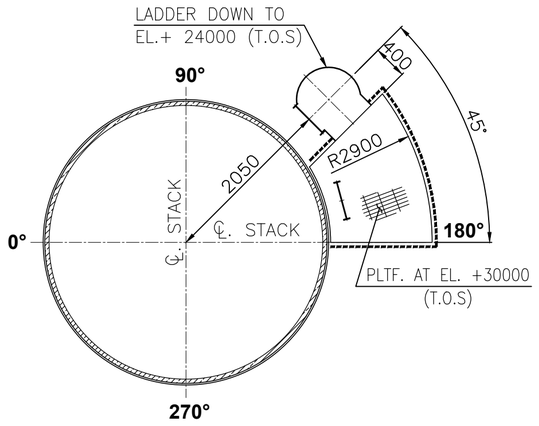
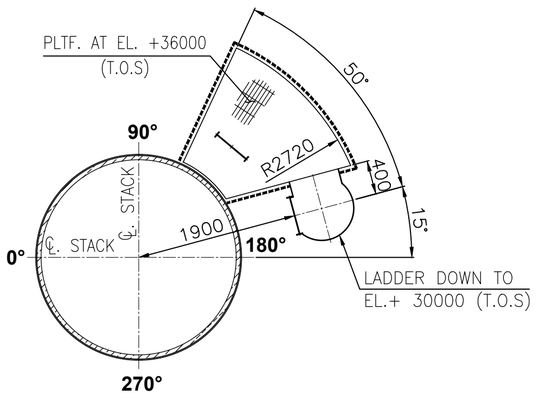
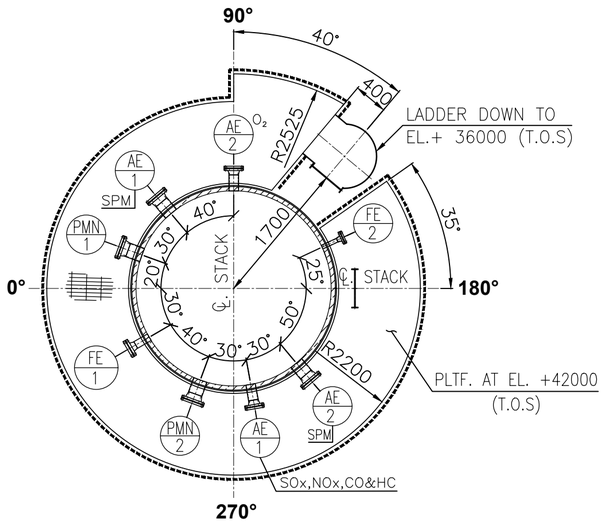
(FOR PLANS ONLY)



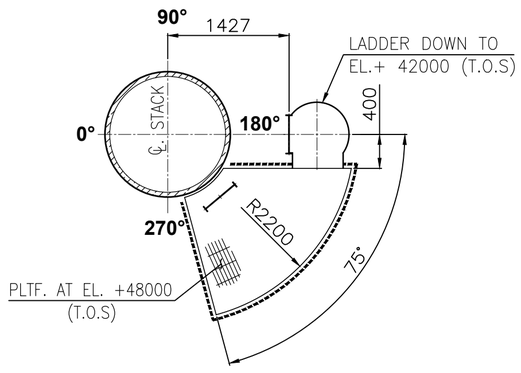
SECTION L-L



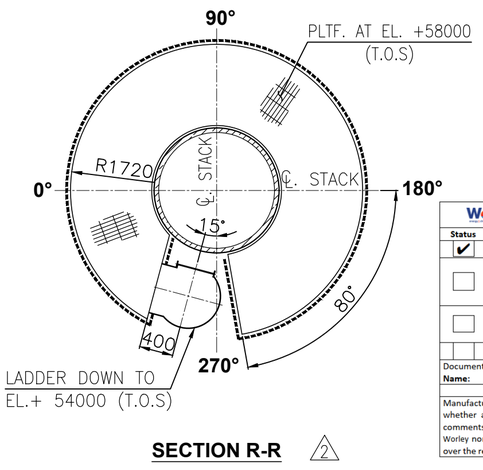
SECTION M-M



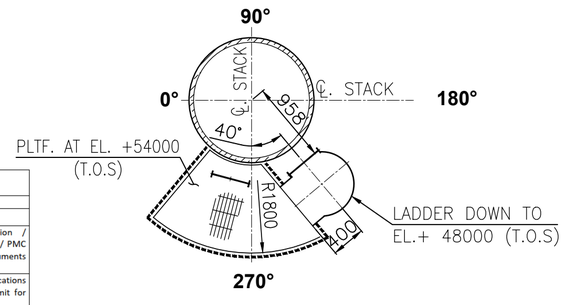
SECTION N-N



SECTION P-P



SECTION R-R 2

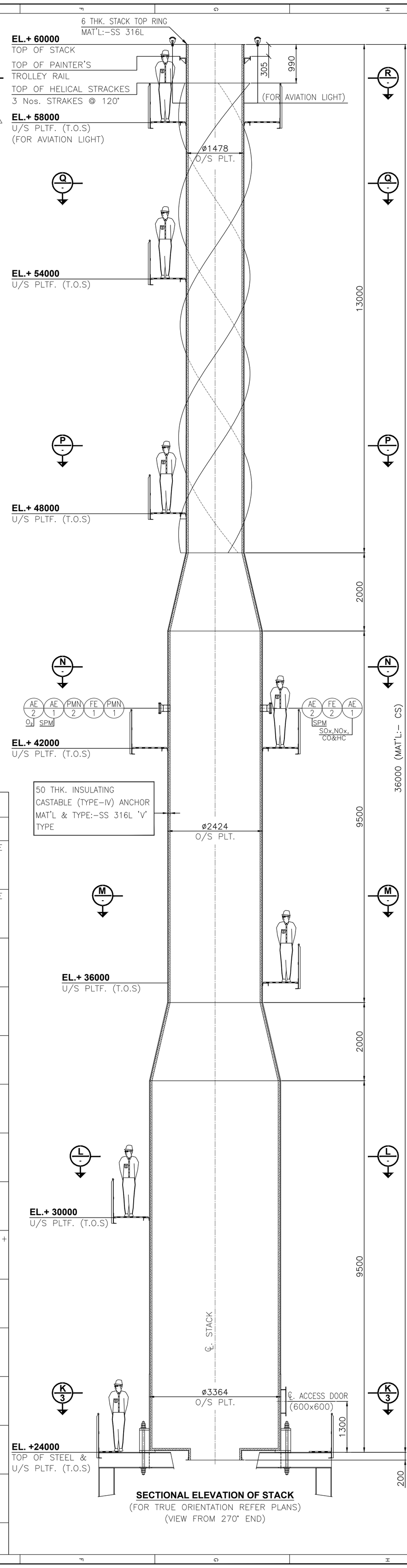


SECTION Q-Q 2

Worley	Document Status Code
Status / Review Code	Status Description
✔ 1	No Comments, Work may proceed.
2	The contractor shall proceed with the fabrication / manufacturing taking care of and incorporating Owner / PMC comments. Contractor shall submit the drawings / documents again duly incorporating Owner / PMC comments.
3	Major non-conformance and deviation to contract specifications and the document is rejected. Contractor is to resubmit for review after incorporating comments.
4	Document / Drawing Retained for Information.

Document status code assigned by:
Name: Ajay Bidwai Date: 17-Nov-2021

Manufacturers and suppliers remain responsible under all circumstances for their drawings, whether accepted without comments or accepted after alteration in accordance with comments and they shall never to entitled to allege express or tacit approval thereof by Worley nor shall they be entitled to allege that Worley has by accepting the drawings taken over the responsibility for any defects in the drawings or the construction founded thereon.



SECTIONAL ELEVATION OF STACK
(FOR TRUE ORIENTATION REFER PLANS)
(VIEW FROM 270° END)

LEGEND:-

O/S : OUTSIDE
EL.+ : ELEVATION
T.O.S : TOP OF STEEL
℄ : CENTER LINE
L.W.P : LOWER WORKING POINT
N/S : NEAR SIDE
F/S : FAR SIDE
FC : FABRICATION CONTRACTOR
I/S : INSIDE
U/S : UNDER SIDE
U.N.O. : UNLESS NOTED OTHERWISE
(TYP.) : TYPICAL
N/S : NEAR SIDE
F/S : FAR SIDE
B.F : BLIND FLANGE

LIST OF AUXILIARY CONNECTION

SYMBOLS	QTY.	SERVICE	DESCRIPTION
TI –	7	FLUE GAS TEMPERATURE	1 1/2"NPS x SCH.80 WITH 300# WNRF FLANGE + B.F + GASKETS + NUTS & STUD PIPE MATERIAL:– SS304L FLANGE MATERIAL:– A105
DG –	10	DRAFT GAUGE	1 1/2"NPS x SCH.80 WITH 300# WNRF FLANGE + B.F + GASKETS + NUTS & STUD PIPE MATERIAL:– SS304L FLANGE MATERIAL:– A105
FGS –	2	FLUE GAS SAMPLING	4"NPS x SCH.40 WITH 300# WNRF FLANGE + B.F + GASKETS + NUTS & STUD PIPE MATERIAL:– SS304L FLANGE MATERIAL:– A105
AE	2	O_2 ANALYZER	4"NPS x SCH.40 WITH 300# WNRF FLANGE + B.F + GASKETS + NUTS & STUD PIPE MATERIAL:– SS304L FLANGE MATERIAL:– A105
AE 1	1	SOx, NOx, CO & HC ANALYZER	4" NPS x SCH.40 WITH 300# WNRF FLANGE + B.F + GASKETS + NUTS & STUD PIPE MATERIAL:– SS304L FLANGE MATERIAL:– A105
AE 1	1	CO/H_2 ANALYZER	4" NPS x SCH.40 WITH 300# WNRF FLANGE + B.F + GASKETS + NUTS & STUD PIPE MATERIAL:– SS304L FLANGE MATERIAL:– A105
AE	2	SPM	6" NPS x SCH.40 WITH 300# WNRF FLANGE + B.F + GASKETS + NUTS & STUD PIPE MATERIAL:– SS304L FLANGE MATERIAL:– A105
FE 1	1	FLUE GAS FLOW METER	3" NPS x SCH.40 WITH 300# WNRF FLANGE + B.F + GASKETS + NUTS & STUD PIPE MATERIAL:– SS304L FLANGE MATERIAL:– A105
FE 2	1	FLUE GAS FLOW METER	1 1/2" NPS x SCH.80 WITH 300# WNRF FLANGE + B.F + GASKETS + NUTS & STUD PIPE MATERIAL:– SS304L FLANGE MATERIAL:– A105
PMN –	2	MONITORING NOZZLES	6" NPS x SCH.40 WITH 300# WNRF FLANGE + B.F + GASKETS + NUTS & STUD PIPE MATERIAL:– SS 304L FLANGE MATERIAL:– A105
SS –	3	SNUFFING STEAM	2"NPS x SCH.40 WITH 300# WNRF FLANGE + B.F + GASKETS + NUTS & STUD PIPE MATERIAL:– SS304L FLANGE MATERIAL:– A105
CV –	2	COIL VENT	6" SCH.40 x 2" SCH.80 3000# WELDOLET +2" NPS x SCH.80 300# WNRTJ FLANGE + B.F + GASKETS + NUTS & STUD MATERIAL:– A105
TW –	2	PROCESS FLUID TEMPERATURE	6" SCH.40 x1 1/2" SCH.80 3000# WELDOLET +1 1/2" NPS x SCH.80 300# WNRTJ FLANGE + B.F + GASKETS + NUTS & STUD MATERIAL:– A105
PI –	2	PRESSURE GAUGE	6" SCH.40 x1 1/2" SCH.80 3000# WELDOLET +1 1/2" NPS x SCH.80 300# WNRTJ FLANGE + B.F + GASKETS + NUTS & STUD MATERIAL:– A105
TSTC –	8	TUBE SKIN THERMOCOUPLE	1 1/2" NPT 3000# THREADED COUPLING WITH PLUG PIPE MATERIAL:– SS304L

REV NO.	0	1	2	
ZONE				
BRIEF RECORD OF REVISIONS	SUBMITTED FOR APPROVAL	SUBMITTED FOR APPROVAL	SUBMITTED FOR REGULARIZATION	
PPD.	SSR	SSR		
CHD.	SV	SV		
APPD.	LRS	SV		

