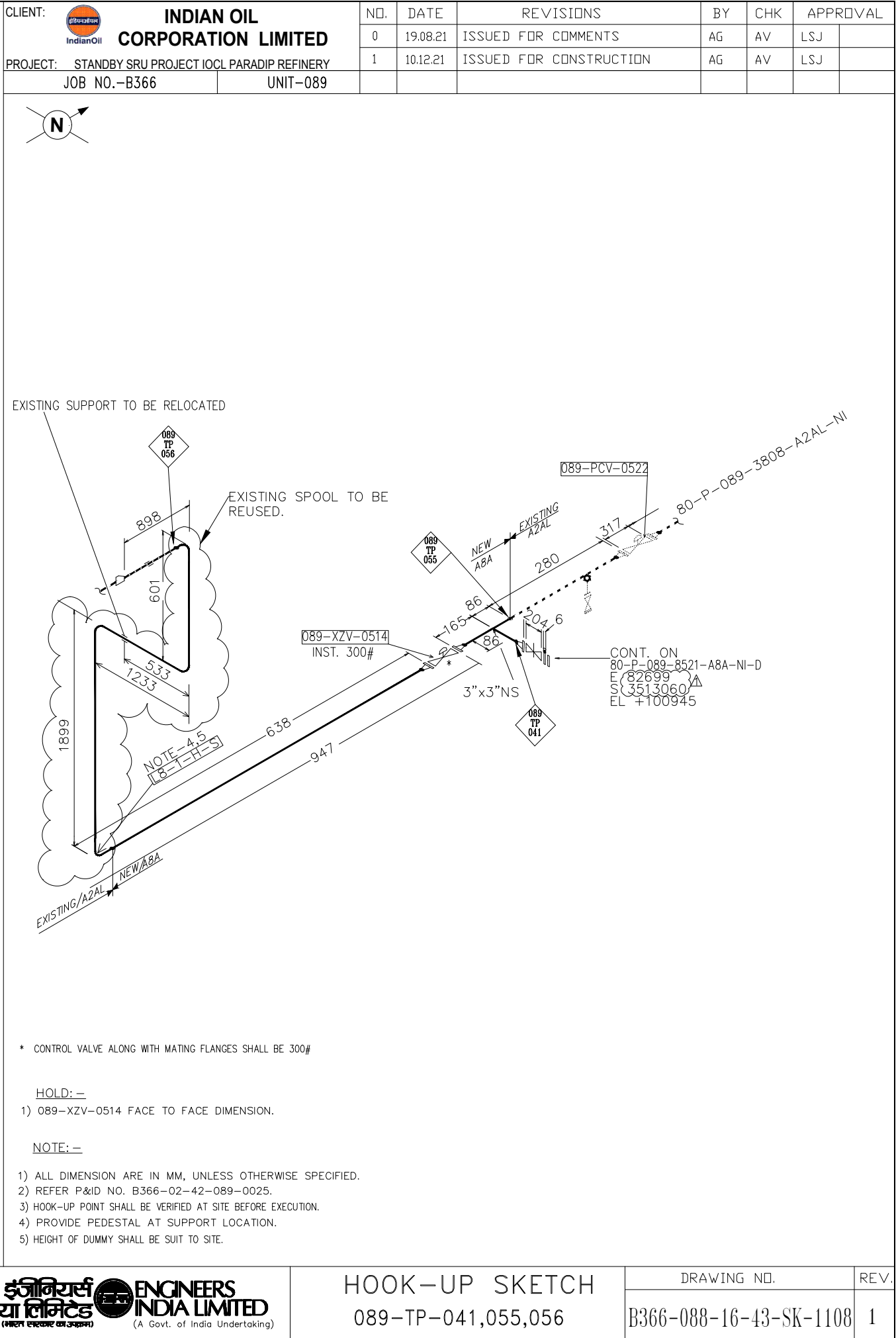


* CONTROL VALVE ALONG WITH MATING FLANGES SHALL BE 300#


NOTE:-

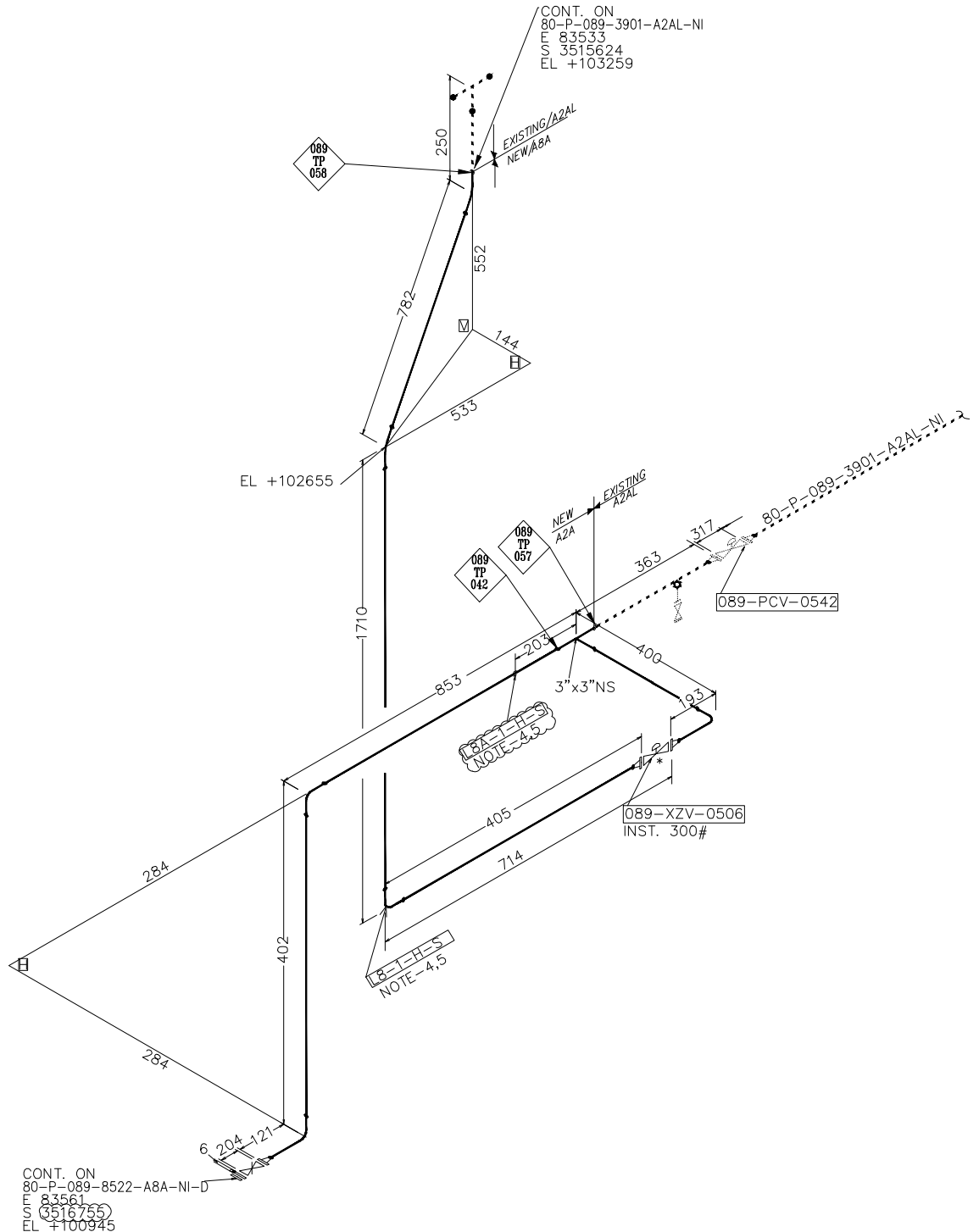
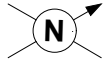
- 1) ALL DIMENSION ARE IN MM, UNLESS OTHERWISE SPECIFIED.
- 2) REFER P&ID NO. B366-02-42-089-0006.
- 3) HOOK-UP POINT SHALL BE VERIFIED AT SITE BEFORE EXECUTION.
- 4) EXISTING TRACING TO BE SUITABLY MODIFIED TO TRACE NEW ARRANGEMENT.

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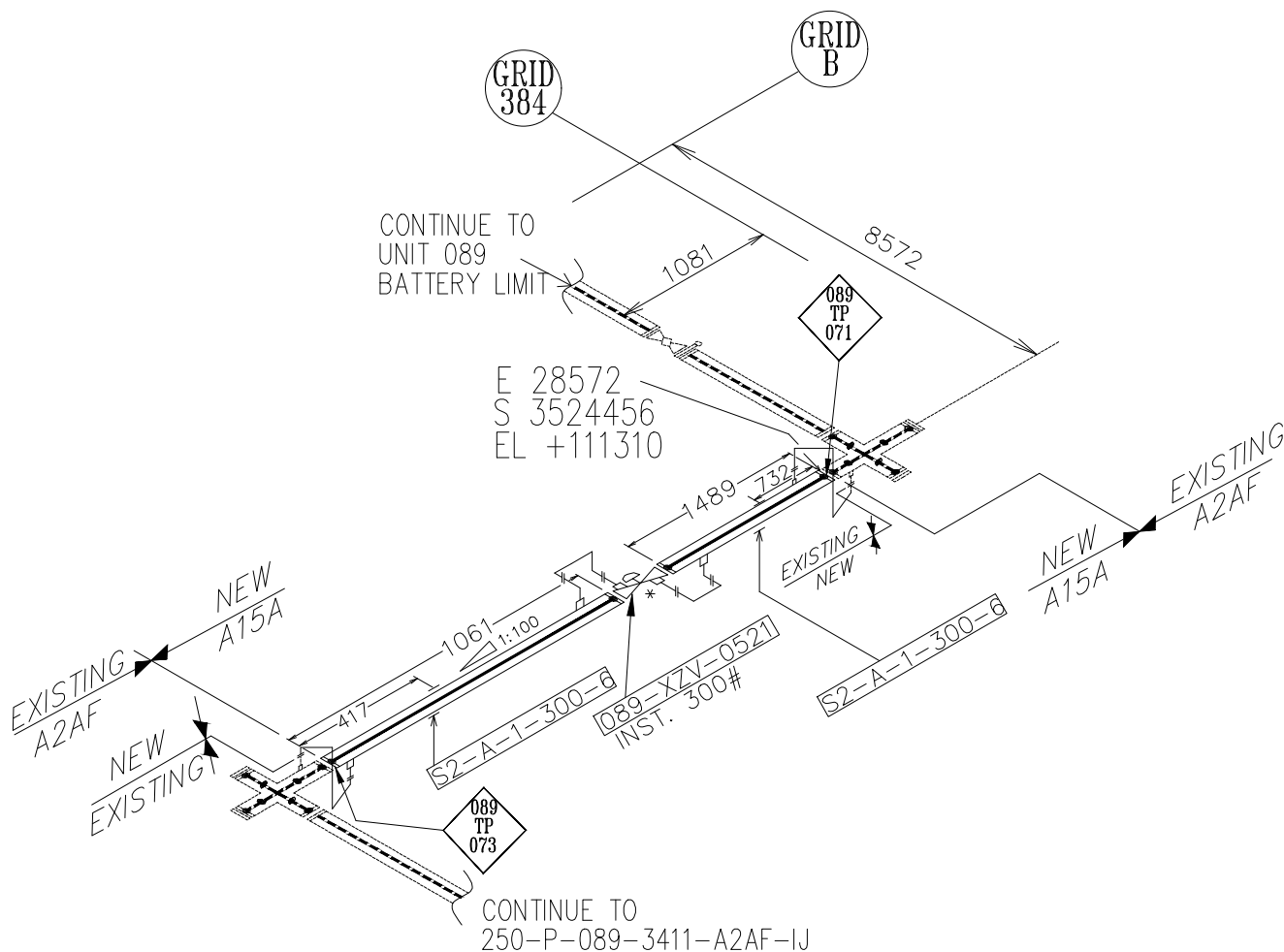
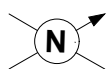
CLIENT:	 INDIAN OIL CORPORATION LIMITED	NO.	DATE	REVISIONS	BY	CHK	APPROVAL
PROJECT:	STANDBY SRU PROJECT IOCL PARADIP REFINERY	0	19.08.21	ISSUED FOR COMMENTS	AG	AV	LSJ
JOB NO.-B366	UNIT-089	1	10.12.2021	ISSUED FOR CONSTRUCTION	AG	AV	LSJ



- * CONTROL VALVE ALONG WITH MATING FLANGES SHALL BE 300#
HOLD:-
- 1) 089-XZV-0506 FACE TO FACE DIMENSION.
NOTE:-
- 1) ALL DIMENSION ARE IN MM, UNLESS OTHERWISE SPECIFIED.
2) REFER P&ID NO. B366-02-42-089-0026.
3) HOOK-UP POINT SHALL BE VERIFIED AT SITE BEFORE EXECUTION.
4) PROVIDE PEDESTAL AT SUPPORT LOCATION.
5) HEIGHT OF DUMMY SHALL BE SUIT TO SITE.

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CLIENT:  INDIAN OIL CORPORATION LIMITED	NO.	DATE	REVISIONS	BY	CHK	APPROVAL	
	0	19.08.21	ISSUED FOR COMMENTS	AG	AV	LSJ	
	1	28.09.21	ISSUED FOR COMMENTS	AG	AV	LSJ	
PROJECT: STANDBY SRU PROJECT IOCL PARADIP REFINERY	2	10.12.21	ISSUED FOR CONSTRUCTION	AG	AV	LSJ	
JOB NO.-B366	UNIT-089						



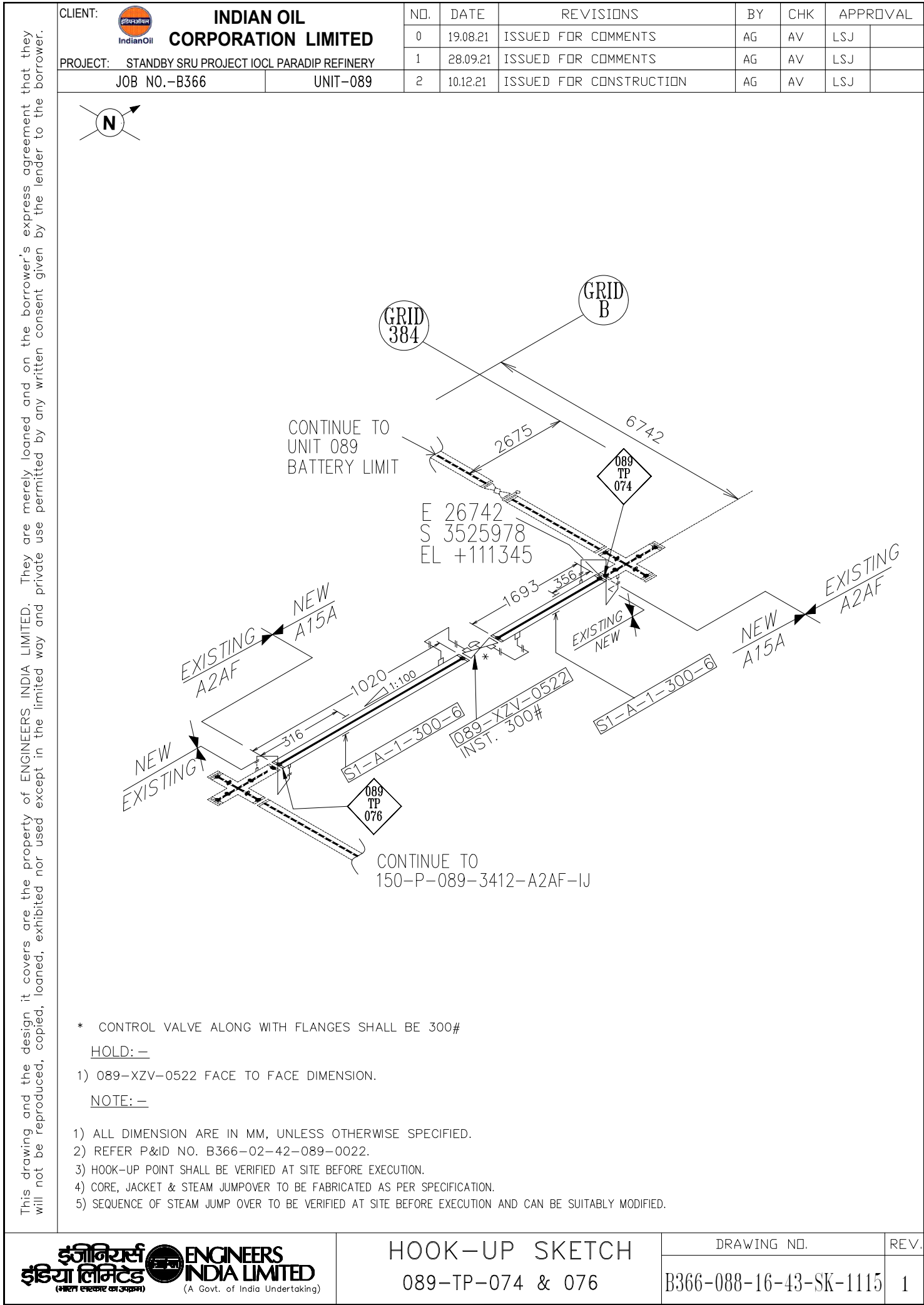
* CONTROL VALVE ALONG WITH FLANGES SHALL BE 300#

HOLD: —


1) 089-XZV-0521 FACE TO FACE DIMENSION.

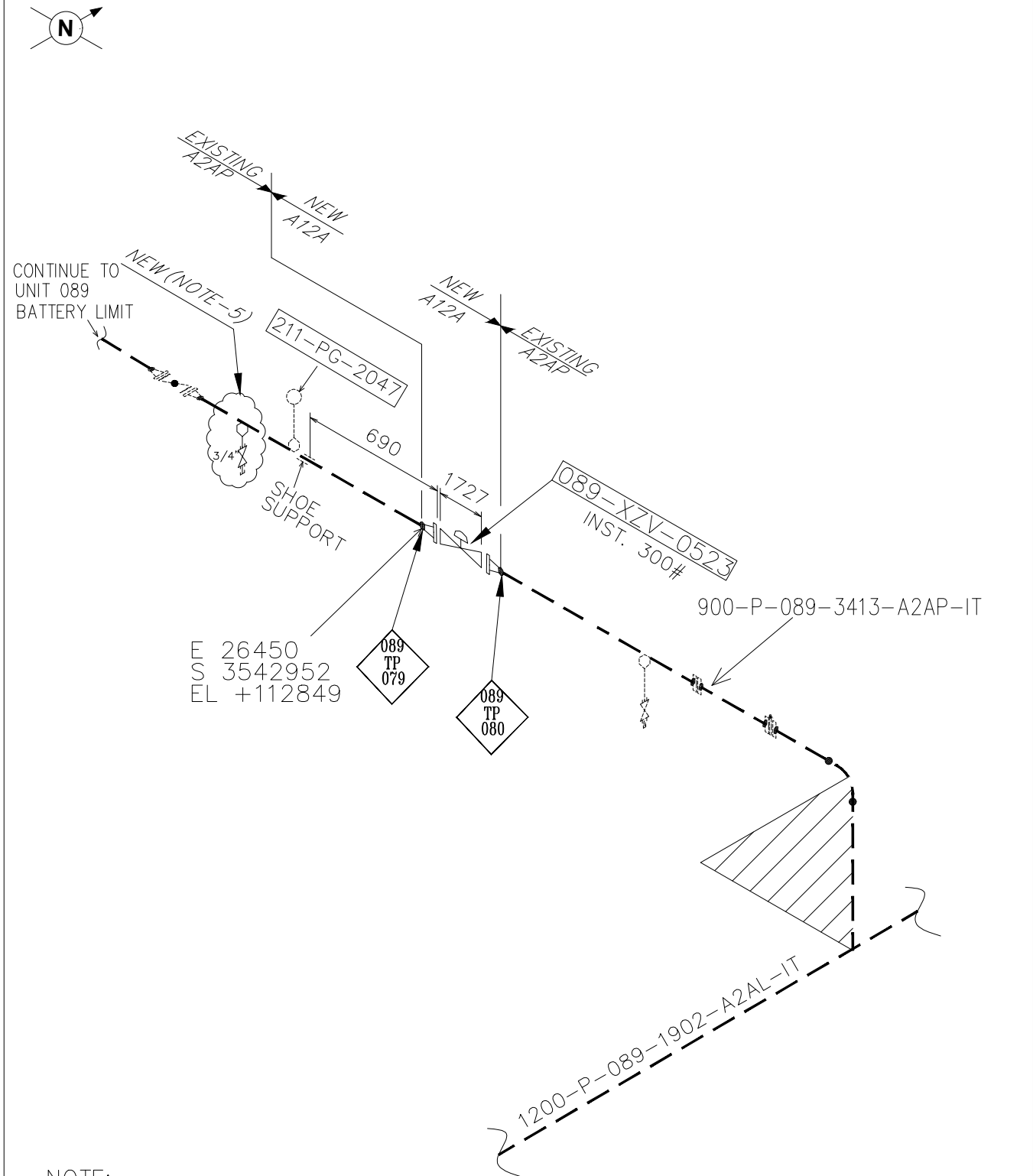
NOTE: —

- 1) ALL DIMENSION ARE IN MM, UNLESS OTHERWISE SPECIFIED.
- 2) REFER P&ID NO. B366-02-42-089-0022.
- 3) HOOK-UP POINT SHALL BE VERIFIED AT SITE BEFORE EXECUTION.
- 4) CORE, JACKET & STEAM JUMPOVER TO BE FABRICATED AS PER SPECIFICATION.
- 5) SEQUENCE OF STEAM JUMP OVER TO BE VERIFIED AT SITE BEFORE EXECUTION AND CAN BE SUITABLY MODIFIED.



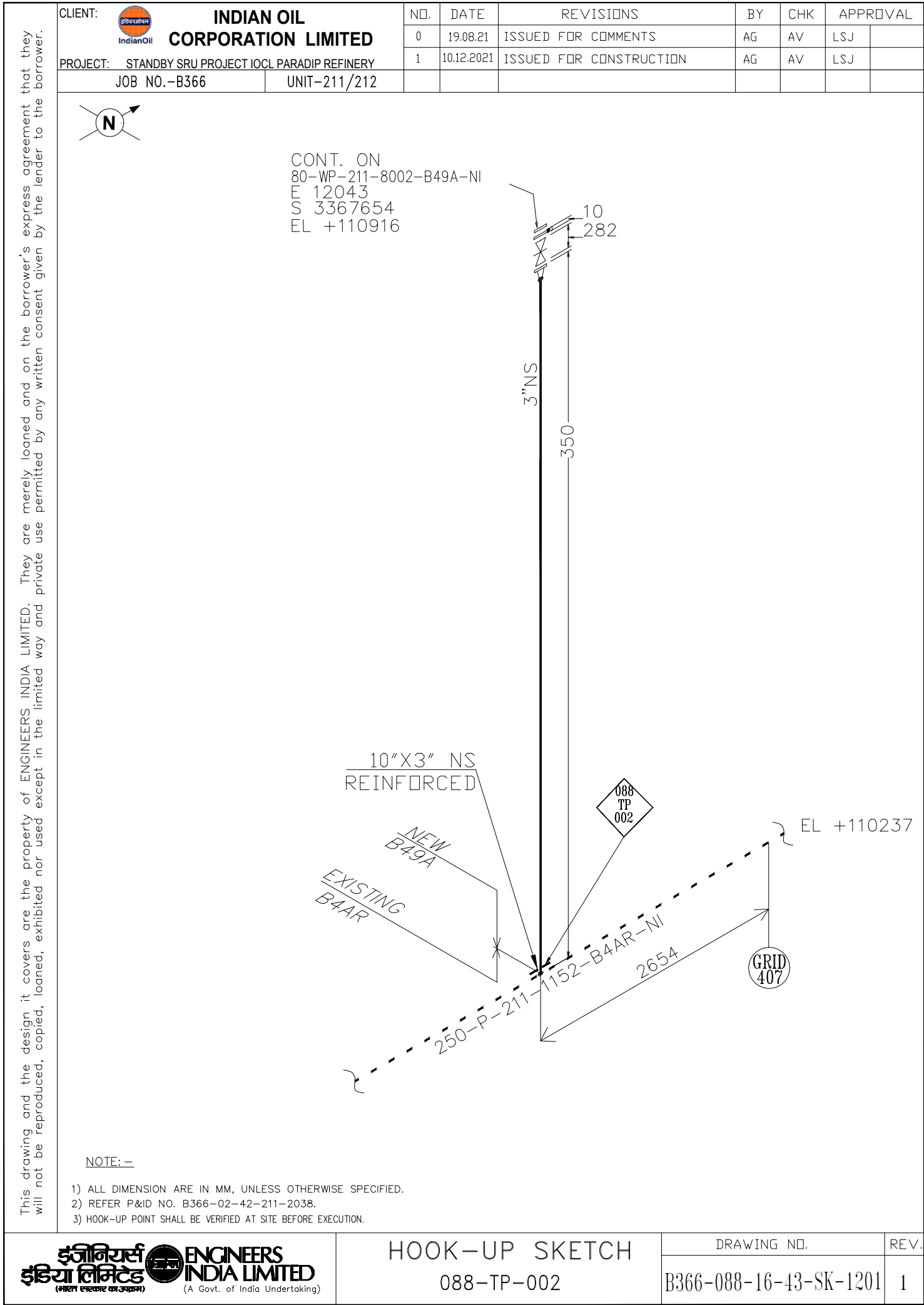
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CLIENT:  INDIAN OIL CORPORATION LIMITED	NO.	DATE	REVISIONS	BY	CHK	APPROVAL	
	0	19.08.21	ISSUED FOR COMMENTS	AG	AV	LSJ	
	1	28.09.21	ISSUED FOR COMMENTS	AG	AV	LSJ	
PROJECT: STANDBY SRU PROJECT IOCL PARADIP REFINERY	2	10.12.21	ISSUED FOR CONSTRUCTION	AG	AV	LSJ	
JOB NO.-B366	UNIT-089						




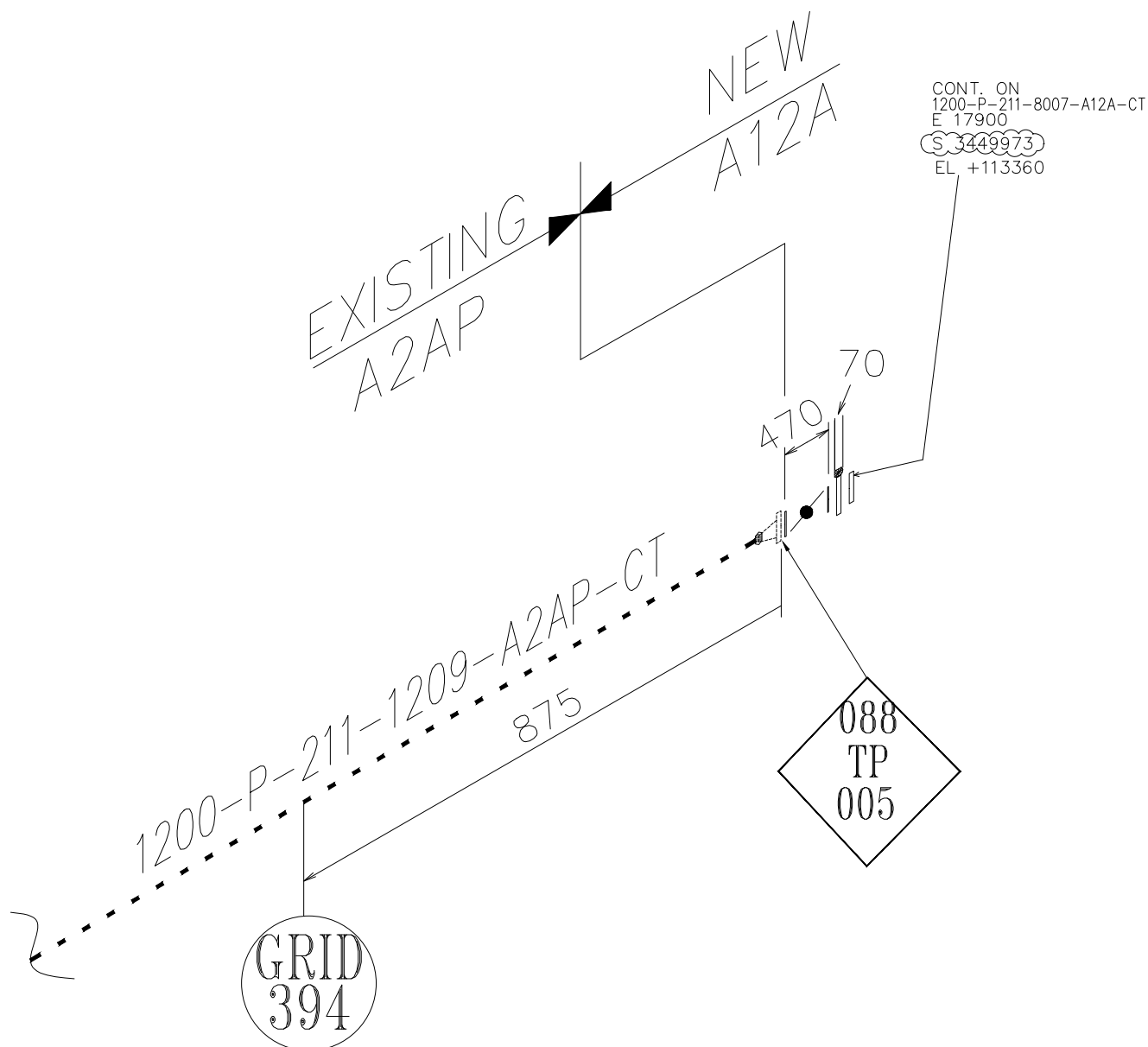
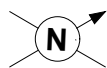
NOTE: —

- 1) ALL DIMENSION ARE IN MM, UNLESS OTHERWISE SPECIFIED.
- 2) REFER P&ID NO. B366-02-42-089-0022.
- 3) HOOK-UP POINT SHALL BE VERIFIED AT SITE BEFORE EXECUTION.
- 4) EXISTING STEAM TRACING TO BE MODIFIED, TO TRACE THE NEW ARRANGEMENT.
- 5) DRAIN TO BE PROVIDED SUIT TO SITE, AS PER THE TESTING PHILOSOPHY.



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CLIENT:  INDIAN OIL CORPORATION LIMITED	NO.	DATE	REVISIONS	BY	CHK	APPROVAL	
	0	19.08.21	ISSUED FOR COMMENTS	AG	AV	LSJ	
	1	10.12.21	ISSUED FOR CONSTRUCTION	AG	AV	LSJ	
PROJECT: STANDBY SRU PROJECT IOCL PARADIP REFINERY							
JOB NO.-B366		UNIT-211/212					

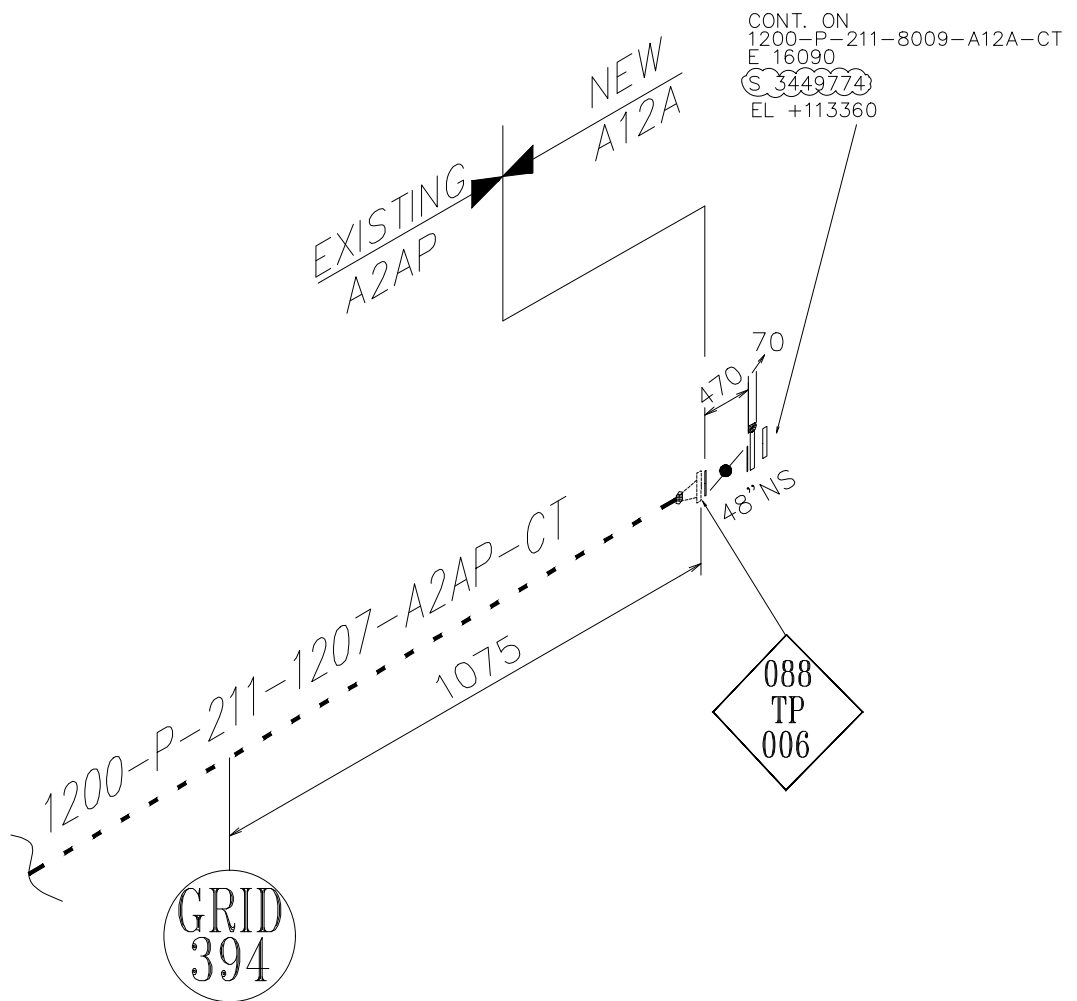
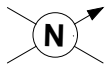


NOTE: —

- 1) ALL DIMENSION ARE IN MM, UNLESS OTHERWISE SPECIFIED.
- 2) REFER P&ID NO. B366-02-42-211-2034.
- 3) HOOK-UP POINT SHALL BE VERIFIED AT SITE BEFORE EXECUTION.
- 4) EXISTING TRACING TO BE SUITABLY MODIFIED TO TRACE THE NEW ARRANGEMENT.

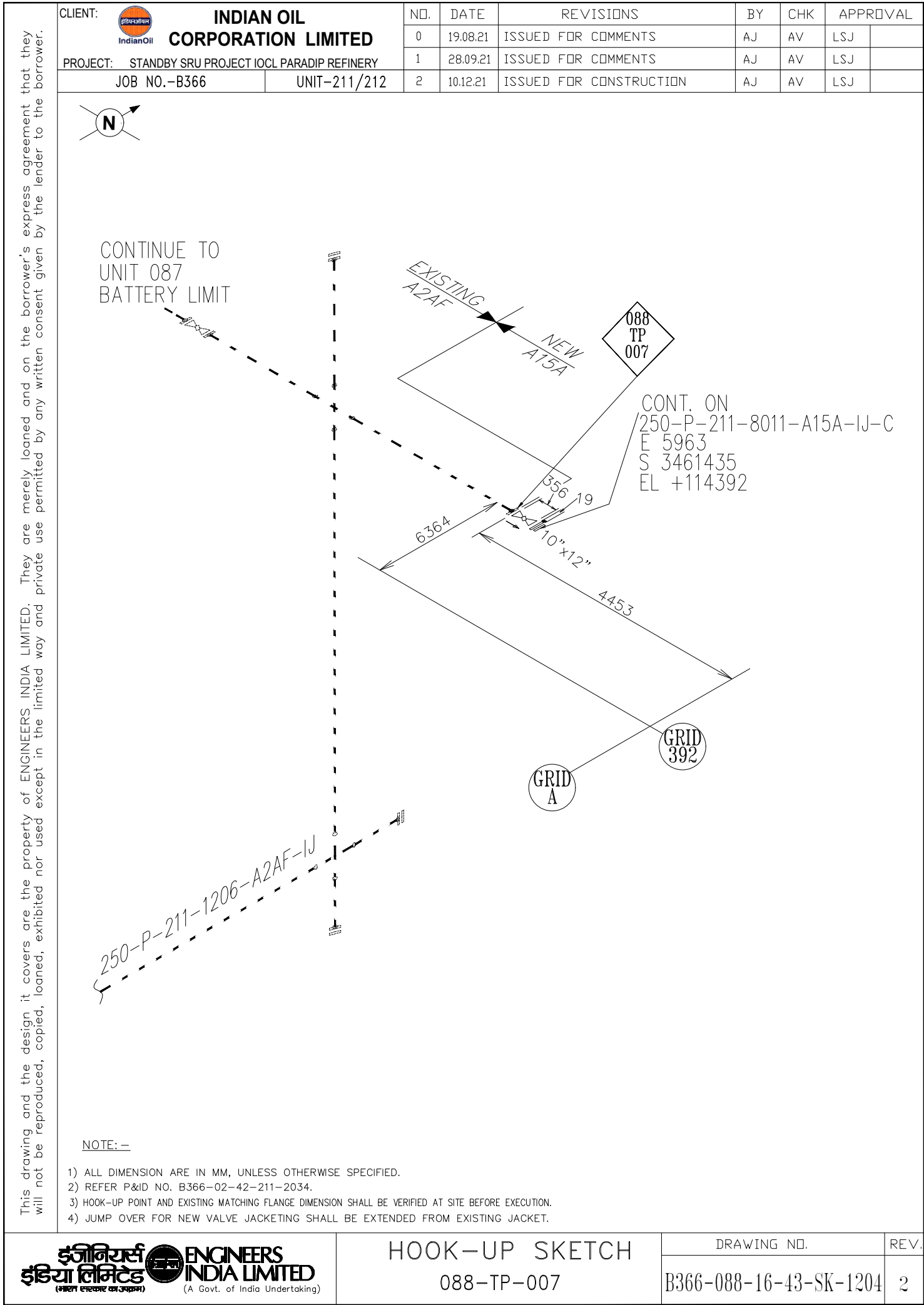
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CLIENT:  INDIAN OIL CORPORATION LIMITED	NO.	DATE	REVISIONS	BY	CHK	APPROVAL	
	0	19.08.21	ISSUED FOR COMMENTS	AG	AV	LSJ	
	1	10.12.21	ISSUED FOR CONSTRUCTION	AG	AV	LSJ	
PROJECT: STANDBY SRU PROJECT IOCL PARADIP REFINERY							
JOB NO.-B366		UNIT-211/212					




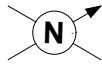
NOTE: —

- 1) ALL DIMENSION ARE IN MM, UNLESS OTHERWISE SPECIFIED.
- 2) REFER P&ID NO. B366-02-42-211-2034.
- 3) HOOK-UP POINT SHALL BE VERIFIED AT SITE BEFORE EXECUTION.
- 4) EXISTING TRACING TO BE SUITABLY MODIFIED TO TRACE THE NEW ARRANGEMENT.



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CLIENT:	 INDIAN OIL CORPORATION LIMITED	NO.	DATE	REVISIONS	BY	CHK	APPROVAL
PROJECT:	STANDBY SRU PROJECT IOCL PARADIP REFINERY	0	19.08.21	ISSUED FOR COMMENTS	AG	AV	LSJ
JOB NO.-B366	UNIT-211/212	1	10.12.21	ISSUED FOR CONSTRUCTION	AG	AV	LSJ



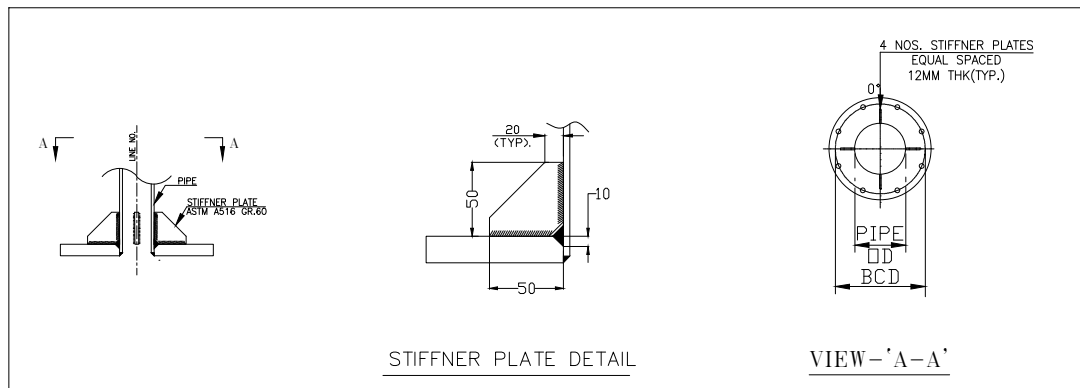
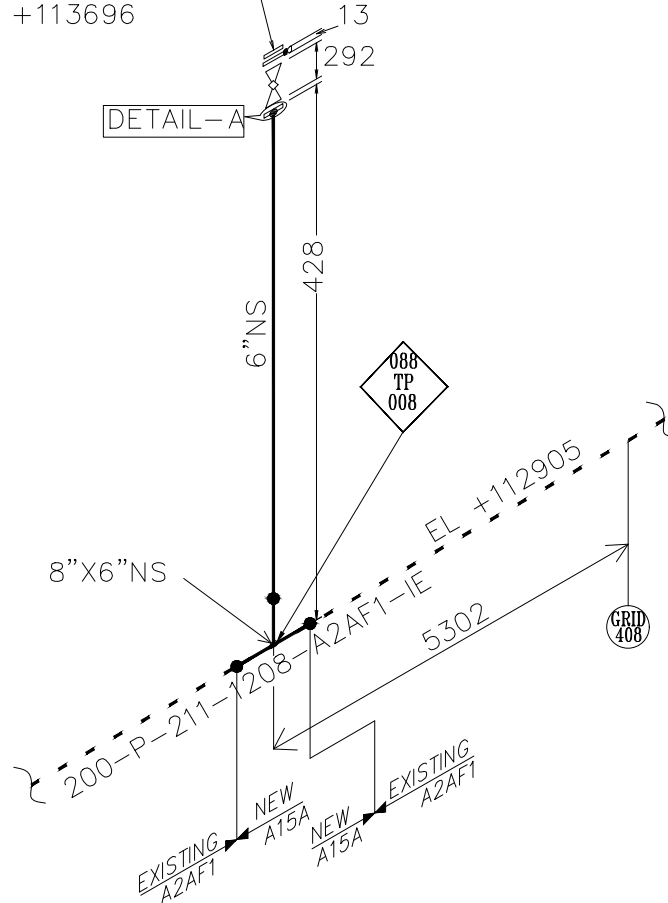
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E 10855

S 3360302

EL +113696




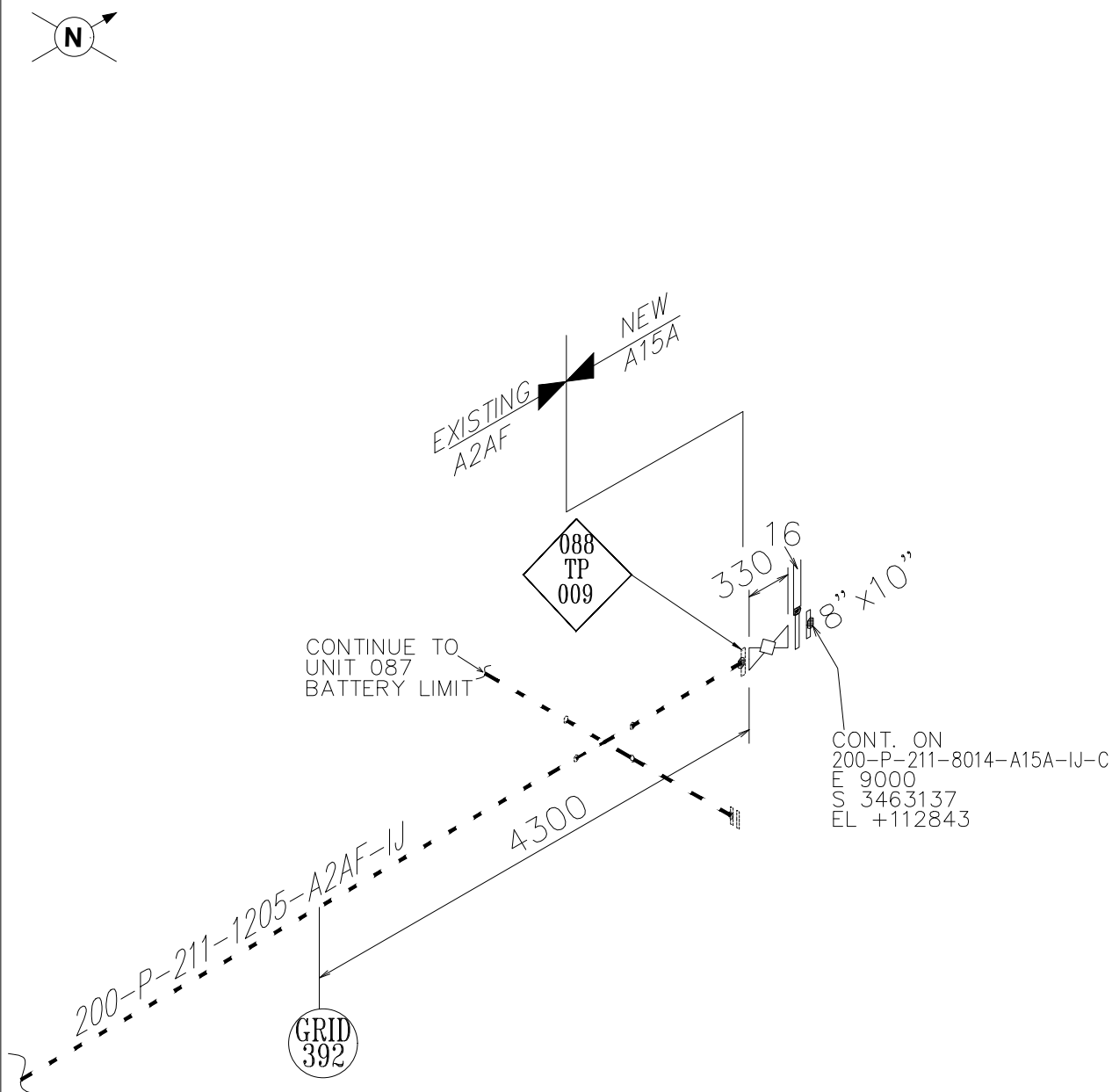
DETAIL-A

NOTE: -

- 1) ALL DIMENSION ARE IN MM, UNLESS OTHERWISE SPECIFIED.
- 2) REFER P&ID NO. B366-02-42-211-2038..
- 3) HOOK-UP POINT SHALL BE VERIFIED AT SITE BEFORE EXECUTION.
- 4) EXISTING ELECTRICAL TRACING TO BE SUITABLY MODIFIED TO TRACE NEW ARRANGEMENT.

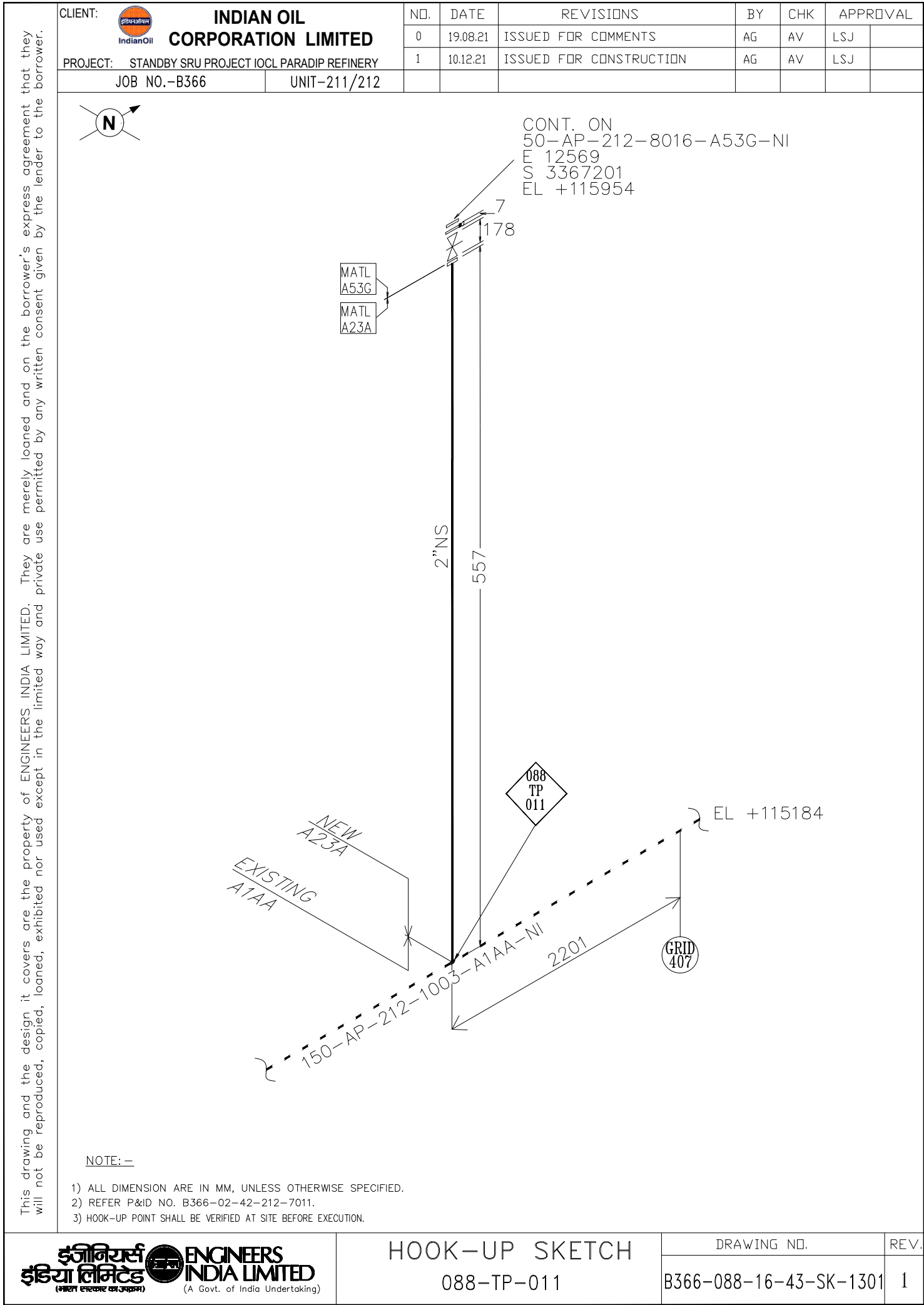
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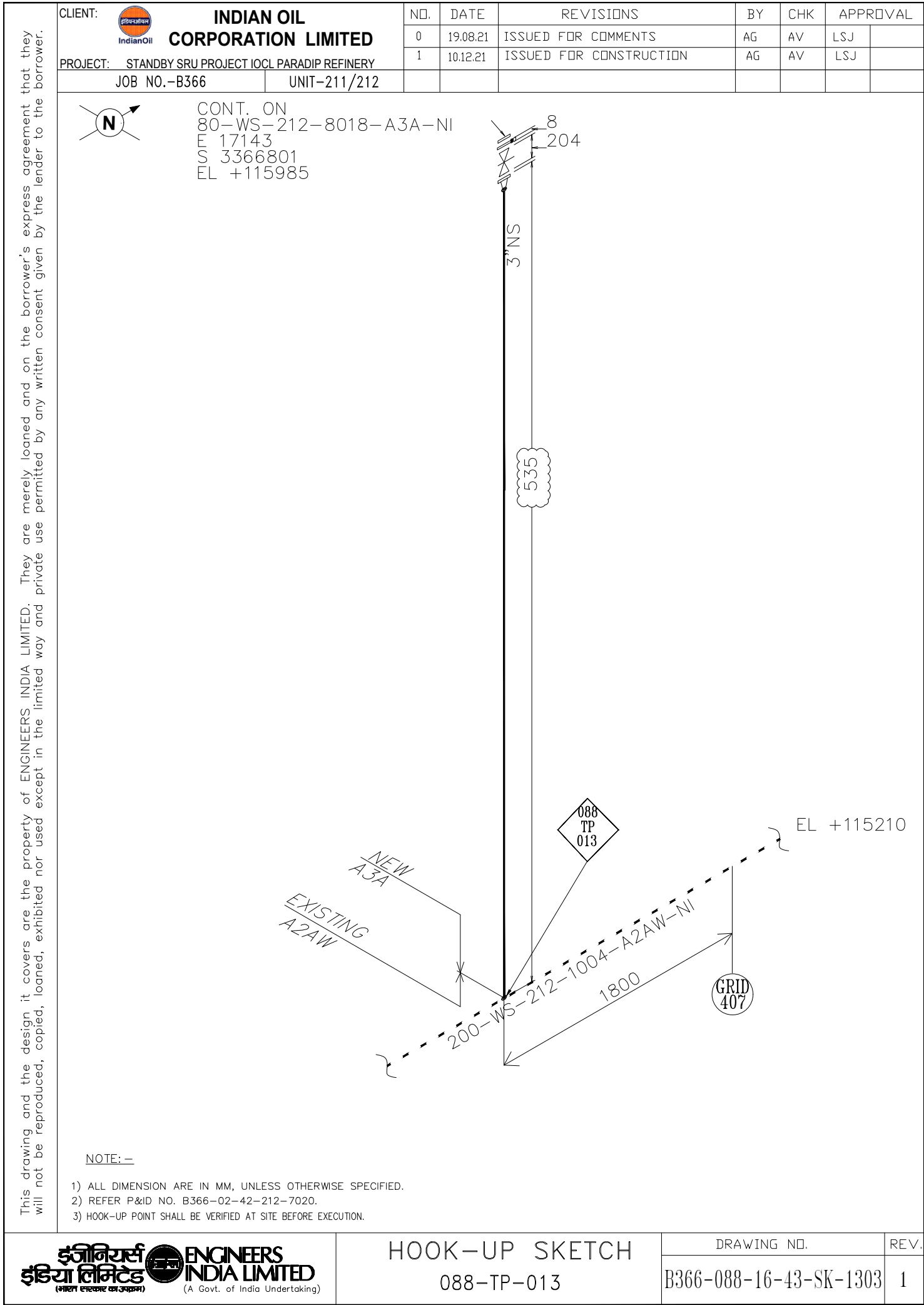
CLIENT:  INDIAN OIL CORPORATION LIMITED	NO.	DATE	REVISIONS	BY	CHK	APPROVAL	
	0	19.08.21	ISSUED FOR COMMENTS	AG	AV	LSJ	
	1	28.09.21	ISSUED FOR COMMENTS	AG	AV	LSJ	
PROJECT: STANDBY SRU PROJECT IOCL PARADIP REFINERY	2	10.12.21	ISSUED FOR CONSTRUCTION	AG	AV	LSJ	
JOB NO.-B366	UNIT-211/212						

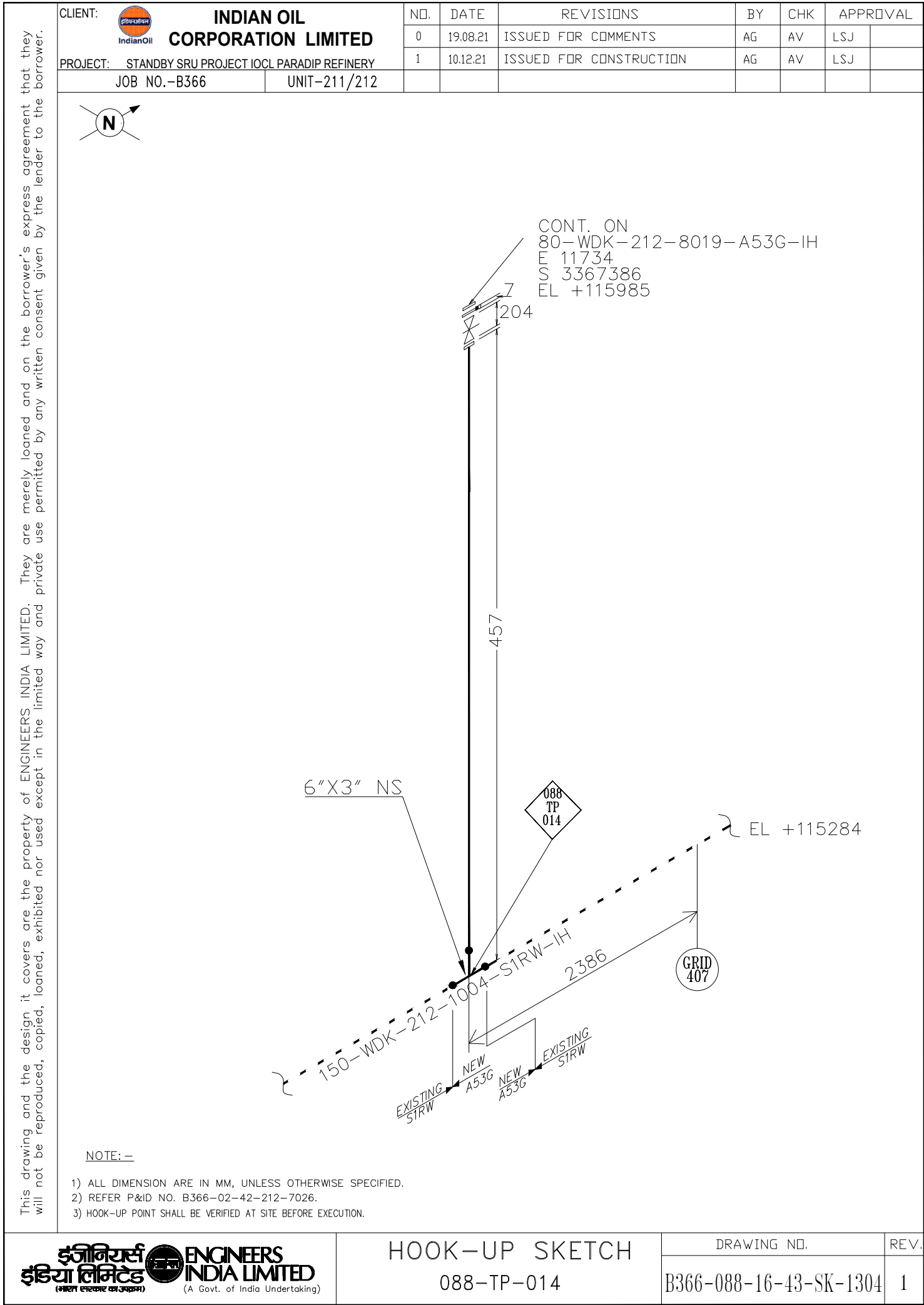


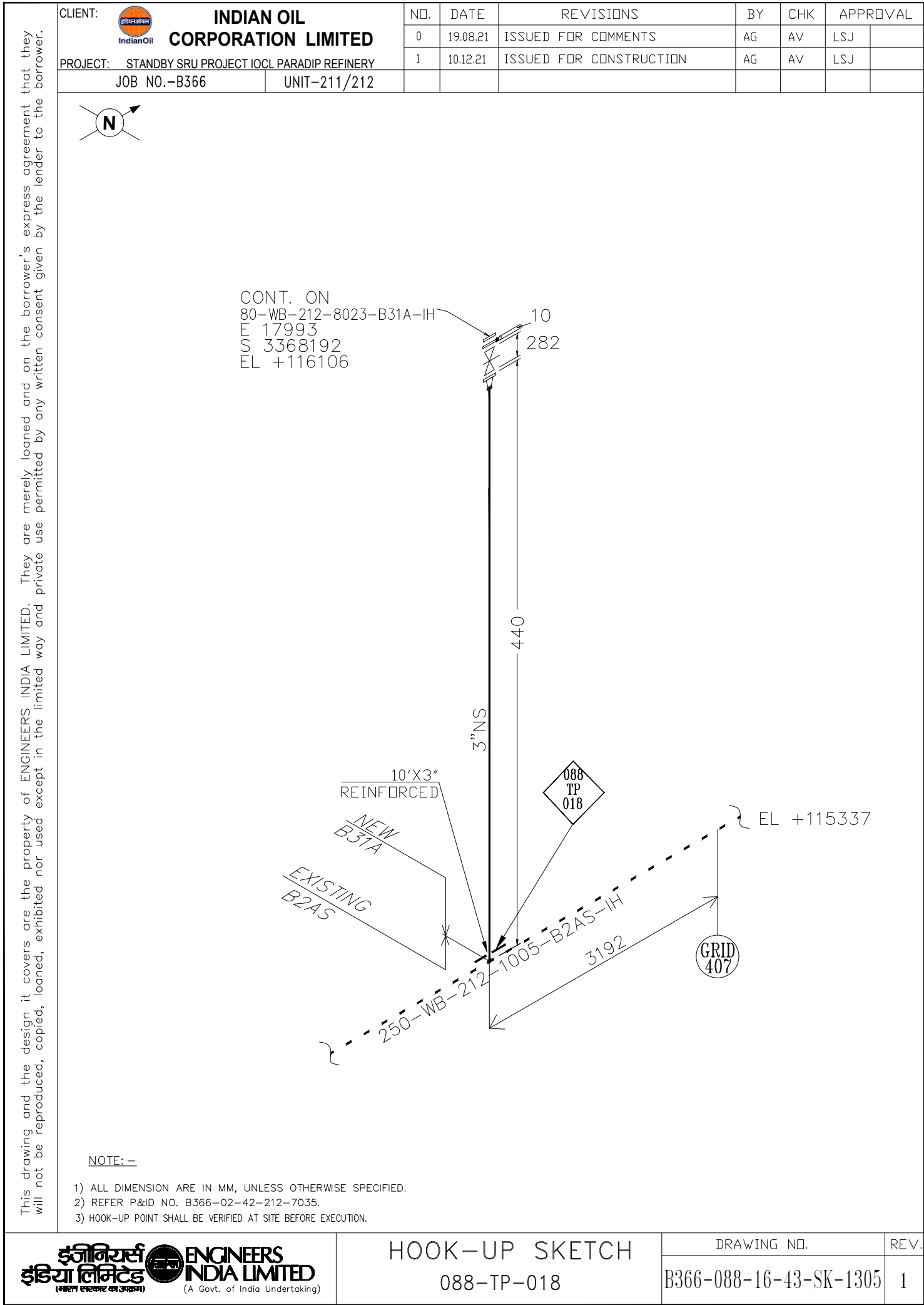
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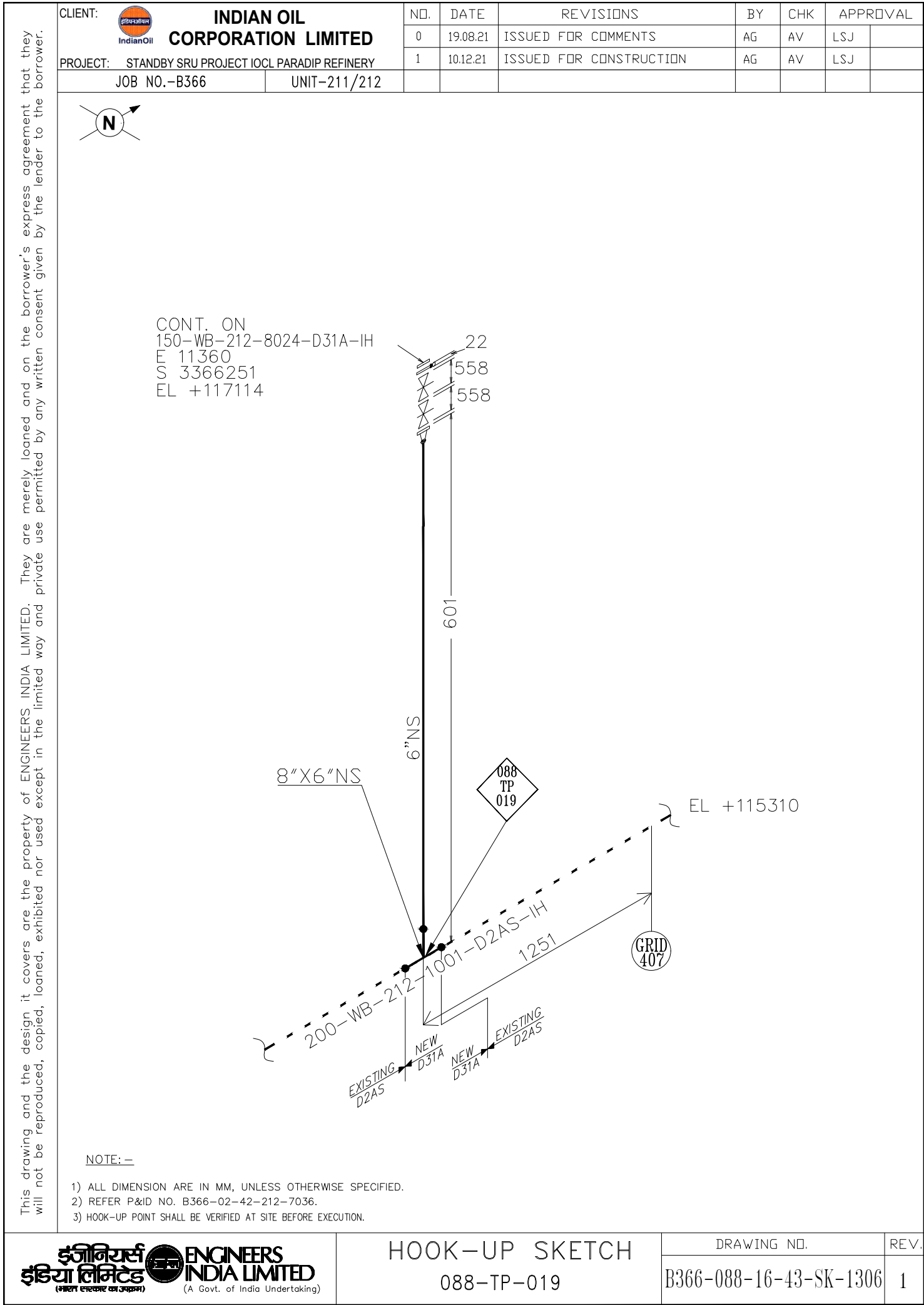
- 1) ALL DIMENSION ARE IN MM, UNLESS OTHERWISE SPECIFIED.
- 2) REFER P&ID NO. B366-02-42-211-2034.
- 3) HOOK-UP POINT AND EXISTING MATCHING FLANGE DIMENSION SHALL BE VERIFIED AT SITE BEFORE EXECUTION.
- 4) JUMP OVER FOR NEW VALVE JACKETING SHALL BE EXTENDED FROM EXISTING JACKET.






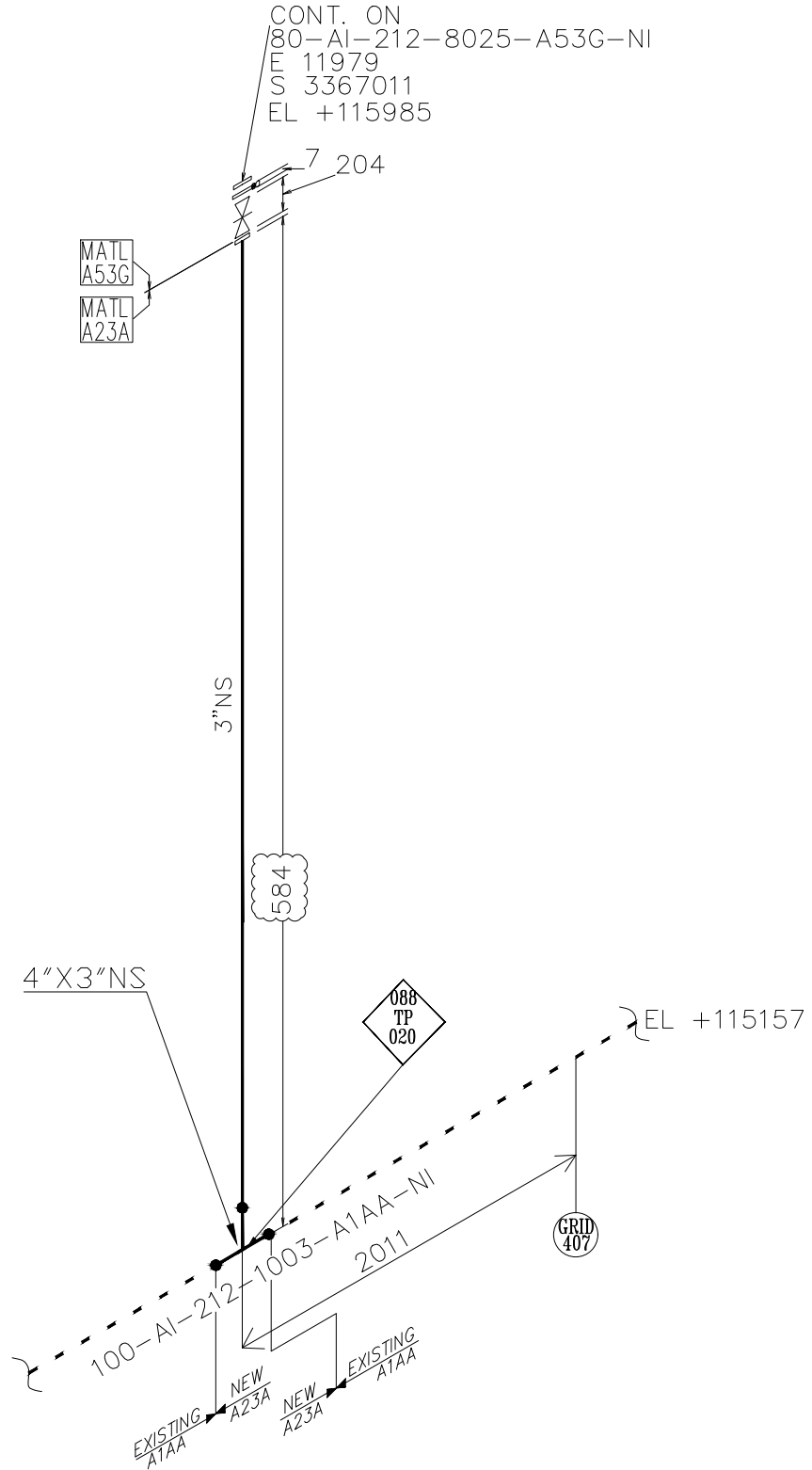
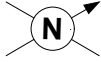






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CLIENT:  INDIAN OIL CORPORATION LIMITED	NO.	DATE	REVISIONS	BY	CHK	APPROVAL	
	0	19.08.21	ISSUED FOR COMMENTS	AG	AV	LSJ	
	1	10.12.21	ISSUED FOR CONSTRUCTION	AG	AV	LSJ	
PROJECT: STANDBY SRU PROJECT IOCL PARADIP REFINERY							
JOB NO.-B366		UNIT-211/212					



NOTE: -

- 1) ALL DIMENSION ARE IN MM, UNLESS OTHERWISE SPECIFIED.
- 2) REFER P&ID NO. B366-02-42-212-7050.
- 3) HOOK-UP POINT SHALL BE VERIFIED AT SITE BEFORE EXECUTION.

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	PROJECT: STANDBY SRU PROJECT IOCL PARADIP REFINERY		0	19.08.21	ISSUED FOR COMMENTS	AG	AV	LSJ										
			1	10.12.21	ISSUED FOR CONSTRUCTION	AG	AV	LSJ										
	JOB NO.-B366	UNIT-211/212																
	<p>The diagram shows a hook-up between two pipeline systems. An existing pipeline labeled "EXISTING A2AS" is shown as a solid line. A new pipeline labeled "NEW A31A" is shown as a dashed line. The hook-up point is indicated by a vertical line segment with dimensions 178 and 6. A callout bubble indicates the elevation at the hook-up point: EL +115230. A diamond-shaped marker labeled "088 TP 023" is located near the hook-up point. A circular marker labeled "GRID 392" is also present. A long dimension line labeled "50-BD-212-1010-A2AS-PP" with a value of 4798 spans across the diagram. A north arrow is located in the top left corner.</p>																	
NOTE: —																		
1) ALL DIMENSION ARE IN MM, UNLESS OTHERWISE SPECIFIED. 2) REFER P&ID NO. B366—02—42—212—7063. 3) HOOK—UP POINT SHALL BE VERIFIED AT SITE BEFORE EXECUTION.																		
ENGINEERS INDIA LIMITED <small>(भारत सरकार का उपक्रम)</small> (A Govt. of India Undertaking)			HOOK—UP SKETCH			DRAWING NO.			REV.									
						B366-088-16-43-SK-1308			1									
			088—TP—023															

EXISTING
A2AS

NEW
A31A

CONT. ON
2"-BD-212-6301-A31A-PP-B
E 12360
S 3462793
EL +115230

6

178

50-BD-212-1010-A2AS-PP
4798

GRID
392

088
TP
023

- 1) ALL DIMENSION ARE IN MM, UNLESS OTHERWISE SPECIFIED.
- 2) REFER P&ID NO. B366-02-42-212-7063.
- 3) HOOK-UP POINT SHALL BE VERIFIED AT SITE BEFORE EXECUTION.

**इंजीनियर्स
इंडिया लिमिटेड**
(भारत सरकार का उपक्रम)

 **ENGINEERS
INDIA LIMITED**
(A Govt. of India Undertaking)



**INDIAN OIL
CORPORATION LIMITED**

JOB NO.-B366

UNIT-211/212

DATE _____

REVISIONS

BY

CHK

APPROVAL

0

19.08.2

ISSUED FOR COMMENTS

AG

AV

LSJ

1

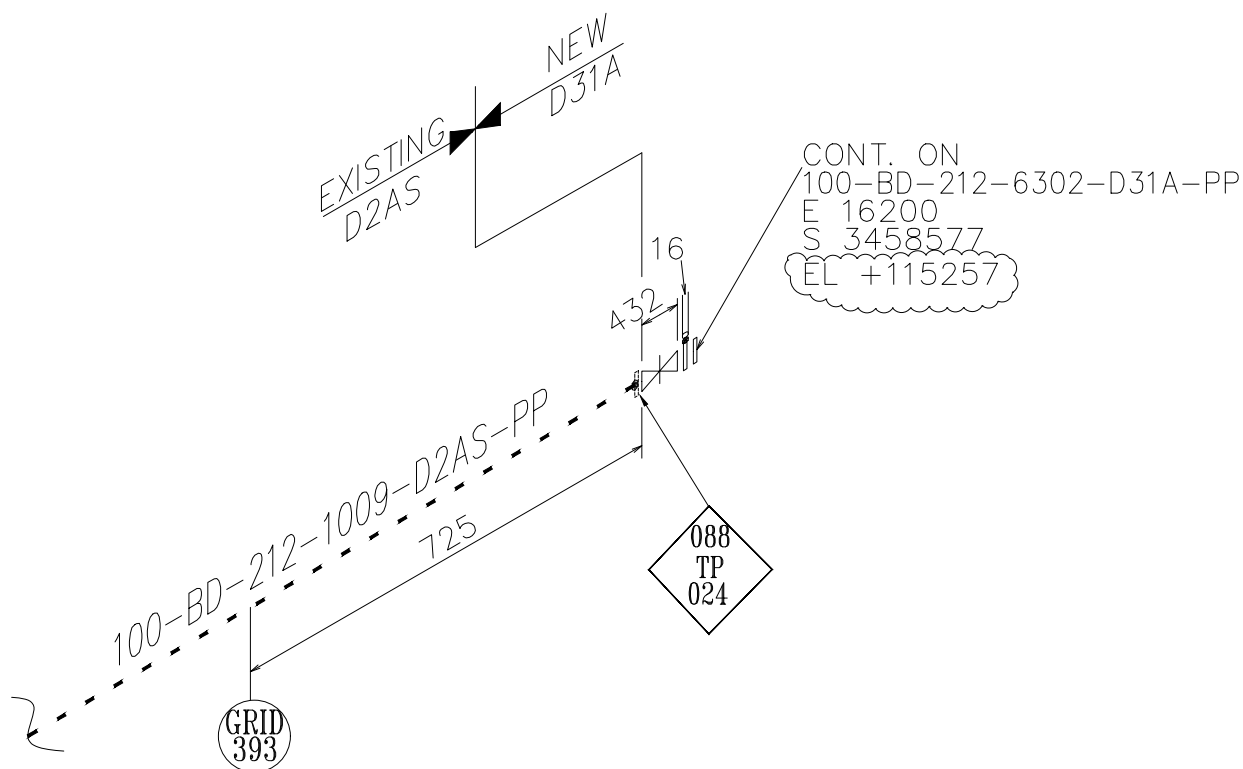
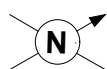
10.12.21

ISSUED FOR CONSTRUCTION

AG

AV

15.



- 1) ALL DIMENSION ARE IN MM, UNLESS OTHERWISE SPECIFIED.
- 2) REFER P&ID NO. B366-02-42-212-7063.
- 3) HOOK-UP POINT SHALL BE VERIFIED AT SITE BEFORE EXECUTION.

HOOK-UP SKETCH

088-TP-024


DRAWING NO.

B366-088-16-43-SK-1309

REV.

1

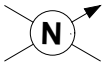
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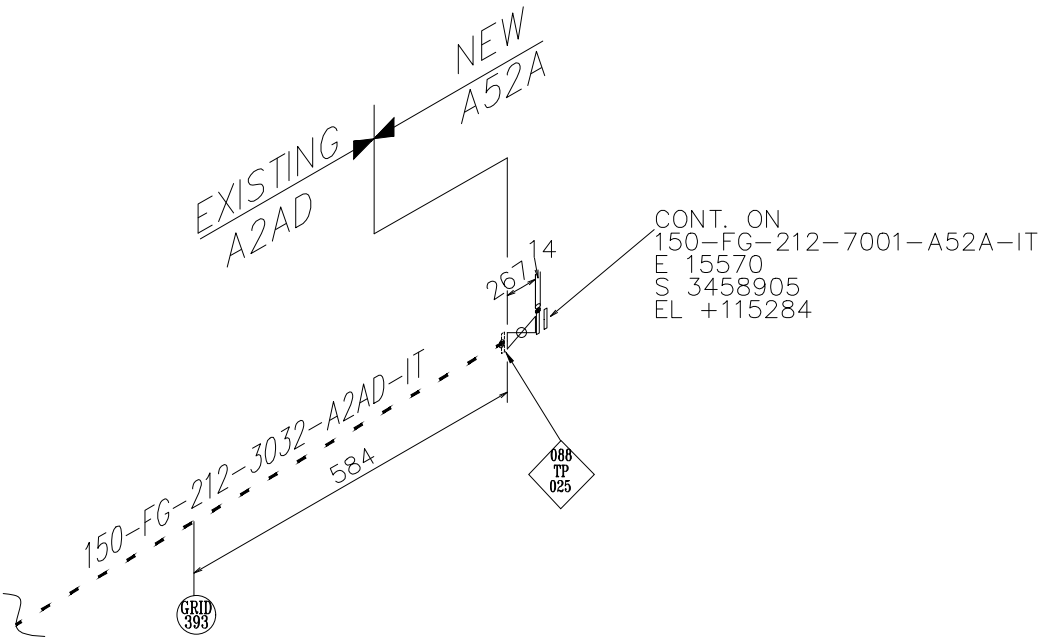
CLIENT:  **INDIAN OIL CORPORATION LIMITED**

PROJECT: **STANDBY SRU PROJECT IOCL PARADIP REFINERY**

JOB NO.-B366 UNIT-211/212


NO.	DATE	REVISIONS	BY	CHK	APPROVAL
0	19.08.21	ISSUED FOR COMMENTS	AG	AV	LSJ
1	10.12.21	ISSUED FOR CONSTRUCTION	AG	AV	LSJ





NOTE: —

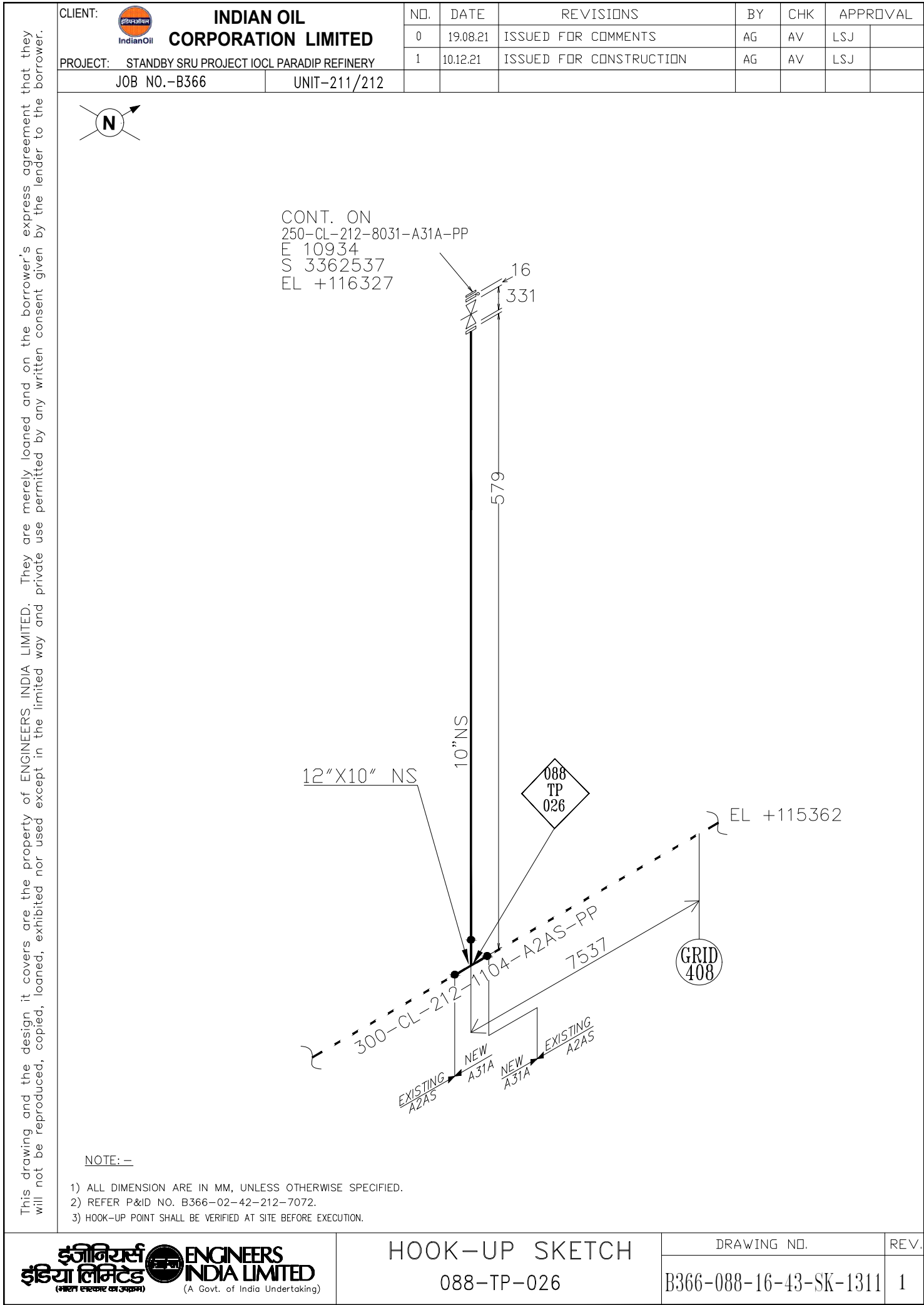
- 1) ALL DIMENSION ARE IN MM, UNLESS OTHERWISE SPECIFIED.
- 2) REFER P&ID NO. B366-02-42-212-7070.
- 3) HOOK-UP POINT SHALL BE VERIFIED AT SITE BEFORE EXECUTION.
- 4) EXISTING TRACING TO BE SUITABLY MODIFIED TO TRACE NEW ARRANGEMENT.

 **ENGINEERS INDIA LIMITED**
(A Govt. of India Undertaking)


HOOK-UP SKETCH

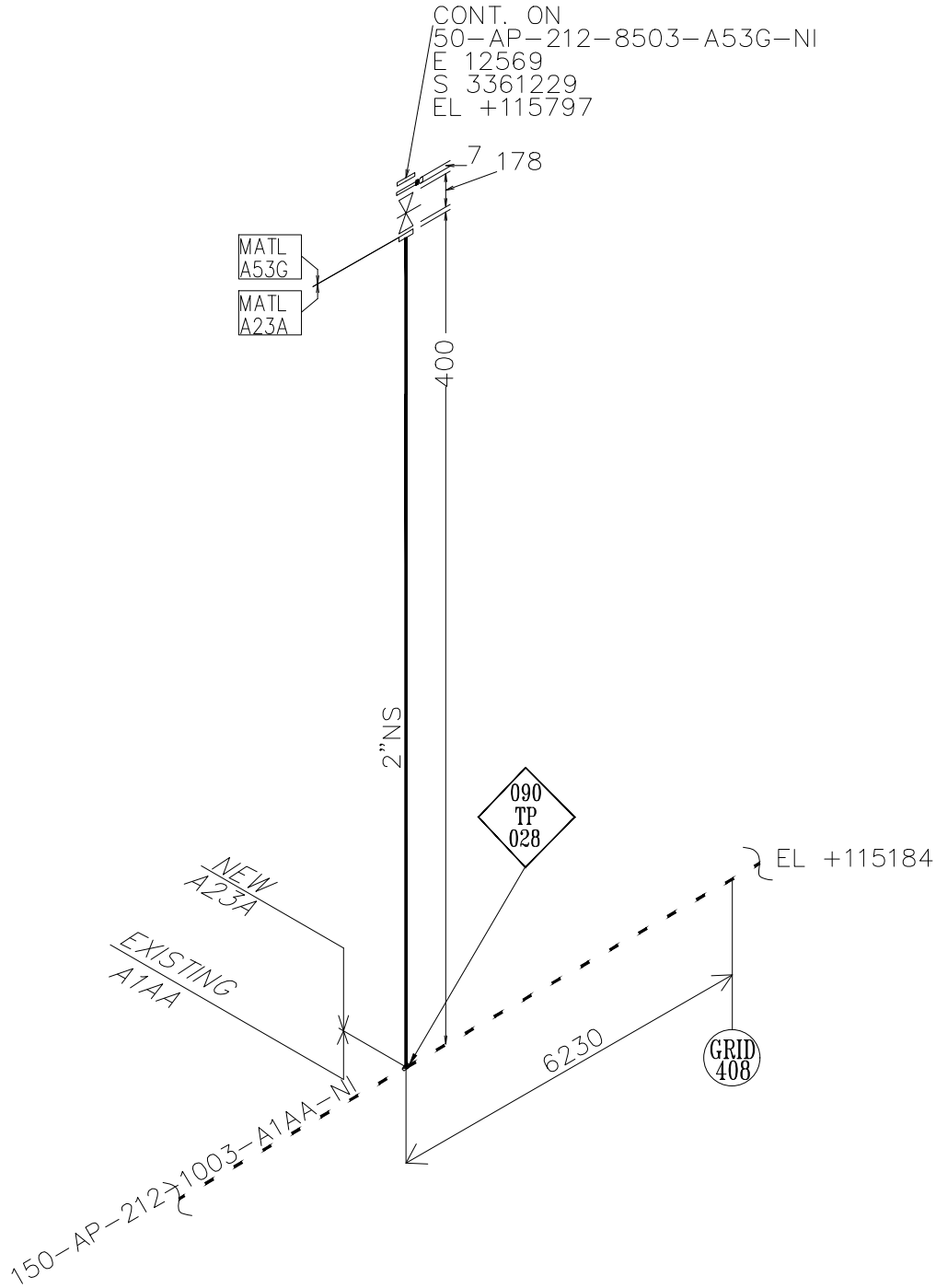
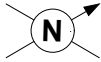
088-TP-025

DRAWING NO.	REV.
B366-088-16-43-SK-1310	1



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CLIENT:  INDIAN OIL CORPORATION LIMITED	NO.	DATE	REVISIONS	BY	CHK	APPROVAL	
	0	19.08.21	ISSUED FOR COMMENTS	AG	AV	LSJ	
	1	10.12.21	ISSUED FOR CONSTRUCTION	AG	AV	LSJ	
PROJECT: STANDBY SRU PROJECT IOCL PARADIP REFINERY							
JOB NO.-B366		UNIT-211/212					

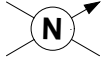


NOTE: -

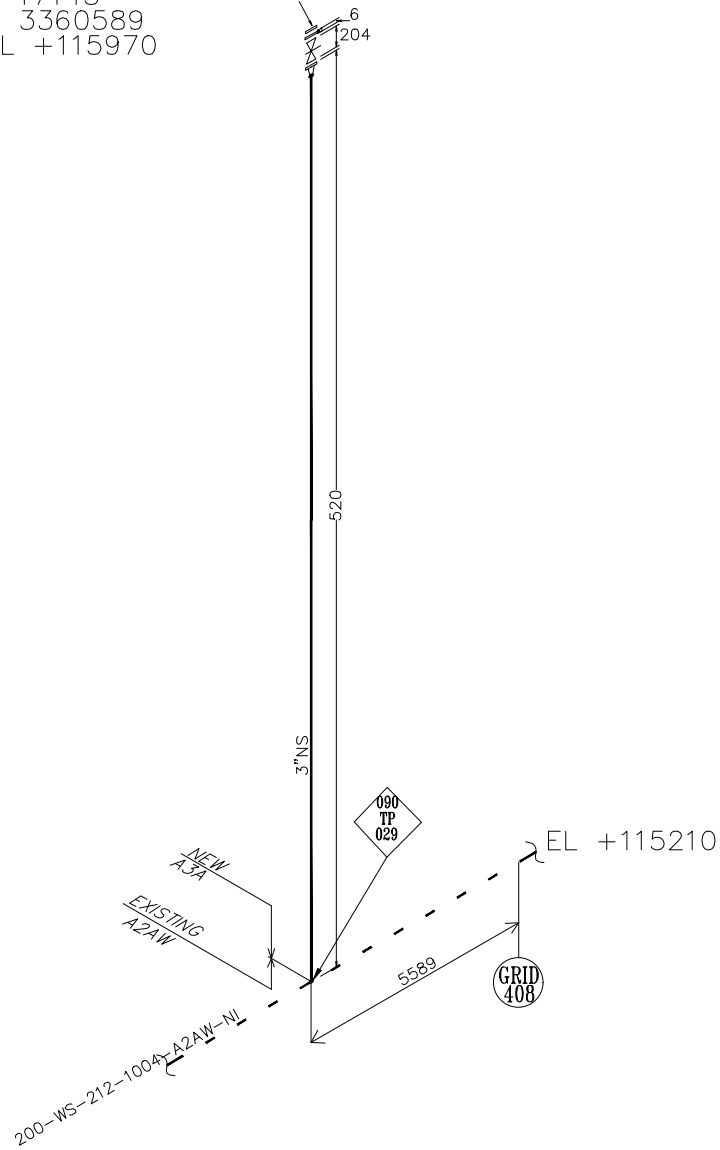
- 1) ALL DIMENSION ARE IN MM, UNLESS OTHERWISE SPECIFIED.
- 2) REFER P&ID NO. B366-02-42-212-7011.
- 3) HOOK-UP POINT SHALL BE VERIFIED AT SITE BEFORE EXECUTION.

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CLIENT:  INDIAN OIL CORPORATION LIMITED	NO.	DATE	REVISIONS	BY	CHK	APPROVAL	
	0	19.08.21	ISSUED FOR COMMENTS	AG	AV	LSJ	
	1	10.12.21	ISSUED FOR CONSTRUCTION	AG	AV	LSJ	
PROJECT: STANDBY SRU PROJECT IOCL PARADIP REFINERY							
JOB NO.-B366		UNIT-211/212					




CONT. ON
80-WS-212-8505-A3A-NI
E 17143
S 3360589
EL +115970

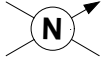


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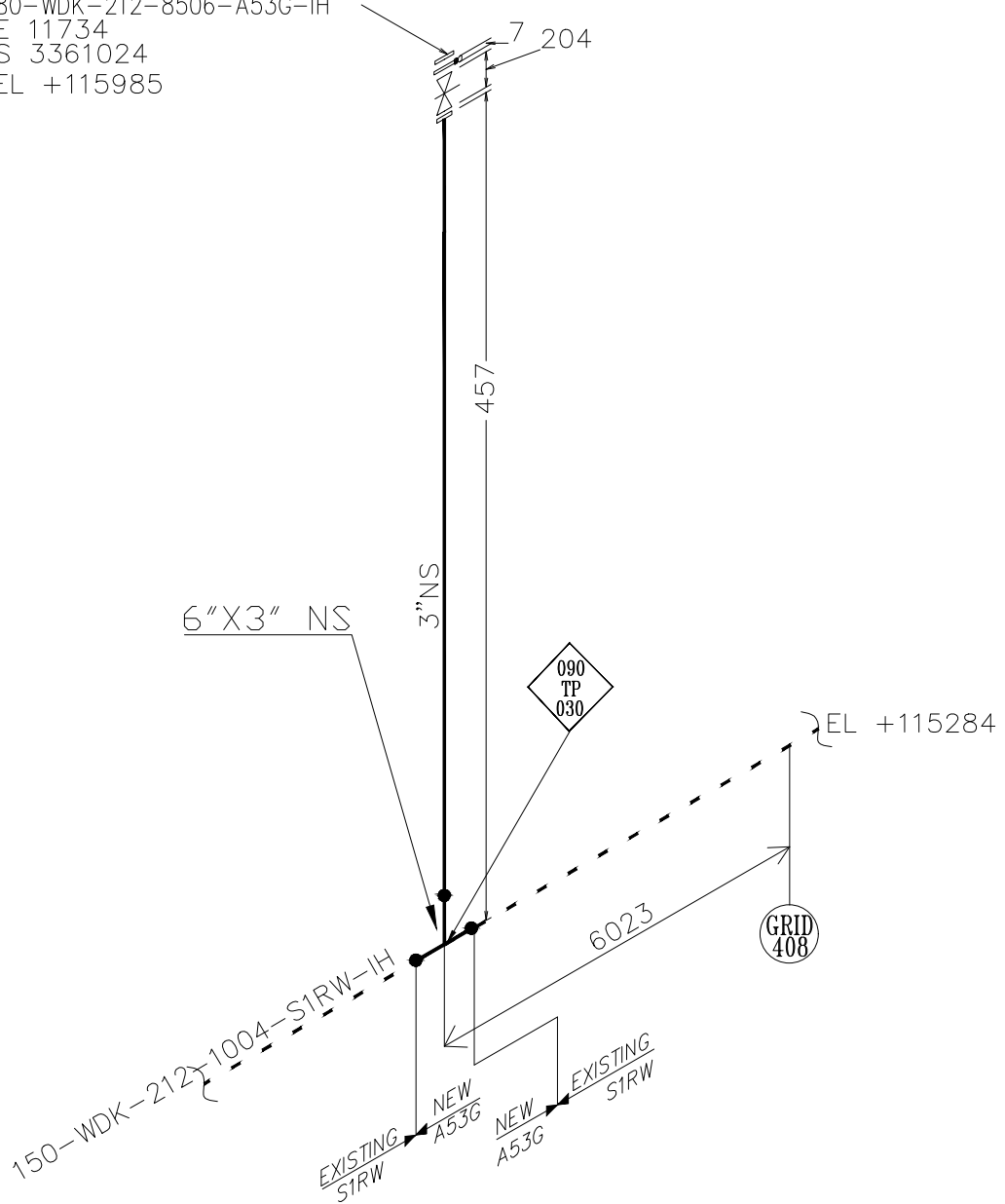
- 1) ALL DIMENSION ARE IN MM, UNLESS OTHERWISE SPECIFIED.
- 2) REFER P&ID NO. B366-02-42-212-7020.
- 3) HOOK-UP POINT SHALL BE VERIFIED AT SITE BEFORE EXECUTION.

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CLIENT:  INDIAN OIL CORPORATION LIMITED	NO.	DATE	REVISIONS	BY	CHK	APPROVAL	
	0	19.08.21	ISSUED FOR COMMENTS	AG	AV	LSJ	
	1	10.12.21	ISSUED FOR CONSTRUCTION	AG	AV	LSJ	
PROJECT: STANDBY SRU PROJECT IOCL PARADIP REFINERY							
JOB NO.-B366		UNIT-211/212					




CONT. ON
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E 11734
S 3361024
EL +115985

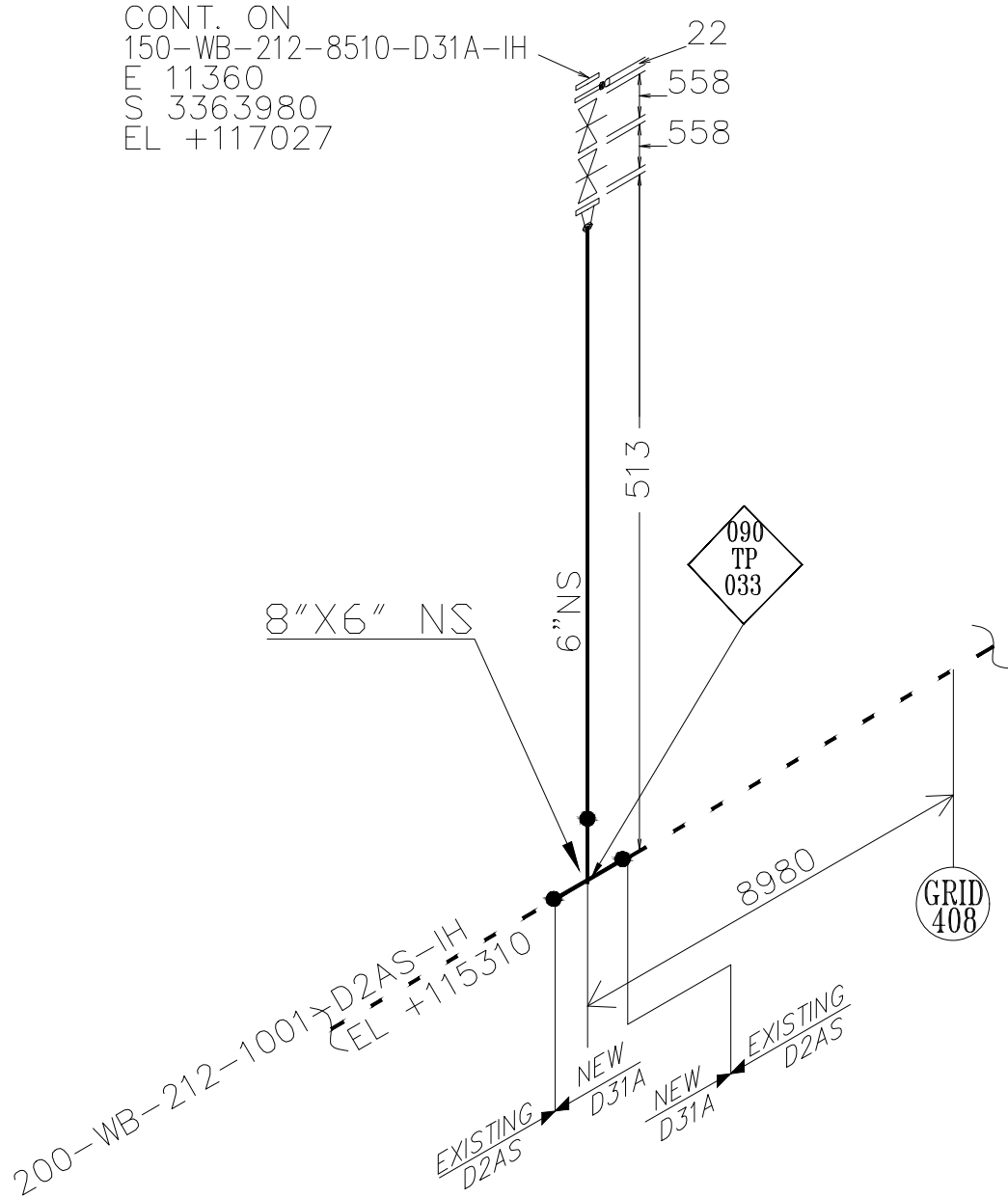
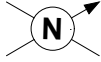


NOTE: -

- 1) ALL DIMENSION ARE IN MM, UNLESS OTHERWISE SPECIFIED.
- 2) REFER P&ID NO. B366-02-42-212-7026.
- 3) HOOK-UP POINT SHALL BE VERIFIED AT SITE BEFORE EXECUTION.

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CLIENT:  INDIAN OIL CORPORATION LIMITED	NO.	DATE	REVISIONS	BY	CHK	APPROVAL	
	0	19.08.21	ISSUED FOR COMMENTS	AG	AV	LSJ	
	1	10.12.21	ISSUED FOR CONSTRUCTION	AG	AV	LSJ	
PROJECT: STANDBY SRU PROJECT IOCL PARADIP REFINERY							
JOB NO.-B366		UNIT-211/212					

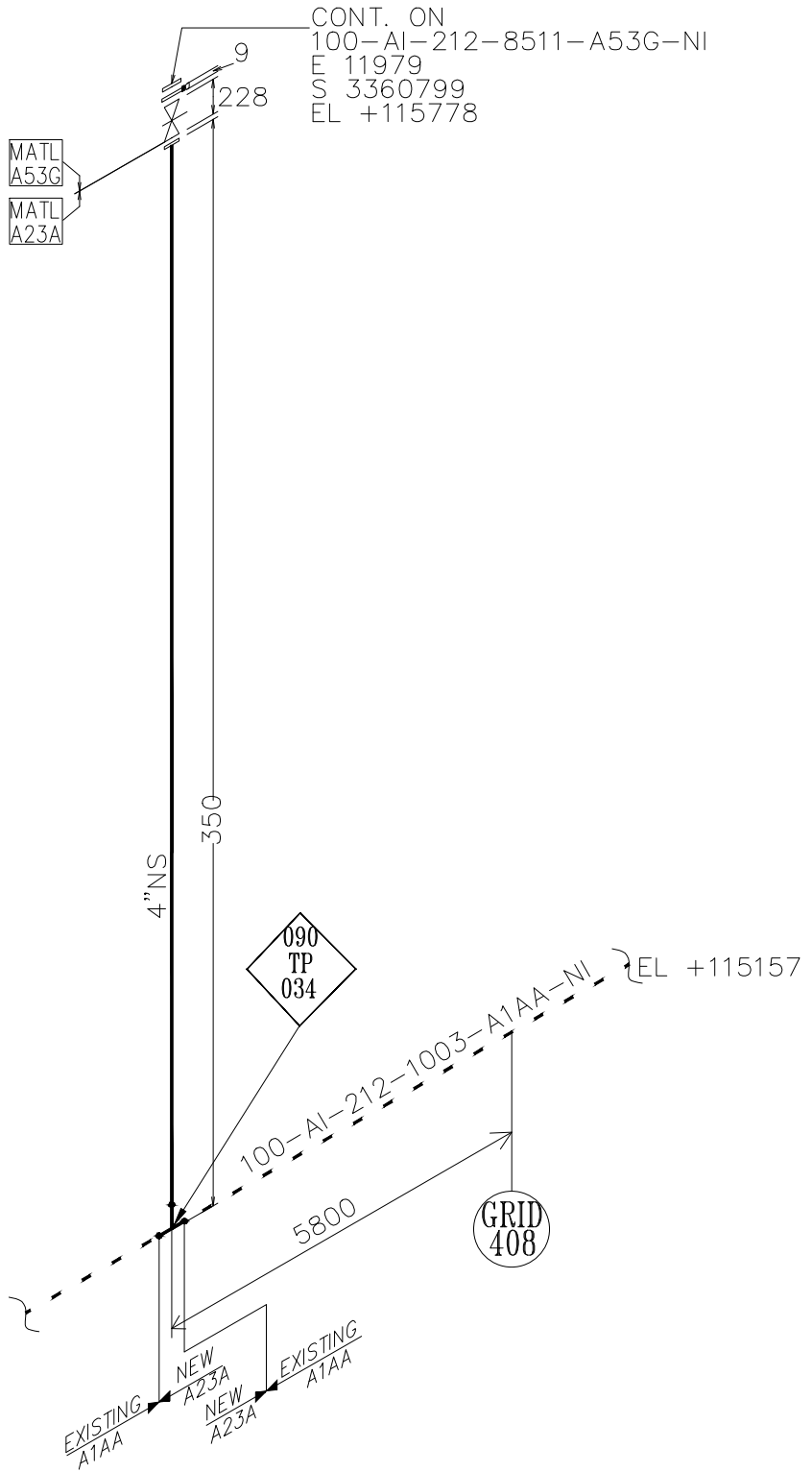
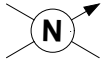


NOTE: —

- 1) ALL DIMENSION ARE IN MM, UNLESS OTHERWISE SPECIFIED.
- 2) REFER P&ID NO. B366-02-42-212-7036.
- 3) HOOK-UP POINT SHALL BE VERIFIED AT SITE BEFORE EXECUTION.

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CLIENT:  INDIAN OIL CORPORATION LIMITED	NO.	DATE	REVISIONS	BY	CHK	APPROVAL	
	0	19.08.21	ISSUED FOR COMMENTS	AG	AV	LSJ	
	1	10.12.21	ISSUED FOR CONSTRUCTION	AG	AV	LSJ	
PROJECT: STANDBY SRU PROJECT IOCL PARADIP REFINERY							
JOB NO.-B366		UNIT-211/212					

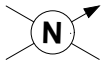


NOTE: -

- 1) ALL DIMENSION ARE IN MM, UNLESS OTHERWISE SPECIFIED.
- 2) REFER P&ID NO. B366-02-42-212-7050.
- 3) HOOK-UP POINT SHALL BE VERIFIED AT SITE BEFORE EXECUTION.

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CLIENT:  INDIAN OIL CORPORATION LIMITED	NO.	DATE	REVISIONS	BY	CHK	APPROVAL	
	0	19.08.21	ISSUED FOR COMMENTS	AG	AV	LSJ	
	1	10.12.21	ISSUED FOR CONSTRUCTION	AG	AV	LSJ	
PROJECT: STANDBY SRU PROJECT IOCL PARADIP REFINERY							
JOB NO.-B366		UNIT-211/212					

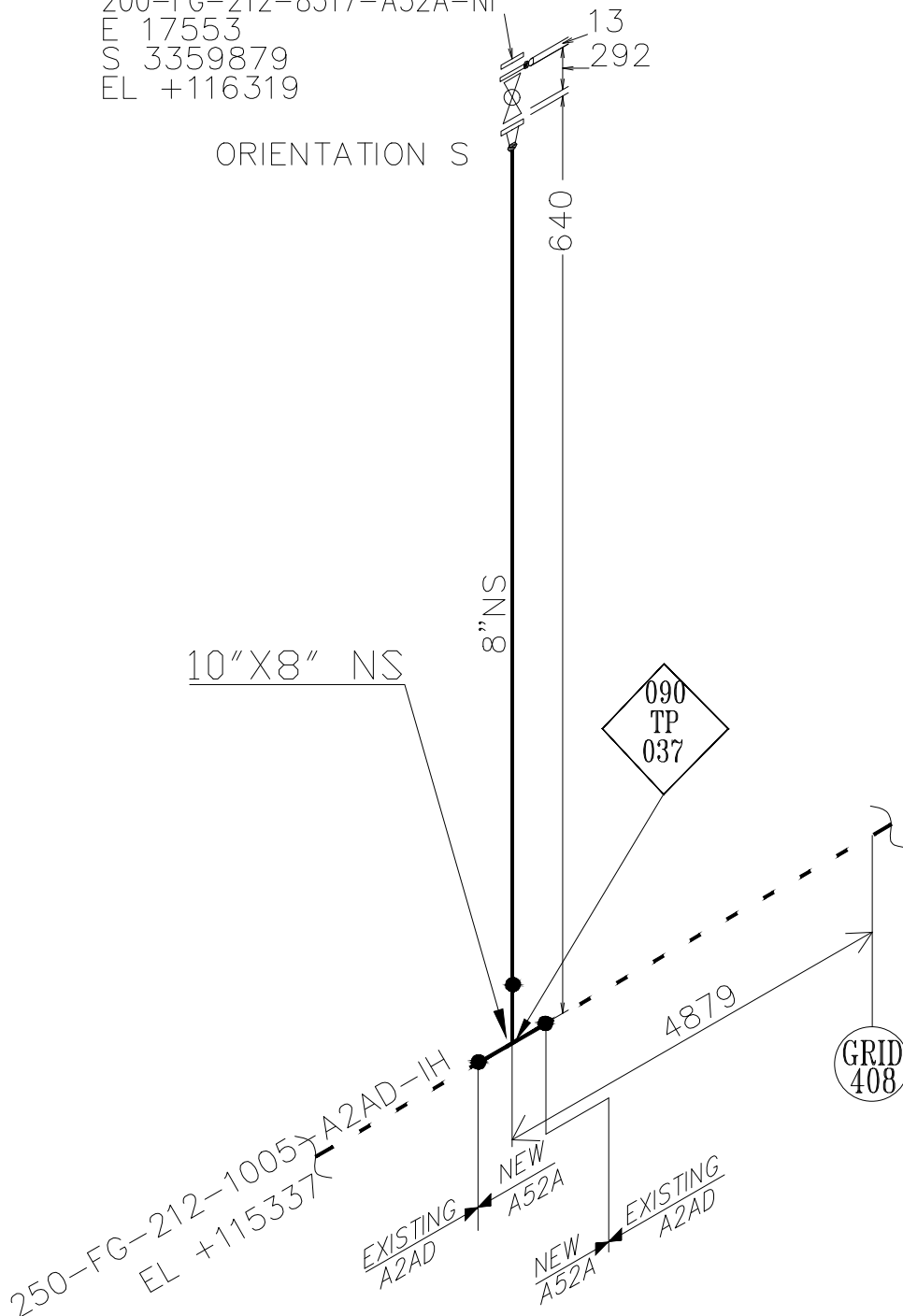


CONT. ON
200-FG-212-8517-A52A-NI
E 17553
S 3359879
EL +116319


ORIENTATION S


NOTE:-

- 1) ALL DIMENSION ARE IN MM, UNLESS OTHERWISE SPECIFIED.
- 2) REFER P&ID NO. B366-02-42-212-7070.
- 3) HOOK-UP POINT SHALL BE VERIFIED AT SITE BEFORE EXECUTION.

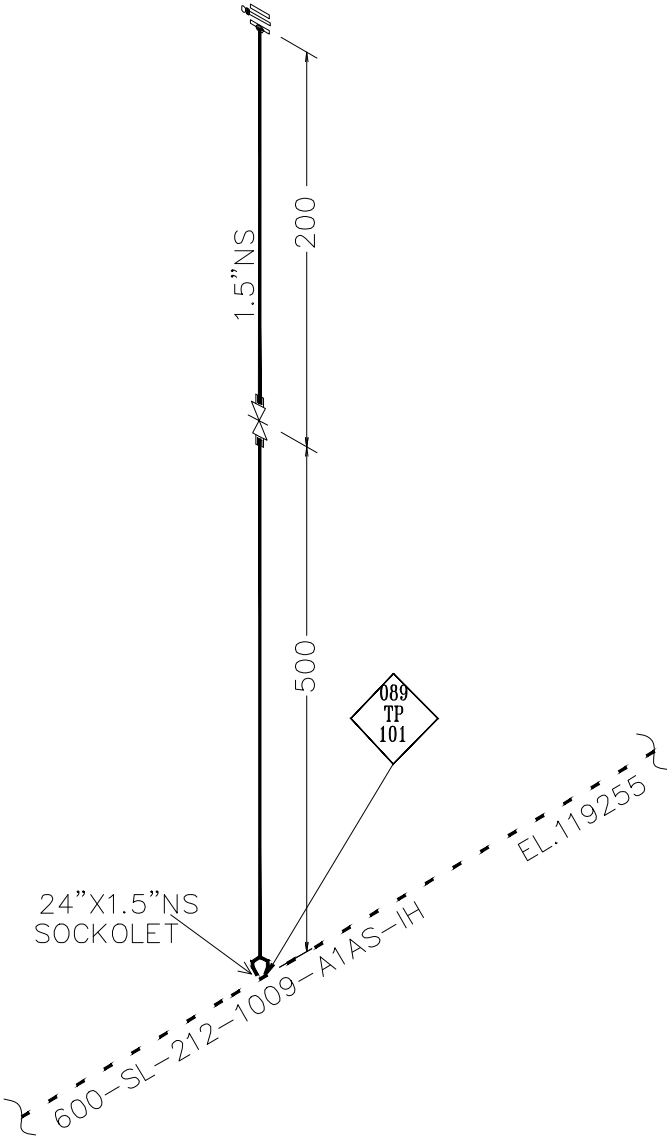


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CLIENT:	 INDIAN OIL CORPORATION LIMITED	NO.	DATE	REVISIONS	BY	CHK	APPROVAL
		0	14.12.21	ISSUED FOR CONSTRUCTION	AG	AV	LSJ
PROJECT:	STANDBY SRU PROJECT IOCL PARADIP REFINERY						
JOB NO.-B366	UNIT-211/212						




S.NO	TIE IN NO	SPEC	SIZE	HEADER	E	S	EL(CENTER LINE OF HEADER)
1	212-TP-101	A2A	1.5	600-SL-212-1009-A1AS-IH	15500	3523800	119255




NOTE: -


1) ALL DIMENSION ARE IN MM, UNLESS OTHERWISE SPECIFIED.

2) HOOK-UP POINT SHALL BE VERIFIED AT SITE BEFORE EXECUTION.

