ANNEXURE-15(A)

BHEL'S JOB SPECIFICATION FOR CONTROL AND INSTRUMENTATION AND DATA SHEETS FOR VARIOUS INSTRUMENTS

SPECIFICATION FOR INSTRUMENTATION AND CONTROL FOR PACKAGE UNITS

PROJECT: CPCL COGEN 20 MW GTG & 100 TPH HRSG.

CUSTOMER: M/s CPCL Chennai

CONTENTS

1.0 SCOPE

This specification together with relevant process parameter/ datasheet/ P&ID covers the requirements for design, engineering, inspection and supply of the instruments, control panel and instrument erection material for installation & interconnection. This general specification shall be complied by the vendor unless other contract provisions are specified by the owner / consultant.

1.1 Package Scope Matrix

The Scope of Control and Instrumentation shall be as per the following scope matrix and described in block diagram (ANNEXURE-1).

Package Type	Design, and Supply of Instruments	Supply of Hookup / Installation Material, Erection Hardware, Cabling accessories,	Supply of Junction Boxes	Supply of Branch Cable /cable trays up to Junction Box	Supply of Cable Trays, support and accessories up to control panel.	Design, Engineering, Supply of Control Panel (PLC, HMI, Etc)	Supply of Cable up to vendor supplied panels.	Supply of Cable from Local Panel to Other's System (DCS)	Design, Engg. , Supply, Erection Of y Control Room	E & C of C&I Supplies	Site Testing and Calibration
P1	√	√	#	#	#	#	#	#	#	#	#
P2	√	√	√	√	#	#	#	#	#	#	#
P3	√	√	√	√	√	√	√	#	#	√	√
P4	√	√	√	√	√	√	√	#	√	√	√

'√' Indicates the Scope of Package Vendor
'#' Indicates the Scope of Purchaser/Customer

SL.No.	NAME OF THE PACKAGE	PACKAGE TYPE	REMARKS
1	LP DOSING SYSTEM - HYDRAZINE	P2- Type	
2	LP DOSING SYSTEM – MORPHOLINE	P2- Type	
3	PUMPS: 1. BFPs (VHP)	P2- Type	
4	FUEL SYSTEM 1. GAS SCRUBBER SKIDs 2. FORWARDING SKIDs 3. HI-TECH SKIDs	P2- Type	

1.2 Proven Track Record

All instruments, Control System and Sub- items shall be of field proven quality both with respect to design and Materials. No items of an experimental nature shall be offered or supplied. No instrument / system requiring special maintenance or operating facilities shall be offered or supplied as far as possible.

1.3 Deviation

Bidder shall submit duly filled deviation format long within the offer, otherwise it will be presumed that there are no deviations from this specification. Offer without this deviation list will not be evaluated and shall be considered for rejection. If, there are no deviations, bidder shall submit signed copy of this format, mentioning "No Deviations".

Sl. No.	Cl. No. of spec	Deviation	Reasons for deviation	Deviation Category	
				Product/design limitation	Optimization
1					
2					

1.4 P&IDs and Instrument Tag Numbering

Vendor shall prepare and submit a detailed P&I diagram for the system within the scope of his supply, showing all the instruments and interlock/trip operations. Each Instrument shall be given individual tag number from blocks of numbers allotted by the purchaser/ client philosophy. Symbols shall be as per ISA-S5.1 unless and otherwise specified or as per Project specific, if any will be intimated during order execution.

Instrument required for the completeness of the system but not given in the frozen P&I diagram shall be under the scope of the vendor without any price implication.
Deviation from the specification may be allowed due to sound engineering reason only after the approval from owner / consultant.

1.5 Codes and Standards

Sl. No.	Standard	Description
1.	IEC 534	Industrial - Process Control Valves
2.	IEC 584	Thermocouples
3.	IEC 654	Measurement and Control equipment
4.	IEC 751	Industrial Platinum Resistance Thermometer Sensor
5.	IEC 801	Electromagnetic Compatibility for Industrial Process Measurement and Control Eqpt.
6.	IEC 902	Industrial Measurement and Control Terms and Definitions
7.	ISA S-5 .1	Instrumentation Symbols and Identification
8.	ISA S-5 3	Graphic Symbols for Distributed Control/ Shared Display Instrumentation, Logic and Computer Symbols
9.	ANSI/ISA S 5.1	Process Instrumentation Terminology
10.	ANSI/ISA S75.01	Control Valve Equations
11.	ANSI/ISA S75.02	Control Valve Procedure Capacity Test

12.	ANSI/ISA S75.03	Face-to-Face Dimensions for Flanged Globe Style Control Valve Bodies
13.	ANSI/ FCI 70.02	Quality Control Standard for Control Valve Seat Leakage
14.	DIN 43760	Measurement Standard for RTD.
15.	DIN 19243	Measurement and Control Electrical Sensors, Electrical Position Sensors and Signal Converters used for Intrinsically safe two-wire DC System.
16.	EN-50-014/020	Electrical Apparatus for Potentially Explosive Atmospheres
17.	ISO 4200	Plain End Steel Tubes, Welded and Seamless - General Table of Dimensions and Masses per Unit Length.
18.	ISO 5167	Measurement of Fluid by Means of Orifice Plates, Nozzles and Venturi Tubes Inserted in Circular cross-section Conduits Running Full.
19.	API RP 520	Sizing, selection and Installation of Pressure relieving devices in Refineries
20.	API RP 521	Guide for Pressure Relieving and Depressurizing System
21.	API RP 2000	Venting Atmospheric and low pressure storage tanks
22.	API-RP-550	Manual on Installation of refinery Instruments Part-I and Control System
23.	ANSI - B 16.104	Control Valve seat leakage
24.	ISA-S 75.01	Control Valve sizing
25.	ISA S 18.1	Specifications and guides for the use of general Annunciators.
26.	IEC 529	Environmental Protection of equipment
27.	ANSI B 2.1	Pipe threads
28.	ANSI B 16.5	Steel pipe flanges, flanged valves and fittings
29.	IEC 60079.11/ IEC-60079.14	Intrinsic safety code and practice
30.	IBR	Indian Boiler Regulation
31.	IS 2148	Ex.proof enclosure of electrical apparatus
32.	VDE 0815	Control and Instrument Cables

1.6 Units and Charts

Measuring units of the process variables shall be calibrated as follows:

a)	Flow	Liquid	T/hr or kg/hr m3/hr (for volumetric)
		Steam	T/hr or kg/hr
		Gas	Nm3/hr (at o °C and 1 atm)
b)	Pressure		kg/cm2g (General) Kg/cm2 (Absolute) mmH2O (Low pressure)
	Diff. pressure		kg/cm2, mm H2O
c)	Level		% of range (General) m (storage tank)
d)	Temperature		°C

Ref. Doc

2.0 STATUTORY REQUIREMENTS / APPROVALS

i. In the event of any conflict between this specifications, data sheets, statutory regulations, related standards, codes etc., the contractor shall refer the matter to the purchase/ purchaser's representative for clarification and only after obtaining the same should proceed with the manufacture/ engineering of the item in question.

ii. Contractor shall be responsible for obtaining all statutory approvals, as applicable for all instruments and control systems.

iii. In addition, equipments/instruments/systems located in the hazardous area shall be certified by the local statutory authorities for their use in the area of their installation. In general following certification shall be given:
- For all intrinsically safe/ FISCO/ explosion proof/flameproof equipments/ instruments/systems or equipments with any other type of protection allowable as per this package which are manufactured abroad and certified by any statutory authority like BASEEFA, FM, UL, PTB, LCIE etc. should also have the approval of Petroleum And Explosives Safety Organization (PESO) or Chief Controller of Explosives (CCOE), Nagpur.
- For all flame proof equipments manufactured locally (indigenously), the testing shall be carried out by any of the approved test house like CMRI/ERTL etc. The equipment shall in addition bear the valid approval from Petroleum and Explosives Safety Organization (PESO)/ Chief Controller of Explosives, Nagpur and a valid BIS license.
- Approvals other than above shall neither be offered nor will these be acceptable.

iv. IBR : IBR Form III shall be furnished for the inline instruments and its accessories. (For e.g. Thermowell, Control Valves, On/Off valves, Flow Elements, Pipe and Pipe fittings etc.)

3.0 SPECIFICATIONS OF INSTRUMENTS AND CONTROL

All Technical specification for field instruments shall be as per attached datasheet (ANNEXURE-2). The Package Vendor to furnish and fill the datasheet along with Make and Model No. for selected instruments for purchaser approval.

The Table indicates the minimum requirements for Instrument Selection.

SL No	MEASUREMENT	FUNCTION	TYPE OF INSTRUMENT	REMARKS
1	**PRESSURE INSTRUMENTS**	INDICATION	TRANSMITTER - HART / REMOTE SEAL FOR CORROSIVE OR VISCOUS SERVICE	
		ALARMS	NOT APPLICABLE	
		INTERLOCK	TRANSMITTER - HART / REMOTE SEAL FOR CORROSIVE OR VISCOUS SERVICE	
		LOCAL GAUGES	<60 kg/cm² - BOURDON TYPE > 60 kg/cm² - SOLID FRONT	
3	**LEVEL INSTRUMENTS**	INDICATION	VESSELS : > 6 MTR HEIGHT - TOP MOUNTED RADAR (HART) < 6 MTR HEIGHT – RADAR / DIAPHRAGM SEAL (HART)	
		ALARMS		
		INTERLOCK		
		LOCAL GAUGES	TRANSPARENT / REFLEX	
4	**TEMPERATURE INSTRUMENTS**	INDICATION	< 500 °C – RTD ,PT100,3 WIRE WITH REMOTE TRANSMITTER (HART) > 500 °C – THERMOCOUPLE.K-TYPE, WITH REMOTE TRANSMITTER (HART)	
		ALARMS		
		INTERLOCK		
		LOCAL GAUGES	BI METALLIC/GAS FILLED	
		THERMOWELLS	FLANGED, SS	

5	**FLOW INSTRUMENTS**	INDICATION	AS PER P&IDs, As a general practice nozzle shall be provided in steam services & orifice shall be provided in water/condensate services.	
		ALARMS		
		INTERLOCK		
6	**VALVES**	FLOW/PRESS./TEMP./LEVEL	CONTROL (GLOBE TYPE)	
		SHUTDOWN	ON/OFF (BALL TYPE)	
		POSITIONER	HART TYPE	
7	**Instrument Hook up's**	<= 600# [Carbon Steel, & Stainless Steel]	CS/SS PIPE WITH CS/SS PIPING HOOKUP	
		>600# [Carbon Steel, & Stainless Steel]	CS/SS PIPE WITH CS/SS PIPING HOOKUP	
		>600# [Alloy Steel]	AS PIPE WITH AS PIPING HOOKUP	

Note:

a) All instruments shall be intrinsically safe & certified to IEC Zone 1 Gas Group IIA/IIB temperature class T3 as a minimum.

b) All Field mounted Instruments should be SIL 2 complied.

3.1 Power Supply Requirements

i. Electric equipment power supply shall be suitable for standard voltages specified below. Voltages normally be used in shown in the below table,

Sl. No.	Description	110V AC 50 Hz. UPS	110V DC	24V DC	110 V AC	230 V AC Non-UPS
a)	Package Units	√				
b)	Alarm Annunciator	√				
c)	PLC	√				
d)	Solenoid Valves			√		
e)	Transmitters			√		
f)	Gas Detection System	√				
g)	Analyzers and Analyzer System	√				√
h)	Level Gauge Illumination					√
i)	Flow Meter	√				
j)	Cabinets Lighting, Control Room					√
k)	Local Panel	√				
l)	Analyzer Shelter (415 V AC)					
m)	Air Conditioning (415 V AC)					

Note:

1. 110V/230V UPS – 1 No. Redundant Feeder at Panel.
2. 230 V AC Non-UPS – 1 No. Non-Redundant feeder,
3. Any further Power Distribution from UPS Feeder shall be by Package Vendor.

3.2 Local Control Panel

i. Control panel shall be fabricated in best workmanship manner. The panel shall be made of 3 mm thick cold rolled steel sheet. The angle iron frame shall use a minimum section of 50x50x4 mm angle. Steel sheets for panels, semigraphic, and accessories shall be cut on a squaring shears to ensure tight flush joint when butted together. Adjacent panels are bolted together with cadmium plated bolts and nuts. Bolts or screws shall not be exposed on the face of the panel. Welded coupling of panel section is not allowed. Adjacent panels shall be assembled with face flush. Gaps or cracks shall not be visible from the front of assembled panels.

ii. Rear of each panel section shall have a steel framework assembled to it for supporting instruments, raceways and other accessories like power distribution boxes etc. Panel stiffeners shall be welded to the rear of the panel and shall not interfere with instrument installation. All structural shapes of steel members shall be as per IS-226 or equivalent standard.

iii. Doors switches operated fluorescent lamps shall be provided for all closed panels/cabinets.

iv. Panel shall be fitted with Lifting lugs.

v. All cable entries to the local panel shall be preferably from panel bottom. All cable entries shall be provided with cable glands of adequate size. Cable gland plate thickness shall be a minimum of 3 mm cold rolled cold annealed (CRCA) as a minimum. All unused cable entries must be plugged. Cable gland plate shall be preferably removable type.

vi. Anti-condensation heaters (with temperature cut-off & Manual Control) shall be provided where required.

vii. One telephone socket, and 110 V/ 230 V, 50 Hz plug in outlets shall be provided for every three panel sections.

viii. Control panel shall be totally enclosed cubicle type typically with 2100 mm (H) x 800 mm (W) x 800 mm (D) dimension of each cubicle. Removable hinged doors shall be provided at the side or back for easy maintenance and accessibility of the instrument. Doors shall be provided with double leave as shown in the GA with handle and lock/key arrangement.

ix. Adequate illumination shall be provided inside the panel. All light fittings shall be suitable for 230 V, 50 Hz ac.

x. In case local control panel is housed outdoor, Local Control Panel shall be designed to meet IP-55 requirements. In addition, panel shall be provided with a rain cum sun shade canopy / shed.

xi. Panels shall be provided with sun screens using side enclosures and overhead deflectors such that all front of panel indications/lamps can be easily seen under direct sunlight conditions.

xii. Anti-vibration pad of suitable material of 15 mm thickness shall be provided between the base channel and the panel frame.

xiii. The panel finish shall include sand blasting, grinding, chemical cleaning, surface finishing by suitable filler and two coats of high grade lacquer with wet sanding between coats. Two coats of paint in panel colour shall be given for non-glossy high stain finish. Panel face final colour can be any of the following shades as per to IS-5 :

Opaline green : ISC No.-275
Light Admiralty Grey : ISC No.-697
Sky blue : ISC No.-101

Panel rear surface, frame work and mounting plates shall have a finish colour of pale cream to IS5 ISC No.-352 or Beige to IS-5 ISC No.-388. A final coat of paint shall be given at site.

xiv. Wires carrying measurement signals associated with thermocouples, resistance temperature detectors (RTDs), pH Instruments and other low level signals shall be routed in separate wire ways and not along with power cables. Power wiring and control wiring should be separated not less than 150 mm. If they have to cross, the crossing should be as close to right angle as possible.

xv. All intrinsically safe wiring shall be routed in separate wire ways, separate from non-intrinsically safe and power wiring.

xvi. Intrinsically safe terminals shall be adequately separated from non-intrinsically safe terminals. The minimum separation shall be 50 mm.

xvii. Wherever it is an operational and safety requirement, local panels shall be provided with pneumatic hooter for high volume annunciation.

xviii. It shall be possible to switch off incoming power to panel from panel front. All such power on / off switches shall be flameproof type. Emergency push buttons shall be fitted with shrouds to prevent inadvertent operation.
In addition, all those devices and terminals, which can't be powered off from on/off switches shall also be located inside flameproof enclosures.

xix. Local panels mounted in hazardous area shall be preferably Ex-proof type including all the components (such as switches, lamps etc.). If purged panel is used the same shall be pressurised as per NFPA 496 requirements to render space within the panel nonhazardous. For all panels located in IEC Zone II, protection shall meet the requirements of Type-Z purging.

xx. All equipment shall be certified for use in the environment and applicable hazardous area.

xxi. For purged panels in the Hazardous area, the Switches, Push-Buttons, Lamps etc. mounted the outside surface of the panel shall be Ex-proof type.

xxii. The design of control panel shall incorporate provision for expansion by installing adequate spare capacity. Each panel shall be designed to accommodate the following additional equipment, as a minimum:

- 20% of panel front / inside mounted instruments including lamps, push buttons, switches, relays, etc.
- 20% additional power feeders each provided with switch fuse assembly.
- 20% additional spare windows in alarm annunciators.
- 20% of spare terminals.
- 20% spare cable entry points (plugged).

3.3 Programmable logic Controller (PLC)

i. Package Vendor shall provide the PLC with minimum requirements as per specification / Project Specific.

ii. The PLC system shall be Triple Modular redundant (TMR) or Quadruplicated Modular redundant (QMR) SIL-3, TUV certified PLC as a minimum. .

iii. PLC shall be a microprocessor-based system, which shall be used to execute process plant control / sequence control / process and safety shutdown / interlock logic of the plant as specified in the job specification.

iv. Other Requirements:

a)	For PLC system	:	1) The field termination assembly for PLC shall be supplied from PLC manufacturer only. 1) The main PLC processor and I/O cards replacement should be possible on line without compromising the plant safety and TUV guidelines. The PLC system shall have high availability. PLC shall have the capability to allow hot swapping of I/O as well as processor modules without causing any interruption to the process. Hot slot shall be provided for all TMR cards & hot slot with I/O module shall be provided for QMR cards. . 2) In case of two out of three voting inputs in PLC, the inputs shall be wired in three different cards. Also the I/O shall be segregated equipment wise and redundant equipment shall be configured in different rack. 3) All PLC I/O signals shall be two wired, with no looping or common sharing of power supply or negative points.
b)	Interposing Relays (IPR)	:	1) Fail safe relays with LED indication shall be used for all Non IS digital inputs / digital outputs. 2) IPR shall be suitable for usage in SER application of 1msec resolution.

			3) The relays used within the PLC shall be TUV SIL 3 approved only.
c)	Barriers	:	1) Active type barriers shall be used for all intrinsic safe inputs & outputs. 2) Non-intrinsic safe inputs/outputs shall be galvanically / optically isolated from external control circuit by using isolators. 3) Barriers should be SIL-3 or SIL-2 certified. 4) For Analog output of DCS, the barriers shall be provided with line fault detector. 5) All analog input barriers shall be one input two output type.
d)	OWS, EWS & SOE PC	:	1) 20.1" color TFT-LCD table top mounted desktop type monitor with key board & mouse. 2) All work stations shall be located in local control room. Hence, PLC monitors shall match with DCS monitors. Details of DCS monitors & make shall be intimated during detail engineering. 3) The hardware shall support and supplied with server grade PC Dual Xeon 3.2GHz (min) CPUs; Five 73GB (min) SAS drives; RAID 5: 2GB RAM; 24X DVD-CDRW Drive; Redundant Control Network Ports ; 3rd Ethernet Port with cooling fans with dust filters. 4) To be loaded with necessary software like Windows, MS office & Anti-virus software, etc. 1) To be loaded with License software used in PLC programming & graphic building for each OWS and EWS
e)	Cables & cable termination accessories **(supply by vendor)** [Qty : As required]	:	1) All cables within package shall be vendor scope. 2) Inter equipment cables shall be armored type. 3) All flexible cables & system cable shall be laid through metallic conduits. 4) Cable glands, lugs, ferrules, etc required for termination of purchaser's cables terminating at PLC panel and for cables supplied by vendor 5) Cable glands shall be SS 304 double compression type with PVC shrouds suitable for armored cables.
f)	MODBUS connectivity	:	1) PLC shall communicate with DCS through RS 485 MODBUS RTU link. 2) Vendor shall be jointly responsible for establishment of MODBUS communication between DCS and PLC by giving all engineering assistance for establishment of communication between the two systems.
g)	Time synchronization	:	PLC and associated work stations time synchronization with master clock [supplied by others] shall be carried out by generating IRIG-B signal. Hence, PLC shall be supplied with necessary hardware and software for time synchronization.
h)	System loading	:	1) Loading for the controller shall not exceed 60% with installed spares. 2) The system memory shall have sufficient capacity for 30% additional application programming & configuration in future.

i)	System redundancy	:	1) Controller – 1:1 2) Input & Output cards – 1:1 3) Communication Bus/cards – 1:1 4) Power supply – 1:1 5) Interlocks & shutdown system – 1: 1
j)	No. of channels per I/O card	:	Vendor to Specify
k)	I/O count for Main equipment	:	Vendor to Specify
l)	Installed Spares	:	1) For I/O cards : 20% of base quantity 2) For system cards: 20% of total quantity to meet project requirement. 3) Marshalling: 20% [this includes isolators, terminals, cable glands, etc.] 4) Power supply: 20% for each variety [like feeders & other sub-components] All the installed spares shall be supplied with fully wired up.
m)	Quantity of Barriers (for AI & AO)	:	Base quantity + installed spares
n)	Quantity of Inter posing relays (for DO's)	:	Base quantity + installed spares [These shall be suitable for interrogation voltages]
o)	Sequence of Events [SOE]	:	1) SOE shall be Integral to PLC 2) Number of SOE points : Vendor to specify 3) Sequence of event recording facility shall be provided with resolution same as PLC scan time. 4) At least 96 hours history for sequence of events should be available in SOEPC/ loader hard disk. It shall be possible to archive history data in CD/ tape. All necessary hardware and software shall be provided. The printout shall be from printer connected to SOE PC.
p)	Spare space	:	1) I/O level: 20% [Internal wiring up to I/O terminals shall be completed with all necessary hardware. Installation of only I/O cards should make this spare space usable]. 2) Marshalling rack : 20%
q)	Spare in Communication bus	:	The communication sub-system shall have sufficient capability to take care of system expansions as mentioned above without degrading the system performance.
r)	Consumables for 1 year operation	:	Vendor to Specify

v. The detailed specification of the Processor shall be as per the job specifications.

vi. The processor shall have capability to implement various control functions including relay logic, timer, counter, numerical calculations, PID control and data processing to implement the plant process control / sequence logic, and / or process and safety shutdown logic.

vii. The processor shall be provided with extensive error checking diagnostic functions such as total checking of memory, battery monitoring, parity checking, reference checking, I/O checking, short / open circuit checking etc.

viii. Each processor shall be provided with separate power supply. Failure of one power supply shall not affect the system operation in case of Hot Back Up system. Whenever TMR system is specified each processor shall preferably be provided with separate power supply.

ix. Each input and output shall be optically isolated from external circuit.

x. Each I/O shall be protected against reversal of polarity of power voltage to the I/O.

xi. Each output shall be short circuit proof and protected by fuse with a visual indication of blown fuse.

xii. The detailed specification/special requirement of the F&G PLC shall be as per the job specifications (Spec. No: 44NC-4602-0000/J.02/0103/A4, Clause No.3.4 & Annex. I to 44NC-4600-0000-/J.02/0103/A4).

4.0 INSTRUMENT ERECTION MATERIAL

The scope of package vendor includes generation of BOQ and supplies all erection hardware required for installation of all instrumentation, which form a part of their package system as per Clause 1.0 Package Scope Matrix.

In addition, others items like cables, cable glands, junction boxes, instrument valves, mounting accessories, cable trays, conduits, identification tags, structural material required for instrument control panel (base frame) supports and trays etc. The erection / installation of instruments will be done as per enclosed standard instrument installation details and guidelines drawings of Purchaser/Customer.

4.1 Instrumentation Cable

I. Single pair(7 stranded / 0.53 mm dia (1.5 mm2) stranded annealed tinned copper conductors of electrolytic grade copper, PVC insulated) shielded signal / alarm cables shall be used between field instruments / switches and junction boxes / local control panels.

II. Single pair shielded thermocouple extension cables shall be used between thermocouple head and junction boxes / transmitters / local control panel mounted instruments.

III. Single triad shielded signal cables shall be used between RTD head and junction boxes / transmitters / local control panel mounted instruments.

IV. Separate Multipair/ multitriad cables shall be used between junction boxes/ local control panel and control room as per following applications.

- 4-20 mA signals
- Thermocouple signals
- Resistance Temperature Detectors (RTD) signals
- Switch contacts / Proximity switch contacts
- Gas detectors

V. The insulation grade shall be 1100 V for all cables.

VI. The primary insulation shall be PVC with temperature rating 85 deg.C. Inner and outer sheath / jacket shall be made of extruded flame retardant PVC with temperature rating 90 deg. C. In case of flame retardant low smoke cables oxygen index of PVC shall be over 30% and temperature index shall be over 250 Deg.C.

VII. All cables shall be armoured and suitable for operation when installed as follows:

- Directly buried in the ground
- Fastened to cable ladder rack or tray in the open air
- In underground ducts
- In overhead closed cable ducts

VIII. Contractor shall ensure a minimum of 20% of quantity of each type of cables supplied as spare including any special cable and in each multipair cables 20% pairs shall be kept as spare.

IX. All cables shall be fire retardant.

X. DESIGN AND TESTING STANDARDS

Instrument signal, RTD and thermocouple cables

DESCRIPTION	STANDARDS
Conductors	BS 6360 for instrument signal and RTD cables and ANSI MC 96.1 for thermocouple cables.
Insulation: PVC	BS-5308 / IS-6474 Part 1 • Primary insulation shall be as per IS-5831 type C / IEC 502 • Fire retardant (FR) shall be as per standard IEC 332

	Part 3 Cat. A. • Fire resistance cables shall be as per standard IEC 331 Cat. A • Fire retardant and low smoke (FRLS) shall be as per standard ASTM D-2863, 2843 and IEC 383, 332.
Armour:	IS-1554 Part I / IEC-502 / BS 5308 / BS 1442
Inner & Outer Sheath-PVC:	• Inner / outer jacket be as per IS-5831 Type ST-2 / IEC 502 / BS 6746 • Fire retardant (FR) shall be as per standard IEC 332 Part 3 Cat. A. • Fire retardant and low smoke (FRLS) shall be as per standard ASTM D-2863, 2843 and IEC 383, 332.
Testing of the instrument signal and RTD cables.	BS 5308
Testing / Calibration of thermocouple cables.	ANSI MC96.1 / IEC-584-2
Dimensions:	BS 5308

4.2 Cable Glands

i. Vendor shall supply all cable glands required for glanding the above mentioned cables both at field instrument and at local panel devices/junction boxes.
ii. All cable glands shall be made of SS 304 with PVC Shrouds double compression type suitable for armored cables.
iii. Flame proof double compression SS type cable glands shall be supplied.
iv. Vendor shall supply a minimum of 20% cable glands as spare.

4.3 Junction boxes

I. Junction Box shall be of die cast aluminium alloy (LM-6) body and shall be of weather proof (IP-65 min.) and flame proof with Ex (d) certification design as required. Junction Box shall be CCOE approved, for specified hazardous area class based on gas group service.
II. These boxes shall have terminals suitable for minimum 2.5sq.mm cable termination mounted on rails. 20% spare terminals shall be supplied in each junction box.
III. Telephone socket and plugs shall be provided in junction boxes.
IV. Each junction box shall have minimum of 20% or 2 nos. whichever is more, spare entry point provided with plugs.
V. These shall have 2 nos. outlets entries for Multi Cable. All the cable entries shall be from bottom only.
VI. All unused Inlets & outlets of the junction boxes shall be provided with SS304 plugs.

4.4 FRP Canopy

I. It shall be machine molded type.
II. Canopies provided shall cover the instrument from all the four sides with transparent front movable side.
III. Canopies shall be provided for all instruments, local panels & junction boxes. Size of the canopies shall be decided by bidder based on standard size of the instrument available with various manufacturers.
IV. Canopy shall be mounted after erection of instrument at site. Bidder shall provide suitable mounting accessories like brackets, studs, washer, bolts, etc as required and provision for mounting canopy on instruments.