DRAWN S SANKARA RAO
CHECKED S VIJAY
APPROVED L RAJA SEKHAR
DATE 24-02-2021
ALL DIMENSIONS ARE IN MILLIMETRES
SCALE 1:55

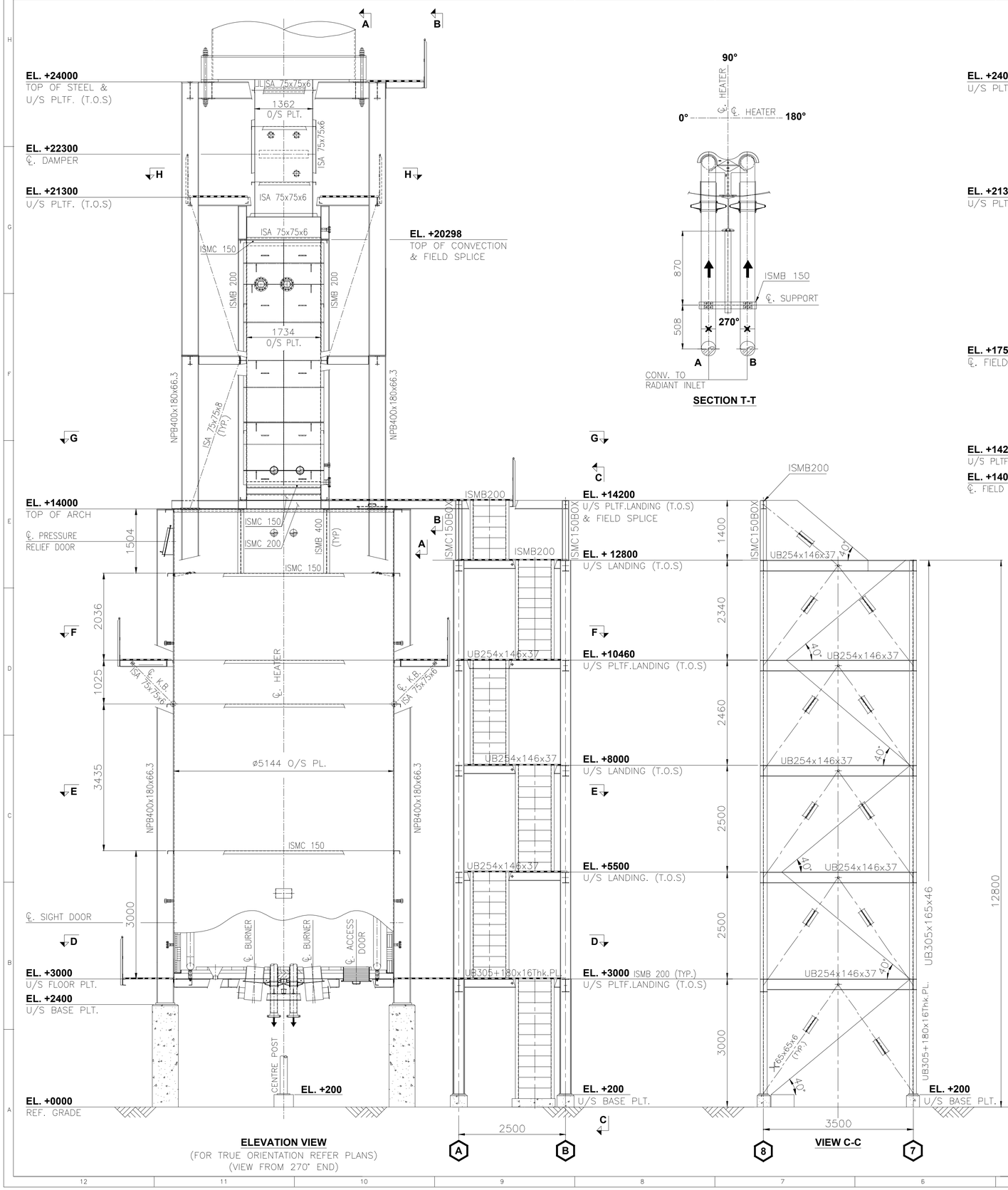
BHARAT HEAVY ELECTRICALS LTD.,
HEAVY PLATES & VESSELS PLANT UNIT, VISAKHAPATNAM-530012

TITLE
GENERAL ARRANGEMENT OF HOT OIL HEATER STACK AND PLANS

BHEL DRG NO. 1-48-000-U6010
C.DRG NO.44AC-7500-221-M-B01-0003-A1
REV. 2

PROJECT: EPCM SERVICES FOR PX-PTA EXPANSION PROJECT
JOB NO. 44AC7500
OWNER: Indian Oil — INDIAN OIL CORPORATION LIMITED-PANIPAT, HARYANA
PMC: Worley — NEW ENERGY HOUSE, RAMKRISHNA MANDIR ROAD, KONDIVITA, ANDHERI (EAST), MUMBAI-400059,INDIA
TEL: +91 22 26812000, FAX: +91 22 28208295
ITEM: HOT OIL HEATER FOR PTA UNIT (21-F1-1251)
CUSTOMER No. 7916

A1:841x594



REFERENCE DRAWINGS	
DRAWING NO.	**TITLE**
FIS-511-DW-1000	FOUNDATION LOADING PLAN
FIS-511-DW-1001	GENERAL ARRANGEMENT ELEVATION & PLANS

NOTES:-

1. ALL DIMENSIONS & ELEVATIONS ARE IN MM UNLESS OTHERWISE NOTED.
2. ELEVATIONS GIVEN ARE RELEVANT TO REFERENCE GRADE EL.+0000.
3. DO NOT SCALE THE DRAWING, ASK IF IN DOUBT.
4. ALL LAPS ON PLATE SHALL BE 25 MM WHERE NOT SPECIFIED.
5. FABRICATOR SHALL PROVIDE DRAIN HOLES WHEREVER REQUIRED.

MEMBER SIZES SHOWN ARE PRELIMINARY AND INDICATIVE ONLY. BHEL TO FINALIZE & OPTIMIZE THE SIZES AFTER STRUCTURAL DESIGN AND ANALYSIS.

NOTE :- FOR BASE PLATE & BOLT DETAILS
REFER LOAD DATA DRG. NO. 1-00-281-U9515

Worley	Document Status Code	
Status	**Review Code**	**Status Description**
☐	1	No Comments, Work may proceed.
☐	2	The contractor shall proceed with the fabrication / manufacturing taking care of and incorporating Owner / PMC comments. Contractor shall submit the drawings / documents again duly incorporating Owner / PMC comments.
☐	3	Major non-conformance and deviation to contract specifications and the document is rejected. Contractor is to resubmit for review after incorporating comments.
✔	4	Document / Drawing Retained for Information.

Document status code assigned by:
Name: Ajay Bidwai **Date:** 17-Nov-2021

Manufacturers and suppliers remain responsible under all circumstances for their drawings, whether accepted without comments or accepted after alteration in accordance with comments and they shall never to entitled to allege express or tacit approval thereof by Worley nor shall they be entitled to allege that Worley has by accepting the drawings taken over the responsibility for any defects in the drawings or the construction founded thereon.

REV NO.	DATE	BRIEF RECORD OF REVISIONS	PPD.	CHD.	APPD.
1	10-11-2021	WORLEY COMMENTS DATED ON 20-AUG.-2021 INCORPORATED			

CUSTOMER No. 7916

PROJECT: EPCM SERVICES FOR PX-PTA EXPANSION PROJECT
JOB NO. 44AC7500

OWNER: INDIAN OIL CORPORATION LIMITED-PANIPAT, HARYANA

PMC: NEW ENERGY HOUSE, RAMKRISHNA MANDIR ROAD, KONDIVITA, ANDHERI (EAST), MUMBAI-400059,INDIA
TEL: +91 22 26812000, FAX: +91 22 28208295

ITEM: HOT OIL HEATER FOR PTA UNIT (21-F1-1251)

BHARAT HEAVY ELECTRICALS LTD.,
HEAVY PLATES & VESSELS PLANT UNIT, VISAKHAPATNAM-530012

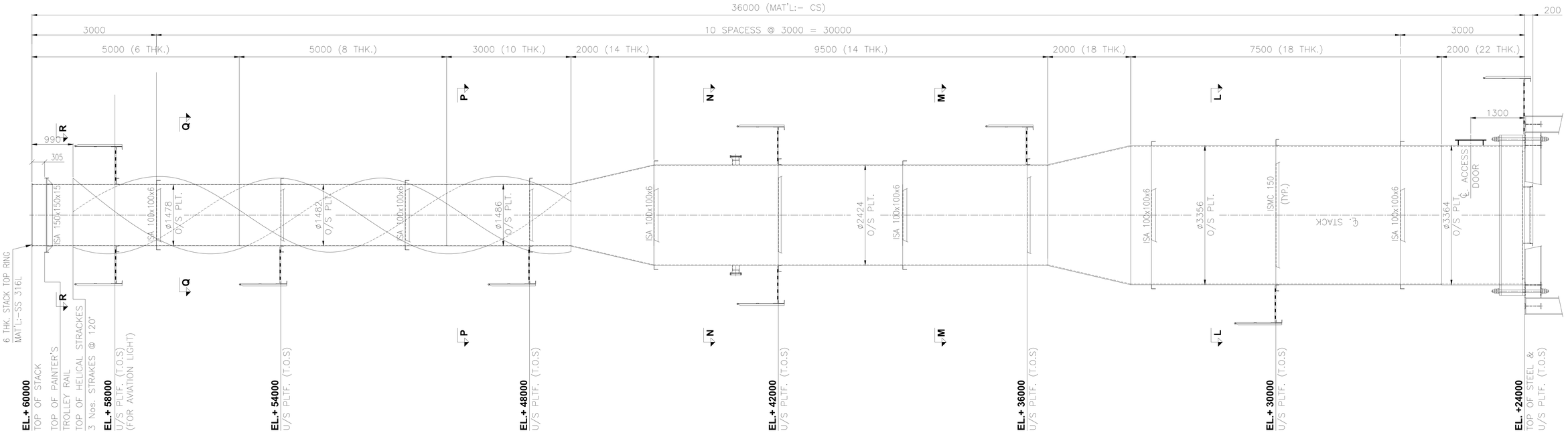
DRAWN	N.Alcheth
CHECKED	N.V.Reddy
APPROVED	E.S.N.PRASAD
DATE	29.07.2021
ALL DIMENSIONS ARE IN MILLIMETRES	SCALE 1:55

TITLE: GENERAL ARRANGEMENT OF HOT OIL HEATER RADIANT AND CONVECTION SUPPORTING STRUCTURE

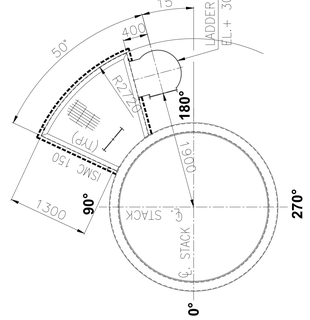
C.DRG NO.44AC-7500-221-M-B01-0008-A1 REV. 1

BHEL DRG NO. 1-35-110-U0368

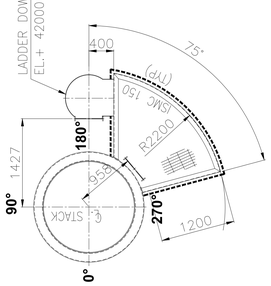
A1:841x594



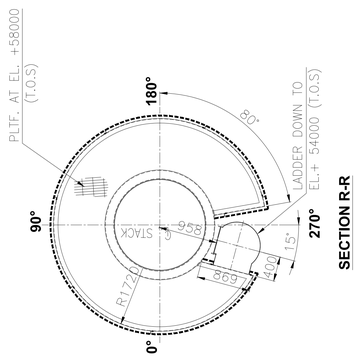
SECTIONAL ELEVATION OF STACK
(FOR TRUE ORIENTATION REFER PLANS)
(VIEW FROM 270° END)



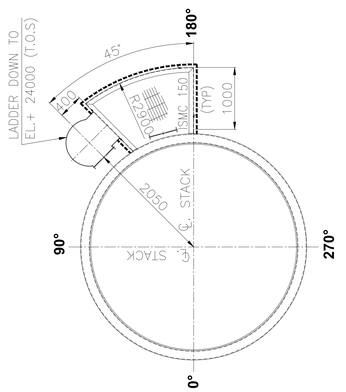
SECTION M-M
(PLTF. AT EL. +36000 T.O.S)



SECTION P-P
(PLTF. AT EL. +48000 T.O.S)



SECTION R-R



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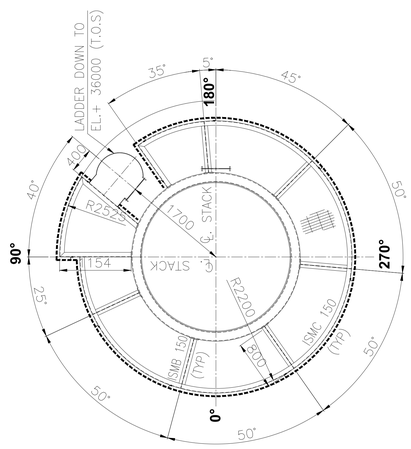
(PLTF. AT EL. +30000 T.O.S)



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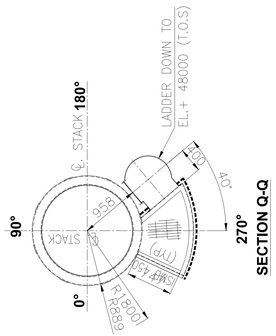
(PLTF. AT EL. +42000 T.O.S)



SECTION Q-Q

(FOR PLANS ONLY)

MEMBER SIZES SHOWN ARE PRELIMINARY AND INDICATIVE ONLY. BHEL TO FINALIZE & OPTIMIZE THE SIZES AFTER STRUCTURAL DESIGN AND ANALYSIS.