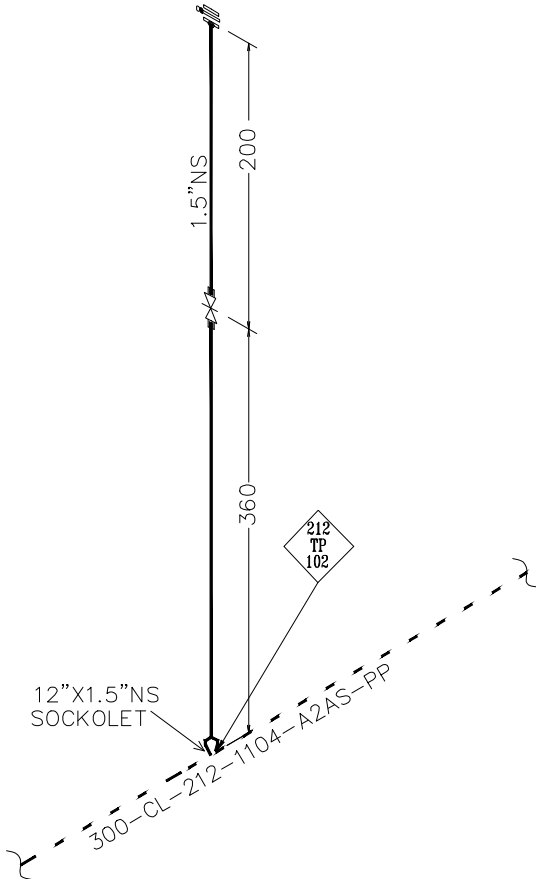
 ENGINEERS INDIA LIMITED (A Govt. of India Undertaking)	HOOK-UP SKETCH 212-TP-101	DRAWING NO.	REV.
		B366-088-16-43-SK-1330	0

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CLIENT:  INDIAN OIL CORPORATION LIMITED		NO.	DATE	REVISIONS	BY	CHK	APPROVAL	
PROJECT: STANDBY SRU PROJECT IOCL PARADIP REFINERY		0	10.12.21	ISSUED FOR CONSTRUCTION	AG	AV	LSJ	
JOB NO.-B366		UNIT-211/212						




S.NO	TIE IN NO	SPEC	SIZE	HEADER	E	S	EL(CENTER LINE OF HEADER)
1	212-TP-102A	A31A	1.5	300-CL-212-1104-A2AS-PP	10934	3496650	115362
2	212-TP-102B	A31A	1.5	300-CL-212-1104-A2AS-PP	10934	3445127	115362
3	212-TP-102C	A31A	1.5	300-CL-212-1104-A2AS-PP	10934	3432447	115362
4	212-TP-102D	A31A	1.5	300-CL-212-1104-A2AS-PP	10934	3432198	115362
5	212-TP-102E	A31A	1.5	300-CL-212-1104-A2AS-PP	10934	3430333	115362
6	212-TP-102F	A31A	1.5	300-CL-212-1104-A2AS-PP	10934	3430083	115362
7	212-TP-102G	A31A	1.5	300-CL-212-1104-A2AS-PP	10934	3407600	115362
8	212-TP-102H	A31A	1.5	300-CL-212-1104-A2AS-PP	10934	3395900	115362
9	212-TP-102I	A31A	1.5	300-CL-212-1104-A2AS-PP	10934	3395650	115362
10	212-TP-102J	A31A	1.5	300-CL-212-1104-A2AS-PP	10934	3394320	115362
11	212-TP-102K	A31A	1.5	300-CL-212-1104-A2AS-PP	10934	3394070	115362
12	212-TP-102L	A31A	1.5	300-CL-212-1104-A2AS-PP	10934	3389650	115362
13	212-TP-102M	A31A	1.5	300-CL-212-1104-A2AS-PP	10934	3373802	115362
14	212-TP-102N	A31A	1.5	300-CL-212-1104-A2AS-PP	10934	3363991	115362
15	212-TP-102O	A31A	1.5	300-CL-212-1104-A2AS-PP	10934	3354047	115362
16	212-TP-102P	A31A	1.5	300-CL-212-1104-A2AS-PP	10934	3353797	115362
17	212-TP-102Q	A31A	1.5	300-CL-212-1104-A2AS-PP	10934	3353547	115362



NOTE: -

1) ALL DIMENSION ARE IN MM, UNLESS OTHERWISE SPECIFIED.

2) HOOK-UP POINT SHALL BE VERIFIED AT SITE BEFORE EXECUTION.

 ENGINEERS INDIA LIMITED (A Govt. of India Undertaking)	HOOK-UP SKETCH 212-TP-102	DRAWING NO.	REV.
		B366-088-16-43-SK-1331	0

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CLIENT:INDIAN OIL CORPORATION LIMITED

PROJECT:STANDBY SRU PROJECT IOCL PARADIP REFINERY

JOB NO.-B366UNIT-089

NO.0

DATE10.12.21

REVISIONSISSUED FOR CONSTRUCTION

BYAG

CHKAV

APPROVALLSJ

N

S.NO	TIE IN NO	SPEC	SIZE	HEADER	E	S	EL(CENTER LINE OF HEADER)
1	089-TP-104A	A31A	1.5	250-CL-089-4202-A2AS-PP	43250	3537311	111236
2	089-TP-104B	A31A	1.5	250-CL-089-4202-A2AS-PP	36053	3537311	111236

1.5" NS

200

325

089 TP 104

10"X1.5"NS SOCKOLET

250-CL-089-4202-A2AS-PP

EL. 111236

NOTE: -

1) ALL DIMENSION ARE IN MM, UNLESS OTHERWISE SPECIFIED.

2) HOOK-UP POINT SHALL BE VERIFIED AT SITE BEFORE EXECUTION.

ENGINEERS INDIA LIMITED

(A Govt. of India Undertaking)

HOOK-UP SKETCH

089-TP-104


DRAWING NO.


B366-088-16-43-SK-1333

REV.

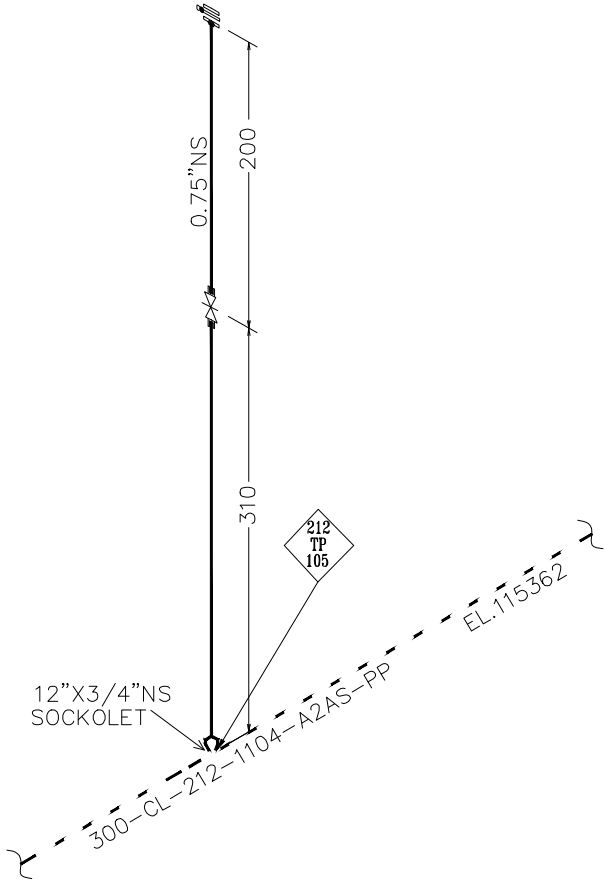
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CLIENT:	 INDIAN OIL CORPORATION LIMITED	NO.	DATE	REVISIONS	BY	CHK	APPROVAL
		0	10.2.21	ISSUED FOR CONSTRUCTION	AG	AV	LSJ
PROJECT:	STANDBY SRU PROJECT IOCL PARADIP REFINERY						
JOB NO.-B366	UNIT-211/212						



S.NO	TIE IN NO	SPEC	SIZE	HEADER	E	S	EL(CENTER LINE OF HEADER)
1	212-TP-105A	A31A	.75	300-CL-212-1104-A2AS-PP	10934	3423247	115362
2	212-TP-105B	A31A	.75	300-CL-212-1104-A2AS-PP	10934	3407850	115362
3	212-TP-105C	A31A	.75	300-CL-212-1104-A2AS-PP	10934	3384047	115362
4	212-TP-105D	A31A	.75	300-CL-212-1104-A2AS-PP	10934	3356547	115362



0.75"NS
200
310
12"X3/4"NS
SOCKOLET
212
TP
105
300-CL-212-1104-A2AS-PP
EL.115362

NOTE: -

1) ALL DIMENSION ARE IN MM, UNLESS OTHERWISE SPECIFIED.

2) HOOK-UP POINT SHALL BE VERIFIED AT SITE BEFORE EXECUTION.


**ENGINEERS INDIA LIMITED**
(A Govt. of India Undertaking)


HOOK-UP SKETCH
212-TP-105

DRAWING NO.
B366-088-16-43-SK-1334

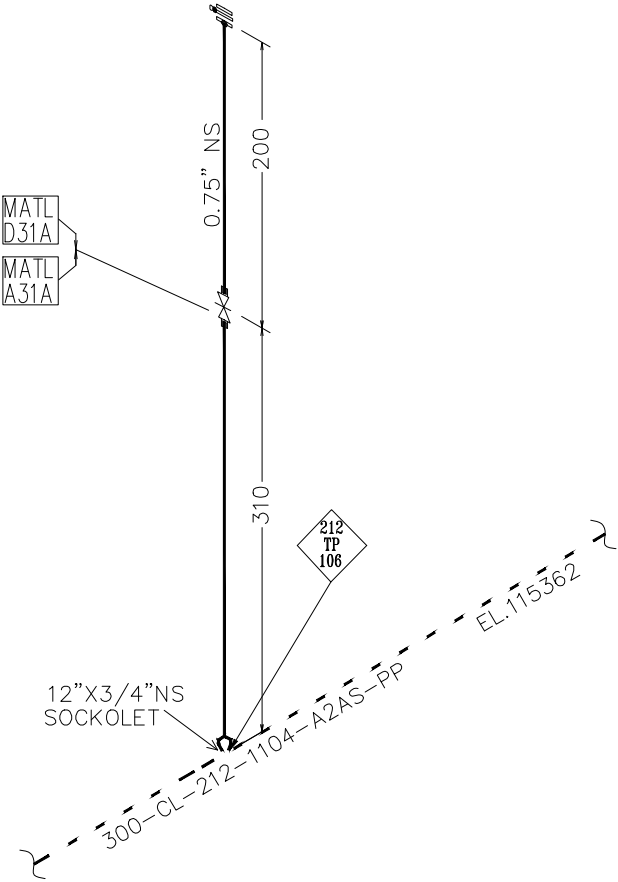
REV.
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CLIENT:	 INDIAN OIL CORPORATION LIMITED	NO.	DATE	REVISIONS	BY	CHK	APPROVAL
		0	10.2.21	ISSUED FOR CONSTRUCTION	AG	AV	LSJ
PROJECT:	STANDBY SRU PROJECT IOCL PARADIP REFINERY						
JOB NO.-B366	UNIT-211/212						



S.NO	TIE IN NO	SPEC	SIZE	HEADER	E	S	EL(CENTER LINE OF HEADER)
1	212-TP-106A	A31A/D31A	.75	300-CL-212-1104-A2AS-PP	10934	3422447	115362
2	212-TP-106B	A31A/D31A	.75	300-CL-212-1104-A2AS-PP	10934	3400548	115362
3	212-TP-106C	A31A/D31A	.75	300-CL-212-1104-A2AS-PP	10934	3357047	115362



NOTE: -

1) ALL DIMENSION ARE IN MM, UNLESS OTHERWISE SPECIFIED.

2) HOOK-UP POINT SHALL BE VERIFIED AT SITE BEFORE EXECUTION.


**ENGINEERS INDIA LIMITED**
(A Govt. of India Undertaking)

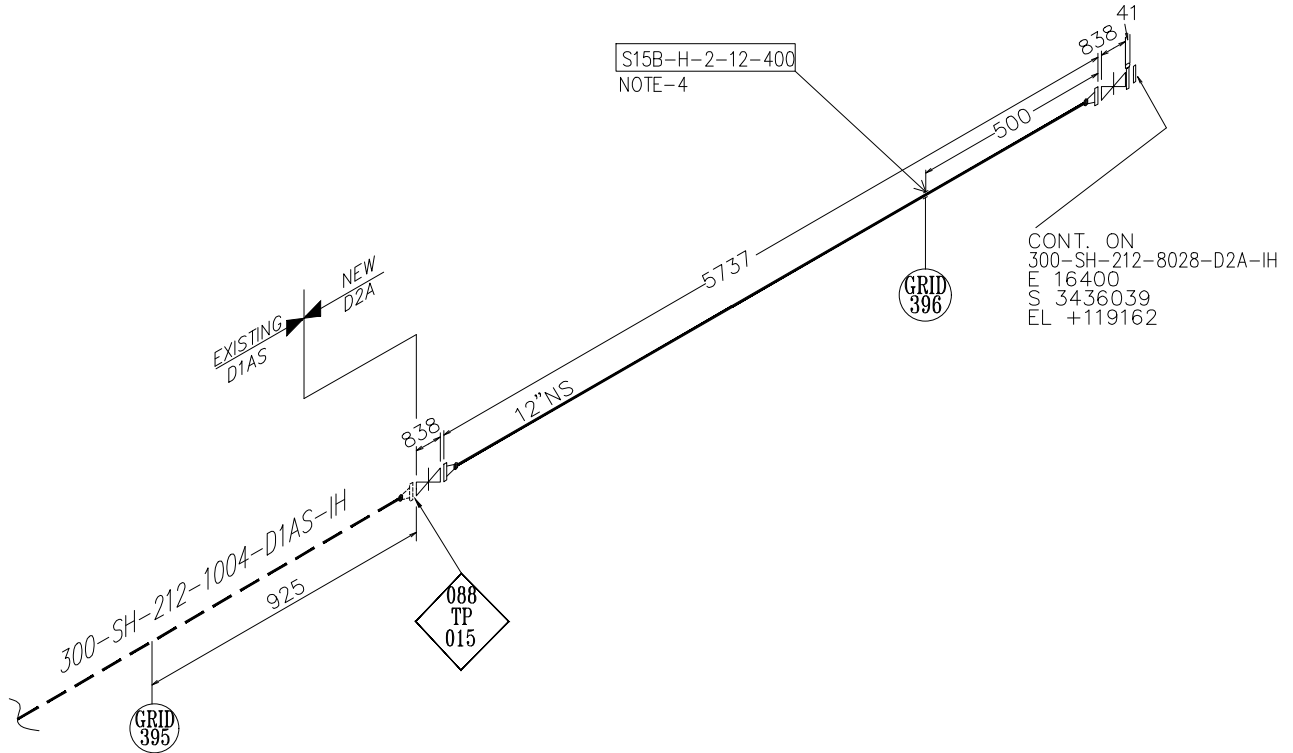
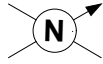
HOOK-UP SKETCH
212-TP-106

DRAWING NO.
B366-088-16-43-SK-1335

REV.
0


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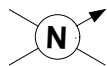
CLIENT:  INDIAN OIL CORPORATION LIMITED	NO.	DATE	REVISIONS	BY	CHK	APPROVAL	
	0	19.08.21	ISSUED FOR COMMENTS	AG	AV	LSJ	
	1	10.12.21	ISSUED FOR CONSTRUCTION	AG	AV	LSJ	
PROJECT: STANDBY SRU PROJECT IOCL PARADIP REFINERY							
JOB NO.-B366		UNIT-211/212					



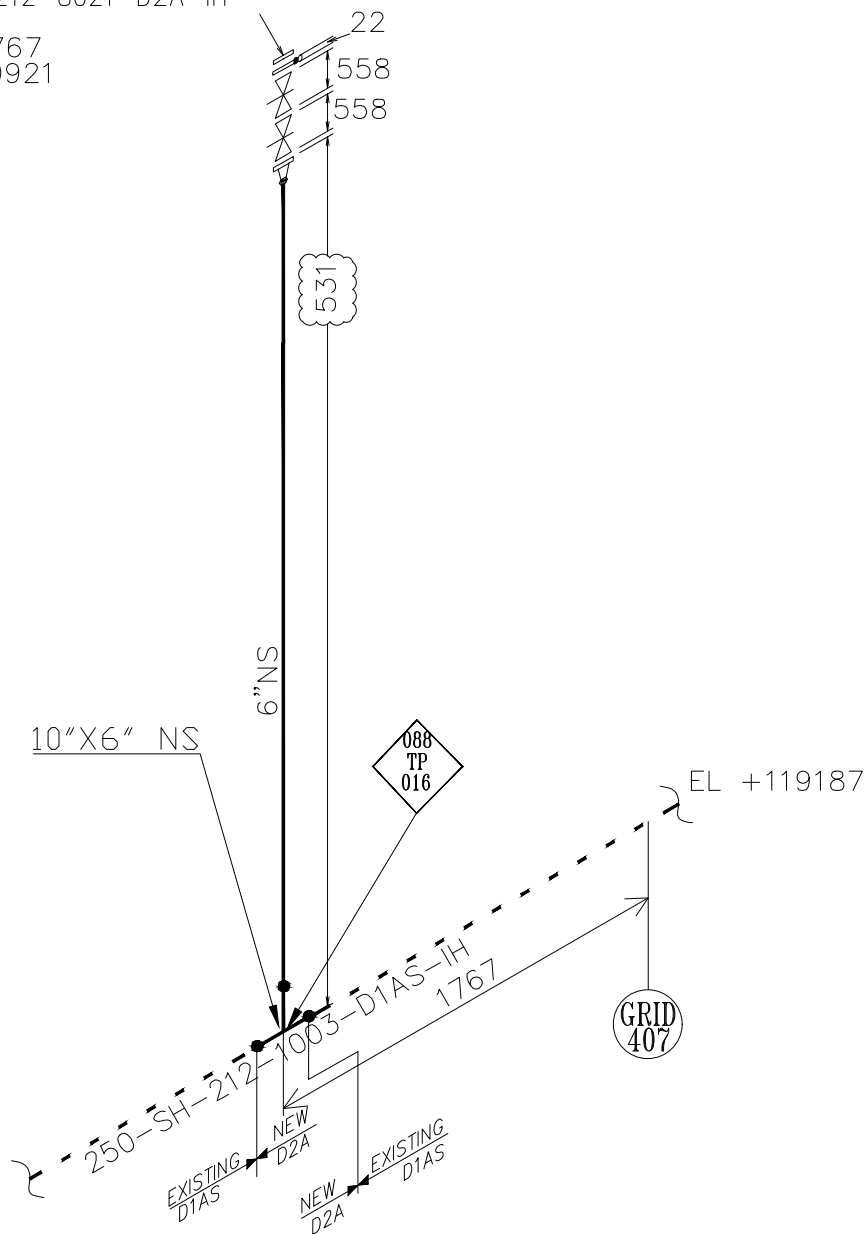
NOTE: -

- 1) ALL DIMENSION ARE IN MM, UNLESS OTHERWISE SPECIFIED.
- 2) REFER P&ID NO. B366-02-42-212-7029.
- 3) HOOK-UP POINT SHALL BE VERIFIED AT SITE BEFORE EXECUTION.
- 4) SHOE HEIGHT SHALL BE EQUAL TO THE EXISTING ADJACENT SHOE HEIGHT.

CLIENT:  INDIAN OIL CORPORATION LIMITED	NO.	DATE	REVISIONS	BY	CHK	APPROVAL	
	0	19.08.21	ISSUED FOR COMMENTS	AG	AV	LSJ	
	1	10.12.21	ISSUED FOR CONSTRUCTION	AG	AV	LSJ	
PROJECT: STANDBY SRU PROJECT IOCL PARADIP REFINERY							
JOB NO.-B366	UNIT-211/212						




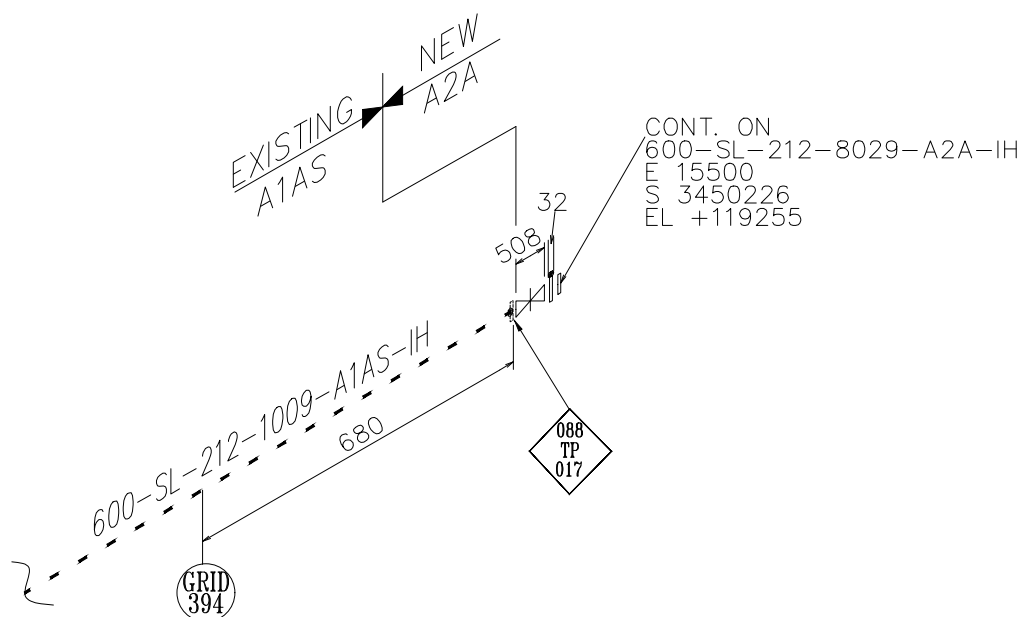
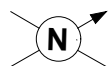
CONT. ON
150-SH-212-8021-D2A-IH
E 14500
S 3366767
EL +120921



NOTE: —

- 1) ALL DIMENSION ARE IN MM, UNLESS OTHERWISE SPECIFIED.
- 2) REFER P&ID NO. B366-02-42-212-7029.
- 3) HOOK-UP POINT SHALL BE VERIFIED AT SITE BEFORE EXECUTION.


CLIENT:  INDIAN OIL CORPORATION LIMITED PROJECT: STANDBY SRU PROJECT IOCL PARADIP REFINERY			NO.	DATE	REVISIONS	BY	CHK	APPROVAL	
			0	19.08.21	ISSUED FOR COMMENTS	AG	AV	LSJ	
			1	10.12.21	ISSUED FOR CONSTRUCTION	AG	AV	LSJ	
JOB NO.-B366		UNIT-211/212							

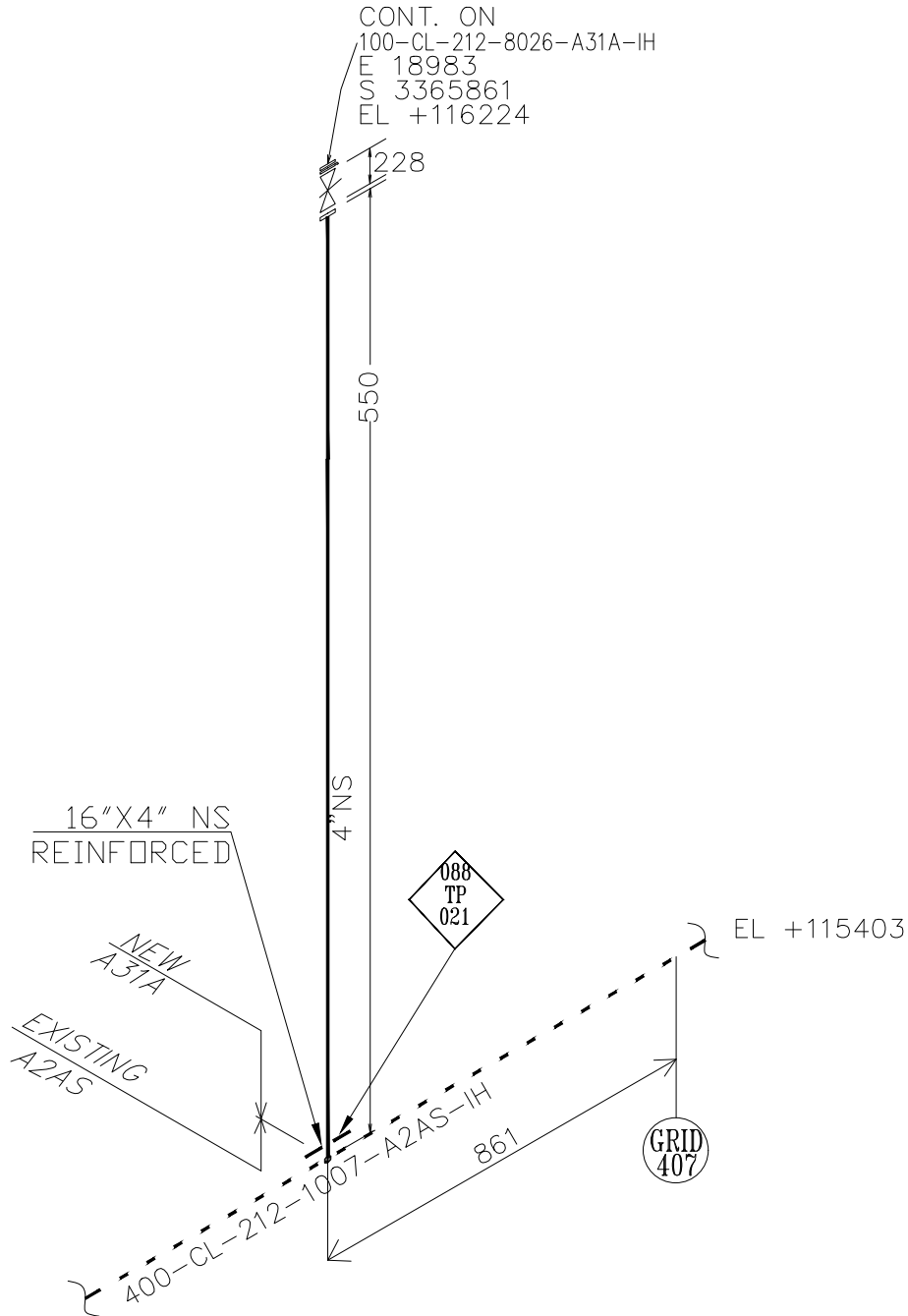
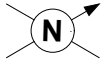


NOTE: —

- 1) ALL DIMENSION ARE IN MM, UNLESS OTHERWISE SPECIFIED.
- 2) REFER P&ID NO. B366-02-42-212-7032.
- 3) HOOK-UP POINT SHALL BE VERIFIED AT SITE BEFORE EXECUTION.

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CLIENT:  INDIAN OIL CORPORATION LIMITED	NO.	DATE	REVISIONS	BY	CHK	APPROVAL	
	0	19.08.21	ISSUED FOR COMMENTS	AG	AV	LSJ	
	1	10.12.21	ISSUED FOR CONSTRUCTION	AG	AV	LSJ	
PROJECT: STANDBY SRU PROJECT IOCL PARADIP REFINERY							
JOB NO.-B366		UNIT-211/212					

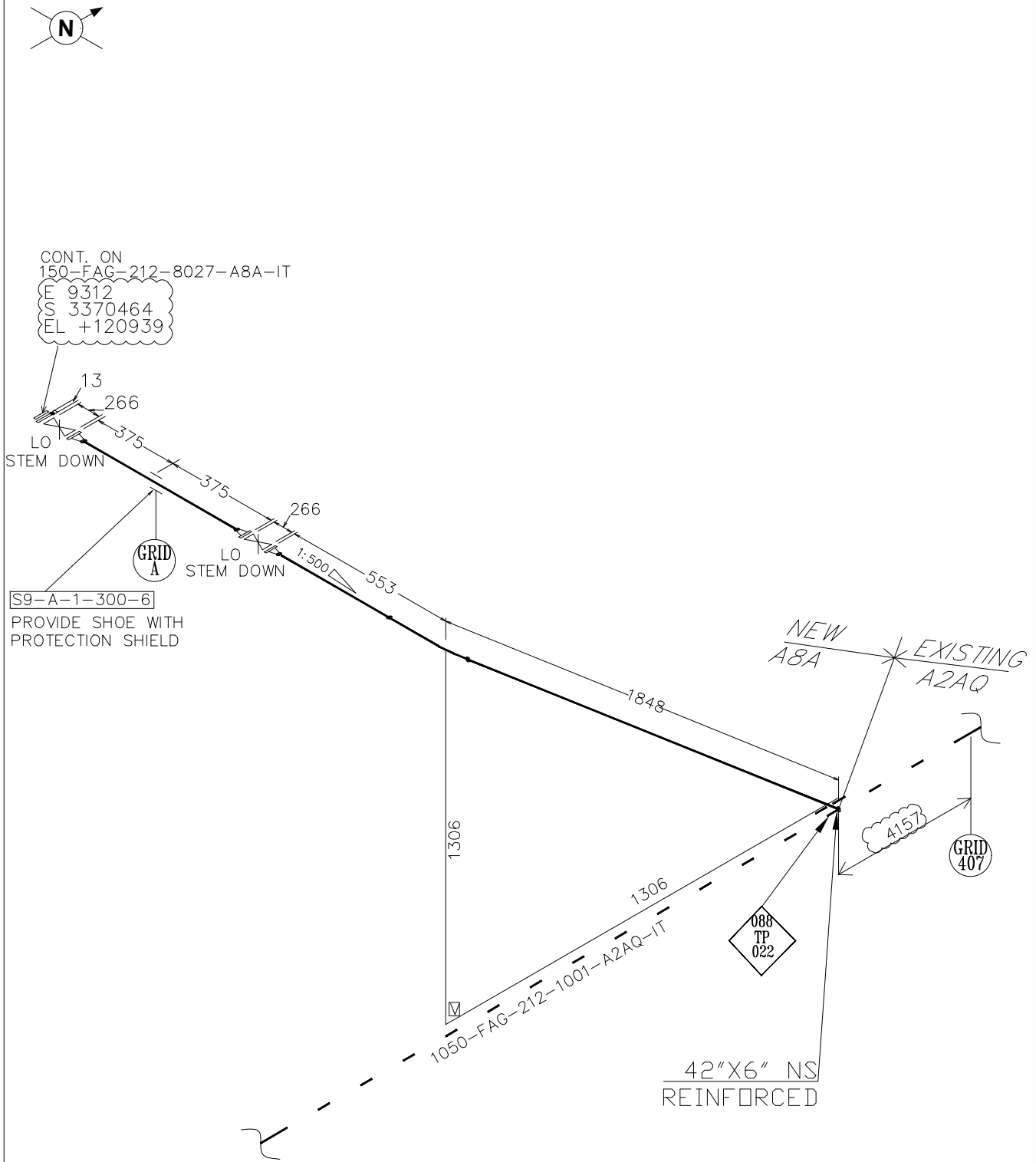


NOTE: -

- 1) ALL DIMENSION ARE IN MM, UNLESS OTHERWISE SPECIFIED.
- 2) REFER P&ID NO. B366-02-42-212-7054.
- 3) HOOK-UP POINT SHALL BE VERIFIED AT SITE BEFORE EXECUTION.

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CLIENT:  INDIAN OIL CORPORATION LIMITED	NO.	DATE	REVISIONS	BY	CHK	APPROVAL	
	0	19.08.21	ISSUED FOR COMMENTS	AG	AV	LSJ	
	1	10.12.21	ISSUED FOR CONSTRUCTION	AG	AV	LSJ	
PROJECT: STANDBY SRU PROJECT IOCL PARADIP REFINERY		JOB NO.-B366	UNIT-211/212				

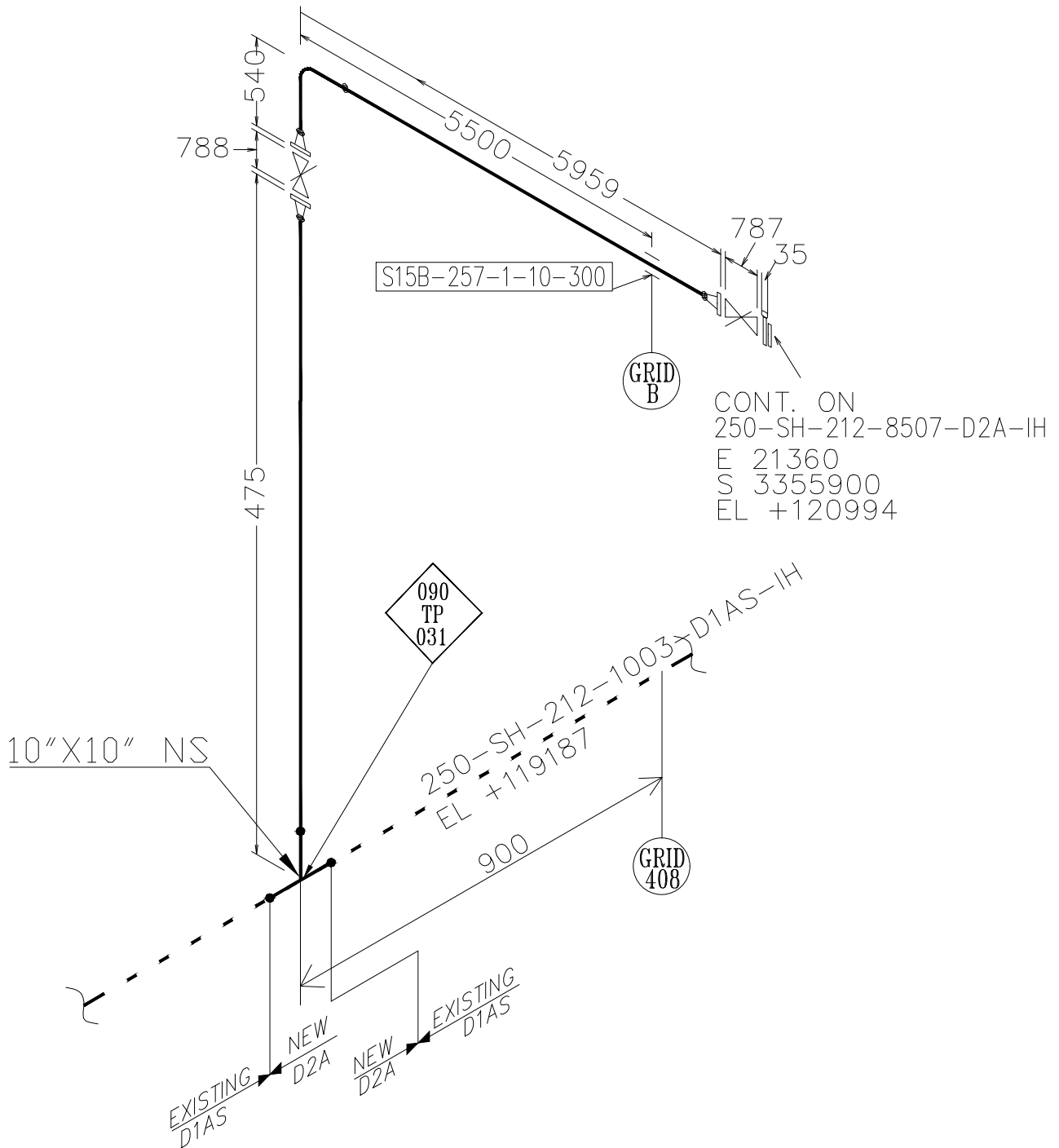
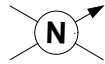


NOTE:-

- 1) ALL DIMENSION ARE IN MM, UNLESS OTHERWISE SPECIFIED.
- 2) REFER P&ID NO. B366-02-42-212-7057.
- 3) HOOK-UP POINT SHALL BE VERIFIED AT SITE BEFORE EXECUTION.
- 4) EXISTING TRACING TO BE SUITABLY MODIFIED TO TRACE THE NEW ARRANGEMENT.

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CLIENT:		INDIAN OIL CORPORATION LIMITED	NO.	DATE	REVISIONS	BY	CHK	APPROVAL
PROJECT:	STANDBY SRU PROJECT IOCL PARADIP REFINERY		0	19.08.21	ISSUED FOR COMMENTS	AG	AV	LSJ
			1	10.12.21	ISSUED FOR CONSTRUCTION	AG	AV	LSJ
JOB NO.-B366	UNIT-211/212							



NOTE:—

- 1) ALL DIMENSION ARE IN MM, UNLESS OTHERWISE SPECIFIED.
- 2) REFER P&ID NO. B366-02-42-212-7029.
- 3) HOOK-UP POINT SHALL BE VERIFIED AT SITE BEFORE EXECUTION.

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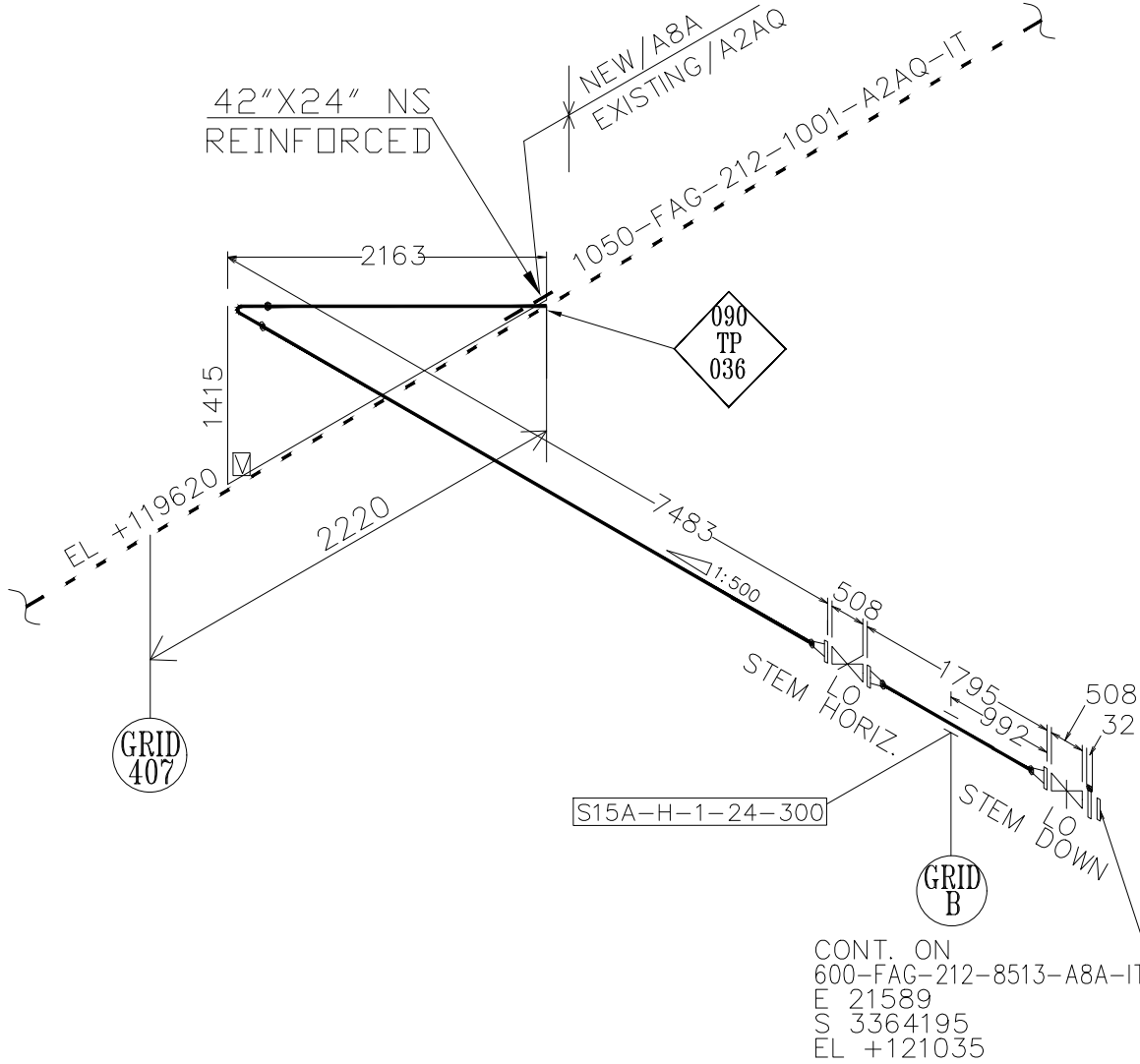
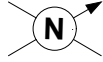


STANDBY SRU PROJECT
IOCL PARADIP REFINERY

NO.	DATE	REVISIONS	BY	CHK	APPROVAL
0	19.08.21	ISSUED FOR COMMENTS	AV	LSJ	LSJ
1	19.08.21	ISSUED FOR CONSTRUCTION	AV	LSJ	LSJ

JOB NO.-B366


UNIT-211/212

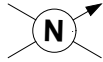


NOTE: -

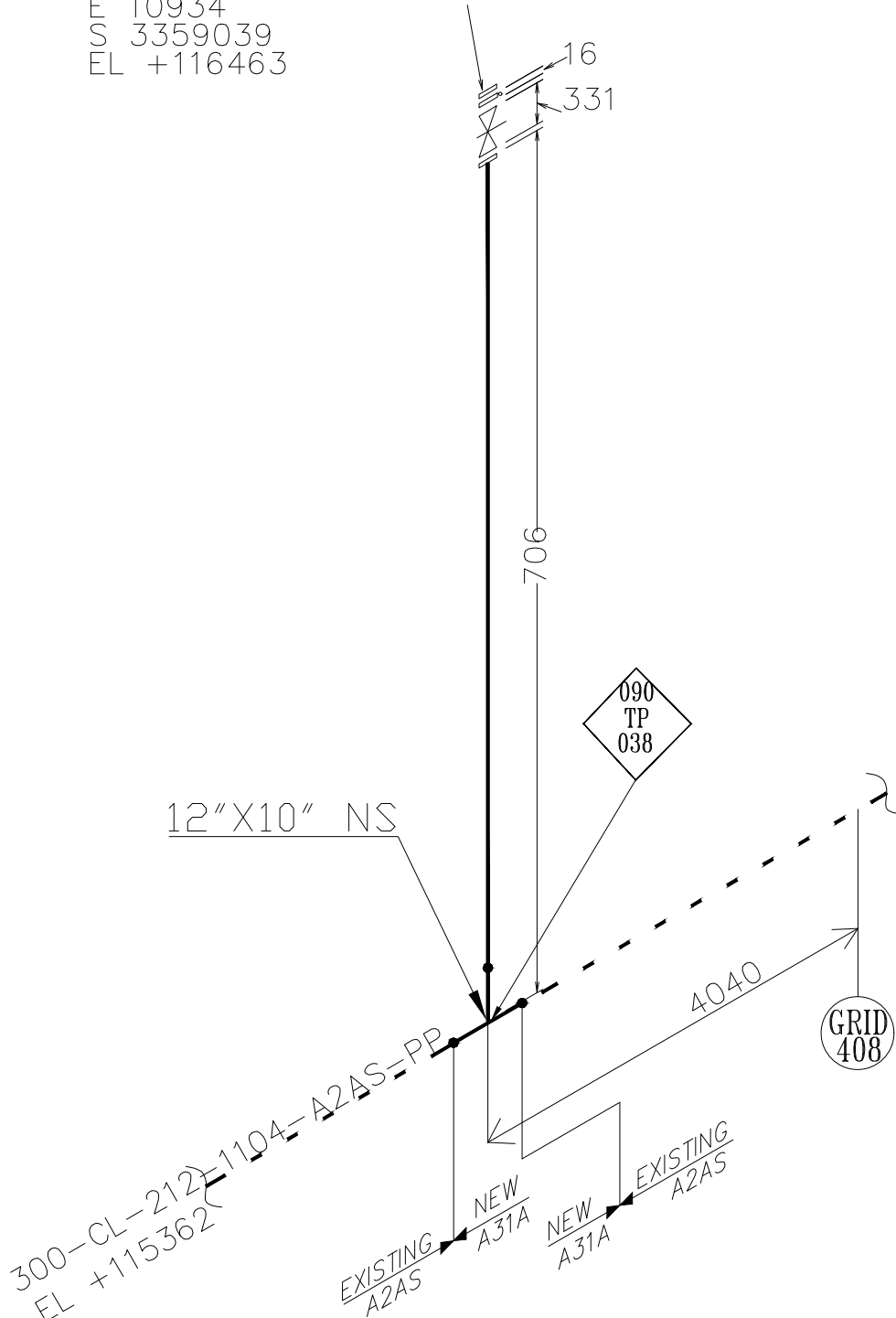
- 1) ALL DIMENSION ARE IN MM, UNLESS OTHERWISE SPECIFIED.
- 2) REFER P&ID NO. B366-02-42-212-7057.
- 3) HOOK-UP POINT SHALL BE VERIFIED AT SITE BEFORE EXECUTION.
- 4) EXISTING TRACING TO BE SUITABLY MODIFIED TO TRACE NEW ARRANGEMENT.

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CLIENT:  INDIAN OIL CORPORATION LIMITED	NO.	DATE	REVISIONS	BY	CHK	APPROVAL
PROJECT: STANDBY SRU PROJECT IOCL PARADIP REFINERY	0	19.08.21	ISSUED FOR COMMENTS	AV	LSJ	LSJ
	1	10.12.21	ISSUED FOR CONSTRUCTION	AV	LSJ	LSJ
JOB NO.-B366	UNIT-211/212					



CONT. ON
250-CL-212-8518-A31A-PP
E 10934
S 3359039
EL +116463



NOTE: -

- 1) ALL DIMENSION ARE IN MM, UNLESS OTHERWISE SPECIFIED.
- 2) REFER P&ID NO. B366-02-42-212-7072.
- 3) HOOK-UP POINT SHALL BE VERIFIED AT SITE BEFORE EXECUTION.

TIE IN MTO

B366-088-16-43-SK-1101(TP-001)

S.NO	DESCRIPTION	QTY
1	FLNG.BLIND, B-16.47-B, ASTM A 105 (NORMALISED), 150, RF/125AARH, NAC6, 36.0 INCH	1
2	SPCR&BLND, ASME B16.47B/JOB'STD, ASTM A 516 GR.70(NORMALISED), 150, FF/125AARH, NAC6, 36.0 INCH	1
3	VLV.BTRFLY, SHEET 563TC, NAC6, 36.0 INCH	1
4	BOLT.STUD WITH 2 NUTS, B-18.2, A193 GR.B7M, A194 GR.2HM, NAC6, 0.875 INCH X 8.75 INCH	44
5	BOLT.STUD WITH 2 NUTS, B-18.2, A193 GR.B7M, A194 GR.2HM, NAC6, 0.875 INCH X 6.75 INCH	44
6	GASKET, B-16.20-ANSI B16.47B, LS SP.WND SS316+FLEX GRAFIL+IR, SPIRAL, 150, NAC6, 36.0 INCH	3

B366-088-16-43-SK-1102(TP-003)

S.NO	DESCRIPTION	QTY
1	FLNG.BLIND, B-16.5, ASTM A 105 (NORMALISED), 150, RF/125AARH, NAC6, 20.0 INCH	1
2	SPCR&BLND, ASME-B16.48, ASTM A 516 GR.70(NORMALISED), 150, FF/125AARH, NAC6, 20.0 INCH	1
3	VLV.BTRFLY, SHEET 563UC, NAC6, 20.0 INCH	1
4	BOLT.STUD WITH 3 NUTS, B-18.2, A193 GR.B7M, A194 GR.2HM, NAC6, 1.125 INCH X 8.75 INCH	20
5	BOLT.STUD WITH 3 NUTS, B-18.2, A193 GR.B7M, A194 GR.2HM, NAC6, 1.125 INCH X 7.5 INCH	20
6	GASKET, B-16.20-ANSI B16.5, LS SP.WND SS316+FLEX GRAFIL+IR, SPIRAL, 150, NAC6, 20.0 INCH	3

B366-088-16-43-SK-1103(TP-010)

S.NO	DESCRIPTION	QTY
1	PIPE, B-36.10, ASTM A 672 GR.B60 CL.32, BE, E.FS.W, 44.0 INCH, XS	2.5
2	FLNG.WN, B-16.47-B, ASTM A 105 (NORMALISED), 150, RF/125AARH, 44.0 INCH, XS	2
3	FLNG.BLIND, B-16.47-B, ASTM A 105 (NORMALISED), 150, RF/125AARH, 44.0 INCH	1
4	SPCR&BLND, ASME B16.47B/JOB'STD, ASTM A 516 GR.70(NORMALISED), 150, FF/125AARH, 44.0 INCH	1
5	VLV.BTRFLY, SHEET 563BA, 44.0 INCH	1
6	BOLT.STUD WITH 3 NUTS, B-18.2, A193 GR.B7, A194 GR.2H, 1.0 INCH X 11.25 INCH	52
7	BOLT.STUD WITH 3 NUTS, B-18.2, A193 GR.B7, A194 GR.2H, 1.0 INCH X 8.75 INCH	104
8	GASKET, B-16.20-ANSI B16.47B, LS SP.WND SS316+FLEX GRAFIL+IR, SPIRAL, 150, 44.0 INCH	4

B366-088-16-43-SK-1104(TP-004)

S.NO	DESCRIPTION	QTY
1	PIPE, B-36.19, ASTM A 358 TP316L CL.1, BE, E.FS.W, 10.0 INCH, 6.35 MM THK	0.4
2	FLNG.WN, B-16.5, ASTM A 182 GR.F316L, 150, RF/125AARH, 10.0 INCH, 6.35 MM THK	1
3	FLNG.BLIND, B-16.5, ASTM A 182 GR.F316L, 150, RF/125AARH, 10.0 INCH	1
4	SPCR&BLND, ASME-B16.48, ASTM A 240 GR.316L, 150, FF/125AARH, 10.0 INCH	1
5	T.EQUAL, B-16.9, ASTM A 403 GR.WP316L-WX, BW, 10.0 INCH, 6.35 MM THK	1
6	VLV.GATE, SHEET 513AM, 10.0 INCH	1
7	BOLT.STUD WITH 2 NUTS, B-18.2, A193 GR.B7, A194 GR.2H, 0.875 INCH X 5.5 INCH	12
8	BOLT.STUD WITH 2 NUTS, B-18.2, A193 GR.B7, A194 GR.2H, 0.875 INCH X 4.75 INCH	12
9	GASKET, B-16.20-ANSI B16.5, LS SPWND SS316L+FLEX GRAFIL+IR, SPIRAL, 150, 10.0 INCH	3

B366-088-16-43-SK-1105(TP-027)

S.NO	DESCRIPTION	QTY
1	FLNG.BLIND, B-16.5, ASTM A 105 (NORMALISED), 150, RF/125AARH, NAC6, 4.0 INCH	1
2	FLNG.FIG.8, ASME-B16.48, ASTM A 516 GR.70(NORMALISED), 150, FF/125AARH, NAC6, 4.0 INCH	1
3	VLV.GATE, SHEET 513TC, NAC6, 4.0 INCH	1
4	BOLT.STUD WITH 2 NUTS, B-18.2, A193 GR.B7M, A194 GR.2HM, NAC6, 0.625 INCH X 3.75 INCH	8
5	BOLT.STUD WITH 2 NUTS, B-18.2, A193 GR.B7M, A194 GR.2HM, NAC6, 0.625 INCH X 4.25 INCH	8
6	GASKET, B-16.20-ANSI B16.5, LS SP.WND SS316+FLEX GRAFIL+IR, SPIRAL, 150, NAC6, 4.0 INCH	3

B366-088-16-43-SK-1106(TP-039,053,054)

S.NO	DESCRIPTION	QTY
1	PIPE, B-36.10, ASTM A 671 GR.CC60 CL.32, BE, E.FS.W, NACE, 48.0 INCH, XS	2.5
2	FLNG.WN, B-16.47-B, ASTM A 105 (NORMALISED), 150, RF/125AARH, NACE, 48.0 INCH, XS	1
3	FLNG.BLIND, B-16.47-B, ASTM A 105 (NORMALISED), 150, RF/125AARH, NACE, 48.0 INCH	1
4	SPCR&BLND, ASME B16.47B/EIL'STD, ASTM A 516 GR.70(NORMALISED), 150, FF/125AARH, NACE, 48.0 INCH	1
5	T.EQUAL, B-16.9, ASTM A 234 GR.WPB-W, BW, NACE, 48.0 INCH, XS	1
6	VLV.BTRFLY, SHEET 563JC, NACE, 48.0 INCH	1
7	BOLT.STUD WITH 3 NUTS, B-18.2, A193 GR.B7M, A194 GR.2HM, NACE, 1.125 INCH X 9.5 INCH	44
8	BOLT.STUD WITH 3 NUTS, B-18.2, A193 GR.B7M, A194 GR.2HM, NACE, 1.125 INCH X 12.25 INCH	44
9	GASKET, B-16.20-ANSI B16.47B, LS SP.WND SS316+FLEX GRAFIL+IR, SPIRAL, 150, NACE, 48.0 INCH	3

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10	PIPE, B-36.10, ASTM A 671 GR.CC60 CL.32, BE, E.FS.W, NACE, 48.0 INCH, XS	1.5
11	FLNG.WN, B-16.47-B, ASTM A 105 (NORMALISED), 300, RF/125AARH, NACE, 48.0 INCH, XS	2
12	BOLT.STUD WITH 3 NUTS, B-18.2, A193 GR.B7M, A194 GR.2HM, NACE, 1.875 INCH X 17.75 INCH	40
13	GASKET, B-16.20-ANSI B16.47B, SP.WND SS316+GRAFIL+ I RING, SPIRAL, 300, NACE, 48.0 INCH	2
14	FLNG.WN, B-16.47-B, ASTM A 105 (NORMALISED), 300, RF/125AARH, NACE, 48.0 INCH, XS	2
15	BOLT.STUD WITH 3 NUTS, B-18.2, A193 GR.B7M, A194 GR.2HM, NACE, 1.875 INCH X 17.75 INCH	40
16	GASKET, B-16.20-ANSI B16.47B, SP.WND SS316+GRAFIL+ I RING, SPIRAL, 300, NACE, 48.0 INCH	2

B366-088-16-43-SK-1107(TP-040,051,052)

S.NO	DESCRIPTION	QTY
1	PIPE, B-36.10, ASTM A 106 GR.B, BE, SEAMLESS, NAC6, 12.0 INCH, STD	1
2	PIPE, B-36.10, ASTM A671GR.CC60 CL.32 (S2,S3), BE, E.FS.W, NAC6, 16.0 INCH, STD	6.2
3	FLNG.WN, B-16.5, ASTM A 105 (NORMALISED), 150, RF/125AARH, NAC6, 16.0 INCH, STD	1
4	FLNG.BLIND, B-16.5, ASTM A 105 (NORMALISED), 150, RF/125AARH, NAC6, 16.0 INCH	1
5	SPCR&BLND, ASME-B16.48, ASTM A 516 GR.70(NORMALISED), 150, FF/125AARH, NAC6, 16.0 INCH	1
6	ELBOW.90, B-16.9, ASTM A 234 GR.WPB-W, BW, 1.5D, NAC6, 16.0 INCH, STD	4
7	T.EQUAL, B-16.9, ASTM A 234 GR.WPB-W, BW, NAC6, 16.0 INCH, STD	1
8	VLV.GATE, SHEET 513TC, NAC6, 16.0 INCH	1
9	BOLT.STUD WITH 3 NUTS, B-18.2, A193 GR.B7M, A194 GR.2HM, NAC6, 1.0 INCH X 7.25 INCH	16
10	BOLT.STUD WITH 3 NUTS, B-18.2, A193 GR.B7M, A194 GR.2HM, NAC6, 1.0 INCH X 6.25 INCH	16
11	GASKET, B-16.20-ANSI B16.5, LS SP.WND SS316+FLEX GRAFIL+IR, SPIRAL, 150, NAC6, 16.0 INCH	3
12	PIPE, B-36.10, ASTM A671GR.CC60 CL.32 (S2,S3), BE, E.FS.W, NAC6, 16.0 INCH, STD	3
13	FLNG.WN, B-16.5, ASTM A 105 (NORMALISED), 300, RF/125AARH, NAC6, 16.0 INCH, STD	2
14	BOLT.STUD WITH 3 NUTS, B-18.2, A193 GR.B7M, A194 GR.2HM, NAC6, 1.25 INCH X 8.75 INCH	20
15	GASKET, B-16.20-ANSI B16.5, SP.WND SS316+GRAFIL+ I RING, SPIRAL, 300, NAC6, 16.0 INCH	2
16	FLNG.WN, B-16.5, ASTM A 105 (NORMALISED), 300, RF/125AARH, NAC6, 16.0 INCH, STD	2
17	BOLT.STUD WITH 3 NUTS, B-18.2, A193 GR.B7M, A194 GR.2HM, NAC6, 1.25 INCH X 8.75 INCH	20
18	GASKET, B-16.20-ANSI B16.5, SP.WND SS316+GRAFIL+ I RING, SPIRAL, 300, NAC6, 16.0 INCH	2

B366-088-16-43-SK-1108(TP-041,055,056)

S.NO	DESCRIPTION	QTY
1	PIPE, B-36.10, ASTM A 106 GR.B, BE, SEAMLESS, NACE, 2.0 INCH, XS	0.7
2	PIPE, B-36.10, ASTM A 106 GR.B, BE, SEAMLESS, NACE, 3.0 INCH, STD	1.2
3	FLNG.WN, B-16.5, ASTM A 105 (NORMALISED), 150, RF/125AARH, NACE, 3.0 INCH, STD	1
4	FLNG.BLIND, B-16.5, ASTM A 105 (NORMALISED), 150, RF/125AARH, NACE, 3.0 INCH	1
5	FLNG.FIG.8, ASME-B16.48, ASTM A 516 GR.70(NORMALISED), 150, FF/125AARH, NACE, 3.0 INCH	1
6	T.EQUAL, B-16.9, ASTM A 234 GR.WPB, BW, NACE, 3.0 INCH, STD	1
7	VLV.GATE, SHEET 513HC, NACE, 3.0 INCH	1
8	BOLT.STUD WITH 2 NUTS, B-18.2, A193 GR.B7M, A194 GR.2HM, NACE, 0.625 INCH X 3.75 INCH	4
9	BOLT.STUD WITH 2 NUTS, B-18.2, A193 GR.B7M, A194 GR.2HM, NACE, 0.625 INCH X 4.0 INCH	4
10	GASKET, B-16.20-ANSI B16.5, LS SP.WND SS316+FLEX GRAFIL+IR, SPIRAL, 150, NACE, 3.0 INCH	3
11	FLNG.WN, B-16.5, ASTM A 105 (NORMALISED), 300, RF/125AARH, NACE, 3.0 INCH, STD	2
12	BOLT.STUD WITH 2 NUTS, B-18.2, A193 GR.B7M, A194 GR.2HM, NACE, 0.75 INCH X 4.25 INCH	8
13	GASKET, B-16.20-ANSI B16.5, SP.WND SS316+GRAFIL+ I RING, SPIRAL, 300, NACE, 3.0 INCH	2
14	FLNG.WN, B-16.5, ASTM A 105 (NORMALISED), 300, RF/125AARH, NACE, 3.0 INCH, STD	2
15	BOLT.STUD WITH 2 NUTS, B-18.2, A193 GR.B7M, A194 GR.2HM, NACE, 0.75 INCH X 4.25 INCH	8
16	GASKET, B-16.20-ANSI B16.5, SP.WND SS316+GRAFIL+ I RING, SPIRAL, 300, NACE, 3.0 INCH	2

B366-088-16-43-SK-1109(TP-042,057,058)

S.NO	DESCRIPTION	QTY
1	PIPE, B-36.10, ASTM A 106 GR.B, BE, SEAMLESS, NACE, 2.0 INCH, XS	1.5
2	PIPE, B-36.10, ASTM A 106 GR.B, BE, SEAMLESS, NACE, 3.0 INCH, STD	4.8
3	FLNG.WN, B-16.5, ASTM A 105 (NORMALISED), 150, RF/125AARH, NACE, 3.0 INCH, STD	1
4	FLNG.BLIND, B-16.5, ASTM A 105 (NORMALISED), 150, RF/125AARH, NACE, 3.0 INCH	1
5	FLNG.FIG.8, ASME-B16.48, ASTM A 516 GR.70(NORMALISED), 150, FF/125AARH, NACE, 3.0 INCH	1
6	ELBOW.90, B-16.9, ASTM A 234 GR.WPB, BW, 1.5D, NACE, 3.0 INCH, STD	2
7	ELBOW.45, B-16.9, ASTM A 234 GR.WPB, BW, 1.5D, NACE, 3.0 INCH, STD	4
8	T.EQUAL, B-16.9, ASTM A 234 GR.WPB, BW, NACE, 3.0 INCH, STD	1
9	VLV.GATE, SHEET 513HC, NACE, 3.0 INCH	1
10	BOLT.STUD WITH 2 NUTS, B-18.2, A193 GR.B7M, A194 GR.2HM, NACE, 0.625 INCH X 3.75 INCH	4

TIE IN MTO

11	BOLT.STUD WITH 2 NUTS, B-18.2, A193 GR.B7M, A194 GR.2HM, NACE, 0.625 INCH X 4.0 INCH	4
12	GASKET, B-16.20-ANSI B16.5, LS SP.WND SS316+FLEX GRAFIL+IR, SPIRAL, 150, NACE, 3.0 INCH	3
13	FLNG.WN, B-16.5, ASTM A 105 (NORMALISED), 300, RF/125AARH, NACE, 3.0 INCH, STD	2
14	BOLT.STUD WITH 2 NUTS, B-18.2, A193 GR.B7M, A194 GR.2HM, NACE, 0.75 INCH X 4.25 INCH	8
15	GASKET, B-16.20-ANSI B16.5, SP.WND SS316+GRAFIL+ I RING, SPIRAL, 300, NACE, 3.0 INCH	2
16	FLNG.WN, B-16.5, ASTM A 105 (NORMALISED), 300, RF/125AARH, NACE, 3.0 INCH, STD	2
17	BOLT.STUD WITH 2 NUTS, B-18.2, A193 GR.B7M, A194 GR.2HM, NACE, 0.75 INCH X 4.25 INCH	8
18	GASKET, B-16.20-ANSI B16.5, SP.WND SS316+GRAFIL+ I RING, SPIRAL, 300, NACE, 3.0 INCH	2

B366-088-16-43-SK-1114(TP-071,073)

S.NO	DESCRIPTION	QTY
1	PIPE, B-36.10, ASTM A 106 GR.B, PE, SEAMLESS, 0.75 INCH, XS	12
2	PIPE, B-36.10, ASTM A 106 GR.B, BE, SEAMLESS, 10.0 INCH, STD	3
3	PIPE, B-36.10, ASTM A 106 GR.B, BE, SEAMLESS, 12.0 INCH, STD	3
4	FLNG.SW, B-16.5, ASTM A 105 (NORMALISED), 300, RF/125AARH, 0.75 INCH, XS	3
5	FLNG.WN, B-16.5, ASTM A 105 (NORMALISED), 150, RF/125AARH, 0.75 INCH, XS	7
6	FLNG.SO, B-16.5, ASTM A 105 (NORMALISED), 300, RF/125AARH, 12.0 INCH, 10.0 INCH	2
7	FLNG.SO, B-16.5, ASTM A 105 (NORMALISED), 150, RF/125AARH, 12.0 INCH, 10.0 INCH	1
8	ELBOW.90, B-16.11, ASTM A 105 (NORMALISED), SW, 3000, 0.75 INCH	13
9	SOCKOLET, MSS-SP97, ASTM A 105 (NORMALISED), SW, 3000, 12.0 INCH, 0.75 INCH	4
10	BOLT.STUD WITH 2 NUTS, B-18.2, A193 GR.B7, A194 GR.2H, 0.5 INCH X 2.5 INCH	16
11	BOLT.STUD WITH 2 NUTS, B-18.2, A193 GR.B7, A194 GR.2H, 0.625 INCH X 3 INCH	12
12	BOLT.STUD WITH 2 NUTS, B-18.2, A193 GR.B7, A194 GR.2H, 0.875 INCH X 4.75 INCH	12
13	BOLT.STUD WITH 3 NUTS, B-18.2, A193 GR.B7, A194 GR.2H, 1.125 INCH X 8 INCH	16
14	GASKET, B-16.20-ANSI B16.5, SP.WND SS316+GRAFIL+ I RING, SPIRAL, 300, 0.75 INCH	3
15	GASKET, B-16.20-ANSI B16.5, SP.WND SS316+GRAFIL+ I RING, SPIRAL, 300, 12.0 INCH	2
16	GASKET, B-16.20-ANSI B16.5, LS SP.WND SS316+FLEX GRAFIL+IR, SPIRAL, 150, 0.75 INCH	4
17	GASKET, B-16.20-ANSI B16.5, LS SP.WND SS316+FLEX GRAFIL+IR, SPIRAL, 150, 12.0 INCH	1
18	PIPE, B-36.10, ASTM A 106 GR.B, PE, SEAMLESS, 0.75 INCH, XS	12
19	PIPE, B-36.10, ASTM A 106 GR.B, BE, SEAMLESS, 10.0 INCH, STD	1.6
20	PIPE, B-36.10, ASTM A 106 GR.B, BE, SEAMLESS, 12.0 INCH, STD	1.6
21	FLNG.SW, B-16.5, ASTM A 105 (NORMALISED), 300, RF/125AARH, 0.75 INCH, XS	1
22	FLNG.WN, B-16.5, ASTM A 105 (NORMALISED), 150, RF/125AARH, 0.75 INCH, XS	7
23	FLNG.SO, B-16.5, ASTM A 105 (NORMALISED), 150, RF/125AARH, 12.0 INCH, 10.0 INCH	1
24	FLNG.SO, B-16.5, ASTM A 105 (NORMALISED), 300, RF/125AARH, 12.0 INCH, 10.0 INCH	2
25	ELBOW.90, B-16.11, ASTM A 105 (NORMALISED), SW, 3000, 0.75 INCH	10
26	SOCKOLET, MSS-SP97, ASTM A 105 (NORMALISED), SW, 3000, 12.0 INCH, 0.75 INCH	2
27	BOLT.STUD WITH 2 NUTS, B-18.2, A193 GR.B7, A194 GR.2H, 0.5 INCH X 2.5 INCH	16
28	BOLT.STUD WITH 2 NUTS, B-18.2, A193 GR.B7, A194 GR.2H, 0.625 INCH X 3 INCH	4
29	BOLT.STUD WITH 2 NUTS, B-18.2, A193 GR.B7, A194 GR.2H, 0.875 INCH X 4.75 INCH	12
30	BOLT.STUD WITH 3 NUTS, B-18.2, A193 GR.B7, A194 GR.2H, 1.125 INCH X 8 INCH	16
31	GASKET, B-16.20-ANSI B16.5, SP.WND SS316+GRAFIL+ I RING, SPIRAL, 300, 0.75 INCH	1
32	GASKET, B-16.20-ANSI B16.5, SP.WND SS316+GRAFIL+ I RING, SPIRAL, 300, 12.0 INCH	2
33	GASKET, B-16.20-ANSI B16.5, LS SP.WND SS316+FLEX GRAFIL+IR, SPIRAL, 150, 0.75 INCH	4
34	GASKET, B-16.20-ANSI B16.5, LS SP.WND SS316+FLEX GRAFIL+IR, SPIRAL, 150, 12.0 INCH	1

B366-088-16-43-SK-1115(TP-074,076)

S.NO	DESCRIPTION	QTY
1	PIPE, B-36.10, ASTM A 106 GR.B, PE, SEAMLESS, 0.75 INCH, XS	12
2	PIPE, B-36.10, ASTM A 106 GR.B, BE, SEAMLESS, 6.0 INCH, STD	3
3	PIPE, B-36.10, ASTM A 106 GR.B, BE, SEAMLESS, 8.0 INCH, STD	3
4	FLNG.SW, B-16.5, ASTM A 105 (NORMALISED), 300, RF/125AARH, 0.75 INCH, XS	3
5	FLNG.WN, B-16.5, ASTM A 105 (NORMALISED), 150, RF/125AARH, 0.75 INCH, XS	7
6	FLNG.SO, B-16.5, ASTM A 105 (NORMALISED), 150, RF/125AARH, 8.0 INCH, 6.0 INCH	1
7	FLNG.SO, B-16.5, ASTM A 105 (NORMALISED), 300, RF/125AARH, 8.0 INCH, 6.0 INCH	2
8	ELBOW.90, B-16.11, ASTM A 105 (NORMALISED), SW, 3000, 0.75 INCH	13
9	SOCKOLET, MSS-SP97, ASTM A 105 (NORMALISED), SW, 3000, 8.0 INCH, 0.75 INCH	4
10	BOLT.STUD WITH 2 NUTS, B-18.2, A193 GR.B7, A194 GR.2H, 0.5 INCH X 2.5 INCH	16
11	BOLT.STUD WITH 2 NUTS, B-18.2, A193 GR.B7, A194 GR.2H, 0.625 INCH X 3 INCH	12

TIE IN MTO

12	BOLT.STUD WITH 2 NUTS, B-18.2, A193 GR.B7, A194 GR.2H, 0.75 INCH X 4.25 INCH	8
13	BOLT.STUD WITH 2 NUTS, B-18.2, A193 GR.B7, A194 GR.2H, 0.875 INCH X 5.5 INCH	12
14	GASKET, B-16.20-ANSI B16.5, SP.WND SS316+GRAFIL+ I RING, SPIRAL, 300, 0.75 INCH	3
15	GASKET, B-16.20-ANSI B16.5, SP.WND SS316+GRAFIL+ I RING, SPIRAL, 300, 8.0 INCH	2
16	GASKET, B-16.20-ANSI B16.5, LS SP.WND SS316+FLEX GRAFIL+IR, SPIRAL, 150, 0.75 INCH	4
17	GASKET, B-16.20-ANSI B16.5, LS SP.WND SS316+FLEX GRAFIL+IR, SPIRAL, 150, 8.0 INCH	1
18	PIPE, B-36.10, ASTM A 106 GR.B, PE, SEAMLESS, 0.75 INCH, XS	12
19	PIPE, B-36.10, ASTM A 106 GR.B, BE, SEAMLESS, 6.0 INCH, STD	2
20	PIPE, B-36.10, ASTM A 106 GR.B, BE, SEAMLESS, 8.0 INCH, STD	2
21	FLNG.SW, B-16.5, ASTM A 105 (NORMALISED), 300, RF/125AARH, 0.75 INCH, XS	1
22	FLNG.WN, B-16.5, ASTM A 105 (NORMALISED), 150, RF/125AARH, 0.75 INCH, XS	6
23	FLNG.SO, B-16.5, ASTM A 105 (NORMALISED), 150, RF/125AARH, 0.75 INCH	1
24	FLNG.SO, B-16.5, ASTM A 105 (NORMALISED), 300, RF/125AARH, 8.0 INCH, 6.0 INCH	2
25	FLNG.SO, B-16.5, ASTM A 105 (NORMALISED), 150, RF/125AARH, 8.0 INCH, 6.0 INCH	1
26	ELBOW.90, B-16.11, ASTM A 105 (NORMALISED), SW, 3000, 0.75 INCH	13
27	SOCKOLET, MSS-SP97, ASTM A 105 (NORMALISED), SW, 3000, 8.0 INCH, 0.75 INCH	4
28	BOLT.STUD WITH 2 NUTS, B-18.2, A193 GR.B7, A194 GR.2H, 0.5 INCH X 2.5 INCH	16
29	BOLT.STUD WITH 2 NUTS, B-18.2, A193 GR.B7, A194 GR.2H, 0.625 INCH X 3 INCH	4
30	BOLT.STUD WITH 2 NUTS, B-18.2, A193 GR.B7, A194 GR.2H, 0.75 INCH X 4.25 INCH	8
31	BOLT.STUD WITH 2 NUTS, B-18.2, A193 GR.B7, A194 GR.2H, 0.875 INCH X 5.5 INCH	12
32	GASKET, B-16.20-ANSI B16.5, SP.WND SS316+GRAFIL+ I RING, SPIRAL, 300, 0.75 INCH	1
33	GASKET, B-16.20-ANSI B16.5, SP.WND SS316+GRAFIL+ I RING, SPIRAL, 300, 8.0 INCH	2
34	GASKET, B-16.20-ANSI B16.5, LS SP.WND SS316+FLEX GRAFIL+IR, SPIRAL, 150, 0.75 INCH	4
35	GASKET, B-16.20-ANSI B16.5, LS SP.WND SS316+FLEX GRAFIL+IR, SPIRAL, 150, 8.0 INCH	1

B366-088-16-43-SK-1116(TP-079,080)

S.NO	DESCRIPTION	QTY
1	PIPE, B-36.10, ASTM A 106 GR.B, PE, SEAMLESS, 0.75 INCH, S160	0.5
2	FLNG.WN, B-16.47-B, ASTM A 105 (NORMALISED), 300, RF/125AARH, 36.0 INCH, XS	2
3	CAP, B-16.11, ASTM A 105 (NORMALISED), SCRF, 3000, 0.75 INCH	1
4	SOCKOLET, MSS-SP97, ASTM A 105 (NORMALISED), SW, 6000, 36.0 INCH, 0.75 INCH	1
5	VLV.GATE, SHEET 510AA, 0.75 INCH	1
6	BOLT.STUD WITH 3 NUTS, B-18.2, A193 GR.B7, A194 GR.2H, 1.625 INCH X 14 INCH	32
7	GASKET, B-16.20-ANSI B16.47B, SP.WND SS316+GRAFIL+ I RING, SPIRAL, 300, 36.0 INCH	2
8	PIPE, B-36.10, ASTM A 672 GR.B60 CL.32, BE, E.FS.W, 36.0 INCH, XS	1.8
9	FLNG.WN, B-16.47-B, ASTM A 105 (NORMALISED), 300, RF/125AARH, 36.0 INCH, XS	2
10	BOLT.STUD WITH 3 NUTS, B-18.2, A193 GR.B7, A194 GR.2H, 1.625 INCH X 14 INCH	32
11	GASKET, B-16.20-ANSI B16.47B, SP.WND SS316+GRAFIL+ I RING, SPIRAL, 300, 36.0 INCH	2

B366-088-16-43-SK-1201(TP-002)

S.NO	DESCRIPTION	QTY
1	PIPE, B-36.10, ASTM A 106 GR.B, BE, SEAMLESS, NAC6, 3.0 INCH, S160	0.3
2	PIPE, B-36.10, ASTM A 106 GR.B, BE, SEAMLESS, NAC6, 10.0 INCH, XS	0.152
3	REINF.PAD, ASTM A 106 GR.B, NAC6, 10.0 INCH, XS, 3.0 INCH	1
4	FLNG.WN, B-16.5, ASTM A 105 (NORMALISED), 300, RF/125AARH, NAC6, 3.0 INCH, S160	1
5	FLNG.BLIND, B-16.5, ASTM A 105 (NORMALISED), 300, RF/125AARH, NAC6, 3.0 INCH	1
6	FLNG.FIG.8, ASME-B16.48, ASTM A 516 GR.70(NORMALISED), 300, FF/125AARH, NAC6, 3.0 INCH	1
7	VLV.GATE, SHEET 514VC, NAC6, 3.0 INCH	1
8	BOLT.STUD WITH 2 NUTS, B-18.2, A193 GR.B7M, A194 GR.2HM, NAC6, 0.75 INCH X 4.25 INCH	8
9	BOLT.STUD WITH 2 NUTS, B-18.2, A193 GR.B7M, A194 GR.2HM, NAC6, 0.75 INCH X 4.75 INCH	8
10	GASKET, B-16.20-ANSI B16.5, SP.WND SS316+GRAFIL+ I RING, SPIRAL, 300, NAC6, 3.0 INCH	3

B366-088-16-43-SK-1202(TP-005)

S.NO	DESCRIPTION	QTY
1	FLNG.BLIND, B-16.47-B, ASTM A 105 (NORMALISED), 150, RF/125AARH, 48.0 INCH	1
2	SPCR&BLND, ASME B16.47B/JOB'STD, ASTM A 516 GR.70(NORMALISED), 150, FF/125AARH, 48.0 INCH	1
3	VLV.BTRFLY, SHEET 563BA, 48.0 INCH	1
4	BOLT.STUD WITH 3 NUTS, B-18.2, A193 GR.B7, A194 GR.2H, 1.125 INCH X 9.5 INCH	44
5	BOLT.STUD WITH 3 NUTS, B-18.2, A193 GR.B7, A194 GR.2H, 1.125 INCH X 12.25 INCH	44
6	GASKET, B-16.20-ANSI B16.47B, LS SP.WND SS316+FLEX GRAFIL+IR, SPIRAL, 150, 48.0 INCH	3

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B366-088-16-43-SK-1203(TP-006)

S.NO	DESCRIPTION	QTY
1	FLNG.BLIND, B-16.47-B, ASTM A 105 (NORMALISED), 150, RF/125AARH, 48.0 INCH	1
2	SPCR&BLND, ASME B16.47B/JOB'STD, ASTM A 516 GR.70(NORMALISED), 150, FF/125AARH, 48.0 INCH	1
3	VLV.BTRFLY, SHEET 563BA, 48.0 INCH	1
4	BOLT.STUD WITH 3 NUTS, B-18.2, A193 GR.B7, A194 GR.2H, 1.125 INCH X 9.5 INCH	44
5	BOLT.STUD WITH 3 NUTS, B-18.2, A193 GR.B7, A194 GR.2H, 1.125 INCH X 12.25 INCH	44
6	GASKET, B-16.20-ANSI B16.47B, LS SP.WND SS316+FLEX GRAFIL+IR, SPIRAL, 150, 48.0 INCH	3

B366-088-16-43-SK-1204(TP-007)

S.NO	DESCRIPTION	QTY
1	PIPE, B-36.10, ASTM A 106 GR.B, PE, SEAMLESS, 0.75 INCH, XS	9
2	FLNG.WN, B-16.5, ASTM A 105 (NORMALISED), 150, RF/125AARH, 0.75 INCH, XS	7
3	FLNG.BLIND, B-16.5, ASTM A 105 (NORMALISED), 150, RF/125AARH, 12.0 INCH	1
4	SPCR&BLND, ASME-B16.48, ASTM A 516 GR.70(NORMALISED), 150, FF/125AARH, 12.0 INCH	1
5	ELBOW.90, B-16.11, ASTM A 105 (NORMALISED), SW, 3000, 0.75 INCH	8
6	SOCKOLET, MSS-SP97, ASTM A 105 (NORMALISED), SW, 3000, 12.0 INCH, 0.75 INCH	2
7	VLV.PLUG, SHEET 553BD, 10.0 INCH	1
8	BOLT.STUD WITH 2 NUTS, B-18.2, A193 GR.B7, A194 GR.2H, 0.5 INCH X 2.5 INCH	16
9	BOLT.STUD WITH 2 NUTS, B-18.2, A193 GR.B7, A194 GR.2H, 0.875 INCH X 5.75 INCH	12
10	BOLT.STUD WITH 2 NUTS, B-18.2, A193 GR.B7, A194 GR.2H, 0.875 INCH X 4.75 INCH	12
11	GASKET, B-16.20-ANSI B16.5, LS SP.WND SS316+FLEX GRAFIL+IR, SPIRAL, 150, 0.75 INCH	4
12	GASKET, B-16.20-ANSI B16.5, LS SP.WND SS316+FLEX GRAFIL+IR, SPIRAL, 150, 12.0 INCH	3

B366-088-16-43-SK-1205(TP-008)

S.NO	DESCRIPTION	QTY
1	PIPE, B-36.10, ASTM A 106 GR.B, PE, SEAMLESS, 0.75 INCH, XS	56
2	PIPE, B-36.10, ASTM A 106 GR.B, BE, SEAMLESS, 6.0 INCH, STD	1
3	FLNG.WN, B-16.5, ASTM A 105 (NORMALISED), 150, RF/125AARH, 0.75 INCH, XS	10
4	FLNG.SO, B-16.5, ASTM A 105 (NORMALISED), 150, RF/125AARH, 8.0 INCH, 6.0 INCH	1
5	FLNG.BLIND, B-16.5, ASTM A 105 (NORMALISED), 150, RF/125AARH, 8.0 INCH	1
6	FLNG.FIG.8, ASME-B16.48, ASTM A 516 GR.70(NORMALISED), 150, FF/125AARH, 8.0 INCH	1
7	ELBOW.90, B-16.11, ASTM A 105 (NORMALISED), SW, 3000, 0.75 INCH	20
8	T.RED, B-16.9, ASTM A 234 GR.WPB, BW, 8.0 INCH, STD, 6.0 INCH, STD	1
9	CPLNG.FULL, B-16.11, ASTM A 105 (NORMALISED), SW, 3000, 0.75 INCH	8
10	VLV.PLUG, SHEET 553BD, 6.0 INCH	1
11	BOLT.STUD WITH 2 NUTS, B-18.2, A193 GR.B7, A194 GR.2H, 0.5 INCH X 2.5 INCH	24
12	BOLT.STUD WITH 2 NUTS, B-18.2, A193 GR.B7, A194 GR.2H, 0.75 INCH X 4.25 INCH	8
13	BOLT.STUD WITH 2 NUTS, B-18.2, A193 GR.B7, A194 GR.2H, 0.75 INCH X 5 INCH	8
14	GASKET, B-16.20-ANSI B16.5, LS SP.WND SS316+FLEX GRAFIL+IR, SPIRAL, 150, 0.75 INCH	6
15	GASKET, B-16.20-ANSI B16.5, LS SP.WND SS316+FLEX GRAFIL+IR, SPIRAL, 150, 8.0 INCH	3

B366-088-16-43-SK-1206(TP-009)

S.NO	DESCRIPTION	QTY
1	PIPE, B-36.10, ASTM A 106 GR.B, PE, SEAMLESS, 0.75 INCH, XS	9
2	FLNG.WN, B-16.5, ASTM A 105 (NORMALISED), 150, RF/125AARH, 0.75 INCH, XS	8
3	FLNG.BLIND, B-16.5, ASTM A 105 (NORMALISED), 150, RF/125AARH, 10.0 INCH	1
4	SPCR&BLND, ASME-B16.48, ASTM A 516 GR.70(NORMALISED), 150, FF/125AARH, 10.0 INCH	1
5	ELBOW.90, B-16.11, ASTM A 105 (NORMALISED), SW, 3000, 0.75 INCH	10
6	SOCKOLET, MSS-SP97, ASTM A 105 (NORMALISED), SW, 3000, 10.0 INCH, 0.75 INCH	2
7	VLV.PLUG, SHEET 553BD, 8.0 INCH	1
8	BOLT.STUD WITH 2 NUTS, B-18.2, A193 GR.B7, A194 GR.2H, 0.5 INCH X 2.5 INCH	24
9	BOLT.STUD WITH 2 NUTS, B-18.2, A193 GR.B7, A194 GR.2H, 0.875 INCH X 4.75 INCH	12
10	BOLT.STUD WITH 2 NUTS, B-18.2, A193 GR.B7, A194 GR.2H, 0.875 INCH X 5.5 INCH	12
11	GASKET, B-16.20-ANSI B16.5, LS SP.WND SS316+FLEX GRAFIL+IR, SPIRAL, 150, 0.75 INCH	6
12	GASKET, B-16.20-ANSI B16.5, LS SP.WND SS316+FLEX GRAFIL+IR, SPIRAL, 150, 10.0 INCH	3

B366-088-16-43-SK-1301(TP-011)

S.NO	DESCRIPTION	QTY
1	PIPE, B-36.10, ASTM A 106 GR.B, BE, SEAMLESS, 2.0 INCH, XS	0.5

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2	FLNG.WN, B-16.5, ASTM A 105 (NORMALISED), 150, RF/125AARH, 2.0 INCH, XS	1
3	FLNG.BLIND, B-16.5, ASTM A 105 N (GALV.), 150, FF/125AARH, 2.0 INCH	1
4	FLNG.FIG.8, ASME-B16.48, ASTM A 516N Gr.70 (GALV.), 150, FF/125AARH, 2.0 INCH	1
5	VLV.GATE, SHEET 513FE, 2.0 INCH	1
6	BOLT.STUD WITH 2 NUTS, B-18.2, A193 GR.B7(GALV), A194 2H(GALV), 0.625 INCH X 3.75 INCH	4
7	BOLT.STUD WITH 2 NUTS, B-18.2, A193 GR.B7(GALV), A194 2H(GALV), 0.625 INCH X 3.25 INCH	4
8	GASKET, B-16.21-ANSI B16.5, NONASB. SYN FIBRE+ RUBR BINDER, FULLFACE, 150, 2.0 INCH, 2 MM	3
9	GASKET, B-16.20-ANSI B16.5, LS SP.WND SS316+FLEX GRAFIL+IR, SPIRAL, 150, 2.0 INCH	1

B366-088-16-43-SK-1302(TP-012)

S.NO	DESCRIPTION	QTY
1	FLNG.BLIND, B-16.5, ASTM A 105 (NORMALISED), 150, RF/125AARH, 8.0 INCH	1
2	FLNG.FIG.8, ASME-B16.48, ASTM A 516 GR.70(NORMALISED), 150, FF/125AARH, 8.0 INCH	1
3	VLV.GATE, SHEET 513FA, 8.0 INCH	1
4	BOLT.STUD WITH 2 NUTS, B-18.2, A193 GR.B7, A194 GR.2H, 0.75 INCH X 5 INCH	8
5	BOLT.STUD WITH 2 NUTS, B-18.2, A193 GR.B7, A194 GR.2H, 0.75 INCH X 4.25 INCH	8
6	GASKET, B-16.20-ANSI B16.5, LS SP.WND SS316+FLEX GRAFIL+IR, SPIRAL, 150, 8.0 INCH	3

B366-088-16-43-SK-1303(TP-013)

S.NO	DESCRIPTION	QTY
1	PIPE, B-36.10, ASTM A 106 GR.B, BE, SEAMLESS, 3.0 INCH, STD	0.5
2	FLNG.WN, B-16.5, ASTM A 105 (NORMALISED), 150, RF/125AARH, 3.0 INCH, STD	1
3	FLNG.BLIND, B-16.5, ASTM A 105 (NORMALISED), 150, RF/125AARH, 3.0 INCH	1
4	FLNG.FIG.8, ASME-B16.48, ASTM A 516 GR.70(NORMALISED), 150, FF/125AARH, 3.0 INCH	1
5	VLV.GATE, SHEET 513DA, 3.0 INCH	1
6	BOLT.STUD WITH 2 NUTS, B-18.2, A193 GR.B7, A194 GR.2H, 0.625 INCH X 4 INCH	4
7	BOLT.STUD WITH 2 NUTS, B-18.2, A193 GR.B7, A194 GR.2H, 0.625 INCH X 3.75 INCH	4
8	GASKET, B-16.20-ANSI B16.5, LS SP.WND SS316+FLEX GRAFIL+IR, SPIRAL, 150, 3.0 INCH	3

B366-088-16-43-SK-1304(TP-014)

S.NO	DESCRIPTION	QTY
1	PIPE, B-36.10, ASTM A 106 GR.B(GALV), BE, SEAMLESS, 3.0 INCH, STD	0.4
2	FLNG.SO, B-16.5, ASTM A 105 N (GALV.), 150, FF/125AARH, 3.0 INCH	1
3	FLNG.BLIND, B-16.5, ASTM A 105 N (GALV.), 150, FF/125AARH, 3.0 INCH	1
4	FLNG.FIG.8, ASME-B16.48, ASTM A 516N Gr.70 (GALV.), 150, FF/125AARH, 3.0 INCH	1
5	T.RED, B-16.9, ASTM A 234 GR.WPB(GALV), BW, 6.0 INCH, STD, 3.0 INCH, STD	1
6	VLV.GATE, SHEET 513FE, 3.0 INCH	1
7	BOLT.STUD WITH 2 NUTS, B-18.2, A193 GR.B7(GALV), A194 2H(GALV), 0.625 INCH X 4.0 INCH	4
8	BOLT.STUD WITH 2 NUTS, B-18.2, A193 GR.B7(GALV), A194 2H(GALV), 0.625 INCH X 3.75 INCH	4
9	GASKET, B-16.21-ANSI B16.5, NONASB. SYN FIBRE+ RUBR BINDER, FULLFACE, 150, 3.0 INCH, 2 MM	3

B366-088-16-43-SK-1305(TP-018)

S.NO	DESCRIPTION	QTY
1	PIPE, B-36.10, ASTM A 106 GR.B, BE, SEAMLESS, IBR, 3.0 INCH, XS	0.4
2	PIPE, B-36.10, ASTM A 106 GR.B, BE, SEAMLESS, IBR, 10.0 INCH, STD	0.152
3	REINF.PAD, ASTM A 106 GR.B, IBR, 10.0 INCH, STD, 3.0 INCH	1
4	FLNG.WN, B-16.5, ASTM A 105 (NORMALISED), 300, RF/125AARH, IBR, 3.0 INCH, XS	1
5	FLNG.BLIND, B-16.5, ASTM A 105 (NORMALISED), 300, RF/125AARH, IBR, 3.0 INCH	1
6	FLNG.FIG.8, ASME-B16.48, ASTM A 516 GR.70(NORMALISED), 300, FF/125AARH, IBR, 3.0 INCH	1
7	VLV.GATE, SHEET 514AB, IBR, 3.0 INCH	1
8	BOLT.STUD WITH 2 NUTS, B-18.2, A193 GR.B7, A194 GR.2H, 0.75 INCH X 4.75 INCH	8
9	BOLT.STUD WITH 2 NUTS, B-18.2, A193 GR.B7, A194 GR.2H, 0.75 INCH X 4.25 INCH	8
10	GASKET, B-16.20-ANSI B16.5, SP.WND SS316+GRAFIL+ I RING, SPIRAL, 300, 3.0 INCH	3

B366-088-16-43-SK-1306(TP-019)

S.NO	DESCRIPTION	QTY
1	PIPE, B-36.10, ASTM A 106 GR.B, BE, SEAMLESS, IBR, 6.0 INCH, S120	0.4
2	FLNG.WN, B-16.5, ASTM A 105 (NORMALISED), 600, RF/125AARH, IBR, 6.0 INCH, S120	1
3	FLNG.BLIND, B-16.5, ASTM A 105 (NORMALISED), 600, RF/125AARH, IBR, 6.0 INCH	1
4	FLNG.FIG.8, ASME-B16.48, ASTM A 516 GR.70(NORMALISED), 600, FF/125AARH, IBR, 6.0 INCH	1
5	T.RED, B-16.9, ASTM A 234 GR.WPB, BW, IBR, 8.0 INCH, S100, 6.0 INCH, S120	1

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6	VLV.GATE, SHEET 515DB, IBR, 6.0 INCH	2
7	BOLT.STUD WITH 3 NUTS, B-18.2, A193 GR.B7, A194 GR.2H, 1.0 INCH X 7.75 INCH	24
8	BOLT.STUD WITH 3 NUTS, B-18.2, A193 GR.B7, A194 GR.2H, 1.0 INCH X 8.75 INCH	12
9	GASKET, B-16.20-ANSI B16.5, SP.WND SS316+GRAFIL+ I RING, SPIRAL, 600, 6.0 INCH	4

B366-088-16-43-SK-1307(TP-020)

S.NO	DESCRIPTION	QTY
1	PIPE, B-36.10, ASTM A 106 GR.B, BE, SEAMLESS, 3.0 INCH, STD	0.5
2	FLNG.WN, B-16.5, ASTM A 105 (NORMALISED), 150, RF/125AARH, 3.0 INCH, STD	1
3	FLNG.BLIND, B-16.5, ASTM A 105 N (GALV.), 150, FF/125AARH, 3.0 INCH	1
4	FLNG.FIG.8, ASME-B16.48, ASTM A 516N Gr.70 (GALV.), 150, FF/125AARH, 3.0 INCH	1
5	T.RED, B-16.9, ASTM A 234 GR.WPB, BW, 4.0 INCH, STD, 3.0 INCH, STD	1
6	VLV.GATE, SHEET 513FE, 3.0 INCH	1
7	BOLT.STUD WITH 2 NUTS, B-18.2, A193 GR.B7(GALV), A194 2H(GALV), 0.625 INCH X 4.0 INCH	4
8	BOLT.STUD WITH 2 NUTS, B-18.2, A193 GR.B7(GALV), A194 2H(GALV), 0.625 INCH X 3.75 INCH	4
9	GASKET, B-16.21-ANSI B16.5, NONASB. SYN FIBRE+ RUBR BINDER, FULLFACE, 150, 3.0 INCH, 2 MM	3
10	GASKET, B-16.20-ANSI B16.5, LS SP.WND SS316+FLEX GRAFIL+IR, SPIRAL, 150, 3.0 INCH	1

B366-088-16-43-SK-1308(TP-023)

S.NO	DESCRIPTION	QTY
1	FLNG.BLIND, B-16.5, ASTM A 105 (NORMALISED), 150, RF/125AARH, IBR, 2.0 INCH	1
2	FLNG.FIG.8, ASME-B16.48, ASTM A 516 GR.70(NORMALISED), 150, FF/125AARH, IBR, 2.0 INCH	1
3	VLV.GATE, SHEET 513AB, IBR, 2.0 INCH	1
4	BOLT.STUD WITH 2 NUTS, B-18.2, A193 GR.B7, A194 GR.2H, 0.625 INCH X 3.75 INCH	4
5	BOLT.STUD WITH 2 NUTS, B-18.2, A193 GR.B7, A194 GR.2H, 0.625 INCH X 3.25 INCH	4
6	GASKET, B-16.20-ANSI B16.5, LS SP.WND SS316+FLEX GRAFIL+IR, SPIRAL, 150, 2.0 INCH	3

B366-088-16-43-SK-1309(TP-024)

S.NO	DESCRIPTION	QTY
1	FLNG.BLIND, B-16.5, ASTM A 105 (NORMALISED), 600, RF/125AARH, IBR, 4.0 INCH	1
2	FLNG.FIG.8, ASME-B16.48, ASTM A 516 GR.70(NORMALISED), 600, FF/125AARH, IBR, 4.0 INCH	1
3	VLV.GATE, SHEET 515DB, IBR, 4.0 INCH	1
4	BOLT.STUD WITH 2 NUTS, B-18.2, A193 GR.B7, A194 GR.2H, 0.875 INCH X 5.75 INCH	8
5	BOLT.STUD WITH 2 NUTS, B-18.2, A193 GR.B7, A194 GR.2H, 0.875 INCH X 6.5 INCH	8
6	GASKET, B-16.20-ANSI B16.5, SP.WND SS316+GRAFIL+ I RING, SPIRAL, 600, 4.0 INCH	3

B366-088-16-43-SK-1310(TP-025)

S.NO	DESCRIPTION	QTY
1	FLNG.BLIND, B-16.5, ASTM A 105 (NORMALISED), 150, RF/125AARH, 6.0 INCH	1
2	FLNG.FIG.8, ASME-B16.48, ASTM A 516 GR.70(NORMALISED), 150, FF/125AARH, 6.0 INCH	1
3	VLV.BALL, SHEET 543LA, 6.0 INCH	1
4	BOLT.STUD WITH 2 NUTS, B-18.2, A193 GR.B7, A194 GR.2H, 0.75 INCH X 4.75 INCH	8
5	BOLT.STUD WITH 2 NUTS, B-18.2, A193 GR.B7, A194 GR.2H, 0.75 INCH X 4 INCH	8
6	GASKET, B-16.20-ANSI B16.5, LS SP.WND SS316+FLEX GRAFIL+IR, SPIRAL, 150, 6.0 INCH	3

B366-088-16-43-SK-1311(TP-026)

S.NO	DESCRIPTION	QTY
1	PIPE, B-36.10, ASTM A 106 GR.B, BE, SEAMLESS, IBR, 10.0 INCH, STD	0.4
2	FLNG.WN, B-16.5, ASTM A 105 (NORMALISED), 150, RF/125AARH, IBR, 10.0 INCH, STD	1
3	FLNG.BLIND, B-16.5, ASTM A 105 (NORMALISED), 150, RF/125AARH, IBR, 10.0 INCH	1
4	SPCR&BLND, ASME-B16.48, ASTM A 516 GR.70(NORMALISED), 150, FF/125AARH, IBR, 10.0 INCH	1
5	T.RED, B-16.9, ASTM A 234 GR.WPB, BW, IBR, 12.0 INCH, STD, 10.0 INCH, STD	1
6	VLV.GATE, SHEET 513AB, IBR, 10.0 INCH	1
7	BOLT.STUD WITH 2 NUTS, B-18.2, A193 GR.B7, A194 GR.2H, 0.875 INCH X 4.75 INCH	12
8	BOLT.STUD WITH 2 NUTS, B-18.2, A193 GR.B7, A194 GR.2H, 0.875 INCH X 5.5 INCH	12
9	GASKET, B-16.20-ANSI B16.5, LS SP.WND SS316+FLEX GRAFIL+IR, SPIRAL, 150, 10.0 INCH	3

B366-088-16-43-SK-1312(TP-028)

S.NO	DESCRIPTION	QTY
1	PIPE, B-36.10, ASTM A 106 GR.B, BE, SEAMLESS, 2.0 INCH, XS	0.4
2	FLNG.WN, B-16.5, ASTM A 105 (NORMALISED), 150, RF/125AARH, 2.0 INCH, XS	1
3	FLNG.BLIND, B-16.5, ASTM A 105 N (GALV.), 150, FF/125AARH, 2.0 INCH	1

TIE IN MTO

4	FLNG.FIG.8, ASME-B16.48, ASTM A 516N Gr.70 (GALV.), 150, FF/125AARH, 2.0 INCH	1
5	VLV.GATE, SHEET 513FE, 2.0 INCH	1
6	BOLT.STUD WITH 2 NUTS, B-18.2, A193 GR.B7(GALV), A194 2H(GALV), 0.625 INCH X 3.75 INCH	4
7	BOLT.STUD WITH 2 NUTS, B-18.2, A193 GR.B7(GALV), A194 2H(GALV), 0.625 INCH X 3.25 INCH	4
8	GASKET, B-16.21-ANSI B16.5, NONASB. SYN FIBRE+ RUBR BINDER, FULLFACE, 150, 2.0 INCH, 2 MM	3
9	GASKET, B-16.20-ANSI B16.5, LS SP.WND SS316+FLEX GRAFIL+IR, SPIRAL, 150, 2.0 INCH	1

B366-088-16-43-SK-1313(TP-029)

S.NO	DESCRIPTION	QTY
1	PIPE, B-36.10, ASTM A 106 GR.B, BE, SEAMLESS, 3.0 INCH, STD	0.5
2	FLNG.WN, B-16.5, ASTM A 105 (NORMALISED), 150, RF/125AARH, 3.0 INCH, STD	1
3	FLNG.BLIND, B-16.5, ASTM A 105 (NORMALISED), 150, RF/125AARH, 3.0 INCH	1
4	FLNG.FIG.8, ASME-B16.48, ASTM A 516 GR.70(NORMALISED), 150, FF/125AARH, 3.0 INCH	1
5	VLV.GATE, SHEET 513DA, 3.0 INCH	1
6	BOLT.STUD WITH 2 NUTS, B-18.2, A193 GR.B7, A194 GR.2H, 0.625 INCH X 3.75 INCH	4
7	BOLT.STUD WITH 2 NUTS, B-18.2, A193 GR.B7, A194 GR.2H, 0.625 INCH X 4 INCH	4
8	GASKET, B-16.20-ANSI B16.5, LS SP.WND SS316+FLEX GRAFIL+IR, SPIRAL, 150, 3.0 INCH	3

B366-088-16-43-SK-1314(TP-030)

S.NO	DESCRIPTION	QTY
1	PIPE, B-36.10, ASTM A 106 GR.B(GALV), BE, SEAMLESS, 3.0 INCH, STD	0.4
2	FLNG.SO, B-16.5, ASTM A 105 N (GALV.), 150, FF/125AARH, 3.0 INCH	1
3	FLNG.BLIND, B-16.5, ASTM A 105 N (GALV.), 150, FF/125AARH, 3.0 INCH	1
4	FLNG.FIG.8, ASME-B16.48, ASTM A 516N Gr.70 (GALV.), 150, FF/125AARH, 3.0 INCH	1
5	T.RED, B-16.9, ASTM A 234 GR.WPB(GALV), BW, 6.0 INCH, STD, 3.0 INCH, STD	1
6	VLV.GATE, SHEET 513FE, 3.0 INCH	1
7	BOLT.STUD WITH 2 NUTS, B-18.2, A193 GR.B7(GALV), A194 2H(GALV), 0.625 INCH X 3.75 INCH	4
8	BOLT.STUD WITH 2 NUTS, B-18.2, A193 GR.B7(GALV), A194 2H(GALV), 0.625 INCH X 4.0 INCH	4
9	GASKET, B-16.21-ANSI B16.5, NONASB. SYN FIBRE+ RUBR BINDER, FULLFACE, 150, 3.0 INCH, 2 MM	3

B366-088-16-43-SK-1315(TP-033)

S.NO	DESCRIPTION	QTY
1	PIPE, B-36.10, ASTM A 106 GR.B, BE, SEAMLESS, IBR, 6.0 INCH, S120	0.3
2	FLNG.WN, B-16.5, ASTM A 105 (NORMALISED), 600, RF/125AARH, IBR, 6.0 INCH, S120	1
3	FLNG.BLIND, B-16.5, ASTM A 105 (NORMALISED), 600, RF/125AARH, IBR, 6.0 INCH	1
4	FLNG.FIG.8, ASME-B16.48, ASTM A 516 GR.70(NORMALISED), 600, FF/125AARH, IBR, 6.0 INCH	1
5	T.RED, B-16.9, ASTM A 234 GR.WPB, BW, IBR, 8.0 INCH, S100, 6.0 INCH, S120	1
6	VLV.GATE, SHEET 515DB, IBR, 6.0 INCH	2
7	BOLT.STUD WITH 3 NUTS, B-18.2, A193 GR.B7, A194 GR.2H, 1.0 INCH X 8.75 INCH	12
8	BOLT.STUD WITH 3 NUTS, B-18.2, A193 GR.B7, A194 GR.2H, 1.0 INCH X 7.75 INCH	24
9	GASKET, B-16.20-ANSI B16.5, SP.WND SS316+GRAFIL+ I RING, SPIRAL, 600, 6.0 INCH	4

B366-088-16-43-SK-1316(TP-034)

S.NO	DESCRIPTION	QTY
1	PIPE, B-36.10, ASTM A 106 GR.B, BE, SEAMLESS, 4.0 INCH, STD	0.3
2	FLNG.WN, B-16.5, ASTM A 105 (NORMALISED), 150, RF/125AARH, 4.0 INCH, STD	1
3	FLNG.BLIND, B-16.5, ASTM A 105 N (GALV.), 150, FF/125AARH, 4.0 INCH	1
4	FLNG.FIG.8, ASME-B16.48, ASTM A 516N Gr.70 (GALV.), 150, FF/125AARH, 4.0 INCH	1
5	T.EQUAL, B-16.9, ASTM A 234 GR.WPB, BW, 4.0 INCH, STD	1
6	VLV.GATE, SHEET 513FE, 4.0 INCH	1
7	BOLT.STUD WITH 2 NUTS, B-18.2, A193 GR.B7(GALV), A194 2H(GALV), 0.625 INCH X 3.75 INCH	8
8	BOLT.STUD WITH 2 NUTS, B-18.2, A193 GR.B7(GALV), A194 2H(GALV), 0.625 INCH X 4.25 INCH	8
9	GASKET, B-16.21-ANSI B16.5, NONASB. SYN FIBRE+ RUBR BINDER, FULLFACE, 150, 4.0 INCH, 2 MM	3
10	GASKET, B-16.20-ANSI B16.5, LS SP.WND SS316+FLEX GRAFIL+IR, SPIRAL, 150, 4.0 INCH	1

B366-088-16-43-SK-1317(TP-037)

S.NO	DESCRIPTION	QTY
1	PIPE, B-36.10, ASTM A 106 GR.B, BE, SEAMLESS, 8.0 INCH, STD	0.6
2	FLNG.WN, B-16.5, ASTM A 105 (NORMALISED), 150, RF/125AARH, 8.0 INCH, STD	1
3	FLNG.BLIND, B-16.5, ASTM A 105 (NORMALISED), 150, RF/125AARH, 8.0 INCH	1
4	FLNG.FIG.8, ASME-B16.48, ASTM A 516 GR.70(NORMALISED), 150, FF/125AARH, 8.0 INCH	1

TIE IN MTO

5	T.RED, B-16.9, ASTM A 234 GR.WPB, BW, 10.0 INCH, STD, 8.0 INCH, STD	1
6	VLV.BALL, SHEET 543LA, 8.0 INCH	1
7	BOLT.STUD WITH 2 NUTS, B-18.2, A193 GR.B7, A194 GR.2H, 0.75 INCH X 4.25 INCH	8
8	BOLT.STUD WITH 2 NUTS, B-18.2, A193 GR.B7, A194 GR.2H, 0.75 INCH X 5 INCH	8
9	GASKET, B-16.20-ANSI B16.5, LS SP.WND SS316+FLEX GRAFIL+IR, SPIRAL, 150, 8.0 INCH	3

B366-088-16-43-SK-1319(TP-XX1)

S.NO	DESCRIPTION	QTY
1	PIPE, B-36.19, ASTM A 312 TP304L, BE, SEAMLESS, 2.0 INCH, 40S	0.5
2	PIPE, B-36.19, ASTM A 358 TP304L CL.1, BE, E.FS.W, 14.0 INCH, 10S	0.102
3	REINF.PAD, ASTM A 358 TP304L CL.1, 14.0 INCH, 10S, 2.0 INCH	1
4	FLNG.WN, B-16.5, ASTM A 182 GR.F304L, 150, RF/125AARH, 2.0 INCH, 40S	1
5	FLNG.BLIND, B-16.5, ASTM A 182 GR.F304L, 150, RF/125AARH, 2.0 INCH	1
6	FLNG.FIG.8, ASME-B16.48, ASTM A 240 GR.304L, 150, FF/125AARH, 2.0 INCH	1
7	VLV.GATE, SHEET 513AL, 2.0 INCH	1
8	BOLT.STUD WITH 2 NUTS, B-18.2, A193 GR.B7, A194 GR.2H, 0.625 INCH X 3.75 INCH	4
9	BOLT.STUD WITH 2 NUTS, B-18.2, A193 GR.B7, A194 GR.2H, 0.625 INCH X 3.25 INCH	4
10	GASKET, B-16.20-ANSI B16.5, LS SP.WND SS316+FLEX GRAFIL+IR, SPIRAL, 150, 2.0 INCH	3

B366-088-16-43-SK-1320(TP-XX2)

S.NO	DESCRIPTION	QTY
1	PIPE, B-36.19, ASTM A 312 TP304L, BE, SEAMLESS, 2.0 INCH, 40S	0.5
2	PIPE, B-36.19, ASTM A 358 TP304L CL.1, BE, E.FS.W, 14.0 INCH, 10S	0.102
3	REINF.PAD, ASTM A 358 TP304L CL.1, 14.0 INCH, 10S, 2.0 INCH	1
4	FLNG.WN, B-16.5, ASTM A 182 GR.F304L, 150, RF/125AARH, 2.0 INCH, 40S	1
5	FLNG.BLIND, B-16.5, ASTM A 182 GR.F304L, 150, RF/125AARH, 2.0 INCH	1
6	FLNG.FIG.8, ASME-B16.48, ASTM A 240 GR.304L, 150, FF/125AARH, 2.0 INCH	1
7	VLV.GATE, SHEET 513AL, 2.0 INCH	1
8	BOLT.STUD WITH 2 NUTS, B-18.2, A193 GR.B7, A194 GR.2H, 0.625 INCH X 3.25 INCH	4
9	BOLT.STUD WITH 2 NUTS, B-18.2, A193 GR.B7, A194 GR.2H, 0.625 INCH X 3.75 INCH	4
10	GASKET, B-16.20-ANSI B16.5, LS SP.WND SS316+FLEX GRAFIL+IR, SPIRAL, 150, 2.0 INCH	3

B366-088-16-43-SK-1330(TP-101)

S.NO	DESCRIPTION	QTY
1	PIPE, B-36.10, ASTM A 106 GR.B, PE, SEAMLESS, IBR, 1.5 INCH, XS	0.3
2	FLNG.WN, B-16.5, ASTM A 105 (NORMALISED), 150, RF/125AARH, IBR, 1.5 INCH, XS	1
3	FLNG.BLIND, B-16.5, ASTM A 105 (NORMALISED), 150, RF/125AARH, IBR, 1.5 INCH	1
4	FLNG.FIG.8, ASME-B16.48, ASTM A 516 GR.70(NORMALISED), 150, FF/125AARH, IBR, 1.5 INCH	1
5	SOCKOLET, MSS-SP97, ASTM A 105 (NORMALISED), SW, 3000, IBR, 24.0 INCH, 1.5 INCH	1
6	VLV.GATE, SHEET 510AB, IBR, 1.5 INCH	1
7	BOLT.STUD WITH 2 NUTS, B-18.2, A193 GR.B7, A194 GR.2H, 0.5 INCH X 3.25 INCH	4
8	GASKET, B-16.20-ANSI B16.5, LS SP.WND SS316+FLEX GRAFIL+IR, SPIRAL, 150, 1.5 INCH	2

B366-088-16-43-SK-1331(TP-102)

S.NO	DESCRIPTION	QTY
1	PIPE, B-36.10, ASTM A 106 GR.B, PE, SEAMLESS, IBR, 1.5 INCH, XS	5.1
2	FLNG.WN, B-16.5, ASTM A 105 (NORMALISED), 150, RF/125AARH, IBR, 1.5 INCH, XS	17
3	FLNG.BLIND, B-16.5, ASTM A 105 (NORMALISED), 150, RF/125AARH, IBR, 1.5 INCH	17
4	FLNG.FIG.8, ASME-B16.48, ASTM A 516 GR.70(NORMALISED), 150, FF/125AARH, IBR, 1.5 INCH	17
5	SOCKOLET, MSS-SP97, ASTM A 105 (NORMALISED), SW, 3000, IBR, 12.0 INCH, 1.5 INCH	17
6	VLV.GATE, SHEET 510AB, IBR, 1.5 INCH	17
7	BOLT.STUD WITH 2 NUTS, B-18.2, A193 GR.B7, A194 GR.2H, 0.5 INCH X 3.25 INCH	68
8	GASKET, B-16.20-ANSI B16.5, LS SP.WND SS316+FLEX GRAFIL+IR, SPIRAL, 150, 1.5 INCH	34

B366-088-16-43-SK-1332(TP-103)

S.NO	DESCRIPTION	QTY
1	PIPE, B-36.10, ASTM A 106 GR.B, PE, SEAMLESS, IBR, 1.5 INCH, XS	0.9
2	FLNG.WN, B-16.5, ASTM A 105 (NORMALISED), 150, RF/125AARH, IBR, 1.5 INCH, XS	3
3	FLNG.BLIND, B-16.5, ASTM A 105 (NORMALISED), 150, RF/125AARH, IBR, 1.5 INCH	3
4	FLNG.FIG.8, ASME-B16.48, ASTM A 516 GR.70(NORMALISED), 150, FF/125AARH, IBR, 1.5 INCH	3
5	SOCKOLET, MSS-SP97, ASTM A 105 (NORMALISED), SW, 3000, IBR, 18.0 INCH, 1.5 INCH	3

TIE IN MTO

6	VLV.GATE, SHEET 510AB, IBR, 1.5 INCH	3
7	BOLT.STUD WITH 2 NUTS, B-18.2, A193 GR.B7, A194 GR.2H, 0.5 INCH X 3.25 INCH	12
8	GASKET, B-16.20-ANSI B16.5, LS SP.WND SS316+FLEX GRAFIL+IR, SPIRAL, 150, 1.5 INCH	6

B366-088-16-43-SK-1333(TP-104)

S.NO	DESCRIPTION	QTY
1	PIPE, B-36.10, ASTM A 106 GR.B, PE, SEAMLESS, IBR, 1.5 INCH, XS	0.6
2	FLNG.WN, B-16.5, ASTM A 105 (NORMALISED), 150, RF/125AARH, IBR, 1.5 INCH, XS	2
3	FLNG.BLIND, B-16.5, ASTM A 105 (NORMALISED), 150, RF/125AARH, IBR, 1.5 INCH	2
4	FLNG.FIG.8, ASME-B16.48, ASTM A 516 GR.70(NORMALISED), 150, FF/125AARH, IBR, 1.5 INCH	2
5	SOCKOLET, MSS-SP97, ASTM A 105 (NORMALISED), SW, 3000, IBR, 10.0 INCH, 1.5 INCH	2
6	VLV.GATE, SHEET 510AB, IBR, 1.5 INCH	2
7	BOLT.STUD WITH 2 NUTS, B-18.2, A193 GR.B7, A194 GR.2H, 0.5 INCH X 3.25 INCH	8
8	GASKET, B-16.20-ANSI B16.5, LS SP.WND SS316+FLEX GRAFIL+IR, SPIRAL, 150, 1.5 INCH	4

B366-088-16-43-SK-1334(TP-105)

S.NO	DESCRIPTION	QTY
1	PIPE, B-36.10, ASTM A 106 GR.B, PE, SEAMLESS, IBR, 0.75 INCH, S160	1.2
2	FLNG.WN, B-16.5, ASTM A 105 (NORMALISED), 150, RF/125AARH, IBR, 0.75 INCH, S160	4
3	FLNG.BLIND, B-16.5, ASTM A 105 (NORMALISED), 150, RF/125AARH, IBR, 0.75 INCH	4
4	FLNG.FIG.8, ASME-B16.48, ASTM A 516 GR.70(NORMALISED), 150, FF/125AARH, IBR, 0.75 INCH	4
5	SOCKOLET, MSS-SP97, ASTM A 105 (NORMALISED), SW, 6000, IBR, 12.0 INCH, 0.75 INCH	4
6	VLV.GATE, SHEET 510AB, IBR, 0.75 INCH	4
7	BOLT.STUD WITH 2 NUTS, B-18.2, A193 GR.B7, A194 GR.2H, 0.5 INCH X 2.75 INCH	16
8	GASKET, B-16.20-ANSI B16.5, LS SP.WND SS316+FLEX GRAFIL+IR, SPIRAL, 150, 0.75 INCH	8