4.5 Pneumatic Distribution

i. 6mm OD x 0.028-inch thick SS 304 tubes as per ASTM A 269 seamless type shall be supplied. Where air supply requirement is more such as large size on/off valves 12 mm OD tube shall be used.
ii. Isolation valves on instrument air service shall be packless gland type full-bore ball valves and body material shall be SS 316.
iii. Instrument air manifolds are not acceptable.

4.6 Air Filter Regulators

I. Instrument air filter regulator of suitable sizes shall be supplied for each pneumatic instrument. Connection shall be ¼", ½" only.
II. The body of the filter shall be SS.
III. The filter shall have 5 micron sintered bronze/ceramic filter element and shall be provided with manual drain and 2" nominal size pressure gauge.

4.7 Instrument support/structural steel

i. Vendor shall supply instrument stands (stanchions) and other structural steel material required for supporting the cable trays, impulse lines and instruments. Stanchions shall be made out of MS pipe galvanized.
ii. Steam tracing shall be through 6mm OD copper tubes of electrolytic grade copper.

4.8 Cable Tray / Duct

i. All cable / tubes shall run on cable trays. Cable trays shall be of perforated made of hot dip galvanized M.S. sheets.
ii. The width shall be so selected that at least 50% of tray space is available for future use of the complete installation.
iii. Suitable cable clamps made of aluminium shall be supplied for binding the cables/tubes at every 500mm.
iv. All tubes/cables shall be properly laid on cable trays, which shall be supported at regular intervals.
v. Separate routing or physical separation shall be maintained between signal cables and shut down/power cables.
vi. Wherever intrinsically safe system cabling is employed the minimum separation of 150mm shall be adhered to between IS and Non-IS signal cables.
vii. In case the cables are to be buried or laid in concentrated trench the same shall be carried out by vendor with prior intimation to owner.

5.0 INSTALLATION AND PROCESS CONNECTION

5.1 Instrument Installation

i. Instrument erection shall be carried out as per installation drawing approved by Project Requirement or as per Installation Drawing (ANNEXURE -5).
ii. All direct mounted instruments like thermocouple thermowells, temperature gauges, pressure gauges, pressure switches etc. shall be installed in such a way that they have better readability and accessibility.
iii. All primary piping (impulse lines) shall have a slope of 1:10 on the horizontal run.
iv. All welding shall be carried out as per the relevant code with proper electrodes. Any testing (non-destructive) like DP test on root weld and final weld shall be carried out as applicable. All consumables shall be part of vendor's scope of supply.

v. All threaded joints shall be tightened by Teflon tapes only.
vi. All impulse lines shall be supported at regular intervals with 'U' clamps.
vii. All level gauges/transmitters to be provided with drain connection at ground level.
viii. Steam tracing wherever require shall be carried out by 6mm OD 1mm thick copper tubes, and condensate traps shall be provided to collect all the condensate.
ix. The cases of instruments shall be earthed by earthing wire to the nearest earth bus provided by Purchaser/ Customer for safety reasons.

5.2 Process Connection

Instrument generally is equipped with its own process connection on Pipe and Vessel shall be as per ANNEXURE – 3.

6.0 TESTING AND CALIBRATION

Testing, Calibration and Inspection requirements shall be in general as per Inspection and Testing Table (ANNEXURE-4). In addition, the following shall also be taken care testing at Site / Works.

i. All impulse lines shall be properly flushed after isolating both the instrument and the vessel/piping.
ii. All impulse line shall be tested hydraulically at 1.5 times the maximum operating pressure. Instrument and vessel/piping must be isolated during this test.
iii. In case of special conditions where hydro testing is not permitted due to service conditions, the impulse lines testing shall be carried out by using air or nitrogen. (Consumables shall be supplied by vendor.)
iv. All external cage type level instruments shall also be tested up to 1.5 times operating pressure.
v. After pressure testing all these impulse lines shall be drained and dried with dry air to remove any moisture.
vi. Instrument air lines will be service tested only for any leak after pressurizing and isolating the main root valve, by soap solution.
vii. All instrument cables shall be tested for continuity and insulation. While megger is used for insulation testing, ensure that all instruments and zener barriers are isolated at both ends.
viii. All instruments supplied by the vendor shall be calibrated using proper test equipment
ix. All instruments shall be calibrated for 0%, 25%, 50%, 75% and 100% in increasing & decreasing order.
x. All temperature gauges shall be calibrated using temperature baths.
xi. All thermocouples shall be calibrated as per instrument ranges.
xii. All transmitters shall be calibrated as per instrument ranges.
xiii. All displacer type level transmitters shall be calibrated with water or suitable fluids and corrected for specific gravity.
xiv. All alarm and trip switches shall be calibrated over the entire range and finally set and checked for alarm/ trip points and reset points as per the alarm/trip set point schedule. After setting these points shall be sealed.
xv. All control valves prior to stroke checking shall be thoroughly cleaned externally. The full stroke of valve shall be checked for opening and closing. Any adjustments required for obtaining full stroke and reducing hysteresis shall be carried out.
xvi. Bubble tight shut-off control valves and shut down valves shall be checked for seat leak test and gland leak test.
xvii. Solenoid valve shall be checked functionally for its operation.
xviii. Safety relief valves shall be set / tested by using dry air/nitrogen. Leakage (if any) shall be removed by proper lapping of seat and disc.
xix. All field instruments shall be calibrated as per the manufacturer's instruction.
xx. The entire loop shall be checked for proper operation through DCS system after performing the calibration of all instruments.
xxi. The entire PLC system shall be simulated from the process trip switches and the scheme shall be tested for its proper operation, prior to start up of the unit.

7.0 COMMISSIONING

i. This activity shall be carried out in a systematic manner to avoid any accident of operating personnel and damage to plant as per the agreed procedure between Vendor/Purchaser/Customer.

ii. During the plant start up calibration of instruments, controller's alignment and trip point settings shall be trimmed so as to meet the operation requirements.

iii. All instruments have to be recalibrated and the results recorded as required and mutually agreed between vendor/client/BHEL prior to guarantee run of plant.

8.0 SPARES

8.1 Mandatory Spares

Mandatory spares shall be quoted by Package vendor for all instruments as per (ANNEXURE - 6).

8.2 Commissioning Spares

Any kind of spares required for start-up & commissioning shall be provided.

Commissioning spares shall be quoted by Package vendor for all instruments as per Vendors Recommendation/project specific requirements.

Package Vendor shall supply the following commissioning spare irrespective of the above,

a) Gauges – 5% or Minimum 1 No. of Each Type
b) Transmitters - 5% or Minimum 1 No. of Each Type
c) Fittings – 5% of Each Type
d) Cable Glands – 5% of Each Type
e) Switches - 5% or Minimum 1 No. of Each Type

8.3 Two years Operational & Maintenance Spares

Two years Operational and Maintenance Spares shall be quoted by Package vendor for all instruments as per Vendors Recommendation/project specific requirements.

9.0 DOCUMENTATION

Sl.No.	Description of documents	Along with bid	After placement of order		Docs. / Drgs. Submission as per Package type
			For approval/ information within six weeks	Final documents before dispatch of consignment.	
1.	Control and Instrumentation Document Schedule	X	Yes (I)	Yes	P1,P2,P3,P4
2.	Instrument Index List	X	Yes (I)	Yes	P1,P2,P3,P4
3.	Deviation if any from the technical specification giving justification for the same.	Yes	X	X	P1,P2,P3,P4
4.	Catalogue /technical literature of instruments and accessories including dimensional drawings, weight, special support etc.	X	Yes	Yes	P1,P2,P3,P4
5.	Data sheet/Instrument specification	X	Yes (A)	Yes	P1,P2,P3,P4
6.	Chemical analysis and material test certificates from recognized/ approved laboratory.	X	X	Yes	P1,P2,P3,P4
7.	Certificate of recognized authority for	Yes	Yes(I)	Yes	P1,P2,P3,P4

	(a) degree of protection against environment (b) for intrinsic safety/ex-proof/flame proof certification				
8.	Calibration / test certificate	X	X	Yes	P1,P2,P3,P4
9.	Applicable boiler regulation certificate for steam & condensate service	X	X	Yes	P1,P2,P3,P4
10.	Loop drawings and legends	X	Yes (I)	Yes	P3,P4
11.	I/O list		NA	NA	P2
12.	Logic (Interlock) diagram	X	Yes (I)	Yes	P3,P4
13.	Installation Details	X	Yes (I)	Yes	P1,P2,P3,P4
14.	Junction box layout and terminal details	X	Yes (I)	Yes	P2,P3,P4
15.	Cable Tray layout for instruments	X	Yes (I)	Yes	P4
16.	PLC Configuration / Block Diagram	NA	NA	NA	P3,P4
17.	Local Control Room Layout	X	Yes (I)	Yes	P4
18.	Cable Schedule and Interconnection Diagrams	X	Yes (I)	Yes	P1,P2,P3,P4
19.	Junction Box Termination Details	X	Yes (I)	Yes	P1,P2,P3,P4
20.	Panel Wiring Diagram	X	Yes(I)	Yes	P3,P4
21.	Bill of Quantity (Control Systems, Panels)	X	Yes(I)	Yes	P3,P4
22.	Earthing Configuration	X	Yes(I)	Yes	P3,P4
23.	Power Distribution Scheme	X	Yes(I)	Yes	P3,P4
24.	Panel GA Drawings	X	Yes (I)	Yes	P3,P4
25.	Manuals for installation, operation and maintenance	X	X	Yes	P1,P2,P3,P4
26.	Instrumentation & control design philosophy	X	Yes (I)	Yes	P1,P2,P3,P4
27.	Quality assurance plan	X	Yes	X	P1,P2,P3,P4
28.	All items in final form (i.e. as built)	X	X	Yes	P1,P2,P3,P4
29.	Sub Vendor List	X	Yes	Yes	P1,P2,P3,P4

Notes: 1. (A) For approval (I) For information

10.0 IDENTIFICATION AND MARKING

Self adhesive tapes or signs are not permissible for permanent marking of any instruments

All instruments shall be having stainless steel tag plate screwed to the instrument case indicating, Make, Model No., Tag No. etc.

Tag plates shall also indicate execution (body and trim sizes, body rating and end connection, trim characteristic, air failure action and spring range, air supply pressure – for control valve, inlet & outlet sizes with ratings, bellows material, designated orifice with area in sq. mm., set pressure for safety/relief valves), details of orifice flange/plate/spacer ring and similarly for all other instrument items whichever is applicable.

Each instrument also has a separate circular tag number plate in stainless steel with engraved tag no. and calibration range and attached securely to the instrument with a soft stainless wire. The size of letters and figures shall be minimum 4 mm and the plate should be 2.5 mm diameter with 1-2 mm thickness.

All spare parts supplied with the main consignment shall be fitted with identification plate with the following data clearly printed and easily readable.

- Spare parts name/ model nos. as per purchaser's instrument specification sheet.
- Serial no.

11.0 PACKING AND SHIPPING

Each instrument and its accessories wherever applicable shall be suitably packed & protected from damage due to transportation, loading and unloading.

Skid Mount instruments to be mounted at factory for P1, P2, P3 type of packages, except P4 type at site.

Packing for shipping of instruments and its accessories shall be crash proof, weatherproof and road / sea worthy.

Very fragile instrument will be protected, as the case may demand.

Skilled personnel will generally look after shipping formalities.

Transport of materials will be done by firms specialized in this field.

All opening shall be closed/ sealed suitably to prevent entry of external matter during transportation, storage/ handling. Cables and pneumatic entries shall be plugged with the aluminium plugs to prevent moisture entry.

The instrument and accessories along-with spares (for commissioning and 2 years operation/ maintenance) shall be dispatched as a single consignment.

12.0 WARRANTY

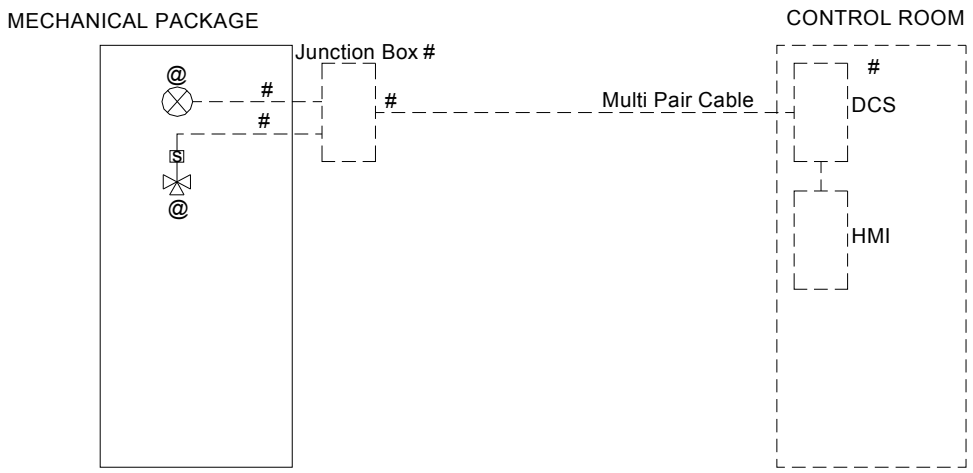
Warranty of the Package shall be as mentioned in the Main Specification.

13.0 ATTACHMENTS

ANNEXURE – 1 (PACKAGE SCOPE PHILOSOPHY)
ANNEXURE – 2 (INSTRUMENT DATASHEETS)
ANNEXURE – 3 (PROCESS CONNECTION DETAILS)
ANNEXURE – 4 (INSPECTION AND TEST PLAN)
ANNEXURE – 5 (INSTRUMENT INSTALLATION DRAWINGS)
ANNEXURE – 6 (MANDATORY SPARE LIST)

ANNEXURE-1 (PACKAGE SCOPE PHILOSOPHY)

PACKAGE TYPE - P1

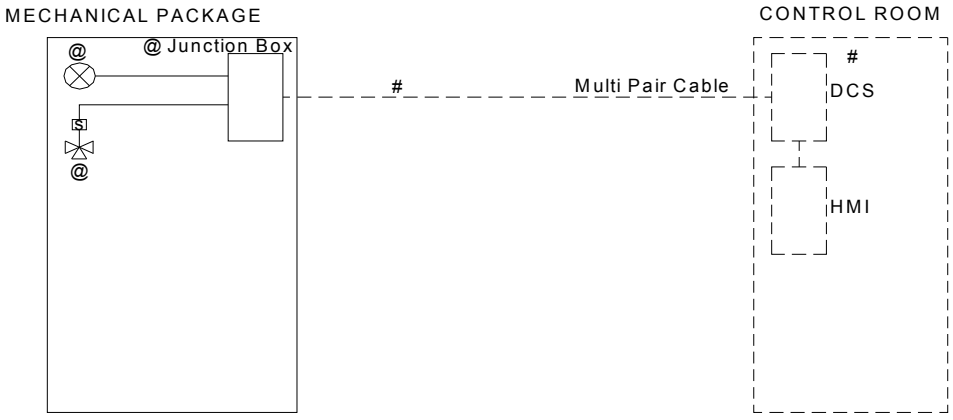


'@' SUPPLY BY PACKAGE VENDOR
'#' SUPPLY BY BHEL

NOTES:

1. THE PACKAGE SHALL BE SUPPLIED WITH FIELD INSTRUMENTS WITHOUT JUNCTION BOX.
2. INSTRUMENT INSTALLATION FOR ALL INSTRUMENTS (PIPE/TUBING/ FITTINGS/ SUPPORTS /CABLE GLANDS ETC..) WITHIN THE PACKAGE SHALL BE BY PACKAGE VENDOR.
3. ALL MONITORING AND CONTROL SIGNALS SHALL BE HARDWIRED FROM JUNCTION BOX TO PLANT DCS SYSTEM BY BHEL.

PACKAGE TYPE - P2

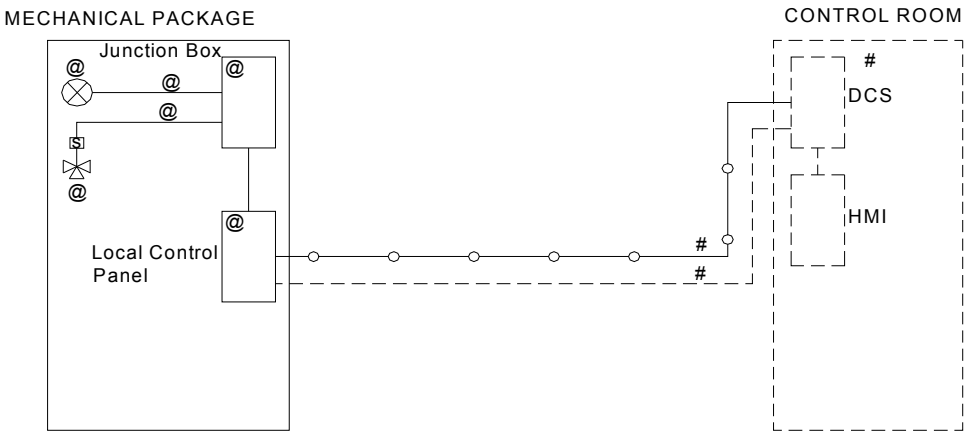


'@' SUPPLY BY PACKAGE VENDOR
'#' SUPPLY BY BHEL

NOTES:

1. THE PACKAGE SHALL BE SUPPLIED WITH FIELD INSTRUMENTS WITH JUNCTION BOX.
2. ALL BRANCH CABLING FROM FIELD INSTRUMENTS TO JUNCTION BOX , INSTRUMENT INSTALLATION FOR ALL INSTRUMENTS (PIPE/TUBING/ FITTINGS/ SUPPORTS/CABLE GLANDS ETC..) WITHIN THE PACKAGE SHALL BE BY PACKAGE VENDOR.
3. ALL MONITORING AND CONTROL SIGNALS SHALL BE HARDWIRED FROM JUNCTION BOX TO PLANT DCS SYSTEM BY BHEL.

PACKAGE TYPE - P3



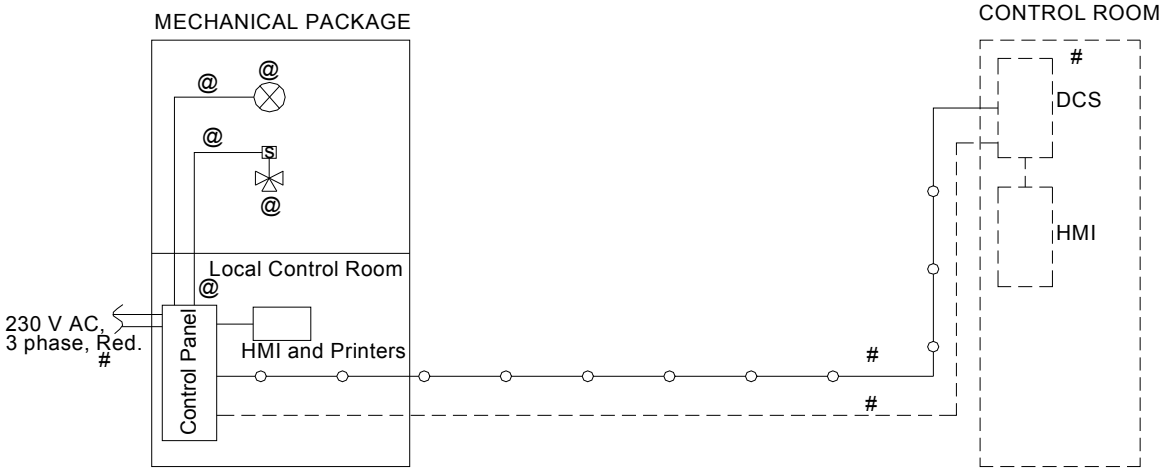
'@' SUPPLY BY PACKAGE VENDOR

'#' SUPPLY BY BHEL

NOTES:

1. THE PACKAGE SHALL BE SUPPLIED WITH FIELD INSTRUMENTS, JUNCTION BOX, AND LOCAL CONTROL PANEL .
2. ALL BRANCH CABLING FROM FIELD INSTRUMENTS TO JB, CABLE FROM JB TO CONTROL PANEL , INSTRUMENT INSTALLATION FOR ALL INSTRUMENTS (PIPE/TUBING/ FITTINGS/ SUPPORTS/CABLE GLANDS ETC..) WITHIN THE PACKAGE SHALL BE BY PACKAGE VENDOR.
3. ALL MONITORING AND CONTROL OF THE PACKAGE SHALL BE BY LOCAL CONTROL PANEL SUPPLIED BY PACKAGE VENDOR.
4. ALL MONITORING OF PACKAGE SIGNALS SHALL BE COMMUNICATED THROUGH SERIAL LINK (MODBUS PROTOCOL), AS WELL AS HARDWIRED FROM LOCAL CONTROL PANEL TO PLANT DCS SYSTEM BY BHEL.

PACKAGE TYPE - P4



'@' SUPPLY BY PACKAGE VENDOR

'#' SUPPLY BY BHEL

NOTES:

1. THE PACKAGE SHALL BE SUPPLIED WITH FIELD INSTRUMENTS , CONTROL PANEL (PLC BASED), HMI AND PRINTERS AS PER PROJECT REQUIREMENT.
2. ALL BRANCH CABLING FROM FIELD INSTRUMENTS TO CONTROL PANEL , INSTRUMENT INSTALLATION FOR ALL INSTRUMENTS (PIPE/TUBING/ FITTINGS/ SUPPORTS/CABLE ETC..) WITHIN THE PACKAGE SHALL BE BY PACKAGE VENDOR.
3. ALL MONITORING AND CONTROL OF THE PACKAGE SHALL BE BY LOCAL CONTROL PANEL SUPPLIED BY PACKAGE VENDOR.
4. ALL MONITORING OF PACKAGE SIGNALS SHALL BE COMMUNICATED THROUGH SERIAL LINK (MODBUS PROTOCOL) FROM LOCAL CONTROL PANEL TO PLANT DCS SYSTEM BY BHEL.
5. CRITICAL SIGNALS AND ALARMS SHALL BE HARDWIRED TO PLANT DCS AND THE SAME SHALL BE FINALIZED DURING DETAIL ENGINEERING.

ANNEXURE-2 (INSTRUMENT DATASHEETS)

INDEX

GENERAL	1	Item Number			
	2	Tag Number			
	3	P & ID No.			
	4	Hazardous Area Classification			
	5	NACE Requirement			
	6	Statutory Approval			
	7				
PROCESS CONDITIONS	8	Fluid	Phase		
	9	Design Pressure	Oper. Pressure		
	10	Design Temperature	Oper. Temperature		
	11	Diff. Pressure			
	12				
TRANSMITTER	13	Type		Microprocesor based,Yoke mounted SMART type	
	14	Range			
	15	Element Type	Element Material	Diphragm	316SS
	16	Enclosure Material		304SS	
	17	Instrument Connection		1/2" NPT(F)	
	18	Electrical Connection		1/2" NPT(F)	
	19	Integral Meter		Yes	
	20	Mounting		Suitable for 2" Pipe	
	21	Self Diagnostics		Required	
	22	Power Supply		24V DC ± 10%	
	23	Output		4-20 mA	
	24	Signal Termination Type		2 Wire, 4-20mA DC (HART)	
	25	Max. Laod @ 24 VDC		600Ω	
	26	Accuracy		± 0.075% of calibrated span	
	27	Enclosure		Weather Proof	
	28	Ingress Protection		IP-65	
ACCESSORIES	29	Manifold		2 way, SS manifold	
	30	Mounting Bracket Material		SS 304 min.	
	31	Bolts & Nuts Material		SS 304 min.	
	32	Canopy		Required	
	33	Cable glands		Flame Proof Double compression type, 1/2" NPT, SS304	
	34	Prefabricated Close coupled Hook-up		Required	
OTHERS	35	Manufacturer			
	36	Model			

NOTES:

1. Minimum requirement has been furnished in datasheet. Vendor has to complete the datasheet i.e. furnish the data in all blank cells and adhere with the minimum requirement.
2. All Instruments should be SIL 2 and intrinsic safe compiled.

							Design Data Sheet	
					Unit		PRESSURE TRANSMITTER-HART	
					Location	Manali,Chennai,Tamilnadu		HYDERABAD
					Client	CPCL		
Rev	**Date**	**By**	**Chk**	**Appv**				Sheet No. 1 of 9

GENERAL	1	Item Number				
	2	Tag Number				
	3	P & ID No.				
	4	Hazardous Area Classification				
	5	NACE Requirement				
	6	Statutory Approval				
	7					
PROCESS CONDITIONS	8	Fluid	Phase			
	9	Design Pressure	Oper. Pressure			
	10	Design Temperature	Oper. Temperature			
	11	Diff. Pressure				
	12					
TRANSMITTER	13	Type		Microprocesor based,Yoke mounted SMART type		
	14	Range				
	15	Element Type		Diphragm		
	16	Enclosure Material		304SS		
	17	Instrument Connection		1/2" NPT(F)		
	18	Electrical Connection		1/2" NPT(F)		
	19	Integral Meter		Yes		
	20	Mounting		Suitable for 2" Pipe		
	21	Self Diagnostics		Required		
	22	Power Supply		24V DC ± 10%		
	23	Output		4-20 mA		
	24	Signal Termination Type		2 Wire, 4-20mA DC (HART)		
	25	Max. Laod @ 24 VDC		600Ω		
	26	Accuracy		± 0.1% of span for a rangeability of 1:10		
	27	Enclosure		Weather Proof		
	28	Ingress Protection		IP 65		
	29	Over Range Protection		150%		
DIAPHRAGM SEAL	30	Type		Flush Flange		
	31	Fill Fluid		Suitable for specified process condition		
	32	Diaphragm Material	Flange Material	SS316L		SS 316
	33	Connection (HP)	Size & Rating	Flanged		1.5", As per Piping Class
	34		Facing & Finish			As per Piping Class
	35	Connection (LP)	Size & Rating	Flanged		1.5", As per Piping Class
	36		Facing & Finish			As per Piping Class
	37	Capillary Material	Capillary Length	SS armored with PVC cover		3 metre
	38	Armour Type				
	39	Armour Material		SS 316		
	40	Flushing Ring Material		Suitable for specified process condition		
ACCESSORIES	41	Manifold Valve		2 way, SS manifold		
	42	Mounting Bracket Material		SS 304 min.		
	43	Bolts & Nuts Material		SS 304 min.		
	44	Canopy		Required		
	45	Cable glands		Flame Proof Double compression type, 1/2" NPT, SS304		
OTHERS	46	Manufacturer				
	47	Model				

Notes: 1. Minimum requirement has been furnished in datasheet. Vendor has to complete the datasheet i.e. furnish the data in all blank cells and adhere with the minimum requirement.
2. All Instruments should be SIL 2 and intrinsic safe compiled.

						Design Data Sheet	BHEL Maharatna Company 50 Years
				Unit		PRESSURE TRANSMITTER-HART (DIAPHRAGM SEAL)	
				Location	Manali, Chennai, Tamilnadu		L&T HYDERABAD
				Client	CPCL		
Rev	Date	By	Appv				Sheet No. 2 of 9

GENERAL	1	Item No			
	2	Tag Number			
	3	Service			
	4	Line Number / Equipment No.			
	5	P & ID No.			
	6	IBR Certification			
	7				
	8				
PROCESS CONDITIONS	9	Fluid	Phase		
	10	Design Pressure	Operating Pressure		
	11	Design Temperature	Operating Temperature		
	12				
	13				
	14				
GAUGE	15	Mounting		Direct bottom entry	
	16	Pressure Range			
	17	Dial Diameter		150 mm	
	18	Case Material		304SS	
	19	Bezel Ring		screwed metallic bezel ring required	
	20	Lens			
	21	Overpressure Protection		130% of FSD	
	22	Accuracy		± 1% of full scale minimum	
	23	Enclosure Class		IP-65	
	24				
ELEMENT	25	Element Type		bourdon tube/ capsule	
	26	Element Material		AISI-316 seamless drawn SS tube/ AISI-316 bored SS	
	27	Movement Material	Socket Material	SS 304	SS316L
	28	Connection Size & Rating		1/2" NPT (M)	
	29	Connection Material		316SS	
	30	Connection Location			
	31				
	32				
ACCESSORIES	33	Syphon	Material	Not Applicable	
	34	Snubber	Material	Not Applicable	
	35	Gauge Saver	Material	Not Applicable	
	36	Gauge Union	Material	Not Applicable	
	37	Blow Out Disc Back		Required	
	38	2-Way Valve Manifold for Isolation & Vent/Drain		Not required	
	39	Manifold Material & Connection		Not Applicable	
	40	Glycerine Filled		Applicable	
OTHERS	41	Manufacturer			
	42	Model			

NOTE:
1. Minimum requirement has been furnished in datasheet. Vendor has to complete the datasheet i.e. furnish the data in all blank cells and adhere with the minimum requirement.
2. All Instruments should be SIL 2 and intrinsic safe compiled.