Worley	Document Status Code
Status	**Review Code**	**Status Description**
☐	1	No Comments, Work may proceed.
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☑	4	Document / Drawing Retained for Information.

Document status code assigned by:
Name: Ajay Bidwai **Date:** 17-Nov-2021

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REV NO.	ZONE	BRIEF RECORD OF REVISIONS	PPD.	CHD.	APPD.
1	10-11-2021	WORLEY COMMENTS DATED ON 20-AUG.-2021 INCORPORATED			

CAUTION: THE INFORMATION ON THIS DOCUMENT IS THE PROPERTY OF BHARAT HEAVY ELECTRICALS LIMITED. IT MUST NOT BE USED DIRECTLY OR INDIRECTLY IN ANY WAY DETRIMENTAL TO THE INTEREST OF THE COMPANY.

CUSTOMER No. 7916

PROJECT: EPCM SERVICES FOR PX–PTA EXPANSION PROJECT
JOB NO. 44AC7500

OWNER: INDIAN OIL CORPORATION LIMITED–PANIPAT, HARYANA

PMC: NEW ENERGY HOUSE, RAMKRISHNA MANDIR ROAD, KONDIVITA, ANDHERI (EAST), MUMBAI–400059,INDIA
TEL: +91 22 26812000, FAX: +91 22 28208295

ITEM: HOT OIL HEATER FOR PTA UNIT (21–F1–1251)

BHARAT HEAVY ELECTRICALS LTD.,
HEAVY PLATES & VESSELS PLANT UNIT, VISAKHAPATNAM–530012

DRAWN	N.Alekuth	TITLE
CHECKED	N.V.Reddy	AUXILIARY HOT OIL HEATER (21–F1–1251)
APPROVED	E.S.N.PRASAD	G.A OF STACK WITH PLATFORMS
DATE	29.07.2021	
ALL DIMENSIONS ARE IN MILLIMETRES		C–DRG.NO.44AC–7500–221–M–B01–0004–A1 REV.
SCALE 1:55		BHEL DRG NO. 0–87–111–U0002 1

A1:841x594

	MANUFACTURER'S NAME & ADDRESS **BHEL-VISAKHAPATNAM or Approved Sub-Contractor**	**MANUFACTURING QUALITY PLAN** **ITEM:** Hot Oil Heater QP NO: CQP 2519 Rev 00 Date: 31.08.2021 PAGE 1 of 3	PROJECT: IOCL Panipat PACKAGE: Hot Oil Heater SO NO: 7916 Customer PO : 44AC7500-00-ER-06-0105/2020-21/FOA/142 Dt. 08-01-2021

SL No	COMPONENT & OPEARATION	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENTS	ACCEPTANCE NORMS	FORMAT OF RECORD		AGENCY			REMARKS
										M	C	N	
1	2	3	4	5	6	7	8	9	D				
1.0	**RAW MATERIALS & BOUGHT OUT ITEMS**												
1.1	Pipes & Tubes as applicable	Mechanical Chemical NDT as applicable	A	TC verification	100%	Material Specification as per Column 2, Internal TDC.	Mfg TC/ Material Data Report	√		-	QC	R	Note 1
1.2	Flanges & Fittings as applicable	Mechanical Chemical NDT as applicable	A	TC verification	100%	Material Specification as per Column 2, Internal TDC	Mfg TC/ Material Data Report	√		-	QC	R	Note 1
1.3	Plates as applicable	Mechanical Chemical NDT as applicable	B	TC verification	100%	Material Specification as per Column 2, Internal TDC	Mfg TC As applicable	√		-	QC	R	Note 1
1.4	Other Materials as per respective material specification and BHEL Drawing						-				QC	-	Check on sample basis

Prepared by	Reviewed & Approved By	LEGEND:	Approved By
P. Gopi Kishore Manager/QA	A.K. Mandal AGM (Q&BE)	A: Critical; B: Major; P: Perform; R: Review; W: Witness; RW: Random Witness; V: Verification QC: Quality Control; NDT: Non Destructive Testing; TDC: Technical Delivery Condition; TC: Test Certificate; AWS: American Welding Society; WPS: Welding Procedure Specification; PQR: Procedure Qualification Record; WQR: Welder Qualification Record; RT: Radiographic testing; LPI: Liquid Penetrant Inspection; PMI: Positive Material Identification M: BHEL/Approved sub-contractor; C: BHEL QC/ND/Authorized Inspection Agency (AIA); N: TPIA appointed by BHEL for this project; For clauses marked with (TICK) in "D", Certificates shall be included in Documentation.	Customer Signature & Stamp

SL No	COMPONENT & OPEARATION	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENTS	ACCEPTANCE NORMS	FORMAT OF RECORD		AGENCY			REMARKS
										M	C	N	
1	2	3	4	5	6	7	8	9	D				
2.0	**INPROCESS INSPECTION**												
2.1	Welding Qualification	Procedure Qualification	B	WPS Review	100%	ASME Sec IX as applicable	WPS PQR	-		P	QC	V	
2.2	Welder Qualification	Personnel Qualification	B	WQR Review	100%	AWS/IBR/IS (#)	WQR	-		P	QC	V	# As applicable
2.3	Edge preparation of Pressure parts	Soundness	B	Visual & LPI	100%	IS 800	LPI Report	√		P	QC & NDT	-	
2.4	Fit up inspection	Weld angle, mismatch, root gap	B	Visual & Dimension	100%	BHEL Drawing	-	-		P	QC	-	
2.5	**NDE for Welds**												
2.5.A	Butt welds in Radiant coils, Convection coils Crossover lines and all T joints	Soundness	B	RT	100%	Customer Specification	RT Report	√		P	NDT	*	*Random check
2.5.B	Root and final welds of all butt and fillet joints	Soundness	B	PT	100%	Customer Specification	RT Report			P	NDT	*	*Random check
2.5. C	All other welds	Soundness	B	Visual	100%	As per drawing	-			P	QC	-	
2.6	PWHT	Temp Vs Time	B	Review	100 %	Drawing & HT Cycle	HT Chart			P	QC	R	
2.7	Hydro test	Soundness	B	Visual	100%	Customer Specification & BHEL Drawing	Hydro test report	√		P	QC	W	Note 2

	MANUFACTURER'S NAME & ADDRESS **BHEL-VISAKHAPATNAM or Approved Sub-Contractor**	**MANUFACTURING QUALITY PLAN** **ITEM:** Hot Oil Heater QP NO: CQP 2519 Rev 00 Date: 31.08.2021 PAGE 3 of 3	PROJECT: IOCL Panipat PACKAGE: Hot Oil Heater SO NO: 7916 Customer PO : 44AC7500-00-ER-06-0105/2020-21/FOA/142 Dt. 08-01-2021

SL No	COMPONENT & OPEARATION	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENTS	ACCEPTANCE NORMS	FORMAT OF RECORD		AGENCY			REMARKS
										M	C	N	
1	2	3	4	5	6	7	8	9	D				
3.0	**FINAL INSPECTION & TESTING**												
3.1	Visual & Dimensional check	Visual & Dimensions	B	Visual Measurement	100%	BHEL Drawing	Inspection Report	√		P	QC	W	
3.2	Identification & Painting	Stenciling, Cleanliness & PMI	B	Verification, Visual	100%	Customer Specification & BHEL Drawing	PMI report			P	QC	V	PMI for SS & Alloy Steel Items
3.3	Preservation & packing	Packing	B	Visual & Verification	100%	BHEL Drawing	-			P	QC	V	
3.4	Data Folder	Documents	B	Verification	100%	IBR As applicable #	IBR forms				QC		# For other than IBR, as per customer specification

Notes for CQP 2519 for Hot Oil Heater of IOCL Panipat;

* As per the approved PGMA Inspection Categorization Plan 7916 PGMA Cat List (Latest Revision).

1) Pipes and fittings shall be procured in seamless condition

2) Only for Radiant coils and convection coils. After hydro test in coils, dry / hot air shall be used for cleaning.

3) Coil ends shall be capped for safety.

4) After completion of painting, stenciling shall be done on all the equipment using normal Arial lettering style. Lettering colour can be black or white depending on the background to have legibility.

5) PMI shall be 100%. PMI is only for stainless steel (pipes, flanges, fittings and plates), alloy steel (flanges and fittings) and weldments of alloy steel and stainless steel. All alloy stainless steel. All alloy materials shall be stenciled with PMI OK after satisfactory PMI check.

6) Quality Plan for Site Construction Activity (CQP 2520 Rev.00) in line to point no.26 of KOM MOM Dt. 22-01-2021 is being submitted separately.

Painting Schedule for Hot Oil Heater Package

BHARAT HEAVY ELECTRICALS LTD .
Heavy Plates & Vessels Plant
Visakhapatnam - 530 012

Project : Hot Oil Heater for M/s IOCL-Panipat

Doc.No.: 44AC-7500-221-M-N04-0001-A4 / R2

S.No.	DESCRIPTION	SURFACE PREPARATION & PROFILE	Temp. applicable Deg C	Coating type/system	PRIMER COAT		Build Coat		FINISH PAINT		TOTAL DFT
					PAINT	NO OF COATS / DFT	PAINT	NO OF COATS / DFT	PAINT	NO OF COATS / DFT	µm/min
1	External surfaces of Heater casing, FG Duct, H/Box, ACHE, Heater & ACHE Supporting structure & Stack	Abrasive Blast Clean to Sa 2½	>0 and ≤200	CS1	Inorganic zinc silicate @ 75µm	1	High Build Empoxy MIO @ 125 µm	1	High temperature silicon acrylic @ 50µm-Color code_RAL9006 Aluminum.	1	250
2	Heater inside surface in contact with Ceramic Fiber	Abrasive Blast Clean to Sa 2½	-	-	Epiplus-56 of Shalimar or Equ.@ 90-100 microns each	2	-	-	-	-	180-200
3	Stair tower & Other Misc. structures.	Abrasive Blast Clean to Sa 2½	>0 and ≤200	CS1	Inorganic zinc silicate @ 75µm	1	High Build Empoxy MIO @ 125 µm	1	High temperature silicon acrylic @ 50µm-Color code_RAL7035 Light grey	1	250
4	Hand railing (Hot dip Galvanized as per latest revision of BS 1461 Coating weights as per Table-1 BS1461)	Sweep blast Using Aluminium oxide or garnet abrasive media.	>0 and ≤120	CS1	High build epoxy @75µm	1	High Build Empoxy MIO @ 125 µm	1	Two pack acrylic polyurethane @50µm Color code_RAL3001 Red	1	250
5	Staircase, Ladders and Walkways	Abrasive Blast Clean to Sa 2½	>0 and ≤200	CS1	Inorganic zinc silicate @ 75µm	1	High Build Empoxy MIO @ 125 µm	1	High temperature silicon acrylic @ 50µm-Color code_RAL9017 Black	1	250
6	LP Steam Piping & Fittings (PGMA: 24-400)	Abrasive Blast Clean to Sa 2½	>200 and <400	CS 4	Inorganic zinc silicate @ 75µm; Colour Code: Aluminium RAL-9006	1	-	-	-	-	75
7	Instrument Air Piping & Fittings (PGMA: 24-300)	Surface Profile to 40-60 µm	>0 and ≤200	SS 1	Two pack Epoxy phenolic @ 150µm; Colour Code: May Green RAL-6017	1	-	-	Two pack Epoxy phenolic @ 150µm; Colour Code: May Green RAL-6017	1	300
8	Hot Oil piping external to Heater	Abrasive Blast Clean to Sa 2½	>201 and <400	CS4	Inorganic zinc silicate @ 75µm Colour Code: Aluminium RAL-9006	1	-	-	-	-	75
9	Fuel Gas line	Abrasive Blast Clean to Sa 2½	≤200	INS1	Two pack epoxy phenolic @ l50µm Colour Code: Orange RAL-2008	1	-	-	Two pack epoxy phenolic @ l50µm Colour Code: Orange RAL-2008	1	300

Notes: Sweep blast stainless steel, Galvanized steel surfaces using Aluminum oxide or garnet abrasive media.

1. Insulation/Refractory related paint will be supplied by Refractory supplier

Coating system revised and build coat added for Sl.No. 1,3 to 5

JACOBS

IndianOil

DEPARTMENT	:	CONSTRUCTION
DOCUMENT NO	:	44AC7501/K.02/0006/A4
DOCUMENT TITLE	:	ACTIVITIES FOR MECHANICAL COMPLETION
PROJECT NO.	:	44AC7501
LSTK	:	
PART/ SECTION	:	
PROJECT LOCATION	:	IOCL PANIPAT
PROJECT TITLE	:	EPCM SERVICES FOR PTA UNIT
CLIENT	:	INDIAN OIL CORPORATION LIMITED
CLIENT PROJECT NO.	:	
CLIENT AUTHORIZATION	:	
PM AUTHORIZATION	:	NITIN PHATAK

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☐	Revised Pages Only Issued this Revision	☐	Client Approval	☐	Construction
		✓	Enquiry		

CONTENTS

1.0 PURPOSE AND OBJECTIVE

1.1 As various plants, systems and facilities are being completed; the responsibilities of CONTRACTOR & OWNER are to be defined for executing their assignments and facilitate the transfer of responsibility from CONTRACTOR / OWNER for custody of the plant. The various activities to be performed are identified and check list prepared to identify work responsibilities. The objective of this checklist is to assist the CONTRACTOR / OWNER in achieving the same. Negotiations can be held between the two to finalize their responsibility, should there be need for revision in checklist.