B366-088-16-43-SK-1335(TP-106)

S.NO	DESCRIPTION	QTY
1	PIPE, B-36.10, ASTM A 106 GR.B, PE, SEAMLESS, IBR, 0.75 INCH, S160	1
2	FLNG.SW, B-16.5, ASTM A 105 (NORMALISED), 600, RF/125AARH, IBR, 0.75 INCH, S160	3
3	FLNG.BLIND, B-16.5, ASTM A 105 (NORMALISED), 600, RF/125AARH, IBR, 0.75 INCH	3
4	FLNG.FIG.8, ASME-B16.48, ASTM A 516 GR.70(NORMALISED), 600, FF/125AARH, IBR, 0.75 INCH	3
5	SOCKOLET, MSS-SP97, ASTM A 105 (NORMALISED), SW, 6000, IBR, 12.0 INCH, 0.75 INCH	3
6	VLV.GATE, SHEET 510DB, IBR, 0.75 INCH	3
7	BOLT.STUD WITH 2 NUTS, B-18.2, A193 GR.B7, A194 GR.2H, 0.625 INCH X 4 INCH	12
8	GASKET, B-16.20-ANSI B16.5, SP.WND SS316+GRAFIL+ I RING, SPIRAL, 600, 0.75 INCH	6

B366-088-16-43-SK-1401(TP-015)

S.NO	DESCRIPTION	QTY
1	PIPE, B-36.10, ASTM A 106 GR.B, BE, SEAMLESS, IBR, 12.0 INCH, XS	5.8
2	FLNG.WN, B-16.5, ASTM A 105 (NORMALISED), 600, RF/125AARH, IBR, 12.0 INCH, XS	2
3	FLNG.BLIND, B-16.5, ASTM A 105 (NORMALISED), 600, RF/125AARH, IBR, 12.0 INCH	1
4	SPCR&BLND, ASME-B16.48, ASTM A 516 GR.70(NORMALISED), 600, FF/125AARH, IBR, 12.0 INCH	1
5	VLV.GATE, SHEET 515AB, IBR, 12.0 INCH	2
6	BOLT.STUD WITH 3 NUTS, B-18.2, A193 GR.B7, A194 GR.2H, 1.25 INCH X 10 INCH	60
7	BOLT.STUD WITH 3 NUTS, B-18.2, A193 GR.B7, A194 GR.2H, 1.25 INCH X 11.75 INCH	20
8	GASKET, B-16.20-ANSI B16.5, SP.WND SS316+GRAFIL+ I RING, SPIRAL, 600, 12.0 INCH	5

B366-088-16-43-SK-1402(TP-016)

S.NO	DESCRIPTION	QTY
1	PIPE, B-36.10, ASTM A 106 GR.B, BE, SEAMLESS, IBR, 6.0 INCH, XS	0.3
2	FLNG.WN, B-16.5, ASTM A 105 (NORMALISED), 600, RF/125AARH, IBR, 6.0 INCH, XS	1
3	FLNG.BLIND, B-16.5, ASTM A 105 (NORMALISED), 600, RF/125AARH, IBR, 6.0 INCH	1
4	FLNG.FIG.8, ASME-B16.48, ASTM A 516 GR.70(NORMALISED), 600, FF/125AARH, IBR, 6.0 INCH	1
5	T.RED, B-16.9, ASTM A 234 GR.WPB, BW, IBR, 10.0 INCH, XS, 6.0 INCH, XS	1
6	VLV.GATE, SHEET 515AB, IBR, 6.0 INCH	2
7	BOLT.STUD WITH 3 NUTS, B-18.2, A193 GR.B7, A194 GR.2H, 1.0 INCH X 7.75 INCH	24
8	BOLT.STUD WITH 3 NUTS, B-18.2, A193 GR.B7, A194 GR.2H, 1.0 INCH X 8.75 INCH	12
9	GASKET, B-16.20-ANSI B16.5, SP.WND SS316+GRAFIL+ I RING, SPIRAL, 600, 6.0 INCH	4

B366-088-16-43-SK-1403(TP-017)

S.NO	DESCRIPTION	QTY
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TIE IN MTO

1	FLNG.BLIND, B-16.5, ASTM A 105 (NORMALISED), 150, RF/125AARH, IBR, 24.0 INCH	1
2	SPCR&BLND, ASME-B16.48, ASTM A 516 GR.70(NORMALISED), 150, FF/125AARH, IBR, 24.0 INCH	1
3	VLV.GATE, SHEET 513AB, IBR, 24.0 INCH	1
4	BOLT.STUD WITH 3 NUTS, B-18.2, A193 GR.B7, A194 GR.2H, 1.25 INCH X 8 INCH	20
5	BOLT.STUD WITH 3 NUTS, B-18.2, A193 GR.B7, A194 GR.2H, 1.25 INCH X 9.5 INCH	20
6	GASKET, B-16.20-ANSI B16.5, LS SP.WND SS316+FLEX GRAFIL+IR, SPIRAL, 150, 24.0 INCH	3

B366-088-16-43-SK-1404(TP-021)

S.NO	DESCRIPTION	QTY
1	PIPE, B-36.10, ASTM A 106 GR.B, BE, SEAMLESS, IBR, 4.0 INCH, STD	0.5
2	PIPE, B-36.10, ASTM A 672 GR.B60 CL.32, BE, E.FS.W, IBR, 16.0 INCH, STD	0.203
3	REINF.PAD, ASTM A 672 GR.B60 CL.32, IBR, 16.0 INCH, STD, 4.0 INCH	1
4	FLNG.WN, B-16.5, ASTM A 105 (NORMALISED), 150, RF/125AARH, IBR, 4.0 INCH, STD	1
5	FLNG.BLIND, B-16.5, ASTM A 105 (NORMALISED), 150, RF/125AARH, IBR, 4.0 INCH	1
6	FLNG.FIG.8, ASME-B16.48, ASTM A 516 GR.70(NORMALISED), 150, FF/125AARH, IBR, 4.0 INCH	1
7	VLV.GATE, SHEET 513AB, IBR, 4.0 INCH	1
8	BOLT.STUD WITH 2 NUTS, B-18.2, A193 GR.B7, A194 GR.2H, 0.625 INCH X 4.25 INCH	8
9	BOLT.STUD WITH 2 NUTS, B-18.2, A193 GR.B7, A194 GR.2H, 0.625 INCH X 3.75 INCH	8
10	GASKET, B-16.20-ANSI B16.5, LS SP.WND SS316+FLEX GRAFIL+IR, SPIRAL, 150, 4.0 INCH	3

B366-088-16-43-SK-1405(TP-022)

S.NO	DESCRIPTION	QTY
1	PIPE, B-36.10, ASTM A 106 GR.B, BE, SEAMLESS, NACE, 6.0 INCH, STD	3.2
2	PIPE, B-36.10, ASTM A 671 GR.CC60 CL.32, BE, E.FS.W, NACE, 42.0 INCH, XS	0.305
3	REINF.PAD, ASTM A 671 GR.CC60 CL.32, NACE, 42.0 INCH, XS, 6.0 INCH	1
4	FLNG.WN, B-16.5, ASTM A 105 (NORMALISED), 150, RF/125AARH, NACE, 6.0 INCH, STD	3
5	FLNG.BLIND, B-16.5, ASTM A 105 (NORMALISED), 150, RF/125AARH, NACE, 6.0 INCH	1
6	FLNG.FIG.8, ASME-B16.48, ASTM A 516 GR.70(NORMALISED), 150, FF/125AARH, NACE, 6.0 INCH	1
7	ELBOW.90, B-16.9, ASTM A 234 GR.WPB, BW, 1.5D, NACE, 6.0 INCH, STD	1
8	VLV.GATE, SHEET 513HC, NACE, 6.0 INCH, LOCK OPEN, FULL BORE	2
9	BOLT.STUD WITH 2 NUTS, B-18.2, A193 GR.B7M, A194 GR.2HM, NACE, 0.75 INCH X 4.0 INCH	24
10	BOLT.STUD WITH 2 NUTS, B-18.2, A193 GR.B7M, A194 GR.2HM, NACE, 0.75 INCH X 4.75 INCH	8
11	GASKET, B-16.20-ANSI B16.5, LS SP.WND SS316+FLEX GRAFIL+IR, SPIRAL, 150, NACE, 6.0 INCH	5

B366-088-16-43-SK-1406(TP-031)

S.NO	DESCRIPTION	QTY
1	PIPE, B-36.10, ASTM A 106 GR.B, BE, SEAMLESS, IBR, 10.0 INCH, XS	5.9
2	FLNG.WN, B-16.5, ASTM A 105 (NORMALISED), 600, RF/125AARH, IBR, 10.0 INCH, XS	3
3	FLNG.BLIND, B-16.5, ASTM A 105 (NORMALISED), 600, RF/125AARH, IBR, 10.0 INCH	1
4	SPCR&BLND, ASME-B16.48, ASTM A 516 GR.70(NORMALISED), 600, FF/125AARH, IBR, 10.0 INCH	1
5	ELBOW.90, B-16.9, ASTM A 234 GR.WPB, BW, 1.5D, IBR, 10.0 INCH, XS	1
6	T.EQUAL, B-16.9, ASTM A 234 GR.WPB, BW, IBR, 10.0 INCH, XS	1
7	VLV.GATE, SHEET 515AB, IBR, 10.0 INCH	2
8	BOLT.STUD WITH 3 NUTS, B-18.2, A193 GR.B7, A194 GR.2H, 1.25 INCH X 11.25 INCH	16
9	BOLT.STUD WITH 3 NUTS, B-18.2, A193 GR.B7, A194 GR.2H, 1.25 INCH X 9.75 INCH	48
10	GASKET, B-16.20-ANSI B16.5, SP.WND SS316+GRAFIL+ I RING, SPIRAL, 600, 10.0 INCH	5

B366-088-16-43-SK-1407(TP-036)

S.NO	DESCRIPTION	QTY
1	PIPE, B-36.10, ASTM A 671 GR.CC60 CL.32, BE, E.FS.W, NACE, 24.0 INCH, STD	9.6
2	PIPE, B-36.10, ASTM A 671 GR.CC60 CL.32, BE, E.FS.W, NACE, 42.0 INCH, XS	1.219
3	REINF.PAD, ASTM A 671 GR.CC60 CL.32, NACE, 42.0 INCH, XS, 24.0 INCH	1
4	FLNG.WN, B-16.5, ASTM A 105 (NORMALISED), 150, RF/125AARH, NACE, 24.0 INCH, STD	3
5	FLNG.BLIND, B-16.5, ASTM A 105 (NORMALISED), 150, RF/125AARH, NACE, 24.0 INCH	1
6	SPCR&BLND, ASME-B16.48, ASTM A 516 GR.70(NORMALISED), 150, FF/125AARH, NACE, 24.0 INCH	1
7	ELBOW.90, B-16.9, ASTM A 234 GR.WPB-W, BW, 1.5D, NACE, 24.0 INCH, STD	1
8	VLV.GATE, SHEET 513HC, NACE, 24.0 INCH, LOCK OPEN, FULL BORE	2
9	BOLT.STUD WITH 3 NUTS, B-18.2, A193 GR.B7M, A194 GR.2HM, NACE, 1.25 INCH X 8.0 INCH	60
10	BOLT.STUD WITH 3 NUTS, B-18.2, A193 GR.B7M, A194 GR.2HM, NACE, 1.25 INCH X 9.5 INCH	20
11	GASKET, B-16.20-ANSI B16.5, LS SP.WND SS316+FLEX GRAFIL+IR, SPIRAL, 150, NACE, 24.0 INCH	5





TIE IN MTO

B366-088-16-43-SK-1408(TP-038)

S.NO	DESCRIPTION	QTY
1	PIPE, B-36.10, ASTM A 106 GR.B, BE, SEAMLESS, IBR, 10.0 INCH, STD	0.4
2	FLNG.WN, B-16.5, ASTM A 105 (NORMALISED), 150, RF/125AARH, IBR, 10.0 INCH, STD	1
3	FLNG.BLIND, B-16.5, ASTM A 105 (NORMALISED), 150, RF/125AARH, IBR, 10.0 INCH	1
4	SPCR&BLND, ASME-B16.48, ASTM A 516 GR.70(NORMALISED), 150, FF/125AARH, IBR, 10.0 INCH	1
5	T.RED, B-16.9, ASTM A 234 GR.WPB, BW, IBR, 12.0 INCH, STD, 10.0 INCH, STD	1
6	VLV.GATE, SHEET 513AB, IBR, 10.0 INCH	1
7	BOLT.STUD WITH 2 NUTS, B-18.2, A193 GR.B7, A194 GR.2H, 0.875 INCH X 5.5 INCH	12
8	BOLT.STUD WITH 2 NUTS, B-18.2, A193 GR.B7, A194 GR.2H, 0.875 INCH X 4.75 INCH	12
9	GASKET, B-16.20-ANSI B16.5, LS SP.WND SS316+FLEX GRAFIL+IR, SPIRAL, 150, 10.0 INCH	3

TPTRAC(TPTRAC)

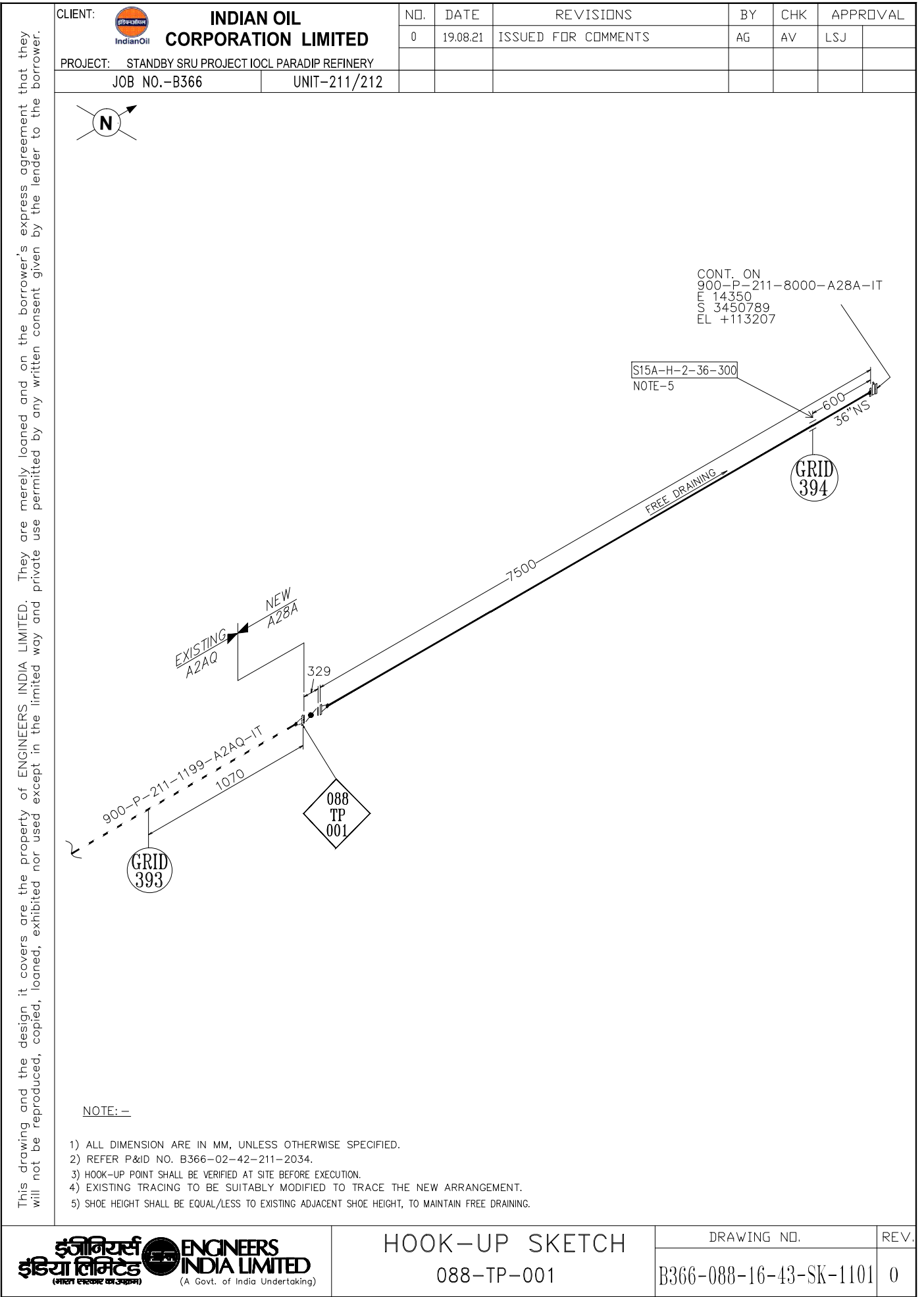
S.NO	DESCRIPTION	QTY
1	PIPE, B-36.10, ASTM A 106 GR.B, PE, SEAMLESS, 0.5 INCH, XS	70
2	PIPE, B-36.10, ASTM A 106 GR.B, PE, SEAMLESS, 0.75 INCH, XS	20
3	FLNG.WN, B-16.5, ASTM A 105 (NORMALISED), 150, RF/125AARH, 0.5 INCH, XS	60
4	FLNG.WN, B-16.5, ASTM A 105 (NORMALISED), 150, RF/125AARH, 0.75 INCH, XS	32
5	ELBOW.90, B-16.11, ASTM A 105 (NORMALISED), SW, 3000, 0.5 INCH	30
6	ELBOW.90, B-16.11, ASTM A 105 (NORMALISED), SW, 3000, 0.75 INCH	10
7	SWAGE.CONC, BS-3799, ASTM A 105 (NORMALISED), PBE, 0.75 INCH, XS, 0.5 INCH, XS	10
8	CPLNG.FULL, B-16.11, ASTM A 105 (NORMALISED), SW, 3000, 0.5 INCH	30
9	CPLNG.FULL, B-16.11, ASTM A 105 (NORMALISED), SW, 3000, 0.75 INCH	10
10	BOLT.STUD WITH 2 NUTS, B-18.2, A193 GR.B7, A194 GR.2H, 0.5 INCH X 2.5 INCH	64
11	BOLT.STUD WITH 2 NUTS, B-18.2, A193 GR.B7, A194 GR.2H, 0.5 INCH X 2.25 INCH	120
12	GASKET, B-16.20-ANSI B16.5, LS SP.WND SS316+FLEX GRAFIL+IR, SPIRAL, 150, 0.5 INCH	30
13	GASKET, B-16.20-ANSI B16.5, LS SP.WND SS316+FLEX GRAFIL+IR, SPIRAL, 150, 0.75 INCH	16

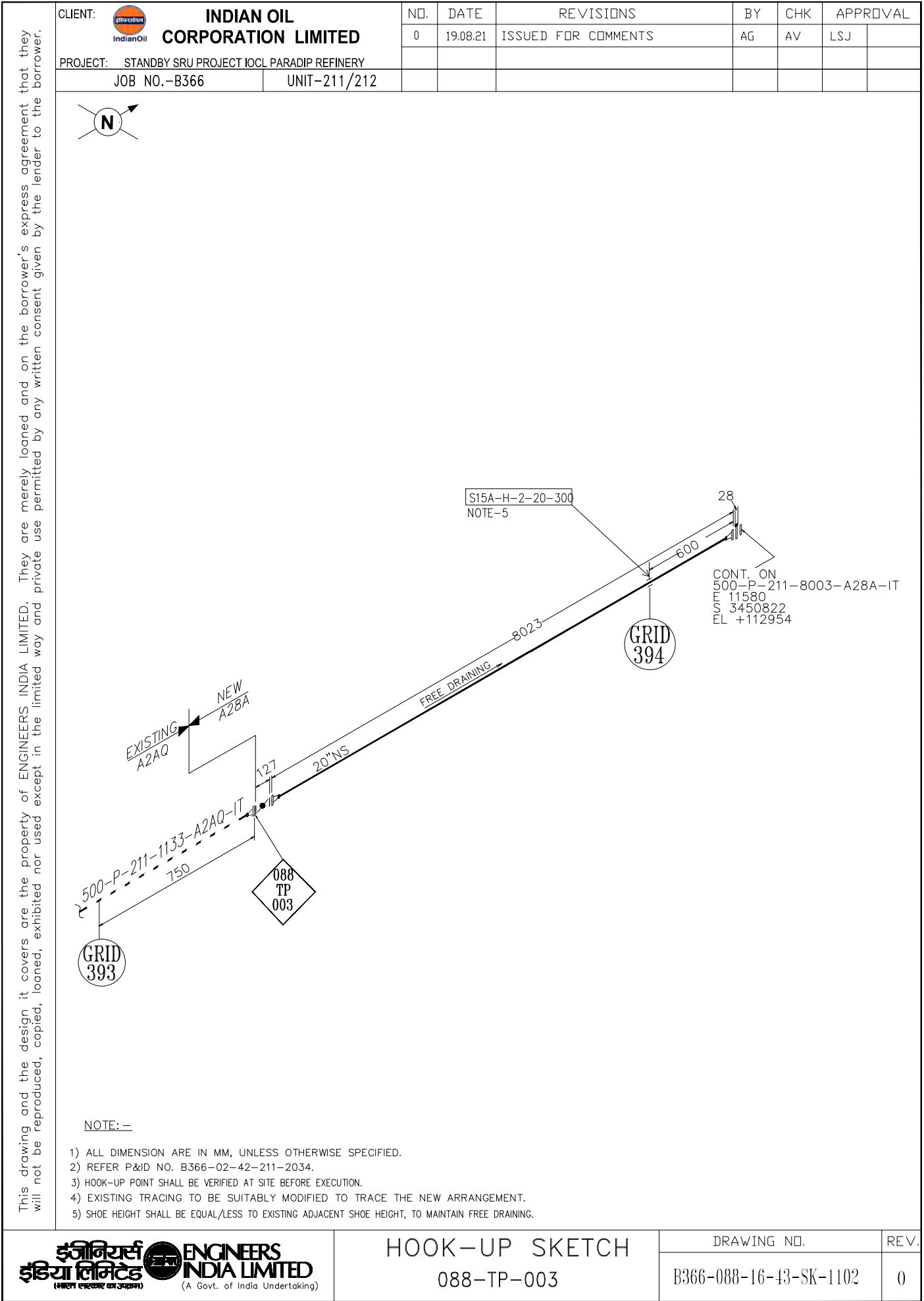
DOCUMENT CATEGORY		DOCUMENT REVIEW STATUS (BY CLIENT)					
(USE "X" MARK)\ <input checked="" type="checkbox"/> APPROVAL <input type="checkbox"/> REVIEW <input type="checkbox"/> INFORMATION							
0	20.08.2021	ISSUED FOR COMMENTS	AG	AV	LSJ		
REV	DATE	DETAILS OF REVISION	PREPARED	CHECKED	APPROVED		
CLIENT	 IndianOil	INDIAN OIL CORPORATION LIMITED PARADIP REFINERY PROJECT PARADIP ODISHA					
CONSULTANT			TECHNIP ENERGIES				
PROJECT	525 TPD STANDBY SRU PROJECT IOCL PARADIP REFINERY, ODISHA, INDIA						
ESC							
	BHEL Hyderabad		NAME	SIGN	DATE		
		DRN					
		CHD					
DEPT. PE&SD.	CODE 450						
The information on this document is the property of BHARAT HEAVY ELECTRICALS LIMITED, It must not be used directly or indirectly in any way detrimental to the interest of the company		TITLE- TIE-IN DRAWINGS					
		BHEL/EIL DRG NO.- B366-088-16-43-SK-1001					REV
		CUST. DRG NO.- 080557C-26899053-PIP-A2301-001					0
		SHT NO.- 1 of 45	NO. OF SHT.- 45				

TIE-IN INDEX			
S.NO.	TIE-IN SKETCH DWG NO.	TIE - IN NO.	REMARKS
1	B366-088-16-43-SK-1101	088-TP-001	
2	B366-088-16-43-SK-1102	088-TP-003	
3	B366-088-16-43-SK-1103	088-TP-010	
4	B366-088-16-43-SK-1104	088-TP-004	
5	B366-088-16-43-SK-1105	090-TP-027	
6	B366-088-16-43-SK-1106	089-TP-039	HOLD
7	B366-088-16-43-SK-1106	089-TP-053	HOLD
8	B366-088-16-43-SK-1106	089-TP-054	HOLD
9	B366-088-16-43-SK-1107	089-TP-040	
10	B366-088-16-43-SK-1107	089-TP-051	
11	B366-088-16-43-SK-1107	089-TP-052	
12	B366-088-16-43-SK-1108	089-TP-041	
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15	B366-088-16-43-SK-1109	089-TP-042	
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21	B366-088-16-43-SK-1115	089-TP-076	
22	B366-088-16-43-SK-1116	089-TP-079	
23	B366-088-16-43-SK-1116	089-TP-080	
24	B366-088-16-43-SK-1201	088-TP-002	
25	B366-088-16-43-SK-1202	088-TP-005	
26	B366-088-16-43-SK-1203	088-TP-006	
27	B366-088-16-43-SK-1204	088-TP-007	
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31	B366-088-16-43-SK-1302	088-TP-012	
32	B366-088-16-43-SK-1303	088-TP-013	
33	B366-088-16-43-SK-1304	088-TP-014	
34	B366-088-16-43-SK-1305	088-TP-018	
35	B366-088-16-43-SK-1306	088-TP-019	HEADER SIZE (10" OR 8") TO BE CONFIRMED AT SITE.
36	B366-088-16-43-SK-1307	088-TP-020	
37	B366-088-16-43-SK-1308	088-TP-023	
38	B366-088-16-43-SK-1309	088-TP-024	
39	B366-088-16-43-SK-1310	088-TP-025	
40	B366-088-16-43-SK-1311	088-TP-026	
41	B366-088-16-43-SK-1312	090-TP-028	
42	B366-088-16-43-SK-1313	090-TP-029	
43	B366-088-16-43-SK-1314	090-TP-030	
44	B366-088-16-43-SK-1315	090-TP-033	HEADER SIZE (10" OR 8") TO BE CONFIRMED AT SITE.
45	B366-088-16-43-SK-1316	090-TP-034	
46	B366-088-16-43-SK-1317	090-TP-037	
47	B366-088-16-43-SK-1318	088-TP-043	HOLD
48	B366-088-16-43-SK-1319	088-TP-XX1	HOLD
49	B366-088-16-43-SK-1320	090-TP-XX2	HOLD
50	B366-088-16-43-SK-1330	086-TP-XXX	DETAILS OF TIE-IN TO BE CONFIRMED BY PROCESS
51	B366-088-16-43-SK-1330	087-TP-XXX	DETAILS OF TIE-IN TO BE CONFIRMED BY PROCESS
52	B366-088-16-43-SK-1330	089-TP-XXX	DETAILS OF TIE-IN TO BE CONFIRMED BY PROCESS
53	B366-088-16-43-SK-1330	212-TP-101	DETAILS OF TIE-IN TO BE CONFIRMED BY PROCESS
54	B366-088-16-43-SK-1401	088-TP-015	
55	B366-088-16-43-SK-1402	088-TP-016	
56	B366-088-16-43-SK-1403	088-TP-017	
57	B366-088-16-43-SK-1404	088-TP-021	
58	B366-088-16-43-SK-1405	088-TP-022	
59	B366-088-16-43-SK-1406	090-TP-031	
60	B366-088-16-43-SK-1407	090-TP-036	
61	B366-088-16-43-SK-1408	090-TP-038	
62	B366-088-16-43-SK-1409	088-TP-044	HOLD


NOTES

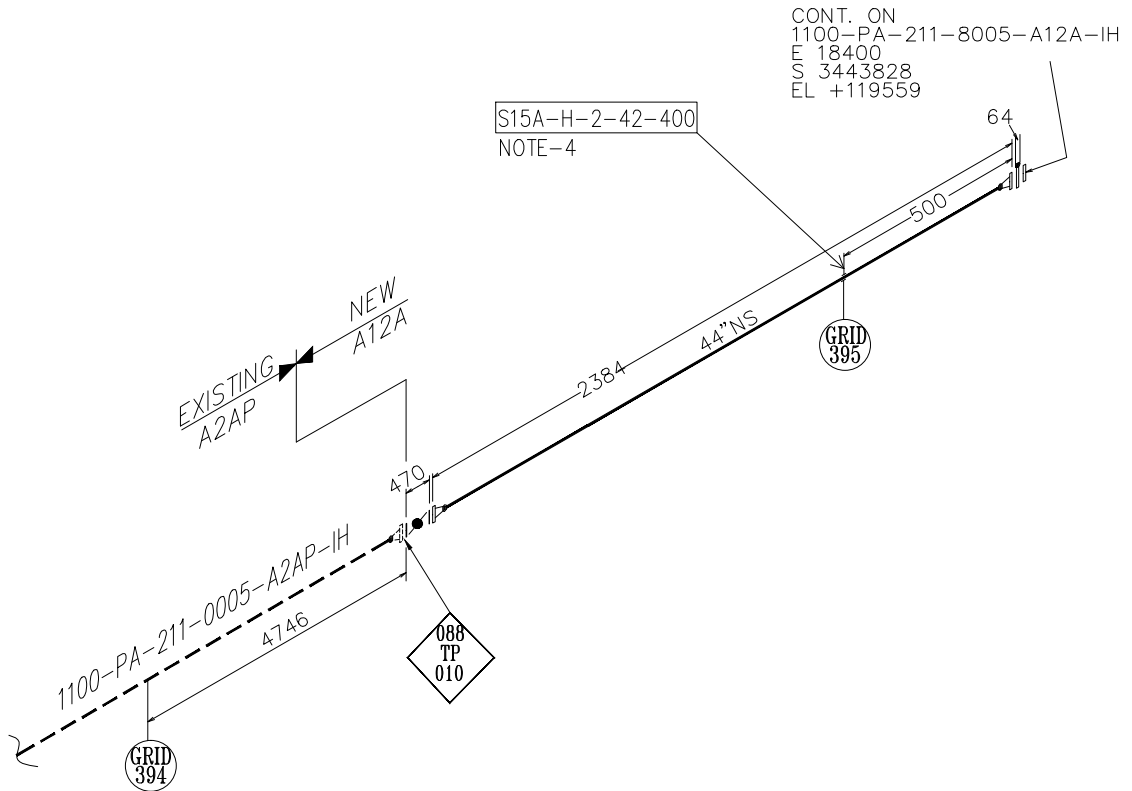
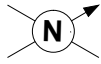
- 1 Insulation to be considered as per the P&ID.
- 2 No condensate recovery from Steam tracing/jacketing/CT envisaged in OSBL & existing Unit.
- 3 For Tie-in 089-TP-039/040, 088-TP-022, 090-TP-031/036, structural member required.





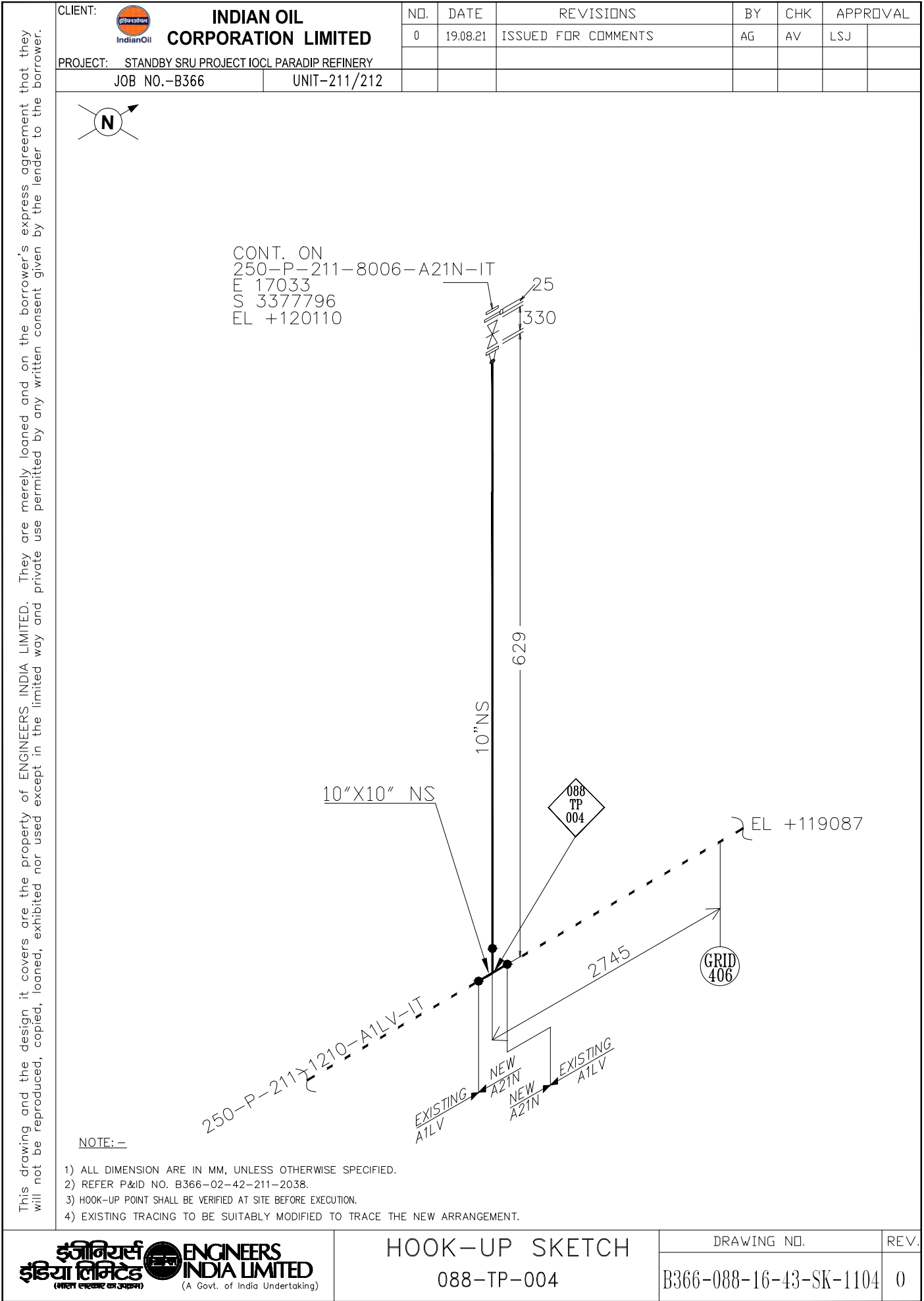
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CLIENT:  INDIAN OIL CORPORATION LIMITED	NO.	DATE	REVISIONS	BY	CHK	APPROVAL	
	0	19.08.21	ISSUED FOR COMMENTS	AG	AV	LSJ	
PROJECT: STANDBY SRU PROJECT IOCL PARADIP REFINERY							
JOB NO.-B366	UNIT-211/212						




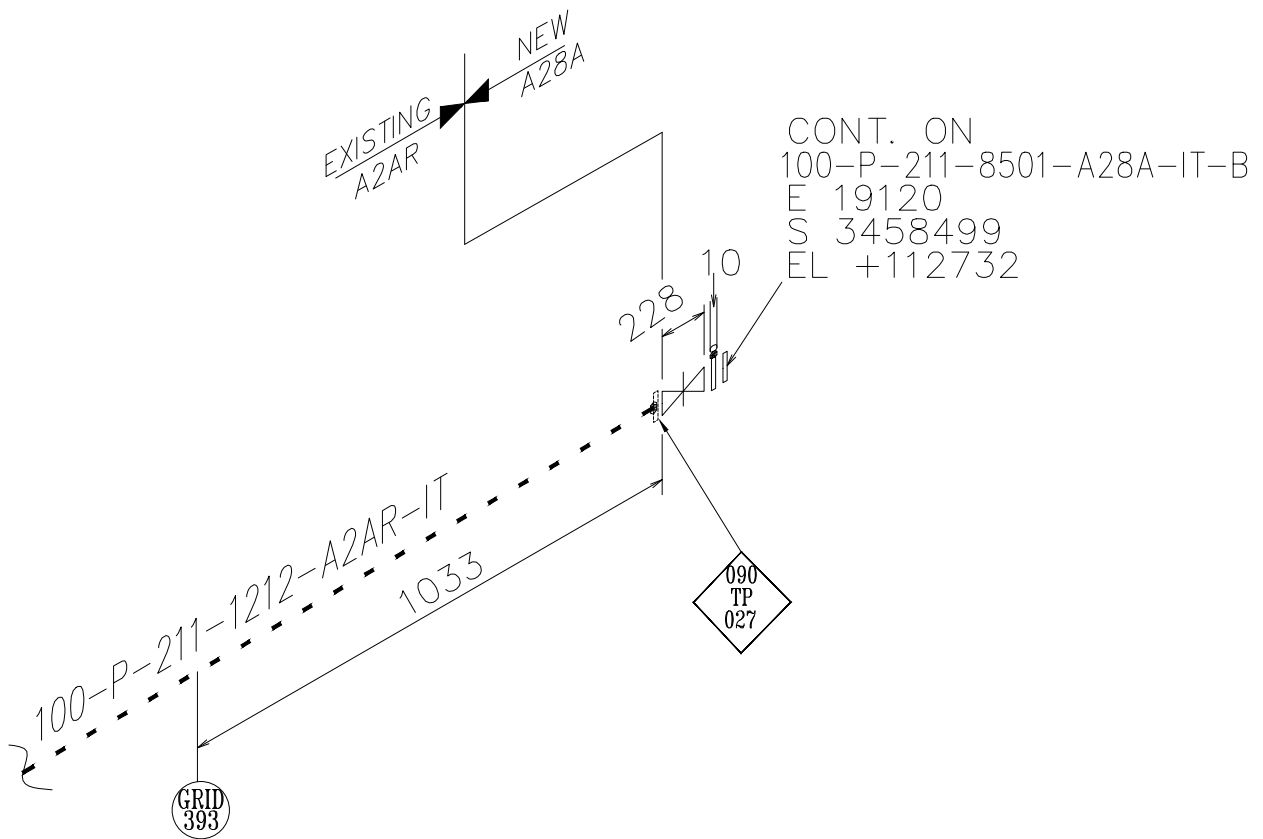
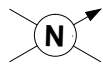
NOTE: —

- 1) ALL DIMENSION ARE IN MM, UNLESS OTHERWISE SPECIFIED.
- 2) REFER P&ID NO. B366-02-42-211-2036.
- 3) HOOK-UP POINT SHALL BE VERIFIED AT SITE BEFORE EXECUTION.
- 4) SHOE HEIGHT SHALL BE EQUAL TO EXISTING ADJACENT SHOE HEIGHT.



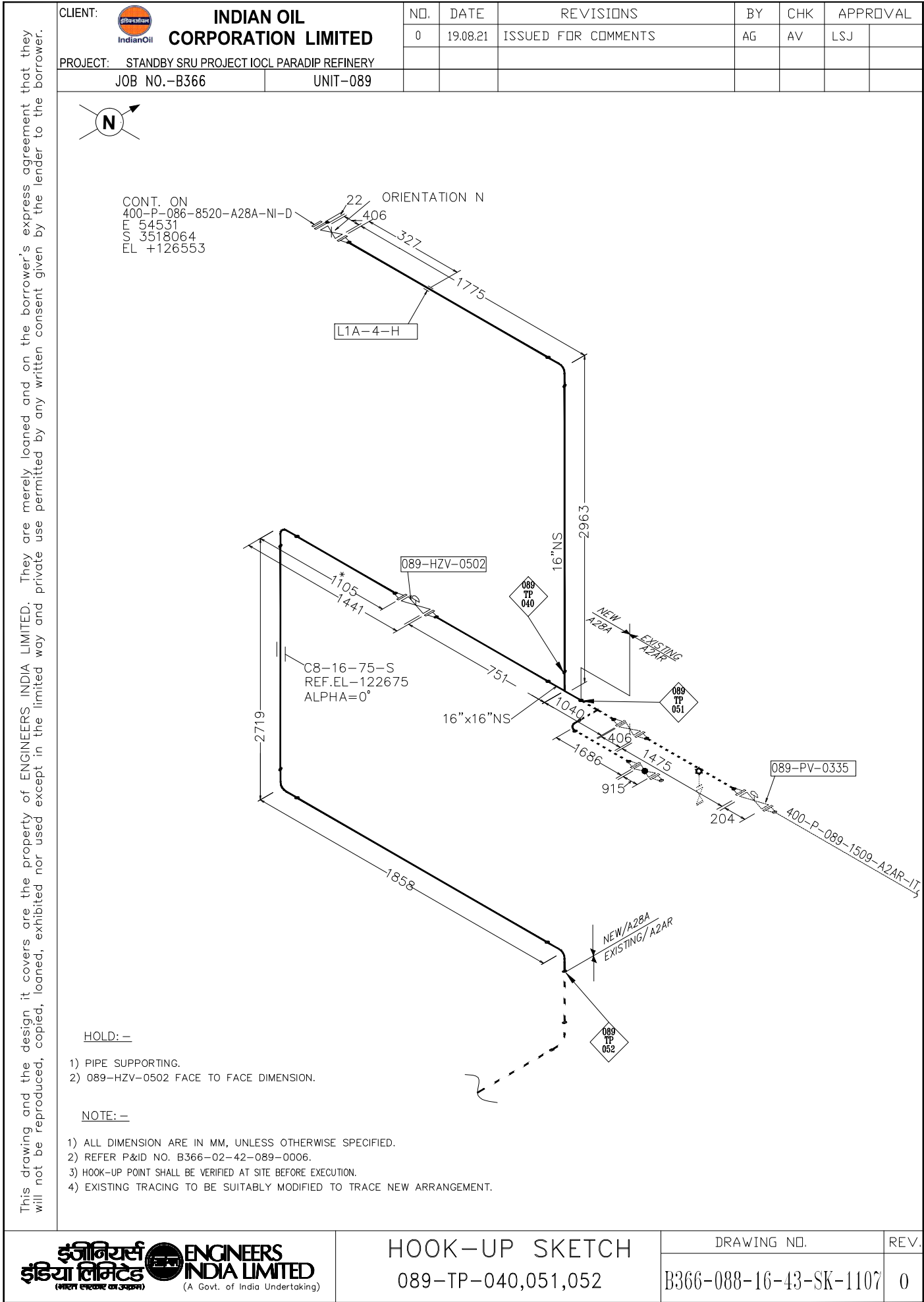
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PROJECT: STANDBY SRU PROJECT IOCL PARADIP REFINERY							
JOB NO.-B366		UNIT-211/212					



NOTE: -

- 1) ALL DIMENSION ARE IN MM, UNLESS OTHERWISE SPECIFIED.
- 2) REFER P&ID NO. B366-02-42-211-2036.
- 3) HOOK-UP POINT SHALL BE VERIFIED AT SITE BEFORE EXECUTION.
- 4) EXISTING TRACING TO BE SUITABLY MODIFIED TO TRACE THE NEW ARRANGEMENT.



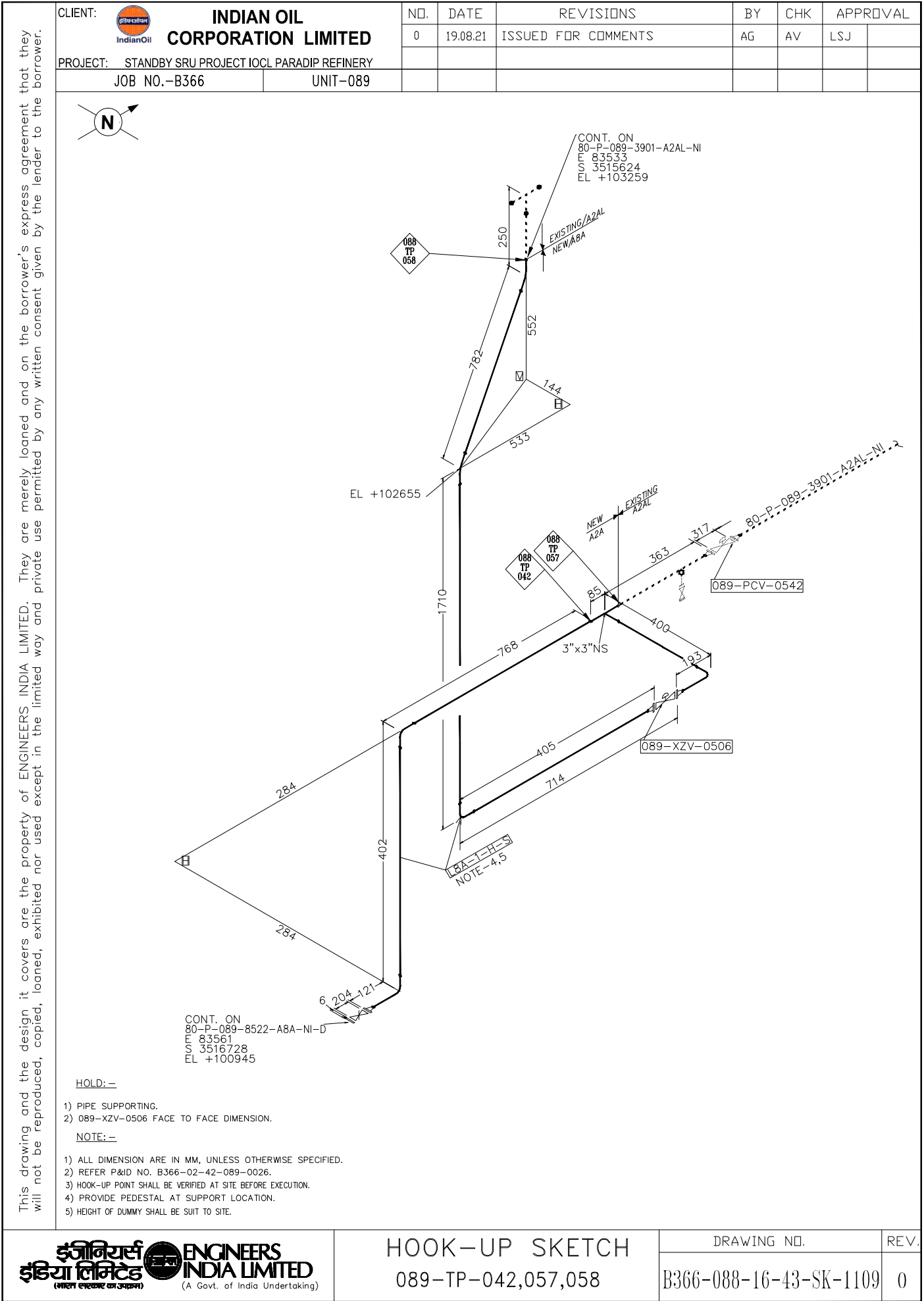
CLIENT:  INDIAN OIL CORPORATION LIMITED	NO.	DATE	REVISIONS	BY	CHK	APPROVAL	
	0	19.08.21	ISSUED FOR COMMENTS	AG	AV	LSJ	
PROJECT: <u>STANDBY SRU PROJECT IOCL PARADIP REFINERY</u>							
JOB NO.-B366	UNIT-089						




- 1) PIPE SUPPORTING.
- 2) 089-XZV-0514 FACE TO FACE DIMENSION.

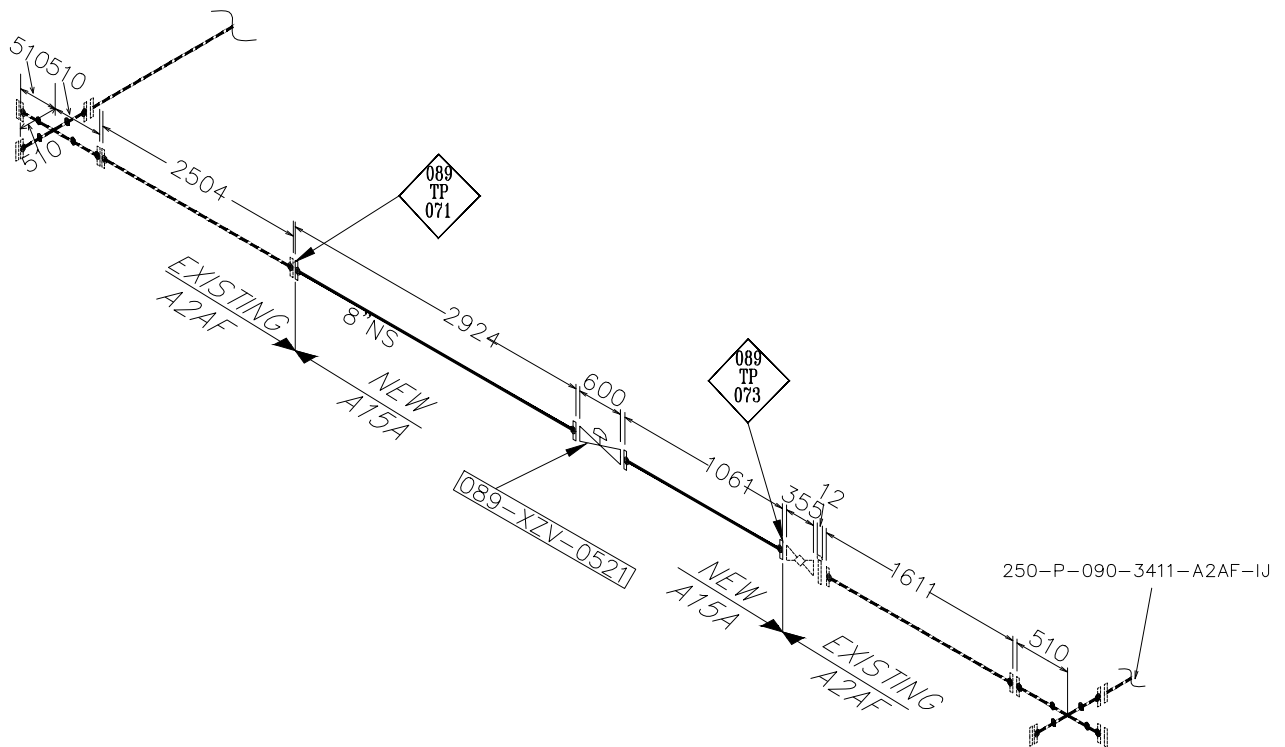
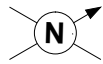
NOTE: —

- 1) ALL DIMENSION ARE IN MM, UNLESS OTHERWISE SPECIFIED.
- 2) REFER P&ID NO. B366-02-42-089-0025.
- 3) HOOK-UP POINT SHALL BE VERIFIED AT SITE BEFORE EXECUTION.
- 4) PROVIDE PEDESTAL AT SUPPORT LOCATION.
- 5) HEIGHT OF DUMMY SHALL BE SUIT TO SITE.



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	0	19.08.21	ISSUED FOR COMMENTS	AG	AV	LSJ	
PROJECT: STANDBY SRU PROJECT IOCL PARADIP REFINERY							
JOB NO.-B366		UNIT-089					




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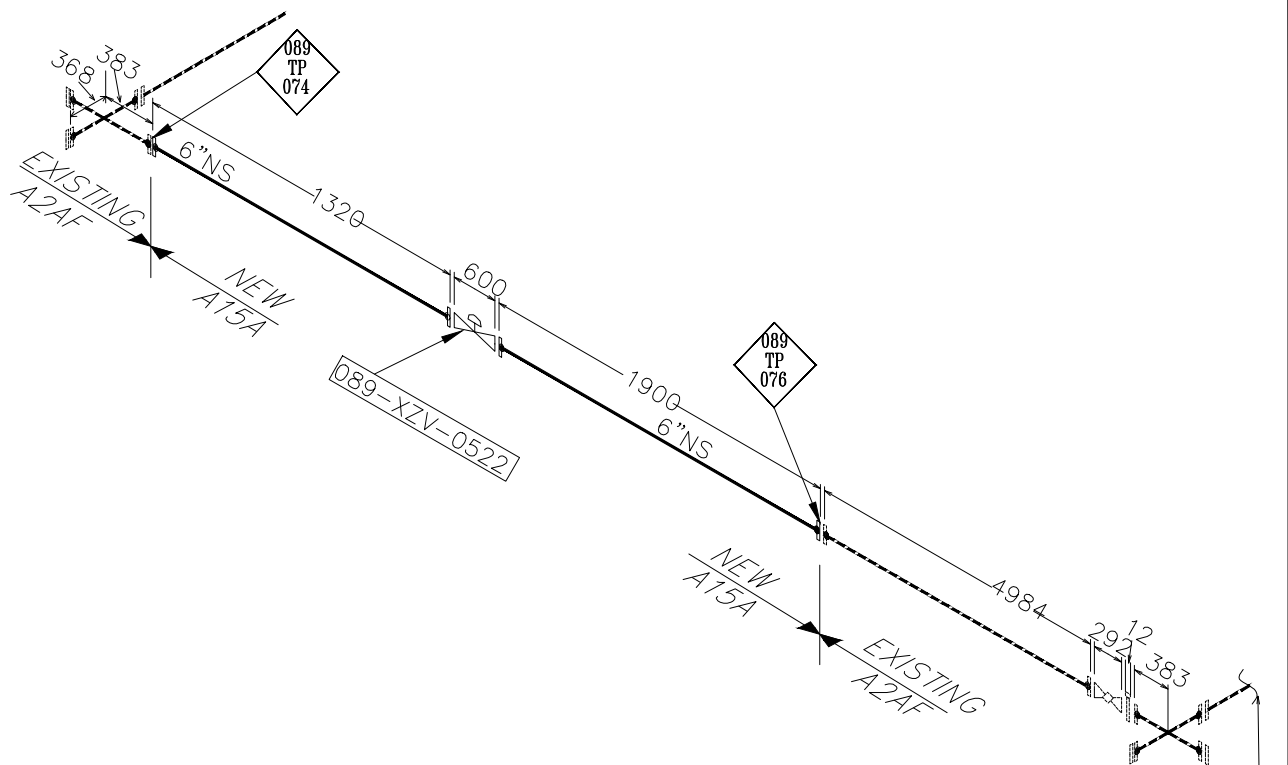
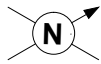
- 1) PIPE SUPPORTING.
- 2) 089-XZV-0521 FACE TO FACE DIMENSION.

NOTE: —

- 1) ALL DIMENSION ARE IN MM, UNLESS OTHERWISE SPECIFIED.
- 2) REFER P&ID NO. B366-02-42-089-0022.
- 3) HOOK-UP POINT SHALL BE VERIFIED AT SITE BEFORE EXECUTION.
- 4) CORE & JACKET TO BE FABRICATED AS PER SPECIFICATION. EXISTING STEAM JUMP OVERS TO BE MODIFIED TO PROVIDE STEAM TO THE NEW ARRANGEMENT.

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PROJECT: STANDBY SRU PROJECT IOCL PARADIP REFINERY							
JOB NO.-B366							
UNIT-089							

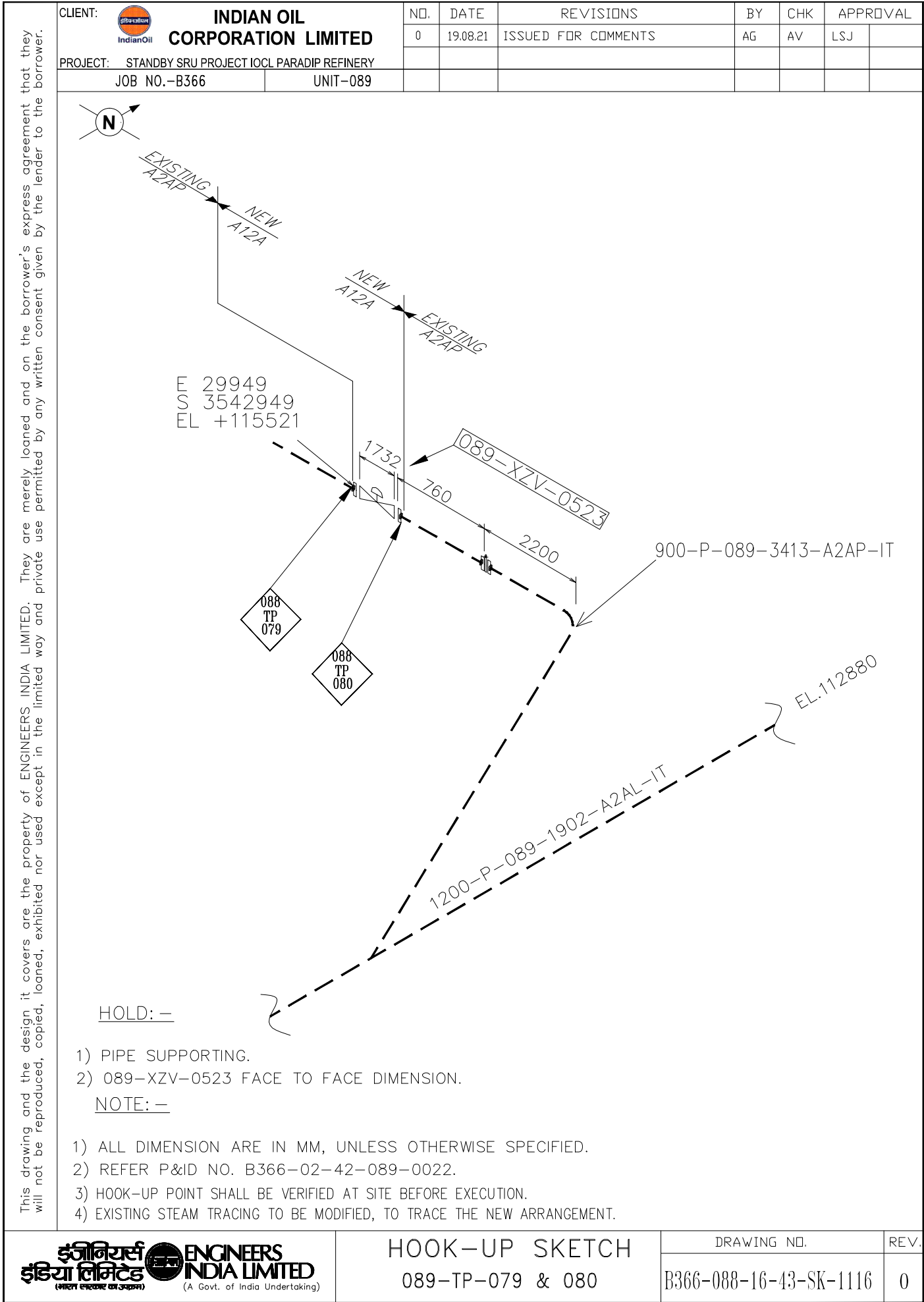


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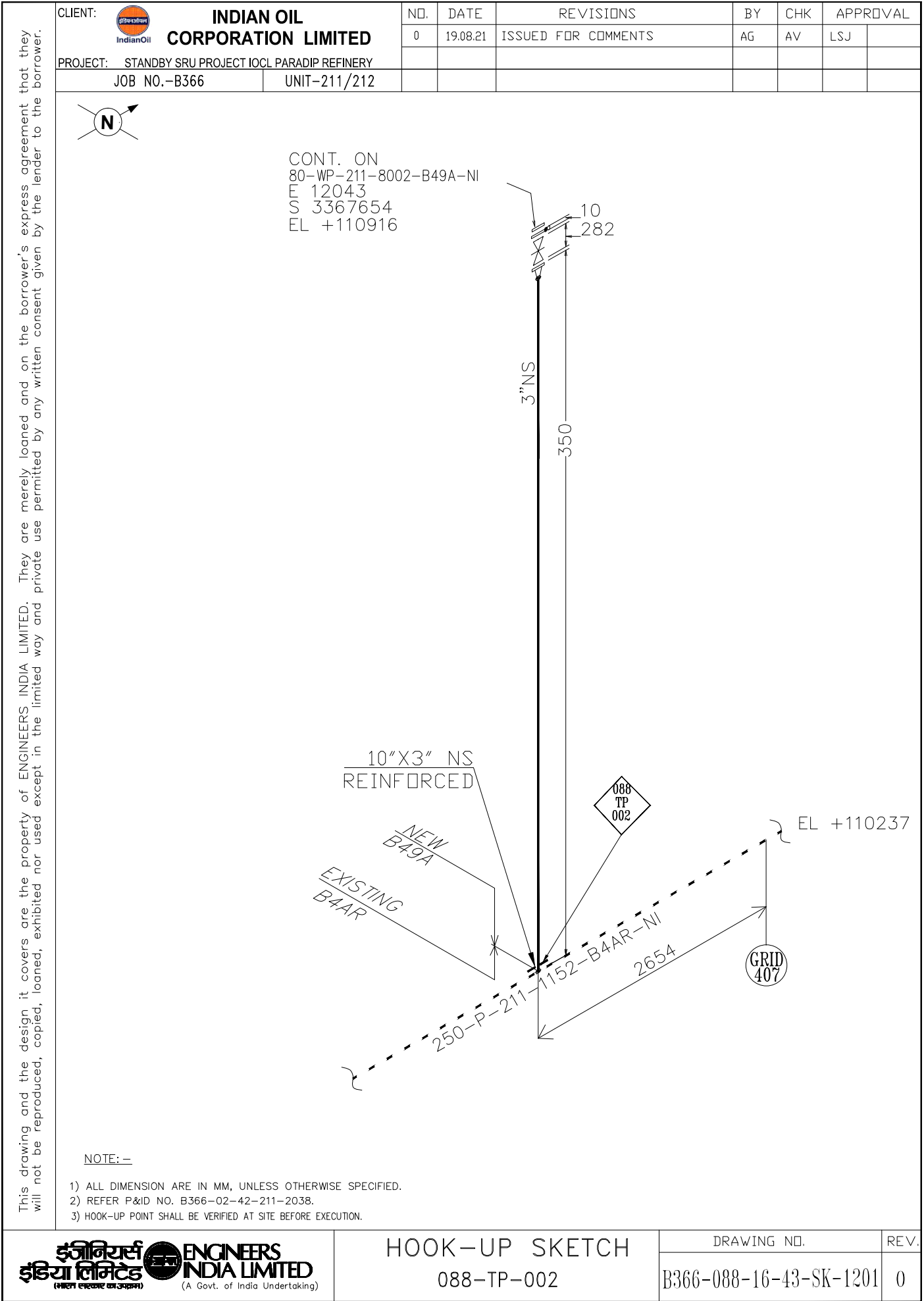
- 1) PIPE SUPPORTING.
- 2) 089-XZV-0522 FACE TO FACE DIMENSION.

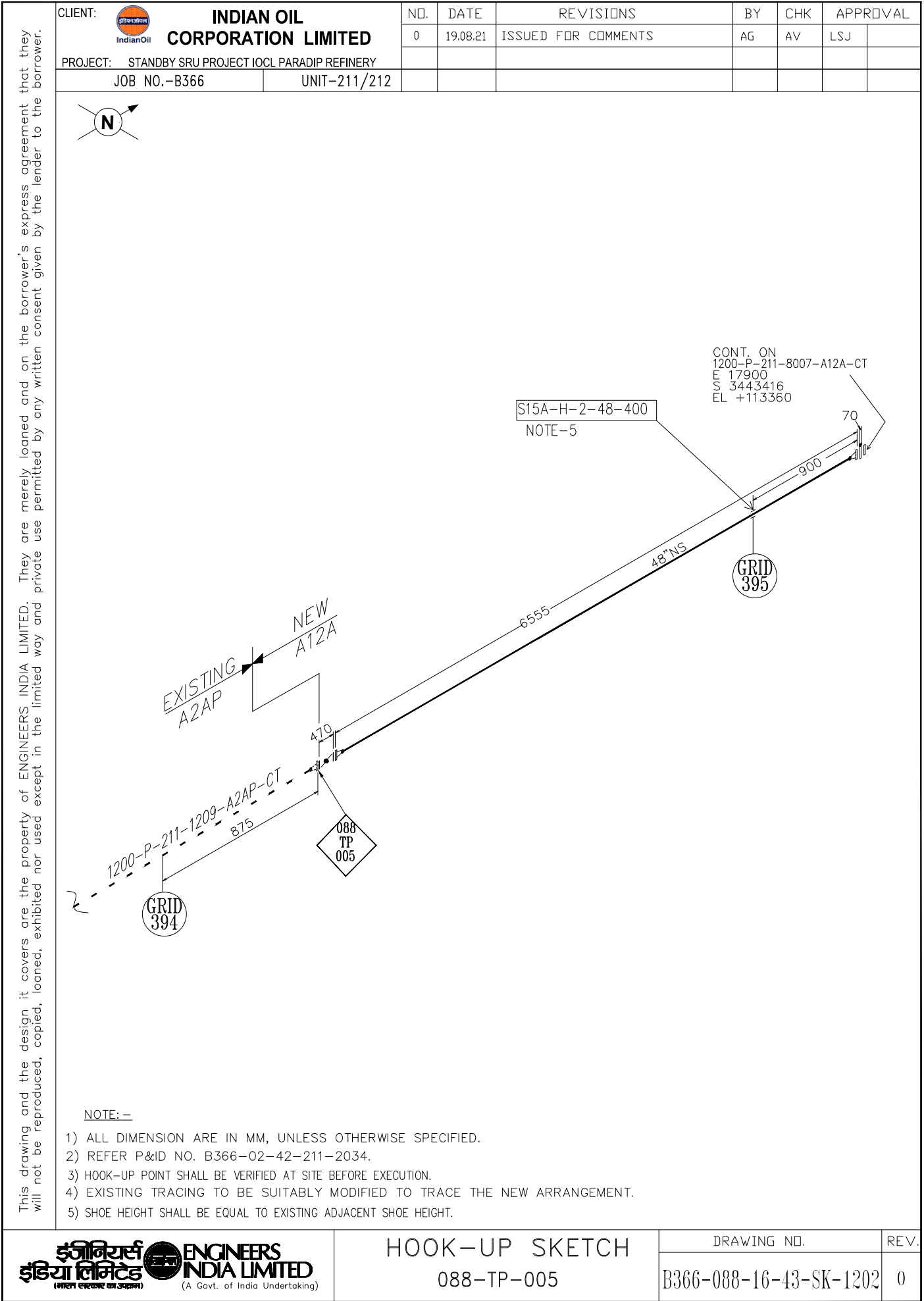
NOTE: —

- 1) ALL DIMENSION ARE IN MM, UNLESS OTHERWISE SPECIFIED.
- 2) REFER P&ID NO. B366-02-42-089-0022.
- 3) HOOK-UP POINT SHALL BE VERIFIED AT SITE BEFORE EXECUTION.
- 4) CORE & JACKET TO BE FABRICATED AS PER SPECIFICATION. EXISTING STEAM JUMP OVERS TO BE MODIFIED TO PROVIDE STEAM TO THE NEW ARRANGEMENT.




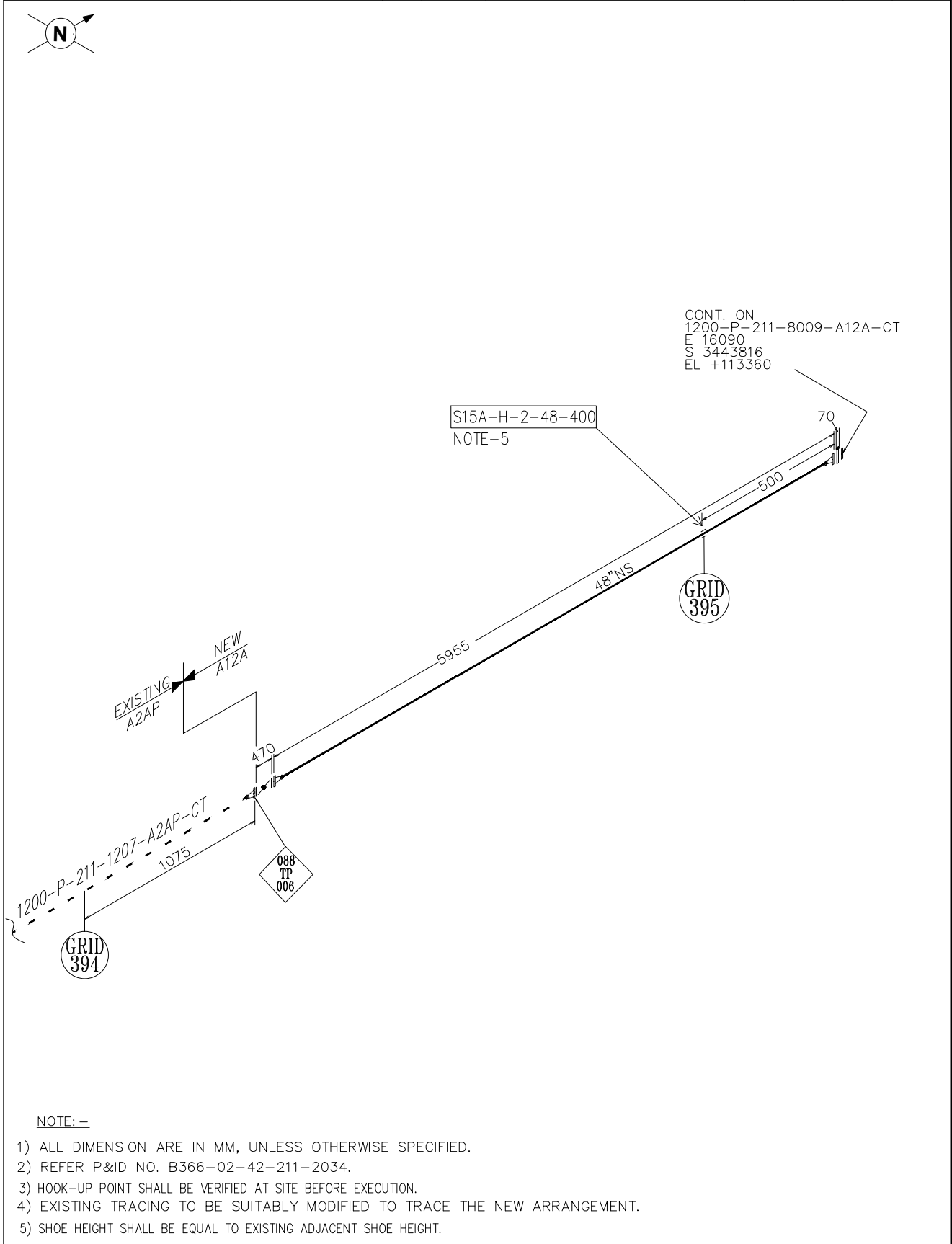
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	0	19.08.21	ISSUED FOR COMMENTS	AG	AV	LSJ	
PROJECT: STANDBY SRU PROJECT IOCL PARADIP REFINERY							
JOB NO.-B366		UNIT-211/212					



CLIENT:



INDIAN OIL
CORPORATION LIMITED

PROJECT:

STANDBY SRU PROJECT IOCL PARADIP REFINERY

JOB NO.-B366

UNIT-211/212

NO.

0

DATE

19.08.21

REVISIONS

ISSUED FOR COMMENTS

BY

AJ

CHK

AV

APPROVAL

LSJ

088
TP
007

20

356

EXISTING
A2AF

NEW
A15A

250-P-211-1206-A2AF-IJ

4375

GRID
393

CONT. ON
250-P-211-8011-A15A-IJ
E 8399
S 3455036
EL +113894

NOTE: —


1) ALL DIMENSION ARE IN MM, UNLESS OTHERWISE SPECIFIED.

2) REFER P&ID NO. B366-02-42-211-2034.

3) HOOK-UP POINT AND EXISTING MATCHING FLANGE DIMENSION SHALL BE VERIFIED AT SITE BEFORE EXECUTION.

4) JUMP OVER FOR NEW VALVE JACKETING SHALL BE EXTENDED FROM EXISTING JACKET.

इंजीनियर्स
इंडिया लिमिटेड



ENGINEERS
INDIA LIMITED

(भारत सरकार का उपक्रम)
(A Govt. of India Undertaking)

HOOK-UP SKETCH

088-TP-007

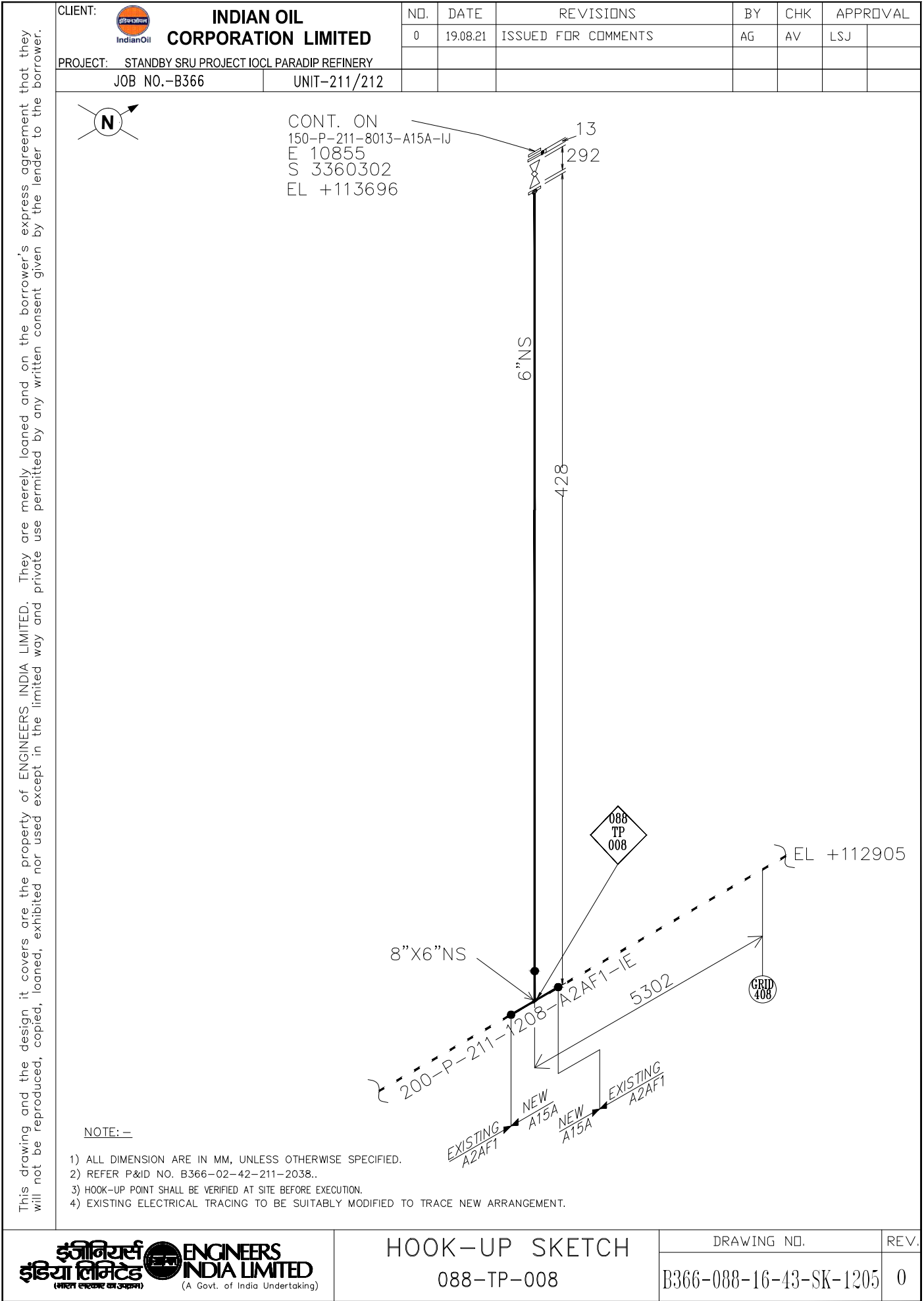
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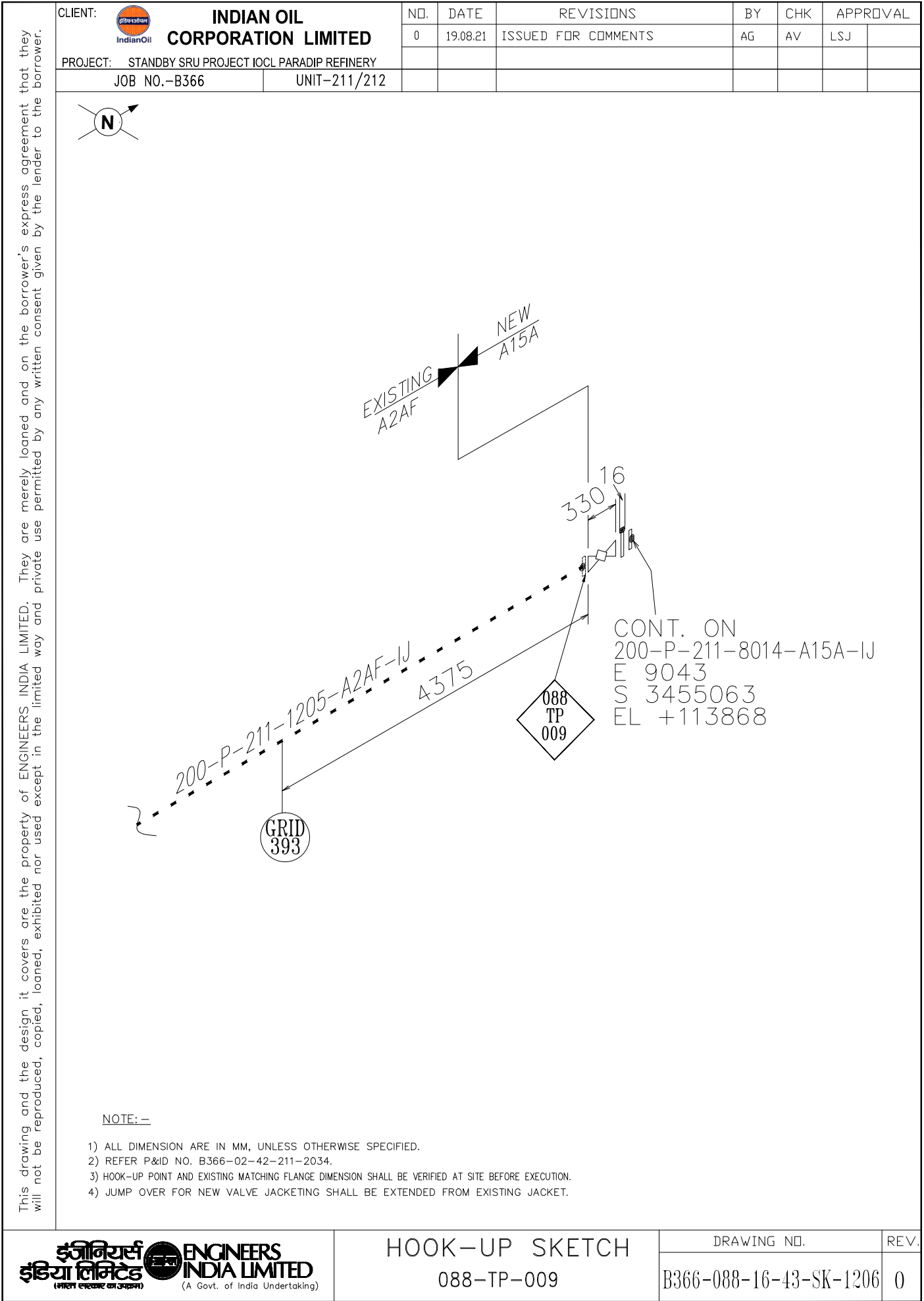
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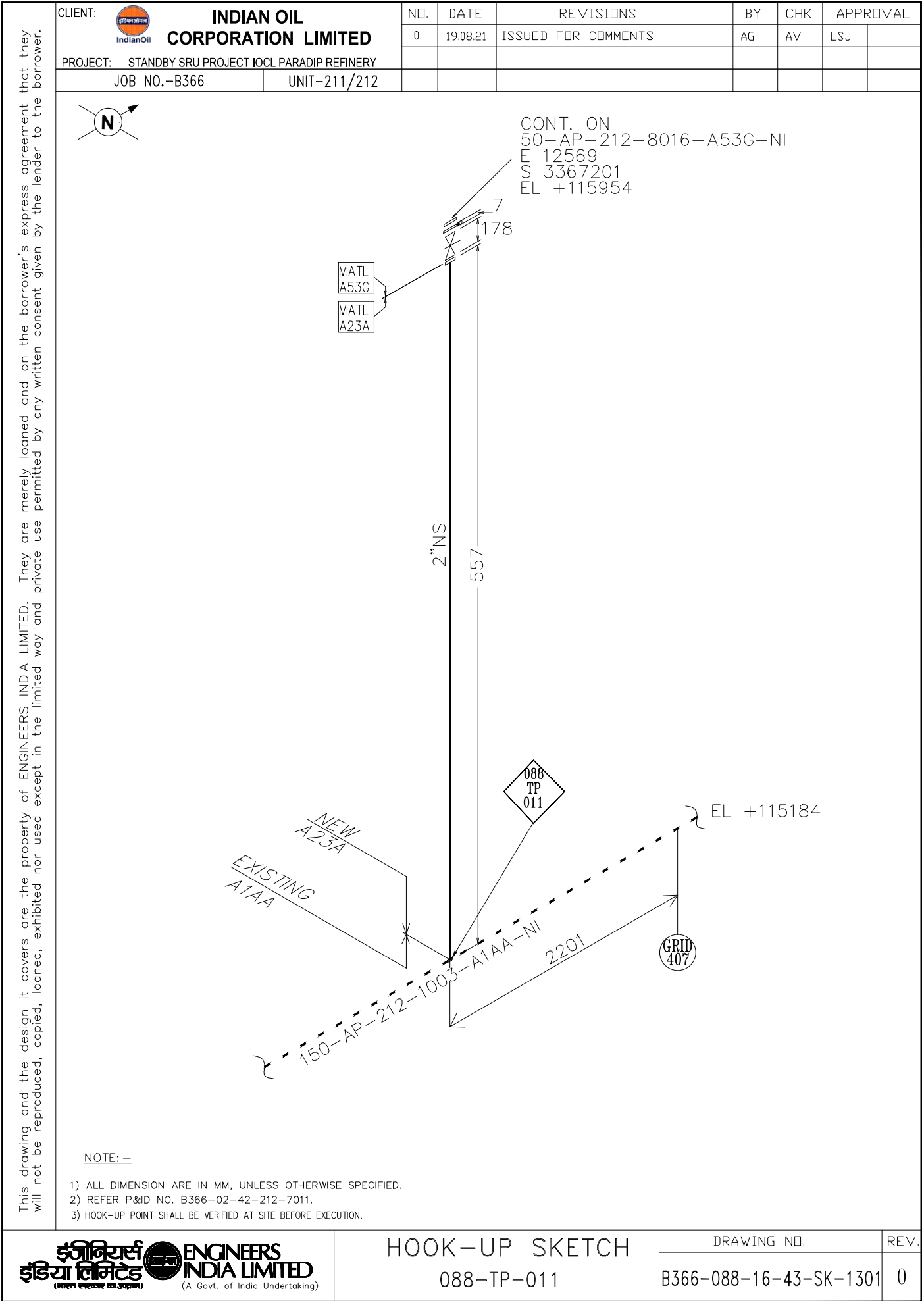
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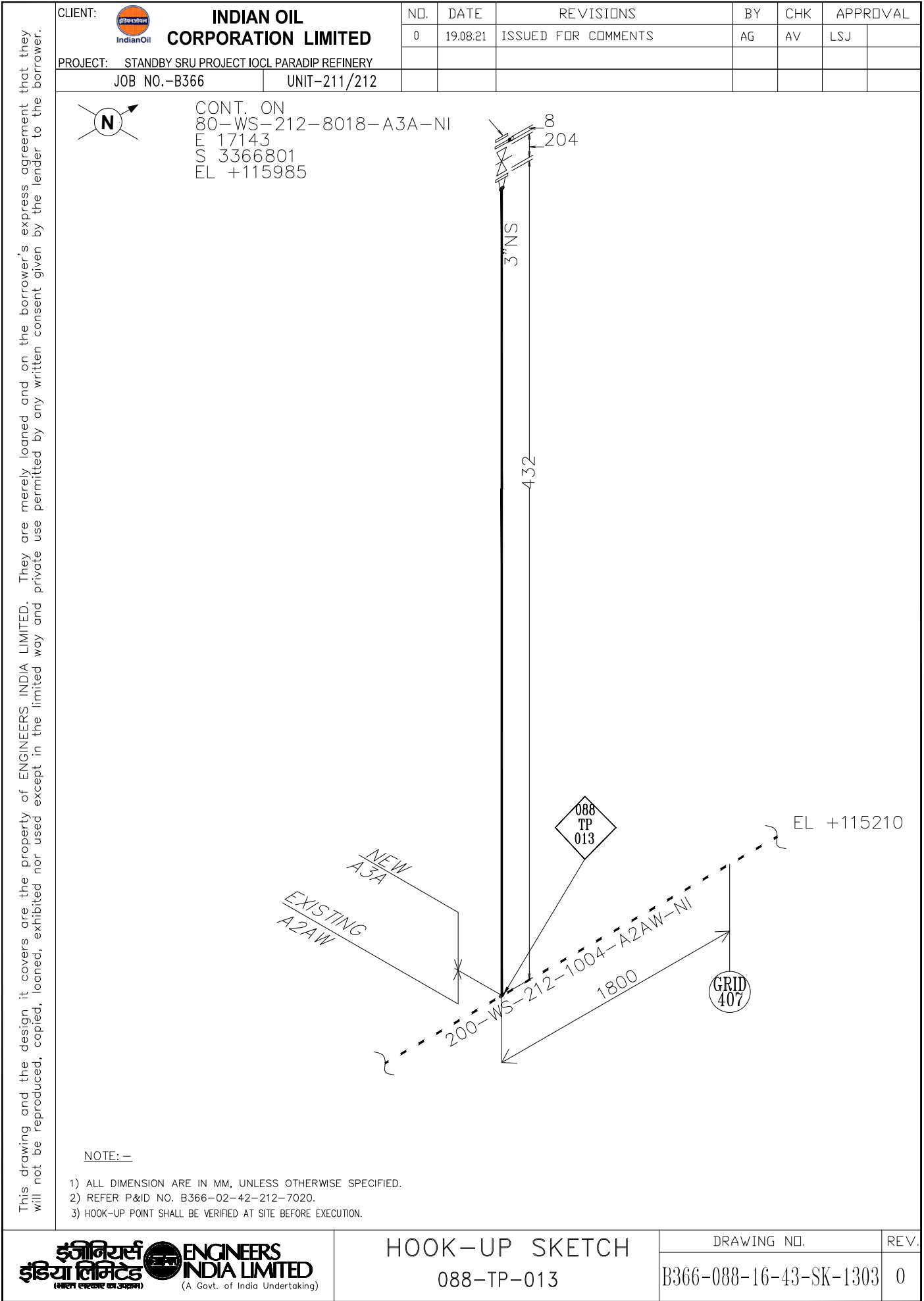


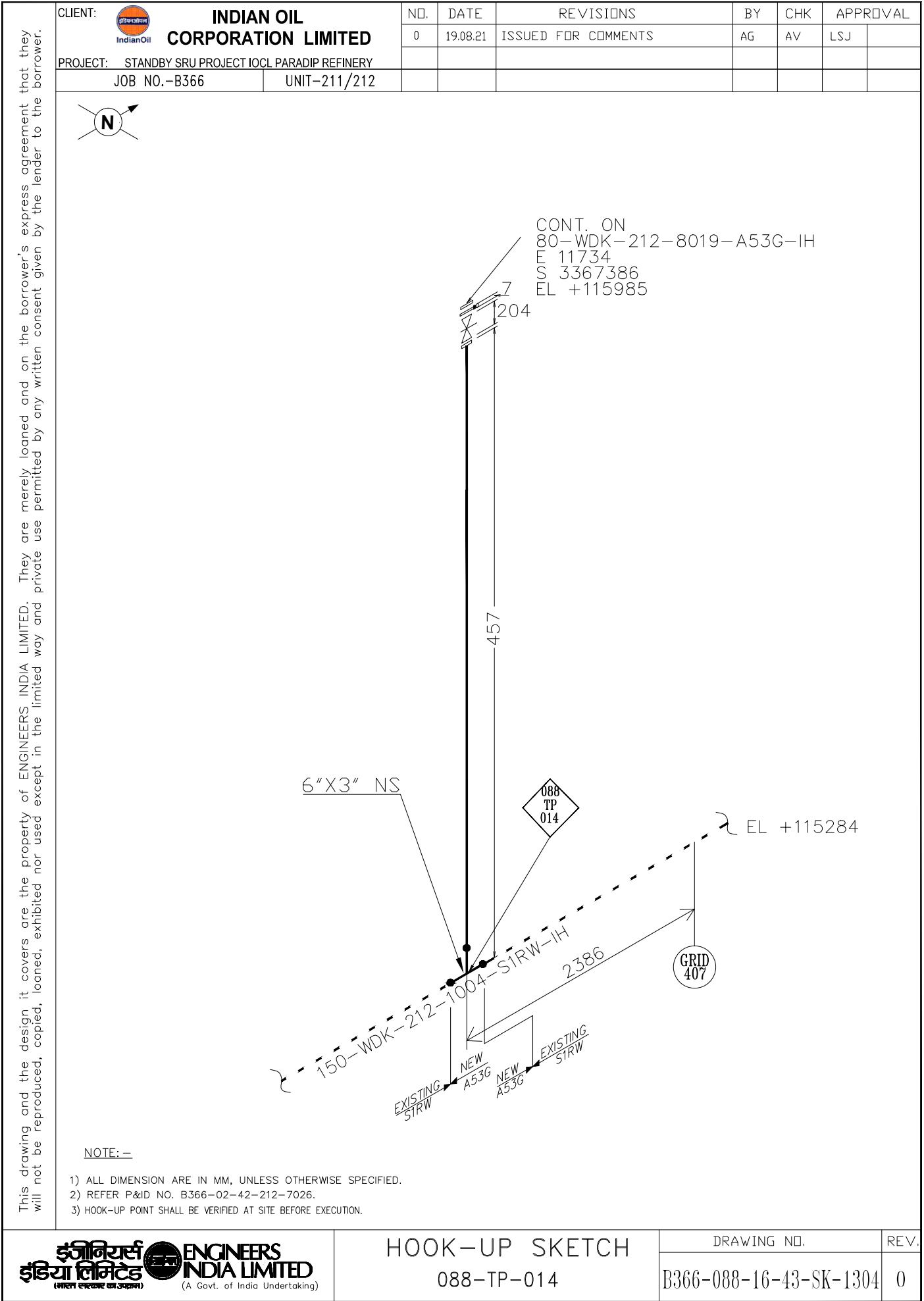
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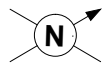
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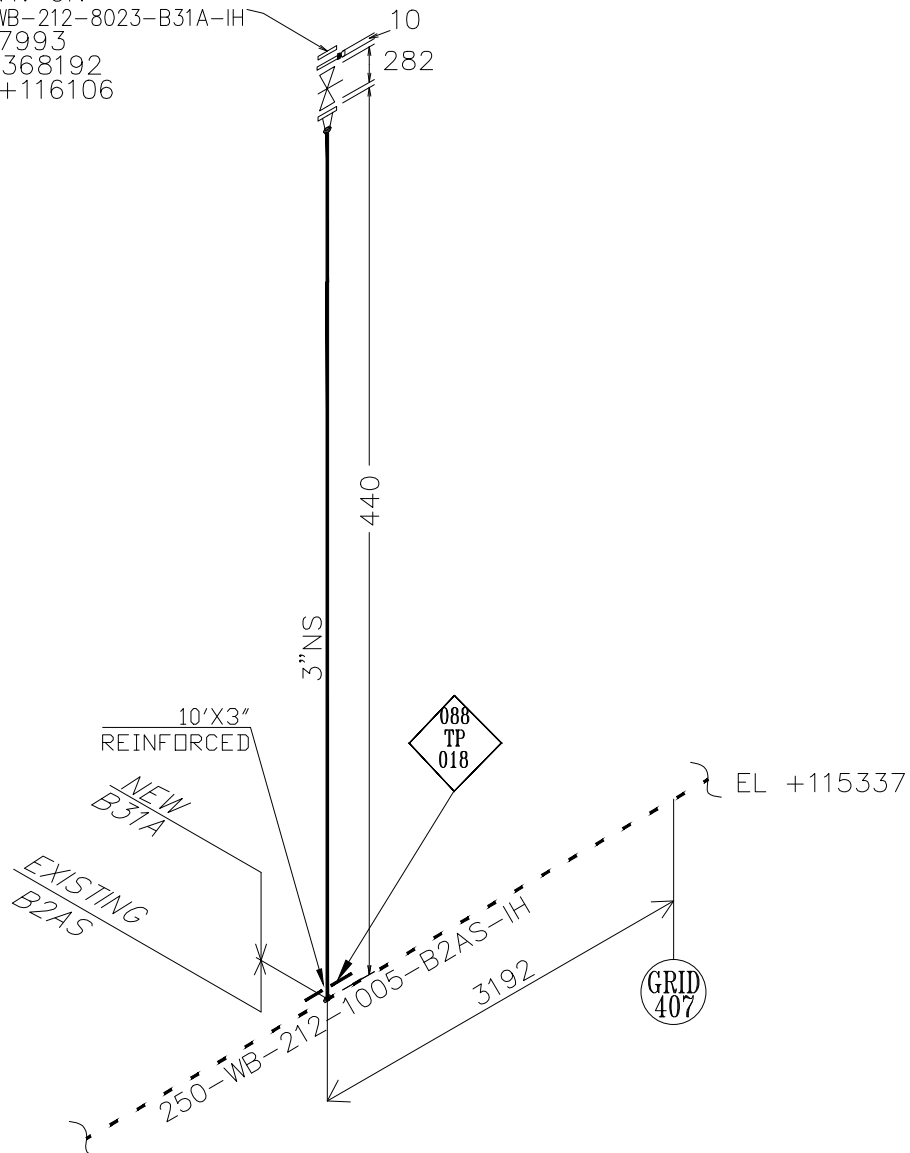




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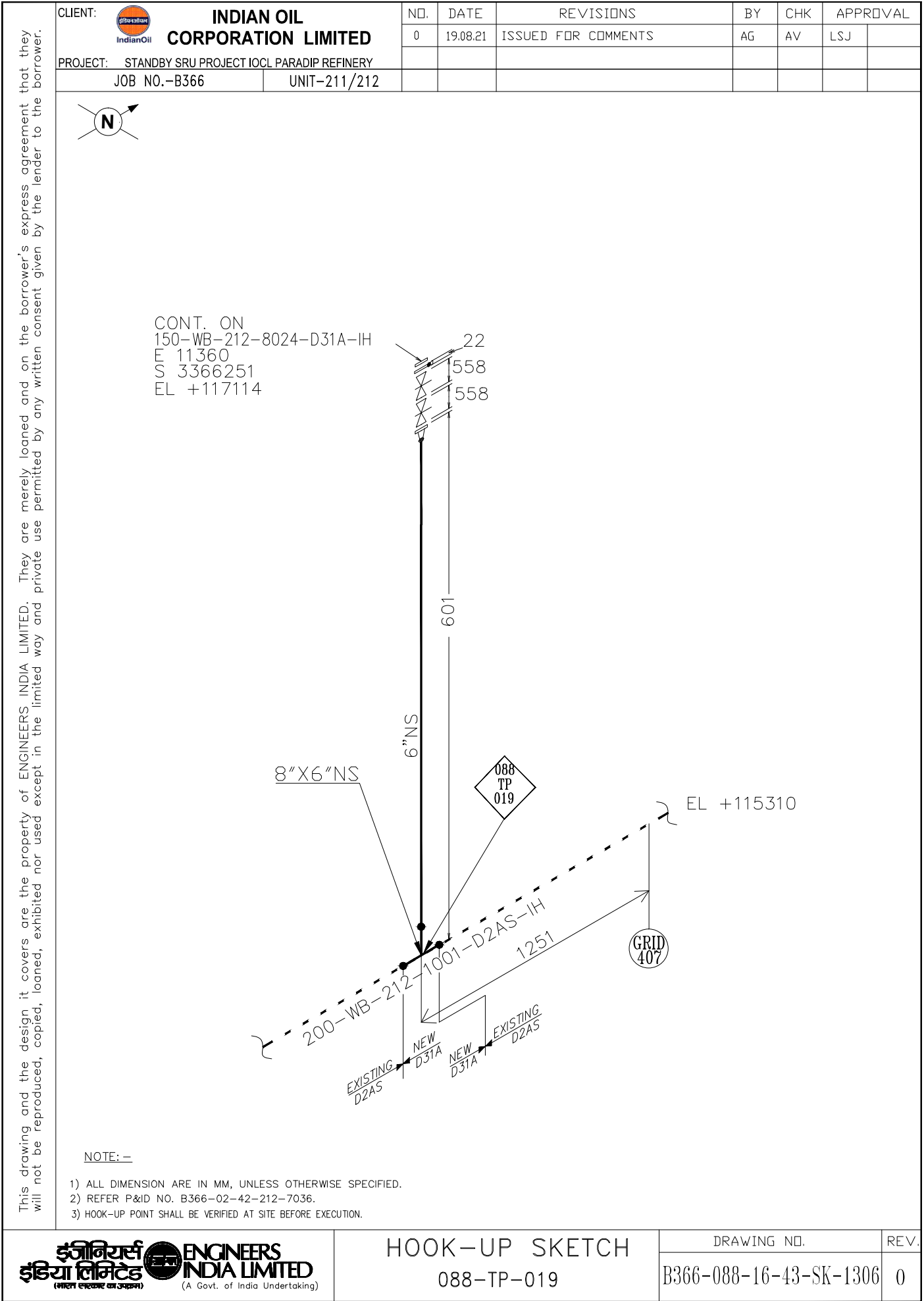
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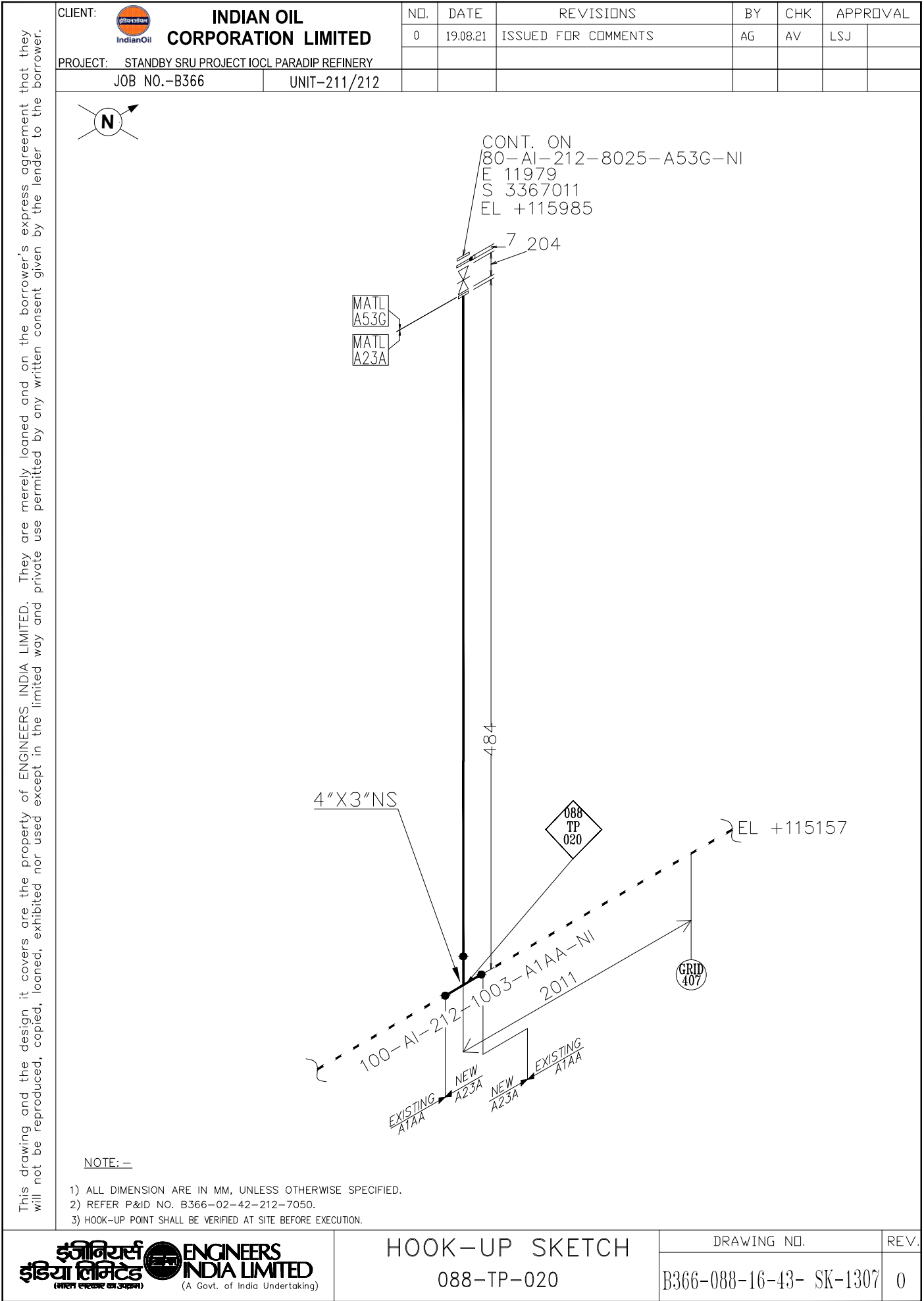
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STANDBY SRU PROJECT IOCL PARADIP REFINERY

JOB NO.-B366

UNIT-211/212

NO.