							Design Data Sheet PRESSURE GAUGE	BHEL Maharatna Company HYDERABAD
					Unit			
					Location	Manali,Chennai,Tamilnadu		
					Client	CPCL		
Rev	**Date**	**By**	**Chk**	**Appv**				Sht. No. 3 of 9

GENERAL	1	Item Number			
	2	Tag Number			
	3	Service			
	4	Line No.	P & ID No.		
	5	IBR Certification			
	6				
PROCESS CONDITIONS	7	Fluid	Phase		
	8	Design Pressure	Oper. Pressure		
	9	Design Temperature	Oper. Temperature		
	10				
GAUGE	11	Type		Dial Thermometer (Gas filled type) / Bimetallic	
	12	Stem Type		Hermetically sealed	
	13	Stem Material		SS316	
	14	Stem or Union Thread			
	15	Stem Diameter		8mm	
	16	Stem Length			
	17	Connection Location			
	18	Instrument Connection		1/2" NPT(M)	
	19	Mounting		Direct, Bottom entry, adjustable	
	20	Dial Size		150mm	
	21	Case Material		SS304	
	22	Window Material		Shattered proof glass	
	23	Enclosure Material		IP-65	
	24	Scale Range			
	25	Accuracy		±1% of FSD	
	26	Zero Adjustment Scerw		Ext, Micro meter pointer	
	27	Over Range Protection		130% of FSD	
	28				
THERMOWELL	29	Material		SS316	
	30	Flange Material		As per piping class	
	31	Process Connection	Size & Rating	Flanged	1 1/2", #300 minimum
	32		Facing & Finish		
	33	Insertion Length		Note-3	
	34	Construction		Bar Stocked Drilled, Flanged.	
	35				
OTHERS	36	Manufacturer			
	37	Model			

NOTES:

1. Minimum requirement has been furnished in datasheet. Vendor has to complete the datasheet i.e. furnish the data in all blank cells and adhere with the minimum requirement.
2. All Instruments should be SIL 2 and intrinsic safe compiled.
3. Refer Notes 2 to 7 of RTD data sheet.

							Design Data Sheet TEMPERATURE GAUGE	BHEL Maharatna Company Golden Jubilee 50 Years HYDERABAD
					Unit			
					Location	Manali, Chennai, Tamilnadu		
					Client	CPCL		
Rev	**Date**	**By**	**Chk**	**Appv**				Sheet No. 4 of 9

GENERAL	1	Item Number			
	2	Tag Number			
	3	Line Number	Equipment Name		
	4	P & ID No.			
	5	Hazardous Area Classification			
	6	IBR Certification			
	7				
PROCESS CONDITIONS	8	Fluid	Phase		
	9	Oper. Pressure	Design Pressure		
	10	Oper.Temperature	Design Temperature		
	11	Velocity	Density		
	12	Type		Required	
	13	Description		Required	
	14	No. of Elements		Duplex-3wire	
	15	Element Wire Size			
	16	Lead Wire System		Herm. Selaed	
	17	Sheath Material		SS304	
	18	Sheath Diameter		Suit for TW	
	19	Connection Size & Rating		1/2" NPT(F)	
	20	Element Material		'Pt-100@3wire	
	21	Ice Point Resistance		100Ω	
	22	Accuracy		0.25% or better	
HEAD	23	Type		Screwed	
	24	Material		Die cast Al	
	25	Extension Type	Extension Length		
	26	Conduit Connec & Rating			
	27	Enclosure		IP-65	
	28	Cable glands / Plugs		As required	
WELL	29	Well Material	Flange Material	SS316	As per piping class
	30	Construction Type		Bar Stocked Drilled, Flanged.	
	31	Connection Size	Connection Rating	1 1/2" Flanged	#300 minimum
	32	Insertion Length		As per table below	
	33				
	34				
OTHERS	35	Manufacturer			
	36	Model			
	37				

NOTES:

1. Minimum requirement has been furnished in datasheet. Vendor has to complete the datasheet i.e. furnish the data in all blank cells and adhere with the minimum requirement. The other requirements are as follows:
2. All temperature Elements shall be provided along with suitable Thermowell only.
3. Thermowell Inner Diameter shall be 4MM greter than Element stem diameter.
4. Element along with thermowell shall be supplied in a pre-assembled condition.
5. If the element is to be provided for less than 4" line size, same to be expanded to 4" line for gauge mounting purpose.
6. Thermowell Insertion length for different line sizes are as follows:

Line size	Immersion length(U)
Upto 6"	280mm
8" and above	320mm
Vessels	400mm

7. All used cable entries shall be provided with Double compression Ni-plated cable glands, and unused cable entries shall be provided with SS dummy plugs.
8. All Instruments should be SIL 2 and intrinsic safe compiled.

							Design Data Sheet RESISTANCE TEMPERATURE DETECTOR (RTD)	BHEL Maharatna Company HYDERABAD
					Unit			
					Location	Manali, Chennai, Tamilnadu		
					Client	CPCL		
Rev	**Date**	**By**	**Chk**	**Appv**				Sheet No. 5 of 9

GENERAL	1	Item Number			
	2	Tag Number			
	3	Service			
	4	Line Number	Equipment Name		
	5	P & ID No.			
	6	Hazardous Area Classification			
	7	NACE Requirement			
	8	IBR Certification			
	9				
PROCESS CONDITIONS	10	Fluid	Phase		
	11	Oper. Pressure	Design Pressure		
	12	Oper.Temperature	Design Temperature		
	13	Velocity	Density		
ELEMENT	14	Type		Magnesium oxide (MgO) filled grounded type	
	15	Description		K type with 20 AWG duplex	
	16	No. of Elements		Duplex-3wire	
	17	Element Wire Size		20AWG	
	18	Lead Wire System		Hermitcally sealed	
	19	Characterisitc			
	20	Grounded Type		Magnesium oxide (MgO) filled	
	21	Sheath Material		SS 316	
	22	Sheath Diameter		Suit for TW	
	23	Connection Size & Rating		1/2" NPT(F)	
	24				
	25				
	26				
HEAD	27	Type		Screwed	
	28	Material		Die cast Al	
	29	Extension Type	Extension Length		
	30	Nipple Size & Rating			
	31	Conduit Conn& Rating			
	32	Enclosure		Weather Proof, Ip-65	
	33				
WELL	34	Well Material	Flange Material	SS316	As per piping class
	35	Construction Type		Bar Stocked Drilled, Flanged.	
	36	Connection Size	Connection Rating	1 1/2" Flanged	#300 minimum
	37	Insertion Length		Note-2	
	38				
	39				
OTHERS	40	Manufacturer			
	41	Model			
	42				

NOTES:

1. Minimum requirement has been furnished in datasheet. Vendor has to complete the datasheet i.e. furnish the data in all blank cells and adhere with the minimum requirement.
2. All Instruments should be SIL 2 and intrinsic safecompiled.
3. Refer Notes 2 to 7 of RTD data sheet.

						Design Data Sheet	BHEL Maharatna Company HYDERABAD
				Unit			
				Location	Manali, Chennai, Tamilnadu	THERMOCOUPLE	
				Client	CPCL		
Rev	Date	By	Chk	Appv			Sheet No. 6 of 9

GENERAL	1	Item Number			
	2	Tag Number			
	3	P & ID No.			
	4	Hazardous Area Classification			
	5	Stautory Approval			
	6	SIL Certification			
	7				
PROCESS CONDITIONS	8	Fluid	Phase		
	9	Oper. Pressure	Design Pressure		
	10	Oper. Temperature	Design Temperature		
	11				
	12				
ELEMENT	13	Type		2 wire, Remote mounted type	
	14				
TRANSMITTER	15	Type		Microprocesor based , Dual Compartment Type	
	16	Measuring Range			
	17	Case Material		SS 304	
	18	Electrical Connection		1/2" NPT(F)	
	19	Power Supply		24V DC ± 10%	
	20	Output		4-20 mA	
	21	Integral Meter			
	22	Signal Termination Type		2 Wire, 4-20mA DC (HART)	
	23	Self Diagnostic		Required	
	24	Cold Junction Compensation		Required	
	25	Burnout Protection		Required	
	26	Max. Load @24V DC		600Ω	
	27	Accuracy		± 0.1% of Calibrated span	
	28	Mounting		Suitable for 2" Pipe	
	29	Ingress Protection		Weather Proof	
	30	Enclosure Classification		IP-65	
	31				
	32				
ACCESSORIES	33	Mounting Bracket		As required, SS 304 min	
	34	Bolts & Nuts		As required, SS 304 min	
	35				
OTHERS	36	Manufacturer			
	37	Model			
	38				

Notes:

1.Minimum requirement has been furnished in datasheet. Vendor has to complete the datasheet i.e. furnish the data in all blank cells and adhere with the minimum requirement.

2. All Instruments should be SIL 2 and intrinsic safe compiled.

							DESIGN DATA SHEET TEMPERATURE TRANSMITTER	BHEL Maharatna Company 50 Years HYDERABAD
					Unit			
					Location	Manali, Chennai, Tamilnadu		
					Client	CPCL		
Rev	Date	By	Chk	Appv				Sheet No. 7 of 9

GENERAL	1	Item Number		
	2	Tag Number		
	4	Tank/Equipment No.		
	5	P&ID No.		
	6	Service		
	7			
PROCESS	8	Type		
	9	Length	Internal Dia	
Haz. Location	12	Electrical Area Classification		IEC zone 2 group IIC
	13			
TRANSMITTER	14	Antenna Type		
	15	Antenna Material		ANSI 316
	16	Function - Indicating / Trans		
	17	Gauge Head Location		At tank top
	18	Range		Full Height of the tank
	19	Accuracy		± 3mm OR better
	20	Cable Entry-Signal	Power	Screwed ½" NPT
	22	Power Supply		Loop powered, 24 V DC from DCS
	23	Enclosure Class		IP-65
	24	Refer Assembly Drawing No.		
	25	Gauge Head Connections & Ratings		
	26	Gauge Head Material		Die-cast aluminum
	27	Body Material		
	28	Output		Isolated 4-20 mA
	29	Protocol		HART
	30	Interface Devices		
	31	-Temprature Element		
	32	-Water Cut Probe		
	33	Cabling		
	34	Mounting		Top
	35	Cable Gland		
	36	-Type		Radar
	37	-Size	Signal / Power	
	38	-MOC		
	39	-Quantity		One
	40	Programming & Calibration Facility		Required
	41			
LOCAL INDICATOR	42	Type		
	43	Temperature		
	44	Location		Vicinity of transmitter
	45	Graduations		
	46	Enclosure		Die cast Aluminium
	47	Power Supply		
	48	Power Consumption		
	49	Communication		
	50	MOC		
	51	Cable Entry		
	52	Parameters to be Displayed		
	53			
TEMP. ELEMENT	54	Type		Not Applicable
	55	Element Type	No. of Elements	
	56	Connection Size & Rating		
	57	Element Anchoring		
	58	Sheath Material		
WATER CUT PROBE	59	Type		
	60	Dedicated	With Temp. Probe	
	61	Length		
OPTIONS	62	Calibration Pin		
	63	Still Well		
	64	Power Switch		
	65	Mounting Brackets		
	66	Built-In Alarm Contacts		
	67	Inter connecting cables between		
	68	-Tank side Indicator & Gauge head		
	69	-Cable between RTD & Radar		
	70	-Tank Gauge and Water Probe		
	71	-Power Cable between Gauge head and Indicator		
	72	Junction Box		Not Applicable
	73	-Type		
	74	-Material		
	75	-Mounting		
	76	-Cable Gland		
	77	-Gland Type	Gland Size / Gland Moc	Flame Proof Double compression type / Screwed ½" NPT / SS 304
	78	Name Plate		
	79			
SERVICE CONDITION	80	Fluid		
	81	Pressure - Oper.	Max. Kg/Cm² g	
	82	Temp. - Oper.	Max. ℃	
	83	Operating Specific Gravity		
	84	Viscosity	CST	
CERTIFICATION	85	Statutory		Required
	86	Others		
OTHERS	87	Manufacturer		
	88	Model Number		

NOTES:

1. Minimum requirement has been furnished in datasheet. Vendor has to complete the datasheet i.e. furnish the data in all blank cells and adhere with the minimum requirement.
2. All Instruments should be SIL 2 and intrinsic safe compiled.

Rev	Date	By	Chk	Appv		
					Unit	
					Location	Manali, Chennai, Tamilnadu
					Client	CPCL

Design Data Sheet
TANK LEVEL INSTRUMENT
(FOR RADAR TYPE
LEVEL TRANSMITTER)

BHEL Maharatna Company 50 Years
HYDERABAD

GENERAL	1	Item Number						
	2	Tag Number						
	3	Service						
	4	Equipment Name		P & ID No.				
	5	NACE Requirement						
	6	IBR Certification						
	7							
PROCESS CONDITIONS	8	Upper Fluid		Phase				
	9	Lower Fluid		Phase				
	10	Pressure	Unit	Design	Oper.			
	11	Temperature	Unit	Design	Oper.			
	12	Upper Fluid	Unit	Density	Viscosity			
	13	Lower Fluid	Unit	Density	Viscosity			
GAUGE	15	Type				Transparent / Reflex		
	16	Connection Type						
	17	Body Material		Float Material		CS A 105		SS316
	18	Flange Material						
	19	Connection		Size & Rating		SW		Suitable to process
	20			Facing & Finish				
	21	Center To Center Distance				Should cover the full range		
	22	Dimension Visible						
	23	Gauge Cock						
	24	Vent Connection				1/2" NPT		
	25	Drain Connection				1/2" NPT		
	26	Indicator Scale		Material				
	27	Float Failure Indication						
	28	Enclosure Class				IP-65		
	29							
OTHERS	30	Manufacturer						
	31	Model						

Notes:

1. Minimum requirement has been furnished in datasheet. Vendor has to complete the datasheet i.e. furnish the data in all blank cells and adhere with the minimum requirement.
2. All Instruments should be SIL 2 and intrinsic safe compiled.

					Unit	
					Location	MANALI,CHENNAI,TAMILNADU
					Client	CPCL
Rev	Date	By	Chk	Appv	.	

Design Data Sheet

LEVEL GAUGE

HYDERABAD

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ANNEXURE-3
(PROCESS CONNECTION DETAILS)

SR. NO	TYPE OF INSTRUMENTS	UNCLADD ED EQUIPMENTS		CLADDED EQUIPMENTS		INSTRUMENT CONNECTION
		EQUIPMENT/STANDPIPE CONNECTION	FIRST BLOCK VALVE	EQUIPMENT/STANDPIP E CONNECTION	FIRST BLOCK VALVE	
1.	EXTERNAL DISPLACER LEVEL INSTRUMENTS ON EQUIPMENT	2" FLGD.	2" FLGD.	3" FLGD	3" FLGD.	2" FLGD
2	EXTERNAL DISPLACER LEVEL INSTRUMENTS ON STANDPIPE	2" FLGD.	2" FLGD.	2" FLGD.	2" FLGD.	2" FLGD
3	EXTERNAL GUIDED WAVE LEVEL INSTRUMENT ON EQUIPMENT	2" FLGD.	2" FLGD.	3" FLGD.	3" FLGD.	2" FLGD
4.	EXTERNAL GUIDED WAVE LEVEL INSTRUMENT ON STANDPIPE	2" FLGD.	2" FLGD	2" FLGD.	2" FLGD.	2" FLGD
5.	EXTERNAL MAGNETIC LEVEL INSTRUMENT ON EQUIPMENT	2" FLGD.	2" FLGD.	3" FLGD.	3" FLGD.	2" FLGD
6	EXTERNAL MAGNETIC LEVEL INDICATOR ON STANDPIPE	2" FLGD.	2" FLGD.	2" FLGD.	2" FLGD.	2" FLGD
7.	EXTERNAL BALL FLOAT LEVEL INSTRUMENTS ON VESSEL	2" FLGD.	2" FLGD.	3" FLGD.	3" FLGD.	1" SW
8	EXTERNAL BALL FLOAT LEVEL INSTRUMENTS ON STANDPIPE	1" SW/BW/FLGD #	1" SW/BW/FLGD #	1" SW/BW/FLGD #	1" SW/BW/FLGD #	1" SW
9	INTERNAL DISPLACER / FLOAT LEVEL INSTRUMENTS	4" FLGD	-	4" FLGD	-	4" FLGD
10.	INTERNAL GUIDED WAVE LEVEL INSTRUMENT ON EQUIPMENT	4" FLGD.	-	4" FLGD.	-	4" FLGD
11.	MAGNETIC LEVEL INDICATOR (INTERNAL - TOP MOUNTED)	4" FLGD.	-	4" FLGD	-	4" FLGD
12.	LEVEL GAUGE ON VESSEL	2" FLGD.	2" FLGD.	3" FLGD.	3" FLGD.	¾" SCRD
13.	LEVEL GAUGE ON STANDPIPE	¾" SW/BW/ FLGD #	¾" SW/BW/ FLGD #	¾" SW/BW/ FLGD #	¾" SW/BW/ FLGD #	¾" SCRD
14	SPECIAL LEVEL INSTRUMENTS ON EQUIPMENT (CAPACITANCE PROBE/ULTRASONIC PROBE/R F PROBE)	2" FLGD.	-	3" FLGD.	-	2" FLGD
15.	D.P. INSTRUMENTS ON VESSEL	1½ " FLGD.	1½ " SW/BW/FLGD #	3" FLGD.	3" FLGD.	½ " SCRD
16.	D.P. INSTRUMENTS ON STANDPIPE	¾" SW/BW/ FLGD #	¾" SW/BW/ FLGD #	¾" SW/BW/ FLGD #	¾" SW/BW/ FLGD #	½ " SCRD
17.	DIAPHRAGM SEAL D.P. INSTRUMENTS ON VESSEL	3" FLGD.	3" FLGD.	3" FLGD.	3" FLGD.	3" FLGD.
18.	EXTENDED DIAPHRAGM SEAL D.P. INSTRUMENTS ON VESSEL	4" FLGD. (NOTE-1)	-	4" FLGD. (NOTE-1)	-	4" FLGD.
19	DIP TUBE LEVEL INSTRUMENTS	1¼ " FLGD.	½ " SW (BY INST)	3" FLGD	½ " SW (BY INST)	½ " SCRD

INSTRUMENT CONNECTIONS ON VESSELS, STANDPIPES AND TANKS

CLIENT

CPCL CHENNAI PETROLEUM CORPORATION LIMITED
MANALI, CHENNAI, TAMILNADU

भेल BHEL Maharatna Company

Golden Jubilee 1964 - 2014 50 Years

HYDERABAD

SR. NO	TYPE OF INSTRUMENTS	UNCLADD ED EQUIPMENTS		CLADDED EQUIPMENTS		INSTRUMENT CONNECTION
		EQUIPMENT/STANDPIPE CONNECTION	FIRST BLOCK VALVE	EQUIPMENT/STANDPIPE CONNECTION	FIRST BLOCK VALVE	
20.	TANK LEVEL INSTRUMENTS (MECH)	1½" FLGD	1½" FLGD (BY INST)	-	-	½" SCRD
21.	TANK LEVEL INSTRUMENTS (SERVO) ON ATMOSPHERIC TANKS	6" FLGD.	6" FLGD. (BY INST)	-	-	6" FLGD
22.	TANK LEVEL INSTRUMENTS (SERVO) FOR PRESSURISED EQUIPMENTS	6" FLGD.	6" FLGD. (BY INST)	6" FLGD.	6" FLGD (BY INST)	6" FLGD
23.	TANK LEVEL INSTRUMENTS (RADAR) ON ATMOSPHERIC TANK (CLEAN SERVICE)	8" FLGD.	-	-	-	8" FLGD
24.	TANK LEVEL INSTRUMENTS (RADAR) ON ATMOSPHERIC TANK (VISCOUS SERVICE)	24" FLGD.	-	-	-	24" FLGD
25.	TANK LEVEL INSTRUMENTS (RADAR) FOR PRESSURISED EQUIPMENTS	8" FLGD.	-	8" FLGD.	-	8" FLGD.
26.	TANK LEVEL INSTRUMENTS – CAPITANCE / ULTRASONIC/ RF TYPE ON ATMOSPHERIC TANKS/PRESSURISED EQUIPMENTS	2" FLGD.	-	3" FLGD.	-	2" FLGD
27.	PRESSURE INSTRUMENTS ON VESSEL	1½" FLGD	1½ "SW/BW/ FLGD #	3" FLGD	3" FLGD.	½" SCRD
28.	PRESSURE INSTRUMENTS ON STANDPIPE	¾" SW/BW/ FLGD #	¾" SW/BW/ FLGD #	¾" SW/BW/ FLGD #	¾" SW/BW/ FLGD #	½" SCRD
29.	CHEMICAL SEAL PRESSURE INSTRUMENT GAUGE ON VESSEL	1½" FLGD	1½" FLGD	3" FLGD.	3" FLGD	½" SCRD
30.	DIAPHRAGM SEAL PRESSURE INSTRUMENT GAUGE ON VESSEL	1½" FLGD	1½" FLGD	3" FLGD.	3" FLGD	1½" FLGD
31.	THERMOWELL ON EQUIPMENT	1½" FLGD	-	3" FLGD.	-	1½" FLGD/ 3" FLGD
32.	MULTI-POINT TEMPERATURE ELEMENTS FOR TANKS	2"FLGD.	-	3" FLGD.	-	2" FLGD/ 3" FLGD
33.	STANDPIPE (RATING UP TO 600#)	2"FLGD.	-	3" FLGD.	-	-
34.	STANDPIPE (RATING > 600#)	3"FLGD.	-	3" FLGD.	-	-

REV. NO.	REVISION DESCRIPTION	DRAWN	CHK	APPROVED	DATE
0	ISSUED FOR FEED	JPK	MSD	BSP	03-03-10

INSTRUMENT CONNECTIONS ON VESSELS, STANDPIPES AND TANKS

CLIENT

CPCL CHENNAI PETROLEUM CORPORATION LIMITED
MANALI, CHENNAI, TAMILNADU

BHEL Maharatna Company

Golden Jubilee 1964 - 2014

50 Years

HYDERABAD

NOTES:

1. NOZZLE I.D ON EQUIPMENT SHALL BE SELECTED TO SUIT O.D OF EXTENDED DIAPHRAGM OF INSTRUMENT.
2. ALL FLANGES/S.W RATING SHALL BE AS PER PIPING SPECIFICATION.
3. IN CASE OF DIRECT MOUNTED FLANGED INSTRUMENTS AND WHERE FLANGED TYPE FIRST ISOLATION VALVE ARE PROVIDED, BOLTING AND GASKETS SHALL BE IN PIPING SCOPE
4. INSTALLATION OF TANK LEVEL INSTRUMENTS (SERVO, MECHANICAL AND MULTIPOINT TEMPERATURE ELEMENT) ON TANKS ARE IN TANK VENDOR SCOPE.
5. FOR ANY OTHER INSTRUMENTS NOT REFERED ABOVE THE CONNECTION DETAILS SHALL BE AS PER INDIVIDUAL REQUIREMENT.
6. AS PER PIPING SPECIFICATION.

REV. NO.	REVISION DESCRIPTION	DRAWN	CHK	APPROVED			DATE
0	ISSUED FOR FEED	JPK	MSD	BSP			03-03-10

INSTRUMENT CONNECTIONS ON VESSELS, STANDPIPES AND TANKS

CLIENT

CPCL CHENNAI PETROLEUM CORPORATION LIMITED
MANALI, CHENNAI, TAMILNADU

BHEL Maharatna Company

Golden Jubilee 1964 - 2014

50 Years

HYDERABAD

A MEMBER OF THE JACOBS ENGINEERING GROUP, INC.