1.2 For purpose of defining mechanical completion various activities defined in the job specification shall prevail in case of any contradiction elsewhere in the Bidding document.

2.0 GENERAL PROCEDURES

The Tick Mark shown in the First Column pertains to the activities to be performed by the CONTRACTOR to achieve Mechanical Completion as per Contract. The activities indicated in the Second Column are also to be performed by the CONTRACTOR. However, the same shall not be reckoned for Mechanical Completion with regard to Contracts. For activities where tick marks are there in both first and second column, the activity needs to be completed by the CONTRACTOR to the extent possible for Mechanical Completion, i.e. the reason for non-completion should not be attributable to the CONTRACTOR.

		Work Responsibility		
		Contractor		Owner
		1	2	3
2.1	Manufacturer OR Vendor Service Assistance Where responsibility is not indicated in Section 3			
	a) Obtain the assistance of the manufacturer or vendor, when necessary, to make a satisfactory installation as agreed on by the CONTRACTOR and the OWNER.	√		
	b) Obtain the assistance of the manufacturer or vendor, as required, for technical assistance during run-in by the OWNER's operating and maintenance personnel, for training or for informational and operating purposes.		√	
	c) Furnish names and telephone numbers including emergency contact of manufacturers, and vendors, technical service representatives for use by the OWNER.	√	√	

		Work Responsibility		
		Contractor		Owner
		1	2	3
2.2	Permits			
	a) Procuring all necessary permits and certifications required to be secured by the OWNER for initial use of the plant.	√		
	b) Make applications for all necessary permits issued in the OWNER's name that are required for plant use, occupancy and operation.	√		
2.3	Instructions			
	a) Maintain an adequate vendor instruction file so that information may be readily retrieved through plant commissioning.	√		
	b) Transmit to the OWNER all applicable vendor's or manufacturer's instructions and drawings.	√		
	c) Provide the OWNER with any special instructions such as the required procedures for drying liners.	√		
2.4	Removal of Rust Preventives			
	a) Remove all rust preventives and oils used to protect the equipment during the construction period whenever these protective materials will be detrimental to operation.	√		
	b) Provide the OWNER with a record of work completed.	√		
2.5	Lubricants			
	a) Provide a list of the manufacturer's recommended lubricants for use in the plant	√		
	b) Approve the lubricant list			√
	c) Provide all lubricants	√		
	d) Flush systems and install initial charge of the lubricants. Dispose of all flushing oil in accordance with the OWNER's instructions	√		
	e) Maintain Lubrication after initial charge	√		√

		Work Responsibility		
		Contractor		Owner
		1	2	3
2.6	Packing and Seals			
	a) Install mechanical seals and accessories, as required.	√		
	b) Install permanent packing and accessories as required.	√		
	c) Adjust and replace mechanical seals, packing and accessories as necessary during commissioning period.		√	
2.7	Removal of Temporary Bracing			
	a) Remove all temporary supports, bracing or other foreign objects that were installed in vessels, ducts piping, transformers, machinery or other equipment to prevent damage during shipping, storage and erection and repair any damage sustained.	√		
	b) Remove other items as specified in items 3.7h for the appropriate equipment type.	√		
2.8	Rotation and Alignment			
	a) Check rotating machinery for correct direction of rotation and for freedom of moving parts before connecting the driver.	√		
	b) Perform cold alignment to the manufacturer's tolerances and record data.	√		
	c) Perform hot alignment.		√	
	d) Perform any doweling required.	√		
	e) Obtain the services of a factory representative to witness installation of equipment as required.	√		
2.9	Tie-Ins at Unit Limits			
	a) Prepare all systems for safe tie-ins	√		
	b) Obtain approval and make the necessary tie-ins at the unit limits, as required by the specifications and as directed by the OWNER.	√		
	c) Remove / install blinds, car seals and so forth as required.	√		

		Work Responsibility		
		Contractor		Owner
		1	2	3
2.10	Leak and Pressure Tests			
	a) Notify the OWNER of the schedule for non-operating field leak tests or field pressure tests on piping and field fabricated equipment, unless otherwise directed by the OWNER.	√		
	b) Notify the OWNER of the schedule & accordingly carry out all Pre-Commissioning field leak tests, which require compressor to run on nitrogen or hydrogen, unless otherwise directed by OWNER		√	
	c) Provide any special media for test purposes.	√		
	d) Conduct all tests in accordance with applicable codes, specifications, regulations and the OWNER's instructions.	√		
	e) Witness Tests	√	√	√
	f) Maintain records as required.	√		
	g) Dispose of all test media in accordance with the OWNER's instructions.	√		
	h) Conduct all operational tightness tests.		√	
2.11	Inspection			
	a) Provide inspection of the plant to verify that erected facilities conform to flow diagrams, construction drawings, vendor prints and specifications.	√		
	b) Verify that specified materials have been installed in the plant and document verification to the extent required by the OWNER.	√		√
	c) Verify and approve the plant inspection. Note any exceptions on a separate work order list (punch list).			√
	d) Provide for special inspections such as those required by insurance or governmental agencies.	√		
	e) Perform and report routine shop inspection.	√		
	f) Perform shop inspection and witness tests as desired.	√		
	g) Witness final shop inspections, as specified.	√		

		Work Responsibility		
		Contractor		Owner
		1	2	3
2.12	Pressure / Vacuum Safety Relief devices			
	a) Provide the OWNER with a list of proper pressure settings.	√		
	b) Transfer relief devices to and from the specified facility	√		
	c) Test and adjust all devices to and from the specified facility.	√		
	d) Install all devices after testing, adjusting and tagging.	√		
	e) Maintain records as required.	√		
2.13	Flushing and Chemical / Mechanical Cleaning.			
	a) Except as noted in 3.4, 3.5, 3.9, 3.10 and 3.12			
	i Conduct all flushing, blowing and chemical / mechanical cleaning operations where such operation can be accomplished without using permanently installed equipment.		√	
	ii. Dispose of all media in accordance with the OWNER's instructions.		√	
	iii. Conduct all flushing and blowing operations where permanently installed equipment must be used to obtain proper line velocities.		√	
	iv. Provide any special media for flushing and/or cleaning purposes.		√	
	b) Turn systems over to the OWNER free of trash and construction debris (not necessarily free of welding slag only)	√	√	
	c) Maintain records, as required.	√	√	
2.14	Temporary Screens, Strainers and Blinds			
	a) Provide and install all required temporary strainers	√	√	
	b) Clean strainers, as required during circulation.	√	√	
	c) Remove temporary strainers when system is adequately cleaned and install permanent strainers	√	√	

		Work Responsibility		
		Contractor		Owner
		1	2	3
	d) Provide install and remove all blinds, spools required for flushing and isolation.	√	√	
	e) Maintain records as required.	√	√	
2.15	Purging / Inerting			
	a) Install purge / inerting connections.	√		
	b) Provide purge materials and conduct necessary purge operations.	√	√	
	c) Provide inerting materials and introduce where specified.	√	√	
2.16	Vessel Packing and Fixed Beds			
	a) Install all inert materials such as sand, gravel balls, rings and saddles.	√		
	b) Install all materials other than the materials specifically noted in Section 3, such as chemicals, resins desiccants and catalysts.	√	√	
	c) Install all mixed beds involving combinations of materials covered by a) and b) above.	√	√	
	d) Inspect the vessel interior before and during loading to ensure proper installation.	√	√	
	e) Maintain records, as required.	√	√	
2.17	House-keeping			
	a) At completion of construction, remove excess materials, temporary facilities and scaffolding, rough sweep or rake the area and pick up trash, perform washing or further cleanup, as required.	√		
	b) After completion of construction, maintain adequate housekeeping practices, as required for safe operation.	√	√	
2.18	Maintenance, Spare Parts and special tools			
	a) After pre-commissioning is complete, protect equipment from normal weather conditions, corrosion or damage.		√	

		Work Responsibility		
		Contractor		Owner
		1	2	3
	b) After pre-commissioning is complete provide adequate maintenance for equipment including the cleaning of strainers and the repairing of steam traps.		√	
	c) Provide the OWNER with spare parts list as recommended by the manufacturers.	√		
	d) After pre-commissioning is complete, maintain adequate spare parts and supplies required during commissioning & performance test run.		√	
2.19	Noise Survey			
	a) Conduct individual equipment noise surveys, as required by the Occupational Safety & Health administration or the OWNER's specifications.	√	√	
	b) Document all survey data	√	√	
2.20	Plant Check out by Licensor			
	a) Provide Licensor specialist's engineering services for checking the critical stage on the equipment			√
	b) Provide Licensor's assistance for plant check out			√
	c) Liquidate any check list points generated	√		
2.21	Quality and Inspection Records			
	a) Provide all records in bound folders pertaining to stage wise inspection as per QAP and base data collected for OWNER's/ PMC's scrutiny/ records.	√		
2.22	Painting and Insulation			
	a) Application of paint prior to installation of piping / equipment as per specifications.	√		
	b) Finish painting of structures, equipment, piping etc. as per specification.		√	
	c) Complete insulation on all equipment, where ever applicable.	√		
	d) Complete insulation on all piping, where ever applicable.	√	√	

3.0 SPECIFIC PROCEDURES

In addition to the work responsibility described in Section 2.0 the detailed procedures Outlined below further define the work responsibility of the Contractor and the Owner for specific systems and items of equipment.

		Work Responsibility		
		Contractor		Owner
		1	2	3
3.1	Vessels			
	a) Open the vessel after erection and put in place any internals requiring field installation. These internals will be inspected before and after installation.	√		
	b) Open both internal and external man ways for inspection of the vessel by the Owner, unless otherwise specified.	√		
	c) Witness inspections to the extent desired.			√
	d) Carry out hydro-test at site, if required	√		
	e) Dry out, if required, upon vessel and install materials that are designated in 2.16	√	√	
	f) Close after proper execution of closure permits.	√	√	
3.2	Shell and Tube Exchangers			
	a) Perform field inspection, if required of exchangers that have previously been shop inspected.	√		
	b) Carry out hydro test at Site.	√		
3.3	Air Cooled Exchangers			
	a) Inspect exchangers to ensure that temporary shipping supports and erection materials have been removed.	√		
	b) Adjust fan assemblies to obtain specified tip clearance and test.	√		
	c) Check operation of louvers and operating linkage.	√		
3.4	Hot Oil Heaters			
	a) Perform the pressure test in accordance with the applicable codes, specifications and the Owner's instructions if required.	√		

		Work Responsibility		
		Contractor		Owner
		1	2	3
	b) Provide all non-operating preferring checks in accordance with the manufacturer's instruction.	√		
	c) Blow fuel lines, check them for cleanliness and connect burner piping.	√		
	d) Check operation of registers and dampers and verify position of indicators		√	
	e) Check operation of air preheaters, blowers and soot blowers		√	
	f) Dry refractory during initial firing by following manufactures temperature cycle.		√	
	g) Conduct Boil out, chemical cleaning, and flushing operations, conduct light off, drying, and purging operations, as required. Dispose of wasted, cleaning media, in accordance with Owners, instruction.	√	√	
	h) Obtain and charge liquid heat transfer heat media, if required.		√	
	i) Conduct light off, drying, and purging operations.		√	
	j) Obtain the assistance of a service engineer for technical advice during installation of start up if desired.	√	√	
3.5	Pumps, Compressors and Drives			
	a) Level base plates and sole plates and grout all bearing surfaces	√		
	b) Alleviate any excess piping stresses that may be imposed on pumps, compressors and drivers.	√		
	c) Chemically clean any completed lube and seal oil system when specified. Dispose of wastes and cleaning media in accordance with the Owner's instructions.	√		
	d) Charge the lube oil, seal oil and oil cooling systems with flushing oil and circulate for cleaning purpose. Dispose of any flushing oil in accordance with Owner's instructions.	√	√	

		Work Responsibility		
		Contractor		Owner
		1	2	3
	e) Charge the lube oil, seal oil and oil cooling systems with the operating oil recommended by the manufacturer.	√	√	
	f) Operate equipment and make vibration trip governor and safety device checks and any operating tests and adjustments as required.	√		
	g) Obtain the assistance of service engineer for technical advice during installation or start up if desired.	√		
	h) Carryout no load trail run, vibration check, speed check and power consumption check.	√		
	i) Replace driver and equipment, if required.	√		
	j) Maintain records as required.	√		
3.6	Tanks			
	a) After erection and installation, install any internals, which require field installation.	√		
	b) Test tank and internals as required. Dispose of test water in accordance with the Owner's instructions.	√		
	c) Conduct chemical cleaning or flushing operations as required. Dispose of wastes and cleaning media in accordance with the Owner's instructions.	√		
	d) Witness test and inspections to the extent desired.			√
	e) Close after proper execution of closure permits.	√		
3.7	Piping System			
	a) Notify the Owner of test schedule.	√		
	b) Hydrostatically or pneumatically test all piping as required by codes, specifications and the Owner's instructions.	√		
	c) Witness field pressure tests, when notified.			√
	d) Flush and drain system and install orifice plates. Orifice plates shall not be installed before hydrostatic testing. (See 3.9 for the removal or isolation of other inline components)	√		
	e) Drain system, remove blinds and perform tightness tests as required.	√		

