

**IOCL PARADIP 525 TPD STANDBY SRU
Pre-Qualification Criteria (Technical)**

Item Name : PIPING PACKAGE (3 LPE COATED)
PR No : 1900150682

Manufacturers, Authorised Stockists, Dealers and Traders of 3LPE (3 Layer Polyethylene) Factory Coated Pipes (documentary evidence to be provided), qualified as per the Pre-qualification criteria laid down below, **are allowed to bid.**

The bid evaluation shall be on Overall L1 basis. Bidder has to quote for all the items. Partial offers will not be considered for evaluation.

Qualification Criteria of the Bidder:

The Bidders shall meet the Pre-Qualification Criteria (listed below). *Non-compliance to any of the criteria listed below will lead to disqualification of bidder for the subject tender.*

1. The bidder should be an established Manufacturer, Stockists and Traders of 3 LPE Factory Coated Pipes and should have successfully completed supply of Supply of 3 LPE Factory Coated Pipes conforming to DIN 30670, 2012 Edition.
2. The Bidder should have successfully completed supply of 3 LPE factory coated pipes **of size 4” and above, of Cumulative quantity not less than 80 meters** through a single Purchase Order or multiple Purchase Orders in the last 7 years ending on original due date of this tender.
3. Detailed BOQ of the 3LPE coated pipes supplied, satisfying the criteria laid down above, shall be provided in PEMC document, with details like Project & Customer, Description, Quantity & Weight of Items supplied, PO details etc. as a minimum for assessing pre-qualification. **PO Copies, Inspection Reports and Dispatch documents shall be enclosed for the references provided.**
4. The bidder should not have been under suspension for business or blacklisted by any of the BHEL units or in the Blocked list of IOCL.
5. Consideration of the Bidder offer is subjected to end customer’s approval.

Annexure-1

Supply References for the Last 5 Years ending on the Original due date of this tender

Details of supplies made by the Bidder:

[illegible]

PROJECT:IOCL SRU PRDP PROJECT
PACKAGE:3LPE COATED PIPING PACKAGE
UNPRICED PRICE BID FORMAT

Sl.no	ITEM DESCRIPTION	COATING	Total QTY (m)	Price Weightage Factor	Bidder Confirmation (Quoted)
1	PIPE, B-36.10, ASTM A 106 GR.B (LPE COATED), BE, SEAMLESS, 4.0 INCH, S120	External 3LPE coated	100	1	

NOTES:

- 1 Vendor to Quote Lumpsum Price for the Total Package.
- 2 Unit Rates shall be further derived by dividing the Line item rates with the total qty of line item.
- 3 Unit Rates of the Individual items thus arrived, shall be binding on the bidder, in case of any repeat order as per BHEL policies.
- 4 Observations / Objections, if any, of the Bidder, to the "Price Weightage Factor" shall be brought to the notice of BHEL, during Pre-Bid Stage.
- 5 No Observations / Objections shall be entertained after the Techno-Commercial Bid is opened.
- 6 Bidder to indicate "Quoted" in the column "Bidder's Confirmation" as a confirmation of their bid to the respective item.
- 7 The Bid Evaluation is on Overall L1 Basis. Each and Every item of the Package shall be quoted by the bidder.
- 8 Partial offers will not be considered for evaluation and the same are liable for rejection.
- 9 The Total Lump price quoted shall be INCLUSIVE of Freight, Packing & Forwarding and Testing Charges& GST charges.
- 10 The Total Lump price quoted shall be EXCLUSIVE of Third party inspection (TPI) & Insurance Charges.

VENDOR'S NAME & ADDRESS:			MANUFACTURING QUALITY PLAN						QP. NO.:				
			END CUSTOMER: BHEL, HYDERABAD PROJECT: IOCL PARADIP SRU Project PRODUCT: ASTM A106 GR B PIPE TYPE: CS SEAMLESS PIPE PIPE SIZES:			BHEL PO NO: BHEL SPECIFICATION:			REV NO: 1		DATE:		
									PAGE 1 OF 3				
SL NO	COMPONENTS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	*D	AGENCY P W V			REMARKS
1.0 RAW MATERIALS & BOUGHT OUT ITEMS													
1.1	RAW MATERIAL	MECHANICAL AND CHEMICAL PROPERTIES	MAJOR	MECH., CHEM., ANALYSIS	100%	DOCUMENT NO. 080557C-000-JSS-1320-001 REV. NO. B AS PER ASTM/ASME STANDARD		MTC As per EN 10204 Type 3.1	✓	2	-	1	
2.0 INPROCESS INSPECTION													
2.1	PIPES	AS PER ASTM A106 [HOT FINNISHED/COLD DRAWN NORMALIZED]	MAJOR	TC REVIEW	MILL	DOCUMENT NO. 080557C-000-JSS-1320-001 REV. NO. B/ AS PER ASTM/ASME STANDARD		MTC As per EN 10204 Type 3.1	✓	BY MILL	-	1	*IF APPLICABLE
2.2	DESTRUCTIVE TEST	MECHANICAL ANALYSIS (UTS, YS, EL, BEND/FLATENING HARDNESS TEST)	MAJOR	MECH. ANALYSIS	One per lot/Batch/Heat			MTC As per EN 10204 Type 3.1	✓	BY MILL	-	1	REVIEW FROM MTC
2.3	CHEMICAL ANALYSIS	CHEMICAL ANALYSIS	MAJOR	CHEM. ANALYSIS	One per lot/Batch/Heat			MTC As per EN 10204 Type 3.1	✓	BY MILL	-	1	REVIEW FROM MTC
3.0 FINAL INSPECTION & TESTING													
3.1	PIPES	HYDROTEST & ECT TEST	CRITICAL	HYDRO & ECT TEST	100% BY MILL	AS PER ASTM/ASME STANDARD		MTC As per EN 10204 Type 3.1	✓	BY MILL	1	1	REFER NOTE POINT 3

LEGEND: P: PERFORM, W: WITNESS, V: VERIFICATION. INDICATE 1 FOR BHEL APPOINTED TPIA & 2 FOR VENDOR/SUB VENDOR, 3 FOR PMC AS APPROPRIATE AGAINST EACH COMPONENT /CHARACTERISTIC UNDER P, W & V COLUMNS. * FOR ITEMS MARKED ✓ (TICK) IN COLUMN 'D', TEST CERTIFICATES SHALL BE SUBMITTED TO BHEL FOR RECORDS.	PREPARED BY	APPROVED	APPROVED	APPROVED BY	APPROVED BY
	VENDOR'S SIGNATURE & STAMP	BHEL ENGG SIGNATURE & STAMP	SIGNATURE & STAMP	BHEL APPOINTED TPIA 30.05.2022	PMC

VENDOR'S NAME & ADDRESS:		MANUFACTURING QUALITY PLAN							QP. NO.:				
		END CUSTOMER: BHEL, HYDERABAD PROJECT: IOCL PARADIP SRU Project PRODUCT: ASTM A106 GR B PIPE TYPE: CS SEAMLESS PIPE PIPE SIZES:			BHEL PO NO: BHEL SPECIFICATION:		INSPECTION CATEGORY-III		REV NO: 1		DATE:		
									PAGE 2 OF 3				
SL NO	COMPONENTS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	*D	AGENCY			REMARKS
										P	W	V	
3.2	DIMENSIONAL INSPECTION	DIMENSIONAL (OD, ID, LENGTH, THICKNESS, EDGE, PREPARATION, STRAIGHTNESS, ETC)	CRITICAL	MEASUREMENT	100% BY MILL 10% BY TPIA			MTC As per EN 10204 Type 3.1	✓	2	1	-	10% DIMENSION CHECK
3.3	VISUAL INSPECTION	APPEARANCE, SURFACE DEFECT, IDENTIFICATION, MARKING ETC	CRITICAL	VISUAL				MTC As per EN 10204 Type 3.1	✓	2	1	-	100% VISUAL CHECK
4.0	PRESERVATION & PACKING												
4.1	RUST PREVENTION COATING & COLOR CODING (IF APPLICABLE)	PAINTING	MAJOR	VISUAL	RANDOM	DOCUMENT NO. 080557C-000-JSS-1320-001 REV. NO. B		MTC As per EN 10204 Type 3.1	✓	2	-	1	*IF APPLICABLE
4.2		PACKING	MAJOR	VISUAL	RANDOM			PACKING LIST	✓	2	-	1	
5.0	DOCUMENTATION & IC												
5.1	FINAL DOCUMENT	REVIEW OF DOCUMENT	MAJOR	DOCUMENTS	100%			MTC As per EN 10204 Type 3.1	✓	2	-	1	MTC AS PER EN 10204 TYPE 3.1

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	VENDOR'S SIGNATURE & STAMP	BHEL ENGG SIGNATURE & STAMP	SIGNATURE & STAMP	BHEL APPOINTED TPIA 30.05.2022	PMC

VENDOR'S NAME & ADDRESS:		MANUFACTURING QUALITY PLAN							QP. NO.:				
		END CUSTOMER: BHEL, HYDERABAD PROJECT: IOCL PARADIP SRU Project PRODUCT: ASTM A106 GR B PIPE TYPE: CS SEAMLESS PIPE PIPE SIZES:				BHEL PO NO: BHEL SPECIFICATION:			REV NO: 1		DATE:		
		INSPECTION CATEGORY-III							PAGE 3 OF 3				
SL NO	COMPONENTS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	*D	AGENCY			REMARKS
										P	W	V	
5.2	IRN	ISSUE IRN	MAJOR	DOCUMENTS	100%			MTC As per EN 10204 Type 3.1	✓	2	-	1	

NOTES: -

- 1) All the final pipe product tested as per specification done at Mill and we as submit original MTC for review So, testing can be wavier in present of original MTC
- 2) TPI can review of 100% document like visual & dimensional as per PO only.
- 3) Hydrotest will be review from MTC. In absence of MTC, 10% of hydrotest shall be perform by Vendor under witness by TPI.


Abbreviations: -

MTC	-	Material Test Certificate
TC	-	Test Certificate
IS	-	Indian Standard
PMI	-	Positive Material Identification
UTS	-	Ultimate Tensile Strength
YS	-	Yield Strength
EL	-	Elongation
OD	-	Outer Diameter

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	VENDOR'S SIGNATURE & STAMP	BHEL ENGG SIGNATURE & STAMP	SIGNATURE & STAMP	BHEL APPOINTED TPIA 30.05.2022	PMC

Manufacurer's Name & address		INSPECTION TEST PLAN for External 3LPE Coating INSPECTION CATEGORY-III							
Purchaser : Bharat Heavy Electricals Limited (BHEL),Hyderabad		Item Description		Inspection Test Plan for External 3LPE Coating on C.S. Pipes, Fittings & Flanges					
Project : Standby SRU & Additional Tanks IOCL- Paradip Refinery		ITP Document No.		DPC-3LPE-BHEL-IOCL_PARADEEP-2022/01				Rev no.: 01	
Owner : Indian Oil Corporation Limited, Paradeep (IOCL)		MR/PR/Specification No.		Order technical specification: 080557C-000-JSS-1300-001		Reference Documents:		1) 080557C-000-JSS-1300-001	
PMC : Technip Energies		Inspection Category		NA				2) DIN 30670:2012	
PMC Job No : 080557C001		ITP approval by		BHEL Appointed TPIA as per contract & BHEL				3) ISO 8501-1/ ISO 8502	
Vendor Name :		PO Number		T721G00085 Dated : 07-01-2022					
Page 01 of 04		Vendor Document No.:		DPC/2022/QAP/3LPE_BHEL Rev. 00 Dt. 22-01-2022					
Sr. No.	Activity	Ref. Std./Method	Test frequency	Acceptance criteria	Record of document	Inspection By			Remark
						DPC	BHEL appointed TPIA	PMC	
1.0	Document Approval								
1.1	ITP approval	DIN 30670	100 %	DIN 30670	ITP	H	A	-	
1.2	3LPE Coating Procedure	DIN 30670	100 %	DIN 30670	ITP	H	R	-	
2.0	Raw Material Inspection - System Test covered in Table 6 of DIN 30670 shall be verified in Raw material TC.Coating materials Mfg. - Fusion Bonded Epoxy (FBE) – 1st Layer - JOTAPIPE AC 1003 or JOTAPIPE AC 2001- JOTUN, India, Copolymer Adhesive – 2nd Layer - COESIVE L8.92.8 (u) P - Industrie Polieco-MPB, Italy, High Density Polyethylene – 3rd Layer - UPA-003 (3LPE Coating Grade) - United Polycos, India								
2.1	Fusion bonded epoxy resin (Green Color)								
2.1.1	Cure time, Gelt Time, Moisture Content etc	Table 2,4 & 6 of DIN 30670 & PR	Once per batch	DIN 30670	Raw Material TC	H	R	-	Properties reviewed as per Raw material TC
2.2	Polyethelene Adhesive								
2.2.1	Melt flow rate, Vicat Softening Point etc.	Table 2,4 & 6 of DIN 30670 & PR	Once per batch	DIN 30670	Raw Material TC	H	R	-	Properties reviewed as per Raw material TC
2.3	High Density Polyethylene								
2.3.1	MFR, Density, Oxidation Induction Time. Heat Ageing & Light Ageing etc.	Table 2,4 & 6 of DIN 30670 & PR	Once per batch	DIN 30670	Raw Material TC	H	R	-	Properties reviewed as per Raw material TC
2.4	Shots/Grits								
2.4.1	Density, Hardnes, Carbon Conent etc.	As per Manufacturer TC	Once per batch	As per material manufacturer	Raw Material TC	H	R	-	Properties reviewed as per Raw material TC
3.0	Coating Raw Material Storage								
3.1	Coating Raw Material Storage	DIN 30670 & PR	All raw material	As per material manufacturer	Test Report	H	R	-	-
3.2	Batch Number, Date of Production and Shelf Life	DIN 30670 & PR	All raw material	As per Manufacturer TC	Raw Material TC				
4.0	Coating Procedure Qualification (PQT)								
4.1	Sample pipe to be partially coated before commencing actual production	DIN 30670	Once Per Order	FBE and Adhesive Layer Thk, Cross cut Adhesion Test, Visual, Overlap of each layer	Inspection Test Report	P	H	-	
Legends:: P- Perform, H - Hold; W - 100% Witness; RW - RW-as specified or 10% (Min. 1 no. each type & size); R - Review; M - Monitor; IC - Inspection Certificate; IRN- Inspection Release Note; RMTc - Raw Material Test Certificate, MTC- Material Test Certificate E - Endorsement; A - Approval									

Manufacurer's Name & address		<h2 style="text-align: center;">INSPECTION TEST PLAN for External 3LPE Coating</h2> <h3 style="text-align: center;">INSPECTION CATEGORY-III</h3>							
Purchaser : Bharat Heavy Electricals Limited (BHEL),Hyderabad		Item Description		Inspection Test Plan for External 3LPE Coating on C.S. Pipes, Fittings & Flanges					
Project : Standby SRU & Additional Tanks IOCL- Paradip Refinery		ITP Document No.		DPC-3LPE-BHEL-IOCL_PARADEEP-2022/01				Rev no.: 01	
Owner : Indian Oil Corporation Limited, Paradeep (IOCL)		MR/PR/Specification No.		Order technical specification: 080557C-000-JSS-1300-001				1) 080557C-000-JSS-1300-001	
PMC : Technip Energies		Inspection Category		NA				2) DIN 30670:2012	
PMC Job No : 080557C001		ITP approval by		BHEL Appointed TPIA as per contract & BHEL				3) ISO 8501-1/ ISO 8502	
Vendor Name :		PO Number		T721G00085 Dated : 07-01-2022					
Page 02 of 04		Vendor Document No.:		DPC/2020/QAP/3LPE_BHEL Rev. 00 Dt. 22-01-2022					
Sr. No.	Activity	Ref. Std./Method	Test frequency	Acceptance criteria	Record of document	Inspection By			Remark
						DPC	BHEL appointed TPIA	PMC	
5.0 Inspection of Received Bare Pipes									
5.1	Visual inspection	Visual	Every Pipe/Fittngs	Free from harmful defects	Intenral Inspection Report	P	R	-	Each pipe shall be identified with unique Pipe Number and Heat Number - Refer Note D
5.2	Recording of bare pipe	Visual	Every Pipe/Fittngs	Marking from pipe mill	Intenral Inspection Report				
5.3	Ambient condition recording	Hygrometer and as per Cl. 8.3.1. of DIN 30670	Every Pipe/Fittngs	Pipe temp shall be 3° C above dew point.	Intenral Inspection Report				
5.4	Marking verification and correlation with Pipe MTC	Visual	Every Pipe/Fittngs	Heat number, grade etc marked on the pipes to be matched with certificates	Intenral Inspection Report				
6.0 Production									
6.1 Abrasive Blasting									
6.1.1	Degree of cleanliness	ISO 8501-1	Every Pipe/Fittngs	Sa 2 ¹ / ₂	Intenral Inspection Report	H	R	-	
6.1.2	Anchor pattern of blasted pipe	DIN 30670	Every Pipe/Fittngs	50 to 70 µm	Intenral Inspection Report				
6.1.3	Salt contamination check	ISO 8502-6	Once per order	2 µg/cm ²	Intenral Inspection Report				
6.1.4	Dust Level Check	ISO 8502-3	Every Pipe/Fittngs	Rating 2 or Class 2	Intenral Inspection Report				
6.1.5	Visual inspection	Visual	Every Pipe/Fittngs	Free from harmful defects	Intenral Inspection Report				
6.1.6	Time delay to coating	-	Every Pipe/Fittngs	Maximum 2 hrs.	Intenral Inspection Report				
6.1.7	Ambient condition recording	temperature, humidity measurement	Every Pipe/Fittngs	Temp shall be 3° C above dew point, Humidity <85%	Intenral Inspection Report				
6.2 Coating Application									
6.2.1	Temperature before FBE application	DIN 30670 / Material data sheet	Every Pipe/Fittngs	As per manufacturer	Internal Record	H	R	-	
6.2.2	Adhesive cure temerature	Material data sheet	Every Pipe/Fittngs	As per manufacturer	Internal Record				
6.2.3	Polyethylene cure temperature	Material data sheet	Every Pipe/Fittngs	As per manufacturer	Internal Record				
6.2.4	FBE Layer Thickness	DIN 30670/ISO 2808 Method 1A	Once per order	Minimum 150 microns	Internal Record				
6.2.5	Adhesive Layer Thickness	DIN 30670/ISO 2808 Method 1A	Once per order	Minimum 200 microns	Internal Record				
Legends:: P- Perform, H - Hold; W - 100% Witness; RW - RW-as specified or 10% (Min. 1 no. each type & size); R - Review; M - Monitor; IC - Inspection Certificate; IRN- Inspection Release Note; RMTC - Raw Material Test Certificate, MTC- Material Test Certificate E - Endorsement; A - Approval									


Form No:	 PE&SD	BHARAT HEAVY ELECTRICALS LIMITED PROJECT ENGINEERING & SYSTEMS DIVISION	PEMC-07558
		JOB SPECIFICATION FOR	Rev. No. 00
		PIPE PACKAGE (3 LPE COATED)	Page 1 of 3

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**JOB SUPPLY SPECIFICATION
 FOR
 PIPING PACKAGE (3 LPE COATED)**

**PROJECT NAME: 525 TPD Standby Sulphur Recovery Unit (SRU),
 IOCL Paradip Refinery**

Refer Doc	LAYOUTS & PIPING ENGINEERING PROJECT ENGINEERING & SYSTEMS DIVISION	PREPARED	CHECKED	APPROVED	DATE
		V.Uday Kumar	V.Uday Kumar	SRIKANTH G	16.08.2021

Form No:	 PE&SD	BHARAT HEAVY ELECTRICALS LIMITED PROJECT ENGINEERING & SYSTEMS DIVISION	PEMC-07558
		JOB SPECIFICATION	Rev. No. 01
		PIPE PACKAGE (3 LPE COATED)	Page 2 of 3