(A) **BARE PIPES**

S. NO	TYPE OF INSTRUMENTS		WHERE PIPING CLASS RECOMMENDS SCRD CONNECTION			WHERE PIPING CLASS RECOMMENDS SW/BW # CONNECTION			WHERE PIPING CLASS RECOMMENDS FLGD CONNECTION		
			PROCESS CONNECTION	FIRST BLOCK VALVE	INSTRUMENTS CONNECTION	PROCESS CONNECTION	FIRST BLOCK VALVE	INSTRUMENTS CONNECTION	PROCESS CONNECTION	FIRST BLOCK VALVE	INSTRUMENTS CONNECTION
1	FLOW METER ORIFICE	≤ 600#	½" SCRD*	½" SCRD*	½" SCRD	½" SCRD*	½" SW/BW#	½" SCRD	½" SCRD*	¾" FLGD	½" SCRD
		> 600#	-	-	-	¾" SCRD**	¾" SW/BW#	½" SCRD	¾" SCRD**	¾" FLGD	½" SCRD
2	FLOWMETER VENTURI/NOZZLE	≤ 600#	½" FLGD	½" FLGD	½" SCRD	½" FLGD	½" FLGD	½" SCRD	½" FLGD	½" FLGD	½" SCRD
		> 600#	-	-	-	¾" FLGD	¾" FLGD	½" SCRD	¾" FLGD	¾" FLGD	½" SCRD
3	FLOW METER ORIFICE (DIAPH.SEAL)	≤ 600#	½" SCRD*	½" SCRD*	3"FLGD	½" SCRD*	½" SW/BW#	3" FLGD	½" SCRD*	½" FLGD	3"FLGD
		> 600#	-	-	-	¾" SCRD**	¾" SW/BW#	3" FLGD	¾" SCRD**	½" FLGD	3"FLGD
4	FLOW METER VENTURI/NOZZLE (DIAPH.SEAL)	≤ 600#	½" FLGD	½" FLGD	3" FLGD	½" FLGD	½" FLGD	3" FLGD	½" FLGD	½" FLGD	3"FLGD
		> 600#	-	-	-	¾" FLGD	¾" FLGD	3" FLGD	¾" FLGD	¾" FLGD	3"FLGD
5	FLOW METER AVERAGE PITOT TUBE		3" FLGD	3" FLGD (BY INST)	3" FLGD+	3" FLGD	3" FLGD (BY INST)	3" FLGD	3" FLGD	3" FLGD (BY INST)	3" FLGD+
6	DIFFERENTIAL PRESSURE (DP) INSTRUMENTS		¾" SCRD*	¾" SCRD*	½" SCRD.	¾" SW/BW#	¾" SW/BW#	½" SCRD	¾" FLGD	¾" FLGD	½" SCRD
7	DIAPHGRAM SEAL D.P. INSTRUMENTS		3" FLGD.	3" FLGD	3" FLGD.	3" FLGD.	3" FLGD.	3" FLGD	3" FLGD.	3" FLGD.	3" FLGD
8	PRESSURE INSTRUMENTS <5>		¾" SCRD*	¾" SCRD*	½" SCRD.	¾" SW/BW#	¾" SW/BW#	½" SCRD	¾" FLGD	¾" FLGD	½" SCRD
9	DIAPH. (CHEMICAL) SEAL PRESSURE INSTRUMENT<5> (SCRD)		¾" SCRD*	¾" SCRD*	½" SCRD.	¾" SW/BW#	¾" SW/BW#	½" SCRD	¾" FLGD	¾" FLGD	½" SCRD
10	DIAPHGRAM SEAL PRESSURE INSTRUMENTS (FLGD.)		1 ½" FLGD.	1 ½" FLGD.	1 ½" FLGD.	1 ½" FLGD.	1 ½" FLGD	1 ½" FLGD.	1 ½" FLGD.	1 ½" FLGD.	1 ½" FLGD.
11	THERMOWELL		1 ½" FLGD.	-	1 ½" FLGD	1 ½" FLGD.	-	1 ½" FLGD	1 ½" FLGD.	-	1 ½" FLGD

REV. NO.	REVISION DESCRIPTION	DRAWN	CHK	APPROVED			DATE
0	ISSUED FOR FEED	JPK	MSD	BSP			03-03-10

INSTRUMENT CONNECTIONS ON PIPES

CLIENT

CPCL CHENNAI PETROLEUM CORPORATION LIMITED
MANALI, CHENNAI, TAMILNADU

BHEL Maharatna Company — Golden Jubilee 1964 - 2014 — 50 Years

HYDERABAD

(B) CLADDED\CEMENTED\LINED PIPES

S. NO	TYPE OF INSTRUMENTS		WHERE PIPING CLASS SPECIFIES CLADDED PIPES			WHERE PIPING CLASS SPECIFIES CEMENT LINED PIPES			WHERE PIPING CLASS SPECIFIES RUBBER/TEFLON LINED PIPES		
			PROCESS CONNECTION	FIRST BLOCK VALVE	INSTRUMENTS CONNECTION	PROCESS CONNECTION	FIRST BLOCK VALVE	INSTRUMENTS CONNECTION	PROCESS CONNECTION	FIRST BLOCK VALVE	INSTRUMENTS CONNECTION
1	FLOW METER ORIFICE	≤ 600#	½" SCRD*	½" SCRD*	½" SCRD	½" SCRD*	½" SW/BW	½" SCRD	1" FLGD	1" FLGD	½" SCRD
		> 600#	¼" SCRD**	¼" SW/BW	½" SCRD	-	-	-	-	-	-
2	FLOW METER ORIFICE (DIAPHGRAM. SEAL)		½" SCRD*	½" SCRD*	3" FLGD	½" SCRD*	½" SW/BW	3" FLGD	1" FLGD	1" FLGD	3" FLGD
			¼" SCRD**	¼" SCRD*	3" FLGD	-	-	-	-	-	-
3	FLOW METER AVERAGE PITOT TUBE		3" FLGD	3" FLGD (BY INST)	3" FLGD+	3" FLGD	3" FLGD (BY INST)	3": FLGD+	3" FLGD	3" FLGD (BY INST)	3" FLGD+
4	DP INSTRUMENTS		¾"SW/BW#	¾"SW/BW#	½" SCRD.	3" FLGD	¾" FLGD	½" SCRD	1½" FLGD	1 ½" FLGD	½" SCRD
5	DIAPHGRAM SEAL D.P. INSTRUMENTS		3 " FLGD.	3 " FLGD.	3" FLGD	3" FLGD	3"FLGD	3" FLGD	3" FLGD.	3" FLGD	3" FLGD.
6	PRESSURE INSTRUMENTS		¾"SW/BW#	¾"SW/BW#	½" SCRD.	3" FLGD	¾"SW/BW	½" SCRD	1" FLGD	1" FLGD	½" SCRD
7	DIAPHGRAM (CHEMICAL) SEAL PRESSURE INSTRUMENTS (SCRD.) <5>		¾"SW/BW#	¾"SW/BW#	½" SCRD.	3" FLGD	1 ½" SW/BW	½" SCRD	1" FLGD	1" FLGD	½" SCRD
8	DIAPHGRAM SEAL PRESSURE INSTRUMENTS (FLGD) <5>		1 ½ " FLGD	1 ½ " FLGD.	1 ½ " FLGD.	3" FLGD	1 ½"FLGD	1 ½" FLGD	1 ½" FLGD	1 ½" FLGD	1 ½" FLGD
9	THERMOWELL		1 ½ " FLGD.	-	1 ½ " FLGD	3" FLGD	-	3" FLGD	3" FLGD	-	3" FLGD

NOTES:
1. FOR ANY OTHER INSTRUMENTS NOT REFERRED ABOVE THE CONNECTION DETAILS SHALL BE AS PER INDIVIDUAL REQUIREMENT.
2. ALL FLANGES/SW RATING SHALL BE AS PER PIPING SPECIFICATION.
3. IN CASE OF DIRECT MOUNTED FLANGED INSTRUMENTS AND WHERE FLANGED FIRST ISOLATION VALVE ARE PROVIDED, BOLTING AND GASKETS SHALL BE IN PIPING SCOPE
4. INSTALLATION OF ALL IN LINE INSTRUMENTS SHALL BE IN PIPING SCOPE.
5. PRESSURE INSTRUMENTS INCLUDE PRESSURE TRANSMITTERS AND PRESSURE GAUGES

* SEAL WELDING REQUIRED.
** AS PER PIPING SPECIFICATION.
\# STRENGTH WELD
\+ CONNECTIONS FOR D.P. INSTRUMENT ½" SCRD

REV. NO.	REVISION DESCRIPTION	DRAWN	CHK	APPROVED	DATE
0	ISSUED FOR FEED	JPK	MSD	BSP	03-03-10

INSTRUMENT CONNECTIONS ON PIPES

CLIENT

CPCL CHENNAI PETROLEUM CORPORATION LIMITED
MANALI, CHENNAI, TAMILNADU

BHEL Maharatna Company

Golden Jubilee 1964 - 2014

50 Years

HYDERABAD

ANNEXURE-4 (INSPECTION AND TEST PLAN)

Notes:

1. This inspection and test table gives overall guidelines.The supplier shall develop ITP for each type of instrument withrespect to all specific requirements as applicable to ensure compliance with codes ,specifications and/or contractual requirements .
   Supplier's ITP is subject to approval by client

2. Supplier shall carry out 100% inspection for compliance with requirements of purchase order at every stage of manufacturing. Supplier shall maintain records / documents of all the inspections/ tests carried out and will satisfy himself about the acceptability of the item before offering the item for inspection by client.

3. R - Review
   W - Witness

Sl.No.	Equipment	Material Test	Dye Penetration Test	Radiographic Testing	Visual Inspection	Dimensional Inspection	Hydro Testing / Over Pressure	Seat Leakage	Calibration	Performance / Functional Testing	Pneumatic Testing	HV / Inst. Test	Fire Safety	IBR	Factory Acceptance Test	Certificate from Statutory body
1	Presure Gauges and Diff. Pressure Gauges	R			W	W			R	W						
2	Temperature Gauges	R			W	W			R	W						
3	Temperature Element with Thermowell	R			W	W			R	W						
4	Level Gauges (Transparent / Reflex)	R			W	W			R	W						
5	Level Transmitter (Radar)	R			W	W			R	W						
6	Field Transmitters(Pressure, Flow, Level)	R			W	W			R	W					W	
7	Flow Element	R			W	W			R							
8	Flow Meters (Mass, Vortex, Ultrasonic, etc.)	R		R	W	W			R							R
9	Rotameter	R			W	W			R	W						
10	Control Valves with Complete Assbly.	R	R	R	W	W	R	R	R	W	W			R	W	R
11	On-Off Valves with Complete Assembly	R	R	R	W	W	R	R	R	W	W			R	W	R
12	Pressure Relief Valves	R	R	R	W	W	R	R	R	W	W			R		R
13	Signal and Control Cables	R			W	W						W				

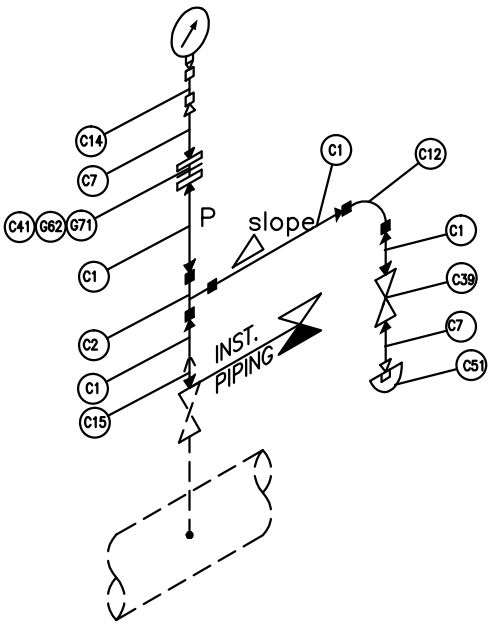
Sl.No.	Equipment	Material Test	Dye Penetration Test	Radiographic Testing	Visual Inspection	Dimensional Inspection	Hydro Testing / Over Pressure	Seat Leakage	Calibration	Performance / Functional Testing	Pneumatic Testing	HV / Inst. Test	Fire Safety	IBR	Factory Acceptance Test	Certificate from Statutory body
14	Junction Boxes & Cable Glands	R			W	W										
15	Analysers	R			W	W				W						
16	Control Panel	R			W	W									W	
17	PLCs , HMI etc				W	W									W	
18	Switches (Level, Pressure, Diff. Pr., Vibration , Reverse rotation)	R			W	W			R	W						
19	Pipes and pipe Fittings, Tube and Tube fittings,thermowell for temp. elements	R			W	W								R		

ANNEXURE-5
(INSTRUMENT INSTALLATION DRAWINGS)

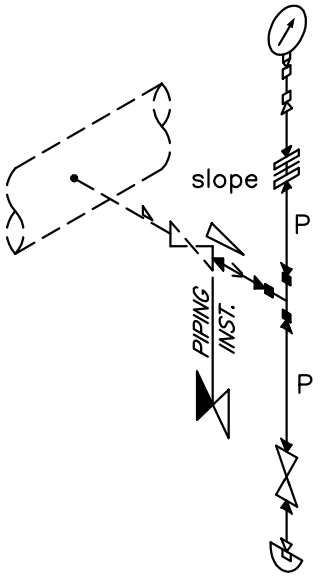
NOTE: All tube and tube fittings shall be flareless double compression (four pieces) type & of reputed make such as Parker, Swagelok and Ermeto.

INDEX

FOR GAS



FOR LIQUID



NOTES:

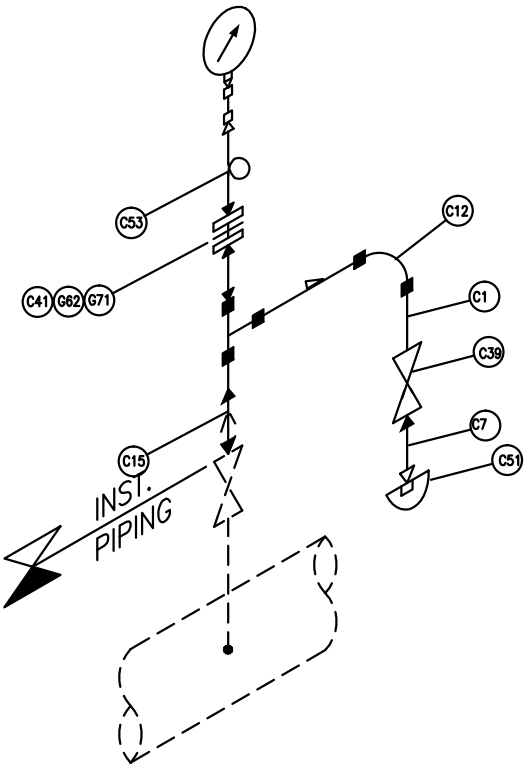
1. INSTRUMENT ORIENTATION SHALL BE SUITABLE FOR METER READING ACCESIBILITY SUITABLE SPACE SHALL BE PROVIDED FOR MAINTENENCE ACCESIBILITY.
2. THE ORIENTATION OF TAPPING FROM PROCESS PIPE (VERTICAL/HORIZONTAL) SHALL BE SELECTED SUCH THAT PRESSURE GAUGE SHALL BE ACCESSIBLE FOR MAINTENANCE

LIST OF ITEMS

SYMBOL	ITEM NO.	DESCRIPTION	SIZE	ENDS	QTY	UNIT
P	C1	PIPE/PIPE NIPPLE	1/2"	PL	10	m
⟷	C7	NIPPLES	1/2"	TH x PL	2	No
□—□	C14	STRAIGHT COUPLING	1/2"	TH x TH	1	No
⟷	C15	SWAGE NIPPLE	3/4"x1/2"	PL x PL	1	No
	C22	EQUAL TEE	1/2"	SW X SW X SW	1	No
⋈	C39	GATE VALVE	1/2"	SW	1	No
	C51	CAP	1/2"	TH	1	No
	C12	ELBOW	1/2"	SW	1	No
	C41	FLANGE, 300#	1/2"	WNRF	2	No
	G62	MSW GASKET	1/2"	–	1	No
	G71	STUD WITH TWO NUTS	M12x80	–	4	No
	G113	PIPE U–CLAMP	1/2"	TH	4	No

भीएचईएल BHEL HYDERABAD	SERVICE	INSTALLATION:	DIRECT-ON PIPE METER ABOVE/BELOW	STANDARD	
	LIQUID, COND.VAPOUR GAS	INST. TYPE:	PRESSURE GAUGE		
		PR. RATING	LOW PRESSURE (UPTO 600#)	SHEET NO. 01 of 16	REV. 00

Scheme-2

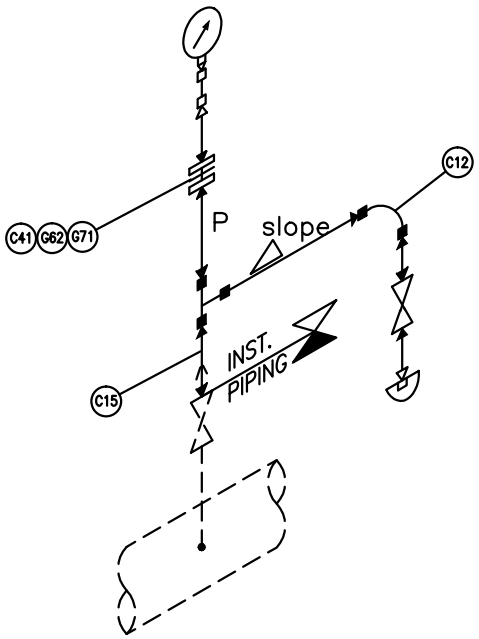


LIST OF ITEMS

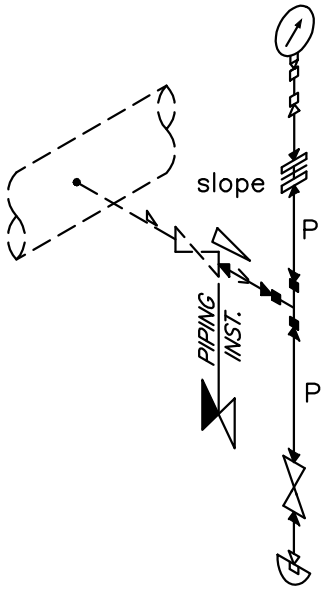
SYMBOL	ITEM NO.	DESCRIPTION	SIZE	ENDS	QTY	UNIT	
——	C1	PIPE	1/2"	PL	10	m	
◁—▷	C7	NIPPLES	1/2"	TH x PL	1	No	
□—□	C14	STRAIGHT COUPLING	1/2"	THXTH–F	1	No	
◁—▷	C15	SWAGE NIPPLE	3/4"x1/2"	PL x PL	1	No	
⊥	C22	EQUAL TEE	1/2"	SW	1	No	
⋈	C38	GATE VALVE, 800	1/2"	SW	1	No	
⊢	C51	CAP	1/2"	TH	1	No	
◁—○—▷	C53	SYPHON	1/2"	BW x TH	1	No	
⌐	C12	ELBOW	1/2"	SW	1	No	
▯	C41	FLANGE, 300#	1/2"	WNRF	2	No.	
|	G62	MSW GASKET,300#	1/2"	–	1	No	
	G71	STUD WITH TWO NUTS	M20x90	–	4	No	
	G113	PIPE U–CLAMP	1/2"	TH	4	No	

भारत हेवी BHEL HYDERABAD	SERVICE	INSTALLATION:	DIRECT–ON PIPE METER ABOVE	STANDARD	
	STEAM	INST. TYPE:	PRESSURE GAUGE		
		PR. RATING	LOW PRESSURE (UPTO 600#)	SHEET NO. 02 of 16	REV. 00

FOR GAS



FOR LIQUID



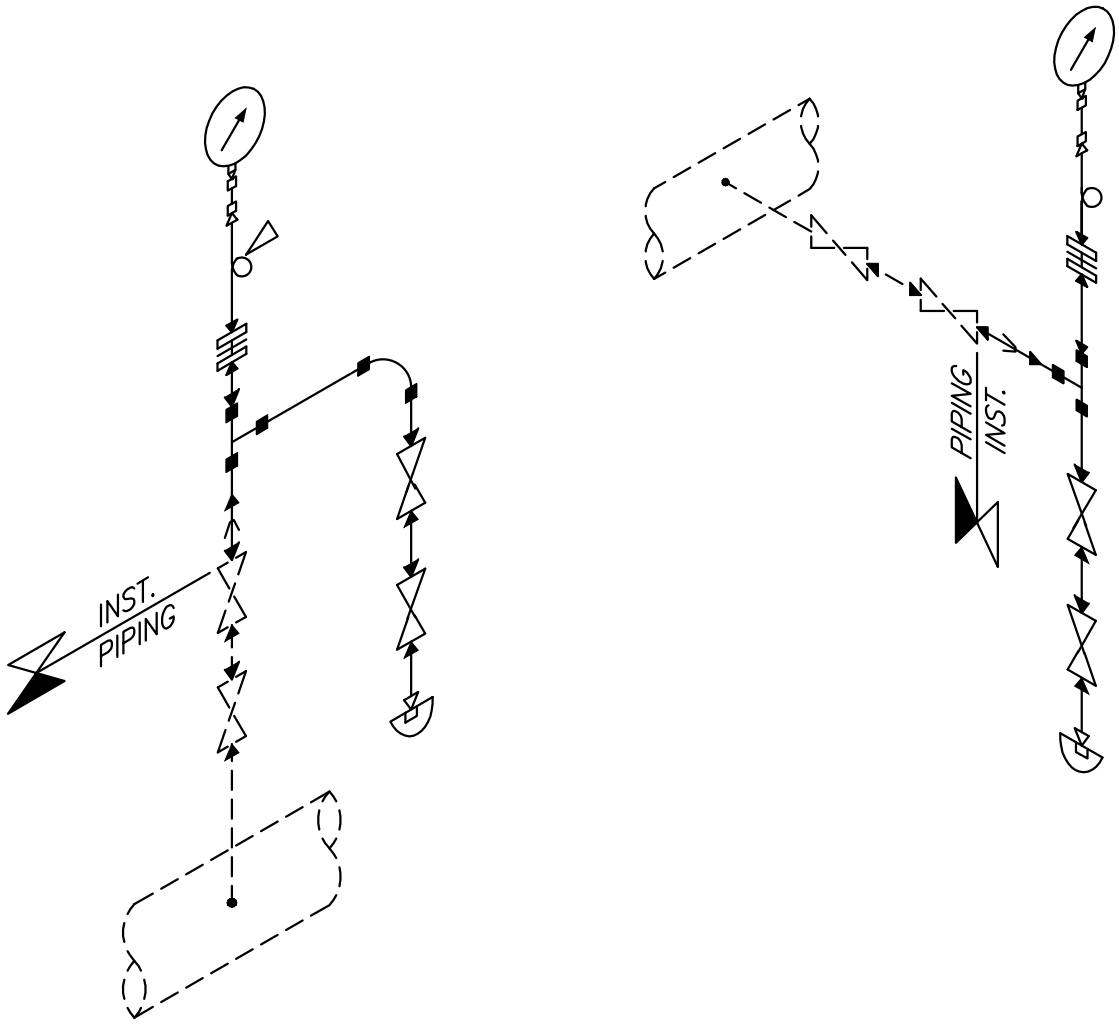
NOTES:

1. INSTRUMENT ORIENTATION SHALL BE SUITABLE FOR METER READING ACCESIBILITY SUITABLE SPACE SHALL BE PROVIDED FOR MAINTENENCE ACCESIBILITY.
2. THE ORIENTATION OF TAPPING FROM PROCESS PIPE (VERTICAL/HORIZONTAL) SHALL BE SELECTED SUCH THAT PRESSURE GAUGE SHALL BE ACCESSIBLE FOR MAINTENANCE

LIST OF ITEMS

SYMBOL	ITEM NO.	DESCRIPTION	SIZE	ENDS	QTY	UNIT	
P	S1	PIPE/PIPE NIPPLE	1/2"	PL	10	m	
	S7	NIPPLES	1/2"	TH x PL	2	No	
	S14	STRAIGHT COUPLING	1/2"	TH x TH	1	No	
	S15	SWAGE NIPPLE	3/4"x1/2"	PL x PL	1	No	
	S22	EQUAL TEE	1/2"	SW X SW X SW	1	No	
	S39	GATE VALVE	1/2"	SW	1	No	
	S51	CAP	1/2"	TH	1	No	
	S12	ELBOW	1/2"	SW	1	No	
	C41	FLANGE, 300#	1/2"	WNRF	2	No	SS FLANGE
	G62	MSW GASKET	1/2"	–	1	No	
	G71	STUD WITH TWO NUTS	M12x80	–	4	No	
	G113	PIPE U–CLAMP	1/2"	TH	4	No	

भीएचईएल BHEL HYDERABAD	SERVICE	INSTALLATION:	DIRECT-ON PIPE METER ABOVE/BELOW	STANDARD	
	LIQUID, COND.VAPOUR GAS	INST. TYPE:	PRESSURE GAUGE		
		PR. RATING	LOW PRESSURE (UPTO 600#)	SHEET NO. 03 of 16	REV. 00

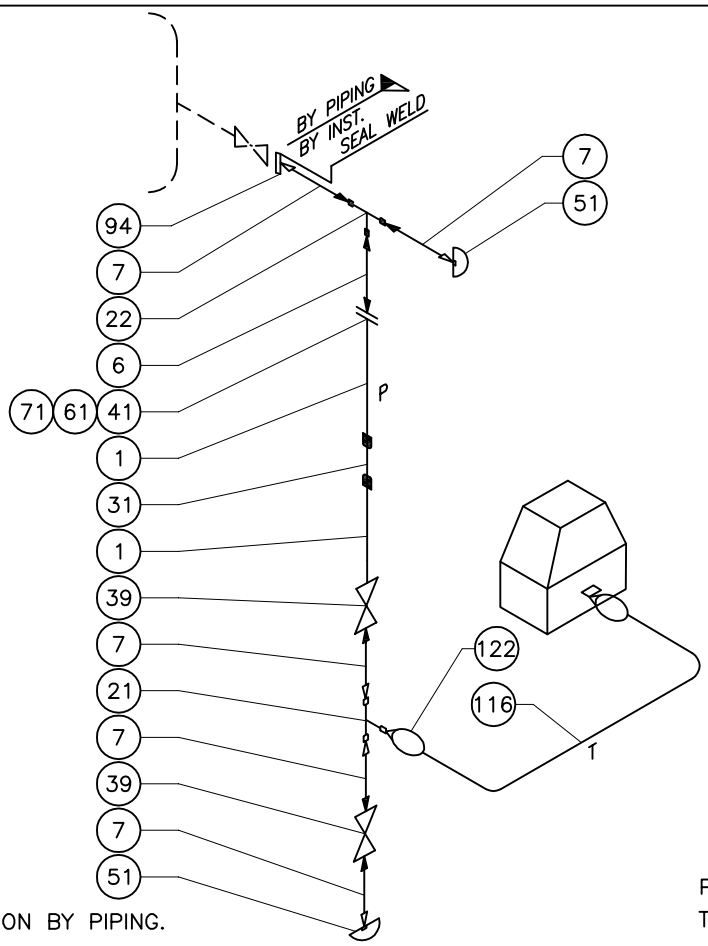


LIST OF ITEMS

SYMBOL	ITEM NO.	DESCRIPTION	SIZE	ENDS	QTY	UNIT	
——	A1	PIPE	1/2"	PL	5	m	
	A7	NIPPLES	1/2"	TH x BW	1	No	
	A14	STRAIGHT COUPLING	1/2"	THXTH–F	1	No	
	A15	SWAGE NIPPLE	3/4"x1/2"	BW x BW	1	No	
	A22	EQUAL TEE	1/2"	BWxBWxBW	1	No	
	A39	GATE VALVE, 1500#	1/2"	BW	2	No	
	A51	CAP	1/2"	TH	1	No	
	A53	SYPHON C–TYPE	1/2"	BW x TH	1	No	
	A12	ELBOW	1/2"	BW	1	No	
	A41	FLANGE, 1500#	1/2"	WNRTJ	2	No.	
	G61	GASKET–SOFT IRON	1/2"	O–RING	1	No	
	G71	STUD WITH TWO NUTS	M20x120	–	4	No	
	G113	PIPE CLAMP	1/2"	TH	4	No	

भेल BHEL HYDERABAD	SERVICE	INSTALLATION:	DIRECT–ON PIPE METER ABOVE	STANDARD	
	STEAM	INST. TYPE:	PRESSURE GAUGE		
		PR. RATING	HIGH PRESSURE (ABOVE 600#)	SHEET NO. 04 of 16	REV. 00

Scheme-5



P : PIPE
T : TUBE

* GASKET,STUD,NUTS FOR FLANGE CONNECTION BY PIPING.

LIST OF ITEMS

SYMBOL	ITEM NO.	DESCRIPTION	SIZE	ENDS	QTY.	UNIT
——	1	PIPE	1/2"	PL	A/R	MTR.
⟷	6	NIPPLE	1/2"	PL x PL	1	NO.
⟷	7	NIPPLE	1/2"	TH x PL	5	NO.
⊥	21	EQUAL TEE	1/2"	TH	1	NO.
⊥	22	EQUAL TEE	1/2"	SW	1	NO.
——	31	COUPLING	1/2"	SW	1	NO.
⋈	39	GATE VALVE	1/2"	SW	2	NO.
||	41	FLANGE	1/2"	SW	2	NO.
⊢	51	CAP	1/2"	TH	2	NO.
	61	GASKET	1/2"		1	NO.
	71	STUD & NUTS	1/2"FL		1	SET
||	94	FLANGE	1 1/2" X 1/2"	FL X TH	1	NO.
———	116	TUBE	12MM	OD	A/R	MTR.
	122	MALE CONNECTOR	1/2" x 12MM	TH x OD	2	NO.

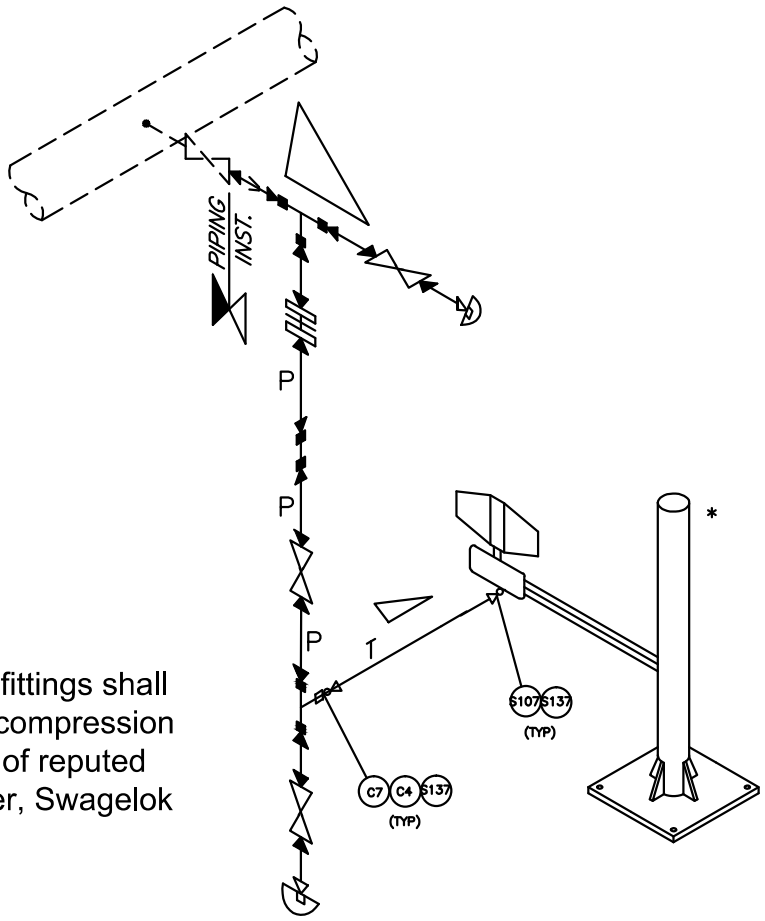
Note:
1. All tube and tube fittings shall be flareless double compression (four pieces) type & of reputed make such as Parker, Swagelok and Ermeto.