		Work Responsibility		
		Contractor		Owner
		1	2	3
	f) Insulate or paint flanges, threaded joints or field welds after the specified testing of each system has been completed. Unless instructed otherwise by Owner.	√	√	
	g) All welded joints (longitudinal, girth and nozzle) in underground piping that have not been shop tested shall be left exposed (free of paint, dope and wrap) until the specified testing has been completed. After final testing of these joints cover the system.	√		
	h) Check pipe hangers, supports, guides, expansion joints and other pipe specialties for the removal of all shipping and erection stops and for the correctness of cold settings for the design service. Also provide the Owner with instructions for hot settings.	√		
	i) Check pipe hangers, supports guides and pipe special items for hot settings and make minor adjustments as necessary.		√	
	j) Install permanent filter elements as required.		√	
	k) Verify, to the extent required by the Owner that specified valve packing has been provided in valves installed in the plant.	√	√	
	l) Install car seals on valves whether necessary.	√		
	m) Check and record the positions of all car sealed valves paint of identify valves as required.	√		
	n) Correct support, vibration and thermal expansion problems detected during commissioning.			
	o) Re-torque all hot and cold service bolting during commissioning and startup as required		√	
3.8	Electrical Power and Lighting Systems			
	a) Notify the Owner of the test schedule.	√		
	b) Witness tests when notified and record test data as required.			√
	c) Using a megohmmeter, make insulation tests on all wiring except lighting wiring.	√		

		Work Responsibility		
		Contractor		Owner
		1	2	3
	d) Using a megohmmeter, make insulation tests on motor and transformer winding from phase to phase and phase to ground.	√		
	e) Make grounding system tests to determine the continuity of connections and the value of resistance to ground.	√		
	f) Arrange for breakdown tests on oil sample from oil insulated transformers larger than 100 kilovolts absolute.	√		
	g) Charge electrical gear with oil and / or other media as required.	√		
	h) Perform trails and adjustments on all switchgear, motor control equipment and generators.	√	√	
	i) Test and set switchgear and circuit breaker relays for proper coordination.	√		
	j) Check installation of PA & paging system, EPABX system etc. where ever applicable.		√	
	k) Check installation of FA & Detection system, where ever applicable.	√		
	l) Check performance of soft starters (if applicable) & variable speed drives.	√		
	m) Obtain local inspector's approval, where required.	√		
	n) Energize all substations with approval of the Owner after completion of all tests.	√		
	o) Check phase sequence polarity and motor rotation.	√		
	p) Check installation of emergency power and lighting systems.	√		
	q) Provide the Owner with a record of work completed.	√	√	
3.9	Instrument System			
	a) Conduct any non-operating checks to ensure instrument operability, that is remove all shipping stops, check pointer travels and verify instrument capability to measure operate and stroke in the direction and manner required by the process application.	√	√	

		Work Responsibility		
		Contractor		Owner
		1	2	3
	b) As dictated by the Owner's practice, bench or field calibrate instruments with standard test equipment and make all required adjustments and control point settings.		√	
	c) Clean all transmission and control tuning by blowing with cooled and filtered clean air before connecting to instrument components.		√	
	d) Clean all air-supply headers by blowing with clean air and check them for tightness		√	
	e) Leak test pneumatic control circuits in accordance with clean the latest edition of ISA Recommended Practice 7.1. Pneumatic control circuit pressure test.		√	
	f) Check piping from instruments to process piping for tightness.		√	
	g) Install and connect all system components and verify their conformance to specification and design criteria for function and range using dummy transmission signals as need.	√		
	h) Check all electrical signals and alarm wiring for continuity, correct source of power and polarity.	√		
	i) Check thermocouples for proper joining of wires, position of elements in wells proper polarity and continuity of receiving instruments.		√	
	j) Identify orifice plates by tagging.	√		
	k) Check and record bores of orifice plates and install after completion of flushing operations.		√	
	l) Isolate or remove, if necessary, inline components such as control valves, positive displacement meters and turbine meters for pressure testing. Reinstall these items after testing the system with the components removed or isolated.		√	
	m) Identify instrument and junction boxes and tagging	√		
	n) Loop checking of instrument from field to control room	√		

		Work Responsibility		
		Contractor		Owner
		1	2	3
	o) Isolate or remove components for flushing operations and reinstall them on the completion of these operations.		√	
	p) Install any sealing fluids as required.	√	√	
	q) Fully pressurize and energize the transmitting and control signal system(s) by opening process connections at primary sensors and final regulations and by making control mode settings for automatic operation of equipment as the process unit is charged and brought on stream.		√	
	r) Provide a schedule of recorder charts.	√	√	
3.10	Fire Water Systems			
	a) Inspect for completeness and correctness of installations and make any non-operating checks that may be required	√		
	b) Operate fire pumps to check performance of systems.		√	√
	c) Head up reservoirs, vessels, tanks and other water system equipment as required, fill with water check for leaks and flush to clean.	√		
	d) Provide insurance company inspection of the fire system as required.	√	√	
	e) Obtain and install all required fire fighting chemicals and portable equipment such as hoses, fire extinguishers and related equipment.	√		
3.11	Waste Disposal			
	a) Inspect facilities for completeness and correctness of installation and make any non-operating checks to ensure their conformance to specifications.	√		
	b) Operate all equipment and supply all chemicals and agents to waste treatment.		√	
	c) Obtain the services of a waste treatment consultant to advise and monitor the system operation as required by the Owner.	√	√	

		Work Responsibility		
		Contractor		Owner
		1	2	3
3.12	Buildings and Accessories			
	a) Check installation of buildings and accessories including all heating ventilating and air conditioning equipment to ensure their completeness and conformance of specifications.	√		
	b) As required obtain certification that all plumbing, electrical, fire protection, elevation and special material handling installations comply with local government regulations.	√		
	c) Operate heating, ventilation and air conditioning units and make all performance tests.		√	
	d) Obtain certificate for occupancy and use, if required.	√	√	
3.13	Miscellaneous Equipment (Agitators, Mixers, Rotary Filters, Weigh Scales and Materials Handling Equipment.			
	a) Fully assemble rotary filters except for final filter media (cloth, precoat or screen).	√		
	b) Install all final filter media.		√	
	c) Level and calibrate weigh scales with the assistance of the manufacturer's representation and set tare weights wherever possible.	√		
	d) Manually check materials handling equipment for freedom and direction of movement.	√		
	e) Check clearance on materials handling equipment as directed by the Owner.		√	
	f) Make all final adjustments during run in and conduct any required performance test.		√	
	g) Obtain a service engineer for technical assistance during installation of startup, if required.	√	√	
	h) As required obtain certification that all lifting and materials handling installations and other items of equipment comply with government regulations.	√	√	

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PROJECT TITLE	:	**HOT OIL HEATERS (EPCM SERVICES FOR PTA UNIT)**
CLIENT	:	**INDIAN OIL CORPORATION LIMITED**
CLIENT PROJECT NO.	:	
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CONTENTS

1.0 GENERAL

1.1 The LSTK CONTRACTOR is required to organize and mobilize construction ~~management~~ services in a systematic and sequential manner to ensure that the plant installation is carried out in accordance with the approved engineering drawings, specifications, standards, QA/QC procedures etc., and its completion is achieved within targeted time schedule.

1.2 The construction supervision, co-ordination and management activities shall be carried out by the LSTK CONTRACTOR in accordance with the construction procedures developed and submitted by the LSTK CONTRACTOR and approved by OWNER/PMC. LSTK CONTRACTOR will prepare construction schedules within the framework of overall contract schedule and submit to OWNER/PMC for approval. LSTK CONTRACTOR shall plan, execute, monitor and control construction activities as per the approved construction schedule.

Home office support shall be provided, during construction, on all matters of project execution including but not limited to the followings:

- Field engineering
- Availability of Vendor specialists, as required, during construction
- Rectification/ replacement of defective supplies, if any, noticed during construction and commissioning
- Inspection/expediting of replacement orders/field purchase orders for items ordered by Field Purchase Cell
- Expediting replacement of imported / indigenous items found short/damaged
- Material receiving inspection at site and the required documentation
- Compliance of all statutory requirements and the documentation required as per statutory regulations including co-ordination with OWNER/PMC, as required LSTK CONTRACTOR will depute a project team at site during construction phase under a Project Manager/Coordinator for providing above-mentioned support to site team.

1.3 The LSTK CONTRACTOR shall establish and maintain a material-testing laboratory for carrying out field tests during execution for various disciplines (civil, structural, piping etc.) at no extra cost to OWNER. All the test equipment deployed shall have valid test/ calibration certificates. If the OWNER/ PMC desires to have any testing to be done by an approved independent test laboratory, LSTK CONTRACTOR shall carry out the same at no extra cost to the OWNER

1.4 LSTK CONTRACTOR is deemed to be having full knowledge of the applicable laws and regulations, conditions of labour, local conditions, the site conditions and environmental aspects and shall comply with the requirements thereof including OISD standards.

1.5 The following functions to be performed by the LSTK CONTRACTOR will include but not limited to the following as key function for effective timely and safe execution, monitoring and

control.

- Health, Safety and Environment (HSE) Management
- Work Permit system
- Quality assurance and quality control
- Inspection on receipt of materials at site
- Shipping, custom clearances, inland transportation
- Construction supervision
- Field Engineering
- Field Purchase
- Statutory clearances and enforcement of statutory rules / regulations and labour laws.
- Personnel/Administration/Industrial Relations
- Billing and Invoicing
- Finance and Accounts
- Security

2.0 CONSTRUCTION MANAGEMENT AND EXECUTION

2.1 TEMPORARY FACILITIES AND INFRASTRUCTURE – NOT APPLICABLE

a) The LSTK CONTRACTOR shall make arrangement for the followings outside the project premises

- Accommodation for staff and labours
- Borrow earth area (if required)/ excess earth-dumping yards

b) Material/Crane movement roads required shall be identified by LSTK CONTRACTOR and got reviewed/ accepted for availability by OWNER/PMC. However, construction of hard stands for the positioning of crane in the fabrication yard and at erection site/ locations including approach roads to the hard stands from the plant roads shall be LSTK Contractor's responsibility. The hard stands shall be suitable for the crane loads provided by the crane manufacturer.

c) The LSTK CONTRACTOR shall be responsible for the followings:

- All necessary permits associated with the transportation of materials using public facilities such as the harbour and public roads, including police escorts if applicable.
- Removal and restoration of all obstructions previously removed to facilitate the transportation and erection of materials.
- LSTK CONTRACTOR shall make available to OWNER/PMC, developed plans and procedures with respect to the above at least four months prior to the planned date for the first off-loading and transportation of materials.
- Building temporary roads including access roads (of adequate width) to plant and culverts for transportation of equipment and other items as required.

- Strengthening of available permanent roads and existing culverts for transportation of equipment and other materials as required.

2.2 CONSTRUCTION WATER AND POWER -

The scope of supply of construction water and power shall be as indicated in the bid document.

2.3 UNDERGROUND INSTALLATIONS

The LSTK CONTRACTOR shall be responsible to carry out a detailed study for identification of the underground installations using the modern technologies available for such study. The report for such study to be submitted for review of OWNER/PMC. The LSTK CONTRACTOR shall execute the work in such a manner that the said structures, utilities, pipelines etc. are not disturbed or damaged during the course of execution of works.

2.4 CONSTRUCTION STRATEGIES

The construction strategy shall consider and address potential for the use of skid mounted, Vendor package units, pre-assembled heaters and boilers, prefabrication and pre-assembly of structural steelwork and the pre-dressing of columns/vessels/exchangers prior to their erection. Construction strategies shall also take account of the method of delivery of materials to the Site and the subsequent transport to the Project Site, ensuring that the principle of constructability is maintained throughout all phases of the Project.

2.5 CONSTRUCTABILITY REVIEW

LSTK CONTRACTOR will perform a programme of Constructability reviews throughout the LSTK phase, commencing early in detail engineering, to ensure key issues of constructability are built into the design, and requirements for construction are established. Executions of the programme will optimize detail design, engineering, planning and procurement with construction methods, logistics and safety objectives. Aspects of constructability that require specific consideration include, but are not limited to:

- Construction plot plan requirements
- Construction/Maintenance/Operational access
- Space and access requirement for heavy lift operations
- Heavy lifting studies and transportation requirements
- Demolition and new construction
- Construction sequence planning Reference Documents
- Temporary Site Facility requirements-storage, laydown and fabrication areas

LSTK CONTRACTOR shall submit for review by OWNER/PMC, its detailed Constructability Review Procedure and also update the regular reviews by LSTK CONTRACTOR in order to

ensure that the principle of Constructability is being maintained throughout all phases of the Project.

