	PROJECT		Standby SRU & Additional Tanks		
	CLIENT		IOCL Paradip Refinery		
STANDARD SPECIFICATION FOR FABRICATION & ERECTION OF PIPING		Project No. 080557C001	Document No. 080557C-000-JSC-1300-001	Rev. No. A	Page 1 of 23

STANDARD SPECIFICATION FOR FABRICATION & ERECTION OF PIPING

A	11-10--2019	ISSUED FOR EXECUTION	SMM	SL	TI	JMC
REV.	DATE	DESCRIPTION	PREPARED	CHECKED	APPROVED	AUTHORIZED

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

CONFIDENTIAL – Not to disclose without Authorization




 	PROJECT		Standby SRU & Additional Tanks	
	CLIENT		IOCL Paradip Refinery	
STANDARD SPECIFICATION FOR FABRICATION & ERECTION OF PIPING		Project No. 080557C001	Document No. 080557C-000-JSC-1300-001	Rev. No. A
		INDIAN OIL CORPORATION LIMITED		Page 2 of 23

TABLE OF CONTENTS

1. Introduction:	3
2. Definitions & Abbreviations	3
3. Scope.....	4
4. Conflicts, Deviations and Clarifications:	4
5. Scope of Work of Contractor.....	5
6. Basis For Work	9
7. Storage & Handling Materials.....	10
8. Fabrication.....	11
9. Erection	18

		PROJECT	Standby SRU & Additional Tanks		
		CLIENT	IOCL Paradip Refinery		
STANDARD SPECIFICATION FOR FABRICATION & ERECTION OF PIPING	Project No. 080557C001	Document No.		Rev. No.	Page 3 of 23
		080557C-000-JSC-1300-001		A	



1. Introduction:

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

2. Definitions & Abbreviations

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

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

 	PROJECT		Standby SRU & Additional Tanks	
	CLIENT		IOCL Paradip Refinery	
STANDARD SPECIFICATION FOR FABRICATION & ERECTION OF PIPING		Project No. 080557C001	Document No. 080557C-000-JSC-1300-001	Rev. No. A
				Page 4 of 23

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

3. Scope

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



4. Conflicts, Deviations and Clarifications:

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

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

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

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

 	PROJECT		Standby SRU & Additional Tanks	
	CLIENT		IOCL Paradip Refinery	
STANDARD SPECIFICATION FOR FABRICATION & ERECTION OF PIPING	Project No. 080557C001	Document No. 080557C-000-JSC-1300-001	Rev. No. A	Page 5 of 23

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

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



5. Scope of Work of Contractor

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

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

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

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

		PROJECT	Standby SRU & Additional Tanks		
		CLIENT	IOCL Paradip Refinery		
STANDARD SPECIFICATION FOR FABRICATION & ERECTION OF PIPING	Project No. 080557C001	Document No.		Rev. No.	Page 6 of 23
		080557C-000-JSC-1300-001		A	

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



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

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



5.4 Fabrication of Piping items

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



- 5.4.1 Fabrication of piping specials like special radius bends, reducers, mitres etc.
- 5.4.2 Fabrication of plain and threaded nipples from pipes as required during erection.
- 5.4.3 Fabrication of swage nipples as and when required.
- 5.4.4 Fabrication of odd angle elbow like 60°, 30° or any other angle from 90°/45° elbows as and when required.
- 5.4.5 Fabrication of flange, reducing flange, blind flange, spectacle blinds as and when required.
- 5.4.6 Fabrication of stub-in connection with or without reinforcement. External reinforcing pads shall have a minimum of one 1/4" vent hole. Pads for branch connections greater than 16 inch shall have minimum of 2 vent holes. Pads installed in sections shall have at least one vent per section. Vents shall remain open until the completion of pressure testing. Plug material shall be adequate for the operating temperature but shall not be capable of sustaining pressure between the reinforcing plate and pipe.
- 5.4.7 Grinding of edges of pipes, fittings, flanges etc. to match mating edges of uneven/different thickness wherever required.