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1.0 SCOPE OF SUPPLY

- 1.1 This job specification document specifies the requirements for supply pipes with 3 LPE COATING applicable for IOCL SRU PROJECT.
- 1.2 The supplies shall meet the requirements of the following specifications, without any deviations:
 - 080557C-000-JSS-1320-001_B: Pipes
 - 080557C-000-JSS-1300-001_A 3 Layer Polyethylene Coating
 - 080557C-000-ITP-1300-001_B Inspection and test plan for piping items
- 1.3 The documentation, quality and inspection requirements shall be as per the Contract specifications.
- 1.4 Both SINTERING and SIDE EXTRUSION methods of external coating are acceptable as per the DIN 30670 2012 Standard. This shall override the applicable clauses of the above spec

2. Bare pipe Vendor list:

The Bare pipes (I.e Un-coated pipes) used for 3LPE coated pipes shall be of approved make, Vendor list of the Bare pipes is as follows:


01. ANAND SEAMLESS TUBES PVT LTD INDIA
02. AVON TUBETECH PVT LTD INDIA
03. BHARAT HEAVY ELECTRICALS LIMITED INDIA
04. HEAVY METAL & TUBES (INDIA) PRIVATE LIMITED INDIA
05. ISMT LTD INDIA
06. JINDAL SAW LTD (NASHIK WORKS) INDIA
07. JR SEAMLESS PVT LTD INDIA
08. LAL BABA SEAMLESS TUBES PVT LTD INDIA
09. PATELS AIRFLOW LTD INDIA
10. RATNADEEP METAL AND TUBES LTD INDIA
11. SAINEST TUBES PVT LTD INDIA
12. SN TUBES PRIVATE LIMITED INDIA
13. GLOBAL SEAMLESS TUBES AND PIPES PRIVATE LIMITED INDIA

2.0 BILL OF MATERIAL

S.NO	DESCRIPTION	QTY(M)
01	PIPE, B-36.10, ASTM A 106 GR.B (LPE COATED), BE, SEAMLESS, 4.0 INCH, S120	100

3.0 NOTES:

- 3.1 Bidder shall obtain necessary clarifications (if any) from BHEL, before bid submission. This is a no deviation tender and no deviation or price implication is acceptable after bid submission.
- 3.2 Bidder shall submit the following along with their bid:
 - No technical Deviation Certificate



Form No:	 PE&SD	BHARAT HEAVY ELECTRICALS LIMITED PROJECT ENGINEERING & SYSTEMS DIVISION	PEMC-07558
		JOB SPECIFICATION	Rev. No. 01
		PIPE PACKAGE (3 LPE COATED)	Page 3 of 3

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



3.3 Vendor shall comply to Supply the finished piping materials within 8 WEEKS

4.0 RECORD OF REVISIONS

Rev No	Date	Revision Detail	Revised by	Approved by
00	26.08.2021	FIRST ISSUE	V.Uday Kumar	SRIKANTH G
01	16.03.2023	SECOND ISSUE	M. Shankar Ganesh	V.Uday Kumar

 	PROJECT		Standby SRU & Additional Tanks IOCL- Paradip Refinery	
	CLIENT		INDIAN OIL CORPORATION LIMITED	
JOB SUPPLY SPECIFICATION FOR PIPES	Project No. 080557C001	Document No. 080557C-000-JSS-1320-001	Rev. No. B	Page 1 of 27

JOB SUPPLY SPECIFICATION FOR PIPES

			 Written By Karthikeyan Chokkalingam 2020.04.28 19:27:35 +05'30'	 Checked By Loganathan Sudarshan 2020.04.29 10:52:30 +05'30'	 Approved By Vedysubramanian V 2020.05.06 12:26:55 +05'30'	 Authorized By Jesumarian 2020.05.07 22:39:38 +05'30'
B	28-APR-2020	ISSUED FOR DESIGN	CK	AS/SL	VVS	JM
A	9-OCT-2019	ISSUED FOR DESIGN	CK	AS	VV	JM
REV.	DATE	DESCRIPTION	PREPARED	CHECKED	APPROVED	AUTHORIZED

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		PROJECT	Standby SRU & Additional Tanks IOCL- Paradip Refinery		
		CLIENT	INDIAN OIL CORPORATION LIMITED		
JOB SUPPLY SPECIFICATION FOR PIPES	Project No. 080557C001	Document No. 080557C-000-JSS-1320-001	Rev. No. B	Page 2 of 27	

TABLE OF CONTENTS

1.	INTRODUCTION	3
2.	DEFINITIONS & ABBREVIATIONS.....	3
3.	SCOPE	4
4.	TERMINOLOGY	5
5.	REFERENCE CODES & STANDARDS.....	6
6.	GENERAL REQUIREMENTS.....	7
7.	DESIGN REQUIREMENTS	7
8.	MANUFACTURING PROCESSES	8
9.	MATERIALS	9
10.	IBR PIPES & DOCUMENTATION	13
11.	SPECIAL REQUIRMENTS FOR NACE SERVICE	15
12.	SPECIAL REQUIRMENTS FOR HYDROGEN SERVICE	18
13.	HEAT TREATMENT	20
14.	TESTING.....	21
15.	HYDROSTATIC TEST & GENERAL REQUIREMENTS.....	22
16.	SPECIAL TESTS	23
17.	INSPECTION.....	24
18.	MARKING	25
19.	PROTECTION.....	26
20.	DOCUMENTATION AND DESPATCH	26
21.	CERTIFICATION AND TRACEABILITY	27
22.	POSITIVE MATERIAL IDENTIFICATION (PMI).....	27
23.	OTHER REQUIREMENTS.....	27

 TechnipFMC	 IndianOil	PROJECT	Standby SRU & Additional Tanks IOCL- Paradip Refinery		
		CLIENT	INDIAN OIL CORPORATION LIMITED		
JOB SUPPLY SPECIFICATION FOR PIPES	Project No. 080557C001	Document No. 080557C-000-JSS-1320-001		Rev. No. B	Page 3 of 27

1. INTRODUCTION

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

2. DEFINITIONS & ABBREVIATIONS

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

 	PROJECT	Standby SRU & Additional Tanks IOCL- Paradip Refinery		
	CLIENT	INDIAN OIL CORPORATION LIMITED		
JOB SUPPLY SPECIFICATION FOR PIPES	Project No. 080557C001	Document No. 080557C-000-JSS-1320-001	Rev. No. B	Page 4 of 27

API	American Petroleum Institute
P&ID	Piping and Instrumentation Diagram
A/G	Above Ground
U/G	Under Ground
B/L	Battery Limit
ISBL	Inside Battery Limit
EOT	Electrically-operated Overhead Travelling
MTO	Material Take Off

3. **SCOPE**

This specification covers the technical requirements for procurement of carbon steel, alloy steel, stainless steel, higher alloys, duplex steel or special material pipes, coated or lined pipes and other metallic pipes commonly used in refineries, Petro-chemicals, onshore terminals and other chemical / industrial plants. This specification is applicable for the supply of all pipes specified in the material requisition and broadly covers the technical, manufacturing, inspection and other requirements.

Pipes of cast iron, non-ferrous, non-metals, copper, aluminium are not covered herein. However, this specification may be used for such pipes by suitably specifying additional requirements if any.

This specification is not intended for purchase of pipes required for offshore installations, subsea pipelines or onshore pipelines. (If governing codes are different from ASME B31.3 / B31.1 or material requirements are different)

 TechnipFMC	 IndianOil	PROJECT	Standby SRU & Additional Tanks IOCL- Paradip Refinery		
		CLIENT	INDIAN OIL CORPORATION LIMITED		
JOB SUPPLY SPECIFICATION FOR PIPES	Project No. 080557C001	Document No. 080557C-000-JSS-1320-001		Rev. No. B	Page 5 of 27

4. TERMINOLOGY

MR	Material Requisition
PR	Purchase Requisition
PO	Purchase Order
CS	Carbon steel
LTCS	Low Temp. Carbon Steel
AS	Alloy Steel
SS	Stainless steel
PE	Plain End
BE	Bevelled End
SCRD	Screwed
OD	Outside Diameter
WT	Wall Thickness
SMLS	Seamless
E.R.W	Electric Resistance Welded
E.F.W	Electric Fusion Welded
SAW	Sub-merged Arc Welded
SRL	Single Random Length
DRL	Double Random Length
Galv.	Galvanized
NPT	Nominal Pipe Threads
PMI	Positive Material Identification
IGC	Inter Granular Corrosion
ECT	Eddy Current Test
HIC	Hydrogen Induced cracking
SSC	Sulfide stress cracking
CRYO	Cryogenic
ITP	Inspection Test Plan
TPI	Third Party Inspection
IBR	Indian Boiler Regulation
HAZ	Heat affected Zone
PMS	Piping Material Specification
SMYS	Specified minimum yield strength

		PROJECT	Standby SRU & Additional Tanks IOCL- Paradip Refinery	
		CLIENT	INDIAN OIL CORPORATION LIMITED	
JOB SUPPLY SPECIFICATION FOR PIPES	Project No. 080557C001	Document No. 080557C-000-JSS-1320-001	Rev. No. B	Page 6 of 27

5. REFERENCE CODES & STANDARDS

The following codes shall be applicable, however purchaser may specify any other relevant code for any purpose at any time. The codes latest edition as on date of issue of material requisition shall be applicable. Some BS codes may have been superseded by ISO / BS –EN codes, the latest one shall be acceptable.

Code /Std. No	Description
API 5L	Specification for Line pipe
ASME.B31.3	Process Piping
ASME B36.10	Welded and seamless Wrought Steel Pipe
ASME B36.19	Stainless Steel Pipe
ASME B16.25	Butt Welding Ends
ASME B1.20.1	Pipe Threads, General Purpose (Inch)
ASTM A123	Zinc (Hot-Dip Galvanized) Coatings on Iron and steel Products
MSS SP-6	Standard Finishes for Contact Faces of Pipe Flanges and Connecting-End Flanges of Valves and Fittings
MSS SP-9	Spot Facing for Bronze, Iron and Steel Flanges
IS 1239 (Part 1)	Steel Tubes, Tubulars and other Wrought Steel Fittings - Specification
IS 1239 (Part 2)	Steel Tubes, Tubulars and other Steel Fittings - Specification
IS 3589	Steel Pipes for Water and Sewage (168.3 to 2540 mm Outside Diameter) - Specification
IS 554	Pipe Threads where pressure-Tight Joints are made on the Threads- Dimensions Tolerances and Designation
IS 4736	Specification for Hot-Dip Zinc Coatings on Mild Steel Tubes
BS EN 10204	Metallic Products – Types of Inspection Documents
NACE MR0103	Petroleum, Petrochemical and Natural Gas Industries -Materials Resistant to Sulphide Stress Cracking in Corrosive Petroleum Refining Environments
NACE MR0175 / ISO 15156	Petroleum, Petrochemical and Natural Gas Industries – Materials for Use In H ₂ S-Containing Environments in Oil And Gas Production.

		PROJECT	Standby SRU & Additional Tanks IOCL- Paradip Refinery		
		CLIENT	INDIAN OIL CORPORATION LIMITED		
JOB SUPPLY SPECIFICATION FOR PIPES	Project No. 080557C001	Document No. 080557C-000-JSS-1320-001	Rev. No. B	Page 7 of 27	

080557C-000-SP-1390-009	Specification for colour coding of piping materials by vendors
080557C -000-ITP-1300-001	Inspection and Test Plan for piping bulk items and specialities

6. **GENERAL REQUIREMENTS**

- Pipe dimensions, tolerances, chemical composition, physical properties, hardness, heat treatment, non-destructive testing, hydro testing, marking and other requirements shall conform to the relevant latest codes / standards (including their supplementary requirements) or as specified in the material requisition. Deviation from the above, if any, shall be specifically highlighted to the purchaser by the vendor.
- Any conflicts between requirements of the purchase specifications, material requisition and referred related standards and other attachments shall be brought to the notice of the purchaser for resolution before proceeding with the manufacture, fabrication or procurement of such items.
- Supply of Line pipe shall conform to API 5L Code or any other codes specified and additional purchase specifications for the purpose.

7. **DESIGN REQUIREMENTS**

7.1 **Pipe Dimensions, Seams and Joints:**

- Pipe dimensions shall be in accordance with ASME B36.10M for carbon and low alloy steel pipes and ASME B36.19M for stainless steel pipes. For non-ferrous and non-metallic pipes the respective ASTM standard and IS (Indian Standard) shall be applied.
- Pipes single random lengths (SRL) 5 m -7 m shall be in accordance with the code to which the pipe is manufactured. However, double random lengths (DRL) 11m to 13 m shall be supplied wherever specified in material requisition. Pipes supplied in double random length shall be preferred. Permissible variations in lengths shall be in accordance with the applicable material standard or as agreed by the purchaser.
- Pipes tolerances such as outside diameter (OD), Wall thickness (WT), Ovality etc. shall not exceed the relevant manufacturing code.
- Weld seam of welded pipe shall have straight seam, except where spiral seam welded pipes are called for in material requisition.
- There shall not be any circumferential weld joint in seamless (single length or in double length) unless specified otherwise or agreed by purchaser. However in case of E.Fs.W pipes, in each random length of pipe, one welded circumferential seam of same quality as longitudinal weld is permitted. This weld shall be at least 2.5 m from either end. The longitudinal "seams of the two portions shall be staggered by 90°".
- Unless otherwise mentioned in the respective material code, E.F.W pipes <36" Shall not

 		PROJECT	Standby SRU & Additional Tanks IOCL- Paradip Refinery	
		CLIENT	INDIAN OIL CORPORATION LIMITED	
JOB SUPPLY SPECIFICATION FOR PIPES	Project No. 080557C001	Document No. 080557C-000-JSS-1320-001	Rev. No. B	Page 8 of 27

have more than one longitudinal seam joint and E.F.W pipes $\geq 36"$ Shall not have more than two longitudinal seams 180° apart.

- For black or galvanized pipes to IS 1239, the minimum percentage of elongation shall be 20%.
- Galvanized Pipe shall be coated with zinc by hot dip galvanizing process, confirming to ASTM A153. Electro galvanizing process is not acceptable.
- ERW welded pipes shall not be used in any service.

Threaded ends shall be as per NPT ASME B 1.20.1. Galvanized pipes shall be supplied with threads free of galvanizing and with a threaded galvanized coupling installed on one end.

7.2 Pipe Schedules:

Pipe thickness/ schedules as specified in material requisition shall not be substituted by lower or higher schedule, without purchaser's approval. Purchaser may or may not accept the higher schedule.

7.3 Bevelling:


All pipes of size 2" & above (for Galv. 4" & above) shall have bevel ends. Bevel ends of pipes shall conform to ASME B16.25. Bevelling shall be as per below:

Pipe Material	Pipe Wall Thickness	Weld Contour
Carbon Steel (Except Low Temp. Carbon Steel)	Up to 22 mm	Figure 2 Type a
	> 22 mm	Figure 3 Type a
Alloy Steel, Stainless Steel & Low Temp. Carbon Steel	Up to 10 mm	Figure 4
	> 10 mm & Up to 25 mm	Figure 5 Type A
	> 25 mm	Figure 6 Type A

Bevel ends of pipe shall undergo Dye penetrant examination as per ASME Sec "V" E165.

8. MANUFACTURING PROCESSES

- Pipes shall be made by open hearth, electric furnace or basic oxygen process. Pipes made by Acid Bessemer process shall not be acceptable.
- Pipes forming method (Cold drawn/hot finished) shall be specified by vendor in the offer.
- ERW or spiral welded pipes shall not be supplied unless specifically called for in material requisition
- All longitudinally welded pipes other than IS 3589 should employ only automatic welding. Vendor shall confirm the same. However, manual welding may be accepted, if the quantity required is less. Purchaser's prior approval shall be taken for acceptance of manual welding

		PROJECT	Standby SRU & Additional Tanks IOCL- Paradip Refinery		
		CLIENT	INDIAN OIL CORPORATION LIMITED		
JOB SUPPLY SPECIFICATION FOR PIPES	Project No. 080557C001	Document No. 080557C-000-JSS-1320-001	Rev. No. B	Page 9 of 27	

of pipes item wise, where quantity are less, indicating specifically the proposed technique of welding employed.

- Pipes or plate material used in the fabrication of pipes and other components shall be new from mill, clean and unused free of damage, dents or corrosion. No materials without proper mill certificate or scrap materials shall be used.
- Carbon steel and LTCS pipes shall be seamless for all pipe sizes up to and including 14" size. Pipes of size 16" and above shall also be seamless unless specified otherwise. EFW pipes where specified shall have 100% radiography of weld seam so as to have a joint factor of 1.0.
- Stainless steel pipes up to 6" size shall be seamless. Pipes of size 8" and above shall also be seamless unless specified otherwise. EFW pipes where specified shall have 100% radiography of weld seam so as to have a joint factor of 1.0
- Welded pipes can be substituted by seamless pipes but not vice versa.

9. **MATERIALS**

Materials shall be strictly adhered to as specified in the material requisition. Any substitution of materials shall require the prior written approval of purchaser.

9.1 **Carbon Steel:**

Carbon Steel shall conform to the referenced specification.

- **Carbon Steel Seamless Pipe**

Carbon Steel Seamless Pipe shall be according to relevant ASTM and shall have the following additional requirements:

The full volume of all pipe shall be inspected by either an ultrasonic or electromagnetic technique using the reference standard/s as described in the appropriate specification.

Particularly, ECT test is required for size up to 6" included and thickness equal or less than 7.11mm. For the other cases (i.e. sizes larger than 6" and/or thickness greater than 7.11mm) 100% UT on full volume of pipe shall be carried out.

If ultrasonic testing is used, multiple techniques capable of locating both longitudinally and circumferentially oriented imperfections shall be used and the reference standard shall contain longitudinal and transverse notches on both the OD and ID appropriate for the technique being run.

If the appropriate specification allows it, a hydrotest is not required if a nondestructive electric test is completed successfully.

However, hydrotest is mandatory for the pipes in IBR service.

 		PROJECT	Standby SRU & Additional Tanks IOCL- Paradip Refinery	
		CLIENT	INDIAN OIL CORPORATION LIMITED	
JOB SUPPLY SPECIFICATION FOR PIPES	Project No. 080557C001	Document No. 080557C-000-JSS-1320-001	Rev. No. B	Page 10 of 27

- **Carbon Steel Welded Pipe:**

Carbon Steel welded Pipe shall be according to relevant ASTM and shall have the following additional requirements:

For ASTM A671 / 672 supplementary S10 Straight Beam UT is required on 100% of starting plate material.

Radiographic examination shall be done for 100% of full length welds. Radiograph reports shall also be submitted in digital/real time formats for 100% of all full length welds as an alternative to conventional radiograph films.

No alternative test is allowed instead of Hydrostatic test.

For API5L Grade B pipes, the Product specification level is PSL2

Cold expanded API 5L pipe is not acceptable. Pipe shall be furnished in the nonexpanded condition. Pipe shall be fabricated with Submerged Arc Welding and the welded pipe shall have weld seams 100% ultrasonically tested, and at least 200mm each end radiographed. ERW pipe in lieu of EFW pipe is not acceptable.

Only longitudinally welded pipes are acceptable. No circumferential welds allowed in the manufacturer of welded pipe.

Delivery condition shall be normalizing rolled, normalizing formed or normalizing.

Hydrostatic testing of finished pipe is required prior to UT and RT inspection.

9.2 **Austenitic stainless steel:**

- **General:**

Austenitic stainless steels shall be furnished in the solution heat treated condition and free of subsequent cold work. Specifically, components shall not be provided with residual stresses from forming or handling.

Dual Marked Stainless Steel (e.g. 316/316L) shall be supplied provided that the chemical and mechanical properties comply with the requirements of both grades

Only L-grade Stainless Steel can be supplied in substitution of relevant dual marked under Client approval.