2.6 SUB CONTRACTING

a) The LSTK CONTRACTOR shall clearly indicate in his construction methodology whether work shall be done departmentally or by engaging SUB-CONTRACTOR(s) or the combination of both. LSTK CONTRACTOR will prepare detailed methodology for the work to be carried out departmentally as well as through SUB-CONTRACTOR(s) clearly defining the scope and responsibility of LSTK CONTRACTOR and his SUB-CONTRACTOR(s).

b) If LSTK CONTRACTOR proposes to engage SUB-CONTRACTOR(s) for the execution of various activities, he must enter into an agreement or Memorandum of Understanding and the same shall be furnished along with their credential with the bid. SUB-CONTRACTOR(s) credentials will be evaluated along with the offer. LSTK CONTRACTOR shall not be permitted to change the SUB-CONTRACTOR(s) after the award of work under any circumstances without prior approval of OWNER/PMC. Non-compliance of the above will be strictly dealt within relevant provision(s) of the contract.

c) LSTK CONTRACTORS shall only use SUB- CONTRACTOR's who are technically qualified to carry out the required work, who operate quality systems in accordance with ISO 9001–2000 or equivalent, who are financially stable and who can demonstrate past satisfactory experience of similar work.

d) During the execution of works at site, if the LSTK CONTRACTOR engages SUB-CONTRACTOR(s) for execution of works at site as per approval obtained from OWNER/ PMC in line with contract provision(s) and in the event SUB-CONTRACTOR complains in writing to the OWNER with regard to the non-payment of their dues from the LSTK CONTRACTOR for the works executed by them (excluding final payments and payments due after termination of SUB-CONTRACTOR's services by the main LSTK CONTRACTOR), OWNER/ PMC reserves the right to make such payment to the SUB-CONTRACTOR(s) directly based on approved measurements with due notice to the LSTK CONTRACTOR. OWNER/PMC shall release such payments to the SUB-CONTRACTOR at the cost and risk of the LSTK CONTRACTOR in order to ensure smooth execution of work at site. All such payments made by OWNER/ PMC to the SUB-CONTRACTOR(s) shall be deducted from the running account bills or any other payments due to the LSTK CONTRACTOR.

e) The works of all SUB-CONTRACTOR's will be managed by the construction staff of the main LSTK CONTRACTOR who will perform the duties of construction management and will administer, co-ordinate, and inspect the works of the SUB-CONTRACTOR(s) and be responsible for the quality and timely completion of the respective works. The LSTK CONTRACTOR will establish the pre-requisites for successful completion of SUB-CONTRACTOR(s) work. However, by deploying the SUB-CONTRACTOR(s), as approved by OWNER/PMC for any discipline, does not absolve the LSTK CONTRACTOR

for his total responsibility under the subject contract.

2.7 LSTK CONTRACTOR shall submit Construction Management Plan to OWNER/PMC for approval during kick-off meeting. The plan shall detail the management methodology to be applied during the construction phase of the project along with a list of procedures to be utilized in undertaking the work. All reference procedures and detail work plans referred to in this document must be submitted for review and approval by OWNER/PMC at least four (4) weeks in advance of actual commencement of the activity concerned.

2.8 The construction execution plan shall include

a) Temporary facilities

- Exact location of temporary work area, access and general layout inside the area
- Plan and description of the temporary facilities for LSTK CONTRACTOR/ Sub-CONTRACTOR's such as:
  - Identification of borrow earth area (if required)/ excess earth-dumping yards
  - LSTK CONTRACTOR/ SUB-CONTRACTOR's site office and fabrication yards
  - Open storage area and warehouse
  - Miscellaneous work shops
  - Temporary roads including access roads (of adequate width) to plant and culverts for transportation of equipment and other items as required
  - Strengthening of available permanent roads and existing culverts for transportation of equipment and other materials, if required.
  - Security, watch & ward, security gates and watch towers
  - Barrication of area of works from existing plant installations wherever required to get easier work permits
  - Utility supply, storage and distribution systems, as applicable for construction power, construction water, drinking water, water for hydro testing etc.
  - Area lighting
  - Firefighting equipment
  - Drainage and sanitation
  - Field testing laboratory
  - Communication facilities viz. telephone, fax, e-mail etc.
  - Canteen for staff and workers
  - Vehicle parking area
  - First aid arrangement/ medical and health care facilities
  - Safety training / induction room
  - Facilities for OWNER / PMC personnel
- LSTK CONTRACTOR will develop the temporary facilities layout for approval of OWNER/PMC.

b) Sub-Contracting

LSTK CONTRACTOR's plan shall include:

- Sub-contracting philosophy
- List and Scope of work of each sub-contract
- Sub-contract administration plan
- Organization chart of each SUB-CONTRACTOR and controls by LSTK CONTRACTOR

The list and major scope of each sub-contract shall not be changed from those of the LSTK CONTRACTOR's plan unless specially approved by OWNER.

c) LSTK CONTRACTOR's manpower and man-hour histogram by major section and discipline and manpower deployment schedule on monthly basis with distribution of Foreign / Indian/ Local personnel.

d) Major equipment mobilization plan on monthly basis with short description.

e) Route survey inside the project premises for movement of equipment and other materials.

f) Sequence of erection of the entire plant. LSTK CONTRACTOR shall ensure that equipment to be directly erected on receipt as for as possible.

g) Co-ordination with other agencies working in the same project.

h) Other plans of LSTK CONTRACTOR/SUB-CONTRACTOR and procedures to be submitted at least four (4) weeks prior to start of their activities, which shall include the following as a minimum:

- Procedure for identification of underground installations
- Heavy transport and heavy lifting plan (Rigging Plan)
- Pre-fabrication plan
- Erection methodology for all equipment weighing more than ten (10) MT indicating sequence of erection.
- Execution methodology for tie-ins.
- Hydro test plan
- Other activity plans e.g. piping and steel structure erection plan etc. indicating sequence of erection as per material received at site.
- Instrument loop check plan.
- Monsoon counter measures and preparation
- Emergency evacuation plan/procedure
- Storm management plan

3.0 CONSTRUTION PLANNING, SCHEDULING, MONITORING & REPORTING

3.1 LSTK CONTRACTOR shall develop a detailed procedure for construction planning, scheduling, monitoring and reporting for review and approval of OWNER/PMC.

3.2 Construction Master Schedule

a) The construction master schedule developed based on the overall project schedule for review and approval of OWNER/PMC shall,

- Clearly identify activities of the Master Project Schedule
- Indicate major milestones
- Show critical path and activity float time
- Apply activities conforming to the LSTK CONTRACTOR's work breakdown structure
- Take monsoon and holiday seasons into consideration

Detailed activity schedule will be required for each activity identified in Master Project/Construction Schedule, two (2) months after award.

3.3 Schedule control/monitoring

a) Monitoring and control of the construction activities will be carried out as per the approved construction schedule and procedures. To ensure effective monitoring of the programme/schedule, the LSTK CONTRACTOR shall,

- Prepare monthly, weekly and daily construction schedules
- Measure and report construction progress based on physical progress measurement at site as approved by OWNER/PMC
- Prepare Catch up plans, wherever necessary
- Prepare and monitor Hold up reports in respect of drawings, materials and front etc.

4.0 QUALITY ASSURANCE AND QUALITY CONTROL (QA/QC)

4.1 The QA/QC personnel of LSTK CONTRACTOR will be responsible for ensuring quality of construction carried out by the LSTK CONTRACTOR / their approved SUB-CONTRACTOR's in accordance with the approved QA/QC procedures, and management of material testing laboratory.

4.2 The requirements for construction quality management / quality control are given in Annexure-A.

4.3 LSTK CONTRACTOR will carry out inspection, non-destructive tests, analyse and certify acceptability of all welds, materials and works in accordance with specified technical standards/ international standards and carryout inspection and testing of incoming materials as per agreed procedures.

4.4 A procedure for identification and boxing up of flange joints not subjected to hydrostatic tests

at site is enclosed as Annexure - B, which shall be strictly followed by the LSTK CONTRACTOR.

4.5 LSTK CONTRACTOR is required to prepare and submit documents as evidence of the tests performed and quality of works to OWNER/ PMC as per the contract.

4.6 All inspections and QA/QC Test records are to be kept up to date and in first-rate condition by the LSTK CONTRACTOR and shall be made available to PMC/OWNER whenever requested. These documents shall be handed over to OWNER on completion of commissioning of the unit/plant with full compilation and with agreed number of copies.

4.7 All work/ services to be performed by the LSTK CONTRACTOR under this contract shall be of specified/ approved quality and the LSTK CONTRACTOR shall have a Quality assurance / Quality Control (QA/QC) system during the performance of various activities such as engineering, procurement, tendering, construction and commissioning etc.

4.8 Review approval of the activities by OWNER / PMC shall not however dilute the responsibility of the LSTK CONTRACTOR for maintaining quality.

5.0 FIELD ENGINEERING

6.1 Field Engineering cell will consist of mainly engineers who have worked at the design center.

6.2 LSTK CONTRACTOR shall ensure that facilities for viewing & modification of the Plot Plan, Drawings, 3-D Model etc. are available at LSTK CONTRACTOR's respective site offices. Also, the LSTK CONTRACTOR within the scope of services specified in the tender shall facilitate the PMC & OWNER to install such facilities in their respective site offices.

6.3 LSTK CONTRACTOR will be responsible for controlling and issue of technical drawings and documents, preparation of field sketches, preparation of sketches for field modifications, checking/ preparation of as-built drawings, technical assistance for field purchase and field tendering etc. Specialist engineers from LSTK CONTRACTOR's home office will also be deployed at site as per requirements. Site should have necessary facilities to incorporate the field changes and prepare As-built drawings at site itself.

6.4 During prefabrication, pre-assembly and installation of materials at the Site, LSTK CONTRACTOR shall keep a register of all construction defects identified by his own QA/QC inspection team and OWNER/PMC. All such identified defects shall be rectified in accordance with the original design.

6.5 The 3-D model shall be made available at site after 60% model review.

6.0 FIELD PURCHASE

8.1 LSTK CONTRACTOR will be responsible for carrying out field purchase activities as required.

8.2 The bulk of procurement action should be done from LSTK CONTRACTOR's home office. Field purchase items should be restricted to those required for running and maintenance of the field offices, items required to expedite construction work and items found short, missing or damaged against the main order when received at site/ware house/fabrication yard. Any material purchased from field for usage in the Plant should have proper inspection certificate and should be purchased only from PMC/OWNER approved vendors.

7.0 HEALTH, SAFETY AND ENVIRONMENT (HSE) MANAGEMENT

9.1 Safety documents included in the bidding document though are separately written, shall be considered as mutually complementary to one another. In case of ambiguities in the descriptions of safety requirements stringent one shall be considered as applicable.

9.2 LSTK CONTRACTOR shall have a documented HSE policy to cover commitment of their organization to ensure health, safety and environment aspect in their line of operation.

9.3 Safety specifications required to be followed by the LSTK CONTRACTOR are given in Appendix – C.

9.4 It is the responsibility of the LSTK CONTRACTOR to ensure that safe construction procedures are complied with. LSTK CONTRACTOR will also ensure that adequate First Aid medical facilities with trained nurse and ambulance are available for emergency purpose and that safety practices as per the approved safety procedure are followed by his SUB-CONTRACTOR's.

9.5 To assist in the development of an effective safety programme, a HSE Manual including safety checklist for various jobs shall be developed by the LSTK CONTRACTOR and the same shall be submitted to OWNER/PMC for approval.
The responsibilities will include the followings:

a) Co-ordination and supervision of the details of the job safety programme.
b) Initiation of accident reporting, investigation and follow-up actions.
c) Preparation of periodic accident summaries.
d) Periodic accident analysis reports.
e) Tallying safety inspection of the job and submission of summary inspection report to OWNER/PMC.
f) Obtaining work permits for Hot/Cold works, excavation, and higher elevation jobs from the OWNER.
g) Check the fitness of cranes and other hoisting equipment and submit to OWNER/PMC valid/latest test certificates of tackles used for lifting before execution.
h) Submission of any other report required by OWNER/PMC

9.6 Risk Assessment methodology shall be used to identify and assess Health & Safety and Environmental Hazards during field erection and testing up to Final Test Certificate. These hazards may be identified at any stage of the project; e.g. OWNER/PMC data, existing

drawings, site survey investigations, design and Constructability reviews, or information that may emerge during the construction and Pre-commissioning phases.
Once potential hazards are identified, the risk to health and safety must be assessed. The assessment shall characterize the risk in terms of severity and probability. From the risk assessment, a method statement shall be developed which at best would eliminate the risk or as a minimum, would contain the risk to an acceptable level. If the work is similar to other work which has been assessed for risk, the original assessment may be modified to suit the specific circumstances.
All risk assessments, (together with associated detailed job specific method statements) generated throughout the duration of the Project shall be retained by:

- LSTK CONTRACTOR Construction Manager
- LSTK CONTRACTOR Safety Management

LSTK CONTRACTOR shall carry out, during detail design phase-prior to commencement of construction operations, comprehensive risk assessments in regard to all its construction operations, and particularly in respect of those that will take place alongside existing facilities. LSTK CONTRACTOR shall ensure that the identified risks are addressed in the design so as to mitigate any impact of any adverse factors. Risk assessments shall be carried out progressively during the course of construction to address the changing phases and nature of the works.