भीएचईएल BHEL HYDERABAD

TITLE :
PRESSURE INSTRUMENT ON VESSEL
METER BELOW

Sheet No. 05 of 16, Rev 00

Scheme-6



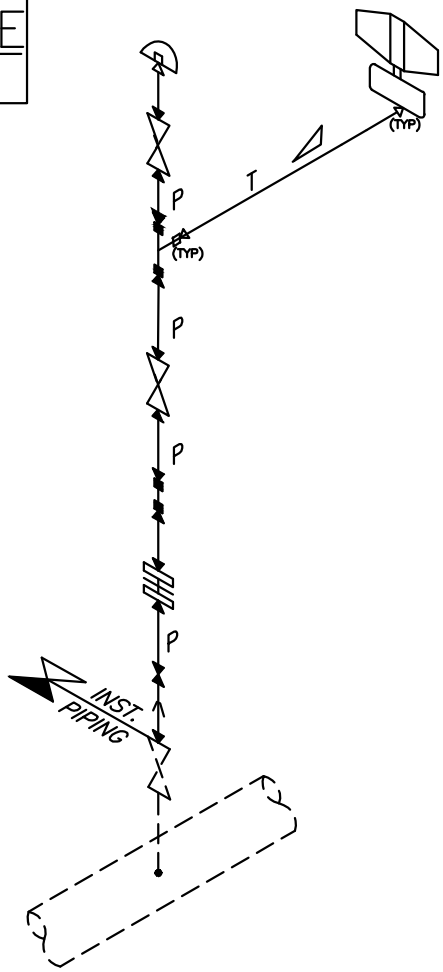
Note:
1. All tube and tube fittings shall be flareless double compression (four pieces) type & of reputed make such as Parker, Swagelok and Ermeto.

* INSTRUMENT SUPPORT SHOWN IS TYPICAL. IT MAY BE FABRICATED AS PER SITE CONDITIONS.

SYMBOL	ITEM NO.	DESCRIPTION	SIZE	ENDS	QTY	UNIT	
T	S107	TUBE 1/2"	1/2"	PL	10.0	m	
o	S137	MALE CONNECTOR	1/2"	TH	2	NoX	
P	C1	PIPE	1/2"	PL	10.0	m	
◂▸	C6	NIPPLES	1/2"	PL x PL	3	No	
◂▸	C7	NIPPLES	1/2"	TH x PL	3	No	
◂▸	C15	SWAGE NIPPLE	3/4"x1/2"	PL x PL	1	No	
⊥	C22	EQUAL TEE	1/2"	SWxSWxTH	2	No	
⋈	C39	GATE VALVE	1/2"	SW	3	No	
▯	C41	FLANGE, 300#	1/2"	WNRF	2	No	
|	C61	MSW GASKET, 300#ED	1/2"		1	No	
—	C71	STUD WITH TWO NUTS	M12x80		4	No	
⊢	C51	CAP	1/2"	TH	2	No	
⌐	C12	ELBOW	1/2"	SW	1	No	
	C113	PIPE U CLAMP	1/2"	TH	6	No	
▪—▪		STRAIGHT COUPLING	1/2"	SWxSW	1	No	

भेल BHEL HYDERABAD	SERVICE	INSTALLATION: REMOTE-ON PIPE METER BELOW	STANDARD	
	LIQUID, COND. VAPOURS	INST. TYPE: PRESSURE TRANSMITTER/SWITCH		
		PR. RATING: LOW PRESSURE (UPTO 600#)	SHEET NO. 06 of 16	REV. 00

NOT APPLICABLE

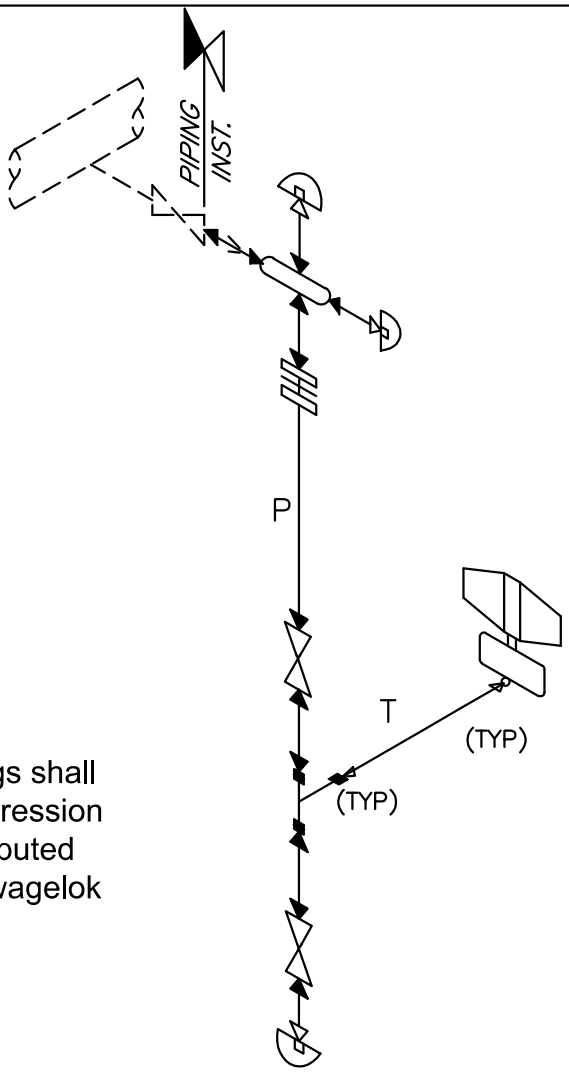


Note:
1. All tube and tube fittings shall be flareless double compression (four pieces) type & of reputed make such as Parker, Swagelok and Ermeto.

SYMBOL	ITEM NO.	DESCRIPTION	SIZE	ENDS	QTY	UNIT	
T	S107	TUBE, SS 316	1/2"	PL	2	m	
○	S137	MALE CONNECTOR	1/2"	TH	2	No	
P	C1	PIPE	1/2"	PL	10.0	m	
←→	C6	NIPPLES	1/2"	PL x PL	2	No	
←→	C7	NIPPLES	1/2"	TH x PL	2	No	
←→	C15	SWAGE NIPPLE	3/4"x1/2"	PL x PL	1	No	
⊥	C22	EQUAL TEE	1/2"	PLxPLxTH	1	No	
⋈	C39	GATE VALVE, 800#	1/2"	SW	2	No	
▯	C41	FLANGE, 300#	1/2"	WNRF	2	No	
|	G61	MSW GASKET, 300#	1/2"		1	No	
—	G71	STUD WITH TWO BOLTS	M12x80		4	No	
⊢	51	CAP	1/2"	TH	1	No	
⌐	C12	ELBOW	1/2"	SW	1	No	
■—■	C14	STRAIGHT COUPLING	1/2"	SWxSW	1	No	
	G113	PIPE U CLAMP	1/2"	TH	6	No	

भेल BHEL HYDERABAD	SERVICE	INSTALLATION:	REMOTE-ON PIPE METER ABOVE	STANDARD	
	GAS SERVICE, AIR	INST. TYPE:	PRESSURE TRANSMITTER/SWITCH		
		PR. RATING	LOW PRESSURE (UPTO 600#)	SHEET NO. 07 of 16	REV. 00

Scheme-8

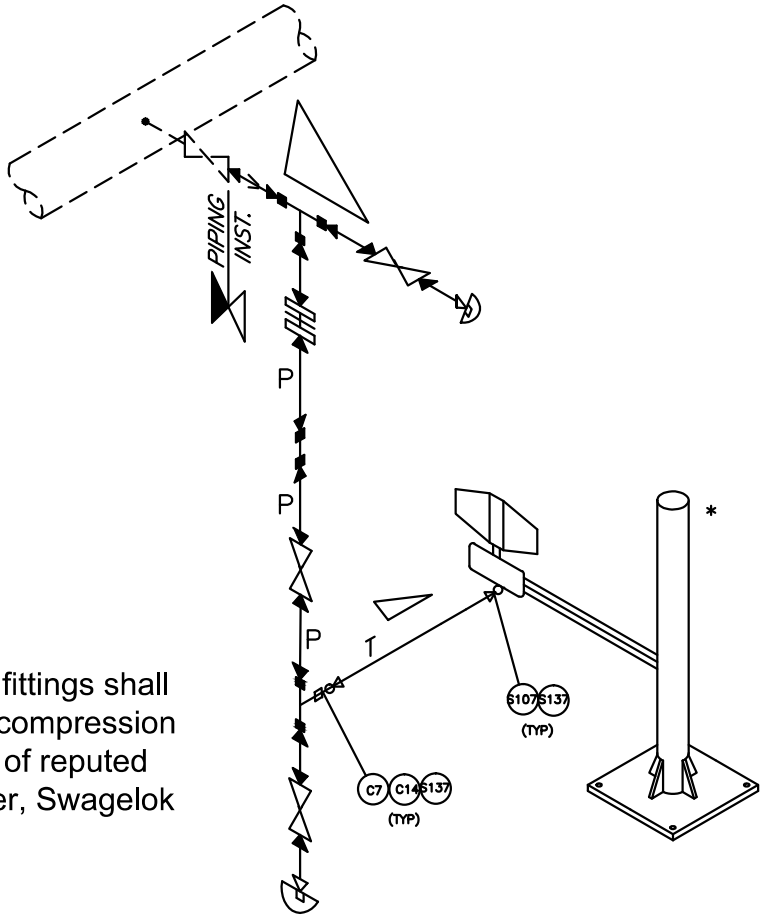


Note:
1. All tube and tube fittings shall be flareless double compression (four pieces) type & of reputed make such as Parker, Swagelok and Ermeto.

SYMBOL	ITEM NO.	DESCRIPTION	SIZE	ENDS	QTY	UNIT	
T	S107	TUBE SS316	1/2"	PL	2	m	
○	S137	MALE CONNECTOR	1/2"	TH	2	No	
P	C1	PIPE	1/2"	PL	10	m	
←→	C6	NIPPLE	1/2"	PL x PL	3	No	
←→	C7	NIPPLE	1/2"	TH x PL	4	No	
←→	C15	SWAGE NIPPLE	3/4"x1/2"	PL x PL	1	No	
⊥	C21	EQUAL TEE	1/2"	SWXSWXTH	1	No	
⋈	C39	GATE VALVE, 800#	1/2"	SW	2	No	
▯	C41	FLANGE, 300#	1/2"	WNRF	2	No	
|	G62	GASKET, 300#	1/2"		1	No	
—	C71	STUD WITH TWO NUTS	M12x80		4	No	
⊢	C51	CAP	1/2"	TH	3	No	
⊂⊃	C10	CONDENSATE POT	1/2"	SW	1	No	
□—□	C14	STRAIGHT COUPLING	1/2"	SW	1	No	
	G113	PIPE U CLAMP	1/2"	TH	6	NO	

भेल BHEL HYDERABAD	SERVICE	INSTALLATION: REMOTE ON PIPE METER BELOW	STANDARD	
	STEAM	INST. TYPE: PR. TRANSMITTER/SWITCH		
		PR. RATING: LOW PRESSURE (UPTO 600#)	SHEET NO. 08 of 16	REV. 00

Scheme-9

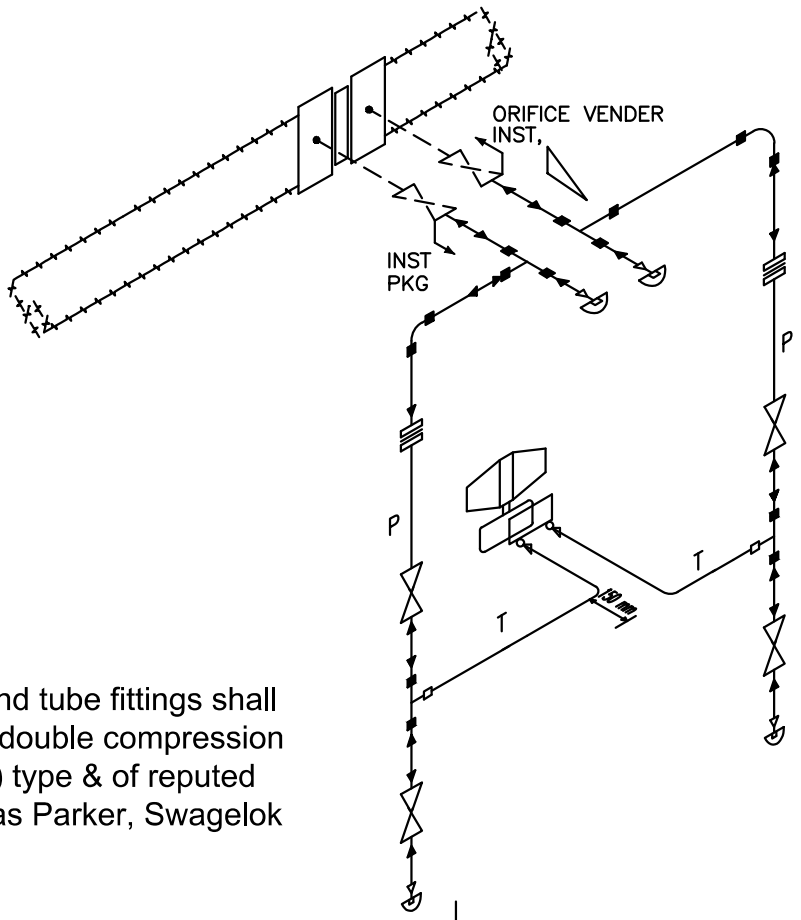


Note:
1. All tube and tube fittings shall be flareless double compression (four pieces) type & of reputed make such as Parker, Swagelok and Ermeto.

* INSTRUMENT SUPPORT SHOWN IS TYPICAL. IT MAY BE FABRICATED AS PER SITE CONDITIONS.

SYMBOL	ITEM NO.	DESCRIPTION	SIZE	ENDS	QTY	UNIT	
T	S107	TUBE 1/2"	1/2"	PL	10.0	m	
O	S137	MALE CONNECTOR	1/2"	TH	2	NoX	
P	S1	PIPE	1/2"	PL	10.0	m	
←→	S6	NIPPLES	1/2"	PL x PL	3	No	
←→	S7	NIPPLES	1/2"	TH x PL	3	No	
←→	S15	SWAGE NIPPLE	3/4"x1/2"	PL x PL	1	No	
⊥	S22	EQUAL TEE	1/2"	SWxSWxTH	2	No	
⋈	S39	GATE VALVE,800#	1/2"	SW	3	No	
▯	S41	FLANGE, 300#	1/2"	WNRF	2	No	
|	S61	MSW GASKET, 300#	1/2"		1	No	
—	S71	STUD WITH TWO NUTS	M12x80		4	No	
⊢	S51	CAP	1/2"	TH	2	No	
⌐	S12	ELBOW	1/2"	SW	1	No	
	S113	PIPE U CLAMP	1/2"	TH	6	No	
⊏⊐	S14	STRAIGHT COUPLING	1/2"	THxTH	1	No	

भीएचईएल BHEL HYDERABAD	SERVICE	INSTALLATION:	REMOTE-ON PIPE METER BELOW	STANDARD	
	LIQUID, COND. VAPOURS	INST. TYPE:	PRESSURE TRANSMITTER/SWITCH		
		PR. RATING	LOW PRESSURE (UPTO 600#)	SHEET NO. 09 of 16	REV. 00

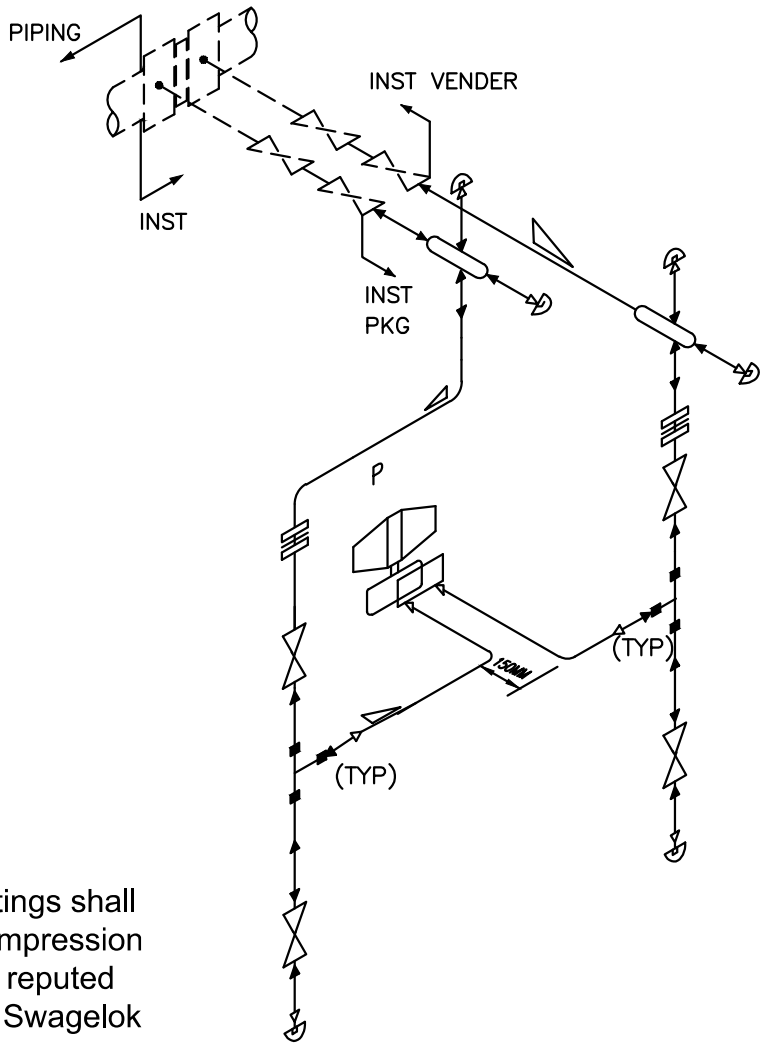


Note:
1. All tube and tube fittings shall be flareless double compression (four pieces) type & of reputed make such as Parker, Swagelok and Ermeto.

SYMBOL	ITEM NO.	DESCRIPTION	SIZE	ENDS	QTY	UNIT	
T	S107	TUBE SS316	1/2"	PL	4	m	
○	S137	MALE CONNECTOR	1/2"	TH	4	m	
	C24	TEE	1/2"	PL	2	No	
P	C1	PIPE	1/2"	PL	20	m	
←→	C6	NIPPLE	1/2"	PL x PL	6	No	
	C12	STRAIGHT COUPLING	1/2"	TH	2	M	
←→	C7	NIPPLE	1/2"	TH x PL	6	No	
	C22	TEE	1/2"	PLxPLxPL	4	No	
⋈	C38	GATE VALVE, 800#	1/2"	SW	4	No	
	C51	CAP	1/2"	TH	4	No	
▯	C41	FLANGE, 300#	1/2"	WNRF	4	No	
|	G62	MSW GASKET 300#	1/2"		2	No	
—	G71	STUD WITH TWO NUTS	M12x80		8	No	
	G900	3 WAY MANIFOLD	1/2"NPTM	TH	1	No	
	G113	PIPE U-CLAMP	1/2"	TH	12	No	
	C12	ELBOW	1/2"	SW	4	No	

भेल BHEL HYDERABAD	SERVICE	INSTALLATION:	REMOTE-ON-PIPE METER BELOW	STANDARD	
	LIQUID	INST. TYPE:	FLOW TRANSMITTER (DP TYPE)		
		PR. RATING	LOW PRESSURE (UPTO 600#)	SHEET NO. 10 of 16	REV. 00

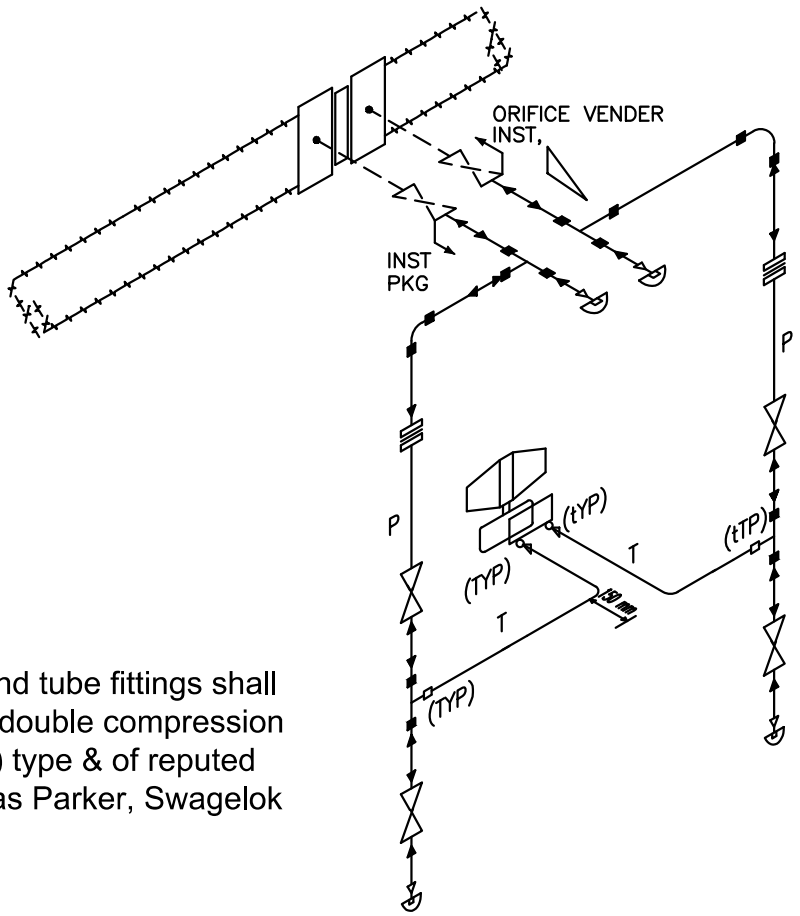
Scheme-11



Note:
1. All tube and tube fittings shall be flareless double compression (four pieces) type & of reputed make such as Parker, Swagelok and Ermeto.

SYMBOL	ITEM NO.	DESCRIPTION	SIZE	ENDS	QTY	UNIT	
	C14	STRAIGHT COUPLING	1/2"	TH	2	NO	
T	S107	TUBE SS316	1/2"	PL	4	m	
	S137	MALE CONNECTOR	1/2"	TH	4	No	
P	C1	PIPE	1/2"	PL	20	m	
	C6	NIPPLE	1/2"	PL x PL	8	No	
	C7	NIPPLE	1/2"	TH x PL	8	No	
	C39	GATE VALVE 800#	1/2"	SW	4	No	
	C51	CAP	1/2"	TH	6	No	
	C41	FLANGE 300#	1/2"	WNRF	4	No	
	G62	MSW GASKET 300#	1/2"		2	No	
	G71	STUD WITH BOLTS	M12x80		8	No	
	10	CONDENSATE POT	1/2"	SW	2	No	
	C22	TEE	1/2"	SWxSWxSW	4	No	
	C12	ELBOW	1/2"	SW	2	No	
	G113	PIPE U-CLAMP	1/2"	TH	12	No	

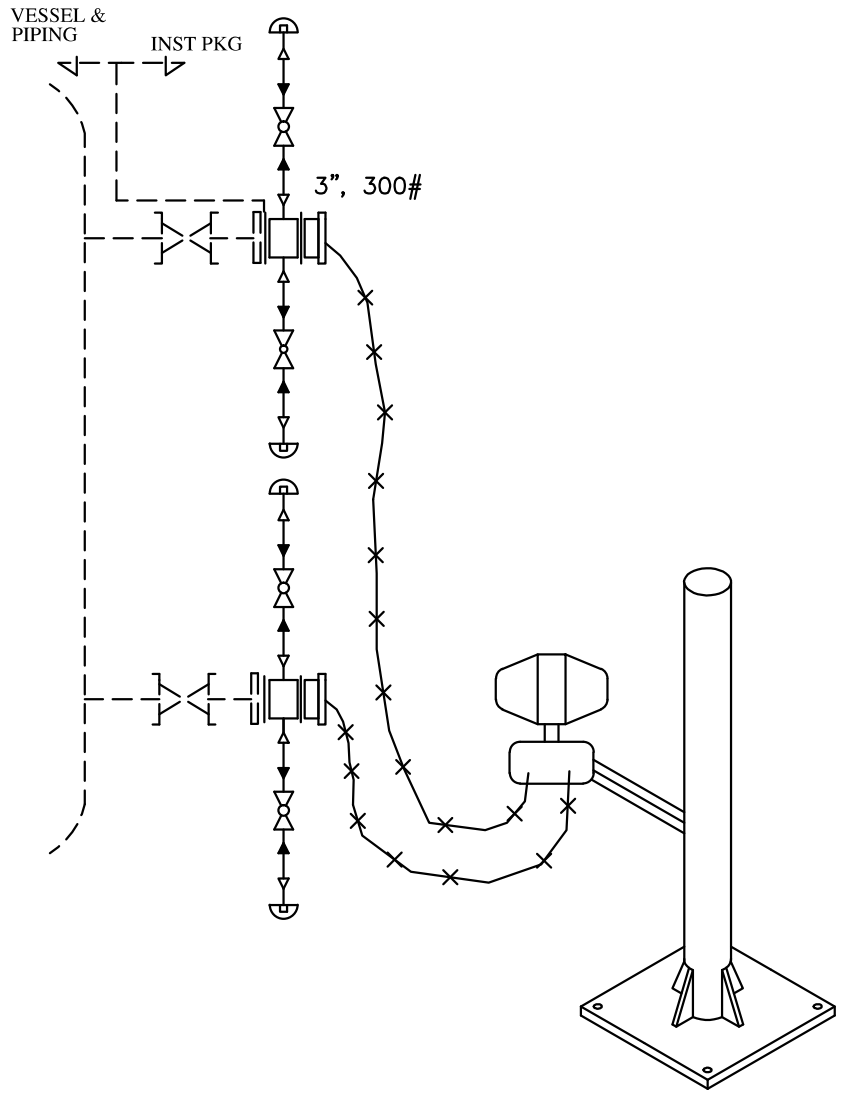
भेल BHEL HYDERABAD	SERVICE	INSTALLATION:	REMOTE-ON-PIPE METER BELOW	STANDARD	
	STEAM	INST. TYPE:	FLOW TRANSMITTER (DP TYPE)		
		PR. RATING	LOW PRESSURE (UPTO 600#)	SHEET NO. 11 of 16	REV. 00



Note:
1. All tube and tube fittings shall be flareless double compression (four pieces) type & of reputed make such as Parker, Swagelok and Ermeto.