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S 3458577
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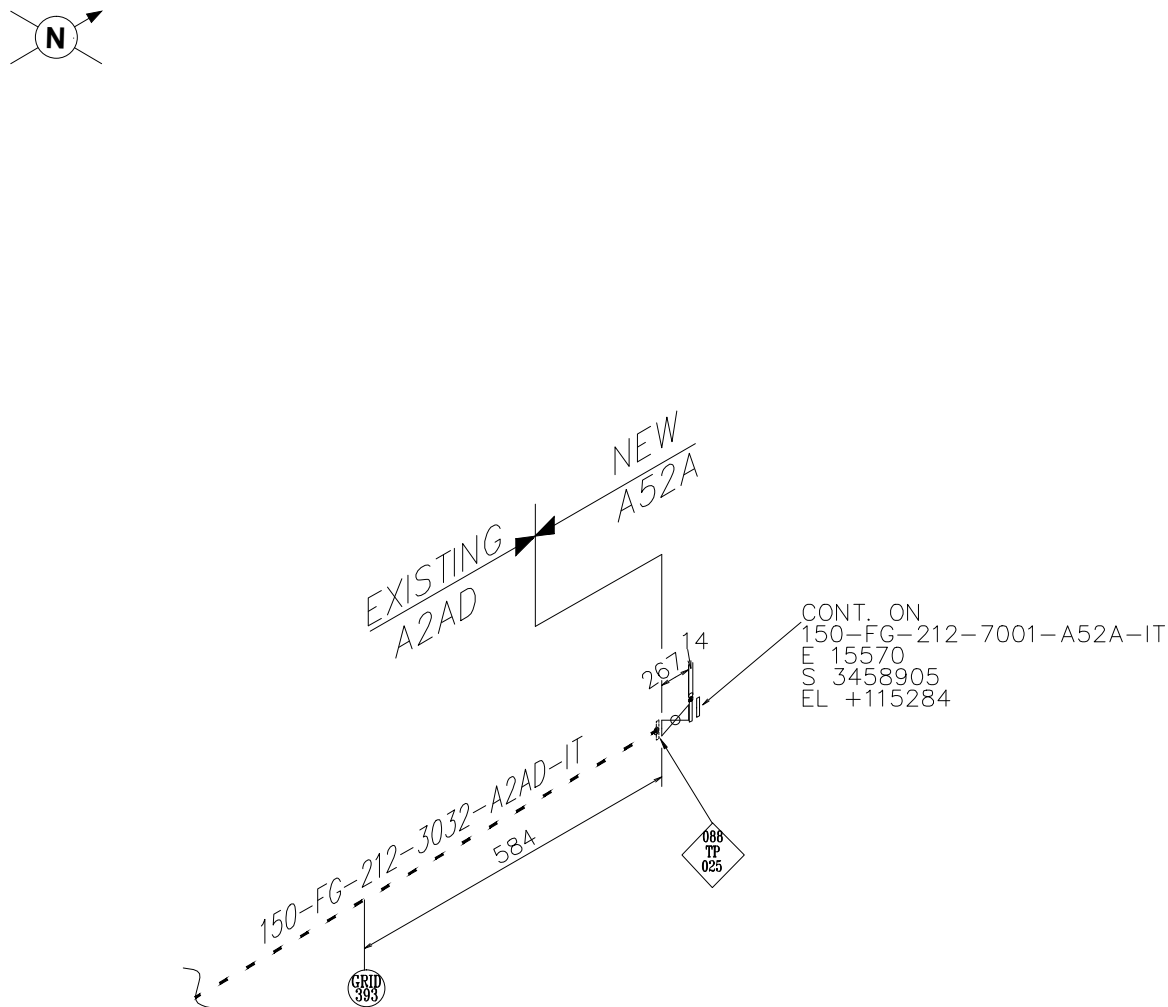
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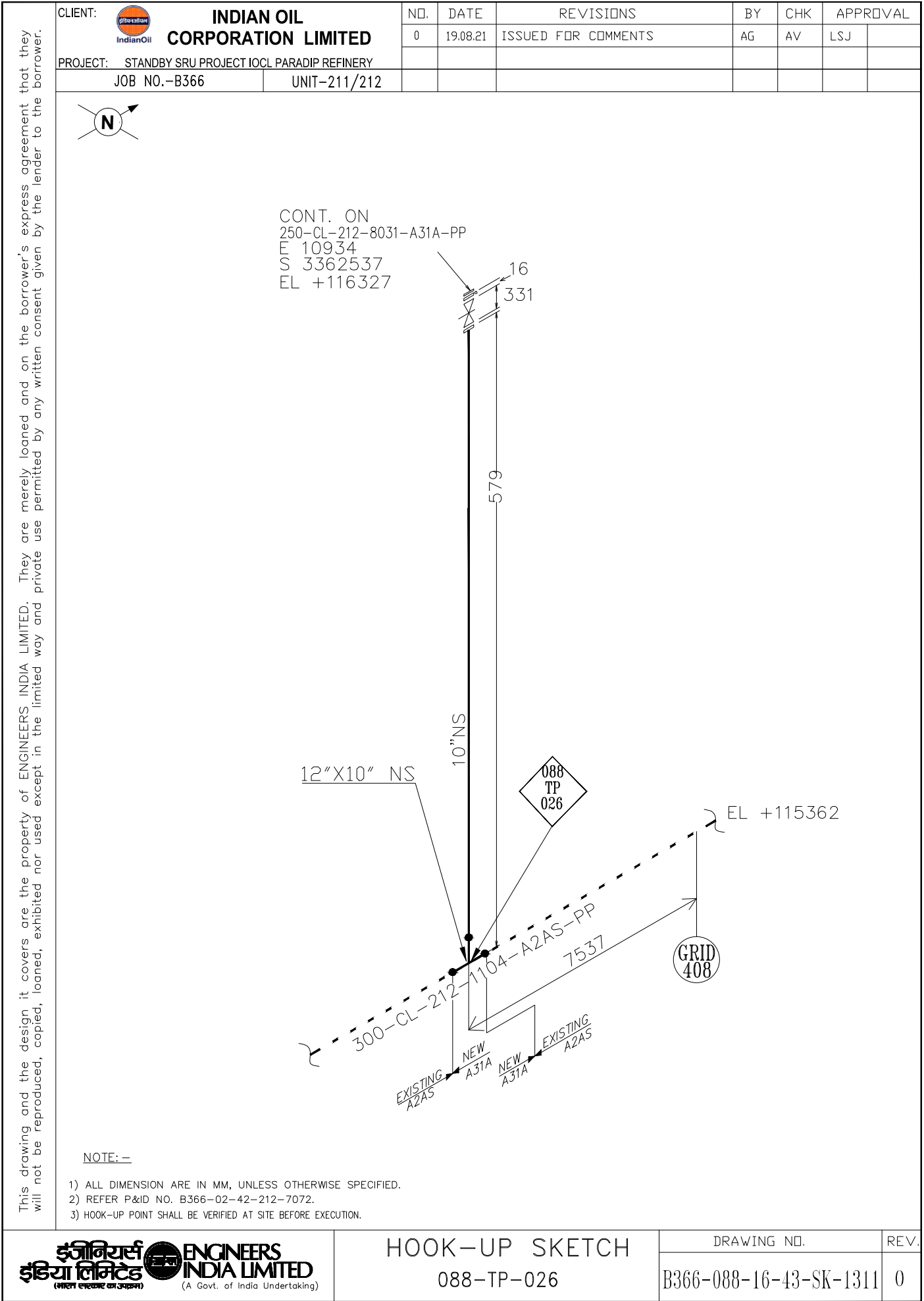
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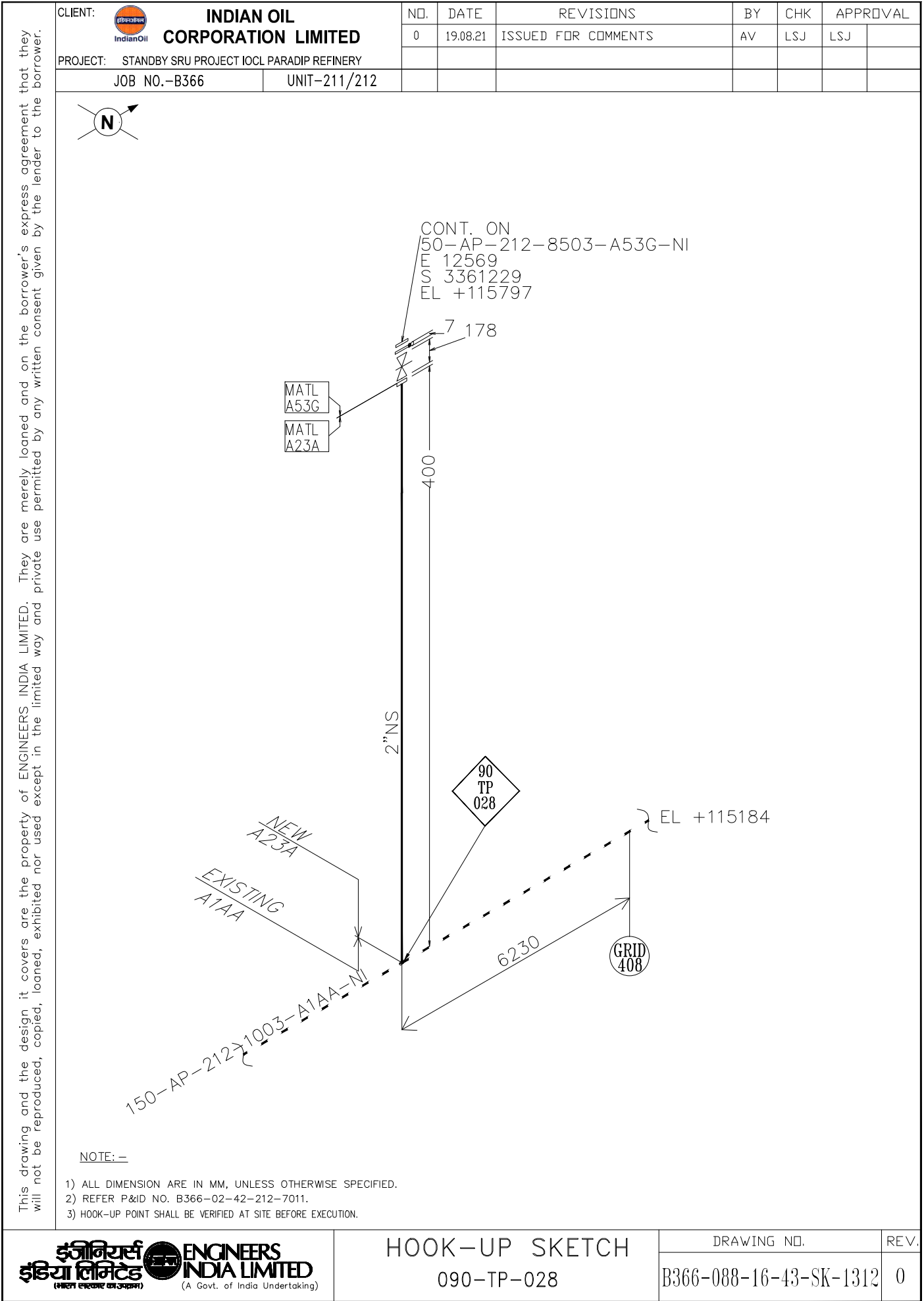
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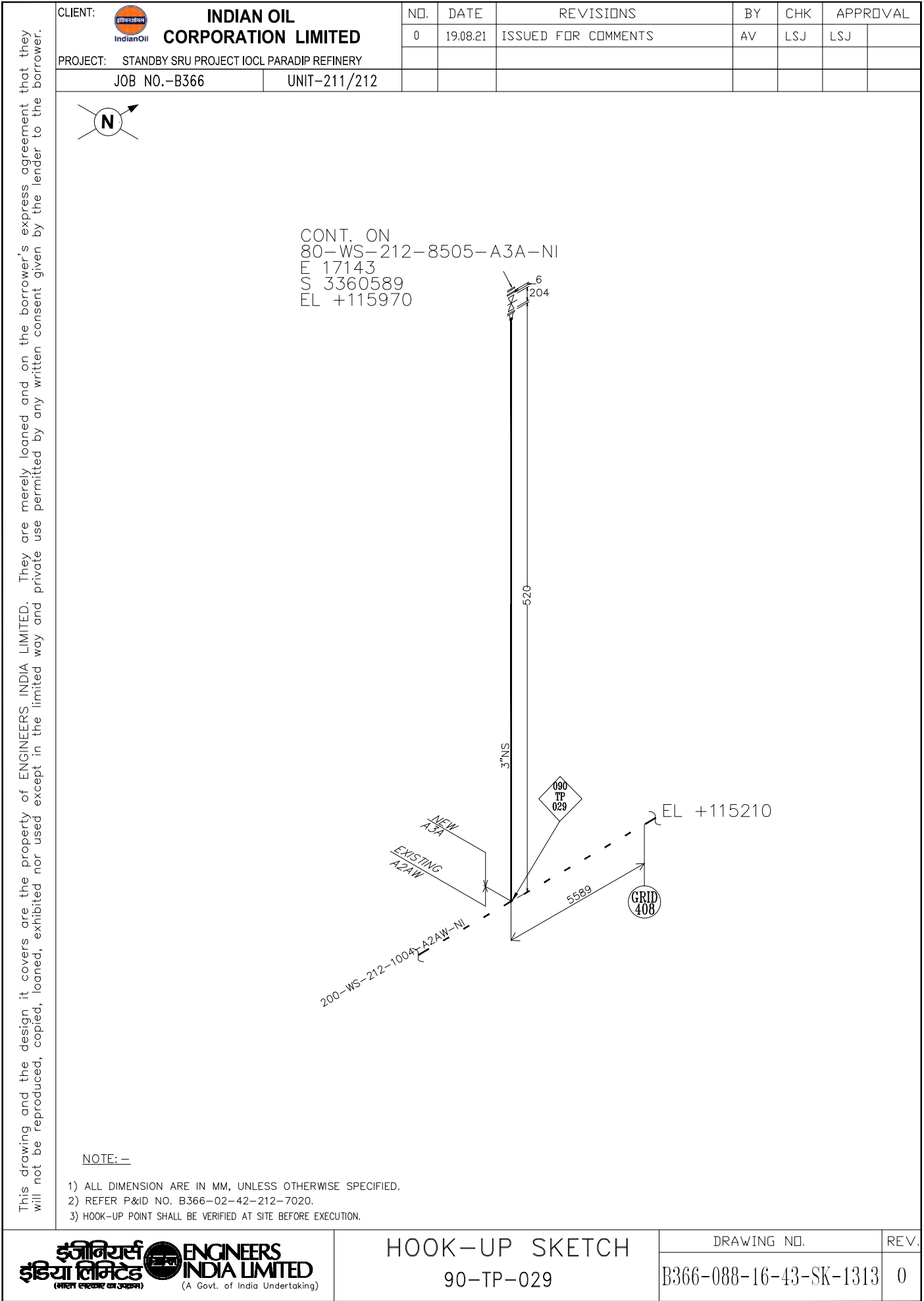
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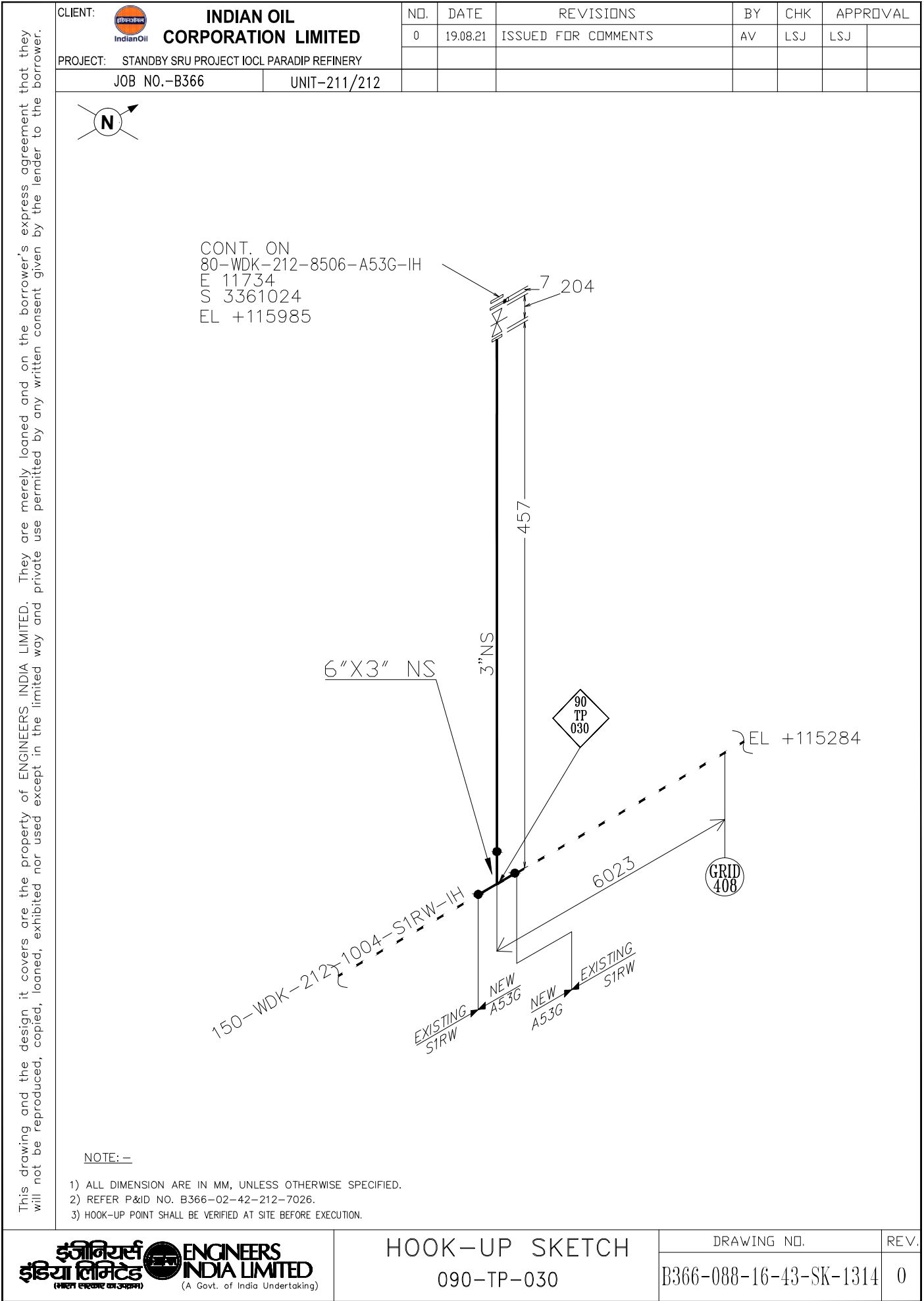


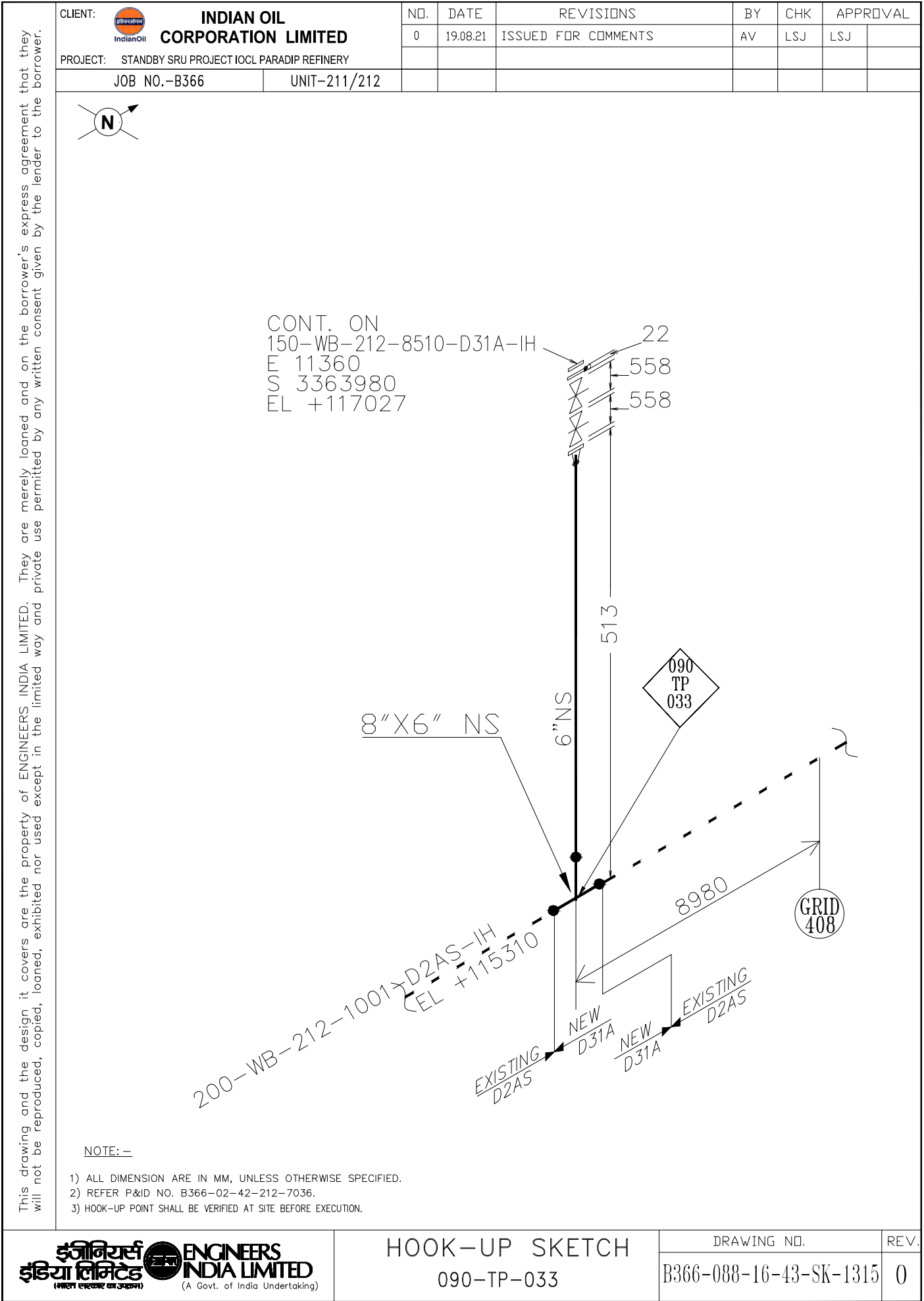
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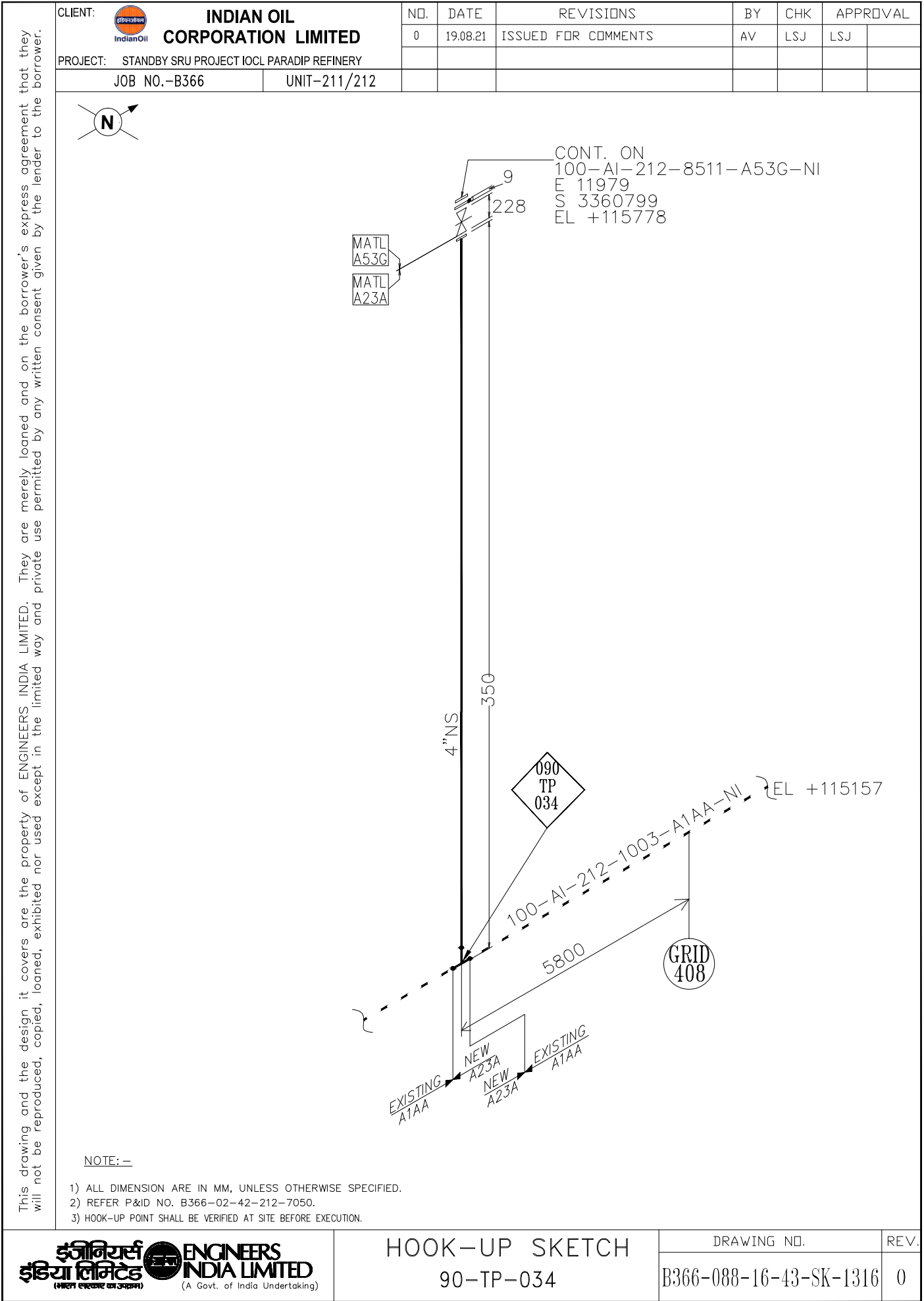


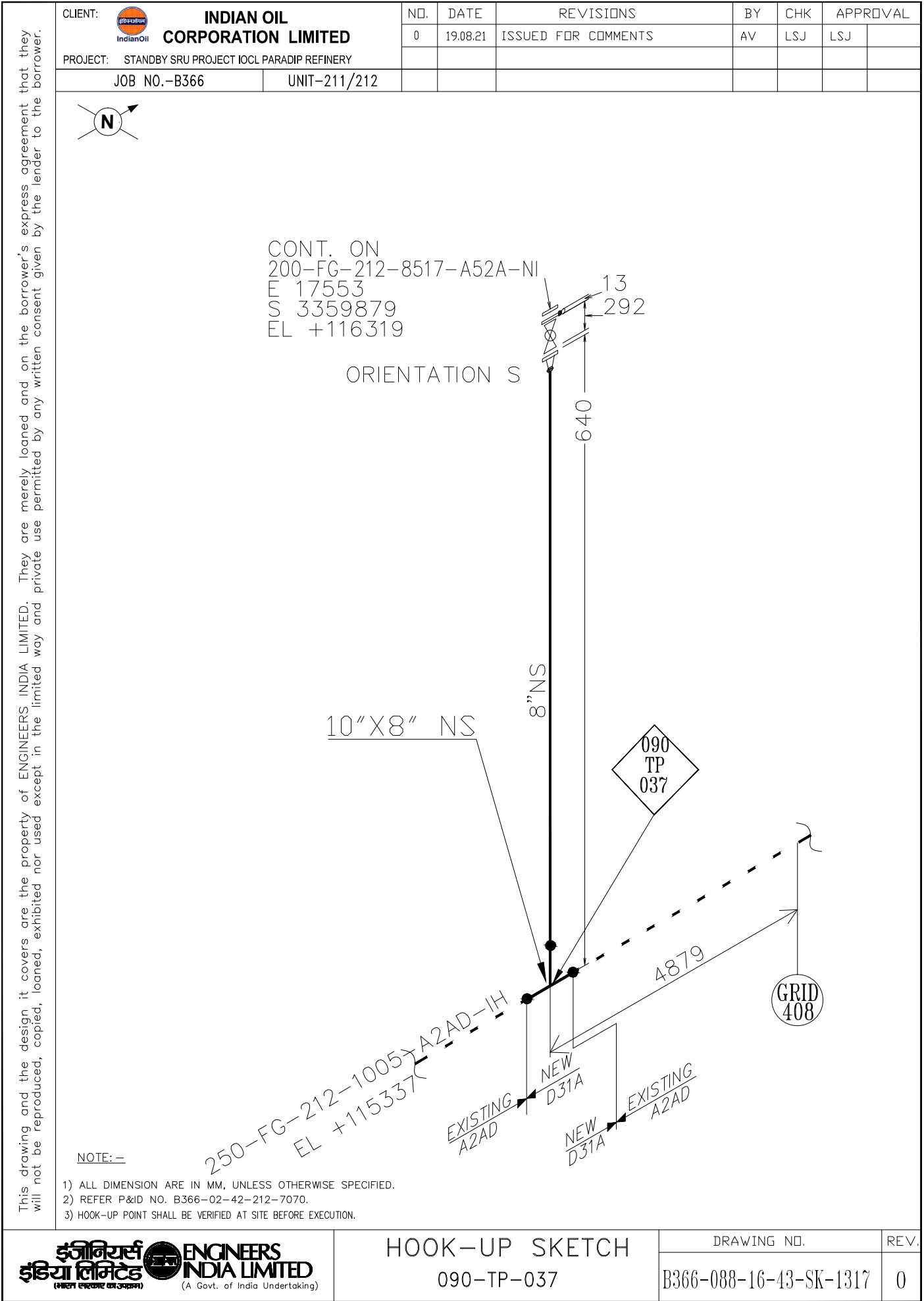













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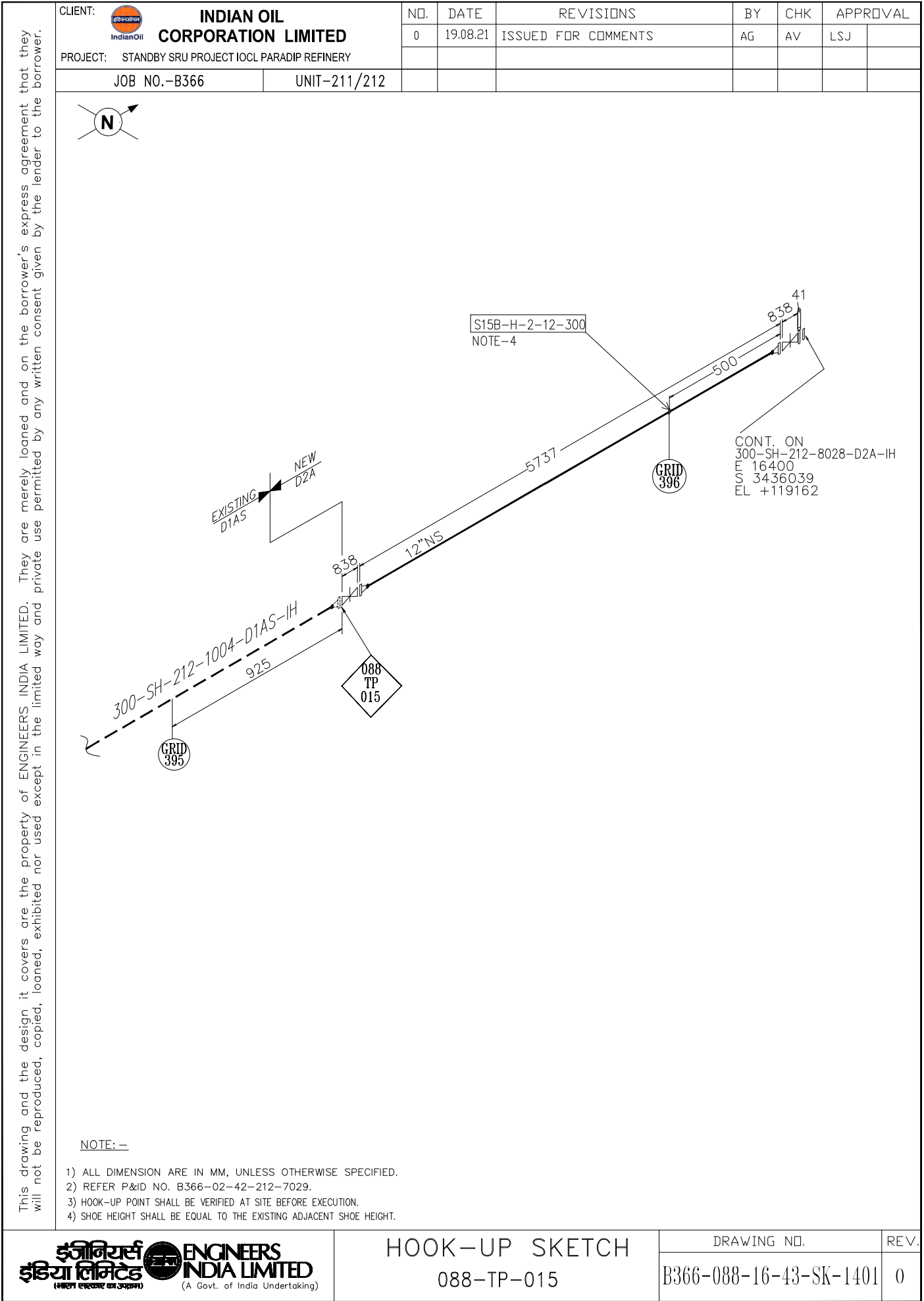
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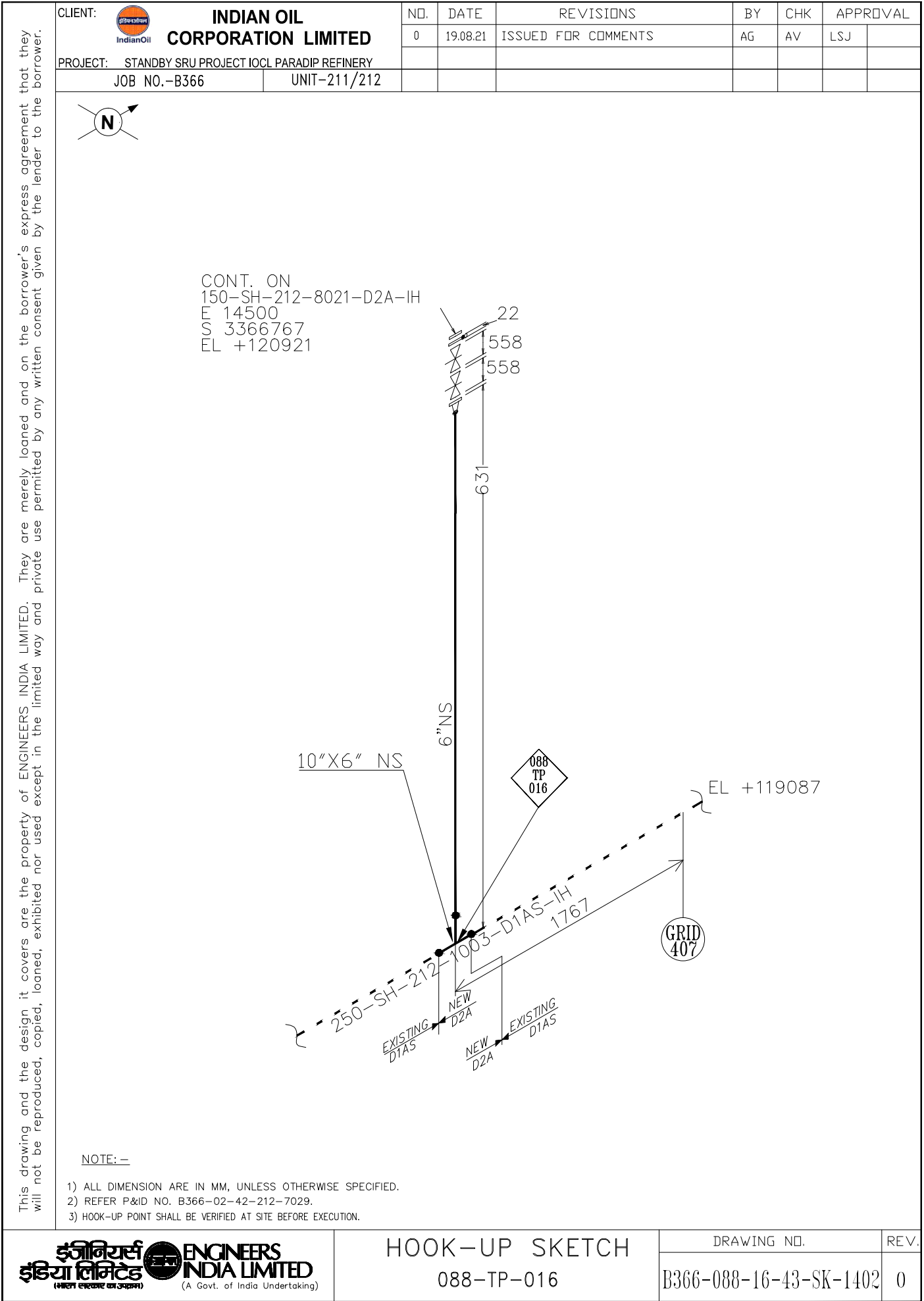
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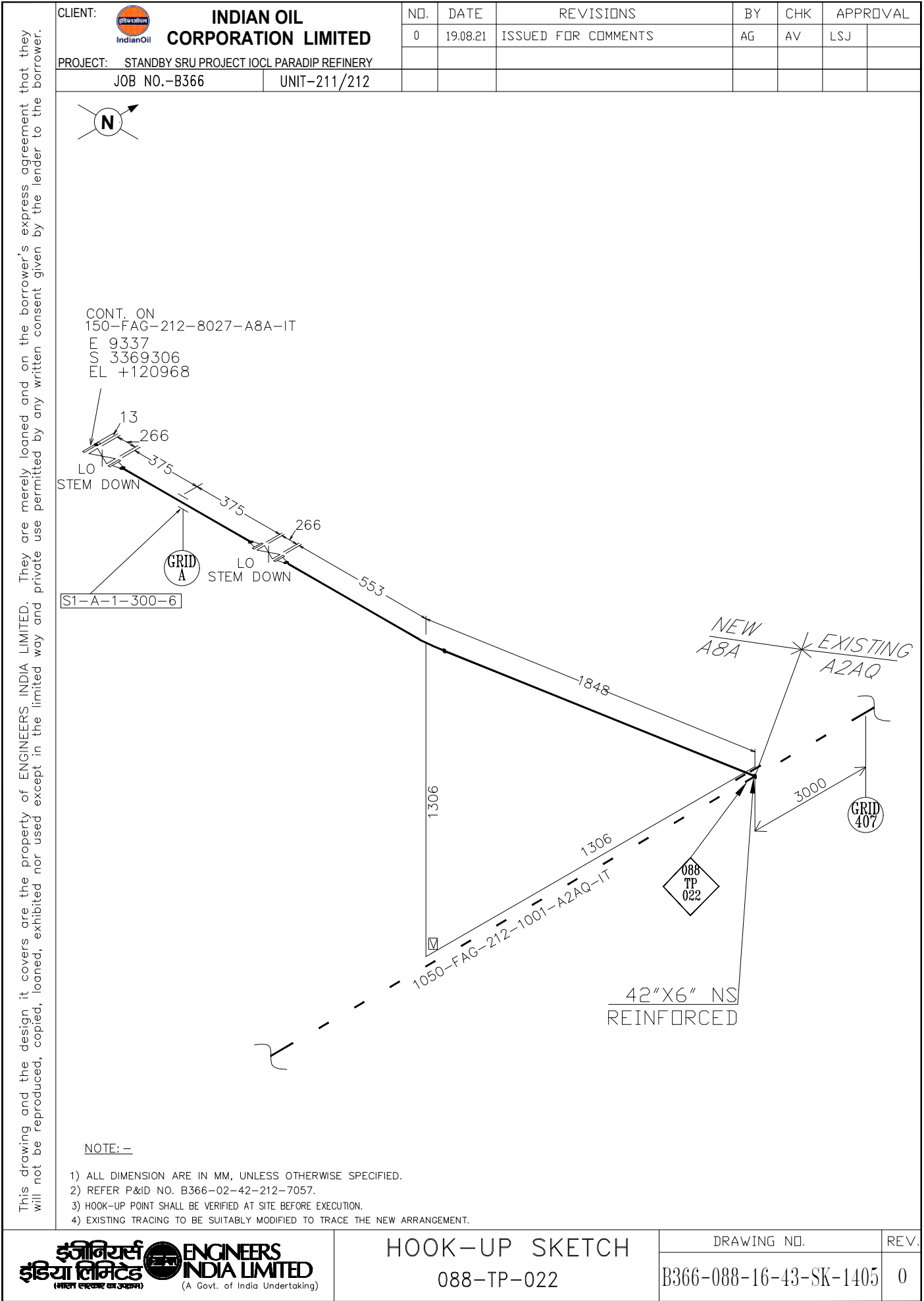
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PROJECT: <u>STANDBY SRU PROJECT IOCL PARADIP REFINERY</u>							
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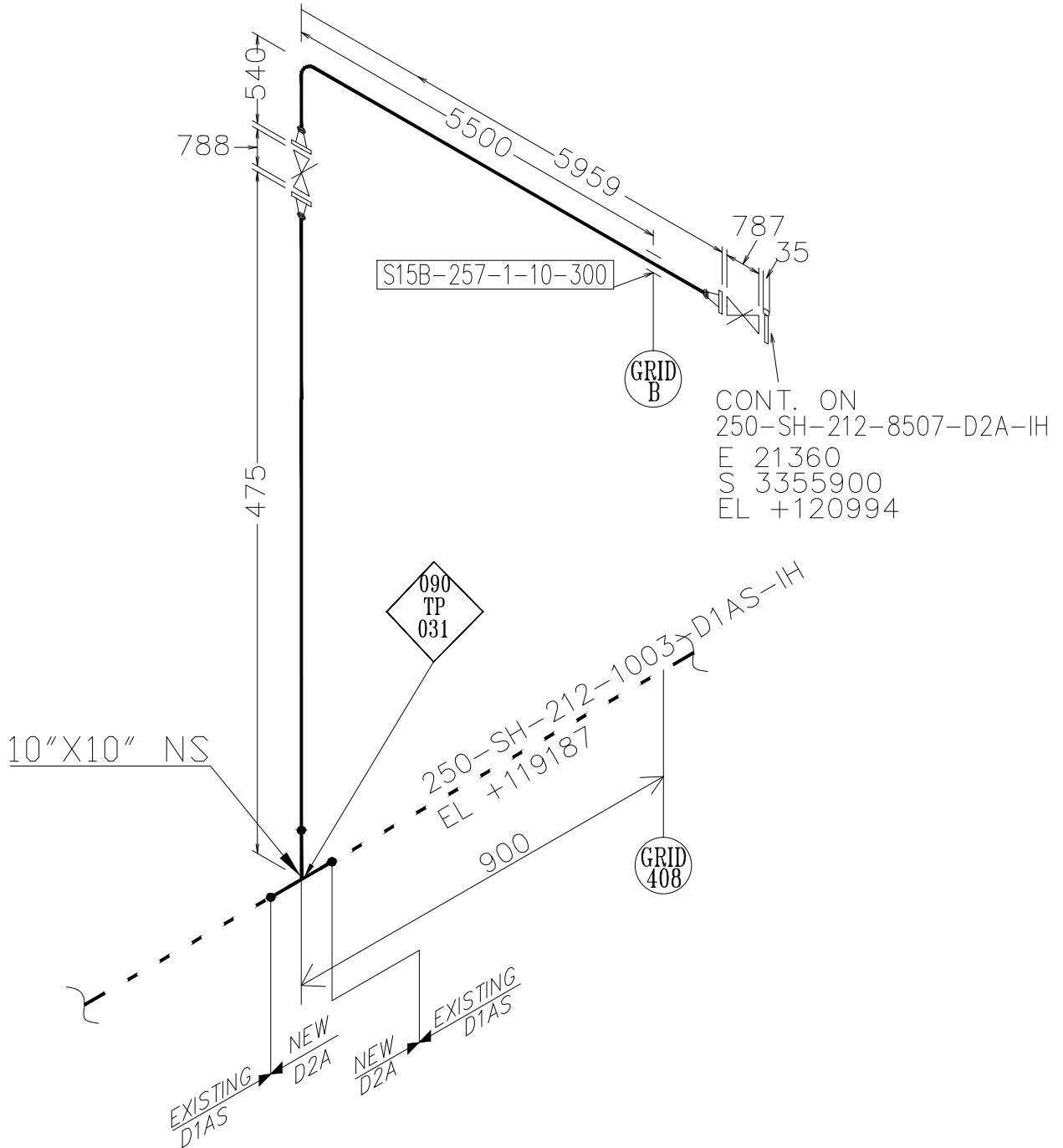
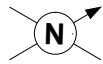
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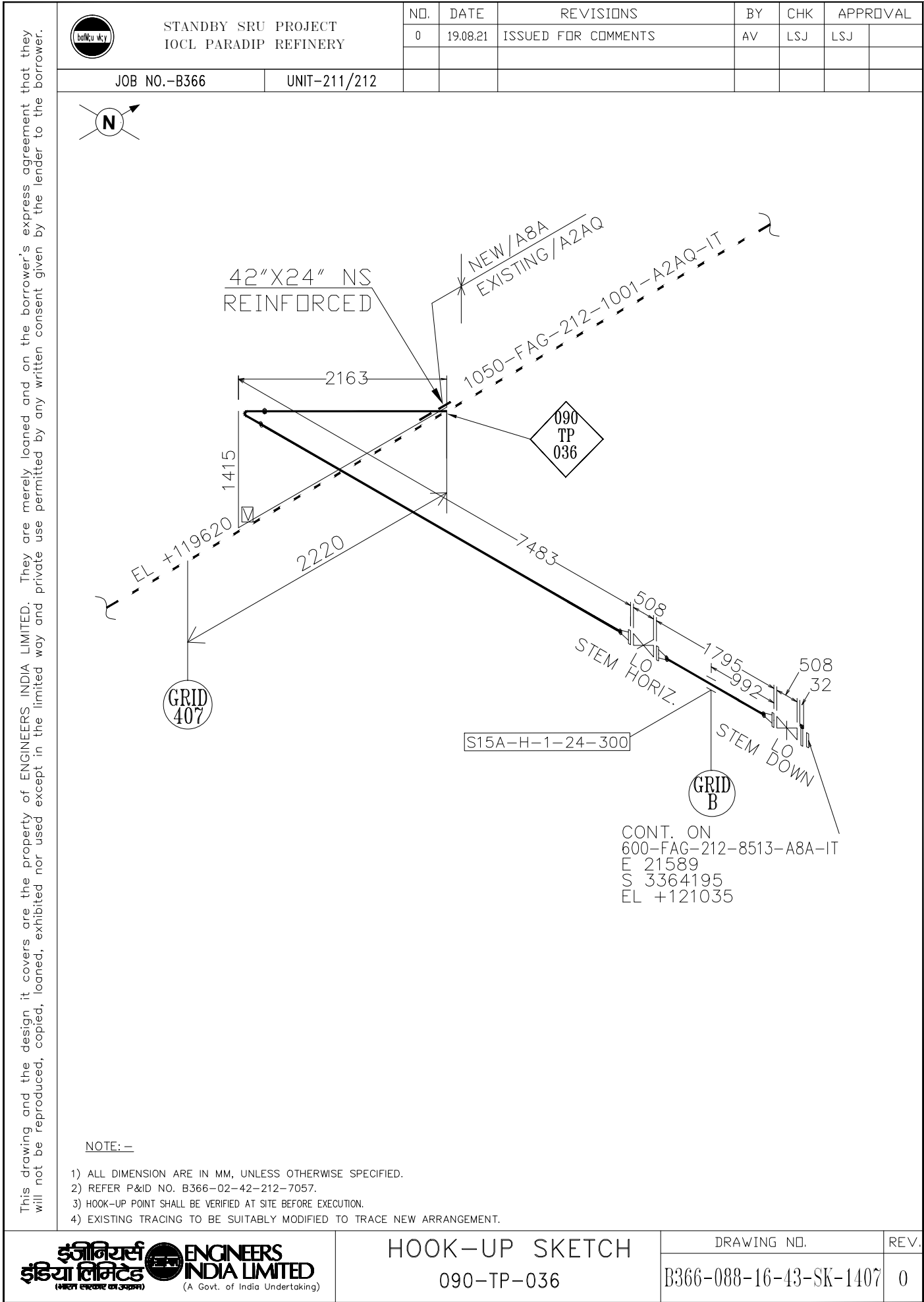
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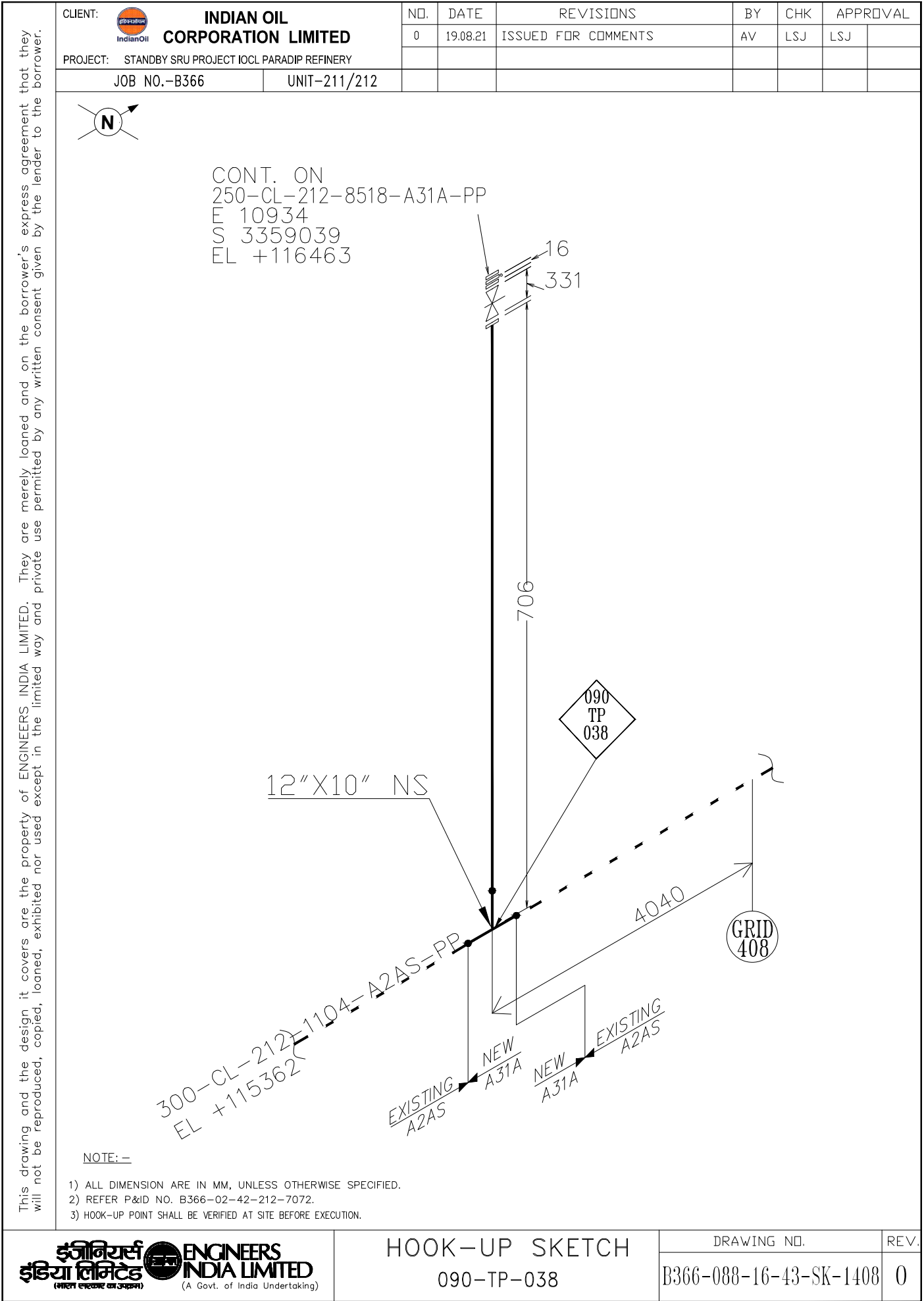
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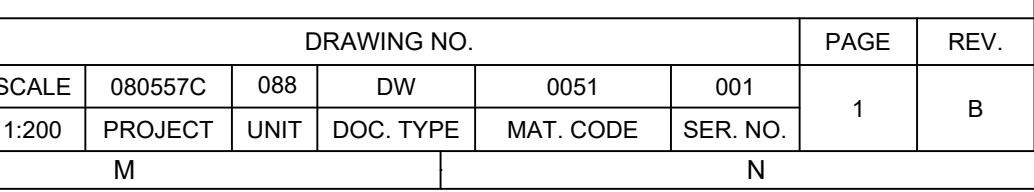


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PACKAGES EQUIPMENT LIST	
EQUIPMENT TAG	DESCRIPTION
088-A-001*	REACTION FURNACE PACKAGE
*CONSISTS OF FOLLOWING ITEMS	
088-WHB-001	WASTE HEAT EXCHANGER 1ST PASS
088-WHB-002	WASTE HEAT EXCHANGER 2ND PASS
088-F-001	REACTION FURNACE BURNER
088-F-002	REACTION FURNACE
088-A-004	WASTE HEAT EXCHANGER STEAM DRUM
088-T-002	TSP DOSING PACKAGE
EQUIPMENT TAG	DESCRIPTION
090-A-001*	INCINERATOR PACKAGE
*CONSISTS OF FOLLOWING ITEMS	
090-WHB-001A/B	INCINERATOR WASTE HEAT EXCHANGER
090-F-001	INCINERATOR BURNER
090-F-002	INCINERATOR
090-V-006	INCINERATOR WHE STEAM DRUM
090-W-001	INCINERATOR WHE MTD RUM
090-DS-002	INCINERATOR HPF STEAM DESUPERHEATER
090-K-001 A/B	INCINERATOR FANS
090-SK-001	INCINERATOR SACK
090-T-002	TSP DOSING PACKAGE
090-AH-001	ANALYZER STRAIGHT

 IndianOil	<p align="center">STANDBY SRU (525 TPD) TRAIN FOR IOCL PARADIP REFINERY</p> <p align="center">ANNEXURE TO SCC</p>		
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SPECIFICATION
HEALTH, SAFETY, SECURITY AND ENVIRONMENT
MANAGEMENT







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ANNEXURE A-V :

SPECIFICATION HEALTH, SAFETY, SECURITY AND ENVIRONMENT MANAGEMENT

1. SCOPE

This document defines the requirements of the Owner / Consultant on Health, Safety and Environment (HSE) associated with the CONTRACTOR and any other agency to be practiced at construction worksites at all time. This specification establishes the Health, Safety and Environmental (HSE) management

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requirement to be complied by CONTRACTORS / Vendors including their Sub-CONTRACTORS / Sub vendors during construction for Project execution in Home office and Project site.

This specification is not intended to replace the necessary professional judgment needed to design & implement an effective HSE system for construction activities and the CONTRACTOR is expected to fulfil HSE requirements in this specification as minimum.



2. REFERENCE DOCUMENTS

The document should be read in conjunction with following:

- Applicable standards like Environmental management system and Occupational Health and Safety Standards
- Safety Practices during Constructions - OISD-192 and OISD-207
- OISD-STD-129 - Inspection of Storage Tanks
- OISD-RP-108 - Recommended Practices on Oil Storage and Handling
- OISD-GDN-166 - Guidelines for Occupational Health Monitoring in Oil and Gas Industry



3. DEFINITIONS & ABBREVIATIONS

AERB	:	Atomic Energy Regulatory Board
ANSI	:	American National Standards Institute
BARC	:	Bhabha Atomic Research Centre
BS	:	British Standard
CONSULTANT	:	Project Management Consultant
ELCB	:	Earth Leakage Circuit Breaker
EPC	:	Engineering, Procurement and Construction
EPCC	:	Engineering, Procurement, Construction and Commissioning
ESI	:	Employee State Insurance
GCC	:	General Conditions of Contract

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GM	:	General Manager
GTAW	:	Gas Tungsten Arc Welding
HOD	:	Head of Department
HSE	:	Health, Safety & Environment
HV	:	High Voltage
IS	:	Indian Standard
IE	:	Indian Electricity
JSA	:	Job Safety Analysis
LOTO	:	Lock Out & Tag Out
LPG	:	Liquefied Petroleum Gas
LSTK	:	Lump Sum Turn Key
MV	:	Medium Voltage
PPE	:	Personal Protective Equipment
RCM	:	Resident Construction Manager or Site-in-Charge
ROW	:	Right of Way
SCC	:	Special Conditions of Contract
SLI	:	Safe Load Indicator
TBT	:	Tool Box Talks

- The use of 'Shall' indicates a mandatory requirement.
- The use of 'Should' indicates a guideline that is strongly recommended.
- The use of 'May' indicates a guideline that is to be considered.
- 'HSE' means Health Safety and Environment.
- OWNER means Indian Oil Corporation Limited,
- PROJECT MANAGEMENT CONSULTANCY (Consultant) means Technip India Limited
- CONTRACTOR means the party with whom contractual relationship are formed by Owner / Consultant.
- SUBCONTRACTOR means the party with whom contractual relationship are formed by

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CONTRACTOR

HSE REQUIREMENTS TO BE COMPLIED BY BIDDERS

4. HSE GENERAL



4.1 Management Responsibility

4.1.1 HSE Policy & Objectives

The CONTRACTOR shall have a documented HSE policy and objectives to cover commitment of their organization to ensure Health, Safety and Environment aspects in their line operation. Within 4 weeks of the notification of acceptance of the tender, the CONTRACTOR shall submit a detailed and comprehensive Contract specific HSE Plan. The HSE Plan shall include detailed policies, procedures and regulations with detailed implementation will ensure compliance of the contract provisions.

The HSE Plan shall include the following but not be restricted to:

- A statement of the CONTRACTOR's policy, organization and arrangements for HSE.
- The name(s) and experience of person(s) within the CONTRACTOR's proposed Management who shall be responsible for coordinating and monitoring their HSE performance.
- The number of HSE staff who shall be employed on the Works, their responsibilities, authority and line of communication with the proposed CONTRACTOR's agent.
- A statement of the CONTRACTOR's procedures for identifying and estimating hazards, and the measures for addressing the same.
- A list of HSE hazards anticipated for this Contract and sufficient information to demonstrate the CONTRACTOR's proposals for achieving effective and efficient health and safety procedures;
- A description of the HSE training courses and emergency drills which shall be provided by the CONTRACTOR, with an outline of the syllabus to be followed.
- Details of the safety equipment which shall be provided by the CONTRACTOR, including personal protective equipment;
- A statement of the CONTRACTOR 's procedures for ensuring that CONTRACTOR 's

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Equipment used on the Project Site are maintained in a safe condition and are operated in a safe manner;

4.1.2 HSE Management

CONTRACTOR shall cover the HSE requirements & commitments to fulfil HSE MS. The CONTRACTOR shall obtain the approval of its site specific HSE Plan from Owner / Consultant prior to commencement of any site works. Corporate as well as Site management of the CONTRACTOR shall ensure compliance of their HSE Plan at work sites in its entirety in true spirit.

4.1.3 Indemnification

CONTRACTOR shall indemnify & hold harmless, Owner/Consultant & their representatives, free from any and all liabilities arising out of non-fulfilment of HSE requirements or its consequences.

4.1.4 Deployment & qualifications of HSE personnel



CONTRACTOR shall submit scrutinized CVs as per requirement prior to the job. Consultant HSE shall evaluate the CVs and conduct personal interview of the proposed candidates. Only Consultant approved CONTRACTOR HSE personnel are permitted to work at site. In case of replacement of approved CONTRACTOR HSE Personnel, the CONTRACTOR shall plan in advance and follow the above procedure.

The CONTRACTOR shall designate/deploy various categories of HSE personnel at site as indicated below in sufficient number. i.e. deployment of safety officer/Safety Engineer is compulsory at project site.

Employee strength (Including CONTRACTOR)	Minimum Strength of HSE personal required
Up to 50	HSE Officer/ HSE Engineer & Male Nurse
51 to 150	HSE Officer / HSE Engineer (1 for every 50 workers) + 01 Male nurse
Above 150	1 HSE Manager + HSE Officer/ HSE Engineer for every 50 workers + 01 Male Nurse

The minimum standard for CONTRACTOR HSE personnel should be:

HSE Manager

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Should be Technical graduate engineers (Chemical / Mechanical / Electrical / Civil) with 10 years' experience and above as supervisor in Oil & Gas / Refinery / Petrochemicals or Bulk Chemical Manufacturing companies or Large Construction sector. He / she must be able to communicate, write and read English.

And Degree or Diploma in Industrial Safety with one subject of construction safety from a recognized Institute (Institute recognized by AICTE / State council of technical education for India) or from RLI.

HSE Officer

Should be a Science Graduate (Chemistry / Physics / Mathematics) with 5 years' experience and above as supervisor in Oil & Gas / Refinery / Petrochemicals or Bulk Chemical Manufacturing companies or Large Construction sector. He / she must be able to communicate, write and read English.

And Degree or Diploma in Industrial Safety with one subject of construction safety from a recognized Institute (Institute recognized by AICTE / State council of technical education for India) or from RLI.



HSE Engineer

Should be a graduate Engineer (Chemical / Mechanical / Electrical / Civil) or a Science Graduate from a recognized university with 5 years' experience and above as supervisor / safety in-charge in Oil & Gas / Refinery / Petrochemical / Bulk Chemicals Industry / large construction sector.

And Degree or Diploma in Industrial Safety with one subject of construction safety from a recognized Institute (Institute recognized by AICTE for India). He / she must possess site safety leadership attributes.

4.1.5 Implementation, Inspection / Monitoring

The CONTRACTOR shall be fully responsible for planning, reporting, implementing and monitoring of HSE requirements and compliance of laws & statutory requirements. The CONTRACTOR shall also ensure that the HSE requirements are clearly understood & implemented conscientiously by their site personnel at all levels at site. The CONTRACTOR shall ensure physical presence of their field

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engineers / supervisors, during the continuation of their contract works / site activities including all material transportation activities.

Physical absence of experienced field engineers / supervisors of CONTRACTOR at critical work spot during the course of work, may invite severe penalization as per the discretion of EIC, including halting / stoppage of work. CONTRACTOR shall furnish their annual Inspection Plan, in line with project issues /subjects, frequency and performers to Owner / Consultant.

The CONTRACTOR shall regularly review inspection report internally and implement all practical steps / actions for improving the status continuously. The CONTRACTOR shall ensure important safety checks right from beginning of works at every work site locations and to this effect "Daily Safety Check List" shall be prepared by field engineer & duly checked by safety personnel for conformance.



Adequate records for all inspections shall be maintained by the CONTRACTOR and the same shall be furnished to Owner / Consultant, whenever sought. The CONTRACTOR shall not carry-out work by engaging single worker anywhere without any supervisor anytime during day or night.

To demonstrate involvement/commitment of site management of CONTRACTOR, at least one Safety Walk through shall be carried out by CONTRACTOR's head of site (along with his area manager/field engineers) and a report shall be furnished to Owner/Consultant "Safety walk through report as Appendix – 12 " followed by compliance for unsatisfactory remarks.

As a general practice lifting tools/tackles, machinery, accessories etc. shall be inspected, tested and examined by competent people (approved by concerned State authorities) before being used at site and also at periodical interval (e.g. during replacement, extension, modification, elongation/reduction of machine/parts, etc.) as per relevant statutes.

Hydra, cranes, lifting machinery, mobile equipment / machinery / vehicles(as Appendix in 14), etc. shall be inspected regularly by only competent / experienced personnel at site and requisite records for such inspections shall be maintained by every CONTRACTOR.

CONTRACTOR shall also maintain records of maintenance of all other site machinery (e.g. generators, rectifiers, compressors, cutters, etc.) & portable tools / equipment being used at project related works (e.g. drills, abrasive wheels, punches, chisels, spanners, etc.). The CONTRACTOR shall not make use of arbitrarily fabricated 'derricks' at project site for lifting / lowering of construction materials.

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All sites facilities and working condition should be periodically inspected by CONTRACTOR and records are to be maintained.

4.1.6 Behavior Based Safety

The CONTRACTOR shall develop a system to implement Behaviour-Based Safety (BBS) through which work groups can identify, measure and change the behaviours of employees and workers.



The BBS process shall include the following:

- Identify the behaviors critical to obtaining required safety performance.
- Communicate the behaviors and how they are performed correctly to all
- Observe the work force and record safe/at risk behaviors. Intervene with workers to give positive reinforcement when safe behaviors are observed. Provide coaching/correction when at risk behaviors are observed
- Collect and record observation data
- Summarize and analyze observation data
- Communicate observation data and analysis results to all employees
- Provide recognition or celebrate when safe behavior improvements occur
- Change behaviors to be observed or change activators or change consequences as appropriate.
- Communicate any changes to workforce

CONTRACTOR through its own HSE committee shall implement the above process. The necessary procedures and reporting formats shall be developed by the CONTRACTOR for approval by Owner/Consultant.

CONTRACTOR shall observe individual's behaviour for safe practices adapted for utilization/execution of work for the following as a minimum:-

- PPE
- Tools & equipment
- Hazard Identification & control
- House keeping
- Confined space entry

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- Hot works
- Excavation
- Loading & unloading
- Work At height
- Stacking & storage
- Ergonomics
- Procedures

4.1.7 Awareness and Motivation



The CONTRACTOR shall promote and develop awareness on Health, Safety and Environment protection among all personnel working for the CONTRACTOR. Regular awareness programs and fabrication shop / work site meetings at least on monthly basis shall be arranged on HSE activities to cover hazards/risks involved in various operations during construction. CONTRACTOR to motivate & encourage the workmen & supervisory staff by issuing / awarding them with tokens/ gifts/ mementos/ monetary incentives / certificates, etc. CONTRACTOR shall assess & recognize the behavioural change of its site engineers / supervisors periodically and constantly motivate / encourage them to implement HSE practices at project works

4.1.8 Key Performance Indicators

The CONTRACTOR shall measure an activity in both leading & trailing indicators for statistical and performance measurement. The activities pertaining to key performance indicators are covered in Monthly HSE Report. The CONTRACTOR shall try to achieve a statistically fair record and strive for its continual improvement.

Leading Indicators viz:-:

- Number of Safety Inductions carried-out at site (for workmen & staff members)
- Number of HSE inspections carried out
- Number of “Safety Walk Through” carried-out by site-head.
- Number of HSE shortfalls / lapses identified per CONTRACTOR & closed-out in time.
- Number of Safety Meetings conducted (in-house / with CONTRACTORS)
- Numbers of HSE Audits made (Internal & External) vis-à-vis non Conformance raised

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- Number of HSE Awareness / Motivational program conducted by CONTRACTORS
- Number of HSE Trainings conducted at site for supervisors & workmen
- Study of Near miss case reported
- Encouragements / Awards / Recognitions to workmen, job supervisors & field engineers.
- Suggestions for improvement

Trailing Indicators viz:- (Lagging)

- Calculation of HSE statistics viz frequency rate, severity rate, LTA free Manhours
- Analysis of incidents / accidents (nature, severity, types etc.)
- Study of Incident / Accident with respect to :- Variety , Period of the year / project span
- Timings of the incident / accident
- Age profile of victims and Body parts involved
- Penalty levied for causing incident / accident



4.1.9 Documentation

The CONTRACTOR shall evolve a comprehensive, planned and documented system covering the following as a minimum for implementation and monitoring of the HSE requirements and the same shall be submitted for approval by Owner/Consultant.

- HSE Organogram
- Site Specific HSE Plan
- Safety Procedures, forms and Checklist. Indicative list of HSE procedures
- Risk Assessment & Job Safety Analysis for critical works as format attached.

The monitoring for implementation shall be done by regular inspections and compliance of the observations thereof. The CONTRACTOR shall get similar HSE requirements implemented at his sub-CONTRACTOR(s) work site/office. However, compliance of HSE requirements shall be the responsibility of the CONTRACTOR. Any review/approval by Owner/Consultant shall not absolve CONTRACTOR of his responsibility/liability in relation to fulfilling all HSE requirements.

4.1.10 HSE Audit

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The CONTRACTOR shall submit an Audit plan to Consultant indicating the type of audits. Project Manager / RCM holds the ultimate responsibility in ensuring implementation of HSE audit program during the construction work.

4.1.10.1 Internal HSE Audit

The CONTRACTOR shall conduct an internal HSE audit on quarterly basis and submit a report to Owner / Consultant. Internal HSE audits are to be conducted by Qualified HSE Internal Auditors with the prior approval of the Consultant.

4.1.10.2 External HSE Audit

External HSE audits are to be conducted by external agencies that are competent with ISO qualified auditors with the prior approval of the Owner / Consultant.

4.1.10.3 Areas of competence of Audit team



Audit shall be conducted as per the guidelines of ISO, ILO, OISD. External HSE audit shall be conducted requirement basis throughout the period of the contract. The coverage of the external audit shall include the following items but not limited to:

i) HSE Management :

- Organization
- Communication and Motivation
- Inspection
- Emergency preparedness
- Education and Training
- Work permit system First-aid and Medical Facilities
- Welfare measures
- Environmental Management

ii) Technical:

- Building and Structure

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- Construction operational safety
- Material safety
- Hand tools and Power tools
- Electrical system
- Safety Appliances
- Fire prevention and control
- Housekeeping & Maintenance and Machinery safety
- Scaffolding etc.



iii) Audit Documents:

CONTRACTOR shall make the listed documents available for the review at the time.

- HSE policy & HSE manual
- HSE Rules and Regulation
- HSE organization chart
- Annual HSE objectives / programs
- Incident / near miss statistics and analysis
- HSE Training program / records for all personnel
- Operating manuals and maintenance manual of all equipment's
- Safe worthiness certificates of all lifting appliances and gears
- Medical fitness record for all personnel
- Risk identification, assessment and control details
- Environmental management reports
- Emergency management records including mock drill & Reporting:

iv) Audit Findings:

All audit findings as detailed in the audit checklists shall be grouped together as priority 1 and 2 as detailed below in a separate listing.

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Priority 1: Actions to rectify gaps or weakness should generally be implemented within one-week time, if risk potential is high or unacceptable.

Priority 2: Actions should be generally implemented or rectified with a maximum of 4 weeks, if not rectified would create a likelihood of minor injury or business loss.



v) Conformity Report & Action:

The CONTRACTOR shall submit the Compliance report within 15 days of conducting initial audit for priority1 observations and within 04 weeks for priority observations to Consultant. In case of non-conformity of items mentioned by auditor, the Consultant shall take necessary steps including stoppage of work and or imposing any penalty for getting the item implemented. Failure of CONTRACTOR to conduct External / Internal HSE Audit. If the CONTRACTOR fails to conduct the external/ Internal HSE audit in time, the Consultant at the cost of CONTRACTOR shall get it done.

4.1.11 Meetings

The CONTRACTOR shall ensure participation of his top most executive at site (viz. Resident Construction Manager / Resident Engineer / Project Manager / Site-in-Charge) in Safety Committee / HSE Committee meetings arranged by Owner/ Consultant usually on monthly basis or as and when called for. In case CONTRACTOR's top most executive at site is not in a position to attend such meeting, he shall inform Owner/ Consultant in writing before the commencement of such meeting indicating reasons of his absence and nominate his representative – failure to do so may invite very stringent penalization against the specific CONTRACTOR, as deemed fit in Contract. The obligation of compliance of any observations during the meeting shall be always time bound. The CONTRACTOR shall always assist Owner/ Consultant to achieve the targets set by them on HSE management during the project implementation.

In addition, the CONTRACTOR shall also arrange internal HSE meetings chaired by his top most executive at site on weekly basis and maintain records. Such internal HSE meetings shall essentially be attended by field engineers / supervisors (& not by safety personnel only) of the CONTRACTOR and its associates. Records of such internal HSE meetings shall be maintained by the CONTRACTOR for review by Owner/ Consultant or for any HSE Audits.

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Agenda of internal HSE meeting should broadly cover: -

- Confirmation of record notes / minutes of previous meeting
- Discussion on outstanding subjects of previous points / subjects, if any
- Incidents / Accidents (of all types) at project site, if any
- Current topics related to site activities / subjects of discussion
- House keeping
- Behavioral Safety
- Information / views / deliberations of members / site sub-CONTRACTORS
- Report from Owner / Consultant
- Status of Safety awareness, Induction programs & Training programs
- The time frame for such HSE meeting shall be religiously maintained by one and all.

For minutes of meeting Refer Appendix – 10

4.1.12 Laws and Regulations - National Regulations and Standards



CONTRACTOR shall comply and ensure compliance with the relevant applicable National regulations and any other Local regulation applicable throughout the performance of the Work as per Conditions of the Contract; and in particular the laws and regulations relating to:

- Health safeguarding
- Safety
- Respect for the Environment
- Fire safety
- Emergency situation prevention and preparedness

With regards to the Construction Site, CONTRACTOR shall comply with Local regulation applicable in the working site . Refer appendix - 2

5. OCCUPATIONAL HEALTH REQUIREMENTS

5.1 General

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The CONTRACTOR shall identify all operations that can adversely affect the health of its workers and issue & implement mitigation measures. CONTRACTOR shall establish a format for Pre-employment medical examination for their employees and Subcontract workers in compliance with BOCW Act / Factories Act.

No female labour shall be employed in dark hours i.e. hours prohibited under the applicable law. (Ref.- Section 66(1) (b) of the Factories Act, 1948)

Pre-employment medical fitness criteria for the persons assigned to HSE sensitive job like confined space, radiation, crane and fork lift operators, vehicle drivers; and exposure to hazardous chemicals and noise should include specific medical tests / examination related to the these activities.

5.2 Occupational Hazards



To eliminate radiation hazard, Tungsten electrodes used for Gas Tungsten Arc Welding shall not contain Thorium. Appropriate respiratory protective devices(hood with respiratory devices) shall be used to protect workmen from inhalation of air borne contaminants like silica, asbestos, gases, fumes.

CONTRACTOR workers carrying slag blasting operation shall use slag blasting hood with vortex cooling system, airline supply and face shields, with respiratory protection. Workmen shall be made aware of correct methods for lifting, carrying, pushing & pulling of heavy loads. Wherever possible, manual handling shall be replaced by mechanical lifting equipment. For jobs like drilling/demolishing/dismantling where noise pollution exceeds the specified limit of 85 decibels, ear muffs shall be provided to the workers.

To avoid Work Related Upper Limb Disorders (WRULD) and backaches, Display Screen Equipment workplace stations shall be carefully designed & used with proper sitting postures. Power driven hand-held tools shall be maintained in good working condition to minimize their vibrating effects and personnel using these tools shall be taught how to operate them safely & how to maintain good blood circulation in hands.

5.3 Health Centre

The CONTRACTOR shall ensure at a construction site an occupational health centre, mobile or static is provided and maintained in good order.

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5.4 Ambulance

The CONTRACTOR shall ensure the availability of an ambulance at construction site for transportation of serious cases of Incident or sickness of workers to hospital promptly and such ambulance and room are maintained in good repair and is equipped with standard facilities.

5.5 Rest Room

The CONTRACTOR shall provide one latrine seat for every 20 workers up to 100 workers and thereafter one for every additional 50 workers. In addition one urinal accommodation shall be provided for every 100 workers.

When women are employed, Separate latrine and urinals accommodation shall be provided on the same scale and maintained and shall comply with the requirements of public health authorities.

5.6 Rest Shelters cum Lunch Room



CONTRACTOR shall provide Adequate rest shelter cum lunch room for the workers as a min. requirement of 45 m² / person. The rest shelter shall be well illuminated and ventilated by providing sufficient lights, fans & windows. The rest shelters shall have sufficient numbers of tables and chairs and drinking water facility etc.

5.7 Canteen

In every workplace wherein not less than 250 workers are ordinarily employed the CONTRACTOR shall provide an adequate canteen. Reasonable canteen facilities at site and in Labour camps at appropriate location depending upon site conditions. CONTRACTOR shall make use of “industrial” variety of LPG cylinder & satisfactory illumination at the canteens.

Necessary arrangement for efficient disposal of wastes from canteens & urinals /toilets shall also be made and regular review shall be made to maintain the ambience satisfactorily hygienic & shall also comply with all applicable statutory requirements.

5.8 Drinking water

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The CONTRACTOR shall make in every worksite, effective arrangements to provide sufficient supply of wholesome drinking water with minimum quantity of 5 liters per workman per day. Quality of the drinking water shall conform to the requirements of national standards on Public Health (i.e IS10500). While locating these drinking water facilities due care shall be taken so that these are easily accessible within a distance of 200m from the place of work for all workers at all location of work sites. All such points shall be legible marked “Drinking Water” in a language understood by a majority of the workmen employed in such place and such point shall be situated within six meters of any washing places, urinals or latrines. CONTRACTOR shall submit Drinking water Test Report as per IS : 10500 every quarter to Owner / Consultant.

5.9 Labour Accommodation

The CONTRACTOR shall provide temporary living accommodation to all workers. These accommodations shall have cooking place, bathing, washing and lavatory facilities as per local legislation. Adequately ventilated / illuminated rooms at Labour camps & its hygienic up-keeping.



5.10 Welfare Measures

CONTRACTOR shall, at the minimum, ensure the following facilities at work sites:

A crèche at site where 30 or more female workers are having children below the age of 6 years. Adequately ventilated / illuminated rooms at labour camps & its hygienic up-keeping. Reasonable canteen facilities at site and in labour camps at appropriate location depending upon site conditions. CONTRACTOR shall make use of “industrial” variety of LPG cylinder & satisfactory illumination at the canteens. Necessary arrangement for efficient disposal of wastes from canteens & urinals /toilets shall also be made and regular review shall be made to maintain the ambience satisfactorily hygienic & shall also comply with all applicable statutory requirements. Adequately lighted & ventilated Rest rooms at site (separate for male workers and female workers). Urinals, Toilets, drinking water, washing facilities, adequate lighting at site and labour camps, commensurate with applicable Laws / Legislation.

5.11 First-Aid

The CONTRACTOR shall arrange suitable First-aid measures such as First Aid Box, trained personnel/nurse (male) to administer First Aid, stand-by Ambulance vehicle and shall arrange

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installation of fire protection measures such as adequate number of steel buckets with sand & water and adequate number of appropriate portable fire extinguishers to the satisfaction of Owner/ Consultant. The CONTRACTOR shall deploy trained supervisory personnel / field engineers to cater to any emergency situation. Spraying chemicals / repellent at site shall be made available to prevent Snakes. Anti-venom shall be kept in First Aid box. List of details of First Aid Box refer Appendix – 1

CONTRACTOR medical department shall have an ongoing first-aid training program for their staff. CONTRACTORS are responsible for ensuring first-aid training for their staff. Training shall be structured and based on international standard. At least 1 person out of 50 will follow the first-aid basic training course. All safety staff shall be trained. All the first-Aiders will be identified by a sticker.



The CONTRACTOR shall ensure at a construction site one First-aid box for 100 workers provided and maintained for providing First-aid to the workers. Every First-aid box is distinctly marked “First-aid” and is well equipped.

CONTRACTOR will ensure for availability of adequate number of qualified first aider available at site. Number of first aiders will depend on type and size of work. Minimum one first aider should be available in a group of workers engaged in a specific task. For this, the CONTRACTOR will ensure that a suitable number of personnel receive formal first aid training from a recognized agency. Before deploying the workforce this should happen and refresher training of the same also need to be taken care.

5.12 Prevention of mosquito breeding

CONTRACTOR shall take measures to prevent mosquito breeding at site. The measures to be taken shall include:

- Empty cans, oil drums, packing and other receptacles, which may retain water shall be deposited at a central collection point and shall be removed from the site regularly.
- Still waters shall be treated at least once every week with oil in order to prevent mosquito breeding.
- CONTRACTOR'S equipment and other items on the site, which may retain water, shall be stored, covered or treated in such a manner that water could not be retained.

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- Posters in both Hindi and English or local Languages, which draw attention to the dangers of permitting mosquito breeding, shall be displayed prominently on the site.
- The CONTRACTOR at periodic interval shall arrange to prevent mosquito breeding by fumigation / spraying of insecticides. Most effective insecticides shall include SOLFAC WP 10 or Baytex, The Ideal Larvicide etc.
- Spraying of chemicals shall be done to keep away mosquitoes and to kill its larvae. Ensure availability of proper medical care for the infected victim. Medical Awareness shall be created among site personnel regarding Malaria.



5.13 Noise

The CONTRACTOR shall consider noise as an environmental constraint in his design, planning and execution of the Works and provide demonstrable evidence of the same. The CONTRACTOR shall, take all appropriate measures to ensure that work carried out by the CONTRACTOR, whether on or off the Site, will not cause any unnecessary or excessive noise which may disturb the occupants of any nearby dwellings, premises with similar sensitivity to noise.

The CONTRACTOR shall ensure that all powered mechanical equipment used in the Works shall be effectively sound reduced using the most modern techniques available including but not limited to silencers and mufflers. Noise level shall be as prescribed by standards. The CONTRACTOR shall construct acoustic screens or enclosures around any parts of the Works from which excessive noise may be generated. The same may be varied from time to time by and at the sole discretion of the Consultant, In the event of a breach of this requirement, the CONTRACTOR shall immediately re-deploy or adjust the relevant equipment or take other appropriate measures to reduce the noise levels and thereafter maintain them at levels which do not exceed the said limits. Such measures may include without limitation the temporary or permanent cessation of use of certain items of equipment.

5.13.1 Noise Control Requirements

Construction material should be operated and transported in such a manner as not to create unnecessary noise as outlined below:

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Perform Work within the procedures outlined herein and comply with applicable codes, regulations, and standards established by the Central and State Government and their agencies.

Keep noise to the lowest reasonably practicable level. Appropriate measures will be taken to ensure that construction works will not cause any unnecessary or excessive noise, which may disturb the occupants of any nearby dwellings, premises with similar sensitivity to noise.

Use equipment with effective noise-suppression devices and employ other noise control measures.

5.14 Ventilation and Illumination

5.14.1 Ventilation

The CONTRACTOR shall ensure at a construction site of a building or other construction work or confined areas that all working areas are provided with ventilation system as approved by the Consultant and the fresh air supply in such areas is not less than 6 m³ / min for each worker working in such areas and the free air flow movement inside such tunnel is not less than 9 m / min.



The oxygen level shall not be less than 19.5% in the working environment.

5.15 Illumination

The CONTRACTOR shall take every effort to illuminate the work site. The CONTRACTOR shall conduct a monthly illumination monitoring by Lux meter for all the locations and the report shall be sent to the Consultant on periodical basis as planned and the same shall be reviewed during the monthly HSE committee meeting. The minimum illumination for the work area will be 250 lux.

5.16 Radiation

The use of radioactive substances and radiating apparatus shall comply with the Govt. regulatory requirements and all subsidiary legislation. Operations involving ionizing radiation shall only be carried out after having been reviewed without objection by the Consultant representative and shall be carried out in accordance with a method statement. Each area containing irradiated apparatus shall have warning notices and barriers, as required by the Regulations, conspicuously posted at or near the area. Radioactive substances will be stored, used or disposed shall be strictly in accordance with the Govt.

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Enactments. The CONTRACTOR shall ensure that all site personnel and members of the public are not exposed to radiation. Periodical medical check have to be carried out as stipulated in the HSE Plan.

5.17 Intoxicating drinks & drugs and Smoking

The CONTRACTOR shall ensure that his staff members & workers (permanent as well casual) shall not be in a state of intoxication during working hours and shall abide by any law relating to consumption & possession of intoxicating drinks or drugs in force. The CONTRACTOR shall not allow any workman to commence any work at any locations of project activity who is/are influenced / effected with the intake of alcohol, drugs or any other intoxicating items being consumed prior to start of work or working day.

Awareness about local laws on this issue shall form part of the Induction Training and compulsory work-site discipline.

The CONTRACTOR shall ensure that all personnel working for him comply with “No-Smoking” requirements of the Owner as notified from time to time. Cigarettes, lighters, auto ignition tools or appliances as well as intoxicating drugs, dry tobacco powder, etc. shall not be allowed inside the project / plant complex.

Smoking not at all allowed in the vicinity of workplace.

6. SAFETY REQUIREMENTS



6.1 Site preparation & development

Good Housekeeping shall be maintained during site preparation and development work

Water Sprinkling shall be done to control dust. While storing, soil or other fine particles material shall be stored in low height of the heap. Cover them with empty gunny bags to prevent dust particle flying. Vegetation clearing shall be carried out on a needs basis.



6.2 Site Labour Camp / Colony

- Proper 1.8m wire net fence with barbed-wire or wall shall be provided around camp. 24 hours Security Guards shall be deployed at camp. Security cameras to be provided all places wherever required including all site gates.
- Living facilities are built with masonry materials or porta cabins. Approximate area of 45 m²

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per person to be provided within each accommodation units.

- All occupants to be provided with a comfortable mattress, pillow, cover and clean bedding.
- Adequate space for hanging, drying, and airing clothes to be provided.
- Provide adequate nos. of latrines, bathrooms & urinals in ratio 1:25 employees..
- Separate accommodation, bathrooms, urinals & latrines to be provided for males
- & females, where both male & female employees are employed.
- For food preparation/cooking separate common kitchen with proper platforms to be provided which can be used for food cooking by occupants. In case if food cooking done inside accommodation, then proper platform to be provided for cooking purpose & gas cylinder connection and also partition to keep safe distance from occupants sleeping / resting space.
- Only authorized Commercial LPG gas connection to be used for food cooking. Gas stove, gas hoses and regulator in use shall have ISI marks. Gas stove, gas hoses and regulators shall be periodically inspected maintaining record. Wood burning is prohibited in camp.
- LPG gas cylinders to be stored in well ventilated area. Cylinder Storage area to be shielded from direct sunlight or any heat/ignition source. Cylinder to be stored vertically separated and marked "Empty" or "Full". Provide fire extinguishers for gas cylinder storage and kitchen.
- Ensure Liquefied petroleum (LPG) gas total quantity of gas in storage does not exceed 100 kg at a time for own use.
- Provide LPG detectors in kitchen/ cooking area and LPG storages.
- Provide LPG gas stoves, gas hoses and gas regulators complying with relevant Indian standards.
- Adequate quantity of drinking and washing water provided. Drinking water quality to be regularly monitored and tested periodically as per IS 10500. Drinking water tanks to be cleaned periodically. Maintain area around drinking water tanks in hygienic condition.
- Proper roads & walkways/ passages shall be provided in camp area with illumination.
- Adequate nos. of two types of Bins (Green & Blue) with lids shall be provided for storage and segregation of solid waste as biodegradable (Wet waste) and non-biodegradable (Dry waste).
- Rooms, Latrines, bathroom, urinals and surrounding area to be maintained in a clean and sanitary condition cleaning twice per day.
- Walls, ceilings, and partitions of every latrine / urinal white washed or colour washed once in

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every period of four months.

- Smoking is strictly prohibited inside the accommodations, kitchen, recreation rooms, in vicinity of LPG storage area. Designated smoking areas to be provided with fire extinguishers.
- All Electrical panels shall be provided with 30 mA rating ELCB.s. Provide fire extinguishers for electrical panels.
- Pest control to be done periodically. Handling of pesticides is done by trained personnel with suitable PPE. Pesticides and related chemicals are stored in a dedicated well-ventilated storage room displaying MSDS.
- Sewage Treatment Plant (STP) to be set up with in the camp area for treatment of sewage & waste water and disposed such that it does not present a hazard to health and environment. Six monthly environmental monitoring of influent sewage water and effluent sewage water of STP shall be carried out through MOEF approved agency.
- All waste water, sewage, food waste and any other waste material are disposed as per Environment Protection Act/Rules & respective Waste Management Rules.
- Separate first aid facility with male nurse to be provided for camp in case site first aid center is not within the reach.
- Sufficient nos. of First Aid Boxes shall be provided at adequate locations. First aid facility & first aid boxes shall be inspected monthly by male nurse.
- Doctor consultation shall be made available on Every Sunday at Camp.
- Adequate and appropriate type of Fire Fighting Equipment to be installed in camp and checked regularly and maintained to use readily.
- Assembly points to be designated. Emergency Telephone Contact numbers to be displayed at prominent location in camp.
- Adequate emergency lights are installed in kitchen and evacuation routes.
- Sufficient number of camp occupants to be trained on basic firefighting, fire warden and first aid,
- Indoor /outdoor recreational facilities to be provided for camp occupants.
- CONTRACTOR (s) shall depute camp supervisor and also persons for carrying daily housekeeping, maintenance work etc.
- Camp office / sitting arrangement for camp Supervisors. Weekly/monthly camp inspection

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shall be done by camp supervisor.

- Food handlers of camp undergo pre-employment and periodic medical exams for any infectious, contagious and other communicable diseases



6.3 Signs and Tags

Fire prevention warning signs shall be displayed at the site. The fire prevention signs shall include the following:

- Action to be taken in the “event of a fire” signs shall be displayed in all offices.
- Information signs for the use of fire extinguishers to be displayed.
- Fire equipment layout signs shall be displayed.

CONTRACTOR (s) shall display safety signs, signals and banners as minimum but not limited to:

- Personnel Protective Equipment Requirements
- Road Closure warning
- Excavation warning
- Caution Men Working Above
- No Smoking
- No Cameras/Photography
- Site Speed Limit
- Housekeeping
- Lifting in Progress
- Hearing Protection
- Confined Space Working
- Fall Protection Required
- Electrical Hazard
- Potential for Slip, Trip, Fall
- Radiation warning
- Danger – Hot Surface
- Traffic safety / warning signage

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- High noise zone / area
- Other signage required as per JSA/TRA or as per the site specific conditions.
- Emergency warning signs shall be displayed at the site.
- Emergency escape route signs at the site and in all offices shall be displayed
- Emergency assembly point locations shall be identified and sign posted
- The Site Medical Facility shall be clearly identified.
- Emergency control center shall be clearly identified.
- Emergency telephone contact numbers shall be displayed.

A scaffold tagging system (color coded) is to be employed at the site. Safety signs shall be prominently displayed on all scaffolds erected at the site indicating "RED" tag to indicate "Do not use" and "GREEN" tag to indicate "safe for use".

6.4 House Keeping

The CONTRACTOR shall ensure that housekeeping is maintained and shall follow

- a) All surplus earth and debris are removed/disposed of from the working areas to designated location(s).
- b) Unused/surplus cables, steel items and steel scrap lying scattered at different places within the working areas are removed to identify location(s).
- c) All wooden scrap, empty wooden cable drums and other combustible packing materials, shall be removed from work place to identified location(s).
- d) Roads shall be kept clear and materials like pipes, steel, sand, boulders, concrete, chips And bricks etc. shall not be allowed on the roads to obstruct free movement of men & machineries.
- e) Fabricated steel structural, pipes & piping materials shall be stacked properly for erection.
- f) Water logging on roads shall not be allowed.
- g) No parking of trucks/trolleys, cranes and trailers etc. shall be allowed on roads, which may obstruct the traffic movement.
- h) Utmost care shall be taken to ensure over all cleanliness and proper upkeep of the working areas.

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- i) Trucks carrying sand, earth and pulverized materials etc. shall be covered while moving within the plant area/ or these materials shall be transported with top surface wet.
- j) The CONTRACTOR shall ensure that the atmosphere in plant area and on roads is free from particulate matter like dust, sand, etc. by keeping the top surface wet for ease in breathing.
- k) At least two exits for any unit area shall be assured at all times – same arrangement is preferable for digging pits / trench excavation / elevated work platforms / confined spaces etc.
- l) Welding cables and the power cable must be segregated and properly stored and used the same shall be laid away from the area of movement and shall be free from obstruction.
- m) Schedule for upkeep/cleaning of site to be firmed up and implemented on regular basis



The CONTRACTOR shall carry-out regular checks (minimum one per fortnight) for maintaining high standard of housekeeping and maintain records for the same.

6.5 Fire prevention

The CONTRACTOR shall arrange FIRE DRILL at each site at least once in three months, involving site workmen and site supervisory personnel & engineers. The CONTRACTOR shall maintain adequate record of such fire drills at project site.

6.6 Personal Protective Equipment (PPEs)

The CONTRACTOR shall ensure that all their staff, workers and visitors including their sub-CONTRACTOR(s) have been issued (records to be kept) & wear appropriate PPEs like nape strap type safety helmets preferably with head & sweat band with ¾" cotton chin strap (made of industrial HDPE), safety shoes with steel toe cap and antiskid sole, full body harness (CE marked and conforming to EN361), protective goggles, gloves, ear muffs, respiratory protective devices, etc. All these gadgets shall conform to applicable IS Specifications /CE or other applicable international standards. The CONTRACTOR shall implement a regular regime of inspecting physical conditions of the PPEs being issued / used by the workmen of their own & also its sub-agencies and the damaged / unserviceable PPEs shall be replaced forthwith.

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For shot blasting, the usage of protective face shield and helmets, gauntlet and protective clothing is mandatory. Such protective clothing should conform relevant IS Specification.



The CONTRACTOR shall provide required PPEs to workmen to protect against safety and / or health hazards. Primarily PPEs shall be as per the applicable standard given below.

S.No.	PPE	Applicable standard
1	Head Protection* (Safety helmets)	EN 397, IS:2925:1984, OSHA 1926.135, ANSI Z89.1/89.2, AS 1808, BS 5240, DIN 4840
2	Foot Protection* (Safety footwear, Gumboot, etc.)	ASTM F-2412-2005, EN ISO 20345, ANSI Z 41.1, AS 2210, EN 345
3	Body Protection* (High visibility clothing (reflective jacket / coverall), Apron, etc.)	EN 13034, EN 13034, BS EN 471: 1994.
4	Personal fall protection (Full body harness, Rope-grap fall arrester, etc.)	EN 361, EN 354, EN 355, EN 353-1, EN 353-2, EN 360
5	Eye Protection* (Goggles, Welders glasses, etc.)	EN166, EN 169, ANSI Z87.1, ANSI ZZ87.1, AS1337, BS 2092, BS 1542, BS 679, DIN 4646/58311,
6	Hand Protection* (Gloves, Finger coats, etc.)	EN 388, EN 420, EN 407, EN 374-3, BS 1651
7	Respiratory Protection. (Nose Mask, SCBAs, etc.)	EN 133, EN 149, EN 405, EN 140, EN 141
8	Hearing Protection (Ear plugs, Ear muffs, etc.)	EN 352-2, EN 458, BS 6344, ANSI S 31.9

The wearing of short pants or skirts and of sleeveless shirts shall not be allowed even for office activities. As well, loose or torn clothing and sandals are prohibited. Facial hair must be worn short so as not to hinder the wearing of PPE.

Color coding for helmets*

Categories	Color of Helmet
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Staff	White
Safety Personnel	Green
Workers	Yellow
Electrician	Red
Visitors	White

* Color coding of helmets are subjected to change as per Owner / Consultant requirements.

CONTRACTOR shall ensure procurement & usage of following safety equipment / accessories (conforming to applicable IS Mark / CE standard) by their staff, workmen & visitors in all stages of operations.

CONTRACTOR shall ensure procurement & usage of following safety equipment/ accessories (conforming to applicable IS mark / CE standard) by their staff, workmen & visitors in all stages of operations through the span of project construction / pre-commissioning/ Commissioning.

- PPEs (Helmet, Spectacle, Ear-muff, Face shield, Hand gloves, Safety Shoes, Gum boot)
- Barricading tape / warning signs
- Rechargeable Safety torch (flame-proof)
- Safety nets (with tie-chords)
- Fall arresters
- Portable ladders (varying lengths)
- Life-lines (steel wire-rope, dia not less than 8.0 mm)
- Full body harness (double lanyard)
- Lanyard
- Karabiner
- Retractable fall arresters (various length)
- Portable fire extinguishers (DCP type) – 5 kg capacity

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- Portable Multi Gas detector
- Sound level meter
- Digital Lux meter
- Fire hoses & flow nozzles
- Fire blankets / Fire retardant cloth (with eyelets)



Please refer ANNEXURE for the details of “ **Guidelines on Personal Protective Equipment (PPE)**”

6.7 Working at Height

The CONTRACTOR shall arrange and ensure use of Fall Arrester Systems by his workers. Fall arresters are to be used while climbing/descending tall structures or vessels / columns etc. These arresters should lock automatically against the anchorage line, restricting free fall of the user. The device is to be provided with a double security opening system to ensure safe attachment or release of the user at any point of rope. In order to avoid shock, the system should be capable of keeping the person in vertical position in case of a fall. Working at a height, where the person has the potential of free fall of more than 1.8 meters or 6 feet, work permit should be received before commencement of the job as per Work Permit procedure.

The CONTRACTOR shall ensure that Full body harnesses conforming EN361 and having authorized CE marking is used by all personnel while working at height. The lanyards and life lines should have enough tensile strength to take the load of the worker in case of a fall. One end of the lanyard shall be firmly tied with the harnesses and the other end with life line. The harness should be capable of keeping the workman vertical in case of a fall, enabling him to rescue himself. The CONTRACTOR shall provide Roof Top Walk Ladders for carrying out activities on sloping roofs in order to reduce the chances of slippages and falls.

The CONTRACTOR shall ensure that a proper Safety Net System is used wherever the hazard of fall from height is present. The safety net, preferably a knotted one with mesh ropes conforming to IS 5175/ ISO 1140 shall have a border rope & tie cord of minimum 12mm dia. The Safety Net shall be located not more than 6.0 meters below the working surface extending on either side up to sufficient margin to arrest fall of persons working at different heights.

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In case of accidental fall of person on such Safety Net, the bottom most portion of Safety Net should not touch any structure, object or ground.

The CONTRACTOR shall ensure positive isolation while working at different levels like in the pipe rack areas. The working platforms with toe boards & hand rails shall be sufficiently strong & shall have sufficient space to hold the workmen and tools & tackles including the equipment required for executing the job. Such working platforms shall have mid-rails, to enable people work safely in sitting posture.



6.8 Scaffoldings & Barricading

Suitable scaffoldings shall be provided to workmen for all works that cannot be safely done from the ground or from solid construction except such short period work that can be safely done using ladders or certified (by 3rd party competent person) man-basket. When a ladder is used, an extra workman shall always be engaged for holding the ladder. All scaffolding at the site shall be erected and maintained in accordance with applicable Indian codes of practice viz. IS: 3696, IS: 4014-1967, IS: 1161, IS: 2750 or other equivalent international standards.

The CONTRACTOR shall ensure that the scaffolds used during construction activities shall be strong enough to take the designed load. Main CONTRACTOR shall always furnish duly approved construction-design details of scaffold & SWL (from competent designers) free of charge, before they are being installed / constructed at site. Owner/ Consultant reserves the right to ask the CONTRACTOR to submit certification and or design calculations from his Head office / Design/ Engineering expert regarding load carrying capacity of the scaffoldings.

All scaffolds shall be inspected by a competent Scaffolding Inspector of the CONTRACTOR. He shall paste a GREEN tag (duly signed by competent Scaffolding Inspector) on each scaffold found safe and a RED tag (duly signed by competent Scaffolding Inspector) on each scaffold found unsafe. Scaffolds with GREEN tag only shall be permitted to be used and Scaffolds with RED ones shall immediately be made inaccessible. Work being found continuing on scaffolds with RED tag shall be considered unauthorized work by CONTRACTOR and may invite penalization from Owner/ Consultant.

For every 120-125 m² / m³ area / volume or its parts thereof minimum one TAG shall be provided.

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The CONTRACTOR shall ensure positive barricading (indicative as well as protective) of the excavated, radiography, heavy lift, high pressure hydrostatic & pneumatic testing and other such areas. Sufficient warning signs shall be displayed along the barricading areas.

Scaffolding shall be constructed using foot seals or base plates only (Appendix – 23)

6.9 Ergonomics and tools & tackles



The CONTRACTOR shall assign to his workmen, tasks commensurate with their qualification, experience and state of health. All lifting tools, tackles, equipment, accessories including cranes shall be tested periodically by statutory/competent authority for their condition and load carrying capacity. Valid test & fitness certificates from the applicable authority shall be submitted to Owner/ Consultant for their review/acceptance before the lifting tools, tackles, equipment, accessories and cranes are used.

The CONTRACTOR shall not be allowed to use defective equipment or tools not adhering to safety norms. CONTRACTOR shall arrange non-sparking tools for project construction works in operating plant areas / hydrocarbon prone areas. Wherever required the CONTRACTOR shall make use of Elevated Work Platforms (EWP) or Aerial Work Platforms (mobile or stationary) to avoid ergonomically risks and workmen shall be debarred to board such elevated platform during the course of their shifting / transportation.

CONTRACTOR shall ensure installation of Safe Load Indicator (SLI) on all cranes (while in use) to minimize overloading risk. SLI shall have capability to continuously monitor and display the load on the hook, and automatically compare it with the rated crane capacity at the operating condition of the crane. The system shall also provide visual and audible warnings at set capacity levels to alert the operator in case of violations. The CONTRACTOR shall be responsible for safe operations of different equipment mobilized and used by him at the workplace like transport vehicles, engines, cranes, mobile ladders, scaffoldings, work tools, etc.

The CONTRACTOR shall arrange periodical training for the operators of hydra, crane, excavator, mobile machinery, etc. at site by utilizing services from renowned manufacturers.

6.10 Hazardous substances

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Hazardous, inflammable and/or toxic materials such as solvent coating, thinners, anti-termite solutions, water proofing materials shall be stored in appropriate containers preferably with lids having spillage catchment trays and shall be stored in a good ventilated area. These containers shall be labeled with the name of the materials highlighting the hazards associated with its use and necessary precautions to be taken. Respective MSDS (Material Safety Data Sheet) shall be made available at site & may be referred whenever problem arises.

Where contact or exposure of hazardous materials are likely to exceed the specified limit or otherwise have harmful effects, appropriate personal protective equipment such as gloves, goggles/face-shields, aprons, chemical resistant clothing, respirator, etc. shall be used.

The work place shall be checked prior to start of activities to identify the location, type and condition of any asbestos materials which could be disturbed during the work. In case asbestos material is detected, usage of appropriate PPEs by all personnel shall be ensured and the matter shall be reported immediately to Owner / Consultant.



6.11 Slips, trips & falls

The CONTRACTOR shall establish a regular cleaning and basic housekeeping programme that covers all aspects of the workplace to help minimize the risk of slips, trips & falls. The CONTRACTOR shall take positive measures like keeping the work area tidy, storing waste in suitable containers & harmful items separately, keeping passages, stairways, entrances & exits especially emergency ones clear, cleaning up spillages immediately and replacing damaged carpet/ floor tiles, mats & rugs at once to avoid slips, trips & falls.

6.12 Barriers

Physical (hard) barriers shall be erected by CONTRACTOR (s) to provide protection against hazards and dangers, hazardous work areas and hazardous work in all cases where the hazard or danger will exist for a period longer than 72 hours.



Appropriate barriers must be provided in hazardous situations and during work presenting hazards. This is to be done in conformity with the table below and each CONTRACTOR shall provide enough barriers for their own activities:

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Situation	Barrier
Plant out of service	Crush barriers or continuous fencing
Open grated flooring, pit or gutter	Uprights and horizontals (hard barricades)
Acid/caustic treatment of equipment High pressure bead or grit blasting Welding, grinding, lifting, scaffold erection/ disassembly Activities in pipe racks	Red and white tape combined with pictogram signs
High pressure jetting Work with X-rays	Yellow and black barrier tape combined with pictogram signs
Hoisting operations	Special red and white barrier tape with printed inscription
Storage areas	Delimited by hard barriers (temporary=red and white chain combined with pictogram signs)
(Demolition) work involving asbestos-containing products	Yellow/black barrier tape or chain and warning notice

6.13 Work Permit System

The CONTRACTOR shall develop a Work Permit system, which is a formal written system used to control certain types of work that are potentially hazardous. A work permit is a document, which

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specifies the work to be done, and the precautions to be taken. Work Permits form an essential part of safe systems of work for many construction activities. They allow work to start only after safe procedures have been defined and they provide a clear record that all foreseeable hazards have been considered. Permits to Work are usually required in high-risk areas as identified by the Risk Assessments. Permit to Work format as Appendix in 18.

The CONTRACTOR shall issue Permit To Work (PTW) at height after verifying and certifying the checkpoints as specified in the attached permit. He shall also undertake to ensure compliance to the conditions of the permit during the currency of the permit including adherence of personal protective equipment. CONTRACTOR's Safety Officer shall verify compliance status of the items of permit document after implementation of action is completed by CONTRACTOR's execution / field engineers at work site. Job Safety Analysis (JSA) for specific works at height shall be kept attached with particular Permit To Work (PTW) at site for ready reference & follow-up.



Such PFW shall be initially issued for one single shift or expected duration of normal work and extended further for balance duration, if required. Owner/ Consultant can devise block-permit system at any specific area, in consultation with project specific HSE Committee to specify the time-period of validity of such PFW or its renewal. Owner/ Consultant field Engineers/Safety Officers/Area Coordinators may verify and counter sign this permit (as an evidence of verification) during the execution of the job.

All personnel shall be medically examined & certified by registered doctor, confirming their 'medical fitness for working at height. The fitness examination shall be done once in six months.

In case work is undertaken without taking sufficient precautions as given in the permit, Owner/ Consultant Engineers may exercise their authority to cancel such permit and stop the work till satisfactory compliance/rectification is arranged made. CONTRACTORS are expected to maintain a register for issuance of permit and extensions thereof including preserving the used permits for verification during audits etc.

A permit is needed when construction work can only be carried out if normal safeguards are dropped or when new hazards are introduced by the work. Examples of high-risk activities include but are not limited to:

- Entry into confined spaces

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- Work in close proximity to overhead power lines and telecommunication cables.
- Hot work.
- To dig—where underground services may be located.
- Work with heavy moving machinery.
- Working on electrical equipment
- Work with radioactive isotopes.
- Heavy lifting operations and lifting operations closer to live power line.
- Removal of Grating. (Conditions of Contract on HS & E)

The permit-to-work system should be fully documented, laying down:

- How the system works;
- The jobs it is to be used for;
- The responsibilities and training of those involved; and how to check its operation.

A Work Permit authorization form shall be completed with the maximum duration period not exceeding 12 hours. Copy of each Permit to Work shall be displayed, during its validity, in a conspicuous location in close proximity to the actual works location to which it applies.



6.14 Batching Plant / Fabrication Yard / Casting Yard

The batching plant / casting yard shall be effectively planned for smooth flow of Unloading and stacking the aggregates reinforcements and cement, batching plant, transport of concrete, casting the segment, stacking the segment and loading the segments to the trucks. As far as possible the conflicts should be avoided.

The batching plant / casting yard shall be barricaded and made as a compulsory PPE zone.

If in case of material unloading area is not maintainable as PPE zone, the same shall be segregated properly and made as a non-PPE zone with appropriate barricading. Electrical system shall also be suitably planned so that location of diesel generator, if any, location of DBs, routing of cables and positioning of area lighting poles/masts does not infringe on any other utility and pose danger.

Drainage shall be effectively provided and waste water shall be disposed after proper treatment.

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Time office, canteen, drinking water, toilet and rest place shall be suitably located for the easy access to workers. All the facilities shall be properly cleaned and maintained during the entire period of operation. Manual handling of cement shall be avoided to a larger extent. Whenever it is absolutely necessary the workmen shall be given full body protection, hand protection and respiratory protection as a basic measure of ensuring better health.

The PPEs provided to cement handling workmen shall conform to international standards. Access roads and internal circulation roads shall be well laid and maintained properly at all time. Non-adherence to any of the above provision shall be penalized as per relevant penalty clause.

6.15 Construction Hazards

The CONTRACTOR shall ensure identification of all Occupational Health, Safety & Environmental hazards in the type of work he is going to undertake and enlist mitigation measures. CONTRACTOR shall carry out Job Safety Analysis (JSA) /Risk Analysis specifically for high risk jobs / critical jobs like

- Working at height (+2.0 Mts height) for cold incl. color washing, painting, insulation & hot works.
- Work in confined space,
- Deep excavations & trench cutting (depth > 1.2 mts.)
- Operation & Maintenance of Batching Plant.
- Shuttering / concreting (in single or multiple pour) for columns, parapets & roofs.
- Erection & maintenance of Tower Crane.
- Erection of pipes (full length or fabricated) at height more than 2.0 Mts. height with
- Crane of 50T capacity.
- All lifts using 50T Crane plus mechanical pulling.
- All lifts using two cranes in unison (Tandem Lifting).
- Any lift exceeding 75% capacity of the lifting equipment (hydra, crane etc.).
- Laying of pipes (isolated or fabricated) in deep narrow trenches – manually or mechanically.
- Maintenance of crane / extension or reduction of crane-boom on roads or in yards.
- Hydrostatic test of pipes, vessels & columns and water-flushing.
- Radiography jobs (in-plant & open field)



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- Work in Live Electrical installations / circuits
- Handling of explosives & Blasting operations
- Demolishing / dismantling activities
- Welding / gas cutting jobs at height (+2.0 Mts.)
- Lifting / placing roof-girders at height (+2.0 Mts.)
- Lifting & laying of metallic / non-metallic sheet over roof/structures.
- Lifting of pipes, gratings, equipment / vessels at heights (+2.0 Mts) with & without using cranes
- Calibration of equipment, instruments and functional tests at yards / work-sites.
- Operability test of Pump, Motors (after coupling) & Compressors.
- Cold or Hot works inside Confined Space.
- Transportation & shifting of ODC consignments into project areas.
- Working in “charged/Live” elect. Panels
- Stress Relieving works (Electrically or by Gas-burners).
- Pneumatic Tests
- Card board blasting
- Chemical cleaning

The necessary HSE measures devised shall be put in to place, prior to start of an activity & also shall be maintained during the course of works, by the CONTRACTOR. Copies of such JSAs shall be kept available at work sites to enable all concerned carrying out checks / verification. (Appendix – 15). CONTRACTOR (s) shall submit HIRA Register to Consultant for approval, 15 days before implementing at site.

6.16 Accessibility

The CONTRACTOR shall provide safe means of access(in sufficient numbers) & efficient exit to any working place including provisions of suitable and sufficient scaffolding at various stages during all operations of the work for the safety of his workmen and Owner/ Consultant.

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The shall implement use of all measures including use of “life line”, “fall-arresters”, “retractable fall arresters” , “safety nets” etc. during the course of using all safe accesses & exits, so that in no case any individual remains at risk of slip & fall during their travel. The access to operating plant / project complex shall be strictly regulated. Any person or vehicle entering such complex shall undergo identification check, as per the procedures in force / requirement of Owner/ Consultant.

Accessibility to ‘confined space’ shall be governed by specific system / regulation, as established at project site



6.17 Road Safety

The CONTRACTOR shall ensure adequately planned road transport safety management system. The vehicles shall be fitted with reverse warning alarms & flashing lights / fog-lights and usage of seat belts shall be ensured. The CONTRACTOR shall also ensure a separate pedestrian route for safety of the workers and comply with all traffic rules & regulations, including maintaining speed limit of 20 kmph or indicated by owner for all types of vehicles / mobile machinery. The maximum allowable speed shall be adhered to.

In case of an alert or emergency, the CONTRACTOR must arrange clearance of all the routes, roads, access. The CONTRACTOR shall deploy sufficient number of traffic controllers at project site routes / roads/ accesses, to alert reversing movement of vehicles & machinery as well as pedestrians.

Dumpers, Tippers, etc. shall not be allowed to carry workers within the plant area and also to & from the labor colony to & from project sites. Hydras shall only be allowed for handling the materials at fabrication/ storage yards and in no case shall be allowed to transport the materials over project / plant roads. The CONTRACTOR shall not deploy any such mobile machinery / equipment, which do not have competent operator and / or experienced banks-man / signal-man. Such machinery / equipment shall have effective limit-switches, reverse-alarm, front & rear-end lights etc. and shall be maintained in good working order.

The CONTRACTOR shall not carry-out maintenance of vehicles / mobile machinery occupying space on project / plant roads and shall always arrange close supervision for such works. For pipeline jobs, the CONTRACTOR shall submit a comprehensive plan covering transportation, loading / unloading of pipes, movement of side booms, movement of vehicles on the ROW, etc. CONTRACTOR's shall

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arrange /install visible road signs, diversion boards, caution boards, etc on project roads for safe movement of men and machinery.

6.18 Communication

All persons deployed at the work site shall have access to effective means of communication so that any untoward incident can be reported immediately and assistance sought by them. All health & safety information shall be communicated in a simple & clear language easily understood by the local workforce. For information to all, typical subjects that should be communicated are:

Inside the company (Top to down)



- Quality and HSE Policy contents
- HSE Objectives
- HSE Target – reached or missed
- Praises & Warnings to personnel for HSE Management
- Safety Walk Through Reports and safety defects / shortfalls (by management)
- HSE Audit results
- Revised Statutory Health & Safety provisions, if any
- H & S publicity
- Suggestions

Inside the Company (Bottom to up)

- Complaints
- Compliances on safety defects / shortfalls
- Suggestions
- Proposals for changes & improvements
- HSE Reports (including near-miss reports)

6.19 Unsuitable Land Conditions

CONTRACTOR shall take appropriate measures and necessary work permits/clearances if work is to be done in or around marshy areas, river crossings, mountains, monuments, etc. The CONTRACTOR

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shall make right assessment and take all necessary action for developing work areas to make them safe & suitable for crane operations or other vehicular movement before carrying out any project related activity / operation. CONTRACTOR shall take all necessary actions to make the surroundings of its site establishments (site office, stores, lay-down area etc.) work-worthy safe and secure.

6.20 Tool Box Talks (TBT)



CONTRACTOR shall conduct daily TBT with workers prior to start of work and shall maintain proper record of the meeting. A suggested format is attached. The TBT is to be conducted by the immediate supervisor of the workers. The CONTRACTOR shall conduct TBT before start of every morning or evening shift or night shift activities, for alerting the workers on specific hazards and their appropriate dos & don'ts. The CONTRACTOR shall provide sufficient rests to the site workmen and their foremen to avert fatigue & thereby endangering their lives during the course of site works.

6.21 Training & Induction Program

Initial induction of workers into Construction oriented activities and appraising them about the methodology of works and how to carry-out safely and the same should not be inter mixed with Tool Box Talks or HSE Training. In this regard careful action should be made & maintained for imparting HSE induction to every individual, irrespective of his task/designation/level of employment, whereas, HSE Training should be imparted to specific person/group of people who are to carry-out that specific task more than once – for example, Riggers must be trained for working at heights, welders must be trained for work in confined space, fitters/carpenters, mesons must be trained for work at heights, etc

CONTRACTOR shall conduct Safety induction program on HSE for all his workers and maintain records. The Gate Pass shall be issued only to those workers who successfully qualify the Safety induction program.

The CONTRACTOR shall brief the visitors about the HSE precautions which are required to be taken before their proceeding to site and make necessary arrangements to issue appropriate PPEs like Aprons, hard hats, ear-plugs, goggles & safety shoes etc., to his visitors. The CONTRACTOR shall always maintain relevant acknowledgement from visitor on providing him brief information on HSE actions.

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CONTRACTOR shall ensure that all his personnel possess appropriate training to carry out the assigned job safely. The training should be imparted in a language understood by them and should specifically be trained about

- Potential hazards to which they may be exposed at their workplace
- Measures available for prevention and elimination of these hazards



The topics during training shall cover, at the minimum: -

- Why safety should be considered during work - explanation
- Education about hazards and precautions required
- Employees' duties & responsibilities
- Emergency and evacuation plan
- HSE requirements during project activities
- Firefighting and First-Aid
- Use of PPEs
- Occupational health issues – dos & don'ts
- Local laws on intoxicating drinks, drugs, smoking in force
- Common environmental subjects – lighting, ventilation, vibration, smoke/fumes etc.
- Records of the training shall be kept and submitted to Owner / Consultant.

The CONTRACTOR shall make regular program for conducting Safety Training on various topics related to various activities & their safe-guarding utilizing experienced persons / outside agency / faculty. A program for Safety Training (indicative list as Appendix – 13) shall be furnished by the CONTRACTOR in its HSE Plan .

For offshore and jetty jobs, CONTRACTOR shall ensure that all personnel deployed have undergone a structured sea survival training including use of lifeboats, basket landing, use of radio communication etc. from an agency acceptable to Owner/ Consultant

6.22 Self-Assessment and Enhancement

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The CONTRACTOR shall develop a method of check & balance through self-assessment & enhancement techniques and shall explore the opportunities for continual improvement in the HSE system

6.23 HSE Promotion

The CONTRACTOR shall encourage his workforce to promote HSE efforts at workplace by way of organizing workshops/seminars/training Programs, celebrating HSE awareness weeks & National Safety Day, conducting quizzes & essay competitions, distributing pamphlets, posters material on HSE, providing incentives for maintaining good HSE practices and granting incentives / bonus for completing the job without any lost time accident.

6.24 Incident Reporting and Investigation

6.24.1 Reporting to Consultant



All Incidents and dangerous occurrences shall immediately be informed verbally to the Consultant. This will enable the Consultant to reach to the scene of Incident / dangerous occurrences to monitor assist any rescue work and / or start conducting the investigation process so that the evidences are not lost. Reports of all Incidents (fatal / injury) and dangerous occurrences shall also be sent within 24 hours as per format provided in the Consultant (Incident reporting format as Appendix in 11). No Incident / dangerous occurrences are exempted from reporting to the Consultant. Any willful delay in verbal and written reporting to the CONTRACTOR shall be penalized.

6.24.2 Accident Investigations

Investigations should be conducted in an open and positive atmosphere that encourages the witnesses to talk freely. The primary objective is to ascertain the facts with a view to prevent future and possibly more serious occurrences. Incidents and Dangerous Occurrences which result in death, serious injury or serious damage must be investigated by the CONTRACTOR immediately to find out the cause of the Incident / occurrence so that measures can be formulated to prevent any recurrence.

Near misses and minor Incidents should be investigated in detail by the CONTRACTOR as soon as possible as they are signals that there are inadequacies in the safety management system.

6.24.3 Procedure of incident investigation

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It is important after any Incident or dangerous occurrence that information relating to the incident is gathered in an organized way. The following steps shall be followed;

- Take photographs and make sketches
- Examine involved equipment, work piece & the environmental conditions
- Interview the injured, eye-witnesses and other involved parties
- Consult expert opinion where necessary & identify the specific CONTRACTOR involved.
- Having gathered information, it is then necessary to make an analysis of incident
- Establish the chain of events leading to the Incident.
- Find out at what stage the Incident took place



Consider all possible causes and the interaction of different factors that led up to the Incident, and identify the most probable cause. The cause of an Incident should never be classified as carelessness. The specific act or omission that caused the Incident must be identified.

- The next stage is to proceed with the follow-up action
- report on the findings and conclusions
- formulate preventive measures to avoid recurrence
- Consultant independent incident investigation.

All the HIPO (High Potential) Incidents / Near misses are subject to TOPSET investigation by Consultant. In case of fatal / dangerous occurrence the Consultant shall also conduct independent investigation. CONTRACTOR and his staff shall extend necessary co-operation and testify about the Incident. The CONTRACTOR shall take every effort to preserve the scene of Incident till the Consultant completes the investigation. All persons summoned by the Consultant in connection to witness recording shall obey the instructions without delay. Any willful suppression of information by any person shall be removed from the site immediately and / or punishable.

6.25 Confined Space Entry

The CONTRACTOR shall generate a work permit before entering a confined space. People, who are permitted to enter into confined space, must be medically examined & certified by registered doctor, confirming their 'medical fitness for working in confined space'. All necessary precautions mentioned

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therein shall be adhered to. An attendant shall be positioned outside a confined space for extending help during an emergency. All appropriate PPEs and air quality parameters shall be checked before entering a confined space. It shall be ensured that the piping of the equipment which has to be opened is pressure- free by checking that blinds are in place, vents are open and volume is drained. Inside confined space works, only electrical facilities / installations of 24V shall be permitted. Contactor shall ensure usage of safe suitable arrangement of oxygen supply for individual workmen (during the course of work in confined space), if oxygen concentration is found to be less than 19.5% (v/v) there.

6.26 Lock Out and Tag Out (LOTO) for isolation of energy source

CONTRACTOR shall follow the LOTO/Isolation procedure of owner for all energy source isolations installed/under purview by /of owner i.e.. “Brown field” . For all the other energy source (not under purview of Owner/Consultant) i.e. “Green field” CONTRACTOR shall develop a system to ensure the isolation of equipment, pipelines, Vessel, electrical panels from the energy source covering following as minimum:-

- Identification of all energy source viz electrical, mechanical, hydraulic, pneumatic, chemical, thermal, gravitational, radiation and other forms of stored or kinetic energy.
- Establishing the energy isolation devices viz: manually operated electrical circuit breakers, disconnection switches, blind flanges, etc.
- Installation of Lock Out devices for preventing the inadvertent release of stored energy and Tag Out devices (“Danger”, “Do Not operate” or Do not Remove” tags) to indicate that testing, maintenance or servicing is underway and the device cannot be operated until the tag out device is removed.
- Lock Out and Tag out log book
- Permit for isolation and de-isolation of energy source
- Availability of competent persons like experienced operators at substations, pump house, units

CONTRACTOR shall ensure that all the sources are locked out and tagged properly before giving clearance to start the job. After the completion of job, CONTRACTOR shall ensure all tools and tackles are removed and nobody is present in the working area and signing on LOTO log book Only on confirmation of above the CONTRACTOR will remove their lock and tag from the isolation points and give instructions for energizing the same. Only the person carrying out the task shall himself carry the

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key for the lock in /Lock out. LOTO tags as in Appendix - 8

6.27 Electrical installations



All electrical installations/ connections shall be carried out as per the provisions of latest revision of following codes/standards, in addition to the requirements of Statutory Authorities and IE/applicable international rules & regulations:

- ❖ OISD STD 173: Fire prevention & protection system for electrical installations
- ❖ SP 30 (BIS) : National Electric Code

All electrical installations shall be approved by the concerned statutory authorities. All temporary electrical installations / facilities shall be regularly checked by the licensed/competent electricians of the CONTRACTOR and appropriate records shall be maintained Inspection of temporary electrical booth/installation at project construction site". Such inspection records are to be made available to Owner/ Consultant, whenever asked for.

The CONTRACTOR shall meet the following requirements:



- Shall make Single Line Diagram (SLD) for providing connection to each equipment's & machinery and the same (duly approved by Owner/ Consultant) shall be pasted on the front face DBs (distribution boards) or JBs (Junction boxes) at every site.
- Ensure that electrical systems and equipment including tools & tackles used during construction phase are properly selected, installed, used and maintained as per provisions of the latest revision of the Indian Electrical/ applicable international regulations.
- Shall deploy qualified & licensed electricians for proper & safe installation and for regular inspection of construction power distribution system/points including their earthing. A copy of the license shall be submitted to Owner/ Consultant for records.
Availability of at least one competent (ITI qualified) / licensed electrician (by State Elec. authorities) shall be ensured at site round the clock to attend to the normal/emergency jobs.
- All switchboards / welding machines shall be kept in well-ventilated & covered shed/ with rain

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shed protection. The shed shall be elevated from the existing ground level to avoid water logging inside the shed . Installation of electrical switch board must be done taking care of the prevention of shock and safety of machine.

- No flammable materials shall be used for constructing the shed. Also flammable materials shall not be stored in and around electrical equipment / switchboard. Adequate clearances and operational space shall be provided around the equipment.
- Fire extinguishers and insulating mats shall be provided in all power distribution centers.
- Temporary electrical equipment shall not be employed in hazardous area without obtaining safety permit.
- Proper housekeeping shall be done around the electrical installations.
- All temporary installations shall be tested before energizing, to ensure proper earthing, bonding, suitability of protection system, adequacy of feeders/cables etc.
- All welders shall use hand gloves irrespective of holder voltage.
- Multilingual caution boards, shock treatment charts and instruction plate containing location of isolation point for incoming supply, name & telephone No. of contact person in emergency shall be provided in substations and near all distribution boards / local panels.
- Operation of earth leakage device shall be checked regularly by temporarily connecting series test lamp (2 bulbs of equal rating connected in series) between phase and earth.
- Test meter shall be used for testing ELCBs
- Regular inspection of all installations at least once in a month.
- The following features shall also be ensured for all electrical installations during construction phase by the CONTRACTOR:
- Each installation shall have a main switch with a protective device, installed in an enclosure adjacent to the metering point. The operating height of the main switch shall not exceed 1.5 M. The main switch shall be connected to the point of supply by means of armored cable.
- The outgoing feeders shall be double or triple pole switches with fuses / MCBs. Loads in a three phase circuit shall be balanced as far as possible and load on neutral should not exceed 20% of load in the phase.

The installation shall be adequately protected against overload, short circuit and earth leakage by the use of suitable protective devices. Fuses wherever used shall be HRC type. Use of rewirable fuses

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shall be strictly prohibited. The earth leakage device shall have an operating current not exceeding 30 mA. All connections to the hand tools / welding receptacles shall be taken through proper switches, sockets and plugs.

All single phase sockets shall be minimum 3 pin type only. All unused sockets shall be provided with socket caps. Only 3 core (P+N+E) overall sheathed flexible cables with minimum conductor size of 1.5 mm² copper shall be used for all single phase hand tools.



Only metallic distribution boxes with double earthing shall be used at site. No wooden boxes shall be used. All power cables shall be terminated with compression type cable glands. Tinned copper lugs shall be used for multi-strand wires / cables.

Cables shall be free from any insulation damage. Minimum depth of cable trench shall be 750 mm for MV & control cables and 900 mm for HV cables. These cables shall be laid over a sand layer and covered with sand, brick & soil for ensuring mechanical protection. Cables shall not be laid in waterlogged area as far as practicable. Cable route markers shall be provided at every 25 M of buried trench route. When laid above ground, cables shall be properly cleated or supported on rigid poles of at least 2.1 M high. Minimum head clearance of 6 meters shall be provided at road crossings.

Underground road crossings for cables shall be avoided to the extent feasible. In any case no underground power cable shall be allowed to cross the roads without pipe sleeve. All cable joints shall be done with proper jointing kit. No taped/ temporary joints shall be used.