9.7 It is the responsibility of the LSTK CONTRACTOR to maintain cleanliness and proper housekeeping at work site. LSTK CONTRACTOR shall organise disposal of excavated earth/garbage/rubbish/scrape etc. on day-to-day basis to identified disposal areas/safe areas. LSTK CONTRACTOR shall sprinkle water on the road periodically to prevent dust. All roads used by the LSTK CONTRACTOR during construction shall be properly maintained for good house-keeping

9.8 TRAFFIC PLANNING

The construction site shall be organized in such a way that pedestrians can move safely and without risk. Consideration will be given to:

- Development of detailed layout drawings from the Construction Site Logistics Plan
- Separate gates for vehicle and pedestrian use.
- Separation between vehicles or pedestrians where practicable.

Private vehicles shall not be permitted within any construction areas and operating plant areas.
LSTK CONTRACTOR shall make provision for transporting of workers to construction areas.

8.0 INDUSTRIAL LABOUR RELATIONS

10.1 LSTK CONTRACTOR will be responsible for industrial relation functions and implementation of labour laws at site. LSTK CONTRACTOR's staff shall be suitably trained and experienced

in labour relation functions so as to ensure a good relationship with labour and to prevent the occurrence of industrial disputes resulting in subsequent delays or work stoppages. In particular, LSTK CONTRACTOR shall maintain close liaison with OWNER/PMC and with official union representatives (if any) of LSTK CONTRACTOR's work force.

10.2 LSTK CONTRACTOR shall develop a mutual working relationship with the Local Community, which maintains harmonious public relations during the total period of the Contract. LSTK CONTRACTOR will be expected to ensure that the activities and the behavior of the workforce employed by itself and its SUB- CONTRACTOR's conduct itself in a responsible and appropriate manner.

10.3 LSTK CONTRACTOR shall ensure that it and all its SUB- CONTRACTOR's and Vendors' Representatives maintain harmonious Labour Relations whilst on the Site. There shall also be a strict observance of a mutual understanding, between employers, that persons, still employed by one company, will not be offered employment by another company.

10.4 LSTK CONTRACTOR shall maintain proper liaison with statutory authorities and local bodies and will be responsible to implement and observe all statutory laws at site.

10.5 LSTK CONTRACTOR must have on his staff, a well-experienced Labour Relation Officer, preferably from local area.

10.6 LSTK CONTRACTOR shall report immediately to OWNER/PMC any problems including labour disputes, fight and work stoppages. A written report shall be submitted to OWNER/PMC within 48 hours after the incident.

10.7 LSTK CONTRACTOR must submit a Labour Relations Plan prior to the start of the work/ within one month of award of the contract; whichever is earlier.

10.8 LSTK CONTRACTOR's plan shall include:

a) A detailed estimate of the number of foreign labour/local labour / labour from other States of India, both indirect and direct, sorted by craft. This estimate shall specifically include the months and durations that potential foreign labour will be required.

b) Training plan for local semi-skilled labour and respective crafts.

c) Recruiting plans for all manpower requirements.

d) Identification of the personnel involved with labour relations and procedures to mitigate disputes, problems should they occur with the labour force.

e) Labour welfare plan.

10.9 LSTK CONTRACTOR shall hold labour relations meeting twice a month with their work force

as well as a separate meeting with OWNER/PMC.

9.0 CONSTRUCTION EQUIPMENT

11.1 The LSTK CONTRACTOR is required to organise and mobilise the construction equipment and other tools /tackles in a sequential manner to ensure that plant installation is carried out in a mechanized manner and its completion is achieved within the targeted time schedule.

11.2 The LSTK CONTRACTOR shall without prejudice to his responsibility to execute and complete the work, strictly as per the specifications and other laid down procedures, execute all the work by mechanizing the construction activities to the maximum extent by deploying all necessary construction equipment / machinery of adequate capacities and numbers.

11.3 LSTK CONTRACTOR shall ensure deployment of the following construction equipment as per requirement to the maximum extent

a) Automatic welding machines
b) Tower crane
c) Cranes of different capacities
d) Stress relieving equipment with recording facility
e) All weather fabrication sheds
f) Shot blast cleaning and painting shop
g) Field instrument calibration testing equipment
h) Electrical & earthing testing equipment

11.4 The LSTK CONTRACTOR shall ensure that the plant is constructed with innovative construction methods, some of which are indicated below, to minimise the requirement of space during construction.

a) Use of modular construction methods wherever feasible.

b) Use of tower cranes to minimize crane movements and vehicle movements inside construction plot area. The use of tower cranes shall not be limited to civil works only but also to be used for the erection of piping spools and structural erection etc. as far as practicable.

c) Usage of stand jacks for heavy equipment erection to reduce space requirements for cranes and its movements

The details of such methods proposed to be used by the LSTK CONTRACTOR should form a part of the construction management/execution plan.

11.5 LSTK CONTRACTOR shall deploy portable alloy analyser with print out facility and carryout “Positive Material Identification (PMI)” of materials and welds after erection/ installation but prior to hydro testing. Any non-conformance detected shall be removed and replaced prior to final testing.

11.6 LSTK CONTRACTOR shall be responsible for provision of adequate radiography sources to meet the NDT requirements.

11.7 LSTK CONTRACTOR shall be responsible for arranging all facilities for torque tightening / tensioning of bolts/ fasteners as specified in the bid document. LSTK CONTRACTOR shall ensure that stud bolts are ordered extra-long by one diameter to facilitate tensioning. Guidelines for torque tightening / tensioning are specified in specifications for boxing up of flanged joints attached as Appendix – B.

11.8 In order to minimize fabrication at site, major fabricated equipment like reactors, columns/ towers, vessels shall be transported in single/minimum number of pieces depending upon transportation limitations and erected in single piece. LSTK CONTRACTOR shall carryout the route survey for transportation of over dimensioned consignments including water ways from source of manufacturing/supply to site, well in advance of placement of order to ensure unhindered transportation of the same to construction site. LSTK CONTRACTOR shall arrange cranes/strand jacks of suitable capacities to match with the erection requirements and inform the source and ownership of the same.

11.9 For efficient working and maintenance of construction aids, LSTK CONTRACTOR shall establish and maintain crane yard/workshop equipped with regular maintenance facilities for various construction aids for routine field maintenance during performance of the contract. Weekly/fortnightly maintenances shall be planned in such a way that the same does not hamper the erection schedule.

11.10 LSTK CONTRACTOR shall ensure timely augmentation of equipment and machinery depending upon the exigencies of the work to meet the overall project schedule and as per instructions of OWNER/PMC.

11.11 During the execution of the work, LSTK CONTRACTOR must ensure that structures, materials and equipment are adequately braced with Guys, Struts or any other means as deemed fit and approved by OWNER/PMC. Such means shall be supplied and installed by the LSTK CONTRACTOR as required till the erection works are satisfactorily completed. Such guys shoring, bracing, strutting, planking supports etc. shall not interfere with the work of other agencies and shall not damage or cause distortion to works executed by other agencies. All lifting tools, tackles and cranes shall be tested periodically by statutory/competent authorities for their load carrying capacity. Such relevant valid/test certificates shall be submitted to OWNER/PMC for review before actual use of tools, tackles, lifting devices and cranes.

11.12 LSTK CONTRACTOR shall submit the construction equipment deployment schedule. Daily construction equipment deployment report shall also be submitted by the LSTK CONTRACTOR to OWNER/PMC in the proforma approved by the OWNER/PMC.

10.0 CONSTRUCTION MANPOWER

12.1 The LSTK CONTRACTOR is required to organise and mobilise supervisory personnel/ staff/manpower in a sequential manner to ensure that the plant installation is carried out in accordance with the construction schedule defined in the bid document.

12.2 The LSTK CONTRACTOR shall ensure that the minimum deployment of personnel for supervision of construction activities for each discipline would be as indicated below. However, deployment of minimum supervisory personnel for each discipline, as stipulated below, shall not absolve the LSTK CONTRACTOR of his total responsibility under the subject contract.

No. of Workers deployed	Requirement of supervisory personnel		
	Discipline Supervisor	Discipline Engineer	Lead Discipline Engineer
Up to 50	One (1)	One (1)	One (1)
Up to 250	Five (5)	Two (2)	One (1)
Up to 500	Ten (10)	Four (4)	One (1)
Up to 1000	Fifteen (15)	Eight (8)	One (1)
Up to 2000	Twenty five (25)	Twelve (12)	Two (2)

12.3 The LSTK CONTRACTOR shall also be responsible for progressive deployment of adequate manpower for supervision and management of construction activities and augment the same depending on the exigencies of work to suit the construction schedule.

12.4 LSTK CONTRACTOR must submit the construction manpower deployment schedule along with the bid. Construction manpower deployment schedule shall clearly indicate deployment of national and international (foreigner) manpower with specific man hour /man months in particular for foreign nationals who will be deployed at site along with details of their qualification/ experience and nationality. Daily construction manpower deployment report will also be submitted by the LSTK CONTRACTOR to PMC/OWNER on approved format. Any additional manpower of any category required to be deployed during the actual execution of the work to meet the Project time schedule and as instructed by OWNER/ PMC, shall be mobilized by the LSTK CONTRACTOR within a reasonable time. Mobilisation of such additional manpower by the LSTK CONTRACTOR will not entitle him for any additional compensation at all.

12.5 The construction supervision, co-ordination and management activities shall be carried out by the LSTK CONTRACTOR in accordance with the construction procedures approved by OWNER / PMC.

11.0 CONSTRUCTION MANUAL/ METHOD STATEMENT

13.1 LSTK CONTRACTOR shall prepare Construction manual/ methods statements for all major

construction activities.

12.0 INSPECTION OF FIELD JOINTS

14.1 The LSTK CONTRACTOR shall strictly follow the standard procedures for boxing up of interface joints not subjected to hydrostatic test at site given in Annexure - B.

JACOBS

IndianOil

DEPARTMENT	:	CONSTRUCTION
DOCUMENT NO	:	44AC7501/K.02/0001/A4
DOCUMENT TITLE	:	REQUIREMENT OF CONSTRUCTION QUALITY MANAGEMENT AND QUALITY CONTROL
PROJECT NO.	:	44AC7501
LSTK	:	
PART/ SECTION	:	
PROJECT LOCATION	:	IOCL, PANIPAT
PROJECT TITLE	:	HOT OIL HEATERS (EPCM SERVICES FOR PTA UNIT)
CLIENT	:	INDIAN OIL CORPORATION LIMITED
CLIENT PROJECT NO.	:	
CLIENT AUTHORIZATION	:	
PM AUTHORIZATION	:	NITIN PHATAK

				APPROVALS		
Rev. No.	Issue Date	Pages	Revision Description	Prepared	Checked	Approved
0	31-Oct-19	9	Issued for Enquiry	SC	DM	NP

✓	Entire Document Issued this Revision	DOCUMENT ISSUED FOR: (please ✔ as applicable)			
		☐	In-house Review	☐	Purchase
☐	Revised Pages Only Issued this Revision	☐	Client Approval	☐	Construction
		✓	Enquiry		

CONTENTS

1.0 PURPOSE

1.1 The purpose of this document is for uniform understanding and implementation of quality management and quality control activities that satisfy the requirements of the project and meet specified quality requirements and are in accordance with contractual and legislative commitments.

2.0 SCOPE

2.1 This document shall be applicable for all construction works to be followed by LSTK CONTRACTOR's as well as OWNER/PMC for achieving overall objective of quality of various activities during construction. The management of quality shall also cover co-ordination, review, approval audit and proper documentation of the works performed. Indicative Inspection and Test Plans (ITP's) are forming part of this document as attachments.

3.0 RESPONSIBILITY

3.1 It is LSTK CONTRACTOR's prime responsibility to arrange / produce the product conforming to contract specifications and inspect all equipment, materials and works at various stages of execution as per the approved QA Plans. In addition, they are to coordinate all efforts in this regard directly with the OWNER/PMC and other involved agencies to give adequate confidence that the activities have been performed as per agreed ITPs and necessary documentation are available. Verification by OWNER/PMC at any stage shall not relieve LSTK CONTRACTOR of his responsibility for the quality of the product.

4.0 METHODOLOGY

4.1 The management of construction quality control is divided into the following categories:

a) Procurement of materials required for the construction works.
b) Execution of works.
c) Documentation.

5.0 PROCUREMENT OF MATERIALS REQUIRED FOR EXECUTION OF WORKS

5.1 It is LSTK CONTRACTOR's prime responsibility to arrange / produce the product conforming to contract specifications and inspect all equipment, materials and works at various stages of execution as per the approved QA Plans. In addition, they are to coordinate all efforts in this regard directly with the OWNER/PMC and other involved agencies to give adequate confidence that the activities have been performed as per agreed ITPs and necessary documentation are available. Verification by OWNER/PMC at any stage shall not relieve LSTK CONTRACTOR of his responsibility for the quality of the product.