SYMBOL	ITEM NO.	DESCRIPTION	SIZE	ENDS	QTY	UNIT	
T	S107	TUBE SS316	1/2"	PL	4	m	
◯	S137	MALE CONNECTOR	1/2"	TH	4	m	
P	S1	PIPE	1/2"	PL	20	m	
←→	S6	NIPPLE	1/2"	PL x PL	6	No	
←→	S7	NIPPLE	1/2"	TH x PL	6	No	
⊥	S22	TEE	1/2"	PLxPLxPL	4	No	
⋈	S39	GATE VALVE, 800#	1/2"	SW	4	No	
⊐	S51	CAP	1/2"	TH	4	No	
▯	S41	FLANGE, 300#	1/2"	WNRF	4	No	
|	G62	MSW GASKET 300#	1/2"		2	No	
—	G71	STUD WITH TWO NUTS	M12x80		8	No	
▭	G900	3 WAY MANIFOLD	1/2"NPTM	TH	1	No	
	G113	PIPE U-CLAMP	1/2"	TH	12	No	
⌐	S12	ELBOW	1/2"	SW	4	No	

भेल BHEL HYDERABAD	SERVICE	INSTALLATION:	REMOTE-ON-PIPE METER BELOW	STANDARD	
	LIQUID	INST. TYPE:	FLOW TRANSMITTER (DP TYPE)		
		PR. RATING	LOW PRESSURE (UPTO 600#)	SHEET NO. 12 of 16	REV. 00



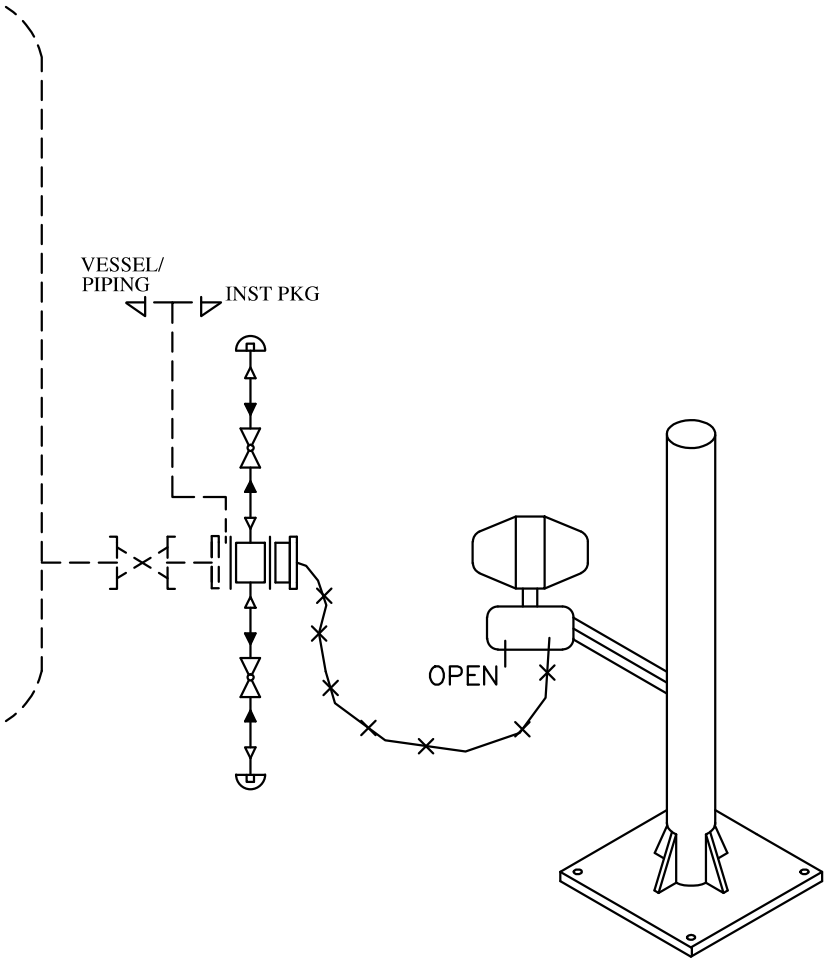
NOTE:

1. INSTRUMENT TAPPING ON ALL VESSELS, TANKS, STAND PIPE SHALL BE FREE DRAWING STOP TOWARDS VESSEL/TANK.

LIST OF ITEMS

SYMBOL	ITEM NO.	DESCRIPTION	SIZE	ENDS	QTY	UNIT	
⟷	C7	NIPPLE	1/2"	TH x PL	8	No	
⌐	C12	ELBOW	1/2"	SW	4	No	
⋈	C38	GLOBE VALVE, 800#	1/2"	SW	4	No	
⊐	C51	CAP	1/2"	TH	4	No	
|	G705	GASKET, 300#	3"		4	No	
—	G73	STUDS WITH TWO NUTS	M20 x 120	TH	2	Sets	
▯		DRIP RING WITH 2 TAPS	3" x 1/2"	FL x TH	2	No	

BHEL HYDERABAD	SERVICE	INSTALLATION: REMOTE ON PRESSURISED VESSELS/STAND PIPE	STANDARD	
	LIQUID LEVEL–PRESSURISED VESSELS/STAND PIPES	INST. TYPE: REMOTE SEAL LEVEL INSTRUMENT		
		PR. RATING: LOW PRESSURE (UPTO 600#)	SHEET NO. 13 of 16	REV. 00



NOTES:

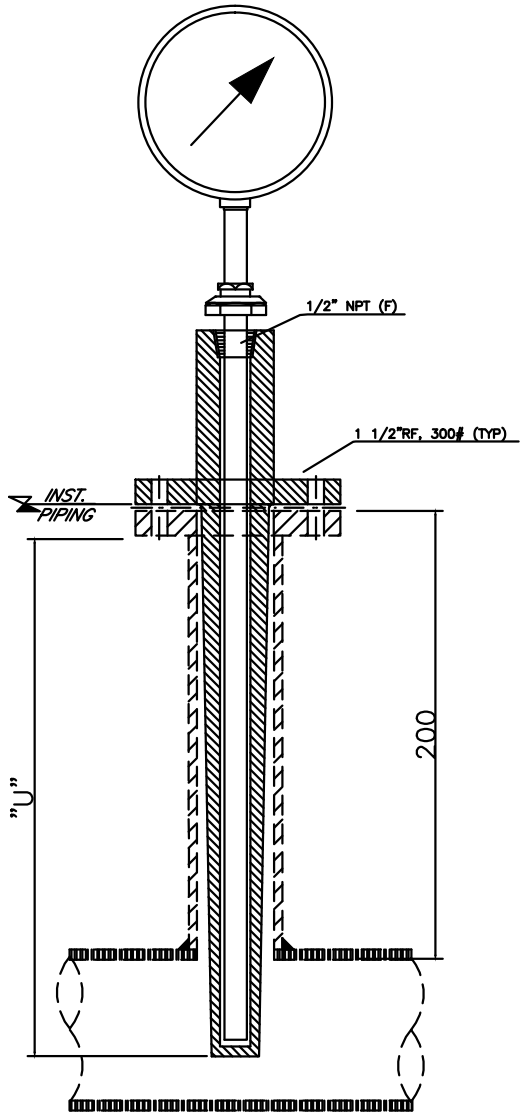
1. INSTRUMENT TAPPING ON ALL VESSELS, TANKS, STAND PIPE SHALL BE FREE DRAWING STOP TOWARDS VESSEL/TANK.
2. LP–SIDE OF TRANSMITTER SHALL BE LEFT OPEN TO ATMOSPHERE.

LIST OF ITEMS

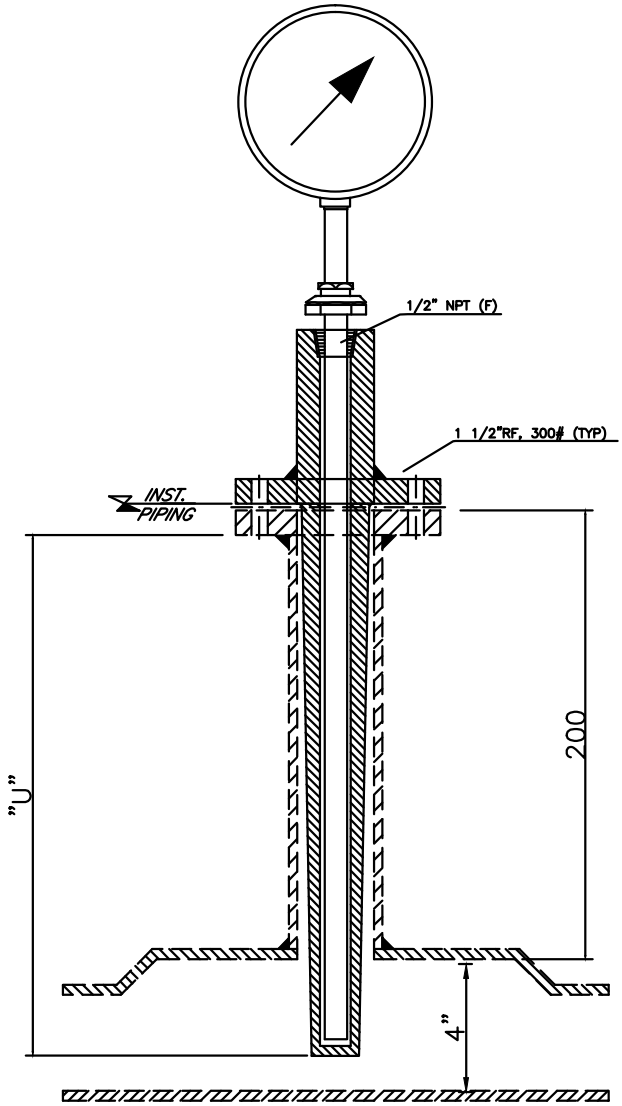
SYMBOL	ITEM NO.	DESCRIPTION	SIZE	ENDS	QTY	UNIT	
	C7	NIPPLE	1/2"	TH x PL	4	No	
	C12	ELBOW	1/2"	SW	2	No	
	C38	GATE VALVE, 800#	1/2"	SW	2	No	
	C51	CAP	1/2"	TH	2	No	
	G706	GASKET	3"		2	No	
	G73	STUDS WITH BOLTS	M20x120	TH	1	Sets	
		DRIP RING WITH 2 TAPS	3" x 1/2"		1	No	

भेल BHEL HYDERABAD	SERVICE	INSTALLATION:	REMOTE–ON NON–PRESSURISED VESSEL /STAND PIPE	STANDARD	
	LIQUID LEVEL–NON–PRESSURISED VESSELS, STAND PIPE	INST. TYPE:	REMOTE SEAL LEVEL INSTRUMENT		
		PR. RATING	LOW PRESSURE (UPTO 600#)	SHEET NO. 14 of 16	REV. 00

FOR LINE SIZE 4" & ABOVE



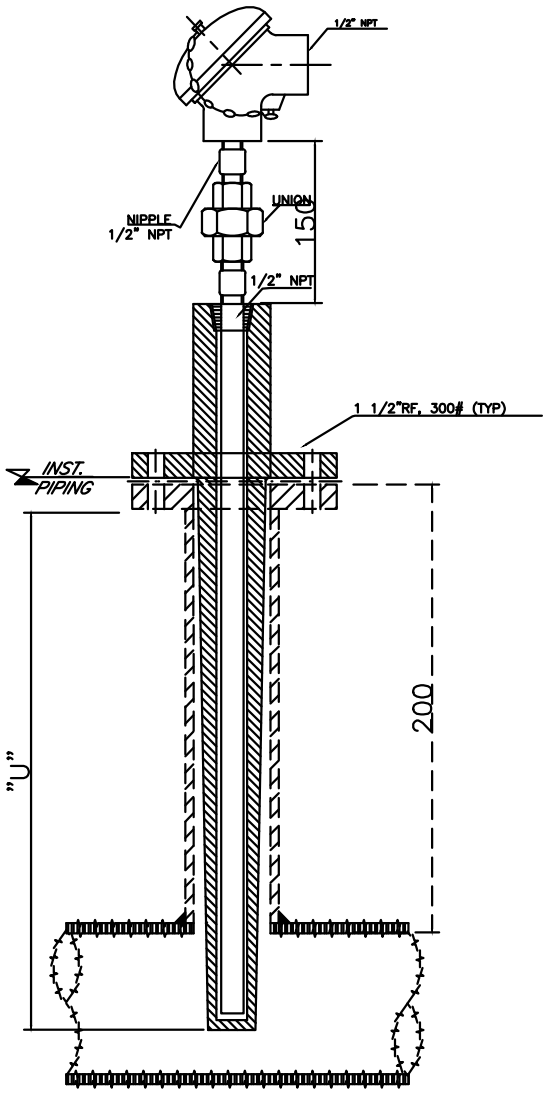
FOR LINE SIZE BELOW 4"



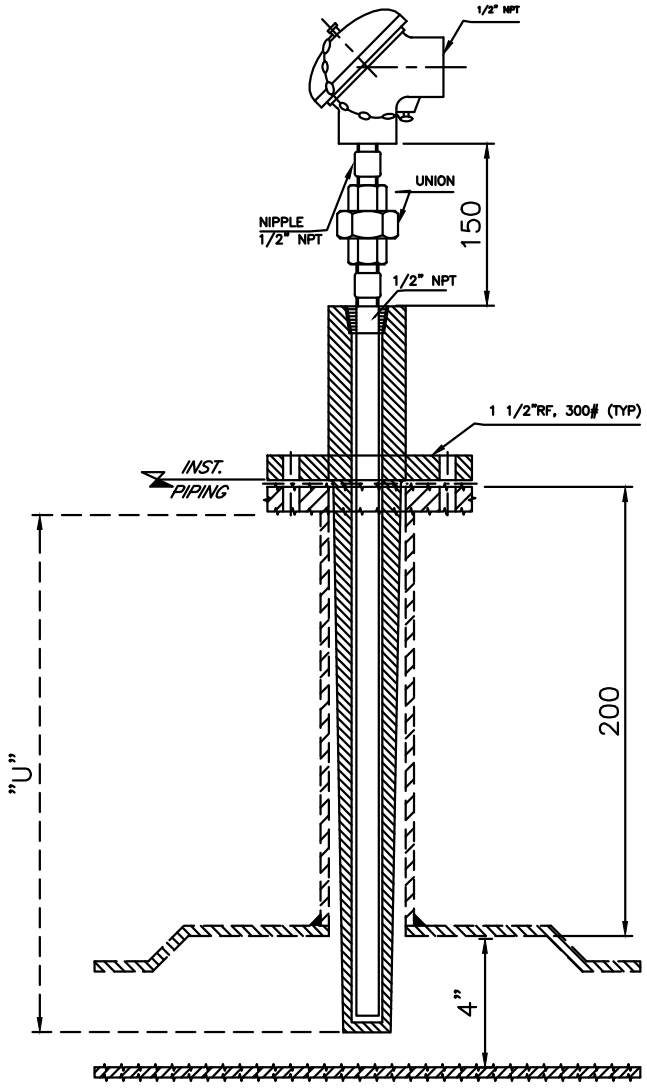
NOTE: GASKET, STUD NUTS & BOLTS ARE IN PIPING SCOPE.

भेल BHEL HYDERABAD	SERVICE	INSTALLATION:	DIRECT-ON PIPE/VESSEL	STANDARD	
	ALL SERVICES	INST. TYPE:	TEMP GAUGE WITH THERMOCOUPLE		
		PR. RATING	ALL PRESSURE	SHEET NO. 15 of 16	REV. 00

For line size 4" and above



For line size below 4"



NOTES:

IN CASE OF DUPLEX RTD / THERMOCOUPLE, TWO INDEPENDENT ELECTRICAL ENTRIES WILL BE PROVIDED.

HYDERABAD	SERVICE	INSTALLATION:	DIRECT-ON PIPE/VESSEL	STANDARD	
	ALL SERVICES	INST. TYPE:	RTD&THERMOCOUPLE WITH THERMOCOUPLE		
		PR. RATING	ALL PRESSURE	SHEET NO. 16 of 16	REV. 00

ANNEXURE - 6

MANDATORY SPARE LIST

INSTRUMENTATION

Sr.No.	Part Description	Quantity Required	Quoted–yes/no /not applicable
	Mandatory spares shall be quoted and included in base price as follows:		
1	**FIELD INSTRUMENTS**		
1.1	Pressure Gauges & Differential Pressure Gauges	20% (Subject to min. of 1) of each type, range, material of construction and rating, whichever is higher.	
1.2	Draft Gauges	10% (subject to minimum of 1) of each range of Draft gauge, whichever is higher.	
1.3	Temperature Gauges	20% (Subject to min. of 1) of each type / range of Temperature Gauges with Thermo well, whichever is higher	
1.4	Level Gauges	A) For transparent gauges, 20% of illuminators with holder and reflector and 50% of bulbs	
		B) In case of magnetic type level gauges, **1** set of float and 10% of bi-color rollers for each gauge to be provided in addition to above.	
		C) 30% subject to minimum one number of glass of each type, size along with pair of Gaskets (Cushion & Wet Gaskets), whichever is higher	
		D) 20% subject to minimum one number of Gaskets for Gauge Cocks/Valves Bonnet / Packing	
	Hydra Strap	1 no. of electronic Unit or 10% subject to minimum.	
1.5	SMART/FF Transmitters for Pressure (including PDT), Flow (DP), Level (DP) including remote seals and Temperature	15% or minimum of 2, whichever is higher of each type, range (model no.), make and material of construction of whole unit. 100% spare for transmitter manifold O-ring shall be provided.	
1.6	3 Way manifold	15% (subject to minimum of 1) of each size and material of construction, whichever is higher.	

Sr.No.	Part Description	Quantity Required	Quoted–yes/no /not applicable
1.7	Displacer Type Level Transmitters	10% subject to minimum of 1 no. of each type of complete displacer transmitter head unit including torque tube assembly.	
1.8	Servo Type Level Gauges	A) 10% or minimum one number of complete electronic unit assembly whichever is higher	
		B) 10% or minimum one number of each type of displacer whichever is higher	
		C) 10% or minimum one number of local indicators, which ever is higher.	
1.9	Ultrasonic / Radar instrument	A) 1 pair probe for each flow instrument & 1 probe / antenna for each level instrument	
		B) 10% or minimum 1 number electronic complete electronic unit assembly of each type	
		C) 2 number fuses of all types	
1.10	Capacitance/RF type instruments	10% or minimum one number of each type of complete electronic unit assembly including display of each type whichever is higher.	
1.11	Temperature Elements	20% (subject to minimum of 1) of each type, range, length and make of Thermocouple with Thermowell, whichever is higher. Same philosophy to be followed for multi point thermocouples also but without thermowell.	
1.12	RTD's	20% (subject to minimum of 1) of each length of RTD with Thermowell, whichever is higher.	
1.13	Skin Type Thermocouple	10% (subject to minimum of 1) of each length & type of skin Thermocouple, whichever is higher.	
1.14	Ceramic Thermowell	1 no. for each Tag.	
1.15	Temperature transmitters	Same as Para 1.5.	
1.16	Variable Area Flowmeter (Rotameters)	20% or minimum one no. float & set of Packing for each type, size, rating and material, whichever is higher	

Sr.No.	Part Description	Quantity Required	Quoted–yes/no /not applicable
1.17	Averaging Pitot Tube	Set of Gasket, O-ring, Packing for Retract Mechanism and one no. Needle Valve with each Pitot Tube.	
1.18	Mass Flow Meter (Coriolis and Thermal), Ultrasonic Flow meter and Magnetic Flow meter	A) Power fuses 6 no. per set B) 10% of Sensor Assembly or minimum 1 one. c) Magnetic pick up for Mag Flow meter flow measurement: 100% spare	
		C) 10% or minimum one number of each type of complete electronic unit assembly including display whichever is higher.	
1.19	Vortex Flow Meter	A) One set of gasket and Packing for each type and size.	
		B) 10% or minimum one number of each type of complete electronic unit assembly including display whichever is higher.	
1.20	PH , conductivity & Silica Transmitter	A) Electrode - 10 % or minimum 2 nos with delayed delivery to ensure shelf life.	
		B) Complete Transmitter Unit with display – 10 % or minimum 1 no.	
	Flame scanner and optical pyrometer a) Electronics b) Detector / sensor or parts with limited life	10% subjected to minimum of 1 number of each type and as required for 1 year operation or 1 set minimum.	
	Nucleonic Level Instruments	Detector Unit (full assembly) - 10 % or minimum 1 no. of each type. Radiation Survey Meter – 2 nos. minimum.	
2	**IN-LINE INSTRUMENTS**		
2.1	Control Valves	A) 100% spare for each valve 10% or minimum 2 nos of each type, size, rating of Trim set consisting of seat, seat ring / seal ring, plug with stem, cage (wherever applicable), packing material.	
		B) 20% (subject to minimum of 1) of Positioners (Smart) with links of each type and make, whichever is higher.	

Sr.No.	Part Description	Quantity Required	Quoted–yes/no /not applicable
		C) 15% (subject to minimum of 1) of Diaphragm, Actuator spring of each type/ range, whichever is higher.	
		D) 20% (subject to minimum of 1) of Air filter regulators of each make, whichever is higher.	
		E) 100% of Bonnet Gaskets/gland packing, piston O-rings, bearing & liner (of butter-fly valves) (for all types of valves).	
		F) 10% (subject to minimum of 1) of any special accessories provided along with the control valve like boosters, position transmitters (wherever applicable), proximity switches, I/P converters, air lock relay, quick exhaust relay, regulator gauges etc whichever is higher.	
	Governor Control valve	100% of Actuator & SOV	
	IGV Control Valve	100% spare with Actuator	
	Fuel Stop Valve	100% spare with Actuator	
	Diesel Engine SOV	100% Spare	
	Compressor Bleed off Valve	100% spare with Actuator	
	False start drain valve	100% spare with Actuator	
2.2	Shutdown Valves	10% or minimum one of valve with actuator of each type.	
		A) 20% (subject to minimum of 1) of Air filter regulators, whichever is higher.	
		b) Seal kit consisting of O rings, gaskets, etc. against each valve.	
		c) 20% (subject to minimum of 1) of proximity switches, whichever is higher.	

		d) 20% (subject to minimum of 1) of solenoid valves of each type, whichever is higher.	
		e) 20% (subject to minimum of 1) of accessories like quick exhaust valves and temperature dependent fuses, whichever is higher.	
2.3	Pressure Relief Valves		
	A) Disc, guide and nozzle	10% of total quantity of identical pressure relief valves or minimum one number whichever is higher.	
	B) Expansion Bellow	20% of total quantity of identical pressure relief valves or minimum one number whichever is higher.	
	C) Spring	10% of total quantity of identical pressure relief valves or minimum one number whichever is higher.	
	D) Gasket Set	20% of total quantity of identical pressure relief valves or minimum one number whichever is higher.	
2.4	Pressure control Valve (Self actuating valve)	A) Repair kit consisting of (orifice, plug, spring, gasket, diaphragm, O-ring for each valve.	
		B) 20 % or minimum 2 nos of each type/size, rating etc. of Trim set consisting of seat, seat ring / seal ring, plug with stem, cage (wherever applicable), packing material for each valve to be provided as spare.	
2.5	PRDS & De-superheater unit	Same as those of Control Valves and Shut Down valves and additionally	
		A) Gaskets for actuator per unit. B) Gaskets for valve and connections per unit (if such gaskets are special and supplied by PRDS/De-Superheater vendor)	
		C) Spray nozzle per unit.	
2.6	Breather Valves	1 Set of seal kit for each valve.	
2.7	Flame Arresters	One no. of flame arrester element and one set Gasket for each Type, Size, Rating and material.	

Sr.No.	Part Description	Quantity Required	Quoted–yes/no /not applicable
2.8	Rupture Disc	3 Nos. of Gaskets & 3 Nos. of spare discs for each Tag.	
3	**ANALYSER**	(Spares for each analyzer)	
3.1	O2 Analyser	a) Furnace Assembly – 1 b) Electronic Unit- 5% or 1 no. minimum c) Thermocouple –1 d) Sensor board –1 e) Zirconia Oxide Cell –1	
		f) Each type/rating of Fuses – 1 set	
		g) Thermistor assembly –1	
		h) Ceramic filter –1	
		i) Processor card –1	
		j) Other cards –1 each	
3.2	Methane Analyser (Infrared)	a) Rings and gasket – 2 sets of each type	
		b) Sensor and Detector – 1 no.	
		c) Rotameter – 1 no.	
		d) Pressure Control Valve – 1 no.	
		e) Fuses – 5 sets	
		f) Electronic card – 1 no.	
		g) Other Aux. Cards – 1 each	
		h) Processor card and other electronic – 1 no. Each	
3.3	Moisture Analyser	a) Sensor and detector – 1 no.	
		b) Electronic card – 1 no. each type	
		c) Fuses – 5 sets	
		d) Flow indicator & switch – 1 no.	
3.4	Hydrogen Analyser	a) Rings and gasket – 2 set of each type	
		b) Sensor and Detector – 1 no. with each analyser	
		c) Rotameter – 1 no.	
		d) Pressure Control Valve – 1 no.	
		e) Each type/rating of Fuses - 5 sets	
		f) Electronic card – 1 no. with each analyser	
		g) Other Aux. Cards – 1 each	
3.5	H2S Analyser	a) Cadmium lamp – 2 nos.	
		b) Cell window – 2 nos.	
		c) Window gasket – 10 nos.	
		d) Air regulator – 1 no.	

Sr.No.	Part Description	Quantity Required	Quoted–yes/no /not applicable
		e) Seal kit fro ball valve – 4 nos.	
		f) Kit-o-ring – 2 sets	
		g) Seal kit, Air act. – 2 nos.	
		h) Fuse – 5 Set each	
		i) Relay – 1 set each	
		j) Display Board – 1 no. with each analyser	
		k) Processor Board – 2 nos.	
		l) Other Cards – 2 each	
3.6	CO + CO2 Analyser	a) Fuses – 1 set of each type	
		b) Ring – 2 sets of each type	
		c) Mother board – 2 nos.	
		d) Filter assembly band pass with guard – 2 nos.	
		e) Filter – 1 set of each type	
		f) IR/UV Lamp – 2 nos.	
		g) Other cards – 1 each	
		h) Detector heaters – 1 each	
3.7	SOx / NOx Analyser	a) Filter of each type – 2 sets	
		b) Critical orifice – 1 no.	
		c) Vacuum pump / Ejector – 1 no.	
		d) Ring set – 1 no. each	
		e) Processor / Mother board – 2 nos.	
		f) Display board – 2 nos.	
		g) Optical bench – 1 no.	
		h) Filter detector – 2 nos.	
		i) Fuses – 1 set of each type	
		j) Other cards –1 each	
		k) Ozonaotor –1	
		l) Cuvette –2 nos	
		m) Chopper motor – 1 no.	
		n) Dessican & flow sensor – 1 no. each	
3.8	Chromatograph	a) Filter – 2 sets	
		b) Display Board – 1 no.	
		c) Processor Board – 1 no.	
		d) Chromatograph Column	
		e) Solenoid valve (10% subject to minimum of 1 of each type	

Sr.No.	Part Description	Quantity Required	Quoted–yes/no /not applicable
3.9	Sampling systems	For various instrument types used in sampling systems, spares philosophy shall be as per this document.	
	Sample Conditioning system applicable for all analysers	a) Complete sample kit for sample pumps inclusive of 'O-ring, Seal ring, Diaphragm etc. – 1 set for each pump.	
		Consumables like filters, membranes, reagents, Calibration Gas, Carrier Gas, Reference gas, etc., – for 1 year continuous operation.	
		SHS fittings, valves, pressure gauges, regulators, solenoid valves, flow meters, switches and other components, etc.- 10% or minimum 1 no.	
		c) Flow switch – 1 no	
		d) Vaporization system if required, which includes vaporizer, thermostat, electrical tracing cable and heater etc. – 1 set	
		e) Cooling system if required, which includes one cooler, flow conditioning system etc., - 1 set.	
		f) Probe Filter – 2 Nos.	
		i) Probe Tube – 2 Nos.	
		j) Probe heater & Temp. sensors – 2 nos.	
3.10	HC Analyzer	1 No. set consist of a) PCX 2 Power Board b) Water Detector Set c) Strainer Set	
3.11	SPM Analyzer	a) Power supply unit- 1 no. b) Processor Board-1 no. c) LCD Module- 1 no.	
4	**DCS, PLC, AIMS, HART, OPC Server, Annunciation system, SCADA and Governor Control System**	These spares are in addition to 20% installed spares.	
	A) Modules	10% or minimum 2 modules of each type (processor module, I/O module, communication module, power supply module, FTA Cards, Switches, Operator	

		Keyboard, hard disk etc.) being used inclusive of those used in consoles. This shall include spare modules for hardwired instruments also.	
		10% or minimum 2 nos. of Safety Barriers, Signal Converters, Trip Amplifiers, PB, Selector switches, Lamps, including all hardwired instruments, etc.	
		20% or minimum one no. of each type of Fuses, MCB's, Auxiliary relays.	
		10% or minimum 2 Nos. of bulk power supply unit, diode O-ring Unit of each rating.	
		10% or minimum 2 nos. of communication system components such as hubs, switches, routers, etc. whichever is higher.	
		10% or minimum 1 nos. of Cables like FTA, communication bus, etc. of each type and rating.	
		10% or minimum 2 nos. of System oriented items like FF Bus system, power conditioners, Field barriers, FTA Card, Barrier power supply unit, surge suppressor, Field Junction Boxes, special cables, connectors, fuse, etc.	
	C) Consumables	Consumable spares including Laser printer cartridges, Paper or any other consumable items supplied along with the system required for a minimum of 6 months duration after system acceptance.	
5	**OTHER ITEMS**		
5.1	Loop powered indicators	20% (subject to minimum of 2) of Loop powered indicators used, whichever is higher.	
5.2	Solenoid Valves	20% or minimum 2 nos. of solenoid valves of each type used.	
5.3	Junction Box & Cable glands	10% subject to minimum one no. for each type, size whichever is higher.	
5.4	Panel mounted instruments	10% or minimum one no. whichever is higher.	
	Local Panel & Hardwired	Loose supply 10% or minimum one no.	