		PROJECT	Standby SRU & Additional Tanks		
		CLIENT	IOCL Paradip Refinery		
STANDARD SPECIFICATION FOR FABRICATION & ERECTION OF PIPING	Project No. 080557C001	Document No.		Rev. No.	Page 7 of 23
		080557C-000-JSC-1300-001		A	

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

 	PROJECT		Standby SRU & Additional Tanks	
	CLIENT		IOCL Paradip Refinery	
STANDARD SPECIFICATION FOR FABRICATION & ERECTION OF PIPING	Project No. 080557C001	Document No. 080557C-000-JSC-1300-001		Rev. No. A
				Page 8 of 23

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

		PROJECT	Standby SRU & Additional Tanks		
		CLIENT	IOCL Paradip Refinery		
STANDARD SPECIFICATION FOR FABRICATION & ERECTION OF PIPING	Project No. 080557C001	Document No.		Rev. No.	Page 9 of 23
		080557C-000-JSC-1300-001		A	

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

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

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

6 Basis For Work

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

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



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

6.1.3 Approved Process Licensor's standards and specification

6.1.4 Approved construction job procedures prepared by Contractor as stipulated.

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

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

 	PROJECT		Standby SRU & Additional Tanks	
	CLIENT		IOCL Paradip Refinery	
STANDARD SPECIFICATION FOR FABRICATION & ERECTION OF PIPING	Project No. 080557C001	Document No. 080557C-000-JSC-1300-001	Rev. No. A	Page 10 of 23

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



6.1.6 Following codes, standards and regulations

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

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

7 Storage & Handling Materials

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

 	PROJECT		Standby SRU & Additional Tanks	
	CLIENT		IOCL Paradip Refinery	
STANDARD SPECIFICATION FOR FABRICATION & ERECTION OF PIPING	Project No. 080557C001	Document No. 080557C-000-JSC-1300-001		Rev. No. A
				Page 11 of 23

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

8 FABRICATION

8.1 General

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

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

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

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

These requirements apply to shop and field fabrication.

8.2 Shop Fabrication



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

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

8.3 Shop Detail Drawings

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

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

		PROJECT	Standby SRU & Additional Tanks		
		CLIENT	IOCL Paradip Refinery		
STANDARD SPECIFICATION FOR FABRICATION & ERECTION OF PIPING	Project No. 080557C001	Document No.		Rev. No.	Page 12 of 23
		080557C-000-JSC-1300-001		A	

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

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

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

8.4 Spool Identification

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

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

8.5 Location of Field Welds

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

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



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

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

8.6 Field Fabrication

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

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

		PROJECT	Standby SRU & Additional Tanks		
		CLIENT	IOCL Paradip Refinery		
STANDARD SPECIFICATION FOR FABRICATION & ERECTION OF PIPING	Project No. 080557C001	Document No.		Rev. No.	Page 13 of 23
		080557C-000-JSC-1300-001		A	

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

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

8.7 Verification of Field Dimensions

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

8.8 Longitudinal welding Joints


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

8.9 Piping Material

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

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

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

 	PROJECT		Standby SRU & Additional Tanks	
	CLIENT		IOCL Paradip Refinery	
STANDARD SPECIFICATION FOR FABRICATION & ERECTION OF PIPING	Project No. 080557C001	Document No. 080557C-000-JSC-1300-001	Rev. No. A	Page 14 of 23

8.10 Dimensional Tolerances



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

8.11 IBR Piping

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

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

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

 	PROJECT		Standby SRU & Additional Tanks	
	CLIENT		IOCL Paradip Refinery	
STANDARD SPECIFICATION FOR FABRICATION & ERECTION OF PIPING	Project No. 080557C001	Document No. 080557C-000-JSC-1300-001		Rev. No. A
				Page 15 of 23