6.0 EXECUTION OF WORKS

6.1 The QA plans for execution shall be developed by the LSTK CONTRACTOR well before start of the works and OWNER/PMC approval shall be taken. The final inspection & test plans (ITP's) on the lines of indicative ITP's enclosed, as attachments, shall be developed by LSTK CONTRACTOR as per contract specifications for approval by OWNER/PMC. For the activities that are identified as witness or Hold point, specific inspection call shall be raised by LSTK CONTRACTOR with OWNER/PMC in the requisite format well before time. It is intended that the LSTK CONTRACTOR shall be completely responsible for management of approved quality plans and OWNER/PMC involvement will be only of surveillance in nature to check at selective /critical junctures. Their role shall be to monitor that the LSTK CONTRACTOR is executing the quality plans as per the approved drawings employing adequately qualified staff and other resources for various items of works. Any deviation to the specification shall be brought to the notice of OWNER/PMC in proper formats by LSTK CONTRACTOR for approval.

6.2 A construction activity will not start until all prescribed quality preconditions and prerequisites have been met.

6.3 It is likely that the LSTK CONTRACTOR may engage SUB-CONTRACTOR(s)/VENDOR(s) for performance of the work. LSTK CONTRACTOR shall be responsible for ensuring the implementation of approved QA plan, contract specifications and contract conditions through their SUB-CONTRACTOR's to achieve the quality during all stages of construction. It shall be the responsibility of the LSTK CONTRACTOR to ensure proper co-ordination between his SUB-CONTRACTOR(s) and other agencies working at site.
The SUB-CONTRACTOR(s)/VENDOR(s) selection shall be done after evaluation by the LSTK CONTRACTOR in line with contract requirements and shall be got approved by OWNER/PMC before engaging for the works.

6.4 The OWNER/PMC reserves the right to revise the content of the inspection and test plan in line with ongoing construction activities, should it be deemed necessary. If this is the case LSTK CONTRACTOR will be advised of the changes required and will reissue the ITP at the next revision.

6.5 Concessions and Non- Conformances

The LSTK CONTRACTOR shall be responsible for reviewing proposed deviations and non-conformance issues for the work within his scope. Deviations and non-conformances from the Project Specifications shall be reviewed with the OWNER/PMC.

6.6 Quality Reporting of inspection activities and problems

If defects are found during construction the OWNER/PMC's supervisor/Inspector shall require the LSTK CONTRACTOR to correct said defects and may increase his percentage inspection surveillance until the LSTK CONTRACTOR performs within the quality requirements

6.7 Source Selection /Vendor approval

6.7.1 For all the material which are naturally available, and which will be used in the respective works shall be identified and approved by OWNER/PMC on the request of the LSTK CONTRACTOR. The source(s) shall be capable of giving good quality materials meeting to the requirement of contract document and various relevant code/ standards and supplying without interruption of the entire quantity required for the works. After the source(s) are identified the samples shall be collected and the same shall be got tested in a reputed laboratory. The test results shall be reviewed and approved. Only after getting the approval for the source / vendor, material shall be brought to the work site. Without approval of the source/ material/ vendor, the same shall not be procured by the LSTK CONTRACTOR.

6.7.2 Other materials preferably shall be bought from approved vendors given in the contract only. If there is change from the approved vendor list given in the contract, specific approval from OWNER/ PMC shall be taken in the prescribed format. In case for the bought out items where approved vendors are not given and which are readily available in market, reputed vendors/brand/product shall be identified by LSTK CONTRACTOR and approval for the same shall be taken before hand from OWNER/PMC. Wherever the case demands samples of manufacturer's products shall also be produced for inspection and approval by OWNER/PMC.

6.8 Storage

6.8.1 All the material shall be stored/stacked as per the standard norms and as recommended in various clauses of relevant Indian Standard Codes and contract document. The storage of material shall be such as to avoid damage to life/properties (physical and chemical) of the material. The storage shall not cause deterioration, rusting, mix-up etc. and hamper the other related works. The colour coding and markings shall be provided by LSTK CONTRACTOR for piping and other fittings. PMI for alloy steel materials shall be done on receipt at stores. LSTK CONTRACTOR shall submit his detailed warehouse plan for OWNER/PMC approval to manage the above in open/covered areas.

6.8.2 The cement bags shall be stored in a leak proof room with minimum openings. The bags shall be kept sufficiently away from the wall and some gap shall be maintained from floor to keep the moisture away from it. Not more that 10 cement bags shall be kept one above another. The bags, which have hardened, shall be rejected and removed from cement godown. The cement bags shall be stored and used as per the guidelines of IS 456-2000.

6.8.3 Reinforcement steel, structural steel, piping materials, cable drums etc shall be kept in a separate yard. Wooden/Concrete sleeper support shall be provided below structural steel members and also for piping materials.

6.8.4 Aggregates shall be stacked separately to avoid intermixing of different sizes and to allow proper drainage of water.

6.8.5 Chemicals for construction like paints, anti-termite treatment chemicals etc. shall be kept separately.

6.8.6 The materials susceptible to fire shall be kept away in a separate protected place.

6.8.7 In general, the materials shall be kept systematically in order of the class, batch number and identification number, so that it is accessible to the inspection by OWNER/PMC as well as the mix up in those materials avoided in all cases.

6.9 Use

6.9.1 The material shall be stacked in such a way that the lot, which is procured, first will be consumed first. No material beyond its expiry date shall be used. If any material expiry date has elapsed or its properties have changed, it shall be removed from site or wherever there is any doubt, with the consent of PMC/OWNER, it shall be sent to a reputed approved laboratory for testing and acceptance.

6.10 Inspection

6.10.1 Before collecting the samples of naturally available materials the sources shall be identified by LSTK CONTRACTOR and on their request inspected by OWNER/PMC or his representative team. The samples shall be collected in good clean bags, containers etc in sufficient quantities, sealed and sent to reputed approved laboratory for testing.

6.10.2 The testing, selection of source/vendor/brand for each material shall be done as per relevant code. Frequency of testing during the course of the work shall be identified and documented as per specs/code and strictly adhered.

6.10.3 If any of the test is done in the field laboratories, the entire stage of testing shall be done in presence of LSTK CONTRACTOR's representative and test results shall be reviewed by OWNER/PMC.

6.10.4 The frequency and type of tests listed out in various specs are the minimum for which the material shall be tested. However, if at any time OWNER/PMC feels that the quality of any particular lot of material is not good or deteriorated, the same material shall be sent for testing as directed by OWNER/PMC. Until such time the result comes and duly reviewed, that particular lot of material shall not be used in works. The cost of such tests shall be borne by LSTK CONTRACTOR. In case of any defect/discrepancy is observed in the materials, the LSTK CONTRACTOR has to replace the same with a good one without any financial implications.

6.10.5 As and when asked by OWNER/PMC the LSTK CONTRACTOR shall arrange at their own cost for witnessing the testing process of the materials, which are being sent to the reputed outside laboratories approved by OWNER/PMC.

6.10.6 OWNER/PMC shall at any time inspect the storage yard of different materials. As and when required, OWNER/PMC also reserves the right to check the store records.

6.10.7 All the bought-out items, which are accompanied with manufacturer's test certificate (MTC),

OWNER/PMC shall check at any time for the co-relation of lot/ heat/ Identification No. as shown in the MTC and as marked over the materials. Records of supplier, total quantity supplied etc shall be maintained for review by PMC/OWNER. In case it is not possible to co-relate the material with MTC, challan etc. to the satisfaction of OWNER/PMC, tests as per relevant codes shall be arranged by LSTK CONTRACTOR at his own cost as per defined frequency for acceptance of material.

6.10.8 Wherever MTC is required it should cover all the properties of the materials in accordance with relevant codes/specifications.

6.10.9 LSTK CONTRACTOR shall prepare MRR (material receipt report) of each material. It shall also include any third party inspection report on behalf of LSTK CONTRACTOR, supplier's name, total quantity received, date of receipt, site inspection report covering physical verification of quantity and quality and acceptance thereof.

6.10.10 All MRR (material receipt report), MTC (material test certificates), test results shall be reviewed by LSTK CONTRACTOR first and then offered to OWNER/PMC for final review and acceptance along with its copies.

6.10.11 The LSTK CONTRACTOR shall maintain all inspection reports and files with proper cross identification with field materials and are handed over to OWNER/PMC within one (1) month after completion of Mechanical Completion of any part of the Project.

6.11 In process and final inspection

6.11.1 LSTK CONTRACTOR shall be responsible to arrange verification of product during in process and final inspection. Relevant checks and tests shall be arranged for the works performed and records maintained. Tolerances with respect to contract specification and execution drawings for various activities/processes shall be ascertained and submitted to OWNER/PMC for approval. Efforts shall be made to keep checks to avoid getting the non-conforming product. In case the tolerances are varying beyond the acceptable values given in the contract, non-conformation / resolution / waiver need to be got approved from OWNER/PMC. For Alloy and special piping materials and welds, PMI (positive material identification) shall be arranged by LSTK CONTRACTOR in position before final acceptance.

7.0 DOCUMENTATION

7.1 The Documentation plays a very important role in quality management including quality control. Necessary documentation shall be maintained by LSTK CONTRACTOR during completion of project and handed over to OWNER/PMC. Area(s) wherever PMC personnel are directly involved, particularly in witness and hold point, the copies of the same shall also be provided to them on inspection of those activities.

The documentation shall include but not limited to the following:

a) Approved Quality Assurance Plan.

b) Approved inspection and Test Plans.
c) Inspection and test documents covering:

- Manufacturer's Test Certificate.
- Material Receipt Report including Inspection Release Note applicable and site inspection and acceptance report on quality and quantity of material.
- Site test/laboratory test report reviewed by LSTK CONTRACTOR for acceptance vis-à-vis to contract/code requirements of materials/ including PMI report at warehouse.
- In process verification reports of LSTK CONTRACTOR representative to OWNER/ PMC as applicable.
- Final verification report including any test checks done for compliance.
- As-built vis-à-vis to contract/drawings including tolerances.
- As-built for erection.
- Non-conformance resolution raised by LSTK CONTRACTOR/OWNER/PMC.
- Deviation approval by OWNER/ PMC.
- Waiver / approval by OWNER/PMC in case there is variation from contract/drawings.

7.2 The LSTK CONTRACTOR shall maintain a proper up-to-date documentation system of the radiographs, which can identify the location of the weld and the welder concerned.

8.0 CONSTRUCTION QUALITY AUDIT

8.1 The LSTK CONTRACTOR shall carry out a construction Quality Audit of the project facility at every three months during the construction phase of the project by an independent group of personnel not reporting to the site-in-charge. An additional audit of the total piping system shall also be carried out by LSTK Contractor Piping Specialist group. The audit will utilize special tools such as positive material identification through alloy analysers, which shall be arranged by LSTK CONTRACTOR. The report of findings & observations and proposed corrective action, if any, shall be furnished to the OWNER/PMC.
PMC's piping specialist group will also carry out an additional audit of total piping system.

8.2 The OWNER/PMC as part of his scheduled auditing of the Project will conduct Quality Audits to ensure that the Quality Plan is fully implemented. In addition, OWNER/PMC at site shall audit the implementation of the LSTK CONTRACTOR's Quality Plans and monitor the effectiveness of the LSTK CONTRACTOR's audits for his own activities. The site QA/QC Engineer of LSTK CONTRACTOR shall plan and maintain a log of site audits in accordance with standard procedures. The LSTK CONTRACTOR's QA/QC Manager/Engineer shall ensure through personal review and audit that material and document control procedures are fully implemented. Material preservation requirements shall be audited by the LSTK CONTRACTOR's QA/QC Manager/Engineer on monthly basis.

9.0 GENERAL NOTE AND LEGEND

9.1 General Note

Before start of work, the LSTK CONTRACTOR shall develop and submit for approval of OWNER / PMC, a detailed stage wise micro level Inspection & Test Plan depending upon the construction Process/technology to be deployed.

9.2 Legend

HP : Hold Point
A point, which requires inspection/verification and acceptance by OWNER/PMC before any further processing is permitted.
The LSTK CONTRACTOR shall not process the activity /item beyond a Hold Point without written approval by OWNER/PMC except where prior written permission for further processing is available.

W : Witness Point
An activity which requires witnessing by OWNER/PMC when the activity is performed After proper notification has been provided (notification modalities and period shall be finalized beforehand) the LSTK CONTRACTOR is not obliged to hold further processing if OWNER/PMC is not available to witness the activity or does not provide comments before the date notified. Basis of acceptance shall be as per relevant technical specification.

Rw : Review of LSTK CONTRACTOR's Documentation

S : Surveillance Inspection by OWNER/PMC
Monitoring or making observations to verify whether or not material/items or services conform to specified requirements. Surveillance activities may include audit inspections, witness of testing, review of quality documentation & records, personnel qualifications etc.

WC : 100 % Examination by LSTK CONTRACTOR.
(Prime responsibility for execution of the inspection is with the LSTK CONTRACTOR. OWNER/PMC only monitors LSTK CONTRACTOR's performance)