(e.g. SS304L can be supplied instead of SS304/304L).

All SS components shall be supplied in the pickled and passivated condition.

		PROJECT	Standby SRU & Additional Tanks IOCL- Paradip Refinery		
		CLIENT	INDIAN OIL CORPORATION LIMITED		
JOB SUPPLY SPECIFICATION FOR PIPES	Project No. 080557C001	Document No. 080557C-000-JSS-1320-001	Rev. No. B	Page 11 of 27	

To optimize weldability and castability the following ferrite limits for SS300 series are required:

- a) Casting: 5-15 volume% ferrite
- b) Weld Metal of 300 Series SS components: 3-5 volume% ferrite preferred (up to 10% volume % acceptable)

- **Austenitic Stainless Steel Welded & Seamless Pipe:**

Austenitic Stainless Steel seamless shall be accordance to A312 & Welded Pipes shall be accordance to A358.

a) Welded pipes purchased to ASTM A358 shall be specified as Class 1. Class 3 is acceptable for thickness lower than 12 mm.

b) All seamless pipe of size up to 6" included and thickness equal or less than 7.11 mm shall be eddy current tested (ECT) and pass requirements of ASTM A999. For the other cases (i.e. sizes larger than 6" and/or thickness greater than 7.11mm) 100% UT on full volume of pipe shall be carried out. If a more stringent requirement is specified in another referenced standard, it shall take precedence. If the appropriate specification allows it, a hydrotest is not required if a nondestructive electric test is completed successfully. However hydrotest is mandatory for IBR certified piping material.

c) Full length welds of welded pipes shall be 100% Radiographic examined. No alternative test is allowed instead of Hydrostatic test.

d) A999 - Repair Welding of base metal is not acceptable.

e) Intergranular Corrosion Test is required and shall satisfy the requirements in ASTM A312 Supplementary requirement S7 or A358 S6.

9.3 **Duplex Stainless Steel seamless and welded pipes:**

Eddy Current Testing is required for seamless pipes of size up to 6" included and thickness equal or less than 7.11 mm and shall follow the guideline in ASTM A790 in addition to the hydrostatic test.

Welded Pipe with autogenous welding is not permitted. Welded Pipe with addition of filler metal is only accepted.

Full length welds of welded pipes shall be 100% Radiographic examined in addition to the hydrostatic test.

 		PROJECT	Standby SRU & Additional Tanks IOCL- Paradip Refinery	
		CLIENT	INDIAN OIL CORPORATION LIMITED	
JOB SUPPLY SPECIFICATION FOR PIPES	Project No. 080557C001	Document No. 080557C-000-JSS-1320-001	Rev. No. B	Page 12 of 27

Welded pipes shall be ferrite checked as per AWS A4.2 or ASTM E562, Impact Test as per ASTM A923, Corrosion resistance check as per ASTM G48A.

Duplex stainless steel pipes shall be subject to a metallographic examination in accordance with ASTM E562 to demonstrate that the ferrite content of two samples per heat treatment batch is between 35% and 65%. The microstructure shall exhibit no grain boundary carbides and shall be free of sigma, chi, and laves phases.

ASTM G48 Method A Supplemental Test Requirement:

ASTM G48 Method A Ferric Chloride Pitting Test is required. The full 72 hour test is required, the 24 hour test is not acceptable. The acceptance criteria is that there shall be no pitting in the base metal or weld metal at or above the following temperatures: (S32205 or S31803) at 22 °C (72°F)

9.4 Alloy C-276 welded pipe:

Alloy C-276 welded pipe shall be made from flat-rolled alloy by an automatic welding process with no addition of filler metal as required in ASTM B619, even for size larger than 8".

Welded Pipe not referenced in ASME B31.3 or ASME Div. II part D (e.g. ASTM A619 Grade N10276 welded pipe with addition of filler metal, or size greater than 8") shall have the same mechanical properties (yield strength and tensile strength) of welded pipe without filler metal at room temperature and at the maximum design temperature set forth in the project (e.g. 315°C for Alloy C-276 welded pipe).

If SUPPLIER has not data relevant to the required mechanical properties, a hot tensile test at the maximum design temperature is required.

9.5 Inconel 625:

Materials shall confirm to the required ASTM standard. Nickel base alloys shall be furnished in solution annealed condition, specifically components shall not be provided with residual stresses from forming or handling.

9.6 High Strength Low alloy steel:

Materials shall confirm to the required ASTM standard.

 		PROJECT	Standby SRU & Additional Tanks IOCL- Paradip Refinery	
		CLIENT	INDIAN OIL CORPORATION LIMITED	
JOB SUPPLY SPECIFICATION FOR PIPES	Project No. 080557C001	Document No. 080557C-000-JSS-1320-001	Rev. No. B	Page 13 of 27

9.7 Externally Coated Pipe for Underground Service:

“080557C-000-JSS-1300-001” – Specification for 3-Layer Polyethylene coating (Fusion Bonded Epoxy and Polyethylene Tapes) to be referred.

9.8 Internally Coated Pipe for Fire water Service & Cooling water service:

“080557C-000-JSS-1300-002” – Specification for coating of Internal Surface of CS Steel Pipelines and fittings for fire water pipelines with heat cured Phenol formaldehyde (Baked Phenolic) to be referred.

9.9 Material Substitution:

- Any substitution of materials shall require the prior approval of purchaser
- Substitution of seamless pipes with welded pipe is not permitted
- Substitution of A106 grade B pipe with grade A pipes is not permitted
- Substitution of EFW / SAW pipes with ERW pipes is not permitted
- ASTM A 106 Gr. B pipes are acceptable in lieu of API 5L Gr. B pipes
- IS 3589 Gr.410 is acceptable in lieu of grade 330 but not vice versa. Only SAW welded pipe as per IS 3589 shall be accepted.

9.10 Chemical Composition:

Carbon steels shall have the Carbon content and Carbon equivalent (CE) as specified in the relevant code or as mentioned specifically in the material requisition. However, as a general, the Carbon content should not be more than 0.23% max. (For ferritic alloy steel, 0.14% max.) and CE should not be more than 0.45 for pipes intended for welding.

The Carbon equivalent may be established by using the formula

$$CE = C + Mn/6 + (Cr + Mo + V)/5 + (Ni + Cu)/15$$

10. IBR PIPES & DOCUMENTATION

- All pipes under the purview of 'IBR' (Indian Boiler Regulations) shall be accompanied with original IBR certificate in Form IIIA duly approved by IBR Authority / Local Authority empowered by Central Boiler Board of India. Photocopy of the original certificate duly attested by the local boiler Inspector, where the supplier is located is the minimum acceptable requirement.

		PROJECT	Standby SRU & Additional Tanks IOCL- Paradip Refinery	
		CLIENT	INDIAN OIL CORPORATION LIMITED	
JOB SUPPLY SPECIFICATION FOR PIPES	Project No. 080557C001	Document No. 080557C-000-JSS-1320-001	Rev. No. B	Page 14 of 27

- For materials 1 ¼ Cr – ½ Mo (ASTM A335 Gr.P11/A691 Gr. 1 ¼ Cr) & 2 ¼ Cr- 1 Mo (ASTM A335 Gr.P22/A691 Gr.2 ¼ Cr) from IIIA approved by IBR should include the tabulation of Et, Sc & Sr values for the entire temperature range given below.

Et, Sc & Sr values shall be such that throughout the temperature range.

$$\left. \begin{array}{l} E_t/1.5 \geq \\ S_r/1.5 \geq \\ S_c \geq \end{array} \right\} S_A$$

Where

S_A : Allowable stress at the working metal temperature.

E_t : Yield point (0.2% proof stress at the working metal temperature)

S_c : The average stress to produce elongation of 1 % (creep) in 100000 hrs at the working metal temperature.

S_r : The average stress to produce rupture in 100000 hrs at the working metal temperature and in no case more than 1.33 times the lowest stress to produce rupture at this temperature.

S _A (PSI)												
TEMP (F)	500	600	650	700	750	800	850	900	950	1000	1050	1100
MATERIAL												
A335 P11	16200	15700	15400	15100	14800	14400	14000	13600	9300	6300	4200	2800
A691 Gr. 1 ¼ Cr Cl.42	21400	21400	21400	21400	21400	21400	20200	13700	9300	6300	4200	2800
A335 P22	16600	16600	16600	16600	16600	16600	16600	13600	10800	8000	5700	3800
A691 Gr.2 ¼ Cr Cl.42	20500	20400	20200	20000	19700	19300	18700	15800	11400	7800	5100	3200

NOTE: S_A values are from ASME B31.1. Values shall be as per the latest edition

- For carbon steel pipes under IBR the chemical composition shall conform to the following:

 		PROJECT	Standby SRU & Additional Tanks IOCL- Paradip Refinery	
		CLIENT	INDIAN OIL CORPORATION LIMITED	
JOB SUPPLY SPECIFICATION FOR PIPES	Project No. 080557C001	Document No. 080557C-000-JSS-1320-001	Rev. No. B	Page 15 of 27

Carbon (Max.) : 0.25 %

Others (S ,P & Mn) : As prescribed in IBR regulations

The chemical composition as indicated in this clause is not applicable for pipes other than IBR services.

11. SPECIAL REQUIRMENTS FOR NACE SERVICE

11.1 General:

- All items under this category shall generally be as par NACE MR-0103 latest edition. Where NACE MR 0175 is specified same shall be applicable.
- All steels shall be fully killed and fine grained.
- Hardness of the production weld shall be lower than 200 HB. This value is slightly lower than the one defined for the base metal (22 HRC or 237 HB) in order to anticipate potential non- homogeneity of certain weld deposits.
- The steel making process shall produce steel with high resistance to hydrogen sulphide attack i.e. HIC & SSC.
- All steels shall be manufactured by either basic oxygen or electric furnace process only.
- Carbon content shall be limited below 0.20 % w.
- CS base plate material shall be supplied in normalized condition (or quenched and tempered), regardless of thickness.
- Thermal stress relieving (PWHT) required for seamless pipe welds as minimum, even if it is not required by code.
- Thermal stress relieving required for cold bend zones even if it is not required by code. Level of deformation may require recovery annealing to restore properties of steel.
- Carbon equivalent (CE) shall be limited to below 0.42% for thickness below 2" and below 0.45% for thickness above 2"

$$CE = C\% + Mn\% / 6 + (CR\% + Mo\% + V\%) / 5 + (Ni\% + Cu\%) / 15.$$

- Pipes where specified HIC and or NACE, in the material requisition shall comply with latest edition of NACE standard specified

11.2 Wet H2S RESISTANT PIPE (SEAMLESS & WELDED):

Chemical composition as per Table-1 specified against each product are permitted.

		PROJECT	Standby SRU & Additional Tanks IOCL- Paradip Refinery	
		CLIENT	INDIAN OIL CORPORATION LIMITED	
JOB SUPPLY SPECIFICATION FOR PIPES	Project No. 080557C001	Document No. 080557C-000-JSS-1320-001	Rev. No. B	Page 16 of 27

Table-1

Chemical composition for pipes

Element	Percentage
C	< 0.20 % w
Mn	1.35 % max
Si	0.10 % to 0.35 % max
P	0.020 % max
Ni	0.20 % max
S	0.010 % max for seamless 0.015 % max for welded
Other	As per specification
Pcm	0.21 % max
CE	0.40 % max

Pipes shall be supplied in quenched and tempered or normalised condition regardless of thickness.

Welded pipes shall fulfill the same requirements as for plate's material.

- Chemical Composition**

This shall be carried out on heat as well as on finished product as per relevant product material specifications and shall meet the requirements on Table-1.

- Mechanical Properties**

The following mechanical properties shall only be acceptable over and above that specified in the relevant product material specification.

Ultimate Tensile Strength = 77000 psi (max) on finished product

Ratio of yield to tensile strength shall not exceed 0.8 on finished product.

- Hardness Test**

Hardness (max) shall be HRC22 (237 HB) on finished product.

- Non Destructive Examination**

The inside and outside surface of all pipes shall be visually examined. The longitudinal seam of the welded pipe shall be subjected to 100% radiography; However weld repairs are restricted to 2 numbers at the same spot.

 		PROJECT	Standby SRU & Additional Tanks IOCL- Paradip Refinery	
		CLIENT	INDIAN OIL CORPORATION LIMITED	
JOB SUPPLY SPECIFICATION FOR PIPES	Project No. 080557C001	Document No. 080557C-000-JSS-1320-001	Rev. No. B	Page 17 of 27

- **SSC (Sulfide Stress corrosion)Test**

SSC test is not required. But in case of deviation of S & P % from respective on the chemical analysis of the finished product or UTS being greater than 77000 psi the manufacturer shall either conduct SSC test on every heat as per NACE TM-0177, successfully OR reject all the finished products made from that heat.

- **Seamless Pipes**

Seamless pipe shall contain max. 0.010% sulphur and max 0.03% phosphorus, otherwise HIC testing is required. If the bidder is unable to offer seamless pipe with a sulphur content less than or equal to 0.010% and phosphorous content less than or equal to 0.02%, then HIC testing shall be carried out on pipe where the check analysis exceeds the above value.

- **Welded Pipes**

Impurity level in carbon steel products originated from plates shall be controlled in order to avoid the occurrence of brittle phases during welding:

- maximum allowable Phosphorus content 0.020%w
- maximum allowable Sulphur content 0.015%w

11.3 **Welding in wet H2S service:**

Filler metal and weld deposit shall have diffusible hydrogen content typically below 5mL/100g. Nickel content of filler metal also shall remain below 1% and Manganese content below 1.5%.

Welding Procedure Specification WPS for CS material in wet H2S service shall include PWHT regardless of construction code requirement. PWHT temperature shall not be less than 620°C (1150°F) and minimum 93 °C (200°F) preheat temperature should be used for all welding. Hardness survey on preproduction welded coupons to be conducted. Test indentations should be taken on the weld deposit, Heat Affected Zone (HAZ) and base metal, in the cap and root of the weld. Welding Procedure Qualification Record (PQR) shall be documented with hardness survey.

Hardness should be limited to the following after PWHT:

- Base metal: 237HBW (22HRC)
- Weld deposit: 200HBW
- Heat Affected Zone: 237HBW (22HRC)

PWHT shall be applied to welded assemblies for corrosion reasons, and production welds shall be 100% UT tested. Hardness verification of production welds is required.

		PROJECT	Standby SRU & Additional Tanks IOCL- Paradip Refinery		
		CLIENT	INDIAN OIL CORPORATION LIMITED		
JOB SUPPLY SPECIFICATION FOR PIPES	Project No. 080557C001	Document No. 080557C-000-JSS-1320-001	Rev. No. B	Page 18 of 27	

More information on welding practice of CS material in wet H₂S service can be found in document NACE SP0472.

11.4 HIC Resistant Material:

When HIC test is specified the following requirements shall also be met

- HIC testing shall be carried out for welded pipes irrespective of S & P % values.
- Max allowable phosphorus content 0.010 % w
- Max allowable sulphur content 0.002 % w
- maximum allowable Oxygen content 0.0025% w(target 0.0020%w)

Welded pipes, if any, shall fulfil the same requirements as for the plate.

Killed carbon steel plates shall be obtained by vacuum degassing process. Inclusion shape control by calcium treatment (or equivalent process) is also required, and impurity level shall be controlled in order to limit the level of inclusions:

- maximum allowable Phosphorus content 0.010%w
- maximum allowable sulphur content 0.002%w
- maximum allowable Oxygen content 0.0025% w(target 0.0020%w)

Plates, welded pipes and other products originated from plates shall pass HIC test as per NACE TM0284. Mill test reports shall include the values for the Crack Length Ratio (CLR), Crack Sensitivity Ratio (CSR) and Crack Thickness Ratio (CTR).

HIC test results requirements:

- Average CLR ≤ 5% with CLR < 7% for each individual section
- Average CTR < 1.5% with CTR < 2% for each individual section
- Average CSR < 0.5% with CSR < 0.7% for each individual section

The average is the sum of the values obtained on each section divided by the total number of sections examined (arithmetic mean).

Steel shall be calcium treated for inclusion morphology control. To determine the effectiveness of calcium treatment inclusion count check shall be performed as per ASME E-45 (Microscopic method).

Steel shall be specifically treated to control non-metallic inclusion like metallic oxide clusters, silicates and magnesium sulphide etc.

12. SPECIAL REQUIRMENTS FOR HYDROGEN SERVICE

These special requirements are applicable for the pipes to be supplied for Hydrogen service as marked "Hydrogen Service" in material requisition.

 		PROJECT	Standby SRU & Additional Tanks IOCL- Paradip Refinery	
		CLIENT	INDIAN OIL CORPORATION LIMITED	
JOB SUPPLY SPECIFICATION FOR PIPES	Project No. 080557C001	Document No. 080557C-000-JSS-1320-001	Rev. No. B	Page 19 of 27

12.1 Carbon Steel:

All carbon steel pipes shall be normalized. Cold drawn pipes shall be normalized after the final cold draw pass for all thicknesses. The normalizing heat treatment shall be a separate heating operation and not a part of the hot forming operation.

All carbon steel pipes having wall thickness 19 mm and above shall be post weld heat treated.

All welds shall be 100% radiographed.

The MDMT (Minimum Design Metal temperature) shall be no greater than +32°F (0°C). Figure 323.2.2.A and Table 323.3.5 of ASME B31.3 shall be used to determine impact testing requirements.

12.2 Alloy Steel:

All alloy steel (Cr-Mo) pipes shall be normalized and tempered. The normalizing and tempering shall be separate heating operation and not a part of the hot forming operation. The maximum room temperature tensile strength shall be 100,000 psi.

All alloy steel (Cr-Mo) pipes shall be post weld heat treated irrespective of type or thickness of weld.

All welds shall be 100% radiographed.

The MDMT (Minimum Design Metal temperature) shall be no greater than +32°F (0°C). Figure 323.2.2.A and Table 323.3.5 of ASME B31.3 shall be used to determine impact testing requirements.

For 9Cr-1Mo-V Grade 91 material all requirements shall be as per API 938 B-2008.

Alloy 825 Pipes, all welds shall be 100% radiographed.

12.3 Stainless steel:

All austenitic stainless steel grades shall be solution annealed after welding. 100% radiography of welded joints shall be done.

For all austenitic stainless steels, the weld deposit shall be checked for ferrite content. A Ferrite No. (FN) not less than 3% and not more than 10% is required to avoid sigma phase embrittlement during heat treatment. FN shall be determined by Ferrite scope prior

 		PROJECT	Standby SRU & Additional Tanks IOCL- Paradip Refinery	
		CLIENT	INDIAN OIL CORPORATION LIMITED	
JOB SUPPLY SPECIFICATION FOR PIPES	Project No. 080557C001	Document No. 080557C-000-JSS-1320-001	Rev. No. B	Page 20 of 27

to post weld heat treatment.

12.4 Impact test:

For all carbon steels and alloy steels pipes with thickness over 19 mm, Charpy -V Notch impact testing shall be carried out in accordance with paragraph UG-84 of ASME Section VIII, Div-1 for weld metal and base metal from the thickest item per heat of material and per heat treating batch. Impact test specimen shall be in complete heat treated condition and in accordance with ASTM A370. Impact energies at 0° C shall average greater than 27J (20 ft-lb) per set of 3 specimens, with a minimum of 19J (15 ft-lb).

If welding is used in manufacture, impact test of Heat Affected Zone (HAZ) and weld metal shall also be carried out.

12.5 Hardness:

For carbon steel pipes hardness of weld and HAZ shall be limited to 200 BHN (max.).

For alloy steel pipes, hardness of weld and HAZ shall be limited to 225 BHN (max.).

12.6 Radiography:

All girth welded joints (longitudinal and circumferential) shall be 100% radiographed in accordance with UW-51 of ASME Section VIII, Div-1 and ASME Section V.