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

8.12 Pipe Joints

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

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

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

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

8.13 Butt Welded and Socket Welded Piping



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

8.14 Screwed Piping

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

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

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

 	PROJECT		Standby SRU & Additional Tanks	
	CLIENT		IOCL Paradip Refinery	
STANDARD SPECIFICATION FOR FABRICATION & ERECTION OF PIPING	Project No. 080557C001	Document No. 080557C-000-JSC-1300-001	Rev. No. A	Page 16 of 23

8.15 Flange Connections

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

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

8.16 Branch Connections

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

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

Prior to welding, saddles or rings shall be drilled with one number of ¼" NPT threaded hole for testing and venting. Threaded hole shall be sealed with compound after testing. No gap larger than 3 mm shall exist between the OD of the pipe and ID of the ring or saddle.

8.17 Bending



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

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

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

8.18 Forging and Forming

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

 	PROJECT		Standby SRU & Additional Tanks	
	CLIENT		IOCL Paradip Refinery	
STANDARD SPECIFICATION FOR FABRICATION & ERECTION OF PIPING	Project No. 080557C001	Document No. 080557C-000-JSC-1300-001		Rev. No. A
				Page 17 of 23

8.19 Mitre Bends and Fabricated Reducers

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

8.20 Cutting and Trimming of Standard Fittings & Pipes

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

8.21 Galvanized Piping

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



8.22 Jacketed Piping & Tracing

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

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

8.23 Shop Fabrication /Prefabrication

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

		PROJECT	Standby SRU & Additional Tanks		
		CLIENT	IOCL Paradip Refinery		
STANDARD SPECIFICATION FOR FABRICATION & ERECTION OF PIPING	Project No. 080557C001	Document No.		Rev. No.	Page 18 of 23
		080557C-000-JSC-1300-001		A	

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

8.24 Miscellaneous

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

9.0 ERECTION

9.1 Cleaning of Piping before Erection

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

9.2 Piping Routing



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

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

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

9.3 Slopes

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



		PROJECT	Standby SRU & Additional Tanks		
		CLIENT	IOCL Paradip Refinery		
STANDARD SPECIFICATION FOR FABRICATION & ERECTION OF PIPING	Project No. 080557C001	Document No.		Rev. No.	Page 19 of 23
		080557C-000-JSC-1300-001		A	

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

9.4 Expansion Joints / Bellows

Installation of Expansion Joints/Bellows shall be as follows:

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

		PROJECT	Standby SRU & Additional Tanks		
		CLIENT	IOCL Paradip Refinery		
STANDARD SPECIFICATION FOR FABRICATION & ERECTION OF PIPING	Project No. 080557C001	Document No.		Rev. No.	Page 20 of 23
		080557C-000-JSC-1300-001		A	

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



9.5 Flange Connections

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

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

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

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

		PROJECT	Standby SRU & Additional Tanks		
		CLIENT	IOCL Paradip Refinery		
STANDARD SPECIFICATION FOR FABRICATION & ERECTION OF PIPING	Project No. 080557C001	Document No.		Rev. No.	Page 21 of 23
		080557C-000-JSC-1300-001		A	

not more than 1/4".

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

9.6 Vents and Drains

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

9.7 Valves

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



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

9.8 Instruments

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

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

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

		PROJECT	Standby SRU & Additional Tanks		
		CLIENT	IOCL Paradip Refinery		
STANDARD SPECIFICATION FOR FABRICATION & ERECTION OF PIPING	Project No. 080557C001	Document No.		Rev. No.	Page 22 of 23
		080557C-000-JSC-1300-001		A	

9.9 Line Mounted Equipment / Items

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

9.10 Bolts and Nuts

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

9.11 Pipe Supports

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

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

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

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

 	PROJECT		Standby SRU & Additional Tanks	
	CLIENT		IOCL Paradip Refinery	
STANDARD SPECIFICATION FOR FABRICATION & ERECTION OF PIPING		Project No. 080557C001	Document No. 080557C-000-JSC-1300-001	Rev. No. A
				Page 23 of 23

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

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