An independent earthing facility should preferably be established within the temporary installation premises. All appliances and equipment shall be adequately earthed. In case of armoured cables, the armor shall be bonded to the earthing system. All cables and wire rope used for earth connections shall be terminated through tinned copper lugs.

In case of local earthing, earth electrodes shall be buried near the supply point and earth continuity wire shall be connected to local earth plate for further distribution to various appliances. All insulated wires for earth connection shall have insulation of green colour.

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Separate core shall be provided for neutral. Earth / Structures shall not be used as a neutral in any case. ON/OFF position of all switches shall be clearly designated / painted for easy isolation in emergency.

6.28 Static Electricity Control



All necessary grounding and/or bonding precautions shall be taken to prevent the generation of static electricity in areas where this may cause hazard or fire such as, motorized agitation, mixing splash filling, grit blasting hoses, paint spraying and ventilation fans.

When flammable liquids are transferred from one container to another, bonding between the two conductive containers, prior to pouring, shall be in place.

6.29 Portable / Hand Tools

Adequate safety measures must govern the use of portable tools particularly:

- Tools must be inspected and appropriate color-coded
- Tools are only used for the application for which they are intended.
- All tools shall be properly stored and maintained.
- Hand tools shall be used properly and with caution to prevent slippage or injury.
- The use of adjustable spanners and wrenches as a substitute for a spanner of the correct size shall be discouraged.
- All tools shall be inspected for defects that may cause breakage or failure during use. On no account shall damaged tools be used.
- Only authorized persons shall change grinding disks.
- Wherever possible reduced voltage should be used.
- Rotating power tools such as angle grinders, threading machines, drills etc. shall be fitted With a “Dead Man Switch” that will cause automatic shutdown of the equipment when the operator no longer has control.
- All hand tools shall be of insulated type.
- All electrical tools should be earthed, unless they are ‘all insulated’ or ‘double insulated’ tools which do not require earthing.
- Employees provided with bags / box to carry bolts, nuts and hand tools.



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- Pneumatic / hydraulic hose connections properly secured.
- Tools shall be provided with adequate guard, shields or other protective devices.
- Only insulated or non-conducting tools should be used on or near live electrical installations.
- Only non-sparking tools shall be used near or in the presence of flammable Liquids / vapors or explosive dusts or vapors.
- Heads of hammers and other sharp tools shall be dressed or ground to a suitable radius on the edge as they begin to mushroom or crack.
- Tools should be switched off when not in use and positively isolated before any adjustment, cleaning or maintenance is done.
- Tools shall be provided with adequate guard, shields or other protective devices.
- Only insulated or non-conducting tools should be used on or near live electrical installations.
- Only non-sparking tools shall be used near or in the presence of flammable Liquids / vapors or explosive dusts or vapors.
- Heads of hammers and other sharp tools shall be dressed or ground to a suitable radius on the edge as they begin to mushroom or crack.
- Tools should be switched off when not in use and positively isolated before any adjustment, cleaning or maintenance is done.

6.30 Grinding

Adequate Safety Measures shall be taken by CONTRACTOR (s):-

- Always wear safety glasses or face shield while grinding.
- Do not over speed grinding wheel
- Do not use grinding wheel for cutting purpose.
- How work permit required to obtain before starting grinding work.
- Before wheels are mounted, they should undergo a visual inspection and ring test.
- Use ELCB protection for electrical supply providing to grinding machines.
- Ensure all cutting edges, teeth etc. are adequately guarded or well protected when not in use.
- Grinding Machine shall be kept at safe place and not into walkways which creates the hazard.
- Grinding Machine shall be not carried in hands when climbing up ladders. Use proper toolkit bags while climbing the ladder.

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- Contain grinding sparks by fire blanket. Cover sewers and manholes located near the source of ignition
- Assign fire watch where fire could occur and provide fire extinguisher where hot works are conducted.
- Dead man switch shall be provided for all portable grinders. The purpose is that once the pressure on the knob operating the portable grinder is released, the grinding wheel shall stop immediately.
- RPM of the grinding wheel should always be more than the rpm of grinding machine.
- Every grinding machine shall be provided with “Deadman switch”.
- Grinding machine to be monthly inspected by authorized engineer and inspection tag in assigned color coding to be displayed on it.



6.31 Lifting appliances and Gear

Lifting appliances means a crane, hoist machinery, derrick, winch, gin pole, sheer legs, jack, hoist drum, slewing machinery, slewing bearing fasteners, lofting machinery Sheave's, pulley blocks, hooks or other equipment used for lifting materials, objects or building workers and lifting gears means ropes, chain slings, shackles, hooks, lifting lugs, wire ropes, lifting eyebolts and eye nuts and other accessories of a lifting appliance..

Use of Hydra is prohibited at site. In place of Hydra, F-15 crane can be used on prior approval by Site Manager / HSE Manager.

No machine shall be selected to do any lifting on a specific job until its size and Characteristics are considered against:

- The weights, dimensions and lift radii of the heaviest and largest loads
- The maximum lift height, the maximum lift radius and the weight of the loads that must be handled at each the number and frequency of lifts to be made
- How long the crane will be required on site
- The type of lifting to be done (for example, is precision placement of loads important)
- The type of carrier required (this depends on ground conditions and machine capacity In its
- operating quadrants: capacity is normally greatest over the rear, less over the side, and non-

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existent over the front

- Whether loads will have to be walked or carried
- Whether loads will have to be suspended for lengthy periods
- The site conditions, including the ground where the machine will be set up, access roads and ramps it must travel, space for erection and any obstacles that might impede access or operation.

The CONTRACTOR shall ensure that a valid certificate of fitness issued for all lifting appliances including synchronized mobile jacks, pre-stressing hydraulic jacks, jacks fitted with launching girders etc. Only after obtaining the approval from the Consultant any lifting appliances and gear shall be used.

The laminated photocopies of fitness certificate issued by competent person, the CONTRACTOR' approval letter, the operators' photo, manufacturer's load chart and Conditions of Contract on Health, Safety and Environment, competency certificate shall always be either kept in the operator cabin or pasted on the visible surface of the lifting appliances.



All lifting appliances and loose gears shall be clearly marked for its safe working load and identification by stamping or other suitable means. The CONTRACTOR shall also maintain a register containing a system of identification of all tools and tackles, its date of purchase, safe working load, competent person date of examination etc.

6.31.1 Test and periodical examination of lifting appliances and gears

All lifting appliances including all parts and gears thereof, whether fixed or movable shall be thoroughly tested and examined by a competent person once at least in every six months or after it has undergone any alterations or repairs liable to affect its strength or stability. Within the validity, if the lifting appliances are shifted to a new site, re-examination by the same competent person for ensuring its safety shall also be done.

CONTRACTORS can utilize the services of any competent person as defined in Factories Act, 1948 and approved by Chief Inspector of Factories with the permission of the Consultant.

All alarms and signals like automatic safe load indicators (SLI), boom angle indicators, boom extension indicators, over lift boom alarm, swing alarm, hydraulic safety valves, mechanical radius indicators, load moment indicators etc. shall be periodically examined and maintained always in working condition.

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CONTRACTOR shall ensure that Equipment shall be properly marked with an identification number and safe working load and be inspected and color coded each quarter by CONTRACTORS as indicated below.

January - March	Yellow
April - June	Orange
June - September	White
October - December	Blue

Any equipment which is unfit for use must be color coded Red and removed from site immediately.

6.31.2 Automatic safe load indicators

Every lifting appliances and gears like cranes, F15 crane etc., if so constructed that the safe working load may be varied by raising or lowering of the jib or otherwise shall be attached with an automatic indicator of safe working loads approved by Bureau of Indian standards/ International certifying bodies which gives a warning to the operator and arrests further movements of the lifting parts.



Qualification of operator of lifting appliances and of signaler etc.

The CONTRACTOR shall not employ any person to drive or operate a lifting machine like crane, F15 crane etc. whether driven by mechanical power or otherwise or to give signals to work as a operator of a rigger or derricks Possesses the knowledge of the inherent risks involved in the operation of lifting appliances by undergoing a formal training at any institution of national importance acceptable to Consultant Is medically examined periodically .

6.31.3 General requirements of appliances

Out-of level

One of the most severe effects of being out-of fit level is that side loads develop in the boom. Because of side loads all mobile cranes lose capacity rapidly as the degree of out-of-level increases and therefore.

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Boom

- The boom is one of the more critical elements of the crane and must be in perfect condition at all time. No boom section with a bent lattice member shall be allowed
- All welds shall be crack and corrosion free
- No member of the boom shall be bent
- All telescopic booms shall be free from cracks, rust, flaking or cracked paint, bulges, greases or varnishes.
- The sweep area (work area) of the construction machinery shall be always free from obstructions.
- All hydraulic piping and fittings shall be maintained leak proof.
- The operator cab shall possess good and safe:
 - Structure, windows and windshield wipers
 - Drivers chair and foot rest
 - Control handles
 - Cab instrumentation
 - Telecommunication
 - Cab out fitting
- Wind indicator with an adjustable set point shall be in a position representative for the wind on the crane. The indicator shall give continuous information regarding constant speeds and gusts.

6.31.4 Mandatory rigging requirements

Rigging shall be done under experienced and qualified rigger only.

- The primary requirement in rigging shall be to assess the weight of load before attempting any lift.
- All hooks shall be fitted with Master Rings having certificate of fitness from the competent

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person, so that the hooks are subjected to balance vertical loading only.



- Only four legged slings shall be allowed which includes master link (ring), intermediate master link (ring) if necessary, chain / wire rope sling, sling hook or other terminal fitting. Conditions of Contract on Safety
- Hand spliced slings up to 32mm diameter shall not be used at site for any lifting purpose.
- No load shall be slewed over public areas without stopping the pedestrians and road traffic. A separate pedestrian path shall be provided at the beginning of site activities.
- Requirements of outriggers

All outriggers shall be fully extended and at all tyre are clear of the ground. Heavy duty blocking having large bearing area shall be necessary to prevent sinking of floats. All loads shall have tag-lines attached in order to ensure that the load can be controlled at all times.

No close working to any live overhead power line is permitted without the operation of a strict Permit to Work. Minimum lighting is to be ensured at all lifting operations. Failure to do any of the above shall attract penalty from the CONTRACTOR as per relevant clause

6.32 Use of Man-Lift (Aerial Lift, Elevated Work Platform)

- Ground condition shall be checked. Man-Lift should not place on uneven surface.
- Assess the weight/number of persons to be lifted. Man-Lift shall not operate beyond the SWL rating.
- The man-lift shall be moved slowly and carefully.
- Assign signalman/flagman during movement of man-lift.
- Ensure valid TPIs of Man lifts before use.
- Only trained, certified & authorized operator permitted to operate the Man-lift.
- Out rigger if any shall be extended fully and tyres cleared off the ground.
- Outriggers if any support plate shall have adequate strength to withstand load.
- Ensure Man-Lift, load chart is provided.
- All limit switch, Alarm, safety devices should be in good working condition.
- All limit switch, Alarm, safety devices of the Man-Lift shall be inspected before lifts.
- All limit switch, Alarm, safety devices of the Man-Lift shall never be tampered with or



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deactivated.

- Before lifting always survey the site for overhead power lines/utilities.
- If necessary Overhead utilities shall be de-energized following LOTO permit.
- Erect goal posts.
- Check clearance from overhead lines (OHL) before setting Man-Lift, considering OHL voltage.
- Do not allow boom or other parts of Man-Lift/ to come within 3m reach of Overhead utilities.
- Man-Lift should not be elevated whilst on a sloping, uneven, or soft surface. Personnel shall not be driven with the platform elevated.
- Before operating the machine, make sure all safety gates are closed and fastened in their proper position. Wear fall protection with a lanyard attached to an authorized lanyard anchorage point.
- Do not raise the platform or drive unless the machine is on firm, level surfaces and evenly supported.
- Operator should follow signals from designated rigger.
- Never attempt to use the machine as a crane. Do not tie-off machine to any adjacent structure
- Do not operate an aerial lift in high winds / heavy rain above those recommended by the manufacturer.

6.33 Use of Man Basket

- A Crane Lift Permit must be submitted by CONTRACTOR (s) for Consultant review and approval prior to making the lift.
- Man basket can be used only where and when another means of access is not possible because of structural design and site work conditions.
- Man baskets shall be inspected and certified by a competent third party agency prior to it being used at site. A copy of man baskets certification must be displayed by CONTRACTOR (s) on basket.
- Personnel occupying the man basket shall complete "Working at Height" training and follow 100% tie-off procedure.
- Prior to use each day and at each new work location, the Work Basket shall undergo a full cycle test at 200% of the maximum design capacity.
- A qualified design engineer shall design the Man Basket with a safety factor more than 5.
- Man Baskets shall be at least 1.2 m square on plan and provide head clearance which allows

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personnel to stand upright.

- Man Basket weight, maximum number of personnel, and load capacity shall be posted on the basket.
- Cranes carrying personnel in Man Basket shall be uniformly leveled within 1% of the level grade and located on firm footing.
- Crane travel shall be prohibited while carrying persons.
- The total weight of the loaded Man Basket and related rigging shall NOT exceed 25% of Crane rated capacity.
- The minimum safety factor of load hoist wire rope shall be 7.
- Lifting and lowering speeds shall NOT exceed 30 m /minute.
- Use a full body harness with double lanyards attached to the crane hook to prevent the worker(s) from being ejected or pulled from the basket.
- A Pre-Lift Meeting attended by the responsible supervisor/foremen, crane operator, signalman and personnel to be lifted shall be held before the beginning of personnel lift at each new work location and thereafter for any personnel newly assigned to the lifting work.

6.34 Heavy Lifts

The CONTRACTOR shall submit detailed rigging studies plan for Owner / Consultant approval prior to lifting equipment which cannot be erected with a crane of approx. 100 MT capacity due to constraints of its dimensions, location of foundation height, approach & weight. CONTRACTOR shall generate the "Permit for heavy lift/critical erection". Prior to actual lifting activities, CONTRACTOR shall check the validity of the crane inspection certificate issued by statutory/ competent authority. This requirement shall also apply to all rigging equipment utilized for the job. The CONTRACTOR shall, at all times, be responsible for all rigging activities.

The CONTRACTOR shall ensure medical fitness of all workmen who are engaged / involved in erection of equipment, vessels etc. and such fitness checks shall be carried-out every six months interval with the help of a registered medical practitioner & record shall be maintained. Use Tools & tackles with sufficient strength having capacity at least of 120% of actual load to be lifted. In case of lifting equipment

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more than 40 Ton, Qualified lifting engineer of CONTRACTOR(s) shall endorse.

Adequate safety measures such as positive barricading, usage of appropriate PPEs, permit to work, etc. shall be taken during all heavy or critical lifts. For lifting any material (irrespective of shape, size or volume), at any height, it is always advisable to prepare a Plan of Erection (PoE) taking into consideration hazards & risks associated therein – this can enable people to put their own experiences of various natures & side-by-side establish a practical method for risk-free erection / lifts.

The CONTRACTOR shall prepare PoE & shall document the same, when risks are identified as “medium” or “high” and the same shall be approved by its competent / qualified engineer.



6.35 Excavation

The CONTRACTOR shall obtain permission from competent authorities prior to excavation wherever required. The CONTRACTOR shall locate the position of buried utilities (water line, cable route, etc.) by referring to project / plant drawing / in consultation with Owner/ Consultant. The CONTRACTOR shall start digging manually to locate the exact position of buried utilities & thereafter use mechanical means.

The CONTRACTOR shall keep soil heaps at least 1.2 M away from edge or a distance equal to depth of pit (whichever is more) The CONTRACTOR shall maintain sufficient “angle of repose” during excavation – shall also provide slope or suitable bench as decided by Owner/ Consultant. The CONTRACTOR shall arrange “battering” or “benching” wherever required for preventing collapse of edge of excavations. The CONTRACTOR shall identify & arrange de-watering pump or well-point system to prevent earth collapse due to heavy rain / influx of underground water.

The CONTRACTOR shall arrange protective fencing / barricading with warning signal around excavated pits, trenches, etc. along with minimum 2 (two) entries, exits / escape ladders. The CONTRACTOR must avoid “underpinning” / under-cutting to prevent collapse of chunk of earth during excavation. The CONTRACTOR shall use “stoppers” to prevent over-run of vehicle wheels at the edge of excavated pits / trenches. The CONTRACTOR shall arrange strengthening of “shoring” & “strutting” proactively to avoid collapse of earth / edges due to vehicular movement in close proximity of excavated areas / pits / trenches, etc.

Take "Confined space entry permit" (excavation \geq 1.5 meter depth) in addition to "Excavation Work

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Permit" for Excavations having more than 1.5 m depth & width is also more than 4.5 m but where release of toxic/poisonous/flammable fumes, gases is possible by any means (through soil or ruptured pipe line) Or Excavations having more than 1.5 m depth & width is also more than 4.5 meter but access is very critical.

6.36 Road work

Site shall be barricaded and provided with warning signs including night warning lamps at appropriate locations for traffic diversion.

Experienced drivers with valid driving license shall drive road rollers, bitumen sprayers and pavement finishers and all vehicles on site.



Employees handling hot bitumen sprayers or spreading bitumen aggregate mix or mixing bitumen with aggregate shall be provided with PVC hand gloves and rubber gumboot up to knee joints. If bitumen accidentally falls on ground, sprinkle sand immediately to cover it and to prevent anybody stepping on it. It shall then be removed with the help of spade.

For cement concrete roads, besides site barricading and installation of warning signs for traffic diversion, safe practices mentioned in the section on 'Concreting' shall be also applicable. Use PPEs such as Safety Goggle, Apron, Safety helmet, Dust mask and Safety Shoes at site.

6.37 Piling / Boring

Adequate Safety Measures shall be taken by CONTRACTOR (s):-

- All rig accessories must be thoroughly examined & certified by 3rd party competent authority.
- Only trained or authorized persons shall operate the piling/boring rig and other equipment. Competency certificate of rig operator to be submitted to Consultant.
- Piling/boring area shall be barricaded and sign boards should be installed.
- Surface of the piling/boring area shall be levelled for the safe movement of Rigs.
- Pile pieces once removed during dressing operation shall not be left on edge of excavated pit; it shall be shifted to designated area. Check underground utilities before work commences.
- Guys, outriggers or counter weight shall be provided for stability.

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- Route the electrical cables such that they will not get damaged mechanically and will not come in contact with water.
- Guards for rotating parts of machines are in place.
- Wear ear plug/muffs when working at high noise area.
- Periodic servicing & maintenance to rig, all the parts & accessories shall be done.
- Discard the damaged or cracked accessories immediately. Replace them at once.
- Ensure sound condition of the main rope attached to the hammer and is in accordance with the weight of the hammer.
- Ensure proper tightness, slackness of the guy ropes as per requirement of the job.
- Use of Tripod type of rig for boring/piling is not allowed. Rigs shall be inspected as per checklist during piling and boring.

6.38 Bar Bending and Cutting



Only trained persons shall carry out bar bending and cutting activities. Supervisor shall ensure that all rotating parts are guarded. Good housekeeping shall be maintained in bar cutting area. Protruding bars shall be cut or guarded. Use safety helmet, safety shoes, safety goggles, and leather gloves while Bar Bending and Cutting.

6.39 Shuttering

Cutting machine shall be guarded while cutting and joining plywood. Shutters shall be stacked and stored properly. Loose shuttering shall be secured properly to prevent fall of shutters. Shuttering activity shall be barricaded. Rebar's shall be capped / secured to prevent injuries.

6.40 Structural Work, Laying Of Reinforcement Concreting

Structural steel or prefabricated parts should be stored and handled in such a manner that they shall not fall or overturn. Racks are to be set on firm ground. Structural steel or prefabricated parts should be lifted, by methods or appliances that prevent them from spinning accidentally. While structural steel or prefabricated parts are being erected, the employees shall be provided with appliances for guiding them as they are being lifted and set down, so as to avoid crushing of hands and to facilitate the

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operations. Use of such appliances should be ensured.

A raised structural steel or prefabricated part shall be secured against external agencies such as wind and passing loads before its release from the lifting appliance. When adverse weather conditions such as high-speed wind or reduced visibility entail risks of accidents the work should be carried on with particular care, or if necessary, interrupted. Personnel shall not be on any scaffold or other temporary elevated work area during storms or high winds - sustained winds more than 65 kph (40 mph) - unless the scaffold or working level is indoors or otherwise unaffected by the weather conditions. Outdoor scaffolds or elevated work platforms shall not be used during thunderstorms or when there is likelihood of lightning. Structural steel parts that are to be erected at a great height should as far as practicable be assembled on the ground.

When structural steel or prefabricated parts are being erected, a sufficiently extended area underneath the workplace should be barricaded or guarded and no one shall be allowed to work underneath. Ensure that employees use PPE like Safety Helmet, Safety Hand gloves, Safety Shoes.

6.40.1 Reinforcement



All protruding reinforcing steel, onto and into which employees could fall, shall be guarded to eliminate the hazard of piercing. Ensure that employees use PPE like safety helmet, safety shoes, safety glasses / goggles, gloves etc. DO NOT stand on cantilever rods. While transporting material by trucks / trailers, the rods protruding outside should be tied and tagged with red flags/lights.

6.40.2 Concreting

Barricade the concreting area while pouring at height / depths. Keep vibrator hoses, pumping accessories in good condition. Pipelines in concrete pumping system shall not be attached to temporary structures such as scaffolds and formwork support as the forces and movements may affect their integrity.

Safety cages & guards around moving motors/parts etc. should be provided in concreting mixers.

Use PPEs like gloves, PVC / Rubber, Safety Shoes / Gumboots with steel toe, safety goggles, safety helmet etc. while handling concrete and wear respirators for handling with cement. Use Safety shoes, while climbing on structure/ scaffold or at higher elevation. Earthing of electrical mixers, vibrators, etc. should be done and verified. Cleaning of rotating drums of concrete mixers shall be done from outside. LOTO Work Permit with positive Isolation / and tag out devices shall be ensured prior to entry.

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Where concrete mixers are driven by internal combustion engine, exhaust points shall be located away from the employee workstation so as to eliminate their exposure to obnoxious fumes. Ensure adequate lighting arrangements for carrying out concrete work during night. Projected re-bars which may cause injury shall be provided with protective caps/covers.

6.41 Temporary Structure / Fixtures

Before erecting temporary shelters like sheds or tents anywhere within the site/plant premises, written permission of the concerned authorities must be obtained. Temporary fixtures like; sheds, tents, etc. shall be erected in conformity with normal safety standards. Thatched roof to such fixtures will not be permitted.



Temporary piping, hose connections and electrical wiring must be laid as in such manner that they do not cause tripping or hitting hazard. Temporary sheds can be constructed only for the storing of the material /site office. It should not be used for any other purpose. The shed shall be made of safe construction material and good aesthetic view. The shed shall be made strictly at the authorized location and size. All windows shall be either of wire mesh or glass.

After completion of the job, shed must be demolished informing to concerned authorities and area must be cleaned. All precautions shall be taken to ensure that any temporary electrical wiring used within Plant premises will not cause spark or shock.



6.42 Gas Cylinders

Gas Cylinders utilized in flame cutting and welding shall:

- CONTRACTOR (s) shall not use LPG gas cylinder inside site.
- Where a cylinder is designed to accept a valve protection cap, caps shall be in place except when the cylinder is in use or connected.

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- Be checked for leaks by means of soapy liquid applied to each joint.
- Be stored separately, oxygen and acetylene cylinders shall be at least 5 meters apart.
- Be stored vertically, separated and marked 'EMPTY' or 'FULL'.
- Be stored in well-ventilated areas.
- Be shielded from direct sunlight or any heat /ignition source.
- Be secured vertically during use and transportation. Cylinders shall never be used in a horizontal position.
- Not be lifted by any slings, rolled or used as rollers themselves.
- Be fitted with Flashback Arrestors at the torch and the regulator, being devices designed to prevent an explosive mix developing in either cylinder.
- No attempt shall be made to transfer gas from one cylinder to another.
- The regulator and other equipment shall be connected and a test shall be made to ensure that all joints are gas tight and free from leakage and shall be suitable for the equipment being used.
- Be fitted with approved pressure reducing regulator and gauges for the intended use.
- Not have joint fittings on acetylene cylinders made of copper or silver, as when in contact with the gas, these metals form explosive compounds.
- No jointing compound or grease shall be applied to the threaded joints of the cylinders and fittings.
- Have leaking cylinders taken out of service immediately, removed outdoors and closely attended until completely and safely depressurized.
- Not have cylinders positioned directly beneath a working area as molten metal may fall onto hoses causing leaks and possibly igniting the gases.
- Hoses shall be inspected regularly. If a hose is found to be leaking a few millimeters of the hose nearest the torch and regulator, which is subjected to the hardest use, shall be cut off and the hose reattached. Hoses shall not be taped to try and prevent gas leaks.
- Only IS or equivalent international standard hoses, regulators, pressure gauges, valves and flash back arrestors shall be used.
- CONTRACTOR (s) shall take the precautions that no hot work or Smoking carried out where gas cylinders are stored. CONTRACTOR (s) to Display the board in English, Hindi and Local Language "NO SMOKING" & "NO HOT WORK" at storage of gas cylinders.

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- Dry chemical fire extinguisher shall be readily available at the work area.
- Provide Flash Back arrestor /NRV complying IS 11006/EN 7301/ISO 5175 std or other equivalent standard.
- Provide gas cylinder hoses complying IS447 or other equivalent standard.



6.43 Welding / Gas cutting

CONTRACTOR shall ensure that flash back arrestors conforming to BS: 6158 or equivalent are installed on all gas cylinders as well as at the torch end of the gas hose, while in use. All cylinders shall be mounted on trolleys and provided with a closing key. Empty & filled-up gas cylinders shall be stored separately with TAG, protecting them from direct sun or rain. Minimum 2 nos. of Portable DCP type fire extinguishers (10 kg) shall be maintained at the gas cylinder stores. Stacking & storing of compressed gas cylinders shall be arranged away from DG set, hot works, Elect. Panels / Elec. boards, etc. The burner and the hose placed downstream of pressure reducer shall be equipped with Flash Back Arrestor/Non Return Valve device. The hoses for acetylene and oxygen cylinders must be of different colours. Their connections to cylinders and burners shall be made with a safety collar.

At end of work, the cylinders in use shall be closed and hoses depressurized. Cutting of metals using gases, other than oxygen & acetylene, shall require written concurrence from Owner.

All welding machines shall have effective earthing at least at distinctly isolated two points. In order to help maintain good housekeeping, and to reduce fire hazard, live electrode bits shall be contained safely and shall not be thrown directly on the ground. The hoses of Acetylene and Oxygen shall be kept free from entanglement & away from common pathways / walkways and preferably be hanged overhead in such a manner which can avoid contact with cranes, hydra or other mobile construction machinery.

Hot spatters shall be contained / restricted appropriately (by making use of effective fire-retardant cloth/fabric) and their flying-off as well as chance of contact with near-by flammable materials shall be stopped. The CONTRACTOR shall arrange adequate systems & practices for accumulation / collection of metal & other scraps and remnant electrodes and their safe disposal at regular interval so as to maintain the fabrication and other areas satisfactorily clean & tidy. All gas cylinders must have a cylinder cap on at all times when not in use.

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6.44 Radiography

CONTRACTOR (s) shall conduct Radiography only after receipt of the Approved Radiography work permit. Only trained and competent person shall be allowed to work. Prior to start the activity JSA/TRA to be conducted and get approved by the CONSULTANT/PMC. All the precautions to taken to avoid the exposure of employees to Radiation during the use of Radiography Equipment.

CONTRACTOR (s) shall be responsible for the safe storage of the radio graphic sources.

Radiography shall be carried out only outside of normal working hours i.e. usually night time and following completion of all other work activities.

- All site personnel are to comply with the Radiography Work Permit requirements.
- Radiography shall be carried out from certified or authorized agency from AERB / BARC and under supervision of RSO (Radiography safety officer).
- Only the authorized Radiation Protection Officer / Radiographer (RPO) shall handle Radioactive Equipment as required by from AERB / BARC.
- Radioactive Material shall be placed under the direct control of the RPO and under no circumstances shall radioactive material be handled without the attendance of the RPO.
- Radiography Permits shall not be issued until the area of the work has been checked and all personnel, other than personnel performing the radiography work, are directed out of the work area.
- Radiography Permits issued for other tasks shall be reviewed and rescinded if necessary in order to prevent unauthorized personnel from being within the regulated area.
- The designated RPO performing radiography shall be responsible for establishing boundaries around the radiography work area with Magenta and Yellow barricade tape and signs showing magenta letters and symbols on a yellow background, to warn personnel that hazardous work is in progress.
- This shall include structures or those working at different elevations. Additionally at every corner boundary a flashing light shall mark the perimeters where the work is being performed.
- Hand Operated "Manual Siren" to be provided at site by the CONTRACTOR (s) to give the

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Radiography start & Stop alarm at site.

- Only persons approved in the Radiography Permit shall be allowed inside the radiography boundary. Stairs, ladders or other means of access to the restricted area must be tape barricaded and the radiation caution sign in place.
- All personnel involved in radiography shall be equipped with personnel monitoring devices to control the level of exposure to radiation. Established maximum exposure levels shall not be exceeded.
- Radiography source storage pit shall be approved by AERB / BARC.
- A lockable security fence shall surround the pit. Signs indicating the hazardous nature of the stored materials and emergency telephone number/s of contact personnel shall be displayed at the security fence.

6.45 Catalyst Storage and Handling

A) CONTRACTOR shall ensure the following criteria during catalyst Storage and Handling



- The catalyst containers are to be handled carefully without bumping and must never be rolled to avoid any damage of the catalyst.
- The catalyst drums should be inspected carefully for damage during shifting from store to site, and Drums must not be stacked on their sides or stacked more than four drums high, even when held on pallets.
- The lids should be left on the drums until just before the catalyst is to be charged, and if the lids are accidentally knocked off or removed for inspection, it is important that they should be replaced as soon as possible, so that contamination of the catalyst is avoided. If the drum lid cannot be replaced, then the catalyst should be re-drummed without delay, this process shall be carried out in presence of CONTRACTOR's representative.
- Handled the Catalyst drums as gently as possible. Suitable space is required for storing the drums between deliveries and charging, and double handling shall be avoided if this space is close to the equipment to be loaded.

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- Catalyst Drums must not be rolled, and if manual handling is unavoidable, the suitable drum barrows, opening levers and skids should be provided.
- Adopt a good method of sieving, which is to pass the catalyst over a simple inclined screen, since vibrating screens can cause additional unnecessary damage and loss. The mesh spacing should be about half of the smallest dimension of the catalyst pellet.
- Suitable masks must be provided for those who are engaged in this kind of operation, and some Provisions should be made to collect the fines for disposal, based on catalyst supplier recommendation.
- Reforming catalyst does not usually require sieving, but CONTRACTOR shall ensure broken rings should be removed whilst the socks are being charged, since relatively broken rings can affect the tube pressure drop significantly.
- CONTRACTOR shall make an assessment of incompatibility of Catalyst as per MSDS recommendations. Flammable substances shall not be stored with oxidizing substances.
- All the substances can be kept in three categories – one which does not burn, other which burn and the third one, which produces oxygen and may be the cause of fire. While storing, the first thing is that the solids and liquids should be kept separately and the properties must be seen before it is decided to store at one place.

B) CONTRACTOR shall ensure to follow/ implement the below General applicable safety rules during Catalyst Loading.



- Wear protective clothing and gear provided and required for plant operation.
- Wear a Full body Harness double Lanyard this Shock absorber when working at elevated locations if adequate protection against falling is not available.
- Wear a suitable air mask when working on pipelines or equipment containing hydrocarbons, toxic gases or chemicals.

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- Use the correct hose for air, water, steam or chemicals; secure it during use. Tag any hose that needs repairing and send it to the workshop. Clean chemical hoses after use.
- Be sure that hoses are in good condition and that all connections are tight so that there is no chance of leakage that could result in a hazardous situation.
- When using steam hoses, crack the steam valve at first until all water in the hose is discharged and the hose is heated up. This will prevent high velocity water jets from the hose.
- Report hazards immediately and take all measures to mitigate the hazard.
- Wear goggles and gloves while taking samples.
- Be thoroughly familiar with the location and operation of all firefighting equipment, blankets, safety showers, gas mask, and other safety equipment.
- When giving clearance to maintenance to perform work in the unit, be sure the equipment is in a safe condition to work on. Be specific in your instructions and be sure that they are understood and followed. Check to see if instructions are being observed.
- Isolate the equipment to be opened for clean-out or repairs. Leave rest of the equipment inactive with valves closed. Isolation is to be done by blinding-off.
- Purge the equipment with nitrogen, especially those that have contained H₂S and hydrocarbon. Thereafter, steam-out with purge steam to remove heavy hydrocarbons. While purging and during initial steam-out operations, vent to flare.
- Close vent, and open the drain. Steam-out any liquid to the sewer for half an hour. Beware that hydrocarbons can contain H₂S and that release of H₂S from the drained-out condensate could occur.
- Check for the presence of hydrocarbon vapors within certain proportions. If toxic vapors present, a test for these should be made.

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- Precaution in loading unloading of catalyst drums. Drums shall be kept on pallets. This includes safety precaution of crane & lifting tools/tackles.
- Refer MSDS & follow manufacturer safety guide line.
- Open catalyst drum by pneumatic tools.
- Catalyst fine dust is poisonous and irritating to eyes and skin, a minimum dust respirator, Apron, face mask, goggles and hand gloves to be used.
- Standard vessel entry procedure should be followed at all times, this includes minimum, followings
- Routine testing of oxygen level.
- A person stationed outside the vessel. This individual should be equipped with rescue gears and an independent air supply.
- Catalyst should be loaded, unloaded, handled, and stored under the supervision of a competent person as per guidance of Consultant, persons familiar with hazards and the precautions to be deputed for emergency.
- Be familiar with Materials Safety Data Sheets of Catalyst to be handled in the respective area.
- Lifting appliances used should be of good construction and free from defects. They should be not be overloaded or overfilled.
- When highly flammable catalyst are being loaded or unloaded, adequate firefighting equipment should be provided so that an incipient fire can be controlled immediately.
- Where necessary, non-sparking tools should be provided and used in explosive atmospheres.
- Foodstuff and other articles for consumption must be stored well away from Catalyst classified as toxic or harmful or which have a strong smell.

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- Take all the care to see that passages are not blocked. Easy accessibility should be kept to reach the substance from all the sides. In solid storage, always care should be taken to maintain first in, first out otherwise on long storage decomposition may take place causing unknown hazards.

6.46 Explosives/Blasting operations

Blasting operations shall be carried out as per latest Explosive Rules (Indian / International) with prior permission. The CONTRACTOR shall obtain license from Chief Controller of Explosives (CCoE) for collection, transportation, storage of explosives as well as for carrying out blasting operations. The CONTRACTOR shall prepare exclusive method statement (in cognizance with statutory requirements) for diffusing unfired explosives, if any, at project site before carrying out actual task. Nowhere blasting shall be carried out by the CONTRACTOR or its agency without the involvement of competent supervisor and licensed blaster / shot blaster

6.47 Grit Blasting

- CONTRACTOR shall produce detailed Method Statement, Risk Assessment and Job Safety Analysis prior to work commencing.
- CONTRACTOR shall ensure grit blasting shall be carried out in an enclosed designated area, levelled, and with sufficient safe access, both to the area, and around the work pieces. The grit blasting area shall be indicated by prominent warning signs.
- Only proper grit blast shall be used. Under no circumstances shall products containing free silica be used.
- Personnel involved in the actual blasting of material shall be protected by a blast hood that meets approved standards and providing both respiratory and eye protection.
- The nozzle shall be fitted with a properly functioning dead mans handle, and a standby man shall stay by the blast pot and Nozzle and hose must be earthed.
- Standby men shall be provided with suitable respiratory and eye protection.
- Spent grit shall be collected and properly disposed off.

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6.48 Painting



CONTRACTOR shall provide Specific training on the MSDS of the painting and any other solvents used in paint related work. Workers shall be instructed and trained on the hazards related to their work, particularly for long term activities, in the correct handling of chemicals and on the correct use of the equipment. CONTRACTOR shall consider HSE aspects during selection and purchasing of painting material. MSDS shall be always available.

6.48.1 Paint Handling, Storage and Preparation

- Use and storage of flammable paints and solvents shall be kept to well ventilated restricted areas;
- Fire prevention and ventilation to be maintained in storage/preparation areas;
- These areas shall be suitably marked with the appropriate warning signs;
- No painting preparation and application should be carried out close to ignition sources (welding, cutting, smoking areas, sparking tools, etc.) unless safe measure are taken;
- Electrical lighting and equipment shall be explosion-proof when required in areas where solvent vapors are likely to be present;
- Fire extinguishers shall be located at the storage and at the work areas.

6.48.2 Paint Application

- Face, eyes and skin shall always be protected;
- Avoid touching any part of the body and wear protective equipment when handling irritating materials;
- Adequately ventilate all painting areas and provide approved or equivalent respiratory protection where necessary;
- Introduction of solvents and paint in confined space shall be subjected to hazard analysis, because can cause serious health and fire risks;

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- While painting in confined space, natural ventilation may be not sufficient and forced ventilation shall be foreseen (fresh air inlet of the ventilation system should be located near the top, and the discharge should be located near the bottom);
- If the confined space has a low volume (from about 15 cube meters) then suitable respirator apparatus can be used as necessary;
- Often while painting workers are exposed to fall hazards so fall protection system shall be applied;
- Painting operators shall wash thoroughly before eating and at the end of the day. Adequate washing facilities shall be foreseen. Solvents shall never be used for personnel washing.

6.48.3 Spray Painting

- Spraying paint shall only be done by trained operators;
- All workmen spray painting shall wear chemical cartridge respirators or airline hoods depending upon the hazards of the paint (containing toxic solvents);
- Overall or other full body working dress shall be wear by spray painters;
- All pressurized equipment shall be handled carefully. System, hoses, etc. shall be anti-static type and so grounded as needed;
- Operators and their assistants shall know how to operate and de-energize the equipment in accordance to manufacturer's recommendations;
- Before using airless spray equipment, all guards recommended by the manufacturer shall be in place (hoses, conjunction safe lash, etc.) and the system shall be grounded to prevent static build-up; No spray gun should be pointed at anyone or part of the user's body;
- The area around spray painting activity should be enclosed by fence thick net (better if fire resistant) or equivalent to protect outside personnel and things from paint over spray. Work areas shall be kept as clean as practicably possible;
- Spray paint should be limited in windy situation.

6.49 Pressure Testing

Job safety analysis shall be conducted prior to any pressure test.

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The person in charge of hydrostatic testing must fully understand the safety requirements and procedures involved with pressure testing. All persons who will work on the pressure test must be informed of the potential hazards and the necessary safety precautions.

A work permit shall be issued prior to commencement of hydrostatic test operations.

6.49.1 Supports

Piping, vessels, supports and foundations designed for gas service shall not be overloaded by the extra weight of the test liquid. Temporary supports and braces may be required.

6.49.2 Vent Drains and Blinds



- Vents of adequate capacity shall be installed at high points, to vent air / gas from the item while it is being filled with the test liquid.
- Hazardous gases or vapors must be vented clear of any area where personnel are working or where there is any possible source of ignition.
- Drains must be installed at a suitable location to allow removal of the test liquid.
- Only approved rating blinds shall be used and all vent bolts tightened to proper torque levels
- HP pipe end points and areas very close to HP vents shall be barricaded and suitable safety signage displayed in local languages and English.

6.49.3 Valves

Where isolation valves are used to contain test pressures, they must be of adequate rating for the pressure to be encountered. If isolation valves are used in lieu of blinds, provisions shall be made to ensure that no over-pressurizing can occur in equipment that is not being tested, due to possible valve leak.



6.49.4 Vacuum

On vessels or tanks which could collapse if subjected to a vacuum, there must be sufficient vent relief capacity to assure that the vessel cannot be subjected to a vacuum by draining the test fluid or by sudden cooling.

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6.49.5 General Requirements

- Do not approach system never previously tested, corroded piping or vessels, or vessels with welds never previously tested during the stepwise increase in pressure to the strength test pressure.
- After the strength test pressure has been reached and held for a specified interval, the equipment may be approached.
- The actual pressure at which the system under test will be approached for close inspection shall be specified in the test procedure.
- Pressure relief valve(s) shall be used to prevent over pressuring of the equipment.
- Any ancillary equipment not under test must be isolated by valves or blind flanged and vented or disconnected.
- Only calibrated test gauges and recorders shall be used and test gauges should be mounted in the upright position. Pump discharge gauges must be visible to the pump operator for the duration of the test.
- The equipment / vessel shall have adequate vacuum relief capacity to avoid damage or collapse, when draining the test liquid.
- Lines should be drained and dried mechanically when the test liquid is corrosive or otherwise hazardous. The pressure rise during a pressure test should be gradual and under control to allow time for material to strain, and time for personnel to check for leaks.
- A system under test shall be depressurized (with the exception of pressure due to a liquid head) before any work is done to stop leaks or repair weakness, including the tightening of bolts. In tightness tests, bolts may be tightened without depressurizing, if specifically approved in the written test procedure.
- A block valve is required on the line from the test pump to the equipment under test.
- Air shall not be used to displace test fluid from underwater equipment unless it has been determined that the equipment will not float.
- Salt water must not be used for testing any material subject to stress corrosion cracking in the presence of chloride ions (such as stainless steel type 304 or 18.8 - CrNi).

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- Possible changes in pressure due to thermal expansion, contraction or hydrostatic heads must be taken into account.
- Written procedures approved prior to testing shall be followed for the disposal of test mediums containing chemical additives for control of corrosion or bacteria.
- All tests need test manifold fitted with gauge, valve and PRV. The test manifold need to be certified.
- No homemade/non-standard flanges shall be used for testing purposes.

6.50 Compressed Air



All air receivers and compressors shall be in good condition and properly maintained. Air receivers shall be individually identified and marked with their safe working pressure. All air receivers must be fitted with a properly set pressure relief valve. Air receiver and related relief valve shall be accompanied by a valid test certificate, which shall be kept on site by CONTRACTOR and shown to the Consultant representative before bringing the vessel onto site. Guard should be constructed to compressed air in order to prevent worker to get into contact with the hazardous machine. Air receivers shall be examined and the pressure relief valve tested by an independent examiner at yearly intervals.

A register of all air receivers containing:-

- Individual identification numbers
- Dates of independent inspections
- Name and signature of independent examiner
- Rated safe working pressure
- Pressure at which pressure relief valve lifted shall be kept on site by CONTRACTOR .

All compressed air fittings shall be wired and/or restrained to prevent them from whipping should the coupling be broken. Only hose clamps designed for compressed air service shall be used. Worm drive (Jubilee) clips are not acceptable.

6.51 Demolition/ Dismantling

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The CONTRACTOR shall adhere to safe demolishing/ dismantling practices at all stages of work to guard against unsafe working practices. The CONTRACTOR shall disconnect service lines (power, gas supply, water, etc.)/ make alternate arrangements prior to start of work and restore them, if required as directed by Owner / Consultant at no extra cost. Before carrying out any demolition/ dismantling work, the CONTRACTOR shall take prior approval of Owner/ Consultant and generate. For revamp jobs in operating plants where location of underground utilities is not known with certainty, the CONTRACTOR shall depute an experienced engineer for supervision and shall make adequate arrangements for Firefighting & First-Aid during the execution of these activities.

The CONTRACTOR shall arrange approved Job Safety Analysis (JSA) / Method Statement for the specific demolition / dismantling task and corresponding action plan commensurate with hazards / risks associated therein. In no case any activity related to demolition / dismantling shall be carried out by the CONTRACTOR without engaging own supervision / field engineer.



6.52 Maintenance Work-Machine, equipment, DG, etc.

Preventive maintenance schedule of vehicles, tools, equipment, etc. shall be prepared and done according and pertaining records shall be maintained. All electrical, mechanical, construction equipment and /or construction vehicle, power operated and battery operated equipment, machines and tools shall be certified and inspected by concerned CONTRACTOR (s) discipline jointly with HSE and provide colour code of the month on the machine, tools and/or equipment. Each machine, tools or equipment shall be inspected every month with defined colour code.

CONTRACTOR (s) must maintain the records of all inspection and maintenance activities and to produce whenever demanded by Owner / Consultant. Legal requirements shall be followed for DG Sets as per Indian Electricity Act/Rules and Environment Protection Act/Rules. Practice preventive maintenance of vehicles and machines and maintain associated records and documents. Exhaust of the prime mover, if IC engine is used, should be fitted with PESO approved spark arrester (in case of work in hazardous area).

6.53 Stoppage of Work

The Consultant shall have the right to stop the work at his sole discretion, if any unsafe condition or

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unsafe act is found . In such cases, the CONTRACTOR shall be informed in writing about the nature of hazards and possible injury / Incident. The CONTRACTOR shall not proceed with the work until he has complied with each direction to the satisfaction of Consultant.

The CONTRACTOR shall not be entitled for any damages / compensation for stoppage of work, due to safety reasons and the period of such stoppage of work shall not be taken as an extension of time for Completion of the Facilities and will not be the ground for waiver of levy of liquidated damages



6.54 Additional Safety Requirements for Working inside a Running Plant

As a minimum, the CONTRACTOR shall ensure adherence to following safety requirements while working in or in the close vicinity of an operating plant:

- a) CONTRACTOR shall obtain permits for Hot work, Cold work, Excavation and Confined Space from Owner in the prescribed format.
- b) The CONTRACTOR shall monitor record and compile list of his workers entering the operational plant/unit each day and ensure & record their return after completing the job.
- c) CONTRACTOR's workers and staff members shall use designated entrances and proceed by designated routes to work areas only assigned to them. The workers shall not be allowed to enter units' area, tanks area, pump rooms, etc. without work authorization permit.
- d) Work activities shall be planned in such a way so as to minimize the disruption of other activities being carried out in an operational plant/unit and activities of other CONTRACTORS.
- e) The CONTRACTOR shall submit a list of all chemicals/toxic substances that are intended to be used at site and shall take prior approval of the Owner.
- f) Specific training on working in a hydrocarbon plant shall be imparted to the work force and mock drills shall be carried out for Rescue operations/First-Aid measures.
- g) Proper barricading/cordoning of the operational units/plants shall be done before starting the construction activities. No unauthorized person shall be allowed to trespass. The height and overall design of the barricading structure shall be finalized in consultation and approval from the Owner.
- h) Care shall be taken to prevent hitting underground facilities such as electrical cables, hydrocarbon piping during execution of work.

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- i) Barricading with water curtain shall be arranged in specific/critical areas where hydrocarbon vapors are likely to be present such as near horton spheres or tanks. Positioning of fire tenders (from owner) shall also be ensured during execution of critical activities.
- j) Emergency evacuation plan shall be worked out and all workmen shall be apprised about evacuation routes. Mock drill operations may also be conducted.
- k) Flammable gas test shall be conducted prior to any hot work using appropriate measuring instruments.
- l) Sewers, drains, vents or any other gas escaping points shall be covered with flame retardant tarpaulin.
- m) Respiratory devices shall be kept handy while working in confined zones where there is a danger of inhalation of poisonous gases. Constant monitoring of presence of Gas/ Hydrocarbon shall be done.
- n) Clearance shall be obtained from all parties before starting hot tapping, patchwork on live lines and work on corroded tank roof.
- n) Positive isolation of line/equipment by blinding for welding/cutting/grinding shall be done. Closing of valve will not be considered sufficient for isolation
- o) Welding spatters shall be contained properly and in no case shall be allowed to fall on the ground containing oil. Similar care shall be taken during cutting operations.
- p) The vehicles, cranes, engines, etc. shall be fitted with spark arresters on the exhaust pipe and got it approved from Safety Department of the Owner.
- q) Plant air should not be used to clean any part of the body or clothing or use to blow off dirt on the floor.
- r) Hydro carbon detector & Multi Gas detectors(standalone type with loud siren type) shall be installed in gas leakage prone areas as per requirement of Owner's plant operation personnel.
- s) Experienced full-time safety personnel shall be exclusively deployed to monitor safety aspects in running plants
- t) CONTRACTOR shall be responsible for arranging suitable communication system as applicable for the construction activities to be carried out inside the refinery as mobile phones are not allowed inside the running refinery.

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7. EMERGENCY PREPAREDNESS & RESPONSE PLAN

The CONTRACTOR shall prepare and submit Emergency preparedness & Response Plan for approval of their respective work sites within 30 days of site mobilization. The plan shall integrate the emergency response plans of the CONTRACTOR.

The Emergency Response Plan shall detail the CONTRACTOR's procedures, including Construction Phase and pre-commissioning & commissioning Phase referring site HIRA. detailed communications arrangements, for dealing with all emergencies that could affect the Site. This include where applicable, injury, sickness, evacuation, fire, chemical spillage, severe weather and rescue.

Emergency awareness trainings shall be part of Site Emergency preparedness and response Plan. Employees shall be fully made aware about potential emergencies and their role and responsibilities during emergencies in HSE induction and subsequent emergency management awareness programs.



The CONTRACTOR shall ensure that an Emergency Response Plan is prepared to deal with emergencies arising out of :

- Fire and explosion
- Collapse of lifting appliances and equipment
- Collapse of building or structure etc.
- Gas leakage or spillage of dangerous goods or chemicals
- Bomb threatening, criminal or terrorist attack
- Drowning of worker and Landslides getting workers buried floods, Earthquake, storms etc.

8. ENVIRONMENTAL MANAGEMENT

8.1 Environment Protection

CONTRACTOR shall ensure proper storage and utilization methodology of materials that are detrimental to the environment. Where required, CONTRACTOR shall ensure that only the environment friendly materials are selected and emphasize on recycling of waste materials, such as metals, plastics, glass, paper, oil & solvents.

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The waste that cannot be minimized, reused or recovered shall be stored and disposed of safely. In no way, toxic spills shall be allowed to percolate into the ground. The CONTRACTOR shall not use the empty areas for dumping the wastes.



The CONTRACTOR shall strive to conserve energy and water wherever feasible. The CONTRACTOR shall ensure dust free environment at workplace by sprinkling water on the ground at frequent intervals. The air quality parameters for dust, poisonous gases, toxic releases, harmful radiations, etc. shall be checked by the CONTRACTOR on daily basis and whenever need arises. The CONTRACTOR shall not be allowed to discharge chemicals, oil, silt, sewage, sullage and other waste materials directly into the controlled waters like surface drains, streams, rivers, ponds. A discharge plan suggesting the methods of treating the waste before discharging shall be submitted to Owner/ Consultant for approval. For pipeline jobs, top soil shall be stacked separately while making ROW through fields. This fertile soil shall be placed back on top after backfilling.

8.2 Rules & Regulations

All persons deployed at site shall be knowledgeable of and comply with the environmental laws, rules & regulations relating to the hazardous materials, substances and wastes. CONTRACTOR shall not dump, release or otherwise discharge or disposes off any such materials without the express authorization of Owner/ Consultant. An indicative list of Statutory Acts & Rules relating to HSE to be displayed

8.3 Weather Protection

CONTRACTOR shall take appropriate measures to protect workers from severe storms, rain, solar radiations, poisonous gases, dust, etc. by ensuring proper usage of PPEs like Sun glasses, Sun screen lotions, respirators, dust masks, etc. and rearranging/ planning the construction activities to suit the weather conditions. Effective arrangement (without creating inconvenience to project facilities & permanent installations) for protecting workmen from hailstorm, drizzle in the form of temporary shelter shall be made at site

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8.4 Air Quality

The CONTRACTOR shall take all necessary precautions to minimize fugitive dust emissions from operations involving excavation, grading, and clearing of land and disposal of waste. He shall not allow emissions of fugitive dust from any transport, handling, construction or storage activity to remain visible in atmosphere beyond the property line of emission source for any prolonged period of time without notification to the Consultant.



The CONTRACTOR shall use construction equipment designed and equipped to minimize or control air pollution. He shall maintain evidence of such design and equipment and make these available for inspection by Consultant.

If after commencement of construction activity, Consultant believes that the CONTRACTOR'S equipment or methods of working are causing unacceptable air pollution impacts then these shall be inspected and remedial proposals shall be drawn up by the CONTRACTOR, submitted for review to the Consultant and implemented.

In developing these remedial measures, the CONTRACTOR shall inspect and review all dust sources that may be contributing to air pollution. Remedial measures include use of additional/ alternative equipment by the CONTRACTOR or maintenance/modification of existing equipment the event that approved remedial measures are not being implemented and serious impacts persist, the Consultant may direct the CONTRACTOR to suspend work until the measures are implemented, as required under the Contract.

CONTRACTOR'S transport vehicles and other equipment shall conform to emission standards fixed by Statutory Agencies of Government of India or the State Government from time to time. The CONTRACTOR shall carry out periodical checks and undertake remedial measures including replacement, if required, so as to operate within permissible norms.

The CONTRACTOR shall establish and maintain records of routine maintenance program for internal combustion engine powered vehicles and equipment used on this project. He shall keep records

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available for inspection by Consultant. Emission level shall be as prescribed by standards.

The CONTRACTOR shall cover loads of dust generating materials like debris and soil being transported from construction sites. All trucks carrying loose material should be covered and loaded with sufficient free-board to avoid spills through the tail board or side boards.

The CONTRACTOR shall promptly transport all excavation disposal materials of whatever kind so as not to delay work on the project. Stockpiling of materials will only be allowed at sites designated by the Consultant. The CONTRACTOR shall place excavation materials in the dumping/disposal areas designated in the plans.



The temporary dumping areas shall be maintained by the CONTRACTOR at all times until the excavate is re-utilized for backfilling or as directed by Consultant. Dust control activities shall continue even during any work stoppage.

The CONTRACTOR shall place material in a manner that will minimize dust production. Material shall be minimized each day and wetted, to minimize dust production. During dry weather, dust control methods must be used daily especially on windy, dry days to prevent any dust from blowing across the site perimeter.

The CONTRACTOR shall water down construction sites as required to suppress dust, during handling of excavation soil or debris or during demolition. The CONTRACTOR will make water sprinklers, water supply and water delivering equipment available at any time that it is required for dust control use. Dust screens will be used, as feasible when additional dust control measures are needed specially where the work is near sensitive receptors.

The CONTRACTOR shall provide a wash pit or a wheel washing and/or vehicle cleaning facility at the exits from work sites such as construction depots and batching plants. At such facility, high-pressure water jets will be directed at the wheels of vehicles to remove all spoil and dirt.

The CONTRACTOR shall design and implement his blasting techniques so as to minimize dust, noise, vibration generation and prevention fly rock. Blasting technique should be consistent not only with nature and quantity of rock to be blasted but also the location of blasting.



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The CONTRACTOR shall give preference to explosives with better environmental characteristics. The CONTRACTOR shall protect structures, utilities, pavements roads and other facilities from disfiguration and damage as a result of his activities. Where this is not possible, the Consultant shall restore the structures, utilities, pavements, roads and other facilities to their original or better, failing which the rectification/restoration work shall be carried out at the risk and cost of the CONTRACTOR. The CONTRACTOR shall submit to the Consultant an Air Monitoring and Control Plan (AMCP) under contract specific Site Environmental Plan to guide construction activity insofar as it relates to monitoring, controlling and mitigating air pollution.

8.5 Dust Control

Dust Control measures shall be implemented at all construction sites, where there will be major soil disturbances or heavy construction activity, such as cleaning, excavation, demolition or excessive vehicle traffic. Dust control measures include:

- Sprinkling: Ground surface shall be sprinkled with water until it is moist. But excess sprinkling may create mud puzzle disturbing the vehicular movements.
- Vegetation: Saplings will be planted near site offices.
- Make low height of the heap of aggregates, fine material while storing. Cover the heaps with empty gunny bags.
- Limit vehicles to designated tracks that can be regularly watered during dry periods.
- Ensure all site traffic adhere to the site speed limit.
- Ensure vehicles are covered during transportation of material.
- Restrict vehicle movements to designated routes. If possible, heavily used vehicle routes shall be paved with hardcore/ aggregate or other stabilizing material.
- Ensure site is managed to limited materials which can become airborne and improve general housekeeping activities to mitigate dust generated due to an untidy site.
- Ensure that during the site induction the workforce is made aware of dust generation and control measures.
- Vegetation clearing shall therefore be carried out on a needs basis and over limited spatial extents where possible.

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Monitoring, Measurements and Reporting

In order to ensure the effective ongoing implementation of this procedure, it is necessary for CONTRACTOR (s) to conduct regular monitoring and inspection, and report any non-conformity to their management.

The following key areas shall be monitored by CONTRACTOR (s) (by self or and by MOEF/PCB approved third party/Lab) for their respective owned/hired vehicles / equipment / plants / machines and allocated area: All Vehicles shall possess valid PUCs. Any out of legal permissible limit Vehicle shall be serviced.

All connected DGs noise and stack emission shall be monitored six monthly for key pollutants as specified by Owner / Consultant.

Ambient Air & Noise shall be monitored six monthly minimum at two sample locations for following key pollutant. Mandatory Parameters to monitor : SO₂, NO₂, PM₁₀, PM_{2.5}, Ozone, Lead, CO



Parameters to monitor depending upon site air pollution sources / aspects & impacts study or requirement from Owner / Consultant: Ammonia, Benzene, Arsenic, Benzo (a) Pyrene and Nickel.

Site walk inspections should be used to monitor for excessive visible engine/ motor emissions (i.e. black smoke), with offending vehicles and equipment removed from site until the motor can be repaired or replaced. Dust emissions shall be monitored as part of site walks/ inspections, and any particularly dust generating activities recorded, along with corrective action taken

8.6 Water Quality

The CONTRACTOR shall comply with the Indian Government legislation and other State regulations as they relate to water pollution control and monitoring. A drainage system should be constructed at the commencement of the Works, to drain off all surface water from the work site into suitable drain outlet.

The CONTRACTOR shall provide adequate precautions to ensure that no spoil or debris of any kind is pushed, washed, falls or deposited on land adjacent to the site perimeter including public roads or existing stream courses and drains within or adjacent to the site. In the event of any spoil or debris from

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construction works being deposited or any silt washed down to any area, then all such spoil, debris or material and silt shall be immediately removed and the affected land and areas restored to their natural state by the CONTRACTOR to the satisfaction of the Consultant.

The CONTRACTOR shall ensure that earth, bentonite, chemicals and concrete agitator washings etc. are not deposited in the watercourses but are suitably collected and residue disposed off in a manner approved by local authorities.

All water and waste products (surface runoff and wastewater) arising on the site shall be collected and removed from the site via a suitable and properly designed temporary drainage system and disposed off at a location and in a manner that will cause neither pollution nor nuisance.

Any mud slurry from drilling, diaphragm wall construction or grouting etc. shall not be discharged into the drainage system unless treatment is carried out that will remove silt, mud particles, bentonite etc. The CONTRACTOR shall provide treatment facilities as necessary to prevent the discharge of contaminated ground water.



The CONTRACTOR shall discharge wastewater arising out of site office, canteen or toilet facilities constructed by him into sewers after obtaining prior approval of Owner / Consultant. A wastewater drainage system shall be provided to drain wastewater into the sewerage system.

The bentonite mixing, treatment and handling system shall be established by the CONTRACTOR giving due regard to its environmental impacts. The disposal of redundant bentonite shall be carefully considered whether in bulk or liquid form.

The disposal location will be advised and agreed with the relevant authorities. The CONTRACTOR shall take measures to prevent discharge of oil and grease during spillage from reaching drainage system or any water body. Oil removal / interceptors shall be provided to treat oil waste from workshop areas etc.

The SUB-CONTRACTOR shall apply to the appropriate authority for installing bore wells for water supply at site.

8.7 Landscape and Greenery

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The CONTRACTOR shall maintain ecological balance by preventing deforestation and defacing of natural landscape. The CONTRACTOR shall, so conduct his construction operations, as to prevent any avoidable destruction, scarring or defacing of natural surroundings in the vicinity of work.

Where destruction, scarring, damage or defacing may occur as a result of operations relating to Permanent or Temporary works, the same shall be repaired, replanted or otherwise corrected at CONTRACTOR'S expense. All work areas shall be smoothened and graded in a manner to conform to natural appearance of the landscape as directed by the Owner / Consultant.



8.8 Waste (Handling, Storage & Disposal)

The CONTRACTOR shall take all necessary precautions to minimize fugitive dust emissions from operations involving excavation, grading, and clearing of land and disposal of waste. The CONTRACTOR shall not allow emissions of fugitive dust from any transport, handling, construction or storage activity to remain visible in atmosphere beyond the line of emission source for any prolonged period of time without notification to the Owner / Consultant.

The CONTRACTOR shall cover loads of dust generating materials like debris and soil being transported from construction sites. All trucks carrying loose material should be covered and loaded with sufficient free- board to avoid spills through the tail board or side boards.

The CONTRACTOR shall promptly transport all excavated disposal materials of whatever kind so as not to delay work on the project. Stockpiling of materials will only be allowed at sites designated, if any, by the OWNER. The temporary dumping areas shall be maintained by the CONTRACTOR at all times until the excavated material is re-utilized for backfilling or as directed by Owner / Consultant.

The CONTRACTOR shall water down construction sites as required to suppress dust, during handling of excavation soil or debris or during demolition. The CONTRACTOR will provide water sprinklers, water supply and water delivering equipment available at any time that it is required for dust control use. Dust screens will be used, as feasible when additional dust control measures are needed especially where the work is near sensitive receptors.

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The CONTRACTOR shall ensure that earth, muck, detonate, chemicals and concrete agitator washings etc. are not deposited in the water courses but are suitably collected and residue disposed off in a manner approved by local authorities.

Any mud slurry from piling, drilling or grouting etc., shall not be discharged into the drainage system unless treatment is carried to remove silt, mud particles, bentonite etc. The CONTRACTOR shall provide treatment facilities as necessary to prevent the discharge of contaminated ground water.

The CONTRACTOR shall discharge waste water arising out of site office, canteen and toilet facilities constructed by him into sewers after obtaining prior approval of agency controlling the system. A waste water drainage system shall be provided to drain waste water into the sewerage system.



The CONTRACTOR is required to develop, institute and maintain a Waste Management Program (WMP) during the construction of the project for his works, which may include:

- Identification of disposal sites.
- Identification of quantities to be excavated and disposed off.
- Identification of split between waste and inert material
- Identification of amounts intended to be stored temporarily on site location such storage.
- Identification of intended transport means and route.
- Obtaining permission, where required, for disposal.

Such a mechanism is intended to ensure that the designation of areas for the segregation and temporary storage of reusable and recyclable materials are incorporate into the WMP. The WMP should be prepared and submitted to the Consultant for approval. The CONTRACTOR shall handle waste in a manner that ensures that they are held securely without loss or leakage thus minimizing potential for pollution. The CONTRACTOR shall maintain and clean waste storage areas regularly.

The CONTRACTOR shall remove waste in a timely manner and disposed off at landfill sites after obtaining approval of Conservancy and Local Municipal Corporation for its disposal.

8.9 Hazardous Chemical & Wastes

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The CONTRACTOR shall identify the nature and quantity of hazardous waste generated as a result of his activities and shall file a 'Request for Authorization' with Local Pollution Control Committee along with a map showing the location of storage area.

Chemicals classified as hazardous chemicals under "Manufacture, Storage and Import of Hazardous Chemical Rules, 1989 of Environment (Protection) Act, 1986 shall be disposed off in compliance with the procedure given in the rules under the aforesaid act. Outside the storage area, the CONTRACTOR shall place a 'display board', which will display quantity and nature of hazardous waste, on date. Hazardous Waste needs to be stored in a secure place.

It shall be the responsibility of the CONTRACTOR to ensure that hazardous wastes are stored, based on the composition, in a manner suitable for handling, storage and transport. The labeling and packaging is required shall be easily visible and be able to withstand physical conditions and climatic factors. The CONTRACTOR shall approach only Authorized Recyclers of Hazardous Waste for disposal of Hazardous Waste, under intimation to the Consultant.



Hazardous and/or toxic materials e.g. solvent coating or thinners shall be stored in appropriate containers. Each material MSDS shall be available at the storage place. Sufficient numbers of fire extinguishers shall be deployed outside the storage area. Chemical spills shall be contained and cleaned up immediately to prevent further contamination.

Where contact or exposure with hazardous materials could have harmful effects, appropriate personal protective equipment e.g. Safety helmet, hand gloves, eye goggles, aprons, chemical resistant clothing, dust mask and respirators shall be used. In area of high noise besides other PPE ear defenders like ear plugs or ear muff shall be used.

If any waste (paints, insulation, refractory wastes etc.) encountered or generated as a result of CONTRACTOR'S activity, then all such wastes classified as hazardous under the "Hazardous Wastes (Management & Handling) Rules, 1989, amendment 2003" shall be disposed off in compliance with the procedure given in the rules under the aforesaid act.

8.10 Spill prevention and response

- Storage Ground surface will be concreted to prevent any leaks or spills from storages

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seeping into the ground.

- The impervious bund/ secondary containment system such as bund shall be as per standard specifications. If more than one container is stored, the system must be capable of storing 110% of the biggest container's capacity or 25% of their total capacity, whichever is the greater.
- Suitable firefighting equipment will be provided in close proximity to the storage areas.
- Spill containment and clean-up materials (Spill clean-up kits) will be kept to deal with emergency spills while storage and transportation. They usually consist of equipment to contain and absorb spills and will typically include absorbent granules, sand bags, absorbent booms, absorbent pads, polythene sheeting, and polythene sacks.
- All maintenance and servicing activities will be performed in an appropriately constructed maintenance and servicing floor in order to prevent spills from seeping into the ground.
- Prior to unloading the content from a fuel, chemical or oil tank or loose barrel, hoses and connections will be checked to ensure that they are free from defects. Holding tanks will also be checked to ensure they are effectively grounded.
- Personnel handling such products will be provided with suitable and appropriate personal protective equipment, which they will be required to wear at all times. CONTRACTOR (s) shall provide training to their persons involved with the storage, handling, transport, decanting and disposal of hazardous chemicals in areas under their control.

8.11 Resource Protection

- Resources, to the extent practical, will be preserved in their existing condition. Construction activities shall be confined to areas necessary to conduct the Work as required by the Contract schedule, plans, specifications, or other documents. Environmental protective measures and procedures shall be provided to limit habitat disruption and mitigate environmental damages that may occur during construction or other activities.
- CONTRACTOR (s) employees shall not deface, injure, or destroy shrubs, grass, or other landscaping in the project or surrounding area, or remove or cut same without advance written permission from Owner / Consultant.

8.12 Energy Management

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The CONTRACTOR shall use and maintain equipment so as to conserve energy and shall be able to produce demonstrable evidence of the same upon Consultant request.

Measures to conserve energy include but not limited to the following:

- Use of energy efficient motors and pumps
- Use of energy efficient lighting, which uses energy efficient luminaries
- Adequate and uniform illumination level at construction sites suitable for the task
- Proper size and length of cables and wires to match the rating of equipment

The CONTRACTOR shall design site offices maximum daylight and minimum heat gain. The rooms shall be well insulated to enhance the efficiency of air conditioners and the use of solar films on windows may be used where feasible.

8.13 Safety, Pollution control and Energy Conservation Measures



Construction shall provide details of safety, pollution control and energy conservation measures to be undertaken under the project and estimate the cost towards the same. The amount shall be earmarked in the total project cost towards implementation of all such measures.

8.14 Sustainable Development

CONTRACTOR shall comply with Sustainable Development as CONTRACTOR considers Sustainable Development as an essential element in the corporate's asset for a deep qualification on its core business. The purpose of complying Sustainable Development is to guarantee the needs of present generations without jeopardizing the possibility for future generations to satisfy their own.

It includes:

- The activities to put in place and prevent the working place from intentional offences in the country (Security Management System)
- The implementation of the requirements of Corporate Social Responsibility.
- The activities regarding the safeguard of health of people, the prevention from incidents and the protection of the natural Environment (HSE Management System).
- The Prevention and Protection Service in the offices as required by Indian Law.

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9. HSE MANAGEMENT FOR ENGINEERING

9.1 Office Management

CONTRACTOR shall ensure to adopt Health, Safety and Environment standards at office . This is applicable to all working in the office for the Project . A detailed Office HSE plan shall be addressed incorporating all necessary Occupational Health , Safety system and Environmental requirements adopted at office.

9.2 HSE General

To ensure a safe and environmentally sound plant and facilities, it is necessary to examine the potential hazard, accessibility, constructability, operability and maintainability during the engineering phases.

Before starting the engineering work, It is required to prepare inventories of all laws and regulations applicable to the Project and the requirements on health, safety, environment (HSE), and internationally recognized HSE codes and standards that are applicable.

These inventories are communicated to all the personnel and groups concerned with engineering, procurement and construction.



A competent HSE Design lead engineer shall be responsible on the project to oversee all issues related to HSE in engineering and reporting to senior authorities.

9.3 HSE Risk Management

HSE Risk management program shall be established and implemented throughout engineering execution.

The Engineering Manager should ensure that engineers identify potential hazards, evaluates risks and takes action to avoid adverse consequences.

To ensure that, HSE reviews are integrated into the engineering cycle. The Engineering Manager shall ensure that all these reviews take place at the right time in the Project, that the actions generated are recorded and properly defined, and that a follow up of requested actions implementation is established.

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Risks associated with the operation of the facilities are quantified through the Project Quantitative Risk Assessment, under the responsibility of the HSE Design lead engineers.

Safety reviews actions close out status shall be reported monthly by Engineering manager and Project HSE Manager as project's HSE leading indicator.

9.4 Constructability

Constructability is a review performed in interface between engineering team and Home office construction team. The purpose is to ensure, as early as possible in the engineering process, the constructability of the designed facilities.

9.5 3D Reviews

Three Dimensional (3D) Model Review is conducted to confirm vehicle and personnel accessibility and operability, maintainability and constructability of the plants and facilities, and evacuation routes and assembly points at an emergency, etc.

9.6 HSE Engineering

HSE aspects of the engineering are managed by the HSE Design lead engineer, in charge of compliance of the design with COMPANY and local HSE rules and industry best practices.



The HSE Design team's areas of responsibilities are:

Risk assessment, Loss prevention engineering and Environmental engineering

10. HSE REQUIREMENT FOR PROCUREMENT

HSE Control over VENDOR's by CONTRACTOR shall be performed to ensure:

- Safety and health insurance of CONTRACTOR personnel and representatives visiting VENDOR's workshops
- Prevention of major incident at VENDOR's premises that could impact due delivery of CONTRACTOR item
- Improvement of overall VENDOR's HSE performances through HSE knowledge and experience sharing

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10.1 VENDOR's qualification

VENDOR shall have a valid prequalification certificate. For new VENDORS, the evaluation shall include HSE criteria to verify VENDOR's capability to meet Technip's principles in terms of health, safety and environment. This shall be done through HSE questionnaire, filled in by VENDOR at bidding stage and part of the Commercial bid Tabulation.

An audit at vendor premises including a HSE part could be . The audit can be performed by any project member on the basis of an audit check list or by Project HSE manager if deemed necessary.

10.2 HSE requirement to VENDORS

Minimum requirement to VENDORS shall be set up and established in particular conditions of purchase order to ensure that the level of HSE at vendor's premises will provide safe condition of visits by CONTRACTOR personnel or their representatives.

10.3 VENDOR'S HSE performances



CONTRACTOR shall follow up and monitor VENDORS HSE performances throughout the execution of the work. In case repetitive violations are reported without improvement from the VENDOR despite notification, Project Procurement and HSE Manager shall decide to perform an audit of VENDOR's premises. The outcomes of the audit and progress made by VENDOR shall serve the purpose of VENDOR final evaluation and VENDORS prequalification for future projects.

10.4 VENDOR REPRESENTATIVES

VENDOR REPRESENTATIVES (further VENDOR REP) are VENDOR personnel assigned on a WORKSITE to provide assistance or services to construction, assembly, pre-commissioning or commissioning. VENDOR REP shall comply with the HSE Rules applicable to the WORKSITE.

CONTRACTOR shall inform VENDOR of the relevant rules to apply and shall guide VENDOR into their implementation by providing necessary assistance and training.

11. SECURITY

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A detailed “Security Plan” shall be developed by the CONTRACTOR and issued on site for Owner / Consultant approval.

All the construction areas shall be duly fenced by the CONTRACTOR; the fence shall be removed at the end of the construction. No photography or videos are allowed unless previously authorized by Owner / Consultant. It is forbidden to go to areas not part of the scope of work.

The CONTRACTOR shall provide additional security as necessary to protect its own facilities and workforce within the project’s areas.

Site HSE Manager full time for the duration of the Project shall ensure the full and consistent implementation of the HSE and Security requirements of this Project and Participates with the Administration Manager and Security Manager (if foreseen), to the coordination of the onsite and off the jobsite Security matters.

Security plan shall be detailed as given below but not limited to



- Personnel admittance and control
- Visitors
- Couriers and delivery vehicles
- Material control
- Vehicle control
- General Gate Control
- Radios & Mobile Phones

12. PRE-COMMISSIONING AND COMMISSIONING PHASES

In addition to HSE controls mentioned in above part “Operation Control during Construction phase”, CONTRACTOR (s) shall follow following Operation Control during Pre-commissioning and Commissioning Phases.

12.1 Pre-commissioning and commissioning area.

Pre-commissioning and commissioning area shall be segregated with barriers / fences and safety &

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warning signs from the other units which are still under construction. Colored tape and warning signs may also be applied where hard barricades are not practical with permission of Owner / Consultant. Access to this commissioning area shall be limited; no person shall be allowed to enter inside the barricade without authorization by Pre-commissioning and commissioning group such as a pass card, a sticker, etc. Works in the commissioning area shall be authorized with the Pre-commissioning and commissioning PTW.

PPE requirement in the Pre-commissioning and commissioning area shall be decided by the Consultant & CONTRACTOR (s) HSE Managers with advice of the commissioning manager and Owner representative. All personnel in the area must complete the Pre-commissioning and commissioning safety training. Trained security guards shall ensure access control.



CONTRACTOR (s) HSE team and the Commissioning team shall hold a commissioning HSE training for all persons who are required to work in the Pre-commissioning and commissioning area including third party's personnel. Person who attends the commissioning safety training shall be recorded, identified by badge, helmet sticker and commissioning pass card.

Emergency Response Plan for Pre-commissioning and commissioning area shall be established before Pre-commissioning and commissioning activity starts by Owner, Consultant & CONTRACTOR (s) and shall be reviewed and updated as per the site condition.

Emergency Response and Evacuation Plan shall be included as follows as minimum:

- Emergency communications route and method
- Emergency site alarm, emergency egress routes, locations of muster points and rendezvous for emergency vehicles
- Required action plan for site emergency organization for each case
- Emergency drill shall be carried out periodically .

As the new plant is going put up inside the running refinery no Mobile phones are allowed during the Construction-commissioning and commissioning stage,. Hence Contractor shall do the all communications shall use either dedicated land lines or approved intrinsically safe radio systems (Walky-Talky) e.g. explosion-proof type radios,etc. Spark arrestors shall be provided on the vehicle and

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engines exhaust outlet.

Daily Pre-commissioning and commissioning meeting shall be held to address the overall plant Pre-commissioning and commissioning activities including weekly look ahead, progress, interfaces, simultaneous work activities, safety, emissions, utilities requirements, security, etc. Representatives for all related personnel include HSE Manager shall attend this meeting.



The CONTRACTOR (s) Commissioning Manager shall issue written Commissioning Notice before main commissioning activities (e.g. power receive, nitrogen in, hydro-carbon in, main rotating machine test and in service, etc.) are started in the plant and/or system. The notice shall be sent to the all related parties, defining the impending change in plant status with enough detail to enable clear understanding of the nature and location of the changes. Issuing the Commissioning Notice provides formal notification to all related parties. CONTRACTOR (s) Site HSE managers shall inform this Commissioning Notice to HSE staff (including night shift staff and medical team).

CONTRACTOR (s) shall obtain, as per agreed contract conditions, an authorization from the State Pollution Control Board as per Rule 6 of Hazardous and Other Wastes (Management and Transboundary Movement) Rules, 2016 for handling, storage and disposal of hazardous waste generated during Construction, Pre-commissioning and Commissioning Phases of this project.

Waste effluent such as waste gas, chemical, oily water, etc. will be generated during commissioning. These waste effluents shall be controlled by CONTRACTOR (s) as per Owner / Consultant and legal requirements. Dust control shall be accomplished by proper housekeeping. Disposal of the chemical wastes shall be in accordance with the Owner / Consultant Specification and Legal Requirements. Permanent drainage system or temporary arrangement shall be ready for use prior to chemical/oil handling. Flare and oily sewer systems shall be in service prior to Hydro-Carbon Introduction

In case live drain system connect into a construction area drain system, segregation of the drain system between the construction area and Pre-commissioning and commissioning area is required to avoid flammable liquid / vapor leakage into the construction area.

During the commissioning and initial start-up phases unusual high sound pressure levels are generated

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by the activities, these would include such items as air and steam blowing, safety vent lifting, machinery runs without complete acoustic enclosures etc. Suitable protection shall be available and provided to the people expected to work in these effected areas.



12.2 Motor Solo Run / No Load Motor Run

Special precautions shall be taken by involving the supervision and direction of the electrical team.

- Inform hazards and area to all related parties in the daily Tool Box Meeting.
- Ensure that the area of the motor solo run shall be taped or barricaded. Suitable Warning Notice / Signs indicating “Equipment in Service – Keep Away” or “Test Runs in progress – Keep Away” shall be positioned to cover all points of access.
- Ensure that motor tests shall be monitored continuously and not be left unattended under any circumstances.
- Ensure licensed electrician, trained & competent personnel are only involved in the Electrical Activity.
- The Machinery is checked for the unguarded rotating part. & precaution taken to avoid any injury by guarding the same or barricading.
- Follow Permit to work system, LOTO Permit system is in place.
- Ensuring proper communication & coordination between the Field & the panel operators.
- Ensure that motor tests shall be monitored continuously and not be left unattended under any circumstances.
- Ensure that Motor Control Center must be controlled as per LOTO system.
- Ensure that the earthing of the machines are proper.
- Ensure that no loose clothing is used near Rotating parts.
- Follow all the instructions mention in manufacture’s guide.

12.3 Commission of the Pumps & Motors

- Follow Permit to work system.



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- Ensure only trained & experienced personnel are involved in the activity.
- Ensure the Checklist for pump commissioning is complete, such that guards are in place, interlocks are positioned, coupling is aligned etc.
- Ensure the energization of the system is done under competent person.
- Ensure the proper communication among field, control room and power substation. And Emergency controls are functional conditions etc.

12.4 Card Board Blasting & Air Blowing

Management of pressurized system and air blow discharge point are the most essential. Special precautions shall be taken.

- Follow Permit to work system.
- Barricade the exit blow out points and put a warning notice indicating “Air Blowing is in Progress – Keep Away”
- Barricade and put a warning sign around the pressurized area.
- Provide protection for facilities around discharge points.
- Ensure that hose couplings and any other temporary connection or pipe spool shall be properly secured.
- Confirm line and equipment being adequately supported
- Air blowing generates big noise near the blow point, so ear protection shall be worn by operator and persons working in vicinity.
- Ensure trained & experienced personnel are only involved in the Activity.
- Ensure that design pressure of line is checked and pressurization of line is maintained well below design pressure.
- The Air pressurization system is checked, for proper connection, pressure gauges, leakage from the flanges etc.
- The Card Board Blasting event is communicated using check/ clearance sheet.
- Ensure personnel are provided with Safety Helmet, Safety Shoes, Ear Plugs, Dust Mask, & Safety Goggles.
- During card board blasting, compressed gas will be suddenly released with high energy and foreign

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particles may come out along with gas, so special precaution to be taken care.

- All unwanted materials to be cleaned and all the temporary arrangement to be removed for original reinstatement after completion of the activity.



12.5 Water Flushing

Management of water discharge point is the most essential. Special precautions shall be taken.

- Follow Permit to work system.
- Inform hazards and area to all related parties in the daily Tool Box Meeting.
- Barricade the discharge points and put a warning notice indicating "Water flushing is in Progress – Keep Away"
- Provide cover or protection to equipment around discharge points.
- Proper positive isolation for other equipment and lines shall be ensured.
- Ensure that all electrical equipment, welding machines, temporary electrical supply systems etc. shall be covered or removed from the area.
- Ensure that sewer system or surface drains must be capable of disposing of the water to avoid any water build-up in the area.
- Ensure that soft soil shall be protected with planks or sheeting to minimize erosion.
- Ensure that hose couplings and any other temporary connection or pipe spool shall be properly secured.
- Drain the residue water and dry the line if required.
- Waste water / Waste disposal shall be as per legal requirements.
- Equipment/ materials below the flushing point shall be covered

12.6 Steam Blowing

CONTRACTOR (s) shall ensure following safety measures.



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- Inform hazards and area to all related parties in the daily Tool Box Meeting.
- Barricade the discharge points & put a warning notice as “Steam blow in Progress – Keep Out”.
- Open all drain valves on the steam header and/or steam traps to drain condensate until warming up completion.
- Provide permanent or temporary insulation at flange and pipe surface if required.
- Flow the steam slowly for warming up.
- Check line and shoes to avoid abnormal thermal expansion during warming up and steam blowing.
- Utilize silencer or silent blow system at the blowing point, if required.
- Ensure that no person is working in vicinity of the vents and drains during steam blowing operations.
- Proper positive isolation for other equipment's shall be ensured.
- Leak test of the system shall be conducted prior to charging of pressurized steam.
- Until the warming up all drains must be opened.
- Provide adequate pressure in lines.
- Provide minimum bends in pipes to minimize Water hammering.
- Ear protection shall be worn by operator and persons working in vicinity. Reduce the fluid velocity/ flow during venting.
- Ensure F- keys / Valve handle keys readily available to operate the valves.

12.7 Oil Flushing

Oil handling is the most essential. Special precautions shall be taken.

- Follow Permit to work system.
- Inform hazards and area to all related parties in the daily Tool Box Meeting.
- Barricade the area and put a warning notice indicating “Lube oil flushing in Progress – Keep Away
- Provide fire extinguishers.
- Prepare absorbent in case of oil spill.
- Waste oil will be stored in drum for safe disposal.
- Hot work to be restricted in nearby area.

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12.8 Lube Oil Charging

- Follow Permit to work system.
- Ensure trained & experienced personnel are only involved in the Activity.
- The charged system is properly marked
- Ensure the spillage & waste oil is collected & properly disposed.
- Hot work to be restricted in nearby area.



12.9 Large Diameter Pipe Manual Cleaning

- Follow Permit to work system.
- Apply Confined Space Entry Work Permit. Check O₂ concentration before and throughout the activities.
- Ensure that the pipe shall be adequately ventilated with atmospheric air. Fans or air movers shall be used.
- Ensure that a Safety Watcher shall be stationed at the entry point at all times in contact by radio with those entering.
- Ensure that internal means of safe access shall be provided to inspect vertical sections.
- Provide physical/positive isolation to avoid the unexpected introduction of nitrogen, hydro-carbon, etc. into the system from its adjacent system(s) where has been in service.
- Check temperature in the pipe.

12.10 Chemical handling and Cleaning

Characteristic of Chemical is the most essential. Special precautions shall be taken involving the supervision and direction of the commissioning department.

- Chemical shall be handled in according with MSDS instructions. Display MSDS at storage area.
- Train personnel for safe handling of chemicals.
- Barricade the area, display warning signs. Restrict unauthorized entry near chemical storage, tanks & chemical pump.
- Secondary containment shall be provided for chemical storage & handling systems.

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- Provide eye wash and emergency shower.
- Confirm line and equipment being adequately supported.
- Check all flanges, valves/ pipeline leakage shall be monitored.
- Leak test of the system shall be conducted prior to charging.
- Inspect temporary hoses & connections prior to use.
- Do not attend leakages without proper PPE. Wear PPE as per MSDS. Provide Spill Kit.
- Suitable type of fire extinguisher shall be provided.
- Ensure that chemical drainage system should be ready for use for spillage. Other adjacent drainage system where is not ready for use shall be plugged to prevent the system from contamination with the chemical. Provide temporary curved area if drainage system is not available.
- Stand-by absorber or counteragent.
- Establish emergency actions (emergency car, medical service, etc.).
- Disposal of the chemical wastes shall be in accordance with the Owner / Consultant Specification and Legal Requirements.

12.11 Loading of the Chemicals in the system

- Ensure the Availability of MSDS for each chemical to be handled.
- Ensure all personnel are aware of the chemical Hazards and trained in the Safety practices.
- Ensure Permit to Work System is followed.
- Ensure proper PPE are used by the personnel while handling the Chemicals.
- Ensure proper arrangements for the chemicals drum handling & transfer facility.
- Ensure Spill controls & exposure control arrangements are in place in the event of spillage.
- Ensure availability of Safety Shower & Eye wash.

12.12 Charging of the Heater (Electric Heater)

- Ensure trained & experienced personnel are only involved in the Activity.

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- Proper Permit to work system is implemented prior to commissioning the Heater.
- The Heater is charged under supervision in line with the manufactures / process Manual and The Stand by firefighting personnel is recommended.

12.13 Instrument Check (Loop/Function Test)



- Establish LOTO system for electrical safety control and isolate all circuits which should not be energized.
- Inform activities to all related parties in daily Tool Box Meeting.
- Record valve position requirement and control the position by specific person.

12.14 Rotating Machine Run

Risk of personnel injury and equipment damage will be extremely increased during rotating machine running. Special precautions shall be taken involving the supervision and direction of the commissioning department.

- Follow PTW.
- Inform hazards and area to all related parties in the Daily Tool box Meeting.
- Ensure that the rotating machine shall be completely assembled including the coupling guard.
- Ensure that all necessary documents and certificates shall be confirmed and approved by the Commissioning Group and Owner.
- Ensure that the area of the pump or compressor to be tested shall be taped or barricaded. Suitable Warning Notice / Signs indicating “Equipment in Service – Keep Out” or “Test Runs in progress – Keep Out” shall be positioned to cover all points of access.
- Ensure that the live line in the pump or compressor circuits shall be clearly identified with ‘Live Line’ notices and the test system shall be positively isolated from other sections of the plant.
- Ensure that machinery tests shall be monitored continuously and not be left unattended under any circumstances.
- Isolate motor/turbine properly from its power source after run.
- Ensure proper earthing to the equipment.

12.15 Proof Testing / Tightness Test



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High energy fluid is in the system during Tightness Test. Special precautions shall be taken involving the supervision and direction of the commissioning department.

- Follow PTW.
- Ensure that the required PPE should be worn.
- Ensure that suitable communication such as two way radios are ready for use.
- Inform hazards and area to all related parties in the daily Tool Box Meeting.
- Barricade the area and put a warning notice as “Tightness Test in Progress – Keep Out”.
- Line for testing is identified checked for the fittings, Joints, etc. secured at the ends and shall be clearly identified with ‘Live Line’ notices.
- Ensure that test system shall be isolated from other sections of the plant.
- Water once used for service testing it shall be disposed-off safely if necessary.
- Separate calibrated gauges to be provided for pressuring piping & equipment.
- Nip points of Pressure machine shall be guarded properly.
- The pressurization system is checked, for proper connection, pressure gauges etc.
- Flanges and fasteners of the recommended size and strength to withstand the test pressure used.
- Separate calibrated gauges provided for pressuring piping & equipment.
- Hoses shall be of proper rating, tested & certified.
- Ensure necessary precautions, stepwise increase in pressure.
- Close supervision and trained personal required for Proof Testing / Leak Testing jobs.
- The gas used as test fluid, if not air, shall be nonflammable and nontoxic.
- Ensure that depressurizing point must be surrounded with a barricade or caution tape, If the tightness test uses nitrogen as pressurization medium.
- Other activities in area shall be stopped during leak testing.

12.16 Nitrogen Introduction / Purging

Risk of asphyxiation will be extremely increased after Nitrogen Introduction. Special precautions shall be taken involving the supervision and direction of the commissioning department.



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- Inform hazards and area to all related parties in the daily Tool Box Meeting.
- Barricade the area and put a warning notice as “Nitrogen Purge in Progress – Keep Away
- Ensure that the N2 contained line shall be clearly identified with ‘Live Line’ notices.
- Ensure that Nitrogen Hose color coding is followed.
- Ensure that N2 purging and blanketing system shall be positively isolated by spade from other sections of the plant.
- Ensure that all construction work should be restricted as per work permit Procedure.
- Ensure that confined space entry permit shall be strictly controlled during/after inserting with N2.

12.17 Hydro-Carbon/Toxic Fluid Introduction

Potential Risk is extremely increased after Hydro-Carbon Introduction into the system because flammable explosive and/or toxic fluid exists in the system. The Commissioning Manager and the Site HSE Manager must confirm and agree that the system is safe and suitable to introduce hydro-carbon. Pre Startup Safety Review (PSSR) shall be conducted to ensure that the plant or system and facilities can proceed for start-up / initial operation of the plant or part of plant safely.

- Ensure that site-wide notice shall be issued explaining the hazards.
- Hold or reject all of work permit for non-related activities to the hydro-carbon introduction on the day. Only commissioning personnel are allowed to enter the site.
- Ensure that specific training and toolbox talks shall be conducted prior to gas Hydro-carbon introduction.
- Ensure that all systems which introduce hydro-carbon shall be suitably sectioned off and segregated using hard barriers/fences and signs with access restricted to approved personnel only.
- Ensure that fire and gas detection systems associated with the equipment shall be in service.
- Ensure that firefighting system shall be in service and equipment for emergency action are in place.
- Ensure that emergency response plan in place and emergency drill conducted.
- Ensure that site public address system shall be in service.
- Ensure that site safety rules regarding smoking shall be amended within the effected safety areas such that smoking is only allowed in specifically dedicated and tested locations.

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- Ensure that hot work permits shall be required for any potential ignition producing activities within the effected designated safety areas.
- Provide suitable PPEs.
- Ensure that the use/carrying of mobile phone shall not be allowed within the designated safety areas nor shall ignition materials such as lighters or matches.
- Ensure that use of vehicles and temporary generators shall be restricted and strictly controlled.
- Ensure that waste gas system (flare, vent stack, incinerator, etc.) and drainage system (oily water sewer, waste water treatment, etc.) shall be in service.

12.18 Toxic Fluid Case

- Ensure that Specific Toxic Gas Detection System shall be in service and fully operational.
- Ensure that personal multi gas detectors shall be worn by personnel working within high hazard areas.
- Ensure that toxic gas leak response plans shall be in place and fully operational.
- Ensure that training for the hazards of Specific Toxic Fluid and required alarm responses shall be provided to all personnel working within the designated safety areas.
- Ensure that wind socks, muster points, safety shelters shall be identified and available.
- Ensure that gas mask or air mask arrangement shall be considered.
- Ensure antidote / first aid measures suggested in MSDS are in place and people are trained for their use / application.

12.19 Feed intake in to the Plant

- Ensure all personnel trained in the Commissioning activity are only involved in the Job.
- Ensure system checks are complete and ready for commissioning.
- Ensure the electrical system, Instrumentation system interlocks are functional.
- Ensure the Pumps, motors are ready for operation and Utilities are commissioned.
- Ensure the internal of the equipment's are fixed and the systems are properly boxed up.
- Ensure valves are in open / closed condition to make the line through as per process requirements.
- The Feed intake shall be carried out under strict supervision of the Supervisor under proper permit to

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work system and in the presence of firefighting crew as standby for any eventualities.

12.20 System Commissioning Spade Isolation Requirements

Spades are applied to separate live systems from systems under construction or commissioning. Once hydro-carbon or nitrogen is introduced into the system, live systems shall be physically isolated from non-live system, and isolation points shall be strictly controlled. Isolation spades shall be controlled as per isolation procedure.

12.21 Central Control Room (CCR)

Access to CCR and the rooms where control systems are stored shall be limited and controlled by the Commissioning Manager. Personnel working in the CCR shall have taken the safety induction and any special training relating to the CCR building for emergency response and evacuation. Communications for both commissioning and operations shall use radio system compatible intrinsically safe equipment. Mobile phone use is not permitted in the CCR building to avoid any effects to control system. PTW shall be issued and authorized by the Commissioning Manager before starting the work in CCR and the rooms where equipment related to control system.



12.22 HVAC Room

HVAC system is important to protect equipment/computers such as DCS and electrical panel and comfortable work in the building. Access to HVAC Rooms shall be limited and controlled by HVAC representative. PTW for the HVAC is to be issued and authorized by the HVAC responsible personnel before starting the work in HVAC room. Personnel working in the HVAC Room shall have taken the safety induction and any special training relating to the HVAC for emergency action and evacuation.

12.23 Vehicle Control

All vehicles and engines entering in pre-commissioning & commissioning area shall be fitted with Indian standard complied spark arrester on all exhausts. All vehicles driven on site shall be maintained in roadworthy condition and be registered with the appropriate authority in accordance with the relevant laws and regulations. Vehicle shall have the RC book, valid fitness certificate, transport permit, PUC and Insurance document before entering into the site.

Each driver of these vehicles shall hold a valid driving license authorizing him / her to drive that class

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of vehicle and sufficient experience of driving. Only vehicles necessary during pre-commissioning & commissioning operation shall be permitted to enter the construction site. Motorcycles/three wheeler shall not be permitted. Driver to follow the speed limit e.g. below 20km/h within the site.

Practice preventive maintenance of vehicles and machines and maintain associated records and documents.

13. PENALTY

a) Any violation of applicable safety , health and environment related norms results in penalty of Rs. 5000/- per occasion. b) Violation as above resulting in any reportable physical injury, as per Indian Factory Act 1948, a penalty of 0.5% of the contract value (maximum of Rs. 2,00,000/-) per injury in addition to Rs.5000/- per occasion as in item (a).



Fatal accident, a penalty of 1% of the contract value (maximum of Rs.10,00,000/-) per injury in addition to Rs.5000/- per occasion as in item (a). The CONTRACTOR is advised to take appropriate insurance policy(ies) for covering the various penalties/payment deduction provisions in this regard.

In case of accidents, depending on the seriousness of injury etc., in addition to the hospitalization/ Treatment charges and Group insurance amount, compensation shall be paid by the CONTRACTOR to the affected person/ his family members in presence of Engineer-in-charge as per Workmen Compensation Act. This shall be in addition to any other compensation specified elsewhere in the Tender document in this regard.

The CONTRACTOR shall adhere consistently to all provisions of HSE requirements. In case of non-compliance or continuous failure in implementation of any of HSE provisions; Owner / Consultant may impose stoppage of work without any Cost and Time implication to OWNER and / or impose a suitable penalty for non – compliance with a notice of suitable period.

A detailed listed is attached in Appendix - 4

Owner/ Consultant shall have the right to deduct charges for any other unsafe act and or condition depending upon the gravity of the situation on a case-to-case basis.

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14. INCENTIVES / AWARDS

Contractor has developed a broad range of HSE incentive programs designed to motivate its employees and all working under them to maintain a high level of HSE performance. Contractor HSE recognition programs are administered at two levels. At company level through the designation of the 'Contractor of the Month' for the Sub-Contractor that has demonstrated the best safety performance over the previous month. At employees level through the designation of the employees/crews of the week.



Other ways to increase H&S awareness will include: Bulletin boards illustrating safe man-hours worked Employee Safety awards dinners Hard-hat decals for safe performance . CONTRACTOR hats and similar items given to top safety performers. In addition, CONTRACTOR construction and HSE management will randomly select individuals each week, and find where this person are working.

The person will be visited; if he is working safely (all PPE and similar) and can answer two simple HSE related questions then a small prize will be awarded. In addition, the supervisor of each person will also receive an award. If the person is not working safely or cannot answer the questions, then he and his supervisor will be educated and positively reinforced but no award made.

15. SOCIAL ACCOUNTABILITY (CORPORATE SOCIAL RESPONSIBILITY)

The CONTRACTOR shall comply Social Accountability that protect Human Rights, and aims to develop, to monitor and to encourage a policy of protection of Workers' Rights. It defines precise requirements regarding the following themes:

- Child Labor
- Forced Labor
- Health and Safety
- Freedom of Association and Right to Collective Bargaining
- Discrimination
- Disciplinary Practices
- Working hours

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- Remuneration

16. DETAILS OF HSE MANAGEMENT SYSTEM BY CONTRACTOR

16.1 On Award Of Contract



The CONTRACTOR shall submit a comprehensive Health, Safety and Environment Plan or program for approval by Owner/ Consultant prior to start of work. The CONTRACTOR shall participate in the pre-start meeting with Owner/ Consultant to finalize HSE Plans which shall including the following:

- HSE policy & Objectives
- Job procedure to be followed by the CONTRACTOR for construction activities including handling of equipment, scaffolding, electric installations, etc. describing the risks involved, actions to be taken and methodology for monitoring each activity. Indicative list of procedures
- Owner/ Consultant review/audit requirement.
- Organization structure along with responsibility and authority, on HSE activities.
- Administrative & disciplinary steps involving implementation of HSE requirements
- Emergency evacuation plan/ procedures for site and labour camps
- Job Safety Analysis for high risk jobs
- Procedures for reporting & investigation of accidents and near misses.
- HSE Inspection
- HSE Training Programs at project site
- HSE Awareness Programs, at project site
- Reference to Rules, Regulations and statutory requirements.
- HSE documentation viz reporting, analysis & record keeping.

16.2 During Job Execution

CONTRACTOR shall implement approved Health, Safety and Environment management program. CONTRACTOR shall also ensure the following :

To arrange workmen compensation insurance, registration under ESI Act, third party liability insurance, registration under BOCW Act, etc, as applicable.

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To arrange all HSE permits before start of activities (as applicable), like permits for hot work, working at heights, confined space, Radiation Work Permit, Demolishing/ Dismantling Work Permit, Permit for erection/modification & dismantling of scaffolding, Permit for heavy lift/critical erection, Permit for energy Isolation & De-isolation", storage of chemical / explosive materials & its use and implement all precautions mentioned therein. In this regard, requirements of Oil industry Safety Directorate Standard No. Std -105 "Work Permit Systems" shall be complied with while working in existing Oil or Gas processing plants. List of the persons involved shall be maintained as annexure to the work permit issued for a particular activity.

To submit, timely, the completed checklist on HSE activities, Monthly HSE report (as attached) is compulsory wherever the facility is available else a hard copy is to be submitted), accident/ incident reports, investigation reports etc. as per Owner/ Consultant requirements.

Compliance of instructions on HSE shall be done by CONTRACTOR and informed urgently to Owner/ Consultant. that his top most executive at site attends all the Safety Committee/HSE meetings arranged by Owner/ Consultant and carries out safety walk through regularly. Only in case of his absence from site that a second senior most person shall be nominated by him, in advance, and communicated to Owner/ Consultant for performing the above tasks.



Display at site office and at prominent locations HSE Policy, caution boards, list of hospitals, emergency services available, safety signs like Men at work, Speed Limits, Hazardous Area, various do's & don'ts,

Provide posters, banners for safe working to promote safety consciousness.

Identify, assess, analyze & mitigate the construction hazards & incorporate relevant control measures before actually executing site works. (HIRAC = Hazard Identification, Risk Analysis and Control).

Arrange testing, examination, inspection of own as well as borrowed construction equipment machinery (stationary & mobile) before being used at site and also at periodical interval, through own resources and also by 3rd party competent agencies (as deemed fit in statutes). Records of such test, examination etc. shall be maintained & shall be submitted to Owner/ Consultant as & when asked for.

Carryout audits/inspection (internal & external) at his works as well as sub-CONTRACTOR works as per approved HSE plan/procedure/program & submit the compliance reports of identified shortfalls for

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Owner/ Consultant review.



Arranging HSE training for site workmen (of his own & sub-CONTRACTORs) through internal or external faculty at periodical intervals. Assistance & cooperate during HSE audits by Owner/ Consultant or any other 3rd party and submit compliance report.

Generate & submit of HSE records/report as per this specification. apprise Owner/ Consultant on HSE activities at site regularly. Carry-out all dismantling activities safely, with prior approval of Owner/ Consultant representative.

The CONTRACTOR shall ensure that “Hot works” and painting works do not continue at the same place / location at project site for which chance or probability of “fire” incident exists.

16.3 During Short Listing of The Sub-CONTRACTORs

The CONTRACTOR shall review the HSE management system of the sub-CONTRACTORs in line with the requirements given in this specification. The CONTRACTOR shall be held responsible for the shortcomings observed in the HSE management system of the sub-CONTRACTOR(s) during execution of the job.



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APPENDIX



1. DETAILS OF FIRST AID BOX

Appendix : 1

S.No	DESCRIPTION	QUANTITY
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1.	Small size Roller Bandages, 1 Inch Wide	(Finger Dressing small)	6	Pcs.
2.	Medium size Roller Bandages, 2 Inches Wide	(Hand & Foot Dressing)	6	Pcs.
3.	Large size Roller Bandages, 4 Inches Wide	(Body Dressing Large)	6	Pcs.
4.	Large size Burn Dressing	(Burn Dressing Large)	4	Pkts.
5.	Cotton Wool	(20 gms packing)	4	Pkts.
6.	Antiseptic Solution Dettol (100 ml.) or Savlon		1	Bottle
7.	Mercurochrome Solution (100 ml.) 2% in water		1	Bottle
8.	Ammonia Solution (20 ml.)		1	Bottle
9.	A Pair of Scissors		1	Piece
10.	Adhesive Plaster (1.25 cm X 5 m)		1	Spool
11.	Eye pads in Separate Sealed Pkt.		4	pcs.
12.	Tourniquet		1	No.
13.	Safety Pins		1	Dozen
14.	Tinc. Iodine/ Betadin (100 ml.)		1	Bottle
15.	Polythene Wash cup for washing eyes		1	No.
16.	Potassium Permanganate (20 gms.)		1	Pkt.
17.	Tinc. Benzoine (100 ml.)		1	Bottle
18.	Triangular Bandages		2	Nos.
19.	Band Aid Dressing		5	Pcs.
20.	Iodex/Moov (25 gms.)		1	Bottle
21.	Tongue Depressor		1	No.
22.	Boric Acid Powder (20 gms.)		2	Pkt.
23.	Sodium Bicarbonate (20 gms.)		1	Pkt.
24.	Dressing Powder (Nebasulf) (10 gms.)		1	Bottle
25.	Medicinal Glass		1	No.

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26.	Duster	1	No.
27.	Booklet (English & Local Language)	1	each
28.	Soap	1	No.
29.	Toothache Solution	1	No.
30.	Vicks (22 gms.)	1	Bottle
31.	Forceps	1	No.
32.	Note Book	1	No.
33.	Splints	4	Nos.
34.	Lock	1	Piece
35.	Life Saving/Emergency/Over-the counter Drugs		

Box size : 14" x 12" x 4"



Note : The medicines prescribed above are only indicative. Equivalent medicines can also be used.

A prescription, in this regard, shall be required from a qualified Physician.

Appendix : 2

2. LIST OF STATUTORY ACTS & RULES RELATING TO HSE (Latest Version)

- The Indian Explosives Act and Rules
- The Motor Vehicle Act and Central Motor Vehicle Rules

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- The Factories Act and concerned Factory Rules
- The Petroleum Act and Petroleum Rules
- The Workmen Compensation Act
- The Gas Cylinder Rules and the Static & Mobile Pressure Vessels Rules
- The Indian Electricity Act and Rules
- The Indian Boiler Act and Regulations
- The Water (Prevention & Control & Pollution) Act
- The Water (Prevention & Control of Pollution) Cess Act
- The Mines & Minerals (Regulation & Development) Act
- The Air (Prevention & Control of Pollution) Act
- The Atomic Energy Act
- The Radiation Protection Rules
- The Indian Forest Act
- The Wild Life (Protection) Act
- The Environment (Protection) Act and Rules
- The Hazardous Wastes (Management & Handling) Rules
- The Manufacturing, Storage & import of Hazardous Chemicals Rules
- The Public Liability Act
- The BOCW (Regulation of Employment and Condition of service) Act
- The E-waste (Management and Handling) Rules,
- The Bio-Medical Waste (Management and Handling) Rules
- The Plastic Waste Management Rules
- Other statutory acts Like EPF, ESIS, Minimum Wage Act.