	Console All items like Push Button, indicators, hand switches lamps, relays, selectors switches, IS type indicators / Annunciators, holders etc. mounted in the local panel.	whichever is higher.	
6	**CCTV**	10% of or minimum of one number of each type of module / sub-system with minimum of following	
		A) Camera Station – 1 no.	
		B) Camera : 1 no.	
		C) Lens with zoom – 1 no.	
		Pan & Tilt Unit-1 no.	
		D) Water tank with tube, bracket – 1 no.	
		E) Receiver and drive – 1 no.	
		F) Keypad including joy stick – 1 no.	
		Power Supply Unit – 1 no.	
		Monitors – 1 no.	
		Network Switches – 1 no.	
		Amplifiers Switches – 1 no.	
7	**Machine Monitoring System**	A) 10% or minimum 2 nos. of each type of probes (vibration, speed, displacement etc.) and transducers/ proximator/ extension cables/ connector protective sleeves etc.	
		B) Electronic modules / cards: 10% or minimum 1 no. of each type, whichever is higher.	
		C) Portable, offline measurement kits : 1	
		D) Monitor units : 10% or minimum 1 no. of each type, whichever is higher.	
		E) TDxNet cards : 1 set of each type used.	
		F) Bearing Temperature Elements at exhaust, wheel space: 100% spare	
8	**Gas detection system**	Sensors : 20% or minimum 2 sets of each type, whichever is higher.	

		Transmitter Unit with display : 10% or minimum of 1 set of each type used, whichever is higher.	
9	**Anti Surge Controller / Woodward Governor / Power Supply unit**	1 complete set.	
	Compressor / Blower spares like – vibration probes with leads, axial displacement probes with leads, bearing temperature element, speed probes with leads, I/H converter, trip solenoid valves, transducer, barriers, other electronic modules	10% or minimum 1 no. of each type, whichever is higher.	
10	Other Items	a) Manual Call Points – 10 % b) Fire Detectors – 10 %	

NOTES :-

1	Above-mentioned mandatory spares list defines the minimum requirement. Contractor to provide any additional items as recommended by manufacturer. Contractor to submit mandatory spares list to Owner / PMC for approval.
2	Similar philosophy shall be followed for packaged units. For Other Items not covered in this list, 10% or minimum 1 (Which ever is higher) of each type of electronic card & one fuse set shall be provided.
3	Contractor to submit spares list for 2-year operation and maintenance. The prices shall be valid for at least 2 years from date of order.
4	All spare items required for commissioning shall be supplied by contractor.
5	Next rounded figure to be considered wherever % is specified. Example: For total 11 Nos. Instruments with 10% spares basis, 2 Nos. spares shall be provided.

ANNEXURE-16

METEOROLOGICAL DATA AND PLANT LOCATION

3.0 PLANT LOCATION

The Unit will be located in the Refinery III Complex of the Manali Refinery. This section presents brief details.

3.1 Site Location

- State : Tamil Nadu
- Nearest Important Town : Chennai- 15 km
- Nearest Railway : Chennai central - 15 km
- Nearest Port : Chennai port- 13 km
- Nearest Airport : Chennai - 35 km (Meenambakkam airport)

3.2 Source of Water : From Chennai Metropolitan Water Supply & Sewerage Board and Recycled Water

3.3 Rainy season : October to December

4.0 METEOROLOGICAL DESIGN DATA

4.1 Refer Engineering Design Basis for complete details of meteorological design data. This section presents relevant data towards preparing process-engineering specifications.

Sl#	Parameter	Minimum	Normal / Average	Maximum / Design
(A) METEOROLOGICAL DATA				
1	Elevation above mean sea level, m	3.5		
2	Barometric pressure, mbar			
3	Ambient temperature, °C	t_{min} =18	t_{nor} = 35	t_{max} =45
4	Relative humidity, %	@ t_{min}	@ t_{nor}	80% @ t_{max}
5	Rainfall data (mm) (a) for 1-hour period (b) for 24-hour period			100 450
6	Wind data (a) wind velocity (b) wind direction			180 km/hr (as per IS:875 Part-III). North East & South West
(B) DATA FOR EQUIPMENT DESIGN				
1	Design dry bulb temperature, °C			38
2	Design wet bulb temperature, °C			29
3	Low ambient temperature for MDMT, °C			NA
4	Design air temperature for air cooled exchangers where ***followed*** by water cooling, °C			40
5	Design air temperature for air cooled exchangers where ***not followed*** by water cooling, °C			42
6	Coincident temperature and relative humidity for Air Blower / Air Compressor design.			80 % at 45 ^{o} C
7	Min. Design temperature for equipment			65 ^{o} C

ANNEXURE-17

INSPECTION, TESTING, QUALITY AND MONITORING PROCEDURE

JACOBS

CPCL

RESIDUE UPGRADATION PROJECT

TITLE:INSPECTION & MONITORING FOR GAS TURBINE GENERATOR AND HRSG PACKAGE

DOCUMENT NO : 44 NC 4600- 005

A	26.09.13	14	ISSUED FOR FEED	GMG	APK	PKB
Rev No.	**Issue Date**	**Pages**	**Rev Description**	**Prepared By**	**Checked By**	**Approved By**

TABLE OF CONTENTS

1.0 PURPOSE :

This document describes inspection procedure / methodology to be followed for review of QAP/Inspection procedures, Inspection, Monitoring and review of inspection related activities/documents of equipment / items to be supplied by Gas Turbine Generator and HRSG package vendor for CPCL to ensure compliance of Quality Standards.

2.0 SCOPE :

The requirement of this procedure is applicable to Gas Turbine Generator and HRSG package for supply of systems, equipment and materials, etc.

3.0 DEFINITIONS :

3.1 'PMC' means Jacobs Engineering India Pvt.Ltd.

3.2 'Vendor' means supplier of Gas Turbine Generator and HRSG package.

3.3 Supplier, sub-supplier, agents, sub-contractor, etc are considered synonymous to Gas Turbine Generator and HRSG package vendor.

3.4 Abbreviations :

3.6	MR	:	Material Requisition/ Technical Order Indent
	PS	:	Purchase Specification including technical specifications and agreed variations, if any
	QAP	:	Quality Assurance Plan
	PMI	:	Positive Metal Identification
	NDT	:	Non-destructive Testing
	GTAW	:	Gas tungsten are welding
	ITP	:	Inspection & Test Plan
	RT	:	Radiography Testing
	UT	:	Ultrasonic Testing
	MPT	:	Magnetic Particle Testing
	LPT	:	Liquid Penetrant Testing
	MRT	:	Mechanical Run Test
	IRC	:	Inspection Release Certificate
	CR	:	Concession Request
	NCN		Non-conformity notice
	TPIA		Third party Inspection agency **(Appointed by Gas Turbine Generator and HRSG Package vendor)**
	IBR		Indian boiler regulation
	CCEO		Chief controller explosive office
	CMIFR		Central institute of mining & fuel research
	PESO		Petrolium & explosive safety organization
	ATEX		Atmospheric Explosive

3.7 Inspection Category:
Grouping of various equipment and materials based upon criticality of service condition and manufacturing standard.

4.0 GENERAL :

4.1 Items / equipment (indicated in attachment 9.1) to be procured or fabricated from suppliers shall be approved by JACOBS. In this regard, no difference made between the equipment and materials purchased by the vendor directly or through his contracted agencies. Sub-supplier list to be approved at pre-order stage.

Any deviation to sub-vendor list needs JACOBS prior approval. List of JACOBS approved suppliers is attached elsewhere in this bid document / contract.

Some of the lincensed items, if applicable shall be procured from suppliers approved by process licensors.

Equipment/items covered under this specification shall be subjected to inspection and testing by TPI during manufacturing. **JACOBS will also witness inspection stages as indicated in approved QAP/ITP.** However, the approval by the JACOBS during such inspection or test shall not prejudice the right of the JACOBS/CLIENT to reject the equipment if it is found at any stage of supply, erection or commissioning that the equipment/item does not comply the specifications or does not provide complete satisfaction in service w.r.t. performance and / or guarantee parameters and / or reliability and / or safety. The cost of all such repair & test shall be borne by the vendor.

It shall be the responsibility of vendor to ensure that adequate notice is given to the TPI, JACOBS and the statutory authorities to enable them to arrange the visits of their Inspectors to suit the manufacturing schedule.Vendor to ensure readiness of inspection stages before Inspection notification to TPI, JACOBS. In case of failed inspection visit (where inspection stages are not ready as confirmed by vendor), JACOBS can back charge visit cost (professional charges + expenses) to vendor.
Unless specified otherwise, minimum (1 working week for indigenous and 3 working weeks for imported items / equipment) prior notice shall be given for inspection or test to be carried out.
TPI, JACOBS/CLIENT Inspector shall have access at all times to all parts of shop where manufacturing is under progress and also reasonable inspection facilities to be provided by the vendor and his supplier without any cost implications.
Any type of inspection or test, if necessary for installation, commissioning and operation of Gas Turbine Generator and HRSG package in accordance with the statutory requirements, shall be part of Vendor's scope whether specified or not in approved ITP / QAP and shall be carried out by Vendor without any time and cost implication to Owner.

4.2 Inspection of all the components of Gas Turbine Generator and HRSG package shall be carried out by approved TPI. M/s. LRA, TUV, DNV, BV, Intertek-Moodi International are approved TPI agencies. Vendor may propose additional TPI for JACOBS/ CLIENT approval. However the final responsibility of inspection shall be with vendor only.

4.3 Vendor shall include all statutory inspection requirements in Inspection & test plan of all stamped equipment (Like ..ASME, IBR,CMRI, PESO etc.)

4.4 Final inspection and despatch clearance shall be based on drawings/documents approved in Code-F by JACOBS.

5.0 METHODOLOGY :

5.1 Vendor shall prepare and submit the QA / QC procedure to be adapted to Inspection manager of Consultant - Jacobs Engineering for review. The QA / QC procedure shall cover all the activities to be performed by vendor and their supplier. The procedure shall cover the following as a minimum.

a) Quality Assurance Manual including organogram, Standard Quality Assurance Plan.

b) Inspection co-ordination procedure.

c) Inspection procedure giving details such as material inspection , welding, pre/post weld heat treatments, NDT, PMI, performance test, Functional Test, Hydrostatic tests, string test, painting, lining, etc. covering requirement of Engineering / Licensor's specifications .

d) List of equipment (IBR & NON-IBR) with Inspection category.

e) Non-Conformity control & approval system.

f) Name of TPI who will perform the inspection.

g) Bio-data of team leader and Inspection engineers to be deployed.

h) Equipment / item final clearance, packing, logistic procedure, etc.

i) Reporting procedure for monitoring, pre-order, post-order manufacturing status, inspection and frequency of reporting & distribution.

j) Standard formats for above activities.

5.2 Inspection Categorization

5.2.1. The management of quality system shall be the responsibility of Vendor. Vendor shall categorize various items / equipment into three different categories namely A, B and C as explained below and submit the Inspection categorization plan to JACOBS for approval.

5.2.2. Explanation of Inspection category :

CATEGORY A:
Stage wise and final inspection by TPI. Final Inspection by JACOBS/CLIENT which shall be indicated in approved QAP/ITP. IRC to be issued by TPI.
Category A items listed in attachment 9.1.

CATEGORY B:
Final inspection by TPI & JACOBS/CLIENT. IRC to be issued by TPI.

CATEGORY C:
Inspection shall be carried out by TPI. IRC to be issued by TPI. TPI vetted documents shall be submitted to JACOBS/CLIENT for records.

5.2.3. Preliminary list of category 'A' & 'B' items are indicated in attachment 9.1. However, Vendor will submit final Inspection categorization plan based on attached documents, engineering requirement at post order stage for JACOBS/CLIENT approval.

Items left out from Category 'A' and 'B' list shall be considered as Category 'C'.

Vendor shall give minimum one week notice to JACOBS/CLIENT to arrange participation in such Inspections for indigenous equipment and Three weeks notice for imported equipment.

5.3 In post order stage Vendor shall organize Pre-Inspection meeting with TPI, JACOBS, CLIENT, Inspector along with his suppliers for category 'A' & 'B' items to discuss order requirements and to ensure that these requirements are fully understood by all parties including TPI. Pre-inspection meeting schedule will be mutually finalized between vendors, JACOBS & CLIENT after order placement.

5.4 a) Vendor shall submit the following documents to Consultant. Copies of purchase orders, purchase specifications alongwith approved / commented drawings, agreed deviations, variations, if any for carryout inspection/expediting at suppliers' works.

b) Progress reporting :
Vendor shall submit progress report along bar chart/manufacturing plan, engineering status, procurement status, constrints, and etc begining of every month.

5.5 Vendor's ITP and QAPs :

Vendor shall submit QAP/ITPs to JACOBS/CLIENT for each item of category 'A' and 'B' with purchase specifications for approval taking care of contractual technical requirements. This must be done prior to commencement of manufacturing activities. These plans shall be first reviewed and vetted by vendor/ TPI. QAP/ITP shall identify and include the following:

a) A document sequence of QAP/ITP activities related to the product or service provided, specific procedures, methods and work instructions to be applied to each activity shall be defined. This shall include but not limited to material inspection, qualification of welding & NDT procedures & personnel, postweld heat treatment procedures, positive material identifications (PMI) including welds , pressure tests, performance tests, string tests, strip tests and pre-shipment clearing procedures etc. as applicable.

It is recommended to use GTAW welding process for single sided full penetration pipe weld joints. In case of difficulties, Vendor can propose alternative process to JACOBS/CLIENT for review/approval.

b) For products or services to be sub-contracted, the relevant quality programme to be applied.

c) Method of verification of sub-vendors' conformance to requirement.

d) Incoming, in-process and final inspection requirements.

e) Calibration of measuring and test instruments and maintenance of calibration records. Calibration certificates shall have reference to master gauge with documentary traceability to national or International Standards.

f) Identification of the product from applicable drawings, specifications or other documents during all stages of production, delivery and installation and to ensure that each product which is going in the process of fabrication / manufacture / construction / erection has proper identification throughout the process including final output.

g) Inspection & Test status of the product shall be identified by using markings, authorised stamps, tags, route cards, inspection records etc. during the course of manufacture to clearly indicate acceptance/ rejection of tests/ stages of inspection performed during its manufacturing cycle. The identification of inspection and test status shall be maintained.

h) Statistical techniques, if employed to be identified.

i) The specific allocation of responsibilities for each activity, including identification of inspection authority responsible for the release of conforming product.

j) Traceability requirements as applicable.

k) To comply quality system vendor shall ensure the above for the production and supply of material, equipment & services.

The Inspection agencies shall always refer to approved drawings, data sheets, ITP/ QAP and mention same as reference in Inspection Reports / Inspection Release Certificates issued by them.

For Category 'C' items ITP/QAPs vetted by TPI.

5.6 a) Vendor shall ensure that all Alloy Steel / Stainless Steel bulk Materials (pipes, pipe Fittings, valves, flanges, fasteners, etc.) are properly identified and finally check tested by a PMI analyser to avoid possibilities of mix up. PMI testing shall also be done for Alloy Steel / Stainless Steel, Nozzles, Fittings & Welds etc. of Pressure Vessels

b) PMI shall be carried out using portable/mobile optical emission spectrometer / XRF (X – Ray Fluorescence) alloy analyser. Vendor shall submit the PMI procedures to JACOBS/CLIENT for review.

5.7 Inspection Reports :

For Gas Turbine Generator and HRSG package TPI shall issue regular summarised inspection reports. The report shall include the following as minimum:

a) Job No. / Project Title / P.O. No. / Purchase Specification No., Report No. & date and initial / Intermediate / Final Inspection status.
b) Item Tag. No. / Name / Total Quantity ordered and despatched.
c) Manufacturer's Name
d) Date & Place of Inspection, Name of Inspection Agency and Inspection Engineer.
e) Reference of Documents with Revision status.
f) Details of Inspection carried out
g) Results of Inspection
h) Deviations, if any
i) Constraints, if any

5.8 Non-Conformance :
If vendor or TPI find any deviation or non-conformity with respect to the requirement, he shall report the same to JACOBS/CLIENT and seek prior approval before acceptance at his end. Vendor shall also indicate and justify (with complete break up) cost benefits, if any and same shall have to be reimbursed to owner. JACOBS Inspector is also having right to raise NCN (Non-conformity Notice) in case of any deviation noted during shop inspection or review of test reports. Resolution of deviation

to be performed w r t Jacobs Engineering quality system. Deviations request blank formats (CR, NCN) are attached.

6.0 QUALITY ASSURANCE / QUALITY CONTROL:

6.1 All work / services to be performed by the Vendor shall be of specified / approved quality and the vendor shall have a quality assurance / quality control (QA/QC) system during the performance of various activities.

6.2 JACOBS shall conduct minimum four system audits during the execution of Gas Turbine Generator and HRSG package at Vendor's works.

6.3 Review / approval of inspection activities by JACOBS/CLIENT shall not however, dilute the responsibility of the vendor for maintaining quality.

7.0 IMPLEMENTATION OF QAP / INSPECTION REQUIREMENTS:

7.1 Implementation of Quality Assurance Plan / Inspection requirements shall be of vendor's responsibility. However, JACOBS/CLIENT shall have the right to verify / audit any approved QAP related functions in vendor shop / Independent test house and vendor shall be bound to take necessary corrective actions as desired by JACOBS/CLIENT.

Inspection stages where JACOBS/CLIENT desires to participate shall be marked on detailed QA Plans and these stages must necessarily be followed and attended by vendor in addition to the other stages being attended by him. Hold, Witness, Verification points etc. are explained in attachment 9.3 (Glossary of terms).

Indicative Inspection and Test Plan of Category 'A' and 'B' items are attached in 9.1.

Inspection & test plan for the items which left out from 'A' & 'B' category and all category 'C' items shall be prepared by Vendor. ITP for above items to be prepared & vetted by TPI before submission to JACOBS/CLIENT for approval.

7.2 TPI shall ensure and declare compliance to approved QAP/ITP by endorsing the approved QAP/ITP and making it part of Inspection Reports / Inspection Release Certificate.
No material should be dispatched to site without IRC issued by TPI.
Material received at site without Inspection/ Inspection Certificates and/or endorsed approved QAP/ITP and/or found not meeting the desired quality shall be rejected & vendor shall be liable to replace these materials at their own risk & cost and within their contractual period.

7.3 The test mentioned in the document is minimum requirement. In the event there is Any requirement for carrying out additional test by TPI the same shall be included in The scope of Vendor.

8.0 MONITORING :

Vendor shall submit monthly progress report to JACOBS/CLIENT. The progress report will include bar chart /manufacturing status, engineering/procurement status, areas of concern, constraint, etc. Frequency of status report may be changed to fortnightly, weekly, etc depending on job progress & site requirement. Expediting report of equipment / items on critical path is to be forwarded to JACOBS/CLIENT on time to time as advised. Vendor's

representative will monitor the progress at manufacturing works / site & send above status reports. If necessary Vendor shall station their representative at manufacturing place to expedite the progress where manufacturing progress slips with respect to barchart.

Detailed expediting / monitoring procedure are explained elsewhere in the bid document.

- Frequency of visits to vendor shops or meetings with vendors shall be decided as per the actual requirement of the job.

- Any delay in the supply from any sub-supplier, is however, the responsibility of the vendor. Contractual delivery dates shall be closely monitored and vendor shall ensure adherence to expediting functions and implement plans for remedial actions.

- JACOBS/CLIENT shall have complete access to vendor's manufacturing facilities with the purpose of witnessing compliance to manufacturing / QA / QC procedures deployed & monitoring activities with respect to time schedules and manufacturing bar-chart.

9.0 FINAL DOCUMENTATION:

- **V**endor shall prepare one set of final dossier, neatly indexed and filed as per Vendor Document Requirement list attached as a part of contract and get it reviewed and vetted by TPI.
- A content list of final document dossier should be agreed in advance between vendor and JACOBS.
- First set of final dossier duly vetted by TPI shall be submitted to JACOBS for completeness check. After obtaining acceptance from JACOBS on the first set, vendor shall submit requisite sets as per VDR including FCDs.

ATTACHMENT 9.1

9.1.2 PRELIMANARY LIST OF CATEGORY "A" ITEMS / EQUIPMENT

Fabricated Items

- HRSG STEAM GENERATOR.
- STEAM DRUM.
- ECONOMISER AND CONDENSATE PREHEATER.
- EVAPORATOR.
- SUPERHEATER.
- DESUPERHEATER.
- INTEGRATED DEAERATOR.
- CONTINUOUS BLOW DOWN TANK.
- INTERMITTENT BLOW DOWN TANK.

Mechanical Equipment

- GAS TURBINE GENERATOR.
- AXIAL COMPRESSOR.
- COMBUSTION SYSTEM.
- GTG STARTING SYSTEM
- WATER WASHING SYSTEM
- LUBRICATING AND HYDRAULIC OIL SYSTEM
- GTG INLET AIR FILTRATION SYSTEM
- AIR PROCESSING SKID

NOTE :- IBR ITEMS LIST TO BE SUBMITTED BY LSTK CONTRACTOR.

9.1.3 PRELIMANARY LIST OF CATEGORY "B" ITEMS / EQUIPMENT

Fabricated Items

- STACK
- DUCTS
- HRSG CASINGS
- STRUCTURAL FABRICATION
- EXPANSION JOINTS

Mechanical Equipment

- CENTRIFUGAL PUMPS
- GEAR DRIVES
- CENTRIFUGAL FANS
- DAMPERS
- PHOSPHATE DOSING SYSTEM
- MORPHOLINE / HYDRAZINE DOSING SYSTEM

Piping Items

- VALVES
- EXPANSION JOINTS
- PIPES
- FABRICATED PIPE SPOOLS
- FITTINGS
- BOLTING MATERIAL
- STRAINERS
- FLANGES
- GASKETS
- STEAM TRAPS
- PIPING SUPPORTS

Electrical Items

- STARTER PANEL
- MOTORS
- CABLES
- PLC PANELS
- LOCAL CONTROL PANEL
- ELECTRICAL POLE
- LIGHT FITTINGS
- JUNCTION BOXES

Instrumentation Items

- ANALYSER
- ON-OFF VALVES
- CONTROL VALVES
- PRESSURE & TEMPERATURE& LEVEL TRANSMITTERS/ GAUGES
- FLOW METERS

- THERMAL RELIEF VALVE
- INSTRUMENT CABLES
- SAFETY VALVES
- VIBRATION PROBES
- ORIFICE PLATES
- JUNCTION BOX

Misc.

- INSULATION AND REFRACTORY MATERIAL
- CABLE TRAYS
- FOUNDATION BOLTS

GLOSSARY OF TERMS USED:

I. HOLD POINT :

An activity designated by JACOBS/CLIENT in the approved Quality Plan which requires inspection / verification and acceptance by TPI, JACOBS/CLIENT before any further processing is permitted.

The vendor shall not process activity / items beyond a hold point without written approval by JACOBS/CLIENT except where prior written permission for further processing is obtained.

II. WITNESS POINT :

An activity designated by JACOBS/CLIENT which requires witnessing by TPI, JACOBS/CLIENT as the activity is performed after proper notification has been provided (notification modalities and period shall be finalised in the Pre-Inspection Meeting). The Contractor is not obliged to hold further processing if TPI, JACOBS/CLIENT is not available to witness the activity or does not provide the comments before the date notified. Basis of acceptance shall be as per relevant technical specification.

III. VERIFICATION POINT :

An activity where JACOBS/CLIENT plan to audit, monitor or witness in process activity. The Contractor is not obliged to provide any advance written notification of these points. Basis of acceptance shall be as per relevant technical specification.

IV. QUALITY SURVEILLANCE :

Monitoring or making observations to verify whether or not material / items or services confirm to specified requirements, surveillance activity may include audit, inspection witness of testing, review of quality documentation, personnel qualifications etc.

V. QA RECORDS :

Documentation which demonstrate achievement of required quality and verify effective operation of quality systems:

- Inspection Reports / Test Data
- Inspection & Test Plans
- Qualification Reports
- Validation Reports
- Audit Reports
- Material Review Reports
- Calibration Data
- Non – Conformity Notices
- Concession Request

VI. QUALITY AUDIT :

A systematic examination of the acts and decision by people with respect to quality in order to independently verify or evaluate and report degree of compliance to the operational requirement of the quality programme or the specifications or contract requirements of the products of services.

WELDING CONSUMABLES
Approved list of Welding Consumables

WELDING CONSUMABLES	ESAB INDIA LTD,
	HONAVAR
	D&H SECHERON,
	ADVANI FONTEC,
	BOHLER
	GEE LTD,
	MODI ARC

ANNEXURE-17(A)

INDICATIVE INSPECTION AND TEST PLAN

JACOBS

CPCL

INDICATIVE INSPECTION & TEST PLAN
PROJECT : 44NC 4600 - CPCL

EQUIPMENT / ITEM DESCRIPTION: GAS TURBINE GENERATOR AND HRSG PACKAGE **EQUIPMENT / ITEM TAG NO. :** **TEST & INSPECTION AS PER:** **(CODES & SPECIFICATIONS) :** **EQUIPMENT INSPECTION CODE : A**	**VENDOR :** **P.O. NO. :** **PR/PS NO.** **DRG. NO.**

ACTIVITY

1 **WITNESS INSPECTION AND / OR DOCUMENT REVIEW BY CLIENT**

2 **WITNESS INSPECTION AND / OR DOCUMENT REVIEW BY JACOBS**

3 **WITNESS INSPECTION BY VENDOR / SUB VENDOR / STATUTORY AUTHORITY(WHERE APPLICABLE)/TPIA**

4 **CERTIFICATES / DATA TO BE SUBMITTED BY VENDOR FOR APPROVAL / REVIEW BY TPIA / JACOBS**

				•	**FABRICATED ITEMS: - HRSG STEAM GENERATOR, STEAM DRUM, ECONOMISER AND CONDENSATE PREHEATER, EVAPORATOR, SUPERHEATER, DESUPERHEATER, INTEGRATED DEAERATOR, CONTINUOUS BLOW DOWN TANK, INTERMITTENT BLOW DOWN TANK, STACK, DUCTS, HRSG CASINGS, STRUCTURAL FABRICATION, EXPANSION JOINTS.ETC…**
1		R	P	X	WPS/PQR/WELDER QUALIFICATION
2		R	P	X	MATERIAL TEST CERTIFICATES FOR PLATES, PIPES, FLANGES, TUBES, TUBE SHEETS, FITTINGS, FASTENERS & GASKETS
3		W/R	H	X	MATERIAL & CONSUMABLE CERTIFICATE REVIEW. IN PROCESS INSPECTION, WELDING INSPECTION, NDT (RT, UT, MPT, PT, ETC.), PMI, HYDRO TEST, FINAL VISUAL, DIMENSIONAL INSPECTION & FINAL ASSEMBLY INSPECTION.
				•	**MACHANICAL ITEMS:- GAS TURBINEGENERATOR, AXIAL COMPRESSOR, COMBUSTION SYSTEM, GTG STARTING SYSTEM, WATER WASHING SYSTEM, LUBRICATING AND HYDRAULIC OIL SYSTEM, GTG INLET AIR FILTRATION SYSTEM, AIR PROCESSING SKID, CENTRIFUGAL PUMPS, GEAR DRIVES, CENTRIFUGAL FANS, DAMPER, SPHOSPHATE DOSING SYSTEM, MORPHOLINE / HYDRAZINE DOSING SYSTEM. ETC...**
4		W/R	P	X	MATERIAL CERTIFICATE REVIEW, WPS /PQR REVIEW, NDT (RT, UT, MPT, PT, ETC.) PMI, FUNCTIONAL TEST, MECHANICAL RUN TEST & PERFORMANCE TEST, DIMENSIONAL & VISUAL INSPECTION, PAINTING, ETC AS APLLICABLE.
				•	**PIPING ITEMS: VALVES, EXPANSION JOINTS, PIPES, FABRICATED PIPING SPOOLS, PIPE FITTINGS, BOLTING MATERIALS, STRAINERS, FLANGES, GASKETS, STEAM TRAPS, PIPING SUPPORTS.. ETC…**
5		R	P	X	MATERIAL CERTIFICATE REVIEW, WPS/PQR REVIEW, PMI, NDT (RT, UT, MPT, PT, ETC.) HYDROTEST , DIMENSIONAL & VISUAL INSPECTION,
				•	**ELECTRICAL ITEMS**: - **STARTER PANEL, MOTORS, CABLES, PLC PANELS, LOCAL CONTROL PANEL, ELECTRICAL POLE, LIGHT FITTINGS, JUNCTION BOXES ETC…**
6		W/R	R	X	VISUAL & DIMENSIONAL, FUNCTIONAL TEST, ROUTINE TEST, FAT, HV/IR TEST, IP REQUIRMENT, ETC AS APPLICABLE.
7		W/R	P	X	TYPE TEST CERTIFICATE FOR ITEMS LIKE MOTORS AS APPLICABLE.