13. HEAT TREATMENT

All pipes shall be heat treated in accordance with the applicable material specification.

- For all 1Cr.- ½ Mo, 1 ¼ Cr. – ½ Mo and 2 ¼ Cr. – 1 Mo the maximum room temperature tensile strength of all pressure retaining components and welds shall be 100,000 psi (7030 kg/cm²).
- For all 1Cr. - ½ Mo, 1 ¼ Cr. – ½ Mo and 2 ¼ Cr. – 1 Mo accelerated cooling from the austenitizing temperature is acceptable, where permitted by the applicable product from specification.
- All 1 Cr. – ½ Mo , 1 ¼ Cr. – ½ Mo and 2 ¼ Cr. – 1 Mo seamless pipes shall be normalized and tempered. The normalizing and tempering heat treatment shall be a separate operation, not the hot forming operation.
- For welded steel pipes with mandatory requirement of heat treatment and radiography, radiography shall be performed after heat treatment.
- E.F.W pipes to ASTM A 672 and ASTM A 691 and other welded pipes shall be heat treated

 TechnipFMC	 IndianOil	PROJECT	Standby SRU & Additional Tanks IOCL- Paradip Refinery		
		CLIENT	INDIAN OIL CORPORATION LIMITED		
JOB SUPPLY SPECIFICATION FOR PIPES	Project No. 080557C001	Document No. 080557C-000-JSS-1320-001		Rev. No. B	Page 21 of 27

in accordance with respective material specification.

- All austenitic stainless steel pipes shall be solution annealed as per relevant standard.
- Heat treatment shall be carried out after any weld repair. However, weld repairs are restricted to 2 numbers at the same spot.

14. **TENSILE TESTS:**

Tensile properties shall be determined from specimens removed from pipe, which has been subjected to all mechanical and heat treatment operations where stress relieving of pipe will be performed example for welding ,additional tensile testing of parent metal and weld elements shall be performed on stress relieved specimens.

Tensile testing specimens: Full thickness strip shall be used. Longitudinal specimen will be tested.

Tensile testing frequency: Tensile tests shall be performed on samples taken from two pipes per heat. For heats less than 100 tones, tests on only one pipe shall be required.

Longitudinal Tensile test: Longitudinal Tensile test specimens shall be either non flattened or round bar specimens.

Transverse Tensile test: Transverse tensile tests shall be determined on flattened rectangular specimens.

Weld tensile tests: Weld tensile specimens shall be taken from the same part of the pipe used for preparing parent metal tensile specimens. The weld reinforcements shall be removed before tensile testing.

No cracks or breaks shall occur in either weld or parent metal during flattening of the test specimen to 1/3rd of its original OD. The specimen shall be further flattened to 2/3rd of original OD without cracks or breaks other than in the weld.

14.1 **TESTING**

Test reports shall be supplied for all mandatory tests as per the applicable material specification. Test reports shall be furnished for any supplementary tests as specified in the material requisition.

Material test certificates (physical property, chemical composition and heat treatment report) shall be furnished for all pipes.

All items shall be inspected and approved (stage-wise) by third party inspector or any other agency authorised by purchaser.

 		PROJECT	Standby SRU & Additional Tanks IOCL- Paradip Refinery	
		CLIENT	INDIAN OIL CORPORATION LIMITED	
JOB SUPPLY SPECIFICATION FOR PIPES	Project No. 080557C001	Document No. 080557C-000-JSS-1320-001	Rev. No. B	Page 22 of 27

15. HYDROSTATIC TEST & GENERAL REQUIREMENTS

- All finished pipes shall be hydrostatically tested in accordance with ASTM / API / IS Standards requirements as applicable.

For IBR pipes, hydrostatic test is mandatory and additional to the other NDE test.

- “General Requirements” have been specified under a separate ASTM standard in each pipe material ASTM standard. These standards specifying general requirements are also listed in reference documents of each relevant ASTM standard. The requirements for hydrotest are prescribed in these standards along with other general requirements.
- The test fluid used for hydrostatic testing shall be hydraulic oil or an emulsion of water with a water soluble oil to prevent rust. After hydrostatic tests, material shall be carefully drained.
- It is mandatory for the pipe supplier to comply with these standards besides the main ASTM standard
- Water quality for hydrotest is 50 PPM max for Stainless steel materials, in case of carbon steel piping the water quality for hydrotest is 250 PPM max.
- Standards as listed below shall be applicable not only for hydrotest but also other “General Requirements” and vendor shall comply with the same.

Pipe Material Std.	Material	Hydrotest Std	General Requirements Std
ASTM A 106	C.S, Seamless	ASTM A 530	ASTM A 530
ASTM A 312	SS, Seamless	ASTM A 999	ASTM A 999
ASTM A 268	SS, Seamless, Welded	ASTM A 1016	ASTM A 1016
ASTM A 333	LTCS, Seamless	ASTM A 999	ASTM A 999
ASTM A 335	A.S, Seamless	ASTM A 999	ASTM A 999
ASTM A 358	SS, EFW	ASTM A 999	ASTM A 999
ASTM A 671	LTCS, EFW	ASTM A 530	ASTM A 530
ASTM A 672	CS, EFW	ASTM A 530	ASTM A 530
ASTM A 691	CS, AS, EFW	ASTM A 530	ASTM A 530
API 5L	CS, Seamless, Welded	API 5L	API 5L
IS 1239	CS, Galvanized	IS 1239	IS 1239
IS 3589	CS, Welded	IS 3589	IS 3589

		PROJECT	Standby SRU & Additional Tanks IOCL- Paradip Refinery		
		CLIENT	INDIAN OIL CORPORATION LIMITED		
JOB SUPPLY SPECIFICATION FOR PIPES	Project No. 080557C001	Document No. 080557C-000-JSS-1320-001	Rev. No. B	Page 23 of 27	

- Other special alloy pipes, Cupro-Nickel pipes shall generally be tested to their respective material standard or standards referred therein. In all such cases vendor shall seek approval of purchaser for the applicability of the standard for hydrotest requirements.

16. SPECIAL TESTS

16.1 Impact Test:

When impact testing is required as per Table 323.2.2 of ASME B31.3, it shall be done in accordance with Table 323.3.1 using the testing methods and acceptance criteria described in paras. 323.3.2 through 323.3.5.

16.2 Inter-Granular Corrosion (IGC) Test:

Inter-granular corrosion (IGC) test shall be conducted for all grades of austenitic stainless steel pipes as per following:

ASTM A 262, practice 'B' with acceptance criteria of 60 mils / year (max.) or ASTM A262, practice 'E' with acceptance criteria of "No cracks as observed from 20 X magnification and microscopic structure to be observed from 250 X magnification, Microscopic structure photograph shall be submitted for record.

- ASTM A 262, practice 'C' with acceptance criteria of 15 mils / year (max.) shall be conducted on some grades of stainless steel such as SS309, 310, 316, 316H etc. for high temp. application, wherever specified in material requisition.
- For IGC test two sets of samples shall be drawn from each solution annealing lot; one set corresponding to highest carbon content and other set corresponding to the highest pipe wall thickness. When testing is conducted as per Practice "E", photograph of microscopic structure shall be submitted for record.
- All types of 321 or 347 stainless steel piping items / parts shall be in stabilized heat-treated condition above 454°C (based on licensor package). Stabilizing heat treatment shall be carried out subsequent to the normal solution annealing. Soaking time and holding temperature for stabilizing heat treatment shall be 4 hours and 900° C respectively.
- All austenitic stainless steel pipes shall be supplied in solution annealed condition.
- All welded pipes indicated as CRYO & LTCS in material requisition shall be impact tested as per requirement and acceptance criteria of ASME B31.3. The Impact test temperature shall be -193°C & -45°C for Stainless steel and LTCS pipes respectively unless specifically

 TechnipFMC	 IndianOil	PROJECT	Standby SRU & Additional Tanks IOCL- Paradip Refinery		
		CLIENT	INDIAN OIL CORPORATION LIMITED		
JOB SUPPLY SPECIFICATION FOR PIPES	Project No. 080557C001	Document No. 080557C-000-JSS-1320-001		Rev. No. B	Page 24 of 27

mentioned other wise in material requisition.

- Specified heat treatment for carbon steel and alloy steel and solution annealing for stainless steel pipes shall be carried out after weld repairs. Number of weld repairs at the same spot shall be restricted to maximum two numbers as per approved repair procedure.


17. INSPECTION

17.1 General:

- Vendor shall comply with the inspection test plan (ITP) for pipes attached to the material requisition as a minimum.
- However a detailed inspection and test plan (ITP) shall be submitted for review by the purchaser along with bids. All pipes will be subject to inspection in accordance with the purchaser approved inspection and test plan (ITP).
- CONTRACTOR / TPIA will carry out stage wise inspection. All assistance shall be provided for the same and timely co-ordination shall be the responsibility of the vendor.
- All material test report for physical property, chemical composition etc. shall be submitted for all mandatory and supplementary tests specified in accordance with applicable codes /standards or attached specifications.

17.2 Material Inspection:

- All mill test certificates and SUPPLIER's test certificates, if any, shall be verified.
- Chemical and mechanical characteristics, hydraulic tests and recorder diagrams of heat treatment, if any, shall be according to those provided in the relevant Codes, Standards and/or Specifications.
- For materials requiring additional testing, for example, impact tests, mill test reports shall be provided in addition to the documents required by the mentioned material standard. These reports shall include the impact test results.
- Manufacturing data and records, such as mill test reports or certificates, radiographs, results of the other non-destructive examinations, visual examinations, and records of dimensional inspection shall be available for examination by purchaser and/or its representative.
- The CONTRACTOR / OWNER Inspector shall have free entry to those parts of the manufacturer plant which concern the manufacturer and testing of material ordered. CONTRACTOR / OWNER inspector has the right to carry out any check test in order to verify the certified values in any case of doubt or dispute concerning the results obtained. The manufacturer shall allow photographic documentation of those parts by the inspector. Should the results not be according to Specification, re-testing costs shall be at SUPPLIER's charge.

 		PROJECT	Standby SRU & Additional Tanks IOCL- Paradip Refinery	
		CLIENT	INDIAN OIL CORPORATION LIMITED	
JOB SUPPLY SPECIFICATION FOR PIPES	Project No. 080557C001	Document No. 080557C-000-JSS-1320-001	Rev. No. B	Page 25 of 27

17.3 Visual Inspection:

Surfaces shall be sound, clean and free of flaws, cracks, ridges and others defects judged unacceptable by the Inspector and/or as per the Codes.

17.4 Dimensional Inspection:

Unless otherwise specified, tolerances in dimensions shall be according to the relevant Codes, Standards and Specifications.

In particular, the following shall be checked:

- thickness
- diameters
- bevel, threaded dimensions
- roundness
- straightness

18. MARKING

- Pipe size, Sch./ wall thickness, type of construction, material of construction with grade and the Component code along with P.O. No. shall be stamped on each pipe length as per below
 - Code of manufacture, type of pipe, material with grade
 - Nominal diameter and Schedule / wall Thickness
 - Purchase order No.
 - Ident code / Sap item code (if any)

In addition to the above special condition as per below shall also be marked like "IBR", "CRYO", "NACE", "H2" etc.

- Marking shall be legible and carried out in accordance with ASTM /API / MSS SP-25 codes as applicable.
- Marking shall be stamped with inedible paints or stencilled on pipe 100 mm from each end.
- When metal stamping is used it shall be on the long edge of each component as it leaves the mill. Metal stamping on rolled surfaces shall be done with a "low stress" stamp.
- Markings shall be protected from erosion, wear, or other events that may render them unreadable.
- Paint /ink used for marking shall be free of any harmful metal or metallic salts such as zinc, lead or copper which may cause corrosive attack on heating. Particular care shall be taken for austenitic stainless steels.
- Austenitic stainless steels materials shall be vibro etched. Carbon steel and impact tested

 TechnipFMC	 IndianOil	PROJECT	Standby SRU & Additional Tanks IOCL- Paradip Refinery		
		CLIENT	INDIAN OIL CORPORATION LIMITED		
JOB SUPPLY SPECIFICATION FOR PIPES	Project No. 080557C001	Document No. 080557C-000-JSS-1320-001		Rev. No. B	Page 26 of 27

carbon steel materials shall be marked by round nosed low stress stamps.

- All pipes shall be painted as per specification for colour coding of piping materials by vendors Doc No."080557C-000-SP-1390-009".
- For easy identification, pipes shall be painted throughout the length with stripes as per above Specification. additionally following speciality services shall also be identified by colour stripes.

IBR: Red, CRYO: Light Purple, NACE: Canary Yellow, HIC: Dark Brown

19. PROTECTION

- All pipes shall be protected from rust, corrosion, mechanical damage during storage at works, transportation / shipment and delivery to purchaser.
- All items shall be well protected and kept dry, clean and free from dirt, moisture, or loose foreign materials of any kind.
- Stainless steel items shall be protected from the risk of saline corrosion during shipment.
- Rust preventive coating on machined surfaces to be welded shall be of easily removable type with the petroleum solvent and the same shall not be harmful to welding and shall not be harmful for welding. Machined surface (Threads, Bevel end, etc.) shall be coated with a rust preventive.
- For large diameter pipes, in particular when thin wall manufactured, SUPPLIER shall provide suitable reinforcements to avoid buckling and ends ovalization.
- Both ends of pipes shall be suitably protected, and the protectors shall be securely and tightly attached. End protectors to be used on bevelled ends shall be securely and tightly attached with belt or wire. Steel end protectors for galvanized items shall be galvanized.

Flange face	:	Wood, metal or plastic cover
Beveled end	:	Wood, metal or plastic cover
Plain end	:	Plastic cap
Screwed end	:	Screwed plastic cap

20. DOCUMENTATION AND DESPATCH

- All items shall be supplied in separate seaworthy packing / bundles / lots item-wise, size / sch. wise, MOC wise etc. Packing list shall be included as part of each package
- Each packing / bundle / lot shall be marked with purchase order No., Ident code / SAP code No., size, schedule, code of manufacture, type of pipe and material with grade
- All material test report for physical property, chemical composition, heat treatment, etc. shall be despatched for all mandatory and supplementary tests specified in accordance with applicable codes /standards or attached specifications.
- All documentation shall be submitted in accordance with material requisition

 TechnipFMC	 IndianOil	PROJECT	Standby SRU & Additional Tanks IOCL- Paradip Refinery		
		CLIENT	INDIAN OIL CORPORATION LIMITED		
JOB SUPPLY SPECIFICATION FOR PIPES	Project No. 080557C001	Document No. 080557C-000-JSS-1320-001		Rev. No. B	Page 27 of 27

21. CERTIFICATION AND TRACEABILITY



Material Certificates for all items shall be in accordance with EN 10204 type 3.1. All certificates shall be fully traceable to the item covered and shall be marked with the purchasers order number, Ident code / SAP item code (if any). They shall be clearly legible, in the English language.

22. POSITIVE MATERIAL IDENTIFICATION (PMI)

- Positive Material Identification (PMI) shall be performed as per the scope and procedures defined in specification for Positive Material Identification attached with the material requisition, on completion of all manufacturing activities including marking.
- All alloy materials tested by PMI shall be identified using either of the following methods by indicating "PMI OK"
 - Bar Code/ Hologram Sticker
 - A low stress stamp marking
 - Any other method

23. OTHER REQUIREMENTS

Guarantee / Warranty, Quality plan, Inspection (ITP), Positive Material Identification (PMI), Documentation and all other requirements shall be governed by the requirements as per other documents attached with the material requisition.

 		PROJECT	Standby SRU & Additional Tanks IOCL- Paradip Refinery		
		CLIENT	INDIAN OIL CORPORATION LIMITED		
JOB SUPPLY SPECIFICATION FOR 3 LAYER POLYETHYLENE COATING	Project No. 080557C001	Document No. 080557C-000-JSS-1300-001		Rev. No. B	Page 1 of 31

JOB SUPPLY SPECIFICATION FOR 3 LAYER POLYETHYLENE COATING (Fusion Bonded Epoxy and Polyethylene Compound)

Pages revised: All pages.

Generally revised for the application of 3LPE coating at Vendor shop instead of application at site.

REV.	DATE	DESCRIPTION	PREPARED	CHECKED	APPROVED	AUTHORIZED
B	16-JULY-2020	ISSUED FOR DESIGN	CK	SL	VV	JM
A	14-OCT-2019	ISSUED FOR DESIGN	CK	AS	VV	JM

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 	PROJECT		Standby SRU & Additional Tanks IOCL- Paradip Refinery	
	CLIENT		INDIAN OIL CORPORATION LIMITED	
JOB SUPPLY SPECIFICATION FOR 3 LAYER POLYETHYLENE COATING	Project No. 080557C001	Document No. 080557C-000-JSS-1300-001	Rev. No. B	Page 2 of 31

TABLE OF CONTENTS

APPENDIX 1	2
1. INTRODUCTION	3
2. DEFINITIONS & ABBREVIATIONS.....	3
3. SCOPE	4
4. REFERENCE CODES & STANDARDS.....	5
5. MATERIALS	7
6. COATING PROPERTIES AND FUNCTIONAL REQUIREMENTS.....	8
7. COATING PROCEDURE AND QUALIFICATION	11
8. PIPE SURFACE PREPARATION	15
9. COATING APPLICATION	17
10. INSPECTION AND TESTING.....	20
11. HANDLING, TRANSPORTATION AND STORAGE	25
12. REPAIR OF COATING	27
13. MARKING AND PIPE IDENTIFICATION.....	29
14. PRODUCTION REPORT	30

APPENDIX 1

 	PROJECT		Standby SRU & Additional Tanks IOCL- Paradip Refinery	
	CLIENT		INDIAN OIL CORPORATION LIMITED	
JOB SUPPLY SPECIFICATION FOR 3 LAYER POLYETHYLENE COATING	Project No. 080557C001	Document No. 080557C-000-JSS-1300-001	Rev. No. B	Page 3 of 31

1. INTRODUCTION

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

2. DEFINITIONS & ABBREVIATIONS

Abbreviation	Definition /Expanded form
IOCL/ CLIENT	Indian Oil Corporation Limited
PMC/ CONSULTANT	Technip India Limited
LICENSOR	Party selected by IOCL for process technology ownership for any UNIT
CONTRACTOR	Party whose services are obtained for performing the works specified as part of LSTK / packages.
PURCHASER	Party who purchase the required supply from vendor
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 component/materials
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

 		PROJECT	Standby SRU & Additional Tanks IOCL- Paradip Refinery	
		CLIENT	INDIAN OIL CORPORATION LIMITED	
JOB SUPPLY SPECIFICATION FOR 3 LAYER POLYETHYLENE COATING	Project No. 080557C001	Document No. 080557C-000-JSS-1300-001	Rev. No. B	Page 4 of 31

Abbreviation	Definition /Expanded form
ASME	American Society of Mechanical Engineers
API	American Petroleum Institute

3. **SCOPE**

This Technical Specification covers the minimum requirements for surface preparation and the supply, application, inspection and testing of external anti-corrosion coating of pipes and fittings using 3 Layer Side Extruded Polyethylene coating (3LPE) conforming to DIN 30670, 2012 Edition, "Polyethylene coatings on steel pipes and fittings – Requirements and testing". These externally coated pipes and fittings are intended for use in buried pipe services.

Pipes and fittings shall be coated at vendor's factory/shop as per the specifications detailed in this document and supplied to site in coated condition. Pipes and fittings which are being quoted shall meet the technical requirements of Job supply specification for Pipes (080557C-000-JSS-1320-001) and fittings (080557C-000-JSS-1330-001, 080557C-000-JSS-1340-001).

Vendor shall include in its offer all necessary materials for repair of damages and coating of weld joints to be performed at site including application manual/procedure by manufacturer.