3. TRAINING SUBJECTS / TOPICS

Appendix : 3

(For Contractors' personnel)

- The Law & Safety – Statutory Requirement / Applicable statutes / Duties of employer / employee



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- Policy & Administration – Why HSE? / Duties & Responsibilities of Safety Personnel at project site / Effect of incentive on accident prevention
- HSE & Supervision – Duties of Supervisor / HSE integrated supervision / Who should be held responsible for site accidents?
- Safety Budget / Cost of Accidents – Direct costs / Indirect costs
- Hazard Identification / Type of hazards / HIRAC
- Behavioral Safety & Motivation
- Housekeeping – Storage / Stacking / Handling of materials / Hydra handling
- Occupational Health in Construction sector
- Personal Protective Equipment – Respiratory & Non- respiratory
- Electricity & Safety – ELCB / Fuse / Powered tools / Project illumination
- Handling of Compressed Gas – Transportation / Storage / FBAs / Fire prevention
- Machine Safety – Machine guarding / Maintenance
- Transportation – Hazards & risks in transp. of materials / ODC consignments
- Cranes & Other Lifting machinery – Legal requirements vis-à-vis essential safety requirements.
- Communication – HSE Induction / TBTs / Safety Committee / Safety meeting / Propaganda/Publicity.
- Excavation – Risks & Dangers / Safety measures
- Working at Heights – Use of ladder / Work on roofs / Scaffolds / Double harness lanyard
- Life savings. Safety Nets / Floor openings / line / Fall arrest
- Hazards in Welding & important safety precautions and Gas Cutting



4. PENALTY TABLE

Appendix : 4

S.No	Violation of HSE norms	Penalty amount
------	------------------------	----------------

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1	For not using PPE (helmet, shoe, goggles, gloves, full body harness, face shield and boiler suit etc...)	Verbal warning 2 times and then Rs 250 per day/item/person
2	Working without work permit/ clearance	Rs 5000 / per occasion
3	Unsafe electrical practice (not using ELCB, using poor joints of cable, using naked wire without plug top into socket, laying wire /cables on the roads, electrical jobs by incompetent person,etc)	Rs 3000 per item per day
4	Working at height without full body harness using nonstandard / rejected scaffolding and not arranging fall protection arrangement as required like safety net	Rs 3000 per case per day
5	Unsafe handling of compressed gas cylinders(No trolley, jubilee clip double gauge regulator, improper storage/handling)	Rs 100 per time per day
6	Use of domestic LPG for cutting purpose	Rs 1000 / per occasion
7	No fencing/barricading of excavated area.	Rs 1000 / per occasion
8	Not providing shoring/strutting/proper slope and not keeping the excavated earth at least 1.5 m away from excavated area.	Rs 5000 / per occasion
9	Non display of caution board, list of hospital, emergency service available at work location.	Rs 500
10	Traffic rules violation like over speeding of vehicle, rash driving, wrong parking, not using seat belt, vehicles not fitted with reverse warning alarm.	Rs 1000 / per occasion
11	Absence of CONTRACTORS top most executive at site in the safety meeting whenever called by Owner / Consultant.	Rs 5000 / per meeting
12	Failure to maintain safety record by CONTRACTOR safety personnel	Rs1000 / per month
13	Failure to conduct daily site safety inspection HSE meeting and audit at predefined frequencies	Rs 1000 / per occasion
14	Failure to submit the monthly HSE report by 5 th of subsequent month to engineer in charge	Rs5000 / per occasion

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		Rs 100 / per day for further delay.
15	Poor house keeping	Rs1000 / per occasion
16	Failure to report & follow up accident (including near miss) reporting system.	Rs10000 / per occasion
17	Degradation of environment (not confirming toxic spill, spilling oil/lubricants onto ground)	Rs1000 / per occasion
18	Not medically examining the workers before allowing them to work at height, not providing ear muff while allowing them to work in n noise polluted area, made them to work in air polluted area without respiratory protective device etc.	Rs1000 / per occasion
19	Violation of any other safety condition as per job HSE plan, work permit and HSE condition of contract(using crow bar on cable trench, improper welding booth, not keeping fire extinguisher ready to at work site, unsafe rigging practice, non-availability of first Aid box etc....)	Rs 1000 / per occasion
20	Violation of applicable Safety, health and Environment related norm, a price reduction of	Rs. 5000/- Per occasion
21	Any Physical injury, a price reduction of 0.5% of the lumpsum Price / Maximum of	Rs. 2,00,000/- Per injury in addition to Rs. 5000/-
22	Fatal accident, a price reduction of 1% of the contract value	Maximum of Rs. 10,00,000 / per fatality in addition to Rs. 5,000/-
23	Any violation not covered above	To be decided by Owner / Consultant

5. ON-SITE HSE ACTIVITIES PROGRAM (TYPICAL)



Appendix : 5

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ITEM	FREQUENCY	REMARKS
1) HSE Meetings		
HSE Steering Committee Meeting	Monthly & as required	High Mgmt (Site and/or office) and HSE Mgrs of CONTRACTOR and Owner / Consultant
Weekly Subcon's' HSE Meeting	Weekly	HSE Mgmt. of Subcon's, Contactor and Owner / Consultant. Every 4 weeks Site Mgmt of Subcons', CONTRACTOR and Owner / Consultant are invited also
Weekly Mgmt CONTRACTOR & Owner / Consultant meeting	Weekly	Attendance of HSE Mgrs in the weekly Mgmt CONTRACTOR and Owner / Consultant meeting
Weekly CONTRACTOR Mgmt Meeting	Weekly	Attendance of HSE M in the weekly CONTRACTOR Mgmt Meeting
Weekly Construction / Commissioning Meetings by area	Weekly	Attendance of area CONTRACTOR and Subcontractors HSE Spdt / Mgr. in the weekly Construction Meeting by area
CONTRACTOR HSE Dept. meeting	Every 2 weeks	All CONTRACTOR HSE Dept. members
Task Instructions	Daily	Supervisors, Foremen, Workers, HSE SVs
2) HSE Training		
HSE Induction Training	Daily or as required	for all new entrants
CONTRACTOR PULSE Program	Continuous	for all employees
ITEM	FREQUENCY	REMARKS

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HSE personnel specific training + Final written test (eliminator) + On job training	Immediately as required	For all CONTRACTOR and Sub CONTRACTORs new HSE personnel entrants
All Site specific HSE Training modules	As per weekly HSE training schedule	for all employees depending of their job and work specificities
First-aid Training	Yearly for each trainee	All Sub CONTRACTORs and CONTRACTOR HSE personnel + Security Supervisors & Managers
Specific HSE trainings (by external training organisms)	As required	Eg. rescue at height, firefighters, car demarcation, gas testers calibration, etc.
3) HSE Inspection and Audit		
Equipment (type?) Inspection	At bringing onto Site	by Sub-CONTRACTOR's' inspectors
	Monthly/Periodic	by Sub-CONTRACTOR's'/suppliers' inspectors
Equipment Pre-use Inspection	Daily	by operators/users of equipment/facilities
General HSE Inspection	Daily and as required	by CONTRACTOR's supervisors/foremen/HSE staff
LPI System (loss prevention inspections)	Weekly	by CM, Const. SVs, and others assigned HSE CONTRACTOR's staff
Weekly areas walkthroughs and weekly management Site walkthrough	Weekly	By sub-CONTRACTORs / CONTRACTOR / Owner / Consultant Mgrs and HSE staff
Weekly welfare inspections	Weekly	By sub-CONTRACTORs / CONTRACTOR Admin, Safety, Environment and Medical staff

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External HSE Audit of CONTRACTOR/ Sub - CONTRACTOR	Yearly	by CONTRACTOR HSE Committee & HSE MO
Internal HSE Audit of Sub-CONTRACTORs	Every six months	by CONTRACTOR HSE specific personnel
4) Work Permit	Daily or as required	for all work required locations by PTW system
5) Sanitation & Health Service		
Physical Examination	As required	for employees involved in health hazards
Potable Water Test	Monthly	Quality test by authorized laboratory
-Camps, Kitchen & Toilets	Monthly	Camp Manager, HSE SVs
Site Toilets	Weekly or as required	HSE SVs
6) HSE Reporting		
Incident / Accident Notifications	Immediate and as per procedure	from CONTRACTOR HSE M to SM and Owner / Consultant
Daily HSE Report	Daily	from CONTRACTOR HSE SVs to HSE M
Weekly HSE Report	Weekly	- from Sub CONTRACTORs to CONTRACTOR HSE M and - from CONTRACTOR HSE M to Owner / Consultant and to CONTRACTOR Project
Weekly Welfare Inspections Report	Weekly	From CONTRACTOR Admin. Department to SM and HSE M
Training Report	Weekly	from CONTRACTOR Trainer Coordinator to HSE M
Monthly HSE Report	Monthly	from CONTRACTOR HSE M to PM and HSE MO
Monthly HSE Equipment Inspection Report	Monthly	from Inspectors to HSE M & CMs

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HSE Audit Report	As required	from auditors to PM, SM & HSE MO
7) Housekeeping		
Work Site areas	Daily	by every work crew after day's work
Common Site areas (eg. Roads)	Weekly	by designated personnel
Waste disposal	As required	by designated teams

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6. TYPICAL TRAINING MATRIX

Appendix : 6

SITE HSE TRAINING MATRIX - TYPICAL



ATTENDANTS	1 SITE / CAMP INDUCT	2 SEW (MSJHA)/ PTW (TBM) BBB	3 PTW - TEST	4 ALL BBB - OUT	5 FALLS PROTEC -TEST & EXERC.	6 SITE STRUCT TAGS & GRATING REMOV	7 CONF SPACE ENTRY	8 SUPER OTHER SWP	9 GENERAL SITE AWARE NESS	10 SAFE DRIVING - SECURIT Y & TRAFFIC	11 LOTO	12 PC/C INDUCT.	13 ENV	14 PULBE LEADER	15 PULBE SITE SUPERV.
PROJECT MANAGEMENT	V											V		V	
SITE MANAGER	V				V			V	V			V	V	V	
CONSTRUCTION MANAGERS	V	V			V	V	V	V	V	V	V	V	V	V	
MANAGEMENT STAFF	V	V		V	V	V	V	V	V	V	V	V	V	V	
SUPERVISION STAFF	V	V		V	V	V	V	V	V	V	V	V	V		V
EMERG. TEAM / FF / FA / RE	V				V	V	V		V**			V	V		
MEDICAL STAFF	V				V	V	V		V			V	V		
SECURITY	V									V*		V			
HSE PERSONNEL	V	V	V	V	V	V	V	V	V	V	V	V	V		
PTW KEY ROLES			V								V	V			
BBB TASK FORCE				V							V	V			
DRIVERS AND FLAGMAN	V									V		V			
SUPERVISORS (ALL)	V	V			V	V	V	V	V	V	V	V	V		V
FOREMAN (ALL)	V	V			V	V	V	V	V	V	V	V	V		V
ALL LABOUR (at least to be controlled by us)	V											V			

- 8: ELECTRICAL SAFETY - RIGGING / LIFTING / HOISTING – EXCAVATION - MOBILE INDUSTRIAL EQUIPMENTS - HOT WORKS
- 9: GENERAL SITE HAZARDS (WEATHER CONDITIONS, LIVE PLANTS AREAS, ETC.) EMERGENCY TASKS – FIRE FIGHTING – FIRST AID – CHEMICALS
- 12: General PC/C induction to all the site personnel. More deep and specific induction to all the employees directly involved in PC/C activities is needed
- (*) Means – Training in any case to be dedicated to: Emergency Team Staff, Security Staff, those which shall work in Confined Space

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CONSTRUCTION HAZARDS, THEIR EFFECTS & PREVENTIVE MEASURES APPENDIX : 7


ACTIVITY	TYPE OF HAZARD	EFFECT OF HAZARD	PREVENTIVE MEASURES
(A) EXCAVATION Pit Excavation upto 3.0m	Falling into pit	Personal injury	Provide guard rails/ barricade with warning signal Provide at least two entries/ exits. Provide escape ladders.
	Earth Collapse	Suffocation/ Breathlessness Buried	Provide suitable size of shoring and strutting, if required. Keep soil heaps away from the edge equivalent to 1.2m or depth of pit whichever is more. Don't allow vehicles to operate too close to excavated areas. Maintain at least 2m distance from edge of cut. Maintain sufficient angle of repose. Provide slope not less than 1:1 and suitable bench of 0.5m width at every 1.5m depth of excavation in all soils except hard rock. Battering/benching the sides.
	Contact with buried electric cables Gas/ Oil Pipelines	Electrocution Explosion	Obtain permission from competent authorities, prior to excavation, if required. Locate the position of buried utilities by referring to plant drawings. Start digging manually to locate the exact position of buried utilities and thereafter use mechanical means.
Pit Excavation beyond 3.0m	Same as above Flooding due to excessive rain/ underground water	Can cause drowning situation	Prevent ingress of water Provide ring buoys Identify and provide suitable size dewatering pump or well point system
	Digging in the vicinity of existing Building/ Structure	Building/Structure may collapse Loss of health & wealth	Obtain prior approval of excavation method from local authorities. Use under-pining method Construct retaining wall side by side.
	Movement of vehicles/ equipment's close to the edge of cut.	May cause cave-in or slides. Persons may get buried.	Barricade the excavated area with proper lighting arrangements Maintain at least 2m distance from edge of cut and use stop blocks to prevent over-run Strengthen shoring and strutting

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Appendix : 8

LOTO AND SCAFFOLDING TAGS


[TYPICAL TAG OUT – SCAFFOLDING TAGS
 LOCK-OUT - Electrical ⚡ – Other (without sign)
 Plasticized double face signs with metal rings: 15 x 10

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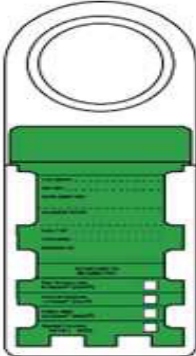
SCAFFOLDING TAGS





**Scaffold
Unsafe
Empty Card
Holder**



**Scaffold
Inspection
Back of Card
Signed and Dated**





**Scaffold
complete and
in use. Front of
Card Showing**

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Appendix : 9

HSE REPORTING FORMAT

Monthly HSE Statistics									
Project Name & No.:									
Month:									
Sl.No	Description	Up to Previous month(X) PTD		Sub-contractor (A)		Sub-contractor (B)		Total This Month (A+B)	CONTRACTOR Project Staff
		Seried	Unseried	Seried	Unseried	Seried	Unseried		
Type of Contractor*		Seried	Unseried	Seried	Unseried	Seried	Unseried		
MAN HOURS									
1.	Total Man Days								
2.	Total Man hours worked								
LAGGING INDICATORS									
3.	First Aid cases								
4.	Near Miss								
5.	RWC								
6.	MTI/ MTE								
7.	Loss Time Injury (LTI)								
8.	Fatal								
9.	Lost Work Days (LWD)								
10.	Environment Incident								
10.	Severity Rate (LWD X 200000/Total Mnh)								
11.	Frequency Rate (LTI X 200000/Total Mnh)								
12.	TRC								
13.	TRFC (TRC X 200000/Total Mnh)								
LEADING INDICATORS									
14.	SOC / SDS Observations (No. of Safe / Hazard observed / recorded)								
15.	No. of Closed Hazard (No. of actions generated / Recorded)								
16.	Leadership Visit *								
17.	Management Walk Through *								
18.	Safety Committee Meeting conducted at site.								
19.	Emergency / Mock Drill								
20.	Safety awareness programme conducted at site								
21.	Pre employment medical check up.								
22.	Training hours.								
23.	Site inspections / Walkthrough								
24.	Site Induction Training								
25.	HSE Audits (External / Internal)								
26.	Number of JSA / Risk Assessment Performed								
27.	Other Safety activity.								
HSE Manager APPROVALS & COMMENTS:									
* Leadership Visit - Visit by Management Committee Member, MR Group Directors / VP.									
* Management Walkthrough - Visit by Sr. Official Other than Management Committee Member & MR.									
LTI = Lost Time Incident		LWD = Lost Work Days		JSA = Job Safety Analysis		MTD = Medical Treatment Case			
PTD = Project to Date		MTI = Medical Treatment Incident		No. = Number		FFRD = Total Recordable Case Frequency			
NRD = Restricted Work Case		SOC = Safety Observation Card		HSE = Health Safety & Environment					
TRD = Total Recordable Case		BSG = Behaviour Based Safety							

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MINUTES OF MEETING FORMAT

Appendix : 10

WEEKLY HSE MEETING REPORT – DRAFT

(all personnel attended this meeting must sign the back of this report)

Project		Date	
Site		Meeting Time	

AGENDA

1)	4)
2)	5)
3)	*) Other

GENERAL

REPORT

1)	
2)	

ACTION PLAN



Item	Topics	Action to Improve	Responsible / Subcontractor	Targeted Date
1				
2				
3				

SEND IT TO

Site Manager / Construction Managers / HSE Manager	Subcontractors Field Manager / HSE Representatives
All the Superintendents South	Others

REGISTRATION FORM – SHEET N° _____



N	Roles	Company	Name and Surname	Signature
1				
2				

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INCIDENT REPORTING FORMAT

Appendix : 11

INCIDENT REPORT			
1. GENERAL INFO			
TYPE OF REPORT *	<input type="checkbox"/> Preliminary	<input type="checkbox"/> Final	
CASE TYPE *	<input type="checkbox"/> Accident	<input type="checkbox"/> Near Miss	
INCIDENT OWNERSHIP*	<input type="checkbox"/> Company Incident	<input type="checkbox"/> CONTRACTOR Incident	
INCIDENT TYPE *	<input type="checkbox"/> Work related	<input type="checkbox"/> Non-work related	
REPORTING ENTITY	Please select		
PERSON IN CHARGE			
2. FACTS			
DATE*		TIME (HH: mm) *	
LOCATION*		PROJECT NUMBER / NAME *	
OWNER*		RESPONSIBLE REPORTING CENTER	
INCIDENT CATEGORISATION	Access / Egress	AUTHORITIES INFORMED	<input type="checkbox"/> YES <input type="checkbox"/> NO If Yes, who?
DESCRIPTION OF THE INCIDENT*			



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3. CLASSIFICATION			
WORK ACTIVITY *			
ACTIVITY *			
CONTRACTOR / SUBCONTRACTOR INVOLVED			
ACTUAL LOST*		<input type="checkbox"/> Harm to people (proceed to 3.1) <input type="checkbox"/> Environment (proceed to 3.2) <input type="checkbox"/> Fire / Explosion (proceed to 3.3) <input type="checkbox"/> Occupational Illness (proceed to 3.4) <input type="checkbox"/> Equipment damage <input type="checkbox"/> Project Schedule Impact	
3.1 - HARM TO PEOPLE			
COURSE OF EVENT	Please select	GENDER	Please select
TYPE OF INJURY*		AGE	
PART OF BODY HARMED*		EXPERIENCE IN POSITION (days)	
POSITION*		EXPERIENCE ON INSTALLATION /SITE (mths)	
EMPLOYMENT CATEGORY	Please select	SHIFT	Please select
COMPANY*		DAYS INTO TOUR	
FOR LTI / RWC* (Estimate days lost)		HOURS INTO SHIFT	
3.2 - ENVIRONMENT			
ENVIRONMENTAL DOMAIN *	Please select	VOLUME (litres) *	
SUBSTANCE TYPE *	Aviation fuel (litres)	DURATION (min) *	



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ENVIRONMENTAL INCIDENT CLASSIFICATION *	Please select		
DESCRIPTION *			
3.3 – FIRE / EXPLOSION			
FIRE TYPE *	Please select	PRIMARY SYSTEM	EXTINGUISHING
IGNITION SOURCES		VOLUME USED	
DESCRIPTION			
3.4 – OCCUPATIONAL ILLNESS			
SEVERITY OF ILLNESS*	Please select	<input type="checkbox"/> Exposure in present employment	
AGENT / INFLUENCE		<input type="checkbox"/> Exposure in previous employment	
TYPE OF ILLNESS		<input type="checkbox"/> Form completed	
ORGAN SYSTEM		<input type="checkbox"/> Authorities notified	
SEX	Please select	AGE	
POSITION		COMPANY	Please select
EMPLOYMENT CATEGORY		ORGANISATION	
4. LOSS POTENTIAL *			
POTENTIAL RECURRENCE/SEVERITY		POTENTIAL RISK	
Potential recurrence: <input type="checkbox"/> A <input type="checkbox"/> B <input type="checkbox"/> C <input type="checkbox"/> D <input type="checkbox"/> E		<input type="checkbox"/> R Low (1-8) <input type="checkbox"/> R Medium (16-32) <input type="checkbox"/> R High (64-256)	
Severity: <input type="checkbox"/> 1 <input type="checkbox"/> 2 <input type="checkbox"/> 3 <input type="checkbox"/> 4 <input type="checkbox"/> 5			
FOLLOWING INCIDENTS HAVE TO BE IMMEDIATELY COMMUNICATED TO HEAD OFFICE			
<input type="checkbox"/> Major Incident	<input type="checkbox"/> High Potential Incidents (= 64)	<input type="checkbox"/> LTI	



IMMEDIATE CAUSES – Report immediate causes at first instance. Consult the following list and describe more as needed. Check below which causes best indicate reason for existence of acts and/or conditions identified. Add other causes if not listed. Why it happened? – Which condition was under-standard? - Generally more than one.

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	PEOPLE		ORGANIZATION
<input type="checkbox"/> 1P	Bypassed control / defense	<input type="checkbox"/> 18O	Inadequate permit / not following permit
<input type="checkbox"/> 2P	Disabled / removed guard / warning system / safety device / shortcut	<input type="checkbox"/> 19O	Poor job plan
<input type="checkbox"/> 3P	Failure to act		ENVIRONMENT
<input type="checkbox"/> 4P	Failure to obey / see safety systems / controls / barriers	<input type="checkbox"/> 20E	Exposure to extreme / unexpected weather
<input type="checkbox"/> 5P	Failure to secure	<input type="checkbox"/> 21E	Exposure to extreme temperature / humidity / dust
<input type="checkbox"/> 6P	Inadequate pre-task checking	<input type="checkbox"/> 22E	Exposure to hazardous atmosphere
<input type="checkbox"/> 7P	Inappropriate manual handling / use of equipment / tools	<input type="checkbox"/> 23E	Inadequate ventilation / light / illumination
<input type="checkbox"/> 8P	Inappropriate position of person(s)	<input type="checkbox"/> 24E	Natural effects (flooding, landslides etc)
<input type="checkbox"/> 9P	Incorrect loading / stacking	<input type="checkbox"/> 25E	Slippery or uneven surface / obstruction etc
<input type="checkbox"/> 10P	Lapse, mistake, omission	<input type="checkbox"/> 26E	Unprotected height risk
<input type="checkbox"/> 11P	Operated without authority / permission		TECHNOLOGY
<input type="checkbox"/> 12P	Operating equipment / vehicle at improper speed etc	<input type="checkbox"/> 27T	Exposure to hazards e.g. fire, chemical, noise etc
<input type="checkbox"/> 13P	Slips, trips, falls	<input type="checkbox"/> 28T	Falling / incorrectly placed objects / materials
<input type="checkbox"/> 14P	Under influence of alcohol / drugs	<input type="checkbox"/> 29T	Improper loading / storing / positioning of material / equipment
<input type="checkbox"/> 15P	Unsafe / inappropriate act / horseplay	<input type="checkbox"/> 30T	Ineffective guards / warning systems / safety device / PPE etc
<input type="checkbox"/> 16P	Used faulty / defective tools / equipment	<input type="checkbox"/> 31T	Leakage (fuel, radiation, chemical, gas) etc
<input type="checkbox"/> 17P	Worked on equipment in operation / live	<input type="checkbox"/> 32T	Plant / equipment status was not correct
		<input type="checkbox"/> 33T	Technical / mechanical failure / faulty equipment etc
		<input type="checkbox"/> 34T	Undetected / unforeseen hazard / failure

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Immediate CAUSES - Report the immediate causes and describe more if needed			
6. UNDERLYING CAUSES – Which specific human factor or work factor have led to immediate causes (at least one for each immediate cause)? – Why that act or condition was present? - The root causes shall be removed by an action plan.			
	PEOPLE		ORGANISATION
<input type="checkbox"/> P1	Deliberate infringement / violation / action	<input type="checkbox"/> O24	Conflicting objectives / goals / standards
<input type="checkbox"/> P2	Extreme work demands / fatigue	<input type="checkbox"/> O25	Financial, resource constraints / purchasing / procurement
<input type="checkbox"/> P3	Followed usual custom & practice	<input type="checkbox"/> O26	Inadequacies in shift handover
<input type="checkbox"/> P4	Illness / injury	<input type="checkbox"/> O27	Inadequate correction of prior hazard / incident / condition
<input type="checkbox"/> P5	Inadequate reaction to changing circumstances	<input type="checkbox"/> O28	Inadequate leader knowledge, ability/supervise./decision
<input type="checkbox"/> P6	Lack of attention / due care / poor work practice	<input type="checkbox"/> O29	Inadequate planning / risk assessment
<input type="checkbox"/> P7	Lack of awareness / perception of risk	<input type="checkbox"/> O30	Inadequate safety controls / warning systems / signs
<input type="checkbox"/> P8	Lack of knowledge of task / procedure / permit	<input type="checkbox"/> O31	Inadequate training / guidance provision / qualifications
<input type="checkbox"/> P9	Lack of skill / knowledge / experience / training	<input type="checkbox"/> O32	Inadequate work planning / programming
<input type="checkbox"/> P10	Miscommunication / inadequate communication of instructions	<input type="checkbox"/> O33	Ineffective auditing / inspection / monitoring
<input type="checkbox"/> P11	Not following / incorrect following of standards / procedures	<input type="checkbox"/> O34	Ineffective identification of hazards
<input type="checkbox"/> P12	Not using / incorrect use of PPE	<input type="checkbox"/> O35	Ineffective management of change
<input type="checkbox"/> P13	Physical / mental capability / stress problems / fatigue	<input type="checkbox"/> O36	Ineffective standards/enforced/procedures/guidelines/ instruct.
<input type="checkbox"/> P14	Poor decision-making / judgment	<input type="checkbox"/> O37	Lack of / ineffective job plans (toolbox talks etc) / ptw
<input type="checkbox"/> P15	Poor team relationships / dynamics / tensions (social / cultural)	<input type="checkbox"/> O38	Lack of accountability / responsibility



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	TECHNOLOGY	<input type="checkbox"/> O39	Lack of means of communication
<input type="checkbox"/> T16	Design deficiencies	<input type="checkbox"/> O40	Missing or inadequate job safety analysis
<input type="checkbox"/> T17	Excessive wear & tear of tools / equipment	<input type="checkbox"/> O41	Poorly controlled CONTRACTORS / external people
<input type="checkbox"/> T18	Improper identification of hazardous materials	<input type="checkbox"/> O42	Security breach
<input type="checkbox"/> T19	Improperly prepared tools / equipment	<input type="checkbox"/> O43	Unclear / conflicting lines of responsibility
<input type="checkbox"/> T20	Inappropriate equipment / vehicle for not fit for purpose		ENVIRONMENT
<input type="checkbox"/> T21	Ineffective adjustment / repair / maintenance	<input type="checkbox"/> E45	Inappropriate construction / layout
<input type="checkbox"/> T22	Ineffective fire / explosion / radiation / chemical / electrical protection	<input type="checkbox"/> E46	Insufficient / restricted access & exits
<input type="checkbox"/> T23	Lack of correct tools / equipment / power	<input type="checkbox"/> E47	Poor housekeeping / disorder
Underlying CAUSES - Report the Underlying causes and describe more if needed			
7. ROOT CAUSES – Report the Root Causes selecting the basic categorization and detailing describing the root causes identified during the investigation.			
<input type="checkbox"/> P	People	<input type="checkbox"/> O	Organization
<input type="checkbox"/> T	Technology	<input type="checkbox"/> E	Environment
Root CAUSES - Report the Root causes and describe more if needed			
8. CORRECTIVE ACTIONS – Report identified actions to remove root causes and prevent recurrence – Use the following guideline as needed. Report in sequence of priority. Assign a target time and person/company responsible to complete the corrective action and give fee-back of completion. Try to be S.M.A.R.T (Specific, Measurable, Achievable, Realistic, Timed)			

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CORRECTIVE ACTION PLAN		TO BE EXECUTED BY	DUE-DATE

9. ATTACHMENTS - Photos, Witnesses statement, Medical report, Other					
N O	TITLE	DOCUMENT NAME			
1					
2					
3					
10. APPROVAL					
REV.	DATE	STATUS	WRITTEN BY (name)	CHECKED BY (name)	APPROVED BY (name)

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WEEKLY HSE WALK AROUND REPORT

| WEEKLY HSE WALK AROUND REPORT

(all personnel attended this survey must sign the back of this report)

Site		Date	
Area visited		Time of survey	
SUMMARY			
Involve People / Discuss with the Workers / Ask Open Questions / Communication	Verify Safe Behaviour / PPE / Tools and Equipment	Method of Work / Risk Management	
Work procedure: Job Hazard Analysis, Permit To Work, Working at height, etc.	Emergency and Fire Fighting preparation and response	Housekeeping and Environmental	



GENERAL OBSERVATION

SAFE ACTIVITIES OBSERVED / REINFORCED

UNSAFE ACTIVITIES OBSERVED / CORRECTION DONE / FURTHER ACTION TO DO TO PREVENT

SEND IT TO

Owner Project Managers	Construction Contractors Field Manager / Safety
Site Manager / Construction Manager / HSE Manager	Others
All the Superintendent	



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WEEKLY HSE TRAINING / TOOL BOX MEETING

WEEKLY HSE TRAINING MEETING / TOOL BOX MEETING (all personnel attended this meeting must sign the back of this report)		
SUBCONTRACTOR	COORDINATOR	DATE DAY XX/YY/ZZ
TIME START	TIME END	SITE PLACE
GENERAL JOBS ON GOING OR TO BE CARRIED OUT SOON.....		
CRITICAL ACTIVITIES.....		
JHA / HSE WORK PRACTICES TO BE ADOPTED		
ACTION TAKEN MORE OVER THE JHA / HSE WORK PRACTICES AFTER DISCUSSION.		
SAFE WORK PRACTICE REMARKS.....		
ANALYSIS OF THE MOST COMMON VIOLATION		
MEDICAL CASES - INCIDENT/ACCIDENT DISCUSSED.....		
QUESTION / RACCOMENDATION / SUGGESTION.....		
OTHER.....		
(Tool Box Meeting to be recorded by Subcontractor – Weekly HSE Meeting to be sent to SHSEM)		
NOTE BY THE SHSEM.....		

**STANDBY SRU (525 TPD) TRAIN
FOR
IOCL PARADIP REFINERY
ANNEXURE TO SCC**

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JOB HAZARDS ANALYSIS (JHA)



JHA DRAFT

PROJECT XXXX –		
JOB HAZARD ANALYSIS		Rev. 0 Page

COMPANY	AREA
JOB	DATE OF ANALYSIS
NUMBER OF JHA	TOTAL NUMBER OF JHA
BRIEF DESCRIPTION AND CONSIDERATION (Scope, Place, Resource, Equipments, Conditions nearby, etc.)	

STEP	HAZARD	PREVENTIVE MEASURE

ISSUED	CHECKED	DATE
Subcontractor Line Supervision	Subcontractor responsible	

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PRE-EMPLOYMENT MEDICAL FITNESS

A. For CONTRACTOR's & Sub- CONTRACTORs Employees

PRE-ASSIGNMENT MEDICAL EXAMINATION RECOMMENDATION (GL 12109)

The basic recommended tests depend on the age of the employee:

a) Up to age 40:

Exams = Physical examination + dental examination

Other exams = Eyes tests + Audiogram + Chest X-Ray (< 3 months) + ECG + Spirometry

Tests = Blood test = FBC/CBC – Fasting blood sugar + HbA1 + Blood group + liver, gastric (lipid profile) and renal functions blood tests + ESR/CRP

Urine analysis

b) 40 to 50: idem +:

= Stress ECG – depending on risk factor and ECG

= Blood test = Uric acid

c) Above age 50: idem 40 to 50 +:

= Stress ECG/Echocardiogram

d) Specific tests can be added, due to specific tasks. Examples of specific tests are:



= Food handlers: stool analysis...

= Noise exposed workers: audiometric test...

= Dust exposure: spirometry, etc...

A copy of the medical record should be given by each Client and Contractor personnel arriving onsite to the on-site doctor.

Examining doctor will issue a medical fitness certificate to the candidate. If any abnormality is observed, it shall be clearly mentioned in fitness certificate. The copy of medical fitness certificate along with reports will be kept at the site.



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N.B. In case of abnormal finding, in consultation with OHA, he will be referred to concerned specialist for his opinion and / or further investigations like USG, TMT etc.

B. Fitness Criteria

To declare the candidate fit/temporary unfit / unfit, in all groups, following guidelines will be adopted for issuance fitness certificate.



Abnormality	Fitness	Remarks
Color Vision Deficiency	Fit	Not to be placed where colour differentiation is required.
Audiometry	Fit	Not to be placed in high noise area
Vision (More than -4 D)	Fit	He/She may be considered fit fulfilling following conditions: 1) He/She is advised to undergo LASIK eye procedure. 2) Post LASIK power of vision should be less than -4.0D. 3) Post LASIK retinoscopy report should be normal.
Severe Obesity (BMI > 35.0)	Temp. Unfit	Due to severe obesity he is temporary unfit.
Diabetes (uncontrolled)	Temp. Unfit	Unfit until diabetes comes under control
Hypertension (Uncontrolled)	Temp. Unfit	Unfit until blood pressure comes under control
Pregnancy	Temp. Unfit	Unfit till the confinement

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CONTROL MEASURES FOR ENVIRONMENTAL ASPECT

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SR NO	ACTIVITIES	ASPECTS	IMPACTS ON ENVIRONMENT	CONTROL MEASURES
1	GENERAL ENV. REQUIREMENTS	Falling due to spreaded material / spool pieces	Land Nuisance /pollution	Housekeeping / Segregation of waste / Disposal at authorized sites
		Pollution due to waste material i.e. Damaged cables, welding rods, Gas cutting set hoses.		
		Noise due to pneumatic hammer/other equipment	Air pollution	Periodic maintenance
2	MATERIAL HANDLING	Possibility of failure during handling of equipment/s	ILand Nuisance /pollution/Loss of resources	Check capacity , route & verify test certificate/s
3	TRANSPORTATION	Vehicle Maintenance	Smoke / pollution	PUC / Fitness Certificates / Regular Maintenance.
			Noise Pollution	Other Special requirements based on the Material / Equipment being transported.
			Lube Oil Spillage.	
		Excessive loading and spillage	Air /Land Pollution	Avoid excessive loading

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SR NO	ACTIVITIES	ASPECTS	IMPACTS ON ENVIRONMENT	CONTROL MEASURES
4	CONSTRUCTION UTILITIES	Power	Air Pollution	Monitoring of exhausts
		Oil	Water & land pollution	Store at defined place and regular maintenance.
		Noise	Air Pollution	Ensure the noise levels as per regulation.
		Waste	Water & land pollution	Proper Segregation, Storage and Disposal
		Water	Air, Water & Land Pollution	Store at defined place and regular maintenance. Proper disposal
5	EXCAVATION	Excavated earth / material	Land Pollution	Disposal at authorized location
6	PILING	Piling equipment	Noise pollution	Ensure the noise levels as per regulation.
			Water & Land Pollution	Proper Segregation, Storage and Disposal at approved location Periodic maintenance, proper operation of equipment
7	PNEUMATIC DRILLING	Pneumatic Equipment	Noise pollution	Ensure the noise levels as per regulation.
			Resource Loss	Periodic maintenance and Proper Operation of Equipment

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SR NO	ACTIVITIES	ASPECTS	IMPACTS ON ENVIRONMENT	CONTROL MEASURES
8	REFRACTORY / INSULATION WORKS	Castables / Ceramic / Mineral / Glass wool material / etc.	Land Pollution	Disposal at authorized location
		Scrap / Waste Material		
9	PAINTING	Leakage / Splash during handling	Land pollution/Air pollution	Proper Operation of Equipment
		Empty paint & thinner Drums, Used brushes, paint soaked dhotis	Water Pollution	Disposal at authorized location
			Land Pollution	
10	GRINDING	Scrap and waste materials, Spillage of coolant	Water pollution and Land pollution	Disposal at Authorized location.
				Secondary Containment.
		Noise	Air Pollution	Ensure the noise levels as per regulation.
11	WELDING	Scrap and waste materials	Land Nuisance / Pollution	Disposal at Authorized location.
				Secondary obtainment.
12	GAS	Scrap and waste materials	Land Nuisance / Pollution	Disposal at Authorized location.
		Storage of Cylinders	Air Pollution	
13	DRILLING	Nosie	Air Pollution	Provide Ear Plugs
				Noise Monitoring
14	NDT	Storage & Use of Radiographic substance	Air Pollution, Water Pollution and Land Pollution	Ensure the storage & use as per regulation.


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15	BLASTING	Dust	Air Pollution	Use of appropriate hood/ sand blaster hood Apron by operators
		High noise	Air pollution	Controlled exposure
16	FLUSHING	Splashing of fluids	Land Pollution	Drained to OWS & then to ETP
	&	Drainage of Fluid used for testing	Water Pollution/Land pollution	Drained to OWS & then to ETP
	TESTING	Disposal of Waste Material, Empty Containers	Water Pollution	Disposed to authorized location.
17	SITE CLEARANCE	Disposal of Hazardous Waste	Water Pollution	Disposed to authorized location.
	HANDING OVER	Disposal of Non-Hazardous Waste	Water Pollution	Disposed to authorized location.

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SITE PERMIT TO WORK

		SITE PERMIT TO WORK				N
1. WORK PERMIT IDENTIFICATION AND DESCRIPTION - by Permit Requester						
<input type="checkbox"/> Cold	<input type="checkbox"/> Electrical Hazard	<input type="checkbox"/> Excavation	<input type="checkbox"/> Manbasket	<input type="checkbox"/> Crane Lift	<input type="checkbox"/> Grating Removal	
<input type="checkbox"/> Hot	<input type="checkbox"/> Work at Height	<input type="checkbox"/> Radiography	<input type="checkbox"/> Hazardous Material	<input type="checkbox"/> Lock out / Tag out	<input type="checkbox"/> Scaffold	
<input type="checkbox"/> Confined Space	<input type="checkbox"/> Road Interruption	<input type="checkbox"/> Night Work	<input type="checkbox"/> Pressure Test	<input type="checkbox"/> Pre-Commissioning	<input type="checkbox"/> Other	
Associated Documents - by Permit Requester						
<input type="checkbox"/> Method Statement	<input type="checkbox"/> JHA	<input type="checkbox"/> Competent pers.	<input type="checkbox"/> MSDS	<input type="checkbox"/> P&ID	<input type="checkbox"/> Grating Removal	
<input type="checkbox"/> Lifting Plan	<input type="checkbox"/> Undergr Map/Draw	<input type="checkbox"/> Scaffold Study	<input type="checkbox"/> Hazardous Material	<input type="checkbox"/> Plot Plan	<input type="checkbox"/> Other	
Performer:		Receiver:		Select Area on the Map		
Description of the work:		Area/Location				
JOB / MEANS - by Permit Requester						
<input type="checkbox"/> Crane	<input type="checkbox"/> Motor Generator	<input type="checkbox"/> Drilling Machine	<input type="checkbox"/> Forklift	<input type="checkbox"/> Gas Cylinder	<input type="checkbox"/> Truck/Vehicle-mixer vacuum	
<input type="checkbox"/> Excavator	<input type="checkbox"/> Elevating Platform	<input type="checkbox"/> Welding Machine	<input type="checkbox"/> Hand Tools	<input type="checkbox"/> Torch/Free flames	<input type="checkbox"/> Electrical hand tools	
<input type="checkbox"/> Pneumatic Tools	<input type="checkbox"/> Ladder	<input type="checkbox"/> Slings/Chain	<input type="checkbox"/> Compressor	<input type="checkbox"/> Thermal treatment	<input type="checkbox"/> Chemicals	
<input type="checkbox"/> Vessel/Sewer	<input type="checkbox"/> Chain Block/Tir fort	<input type="checkbox"/> Scaffolding	<input type="checkbox"/> Man Basket	<input type="checkbox"/> Concrete pump	<input type="checkbox"/> Bridge Crane	
<input type="checkbox"/> NDT Source	<input type="checkbox"/> Other:					
POTENTIAL HAZARD IDENTIFICATION - by Permit Requester						
<input type="checkbox"/> Collapse	<input type="checkbox"/> Falling Object	<input type="checkbox"/> High Noise	<input type="checkbox"/> Hit by Moving Object	<input type="checkbox"/> Crash Moving Object	<input type="checkbox"/> Harmful Contact	
<input type="checkbox"/> Fall from Height	<input type="checkbox"/> Suspended Load	<input type="checkbox"/> High Tension Contact	<input type="checkbox"/> Sharp Contact	<input type="checkbox"/> Hydrocarbons	<input type="checkbox"/> Breathing Danger	
<input type="checkbox"/> Cables/Housekeeping	<input type="checkbox"/> Drown	<input type="checkbox"/> Asphyxia	<input type="checkbox"/> Radiation	<input type="checkbox"/> Burn	<input type="checkbox"/> Dust	
<input type="checkbox"/> Fire/Explosion	<input type="checkbox"/> Pressure/Vacuum	<input type="checkbox"/> Temperature	<input type="checkbox"/> Chemicals	<input type="checkbox"/> Previous Danger Subst.	<input type="checkbox"/> Other:	
GENERAL PRECAUTIONS - by Permit Requester						
<input type="checkbox"/> Mandatory PPE	<input type="checkbox"/> Special Overall C, T	<input type="checkbox"/> Rubber Gloves/Boot	<input type="checkbox"/> Iso. Electrical gloves	<input type="checkbox"/> Face Shield / Hook	<input type="checkbox"/> Restrict Access/Barricade	
<input type="checkbox"/> Goggles	<input type="checkbox"/> Dust Mask FP	<input type="checkbox"/> Filter Mask	<input type="checkbox"/> Ear Muffs	<input type="checkbox"/> Harnesses (2 ropes)	<input type="checkbox"/> Guarded insulated tool	
<input type="checkbox"/> Man Watching	<input type="checkbox"/> Ventilation/Aspiration	<input type="checkbox"/> Air Supplier/Respirator	<input type="checkbox"/> Ear plugs	<input type="checkbox"/> Lifejacket	<input type="checkbox"/> Depressurized/Drained	
<input type="checkbox"/> Entry Log	<input type="checkbox"/> Rescue Plan	<input type="checkbox"/> No Work top/down	<input type="checkbox"/> Additional lighting	<input type="checkbox"/> Alternative route	<input type="checkbox"/> LOTO - Blind	
<input type="checkbox"/> Safety rope	<input type="checkbox"/> Radio/Air Horn	<input type="checkbox"/> Life Rope	<input type="checkbox"/> Winch / tripod	<input type="checkbox"/> Maintain Wet	<input type="checkbox"/> Low Voltage 24 V	
<input type="checkbox"/> Soil Class/Sloping	<input type="checkbox"/> Shoring/Reinforce	<input type="checkbox"/> Isolate the Area	<input type="checkbox"/> Hand Excavation	<input type="checkbox"/> Shields	<input type="checkbox"/> Steamed/water/inert flush	
<input type="checkbox"/> Signs (warning)	<input type="checkbox"/> Night Warning	<input type="checkbox"/> Water ready	<input type="checkbox"/> Sewer/drain isolated	<input type="checkbox"/> Grounding equipment	<input type="checkbox"/> Gas Detector	
<input type="checkbox"/> Fire Watching	<input type="checkbox"/> Extinguisher Ready	<input type="checkbox"/> Antistatic/spark	<input type="checkbox"/> Scaffolding	<input type="checkbox"/> Process (P, T) Safe	<input type="checkbox"/> Spark Containment (100%	
<input type="checkbox"/> GAS TEST	<input type="checkbox"/> AIR TEST	<input type="checkbox"/> Electric. safe	<input type="checkbox"/> No Work above/below	<input type="checkbox"/> Road interruption	<input type="checkbox"/> SCUBA apparatus	
<input type="checkbox"/> Other:						

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COMPLEMENTARY FORMS TO BE FILLED BEFORE TO ISSUE WORK PERMIT (NEXT PAGE)								
<input type="checkbox"/> Lock out / Tag out		<input type="checkbox"/> Gas / Air Test		<input type="checkbox"/> Road Closure		<input type="checkbox"/> Other		
<input type="checkbox"/> Other								
Validity Request	From	Date :	Time :	Until	Time :			
Requester (Name & Surname)			Signature			Date		
2. WORK PERMIT REVIEW - by Permit Reviewer								
Validity Given	From	Date :	Time :	Until	Time :			
Other Cooperation needed :		<input type="checkbox"/> No	<input type="checkbox"/> Yes					
TECHNICAL REVIEWER (Name & Surname)			Signature			Date		
HSE REVIEWER (Name & Surname)			Signature			Date		
3. WORK PERMIT APPROVAL - by Permit Issuer								
Concur that the requirement to proceed cover the job, I certify that I'm aware of the work as defined is to be carried out as per Paragraph 1 and 2, as stated after Reviewer signs (if foreseen). I issue the work permit after complementary measures requested are taken and all the measures related to the work to be done are in place.								
ISSUER (Name & Surname)			Signature			Date		
4. WORK PERMIT EXECUTION - by Permit Receiver								
I accept the job site supervision as per paragraph 1,2,3 and any Complementary Permit and Complying with requirement & precaution needed for safe work.								
RECEIVER (Name & Surname)			Signature			Date		
5. REVALIDATION								
I confirm that the conditions of the permit have not changed since initiation. Work may continue over the next period								
Revalidation N.	Date	Start Time/End Time	Receiver Name	Signature	Issuer Name	Signature	Technical Reviewer Initial	
1								
2								
6. WORK CLOSURE								
If/We have inspected the work and accept that the work has been completed in accordance with the work scope and this permit's requirements - The site has been left in housekeeping and safe conditions related to the work done - All inhibited system for this PTW can be reverted to normal after this section (see next page)								
Receiver			Issuer		Date :			Time :
Permit closed out on			Reviewer		Date :			

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ROUTINE ENVIRONMENTAL INSPECTION

ROUTINE ENVIRONMENTAL INSPECTION

Inspector : _____ Date _____ Time: _____

Area inspected: _____ Subcontractor name: _____

General Site Observations	Compliance		Remarks with Responsible Party
	Acceptable	Action Req.	
Ensure waste is segregated and placed in appropriate containers			
Ensure waste containers are secured and properly covered			
Ensure that no waste is accumulated by site boundaries			
Ensure that all hazardous materials are labelled, stored and handled according to health and safety regulations			
Ensure washout from concrete trucks is contained in defined location			
Ensure oil and hazardous materials are stored away from drains or watercourses			
Ensure oil and chemicals are not left on site unattended			
Ensure that leaking containers are removed from site and disposed of correctly			
Ensure that drip trays are placed under static plant			
Ensure that spill kits are available			
Ensure that secondary containment (e.g. bunds) is provided for storage of hazardous materials			
Ensure diesel tanks are positioned on an impervious surface and within a bunded area			
Ensure diesel tank hoses are kept within the bunded area			
Ensure that fuelling is carried out only by authorised personnel			
Ensure measures are implemented to avoid mud entering drains (e.g. sandbags)			
Ensure no concrete enters drains			
Ensure that pumping is carried out through filters when required			
Visually check water quality from pumping			
Ensure that run-off water cannot directly enter watercourses			
Ensure that temporary or completed earthworks are sealed			
Check cleanness of channels adjacent to Site			
Check cleanness of channels adjacent to Mobil cleanness			
Ensure entrance and site roads are clean and free of mud			
Ensure that stockpiles are located out of the wind to minimise the potential of dust generation			
Ensure plants and vehicles are switched off when not in use			
Ensure that all vehicles on site do not generate smoke			
Ensure noisy plant and machinery is located away from sensitive areas			
Ensure equipment is well maintained			
Ensure appropriate signs are in place where required			
Ensure general housekeeping of the site is acceptable			
Ensure that measures are in place to protect stored materials from vandals			
Other:			
Additional Comments:			

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Appendix : 20

CAMP HYGIENE INSPECTION



CAMP HYGIENE REPORT

1. KITCHEN

- a. Are staffs wearing the correct clothing & shoes? Are haircut and nails being properly maintained? Is personal hygiene well maintained? _____
- b. Are all utensils cleaned and properly maintained? _____
- c. Is the refrigerator clean & operating at correct temperature) _____
- d. Are temperature charts maintained? _____
- e. Are all washing up areas in good order? _____
- f. Are floors, wall, ceiling & cabinets clean? _____
- g. Are the correct cleaning materials used for each job and are they used correctly? _____
- h. Are cleaning materials stored separately from Foodstuff? _____
- i. Are cutlery and crockery & cutting boards in good order? _____
- j. Is the oven & other equipment clean? _____
- k. Is the electric bug killer functional? _____
- l. Is ventilation adequate? _____
- m. Has staff received training in Hygiene? _____
- n. Are staff medical checkups are being done on regular basis? _____
- o. Are Fire extinguishers & fire blanket placed and maintained? _____
- p. Is trash bin covered at all times? _____
- q. Are sanitary fittings functional and working? _____
- r. Is Charcoal filter clean? _____
- s. Are food handlers using separate Toilets / washrooms? _____

2. FOOD STORAGE

- a. Are correct storage methods being used? _____
- b. Is the quality of food products satisfactory? _____
- c. Are shelves and pallets clean? _____
- d. Are cleaning materials stored separately? _____
- e. Is the electric bug killer functional? _____
- f. Is ventilation adequate? _____
- g. Is lighting adequate? _____

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- h. Are fire precautions / prevention satisfactory? _____
- j. Does staff understand the requirement for separate storage areas for different foods? _____
- k. Are freezers / refrigeration / chillers operating at the correct temperature? _____
- l. Are temperature charts maintained regularly? _____
- m. Is cold storage space adequate? _____
- n. Are expiry dates correct and mentioned? _____

3. MESS

- a. Are staffs wearing the correct clothing & shoes? Are haircut and nails being properly maintained? Is personal hygiene well maintained? _____
- b. Are floors, wells & ceiling clean? _____
- c. Is the refrigerator clean & operating at correct temperature? _____
- d. Are temperature charts maintained? _____
- e. Is the electric bug killer functional? _____
- f. Is ventilation adequate? _____
- g. Is lighting adequate? _____
- h. Are tables & chairs clean? _____
- i. Do all items comply with expiry dates? _____
- j. Are ORDS / salt tablets available? _____
- k. Are Food handlers clean and tidy? _____

4. ACCOMMODATIONS

- a. Are rooms correctly ventilated / air-conditioned? _____
- b. Is lighting adequate? _____
- c. Is ventilation adequate? _____
- d. Are rooms clean? _____
- e. Is bed linen clean? _____
- f. Is there evidence of food consumption in room? _____
- g. Are ashtrays provided for smokers at designated locations? _____
- h. Are rest areas adequate? _____

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5. TOILETS AND WASHROOMS

- a. Are toilets in clean condition and unclogged? _____
- b. Are floors, walls and ceiling clean? _____
- c. Is ventilation adequate? _____
- d. Is lighting adequate? _____
- e. Is hot and cold-water supply adequate? _____
- f. Are sanitary fittings functional and working? _____

6. DRINKING WATER SUPPLY



- a. How is Drinking water supplied? _____
- b. Are water filters/UV fitted and maintained correctly? _____
- c. Is quality of drinking water being tested on regular basis? _____

7. LAUNDRY (TWICE IN A WEEK)

- a. Are the laundry and the machines clean? _____
- b. Are washers and dryers working? _____
- c. Is ventilation adequate? _____
- d. Is lighting adequate? _____
- e. Is the laundry neat & tidy? _____
- f. Are washers and dryers adequate in quantity? _____
- g. Are supplies & quality of cleaning materials adequate? _____
- h. Is laundryman clean and tidy? _____
- i. Does laundryman carry out of his work satisfactorily? _____

8. WASTE DISPOSAL

- a. Are bins provided in kitchen, mess, food stores, laundry & rooms? _____
- b. Are these bins washed regularly & emptied everyday? _____
- c. Is proper waste segregation & disposal system in place? _____
- d. Is soak / burn pit not overflowing? _____

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Appendix : 21

DAILY SAFETY CHECKLIST

DAILY SAFETY CHECKLIST (To make use of before start of day's work)

Project :	Sr.No. :
Name of the work :	Date :
Name of contractor :	Job No. :

Description of Job decided to perform :-

Use of PPE / Safety Gadgets

SL No	PPEs	Compliance (Yes / No)	SL No	PPEs	Compliance (Yes / No)
1	Safety Helmets		6	Face Shield	
2	Safety Shoes		7	Full body harness	
3	Hand Gloves		8	Fall Arrest System	
4	Dust Mask		9	Safety net	
5	Safety Goggles		10	Horizontal life-line made of steel wire, (dia not less than 8.0 mm.)	

(Serial No. 1 & 2 are compulsory for everyone. Specify & ensure use of other safety gadgets as required for the job)

Identify following important unsafe conditions: -

SL No	Conditions	Yes / No
1	Access to work site / emergency escape clear	
2	Soil / Loose earth kept away from excavated pit / slope / ladder provided	
3	Electrical wire / welding lead lying entangled on ground / welding m/c. booth accessible	
4	Elevated work platform / open ends are protected	
5	Ground area cordoned off before lifting works or erection at height / ground area checked & cordoned-off before start of height works	
6	Structural members / erected pipes / wooden boards/pieces etc. are safely anchored at heights and are not likely to fall down on people when working beneath	
7	Rope ladders tied-up on tall steel structures, long before are removed to get rid of their use	
8	Any Other	



Indicate actions taken, if status of any of the above items is found "No"

Specific Safety guidelines / precautions, if any (communicated thro' TBT)

Above conditions and PPE compliances are checked by undersigned and correct status are indicated after verification

Inspected by
Contractor Engineer

Verification By
Contractor Safety Officer

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Appendix : 22



HOUSEKEEPING ASSESSMENT & COMPLIANCE

(Sheet 1 of 2)

HOUSEKEEPING ASSESSMENT & COMPLIANCE

Project :	Sr.No. :
Name of the work :	Date :
Name of contractor :	Job No. :
Name of contractor : Fortnightly	

Sl No.	Subjects of Review	Satisfactory/ Yes	Non satisfactory/No	Remarks	Action
1.	Cleanliness at the Main entry / access of site				
2.	Ground condition / floor areas free from water-logging / oil spillage				
3.	Ground & elevated floors free from rubbish / wastes / accumulated debris / scraps.				
4.	Manholes / openings are covered / fenced				
5.	Trenches are barricaded / walkways are in place				
6.	Drains are cleaned / not choked / not occupied by dumped materials				
7.	Sufficient CAUTION boards / instructions displayed				
8.	Construction machinery are maintained & parked in orderly manner.				
9.	Movement of site people are not obstructed because of dumping / storing of construction materials				
10.	Access / egress to Electrical Distribution Boards / Panels clear from wires / cables / earth-strips etc.				
11.	Electrical panel rooms / sheds / MCC / Control rooms / Substations etc. are clean & tidy and not used for storing dress / clothes, tiffin-box or bicycles.				
12.	Passage behind Elec. panels are free for access				
13.	Fire extinguishers / fire-buckets are accessible without any difficulty.				
14.	Stair-steps, platforms & landings are clear & tidy				
15.	Sheds / rooms & work areas have got sufficient illumination as well as ventilation				
16.	Cables / Wires / welding leads are routed / hanged appropriately & are not creating unsafe condition.				
17.	Stacking / storing of insulation materials or their packing.				
18.	Removal or cleanliness of left-over sand, concrete, brick-bats, insulation-materials, excess earth, wastes etc.				
19.	Storing / stacking of sand, metal chips, re-bars, steel pipes, valves, fittings etc.				
20.	One escape route at ground & minimum two escape routes at elevation available,				

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(Sheet 2 of 2)

Sl No.	Subjects of Review	Satisfactory/ Yes	Non satisfactory/No	Remarks	Action
21.	Captions / Posters / Slogans on various safety instructions are displayed legibly in local language				
22.	Cable trenches are water-free or regular arrangement for taking out accumulated water exists.				
23.	Windows of rooms / offices are regularly cleaned				
24.	Facilities for cycle sheds, drinking water, washing, rest-rooms etc. are maintained in tidy manner.				
25.	Toilet, Urinals, Canteen / kitchen / pantry etc. are maintained & free from obnoxious smell.				
26.	Construction tools / tackles are stored systematically - the items are tagged / tested / certified by competent third party.				
27.	Sufficient numbers of Dust-bins / Waste-bins found at site and are regularly emptied.				

Additional remarks, if any -

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.....
.....

Inspected by
Contractor Engineer

Verification By
Contractor Safety Officer



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INSPECTION FOR SCAFFOLDING

(Sheet 1 of 2)

INSPECTION FOR SCAFFOLDING

Sl. No	Description	Yes	No	N.A	Actions taken
1	Whether work permit is obtained to take up work at height above 1.5 Mts?				
2	Whether atmospheric condition is "stormy" or "raining" and works at heights have been permitted?				
3	Whether steel pipes scaffoldings are used for units /off-site areas?				
4	Whether scaffolding has been erected on rigid/firm/leveled surfaces / ground? Whether "foot-seals" or "base-plates" are used beneath the up-rights (vertical steel pipes)				
5	Whether scaffold construction is as per IS specification with toe-board and hand-rails (top-rail as well as mid-rail)?				
6	Whether distance between two successive up-rights are less than 2.5 Mts (height of scaffold & load carrying capacity governs the distance between two uprights)				
7	Whether all uprights are extended at least 900 mm above the top most working platform (to enable fitting of handrails)?				
8	Whether vertical distance of two successive ledgers is satisfactory? (varying between 1.3 Mts. To 2.1 Mts)				
9	Whether the peripheral areas of working at height are cordoned-off? (for avoiding accident to people arising out of dropped / deflected materials)				
10	Whether platform is provided? Is it safely approachable?				
11	Whether end of scaffold platform / board are extended beyond transoms? (125mm to 150 mm)				
12	Whether CE / IS approved quality and worthy conditioned full-body safety harness (with double lanyard & karabiners) are used while working at heights?				
13	Whether life-line of safety harness is anchored to an independent secured support capable of withstanding load of a falling person?				
14	Whether the area around the scaffold is cordoned off to prohibit the entry of unauthorized person / vehicle?				
15	Whether clamps used are of good condition, of adequate strength and free from defects?				
16	Whether ladder is placed at secured and leveled surface?				
17	Whether water-pass and oil-spills are avoided around the scaffold structure?				
18	Whether ladder is extended 1.5mts. above the landing point at height?				
19	Whether more than one access/egress provided to the scaffold?				
20	Whether ladder used are of adequate length and overlapping of short ladders avoided?				
21	Whether metallic ladders are placed much away from near-by electrical transmission line?				
22	Whether rungs of ladder are inspected and found in good order?				
23	Whether fall-arresters provided on both the access/egress routes?				
24	Whether diagonal (cross) bracings are provided at regular interval on the scaffold?				
25	Whether working platform on the scaffold has been made free from "jolt" or "gap"?				
26	Whether tools or materials are removed after completion of the day's job at heights?				
27	Whether a valid Permit for Work (PFW) is obtained before taking up work over asbestos or fragile roof?				
28	Whether sufficient precaution is taken while working on fragile roof?				

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ANNEXURE

“GUIDELINES ON PERSONAL PROTECTIVE EQUIPMENT” - (PPE)

Guidelines on Personal Protective Equipment (PPE)

<u>INDEX</u>			
SN	DESCRIPTION	PPE TO BE USED	Page No
1	Work at Height (height > 2 M)	<ul style="list-style-type: none"> • Safety Shoe (A) • Full Body Safety Harness With shock absorbers (Two alternatives), • Shock absorbing lanyard double 'Y' type • Restrain Lanyard, • Rope Grab (In case of vertical life line being used) • Helmet (A) 	4-11
2	a) Excavation. b) Fire pump Operation. c) Testing of Pressure Gauge	<ul style="list-style-type: none"> • Helmet (B) • Safety Shoe (A) 	12-13
3	Excavation involving dewatering works	<ul style="list-style-type: none"> • Helmet (B) • Gumboot • Gloves (Two alternatives) • Goggles 	14-18
4	Blast Cleaning	<ul style="list-style-type: none"> • Helmet (B) • Safety Shoe(A) • Goggles • Ear Muff • Gloves (Two Alternatives) • Apron (Three Alternatives) • Half face mask 	19-26
5	Painting (Confined space / external)	<ul style="list-style-type: none"> • Helmet (A) • Safety Shoe • Gloves (Two alternative) • Half face mask • Apron (Two Alternatives) 	27-30

Guidelines on Personal Protective Equipment (PPE)

<u>INDEX</u>			
SN	DESCRIPTION	PPE TO BE USED	Page No
6	a) Working in Confined space b) Testing of Gas sensor c) Tank Gauging d) De Gassing of LPG Cylinder e) Shuttering works f) Brick masonry g) Handling of Battery	<ul style="list-style-type: none"> • Helmet (B) • Safety Shoe (A) • Gloves (Two Alternatives) 	31-32
7	a) Road work. b) Reinforcement c) Concreting	<ul style="list-style-type: none"> • Helmet (B) • Gum Boot • Goggles • Gloves (Two Alternatives) 	33-34
8	a) Grass Cutting b) Blinding & de-blinding work	<ul style="list-style-type: none"> • Helmet (B) • Gum Boot 	35
9	Electrical Work	<ul style="list-style-type: none"> • Safety Shoe (B) • Helmet (B) • Gloves (Electrical) 	36-38
10	Working with possibility of	<ul style="list-style-type: none"> • Helmet (B) • Safety Shoe (A) • Goggles • Apron (Two Alternatives) 	39-41

Guidelines on Personal Protective Equipment (PPE)





<u>INDEX</u>			
SN	DESCRIPTION	PPE TO BE USED	Page No
11	Welding and Cutting works	<ul style="list-style-type: none"> • Welding shield • Safety Shoe (A) • Apron Welding • Gloves (Welding) • Helmet (B) 	42-44
12	Tank Cleaning	<ul style="list-style-type: none"> • Helmet (B) • Gum Boot • Apron (Two Alternatives) • Gloves (Two Alternatives) 	45-47
13	Product pump house operation	<ul style="list-style-type: none"> • Helmet (B) • Safety Shoe (A) • Goggles • Gloves (Two Alternatives) 	48-19
14	DG Operation	<ul style="list-style-type: none"> • Helmet (B) • Safety shoe (B) • Ear muff • Electrical glove 	50

- 1) **Additional PPE to be provided for various activities as per requirement of Job Safety Analysis (JSA), OISD and Statutory stipulations.**
- 2) Training inputs as required to be given for proper usage, maintenance of PPE.
- 3) Various EN Standards / BIS codes mentioned are available on line on IOCL CO, HSE website.




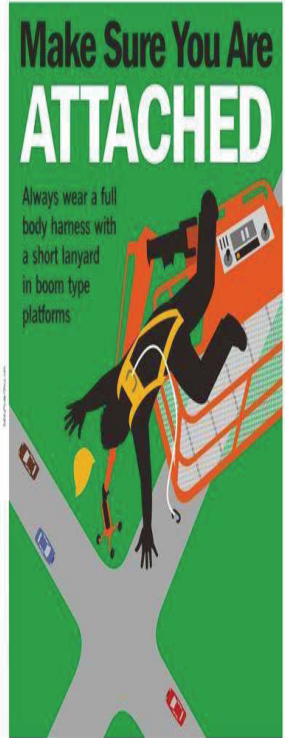
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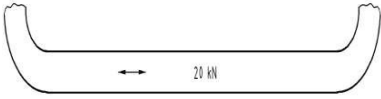

Guidelines on Personal Protective Equipment (PPE)

SN	Activity (Pictorial Display)	Required PPEs	Quality assurance	Protection Against hazard	Limitation of PPE	Hazard of Not wearing of PPE	When to be discard
1	Work at Height (height > 2 M) Contd... 	I) Safety Shoe (A)  	<p>The safety shoe shall have following marking as per IS 15298 (part -2) :</p> <ol style="list-style-type: none"> size; manufacturer's identification mark; Year of manufacture and at least quarter; License No (CM/ L) IS Mark <p>Category of Safety Shoe</p> <p>Category of Safety shoe (S1, S2, S3 etc) as required as per Table 16 of IS 15298 (part 2) : 2011</p> <p>S1 : Closed seat region, Antistatic properties , Energy absorption of seat region</p> <p>S2 : S1 plus Water penetration and water absorption.</p> <p>S3 : S2 plus Penetration resistance (S3) Cleated outsole</p>	<ul style="list-style-type: none"> Striking against stationary object. Striking by moving object Stepping on hot object Stepping on sharp object Penetration (S3 category) Water penetration and absorption. (S2 & S3 category) 	<ul style="list-style-type: none"> Not suitable for hazards like Chemical burns , electrical flash, welding spark and heat radiation Not suitable if it is necessary to minimise electrostatic charges in the shortest possible time . Not suitable for work in explosive work area. 		<ul style="list-style-type: none"> Exceeding one year from the date of first use of the shoe . sign of crack / damage . Excessive wear As per Manufactures recommendations.




Guidelines on Personal Protective Equipment (PPE)

SN	Activity (Pictorial Display)	Required PPEs	Quality assurance	Protection Against hazard	Limitation of PPE	Hazard of Not wearing of PPE	When to be discard
	<p>Work at Height (height > 2 M) Contd...</p> 	<p>II) Full body Safety Harness with energy absorber : (Alternative -I)</p> <ul style="list-style-type: none"> Lanyard along with 5 Point (1 Dorsal + 2 Textile loops+ 2 sternal D ring) harness to be used for rescue or tower climbing <p>The ABC's of Fall Protection</p> 	<p>1. The full body harness shall conform to EN 361</p> <p>Marking on the full body harness shall conform to 2.2 of EN 365:1992 and any text shall be in English. In addition to conforming to 2.2 of EN 365:1992 the marking shall include the following.</p> <ul style="list-style-type: none"> On the full body harness, a pictogram to indicate that users shall read the information supplied by the manufacturer.  <ul style="list-style-type: none"> A capital letter "A" at each fall arrest attachment element; The model/ type identification mark of the full body harness; The number of this European Standard, i.e. EN 361. <p>2. Connector shall conform to EN 362 and Marking on the connector shall conform to EN 365. The marking shall include:</p> <ul style="list-style-type: none"> The model/ type identification mark of the connector. EN number & the letter of the class e.g. EN 362:2004/A 	<p>Accidental fall</p> <ul style="list-style-type: none"> Direct the loads to legs. Keeping body upright. Prevent the neck damage slightly opens the breathing way. Prevents from colliding with the ground or structure in case of a fall. Antistatic characteristics 	<ul style="list-style-type: none"> Shall be of no use if anchor point / life line / lanyard is not properly designed. There should be proper arrangement for rescue After accidental fall & before safety harness becoming effective, the person should not strike ground / object. (Prevent risk of bottoming out) <p>SAFETY BELT NOT TO BE USED</p>		<ul style="list-style-type: none"> Sign of crack / damage/ stitching giving way Webbing and rope for cuts, tears, excessive wear and damages If in doubt "Throw it Out" As per Manufact ures recomme ndations

Guidelines on Personal Protective Equipment (PPE)

SN	Activity (Pictorial Display)	Required PPEs	Quality assurance	Protection Against hazard	Limitation of PPE	Hazard of Not wearing of PPE	When to be discard
	<p>Work at Height (height > 2 M) Contd...</p> <p>CE marking EN Marking Pictogram</p> <p>Capital letter A marking at attachment Element</p>	<p>A Typical specimen of marking.</p> 	<ul style="list-style-type: none"> Marking of major axis strength with gate closed & locked.   <p>Please see required PPE of "Energy absorbing lanyard " for attaching to safety Harness. Energy absorbing lanyard double 'Y' Type</p> <p>To be attached to full body harness at one end and life line at other end</p> <ul style="list-style-type: none"> Must if full body harness being used for protection against fall. The total length of a lanyard connected to an energy absorber (including terminations and connectors) shall not exceed 2 m. 				

Guidelines on Personal Protective Equipment (PPE)

SN	Activity (Pictorial Display)	Required PPEs	Quality assurance	Protection Against hazard	Limitation of PPE	Hazard of Not wearing of PPE	When to be discard
	<p>Work at Height (height > 2 M) - Contd...</p> 	<p>III) Full body Safety Harness with energy absorber (Alternative -II)</p> 	<p>Full body harness conforming to IS 3521 may be allowed in "Green field project" where antistatic safety harness are not required. Following marking to be ensured in case of IS marked full body Harness.</p> <ul style="list-style-type: none"> The name, trade-mark or other means of identification of the manufacturer or the supplier who is responsible for acting on behalf of the manufacturer for claiming compliance with this standard; Manufacturer's product identification information that shall include the manufacturer's batch or serial number that enables the origin of the item to be traced; The year of manufacture; The identity of the fibre used as the material of construction; Information that states by appropriate means the intended purpose of each attachment element and to identify specifically those attachment elements that are designed to be used as part of a complete fall arrest system; and Warning for not to deviate from the manufacturer's instructions. 	<p>Accidental fall</p> <ul style="list-style-type: none"> Direct the loads to legs. Keeping body upright. Prevent the neck damage slightly opens the breathing way. Prevents from colliding with the ground or structure in case of a fall. 	<ul style="list-style-type: none"> Shall of no use if anchor point / life line / lanyard is not properly designed. There should be proper arrangement for rescue After accidental fall & before safety harness becoming effective, the person should not strike ground / object. (Prevent risk of bottoming out) SAFETY BELT NOT TO BE USED ISI marked full body harness are not antistatic hence not recommended in running plants. 		<ul style="list-style-type: none"> Sign of crack / damage/ stitching giving way Webbing and rope for cuts, tears, excessive wear and damages If in doubt "Throw it Out" As per Manufactures recommendations

Name of
Manufacture
and other details

ISI Mark and number


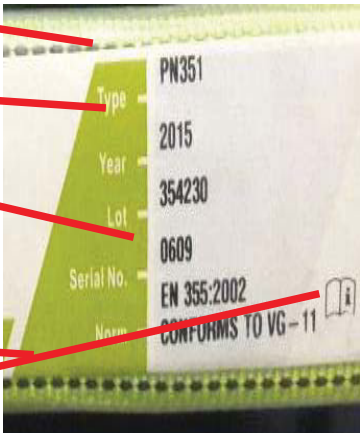


A Typical specimen of marking



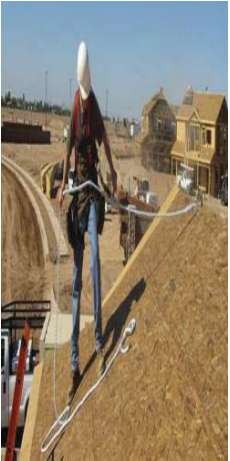

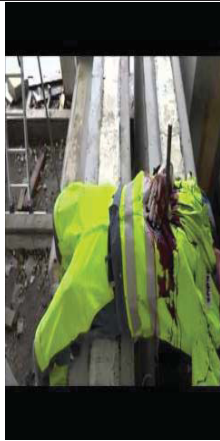

Other details such
year of
manufactures ,
batch number etc

Material used

Guidelines on Personal Protective Equipment (PPE)

SN	Activity (Pictorial Display)	Required PPEs	Quality assurance	Protection Against hazard	Limitation of PPE	Hazard of Not wearing of PPE	When to be discard
	<p>Work at Height (height > 2 M) - Contd...</p>  <p>Model / Type and identification mark</p> <p>Year of manufacturing</p> <p>EN number</p> <p>Maximum length</p> <p>Pictogram</p>	<p>Energy absorbing lanyard double 'Y' Type</p> <p>To be attached to full body harness at one end and life line at other end</p> <ul style="list-style-type: none"> Must if full body harness being used for protection against fall. The total length of a lanyard connected to an energy absorber (including terminations and connectors) shall not exceed 2 m. <p>A Typical specimen of marking</p> 	<p>Energy absorbing lanyard shall conform to EN 355 and shall have the following marking :</p> <p>a) On the energy absorber, a pictogram to indicate that users shall read the information supplied by the manufacturer (see figure);</p>  <p>b) the maximum length allowed of the energy absorber including lanyard;</p> <p>c) the model/ type identification mark of the energy absorber;</p> <p>d) the number of this European Standard, i.e. EN 355.</p> <p>The marking shall conform to EN 365 and additionally shall include the following :</p> <p>a. Means of identification, e.g. manufacturer's name, supplier's name, or trademark;</p> <p>b. Manufacturer's production batch or serial number or other means of traceability;</p> <p>c. Model and type/ identification;</p> <p>d. Number and year of the document to which the equipment conforms;</p> <p>e. Pictogram or other method to indicate the necessity for users to read the instructions for use.</p>	Accidental Fall	<ul style="list-style-type: none"> Shall of no use if anchor point / life line is not properly designed. There should be proper arrangement for rescue After accidental fall & before safety harness becoming effective, the person should not strike ground / object. (Prevent risk of bottoming out) 		<ul style="list-style-type: none"> Sign of cut / damage After every fall. As per manufacturer's recommendation.

Guidelines on Personal Protective Equipment (PPE)




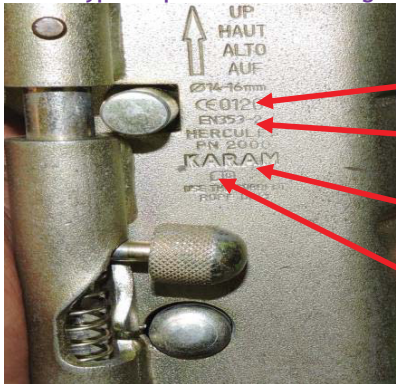

SN	Activity (Pictorial Display)	Required PPEs	Quality assurance	Protection Against hazard	Limitation of PPE	Hazard of Not wearing of PPE	When to be discard
	<p>Work at Height (height > 2 M) - Contd...</p> 	<p>IV) Restraint lanyard</p> <ul style="list-style-type: none"> To be secured to properly designed anchorage The restraint lanyards need not have shock absorption element incorporated in them 	<p>Lanyard shall conform to EN 354 (latest edition). Connector incorporated in lanyard shall conform to EN 362.</p> <p>Marking on the lanyard shall conform to EN 365 and, in addition, shall include at least the following:</p> <p>a) the maximum lanyard length, in accordance with 4.1.6; b) the month and year of manufacture.</p> <p>As per EN 365 marking shall include :</p> <ul style="list-style-type: none"> Means of identification, e.g. manufacturer's name, supplier's name, or trademark; Manufacturer's production batch or serial number or other means of traceability; Model and type/ identification; Number and year of the document to which the equipment conforms; Pictogram or other method to indicate the necessity for users to read the instructions for use. <p>A Typical specimen of marking</p> 	<p>Accidental fall - Lets a worker travel just far enough to reach the edge but not far enough to fall over</p>	<ul style="list-style-type: none"> Shall be of no use if life line & anchor points are not properly designed. To ensure that fall restraint lanyards are never used for the purpose of fall arrest 		<p>Check metal fittings for sharp edges, excessive wear, correct operation and distortion.</p> <ul style="list-style-type: none"> If in doubt "Throw it Out"  <ul style="list-style-type: none"> As per Manufactures recommendations

Name of manufacture

Batch Number, serial Number, Material, Static strength, Pictogram




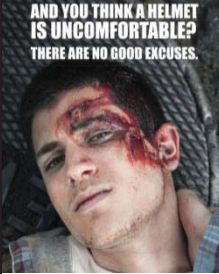
Pictogram

Guidelines on Personal Protective Equipment (PPE)


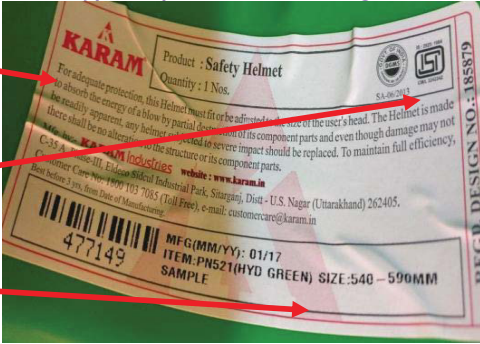

SN	Activity (Pictorial Display)	Required PPEs	Quality assurance	Protection Against hazard	Limitation of PPE	Hazard of Not wearing of PPE	When to be discard
	<p>Work at Height (height > 2 M) - Contd...</p> 	<p>V) Rope Grab (in case of vertical lifeline being used)</p> <p>The rope grab immediately grabs on the line in the event of a fall, thereby arresting the fall</p>   <p>Pictogram</p>	<p>Rope grab shall conform to EN 353-2 : 2002 & Marking on the guided type fall arrester and the flexible anchor line shall conform to EN 365 . In addition shall include the following:</p> <ul style="list-style-type: none"> Means of identification, e.g. manufacturer's name, supplier's name, or trademark; Manufacturer's production batch or serial number or other means of traceability; Model and type/ identification; Number and year of the document to which the equipment conforms; Pictogram or other method to indicate the necessity for users to read the instructions for use. <p>A Typical specimen of marking</p> 	<ul style="list-style-type: none"> Accidental fall The anchorage line in connection with the given rope grab provides necessary shock absorption. 	<p>Shall be of no use if life line & anchor points are not properly designed.</p>		<ul style="list-style-type: none"> Check metal fittings for sharp edges, excessive wear, correct operation and distortion. If in doubt "Throw it Out" Coloured tracer strand which loses its colour in due course of time to show that the rope is now is unfit for future use As per Manufactures recommendations

Note : PPE mentioned at III, IV & V above may not be required simultaneously while working at height. These use shall depend upon type of activity


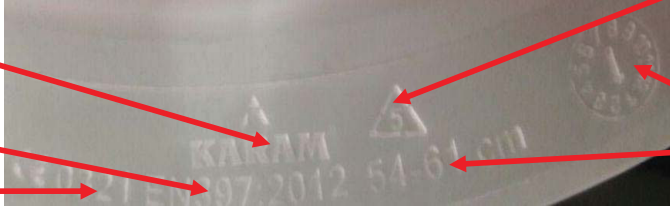


Guidelines on Personal Protective Equipment (PPE)

SN	Activity (Pictorial Display)	Required PPEs	Quality assurance	Protection Against hazard	Limitation of PPE	Hazard of Not wearing of PPE	When to be discard
1	Work at Height (height > 2 M) 	VI) Helmet (A) 	The helmet shall conform to EN 12492 and shall have following markings : a) the number of this European Standard; b) the name or trademark of the manufacturer and/ or his authorized representative; c) the designation of the model; d) the year and quarter of manufacture; e) the size or size range (in cm).	<ul style="list-style-type: none"> Shock absorption Penetration Impact Within limits stipulated in EN 12492	<ul style="list-style-type: none"> The protection given by a helmet depends on the circumstances of the accident and wearing a helmet cannot always prevent death or long term disability. There may be a foreseeable risk that helmets could become trapped and thereby cause a risk of strangulation. Cannot provide protection against hazard like splash of hot liquid, work in hot area, cryogenic or corrosive liquid , flying hot particles like chipping, welding, direct fire hazard, contact with bare live electrical conductor . 	 	<ul style="list-style-type: none"> Sign of crack / damage . De-colouration failing in lab test to be done every 1-2 years depending on condition cradle to be changed after every one year On sustaining a severe blow even if damage is not apparent As per Manufactures recommendations. <div style="border: 1px solid black; padding: 5px; margin-top: 10px;"> For cleaning, maintenance or disinfection, use only substances (No Solvent) that have no adverse effect on the helmet and are not known to be likely to have any adverse effect upon the wearer, when applied in accordance with the manufacturer's instructions and information). </div>




Guidelines on Personal Protective Equipment (PPE)

SN	Activity (Pictorial Display)	Required PPEs	Quality assurance	Protection Against hazard	Limitation of PPE	Hazard of Not wearing of PPE	When to be discard
2	a) Excavation. b) Fire pump Operation. c) Testing of Pressure Gauge	1) Helmet (B) 	<p>The helmet shall conform to either IS 2925 or EN 397</p> <p>a) The helmet conforming to IS 2925 shall have following marking</p> <ul style="list-style-type: none"> Manufacturer's name or trade-mark, Size of helmet. The helmets may also be marked with the ISI Certification Mark. <p>A Typical specimen of marking</p> 	<ul style="list-style-type: none"> Shock Absorption Resistance Penetration Resistance Impact <p>Protection as per EN 397</p> <ul style="list-style-type: none"> Shock absorption Penetration resistance Impact <p>The above protection shall be within the limitations of various test as stipulated in IS 2925 / EN-397.</p> <p>Marking for Optional test as per EN 397 as per clause no 7.2.2.</p> <p>Each helmet shall carry moulded or impressed marking or shall carry a durable self-adhesive label stating the optional requirements complied with, as follows: Optional requirement Marking/ Label</p> <ul style="list-style-type: none"> Very low temperature –20 °C or –30 °C as appropriate Very high temperature + 150 °C Electrical insulation 440 V a.c. Lateral deformation LD Molten metal splash MM 	Not suitable for hazards like splash of hot liquid, work in hot area, cryogenic or corrosive liquid, flying hot particles like chipping, welding, direct fire hazard, contact with bare live electrical conductor		<ul style="list-style-type: none"> Sign of crack / damage . De-colouration cradle to be changed after every one year On sustaining a severe blow even if damage is not apparent As per Manufactures recommendations <div style="border: 1px solid black; padding: 5px; margin-top: 10px;"> <p><i>For cleaning, maintenance or disinfection, use only substances (No Solvent) that have no adverse effect on the helmet and are not known to be likely to have any adverse effect upon the wearer, when applied in accordance with the manufacturer's instructions and information).</i></p> </div>







Guidelines on Personal Protective Equipment (PPE)

SN	Activity (Pictorial Display)	Required PPEs	Quality assurance	Protection Against hazard	Limitation of PPE	Hazard of Not wearing of PPE	When to be discard
2	Contd a) Excavation. b) Fire pump Operation. c) Testing of Pressure Gauge		<p>b) In case helmet conforming to EN 397 to be used to facilitate various attachment for providing protection against hazards like splash of hot liquid, flying hot particles like chipping, welding, direct fire hazard the following moulded or impressed marking to be ensured.</p> <p>a) number of this European Standard ie 397 b) name or identification mark of the manufacturer; c) year and quarter of manufacture; d) type of helmet (manufacturer's designation). This shall be marked on both the shell and the harness; e) size or size range (in centimetres). This shall be marked on both the shell and the harness. f) abbreviation for the material of the shell shall be in accordance with EN ISO 472. (For example, ABS, PC, HDPE, etc.)</p> <p style="text-align: center;">A Typical specimen of marking</p> 	Type of Helmet Year of Manufacture Size			
		<p>II) Safety shoe- (A)</p> 	<ul style="list-style-type: none"> Please refer (I) on page 4 				Please refer (I) on page 4

Guidelines on Personal Protective Equipment (PPE)

SN	Activity (Pictorial Display)	Required PPEs	Quality assurance	Protection Against hazard	Limitation of PPE	Hazard of Not wearing of PPE	When to be discard
3	Excavation work Involving dewatering works : Contd.. 	I) Helmet as per IS and EN (B) 	<ul style="list-style-type: none"> Please refer (I) on page 12 & 13 				Please refer (I) on page 12 & 13.

Guidelines on Personal Protective Equipment (PPE)

SN	Activity (Pictorial Display)	Required PPEs	Quality assurance	Protection Against hazard	Limitation of PPE	Hazard of Not wearing of PPE	When to be discard
3	Excavation work Involving dewatering works : Contd 	II) Gum Boot -Safety   A Typical specimen of marking  	<p>The gum shall conform to IS 12254 and have following marking :</p> <ul style="list-style-type: none"> Name of the manufacturer or its recognised trade-mark, if any; Size No.; Batch No., and Month and year of manufacture. 	<ul style="list-style-type: none"> Striking against stationary object. Striking by moving object Stepping on sharp object Water, alcohols, acids and alkalis 	<ul style="list-style-type: none"> Not suitable for hazards like Chemical burns, electrical flash, welding spark and heat radiation Not suitable if it is necessary to minimise electrostatic charges in the shortest possible time. Not suitable for work in explosive work area. 		<ul style="list-style-type: none"> exceeding one year from the date of first use of the shoe. sign of crack / damage / cut Excessive wear As per Manufactures recommendations





Month and year of manufacture

ISI Mark




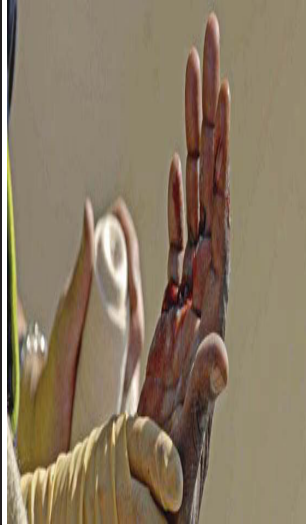
Size

Name of Manufactures




Guidelines on Personal Protective Equipment (PPE)

SN	Activity (Pictorial Display)	Required PPEs	Quality assurance	Typical Industrial Operation	Limitation of PPE	Hazard of Not wearing of PPE	When to be discard
	Excavation work Involving dewatering works : Contd.. 	III) Goggle :  A Typical specimen of marking  CE Marking Optical Class Scratch Resistance Manufacture Name	The goggles shall conform to EN 166 and EN 170 & shall have following markings : <ul style="list-style-type: none"> Marking on the lens as Impact resistance (B) Optical Class (1) , anti fogging (N), Anti Scratch resistance (K), no 2-1.2 marked 2C shade as per EN 170, Manufacture's Name CE and any other point as per discretion of IOCL in line with EN 166 and 170 	<ul style="list-style-type: none"> surround the eye area, give more protection in situations where one encounters splashing liquids, fumes, vapors, powders, dusts, and mists 	Limitation : Uncomfortable to wear with other head gear like helmet, ear muffs or respirator		<ul style="list-style-type: none"> exceeding one year from the date of first use of the goggles . sign of crack / damage . Excessive wear As per Manufactures recommendations

Guidelines on Personal Protective Equipment (PPE)








SN	Activity (Pictorial Display)	Required PPEs	Quality assurance	Protection Against hazard	Limitation of PPE	Hazard of Not wearing of PPE	When to be discard
3	<p>Excavation work Involving dewatering works : Contd..</p>  <p>Name of Manufacture →</p> <p>CE Marking →</p> <p>Size →</p> <p>EN Number and pictograms →</p> <p>EN Pictogram →</p> 	<p>IV) Gloves</p> <p>Alternative - I : Gloves as per EN stand 374 and 388.</p>  <p>A Typical specimen of marking</p>	<p>Gloves shall conform to EN 374 and 388 & gloves shall have the following markings as per as per EN 420</p> <p>a) Name, trade mark or other means of identification of manufacturer or his authorized representative;</p> <p>b) Glove designation (commercial name or code allowing the user to identify clearly the product within the manufacturer's/ authorized representative's range);</p> <p>c) Size designation;</p> <p>d) Date of obsolescence a if applicable per clause 7.2.3</p> <p>e) Pictogram (s) appropriate to the standards accompanied by the reference of the applicable standards and performance levels which shall always be in the same fixed sequence as defined in the corresponding standard</p> <p>Cat -III Certificate to be ensured.</p>	<ul style="list-style-type: none"> • Tear • cut • Abrasion • Puncture 	<p>Not suitable for hazards like electrical flash, welding spark and heat radiation</p>		<ul style="list-style-type: none"> • sign of crack / damage / cut • Excessive wear • IMPORTANT All gloves must be thrown away (in the hazardous waste bin if required) no more than 8 hours after initial contact with the chemical. • Achieving date of obsolescence • As per Manufactures recommendations <div style="border: 1px solid black; padding: 5px; margin-top: 10px;"> <p>WARNING If you work with moving machine parts, choosing a glove that is the right size and made from a less durable material is vital, since the glove easily tears apart if you get caught in the machinery.</p> </div>

Guidelines on Personal Protective Equipment (PPE)




SN	Activity (Pictorial Display)	Required PPEs	Quality assurance	Protection Against hazard	Limitation of PPE	Hazard of Not wearing of PPE	When to be discard
3	Excavation work Involving dewatering works : Contd.. 	Alternative - II Gloves as per IS 6994. 	Alternative -II Alternatively Gloves shall conform to IS : 6994 (Part I) - 1973 & shall have the following marking . a) The manufacturer's name or recognized trade-mark; b) The type and nominal size of the gloves; c) Year of manufacture; and d) Where applicable, the words 'light mass', 'medium mass', or 'heavy mass ' The gloves may also be marked with the Standard Mark. Light Abrasion ix of table 2 Recommended type of Gloves. is 1, 2, 8, 14. 15. 16	<ul style="list-style-type: none"> • Light handling operation • Tear • Puncture • Cut 	Not suitable for hazards like electrical flash, welding spark and heat radiation		<ul style="list-style-type: none"> • sign of crack / damage / cut • Excessive wear • As per Manufactures recommendations <p>IMPORTANT All gloves must be thrown away (in the hazardous waste bin if required) no more than 8 hours after initial contact with the chemical.</p> <div style="border: 1px solid black; padding: 5px; margin-top: 10px;"> <p>WARNING If you work with moving machine parts, choosing a glove that is the right size and made from a less durable material is vital, since the glove easily tears apart if you get caught in the machinery.</p> </div>

As of May 2017 there is no party having BIS license. Use of this product is permitted assuming that in future some party may get BIS license.







Guidelines on Personal Protective Equipment (PPE)

SN	Activity (Pictorial Display)	Required PPEs	Quality assurance	Typical Industrial Operation	Protection Against hazard	Limitation of PPE	Hazard of Not wearing of PPE	When to be discard
4	Blast cleaning - (confined space / external) 	I) Helmet (A) 			Please refer (VI) on page 11			Please refer (VI) on page 11
		II) Safety Shoe 			Please refer (I) on page 4			Please refer (I) on page 4
		III) Goggle 			Please refer (III) on page 16			Please refer (III) on page 16






Guidelines on Personal Protective Equipment (PPE)

	Activity (Pictorial Display)	Required PPEs	Quality assurance	Protection Against hazard	Limitation of PPE	Hazard of Not wearing of PPE	When to be discard																						
4	<div>Blast cleaning - (confined space / external) - Contd</div> <table><thead><tr><th colspan="2">Permissible Noise exposure as per OSHA 29 CFR 1910.95</th></tr><tr><th>DB</th><th>Hours</th></tr></thead><tbody><tr><td>90</td><td>8</td></tr><tr><td>92</td><td>6</td></tr><tr><td>95</td><td>4</td></tr><tr><td>97</td><td>3</td></tr><tr><td>100</td><td>2</td></tr><tr><td>102</td><td>1.5</td></tr><tr><td>105</td><td>1</td></tr><tr><td>110</td><td>0.30</td></tr><tr><td>115</td><td>0.15 or less</td></tr></tbody></table> <div>Name of manufacture</div> <div>CE Marking</div> <div>EN Number</div>	Permissible Noise exposure as per OSHA 29 CFR 1910.95		DB	Hours	90	8	92	6	95	4	97	3	100	2	102	1.5	105	1	110	0.30	115	0.15 or less	<div>IV) Ear Muff of suitable size</div> <div>"Medium size range "fit satisfactorily in majority of Industrial Application</div> <div></div> <div>A Typical specimen of marking</div> <div></div>	<div>Ear muff shall conform to EN 352 shall have following marking :</div> <div>a) the name, trade mark or other identification of the manufacturer or his authorised representative;</div> <div>b) the model designation;</div> <div>c) the number of this EN Standard, i.e "EN 352"</div> <div>d) in the case of ear-muffs intended by the manufacturer to be worn in a particular orientation, an indication of the FRONT and/ or TOP of the cups, and/ or an indication of LEFT and RIGHT cup.</div> <div>Check the NRR (Noise Reduction Rating,) to ensure noise exposure within permissible limits</div>	<div>• Extreme noise</div> <div>• Noise induced hearing losses</div> <div>Note :</div> <div>In addition to hearing loss, excessive noise exposure may contribute to mental and physical stress, certain illnesses, and accidents</div>	<div>• Over 8 hours may be uncomfortable in hot environments .</div> <div>• Eyeglass wearers may not get a good seal Resonate (vibrate) at lower sound frequencies</div>	<div></div>	<div>• Ear muff with cracked, cut, or missing gaskets</div> <div>• Excessive wear & tear</div> <div>• Damage if any.</div> <div>• As per Manufactures recommendations</div>
Permissible Noise exposure as per OSHA 29 CFR 1910.95																													
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90	8																												
92	6																												
95	4																												
97	3																												
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102	1.5																												
105	1																												
110	0.30																												
115	0.15 or less																												




Guidelines on Personal Protective Equipment (PPE)

SN	Activity (Pictorial Display)	Required PPEs	Quality assurance	Protection Against hazard	Limitation of PPE	Hazard of Not wearing of PPE	When to be discard
4	Blast cleaning - (confined space / external) Contd 	V) Gloves Alternative -I Hand gloves - involving high pressure as per EN 388 and 374. 		<ul style="list-style-type: none"> Please refer (IV) on page 17 			Please refer (IV) on page 17.
	Blast cleaning - (confined space / external) Contd 	Alternative -II - Gloves as per IS 6994 		<ul style="list-style-type: none"> Please refer (IV) on page 18 <p>Gross Abrasion sr no. VIII of table 2</p> <p>Recommended type of Gloves. is 2,8</p>			Please refer (IV) on page 18.




Guidelines on Personal Protective Equipment (PPE)

SN	Activity (Pictorial Display)	Required PPEs	Quality assurance	Protection Against hazard	Limitation of PPE	Hazard of Not wearing of PPE	When to be discard
4	Blast cleaning - (confined space / external) - Contd 	VI) Apron Alternative -I : Apron as per EN 13982 -1 	<p>The apron shall conform to EN 13892-1 and shall have following markings :</p> <p>1. The marking shall be clearly visible and as durable as adequate for the life of the clothing.</p> <p>a) name, trademark or other means of identification of the manufacturer; b) manufacturer's type number, identification number or model number; c) type of this chemical protective clothing, i.e. type 5; d) reference number and date of publication of this part of ISO 13982 (i.e. ISO 13982-1:2004); e) year of manufacture and, if appropriate, the expected shelf-life of the clothing (this information may be marked on every commercial packaging unit instead of being marked on every item of clothing); f) size designation as defined in EN 340:2003, Clause 6; g) pictogram showing that the suit is for protection against chemicals [ISO 7000-2414; see Figure 1 a)] and pictogram to show that the manufacturer's instructions should be read [ISO 7000-1641; see Figure 1 b)];</p> <div style="display: flex; justify-content: space-around; align-items: center;"> <div style="text-align: center;">  a) </div> <div style="text-align: center;">  b) </div> </div>	Protection to the full body against airborne solid particulates.	<ul style="list-style-type: none"> Not suitable for flame and Hot material 	Damage / infection to skin etc 	<ul style="list-style-type: none"> exceeding six month from the date of first use of the apron . sign of crack / damage . Excessive wear As per Manufactureres recommendations <div style="border: 1px solid black; padding: 5px; margin-top: 10px;"> <ul style="list-style-type: none"> Do not use compressed air to clean as this will create dust in the air. Clean and decontaminate tarps and other equipment on the worksite. </div>



Guidelines on Personal Protective Equipment (PPE)

SN	Activity (Pictorial Display)	Required PPEs	Quality assurance	Protection Against hazard	Limitati on of PPE	Hazard of Not wearing of PPE	When to be discard
4	<p>Blast cleaning - (confined space / external) : Contd</p> <p>Name of Manufacture</p> <p>Size</p> <p>CE marking</p> <p>Other information</p> <p>Pictograms as per EN</p>	<p>A Typical specimen of marking</p>  <p>Year of manufactures</p>	<p>2.</p>  <p>Type 5 – Protection against airborne solid particulate chemicals (Norm: EN ISO 13982-1)</p> <p>3. Apron / instructions shall have following pictogram indicating the intended purpose . (Table E-2 of EN 340)</p>  <p>Protective clothing (equipment for abrasive blasting operation)</p> <p>ISO 7000-2482</p>				


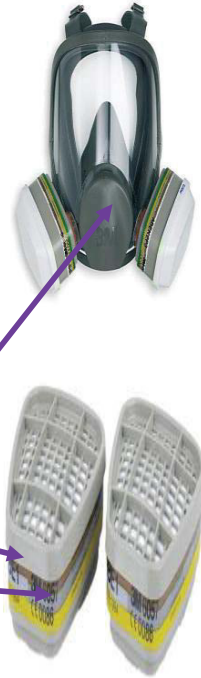

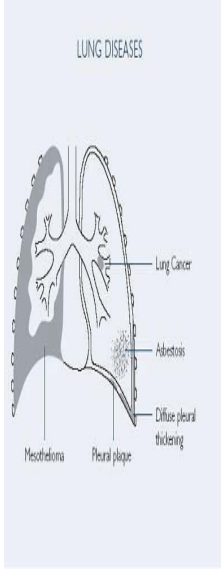
Guidelines on Personal Protective Equipment (PPE)

SN	Activity (Pictorial Display)	Required PPEs	Quality assurance	Protection Against hazard	Limitation of PPE	Hazard of Not wearing of PPE	When to be discard
	Blast cleaning - (confined space / external) Contd 	Alternative -II : Apron as per IS 4501 	Alternative -II : Alternatively suit shall conform to IS : 4501 : 1981 shall have the following marking . The marking shall be clearly visible and as durable as adequate for the life of the clothing. <ul style="list-style-type: none"> marked inside with manufacturer's name or recognized trade mark, if any. The ink shall be non-irritating to skin and shall not impair the quality of aprons. The aprons may also be marked with the ISI Certification Mark. The finished material shall be white or of a suitable colour on two sides as agreed to between the purchaser and the supplier. <div style="border: 1px solid black; padding: 5px; margin-top: 10px;"> As of May 2017 there is no party having BIS license. Use of this product is permitted assuming that in future some party may get BIS license. </div>	Protection to the full body against airborne solid particulates.	<ul style="list-style-type: none"> Not suitable for flame and Hot material 	Damage / infection to skin etc 	<ul style="list-style-type: none"> exceeding six month from the date of first use of the apron . sign of crack / damage . Excessive wear As per Manufactureres recommendations <div style="border: 1px solid black; padding: 5px; margin-top: 10px;"> <ul style="list-style-type: none"> Do not use compressed air to clean as this will create dust in the air. Clean and decontaminate tarps and other equipment on the worksite. </div>










Guidelines on Personal Protective Equipment (PPE)

SN	Activity (Pictorial Display)	Required PPEs	Quality assurance	Protection Against hazard	Limitation of PPE	Hazard of Not wearing of PPE	When to be discard
	Blast cleaning - (confined space / external) Contd	Alternative -III : Boiler suit / coverall 	Alternative -III : Cloth and stitching should be of good quality on visual inspection	Protection to the full body against airborne solid particulates.	<ul style="list-style-type: none"> Not suitable for flame and Hot material 	Damage / infection to skin etc 	<ul style="list-style-type: none"> exceeding six month from the date of first use of the apron . sign of crack / damage . Excessive wear As per Manufactures recommendations <div style="border: 1px solid black; padding: 5px; margin-top: 10px;"> <ul style="list-style-type: none"> Do not use compressed air to clean as this will create dust in the air. </div> <div style="border: 1px solid black; padding: 5px; margin-top: 10px;"> <ul style="list-style-type: none"> Avoid blasting in windy conditions to prevent the spread of any hazardous materials. </div>






Guidelines on Personal Protective Equipment (PPE)

SN	Activity (Pictorial Display)	Required PPEs	Quality assurance	Protection Against hazard	Limitation of PPE	Hazard of Not wearing of PPE	When to be discard
	<p>Blast cleaning - confined space - Contd</p>  <p>Name of Manufactures</p> <p>EN Number</p> <p>CE Marking</p>	<p>VII) Half face mask</p> <p>A Typical specimen of marking</p> 	<p>1. The half air mask shall conform to EN 140 and shall have following :</p> <ol style="list-style-type: none"> The manufacturer shall be identified by name, trade mark or other means of identification. All units of the same model shall be provided with a type-identifying marking. Size (if more than one size is available). The number and the year of this European Standard. ie EN 140 Where the reliable performance of components may be affected by ageing, means of identifying the date (at least the year) of manufacture shall be given <p>Parts which are designed to be replaced by the authorized user and sub-assemblies with considerable bearing on safety shall be readily identifiable.</p> <p>For parts which cannot reasonably be marked e.g. straps of head harness, the relevant information shall be included in the information supplied by the manufacturer.</p> <p>The end of shelf life may be indicated on packing eg e.g. by the following pictogram.</p>  <p style="text-align: center;">Code for dates</p> <p style="text-align: center;">xx/xx</p> <p style="text-align: center;">Month Year</p>	<p>Respiratory protection.</p> <p>Protection against inhaling dust, etc.</p>	<p>Not suitable for heavy gas concentration</p>	<p>Silicosis Occupational lung diseases.</p> <p>Deposition of particulate matter in Lung.</p> 	<ul style="list-style-type: none"> Sign of crack / damage Excessive wear Damage of strap After end of shelf life Change of filter / cartridges at least every six month Performance of the components may be affected by aging As per Manufactures recommendations <div style="border: 1px solid black; padding: 5px; margin-top: 10px;"> <p>Cleaning Always clean the half-mask after use. First remove the filter and remove dust with compressed air. Use a cloth to remove any stubborn deposits. If necessary, dismantle the parts and rinse in warm water with a small quantity of mild detergent. Never use solvents. The inhale and exhale valves should be removed and cleaned thoroughly .</p> </div>





Guidelines on Personal Protective Equipment (PPE)

SN	Activity (Pictorial Display)	Required PPEs	Quality assurance	Protection Against hazard	Limitation of PPE	Hazard of Not wearing of PPE	When to be discard
5	Painting - confined space / external 	I) Helmet (A) 	<ul style="list-style-type: none"> Please refer (VI) on page 11 				Please refer (VI) on page 11
		II) Safety Shoe 	<ul style="list-style-type: none"> Please refer (I) on page 4 				Please refer (I) on page 4
		III) Goggles 	<ul style="list-style-type: none"> Please refer (III) on page 16 				Please refer (III) on page 16



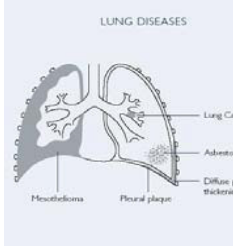
Guidelines on Personal Protective Equipment (PPE)

SN	Activity (Pictorial Display)	Required PPEs	Quality assurance	Protection Against hazard	Limitation of PPE	Hazard of Not wearing of PPE	When to be discard
5	Painting -(confined space / external) : Contd 	VI) Gloves Alternative -I Hand gloves - involving high pressure as per EN 388 and 374 					Please refer (IV) on page 17
		Alternative -II - Gloves as per IS 6994 	• Please refer (IV) on page 18 Spraying paints or cellulose lacquers sr no. XIV of table 2 : Recommended type of Gloves. is 1,8				Please refer (IV) on page 18





Guidelines on Personal Protective Equipment (PPE)

SN	Activity (Pictorial Display)	Required PPEs	Quality assurance	Protection Against hazard	Limitation of PPE	Hazard of Not wearing of PPE	When to be discard
	Painting -(confined space / external) : Contd	<p>V) Apron :Alternative -I Apron as per EN 13982</p> 					Please refer (VI) on page 22 and 23
		<p>Alternative -II Apron as per IS 4501</p> 					Please refer (VI) on page 24





Guidelines on Personal Protective Equipment (PPE)

SN	Activity (Pictorial Display)	Required PPEs	Quality assurance	Protection Against hazard	Limitation of PPE	Hazard of Not wearing of PPE	When to be discard
	Painting -(confined space / external 	VI) Half face mask 		• Please refer (VII) on page 26			Please refer (VII) on page 26







Guidelines on Personal Protective Equipment (PPE)

	Activity (Pictorial Display)	Required PPEs	Quality assurance	Protection Against hazard	Limitation of PPE	Hazard of Not wearing of PPE	When to be discard
6	a) Working in Confined space b) Testing of Gas sensor c) Tank Gauging d) De Gassing of LPG Cylinder e) Shuttering works	I) Safety Helmet (B) 	<ul style="list-style-type: none"> Please refer (I) on page 12 & 13 				Please refer (I) on page 12 & 13
	f) Brick masonry g) Handling of Battery	II) Safety Shoe (A) 					Please refer (I) on page 4




Guidelines on Personal Protective Equipment (PPE)

	Activity (Pictorial Display)	Required PPEs	Quality assurance	Protection Against hazard	Limitation of PPE	Hazard of Not wearing of PPE	When to be discard
6	Contd.. a) Working in Confined space b) Testing of Gas sensor c) Tank Gauging d) De Gassing of LPG Cylinder e) Shuttering works f) Brick masonry g) Handling of Battery	III) Gloves Alternative -I : Hand gloves - involving high pressure as per EN 388 and 374 	Please refer (IV) on page 17				Please refer (IV) on page 17
		Alternative -II Gloves as per IS 6994 	Please refer (IV) on page 18 Light Abrasion ix of table 2 Recommended type of Gloves. is 1, 2, 8, 14. 15. 16				Please refer (IV) on page 18




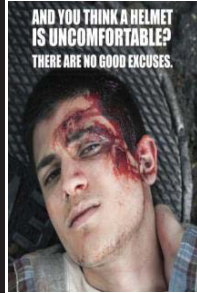
Guidelines on Personal Protective Equipment (PPE)

SN	Activity (Pictorial Display)	Required PPEs	Quality assurance	Protection Against hazard	Limitation of PPE	Hazard of Not wearing of PPE	When to be discard
7	a) Road work b) Reinforcement c) Concreting	I) Helmet (B) 	• Please refer (I) on page 12 & 13				Please refer (I) on page 12 & 13
		II) Gum Boot 	• Please refer (II) on page 15				Please refer (II) on page 15
		III) Goggles 	• Please refer (III) on page 16				Please refer (III) on page 16






Guidelines on Personal Protective Equipment (PPE)

	Activity (Pictorial Display)	Required PPEs	Quality assurance	Protection Against hazard	Limitation of PPE	Hazard of Not wearing of PPE	When to be discard
7	Contd.. a) Road work b) Reinforcement c) Concreting	VI) Gloves Alternative -I : Hand gloves - involving high pressure as per EN 388 and 374 	Please refer (IV) on page 17				
		Alternative II as per IS 6994 	Please refer (IV) on page 18 Light Abrasion ix of table 2 Recommended type of Gloves. is 1, 2, 8, 14. 15. 16				





Guidelines on Personal Protective Equipment (PPE)

N	Activity (Pictorial Display)	Required PPEs	Quality assurance	Protection Against hazard	Limitation of PPE	Hazard of Not wearing of PPE	When to be discard
8	a) Grass Cutting b) Blinding and de- blinding flange work	I) Gum Boot 	• Please refer (II) on page 15				Please refer (II) on page 15
		II) Helment (B) 	• Please refer (I) on page 12 & 13				Please refer (I) on page 12 & 13




Guidelines on Personal Protective Equipment (PPE)

SN	Activity (Pictorial Display)	Required PPEs	Quality assurance	Protection Against hazard	Limitation of PPE	Hazard of Not wearing of PPE	When to be discard
9	<p>Electrical works</p> <p>Electrical sub-station current carrying equipment</p> 	<p>II) Safety Shoe (B)</p>  <p>A Typical specimen of marking</p>  	<p>The safety shoe shall have following marking as per IS 15298 (part -2) :</p> <p>a) size; b) manufacturer's identification mark; c) Year of manufacture and at least quarter; d) License No (CM L) e) IS Mark</p> <p>Category of Safety shoe (,S3 etc) as required as per Table 16 of IS 15298 (part 2) : 2011</p> <p><i>The sole shall be regulated to high voltage test upto 15 KV voltage applied across the sole for 1 min. Necessary test certificate for this test from FDI/NABL accredited party to be furnished .</i></p>	<ul style="list-style-type: none"> Striking against stationary object . Striking by moving object Electrical resistance 	<ul style="list-style-type: none"> Not suitable for work in explosive work area. Or Work activities requiring antistatic work 		<ul style="list-style-type: none"> Exceeding one year from the date of first use of the shoe . Sign of crack / damage Excessive wear As per Manufactureres recommendations








Guidelines on Personal Protective Equipment (PPE)

SN	Activity (Pictorial Display)	Required PPEs	Quality assurance	Protection Against hazard	Limitation of PPE	Hazard of Not wearing of PPE	When to be discard
9	Electrical works : Electrical sub-station current carrying equipment Contd 	II) Electrical Hand gloves Insulating Rubber Electrical Gloves 	<p>The gloves shall be marked indelibly at the back with the following information as per IS 4770</p> <ul style="list-style-type: none"> Size and type of glove; Maximum working potential in Volts; followed by the word 'working' in brackets; Identification of the source of manufacture; and Month and year of manufacture <p>moisture absorption certificate to be checked.</p> <p>A Typical specimen of marking</p>  <p>Labels with arrows pointing to the label:</p> <ul style="list-style-type: none"> Manufacture Name (points to 'Crystal') Test Potential (points to '11,000 VOLTS') Maximum working potential (points to '1,100 VOLTS') Size (points to 'SIZE: 356 (ML/IT)') <p>Type -1 Gloves not to used</p>	<p>Type 2—For use at voltage not exceeding 1 100 ac rms</p> <p>Type 3—For use at voltage not exceeding 7 500 ac rms</p> <p>Type 4—For use at voltage not exceeding 17 000 ac rms.</p>	<p>1) Type of the PPE restricts the maximum voltage at which it can be used</p> <p>2) Other precautions to be taken while working on electrical installation</p>		<ul style="list-style-type: none"> Frequently used Gloves to be re-tested at intervals of not more than 6 months. Gloves issued for occasional use shall be re-tested after use or in any case at intervals of not more than 12 months. Gloves Showing any defects As per Manufactures recommendati ons





Guidelines on Personal Protective Equipment (PPE)

SN	Activity (Pictorial Display)	Required PPEs	Quality assurance	Protection Against hazard	Limitation of PPE	Hazard of Not wearing of PPE	When to be discard
9	<p>Electrical works : Electrical sub- station current carrying equipment Contd</p> 	<p>Helmet as per EN 397</p> 	<ul style="list-style-type: none"> Please refer (I) on page 12 & 13 				<p>Please refer (I) on page 12 and 13</p>




Guidelines on Personal Protective Equipment (PPE)

SN	Activity (Pictorial Display)	Required PPEs	Quality assurance	Protection Against hazard	Limitation of PPE	Hazard of Not wearing of PPE	When to be discard
10	<p>Working with possibility of splashes of hot, cryogenic or corrosive liquids</p> 	<p>I) Helmet (B) as per EN 397</p> 	<ul style="list-style-type: none"> Please refer (I) on page 12 and 13 				<p>Please refer (I) on page 12 and 13</p>
		<p>II) Safety Shoe</p> 	<ul style="list-style-type: none"> Please refer (I) on page 4 				<p>Please refer (I) on page 4</p>
		<p>III) Goggles</p> 	<ul style="list-style-type: none"> Please refer (III) on page 16 				<p>Please refer (III) on page 16</p>






Guidelines on Personal Protective Equipment (PPE)

	Activity (Pictorial Display)	Required PPEs	Quality assurance	Protection Against hazard	Limitation of PPE	Hazard of Not wearing of PPE	When to be discard
10	Working with possibility of splashes of hot, cryogenic or corrosive liquids. Contd 	IV) Gloves Alternative - I : Hand gloves - involving high pressure as per EN 388 and 374 	• Please refer (IV) on page 17				Please refer (IV) on page 17
		Alternative - II Gloves as per IS 6994. 					• Please refer (IV) on page 18 Light Abrasion ix of table 2 Recommended type of Gloves. is 1, 2, 8, 14. 15. 16






Guidelines on Personal Protective Equipment (PPE)

SN	Activity (Pictorial Display)	Required PPEs	Quality assurance	Protection Against hazard	Limitation of PPE	Hazard of Not wearing of PPE	When to be discard
	Working with possibility of splashes of hot, cryogenic or corrosive liquids Contd	V) Apron Alternative -I Apron as per EN 13982 	Please refer (VI) on page 22 &23				Please refer (VI) on page 22 &23
		Alternative -II Apron as per IS 4501 	Please refer (VI) on page 24				Please refer (VI) on page 24



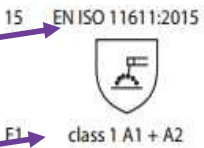


Guidelines on Personal Protective Equipment (PPE)

SN	Activity (Pictorial Display)	Required PPEs	Quality assurance	Protection Against hazard	Limitation of PPE	Hazard of Not wearing of PPE	When to be discard
11	Welding and cutting work 	<p>I) Helmet attachable welding shield (A)</p>  <p>II) Welding Helmet with welding Shield (B)</p>  <p>Name of Manufacture → CE Mark and EN Mark →</p> <div style="border: 1px solid red; padding: 2px; display: inline-block;">Name of Manufacture EN166 FT</div> 	<p>a) Helmet mountable welding shield.</p> <ul style="list-style-type: none"> Conforms to EN 175 Protective lens made of clear high impact resistant. polycarbonate conforming to EN 166 and ANSI Z 87.1 polypropylene Impact Resistance Shell conform to EN 175 F The welding shield shall be CE marked Marking on protective shall be fully visible Ocular marking shall be as per clause 9.2 of EN 166 <p>b) Welding Helmet with welding Shield</p> <ul style="list-style-type: none"> Protective lens made of clear high impact resistant. polycarbonate conforming to EN 166 and ANSI Z 87.1 polypropylene Impact Resistance Shell conform to EN 175 F Marking on protective shall be fully visible Ocular marking shall be as per clause 9.2 of EN 166 	<p>Protection during welding.</p> <p>Liftable welding lens allows clear view while restricting harmful dust particles.</p>	<p>To be used only in conjunction with safety helmet & should not be used independently.</p> <p>However welding helmets can be used independently.</p>		<ul style="list-style-type: none"> Exceeding one year from the date of first use of the goggles. sign of crack / damage on lenses Excessive wear As per Manufact ures recomme ndations






Guidelines on Personal Protective Equipment (PPE)

	Activity (Pictorial Display)	Required PPEs	Quality assurance	Protection Against hazard	Limitation of PPE	Hazard of Not wearing of PPE	When to be discard
11	Welding and cutting work : Contd 	II) Safety Shoe 	Please refer (I) on page 4				Please refer (I) on page 4
		Helmet as per EN 397 (in case Helmet attachable welding shield being used) 	• Please refer (I) on page 12 & 13				Please refer (I) on page 12 and 13




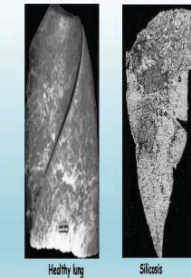
Guidelines on Personal Protective Equipment (PPE)

SN	Activity (Pictorial Display)	Required PPEs	Quality assurance	Protection Against hazard	Limitation of PPE	Hazard of Not wearing of PPE	When to be discard
11	Welding and cutting work Contd. 	III) Apron  <p>A Typical specimen of marking</p> 	<ul style="list-style-type: none"> Apron shall conform to EN ISO 11611 & shall have the following markings : <ul style="list-style-type: none"> classification: : <ul style="list-style-type: none"> Class 1: the number and year of this International Standard (ISO 11611) followed by the graphical symbol shown in below and the indication "Class 1" and the indication "A1" or "A1 + A2" as appropriate for Limited Flame Spread; Class 2: the number and year of this International Standard (ISO 11611) followed by the graphical symbol shown in Figure 1 and the indication "Class 2" and the indication "A1" or "A1 + A2" as appropriate; garments conforming to Class 2 shall meet Class 2 for all performance requirements; instructions for cleaning shall be marked (e.g. on a label). 	<ul style="list-style-type: none"> minimize skin burns caused by sparks, spatter, or radiation 	<ul style="list-style-type: none"> Additional electrical insulation layers will be required where there is an increased risk of electric shock; garments meeting the requirements of clause of en ISO 11611 (6.10) are designed to provide protection against short term, accidental contact with live electric conductors at voltages up to approximately 100 V d.c. any identified hazards against which the clothing is intended to protect (e.g. flames, molten metal spatter, radiant heat, and short term accidental electrical contact); for protective clothing, a warning that additional partial body protection may be required, e.g. for welding overhead; 		<ul style="list-style-type: none"> On contaminated with flammable material. Manufacturers shall include the information that welder's protective clothing be cleaned regularly in accordance with the manufacturer's recommendations. After cleaning, the clothing shall be visually inspected for any sign of damage. Similarly, users should be advised that if they experience sunburn-like symptoms, UVB is penetrating. In either case, the garment should be repaired (if practicable) or replaced and consideration given to the use of additional, more resistant, protective layers in future. As per Manufactures recommendations





Guidelines on Personal Protective Equipment (PPE)

SN	Activity (Pictorial Display)	Required PPEs	Quality assurance	Protection Against hazard	Limitation of PPE	Hazard of Not wearing of PPE	When to be discard
12	Tank cleaning 	I) Helmet (B) 	Please refer (I) on page 12 & 13				Please refer (I) on page 12 & 13
		II) Gum Boot 	Please refer (II) on page 15				Please refer (II) on page 15

Guidelines on Personal Protective Equipment (PPE)

SN	Activity (Pictorial Display)	Required PPEs	Quality assurance	Protection Against hazard	Limitation of PPE	Hazard of Not wearing of PPE	When to be discard
12	Tank cleaning Contd. 	III) Apron Alternative -I Apron as per EN 13982  Alternative -II Apron as per IS 4501 		<ul style="list-style-type: none"> Please refer (VI) on page 22-23 & 24 			Please refer (VI) on page 22-23 & 24

Guidelines on Personal Protective Equipment (PPE)

SN	Activity (Pictorial Display)	Required PPEs	Quality assurance	Protection Against hazard	Limitation of PPE	Hazard of Not wearing of PPE	When to be discard
12	Tank cleaning : Contd 	IV) Gloves Alternative -I : Hand gloves - involving high pressure as per EN 388 and 374 	<ul style="list-style-type: none"> Please refer (IV) on page 17 				Please refer (IV) on page 17
		Alternative - II Gloves as per IS 6994. 					Please refer (IV) on page 18





Light Abrasion ix of table 2

Recommended type of Gloves. is 1, 2, 8, 14. 15. 16



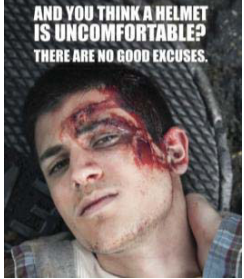






Guidelines on Personal Protective Equipment (PPE)

SN	Activity (Pictorial Display)	Required PPEs	Quality assurance	Protection Against hazard	Limitation of PPE	Hazard of Not wearing of PPE	When to be discard
13		I) Helmet (B)	<ul style="list-style-type: none"> Please refer (I) on page 12 & 13 				Please refer (I) on page 12 & 13
		II) Safety Shoe					
		III) Goggles					

Guidelines on Personal Protective Equipment (PPE)

SN	Activity (Pictorial Display)	Required PPEs	Quality assurance	Protection Against hazard	Limitation of PPE	Hazard of Not wearing of PPE	When to be discard
13	Product pump house operation Contd 	IV) Gloves :Alternative -I : Hand gloves - involving high pressure as per EN 388 and 374 	• Please refer (IV) on page 17				Please refer (IV) on page 17 & 18
		Alternative - II Gloves as per IS 6994. 					

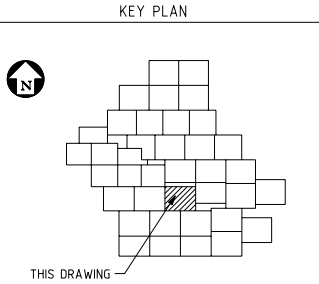
Guidelines on Personal Protective Equipment (PPE)

SN	Activity (Pictorial Display)	Required PPEs	Quality assurance	Protection Against hazard	Limitation of PPE	Hazard of Not wearing of PPE	When to be discard
14	DG Operation : 	I) Helmet (B) 	• Please refer (I) on page 12 & 13				Please refer (I) on page 12 & 13
		II) Safety Shoe (B) 	• Please refer (II) on page 36				Please refer (II) on page 36
		III) Ear Muff 	• Please refer (IV) on page 20				Please refer (IV) on page 20
		IV) Electrical Gloves 	• Please refer (II) on page 37				Please refer (IV) on page 37



DRAWING LIMIT N. -2914.000

THIS DRG. COVERS THE CONSTRUCTION DETS. OF ROADS, PAVING & U/G SERVICES EXCEPT FOR STORM WATER SYSTEM. THE STORM WATER SYSTEM SHOWN IN THIS DRG. IS INDICATIVE ONLY.