JACOBS

CPCL

INDICATIVE INSPECTION & TEST PLAN
PROJECT : 44NC 4600 - CPCL

EQUIPMENT / ITEM DESCRIPTION: GAS TURBINE GENERATOR AND HRSG PACKAGE.

EQUIPMENT / ITEM TAG NO. :

TEST & INSPECTION AS PER:
(CODES & SPECIFICATIONS) :
EQUIPMENT INSPECTION CODE : A

VENDOR :
P.O. NO. :

PR/PS NO.
DRG. NO.

ACTIVITY

1 **WITNESS INSPECTION AND / OR DOCUMENT REVIEW BY CLIENT**

2 **WITNESS INSPECTION AND / OR DOCUMENT REVIEW BY JACOBS**

3 **WITNESS INSPECTION BY VENDOR / SUB VENDOR / STATUTORY AUTHORITY(WHERE APPLICABLE) / TPIA**

4 **CERTIFICATES / DATA TO BE SUBMITTED BY VENDOR FOR APPROVAL / REVIEW BY TPIA / JACOBS**

				•	**INSTRUMENTATION ITEMS:- ANALYSER, ON-OFF VALVES, CONTROL VALVES, PRESSURE & TEMPERATURE TRANSMITTER, LEVEL TRANSMITTERS/ GAUGES, FLOW METERS, THERMAL RELIEF VALVES, INSTRUMENT CABLES, SAFETY VALVES, VIBRATION PROBES ORIFICE PLATES, JUNCTION BOX ETC…**
8		W/ R	P	X	VISUAL & DIMENSIONAL, FUNCTIONAL TEST, ROUTINE TEST, FACTORY ACCEPTANCE TEST, PRESSURE TEST, HV/IR TEST, IP REQUIRMENT, ETC AS APPLICABLE.
				•	**REFRACTORY & INSULATION MATERIAL**
9		W	P	X	PHYSICAL & CHEMICAL TESTS., VISUAL & DIMENSIONAL INSPECTION,
		R	P	X	MATERIAL TEST CERTIFICATE REVIEW,
				•	**MISCELLANEOUS ITEMS : CABLE TRAYS, FOUNDATION BOLTS ETC…**
10		W/ R	P	X	MATERIAL TEST CERTIFICATES, DEFLECTION TEST, COMPRESSIVE TEST, LINEAR CHECK, VISUAL & DIMENSIONAL INSPECTION. UT TEST OF FOUNDATION BOLTS MORE THAN 20MM DIAMETER. BASE PLATE – DIMENSIONAL INSPECTION & STRAIGHTNESS/ FLATNESS
				•	**COMMON REQUIRMENTS FOR ALL ITEMS**
11	H	H	P	X	PRE-INSPECTION MEETING TO BE CONDUCTED BY PACKAGE VENDOR AFTER ISSUE OF PO/PR/PS. JE, CPCL & VENDOR SHALL ATTEND THE PRE-INSPECTION MEETING.
12		A	P	X	DETAILED INSPECTION CATEGARIZATION PLAN SHALL BE SUBMITTED AFTER PLACEMENT OF P.O./PR/PS.
		R	P	X	LIST OF IBR ITEMS.
		R	P	X	IBR DOCUMENTS
13		A	P	X	DETAILED INSPECTION & TEST PLAN AFTER ISSUE OF PO/PR/PS SHALL BE SUBMITTED FOR FABRICATED ITEMS/EQUIPMENT, MECHANICAL ITEMS, ELECTRICAL & INTRUMENT, PIPING ITEMS AS PER INSPECTION CATEGARIZATION PLAN & SPECIFICATION.
14		A	P	X	INSPECTION & TEST PROCEDURE INCLUDING NDT, PWHT, HYDROSTATIC TEST, PERFORMANCE & MECHANICAL RUN TEST, FAT , PMI, AND PAINTING, PACKING PROCEDURE / SHIPPING DRAWING OF COMPLETED EQUIPMENT. ETC.

JACOBS

CPCL

INDICATIVE INSPECTION & TEST PLAN
PROJECT : 44NC 4600 - CPCL

SHEET 3 OF 3

EQUIPMENT / ITEM DESCRIPTION: GAS TURBINE GENERATOR AND HRSG PACKAGE EQUIPMENT / ITEM TAG NO. : TEST & INSPECTION AS PER: (CODES & SPECIFICATIONS) : EQUIPMENT INSPECTION CODE : A	VENDOR : P.O. NO. : PR/PS NO. DRG. NO.

ACTIVITY	1 WITNESS INSPECTION AND / OR DOCUMENT REVIEW BY CLIENT	2 WITNESS INSPECTION AND / OR DOCUMENT REVIEW BY JACOBS	3 WITNESS INSPECTION BY VENDOR / SUB VENDOR / STATUTORY AUTHORITY(WHERE APPLICABLE) / TPIA	4 CERTIFICATES / DATA TO BE SUBMITTED BY VENDOR FOR APPROVAL / REVIEW BY TPIA / JACOBS	
15		A	P	X	SUMMARY OF ALL SUPPLIMENTARY REQUIREMENTS AS SPECIFIED IN THE ORDER PR/PS.
16	A	A	P	X	SUB-VENDOR APPROVAL OF BOUGHT OUT ITEMS.
17		R	P	X	REVIEW OF STATUTORY CERTIFICATES CCOE, IP REQUIRMENT, ATEX, FM ETC...
18		A	P	X	CONTENT LIST OF FINAL DOSSIER
19		R	R	X	FINAL DOCUMENTATION AS PER VDR ATTACHED ALONG WITH TR
20		R	P	X	SPARES & PACKING LIST CHECK, PACKING & LOADING OF EQUIPMENT AS PER SHIPPING DRAWING.
21		H	H		INSPECTION RELEASE CERTIFICATE BY TPIA / JACOBS

LEGENDS : P- PERFORM, H - HOLD, W - WITNESS, R – REVIEW, A - APPROVAL, I - INFORMATION, X – SUBMIT PO – PURCHASE ORDER, PR – PURCHASE REQUISITION, PS – PURCHASE SPECIFICATION

THIS IS AN INDICATIVE INSPECTION AND TEST PLAN IDENTIFYING SCOPE OF INSPECTION /REVIEW OF DOCUMENTS AS A MINIMUM REQUIREMENT, DETAILED INSPECTION AND TEST PLAN INDICATING ALL SPECIFIED REQUIREMENTS AFTER ISSUE OF PO / PR TO BE GENERATED BY VENDOR AND SAME DULY APPROVED BY TPIA TO BE SUBMITTED TO JACOBS FOR APPROVAL.

JACOBS/CLIENT RESERVES RIGHT TO WITNESS INSPECTION OF ANY ITEM AT ANY STAGE WHICH SHALL BE INDICATED ON QAP / INSPECTION & TEST PLAN AT THE TIME OF APPROVAL AND SAME TO BE COVERED AS PART OF PURCHASE ORDER CONDITION.

ANNEXURE-18

QUALITY PLAN FOR MOTORS

JACOBS™

VENDOR QUALITY PLAN
ELECTRICAL

PROJECT NO:	**44NC-4602**
E/O NO.	
VENDOR	

ITEM/TAG. NO. : INDUCTION MOTOR

INSPECTION EXTENT :
- ☐ PRE-INSPECTION MEETING
- ☐ IN-PROCESS INSPECTION
- ☐ FINAL INSPECTION

CALIBRATION RECORDS TO BE FURNISHED AT THE TIME OF TESTING.

APPD. BY	RBD	09.04.10			
CHK'D BY	PPP	09.04.10			
PRPD. BY	ASR	09.04.10			
REV.	**A**	**DATE**	**0**		**DATE**

ACTIVITY	ACTIVITY/INSPECTION POINTS :	HP	WP	RI	RD	CL
1	ADHERENCE TO AGREED QC PLAN	✓	-	-	-	-
2	DRAWING AS PER SPECIFICATION, WITH DIMENSION	✓	-	-	✓	-
3	TECHNICAL & GUARANTEED PARTICULARS OF MOTORS, CMRS CERTIFICATES ,	✓	✓	-	✓	-
	CERTIFICATES, FOR ENCLOSURE (FOR HAZARDOUS AREAS)	✓	-	-	✓	-
4	FINAL VISUAL INSPECTION	-	✓	-		-
4.1	DIMENSIONAL CHECK	-	✓	-	✓	✓
4.2	NAME PLATE / MARKING	-	✓	-	✓	✓
4.3	CABLE ENTRY	-	✓	-	✓	✓
4.4	EARTHING TERMINAL	-	✓	-	✓	✓
5	TYPE TESTS :(WHEN SPECIFIED FOR L V MOTORS / COMPULSORY FOR H V MOTORS)	-	✓	-	✓	✓
5.1	TEMPERATURE RISE TEST	-	-	-	✓	-
5.2	DETERMINATION OF STARTING TORQUE , FULL LOAD TORQUE , SLIP ,EFFICIENCY , PF, ETC.	-	✓	-	✓	-
5.3	VIBRATION TEST	-	✓	-	✓	-
5.4	NOISE MEASUREMENT	-	-	-	✓	-
5.5	MOMENTARY OVERLOAD TEST	-	-	-	-	-
5.6	MEASUREMENT OF STATOR & ROTOR RESISTANCE ON SLIPRING MOTORS	-	✓	-	-	✓
5.7	IMPULSE TEST	-	✓	-	-	✓
5.8	LOAD TESTS	-	✓	-	-	✓
5.9	OVER SPEED TESTS	-	✓	-	-	✓
6	ROUTINE TESTS	-	✓	-	-	✓
6.1	INSULATION RESISTANCE TEST	-	✓	-	-	✓
6.2	H.V TEST	-	✓	-	-	✓
6.3	LOCKED ROTOR TEST	-	✓	-	-	✓
6.4	NO LOAD RUNNING OF MOTOR & READING OF VOLTAGE,PF,CURRENT,POWER INPUT & SPEED.	-	-	-	✓	-
6.5	REDUCED VOLTAGE RUNNING TEST	-	-	-	✓	-
6.6	MEASUREMENT OF WINDING RESISTANCE	-	✓	-	-	✓
6.7	OPEN CIRCUIT VOLTAGE RATIO FOR SLIPRING MOTORS	-	-	-	-	-
7	DYNAMIC BALANCING OF ROTOR	-	-	-	✓	-
8	BEARING INSULATION CHECK	-	-	-	-	-
9	BEARING INSPECTION AFTER HEAT RUN (SLEEVE BEARINGS ONLY)	-	-	-	-	-
10	ADDITIONAL TESTS FOR H.V.MOTORS					
10.1	READING OF VOLTAGE, CURRENT, POWER INPUT & SLIP AT 75% & 50% FULL LOAD					
10.2	MEASUREMENTS TO ENABLE CALCULATIONS OF PULL OUT TORQUE					
10.3	POLARIZATION INDEX TEST					
10.4	TAN DELTA TEST					
10.5	MEASUREMENT OF INDUCED SHAFT VOLTAGE					
11	FUNCTIONAL TEST FOR AUXILIARY SYSTEM					
12	ANY OTHER TEST CALLED FOR IN ORDER (SPECIFY)	-	✓	-	-	-
13	DOCUMENTATION REVIEW PRIOR TO DESPATCH INSTRUCTION (TEST CERTIFICATES ,	✓	-	-	✓	-
	MAINTENANCE & COMMISSIONING MANUAL ETC.)					
14	PREPARATION FOR SHIPMENT (FOR EXPORT ONLY)					

LEGEND : HP - HOLD POINT FOR APPROVAL RI - RANDOM INSPECTION CL - CLIENT INSPECTION
WP - WITNESS POINT RD - REVIEW DOCUMENTATION

APPROXIMATE _____ % OF THE MATERIAL WILL BE INSPECTED. THIS PERCENTAGE WILL BE INCREASED IN CASE DEFICIENCIES ARE FOUND OR DOUBTS ABOUT QUALITY ARISE.

ANNEXURE-19

STANDARD SPECIFICATION FOR LUBE OIL SYSTEM

JACOBS™

CHENNAI PETROLEUM CORPORATION LIMITED
MANALI REFINERY, CHENNAI

RESID UPGRADATION PROJECT

PART : V

SECTION : 3.3

STANDARD SPECIFICATION FOR LUBE & SEAL OIL SYSTEMS

DOCUMENT NO : 44NC-4600-0000/M.02/0007/A4

rev no.	issue date	Pages	Rev Description	Prepared By	Checked By	Approved By
A	22.03.10 .	7	ISSUED FOR FEED	HK	GHD	SNG

TABLE OF CONTENTS

1.0 PURPOSE (INTRODUCTION)

This specification covers design, engineering, manufacture, testing, packing, forwarding, supply, installation (if included in scope) and commissioning of the Lubrication, shaft sealing, and control oil systems with auxiliaries as per API standard 614, fifth Edition, "Lubrication, Shaft sealing, and Control oil systems for Special Purpose Applications " and Owner/PMC's specific requirements as mentioned below.

2.0 SCOPE

2.1 Instructions

2.1.1 Exceptions as revised herein, the lubrication, shaft sealing, and control oil systems and their auxiliaries shall be designed, manufactured, tested and supplied strictly in accordance with API standard 614, Fifth Edition, "Lubrication, Shaft sealing, and Control oil systems for Special Purpose Applications". All requirements specified in the following paragraphs are additions, modifications or substitutions (as given in the parenthesis at the beginning of the paragraph) to above standard.

2.1.2 All paragraph numbers refer to API standard 614, Fifth edition. Paragraph numbers appearing in this specification is either new paragraphs or corresponding modified (as defined below) paragraphs of API standard 614, Fifth Edition. Paragraph numbers, which do not appear in this specification, shall be strictly in accordance with API standard 614, Fifth Edition. The requirements different from the API standard 614 are indicated in parenthesis with the following definitions.

(New) : New paragraph / section having no corresponding paragraph / section in the standard
(Deletion) : The entire paragraph / section deleted.
(Addition) : New section(s) or paragraph(s) added.
(Substitution): Some part(s) of the paragraph changed including parital deletion and addition
(As stated) : The requirement(s) as required to be confirmed by the Owner is confirmed.

2.2 RESPONSIBILITY

2.2.1 The EPCC contractor / Vendor shall make all possible efforts to comply strictly to the requirements of this specifications and other specifications / data sheets as mentioned in the inquiry/ order. In case, any deviations are considered essential by the EPCC contractor/Vendor after making all possible efforts, these shall be separately listed in the EPCC contractor's/ Vendor's offer under " List of deviations / exceptions to the inquiry" for the Owner/PMC's considerations. The deviations / exceptions shall be listed separately for each specifications / documents with the cross-references and proper reasons for the deviations / exceptions required. In the event of any deviation not listed under the 'List of deviations / exceptions to the enquiry, even though it is appearing in other part of the offer, shall not be considered applicable. Hence all the requirements shall be binding on the EPCC contractor/Vendor without any cost and schedule implications to the owner.

2.2.2 The compliance to this specification shall not relieve EPCC contractor / Vendor of the responsibility of supplying the equipments and auxiliaries of proper design, material and workmanship to meet the operating requirements specified in the datasheet / design basis. In case of requirements of additional instruments, controls, safety devices and any other auxiliaries or accessories for safe, smooth and trouble free operation of the equipment, EPCC contractor / Vendor shall include the same in his scope of supply and give reasons with the bid.

PART 1 - GENERAL REQUIREMENTS

4.0 GENERAL

4.1 DIMENSIONS AND UNITS

(Substitution)

Dmension and units shall be in SI units.

4.3.3 (New) GENERAL CLARIFICATIONS

4.3.3.1 EPCC contractor / Vendor shall be responsible for the co-ordination of all sub-suppliers and for the overall guarantee of furnished equipment. It is the specific responsibility of EPCC contractor / Vendor to invoke all applicable referenced specifications to each sub-supplier purchase order.

4.3.3.2 Single lift consoles are preferred. Multi-section consoles are acceptable only if required by shipping limitations. For multi-section consoles, all interconnecting piping shall be flanged at the edge of each section and properly protected and supported for individual shipment.

4.3.3.3 Suppliers shall be qualified by experience in manufacturing the units proposed. To qualify, the Supplier shall have manufactured at the proposed point of manufacture, atleast two units with similar or more stringent performance requirements. These units shall have been in service for atleast two years and be performing satisfactorily.

4.4 PRESSURE DESIGN CODE

(Addition)

Pressure design codes shall be as per FEED documents

4.5 BASIC DESIGN

4.5.2 (Substtution)
The equipment, including all auxiliaries, shall be suitable for operation under the environmental conditions specified else where in FEED document. The equipment shall be suitable for outdoor installation.

4.5.7 (Substtution)
All supplied equipment shall comply with local rules and regulations that will apply at the instaltion site.

4.6 WELDING

4.6.2 (Substtution)
Inspection and testing requirements as specified in FEED document shall be followed.

4.7 STATUTORY REQUIREMENTS

(Substtution)

vendor shall take necessary measures to comply with governmental codes, statutory regulations, ordinances or local rules that are applicable to the equipment, its packaging and any preservatives used at the instaltion site.

APPENDIX D

EPCC contractor / Vendor to specify quality of oil, cleanliness standard to be achieved and supply the oil test kit for cleanliness check as per ISO 4406.

PART 2 - SPECIAL PURPOSE OIL SYSTEMS

4.0 GENERAL REQUIREMENT

4.1 GENERAL

4.1.5 (Substitution)
EPCC contractor / Vendor shall furnish noise emission data with the proposal. The noise level shall not exceed 85 dB (A) at 1.0 m distance from the equipment installation.

4.1.6 (Modification)
The lube-oil and seal-oil systems shall be separate, unless otherwise specified in the data sheet.

4.1.7 (Substitution)
When oil is supplied from a common system to compressor, gear and driver etc., the oil characteristics shall be indicated in the proposal by Vendor, so that the suitability of the same for other equipment shall be verified by EPCC contractor.

4.1.12 (Substitution)
The arrangement of the equipment, including piping and auxiliaries, shall be developed by the vendor. The arrangement shall provide adequate clearance areas and safe access for operation and maintenance.

4.1.14 (Substitution)
Pumps, filters, strainers, coolers, traps, valves, piping and all other components that carry oil and are external to the reservoir shall be made of SS 304 / 316. All piping shall be seamless including restriction orifices wherever applicable.

4.1.19 As stated.
EPCC contractor / Vendor shall advice and include special provisions that are necessary to ensure that an adequate supply of lube or seal oil or both is maintained in the event of complete failure of lube or seal oil supply system. The provisions may include emergency pumps, accumulators, run down tanks and special equipment for equipment safety and protection when the equipment decelerates till coast down time, cool off time and block-in time as applicable. Owner/PMC and EPCC contractor/ Vendor shall mutually agree on the

system and its components.

4.3 OIL RESERVOIRS

4.3.1 (Addition)
The oil tank drain shall have double isolation valves. Two separate nozzles with isolation valve shall be provided for on line cleaning of oil with microfilter and pump or centrifuge.

4.3.2.1 (Addition)
Seal oil reservoir vent shall be provided with an overprotection device to protect the reservoir in case of seal failure.

4.3.7.1 (Modification)
The EPCC contractor / Vendor shall provide, an electric immersion heater, if dictated by the site ambient conditions, on provision for mounting it, if required for flushing of lube oil line prior to startup.

4.3.7.5 (Modification)
Delete `When specified'.

4.3.10.1 (Modification)
Delete "If specified".

4.4 PUMPS AND DRIVES

4.4.1 (Modification)

The oil system shall include a main oil pump and a standby oil pump both suitable for continuous operation. For non shaft-driven pumps, the main and standby pumps shall be identical. Unless other type of pumps are specified by Owner/PMC , the pumps shall be of horizontal type. Lube oil pumps shall be centrifugal type as per API 610, and seal oil pumps shall be rotary type as per API 676.

4.4.5 As stated.

4.4.7 (Modification)
Shaft-driven pumps & air-or-gas driven pumps shall not be provided. Emergency pumps shall be driven by DC power. Type of driver for main pump shall be as per data sheet and standby pump driver shall be electric motor.

4.4.22 As stated.

4.5 COOLERS

4.5.2.1 (Addition)
U bend tubes not acceptable.

4.7 TRANSFER VALVES

4.7.1 (Substitution)
The flow will be switched between coolers and filters via. individual transfer valves independently serving each cooler and filter set.

4.8 ACCUMULATORS

4.8.3 As stated.

4.8.4 (Modification)
A precharge pressure gauge shall be provided along with nitrogen filling kit.

4.10 SEAL-OIL DRAIN TRAPS

4.10.3 (Modification)
Delete “Unless otherwise specified”.

4.11 DEGASSING DRUM
4.11.3 (Modification)

Steam heater not envisaged.

6.0 INSTRUMENTATION, CONTROL AND ELECTRICAL SYSTEMS

6.2 (Modification)
Delete “when specified”. Common relay is not envisaged for group of alarms and trips. For each alarm, separate relay to be provided. Switches are not acceptable.

ANNEXURE-20

EXPERIENCE RECORD PROFORMA FOR HRSG BFP

JACOBS

CHENNAI PETROLEUM CORPORATION LIMITED
MANALI REFINERY

RESID UPGRADATION PROJECT

EXPERIENCE RECORD PROFORMA FOR HRSG FEED PUMPS

DOCUMENT NO: 44NC-4602-0501/M.04/0051/A4

Rev No.	Issue Date	Pages	Rev Description	Prepared By	Checked By	Approved By
A	19-11-13	5	Issued for CPCL approval	PK	VN	SNG

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1.0 CENTRIFUGAL PUMP (HORIZONTAL) (API 610, 10TH EDITION)

ITEM :
ITEM NUMBER :
VENDOR :

INSTRUCTIONS TO BIDDERS

1. This proforma duly filled in shall be submitted for each item separately, along with the bid.

2. Since the information requested in this proforma will be utilised to assess provenness of offered model, it is in the interest of the equipment manufacturer to pick up those cases out of total list of references which most closely match with the offered model. The equipment manufacturer shall also ensure that each and every information asked for is furnished and the same is correct and complete in all respects. **Incorrect information furnished in this proforma shall render the bid liable for rejection.**

3. While furnishing the materials, where asked for, the equipment manufacturer shall furnish ASTM equivalent also.

4. For the referred installations, the equipment manufacturer shall indicate the name of the person (along with his address, telephone no., fax no./ email –id, etc.) who may be contacted by the Purchaser / his representative, if felt necessary.

5. The equipment manufacturer shall also furnish along with the bid his standard reference list for the offered equipment model manufactured and supplied by him.

6. The equipment manufacturer shall clarify the meaning of each letter/ digit used in the model designation below :

Description of Model Designation System:

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SL. NO.	PARAMETER	INFORMATION ON PROPOSED MODEL	INFORMATION ON REFERRED EXISTING INSTALLATIONS			REMARKS
			Ref. –1	Ref. –2	Ref. – 3	
1.	2.	3.	4.	5.	6.	7.
1.	**GENERAL**					
1.1	Cross reference to manufacturer's Standard Reference list					
1.2	Make					
1.3	Model number					
1.4	No. of units supplied					
1.5	Type of driver (Electric motor/ Steam Turbine/ Gas turbine/ IC Engine)					
1.6	Driver rated kW/ speed (rpm)					
1.7	Drive (Fixed speed/ Variable speed/ Variable Frequency)					
1.8	Edition of API 610 to which pump conforms to (10^{th})					
1.9	Shop where gear box is designed, manufactured, packaged, tested and supplied with address					
2	**OPERATING CONDITIONS**					
2.1	Fluid handled					
2.2	Fluid temperature (min./ max.) ^{o}C					
2.3	Capacity (m^3/hr)					
2.4	Maximum suction pressure (kg/cm^2a)					

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SL. NO.	PARAMETER	INFORMATION ON PROPOSED MODEL	INFORMATION ON REFERRED EXISTING INSTALLATIONS			REMARKS
			Ref. –1	Ref. –2	Ref. – 3	
1.	2.	3.	4.	5.	6.	7.
2.5	Differential head, Rated (m)					
2.6	Differential pressure, Rated (kg/cm^2)					
2.7	NPSHR (m)					
2.8	Efficiency					
2.9	BKW, Rated					
2.10	Minimum Continuous Stable flow, (m^3/hr)					
2.11	Rated speed					
2.12	Speed range for variable speed drive					
2.13	MAWP casing (kg/cm^2g) @ 15^oC @ pumping temperature					
3.	**CONSTRUCTION**					
3.1	No. of Stages (single / two)					
3.2	Casing split (axial/ radial)					
3.3	Impeller diameter – Rated / Maximum/ Minimum (mm)					
3.4	Whether the proposed model and reference models have identical hydraulic design (for impeller / diffuser/ volute)					
3.5	Sealing element (packing/ mechanical seal)					
3.6	Type of mechanical seal (single/ double)					
3.7	API Sealing Plan no.					
3.8	API cooling Plan					

SL. NO.	PARAMETER	INFORMATION ON PROPOSED MODEL	INFORMATION ON REFERRED EXISTING INSTALLATIONS			REMARKS
			Ref. –1	Ref. –2	Ref. – 3	
1.	2.	3.	4.	5.	6.	7.
4.	**MATERIAL OF CONSTRUCTION**					
4.1	API 610 Material code					
4.2	Casing					
4.3	Impellers					
4.4	Shaft					
5.	**OTHER INFORMATION ON INSTALLATIONS**					
5.1	Date of supply of entire unit					
5.2	Date of commissioning of entire unit					
5.3	No. of operating hours completed as on the date of issue of material requisition					
5.4	Major problems encountered					
5.5	Name of Plant					
5.6	Purchaser's Name and Address					
5.7	Name (Company / organisation)					
5.8	Name of Contact person					
5.9	Address					
5.10	Telephone no.					
5.11	Fax no.					
5.12	Email-id					