Any conflicts between requirements of the purchase specifications, material requisition and referred related standards and other attachments shall be brought to the notice of the purchaser for resolution before proceeding with the manufacture, fabrication or procurement of such items. PURCHASER/CONTRACTOR to get written approval from the owner/PMC for any change or amendment required in the specification described in this document before proceeding.

3.1 **Scope of Work**

The Schedule of Specific Requirements lists the specific quantity of pipe and fittings that shall be coated with the system detailed herein.

3.2 **Design Information**

The 3LPE coating shall consist of a three-layer coating system comprising: -

- A layer of fusion bonded epoxy (FBE).
- A layer of chemically modified polyethylene copolymer adhesive.

 		PROJECT	Standby SRU & Additional Tanks IOCL- Paradip Refinery	
		CLIENT	INDIAN OIL CORPORATION LIMITED	
JOB SUPPLY SPECIFICATION FOR 3 LAYER POLYETHYLENE COATING	Project No. 080557C001	Document No. 080557C-000-JSS-1300-001	Rev. No. B	Page 5 of 31

- A layer of medium-density UV stabilized polyethylene (MDPE).

The 3LPE external coating is the primary part of the corrosion protection system to be provided for a buried high-pressure pipeline. The corrosion protection system will be supplemented with a cathodic protection system to protect the Pipeline for the specified minimum design life with minimum maintenance. 3LPE coating shall confirm to coating designation DIN 30670 S-n.

The coating system is required to withstand transport, construction handling and installation in the buried condition without damage, and which, once installed, can withstand the stresses imposed on it by the soil and associated environment, for the required design life. An increased coating thickness will be applied to provide additional gouging and abrasion resistance at long Horizontal Directional Drills.

4 REFERENCE CODES & STANDARDS

The coating shall comply in all aspects with the DIN 30670 Standard, 2012 Edition, "Polyethylene coatings on steel pipes and fittings – Requirements and testing"

Reference shall also been made to the latest edition of the following Standards, Codes and Specifications. The latest edition shall be applicable and shall be the edition in force at the date of Tender submission.

Code /Std. No	Description
ASTM D149	Standard Test Methods of Dielectric Breakdown Voltage and Dielectric Strength of Solid Electrical Insulating Materials at Commercial Frequencies
ASTM D257	Standard Test Methods for DC Resistance or Conductance of Insulating Materials
ASTM D543	Standard Practices for Evaluating the Resistance of Plastics to Chemical Reagents
ASTM D570	Standard Test Method for Water Absorption of Plastics
ASTM D638	Standard Test Method for Tensile Properties of Plastics
ASTM D792	Standard Test Methods for Density and Specific Gravity (Relative Density) of Plastics by Displacement
ASTM G42	Standard Test Method for Cathodic Disbonding of Pipeline Coatings Subjected to Elevated Temperatures

 	PROJECT		Standby SRU & Additional Tanks IOCL- Paradip Refinery	
	CLIENT		INDIAN OIL CORPORATION LIMITED	
JOB SUPPLY SPECIFICATION FOR 3 LAYER POLYETHYLENE COATING	Project No. 080557C001	Document No. 080557C-000-JSS-1300-001	Rev. No. B	Page 6 of 31

Code /Std. No	Description
ASTM G8	Standard Test Methods for Cathodic Disbonding of Pipeline Coatings
ASTM G62	Standard Test Methods for Holiday Detection in Pipeline Coatings
DIN 30670	Polyethylene coatings on steel pipes and fittings - Requirements and testing
DIN 30678	Polypropylene coatings on steel pipes and fittings – Requirements and testing
DIN EN ISO 1133-1	DIN EN ISO 1133-1 - Plastics - Determination of the melt mass-flow rate (MFR) and melt volume-flow rate (MVR) of thermoplastics - Part 1: Standard method
DIN EN ISO 1133-2	Plastics - Determination of the melt mass-flow rate (MFR) and melt volume-flow rate (MVR) of thermoplastics - Part 2: Method for materials sensitive to time-temperature history and/or moisture
ISO 2808	Paints and Varnishes - Determination of Film Thickness
ISO 8501-1	Preparation of steel substrates before application of paints and related products - Visual assessment of surface cleanliness - Part 1: Rust grades and preparation grades of uncoated steel substrates and of steel substrates after overall removal of previous coatings
ISO 8502-2	Preparation of steel substrates before application of paints and related products - Tests for the assessment of surface cleanliness - Part 2: Laboratory determination of chloride on cleaned surfaces
ISO 8503-2	Preparation of steel substrates before application of paints and related products - Surface roughness characteristics of blast-cleaned steel substrates - Part 2: Method for the grading of surface profile of abrasive blast-cleaned steel - Comparator procedure
ISO 11124-1	Preparation of Steel Substrates Before Application of Paints and Related Products - Specifications for Metallic Blast-Cleaning Abrasives - Part 1: General Introduction and Classification
NACE SP0394	Application, Performance, and Quality Control of Plant-Applied, Single-Layer Fusion-Bonded Epoxy External Pipe Coating – Item No. 21064
SIS 055900	Swedish Standard, Preparation of Steel Substrates Before Application of Paints and Related Products – Visual Assessment of Surface Cleanliness
API 5L	Specification for Line pipe
ASTM A106	Standard Specification for Seamless Carbon steel pipe.
API RP 5L1	Recommended Practice for Railroad Transportation of Line pipe

 		PROJECT	Standby SRU & Additional Tanks IOCL- Paradip Refinery		
		CLIENT	INDIAN OIL CORPORATION LIMITED		
JOB SUPPLY SPECIFICATION FOR 3 LAYER POLYETHYLENE COATING	Project No. 080557C001	Document No. 080557C-000-JSS-1300-001	Rev. No. B	Page 7 of 31	

5 MATERIALS

5.1 Materials Approval

The basic materials (i.e. fusion bonded epoxy powder, copolymer adhesive and polyethylene compound,) shall have proven compatibility as 3LPE external line pipe coatings. VENDOR shall submit to the PURCHASER, the proposed material data sheets for approval prior to undertaking the works. The group(s) of compatible materials shall be pre-qualified and approved by the PURCHASER in accordance with provision of clause 6.4 of this Specification. VENDOR shall obtain prior approval from PURCHASER for the suppliers of all materials..

5.2 Materials Certificates

VENDOR shall obtain from the manufacturer(s) of all materials the relevant certificates of material conformity and test results, and the same shall be submitted to PURCHASER for approval prior to their use.

5.3 Materials Identification

All materials to be used shall be suitably marked and identifiable with the following minimum information:-

- Name of the manufacturer.
- Type of material and product designation.
- Batch Number.
- Date of manufacturing / expiry and storage temperature limits.
- Safety data sheets.
- Relevant manufacturing standards and specification.

All materials noted to be without above identification shall be deemed suspect and shall be rejected by PURCHASER.

5.4 Batch Information for FBE Material

VENDOR shall obtain from the FBE resin manufacturer the information listed below for each batch of powder produced in a 24-hour interval in one continuous run, designated by a specific batch number assigned by the Coating Manufacturer. Standards for comparison shall be provided for each item. The SUPPLIER to check that no changes have been made in the epoxy formulation will use this information.

 		PROJECT	Standby SRU & Additional Tanks IOCL- Paradip Refinery		
		CLIENT	INDIAN OIL CORPORATION LIMITED		
JOB SUPPLY SPECIFICATION FOR 3 LAYER POLYETHYLENE COATING	Project No. 080557C001	Document No. 080557C-000-JSS-1300-001	Rev. No. B	Page 8 of 31	

- Infra Red scan of powder and typical powder scans for comparison. Infra red spectrograph to be made by using a standard Potassium Bromide (KBr) disc.
- Gel time at recommended application temperature.
- Particle size distribution.

Batch numbers shall segregate coating powder during shipment, storage, and handling. Batches shall be used consecutively during coating application and shall not be mixed except when necessary to keep the coating process continuous.

5.5 Coating Materials Storage

Materials shall be stored, handled and transported in accordance with the Coating Manufacturer's written recommendations. Storage time of materials shall not exceed the shelf life recommended by the Coating Manufacturer.

5.6 Material Substitution

VENDOR shall not substitute alternative materials to those approved by the PURCHASER, without the written approval by PURCHASER, even though the alternative materials may comply with this Specification.

5.7 Abrasive Materials

Abrasive materials shall comply with ISO 11124-1:1993 and shall be free from contaminations and shall contain less than 100mg/kg chlorides, and less than 0.3% copper. VENDOR shall maintain records to demonstrate that the levels of chlorides and copper are within the specified limits.

5.8 Materials Sequencing

VENDOR shall be required to use all materials on a date received rotation basis, i.e. first in, first used basis.

6 COATING PROPERTIES AND FUNCTIONAL REQUIREMENTS

6.1 Operating Temperature

The pipe coating shall be suitable for the required duty and service conditions.

The coating must be able to withstand a maximum continuous in-service operating temperature of +60°C and still comply with the performance requirements of this Specification. In open storage finished pipe coating shall be able to withstand exposure in sunlight with a daytime coating

 		PROJECT	Standby SRU & Additional Tanks IOCL- Paradip Refinery	
		CLIENT	INDIAN OIL CORPORATION LIMITED	
JOB SUPPLY SPECIFICATION FOR 3 LAYER POLYETHYLENE COATING	Project No. 080557C001	Document No. 080557C-000-JSS-1300-001	Rev. No. B	Page 9 of 31

temperature of up to 80°C for a period of 12 months without any change detrimental to the performance of the coating.

6.2 Environmental Conditions

The coating materials used shall be fully stabilized against the influence of ultraviolet radiation (i.e. sunlight), oxygen in air and heat (due to environmental temperature as specified above). The material shall fully comply with the performance requirements of this Specification after 12 months exposure at any location in India. In evaluating this condition, particular attention shall be paid to elongation, resistance to peeling, and lack of voids under the coating.

6.3 Properties

6.3.1 Properties of Polyethylene Compound

Sl. No.	Properties	Unit	Requirement	Test Method
i.	Tensile Strength and Elongation (at break) at +25°C	MPa and %	12.4 min and 600 min	ASTM D 638
ii.	Melt Index	G/10 min	0.15-0.80	ASTM D 1238 or DIN 53735
iii.	Specific gravity at +25°C	g/cm ³	0.925-0.95	ASTM D 792
iv.	Hardness at +25°C	Shore D	50 min	ASTM D 2240
v.	Water Absorption, 24 hours, +25°C	%	0.02 max	ASTM D 570
vi.	Volume Resistivity at +25°C	Ohm-cm	10 ¹⁵ min	ASTM D 257
vii.	Dielectric withstand, 100 Volt/sec rise at +25°C	Volts	30,000 min	ASTM D 149
viii.	ESC at 100% Igepal Conc.	Hours	900 min	ASTM D1693 Condition B (F50)
ix.	Thermal stability after 100 days at 100%	% change in Melt Index	35 max	ASTM D1238 or DIN 53735
x.	Resistance to splitting of 50mm cut	Mm	2 max	Section 10

6.3.2 Properties of Epoxy Powder and Adhesive

VENDOR shall select a brand of epoxy powder and adhesive that will achieve the functional requirements and properties of the coating system as specified in section 7.1 and 7.3.3 respectively, of this Specification. At the time of bidding, VENDOR shall furnish a reference list of epoxy powder and adhesive, having such properties, applied by them in similar coating systems.

 		PROJECT	Standby SRU & Additional Tanks IOCL- Paradip Refinery	
		CLIENT	INDIAN OIL CORPORATION LIMITED	
JOB SUPPLY SPECIFICATION FOR 3 LAYER POLYETHYLENE COATING	Project No. 080557C001	Document No. 080557C-000-JSS-1300-001	Rev. No. B	Page 10 of 31

Sl. No.	Properties	Unit	Requirement	Test Method
i.	Coating porosity	% Coating thickness	33 max total voids at any location	Section 10
ii.	Sieve analysis	%	95 between 10micron and 100micron	ASTM D1921
iii.	Volatile content after 2 hours at 105°C	%	0.5% max	Section 10

6.3.3 Properties of Coating System

Sl. No.	Properties	Unit	Requirement	Test Method
i.	Resistance to Indentation at 23 ± 2°C at 70 ± 2°C	mm	0.1 max 0.3 max	DIN 30670
ii.	Resistance to Impact (Min of 30 impacts. No holiday allowed when tested at 25 KV.)	Nm per mm of coating thickness	8 min (for NB <200mm) 7 min (for NB ≥ 200mm)	DIN 30670
iii.	Resistance to Peeling. Test Method at 20 ± 5°C At 50 ± 5°C	Kg/cm	5 min 4 min	DIN 30670
iv.	Elongation due to tearing	%	600 minimum	DIN 30670
v.	Resistance to Thermal Aging	-	Retain 65% of Melt Index	DIN 30670
vi.	Resistance to exposure to Light	-	Retain 65% of Melt Index	DIN 30670
Vii.	48 hour Cathodic Disbondment Test at 65°C	mm radius of disbondment	8 max	ASTM G42
viii.	Cathodic Disbondment after 28 days, Test method A at +60°C	mm radius of disbondment	13 max	ASTM G42

 		PROJECT	Standby SRU & Additional Tanks IOCL- Paradip Refinery		
		CLIENT	INDIAN OIL CORPORATION LIMITED		
JOB SUPPLY SPECIFICATION FOR 3 LAYER POLYETHYLENE COATING	Project No. 080557C001	Document No. 080557C-000-JSS-1300-001	Rev. No. B	Page 11 of 31	

6.4 Materials Compatibility

Candidate coating materials are shown in Appendix 1. VENDOR may propose to use any other coating material or combination of coating material. The materials brands offered by VENDOR for coating (i.e. epoxy powder, adhesive and the polyethylene compound) shall have proven compatibility. VENDOR shall, in support of its offered coating system, submit at the time of Tender adequate track record demonstrating the compatibility of offered materials. Only PURCHASER's approved materials/combination of materials shall be used for coating of pipes.

Repair materials shall be approved epoxy primed heat shrink sleeves, such as Raychem HTLP 80 (refer Section 14).

7 COATING PROCEDURE AND QUALIFICATION

7.1 Proposed Work Procedures

Prior to the commencement of the work, VENDOR shall submit a pipe Coating Procedure Specification (CPS) giving full details of all the characteristics of the proposed coating process. The project specific CPS shall be formulated by VENDOR and submitted for PURCHASER's approval in the form of a bound manual. No element of pipe coating shall proceed without written approval from PURCHASER of the CPS. The CPS shall include, but not limited to, the following information and proposals: -

- a. Steel surface preparation, including preheating, removal of steel defects, cleanliness, profile, methods of measurements and consumables.
- b. Pipe heating, temperatures and control.
- c. Complete details of raw materials together with quality control and manufacturer's data.
- d. Application of materials, including characteristics, temperature of application, etc.
- e. Pipe and coating quenching and cooling, including time and temperature.
- f. Quality assurance system, Inspection and Testing Plan (ITP) and reporting formats, including instrument and equipment types, makes and uses, etc.
- g. Detailed method of repair of coating defects duly classified depending upon nature and magnitude of defects and repairs thereof.
- h. Details of instrument and equipment calibration methods including relevant standards and examples of calibration certificates.
- i. Complete details and inventory of laboratory and equipment.
- j. Pipe handling and stock piling procedures.

 		PROJECT	Standby SRU & Additional Tanks IOCL- Paradip Refinery	
		CLIENT	INDIAN OIL CORPORATION LIMITED	
JOB SUPPLY SPECIFICATION FOR 3 LAYER POLYETHYLENE COATING	Project No. 080557C001	Document No. 080557C-000-JSS-1300-001	Rev. No. B	Page 12 of 31

k. Sample of recording and reporting formats, including laboratory reports, certificates and requirement.

l. Complete details of test certificates for raw materials including test methods and standards used.

m. Test certificates from PE compound manufacturer for tests for thermal aging and aging under exposure to light. These test certificates shall not be older than three years.

n. Environmental provisions for the storage of raw materials.

Following submission of the Inspection and Test Plan for approval, the PURCHASER will advise VENDOR of the specific inspection review, witness and HOLD points required by the PURCHASER or its Representatives by marking up the ITP.

After approval of the CPS and ITP has been given by PURCHASER, procedural changes shall not be made. Unavoidable changes may be executed only after obtaining written approval from PURCHASER.

7.2 Coating Procedure Qualification (CPQ)

Prior to commencing production, VENDOR shall, at its own expense, carry out a Coating Procedure Qualification (CPQ) trial for each pipe diameter and pipe wall thickness to verify its, materials, and coating procedures can produce a consistent quality of product conforming to the properties stated in Clause 6.3 of this Specification, other relevant Standards and Specifications, and the material manufacturer's recommendations.

- **Tests on Raw Materials**

VENDOR shall furnish test certificates from the coating materials manufacturer(s) for the following properties for each batch of raw materials used in the procedure qualification tests: -

- a.** Polyethylene
 - i. Tensile Strength
 - ii. Melt Index
 - iii. Specific Gravity
 - iv. Hardness
 - v. Water Absorption
 - vi. Volume Resistivity
 - vii. Dielectric withstands.

 		PROJECT	Standby SRU & Additional Tanks IOCL- Paradip Refinery		
		CLIENT	INDIAN OIL CORPORATION LIMITED		
JOB SUPPLY SPECIFICATION FOR 3 LAYER POLYETHYLENE COATING	Project No. 080557C001	Document No. 080557C-000-JSS-1300-001	Rev. No. B	Page 13 of 31	

- b.** Epoxy Powder
 - i. Gel Time
 - ii. Specific Gravity
 - iii. Sieve Analysis.

- c.** Adhesive
 - i. Specific gravity
 - ii. Melt Index.

- **Tests on Coated Pipes:**

At least 5 (five) test pipes per pipe diameter shall be coated in accordance with the approved coating procedure. Trial coated pipes shall be subjected to procedure qualification testing as described below. All tests shall be witnessed by the PURCHASER or the PURCHASER's Representative. Where test rings are cut from the pipes, additional test rings shall be supplied to the PURCHASER for independent testing as required.

i. Coating Thickness

All pipes shall be subject to coating thickness measurements. Acceptance criteria shall be as per Clause 10.4 of this Specification.

ii. Holiday Testing

All the pipes shall be subject to holiday testing at 25kV and shall meet the criteria identified in Clause 10.5.

iii. Resistance to Indentation

Five samples from different pipes shall be taken. If any one of these samples fails to satisfy the requirements of Clause 6.3.3 of this Specification, then the test shall be repeated on ten more samples. In this case, none of the samples shall be permitted to fail.

iv. Resistance to Impact

Three test pipes shall be selected for impact test and each test on each pipe is required to meet the requirement of Clause 6.3.3 of this Specification.

 		PROJECT	Standby SRU & Additional Tanks IOCL- Paradip Refinery	
		CLIENT	INDIAN OIL CORPORATION LIMITED	
JOB SUPPLY SPECIFICATION FOR 3 LAYER POLYETHYLENE COATING	Project No. 080557C001	Document No. 080557C-000-JSS-1300-001	Rev. No. B	Page 14 of 31

v. Resistance to Peeling

Three test pipes shall be selected for peel tests. On each of the selected pipes, three peel tests shall be performed; one at each end and one in the middle of the pipe. None of these samples is permitted to fail the criteria identified in Clause 6.3.3 of this Specification.

vi. Elongation due to Tearing (Ultimate Elongation)

Ten samples each from three coated pipes (i.e. 30 samples in all) shall be tested in accordance with Clause 6.3.3 of this Specification. Only one sample per pipe may fail.

vii. Cathodic Disbondment Test

Two tests shall be conducted in accordance with Clause 6.3.3 of this Specification, one test being performed on each of two test pipes. Tests shall only be performed on samples that have been confirmed to be holiday-free in accordance with test (ii) above.

• Testing Report

After completion of the above tests, VENDOR shall prepare and issue to PURCHASER for approval a detailed report of the above tests including test reports/certificates of all materials and coatings tested.