NOTES

1. PLANT ELEVATION 100.00 IS EQUAL TO 4.06 METRES ABOVE INDIAN MEAN SEA LEVEL (IMSL).
2. FOR DRAINAGE AND MATERIAL WORKMANSHIP REFER TO PROJECT SPECIFICATION PDRP-8310-SP-0019.
3. FOR ELECTRICAL & INSTRUMENTATION TRENCHES, INTERFACE POINTS, LOCATION REFER DRAWING NO. PDRP0275-8310-45-600-0001 TO 0038
4. PAVING AND U/G SERVICES GENERATE NOTES AND LEGENDS Ref. DWG NO. PDRP0275-8310-45-0001

HOLD LIST EXCEPT FOR SERVICES LISTED IN OTHER "HOLD LIST" TABLE IF ANY		
No.	ACTION BY	DESCRIPTION
NIL		

REFERENCE DRAWINGS

DRAWING No.	TITLE
PDRP4200-8230-01-600-0001	OVERALL SITE PLAN
PDRP0275-8310-02-600-8006	O&U OVERALL PAVING & U/G SERVICES SCHEMATICS KEY PLAN
PDRP4200-8230-01-600-0004	S-E SITE PLAN
PDRP4200-8230-01-600-0005	S-W SITE PLAN

ENGINEER'S APPROVAL					APPROVED FOR CONST.		
REV	DATE	SIGNATURE	OE*	AE*	REV	DATE	SIGNATURE

REV	DATE	DESCRIPTION	BY	CHKD	APPD
S3	29.03.12	MANHOLES MODEL NOS. REVISED AND ISSUED FOR CONSTRUCTION	YVM	SR	PVS
S2	05.03.12	O&U SYSTEM ADDED	MRL	SGN	PVS/SGN
S1	21.02.12	ISSUED FOR CONSTRUCTION	NVP/KRA	VVG/SGG	SDP

PARADIP REFINERY PROJECT-LSTK PACKAGE-C
Paradip, Orissa State, India

INDIAN OIL CORPORATION LIMITED

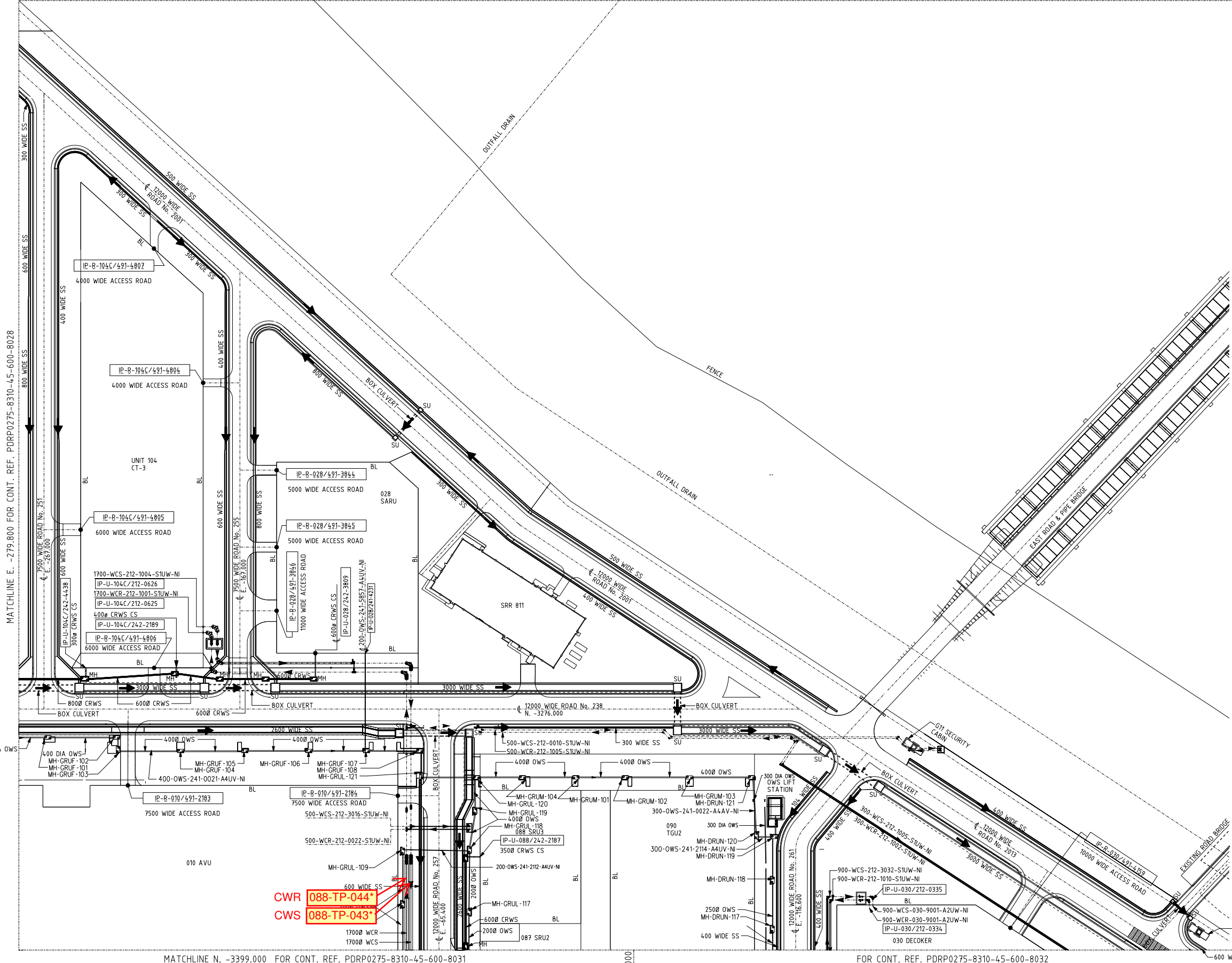
LSTK: **JSC OGCC KSS ALMATY**

TR/DR: **KES KAZSTROY ENGINEERING INDIA JACOBS JACOBS ENGINEERING INDIA PVT. LTD.**

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TITLE:
O&U - OVERALL ROADS, PAVING & U/G SERVICES SCHEMATICS

SCALE: DRAWING NO: 1:1,000	PDRP0275-8310-45-600-8029	SHT NO: =	REV: S3
CONTRACT NO: 1-14-4200/0275		CLASS: =	DSN: =



MATCHLINE N. -3399.000 FOR CONT. REF. PDRP0275-8310-45-600-8031

FOR CONT. REF. PDRP0275-8310-45-600-8032

FOR CONT. REF. PDRP0275-8310-45-600-8017

N. -3248.750

DRAWING LIMIT E. 340.200

* - INDICATIVE LOCATION OF TIE-IN POINT FROM UNDERGROUND HEADERS FOR CWS & CWR. SUCCESSFUL BIDDER TO STUDY AT SITE AND SUITABLY TAKE THE TAPPING DURING PROJECT EXECUTION

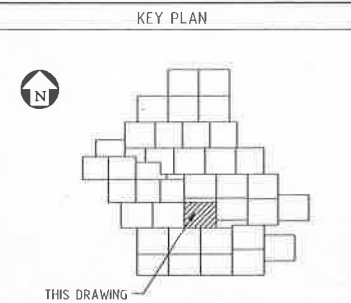


SCALE 1:1000



DRAWING LIMIT N. -2914.000

THIS DRG. COVERS THE CONSTRUCTION DETS. OF ROADS, PAVING & U/G SERVICES EXCEPT FOR STORM WATER SYSTEM. THE STORM WATER SYSTEM SHOWN IN THIS DRG. IS INDICATIVE ONLY.



- NOTES
1. PLANT ELEVATION 100.00 IS EQUAL TO 4.06 METRES ABOVE INDIAN MEAN SEA LEVEL (IMSL).
 2. FOR DRAINAGE AND MATERIAL WORKMANSHIP REFER TO PROJECT SPECIFICATION PDRP-8310-SP-0019.
 3. FOR ELECTRICAL & INSTRUMENTATION TRENCHES, INTERFACE POINTS, LOCATION REFER DRAWING NO. PDRP0275-8310-45-600-0001 TO 0038.
 4. PAVING AND U/G SERVICES GENERAL NOTES AND LEGENDS Ref. DWG NO. PDRP0275-8310-45-0001.

HOLD LIST EXCEPT FOR SERVICES LISTED IN OTHER 'HOLD LIST' TABLE IF ANY		
No.	ACTION BY	DESCRIPTION
		NIL

REFERENCE DRAWINGS	
DRAWING No.	TITLE
PDRP4200-8230-01-600-0001	OVERALL SITE PLAN
PDRP0275-8310-02-600-8006	O&U OVERALL PAVING & U/G SERVICES SCHEMATICS KEYPLAN
PDRP4200-8230-01-600-0004	S-E SITE PLAN
PDRP4200-8230-01-600-0005	S-W SITE PLAN

ENGINEER'S APPROVAL					APPROVED FOR CONST		
REV	DATE	SIGNATURE	OE	AE	REV	DATE	SIGNATURE

S3	29.03.12	HARRICES MODEL NOS. REVISED AND ISSUED FOR CONSTRUCTION	YVM	SR	PVS
S2	05.03.12	OWS SYSTEM ADDED ISSUED FOR CONSTRUCTION	BNL	SGN	PVS/SGN
S1	21.02.12	ISSUED FOR CONSTRUCTION	WVZ/KRA/VYG/SGN	SDP	

PARADIP REFINERY PROJECT-LSTK PACKAGE-C
Paradip, Orissa State, India

INDIAN OIL CORPORATION LIMITED

JSC OGCE KSS ALMATY

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TITLE:
O&U - OVERALL ROADS, PAVING & U/G SERVICES SCHEMATICS

SCALE:	DRAWING NO:	SHT NO:	REV:
1:1000	PDRP0275-8310-45-600-8032		S3
CONTRACT NO:	1-14-4200/0275	CLASS:	DSN:

MATCHLINE E. -279.800 FOR CONT. REF. PDRP0275-8310-45-600-8028

MATCHLINE N. -3399.000 FOR CONT. REF. PDRP0275-8310-45-600-8031

FOR CONT. REF. PDRP0275-8310-45-600-8032

FOR CONT. REF. PDRP0275-8310-45-600-8017

N. -3248.750

DRAWING LIMIT E. 340.200



SCALE 1:1000

Tie In Point wise Summary

Note:-

1- NAC6= NACE + HIC

2- PIPE QTY IN METRES AND OTHERS IN NUMBERS.

3- GALVNISATION AS PER ASTM A153

4- NUTS SHALL BE HEAVY HEXAGONAL

S No.	SERVICE	UNIT	LINE NO	ITEM DESCRIPTION	DIA1	DIA2	QTY
1	AI	212	TP-020	PIPE, B-36.10, ASTM A 106 GR.B, BE, SEAMLESS, 3.0 INCH, STD	3	0	2.5
2	AI	212	TP-020	FLNG.WN, B-16.5, ASTM A 105 (NORMALISED), 150, RF/125AARH, 3.0 INCH, STD	3	0	1
4	AI	212	TP-020	FLNG.BLIND, B-16.5, ASTM A 105 N (GALV.), 150, FF/125AARH, 3.0 INCH	3	0	1
5	AI	212	TP-020	FLNG.FIG.8, ASME-B16.48, ASTM A 516N Gr.70 (GALV.), 150, FF/125AARH, 3.0 INCH	3	0	1
6	AI	212	TP-020	T.RED, B-16.9, ASTM A 234 GR.WPB, BW, 4.0 INCH, STD, 3.0 INCH, STD	4	3	1
7	AI	212	TP-020	VLV.GATE, SHEET 513FE, 3.0 INCH	3	0	1
8	AI	212	TP-020	BOLT.STUD WITH 2 NUTS, B-18.2, A193 GR.B7(GALV), A194 2H(GALV), 0.625 INCH X 4.0 INCH	0.625	4	4
9	AI	212	TP-020	BOLT.STUD WITH 2 NUTS, B-18.2, A193 GR.B7(GALV), A194 2H(GALV), 0.625 INCH X 3.75 INCH	0.625	0	4
10	AI	212	TP-020	GASKET, B-16.21-ANSI B16.5, NONASB. SYN FIBRE+ RUBR BINDER, FULLFACE, 150, 3.0 INCH, 2 MM	3	0	3
11	AI	212	TP-034	PIPE, B-36.10, ASTM A 106 GR.B, BE, SEAMLESS, 4.0 INCH, STD	4	0	2.5
12	AI	212	TP-034	FLNG.WN, B-16.5, ASTM A 105 (NORMALISED), 150, RF/125AARH, 4.0 INCH, STD	4	0	1
14	AI	212	TP-034	FLNG.BLIND, B-16.5, ASTM A 105 N (GALV.), 150, FF/125AARH, 4.0 INCH	4	0	1
15	AI	212	TP-034	FLNG.FIG.8, ASME-B16.48, ASTM A 516N Gr.70 (GALV.), 150, FF/125AARH, 4.0 INCH	4	0	1
16	AI	212	TP-034	T.EQUAL, B-16.9, ASTM A 234 GR.WPB, BW, 4.0 INCH, STD	4	0	1
17	AI	212	TP-034	VLV.GATE, SHEET 513FE, 4.0 INCH	4	0	1
18	AI	212	TP-034	BOLT.STUD WITH 2 NUTS, B-18.2, A193 GR.B7(GALV), A194 2H(GALV), 0.625 INCH X 4.25 INCH	0.625	0	8
19	AI	212	TP-034	BOLT.STUD WITH 2 NUTS, B-18.2, A193 GR.B7(GALV), A194 2H(GALV), 0.625 INCH X 3.75 INCH	0.625	0	8
20	AI	212	TP-034	GASKET, B-16.21-ANSI B16.5, NONASB. SYN FIBRE+ RUBR BINDER, FULLFACE, 150, 4.0 INCH, 2 MM	4	0	3
21	AP	212	TP-011	PIPE, B-36.10, ASTM A 106 GR.B, BE, SEAMLESS, 2.0 INCH, XS	2	0	2.5
22	AP	212	TP-011	FLNG.WN, B-16.5, ASTM A 105 (NORMALISED), 150, RF/125AARH, 2.0 INCH, XS	2	0	1
24	AP	212	TP-011	FLNG.BLIND, B-16.5, ASTM A 105 N (GALV.), 150, FF/125AARH, 2.0 INCH	2	0	1
25	AP	212	TP-011	FLNG.FIG.8, ASME-B16.48, ASTM A 516N Gr.70 (GALV.), 150, FF/125AARH, 2.0 INCH	2	0	1
26	AP	212	TP-011	VLV.GATE, SHEET 513FE, 2.0 INCH	2	0	1
27	AP	212	TP-011	BOLT.STUD WITH 2 NUTS, B-18.2, A193 GR.B7(GALV), A194 2H(GALV), 0.625 INCH X 3.75 INCH	0.625	0	4
28	AP	212	TP-011	BOLT.STUD WITH 2 NUTS, B-18.2, A193 GR.B7(GALV), A194 2H(GALV), 0.625 INCH X 3.25 INCH	0.625	3.25	4
29	AP	212	TP-011	GASKET, B-16.21-ANSI B16.5, NONASB. SYN FIBRE+ RUBR BINDER, FULLFACE, 150, 2.0 INCH, 2 MM	2	0	3
30	AP	212	TP-028	PIPE, B-36.10, ASTM A 106 GR.B, BE, SEAMLESS, 2.0 INCH, XS	2	0	2.5
31	AP	212	TP-028	FLNG.WN, B-16.5, ASTM A 105 (NORMALISED), 150, RF/125AARH, 2.0 INCH, XS	2	0	1
33	AP	212	TP-028	FLNG.BLIND, B-16.5, ASTM A 105 N (GALV.), 150, FF/125AARH, 2.0 INCH	2	0	1
34	AP	212	TP-028	FLNG.FIG.8, ASME-B16.48, ASTM A 516N Gr.70 (GALV.), 150, FF/125AARH, 2.0 INCH	2	0	1
35	AP	212	TP-028	VLV.GATE, SHEET 513FE, 2.0 INCH	2	0	1
36	AP	212	TP-028	BOLT.STUD WITH 2 NUTS, B-18.2, A193 GR.B7(GALV), A194 2H(GALV), 0.625 INCH X 3.75 INCH	0.625	0	4
37	AP	212	TP-028	BOLT.STUD WITH 2 NUTS, B-18.2, A193 GR.B7(GALV), A194 2H(GALV), 0.625 INCH X 3.25 INCH	0.625	3.25	4
38	AP	212	TP-028	GASKET, B-16.21-ANSI B16.5, NONASB. SYN FIBRE+ RUBR BINDER, FULLFACE, 150, 2.0 INCH, 2 MM	2	0	3
40	BD	212	TP-023	FLNG.BLIND, B-16.5, ASTM A 105 (NORMALISED), 150, RF/125AARH, IBR, 2.0 INCH	2	0	1
41	BD	212	TP-023	FLNG.FIG.8, ASME-B16.48, ASTM A 516 GR.70(NORMALISED), 150, FF/125AARH, IBR, 2.0 INCH	2	0	1
42	BD	212	TP-023	VLV.GATE, SHEET 513AB, IBR, 2.0 INCH	2	0	1
43	BD	212	TP-023	BOLT.STUD WITH 2 NUTS, B-18.2, A193 GR.B7, A194 GR.2H, 0.625 INCH X 3.25 INCH	0.625	0	4
44	BD	212	TP-023	BOLT.STUD WITH 2 NUTS, B-18.2, A193 GR.B7, A194 GR.2H, 0.625 INCH X 3.75 INCH	0.625	0	4
45	BD	212	TP-023	GASKET, B-16.20-ANSI B16.5, LS SP.WND SS316+FLEX GRAFIL+IR, SPIRAL, 150, 2.0 INCH	2	0	3
47	BD	212	TP-024	FLNG.BLIND, B-16.5, ASTM A 105 (NORMALISED), 600, RF/125AARH, IBR, 4.0 INCH	4	0	1
48	BD	212	TP-024	FLNG.FIG.8, ASME-B16.48, ASTM A 516 GR.70(NORMALISED), 600, FF/125AARH, IBR, 4.0 INCH	4	0	1
49	BD	212	TP-024	VLV.GATE, SHEET 515AB, IBR, 4.0 INCH	4	0	1
50	BD	212	TP-024	BOLT.STUD WITH 2 NUTS, B-18.2, A193 GR.B7, A194 GR.2H, 0.875 INCH X 6.5 INCH	0.875	0	8
51	BD	212	TP-024	BOLT.STUD WITH 2 NUTS, B-18.2, A193 GR.B7, A194 GR.2H, 0.875 INCH X 5.75 INCH	0.875	0	8
53	BD	212	TP-024	GASKET, B-16.20-ANSI B16.5, SP.WND SS316L+GRAFIL+ I RING, SPIRAL, 600, 4.0 INCH	4	0	3
54	CL	212	TP-021	PIPE, B-36.10, ASTM A 106 GR.B, BE, SEAMLESS, IBR, 4.0 INCH, STD	4	0	12
55	CL	212	TP-021	PIPE, B-36.10, ASTM A 672 GR.B60 CL.32, BE, E.FS.W, IBR, 16.0 INCH, STD	16	0	0.203

56	CL	212	TP-021	REINF.PAD, ASTM A 672 GR.B60 CL.32, IBR, 16.0 INCH, STD, 4.0 INCH	16	4	1
57	CL	212	TP-021	FLNG.WN, B-16.5, ASTM A 105 (NORMALISED), 150, RF/125AARH, IBR, 4.0 INCH, STD	4	0	1
58	CL	212	TP-021	FLNG.BLIND, B-16.5, ASTM A 105 (NORMALISED), 150, RF/125AARH, IBR, 4.0 INCH	4	0	1
59	CL	212	TP-021	FLNG.FIG.8, ASME-B16.48, ASTM A 516 GR.70(NORMALISED), 150, FF/125AARH, IBR, 4.0 INCH	4	0	1
60	CL	212	TP-021	ELBOW.90, B-16.9, ASTM A 234 GR.WPB, BW, 1.5D, IBR, 4.0 INCH, STD	4	0	1
61	CL	212	TP-021	VLV.GATE, SHEET 513AB, IBR, 4.0 INCH	4	0	1
62	CL	212	TP-021	BOLT.STUD WITH 2 NUTS, B-18.2, A193 GR.B7, A194 GR.2H, 0.625 INCH X 4.25 INCH	0.625	0	8
63	CL	212	TP-021	BOLT.STUD WITH 2 NUTS, B-18.2, A193 GR.B7, A194 GR.2H, 0.625 INCH X 3.75 INCH	0.625	0	8
64	CL	212	TP-021	GASKET, B-16.20-ANSI B16.5, LS SP.WND SS316+FLEX GRAFIL+IR, SPIRAL, 150, 4.0 INCH	4	0	3
65	CL	212	TP-026	PIPE, B-36.10, ASTM A 106 GR.B, BE, SEAMLESS, IBR, 10.0 INCH, STD	10	0	5
66	CL	212	TP-026	FLNG.WN, B-16.5, ASTM A 105 (NORMALISED), 150, RF/125AARH, IBR, 10.0 INCH, STD	10	0	1
67	CL	212	TP-026	FLNG.BLIND, B-16.5, ASTM A 105 (NORMALISED), 150, RF/125AARH, IBR, 10.0 INCH	10	0	1
68	CL	212	TP-026	SPCR&BLND, ASME-B16.48, ASTM A 516 GR.70(NORMALISED), 150, FF/125AARH, IBR, 10.0 INCH	10	0	1
69	CL	212	TP-026	ELBOW.90, B-16.9, ASTM A 234 GR.WPB, BW, 1.5D, IBR, 10.0 INCH, STD	10	0	1
70	CL	212	TP-026	T.RED, B-16.9, ASTM A 234 GR.WPB, BW, IBR, 12.0 INCH, STD, 10.0 INCH, STD	12	10	1
71	CL	212	TP-026	VLV.GATE, SHEET 513AB, IBR, 10.0 INCH	10	0	1
72	CL	212	TP-026	BOLT.STUD WITH 2 NUTS, B-18.2, A193 GR.B7, A194 GR.2H, 0.875 INCH X 4.75 INCH	0.875	0	12
73	CL	212	TP-026	BOLT.STUD WITH 2 NUTS, B-18.2, A193 GR.B7, A194 GR.2H, 0.875 INCH X 5.5 INCH	0.875	0	12
75	CL	212	TP-026	GASKET, B-16.20-ANSI B16.5, LS SP.WND SS316+FLEX GRAFIL+IR, SPIRAL, 150, 10.0 INCH	10	0	3
76	CL	212	TP-038	PIPE, B-36.10, ASTM A 106 GR.B, BE, SEAMLESS, IBR, 10.0 INCH, STD	10	0	13.5
77	CL	212	TP-038	FLNG.WN, B-16.5, ASTM A 105 (NORMALISED), 150, RF/125AARH, IBR, 10.0 INCH, STD	10	0	1
78	CL	212	TP-038	FLNG.BLIND, B-16.5, ASTM A 105 (NORMALISED), 150, RF/125AARH, IBR, 10.0 INCH	10	0	1
79	CL	212	TP-038	SPCR&BLND, ASME-B16.48, ASTM A 516 GR.70(NORMALISED), 150, FF/125AARH, IBR, 10.0 INCH	10	0	1
80	CL	212	TP-038	ELBOW.90, B-16.9, ASTM A 234 GR.WPB, BW, 1.5D, IBR, 10.0 INCH, STD	10	0	1
81	CL	212	TP-038	T.RED, B-16.9, ASTM A 234 GR.WPB, BW, IBR, 12.0 INCH, STD, 10.0 INCH, STD	12	10	1
82	CL	212	TP-038	VLV.GATE, SHEET 513AB, IBR, 10.0 INCH	10	0	1
83	CL	212	TP-038	BOLT.STUD WITH 2 NUTS, B-18.2, A193 GR.B7, A194 GR.2H, 0.875 INCH X 4.75 INCH	0.875	0	12
84	CL	212	TP-038	BOLT.STUD WITH 2 NUTS, B-18.2, A193 GR.B7, A194 GR.2H, 0.875 INCH X 5.5 INCH	0.875	0	12
86	CL	212	TP-038	GASKET, B-16.20-ANSI B16.5, LS SP.WND SS316+FLEX GRAFIL+IR, SPIRAL, 150, 10.0 INCH	10	0	3
87	FAG	212	TP-022	PIPE, B-36.10, ASTM A 106 GR.B, BE, SEAMLESS, NACE, 6.0 INCH, STD	6	0	10
88	FAG	212	TP-022	PIPE, B-36.10, ASTM A 671 GR.CC60 CL.32, BE, E.FS.W, NACE, 42.0 INCH, XS	42	0	0.305
89	FAG	212	TP-022	REINF.PAD, ASTM A 671 GR.CC60 CL.32, NACE, 42.0 INCH, XS, 6.0 INCH	42	6	1
90	FAG	212	TP-022	FLNG.WN, B-16.5, ASTM A 105 (NORMALISED), 150, RF/125AARH, NACE, 6.0 INCH, STD	6	0	3
91	FAG	212	TP-022	FLNG.BLIND, B-16.5, ASTM A 105 (NORMALISED), 150, RF/125AARH, NACE, 6.0 INCH	6	0	1
92	FAG	212	TP-022	FLNG.FIG.8, ASME-B16.48, ASTM A 516 GR.70(NORMALISED), 150, FF/125AARH, NACE, 6.0 INCH	6	0	1
93	FAG	212	TP-022	ELBOW.90, B-16.9, ASTM A 234 GR.WPB, BW, 1.5D, NACE, 6.0 INCH, STD	6	0	1
94	FAG	212	TP-022	VLV.GATE, SHEET 513HC, NACE, 6.0 INCH, LOCK OPEN, FULL BORE	6	0	2
95	FAG	212	TP-022	BOLT.STUD WITH 2 NUTS, B-18.2, A193 GR.B7M, A194 GR.2HM, NACE, 0.75 INCH X 4.0 INCH	0.75	4	24
96	FAG	212	TP-022	BOLT.STUD WITH 2 NUTS, B-18.2, A193 GR.B7M, A194 GR.2HM, NACE, 0.75 INCH X 4.75 INCH	0.75	4.75	8
98	FAG	212	TP-022	GASKET, B-16.20-ANSI B16.5, LS SP.WND SS316+FLEX GRAFIL+IR, SPIRAL, 150, NACE, 6.0 INCH	6	0	5
99	FAG	212	TP-036	PIPE, B-36.10, ASTM A 671 GR.CC60 CL.32, BE, E.FS.W, NACE, 24.0 INCH, STD	24	0	14
100	FAG	212	TP-036	PIPE, B-36.10, ASTM A 671 GR.CC60 CL.32, BE, E.FS.W, NACE, 42.0 INCH, XS	42	0	1.219
101	FAG	212	TP-036	REINF.PAD, ASTM A 671 GR.CC60 CL.32, NACE, 42.0 INCH, XS, 24.0 INCH	42	24	1
102	FAG	212	TP-036	FLNG.WN, B-16.5, ASTM A 105 (NORMALISED), 150, RF/125AARH, NACE, 24.0 INCH, STD	24	0	3
103	FAG	212	TP-036	FLNG.BLIND, B-16.5, ASTM A 105 (NORMALISED), 150, RF/125AARH, NACE, 24.0 INCH	24	0	1
104	FAG	212	TP-036	SPCR&BLND, ASME-B16.48, ASTM A 516 GR.70(NORMALISED), 150, FF/125AARH, NACE, 24.0 INCH	24	0	1
105	FAG	212	TP-036	ELBOW.90, B-16.9, ASTM A 234 GR.WPB-W, BW, 1.5D, NACE, 24.0 INCH, STD	24	0	1
106	FAG	212	TP-036	VLV.GATE, SHEET 513HC, NACE, 24.0 INCH, LOCK OPEN, FULL BORE	24	0	2
107	FAG	212	TP-036	BOLT.STUD WITH 3 NUTS, B-18.2, A193 GR.B7M, A194 GR.2HM, NACE, 1.25 INCH X 9.5 INCH	1.25	9.5	20
108	FAG	212	TP-036	BOLT.STUD WITH 3 NUTS, B-18.2, A193 GR.B7M, A194 GR.2HM, NACE, 1.25 INCH X 8.0 INCH	1.25	8	60
110	FAG	212	TP-036	GASKET, B-16.20-ANSI B16.5, LS SP.WND SS316+FLEX GRAFIL+IR, SPIRAL, 150, NACE, 24.0 INCH	24	0	5
112	FG	212	TP-025	FLNG.BLIND, B-16.5, ASTM A 105 (NORMALISED), 150, RF/125AARH, 6.0 INCH	6	0	1
113	FG	212	TP-025	FLNG.FIG.8, ASME-B16.48, ASTM A 516 GR.70(NORMALISED), 150, FF/125AARH, 6.0 INCH	6	0	1
114	FG	212	TP-025	VLV.BALL, SHEET 543LA, 6.0 INCH	6	0	1
115	FG	212	TP-025	BOLT.STUD WITH 2 NUTS, B-18.2, A193 GR.B7, A194 GR.2H, 0.75 INCH X 4.75 INCH	0.75	0	8
116	FG	212	TP-025	BOLT.STUD WITH 2 NUTS, B-18.2, A193 GR.B7, A194 GR.2H, 0.75 INCH X 4 INCH	0.75	0	8

118	FG	212	TP-025	GASKET, B-16.20-ANSI B16.5, LS SP.WND SS316+FLEX GRAFIL+IR, SPIRAL, 150, 6.0 INCH	6	0	3
119	FG	212	TP-037	PIPE, B-36.10, ASTM A 106 GR.B, BE, SEAMLESS, 8.0 INCH, STD	8	0	6
120	FG	212	TP-037	FLNG.WN, B-16.5, ASTM A 105 (NORMALISED), 150, RF/125AARH, 8.0 INCH, STD	8	0	1
121	FG	212	TP-037	FLNG.BLIND, B-16.5, ASTM A 105 (NORMALISED), 150, RF/125AARH, 8.0 INCH	8	0	1
122	FG	212	TP-037	FLNG.FIG.8, ASME-B16.48, ASTM A 516 GR.70(NORMALISED), 150, FF/125AARH, 8.0 INCH	8	0	1
123	FG	212	TP-037	ELBOW.90, B-16.9, ASTM A 234 GR.WPB, BW, 1.5D, 8.0 INCH, STD	8	0	1
124	FG	212	TP-037	T.RED, B-16.9, ASTM A 234 GR.WPB, BW, 10.0 INCH, STD, 8.0 INCH, STD	10	8	1
125	FG	212	TP-037	VLV.BALL, SHEET 543LA, 8.0 INCH	8	0	1
126	FG	212	TP-037	BOLT.STUD WITH 2 NUTS, B-18.2, A193 GR.B7, A194 GR.2H, 0.75 INCH X 5 INCH	0.75	0	8
127	FG	212	TP-037	BOLT.STUD WITH 2 NUTS, B-18.2, A193 GR.B7, A194 GR.2H, 0.75 INCH X 4.25 INCH	0.75	0	8
129	FG	212	TP-037	GASKET, B-16.20-ANSI B16.5, LS SP.WND SS316+FLEX GRAFIL+IR, SPIRAL, 150, 8.0 INCH	8	0	3
131	N	212	TP-012	FLNG.BLIND, B-16.5, ASTM A 105 (NORMALISED), 150, RF/125AARH, 8.0 INCH	8	0	1
132	N	212	TP-012	FLNG.FIG.8, ASME-B16.48, ASTM A 516 GR.70(NORMALISED), 150, FF/125AARH, 8.0 INCH	8	0	1
133	N	212	TP-012	VLV.GATE, SHEET 513FA, 8.0 INCH	8	0	1
134	N	212	TP-012	BOLT.STUD WITH 2 NUTS, B-18.2, A193 GR.B7, A194 GR.2H, 0.75 INCH X 5 INCH	0.75	0	8
135	N	212	TP-012	BOLT.STUD WITH 2 NUTS, B-18.2, A193 GR.B7, A194 GR.2H, 0.75 INCH X 4.25 INCH	0.75	0	8
137	N	212	TP-012	GASKET, B-16.20-ANSI B16.5, LS SP.WND SS316+FLEX GRAFIL+IR, SPIRAL, 150, 8.0 INCH	8	0	3
138	P	89	TP-039	PIPE, B-36.10, ASTM A 671 GR.CC60 CL.32, BE, E.FS.W, NACE, 48.0 INCH, XS	48	0	7
139	P	89	TP-039	FLNG.WN, B-16.47-B, ASTM A 105 (NORMALISED), 150, RF/125AARH, NACE, 48.0 INCH, XS	48	0	1
140	P	89	TP-039	FLNG.BLIND, B-16.47-B, ASTM A 105 (NORMALISED), 150, RF/125AARH, NACE, 48.0 INCH	48	0	1
141	P	89	TP-039	SPCR&BLND, ASME B16.47B/EIL'STD, ASTM A 516 GR.70(NORMALISED), 150, FF/125AARH, NACE, 48.	48	0	1
142	P	89	TP-039	ELBOW.90, B-16.9, ASTM A 234 GR.WPB-W, BW, 1.5D, NACE, 48.0 INCH, XS	48	0	1
143	P	89	TP-039	T.EQUAL, B-16.9, ASTM A 234 GR.WPB-W, BW, NACE, 48.0 INCH, XS	48	0	1
144	P	89	TP-039	VLV.BTRFLY, SHEET 563JC, NACE, 48.0 INCH	48	0	1
145	P	89	TP-039	BOLT.STUD WITH 3 NUTS, B-18.2, A193 GR.B7M, A194 GR.2HM, NACE, 1.125 INCH X 9.5 INCH	1.125	9.5	44
146	P	89	TP-039	BOLT.STUD WITH 3 NUTS, B-18.2, A193 GR.B7M, A194 GR.2HM, NACE, 1.125 INCH X 12.25 INCH	1.125	12.25	44
147	P	89	TP-039	GASKET, B-16.20-ANSI B16.47B, LS SP.WND SS316+FLEX GRAFIL+IR, SPIRAL, 150, NACE, 48.0 INCH	48	0	3
148	P	89	TP-040	PIPE, B-36.10, ASTM A 671 GR.CC60 CL.32, BE, E.FS.W, NAC6, 16.0 INCH, STD	16	0	12
149	P	89	TP-040	FLNG.WN, B-16.5, ASTM A 105 (NORMALISED), 150, RF/125AARH, NAC6, 16.0 INCH, STD	16	0	1
150	P	89	TP-040	FLNG.BLIND, B-16.5, ASTM A 105 (NORMALISED), 150, RF/125AARH, NAC6, 16.0 INCH	16	0	1
151	P	89	TP-040	SPCR&BLND, ASME-B16.48, ASTM A 516 GR.70(NORMALISED), 150, FF/125AARH, NAC6, 16.0 INCH	16	0	1
152	P	89	TP-040	ELBOW.90, B-16.9, ASTM A 234 GR.WPB-W, BW, 1.5D, NAC6, 16.0 INCH, STD	16	0	4
153	P	89	TP-040	T.EQUAL, B-16.9, ASTM A 234 GR.WPB-W, BW, NAC6, 16.0 INCH, STD	16	0	1
154	P	89	TP-040	VLV.GATE, SHEET 513TC, NAC6, 16.0 INCH	16	0	1
155	P	89	TP-040	BOLT.STUD WITH 3 NUTS, B-18.2, A193 GR.B7M, A194 GR.2HM, NAC6, 1.0 INCH X 6.25 INCH	1	6.25	16
156	P	89	TP-040	BOLT.STUD WITH 3 NUTS, B-18.2, A193 GR.B7M, A194 GR.2HM, NAC6, 1.0 INCH X 7.25 INCH	1	7.25	16
158	P	89	TP-040	GASKET, B-16.20-ANSI B16.5, LS SP.WND SS316+FLEX GRAFIL+IR, SPIRAL, 150, NAC6, 16.0 INCH	16	0	3
159	P	89	TP-041	PIPE, B-36.10, ASTM A 106 GR.B, BE, SEAMLESS, NACE, 3.0 INCH, STD	3	0	6
160	P	89	TP-041	FLNG.WN, B-16.5, ASTM A 105 (NORMALISED), 150, RF/125AARH, NACE, 3.0 INCH, STD	3	0	1
161	P	89	TP-041	FLNG.BLIND, B-16.5, ASTM A 105 (NORMALISED), 150, RF/125AARH, NACE, 3.0 INCH	3	0	1
162	P	89	TP-041	FLNG.FIG.8, ASME-B16.48, ASTM A 516 GR.70(NORMALISED), 150, FF/125AARH, NACE, 3.0 INCH	3	0	1
163	P	89	TP-041	ELBOW.90, B-16.9, ASTM A 234 GR.WPB, BW, 1.5D, NACE, 3.0 INCH, STD	3	0	1
164	P	89	TP-041	T.EQUAL, B-16.9, ASTM A 234 GR.WPB, BW, NACE, 3.0 INCH, STD	3	0	1
165	P	89	TP-041	VLV.GATE, SHEET 513HC, NACE, 3.0 INCH	3	0	1
166	P	89	TP-041	BOLT.STUD WITH 2 NUTS, B-18.2, A193 GR.B7M, A194 GR.2HM, NACE, 0.625 INCH X 4.0 INCH	0.625	4	4
167	P	89	TP-041	BOLT.STUD WITH 2 NUTS, B-18.2, A193 GR.B7M, A194 GR.2HM, NACE, 0.625 INCH X 3.75 INCH	0.625	3.75	4
168	P	89	TP-041	GASKET, B-16.20-ANSI B16.5, LS SP.WND SS316+FLEX GRAFIL+IR, SPIRAL, 150, NACE, 3.0 INCH	3	0	3
169	P	89	TP-042	PIPE, B-36.10, ASTM A 106 GR.B, BE, SEAMLESS, NACE, 3.0 INCH, STD	3	0	9
170	P	89	TP-042	FLNG.WN, B-16.5, ASTM A 105 (NORMALISED), 150, RF/125AARH, NACE, 3.0 INCH, STD	3	0	1
171	P	89	TP-042	FLNG.BLIND, B-16.5, ASTM A 105 (NORMALISED), 150, RF/125AARH, NACE, 3.0 INCH	3	0	1
172	P	89	TP-042	FLNG.FIG.8, ASME-B16.48, ASTM A 516 GR.70(NORMALISED), 150, FF/125AARH, NACE, 3.0 INCH	3	0	1
173	P	89	TP-042	ELBOW.90, B-16.9, ASTM A 234 GR.WPB, BW, 1.5D, NACE, 3.0 INCH, STD	3	0	4
174	P	89	TP-042	T.EQUAL, B-16.9, ASTM A 234 GR.WPB, BW, NACE, 3.0 INCH, STD	3	0	1
175	P	89	TP-042	VLV.GATE, SHEET 513HC, NACE, 3.0 INCH	3	0	1
176	P	89	TP-042	BOLT.STUD WITH 2 NUTS, B-18.2, A193 GR.B7M, A194 GR.2HM, NACE, 0.625 INCH X 3.75 INCH	0.625	3.75	4
177	P	89	TP-042	BOLT.STUD WITH 2 NUTS, B-18.2, A193 GR.B7M, A194 GR.2HM, NACE, 0.625 INCH X 4.0 INCH	0.625	4	4

178	P	89	TP-042	GASKET, B-16.20-ANSI B16.5, LS SP.WND SS316+FLEX GRAFIL+IR, SPIRAL, 150, NACE, 3.0 INCH	3	0	3
179	P	89	TP-051	PIPE, B-36.10, ASTM A 671 GR.CC60 CL.32, BE, E.FS.W, NAC6, 16.0 INCH, STD	16	0	1
180	P	89	TP-051	FLNG.WN, B-16.5, ASTM A 105 (NORMALISED), 300, RF/125AARH, NAC6, 16.0 INCH, STD	16	0	2
181	P	89	TP-051	BOLT.STUD WITH 3 NUTS, B-18.2, A193 GR.B7M, A194 GR.2HM, NAC6, 1.25 INCH X 8.75 INCH	1.25	8.75	20
182	P	89	TP-051	GASKET, B-16.20-ANSI B16.5, SP.WND SS316+GRAFIL+ I RING, SPIRAL, 300, NAC6, 16.0 INCH	16	0	1
183	P	89	TP-052	FLNG.WN, B-16.5, ASTM A 105 (NORMALISED), 300, RF/125AARH, NAC6, 16.0 INCH, STD	16	0	2
184	P	89	TP-052	BOLT.STUD WITH 3 NUTS, B-18.2, A193 GR.B7M, A194 GR.2HM, NAC6, 1.25 INCH X 8.75 INCH	1.25	8.75	20
185	P	89	TP-052	GASKET, B-16.20-ANSI B16.5, SP.WND SS316+GRAFIL+ I RING, SPIRAL, 300, NAC6, 16.0 INCH	16	0	1
186	P	89	TP-053	PIPE, B-36.10, ASTM A 671 GR.CC60 CL.32, BE, E.FS.W, NACE, 48.0 INCH, XS	48	0	1
187	P	89	TP-053	FLNG.WN, B-16.47-B, ASTM A 105 (NORMALISED), 300, RF/125AARH, NACE, 48.0 INCH, XS	48	0	2
188	P	89	TP-053	BOLT.STUD WITH 3 NUTS, B-18.2, A193 GR.B7M, A194 GR.2HM, NACE, 1.875 INCH X 17.75 INCH	1.875	17.75	40
189	P	89	TP-053	GASKET, B-16.20-ANSI B16.47B, SP.WND SS316+GRAFIL+ I RING, SPIRAL, 300, NACE, 48.0 INCH	48	0	1
190	P	89	TP-054	FLNG.WN, B-16.47-B, ASTM A 105 (NORMALISED), 300, RF/125AARH, NACE, 48.0 INCH, XS	48	0	2
191	P	89	TP-054	BOLT.STUD WITH 3 NUTS, B-18.2, A193 GR.B7M, A194 GR.2HM, NACE, 1.875 INCH X 17.75 INCH	1.875	17.75	40
192	P	89	TP-054	GASKET, B-16.20-ANSI B16.47B, SP.WND SS316+GRAFIL+ I RING, SPIRAL, 300, NACE, 48.0 INCH	48	0	1
193	P	89	TP-055	PIPE, B-36.10, ASTM A 106 GR.B, BE, SEAMLESS, NACE, 3.0 INCH, STD	3	0	1
194	P	89	TP-055	FLNG.WN, B-16.5, ASTM A 105 (NORMALISED), 300, RF/125AARH, NACE, 3.0 INCH, STD	3	0	2
195	P	89	TP-055	BOLT.STUD WITH 2 NUTS, B-18.2, A193 GR.B7M, A194 GR.2HM, NACE, 0.75 INCH X 4.25 INCH	0.75	4.25	8
196	P	89	TP-055	GASKET, B-16.20-ANSI B16.5, SP.WND SS316+GRAFIL+ I RING, SPIRAL, 300, NACE, 3.0 INCH	3	0	1
197	P	89	TP-056	FLNG.WN, B-16.5, ASTM A 105 (NORMALISED), 300, RF/125AARH, NACE, 3.0 INCH, STD	3	0	2
198	P	89	TP-056	BOLT.STUD WITH 2 NUTS, B-18.2, A193 GR.B7M, A194 GR.2HM, NACE, 0.75 INCH X 4.25 INCH	0.75	4.25	8
199	P	89	TP-056	GASKET, B-16.20-ANSI B16.5, SP.WND SS316+GRAFIL+ I RING, SPIRAL, 300, NACE, 3.0 INCH	3	0	1
200	P	89	TP-057	PIPE, B-36.10, ASTM A 106 GR.B, BE, SEAMLESS, NACE, 3.0 INCH, STD	3	0	1
201	P	89	TP-057	FLNG.WN, B-16.5, ASTM A 105 (NORMALISED), 300, RF/125AARH, NACE, 3.0 INCH, STD	3	0	2
202	P	89	TP-057	BOLT.STUD WITH 2 NUTS, B-18.2, A193 GR.B7M, A194 GR.2HM, NACE, 0.75 INCH X 4.25 INCH	0.75	4.25	8
203	P	89	TP-057	GASKET, B-16.20-ANSI B16.5, SP.WND SS316+GRAFIL+ I RING, SPIRAL, 300, NACE, 3.0 INCH	3	0	1
204	P	89	TP-058	FLNG.WN, B-16.5, ASTM A 105 (NORMALISED), 300, RF/125AARH, NACE, 3.0 INCH, STD	3	0	2
205	P	89	TP-058	BOLT.STUD WITH 2 NUTS, B-18.2, A193 GR.B7M, A194 GR.2HM, NACE, 0.75 INCH X 4.25 INCH	0.75	4.25	8
206	P	89	TP-058	GASKET, B-16.20-ANSI B16.5, SP.WND SS316+GRAFIL+ I RING, SPIRAL, 300, NACE, 3.0 INCH	3	0	1
207	P	89	TP-071	PIPE, B-36.10, ASTM A 106 GR.B, BE, SEAMLESS, 10.0 INCH, STD	10	0	3
208	P	89	TP-071	PIPE, B-36.10, ASTM A 106 GR.B, PE, SEAMLESS, IBR, 0.75 INCH, S160	0.75	0	12
209	P	89	TP-071	PIPE, B-36.10, ASTM A 106 GR.B, BE, SEAMLESS, IBR, 12.0 INCH, STD	12	0	3
210	P	89	TP-071	FLNG.SW, B-16.5, ASTM A 105 (NORMALISED), 300, RF/125AARH, IBR, 0.75 INCH, S160	0.75	0	1
211	P	89	TP-071	FLNG.WN, B-16.5, ASTM A 105 (NORMALISED), 150, RF/125AARH, IBR, 0.75 INCH, S160	0.75	0	5
212	P	89	TP-071	FLNG.SO, B-16.5, ASTM A 105 (NORMALISED), 300, RF/125AARH, 12.0 INCH, 10.0 INCH	12	10	1
213	P	89	TP-071	FLNG.SO, B-16.5, ASTM A 105 (NORMALISED), 150, RF/125AARH, 12.0 INCH, 10.0 INCH	12	10	1
214	P	89	TP-071	ELBOW.90, B-16.11, ASTM A 105 (NORMALISED), SW, 6000, IBR, 0.75 INCH	0.75	0	6
215	P	89	TP-071	SOCKOLET, MSS-SP97, ASTM A 105 (NORMALISED), SW, 6000, IBR, 12.0 INCH, 0.75 INCH	12	0.75	2
216	P	89	TP-071	BOLT.STUD WITH 2 NUTS, B-18.2, A193 GR.B7, A194 GR.2H, 0.5 INCH X 2.5 INCH	0.5	0	12
217	P	89	TP-071	BOLT.STUD WITH 2 NUTS, B-18.2, A193 GR.B7, A194 GR.2H, 0.625 INCH X 3 INCH	0.625	0	4
218	P	89	TP-071	BOLT.STUD WITH 2 NUTS, B-18.2, A193 GR.B7, A194 GR.2H, 0.875 INCH X 4.75 INCH	0.875	0	12
219	P	89	TP-071	BOLT.STUD WITH 3 NUTS, B-18.2, A193 GR.B7, A194 GR.2H, 1.125 INCH X 8 INCH	1.125	0	16
220	P	89	TP-071	GASKET, B-16.20-ANSI B16.5, SP.WND SS316+GRAFIL+ I RING, SPIRAL, 300, 0.75 INCH	0.75	0	1
221	P	89	TP-071	GASKET, B-16.20-ANSI B16.5, SP.WND SS316+GRAFIL+ I RING, SPIRAL, 300, 12.0 INCH	12	0	1
222	P	89	TP-071	GASKET, B-16.20-ANSI B16.5, LS SP.WND SS316+FLEX GRAFIL+IR, SPIRAL, 150, 0.75 INCH	0.75	0	3
223	P	89	TP-071	GASKET, B-16.20-ANSI B16.5, LS SP.WND SS316+FLEX GRAFIL+IR, SPIRAL, 150, 12.0 INCH	12	0	1
224	P	89	TP-073	PIPE, B-36.10, ASTM A 106 GR.B, BE, SEAMLESS, 10.0 INCH, STD	10	0	3
225	P	89	TP-073	PIPE, B-36.10, ASTM A 106 GR.B, PE, SEAMLESS, IBR, 0.75 INCH, S160	0.75	0	12
226	P	89	TP-073	PIPE, B-36.10, ASTM A 106 GR.B, BE, SEAMLESS, IBR, 12.0 INCH, STD	12	0	3
227	P	89	TP-073	FLNG.SW, B-16.5, ASTM A 105 (NORMALISED), 300, RF/125AARH, IBR, 0.75 INCH, S160	0.75	0	1
228	P	89	TP-073	FLNG.WN, B-16.5, ASTM A 105 (NORMALISED), 150, RF/125AARH, IBR, 0.75 INCH, S160	0.75	0	5
229	P	89	TP-073	FLNG.SO, B-16.5, ASTM A 105 (NORMALISED), 150, RF/125AARH, 12.0 INCH, 10.0 INCH	12	10	1
230	P	89	TP-073	FLNG.SO, B-16.5, ASTM A 105 (NORMALISED), 300, RF/125AARH, 12.0 INCH, 10.0 INCH	12	10	1
231	P	89	TP-073	ELBOW.90, B-16.11, ASTM A 105 (NORMALISED), SW, 6000, IBR, 0.75 INCH	0.75	0	6
232	P	89	TP-073	SOCKOLET, MSS-SP97, ASTM A 105 (NORMALISED), SW, 6000, IBR, 12.0 INCH, 0.75 INCH	12	0.75	2
233	P	89	TP-073	BOLT.STUD WITH 2 NUTS, B-18.2, A193 GR.B7, A194 GR.2H, 0.5 INCH X 2.5 INCH	0.5	0	12

234	P	89	TP-073	BOLT.STUD WITH 2 NUTS, B-18.2, A193 GR.B7, A194 GR.2H, 0.625 INCH X 3 INCH	0.625	0	4
235	P	89	TP-073	BOLT.STUD WITH 2 NUTS, B-18.2, A193 GR.B7, A194 GR.2H, 0.875 INCH X 4.75 INCH	0.875	0	12
236	P	89	TP-073	BOLT.STUD WITH 3 NUTS, B-18.2, A193 GR.B7, A194 GR.2H, 1.125 INCH X 8 INCH	1.125	0	16
237	P	89	TP-073	GASKET, B-16.20-ANSI B16.5, SP.WND SS316+GRAFIL+ I RING, SPIRAL, 300, 0.75 INCH	0.75	0	1
238	P	89	TP-073	GASKET, B-16.20-ANSI B16.5, SP.WND SS316+GRAFIL+ I RING, SPIRAL, 300, 12.0 INCH	12	0	1
239	P	89	TP-073	GASKET, B-16.20-ANSI B16.5, LS SP.WND SS316+FLEX GRAFIL+IR, SPIRAL, 150, 0.75 INCH	0.75	0	3
240	P	89	TP-073	GASKET, B-16.20-ANSI B16.5, LS SP.WND SS316+FLEX GRAFIL+IR, SPIRAL, 150, 12.0 INCH	12	0	1
241	P	89	TP-074	PIPE, B-36.10, ASTM A 106 GR.B, BE, SEAMLESS, 6.0 INCH, STD	6	0	3
242	P	89	TP-074	PIPE, B-36.10, ASTM A 106 GR.B, PE, SEAMLESS, IBR, 0.75 INCH, S160	0.75	0	12
243	P	89	TP-074	PIPE, B-36.10, ASTM A 106 GR.B, BE, SEAMLESS, IBR, 8.0 INCH, STD	8	0	3
244	P	89	TP-074	FLNG.SW, B-16.5, ASTM A 105 (NORMALISED), 300, RF/125AARH, IBR, 0.75 INCH, S160	0.75	0	1
245	P	89	TP-074	FLNG.WN, B-16.5, ASTM A 105 (NORMALISED), 150, RF/125AARH, IBR, 0.75 INCH, S160	0.75	0	5
246	P	89	TP-074	FLNG.SO, B-16.5, ASTM A 105 (NORMALISED), 150, RF/125AARH, 8.0 INCH, 6.0 INCH	8	6	1
247	P	89	TP-074	FLNG.SO, B-16.5, ASTM A 105 (NORMALISED), 300, RF/125AARH, 8.0 INCH, 6.0 INCH	8	6	1
248	P	89	TP-074	ELBOW.90, B-16.11, ASTM A 105 (NORMALISED), SW, 6000, IBR, 0.75 INCH	0.75	0	6
249	P	89	TP-074	SOCKOLET, MSS-SP97, ASTM A 105 (NORMALISED), SW, 6000, IBR, 8.0 INCH, 0.75 INCH	8	0.75	2
250	P	89	TP-074	BOLT.STUD WITH 2 NUTS, B-18.2, A193 GR.B7, A194 GR.2H, 0.5 INCH X 2.5 INCH	0.5	0	12
251	P	89	TP-074	BOLT.STUD WITH 2 NUTS, B-18.2, A193 GR.B7, A194 GR.2H, 0.625 INCH X 3 INCH	0.625	0	4
252	P	89	TP-074	BOLT.STUD WITH 2 NUTS, B-18.2, A193 GR.B7, A194 GR.2H, 0.75 INCH X 4.25 INCH	0.75	0	8
253	P	89	TP-074	BOLT.STUD WITH 2 NUTS, B-18.2, A193 GR.B7, A194 GR.2H, 0.875 INCH X 5.5 INCH	0.875	0	12
254	P	89	TP-074	GASKET, B-16.20-ANSI B16.5, SP.WND SS316+GRAFIL+ I RING, SPIRAL, 300, 0.75 INCH	0.75	0	1
255	P	89	TP-074	GASKET, B-16.20-ANSI B16.5, SP.WND SS316+GRAFIL+ I RING, SPIRAL, 300, 8.0 INCH	8	0	1
256	P	89	TP-074	GASKET, B-16.20-ANSI B16.5, LS SP.WND SS316+FLEX GRAFIL+IR, SPIRAL, 150, 0.75 INCH	0.75	0	3
257	P	89	TP-074	GASKET, B-16.20-ANSI B16.5, LS SP.WND SS316+FLEX GRAFIL+IR, SPIRAL, 150, 8.0 INCH	8	0	1
258	P	89	TP-076	PIPE, B-36.10, ASTM A 106 GR.B, BE, SEAMLESS, 6.0 INCH, STD	6	0	3
259	P	89	TP-076	PIPE, B-36.10, ASTM A 106 GR.B, PE, SEAMLESS, IBR, 0.75 INCH, S160	0.75	0	12
260	P	89	TP-076	PIPE, B-36.10, ASTM A 106 GR.B, BE, SEAMLESS, IBR, 8.0 INCH, STD	8	0	3
261	P	89	TP-076	FLNG.SW, B-16.5, ASTM A 105 (NORMALISED), 300, RF/125AARH, IBR, 0.75 INCH, S160	0.75	0	1
262	P	89	TP-076	FLNG.WN, B-16.5, ASTM A 105 (NORMALISED), 150, RF/125AARH, IBR, 0.75 INCH, S160	0.75	0	5
263	P	89	TP-076	FLNG.SO, B-16.5, ASTM A 105 (NORMALISED), 150, RF/125AARH, 8.0 INCH, 6.0 INCH	8	6	1
264	P	89	TP-076	FLNG.SO, B-16.5, ASTM A 105 (NORMALISED), 300, RF/125AARH, 8.0 INCH, 6.0 INCH	8	6	1
265	P	89	TP-076	ELBOW.90, B-16.11, ASTM A 105 (NORMALISED), SW, 6000, IBR, 0.75 INCH	0.75	0	6
266	P	89	TP-076	SOCKOLET, MSS-SP97, ASTM A 105 (NORMALISED), SW, 6000, IBR, 8.0 INCH, 0.75 INCH	8	0.75	2
267	P	89	TP-076	BOLT.STUD WITH 2 NUTS, B-18.2, A193 GR.B7, A194 GR.2H, 0.5 INCH X 2.5 INCH	0.5	0	12
268	P	89	TP-076	BOLT.STUD WITH 2 NUTS, B-18.2, A193 GR.B7, A194 GR.2H, 0.625 INCH X 3 INCH	0.625	0	4
269	P	89	TP-076	BOLT.STUD WITH 2 NUTS, B-18.2, A193 GR.B7, A194 GR.2H, 0.75 INCH X 4.25 INCH	0.75	0	8
270	P	89	TP-076	BOLT.STUD WITH 2 NUTS, B-18.2, A193 GR.B7, A194 GR.2H, 0.875 INCH X 5.5 INCH	0.875	0	12
271	P	89	TP-076	GASKET, B-16.20-ANSI B16.5, SP.WND SS316+GRAFIL+ I RING, SPIRAL, 300, 0.75 INCH	0.75	0	1
272	P	89	TP-076	GASKET, B-16.20-ANSI B16.5, SP.WND SS316+GRAFIL+ I RING, SPIRAL, 300, 8.0 INCH	8	0	1
273	P	89	TP-076	GASKET, B-16.20-ANSI B16.5, LS SP.WND SS316+FLEX GRAFIL+IR, SPIRAL, 150, 0.75 INCH	0.75	0	3
274	P	89	TP-076	GASKET, B-16.20-ANSI B16.5, LS SP.WND SS316+FLEX GRAFIL+IR, SPIRAL, 150, 8.0 INCH	8	0	1
275	P	89	TP-079	FLNG.WN, B-16.47-B, ASTM A 105 (NORMALISED), 300, RF/125AARH, 36.0 INCH, XS	36	0	1
276	P	89	TP-079	BOLT.STUD WITH 3 NUTS, B-18.2, A193 GR.B7, A194 GR.2H, 1.625 INCH X 14 INCH	1.625	0	32
277	P	89	TP-079	GASKET, B-16.20-ANSI B16.47B, SP.WND SS316+GRAFIL+ I RING, SPIRAL, 300, 36.0 INCH	36	0	1
278	P	89	TP-080	FLNG.WN, B-16.47-B, ASTM A 105 (NORMALISED), 300, RF/125AARH, 36.0 INCH, XS	36	0	1
279	P	89	TP-080	BOLT.STUD WITH 3 NUTS, B-18.2, A193 GR.B7, A194 GR.2H, 1.625 INCH X 14 INCH	1.625	0	32
280	P	89	TP-080	GASKET, B-16.20-ANSI B16.47B, SP.WND SS316+GRAFIL+ I RING, SPIRAL, 300, 36.0 INCH	36	0	1
281	P	211	TP-001	PIPE, B-36.10, ASTM A 671 GR.CC60 CL.32, BE, E.FS.W, NACE, 36.0 INCH, XS	36	0	60
282	P	211	TP-001	FLNG.WN, B-16.47-B, ASTM A 105 (NORMALISED), 150, RF/125AARH, NACE, 36.0 INCH, XS	36	0	2
283	P	211	TP-001	FLNG.BLIND, B-16.47-B, ASTM A 105 (NORMALISED), 150, RF/125AARH, NACE, 36.0 INCH	36	0	1
284	P	211	TP-001	SPCR&BLND, ASME B16.47B/EIL'STD, ASTM A 516 GR.70(NORMALISED), 150, FF/125AARH, NACE, 36.	36	0	1
285	P	211	TP-001	ELBOW.90, B-16.9, ASTM A 234 GR.WPB-W, BW, 1.5D, NACE, 36.0 INCH, XS	36	0	2
286	P	211	TP-001	VLV.GATE, SHEET 513HC, NACE, 36.0 INCH	36	0	1
287	P	211	TP-001	BOLT.STUD WITH 2 NUTS, B-18.2, A193 GR.B7M, A194 GR.2HM, NACE, 0.875 INCH X 6.75 INCH	0.875	0	88
288	P	211	TP-001	BOLT.STUD WITH 2 NUTS, B-18.2, A193 GR.B7M, A194 GR.2HM, NACE, 0.875 INCH X 8.75 INCH	0.875	8.75	44
289	P	211	TP-001	GASKET, B-16.20-ANSI B16.47B, LS SP.WND SS316+FLEX GRAFIL+IR, SPIRAL, 150, NACE, 36.0 INCH	36	0	4

290	P	211	TP-003	PIPE, B-36.10, ASTM A 671 GR.CC60 CL.32, BE, E.FS.W, NACE, 20.0 INCH, STD	20	0	60
291	P	211	TP-003	FLNG.WN, B-16.5, ASTM A 105 (NORMALISED), 150, RF/125AARH, NACE, 20.0 INCH, STD	20	0	2
292	P	211	TP-003	FLNG.BLIND, B-16.5, ASTM A 105 (NORMALISED), 150, RF/125AARH, NACE, 20.0 INCH	20	0	1
293	P	211	TP-003	SPCR&BLND, ASME-B16.48, ASTM A 516 GR.70(NORMALISED), 150, FF/125AARH, NACE, 20.0 INCH	20	0	1
294	P	211	TP-003	ELBOW.90, B-16.9, ASTM A 234 GR.WPB-W, BW, 1.5D, NACE, 20.0 INCH, STD	20	0	2
295	P	211	TP-003	VLV.GATE, SHEET 513HC, NACE, 20.0 INCH	20	0	1
296	P	211	TP-003	BOLT.STUD WITH 3 NUTS, B-18.2, A193 GR.B7M, A194 GR.2HM, NACE, 1.125 INCH X 8.75 INCH	1.125	8.75	20
297	P	211	TP-003	BOLT.STUD WITH 3 NUTS, B-18.2, A193 GR.B7M, A194 GR.2HM, NACE, 1.125 INCH X 7.5 INCH	1.125	7.5	40
299	P	211	TP-003	GASKET, B-16.20-ANSI B16.5, LS SP.WND SS316+FLEX GRAFIL+IR, SPIRAL, 150, NACE, 20.0 INCH	20	0	4
300	P	211	TP-004	PIPE, B-36.19, ASTM A 358 TP316L CL.1, BE, E.FS.W, 10.0 INCH, S20	10	0	8.5
301	P	211	TP-004	FLNG.WN, B-16.5, ASTM A 182 GR.F316L, 150, RF/125AARH, 10.0 INCH, S20	10	0	1
302	P	211	TP-004	FLNG.BLIND, B-16.5, ASTM A 182 GR.F316L, 150, RF/125AARH, 10.0 INCH	10	0	1
303	P	211	TP-004	SPCR&BLND, ASME-B16.48, ASTM A 240 GR.316L, 150, FF/125AARH, 10.0 INCH	10	0	1
304	P	211	TP-004	ELBOW.90, B-16.9, ASTM A 403 GR.WP316L-WX, BW, 1.5D, 10.0 INCH, S20	10	0	1
305	P	211	TP-004	T.EQUAL, B-16.9, ASTM A 403 GR.WP316L-WX, BW, 10.0 INCH, S20	10	0	1
306	P	211	TP-004	VLV.GATE, SHEET 513AM, 10.0 INCH	10	0	1
307	P	211	TP-004	BOLT.STUD WITH 2 NUTS, B-18.2, A193 GR.B7, A194 GR.2H, 0.875 INCH X 4.75 INCH	0.875	0	12
308	P	211	TP-004	BOLT.STUD WITH 2 NUTS, B-18.2, A193 GR.B7, A194 GR.2H, 0.875 INCH X 5.5 INCH	0.875	0	12
310	P	211	TP-004	GASKET, B-16.20-ANSI B16.5, SP.WND SS316L+GRAFIL+ I RING, SPIRAL, 150, 10.0 INCH	10	0	3
311	P	211	TP-005	PIPE, B-36.10, ASTM A 672 GR.B60 CL.32, BE, E.FS.W, 48.0 INCH, XS	48	0	60
312	P	211	TP-005	FLNG.WN, B-16.47-B, ASTM A 105 (NORMALISED), 150, RF/125AARH, 48.0 INCH, XS	48	0	2
313	P	211	TP-005	FLNG.BLIND, B-16.47-B, ASTM A 105 (NORMALISED), 150, RF/125AARH, 48.0 INCH	48	0	1
314	P	211	TP-005	SPCR&BLND, EIL'STD, ASTM A 516 GR.70(NORMALISED), 150, FF/125AARH, 48.0 INCH	48	0	1
315	P	211	TP-005	ELBOW.90, B-16.9, ASTM A 234 GR.WPB-W, BW, 1.5D, 48.0 INCH, XS	48	0	2
316	P	211	TP-005	VLV.GATE, SHEET 513CA, 48.0 INCH	48	0	1
317	P	211	TP-005	BOLT.STUD WITH 3 NUTS, B-18.2, A193 GR.B7, A194 GR.2H, 1.125 INCH X 9.5 INCH	1.125	0	88
318	P	211	TP-005	BOLT.STUD WITH 3 NUTS, B-18.2, A193 GR.B7, A194 GR.2H, 1.125 INCH X 12.25 INCH	1.125	12.25	44
319	P	211	TP-005	GASKET, B-16.20-ANSI B16.47B, LS SP.WND SS316+FLEX GRAFIL+IR, SPIRAL, 150, 48.0 INCH	48	0	4
320	P	211	TP-006	PIPE, B-36.10, ASTM A 672 GR.B60 CL.32, BE, E.FS.W, 48.0 INCH, XS	48	0	60
321	P	211	TP-006	FLNG.WN, B-16.47-B, ASTM A 105 (NORMALISED), 150, RF/125AARH, 48.0 INCH, XS	48	0	2
322	P	211	TP-006	FLNG.BLIND, B-16.47-B, ASTM A 105 (NORMALISED), 150, RF/125AARH, 48.0 INCH	48	0	1
323	P	211	TP-006	SPCR&BLND, EIL'STD, ASTM A 516 GR.70(NORMALISED), 150, FF/125AARH, 48.0 INCH	48	0	1
324	P	211	TP-006	ELBOW.90, B-16.9, ASTM A 234 GR.WPB-W, BW, 1.5D, 48.0 INCH, XS	48	0	2
325	P	211	TP-006	VLV.GATE, SHEET 513CA, 48.0 INCH	48	0	1
326	P	211	TP-006	BOLT.STUD WITH 3 NUTS, B-18.2, A193 GR.B7, A194 GR.2H, 1.125 INCH X 9.5 INCH	1.125	0	88
327	P	211	TP-006	BOLT.STUD WITH 3 NUTS, B-18.2, A193 GR.B7, A194 GR.2H, 1.125 INCH X 12.25 INCH	1.125	12.25	44
328	P	211	TP-006	GASKET, B-16.20-ANSI B16.47B, LS SP.WND SS316+FLEX GRAFIL+IR, SPIRAL, 150, 48.0 INCH	48	0	4
329	P	211	TP-007	PIPE, B-36.10, ASTM A 106 GR.B, BE, SEAMLESS, 10.0 INCH, STD	10	0	1
330	P	211	TP-007	PIPE, B-36.10, ASTM A 106 GR.B, PE, SEAMLESS, IBR, 0.75 INCH, S160	0.75	0	9
331	P	211	TP-007	PIPE, B-36.10, ASTM A 106 GR.B, BE, SEAMLESS, IBR, 12.0 INCH, STD	12	0	1
332	P	211	TP-007	FLNG.WN, B-16.5, ASTM A 105 (NORMALISED), 150, RF/125AARH, IBR, 0.75 INCH, S160	0.75	0	7
333	P	211	TP-007	FLNG.SO, B-16.5, ASTM A 105 (NORMALISED), 150, RF/125AARH, 12.0 INCH, 10.0 INCH	12	10	2
334	P	211	TP-007	FLNG.BLIND, B-16.5, ASTM A 105 (NORMALISED), 150, RF/125AARH, 12.0 INCH	12	0	1
335	P	211	TP-007	SPCR&BLND, ASME-B16.48, ASTM A 516 GR.70(NORMALISED), 150, FF/125AARH, 10.0 INCH	10	0	1
336	P	211	TP-007	ELBOW.90, B-16.11, ASTM A 105 (NORMALISED), SW, 6000, IBR, 0.75 INCH	0.75	0	6
337	P	211	TP-007	SOCKOLET, MSS-SP97, ASTM A 105 (NORMALISED), SW, 6000, IBR, 12.0 INCH, 0.75 INCH	12	0.75	2
338	P	211	TP-007	VLV.GATE, SHEET 513AD, 10.0 INCH	10	0	1
339	P	211	TP-007	BOLT.STUD WITH 2 NUTS, B-18.2, A193 GR.B7, A194 GR.2H, 0.5 INCH X 2.5 INCH	0.5	0	16
340	P	211	TP-007	BOLT.STUD WITH 2 NUTS, B-18.2, A193 GR.B7, A194 GR.2H, 0.875 INCH X 4.75 INCH	0.875	0	24
341	P	211	TP-007	BOLT.STUD WITH 2 NUTS, B-18.2, A193 GR.B7, A194 GR.2H, 0.875 INCH X 5.75 INCH	0.875	0	12
343	P	211	TP-007	GASKET, B-16.20-ANSI B16.5, LS SP.WND SS316+FLEX GRAFIL+IR, SPIRAL, 150, 0.75 INCH	0.75	0	4
344	P	211	TP-007	GASKET, B-16.20-ANSI B16.5, LS SP.WND SS316+FLEX GRAFIL+IR, SPIRAL, 150, 12.0 INCH	12	0	4
345	P	211	TP-008	PIPE, B-36.10, ASTM A 106 GR.B, BE, SEAMLESS, 6.0 INCH, STD	6	0	1
346	P	211	TP-008	PIPE, B-36.10, ASTM A 106 GR.B, PE, SEAMLESS, IBR, 0.75 INCH, S160	0.75	0	9
347	P	211	TP-008	PIPE, B-36.10, ASTM A 106 GR.B, BE, SEAMLESS, IBR, 8.0 INCH, STD	8	0	1
348	P	211	TP-008	FLNG.WN, B-16.5, ASTM A 105 (NORMALISED), 150, RF/125AARH, IBR, 0.75 INCH, S160	0.75	0	7

349	P	211	TP-008	FLNG.SO, B-16.5, ASTM A 105 (NORMALISED), 150, RF/125AARH, 8.0 INCH, 6.0 INCH	8	6	2
350	P	211	TP-008	FLNG.BLIND, B-16.5, ASTM A 105 (NORMALISED), 150, RF/125AARH, 8.0 INCH	8	0	1
351	P	211	TP-008	FLNG.FIG.8, ASME-B16.48, ASTM A 516 GR.70(NORMALISED), 150, FF/250AARH, 6.0 INCH	6	0	1
352	P	211	TP-008	ELBOW.90, B-16.11, ASTM A 105 (NORMALISED), SW, 6000, IBR, 0.75 INCH	0.75	0	6
353	P	211	TP-008	SOCKOLET, MSS-SP97, ASTM A 105 (NORMALISED), SW, 6000, IBR, 8.0 INCH, 0.75 INCH	8	0.75	2
354	P	211	TP-008	VLV.GATE, SHEET 513AD, 6.0 INCH	6	0	1
355	P	211	TP-008	VLV.PLUG, SHEET 553BD, 2.0 INCH	2	0	1
356	P	211	TP-008	BOLT.STUD WITH 2 NUTS, B-18.2, A193 GR.B7, A194 GR.2H, 0.5 INCH X 2.5 INCH	0.5	0	16
357	P	211	TP-008	BOLT.STUD WITH 2 NUTS, B-18.2, A193 GR.B7, A194 GR.2H, 0.75 INCH X 5 INCH	0.75	0	8
358	P	211	TP-008	BOLT.STUD WITH 2 NUTS, B-18.2, A193 GR.B7, A194 GR.2H, 0.75 INCH X 4 INCH	0.75	0	16
360	P	211	TP-008	GASKET, B-16.20-ANSI B16.5, LS SP.WND SS316+FLEX GRAFIL+IR, SPIRAL, 150, 0.75 INCH	0.75	0	4
361	P	211	TP-008	GASKET, B-16.20-ANSI B16.5, LS SP.WND SS316+FLEX GRAFIL+IR, SPIRAL, 150, 6.0 INCH	6	0	4
362	P	211	TP-009	PIPE, B-36.10, ASTM A 106 GR.B, BE, SEAMLESS, 8.0 INCH, STD	8	0	1
363	P	211	TP-009	PIPE, B-36.10, ASTM A 106 GR.B, PE, SEAMLESS, IBR, 0.75 INCH, S160	0.75	0	9
364	P	211	TP-009	PIPE, B-36.10, ASTM A 106 GR.B, BE, SEAMLESS, IBR, 10.0 INCH, STD	10	0	1
365	P	211	TP-009	FLNG.WN, B-16.5, ASTM A 105 (NORMALISED), 150, RF/125AARH, IBR, 0.75 INCH, S160	0.75	0	7
366	P	211	TP-009	FLNG.SO, B-16.5, ASTM A 105 (NORMALISED), 150, RF/125AARH, 10.0 INCH, 8.0 INCH	10	8	2
367	P	211	TP-009	FLNG.BLIND, B-16.5, ASTM A 105 (NORMALISED), 150, RF/125AARH, 10.0 INCH	10	0	1
368	P	211	TP-009	FLNG.FIG.8, ASME-B16.48, ASTM A 516 GR.70(NORMALISED), 150, FF/250AARH, 8.0 INCH	8	0	1
369	P	211	TP-009	ELBOW.90, B-16.11, ASTM A 105 (NORMALISED), SW, 6000, IBR, 0.75 INCH	0.75	0	6
370	P	211	TP-009	SOCKOLET, MSS-SP97, ASTM A 105 (NORMALISED), SW, 6000, IBR, 10.0 INCH, 0.75 INCH	10	0.75	2
371	P	211	TP-009	VLV.GATE, SHEET 513AD, 8.0 INCH	8	0	1
372	P	211	TP-009	BOLT.STUD WITH 2 NUTS, B-18.2, A193 GR.B7, A194 GR.2H, 0.5 INCH X 2.5 INCH	0.5	0	16
373	P	211	TP-009	BOLT.STUD WITH 2 NUTS, B-18.2, A193 GR.B7, A194 GR.2H, 0.875 INCH X 4.75 INCH	0.875	0	24
374	P	211	TP-009	BOLT.STUD WITH 2 NUTS, B-18.2, A193 GR.B7, A194 GR.2H, 0.875 INCH X 5.5 INCH	0.875	0	12
376	P	211	TP-009	GASKET, B-16.20-ANSI B16.5, LS SP.WND SS316+FLEX GRAFIL+IR, SPIRAL, 150, 0.75 INCH	0.75	0	4
377	P	211	TP-009	GASKET, B-16.20-ANSI B16.5, LS SP.WND SS316+FLEX GRAFIL+IR, SPIRAL, 150, 10.0 INCH	10	0	4
379	P	211	TP-027	FLNG.BLIND, B-16.5, ASTM A 105 (NORMALISED), 150, RF/125AARH, NAC6, 4.0 INCH	4	0	1
380	P	211	TP-027	FLNG.FIG.8, ASME-B16.48, ASTM A 516 GR.70(NORMALISED), 150, FF/125AARH, NAC6, 4.0 INCH	4	0	1
381	P	211	TP-027	VLV.GATE, SHEET 513TC, NAC6, 4.0 INCH	4	0	1
382	P	211	TP-027	BOLT.STUD WITH 2 NUTS, B-18.2, A193 GR.B7M, A194 GR.2HM, NAC6, 0.625 INCH X 4.25 INCH	0.625	4.25	8
383	P	211	TP-027	BOLT.STUD WITH 2 NUTS, B-18.2, A193 GR.B7M, A194 GR.2HM, NAC6, 0.625 INCH X 3.75 INCH	0.625	3.75	8
384	P	211	TP-027	GASKET, B-16.20-ANSI B16.5, LS SP.WND SS316+FLEX GRAFIL+IR, SPIRAL, 150, NAC6, 4.0 INCH	4	0	3
386	PA	211	TP-010	FLNG.BLIND, B-16.47-B, ASTM A 105 (NORMALISED), 150, RF/125AARH, 44.0 INCH	44	0	1
387	PA	211	TP-010	SPCR&BLND, EIL'STD, ASTM A 516 GR.70(NORMALISED), 150, FF/125AARH, 44.0 INCH	44	0	1
388	PA	211	TP-010	VLV.GATE, SHEET 513CA, 44.0 INCH	44	0	1
389	PA	211	TP-010	BOLT.STUD WITH 3 NUTS, B-18.2, A193 GR.B7, A194 GR.2H, 1.0 INCH X 8.75 INCH	1	0	52
390	PA	211	TP-010	BOLT.STUD WITH 3 NUTS, B-18.2, A193 GR.B7, A194 GR.2H, 1.0 INCH X 11.25 INCH	1	11.25	52
391	PA	211	TP-010	GASKET, B-16.20-ANSI B16.47B, LS SP.WND SS316+FLEX GRAFIL+IR, SPIRAL, 150, 44.0 INCH	44	0	3
392	SH	212	TP-015	PIPE, B-36.10, ASTM A 106 GR.B, BE, SEAMLESS, IBR, 12.0 INCH, S80	12	0	2
393	SH	212	TP-015	FLNG.WN, B-16.5, ASTM A 105 (NORMALISED), 600, RF/125AARH, IBR, 12.0 INCH, S80	12	0	2
394	SH	212	TP-015	FLNG.BLIND, B-16.5, ASTM A 105 (NORMALISED), 600, RF/125AARH, IBR, 12.0 INCH	12	0	1
395	SH	212	TP-015	SPCR&BLND, ASME-B16.48, ASTM A 516 GR.70(NORMALISED), 600, FF/125AARH, IBR, 12.0 INCH	12	0	1
396	SH	212	TP-015	VLV.GATE, SHEET 515AB, IBR, 12.0 INCH	12	0	2
397	SH	212	TP-015	BOLT.STUD WITH 3 NUTS, B-18.2, A193 GR.B7, A194 GR.2H, 1.25 INCH X 11.75 INCH	1.25	11.75	20
398	SH	212	TP-015	BOLT.STUD WITH 3 NUTS, B-18.2, A193 GR.B7, A194 GR.2H, 1.25 INCH X 10 INCH	1.25	0	60
400	SH	212	TP-015	GASKET, B-16.20-ANSI B16.5, SP.WND SS316L+GRAFIL+ I RING, SPIRAL, 600, 12.0 INCH	12	0	5
401	SH	212	TP-016	PIPE, B-36.10, ASTM A 106 GR.B, BE, SEAMLESS, IBR, 6.0 INCH, XS	6	0	7
402	SH	212	TP-016	FLNG.WN, B-16.5, ASTM A 105 (NORMALISED), 600, RF/125AARH, IBR, 6.0 INCH, XS	6	0	3
403	SH	212	TP-016	FLNG.BLIND, B-16.5, ASTM A 105 (NORMALISED), 600, RF/125AARH, IBR, 6.0 INCH	6	0	1
404	SH	212	TP-016	FLNG.FIG.8, ASME-B16.48, ASTM A 516 GR.70(NORMALISED), 600, FF/125AARH, IBR, 6.0 INCH	6	0	1
405	SH	212	TP-016	ELBOW.90, B-16.9, ASTM A 234 GR.WPB, BW, 1.5D, IBR, 6.0 INCH, XS	6	0	1
406	SH	212	TP-016	T.RED, B-16.9, ASTM A 234 GR.WPB, BW, IBR, 10.0 INCH, S80, 6.0 INCH, XS	10	6	1
407	SH	212	TP-016	VLV.GATE, SHEET 515AB, IBR, 6.0 INCH	6	0	2
408	SH	212	TP-016	BOLT.STUD WITH 3 NUTS, B-18.2, A193 GR.B7, A194 GR.2H, 1.0 INCH X 7.75 INCH	1	0	36
409	SH	212	TP-016	BOLT.STUD WITH 3 NUTS, B-18.2, A193 GR.B7, A194 GR.2H, 1.0 INCH X 8.75 INCH	1	0	12

411	SH	212	TP-016	GASKET, B-16.20-ANSI B16.5, SP.WND SS316L+GRAFIL+ I RING, SPIRAL, 600, 6.0 INCH	6	0	5
412	SH	212	TP-031	PIPE, B-36.10, ASTM A 106 GR.B, BE, SEAMLESS, IBR, 10.0 INCH, S80	10	0	8
413	SH	212	TP-031	FLNG.WN, B-16.5, ASTM A 105 (NORMALISED), 600, RF/125AARH, IBR, 10.0 INCH, S80	10	0	3
414	SH	212	TP-031	FLNG.BLIND, B-16.5, ASTM A 105 (NORMALISED), 600, RF/125AARH, IBR, 10.0 INCH	10	0	1
415	SH	212	TP-031	SPCR&BLND, ASME-B16.48, ASTM A 516 GR.70(NORMALISED), 600, FF/125AARH, IBR, 10.0 INCH	10	0	1
416	SH	212	TP-031	ELBOW.90, B-16.9, ASTM A 234 GR.WPB, BW, 1.5D, IBR, 10.0 INCH, S80	10	0	1
417	SH	212	TP-031	T.EQUAL, B-16.9, ASTM A 234 GR.WPB, BW, IBR, 10.0 INCH, S80	10	0	1
418	SH	212	TP-031	VLV.GATE, SHEET 515AB, IBR, 10.0 INCH	10	0	2
419	SH	212	TP-031	BOLT.STUD WITH 3 NUTS, B-18.2, A193 GR.B7, A194 GR.2H, 1.25 INCH X 11.25 INCH	1.25	11.25	16
420	SH	212	TP-031	BOLT.STUD WITH 3 NUTS, B-18.2, A193 GR.B7, A194 GR.2H, 1.25 INCH X 9.75 INCH	1.25	0	48
422	SH	212	TP-031	GASKET, B-16.20-ANSI B16.5, SP.WND SS316L+GRAFIL+ I RING, SPIRAL, 600, 10.0 INCH	10	0	5
423	SL	86	TP-XX5	PIPE, B-36.10, ASTM A 106 GR.B, PE, SEAMLESS, IBR, 1.5 INCH, XS	1.5	0	1
424	SL	86	TP-XX5	FLNG.WN, B-16.5, ASTM A 105 (NORMALISED), 150, RF/125AARH, IBR, 1.5 INCH, XS	1.5	0	2
425	SL	86	TP-XX5	FLNG.BLIND, B-16.5, ASTM A 105 (NORMALISED), 150, RF/125AARH, IBR, 1.5 INCH	1.5	0	2
426	SL	86	TP-XX5	FLNG.FIG.8, ASME-B16.48, ASTM A 516 GR.70(NORMALISED), 150, FF/125AARH, IBR, 1.5 INCH	1.5	0	2
427	SL	86	TP-XX5	SOCKOLET, MSS-SP97, ASTM A 105 (NORMALISED), SW, 3000, IBR, 18.0 INCH, 1.5 INCH	18	1.5	2
428	SL	86	TP-XX5	VLV.GATE, SHEET 510AB, IBR, 1.5 INCH	1.5	0	2
429	SL	86	TP-XX5	BOLT.STUD WITH 2 NUTS, B-18.2, A193 GR.B7, A194 GR.2H, 0.5 INCH X 3.25 INCH	0.5	0	8
430	SL	86	TP-XX5	GASKET, B-16.20-ANSI B16.5, LS SP.WND SS316+FLEX GRAFIL+IR, SPIRAL, 150, 1.5 INCH	1.5	0	4
431	SL	87	TP-XX6	PIPE, B-36.10, ASTM A 106 GR.B, PE, SEAMLESS, IBR, 1.5 INCH, XS	1.5	0	1
432	SL	87	TP-XX6	FLNG.WN, B-16.5, ASTM A 105 (NORMALISED), 150, RF/125AARH, IBR, 1.5 INCH, XS	1.5	0	2
433	SL	87	TP-XX6	FLNG.BLIND, B-16.5, ASTM A 105 (NORMALISED), 150, RF/125AARH, IBR, 1.5 INCH	1.5	0	2
434	SL	87	TP-XX6	FLNG.FIG.8, ASME-B16.48, ASTM A 516 GR.70(NORMALISED), 150, FF/125AARH, IBR, 1.5 INCH	1.5	0	2
435	SL	87	TP-XX6	SOCKOLET, MSS-SP97, ASTM A 105 (NORMALISED), SW, 3000, IBR, 18.0 INCH, 1.5 INCH	18	1.5	2
436	SL	87	TP-XX6	VLV.GATE, SHEET 510AB, IBR, 1.5 INCH	1.5	0	2
437	SL	87	TP-XX6	BOLT.STUD WITH 2 NUTS, B-18.2, A193 GR.B7, A194 GR.2H, 0.5 INCH X 3.25 INCH	0.5	0	8
438	SL	87	TP-XX6	GASKET, B-16.20-ANSI B16.5, LS SP.WND SS316+FLEX GRAFIL+IR, SPIRAL, 150, 1.5 INCH	1.5	0	4
439	SL	89	TP-XX4	PIPE, B-36.10, ASTM A 106 GR.B, PE, SEAMLESS, IBR, 1.5 INCH, XS	1.5	0	2.5
440	SL	89	TP-XX4	FLNG.WN, B-16.5, ASTM A 105 (NORMALISED), 150, RF/125AARH, IBR, 1.5 INCH, XS	1.5	0	5
441	SL	89	TP-XX4	FLNG.BLIND, B-16.5, ASTM A 105 (NORMALISED), 150, RF/125AARH, IBR, 1.5 INCH	1.5	0	5
442	SL	89	TP-XX4	FLNG.FIG.8, ASME-B16.48, ASTM A 516 GR.70(NORMALISED), 150, FF/125AARH, IBR, 1.5 INCH	1.5	0	5
443	SL	89	TP-XX4	SOCKOLET, MSS-SP97, ASTM A 105 (NORMALISED), SW, 3000, IBR, 18.0 INCH, 1.5 INCH	18	1.5	5
444	SL	89	TP-XX4	VLV.GATE, SHEET 510AB, IBR, 1.5 INCH	1.5	0	5
445	SL	89	TP-XX4	BOLT.STUD WITH 2 NUTS, B-18.2, A193 GR.B7, A194 GR.2H, 0.5 INCH X 3.25 INCH	0.5	0	20
446	SL	89	TP-XX4	GASKET, B-16.20-ANSI B16.5, LS SP.WND SS316+FLEX GRAFIL+IR, SPIRAL, 150, 1.5 INCH	1.5	0	10
448	SL	212	TP-017	FLNG.BLIND, B-16.5, ASTM A 105 (NORMALISED), 150, RF/125AARH, IBR, 24.0 INCH	24	0	1
449	SL	212	TP-017	SPCR&BLND, ASME-B16.48, ASTM A 516 GR.70(NORMALISED), 150, FF/125AARH, IBR, 24.0 INCH	24	0	1
450	SL	212	TP-017	VLV.GATE, SHEET 513AB, IBR, 24.0 INCH	24	0	1
451	SL	212	TP-017	BOLT.STUD WITH 3 NUTS, B-18.2, A193 GR.B7, A194 GR.2H, 1.25 INCH X 8 INCH	1.25	0	20
452	SL	212	TP-017	BOLT.STUD WITH 3 NUTS, B-18.2, A193 GR.B7, A194 GR.2H, 1.25 INCH X 9.5 INCH	1.25	0	20
454	SL	212	TP-017	GASKET, B-16.20-ANSI B16.5, LS SP.WND SS316+FLEX GRAFIL+IR, SPIRAL, 150, 24.0 INCH	24	0	3
455	SL	212	TP-XX3	PIPE, B-36.10, ASTM A 106 GR.B, PE, SEAMLESS, IBR, 1.5 INCH, XS	1.5	0	8
456	SL	212	TP-XX3	FLNG.WN, B-16.5, ASTM A 105 (NORMALISED), 150, RF/125AARH, IBR, 1.5 INCH, XS	1.5	0	16
457	SL	212	TP-XX3	FLNG.BLIND, B-16.5, ASTM A 105 (NORMALISED), 150, RF/125AARH, IBR, 1.5 INCH	1.5	0	16
458	SL	212	TP-XX3	FLNG.FIG.8, ASME-B16.48, ASTM A 516 GR.70(NORMALISED), 150, FF/125AARH, IBR, 1.5 INCH	1.5	0	16
459	SL	212	TP-XX3	SOCKOLET, MSS-SP97, ASTM A 105 (NORMALISED), SW, 3000, IBR, 24.0 INCH, 1.5 INCH	24	1.5	16
460	SL	212	TP-XX3	VLV.GATE, SHEET 510AB, IBR, 1.5 INCH	1.5	0	16
461	SL	212	TP-XX3	BOLT.STUD WITH 2 NUTS, B-18.2, A193 GR.B7, A194 GR.2H, 0.5 INCH X 3.25 INCH	0.5	0	64
462	SL	212	TP-XX3	GASKET, B-16.20-ANSI B16.5, LS SP.WND SS316+FLEX GRAFIL+IR, SPIRAL, 150, 1.5 INCH	1.5	0	32
463	WB	212	TP-018	PIPE, B-36.10, ASTM A 106 GR.B, BE, SEAMLESS, IBR, 3.0 INCH, XS	3	0	11.7
464	WB	212	TP-018	PIPE, B-36.10, ASTM A 106 GR.B, BE, SEAMLESS, IBR, 10.0 INCH, STD	10	0	0.152
465	WB	212	TP-018	REINF.PAD, ASTM A 106 GR.B, IBR, 10.0 INCH, STD, 3.0 INCH	10	3	1
466	WB	212	TP-018	FLNG.WN, B-16.5, ASTM A 105 (NORMALISED), 300, RF/125AARH, IBR, 3.0 INCH, XS	3	0	1
467	WB	212	TP-018	FLNG.BLIND, B-16.5, ASTM A 105 (NORMALISED), 300, RF/125AARH, IBR, 3.0 INCH	3	0	1
468	WB	212	TP-018	FLNG.FIG.8, ASME-B16.48, ASTM A 516 GR.70(NORMALISED), 300, FF/125AARH, IBR, 3.0 INCH	3	0	1
469	WB	212	TP-018	ELBOW.90, B-16.9, ASTM A 234 GR.WPB, BW, 1.5D, IBR, 3.0 INCH, XS	3	0	1

470	WB	212	TP-018	VLV.GATE, SHEET 514AB, IBR, 3.0 INCH	3	0	1
471	WB	212	TP-018	BOLT.STUD WITH 2 NUTS, B-18.2, A193 GR.B7, A194 GR.2H, 0.75 INCH X 4.75 INCH	0.75	0	8
472	WB	212	TP-018	BOLT.STUD WITH 2 NUTS, B-18.2, A193 GR.B7, A194 GR.2H, 0.75 INCH X 4.25 INCH	0.75	0	8
473	WB	212	TP-018	GASKET, B-16.20-ANSI B16.5, SP.WND SS316+GRAFIL+ I RING, SPIRAL, 300, 3.0 INCH	3	0	3
474	WB	212	TP-019	PIPE, B-36.10, ASTM A 106 GR.B, BE, SEAMLESS, IBR, 6.0 INCH, S120	6	0	5
475	WB	212	TP-019	FLNG.WN, B-16.5, ASTM A 105 (NORMALISED), 600, RF/125AARH, IBR, 6.0 INCH, S120	6	0	3
476	WB	212	TP-019	FLNG.BLIND, B-16.5, ASTM A 105 (NORMALISED), 600, RF/125AARH, IBR, 6.0 INCH	6	0	1
477	WB	212	TP-019	FLNG.FIG.8, ASME-B16.48, ASTM A 516 GR.70(NORMALISED), 600, FF/125AARH, IBR, 6.0 INCH	6	0	1
478	WB	212	TP-019	ELBOW.90, B-16.9, ASTM A 234 GR.WPB, BW, 1.5D, IBR, 6.0 INCH, S120	6	0	1
479	WB	212	TP-019	T.RED, B-16.9, ASTM A 234 GR.WPB, BW, IBR, 8.0 INCH, S100, 6.0 INCH, S120	8	6	1
480	WB	212	TP-019	T.RED, B-16.9, ASTM A 234 GR.WPB, BW, IBR, 10.0 INCH, S100, 6.0 INCH, S120	10	6	1
481	WB	212	TP-019	VLV.GATE, SHEET 515AB, IBR, 6.0 INCH	6	0	2
482	WB	212	TP-019	BOLT.STUD WITH 3 NUTS, B-18.2, A193 GR.B7, A194 GR.2H, 1.0 INCH X 7.75 INCH	1	0	36
483	WB	212	TP-019	BOLT.STUD WITH 3 NUTS, B-18.2, A193 GR.B7, A194 GR.2H, 1.0 INCH X 8.75 INCH	1	0	12
485	WB	212	TP-019	GASKET, B-16.20-ANSI B16.5, SP.WND SS316L+GRAFIL+ I RING, SPIRAL, 600, 6.0 INCH	6	0	5
486	WB	212	TP-033	PIPE, B-36.10, ASTM A 106 GR.B, BE, SEAMLESS, IBR, 6.0 INCH, S120	6	0	13.5
487	WB	212	TP-033	FLNG.WN, B-16.5, ASTM A 105 (NORMALISED), 600, RF/125AARH, IBR, 6.0 INCH, S120	6	0	3
488	WB	212	TP-033	FLNG.BLIND, B-16.5, ASTM A 105 (NORMALISED), 600, RF/125AARH, IBR, 6.0 INCH	6	0	1
489	WB	212	TP-033	FLNG.FIG.8, ASME-B16.48, ASTM A 516 GR.70(NORMALISED), 600, FF/125AARH, IBR, 6.0 INCH	6	0	1
490	WB	212	TP-033	ELBOW.90, B-16.9, ASTM A 234 GR.WPB, BW, 1.5D, IBR, 6.0 INCH, S120	6	0	1
491	WB	212	TP-033	T.RED, B-16.9, ASTM A 234 GR.WPB, BW, IBR, 8.0 INCH, S100, 6.0 INCH, S120	8	6	1
492	WB	212	TP-033	T.RED, B-16.9, ASTM A 234 GR.WPB, BW, IBR, 10.0 INCH, S100, 6.0 INCH, S120	10	6	1
493	WB	212	TP-033	VLV.GATE, SHEET 515AB, IBR, 6.0 INCH	6	0	2
494	WB	212	TP-033	BOLT.STUD WITH 3 NUTS, B-18.2, A193 GR.B7, A194 GR.2H, 1.0 INCH X 7.75 INCH	1	0	36
495	WB	212	TP-033	BOLT.STUD WITH 3 NUTS, B-18.2, A193 GR.B7, A194 GR.2H, 1.0 INCH X 8.75 INCH	1	0	12
497	WB	212	TP-033	GASKET, B-16.20-ANSI B16.5, SP.WND SS316L+GRAFIL+ I RING, SPIRAL, 600, 6.0 INCH	6	0	5
498	WCR	212	TP-044	PIPE, B-36.10, ASTM A 106 GR.B, BE, SEAMLESS, 6.0 INCH, STD	6	0	6
499	WCR	212	TP-044	FLNG.WN, B-16.5, ASTM A 105 (NORMALISED), 150, RF/125AARH, 6.0 INCH, STD	6	0	1
500	WCR	212	TP-044	FLNG.BLIND, B-16.5, ASTM A 105 (NORMALISED), 150, RF/125AARH, 6.0 INCH	6	0	1
501	WCR	212	TP-044	FLNG.FIG.8, ASME-B16.48, ASTM A 516 GR.70(NORMALISED), 150, FF/125AARH, 6.0 INCH	6	0	1
502	WCR	212	TP-044	ELBOW.90, B-16.9, ASTM A 234 GR.WPB, BW, 1.5D, 6.0 INCH, STD	6	0	1
503	WCR	212	TP-044	VLV.BTRFLY, SHEET 563DA, 6.0 INCH	6	0	1
504	WCR	212	TP-044	BOLT.STUD WITH 2 NUTS, B-18.2, A193 GR.B7, A194 GR.2H, 0.75 INCH X 4.75 INCH	0.75	0	8
505	WCR	212	TP-044	BOLT.STUD WITH 2 NUTS, B-18.2, A193 GR.B7, A194 GR.2H, 0.75 INCH X 4 INCH	0.75	0	8
507	WCR	212	TP-044	GASKET, B-16.20-ANSI B16.5, LS SP.WND SS316+FLEX GRAFIL+IR, SPIRAL, 150, 6.0 INCH	6	0	3
508	WCS	212	TP-043	PIPE, B-36.10, ASTM A 106 GR.B, BE, SEAMLESS, 6.0 INCH, STD	6	0	6
509	WCS	212	TP-043	FLNG.WN, B-16.5, ASTM A 105 (NORMALISED), 150, RF/125AARH, 6.0 INCH, STD	6	0	1
510	WCS	212	TP-043	FLNG.BLIND, B-16.5, ASTM A 105 (NORMALISED), 150, RF/125AARH, 6.0 INCH	6	0	1
511	WCS	212	TP-043	FLNG.FIG.8, ASME-B16.48, ASTM A 516 GR.70(NORMALISED), 150, FF/125AARH, 6.0 INCH	6	0	1
512	WCS	212	TP-043	ELBOW.90, B-16.9, ASTM A 234 GR.WPB, BW, 1.5D, 6.0 INCH, STD	6	0	1
513	WCS	212	TP-043	VLV.BTRFLY, SHEET 563DA, 6.0 INCH	6	0	1
514	WCS	212	TP-043	BOLT.STUD WITH 2 NUTS, B-18.2, A193 GR.B7, A194 GR.2H, 0.75 INCH X 4.75 INCH	0.75	0	8
515	WCS	212	TP-043	BOLT.STUD WITH 2 NUTS, B-18.2, A193 GR.B7, A194 GR.2H, 0.75 INCH X 4 INCH	0.75	0	8
517	WCS	212	TP-043	GASKET, B-16.20-ANSI B16.5, LS SP.WND SS316+FLEX GRAFIL+IR, SPIRAL, 150, 6.0 INCH	6	0	3
518	WDK	212	TP-014	PIPE, B-36.10, ASTM A 106 GR.B(GALV), BE, SEAMLESS, 3.0 INCH, STD	3	0	4.4
519	WDK	212	TP-014	FLNG.SO, B-16.5, ASTM A 105 N (GALV.), 150, FF/125AARH, 3.0 INCH	3	0	1
520	WDK	212	TP-014	FLNG.BLIND, B-16.5, ASTM A 105 N (GALV.), 150, FF/125AARH, 3.0 INCH	3	0	1
521	WDK	212	TP-014	FLNG.FIG.8, ASME-B16.48, ASTM A 516N Gr.70 (GALV.), 150, FF/125AARH, 3.0 INCH	3	0	1
522	WDK	212	TP-014	ELBOW.90, B-16.9, ASTM A 234 GR.WPB(GALV), BW, 1.5D, 3.0 INCH, STD	3	0	1
523	WDK	212	TP-014	T.RED, B-16.9, ASTM A 234 GR.WPB(GALV), BW, 6.0 INCH, STD, 3.0 INCH, STD	6	3	1
524	WDK	212	TP-014	VLV.GATE, SHEET 513FE, 3.0 INCH	3	0	1
525	WDK	212	TP-014	BOLT.STUD WITH 2 NUTS, B-18.2, A193 GR.B7(GALV), A194 2H(GALV), 0.625 INCH X 3.75 INCH	0.625	0	4
526	WDK	212	TP-014	BOLT.STUD WITH 2 NUTS, B-18.2, A193 GR.B7(GALV), A194 2H(GALV), 0.625 INCH X 4.0 INCH	0.625	4	4
527	WDK	212	TP-014	GASKET, B-16.21-ANSI B16.5, NONASB. SYN FIBRE+ RUBR BINDER, FULLFACE, 150, 3.0 INCH, 2 MM	3	0	3
528	WDK	212	TP-030	PIPE, B-36.10, ASTM A 106 GR.B(GALV), BE, SEAMLESS, 3.0 INCH, STD	3	0	11.1
529	WDK	212	TP-030	FLNG.SO, B-16.5, ASTM A 105 N (GALV.), 150, FF/125AARH, 3.0 INCH	3	0	1

530	WDK	212	TP-030	FLNG.BLIND, B-16.5, ASTM A 105 N (GALV.), 150, FF/125AARH, 3.0 INCH	3	0	1
531	WDK	212	TP-030	FLNG.FIG.8, ASME-B16.48, ASTM A 516N Gr.70 (GALV.), 150, FF/125AARH, 3.0 INCH	3	0	1
532	WDK	212	TP-030	ELBOW.90, B-16.9, ASTM A 234 GR.WPB(GALV), BW, 1.5D, 3.0 INCH, STD	3	0	1
533	WDK	212	TP-030	T.RED, B-16.9, ASTM A 234 GR.WPB(GALV), BW, 6.0 INCH, STD, 3.0 INCH, STD	6	3	1
534	WDK	212	TP-030	VLV.GATE, SHEET 513FE, 3.0 INCH	3	0	1
535	WDK	212	TP-030	BOLT.STUD WITH 2 NUTS, B-18.2, A193 GR.B7(GALV), A194 2H(GALV), 0.625 INCH X 3.75 INCH	0.625	0	4
536	WDK	212	TP-030	BOLT.STUD WITH 2 NUTS, B-18.2, A193 GR.B7(GALV), A194 2H(GALV), 0.625 INCH X 4.0 INCH	0.625	4	4
537	WDK	212	TP-030	GASKET, B-16.21-ANSI B16.5, NONASB. SYN FIBRE+ RUBR BINDER, FULLFACE, 150, 3.0 INCH, 2 MM	3	0	3
538	WDM	212	TP-XX1	PIPE, B-36.19, ASTM A 312 TP304L, BE, SEAMLESS, 2.0 INCH, 40S	2	0	12
539	WDM	212	TP-XX1	PIPE, B-36.19, ASTM A 358 TP304L CL.1, BE, E.FS.W, 14.0 INCH, 10S	14	0	0.102
540	WDM	212	TP-XX1	REINF.PAD, ASTM A 358 TP304L CL.1, 14.0 INCH, 10S, 2.0 INCH	14	2	1
541	WDM	212	TP-XX1	FLNG.WN, B-16.5, ASTM A 182 GR.F304L, 150, RF/125AARH, 2.0 INCH, 40S	2	0	1
542	WDM	212	TP-XX1	FLNG.BLIND, B-16.5, ASTM A 182 GR.F304L, 150, RF/125AARH, 2.0 INCH	2	0	1
543	WDM	212	TP-XX1	FLNG.FIG.8, ASME-B16.48, ASTM A 240 GR.304L, 150, FF/125AARH, 2.0 INCH	2	0	1
544	WDM	212	TP-XX1	ELBOW.90, B-16.9, ASTM A 403 GR.WP304L-S, BW, 1.5D, 2.0 INCH, 40S	2	0	1
545	WDM	212	TP-XX1	VLV.GATE, SHEET 513AL, 2.0 INCH	2	0	1
546	WDM	212	TP-XX1	BOLT.STUD WITH 2 NUTS, B-18.2, A193 GR.B7, A194 GR.2H, 0.625 INCH X 3.75 INCH	0.625	0	4
547	WDM	212	TP-XX1	BOLT.STUD WITH 2 NUTS, B-18.2, A193 GR.B7, A194 GR.2H, 0.625 INCH X 3.25 INCH	0.625	0	4
548	WDM	212	TP-XX1	GASKET, B-16.20-ANSI B16.5, LS SP.WND SS316+FLEX GRAFIL+IR, SPIRAL, 150, 2.0 INCH	2	0	3
549	WDM	212	TP-XX2	PIPE, B-36.19, ASTM A 312 TP304L, BE, SEAMLESS, 2.0 INCH, 40S	2	0	4.5
550	WDM	212	TP-XX2	PIPE, B-36.19, ASTM A 358 TP304L CL.1, BE, E.FS.W, 14.0 INCH, 10S	14	0	0.102
551	WDM	212	TP-XX2	REINF.PAD, ASTM A 358 TP304L CL.1, 14.0 INCH, 10S, 2.0 INCH	14	2	1
552	WDM	212	TP-XX2	FLNG.WN, B-16.5, ASTM A 182 GR.F304L, 150, RF/125AARH, 2.0 INCH, 40S	2	0	1
553	WDM	212	TP-XX2	FLNG.BLIND, B-16.5, ASTM A 182 GR.F304L, 150, RF/125AARH, 2.0 INCH	2	0	1
554	WDM	212	TP-XX2	FLNG.FIG.8, ASME-B16.48, ASTM A 240 GR.304L, 150, FF/125AARH, 2.0 INCH	2	0	1
555	WDM	212	TP-XX2	ELBOW.90, B-16.9, ASTM A 403 GR.WP304L-S, BW, 1.5D, 2.0 INCH, 40S	2	0	1
556	WDM	212	TP-XX2	VLV.GATE, SHEET 513AL, 2.0 INCH	2	0	1
557	WDM	212	TP-XX2	BOLT.STUD WITH 2 NUTS, B-18.2, A193 GR.B7, A194 GR.2H, 0.625 INCH X 3.75 INCH	0.625	0	4
558	WDM	212	TP-XX2	BOLT.STUD WITH 2 NUTS, B-18.2, A193 GR.B7, A194 GR.2H, 0.625 INCH X 3.25 INCH	0.625	0	4
559	WDM	212	TP-XX2	GASKET, B-16.20-ANSI B16.5, LS SP.WND SS316+FLEX GRAFIL+IR, SPIRAL, 150, 2.0 INCH	2	0	3
560	WP	211	TP-002	PIPE, B-36.10, ASTM A 106 GR.B, BE, SEAMLESS, NAC6, 3.0 INCH, S160	3	0	3.9
561	WP	211	TP-002	PIPE, B-36.10, ASTM A 106 GR.B, BE, SEAMLESS, NAC6, 10.0 INCH, XS	10	0	0.152
562	WP	211	TP-002	REINF.PAD, ASTM A 106 GR.B, NAC6, 10.0 INCH, XS, 3.0 INCH	10	3	1
563	WP	211	TP-002	FLNG.WN, B-16.5, ASTM A 105 (NORMALISED), 300, RF/125AARH, NAC6, 3.0 INCH, S160	3	0	1
564	WP	211	TP-002	FLNG.BLIND, B-16.5, ASTM A 105 (NORMALISED), 300, RF/125AARH, NAC6, 3.0 INCH	3	0	1
565	WP	211	TP-002	FLNG.FIG.8, ASME-B16.48, ASTM A 105 (NORMALISED), 300, FF/125AARH, NAC6, 3.0 INCH	3	0	1
566	WP	211	TP-002	ELBOW.90, B-16.9, ASTM A 234 GR.WPB, BW, 1.5D, NAC6, 3.0 INCH, S160	3	0	1
567	WP	211	TP-002	VLV.GATE, SHEET 514VC, NAC6, 3.0 INCH	3	0	1
568	WP	211	TP-002	BOLT.STUD WITH 2 NUTS, B-18.2, A193 GR.B7M, A194 GR.2HM, NAC6, 0.75 INCH X 4.25 INCH	0.75	4.25	8
569	WP	211	TP-002	BOLT.STUD WITH 2 NUTS, B-18.2, A193 GR.B7M, A194 GR.2HM, NAC6, 0.75 INCH X 4.75 INCH	0.75	4.75	8
570	WP	211	TP-002	GASKET, B-16.20-ANSI B16.5, SP.WND SS316+GRAFIL, SPIRAL, 300, NAC6, 3.0 INCH	3	0	3
571	WS	212	TP-013	PIPE, B-36.10, ASTM A 106 GR.B, BE, SEAMLESS, 3.0 INCH, STD	3	0	10
572	WS	212	TP-013	FLNG.WN, B-16.5, ASTM A 105 (NORMALISED), 150, RF/125AARH, 3.0 INCH, STD	3	0	1
573	WS	212	TP-013	FLNG.BLIND, B-16.5, ASTM A 105 (NORMALISED), 150, RF/125AARH, 3.0 INCH	3	0	1
574	WS	212	TP-013	FLNG.FIG.8, ASME-B16.48, ASTM A 516 GR.70(NORMALISED), 150, FF/125AARH, 3.0 INCH	3	0	1
575	WS	212	TP-013	ELBOW.90, B-16.9, ASTM A 234 GR.WPB, BW, 1.5D, 3.0 INCH, STD	3	0	1
576	WS	212	TP-013	VLV.GATE, SHEET 513DA, 3.0 INCH	3	0	1
577	WS	212	TP-013	BOLT.STUD WITH 2 NUTS, B-18.2, A193 GR.B7, A194 GR.2H, 0.625 INCH X 4 INCH	0.625	0	4
578	WS	212	TP-013	BOLT.STUD WITH 2 NUTS, B-18.2, A193 GR.B7, A194 GR.2H, 0.625 INCH X 3.75 INCH	0.625	0	4
579	WS	212	TP-013	GASKET, B-16.20-ANSI B16.5, LS SP.WND SS316+FLEX GRAFIL+IR, SPIRAL, 150, 3.0 INCH	3	0	3
580	WS	212	TP-029	PIPE, B-36.10, ASTM A 106 GR.B, BE, SEAMLESS, 3.0 INCH, STD	3	0	5.6
581	WS	212	TP-029	FLNG.WN, B-16.5, ASTM A 105 (NORMALISED), 150, RF/125AARH, 3.0 INCH, STD	3	0	1
582	WS	212	TP-029	FLNG.BLIND, B-16.5, ASTM A 105 (NORMALISED), 150, RF/125AARH, 3.0 INCH	3	0	1
583	WS	212	TP-029	FLNG.FIG.8, ASME-B16.48, ASTM A 516 GR.70(NORMALISED), 150, FF/125AARH, 3.0 INCH	3	0	1
584	WS	212	TP-029	ELBOW.90, B-16.9, ASTM A 234 GR.WPB, BW, 1.5D, 3.0 INCH, STD	3	0	1
585	WS	212	TP-029	VLV.GATE, SHEET 513DA, 3.0 INCH	3	0	1

586	WS	212	TP-029	BOLT.STUD WITH 2 NUTS, B-18.2, A193 GR.B7, A194 GR.2H, 0.625 INCH X 4 INCH	0.625	0	4
587	WS	212	TP-029	BOLT.STUD WITH 2 NUTS, B-18.2, A193 GR.B7, A194 GR.2H, 0.625 INCH X 3.75 INCH	0.625	0	4
588	WS	212	TP-029	GASKET, B-16.20-ANSI B16.5, LS SP.WND SS316+FLEX GRAFIL+IR, SPIRAL, 150, 3.0 INCH	3	0	3

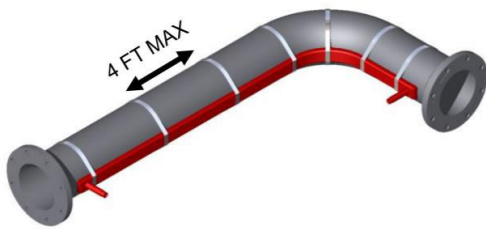
CONTRO TRACING (*ControTrace®*)

Technical Notes

ControTrace® is the proprietary item from CSI Heat (Control Southeast Inc., USA)

This is an unique tracing design system in place of conventional steam tracing using tubes/pipes.

The basic configuration of a ControTrace® heat tracing element is a 2-in. by 1-in. rectangular tube formed of SA178 Grade A boiler tubing. One of the 2-in. sides is contoured to closely fit the outside diameter of the pipe onto which it will be placed. The standard wall thickness is 1/8 in., ensuring ample robustness and pressure-containing capability. Individual elements are fabricated to specific lengths. The ends of the tubing are closed (seal welded), and inlet and outlet connections are added to enable heating medium transfer. When multiple elements are required, these are most often joined together in a panel configuration to minimize the number of inlet/outlet connections. ControTrace® is secured to the pipe or vessel with high-strength banding (no welding is required). Before banding, a thin layer of heat transfer compound is spread onto the surface that will be in contact with the pipe or vessel.



During operation, the heating medium (typically steam or heating fluid) flows through the heating element and transfers its heat through the heat transfer compound and into the pipe/vessel wall and into the process. The number of heating elements required depends upon the design objective and the design conditions. Most ControTrace® applications are designed to maintain a process temperature (to keep liquid flowing) or a minimum pipe wall temperature (to prevent vapor condensation). CSI utilizes finite-difference computer modeling to simulate and predict temperature profiles and heat transfer rates based upon process, ambient, piping, and insulation conditions. The computer model has been corroborated time and again with empirical field data.

Usage and implementation of ControTrace® is recommended for specific critical piping by Licensor for the “SRU” project of IOCL-Paradip Refinery. The piping lines requiring this ControTrace® is identified as “CT” on the line numbering in P&IDs / Line list.

CONTRACTOR to provide this proprietary tracing system from ‘CSI Heat’ vendor for the indicated lines in P&ID to suit the operating condition of the fluids as per Line list .