Only upon written approval from PURCHASER, shall VENDOR commence production coating.

• Test Pipes

On completion of coating qualification tests, coating on all remaining intact test pipes shall be removed at Vendor's cost and the pipes completely recycled as per the approved Coating Procedure Specification.

• Procedure Re-qualification

VENDOR shall re-establish the requirements of the Coating Procedure Qualification to the full Specification requirements, or to the extent considered necessary by PURCHASER, in the event of, but not limited to, the following :-

- Every time there is a change in the previously qualified Coating Procedure Specification.
- Every time there is a change in the manufacturer for the supply of any of the raw materials.
- Every time the coating yard is shifted from one location to another location.
- Any time when, in PURCHASER's opinion, the properties are deemed to be suspect during regular production tests.

 		PROJECT	Standby SRU & Additional Tanks IOCL- Paradip Refinery		
		CLIENT	INDIAN OIL CORPORATION LIMITED		
JOB SUPPLY SPECIFICATION FOR 3 LAYER POLYETHYLENE COATING	Project No. 080557C001	Document No. 080557C-000-JSS-1300-001	Rev. No. B	Page 15 of 31	

- Every time there is a change in pipe diameter.

7.3 Independent Testing

PURCHASER reserves the right to conduct any or all the tests required for Coating Procedure Qualification through an independent laboratory or agency, at the cost of VENDOR, when in PURCHASER's opinion, the test results are deemed suspect. PURCHASER's decision shall be final.

8 PIPE SURFACE PREPARATION

8.1 Pre-Treatment

The pipe shall be preheated prior to blast cleaning to a temperature at least 5°C above the dew point or higher if recommended by the Coating Manufacturer. This is to remove moisture and to identify slivers and surface defects for further treatment.

Pipe shall be handled to prevent any damage to bevels. Ends shall be closed to prevent any abrasives and/or foreign material from entering the pipe's interior during blasting. Any abrasive and/or foreign material entering the pipe shall be removed before and after subsequent coating.

8.2 Surface Contaminants

Unless specified otherwise, the pipes shall be supplied free from mill applied oils or coatings.

All pipes shall be monitored for chloride contamination. Three extracts per day shall be taken from a drip line using the soak method and chloride titration or other approved method. VENDOR shall submit a test procedure to ensure that surfaces are free from chloride, oil and grease contaminants. Chloride contamination of the pipe surface shall not exceed 20 mg/m².

8.3 Pre Inspection

Prior to pipe cleaning operation, each pipe shall be inspected for split seams, dents, gouges, slivers or other imperfections that would make the pipe unsuitable for use. The Supplier shall report all such imperfections to the PURCHASER on receipt, during all stages of the coating process and subsequent handling and load out operations, segregate all pipe containing such defects, and arrange for repair as directed by PURCHASER. Surface preparation shall not reduce the pipe wall thickness below the minimum specified for the pipe grade.

8.4 Removal of Surface Contaminants

Any oil, grease, salt or other contaminants detrimental to the formation of a good coating bond or coating quality shall be removed prior to coating application.

 		PROJECT	Standby SRU & Additional Tanks IOCL- Paradip Refinery		
		CLIENT	INDIAN OIL CORPORATION LIMITED		
JOB SUPPLY SPECIFICATION FOR 3 LAYER POLYETHYLENE COATING	Project No. 080557C001	Document No. 080557C-000-JSS-1300-001	Rev. No. B	Page 16 of 31	

Organic contaminants may be removed by the use of non-oil solvents. Gasoline or kerosene shall not be used for this purpose. Visible oil and grease spots shall be removed by solvent wiping. Solvent cleaning shall be in accordance with SSPC-SP1.

Prior to blast cleaning, pipe shall be cleaned to remove residual surface contamination using high-pressure fresh water. Where necessary, and subject to prior approval from PURCHASER, if the surface chloride contamination level exceeds 200 mg/m² the pipe may given a phosphate pre-treatment to remove all residual chloride and ferrous salt contamination. VENDOR shall submit a detailed Specification and Phosphate Cleaning Procedure for prior approval of the PURCHASER. Excess treatment chemical shall be removed by thorough rinsing with fresh water and the residual chloride monitored in accordance with the PURCHASER approved procedure. Two chloride test per day shall be carried out on phosphate treated pipes and the chloride levels shall not exceed 20 mg/m².

8.5 Pipe Blast Cleaning

In case of the presence of moisture on the pipe, the pipes shall be preheated to a temperature of 65°C to 85°C prior to abrasive blast cleaning. An abrasive blast-cleaning machine shall clean the external surface of the pipe. The standard of finish for cleaned pipe shall conform to white metal finish to Sa 2 ½ of Swedish Standard SIS 055900. The surface of the pipe after abrasive shot/grit blasting shall have an anchor pattern of 50 to 75 microns peak to trough height and an angular and open anchor pattern. This shall be measured for each pipe. At least one pipe at the start and end of each shift shall be measured with Testex Press-O-Film replication tape. Remaining pipes may be measured by a suitable instrument, such as Elcometer, providing that the instrument has been calibrated and the results cross-checked with the replication tape.

At no time shall the blast cleaning be performed when the relative humidity exceeds 90% or when the steel temperature is less than 5°C higher than the dew point, unless the pipes are preheated to a temperature of 65°C to 85°C.

Abrasives shall contain less than 100mg/kg total water soluble salts, less than 0.3% copper and shall be free of moisture.

8.6 Pipe Surface Imperfections

The blast cleaned surface shall not be contaminated with dirt, dust, metal particles, oil, water or any other foreign material, nor shall the surface or its anchor pattern be scarred or burnished. After blast cleaning, all surfaces shall be thoroughly inspected to determine anchor pattern, quality of blasting and identify any surface defects prior to coating application. All surface defects such as slivers, scab, burns, laminations, welds spatters, gouges, scores, indentations, slugs or any other defects considered injurious to the coating integrity shall be reported to PURCHASER's Representative and on permission from PURCHASER, such defects shall be removed by filing or grinding. The method employed to remove surface defects shall not burnish or destroy the anchor pattern or contaminate the surface. Pneumatic tools shall not be used unless they are fitted with

 		PROJECT	Standby SRU & Additional Tanks IOCL- Paradip Refinery	
		CLIENT	INDIAN OIL CORPORATION LIMITED	
JOB SUPPLY SPECIFICATION FOR 3 LAYER POLYETHYLENE COATING	Project No. 080557C001	Document No. 080557C-000-JSS-1300-001	Rev. No. B	Page 17 of 31

effective air/oil and water traps. Where burnishing results in destruction of anchor pattern, the anchor pattern shall be restored by suitable means.

8.7 Acceptance of Surface Preparation

Upon Completion of the blasting operations, the Vendor's quality control supervisor shall accept the pipe for coating, or return it for recleaning. Where imperfections are considered detrimental to the coating quality, the same shall be reported to PURCHASER's Representative for final decision on rejection or recleaning / removal of defects. Recleaning/removal of defects or returning pipe to the yard shall be at the Vendor's cost.

PURCHASER's inspector, reserves the right to initiate any of the above actions during periodic inspections for oil, dust, salt, imperfections, lack of white metal finish and unacceptable surface profile.

8.8 Coating Interval

The total allowable elapsed time between completion of the blasting operations and commencement of the coating and heating operations shall be such that no detectable oxidation of the surface occurs. Relative humidity readings shall be recorded every two hours during the blasting operations in the immediate vicinity of the operations. Blast cleaning shall not be performed when the relative humidity exceeds 90% or when the steel temperature is less than 5°C above the dew point. The maximum elapsed time shall not exceed the maximum time as given below:

Relative Humidity %	Maximum elapsed time
80 to 85	2 hours
61 to 79	3 hours
60 or below	4 hours

Pipes not brought up to the coating application temperatures within these maximum times shall be returned for complete reblasting. Any pipe showing flash rusting shall be reblasted even if the above conditions have not been exceeded.

9 COATING APPLICATION

9.1 Heating of Line Pipe

An induction heater or gas furnace shall be used for heating the pipe. The method shall be capable of maintaining uniform temperature along the total length of the pipe, and shall be such that it shall not contaminate the surface to be coated. Oxidation of the cleaned pipe surfaces prior to coating (in the form of bluing or other apparent oxide formation) is not acceptable.

 		PROJECT	Standby SRU & Additional Tanks IOCL- Paradip Refinery		
		CLIENT	INDIAN OIL CORPORATION LIMITED		
JOB SUPPLY SPECIFICATION FOR 3 LAYER POLYETHYLENE COATING	Project No. 080557C001	Document No. 080557C-000-JSS-1300-001	Rev. No. B	Page 18 of 31	

9.2 Temperature Monitoring

The specified pipe temperature shall be determined using approved temperature-indicating crayons. The specified temperature shall be maintained as it enters and throughout the coating chamber and shall be carefully monitored. If approved Pyrometers are used for continuous temperature monitoring, the Pyrometer shall be calibrated twice every shift and/or as per PURCHASER instruction using approved temperature indicating crayons.

The surface temperature during coating application shall not be lower than that required for complete melt, flow-out, wetting of the pipe surface and fusion; nor shall it be higher than that at which optimum polymerisation occurs without premature gelation before completion of fusion, flow-out and wetting. Post-application cure temperature and time shall not be less than that required for full cure of the applied coating.

The pipe temperature shall not be allowed to exceed 260°C. Any pipe or part of pipe heated in excess of 260°C shall be quarantined and may be rejected, subject to inspection by the PURCHASER.

Any pipe heated to a temperature exceeding 375°C or that would cause the steel surface to turn blue shall be totally rejected and not used for any coating purpose. The cost of the rejected pipe shall then be deducted from the Vendor's charges.

9.3 Coating Application

The external surface of the cleaned pipe conforming to section 8.0 of this Specification shall be immediately coated with 3-layer extruded polyethylene coating in accordance with the coating application procedures approved by PURCHASER, relevant standards and this Specification. In general the procedure shall be as follows: -

During application, curing, and handling, the coating shall not be physically damaged, nor shall it be contaminated with any foreign material including (without limitation) dirt, metal particles, oil, water, coating debris, excess powder drips, whether airborne or from application equipment or enclosures, cutback rings or pipe handling mechanisms.

For all sizes of Pipes and Fittings the DIN 30670 Standard shall be followed for MDPE coating thickness. The external surface of the pipe shall be heated to a temperature as recommended by the powder manufacturer followed by application of the following three layers: -

- i. Electrostatic application of epoxy powder (minimum 150 microns FBE).
- ii. Crystalline Co-polymer Adhesive applied by extrusion (minimum 200 microns thickness).
- iii. Medium density polyethylene coating thickness by extrusion (as specified in DIN 30670).

The coated pipe shall be subsequently quenched and cooled in water for a period that shall sufficiently lower the temperature of pipe coating to allow handling and inspection.

 		PROJECT	Standby SRU & Additional Tanks IOCL- Paradip Refinery		
		CLIENT	INDIAN OIL CORPORATION LIMITED		
JOB SUPPLY SPECIFICATION FOR 3 LAYER POLYETHYLENE COATING	Project No. 080557C001	Document No. 080557C-000-JSS-1300-001	Rev. No. B	Page 19 of 31	

For pipe that has been identified for use at long horizontal directional drills, the thickness of the outer MDPE layer shall be increased by a minimum of 1500 microns, giving a total coating thickness of 3850 microns.

9.4 Air Entrapment

The copolymer adhesive shall be applied by extrusion within the time recommended by the epoxy powder manufacturer and the copolymer adhesive manufacturer.

While applying the coating, VENDOR shall ensure that there is no entrapment of air or void formation along the seam weld (where applicable). VENDOR shall propose a suitable method for achieving this as part of the Coating Application Procedure and the same shall be witnessed for approval by PURCHASER.

9.5 Coating Appearance

The resultant coating shall have a uniform appearance and shall be free from air bubbles, wrinkles, holidays, irregularities, discontinuities and separation between layers of FBE/adhesive/PE.

9.6 End Cut Back

Coating materials shall be cut back to 150 mm (tolerance +10 mm, -15 mm) from the ends of the pipe. The cut back shall be perpendicular to the pipe axis. For Fittings the cut back length shall be 50 mm for sizes up to 24 inch and 100mm for sizes greater than 24 inch.

The MDPE shall be cut so that it is chamfered at an angle of approximately 30° to the pipe surface to facilitate the later application of heat shrink sleeves without the possibility of a void along the shoulder of the line pipe coating. The adhesive shall seal the end of applied coating.

The pipe end faces, bevels and uncoated external surface of the pipe at pipe ends shall be essentially free of all coating and foreign material.

9.7 Rejection of Coating

Failure to comply with any of the above applicable requirements and of the approved procedure shall be cause for the rejection of the coating and such coating shall be removed in a manner approved by PURCHASER at Vendor's cost.

 		PROJECT	Standby SRU & Additional Tanks IOCL- Paradip Refinery		
		CLIENT	INDIAN OIL CORPORATION LIMITED		
JOB SUPPLY SPECIFICATION FOR 3 LAYER POLYETHYLENE COATING	Project No. 080557C001	Document No. 080557C-000-JSS-1300-001	Rev. No. B	Page 20 of 31	

10 INSPECTION AND TESTING

10.1 General

VENDOR shall establish and maintain a comprehensive Quality Assurance system to ensure that all of the requirements of this Specification are met.

The PURCHASER reserves the right to require the inspection or testing of the goods or services during any stage of manufacturing at which the quality of the finished goods may be affected, and to undertake inspection or testing of raw materials or purchased components.

The VENDOR at the frequency as defined herein shall perform the following tests and inspections.

10.2 Visual Inspection

Visual inspection of finished coating for colour, blisters, sags, porosity, burns and handling damage during coating, stacking and loading, for each pipe.

10.3 Gel Time Test

To confirm that the epoxy powder has been manufactured, handled, shipped and stored properly, the VENDOR shall perform Gel time test on each batch of powder one week prior to its use, in accordance with the method and acceptance as recommended by the powder manufacturer.

10.4 Thickness Test

- i. The coating thickness shall be determined by taking at least 10 measurements at locations uniformly distributed over the length and periphery of each pipe. In case of welded pipes, five of the above readings shall be made at the apex of the weld seam, uniformly distributed over the length of the coated pipe. All the readings must meet the minimum requirements. However, localised coating thickness of less than the permissible minimum thickness can be tolerated on the condition that it does not attain a total extent of more than 5 cm² per meter length of coated pipe, and the actual coating thickness does not drop more than 10% below the permissible minimum coating thickness at these locations.

The frequency of thickness measurement as stated above shall be initially on every pipe, but may be reduced depending upon consistency of results, at the sole discretion of PURCHASER's Representative.

 		PROJECT	Standby SRU & Additional Tanks IOCL- Paradip Refinery	
		CLIENT	INDIAN OIL CORPORATION LIMITED	
JOB SUPPLY SPECIFICATION FOR 3 LAYER POLYETHYLENE COATING	Project No. 080557C001	Document No. 080557C-000-JSS-1300-001	Rev. No. B	Page 21 of 31

- ii. Coated pipes not meeting the above requirements shall be rejected. The VENDOR shall remove the entire coating and the pipe shall be recycled to the cleaning and coating operations as per the approved procedure and shall be to Vendor's cost.

10.5 Holiday Detection

- i. Each coated pipe length shall be checked over 100% of coated surface by means of a "holiday detector" of a type approved by PURCHASER for detecting holidays in the finished coating.
- ii. The holiday detector shall be a low pulse D.C. full circle electronic detector with audible alarm and precise voltage control. The set voltage for inspection shall be minimum 25kV.
- iii. VENDOR shall calibrate the holiday detector at least once every 4 hours of production. VENDOR shall have necessary instruments or devices for calibrating the holiday detector.
- iv. Any coated pipe shall be rejected if there is more than 3 (three) holidays on the pipe, or if the area of the one holiday is more than 100cm² in area. Any pipe so rejected shall have the coating removed, and be recycled through the complete cleaning and coating system in accordance with the approved procedure and shall be to Vendor's cost.
- v. A single holiday on a pipe of an area equal or less than 100cm² shall be repaired in accordance with approved procedure and shall be to Vendor's cost.
- vi. Should more than 10% of coated pipes per shift production (typically eight-hour shift) be rejected, VENDOR shall stop production and make a detailed investigation and report on the probable cause(s) of the coating failures. Findings of such an investigation shall be submitted to PURCHASER for approval prior to recommencing coating.

 		PROJECT	Standby SRU & Additional Tanks IOCL- Paradip Refinery	
		CLIENT	INDIAN OIL CORPORATION LIMITED	
JOB SUPPLY SPECIFICATION FOR 3 LAYER POLYETHYLENE COATING	Project No. 080557C001	Document No. 080557C-000-JSS-1300-001	Rev. No. B	Page 22 of 31

10.6 Cathodic Disbondment Tests

48 hour cathodic disbondment tests, in accordance with Clause 6.3.3, shall be performed once per shift (maximum 12 hours) for each pipe diameter and wall thickness.

10.7 Peel Test

- i. VENDOR shall conduct a peel test for composite coating as per Clause 6.3.3(iii) of this Specification.
- ii. The frequency of test shall be initially on one pipe in every twenty five (25) pipes coated which may be further reduced to at least 2 (two) per shift depending upon consistently acceptable results, at the sole discretion of PURCHASER's representative.

The system shall fail only in the adhesive layer. Failure either adhesive to steel or adhesive to backing shall not be permitted.

- iii. In case the above tests do not comply with the above requirement, VENDOR shall test all the preceding and succeeding coated pipes until the coating is proved acceptable and/or at the discretion of the PURCHASER.

10.8 Indentation Resistance Test

- i. VENDOR shall carry out an indentation resistance test as per Clause 7.3.3(i) of this Specification. The frequency of test shall be initially 2 (two) coated pipes per shift which may be further reduced and/or waived depending upon consistent acceptable results, at the sole discretion of PURCHASER's representative.
- ii. The samples shall be taken at five equi-distant points along the length of the coated pipe.
- iii. Where the pipe is rejected for lack of indentation resistance, VENDOR shall test the preceding and succeeding pipes coated until the coating is proved acceptable, and/or at the discretion of the PURCHASER.
- iv. Rejected coated pipes shall be removed and shall be recycled through the cleaning and coating process in accordance with the approved procedure, at Vendor's cost.

 		PROJECT	Standby SRU & Additional Tanks IOCL- Paradip Refinery		
		CLIENT	INDIAN OIL CORPORATION LIMITED		
JOB SUPPLY SPECIFICATION FOR 3 LAYER POLYETHYLENE COATING	Project No. 080557C001	Document No. 080557C-000-JSS-1300-001	Rev. No. B	Page 23 of 31	

10.9 Impact Resistance Test

- i. VENDOR shall carry out impact resistance tests as per Clause 7.3.3(ii) of this Specification. Initially the frequency of test shall be two (2) coated pipes per shift, which may be further reduced and/or waived depending upon consistently acceptable results, at the sole discretion of PURCHASER's Representative.
- ii. A minimum of 30 impacts, located equidistant along the length of coated pipe, shall be performed.
- iii. Immediately after testing, the test area shall be subjected to holiday detection at the same voltage as used prior to impact resistance test. The pipe shall be rejected if any holiday is noted in the test area.
- iv. Where any coated pipe is rejected for lack of impact resistance, VENDOR shall test the preceding and succeeding pipes coated until the coating is proved acceptable and/or at the discretion of the PURCHASER.
- v. Rejected coated pipes shall be recycled through the cleaning and coating process in accordance with the approved procedure, at Vendor's cost.

10.10 Resistance to Splitting Test

VENDOR shall, within 14 days of coating application, take a coating ring sample of length equal to five times pipe diameter and make three 50 ± 3 mm long cuts in the coating parallel to the pipe axis. The cuts shall be through to the steel substrate. The cuts shall essentially be in the middle of the ring sample but shall be separated by 100mm in the longitudinal direction and 100mm in the circumferential direction. The actual length of the cuts shall be measured to ± 0.1 mm.