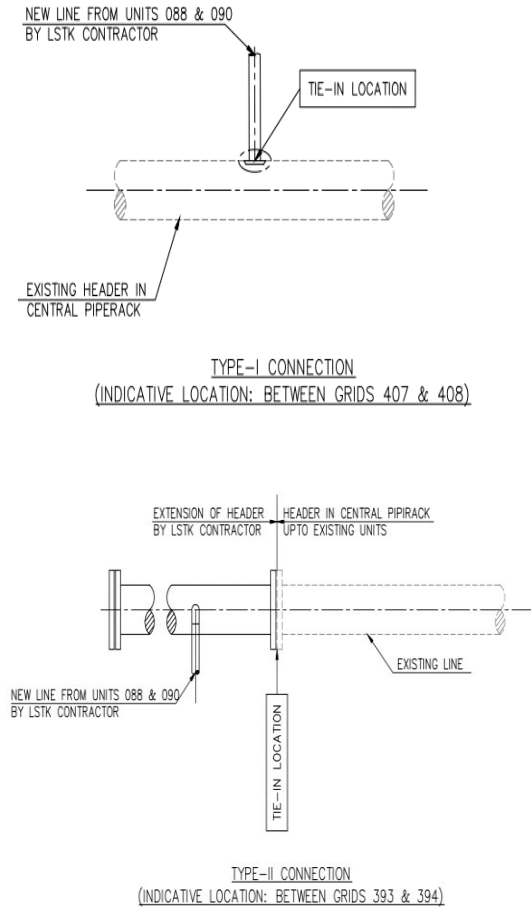
For more details, refer:

<https://www.csiheat.com/whatwedo/industrialtracingandheatingsolutions/controtrace>

Tie-in No	Service	Type	Location	Service	From	To	Line Number	Line Size	Remarks	From / To	Phase	Type	Insu
088-TP-001	Process IN	Type-II	CPR GR 393-394	AMINE ACID GAS	HEADER	UNIT 088	900-P-211-8000-A2AQ-IT	36		ARU	V	EF	IT
088-TP-002	Process OUT	Type-I	CPR GR 407-408	SOUR WATER FROM KOD PUMPS	UNIT 088	HEADER	80-P-211-8002-B4AR-NI	3		SWS UNIT	L	CT	NI
088-TP-003	Process IN	Type-II	CPR GR 393-394	SWS ACID GAS	HEADER	UNIT 088	500-P-211-8003-A2AQ-IT	20		SWS	V	EF	IT
088-TP-004	Process IN	Type-I	CPR GR 407-408	FGD SO2 GAS	HEADER	UNIT 088	250-P-211-8006-A1LV-IT	10		FGD	V	CT	IT
088-TP-005	Process OUT	Type-II	CPR GR 393-394	SRU TAIL GAS FROM FINAL CONDENSER	UNIT 088	HEADER	1200-P-211-8007-A2AP-IT	48		INCINERATOR	V	EF	CT
088-TP-006	Process OUT	Type-II	CPR GR 393-394	SRU TAIL GAS DIVERSION	UNIT 088	HEADER	1200-P-211-8009-A2AP-IT	48	NNF	INCINERATOR	V	EF	CT
088-TP-007	Process OUT	Type-II	CPR GR 393-394	SULFUR PIT VAPOUR	UNIT 088	HEADER	250-P-211-8011-A2AF-IJ	10		INCINERATOR	V	EF	IJ
088-TP-008	Process OUT	Type-I	CPR GR 407-408	LIQUID SULFUR	UNIT 088	HEADER	150-P-211-8013-A2AF-IT	6		STORAGE	L	EF	IJ
088-TP-009	Process OUT	Type-II	CPR GR 393-394	DEGASSING CONTACTOR OVER HEAD	UNIT 088	HEADER	200-P-211-8014-A2AF-IJ	8		INCINERATOR	V	EF	IJ
088-TP-010	Process IN	Type-II	CPR GR 393-394	COMBUSTION AIR	HEADER	UNIT 088	1100-PA-211-8005-A2AP-IH	44		UNIT 085	V	EF	IH
088-TP-011	Utility IN	Type-I	CPR GR 407-408	PLANT AIR	HEADER	UNIT 088	50-AP-212-8016-A1AA-NI	2		HEADER	V	CT	NI
088-TP-012	Utility IN	Type-II	CPR GR 393-394	NITROGEN	HEADER	UNIT 088	200-N-212-8017-A1AA-NI	8		HEADER	V	EF	NI
088-TP-013	Utility IN	Type-I	CPR GR 407-408	SERVICE WATER	HEADER	UNIT 088	80-WS-212-8018-A2AW-NI	3		HEADER	L	CT	NI
088-TP-014	Utility IN	Type-I	CPR GR 407-408	POTABLE WATER	HEADER	UNIT 088	80-WDK-212-8019-S1RW-NI	3		HEADER	L	CT	IH
088-TP-015	Utility OUT	Type-II	CPR GR 393-394	SATURATED HP STEAM	UNIT 088	HEADER	300-SH-212-8020-D1AS-IH	12		HEADER	V	EF	IH
088-TP-016	Utility OUT	Type-I	CPR GR 407-408	SUPERHEATED HP STEAM	UNIT 088	HEADER	150-SH-212-8021-D1AS-IH	6		HEADER	V	CT	IH
088-TP-017	Utility OUT	Type-II	CPR GR 393-394	LP STEAM	UNIT 088	HEADER	600-SL-212-8022-A1AS-IH	24		HEADER	V	EF	IH
088-TP-018	Utility IN	Type-I	CPR GR 407-408	MP BFW	HEADER	UNIT 088	80-WB-212-8023-B2AS-IH	3		HEADER	L	CT	IH
088-TP-019	Utility IN	Type-I	CPR GR 407-408	HP BFW	HEADER	UNIT 088	150-WB-212-8024-D2AS-IH	6		HEADER	L	CT	IH
088-TP-020	Utility IN	Type-I	CPR GR 407-408	INSTRUMENT AIR	HEADER	UNIT 088	80-AI-212-8025-S0RA-NI	3		HEADER	V	CT	NI
088-TP-021	Utility OUT	Type-I	CPR GR 407-408	LP CONDENSATE	UNIT 088	HEADER	100-CL-212-8026-A2AS-IH	4		HEADER	L	CT	IH
088-TP-022	Utility OUT	Type-I	CPR GR 407-408	AG FLARE	UNIT 088	HEADER	150-FAG-212-8027-A2AQ-IT	6	LINE SIZE HOLD	HEADER	V	CT	IT
088-TP-023	Utility IN	Type-II	CPR GR 393-394	LP BLOW DOWN	HEADER	UNIT 088	50-BD-212-8028-A2AS-PP	2		HEADER	L	EF	PP
088-TP-024	Utility IN	Type-II	CPR GR 393-394	HP BLOW DOWN	HEADER	UNIT 088	100-BD-212-8029-D2AS-PP	4		HEADER	L	EF	PP
088-TP-025	Utility IN	Type-II	CPR GR 393-394	FUEL GAS SUPPLY	HEADER	UNIT 088	150-FG-212-8030-A2AD-IT	6		HEADER	V	EF	IT
088-TP-026	Utility IN	Type-I	CPR GR 407-408	LP CONDENSATE	HEADER	UNIT 088	250-CL-212-8031-A2AS-PP	10		HEADER	L	CT	PP
090-TP-027	Process IN	Type-II	CPR GR 393-394	VENT GAS	HEADER	UNIT 090	100-P-211-8501-A2AR-IT	4		SWS VENT GAS	V	EF	IT
090-TP-028	Utility IN	Type-I	CPR GR 407-408	PLANT AIR	HEADER	UNIT 090	50-AP-212-8503-A1AA-NI	2		HEADER	V	CT	NI
090-TP-029	Utility IN	Type-I	CPR GR 407-408	SERVICE WATER	HEADER	UNIT 090	80-WS-212-8505-A2AW-NI	3		HEADER	L	CT	NI
090-TP-030	Utility IN	Type-I	CPR GR 407-408	POTABLE WATER	HEADER	UNIT 090	80-WDK-212-8506-S1RW-NI	3		HEADER	L	CT	IH
090-TP-031	Utility OUT	Type-I	CPR GR 407-408	HP STEAM	UNIT 090	HEADER	250-SH-212-8507-D1AS-IH	10		HEADER	V	CT	IH
090-TP-033	Utility IN	Type-I	CPR GR 407-408	HP BFW	HEADER	UNIT 090	150-WB-212-8510-D2AS-IH	6		HEADER	L	CT	IH
090-TP-034	Utility IN	Type-I	CPR GR 407-408	INSTRUMENT AIR	HEADER	UNIT 090	100-AI-212-8511-S0RA-NI	4		HEADER	V	CT	NI
090-TP-036	Utility OUT	Type-I	CPR GR 407-408	AG FLARE	UNIT 090	HEADER	600-FAG-212-8513-A2AQ-IT	24	LINE SIZE HOLD	HEADER	V	CT	IT
090-TP-037	Utility IN	Type-I	CPR GR 407-408	FUEL GAS SUPPLY	HEADER	UNIT 090	200-FG-212-8517-A2AD-IT	8		HEADER	V	CT	NI
090-TP-038	Utility OUT	Type-I	CPR GR 407-408	LP CONDENSATE	UNIT 090	HEADER	250-CL-212-8518-A2AS-PP	10	LINE SIZE HOLD	HEADER	L	CT	PP
089-TP-039	Process IN	Type-III	TGTU-1	TAIL GAS	UNIT 089	UNIT 090	1200-P-089-8519-A2AL-NI	48		TGTU ABSORBER	V	CT	NI
089-TP-040	Process IN	Type-III	TGTU-1	TAIL GAS	UNIT 089	UNIT 090	400-P-089-8520-A2AR-IT	16	NNF	QUENCH COLUMN	V	CT	IT
089-TP-041	Process IN	Type-III	TGTU-1	VENT GAS	UNIT 089	UNIT 090	80-P-089-8521-A2AL-NI	3	NNF	AMINE SUMP	V	CT	PP
089-TP-042	Process IN	Type-III	TGTU-1	VENT GAS	UNIT 089	UNIT 090	80-P-089-8522-A2AL-NI	3	NNF	SOUR WATER SUMP	V	CT	PP
088-TP-043	Utility IN	Type-I	UG SRU-3 West	COOLING WATER SUPPLY	HEADER	UNIT 088	150-WCS-212-8035-A2AW-NI	6		HEADER	L	EF	NI
088-TP-044	Utility OUT	Type-I	UG SRU-3 West	COOLING WATER RETURN	UNIT 088	HEADER	150-WCR-212-8036-A2AW-NI	6		HEADER	L	EF	NI
089-TP-051	Process IN		TGTU-1	PROCESS GAS				16	NNF	QUENCH COLUMN	V	CT	IT
089-TP-052	Process OUT		TGTU-1	PROCESS GAS				16	NNF	INCINERATOR	V	CT	IT
089-TP-053	Process IN		TGTU-1	PROCESS GAS				48		TGTU ABSORBER	V	CT	NI
089-TP-054	Process OUT		TGTU-1	PROCESS GAS				48		INCINERATOR	V	CT	NI
089-TP-055	Process IN		TGTU-1	VENT GAS				3	NNF	AMINE SUMP	V	CT	PP
089-TP-056	Process OUT		TGTU-1	VENT GAS				3	NNF	INCINERATOR	V	CT	PP
089-TP-057	Process IN		TGTU-1	VENT GAS				3	NNF	SOUR WATER SUMP	V	CT	PP
089-TP-058	Process OUT		TGTU-1	VENT GAS				3	NNF	INCINERATOR	V	CT	PP

Tie-in Summary

IOCL Paradip 525 TPD Standby SRU



IOCL Paradip SRU Tie-In Piping BOQ

Note:-

- 1- NAC6= NACE + HIC
- 2- PIPE QTY IN METRES AND OTHERS IN NUMBERS.
- 3- GALVNISATION AS PER ASTM A153
- 4- NUTS SHALL BE HEAVY HEXAGONAL

S. NO.	ITEM DESCRIPTION	QTY1	FINAL QTY
	1 PIPE, B-36.10, ASTM A 106 GR.B, BE, SEAMLESS, 2.0 INCH, XS	5	12
	2 PIPE, B-36.10, ASTM A 106 GR.B, BE, SEAMLESS, 3.0 INCH, STD	18	24
	3 PIPE, B-36.10, ASTM A 106 GR.B, BE, SEAMLESS, 4.0 INCH, STD	3	12
	4 PIPE, B-36.10, ASTM A 106 GR.B, BE, SEAMLESS, 6.0 INCH, STD	19	24
	5 PIPE, B-36.10, ASTM A 106 GR.B, BE, SEAMLESS, 8.0 INCH, STD	7	12
	6 PIPE, B-36.10, ASTM A 106 GR.B, BE, SEAMLESS, 10.0 INCH, STD	7	12
	7 PIPE, B-36.10, ASTM A 106 GR.B, PE, SEAMLESS, IBR, 0.75 INCH, S160	75	96
	8 PIPE, B-36.10, ASTM A 106 GR.B, PE, SEAMLESS, IBR, 1.5 INCH, XS	13	18
	9 PIPE, B-36.10, ASTM A 106 GR.B, BE, SEAMLESS, IBR, 3.0 INCH, XS	12	18
	10 PIPE, B-36.10, ASTM A 106 GR.B, BE, SEAMLESS, IBR, 4.0 INCH, STD	12	18
	11 PIPE, B-36.10, ASTM A 106 GR.B, BE, SEAMLESS, IBR, 6.0 INCH, S120	19	24
	12 PIPE, B-36.10, ASTM A 106 GR.B, BE, SEAMLESS, IBR, 6.0 INCH, XS	7	12
	13 PIPE, B-36.10, ASTM A 106 GR.B, BE, SEAMLESS, IBR, 8.0 INCH, STD	7	12
	14 PIPE, B-36.10, ASTM A 106 GR.B, BE, SEAMLESS, IBR, 10.0 INCH, STD	20	30
	15 PIPE, B-36.10, ASTM A 106 GR.B, BE, SEAMLESS, IBR, 10.0 INCH, S80	8	12
	16 PIPE, B-36.10, ASTM A 106 GR.B, BE, SEAMLESS, IBR, 12.0 INCH, S80	2	12
	17 PIPE, B-36.10, ASTM A 106 GR.B, BE, SEAMLESS, IBR, 12.0 INCH, STD	7	12
	18 PIPE, B-36.10, ASTM A 106 GR.B, BE, SEAMLESS, NACE, 3.0 INCH, STD	17	24
	19 PIPE, B-36.10, ASTM A 106 GR.B, BE, SEAMLESS, NACE, 6.0 INCH, STD	10	18
	20 PIPE, B-36.10, ASTM A 106 GR.B, BE, SEAMLESS, NAC6, 3.0 INCH, S160	4	12
	21 PIPE, B-36.10, ASTM A 106 GR.B, BE, SEAMLESS, NAC6, 10.0 INCH, XS	0.152	12
	22 PIPE, B-36.10, ASTM A 106 GR.B(GALV), BE, SEAMLESS, 3.0 INCH, STD	16	24
	23 PIPE, B-36.19, ASTM A 312 TP304L, BE, SEAMLESS, 2.0 INCH, 40S	17	24
	24 PIPE, B-36.19, ASTM A 358 TP304L CL.1, BE, E.F.S.W, 14.0 INCH, 10S	0.204	12
	25 PIPE, B-36.19, ASTM A 358 TP316L CL.1, BE, E.F.S.W, 10.0 INCH, S20	9	12
	27 PIPE, B-36.10, ASTM A 671 GR.CC60 CL.32, BE, E.F.S.W, NACE, 24.0 INCH, STD	14	18
	29 PIPE, B-36.10, ASTM A 671 GR.CC60 CL.32, BE, E.F.S.W, NACE, 42.0 INCH, XS	2	12
	30 PIPE, B-36.10, ASTM A 671 GR.CC60 CL.32, BE, E.F.S.W, NACE, 48.0 INCH, XS	8	12
	31 PIPE, B-36.10, ASTM A 671 GR.CC60 CL.32, BE, E.F.S.W, NAC6, 16.0 INCH, STD	13	18
	33 PIPE, B-36.10, ASTM A 672 GR.B60 CL.32, BE, E.F.S.W, IBR, 16.0 INCH, STD	0.203	12
	34 REINF.PAD, ASTM A 672 GR.B60 CL.32, IBR, 16.0 INCH, STD, 4.0 INCH	1	1
	35 REINF.PAD, ASTM A 358 TP304L CL.1, 14.0 INCH, 10S, 2.0 INCH	2	2
	36 REINF.PAD, ASTM A 671 GR.CC60 CL.32, NACE, 42.0 INCH, XS, 6.0 INCH	1	1
	37 REINF.PAD, ASTM A 671 GR.CC60 CL.32, NACE, 42.0 INCH, XS, 24.0 INCH	1	1
	38 REINF.PAD, ASTM A 106 GR.B, IBR, 10.0 INCH, STD, 3.0 INCH	1	1
	39 REINF.PAD, ASTM A 106 GR.B, NAC6, 10.0 INCH, XS, 3.0 INCH	1	1
	40 FLNG.SW, B-16.5, ASTM A 105 (NORMALISED), 300, RF/125AARH, IBR, 0.75 INCH, S160	4	4
	41 FLNG.WN, B-16.5, ASTM A 105 (NORMALISED), 150, RF/125AARH, 2.0 INCH, XS	2	2
	42 FLNG.WN, B-16.5, ASTM A 105 (NORMALISED), 150, RF/125AARH, 3.0 INCH, STD	3	3
	43 FLNG.WN, B-16.5, ASTM A 105 (NORMALISED), 150, RF/125AARH, 4.0 INCH, STD	1	1
	44 FLNG.WN, B-16.5, ASTM A 105 (NORMALISED), 150, RF/125AARH, 6.0 INCH, STD	2	2
	45 FLNG.WN, B-16.5, ASTM A 105 (NORMALISED), 150, RF/125AARH, 8.0 INCH, STD	1	1
	46 FLNG.WN, B-16.47-B, ASTM A 105 (NORMALISED), 300, RF/125AARH, 36.0 INCH, XS	2	2
	48 FLNG.WN, B-16.47-B, ASTM A 105 (NORMALISED), 150, RF/125AARH, 48.0 INCH, XS	4	4
	49 FLNG.WN, B-16.5, ASTM A 105 (NORMALISED), 150, RF/125AARH, IBR, 0.75 INCH, S160	41	41
	50 FLNG.WN, B-16.5, ASTM A 105 (NORMALISED), 150, RF/125AARH, IBR, 1.5 INCH, XS	25	25
	52 FLNG.WN, B-16.5, ASTM A 105 (NORMALISED), 300, RF/125AARH, IBR, 3.0 INCH, XS	1	1
	54 FLNG.WN, B-16.5, ASTM A 105 (NORMALISED), 150, RF/125AARH, IBR, 4.0 INCH, STD	1	1
	55 FLNG.WN, B-16.5, ASTM A 105 (NORMALISED), 600, RF/125AARH, IBR, 6.0 INCH, XS	3	3
	56 FLNG.WN, B-16.5, ASTM A 105 (NORMALISED), 600, RF/125AARH, IBR, 6.0 INCH, S120	6	6
	57 FLNG.WN, B-16.5, ASTM A 105 (NORMALISED), 600, RF/125AARH, IBR, 10.0 INCH, S80	3	3
	58 FLNG.WN, B-16.5, ASTM A 105 (NORMALISED), 150, RF/125AARH, IBR, 10.0 INCH, STD	2	2
	59 FLNG.WN, B-16.5, ASTM A 105 (NORMALISED), 600, RF/125AARH, IBR, 12.0 INCH, S80	2	2
	61 FLNG.WN, B-16.5, ASTM A 105 (NORMALISED), 150, RF/125AARH, NACE, 3.0 INCH, STD	2	2
	62 FLNG.WN, B-16.5, ASTM A 105 (NORMALISED), 300, RF/125AARH, NACE, 3.0 INCH, STD	8	8
	63 FLNG.WN, B-16.5, ASTM A 105 (NORMALISED), 150, RF/125AARH, NACE, 6.0 INCH, STD	3	3
	64 FLNG.WN, B-16.5, ASTM A 105 (NORMALISED), 150, RF/125AARH, NACE, 20.0 INCH, STD	2	2
	65 FLNG.WN, B-16.5, ASTM A 105 (NORMALISED), 150, RF/125AARH, NACE, 24.0 INCH, STD	3	3
	66 FLNG.WN, B-16.47-B, ASTM A 105 (NORMALISED), 150, RF/125AARH, NACE, 36.0 INCH, XS	2	2
	67 FLNG.WN, B-16.47-B, ASTM A 105 (NORMALISED), 300, RF/125AARH, NACE, 48.0 INCH, XS	4	4
	68 FLNG.WN, B-16.47-B, ASTM A 105 (NORMALISED), 150, RF/125AARH, NACE, 48.0 INCH, XS	1	1
	69 FLNG.WN, B-16.5, ASTM A 105 (NORMALISED), 300, RF/125AARH, NAC6, 3.0 INCH, S160	1	1
	71 FLNG.WN, B-16.5, ASTM A 105 (NORMALISED), 150, RF/125AARH, NAC6, 16.0 INCH, STD	1	1
	72 FLNG.WN, B-16.5, ASTM A 105 (NORMALISED), 300, RF/125AARH, NAC6, 16.0 INCH, STD	4	4
	73 FLNG.WN, B-16.5, ASTM A 182 GR.F304L, 150, RF/125AARH, 2.0 INCH, 40S	2	2
	74 FLNG.WN, B-16.5, ASTM A 182 GR.F316L, 150, RF/125AARH, 10.0 INCH, S20	1	1
	75 FLNG.SO, B-16.5, ASTM A 105 (NORMALISED), 300, RF/125AARH, 8.0 INCH, 6.0 INCH	2	4
	76 FLNG.SO, B-16.5, ASTM A 105 (NORMALISED), 150, RF/125AARH, 8.0 INCH, 6.0 INCH	4	8

ITEM	ITEM1	PKG	MATERIAL	MAT	SZ1	SZ2	SCH1	SCH2	TYPE	RATING	EC	SPECIAL	MC	UWT	TWT1	TWT	
PIPE	PIPE	PREFAB	A106GRB	CS		2	XS						PIPE2XS		7.48	37.40	89.76
PIPE	PIPE	PREFAB	A106GRB	CS		3	STD						PIPE3STD	11.29	203.22	270.96	
PIPE	PIPE	PREFAB	A106GRB	CS		4	STD						PIPE4STD	16.08	48.24	192.96	
PIPE	PIPE	PREFAB	A106GRB	CS		6	STD						PIPE6STD	28.26	536.94	678.24	
PIPE	PIPE	PREFAB	A106GRB	CS		8	STD						PIPE8STD	42.55	297.85	510.60	
PIPE	PIPE	PREFAB	A106GRB	CS		10	STD						PIPE10STD	60.29	422.03	723.48	
PIPE	PIPE	PREFAB	A106GRB	CS		0.75	S160					IBR	PIPE0.75S160	2.9	217.50	278.40	
PIPE	PIPE	PREFAB	A106GRB	CS		1.5	XS					IBR	PIPE1.5XS	5.41	70.33	97.38	
PIPE	PIPE	PREFAB	A106GRB	CS		3	XS					IBR	PIPE3XS	15.27	183.24	274.86	
PIPE	PIPE	PREFAB	A106GRB	CS		4	STD					IBR	PIPE4STD	16.08	192.96	289.44	
PIPE	PIPE	PREFAB	A106GRB	CS		6	S120					IBR	PIPE6S120	54.21	1029.99	1301.04	
PIPE	PIPE	PREFAB	A106GRB	CS		6	XS					IBR	PIPE6XS	42.56	297.92	510.72	
PIPE	PIPE	PREFAB	A106GRB	CS		8	STD					IBR	PIPE8STD	42.55	297.85	510.60	
PIPE	PIPE	PREFAB	A106GRB	CS		10	STD					IBR	PIPE10STD	60.29	1205.80	1808.70	
PIPE	PIPE	PREFAB	A106GRB	CS		10	S80					IBR	PIPE10S80	95.98	767.84	1151.76	
PIPE	PIPE	PREFAB	A106GRB	CS		12	S80					IBR	PIPE12S80	132.05	264.10	1584.60	
PIPE	PIPE	PREFAB	A106GRB	CS		12	STD					IBR	PIPE12STD	73.86	517.02	886.32	
PIPE	PIPE	PREFAB	A106GRB	CS		3	STD					NACE	PIPE3STD	11.29	191.93	270.96	
PIPE	PIPE	PREFAB	A106GRB	CS		6	STD					NACE	PIPE6STD	28.26	282.60	508.68	
PIPE	PIPE	PREFAB	A106GRB	CS		3	S160					NACE+HIC	PIPE3S160	21.35	85.40	256.20	
PIPE	PIPE	PREFAB	A106GRB	CS		10	XS					NACE+HIC	PIPE10XS	81.53	12.39	978.36	
PIPE	PIPE	PREFAB	A106GRB	CS		3	STD						PIPE3STD	11.29	180.64	270.96	
PIPE	PIPE	PREFAB	A312GRTP304L	SS		2	S40S						PIPE2S40S	5.44	92.48	130.56	
PIPE	PIPE	PREFAB	A358GRTP304L	SS		14	S10S						PIPE14S10S	41.36	8.44	496.32	
PIPE	PIPE	PREFAB	A358GRTP316L	SS		10	S20						PIPE10S20	41.76	375.84	501.12	
PIPE	PIPE	PREFAB	A671GRCC60	CS		24	STD					NACE	PIPE24STD	141.12	1975.68	2540.16	
PIPE	PIPE	PREFAB	A671GRCC60	CS		42	XS					NACE	PIPE42XS	330.21	660.42	3962.52	
PIPE	PIPE	PREFAB	A671GRCC60	CS		48	XS					NACE	PIPE48XS	377.81	3022.48	4533.72	
PIPE	PIPE	PREFAB	A671GRCC60	CS		16	STD					NACE+HIC	PIPE16STD	93.27	1212.51	1678.86	
PIPE	PIPE	PREFAB	A672GRB60	CS		16	STD					IBR	PIPE16STD	93.27	18.93	1119.24	
RPAD	FITT	PREFAB	A672GRB60	CS		16	4 STD					IBR	RPAD164STD	0	0.00	0.00	
RPAD	FITT	PREFAB	A358GRTP304L	SS		14	2 S10S						RPAD142S10S	0	0.00	0.00	
RPAD	FITT	PREFAB	A671GRCC60	CS		42	6 XS					NACE	RPAD426XS	0	0.00	0.00	
RPAD	FITT	PREFAB	A671GRCC60	CS		42	24 XS					NACE	RPAD4224XS	0	0.00	0.00	
RPAD	FITT	PREFAB	A106GRB	CS		10	3 STD					IBR	RPAD103STD	0	0.00	0.00	
RPAD	FITT	PREFAB	A106GRB	CS		10	3 XS					NACE+HIC	RPAD103XS	0	0.00	0.00	
FLNG	FLNG	FLNG	A105(N)	CS		0.75			SW	CL300	RF-B16.5	IBR	FLNG0.75SWCL300RF-B16.5	1.4	5.60	5.60	
FLNG	FLNG	FLNG	A105(N)	CS		2	XS		WN	CL150	RF-B16.5		FLNG2XSWNCL150RF-B16.5	2.67	5.34	5.34	
FLNG	FLNG	FLNG	A105(N)	CS		3	STD		WN	CL150	RF-B16.5		FLNG3STDWNCL150RF-B16.5	4.97	14.91	14.91	
FLNG	FLNG	FLNG	A105(N)	CS		4	STD		WN	CL150	RF-B16.5		FLNG4STDWNCL150RF-B16.5	7.11	7.11	7.11	
FLNG	FLNG	FLNG	A105(N)	CS		6	STD		WN	CL150	RF-B16.5		FLNG6STDWNCL150RF-B16.5	10.9	21.80	21.80	
FLNG	FLNG	FLNG	A105(N)	CS		8	STD		WN	CL150	RF-B16.5		FLNG8STDWNCL150RF-B16.5	19.23	19.23	19.23	
FLNG	FLNG	FLNG	A105(N)	CS		36	XS		WN	CL300	RF-B16.47B		FLNG36XSWNCL300RF-B16.47B	405	810.00	810.00	
FLNG	FLNG	FLNG	A105(N)	CS		48	XS		WN	CL150	RF-B16.47B		FLNG48XSWNCL150RF-B16.47B	231	924.00	924.00	
FLNG	FLNG	FLNG	A105(N)	CS		0.75	S160		WN	CL150	RF-B16.5	IBR	FLNG0.75S160WNCL150RF-B16.5	0.8	32.80	32.80	
FLNG	FLNG	FLNG	A105(N)	CS		1.5	XS		WN	CL150	RF-B16.5	IBR	FLNG1.5XSWNCL150RF-B16.5	1.78	44.50	44.50	
FLNG	FLNG	FLNG	A105(N)	CS		3	XS		WN	CL300	RF-B16.5	IBR	FLNG3XSWNCL300RF-B16.5	7.46	7.46	7.46	
FLNG	FLNG	FLNG	A105(N)	CS		4	STD		WN	CL150	RF-B16.5	IBR	FLNG4STDWNCL150RF-B16.5	7.11	7.11	7.11	
FLNG	FLNG	FLNG	A105(N)	CS		6	XS		WN	CL600	RF-B16.5	IBR	FLNG6XSWNCL600RF-B16.5	35.29	105.87	105.87	
FLNG	FLNG	FLNG	A105(N)	CS		6	S120		WN	CL600	RF-B16.5	IBR	FLNG6S120WNCL600RF-B16.5	36.66	219.96	219.96	
FLNG	FLNG	FLNG	A105(N)	CS		10	S80		WN	CL600	RF-B16.5	IBR	FLNG10S80WNCL600RF-B16.5	91.28	273.84	273.84	
FLNG	FLNG	FLNG	A105(N)	CS		10	STD		WN	CL150	RF-B16.5	IBR	FLNG10STDWNCL150RF-B16.5	24.48	48.96	48.96	
FLNG	FLNG	FLNG	A105(N)	CS		12	S80		WN	CL600	RF-B16.5	IBR	FLNG12S80WNCL600RF-B16.5	111.51	223.02	223.02	
FLNG	FLNG	FLNG	A105(N)	CS		3	STD		WN	CL150	RF-B16.5	NACE	FLNG3STDWNCL150RF-B16.5	4.97	9.94	9.94	
FLNG	FLNG	FLNG	A105(N)	CS		3	STD		WN	CL300	RF-B16.5	NACE	FLNG3STDWNCL300RF-B16.5	7.15	57.20	57.20	
FLNG	FLNG	FLNG	A105(N)	CS		6	STD		WN	CL150	RF-B16.5	NACE	FLNG6STDWNCL150RF-B16.5	10.9	32.70	32.70	
FLNG	FLNG	FLNG	A105(N)	CS		20	STD		WN	CL150	RF-B16.5	NACE	FLNG20STDWNCL150RF-B16.5	87.67	175.34	175.34	
FLNG	FLNG	FLNG	A105(N)	CS		24	STD		WN	CL150	RF-B16.5	NACE	FLNG24STDWNCL150RF-B16.5	113.09	339.27	339.27	
FLNG	FLNG	FLNG	A105(N)	CS		36	XS		WN	CL150	RF-B16.47B	NACE	FLNG36XSWNCL150RF-B16.47B	129	258.00	258.00	
FLNG	FLNG	FLNG	A105(N)	CS		48	XS		WN	CL300	RF-B16.47B	NACE	FLNG48XSWNCL300RF-B16.47B	731	2924.00	2924.00	
FLNG	FLNG	FLNG	A105(N)	CS		48	XS		WN	CL150	RF-B16.47B	NACE	FLNG48XSWNCL150RF-B16.47B	231	231.00	231.00	
FLNG	FLNG	FLNG	A105(N)	CS		3	S160		WN	CL300	RF-B16.5	NACE+HIC	FLNG3S160WNCL300RF-B16.5	7.93	7.93	7.93	
FLNG	FLNG	FLNG	A105(N)	CS		16	STD		WN	CL150	RF-B16.5	NACE+HIC	FLNG16STDWNCL150RF-B16.5	61.67	61.67	61.67	
FLNG	FLNG	FLNG	A105(N)	CS		16	STD		WN	CL300	RF-B16.5	NACE+HIC	FLNG16STDWNCL300RF-B16.5	111.77	447.08	447.08	
FLNG	FLNG	FLNG	A182GRF304L	SS		2	S40S		WN	CL150	RF-B16.5		FLNG2S40SWNCL150RF-B16.5	2.54	5.08	5.08	
FLNG	FLNG	FLNG	A182GRF316L	SS		10	S20		WN	CL150	RF-B16.5		FLNG10S20WNCL150RF-B16.5	22.63	22.63	22.63	
FLNG	FLNG	PREFAB	A105(N)	CS		8	6		SO-RD	CL300	RF-B16.5		FLNG86SO-RDCL300RF-B16.5	26	52.00	104.00	
FLNG	FLNG	PREFAB	A105(N)	CS		8	6		SO-RD	CL150	RF-B16.5		FLNG86SO-RDCL150RF-B16.5	13.7	54.80	109.60	

77	FLNG.SO, B-16.5, ASTM A 105 (NORMALISED), 150, RF/125AARH, 10.0 INCH, 8.0 INCH	2	4
78	FLNG.SO, B-16.5, ASTM A 105 (NORMALISED), 150, RF/125AARH, 12.0 INCH, 10.0 INCH	4	8
79	FLNG.SO, B-16.5, ASTM A 105 (NORMALISED), 300, RF/125AARH, 12.0 INCH, 10.0 INCH	2	4
81	FLNG.SO, B-16.5, ASTM A 105 N (GALV.), 150, FF/125AARH, 3.0 INCH	2	2
83	FLNG.BLIND, B-16.5, ASTM A 105 (NORMALISED), 150, RF/125AARH, 3.0 INCH	2	2
84	FLNG.BLIND, B-16.5, ASTM A 105 (NORMALISED), 150, RF/125AARH, 6.0 INCH	3	3
85	FLNG.BLIND, B-16.5, ASTM A 105 (NORMALISED), 150, RF/125AARH, 8.0 INCH	3	3
86	FLNG.BLIND, B-16.5, ASTM A 105 (NORMALISED), 150, RF/125AARH, 10.0 INCH	1	1
87	FLNG.BLIND, B-16.5, ASTM A 105 (NORMALISED), 150, RF/125AARH, 12.0 INCH	1	1
88	FLNG.BLIND, B-16.47-B, ASTM A 105 (NORMALISED), 150, RF/125AARH, 44.0 INCH	1	1
89	FLNG.BLIND, B-16.47-B, ASTM A 105 (NORMALISED), 150, RF/125AARH, 48.0 INCH	2	2
90	FLNG.BLIND, B-16.5, ASTM A 105 (NORMALISED), 150, RF/125AARH, IBR, 1.5 INCH	25	25
91	FLNG.BLIND, B-16.5, ASTM A 105 (NORMALISED), 150, RF/125AARH, IBR, 2.0 INCH	1	1
92	FLNG.BLIND, B-16.5, ASTM A 105 (NORMALISED), 300, RF/125AARH, IBR, 3.0 INCH	1	1
93	FLNG.BLIND, B-16.5, ASTM A 105 (NORMALISED), 150, RF/125AARH, IBR, 4.0 INCH	1	1
94	FLNG.BLIND, B-16.5, ASTM A 105 (NORMALISED), 600, RF/125AARH, IBR, 4.0 INCH	1	1
95	FLNG.BLIND, B-16.5, ASTM A 105 (NORMALISED), 600, RF/125AARH, IBR, 6.0 INCH	3	3
96	FLNG.BLIND, B-16.5, ASTM A 105 (NORMALISED), 600, RF/125AARH, IBR, 10.0 INCH	1	1
97	FLNG.BLIND, B-16.5, ASTM A 105 (NORMALISED), 150, RF/125AARH, IBR, 10.0 INCH	2	2
98	FLNG.BLIND, B-16.5, ASTM A 105 (NORMALISED), 150, RF/125AARH, IBR, 12.0 INCH	1	1
99	FLNG.BLIND, B-16.5, ASTM A 105 (NORMALISED), 150, RF/125AARH, IBR, 24.0 INCH	1	1
100	FLNG.BLIND, B-16.5, ASTM A 105 (NORMALISED), 150, RF/125AARH, NACE, 3.0 INCH	2	2
101	FLNG.BLIND, B-16.5, ASTM A 105 (NORMALISED), 150, RF/125AARH, NACE, 6.0 INCH	1	1
102	FLNG.BLIND, B-16.5, ASTM A 105 (NORMALISED), 150, RF/125AARH, NACE, 20.0 INCH	1	1
103	FLNG.BLIND, B-16.5, ASTM A 105 (NORMALISED), 150, RF/125AARH, NACE, 24.0 INCH	1	1
104	FLNG.BLIND, B-16.47-B, ASTM A 105 (NORMALISED), 150, RF/125AARH, NACE, 36.0 INCH	1	1
105	FLNG.BLIND, B-16.47-B, ASTM A 105 (NORMALISED), 150, RF/125AARH, NACE, 48.0 INCH	1	1
106	FLNG.BLIND, B-16.5, ASTM A 105 (NORMALISED), 300, RF/125AARH, NACE, 3.0 INCH	1	1
107	FLNG.BLIND, B-16.5, ASTM A 105 (NORMALISED), 150, RF/125AARH, NACE, 4.0 INCH	1	1
108	FLNG.BLIND, B-16.5, ASTM A 105 (NORMALISED), 150, RF/125AARH, NACE, 16.0 INCH	1	1
109	FLNG.BLIND, B-16.5, ASTM A 182 GR.F304L, 150, RF/125AARH, 2.0 INCH	2	2
110	FLNG.BLIND, B-16.5, ASTM A 182 GR.F316L, 150, RF/125AARH, 10.0 INCH	1	1
111	FLNG.BLIND, B-16.5, ASTM A 105 N (GALV.), 150, FF/125AARH, 2.0 INCH	2	2
112	FLNG.BLIND, B-16.5, ASTM A 105 N (GALV.), 150, FF/125AARH, 3.0 INCH	3	3
113	FLNG.BLIND, B-16.5, ASTM A 105 N (GALV.), 150, FF/125AARH, 4.0 INCH	1	1
114	FLNG.FIG.8, ASME-B16.48, ASTM A 105 (NORMALISED), 300, FF/125AARH, NACE, 3.0 INCH	1	1
115	FLNG.FIG.8, ASME-B16.48, ASTM A 516 GR.70(NORMALISED), 150, FF/125AARH, 3.0 INCH	2	2
116	FLNG.FIG.8, ASME-B16.48, ASTM A 516 GR.70(NORMALISED), 150, FF/250AARH, 6.0 INCH	1	1
117	FLNG.FIG.8, ASME-B16.48, ASTM A 516 GR.70(NORMALISED), 150, FF/125AARH, 6.0 INCH	3	3
118	FLNG.FIG.8, ASME-B16.48, ASTM A 516 GR.70(NORMALISED), 150, FF/125AARH, 8.0 INCH	2	2
119	FLNG.FIG.8, ASME-B16.48, ASTM A 516 GR.70(NORMALISED), 150, FF/250AARH, 8.0 INCH	1	1
120	FLNG.FIG.8, ASME-B16.48, ASTM A 516 GR.70(NORMALISED), 150, FF/125AARH, IBR, 1.5 INCH	25	25
121	FLNG.FIG.8, ASME-B16.48, ASTM A 516 GR.70(NORMALISED), 150, FF/125AARH, IBR, 2.0 INCH	1	1
122	FLNG.FIG.8, ASME-B16.48, ASTM A 516 GR.70(NORMALISED), 300, FF/125AARH, IBR, 3.0 INCH	1	1
123	FLNG.FIG.8, ASME-B16.48, ASTM A 516 GR.70(NORMALISED), 600, FF/125AARH, IBR, 4.0 INCH	1	1
124	FLNG.FIG.8, ASME-B16.48, ASTM A 516 GR.70(NORMALISED), 150, FF/125AARH, IBR, 4.0 INCH	1	1
125	FLNG.FIG.8, ASME-B16.48, ASTM A 516 GR.70(NORMALISED), 600, FF/125AARH, IBR, 6.0 INCH	3	3
126	FLNG.FIG.8, ASME-B16.48, ASTM A 516 GR.70(NORMALISED), 150, FF/125AARH, NACE, 3.0 INCH	2	2
127	FLNG.FIG.8, ASME-B16.48, ASTM A 516 GR.70(NORMALISED), 150, FF/125AARH, NACE, 6.0 INCH	1	1
128	FLNG.FIG.8, ASME-B16.48, ASTM A 516 GR.70(NORMALISED), 150, FF/125AARH, NACE, 4.0 INCH	1	1
129	FLNG.FIG.8, ASME-B16.48, ASTM A 240 GR.304L, 150, FF/125AARH, 2.0 INCH	2	2
130	FLNG.FIG.8, ASME-B16.48, ASTM A 516N Gr.70 (GALV.), 150, FF/125AARH, 2.0 INCH	2	2
131	FLNG.FIG.8, ASME-B16.48, ASTM A 516N Gr.70 (GALV.), 150, FF/125AARH, 3.0 INCH	3	3
132	FLNG.FIG.8, ASME-B16.48, ASTM A 516N Gr.70 (GALV.), 150, FF/125AARH, 4.0 INCH	1	1
133	SPCR&BLND, ASME-B16.48, ASTM A 516 GR.70(NORMALISED), 150, FF/125AARH, 10.0 INCH	1	1
134	SPCR&BLND, EIL'STD, ASTM A 516 GR.70(NORMALISED), 150, FF/125AARH, 44.0 INCH	1	1
135	SPCR&BLND, EIL'STD, ASTM A 516 GR.70(NORMALISED), 150, FF/125AARH, 48.0 INCH	2	2
136	SPCR&BLND, ASME-B16.48, ASTM A 516 GR.70(NORMALISED), 150, FF/125AARH, IBR, 10.0 INCH	2	2
137	SPCR&BLND, ASME-B16.48, ASTM A 516 GR.70(NORMALISED), 600, FF/125AARH, IBR, 10.0 INCH	1	1
138	SPCR&BLND, ASME-B16.48, ASTM A 516 GR.70(NORMALISED), 600, FF/125AARH, IBR, 12.0 INCH	1	1
139	SPCR&BLND, ASME-B16.48, ASTM A 516 GR.70(NORMALISED), 150, FF/125AARH, IBR, 24.0 INCH	1	1
140	SPCR&BLND, ASME-B16.48, ASTM A 516 GR.70(NORMALISED), 150, FF/125AARH, NACE, 20.0 INCH	1	1
141	SPCR&BLND, ASME-B16.48, ASTM A 516 GR.70(NORMALISED), 150, FF/125AARH, NACE, 24.0 INCH	1	1
142	SPCR&BLND, ASME B16.47B/EIL'STD, ASTM A 516 GR.70(NORMALISED), 150, FF/125AARH, NACE, 36.0 INCH	1	1
143	SPCR&BLND, ASME B16.47B/EIL'STD, ASTM A 516 GR.70(NORMALISED), 150, FF/125AARH, NACE, 48.0 INCH	1	1
144	SPCR&BLND, ASME-B16.48, ASTM A 516 GR.70(NORMALISED), 150, FF/125AARH, NACE, 16.0 INCH	1	1
145	SPCR&BLND, ASME-B16.48, ASTM A 240 GR.316L, 150, FF/125AARH, 10.0 INCH	1	1
146	ELBOW.90, B-16.11, ASTM A 105 (NORMALISED), SW, 6000, IBR, 0.75 INCH	42	42
147	ELBOW.90, B-16.9, ASTM A 234 GR.WPB, BW, 1.5D, 3.0 INCH, STD	2	2
148	ELBOW.90, B-16.9, ASTM A 234 GR.WPB, BW, 1.5D, 6.0 INCH, STD	2	2
149	ELBOW.90, B-16.9, ASTM A 234 GR.WPB, BW, 1.5D, 8.0 INCH, STD	1	1
150	ELBOW.90, B-16.9, ASTM A 234 GR.WPB, BW, 1.5D, IBR, 3.0 INCH, XS	1	1
151	ELBOW.90, B-16.9, ASTM A 234 GR.WPB, BW, 1.5D, IBR, 4.0 INCH, STD	1	1
152	ELBOW.90, B-16.9, ASTM A 234 GR.WPB, BW, 1.5D, IBR, 6.0 INCH, S120	2	2
153	ELBOW.90, B-16.9, ASTM A 234 GR.WPB, BW, 1.5D, IBR, 6.0 INCH, XS	1	1
154	ELBOW.90, B-16.9, ASTM A 234 GR.WPB, BW, 1.5D, IBR, 10.0 INCH, S80	1	1
155	ELBOW.90, B-16.9, ASTM A 234 GR.WPB, BW, 1.5D, IBR, 10.0 INCH, STD	2	2

FLNG	FLNG	PREFAB	A105(N)	CS	10	8			SO-RD	CL150	RF-B16.5		FLNG108SO-RDCL150RF-B16.5	19.5	39.00	78.00
FLNG	FLNG	PREFAB	A105(N)	CS	12	10			SO-RD	CL150	RF-B16.5		FLNG1210SO-RDCL150RF-B16.5	29	116.00	232.00
FLNG	FLNG	PREFAB	A105(N)	CS	12	10			SO-RD	CL300	RF-B16.5		FLNG1210SO-RDCL300RF-B16.5	52	104.00	208.00
FLNG	FLNG	FLNG	A105(N)(G)	CS	3				SO	CL150	RF-B16.5		FLNG3SOCL150RF-B16.5	3.7	7.40	7.40
BFLNG	FLNG	FLNG	A105(N)	CS	3					CL150	RF-B16.5		BFLNG3CL150RF-B16.5	4.1	8.20	8.20
BFLNG	FLNG	FLNG	A105(N)	CS	6					CL150	RF-B16.5		BFLNG6CL150RF-B16.5	11.8	35.40	35.40
BFLNG	FLNG	FLNG	A105(N)	CS	8					CL150	RF-B16.5		BFLNG8CL150RF-B16.5	20.5	61.50	61.50
BFLNG	FLNG	FLNG	A105(N)	CS	10					CL150	RF-B16.5		BFLNG10CL150RF-B16.5	32	32.00	32.00
BFLNG	FLNG	FLNG	A105(N)	CS	12					CL150	RF-B16.5		BFLNG12CL150RF-B16.5	50	50.00	50.00
BFLNG	FLNG	FLNG	A105(N)	CS	44					CL150	RF-B16.47B		BFLNG44CL150RF-B16.47B	716.73	716.73	716.73
BFLNG	FLNG	FLNG	A105(N)	CS	48					CL150	RF-B16.47B		BFLNG48CL150RF-B16.47B	928.55	1857.10	1857.10
BFLNG	FLNG	FLNG	A105(N)	CS	1.5					CL150	RF-B16.5	IBR	BFLNG1.5CL150RF-B16.5	1.8	45.00	45.00
BFLNG	FLNG	FLNG	A105(N)	CS	2					CL150	RF-B16.5	IBR	BFLNG2CL150RF-B16.5	2.3	2.30	2.30
BFLNG	FLNG	FLNG	A105(N)	CS	3					CL300	RF-B16.5	IBR	BFLNG3CL300RF-B16.5	7.3	7.30	7.30
BFLNG	FLNG	FLNG	A105(N)	CS	4					CL150	RF-B16.5	IBR	BFLNG4CL150RF-B16.5	7.7	7.70	7.70
BFLNG	FLNG	FLNG	A105(N)	CS	4					CL600	RF-B16.5	IBR	BFLNG4CL600RF-B16.5	18.7	18.70	18.70
BFLNG	FLNG	FLNG	A105(N)	CS	6					CL600	RF-B16.5	IBR	BFLNG6CL600RF-B16.5	39	117.00	117.00
BFLNG	FLNG	FLNG	A105(N)	CS	10					CL600	RF-B16.5	IBR	BFLNG10CL600RF-B16.5	105	105.00	105.00
BFLNG	FLNG	FLNG	A105(N)	CS	10					CL150	RF-B16.5	IBR	BFLNG10CL150RF-B16.5	32	64.00	64.00
BFLNG	FLNG	FLNG	A105(N)	CS	12					CL600	RF-B16.5	IBR	BFLNG12CL600RF-B16.5	134	134.00	134.00
BFLNG	FLNG	FLNG	A105(N)	CS	24					CL150	RF-B16.5	IBR	BFLNG24CL150RF-B16.5	196	196.00	196.00
BFLNG	FLNG	FLNG	A105(N)	CS	3					CL150	RF-B16.5	NACE	BFLNG3CL150RF-B16.5	4.1	8.20	8.20
BFLNG	FLNG	FLNG	A105(N)	CS	6					CL150	RF-B16.5	NACE	BFLNG6CL150RF-B16.5	11.8	11.80	11.80
BFLNG	FLNG	FLNG	A105(N)	CS	20					CL150	RF-B16.5	NACE	BFLNG20CL150RF-B16.5	130	130.00	130.00
BFLNG	FLNG	FLNG	A105(N)	CS	24					CL150	RF-B16.5	NACE	BFLNG24CL150RF-B16.5	196	196.00	196.00
BFLNG	FLNG	FLNG	A105(N)	CS	36					CL150	RF-B16.47B	NACE	BFLNG36CL150RF-B16.47B	404.55	404.55	404.55
BFLNG	FLNG	FLNG	A105(N)	CS	48					CL150	RF-B16.47B	NACE	BFLNG48CL150RF-B16.47B	928.55	928.55	928.55
BFLNG	FLNG	FLNG	A105(N)	CS	3					CL300	RF-B16.5	NACE+HIC	BFLNG3CL300RF-B16.5	7.3	7.30	7.30
BFLNG	FLNG	FLNG	A105(N)	CS	4					CL150	RF-B16.5	NACE+HIC	BFLNG4CL150RF-B16.5	7.7	7.70	7.70
BFLNG	FLNG	FLNG	A105(N)	CS	16					CL150	RF-B16.5	NACE+HIC	BFLNG16CL150RF-B16.5	82	82.00	82.00
BFLNG	FLNG	FLNG	A182GRF304L	SS	2					CL150	RF-B16.5		BFLNG2CL150RF-B16.5	2.3	4.60	4.60
BFLNG	FLNG	FLNG	A182GRF316L	SS	10					CL150	RF-B16.5		BFLNG10CL150RF-B16.5	32	32.00	32.00
BFLNG	FLNG	FLNG	A105(N)(G)	CS	2					CL150	RF-B16.5		BFLNG2CL150RF-B16.5	2.3	4.60	4.60
BFLNG	FLNG	FLNG	A105(N)(G)	CS	3					CL150	RF-B16.5		BFLNG3CL150RF-B16.5	4.1	12.30	12.30
BFLNG	FLNG	FLNG	A105(N)(G)	CS	4					CL150	RF-B16.5		BFLNG4CL150RF-B16.5	7.7	7.70	7.70
F8BLNK	FLNG	FLNG	A105(N)	CS	3					CL300	FF-B16.5	NACE+HIC	F8BLNK3CL300FF-B16.5	2.16	2.16	2.16
F8BLNK	FLNG	FLNG	A516GR70(N)	CS	3					CL150	FF-B16.5		F8BLNK3CL150FF-B16.5	1.14	2.28	2.28
F8BLNK	FLNG	FLNG	A516GR70(N)	CS	6					CL150	FF-B16.5		F8BLNK6CL150FF-B16.5	5.53	5.53	5.53
F8BLNK	FLNG	FLNG	A516GR70(N)	CS	6					CL150	FF-B16.5		F8BLNK6CL150FF-B16.5	5.53	16.59	16.59
F8BLNK	FLNG	FLNG	A516GR70(N)	CS	8					CL150	FF-B16.5		F8BLNK8CL150FF-B16.5	8.5	17.00	17.00
F8BLNK	FLNG	FLNG	A516GR70(N)	CS	8					CL150	FF-B16.5		F8BLNK8CL150FF-B16.5	8.5	8.50	8.50
F8BLNK	FLNG	FLNG	A516GR70(N)	CS	1.5					CL150	FF-B16.5	IBR	F8BLNK1.5CL150FF-B16.5	0.45	11.25	11.25
F8BLNK	FLNG	FLNG	A516GR70(N)	CS	2					CL150	FF-B16.5	IBR	F8BLNK2CL150FF-B16.5	0.68	0.68	0.68
F8BLNK	FLNG	FLNG	A516GR70(N)	CS	3					CL300	FF-B16.5	IBR	F8BLNK3CL300FF-B16.5	2.16	2.16	2.16
F8BLNK	FLNG	FLNG	A516GR70(N)	CS	4					CL600	FF-B16.5	IBR	F8BLNK4CL600FF-B16.5	5.91	5.91	5.91
F8BLNK	FLNG	FLNG	A516GR70(N)	CS	4					CL150	FF-B16.5	IBR	F8BLNK4CL150FF-B16.5	2.77	2.77	2.77
F8BLNK	FLNG	FLNG	A516GR70(N)	CS	6					CL600	FF-B16.5	IBR	F8BLNK6CL600FF-B16.5	15.67	47.01	47.01
F8BLNK	FLNG	FLNG	A516GR70(N)	CS	3					CL150	FF-B16.5	NACE	F8BLNK3CL150FF-B16.5	1.14	2.28	2.28
F8BLNK	FLNG	FLNG	A516GR70(N)	CS	6					CL150	FF-B16.5	NACE	F8BLNK6CL150FF-B16.5	5.53	5.53	5.53
F8BLNK	FLNG	FLNG	A516GR70(N)	CS	4					CL150	FF-B16.5	NACE+HIC	F8BLNK4CL150FF-B16.5	2.77	2.77	2.77
F8BLNK	FLNG	FLNG	A240GR304L	SS	2					CL150	FF-B16.5		F8BLNK2CL150FF-B16.5	0.68	1.36	1.36
F8BLNK	FLNG	FLNG	A516NGR70(G)	CS	2					CL150	FF-B16.5		F8BLNK2CL150FF-B16.5	0.68	1.36	1.36
F8BLNK	FLNG	FLNG	A516NGR70(G)	CS	3					CL150	FF-B16.5		F8BLNK3CL150FF-B16.5	1.14	3.42	3.42
F8BLNK	FLNG	FLNG	A516NGR70(G)	CS	4					CL150	FF-B16.5		F8BLNK4CL150FF-B16.5	2.77	2.77	2.77
SPBLNK	FLNG	FLNG	A516GR70(N)	CS	10					CL150	FF-B16.5		SPBLNK10CL150FF-B16.5	10.93	10.93	10.93
SPBLNK	FLNG	FLNG	A516GR70(N)	CS	44					CL150	FF-B16.47B		SPBLNK44CL150FF-B16.47B	731	731.00	731.00
SPBLNK	FLNG	FLNG	A516GR70(N)	CS	48					CL150	FF-B16.47B		SPBLNK48CL150FF-B16.47B	956	1912.00	1912.00
SPBLNK	FLNG	FLNG	A516GR70(N)	CS	10					CL150	FF-B16.5	IBR	SPBLNK10CL150FF-B16.5	10.93	21.86	21.86
SPBLNK	FLNG	FLNG	A516GR70(N)	CS	10					CL600	FF-B16.5	IBR	SPBLNK10CL600FF-B16.5	44.31	44.31	44.31
SPBLNK	FLNG	FLNG	A516GR70(N)	CS	12					CL600	FF-B16.5	IBR	SPBLNK12CL600FF-B16.5	66.63	66.63	66.63
SPBLNK	FLNG	FLNG	A516GR70(N)	CS	24					CL150	FF-B16.5	IBR	SPBLNK24CL150FF-B16.5	98.04	98.04	98.04
SPBLNK	FLNG	FLNG	A516GR70(N)	CS	20					CL150	FF-B16.5	NACE	SPBLNK20CL150FF-B16.5	62.43	62.43	62.43
SPBLNK	FLNG	FLNG	A516GR70(N)	CS	24					CL150	FF-B16.5	NACE	SPBLNK24CL150FF-B16.5	98.04	98.04	98.04
SPBLNK	FLNG	FLNG	A516GR70(N)	CS	36					CL150	FF-B16.47B	NACE	SPBLNK36CL150FF-B16.47B	416	416.00	416.00
SPBLNK	FLNG	FLNG	A516GR70(N)	CS	48					CL150	FF-B16.47B	NACE	SPBLNK48CL150FF-B16.47B	956	956.00	956.00
SPBLNK	FLNG	FLNG	A516GR70(N)	CS	16					CL150	FF-B16.5	NACE+HIC	SPBLNK16CL150FF-B16.5	35.08	35.08	35.08
SPBLNK	FLNG	FLNG	A240GR316L	SS	10					CL150	FF-B16.5		SPBLNK10CL150FF-B16.5	10.93	10.93	10.93
ELB90	FITT	PREFAB	A105(N)	CS	0.75				LR	CL6000	SW	IBR	ELB900.75L.RCL6000SW	0.67	28.14	28.14
ELB90	FITT	PREFAB	A234GRWPB	CS	3		STD		LR		BW		ELB903STD.LRBW	2.3	4.60	4.60
ELB90	FITT	PREFAB	A234GRWPB	CS	6		STD		LR		BW		ELB906STD.LRBW	11.01	22.02	22.02
ELB90	FITT	PREFAB	A234GRWPB	CS	8		STD		LR		BW		ELB908STD.LRBW	21.62	21.62	21.62
ELB90	FITT	PREFAB	A234GRWPB	CS	3		XS		LR		BW	IBR	ELB903XS.LRBW	3.08	3.08	3.08
ELB90	FITT	PREFAB	A234GRWPB	CS	4		STD		LR		BW	IBR	ELB904STD.LRBW	4.23	4.23	4.23
ELB90	FITT	PREFAB	A234GRWPB	CS	6		S120		LR		BW	IBR	ELB906S120.LRBW	20.72	41.44	41.44
ELB90	FITT	PREFAB	A234GRWPB	CS	6		XS		LR		BW	IBR	ELB906XS.LRBW	16.41	16.41	16.41
ELB90	FITT	PREFAB	A234GRWPB	CS	10		S80		LR		BW	IBR	ELB9010S80.LRBW	60.29	60.29	60.29
ELB90	FITT	PREFAB	A234GRWPB	CS	10		STD		LR		BW	IBR	ELB9010STD.LRBW	38.22	76.44	76.44

156	ELBOW90, B-16.9, ASTM A 234 GR.WPB, BW, 1.5D, NACE, 3.0 INCH, STD	5	5
157	ELBOW90, B-16.9, ASTM A 234 GR.WPB, BW, 1.5D, NACE, 6.0 INCH, STD	1	1
158	ELBOW90, B-16.9, ASTM A 234 GR.WPB, BW, 1.5D, NAC6, 3.0 INCH, S160	1	1
159	ELBOW90, B-16.9, ASTM A 234 GR.WPB(GALV), BW, 1.5D, 3.0 INCH, STD	2	2
160	ELBOW90, B-16.9, ASTM A 234 GR.WPB-W, BW, 1.5D, 48.0 INCH, XS	4	4
161	ELBOW90, B-16.9, ASTM A 234 GR.WPB-W, BW, 1.5D, NACE, 20.0 INCH, STD	2	2
162	ELBOW90, B-16.9, ASTM A 234 GR.WPB-W, BW, 1.5D, NACE, 24.0 INCH, STD	1	1
163	ELBOW90, B-16.9, ASTM A 234 GR.WPB-W, BW, 1.5D, NACE, 36.0 INCH, XS	2	2
164	ELBOW90, B-16.9, ASTM A 234 GR.WPB-W, BW, 1.5D, NACE, 48.0 INCH, XS	1	1
165	ELBOW90, B-16.9, ASTM A 234 GR.WPB-W, BW, 1.5D, NAC6, 16.0 INCH, STD	4	4
166	ELBOW90, B-16.9, ASTM A 403 GR.WP316L-WX, BW, 1.5D, 10.0 INCH, S20	1	1
167	ELBOW90, B-16.9, ASTM A 403 GR.WP304L-S, BW, 1.5D, 2.0 INCH, 40S	2	2
168	T.EQUAL, B-16.9, ASTM A 234 GR.WPB, BW, 4.0 INCH, STD	1	1
169	T.EQUAL, B-16.9, ASTM A 234 GR.WPB, BW, 1BR, 10.0 INCH, S80	1	1
170	T.EQUAL, B-16.9, ASTM A 234 GR.WPB, BW, NACE, 3.0 INCH, STD	2	2
171	T.EQUAL, B-16.9, ASTM A 234 GR.WPB-W, BW, NACE, 48.0 INCH, XS	1	1
172	T.EQUAL, B-16.9, ASTM A 234 GR.WPB-W, BW, NAC6, 16.0 INCH, STD	1	1
173	T.EQUAL, B-16.9, ASTM A 403 GR.WP316L-WX, BW, 10.0 INCH, S20	1	1
174	T.RED, B-16.9, ASTM A 234 GR.WPB, BW, 4.0 INCH, STD, 3.0 INCH, STD	1	1
175	T.RED, B-16.9, ASTM A 234 GR.WPB, BW, 1BR, 12.0 INCH, STD, 8.0 INCH, STD	1	1
176	T.RED, B-16.9, ASTM A 234 GR.WPB, BW, 1BR, 8.0 INCH, S100, 6.0 INCH, S120	2	2
177	T.RED, B-16.9, ASTM A 234 GR.WPB, BW, 1BR, 10.0 INCH, S80, 6.0 INCH, XS	1	1
178	T.RED, B-16.9, ASTM A 234 GR.WPB, BW, 1BR, 10.0 INCH, S100, 6.0 INCH, S120	2	2
179	T.RED, B-16.9, ASTM A 234 GR.WPB, BW, 1BR, 12.0 INCH, STD, 10.0 INCH, STD	2	2
180	T.RED, B-16.9, ASTM A 234 GR.WPB(GALV), BW, 6.0 INCH, STD, 3.0 INCH, STD	2	2
181	SOCKOLET, MSS-SP97, ASTM A 105 (NORMALISED), SW, 6000, 1BR, 8.0 INCH, 0.75 INCH	6	9
182	SOCKOLET, MSS-SP97, ASTM A 105 (NORMALISED), SW, 6000, 1BR, 10.0 INCH, 0.75 INCH	2	3
183	SOCKOLET, MSS-SP97, ASTM A 105 (NORMALISED), SW, 6000, 1BR, 12.0 INCH, 0.75 INCH	6	9
184	SOCKOLET, MSS-SP97, ASTM A 105 (NORMALISED), SW, 3000, 1BR, 18.0 INCH, 1.5 INCH	9	14
185	SOCKOLET, MSS-SP97, ASTM A 105 (NORMALISED), SW, 3000, 1BR, 24.0 INCH, 1.5 INCH	16	24
221	BOLT.STUD WITH 2 NUTS, B-18.2, A193 GR.B7, A194 GR.2H, 0.5 INCH X 2.5 INCH	96	120
222	BOLT.STUD WITH 2 NUTS, B-18.2, A193 GR.B7, A194 GR.2H, 0.5 INCH X 3.25 INCH	100	120
223	BOLT.STUD WITH 2 NUTS, B-18.2, A193 GR.B7, A194 GR.2H, 0.625 INCH X 3.75 INCH	28	40
224	BOLT.STUD WITH 2 NUTS, B-18.2, A193 GR.B7, A194 GR.2H, 0.625 INCH X 3.25 INCH	12	20
225	BOLT.STUD WITH 2 NUTS, B-18.2, A193 GR.B7, A194 GR.2H, 0.625 INCH X 3 INCH	16	20
226	BOLT.STUD WITH 2 NUTS, B-18.2, A193 GR.B7, A194 GR.2H, 0.625 INCH X 4 INCH	8	10
227	BOLT.STUD WITH 2 NUTS, B-18.2, A193 GR.B7, A194 GR.2H, 0.625 INCH X 4.25 INCH	8	10
228	BOLT.STUD WITH 2 NUTS, B-18.2, A193 GR.B7, A194 GR.2H, 0.75 INCH X 4 INCH	40	50
229	BOLT.STUD WITH 2 NUTS, B-18.2, A193 GR.B7, A194 GR.2H, 0.75 INCH X 4.25 INCH	40	50
230	BOLT.STUD WITH 2 NUTS, B-18.2, A193 GR.B7, A194 GR.2H, 0.75 INCH X 4.75 INCH	32	40
231	BOLT.STUD WITH 2 NUTS, B-18.2, A193 GR.B7, A194 GR.2H, 0.75 INCH X 5 INCH	24	30
232	BOLT.STUD WITH 2 NUTS, B-18.2, A193 GR.B7, A194 GR.2H, 0.875 INCH X 5.5 INCH	72	90
233	BOLT.STUD WITH 2 NUTS, B-18.2, A193 GR.B7, A194 GR.2H, 0.875 INCH X 4.75 INCH	108	130
234	BOLT.STUD WITH 2 NUTS, B-18.2, A193 GR.B7, A194 GR.2H, 0.875 INCH X 5.75 INCH	20	30
235	BOLT.STUD WITH 2 NUTS, B-18.2, A193 GR.B7, A194 GR.2H, 0.875 INCH X 6.5 INCH	8	10
236	BOLT.STUD WITH 3 NUTS, B-18.2, A193 GR.B7, A194 GR.2H, 1.0 INCH X 7.75 INCH	108	130
237	BOLT.STUD WITH 3 NUTS, B-18.2, A193 GR.B7, A194 GR.2H, 1.0 INCH X 8.75 INCH	88	110
238	BOLT.STUD WITH 3 NUTS, B-18.2, A193 GR.B7, A194 GR.2H, 1.0 INCH X 11.25 INCH	52	70
239	BOLT.STUD WITH 3 NUTS, B-18.2, A193 GR.B7, A194 GR.2H, 1.125 INCH X 8 INCH	32	40
240	BOLT.STUD WITH 3 NUTS, B-18.2, A193 GR.B7, A194 GR.2H, 1.125 INCH X 9.5 INCH	176	220
241	BOLT.STUD WITH 3 NUTS, B-18.2, A193 GR.B7, A194 GR.2H, 1.125 INCH X 12.25 INCH	88	110
242	BOLT.STUD WITH 3 NUTS, B-18.2, A193 GR.B7, A194 GR.2H, 1.25 INCH X 8 INCH	20	30
243	BOLT.STUD WITH 3 NUTS, B-18.2, A193 GR.B7, A194 GR.2H, 1.25 INCH X 9.5 INCH	20	30
244	BOLT.STUD WITH 3 NUTS, B-18.2, A193 GR.B7, A194 GR.2H, 1.25 INCH X 9.75 INCH	48	60
245	BOLT.STUD WITH 3 NUTS, B-18.2, A193 GR.B7, A194 GR.2H, 1.25 INCH X 10 INCH	60	80
246	BOLT.STUD WITH 3 NUTS, B-18.2, A193 GR.B7, A194 GR.2H, 1.25 INCH X 11.25 INCH	16	20
247	BOLT.STUD WITH 3 NUTS, B-18.2, A193 GR.B7, A194 GR.2H, 1.25 INCH X 11.75 INCH	20	30
248	BOLT.STUD WITH 3 NUTS, B-18.2, A193 GR.B7, A194 GR.2H, 1.625 INCH X 14 INCH	64	80
249	BOLT.STUD WITH 2 NUTS, B-18.2, A193 GR.B7(GALV), A194 2H(GALV), 0.625 INCH X 4.0 INCH	12	20
250	BOLT.STUD WITH 2 NUTS, B-18.2, A193 GR.B7(GALV), A194 2H(GALV), 0.625 INCH X 3.75 INCH	28	40
251	BOLT.STUD WITH 2 NUTS, B-18.2, A193 GR.B7(GALV), A194 2H(GALV), 0.625 INCH X 3.25 INCH	8	10
252	BOLT.STUD WITH 2 NUTS, B-18.2, A193 GR.B7(GALV), A194 2H(GALV), 0.625 INCH X 4.25 INCH	8	10
253	BOLT.STUD WITH 2 NUTS, B-18.2, A193 GR.B7M, A194 GR.2HM, NACE, 0.625 INCH X 3.75 INCH	8	10
254	BOLT.STUD WITH 2 NUTS, B-18.2, A193 GR.B7M, A194 GR.2HM, NACE, 0.625 INCH X 4.0 INCH	8	10
255	BOLT.STUD WITH 2 NUTS, B-18.2, A193 GR.B7M, A194 GR.2HM, NACE, 0.75 INCH X 4.0 INCH	24	30
256	BOLT.STUD WITH 2 NUTS, B-18.2, A193 GR.B7M, A194 GR.2HM, NACE, 0.75 INCH X 4.25 INCH	32	40
257	BOLT.STUD WITH 2 NUTS, B-18.2, A193 GR.B7M, A194 GR.2HM, NACE, 0.75 INCH X 4.75 INCH	8	10
258	BOLT.STUD WITH 2 NUTS, B-18.2, A193 GR.B7M, A194 GR.2HM, NACE, 0.875 INCH X 6.75 INCH	88	110
259	BOLT.STUD WITH 2 NUTS, B-18.2, A193 GR.B7M, A194 GR.2HM, NACE, 0.875 INCH X 8.75 INCH	44	60
260	BOLT.STUD WITH 3 NUTS, B-18.2, A193 GR.B7M, A194 GR.2HM, NACE, 1.125 INCH X 7.5 INCH	40	50
261	BOLT.STUD WITH 3 NUTS, B-18.2, A193 GR.B7M, A194 GR.2HM, NACE, 1.125 INCH X 8.75 INCH	20	30
262	BOLT.STUD WITH 3 NUTS, B-18.2, A193 GR.B7M, A194 GR.2HM, NACE, 1.125 INCH X 9.5 INCH	44	60
263	BOLT.STUD WITH 3 NUTS, B-18.2, A193 GR.B7M, A194 GR.2HM, NACE, 1.125 INCH X 12.25 INCH	44	60
264	BOLT.STUD WITH 3 NUTS, B-18.2, A193 GR.B7M, A194 GR.2HM, NACE, 1.25 INCH X 8.0 INCH	60	80
265	BOLT.STUD WITH 3 NUTS, B-18.2, A193 GR.B7M, A194 GR.2HM, NACE, 1.25 INCH X 9.5 INCH	20	30
266	BOLT.STUD WITH 3 NUTS, B-18.2, A193 GR.B7M, A194 GR.2HM, NACE, 1.875 INCH X 17.75 INCH	80	100
267	BOLT.STUD WITH 2 NUTS, B-18.2, A193 GR.B7M, A194 GR.2HM, NAC6, 0.625 INCH X 3.75 INCH	8	10

ELB90	FITT	PREFAB	A234GRWPB	CS	3	STD		LR		BW	NACE	ELB903STDLRBW	2.3	11.50	11.50
ELB90	FITT	PREFAB	A234GRWPB	CS	6	STD		LR		BW	NACE	ELB906STDLRBW	11.01	11.01	11.01
ELB90	FITT	PREFAB	A234GRWPB	CS	3	S160		LR		BW	NACE+HIC	ELB903S160LRBW	4.23	4.23	4.23
ELB90	FITT	PREFAB	A234GRWPB(G)	CS	3	STD		LR		BW		ELB903STDLRBW	2.3	4.60	4.60
ELB90	FITT	PREFAB	A234GRWPB	CS	48	XS		LR		BW		ELB9048XSLRBW	1080.36	4321.44	4321.44
ELB90	FITT	PREFAB	A234GRWPB	CS	20	STD		LR		BW	NACE	ELB9020STDLRBW	139.11	278.22	278.22
ELB90	FITT	PREFAB	A234GRWPB	CS	24	STD		LR		BW	NACE	ELB9024STDLRBW	201.49	201.49	201.49
ELB90	FITT	PREFAB	A234GRWPB	CS	36	XS		LR		BW	NACE	ELB9036XSLRBW	604.34	1208.68	1208.68
ELB90	FITT	PREFAB	A234GRWPB	CS	48	XS		LR		BW	NACE	ELB9048XSLRBW	1080.36	1080.36	1080.36
ELB90	FITT	PREFAB	A234GRWPB	CS	16	STD		LR		BW	NACE+HIC	ELB9016STDLRBW	88.43	353.72	353.72
ELB90	FITT	PREFAB	A403GRWP316L	SS	10	S20		LR		BW		ELB9010S20LRBW	26.6	26.60	26.60
ELB90	FITT	PREFAB	A403GRWP304L	SS	2	S40S		LR		BW		ELB902S40SLRBW	0.75	1.50	1.50
EQTEE	FITT	PREFAB	A234GRWPB	CS	4	STD				BW		EQTEE4STD BW	6	6.00	6.00
EQTEE	FITT	PREFAB	A234GRWPB	CS	10	S80				BW	IBR	EQTEE10S80BW	68	68.00	68.00
EQTEE	FITT	PREFAB	A234GRWPB	CS	3	STD				BW	NACE	EQTEE3STD BW	3.82	7.64	7.64
EQTEE	FITT	PREFAB	A234GRWPB	CS	48	XS				BW	NACE	EQTEE48XSBW	1498.5	1498.50	1498.50
EQTEE	FITT	PREFAB	A234GRWPB	CS	16	STD				BW	NACE+HIC	EQTEE16STD BW	115	115.00	115.00
EQTEE	FITT	PREFAB	A403GRWP316L	SS	10	S20				BW		EQTEE10S20BW	34.7	34.70	34.70
RDTEE	FITT	PREFAB	A234GRWPB	CS	4	3 STD	STD			BW		RDTEE43STDSTD BW	5.29	5.29	5.29
RDTEE	FITT	PREFAB	A234GRWPB	CS	10	8 STD	STD			BW		RDTEE108STDSTD BW	39.27	39.27	39.27
RDTEE	FITT	PREFAB	A234GRWPB	CS	8	6 S100	S120			BW	IBR	RDTEE86S100S120BW	28	56.00	56.00
RDTEE	FITT	PREFAB	A234GRWPB	CS	10	6 S80	XS			BW	IBR	RDTEE106S80XS BW	54	54.00	54.00
RDTEE	FITT	PREFAB	A234GRWPB	CS	10	6 S120	S120			BW	IBR	RDTEE106S120S120BW	83.08	166.16	166.16
RDTEE	FITT	PREFAB	A234GRWPB	CS	12	10 STD	STD			BW	IBR	RDTEE1210STDSTD BW	58.84	117.68	117.68
RDTEE	FITT	PREFAB	A234GRWPB(G)	CS	6	3 STD	STD			BW		RDTEE63STDSTD BW	11.7	23.40	23.40
HCPLNG	FITT	PREFAB	A105(N)	CS	0.75				CL6000	SW	IBR	HCPLNG0.75CL6000SW	0.29	1.74	2.61
HCPLNG	FITT	PREFAB	A105(N)	CS	0.75				CL6000	SW	IBR	HCPLNG0.75CL6000SW	0.29	0.58	0.87
HCPLNG	FITT	PREFAB	A105(N)	CS	0.75				CL6000	SW	IBR	HCPLNG0.75CL6000SW	0.29	1.74	2.61
HCPLNG	FITT	PREFAB	A105(N)	CS	1.5				CL3000	SW	IBR	HCPLNG1.5CL3000SW	0.57	5.13	7.98
HCPLNG	FITT	PREFAB	A105(N)	CS	1.5				CL3000	SW	IBR	HCPLNG1.5CL3000SW	0.57	9.12	13.68
ST2NT	BOLT	BOLT	A193GRB7/A194GR2H		M12X65							ST2NTM12X65	0	0.00	0.00
ST2NT	BOLT	BOLT	A193GRB7/A194GR2H		M12X85							ST2NTM12X85	0	0.00	0.00
ST2NT	BOLT	BOLT	A193GRB7/A194GR2H		M16X95							ST2NTM16X95	0	0.00	0.00
ST2NT	BOLT	BOLT	A193GRB7/A194GR2H		M16X85							ST2NTM16X85	0	0.00	0.00
ST2NT	BOLT	BOLT	A193GRB7/A194GR2H		M16X80							ST2NTM16X80	0.18	2.88	3.60
ST2NT	BOLT	BOLT	A193GRB7/A194GR2H		M16X100							ST2NTM16X100	0.21	1.68	2.10
ST2NT	BOLT	BOLT	A193GRB7/A194GR2H		M16X110							ST2NTM16X110	0.22	1.76	2.20
ST2NT	BOLT	BOLT	A193GRB7/A194GR2H		M20X100							ST2NTM20X100	0.37	14.80	18.50
ST2NT	BOLT	BOLT	A193GRB7/A194GR2H		M20X110							ST2NTM20X110	0.39	15.60	19.50
ST2NT	BOLT	BOLT	A193GRB7/A194GR2H		M20X120							ST2NTM20X120	0.41	13.12	16.40
ST2NT	BOLT	BOLT	A193GRB7/A194GR2H		M20X130							ST2NTM20X130	0.43	10.32	12.90
ST2NT	BOLT	BOLT	A193GRB7/A194GR2H		M22X140							ST2NTM22X140	0.56	40.32	50.40
ST2NT	BOLT	BOLT	A193GRB7/A194GR2H		M22X120							ST2NTM22X120	0.51	55.08	66.30
ST2NT	BOLT	BOLT	A193GRB7/A194GR2H		M22X150							ST2NTM22X150	0.59	11.80	17.70
ST2NT	BOLT	BOLT	A193GRB7/A194GR2H		M22X165							ST2NTM22X165	0	0.00	0.00
ST2NT	BOLT	BOLT	A193GRB7/A194GR2H		M24X200							ST2NTM24X200	0.84	90.72	109.20
ST2NT	BOLT	BOLT	A193GRB7/A194GR2H		M24X225							ST2NTM24X225	0	0.00	0.00
ST2NT	BOLT	BOLT	A193GRB7/A194GR2H		M24X285							ST2NTM24X285	0	0.00	0.00
ST2NT	BOLT	BOLT	A193GRB7/A194GR2H		M27X205							ST2NTM27X205	0	0.00	0.00
ST2NT	BOLT	BOLT	A193GRB7/A194GR2H		M27X245							ST2NTM27X245	0	0.00	0.00
ST2NT	BOLT	BOLT	A193GRB7/A194GR2H		M27X315							ST2NTM27X315	0	0.00	0.00

268	BOLT.STUD WITH 2 NUTS, B-18.2, A193 GR.B7M, A194 GR.2HM, NAC6, 0.625 INCH X 4.25 INCH	8	10
269	BOLT.STUD WITH 2 NUTS, B-18.2, A193 GR.B7M, A194 GR.2HM, NAC6, 0.75 INCH X 4.75 INCH	8	10
270	BOLT.STUD WITH 2 NUTS, B-18.2, A193 GR.B7M, A194 GR.2HM, NAC6, 0.75 INCH X 4.25 INCH	8	10
271	BOLT.STUD WITH 3 NUTS, B-18.2, A193 GR.B7M, A194 GR.2HM, NAC6, 1.0 INCH X 6.25 INCH	16	20
272	BOLT.STUD WITH 3 NUTS, B-18.2, A193 GR.B7M, A194 GR.2HM, NAC6, 1.0 INCH X 7.25 INCH	16	20
273	BOLT.STUD WITH 3 NUTS, B-18.2, A193 GR.B7M, A194 GR.2HM, NAC6, 1.25 INCH X 8.75 INCH	40	50
285	GASKET, B-16.20-ANSI B16.5, SP.WND SS316+GRAFIL+ SPIRAL, 300, NAC6, 3.0 INCH	3	5
286	GASKET, B-16.20-ANSI B16.5, SP.WND SS316+GRAFIL+ I RING, SPIRAL, 300, 0.75 INCH	4	6
287	GASKET, B-16.20-ANSI B16.5, SP.WND SS316+GRAFIL+ I RING, SPIRAL, 300, 3.0 INCH	3	5
288	GASKET, B-16.20-ANSI B16.5, SP.WND SS316+GRAFIL+ I RING, SPIRAL, 300, 8.0 INCH	2	3
289	GASKET, B-16.20-ANSI B16.5, SP.WND SS316+GRAFIL+ I RING, SPIRAL, 300, 12.0 INCH	2	3
290	GASKET, B-16.20-ANSI B16.47B, SP.WND SS316+GRAFIL+ I RING, SPIRAL, 300, 36.0 INCH	2	3
291	GASKET, B-16.20-ANSI B16.5, SP.WND SS316+GRAFIL+ I RING, SPIRAL, 300, NACE, 3.0 INCH	4	6
292	GASKET, B-16.20-ANSI B16.47B, SP.WND SS316+GRAFIL+ I RING, SPIRAL, 300, NACE, 48.0 INCH	2	3
293	GASKET, B-16.20-ANSI B16.5, SP.WND SS316+GRAFIL+ I RING, SPIRAL, 300, NAC6, 16.0 INCH	2	3
294	GASKET, B-16.20-ANSI B16.5, SP.WND SS316L+GRAFIL+ I RING, SPIRAL, 600, 4.0 INCH	3	5
295	GASKET, B-16.20-ANSI B16.5, SP.WND SS316L+GRAFIL+ I RING, SPIRAL, 600, 6.0 INCH	15	23
296	GASKET, B-16.20-ANSI B16.5, SP.WND SS316L+GRAFIL+ I RING, SPIRAL, 600, 10.0 INCH	5	8
297	GASKET, B-16.20-ANSI B16.5, SP.WND SS316L+GRAFIL+ I RING, SPIRAL, 150, 10.0 INCH	3	5
298	GASKET, B-16.20-ANSI B16.5, SP.WND SS316L+GRAFIL+ I RING, SPIRAL, 600, 12.0 INCH	5	8
299	GASKET, B-16.21-ANSI B16.5, NONASB. SYN FIBRE+ RUBR BINDER, FULLFACE, 150, 2.0 INCH, 2 MM	6	9
300	GASKET, B-16.21-ANSI B16.5, NONASB. SYN FIBRE+ RUBR BINDER, FULLFACE, 150, 3.0 INCH, 2 MM	9	14
301	GASKET, B-16.21-ANSI B16.5, NONASB. SYN FIBRE+ RUBR BINDER, FULLFACE, 150, 4.0 INCH, 2 MM	3	5
302	GASKET, B-16.20-ANSI B16.5, LS SP.WND SS316+FLEX GRAFIL+IR, SPIRAL, 150, 0.75 INCH	24	36
303	GASKET, B-16.20-ANSI B16.5, LS SP.WND SS316+FLEX GRAFIL+IR, SPIRAL, 150, 1.5 INCH	50	75
304	GASKET, B-16.20-ANSI B16.5, LS SP.WND SS316+FLEX GRAFIL+IR, SPIRAL, 150, 2.0 INCH	9	14
305	GASKET, B-16.20-ANSI B16.5, LS SP.WND SS316+FLEX GRAFIL+IR, SPIRAL, 150, 3.0 INCH	6	9
306	GASKET, B-16.20-ANSI B16.5, LS SP.WND SS316+FLEX GRAFIL+IR, SPIRAL, 150, 4.0 INCH	3	5
307	GASKET, B-16.20-ANSI B16.5, LS SP.WND SS316+FLEX GRAFIL+IR, SPIRAL, 150, 6.0 INCH	13	20
308	GASKET, B-16.20-ANSI B16.5, LS SP.WND SS316+FLEX GRAFIL+IR, SPIRAL, 150, 8.0 INCH	8	12
309	GASKET, B-16.20-ANSI B16.5, LS SP.WND SS316+FLEX GRAFIL+IR, SPIRAL, 150, 10.0 INCH	10	15
310	GASKET, B-16.20-ANSI B16.5, LS SP.WND SS316+FLEX GRAFIL+IR, SPIRAL, 150, 12.0 INCH	6	9
311	GASKET, B-16.20-ANSI B16.5, LS SP.WND SS316+FLEX GRAFIL+IR, SPIRAL, 150, 24.0 INCH	3	5
312	GASKET, B-16.20-ANSI B16.47B, LS SP.WND SS316+FLEX GRAFIL+IR, SPIRAL, 150, 44.0 INCH	3	5
313	GASKET, B-16.20-ANSI B16.47B, LS SP.WND SS316+FLEX GRAFIL+IR, SPIRAL, 150, 48.0 INCH	8	12
314	GASKET, B-16.20-ANSI B16.5, LS SP.WND SS316+FLEX GRAFIL+IR, SPIRAL, 150, NACE, 3.0 INCH	6	9
315	GASKET, B-16.20-ANSI B16.5, LS SP.WND SS316+FLEX GRAFIL+IR, SPIRAL, 150, NACE, 6.0 INCH	5	8
316	GASKET, B-16.20-ANSI B16.5, LS SP.WND SS316+FLEX GRAFIL+IR, SPIRAL, 150, NACE, 20.0 INCH	4	6
317	GASKET, B-16.20-ANSI B16.5, LS SP.WND SS316+FLEX GRAFIL+IR, SPIRAL, 150, NACE, 24.0 INCH	5	8
318	GASKET, B-16.20-ANSI B16.47B, LS SP.WND SS316+FLEX GRAFIL+IR, SPIRAL, 150, NACE, 36.0 INCH	4	6
319	GASKET, B-16.20-ANSI B16.47B, LS SP.WND SS316+FLEX GRAFIL+IR, SPIRAL, 150, NACE, 48.0 INCH	3	5
320	GASKET, B-16.20-ANSI B16.5, LS SP.WND SS316+FLEX GRAFIL+IR, SPIRAL, 150, NAC6, 4.0 INCH	3	5
321	GASKET, B-16.20-ANSI B16.5, LS SP.WND SS316+FLEX GRAFIL+IR, SPIRAL, 150, NAC6, 16.0 INCH	3	5
		3120.56	4093.00

ST2NT	BOLT	BOLT	A193GRB7M/A194GR2HM		M16X110							NACE+HIC	ST2NTM16X110	0.22	1.76	2.20
ST2NT	BOLT	BOLT	A193GRB7M/A194GR2HM		M20X120							NACE+HIC	ST2NTM20X120	0.41	3.28	4.10
ST2NT	BOLT	BOLT	A193GRB7M/A194GR2HM		M20X110							NACE+HIC	ST2NTM20X110	0.39	3.12	3.90
ST2NT	BOLT	BOLT	A193GRB7M/A194GR2HM		M24X160							NACE+HIC	ST2NTM24X160	0.72	11.52	14.40
ST2NT	BOLT	BOLT	A193GRB7M/A194GR2HM		M24X185							NACE+HIC	ST2NTM24X185	0	0.00	0.00
ST2NT	BOLT	BOLT	A193GRB7M/A194GR2HM		M30X225							NACE+HIC	ST2NTM30X225	0	0.00	0.00
GASKET	GASK	GASKET	SS316+GRAPH		3				MSW+GRAPH	CL300	RF-B16.5	NACE+HIC	GASKET3MSW+GRAPHCL300RF-B16.5	0.19	0.57	0.95
GASKET	GASK	GASKET	SS316+GRAPH		0.75				MSW+GRAPH	CL300	RF-B16.5		GASKET0.75MSW+GRAPHCL300RF-B16.5	0.04	0.16	0.24
GASKET	GASK	GASKET	SS316+GRAPH		3				MSW+GRAPH	CL300	RF-B16.5		GASKET3MSW+GRAPHCL300RF-B16.5	0.19	0.57	0.95
GASKET	GASK	GASKET	SS316+GRAPH		8				MSW+GRAPH	CL300	RF-B16.5		GASKET8MSW+GRAPHCL300RF-B16.5	0.73	1.46	2.19
GASKET	GASK	GASKET	SS316+GRAPH		12				MSW+GRAPH	CL300	RF-B16.5		GASKET12MSW+GRAPHCL300RF-B16.5	1.41	2.82	4.23
GASKET	GASK	GASKET	SS316+GRAPH		36				MSW+GRAPH	CL300	RF-B16.47B		GASKET36MSW+GRAPHCL300RF-B16.47B	0	0.00	0.00
GASKET	GASK	GASKET	SS316+GRAPH		3				MSW+GRAPH	CL300	RF-B16.5	NACE	GASKET3MSW+GRAPHCL300RF-B16.5	0.19	0.76	1.14
GASKET	GASK	GASKET	SS316+GRAPH		48				MSW+GRAPH	CL300	RF-B16.47B	NACE	GASKET48MSW+GRAPHCL300RF-B16.47B	0	0.00	0.00
GASKET	GASK	GASKET	SS316+GRAPH		16				MSW+GRAPH	CL300	RF-B16.5	NACE+HIC	GASKET16MSW+GRAPHCL300RF-B16.5	2.1	4.20	6.30
GASKET	GASK	GASKET	SS316L+GRAPH		4				MSW+GRAPH	CL600	RF-B16.5		GASKET4MSW+GRAPHCL600RF-B16.5	0.32	0.96	1.60
GASKET	GASK	GASKET	SS316L+GRAPH		6				MSW+GRAPH	CL600	RF-B16.5		GASKET6MSW+GRAPHCL600RF-B16.5	0.56	8.40	12.88
GASKET	GASK	GASKET	SS316L+GRAPH		10				MSW+GRAPH	CL600	RF-B16.5		GASKET10MSW+GRAPHCL600RF-B16.5	1.14	5.70	9.12
GASKET	GASK	GASKET	SS316L+GRAPH		10				MSW+GRAPH	CL150	RF-B16.5		GASKET10MSW+GRAPHCL150RF-B16.5	1.14	3.42	5.70
GASKET	GASK	GASKET	SS316L+GRAPH		12				MSW+GRAPH	CL600	RF-B16.5		GASKET12MSW+GRAPHCL600RF-B16.5	1.41	7.05	11.28
GASKET	GASK	GASKET			2				NM-FLAT	CL150	FF-B16.5		GASKET2NM-FLATCL150FF-B16.5	0.11	0.66	0.99
GASKET	GASK	GASKET			3				NM-FLAT	CL150	FF-B16.5		GASKET3NM-FLATCL150FF-B16.5	0.19	1.71	2.66
GASKET	GASK	GASKET			4				NM-FLAT	CL150	FF-B16.5		GASKET4NM-FLATCL150FF-B16.5	0.32	0.96	1.60
GASKET	GASK	GASKET			0.75				MSW+GRAPH	CL150	RF-B16.5		GASKET0.75MSW+GRAPHCL150RF-B16.5	0.04	0.96	1.44
GASKET	GASK	GASKET			1.5				MSW+GRAPH	CL150	RF-B16.5		GASKET1.5MSW+GRAPHCL150RF-B16.5	0.08	4.00	6.00
GASKET	GASK	GASKET			2				MSW+GRAPH	CL150	RF-B16.5		GASKET2MSW+GRAPHCL150RF-B16.5	0.11	0.99	1.54
GASKET	GASK	GASKET			3				MSW+GRAPH	CL150	RF-B16.5		GASKET3MSW+GRAPHCL150RF-B16.5	0.19	1.14	1.71
GASKET	GASK	GASKET			4				MSW+GRAPH	CL150	RF-B16.5		GASKET4MSW+GRAPHCL150RF-B16.5	0.32	0.96	1.60
GASKET	GASK	GASKET			6				MSW+GRAPH	CL150	RF-B16.5		GASKET6MSW+GRAPHCL150RF-B16.5	0.56	7.28	11.20
GASKET	GASK	GASKET			8				MSW+GRAPH	CL150	RF-B16.5		GASKET8MSW+GRAPHCL150RF-B16.5	0.73	5.84	8.76
GASKET	GASK	GASKET			10				MSW+GRAPH	CL150	RF-B16.5		GASKET10MSW+GRAPHCL150RF-B16.5	1.14	11.40	17.10
GASKET	GASK	GASKET			12				MSW+GRAPH	CL150	RF-B16.5		GASKET12MSW+GRAPHCL150RF-B16.5	1.41	8.46	12.69
GASKET	GASK	GASKET			24				MSW+GRAPH	CL150	RF-B16.5		GASKET24MSW+GRAPHCL150RF-B16.5	3.56	10.68	17.80
GASKET	GASK	GASKET			44				MSW+GRAPH	CL150	RF-B16.47B		GASKET44MSW+GRAPHCL150RF-B16.47B	0	0.00	0.00
GASKET	GASK	GASKET			48				MSW+GRAPH	CL150	RF-B16.47B		GASKET48MSW+GRAPHCL150RF-B16.47B	0	0.00	0.00
GASKET	GASK	GASKET			3				MSW+GRAPH	CL150	RF-B16.5	NACE	GASKET3MSW+GRAPHCL150RF-B16.5	0.19	1.14	1.71
GASKET	GASK	GASKET			6				MSW+GRAPH	CL150	RF-B16.5	NACE	GASKET6MSW+GRAPHCL150RF-B16.5	0.56	2.80	4.48
GASKET	GASK	GASKET			20				MSW+GRAPH	CL150	RF-B16.5	NACE	GASKET20MSW+GRAPHCL150RF-B16.5	2.87	11.48	17.22
GASKET	GASK	GASKET			24				MSW+GRAPH	CL150	RF-B16.5	NACE	GASKET24MSW+GRAPHCL150RF-B16.5	3.56	17.80	28.48
GASKET	GASK	GASKET			36				MSW+GRAPH	CL150	RF-B16.47B	NACE	GASKET36MSW+GRAPHCL150RF-B16.47B	0	0.00	0.00
GASKET	GASK	GASKET			48				MSW+GRAPH	CL150	RF-B16.47B	NACE	GASKET48MSW+GRAPHCL150RF-B16.47B	0	0.00	0.00
GASKET	GASK	GASKET			4				MSW+GRAPH	CL150	RF-B16.5	NACE+HIC	GASKET4MSW+GRAPHCL150RF-B16.5	0.32	0.96	1.60
GASKET	GASK	GASKET			16				MSW+GRAPH	CL150	RF-B16.5	NACE+HIC	GASKET16MSW+GRAPHCL150RF-B16.5	2.1	6.30	10.50
														42924.41		57197.01

IOCL PARADIP 525 TPD STANDBY SRU PROJECT

VALVES REQUIRED FOR PIPING TIE-IN ACTIVITY

SL NO	ITEM	NB	RATING	MATERIAL	SPECIAL SERVICE	END CONN	OPEN MODE	QTY	TIE-IN NO	SERVICE	VMS	SCOPE	REMARKS	PR	ENQUIRY
1	GATE VALVE	300	C600	A216GRWCB	IBR	RF-B16.5	GO	2	088-TP-015	HP STEAM	515AB	PESD VENDOR		1900138301/10 DT 01.06.21	
2	GATE VALVE	250	C600	A216GRWCB	IBR	RF-B16.5	GO	2	090-TP-031	HP STEAM	515AB	PESD VENDOR		1900138301/10 DT 01.06.21	
3	GATE VALVE	150	C600	A216GRWCB	IBR	RF-B16.5	HO	2	088-TP-016	HP STEAM	515AB	PESD VENDOR		1900138301/10 DT 01.06.21	
4	GATE VALVE	150	C600	A216GRWCB	IBR	RF-B16.5	HO	2	088-TP-019	HP BFW	515AB	PESD VENDOR		1900138301/10 DT 01.06.21	
5	GATE VALVE	150	C600	A216GRWCB	IBR	RF-B16.5	HO	2	090-TP-033	HP BFW	515AB	PESD VENDOR		1900138301/10 DT 01.06.21	
6	GATE VALVE	100	C600	A216GRWCB	IBR	RF-B16.5	HO	1	088-TP-024	BLOWDOWN	515AB	PESD VENDOR		1900138301/10 DT 01.06.21	
7	GATE VALVE	80	C300	A216GRWCB	IBR	RF-B16.5	HO	1	088-TP-018	MP BFW	514AB	PESD VENDOR		1900138301/10 DT 01.06.21	
8	GATE VALVE	600	C150	A216GRWCB	IBR	RF-B16.5	GO	1	088-TP-017	LP STEAM	513AB	PESD VENDOR		1900138301/10 DT 01.06.21	
9	GATE VALVE	250	C150	A216GRWCB	IBR	RF-B16.5	HO	1	088-TP-026	LP CONDENSATE	513AB	PESD VENDOR		1900138301/10 DT 01.06.21	
10	GATE VALVE	250	C150	A216GRWCB	IBR	RF-B16.5	HO	1	090-TP-038	LP CONDENSATE	513AB	PESD VENDOR		1900138301/10 DT 01.06.21	
11	GATE VALVE	200	C150	A216GRWCB		RF-B16.5	HO	1	088-TP-012	NITROGEN	513FA	PESD VENDOR		1900138301/10 DT 01.06.21	
12	GATE VALVE	100	C150	A216GRWCB	IBR	RF-B16.5	HO	1	088-TP-021	LP CONDENSATE	513AB	PESD VENDOR		1900138301/10 DT 01.06.21	
13	GATE VALVE	80	C150	A216GRWCB	CAT-D	RF-B16.5	HO	1	088-TP-013	SERVICE WATER	513DA	PESD VENDOR		1900138301/10 DT 01.06.21	
14	GATE VALVE	80	C150	A216GRWCB	CAT-D	RF-B16.5	HO	1	090-TP-029	SERVICE WATER	513DA	PESD VENDOR		1900138301/10 DT 01.06.21	
15	GATE VALVE	50	C150	A216GRWCB	IBR	RF-B16.5	HO	1	088-TP-023	BLOWDOWN	513AB	PESD VENDOR		1900138301/10 DT 01.06.21	
16	GATE VALVE	80	C150	A216GRWCB	NACE	RF-B16.5	HO	1	089-TP-041	VENT GAS	513HC	PESD VENDOR		1900138301/10 DT 01.06.21	
17	GATE VALVE	80	C150	A216GRWCB	NACE	RF-B16.5	HO	1	089-TP-042	VENT GAS	513HC	PESD VENDOR		1900138301/10 DT 01.06.21	
18	GATE VALVE	600	C150	A216GRWCB	NACE	RF-B16.5	GO	2	090-TP-036	FLARE	513HC	PESD VENDOR		1900138301/10 DT 01.06.21	
19	GATE VALVE	400	C150	A216GRWCB	NACE + HIC	RF-B16.5	GO	1	089-TP-040	PROCESS GAS	513TC	PESD VENDOR		1900138301/10 DT 01.06.21	
20	GATE VALVE	150	C150	A216GRWCB	NACE	RF-B16.5	HO	2	088-TP-022	FLARE	513HC	PESD VENDOR		1900138301/10 DT 01.06.21	
21	GATE VALVE	100	C150	A216GRWCB	NACE + HIC	RF-B16.5	HO	1	090-TP-027	SWS VENT GAS	513TC	PESD VENDOR		1900138301/10 DT 01.06.21	
22	GATE VALVE	80	C300	A216GRWCB	NACE + HIC	RF-B16.5	HO	1	088-TP-002	SOUR WATER	514VC	PESD VENDOR		1900138301/10 DT 01.06.21	
23	GATE VALVE	40	C800	A105	IBR	SW	HO	16	086-TP-XX3	LP STEAM	510AB	PESD VENDOR		1900138301/10 DT 01.06.21	
24	GATE VALVE	40	C800	A105	IBR	SW	HO	5	087-TP-XX4	LP STEAM	510AB	PESD VENDOR		1900138301/10 DT 01.06.21	
25	GATE VALVE	40	C800	A105	IBR	SW	HO	2	089-TP-XX5	LP STEAM	510AB	PESD VENDOR		1900138301/10 DT 01.06.21	
26	GATE VALVE	40	C800	A105	IBR	SW	HO	2	212-TP-XX6	LP STEAM	510AB	PESD VENDOR		1900138301/10 DT 01.06.21	
27	GATE VALVE	20	C800	A105N	NACE	SW	HO	12	SPARE	PROCESS GAS	513HC	PESD VENDOR	Not in EIL's Input	1900138301/10 DT 01.06.21	
28	GATE VALVE	250	C150	A351GRCF3M		RF-B16.5	HO	1	088-TP-004	SO2 GAS	513AM	PESD VENDOR		1900138301/10 DT 01.06.21	
29	GATE VALVE	50	C150	A351GRCF3		RF-B16.5	HO	1	088-TP-XX1	DM WATER	513AL	PESD VENDOR		1900138301/10 DT 01.06.21	
30	GATE VALVE	50	C150	A351GRCF3		RF-B16.5	HO	1	090-TP-XX2	DM WATER	513AL	PESD VENDOR		1900138301/10 DT 01.06.21	
31	GATE VALVE	100	C150	B62 UNS C83600		RF-B16.5	HO	1	090-TP-034	INSTRUMENT AIR	513FE	PESD VENDOR			
32	GATE VALVE	80	C150	B62 UNS C83600		RF-B16.5	HO	1	088-TP-014	POTABLE WATER	513FE	PESD VENDOR			
33	GATE VALVE	80	C150	B62 UNS C83600		RF-B16.5	HO	1	088-TP-020	INSTRUMENT AIR	513FE	PESD VENDOR			
34	GATE VALVE	50	C150	B62 UNS C83600		RF-B16.5	HO	1	088-TP-011	PLANT AIR	513FE	PESD VENDOR			
35	GATE VALVE	50	C150	B62 UNS C83600		RF-B16.5	HO	1	090-TP-028	PLANT AIR	513FE	PESD VENDOR			
36	GATE VALVE	80	C150	B62 UNS C83600		RF-B16.5	HO	1	090-TP-030	POTABLE WATER	513FE	PESD VENDOR			
37	GATE VALVE (JACKETED)	10	C150	A216GRWCB		RF-B16.5	HO	1	088-TP-007	SULFUR PIT VAPOUR	513AD	PESD VENDOR	Steam supply/return to be designed	1900138301/20 DT 26.05.21	
38	GATE VALVE (JACKETED)	6	C150	A216GRWCB		RF-B16.5	HO	1	088-TP-008	LIQUID SULFUR	513AD	PESD VENDOR	Steam supply/return to be designed	1900138301/20 DT 26.05.21	
39	GATE VALVE (JACKETED)	8	C150	A216GRWCB		RF-B16.5	HO	1	088-TP-009	DEGASSING OVER HEAD	513AD	PESD VENDOR	Steam supply/return to be designed	1900138301/20 DT 26.05.21	

IOCL PARADIP 525 TPD STANDBY SRU PROJECT

VALVES REQUIRED FOR PIPING TIE-IN ACTIVITY

SL NO	ITEM	NB	RATING	MATERIAL	SPECIAL SERVICE	END CONN	OPEN MODE	QTY	TIE-IN NO	SERVICE	VMS	SCOPE	REMARKS	PR	ENQUIRY
40	VALVE (TRIPLE OFFSET)	1200	C150	A216GRWCB		RF-B16.5	GO	1	088-TP-005	SRU TAIL GAS	563BA	PESD VENDOR		1900138301/30 DT 26.05.21	
41	VALVE (TRIPLE OFFSET)	1200	C150	A216GRWCB		RF-B16.5	GO	1	088-TP-006	SRU TAIL GAS	563BA	PESD VENDOR		1900138301/30 DT 26.05.21	
42	VALVE (TRIPLE OFFSET)	1100	C150	A216GRWCB		RF-B16.5	GO	1	088-TP-010	COMBUSTION AIR	563BA	PESD VENDOR		1900138301/30 DT 26.05.21	
43	VALVE (TRIPLE OFFSET)	1200	C150	A216GRWCB	NACE + HIC	RF-B16.5	GO	1	089-TP-039	PROCESS GAS	563TC	PESD VENDOR		1900138301/30 DT 26.05.21	
44	VALVE (TRIPLE OFFSET)	900	C150	A216GRWCB	NACE + HIC	RF-B16.5	GO	1	088-TP-001	AMINE ACID GAS	563TC	PESD VENDOR		1900138301/30 DT 26.05.21	
45	VALVE (TRIPLE OFFSET)	500	C150	A216GRWCB	NACE + HIC	RF-B16.5	GO	1	088-TP-003	SWS ACID GAS	563TC	PESD VENDOR		1900138301/30 DT 26.05.21	
46	VALVE (TRIPLE OFFSET)	150	C150	A216GRWCB		RF-B16.5	HO	1	088-TP-043	COOLING WATER	563DA	PESD VENDOR		1900138301/30 DT 26.05.21	
47	VALVE (TRIPLE OFFSET)	150	C150	A216GRWCB		RF-B16.5	HO	1	088-TP-044	COOLING WATER	563DA	PESD VENDOR		1900138301/30 DT 26.05.21	
48	BALL VALVE (FLOATING)	150	C150	A216GRWCB		RF-B16.5	HO	1	088-TP-025	FUEL GAS	543LA	PESD VENDOR	HydroCarbon Service	1900138332 DT 27.05.21	
49	BALL VALVE (TRUNNION)	200	C150	A216GRWCB		RF-B16.5	HO	1	090-TP-037	FUEL GAS	543LA	PESD VENDOR	HydroCarbon Service	1900138332 DT 27.05.21	
50	PLUG VALVE	50	C150	A216GRWCB		RF-B16.5	HO	1	088-TP-008	LIQUID SULFUR	553BD	PESD VENDOR	Not required as per P&ID scope. Shown as existing. To be discussed with EIL.		
51	BUTTERFLY VALVE (TRIPLE OFFSET)	400	C300	A216GRWCB+PWHT+SOUR SERVICE	NACE + HIC	RF-B16.5	PO	1	089-TP-051	PROCESS GAS	089-HZV-0502	PESD VENDOR BY SYS (PS)	Common for 089-TP-052		
52	BUTTERFLY VALVE (TRIPLE OFFSET)	1200	C300	A216GRWCB+PWHT+SOUR SERVICE	NACE	RF-B16.5	PO	1	089-TP-053	PROCESS GAS	089-HZV-0508	PESD VENDOR BY SYS (PS)	Common for 089-TP-054		
53	ON-OFF BALL VALVE	80	C300	A216GRWCB+PWHT+SOUR SERVICE	NACE	RF-B16.5	PO	1	089-TP-055	VENT GAS	089-XZV-0514	PESD VENDOR BY SYS (PS)	Common for 089-TP-056		
54	ON-OFF BALL VALVE	80	C300	A216GRWCB+PWHT+SOUR SERVICE	NACE	RF-B16.5	PO	1	089-TP-057	VENT GAS	089-XZV-0506	PESD VENDOR BY SYS (PS)	Common for 089-TP-058		
55	ON-OFF ROTARY PLUG VALVE (JACKETED)	250	C300	A216GRWCB		RF-B16.5	PO	1	089-TP-071	SULFUR PIT VAPOUR	089-XZV-0521	PESD VENDOR BY SYS (PS)	Common for 089-TP-073		
56	ON-OFF ROTARY PLUG VALVE (JACKETED)	150	C300	A216GRWCB		RF-B16.5	PO	1	089-TP-074	DEGASSING OVER HEAD	089-XZV-0522	PESD VENDOR BY SYS (PS)	Common for 089-TP-076		
57	ON-OFF BALL VALVE	900	C300	A216GRWCB		RF-B16.5	PO	1	089-TP-079	SRU TAIL GAS	089-XZV-0523	PESD VENDOR BY SYS (PS)	Common for 089-TP-080		

IOCL PARADIP 525 TPD STANDBY SRU PROJECT

VALVES REQUIRED FOR PIPING TIE-IN ACTIVITY

SL NO	ITEM	NB	RATING	MATERIAL	SPECIAL SERVICE	END CONN	OPEN MODE	QTY	TIE-IN NO	SERVICE	VMS	SCOPE	REMARKS	PR	ENQUIRY
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Notes:

- 1) Enquiry sent to BHEL (T) on 19.05.2021 for Gate Valves. Formal PR will be released after Scope / Price settlement with Trichy.
- 2) BHEL (T) gave regret on 29.05.2021.



ControTrace® Line List

IOCL PARADIP 525 TPD STANDBY SRU

Existing Tail Gas Line List for which ControTrace® to be installed in Shutdown

SI No	Process Description	NPS (in)	Class	Maintenance Temperature (°C)	Insulation Thickness (mm)	Pipe Material	Pipe Schedule	Approx Pipe Length (m) @	Approx CL Elevation @	Location	Line No	P&ID	Core Piping Isometric / Piping GA / Reference Drawing / BOQ
1	Process gas from TGTU absorber to Incinerator	50	A8A	138	50	CS	14.27mm	24	113.300 M	Unit 089	1200-P-089-1902-A2AL-CT	PRRP4220-271-8110-25-089-0022 Rev Z1X	PDRP0271-52-BGRB-P-089-1902 Rev S1 PDRP0271-52-BGAA-P-089-1902 Rev S2 (Sheet 1, 2)
2	Process gas from TGTU absorber to Incinerator	48	A8A	138	50	CS	XS	24	113.300 M	Unit 089	1200-P-089-1902-A2AL-CT	PRRP4220-271-8110-25-089-0022 Rev Z1X	PDRP0271-52-BGRA-P-089-1902 Rev S1 PDRP0271-52-BGRB-P-089-1902 Rev S1
3	Tail gas from SRU Unit to TGTU Incinerator (Header)	48	A12A	138	50	CS	XS	110	113.300 M	Unit 211	1200-P-211-1207-A2AP-CT #	PDRP4240-275-8110-25-211-2030 Rev ZX PDRP4240-275-8110-25-211-2032 Rev ZX PDRP4240-275-8110-25-211-2034 Rev ZX	PDRP4240-275-8230-51-211-0430 Rev S1 PDRP4240-275-8230-51-211-0431 Rev S1 PDRP4240-275-8230-51-211-0432 Rev S1
4	Tail gas from SRU Unit to TGTU (Header)	48	A12A	138	50	CS	XS	110	113.300 M	Unit 211	1200-P-211-1209-A2AP-CT #	PDRP4240-275-8110-25-211-2030 Rev ZX PDRP4240-275-8110-25-211-2032 Rev ZX PDRP4240-275-8110-25-211-2034 Rev ZX	PDRP4240-275-8230-51-211-0430 Rev S1 PDRP4240-275-8230-51-211-0431 Rev S1 PDRP4240-275-8230-51-211-0432 Rev S1
5	SRU Tail gas from Header to TGTU Reactor Preheater	48	A12A	138	50	CS	XS	42	113.200 M	Unit 211	1200-P-211-3025-A2AP-CT #	PDRP4240-275-8110-25-211-2032 Rev ZX	PDRP4240-275-8230-51-211-0431 Rev S1 PDRP4240-275-8230-51-211-0487+ PDRP4240-275-8230-51-211-0488+
6	SRU Tail gas from Header to TGTU Reactor Preheater	48	A12A	138	50	CS	XS	36	114.700 M to 123.500 M	Unit 089	1200-P-089-1111-A2AP-CT	PRRP4220-271-8110-25-089-0001 Rev Z1X	PDRP0271-52-BGRA-P-089-1111 Rev S1 PDRP0271-52-BGRC-P-089-1111 Rev S1 PDRP0271-52-BGAG-P-089-1111 Rev S1
7	SRU Tail gas from Header to TGTU Incinerator	36	A12A	138	50	CS	XS	12	113.200 M	Unit 211	900-P-211-3026-A2AP-CT #	PDRP4240-275-8110-25-211-2032 Rev ZX	PDRP4240-275-8230-51-211-0432 Rev S1 PDRP4240-275-8230-51-211-0487+
8	SRU Tail gas from Header to TGTU Incinerator	36	A12A	138	50	CS	XS	36	115.250 M	Unit 089	900-P-089-3413-A2AP-CT	PRRP4220-271-8110-25-089-0022 Rev Z1X	PDRP0271-52-BGRB-P-089-3413 Rev S1
9	Tail gas from SRU Unit 086 (to header)	36	A12A	138	50	CS	XS	6	115.400 M	Unit 086	900-P-086-2901-A2AP-CT	PDRP4220-271-8110-25-086-0016 Rev Z1X	PDRP0271-52-BEAD-P-086-2901 Rev S2
10	Tail gas from SRU Unit 086 (to header)	36	A12A	138	60	CS	XS	90	111.700 M	Unit 086	900-P-086-2902-A2AP-CT	PDRP4220-271-8110-25-086-0016 Rev Z1X	PDRP0271-52-BEAD-P-086-2902 Rev S2
11	Tail gas from SRU Unit 086 (to header)	36	A12A	138	50	CS	XS	60	114.500 M	Unit 211	900-P-211-0015-A2AP-CT #	PDRP4240-275-8110-25-211-2030 Rev ZX	PDRP4240-275-8230-51-211-0432 Rev S1 PDRP4240-275-8230-51-211-0489+ PDRP4240-275-8230-51-211-0490+
12	Tail gas from SRU Unit 086 (to header)	36	A12A	138	60	CS	XS	60	114.000 M	Unit 211	900-P-211-0016-A2AP-CT #	PDRP4240-275-8110-25-211-2030 Rev ZX	PDRP4240-275-8230-51-211-0432 Rev S1 PDRP4240-275-8230-51-211-0489+ PDRP4240-275-8230-51-211-0490+
13	Tail Gas from SRU unit 087 (to header)	36	A12A	138	50	CS	XS	6	115.400 M		900-P-087-2901-A2AP-CT	PDRP4220-271-8110-25-087-0016 Rev Z1X	PDRP0271-52-BFAD-P-087-2901 Rev S2
14	Tail Gas from SRU unit 087 (to header)	36	A12A	138	60	CS	XS	90	111.700 M		900-P-087-2902-A2AP-CT	PDRP4220-271-8110-25-087-0016 Rev Z1X	PDRP0271-52-BFAD-P-087-2901 Rev S2
15	Tail Gas from SRU unit 087 (to header)	36	A12A	138	50	CS	XS	60	114.500 M	Unit 211	900-P-211-0021-A2AP-CT #	PDRP4240-275-8110-25-211-2034 Rev ZX	PDRP4240-275-8230-51-211-0430 Rev S1 PDRP4240-275-8230-51-211-0482+ PDRP4240-275-8230-51-211-0483+
16	Tail Gas from SRU unit 087 (to header)	36	A12A	138	60	CS	XS	60	114.000 M	Unit 211	900-P-211-0022-A2AP-CT #	PDRP4240-275-8110-25-211-2034 Rev ZX	PDRP4240-275-8230-51-211-0430 Rev S1 PDRP4240-275-8230-51-211-0482+ PDRP4240-275-8230-51-211-0483+
17	Quench Overhead from TGTU Quench Column to Reactor Preheater	24	A28A	138	50	CS	STD	18	123.500 M	Unit 089	600-P-089-1508-A2AR-CT	PRRP4220-271-8110-25-089-0001 Rev Z1X	PDRP0271-52-BGAG-P-089-1508 Rev S2 (Sheet 1, 2)
18	Nitrogen connection to SRU Tail gas line to reactor preheater	3	A12A	138	30	CS	STD	24	115.000 M	Unit 086	80-N-086-2918-A2AP-CT	PDRP4220-271-8110-25-086-0016 Rev Z1X	PDRP0271-52-BEAD-N-086-2918 Rev S2
19	Nitrogen connection to SRU Tail gas line to reactor preheater	3	A12A	138	30	CS	STD	24	115.000 M	Unit 087	80-N-087-2918-A2AP-CT	PDRP4220-271-8110-25-087-0016 Rev Z1X	PDRP0271-52-BFAD-N-086-2918 Rev S2
20	Nitrogen connection to SRU Tail gas line to Incinerator	1	A23A	138	25	CS	XS	3	115.000 M	Unit 086	25-N-086-2201-A1AA-CT	PDRP4220-271-8110-25-086-0016 Rev Z1X	PDRP0271-52-BEAD-N-086-2201 Rev Z1
21	Nitrogen connection to SRU Tail gas line to Incinerator	1	A23A	138	25	CS	XS	3	115.000 M	Unit 086	25-N-086-2202-A1AA-CT	PDRP4220-271-8110-25-086-0016 Rev Z1X	PDRP0271-52-BEAD-N-086-2202 Rev Z1



ControTrace® Line List

IOCL PARADIP 525 TPD STANDBY SRU

Existing Tail Gas Line List for which ControTrace® to be installed in Shutdown

Sl No	Process Description	NPS (in)	Class	Maintenance Temperature (°C)	Insulation Thickness (mm)	Pipe Material	Pipe Schedule	Approx Pipe Length (m) @	Approx CL Elevation @	Location	Line No	P&ID	Core Piping Isometric / Piping GA / Reference Drawing / BOQ
22	Nitrogen connection to SRU Tail gas line to reactor preheater	1	A23A	138	25	CS	XS	3	115.000 M	Unit 086	25-N-086-2203-A1AA-CT	PDRP4220-271-8110-25-086-0016 Rev Z1X	PDRP0271-52-BEAD-N-086-2203 Rev S2
23	Nitrogen connection to SRU Tail gas line to reactor preheater	1	A23A	138	25	CS	XS	3	115.000 M	Unit 086	25-N-086-2204-A1AA-CT	PDRP4220-271-8110-25-086-0016 Rev Z1X	PDRP0271-52-BEAD-N-086-2204 Rev S2
24	Nitrogen connection to SRU Tail gas line to reactor preheater	1	A23A	138	25	CS	XS	6	115.000 M	Unit 086	25-N-086-2205-A1AA-CT	PDRP4220-271-8110-25-086-0016 Rev Z1X	PDRP0271-52-BEAD-N-086-2205 Rev S1
25	Nitrogen connection to SRU Tail gas line to Incinerator	1	A23A	138	25	CS	XS	3	115.000 M	Unit 087	25-N-087-2201-A1AA-CT	PDRP4220-271-8110-25-087-0016 Rev Z1X	PDRP0271-52-BFAD-N-087-2201 Rev Z1
26	Nitrogen connection to SRU Tail gas line to Incinerator	1	A23A	138	25	CS	XS	3	115.000 M	Unit 087	25-N-087-2202-A1AA-CT	PDRP4220-271-8110-25-087-0016 Rev Z1X	PDRP0271-52-BFAD-N-087-2202 Rev Z1
27	Nitrogen connection to SRU Tail gas line to reactor preheater	1	A23A	138	25	CS	XS	3	115.000 M	Unit 087	25-N-087-2203-A1AA-CT	PDRP4220-271-8110-25-087-0016 Rev Z1X	PDRP0271-52-BFAD-N-087-2203 Rev S1
28	Nitrogen connection to SRU Tail gas line to reactor preheater	1	A23A	138	25	CS	XS	3	115.000 M	Unit 087	25-N-087-2204-A1AA-CT	PDRP4220-271-8110-25-087-0016 Rev Z1X	PDRP0271-52-BFAD-N-087-2204 Rev S1
29	Nitrogen connection to SRU Tail gas line to reactor preheater	1	A23A	138	25	CS	XS	6	115.000 M	Unit 087	25-N-087-2205-A1AA-CT	PDRP4220-271-8110-25-087-0016 Rev Z1X	PDRP0271-52-BFAD-N-086-2205 Rev S1

Isometrics awaited from Technip/IOCL

* Piping GAs awaited from Technip/IOCL

@ Actual shall be as per the Piping Isometric / GA attached

Reference Grade Elevation 100.0 M