The prepared ring sample shall be maintained at ambient temperature for 100 days. After 100 days the length of the cuts shall be re measured to ± 0.1 mm. No cut is permitted to have increased its length by more than 2.0mm.

10.11 Epoxy Coating Porosity Test

Fusion bonded epoxy (FBE) coating porosity tests shall be carried out on coated pipe daily and for each batch of FBE powder. A cross section of coating shall be evaluated under a microscope. The porosity, which includes total voids, porosity and foaming, when added over the cross section of any part of the coating shall not to exceed 33% of the thickness of the coating.

Where the allowable limit is exceeded, additional porosity tests shall be performed. Should the further tests indicate that excessive areas of the coating, in the PURCHASER's opinion, contain excess porosity the coating shall be rejected.

 		PROJECT	Standby SRU & Additional Tanks IOCL- Paradip Refinery		
		CLIENT	INDIAN OIL CORPORATION LIMITED		
JOB SUPPLY SPECIFICATION FOR 3 LAYER POLYETHYLENE COATING	Project No. 080557C001	Document No. 080557C-000-JSS-1300-001	Rev. No. B	Page 24 of 31	

10.12 Volatile Content of Epoxy Powder

The volatile content of the FBE powder shall be determined for each batch of powder. VENDOR shall weigh a sample of approximately 1.5g of powder to $\pm 1\text{mg}$ and place a pan containing the powder in a preheated oven at a temperature of 105°C for a period of 2 hours. The pan shall then be removed and placed in a desiccator for 5 minutes while the sample cools. The sample shall then be reweighed immediately and the volatile content of the FBE recorded.

Duplicate tests shall be performed. If the results vary by more than 10%, then two more tests shall be performed. Where three or more of the tests vary by more than 10%, the PURCHASER's approval shall be required to continue using the powder.

10.13 Repair of Test Areas

Damages occurring to pipe coating during the above tests shall be repaired in accordance with the approved coating repair procedure and Section 13 of this Specification. Repairs occurring on account of the production tests are excluded from the limitation of three defects per pipe and the limitation of 100cm^2 area.

10.14 Rate for Pipe Rejection

Any pipe coating shall be rejected if there is more than 3 (three) coating repairs on the pipe, or if the area of the repair is more than 100cm^2 in area. Any pipe so rejected shall have the coating removed and the pipe recycled through the complete cleaning and coating system in accordance with the approved coating application procedure, and shall be to Vendor's cost.

10.15 PURCHASER's Approval

PURCHASER reserves the right to perform inspection and witness test on all activities concerning the pipe coating operations, starting from bare pipe to finished coated pipe, ready for despatch.

VENDOR shall give reasonable notice of time and shall provide, without charge, reasonable access and facilities required for inspection to the PURCHASER's Representative. Inspection and tests performed or witnessed by PURCHASER's Representative shall in no way relieve the VENDOR's obligation to perform the required inspection and tests.

Where the rate of defective or rejected pipes and/or samples tests are 10% or more for a single shift (typically 8 hours), VENDOR shall be required to stop production and carry out a full and detailed investigation and shall submit the findings to PURCHASER for approval. Vendor's shall recommence the production only after receiving written permission from PURCHASER.

 		PROJECT	Standby SRU & Additional Tanks IOCL- Paradip Refinery	
		CLIENT	INDIAN OIL CORPORATION LIMITED	
JOB SUPPLY SPECIFICATION FOR 3 LAYER POLYETHYLENE COATING	Project No. 080557C001	Document No. 080557C-000-JSS-1300-001	Rev. No. B	Page 25 of 31

Under no circumstances shall any action or omission of the PURCHASER's Representative relieve the VENDOR of its responsibility for material and quality of coating produced.

No pipes shall be transported from the coating shop unless authorised in writing by the PURCHASER.

11 HANDLING, TRANSPORTATION AND STORAGE

The Supplier shall submit all details on transport, handling and stockpiling procedures for both coated and un coated, including stockpile location and layout, to PURCHASER or PURCHASER's Representative for approval at least 3 weeks before commencing the work.

11.1 Pipe and Fittings Handling

The VENDOR shall prepare and furnish to PURCHASER a procedure/calculation generally in compliance with API RP-5L1 for pipe stacking, which shall be submitted for approval by PURCHASER prior to commencement.

The VENDOR shall load, unload, transport and stockpile the coated pipes and fittings within the coating shop using approved suitable means and in a manner to avoid damage to the pipe and coating. The Vendor's procedure shall be submitted for approval by PURCHASER prior to commencement.

Coated pipe and fittings shall only be lifted as single pipes.

11.2 Coated Pipes and fittings

Coated pipe and fittings may be handled by means of slings and belts of proper width (minimum 60mm) made of non-abrasive/non-metallic materials. Use of vacuum lifting equipment is permitted for lifting and handling coated pipe.

Pipes and fittings to be stacked shall be separated row by row to avoid coating damage when removing the slings. Use of round sectional slings is prohibited. Forklifts may be used provided that the arms of the forklift are covered with suitable pads, preferably rubber.

11.3 Stacking of Pipes

Coated pipes and fittings at all times shall be stacked completely clear from the ground so that the bottom row of pipes remain free from any surface water. The pipes and fittings shall be stacked at a slope so that water cannot collect inside the pipe.

The coated pipes and fittings may be stacked by placing them on ridges of clean sand and covered with a plastic film, or on wooden supports provided with suitable cover. The supports shall be spaced in such a manner as to avoid permanent bending of the piping components.

 		PROJECT	Standby SRU & Additional Tanks IOCL- Paradip Refinery	
		CLIENT	INDIAN OIL CORPORATION LIMITED	
JOB SUPPLY SPECIFICATION FOR 3 LAYER POLYETHYLENE COATING	Project No. 080557C001	Document No. 080557C-000-JSS-1300-001	Rev. No. B	Page 26 of 31

Stacks shall be limited to 8 layers and such that the pressure exercised by the pipe's own weight does not cause damage to the coating. VENDOR shall submit calculations for PURCHASER's approval in this regard. Each pipe layer shall be separated by means of padded spacers suitably spaced for this purpose and shall be detailed in the VENDOR's handling procedures to be approved by the PURCHASER. Stacks shall be suitably secured against collapsing by use of 150mm wide wooden wedges against the outside pipe of each layer. Stacks shall consist of pipe sections having the same diameter and wall thickness.

The weld seam of pipes shall be positioned always in a manner so as not to touch the adjacent pipes.

The ends of the pipes and fittings during handling and stacking shall always be protected with bevel protectors.

11.4 Transport Vehicles

The vehicles used for transportation shall be equipped with adequate pipe supports, having round hollow beds for each pipe to be placed on the lorry bed. Total width of the supports shall be at least 10% of the pipe length with maximum spacing of 3 metres. The supports shall be lined with heavy rubber and shall be spaced in a manner to support equal load from the pipes. The rubber protection must be free from all nails and staples where pipes are in contact.

The second layer and all following layers shall be separated from the other with adequate number of separating layers of protective material such as heavy rubber strips 200mm wide or equivalent, to avoid direct contact between the coated pipes.

Rubber belts or equivalent shall cover all stanchions. Care shall be exercised to properly cover the top of the stanchions and other positions such as reinforcements of the truck body, rivets, etc., to prevent damage to the coated surface.

Final acceptance of coated pipes shall be conditional upon the following: -

1. All pipes and fittings shall receive a complete visual inspection for defects.
2. One pipe and random fitting numbers per truckload shall be selected at random and holiday tested, plus one other pipe nominated by the PURCHASER or PURCHASER's Representative's representative. If a defect is detected, a further two (2) pipes or more fittings shall be selected and holiday tested.
3. Holiday testing will be at 25,000 volts.
4. Every defect discovered shall be repaired or the pipe, fitting re coated.
5. No coated pipe and fitting shall be accepted which has more than three repairs.

 		PROJECT	Standby SRU & Additional Tanks IOCL- Paradip Refinery	
		CLIENT	INDIAN OIL CORPORATION LIMITED	
JOB SUPPLY SPECIFICATION FOR 3 LAYER POLYETHYLENE COATING	Project No. 080557C001	Document No. 080557C-000-JSS-1300-001	Rev. No. B	Page 27 of 31

11.5 Storage of Coating Materials

Raw coating materials which are susceptible to deteriorating or suffering from damage especially due to humidity, exposure to high thermal excursions or other adverse weather conditions, shall be suitably stored and protected. Deteriorated materials shall not be used and shall be replaced at Vendor's cost.

The materials mentioned above, during loading, unloading, storage and treating should always be handled so as to prevent any damage, alteration and dispersion. When supplied in containers and envelopes, they shall not be dropped or thrown, or removed by means of hooks, both during the transport and handling operations until their complete use.

During unloading, transport and utilisation, any contact with water, earth, crushed stone and any other foreign material shall be carefully avoided.

VENDOR shall strictly follow Manufacturer's instructions regarding storage temperature and conditions. The VENDOR shall provide a climate controlled air-conditioned environment for epoxy powder storage.

11.6 Additional UV Protection During Pipe and fitting Stockpiling

This specification requires the use of UV stabilised polyethylene such that the coating will pass all of the test requirements after 12 months exposure in India. With the present generation UV stabilisers this can be achieved with any colour of PE. If it is likely that the pipe will be stockpiled for longer than 12 months, then a coating of white water-based PVA may be appropriate. However, it should only be applied at the time of stockpiling as it can be easily removed during transport and handling operations.

12 REPAIR OF COATING

VENDOR shall submit and qualify a comprehensive repair system, its methods and materials proposed to be used for executing a coating repair and shall receive approval from PURCHASER prior to use. All repairs shall be performed using epoxy primed heat shrink sleeves.

The repair procedure shall cover application over bare pipe and over the trilaminate coating. The minimum adhesion shall meet or exceed the sleeve manufacturer's requirements. Sleeve installers shall be specially trained and qualified by the sleeve manufacturer, and after qualification, be issued with and carry the manufacturer's certification card.

Only approved sleeve installers shall be allowed to perform production repair. One sleeve per installer per week shall be destructively tested. Method of testing shall be subject to approval by the PURCHASER or PURCHASER's Representative. The adhesion between sleeve and the epoxy and between epoxy and the steel substrate shall be checked using two peel tests. There

 		PROJECT	Standby SRU & Additional Tanks IOCL- Paradip Refinery		
		CLIENT	INDIAN OIL CORPORATION LIMITED		
JOB SUPPLY SPECIFICATION FOR 3 LAYER POLYETHYLENE COATING	Project No. 080557C001	Document No. 080557C-000-JSS-1300-001	Rev. No. B	Page 28 of 31	

shall be less than 5% void or adhesive failure and any one area of loss of adhesion is less than 20 mm².

In open storage the repair coating materials must be able to withstand a temperature of at least +80°C, without impairing its serviceability and properties.

Testing of repairs shall be in the same form as testing production coating. All repairs shall result in a coating thickness no less than the parent coating thickness.

All pipe leaving the coating shop, shall have a sound external coating with no holiday or porosity on 100% of the surface.

Defects, repairs and acceptability criteria shall be as follows:-

- Pipes and fittings showing porosities or very small damage not detected during holiday test and having a surface area less than 0.5cm² or linear damage (cut) of less than 3 cm, and does not expose bare steel, shall be repaired by applying heat shrink sleeves.
- Damage to coating by handling such as scratches, cuts, dents, gouges, not detected during holiday test, having a total reduced thickness on the damaged portion of not less than 2.0mm and an area not exceeding 20cm² shall be repaired by applying a heat shrink sleeve.
- Defects exceeding the above sizes or any holidays or exposed steel, exposing the bare metal surface and applying a heat shrink sleeve shall repair not exceeding 300mm.
- Any production pipe or fitting containing defects in excess of 3 (three) per component, or if the defect length exceeds 300mm (in any direction), shall be stripped and re coated.
- In case of a coating defect close to the coating cut back, VENDOR shall remove the coating throughout the entire circumference of the pipe and fitting down to the steel surface and increase the coating cut back length. If the resulting coating cut back exceeds 300mm length, then the coating shall be repaired by the use of a heat shrink sleeve, thereby making up the coating cut back length to 150mm.
- If the defect is more than 400mm from the original coating cut back length, the entire coating shall be removed and the pipes fittings shall be re coated. Alternatively, the pipe end and fitting may be cut back and rebevelled and the cost of the lost pipe reimbursed to the PURCHASER.

All repairs carried out to coating for whatever reason shall be to the account of the VENDOR.

Cosmetic damages occurring only in the Polyethylene sheathing need not be repaired by exposing up to steel surface, as deemed fit by the PURCHASER's Representative. The VENDOR shall establish its repair procedure qualification by testing and shall receive approval from PURCHASER prior to use.

 		PROJECT	Standby SRU & Additional Tanks IOCL- Paradip Refinery		
		CLIENT	INDIAN OIL CORPORATION LIMITED		
JOB SUPPLY SPECIFICATION FOR 3 LAYER POLYETHYLENE COATING	Project No. 080557C001	Document No. 080557C-000-JSS-1300-001	Rev. No. B	Page 29 of 31	

Testing of repairs shall be the same as testing for production coating and shall be subject to approval from PURCHASER prior to use.

VENDOR shall also demonstrate tests on repaired coating as and when required by PURCHASER.

13 MARKING AND PIPE, FITTING IDENTIFICATION

The VENDOR shall preserve pipe and identity by maintaining the identity of each length of pipe. Final markings shall be applied on the outside wall of the pipe at a maximum distance of 500 mm from the end.

Vendor to have a system of properly transferring the original pipe number/heat number (in addition to bar code system) before application of 3LPE coating so that final marking is having the same information without any error.

Vendor shall place marking on the outside surface of the coating at one end of coated pipe, fitting and marking shall be as per the requirements of DIN 30670, and as given in JSS for pipes and fittings.

The marking shall indicate, but not be limited to, the following information: -

- i. Pipe number, Heat number, Ident code.
- ii. Coated pipe number.
- iii. Colour band.
- iv. Diameter, wall thickness, weight and length.
- v. Re attach barcode labels from inside of pipe, or replace labels.
- vi. Any other information considered relevant by PURCHASER.

VENDOR shall obtain prior approval from PURCHASER for the marking procedure to be adopted.

 		PROJECT	Standby SRU & Additional Tanks IOCL- Paradip Refinery		
		CLIENT	INDIAN OIL CORPORATION LIMITED		
JOB SUPPLY SPECIFICATION FOR 3 LAYER POLYETHYLENE COATING	Project No. 080557C001	Document No. 080557C-000-JSS-1300-001	Rev. No. B	Page 30 of 31	

14 PRODUCTION REPORT

VENDOR shall prepare and maintain a detailed production reporting system, which shall provide a detailed history of each pipe length and fitting

The VENDOR shall obtain from the pipe and fitting supplier, as a minimum, the following data :-

- Pipe, Fitting number
- Heat number
- Pipe ,Fitting grade
- Diameter
- Length
- Wall thickness
- Pipe,Fittings weight.

Prior to acceptance of the pipe at the wharf, the VENDOR in the presence of the PURCHASER shall identify and record any minor defects, such as dents, flats or damaged bevels, found during the acceptance inspection. The VENDOR shall be responsible for any subsequent damage to the pipe.

To the records received from the pipe supplier the VENDOR shall add the following information: -

- Details of defect repairs
- Coating material batch numbers
- Pre-qualification tests for raw materials
- Coating procedure qualification tests
- Coating material balance
- Coated pipe and fitting sampling details
- Coated pipe and fitting test results
- Coated pipe and fitting weight
- Coating defects
- Coating repairs
- Hold points
- Rejected pipe and fittings.

The production report shall be submitted to PURCHASER every seven (7) days. The report shall be submitted as a single sheet Excel format on a CD.

 		PROJECT	Standby SRU & Additional Tanks IOCL- Paradip Refinery		
		CLIENT	INDIAN OIL CORPORATION LIMITED		
JOB SUPPLY SPECIFICATION FOR 3 LAYER POLYETHYLENE COATING	Project No. 080557C001	Document No. 080557C-000-JSS-1300-001	Rev. No. B	Page 31 of 31	



APPENDIX 1

LIST OF ACCEPTABLE COMBINATIONS OF COATING MATERIALS

The following Table provides indicative candidate coating materials. Vendor shall decide their possible options of coating specifications. The OWNER favours the use of FUSABOND 158D adhesive material by DUPONT, since this has proven performance in the field and has been shown to provide good adhesion to a wide range of polyethylene and FBE materials. Alternative resin suppliers for FBE and polyethylene should be approved by DUPONT so that all material suppliers are in agreement with the combinations of coating materials. Notwithstanding this, any combination of materials, including those favoured by the OWNER, shall be subject to the full tender testing and documentation requirements.

Epoxy Powder (Manufacturer)	Adhesive (Manufacturer)	PE Compound (Manufacturer)
EP 971197 (JOTUN) SCOTCHKOTE 226N (3M) HGT 53672343 (BASF)	FUSABOND 158D (DUPONT) FUSABOND E MB 206D(DUPONT) OVERAC 18350 (ATOFINA) ME 0420 (BOREALIS)	SCLAIR 35 BP MDPE (NOVACOR) 2006 PBK 35 (LACQTENE)

The responsibility for suitability for application, performance and compliance to the coating system requirements shall unconditionally lie with the VENDOR whatever combination of coating materials are proposed.

 		PROJECT	Standby SRU & Additional Tanks IOCL- Paradip Refinery		
		CLIENT	INDIAN OIL CORPORATION LIMITED		
INSPECTION AND TEST PLAN FOR PIPING BULK ITEMS AND SPECIALITIES	Project No. 080557C001	Document No. 080557C-000-ITP-1300-001	Rev. No. B	Page 1 of 8	

INSPECTION AND TEST PLAN FOR PIPING BULK ITEMS AND SPECIALITIES

Inspection category: 3

REV.	DATE	DESCRIPTION	PREPARED	CHECKED	APPROVED	AUTHORIZED
B	9-JUNE-2020	ISSUED FOR DESIGN	CK	GM	VV/SL	JMC
A	14-OCT-2019	ISSUED FOR DESIGN	CK	AS	VV	JM

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 	PROJECT		Standby SRU & Additional Tanks IOCL- Paradip Refinery	
	CLIENT		INDIAN OIL CORPORATION LIMITED	
INSPECTION AND TEST PLAN FOR PIPING BULK ITEMS AND SPECIALITIES	Project No. 080557C001	Document No. 080557C-000-ITP-1300-001	Rev. No. B	Page 2 of 8

TABLE OF CONTENTS

1.	INTRODUCTION	3
2.	DEFINITIONS & ABBREVIATIONS.....	3
3.	SCOPE	4
4.	TERMINOLOGY	5
5.	REFERENCE DOCUMENTS.....	6
6.	INSPECTION AND TEST REQUIREMENTS.....	6
7.	SUPPLIER'S FABRICATION AND QUALITY CONTROL PLAN	7
8.	INSPECTION RELEASE CERTIFICATE	8
9.	QUALITY CONTROL MANUFACTURING DOSSIER "QCMD" (ex. Inspection Book).....	8

ATTACHMENTS:

1. Annexure-1 : ITP for Seamless Pipes
2. Annexure-2 : ITP for Welded Pipes
3. Annexure-3 : ITP for Fittings
4. Annexure-4 : ITP for Flanges
5. Annexure-5 : ITP for Valves
6. Annexure-6 : ITP for Gaskets
7. Annexure-7 : ITP for Bolting
8. Annexure-8 : ITP for Steam Traps
9. Annexure-9 : ITP for Strainers
10. Annexure-10: ITP for Hoses and Couplings

 	PROJECT		Standby SRU & Additional Tanks IOCL- Paradip Refinery	
	CLIENT		INDIAN OIL CORPORATION LIMITED	
INSPECTION AND TEST PLAN FOR PIPING BULK ITEMS AND SPECIALITIES	Project No. 080557C001	Document No. 080557C-000-ITP-1300-001	Rev. No. B	Page 3 of 8

1. INTRODUCTION

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

2. DEFINITIONS & ABBREVIATIONS

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

 		PROJECT	Standby SRU & Additional Tanks IOCL- Paradip Refinery	
		CLIENT	INDIAN OIL CORPORATION LIMITED	
INSPECTION AND TEST PLAN FOR PIPING BULK ITEMS AND SPECIALITIES	Project No. 080557C001	Document No. 080557C-000-ITP-1300-001	Rev. No. B	Page 4 of 8

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

3. SCOPE

3.1 This Inspection and Test Plan covers the minimum testing requirements of Piping components.

This Inspection and Test Plan is an engineering document which defines for each type of piping components:

- The type and extent of CONTRACTOR and PMC/OWNER involvement in each phase of fabrication, control and testing requiring an inspection.
- The resulting vendor's contractual obligations, in accordance with applicable project general purchase conditions.

 	PROJECT		Standby SRU & Additional Tanks IOCL- Paradip Refinery	
	CLIENT		INDIAN OIL CORPORATION LIMITED	
INSPECTION AND TEST PLAN FOR PIPING BULK ITEMS AND SPECIALITIES	Project No. 080557C001	Document No. 080557C-000-ITP-1300-001	Rev. No. B	Page 5 of 8

Note: This Inspection and Test Plan may under no circumstances be used as a substitute for the vendor's Quality Control Plan.

3.2 Conflicts, Deviations and Clarifications:

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

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

Where applicable Codes or Standards are not called by this standard or its requirements are not clear, it shall be brought to attention of Authorized Representative by Contractor for resolution.

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

4. TERMINOLOGY

DFT	Dry Film Thickness
DPT	Dye Penetrant Testing
DHT	De-hydrogen Heat Treatment
ERTL	Electronics Regional Test Laboratory
FCRI	Fluid Control Research Institute
HT	Heat Treatment
HIC	Hydrogen Induced Cracking
ITP	Inspection and Test Plan
IP	Ingress Protection
IHT	Intermediate Heat Treatment
IC	Inspection Certificate
IGC	Intergranular corrosion
MPT/MT	Magnetic Particle Testing
MTC	Material Test Certificate
MRT	Mechanical Run Test
NDT	Non-Destructive Testing
NPSH	Net Positive Suction Head
PO	Purchase Order

 		PROJECT	Standby SRU & Additional Tanks IOCL- Paradip Refinery	
		CLIENT	INDIAN OIL CORPORATION LIMITED	
INSPECTION AND TEST PLAN FOR PIPING BULK ITEMS AND SPECIALITIES	Project No. 080557C001	Document No. 080557C-000-ITP-1300-001	Rev. No. B	Page 6 of 8

PESO	Petroleum Explosive Safety Organization
PQR	Procedure Qualification Record
PR	Purchase Requisition
PMI	Positive Material Identification
RT	Radiography Testing
SSCC	Sulphide Stress Corrosion Cracking
TC	Test Certificate
TPI or TPIA	Third Party Inspection Agency
UT	Ultrasonic Testing
VDR	Vendor Data Requirement
WPS	Welding Procedure Specification
WPQ	Welders Performance Qualification

5. REFERENCE DOCUMENTS


PO / PR / Standards referred therein / Job Specifications / Approved documents.

The codes latest edition as on date of issue of material requisition shall be applicable. Some BS codes may have been superseded by ISO / BS –EN codes, the latest one shall be acceptable.

6. INSPECTION AND TEST REQUIREMENTS

6.1 Refer following Annexures for the Inspection and test requirements for the listed Piping bulk items and specialties.

- Annexure- 1 : ITP for Seamless Pipes
- Annexure - 2 : ITP for Welded Pipes
- Annexure - 3 : ITP for Fittings
- Annexure - 4 : ITP for Flanges
- Annexure - 5 : ITP for Valves
- Annexure - 6 : ITP for Gaskets
- Annexure - 7 : ITP for Bolting
- Annexure - 8 : ITP for Steam Traps
- Annexure - 9 : ITP for Strainers
- Annexure - 10: ITP for Hoses and Couplings

 		PROJECT	Standby SRU & Additional Tanks IOCL- Paradip Refinery	
		CLIENT	INDIAN OIL CORPORATION LIMITED	
INSPECTION AND TEST PLAN FOR PIPING BULK ITEMS AND SPECIALITIES	Project No. 080557C001	Document No. 080557C-000-ITP-1300-001	Rev. No. B	Page 7 of 8

6.2 Extent of Inspection:

The extent of Inspection activities are defined as follows:

H: (Hold) Point

The Supplier cannot carry out the specified controls and tests without Inspector attendance.

Consequently, the attendance to witnessing is mandatory. The Supplier must notify the CONTRACTOR / PMC / OWNER by fax of the dedicated inspection activity at least fifteen (15) days in advance.

W: (Witness)

The Supplier must notify dedicated inspection activity at least fifteen (15) days in advance. CONTRACTOR / PMC / OWNER witnessing is not mandatory, but optional. If CONTRACTOR / PMC / OWNER does not elect to be present, the supplier may proceed with the intended activity, provided controls and test reports are made available for the inspector's review during his subsequent visit.

When a percentage value is indicated (i.e. W 10%) the inspection activities will be witnessed on spot basis as per percentage indicated.

R: (Review) - Review of Documents

The Supplier has either to submit to Inspector for comments the documents required prior to the performance of the dedicated activity or to transmit or make available for the review of Inspector the results of the controls and tests conducted, as the case may be.

7. SUPPLIER'S FABRICATION AND QUALITY CONTROL PLAN

The Supplier must issue a Fabrication and Quality Control Plan for each Equipment / Machinery / Package/ Bulk Item.

The Supplier's Fabrication and Quality Control Plan is a document which defines in a chronological manner the list of the operations of fabrication, controls and tests in accordance with his own "know-how" and with the requirements specified in MR.

Following information shall be clearly specified against each operation:

- Reference documents (drawings, procedures, etc.)
- Acceptance criteria (code, etc.)
- Recording documents for controls and tests

 		PROJECT	Standby SRU & Additional Tanks IOCL- Paradip Refinery	
		CLIENT	INDIAN OIL CORPORATION LIMITED	
INSPECTION AND TEST PLAN FOR PIPING BULK ITEMS AND SPECIALITIES	Project No. 080557C001	Document No. 080557C-000-ITP-1300-001	Rev. No. B	Page 8 of 8

- Involvement of the Quality Control department of the Supplier and/or his sub-supplier



This Supplier's Fabrication and Quality Control Plan will have to include all inspection activities defined in Inspection and Test Plan as well as all inspection activities scheduled by Independent Inspection Authority and/or the Client.

8. INSPECTION RELEASE CERTIFICATE

This document issued by Inspector, permits the vendor to proceed with the packing and to notify the shipment.

9. QUALITY CONTROL MANUFACTURING DOSSIER "QCMD" (ex. Inspection Book)

This document must be completely reviewed during the final Inspection. Preliminary Copy (Waiting for CLIENT final approval), checked and signed by the Inspector, must be shipped together with the goods and indicated in the relevant Packing List.

			PROJECT	Standby SRU & Additional Tanks IOCL- Paradip Refinery				
			CLIENT	INDIAN OIL CORPORATION LIMITED				
INSPECTION AND TEST PLAN FOR PIPING BULK ITEMS AND SPECIALITIES		Project No. 080557C001	Document No. 080557C-000-ITP-1300-001		Rev. No. B	Page 1 of 1		
Annexure - 1								
INSPECTION AND TESTING REQUIREMENTS FOR SEAMLESS PIPES								
SL NO.	STAGE/ACTIVITY	CHARACTERISTICS	QUANTUM OF CHECK	RECORD	SCOPE OF INSPECTION			OWNER
					SUPPLIER	CONTRACTOR/TPIA	PMC	
1.0	Procedure							
1.1	Hydrostatic Test, Heat Treatment, NDT and Other Procedures	Documented Procedures	100%	Procedure Documents	R	R		
2.0	Material Inspection							
2.1	Raw Material Inspection	Review of MTC for Chemical, Mechanical Properties, Size & steel making process, etc.	100%	Test Certificates	P	R		
3.0	In Process Inspection							
3.1	Heat Treatment	Normalizing, Tempering, Solution Annealing, Stabilization Heat treatment etc as applicable	100%	HT chart	P	R		
3.2	NDT As applicable	Surface & Internal Imperfections	PR/ Purchase Specifications	NDT Reports	P	R		
3.3	Identification of test Samples	Product Chemical, Tensile, Hardness, Impact, IGC and other test as applicable	Lots as per specification	Test Reports	P	H		
3.4	Product Analysis	Chemical Composition	Lot as per specification	Test Reports	P	W		
3.5	Destructive Testing	Tensile, Hardness, Impact, IGC and Other test as applicable	Lot as per specification	Test Report	P	W		
3.6	Corrosion Test (If any)	Intergranular corrosion	Lot as per specification	Test Report	P	W		
3.7	Galvanizing (If Applicable)	Integrity Of Galvanized Coating	100%	Inspection Report	P	W		
4.0	Final Inspection							
4.1	Hydrostatic Testing	Leak Check	100%	Test Report	P	RW (Note 1)		
4.2	Visual and Dimensional Inspection (VDI)	Surface Condition, Straightness, End Finish, Bevel Angle, Root Face, Outer Dia, Thickness, length, End Finish, Marking, End Caps etc	100%	Inspection Report	P	W (Note-5)		
4.3	PMI Check(If applicable)	Chemical Check	As Applicable	Inspection Report	P	W		
4.4	Final Stamping	Stamping of Accepted Pipes	Stamping of Pipes which are witness by PMC/OWNER, Other pipes to have suppliers Identification	Inspection Report	P	H		
5.0	Painting							
5.1	Rust Preventive Coating & Color Coding(As applicable)	Visual & Color Coding as applicable	100%	Inspection Report	P	W		
6.0	Documentation & IC							
6.1	Final documents	Review of Stage Inspection report / Test Reports	100%	Supplier TC & IC	P	H	R	
6.2	Inspection release certificate	Issue of Inspection release certificate	100%	Supplier TC & IC	-	H	R	

Legend: H-Hold (Do not proceed with approval), P-Perform, RW-Random Witness (As specified or 10% (min.1 no. of each size and type of Bulk item)), R-Review, W-Witness (Give due notice, work may proceed after scheduled date).

NOTES (As applicable)

- Carbon steel Pipes (Other than LTCS & Pipes for special services like NACE, H2, HIC, etc) upto 12" will be accepted on review of supplier test certificates. Supplier test Certificates to be reviewed by TPIA.
- This document describes the generic test requirements. Any additional test or Inspection scope if specified in contract documents shall also be applicable (unless otherwise agreed upon).
- Acceptance Norms for all the activities shall be as per PO/PR/STANDARDS referred there in Job specification / Approved Documents.
- For orders placed on stockist, items shall be accepted based on manufacturer's TC with EN10204 type 3.2 certification from client approved suppliers.
- 100% Visual & 10% dimensional checks of each size, pressure rating and type of component at vendors' works by Third Party Inspection (TPI) and surprise checks by PMC/OWNER.

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			PROJECT		Standby SRU & Additional Tanks IOCL- Paradip Refinery			
			CLIENT		INDIAN OIL CORPORATION LIMITED			
INSPECTION AND TEST PLAN FOR PIPING BULK ITEMS AND SPECIALITIES		Project No. 080557C001	Document No. 080557C-000-ITP-1300-001		Rev. No. B	Page 1 of 1		
Annexure - 2								
INSPECTION AND TESTING REQUIREMENTS FOR WELDED PIPES								
SL NO.	STAGE/ACTIVITY	CHARACTERISTICS	QUANTUM OF CHECK	RECORD	SCOPE OF INSPECTION			OWNER
					SUPPLIER	CONTRACTOR/TPIA	PMC	
1.0	Procedure							
1.1	Hydrostatic Test, Heat Treatment, NDT and Other Procedures	Documented Procedures	100%	Procedure Documents	P	H		
1.2	WPS,PQR & WPQ	Welding Parameters & Qualification Record	100%	WPS, PQR & WPQ	P	H		
2.0	Material Inspection							
2.1	Raw Material Inspection (**Special services like NACE, H2, HIC..etc)	Review of MTC for Chemical, & Mechanical Properties	100%	Test Certificates Suppliers inspection report	P	H		
3.0	In Process Inspection							
3.1	Welding	Welding Parameters as per WPS/PQR	100%	Inspection Reports	P	RW		
3.2	Heat Treatment	Stress Relieving, Normalizing, Tempering, Solution Annealing, Stabilization Heat treatment etc as applicable	100%	HT chart	P	W		
3.3	Corrosion & Metallurgical testing	Intergranular corrosion	Lot as per specification	Test Report	P	W		
3.4	Ferrite Checking of SS Pipes (as Applicable)	% Ferrite Check	Random On Weld	Inspection Report	P	W		
3.5	UT / RT As applicable	Surface & Internal Imperfections	PR / Purchase Specification	RT Films, Reports & UT Reports	P	W		
3.6	Identification of test Samples	Product Chemical, Tensile, Hardness, Impact, IGC and other test as applicable	Lots as per specification	Test Reports	P	W		
3.7	Product Analysis	Chemical Composition	PR / Purchase Specification	Test Reports	P	W		
3.8	Destructive Testing	Tensile, Hardness, Impact, IGC and Other test as applicable	Lot as per specification	Test Report	P	W		
3.9	Galvanizing (If Applicable)	Integrity Of Galvanized Coating	100%	Inspection Report	P	W		
4.0	Final Inspection							
4.1	Hydrostatic Testing	Leak Check	100%	Test Report	P	W		
4.2	Visual and Dimensional Inspection (VDI)	Surface Condition, Straightness, End Finish, Bevel Angle,Root Face, Outer Dia, Profile Thickness, length,End Finish, Marking etc,	100%	Inspection Report	P	W (Note-4)		
4.3	Hardness test(If applicable)	As per specification	100%	Test Report	P	W		
4.4	Corrosion test(If applicable)	As per specification	100%	Test Report	P	W		
4.5	PMI Check	Chemical Check	As Applicable	Inspection Report	P	W		
4.6	Final Stamping	Stamping of Accepted Pipies	Stamping of Pipies which are witness by PMC/OWNER	Inspection Report	P	P		
5.0	Painting							
5.1	Rust Preventive Coating & Color Coding(As applicable)	Visual & Color Coding as applicable	100%	Inspection Report	P	W		
6.0	Documentation & IC							
6.1	Final documents	Review of Stage Inspection report / Test Reports	100%	Supplier TC & IC	P	H	R	
6.2	Inspection release certificate	Issue of Inspection release certificate	100%	Supplier TC & IC	-	H	R	

Legend: H-Hold (Do not proceed with approval), P-Perform, RW-Random Witness (As specified or 10% (min.1 no of each size and type of Bulk item)), R-Review, W-Witness (Give due notice, work may proceed after scheduled date).

NOTES (As applicable)



- This document describes the generic test requirements. Any additional test or Inspection scope if specified in contract documents shall also be applicable (unless otherwise agreed upon).
- Acceptance Norms for all the activities shall be as per PO/PR/STANDARDS referred there in Job specification / Approved Documents.
- For orders placed on stockist, items shall be accepted based on manufacturer's TC with EN10204 type 3.2 certification from client approved suppliers.
- 100% Visual & 10% dimensional checks of each size, pressure rating and type of component at vendors' works by Third Party Inspection (TPI) and surprise checks by PMC/OWNER

			PROJECT	Standby SRU & Additional Tanks IOCL- Paradip Refinery				
			CLIENT	INDIAN OIL CORPORATION LIMITED				
INSPECTION AND TEST PLAN FOR PIPING BULK ITEMS AND SPECIALITIES		Project No. 080557C001	Document No. 080557C-000-ITP-1300-001		Rev. No. B	Page 1 of 1		
Annexure - 3								
INSPECTION AND TESTING REQUIREMENTS FOR FITTINGS								
SL NO.	STAGE/ACTIVITY	CHARACTERISTICS	QUANTUM OF CHECK	RECORD	SCOPE OF INSPECTION			
					SUPPLIER	CONTRACTOR/TPIA	PMC	OWNER
1.0	Procedure							
1.1	Heat Treatment/NDT	Documented Procedures	100%	Procedure Documents	P	R		
1.2	WPS,PQR & WPQ(If applicable)	Welding Parameters & Qualification Record	100%	WPS, PQR & WPQ	P	H		
2.0	Material Inspection							
2.1	Raw Material Inspection (Billets, Rounds, Pipes, Coil, Plates, etc) (**Special services line NACE, H2, HIC..etc)	Review of MTC for Chemical, & Mechanical Properties, size & steel making process, etc	100%	Mill test Certificates, Suppliers inspection Report	P	H		
3.0	In Process Inspection							
3.1	Forming Welding	Forming & Welding Parameters	100%	Supplier's records	P	RW		
3.2	Ferrite check of SS welds (If applicable)	% Ferrite Check	100%	Inspection report	P	RW		
3.3	Heat Treatment	Stress Relieving, Normalizing, Tempering, Solution Annealing, Stabilization Heat treatment etc as applicable	100%	HT Chart/Report	P	RW		
3.4	NDT-RT As Applicable	Surface & Internal Imperfections	PR / Purchase Specification	RT Films, Reports & UT Reports	P	R		
3.5	Corrosion & Metallurgical testing	Intergranular corrosion	Lot as per specification	Test Report	P	W		
3.6	NDT / UT As applicable	Surface & Internal Imperfections	PR / Purchase Specification	UT Reports	P	W		
3.7	NDT-DPT/MPT of bevel ends	Surface / sub surface defects	100%	Test report	P	RW		
3.8	Identification of test Samples	Product Chemical, Tensile, Hardness, Impact, IGC and other test as applicable	Lots as per specification	Test Reports	P	W		
3.9	Product Analysis (as applicable)	Chemical Composition	PR / Purchase Specification	Test Reports	P	W		
3.10	Destructive Testing	Tensile, Hardness, Impact, IGC and Other test as applicable	100%	Test Report	P	W		
3.11	Galvanizing (If Applicable)	Integrity Of Galvanized Coating	100%	Inspection Report	P	W		
4.0	Final Inspection							
4.1	Visual and Dimension	Size, Thickness / Schedule, Dimensions, Surface quality, Marking etc.	100%	Inspection Report	P	W (Note-6)		
4.2	Hardness testing on fittings (** Special services like NACE, H2, HIC,etc)	Hardness value of base metal & Weld / HAZ as applicable	Random 10%	Test report	P	W		
4.3	PMI Check (If applicable)	Chemical check	As Applicable	Inspection Report	P	W		
4.4	Final Stamping	Stamping of Accepted Fittings	Stamping of Fittings which are witness by PMC/OWNER	Inspection Report	P	P		
4.5	Final Stamping	Stamping of Accepted Pipies	Stamping of Pipies which are witness by PMC/OWNER	Inspection Report	P	P		
5.0	Painting							
5.1	Shot Blasting Rust Preventive Coating & color Coding	Visual & Color Coding as applicable	100%	Inspection Report	P	W		
6.0	Documentation & IC							
6.1	Final documents	Review of Stage Inspection report / Test Reports	100%	Supplier TC & IC	P	H	R	
6.2	Inspection release certificate	Issue of Inspection release certificate	100%	Supplier TC & IC	-	H	R	

Legend: H-Hold (Do not proceed with approval), P-Perform, RW-Random Witness (As specified or 10% (min.1 no.of each size and type of Bulk item)), R-Review, W-Witness (Give due notice, work may proceed after scheduled date).

NOTES (As applicable)

- This document describes the generic test requirements. Any additional test or Inspection scope if specified in contract documents shall also be applicable (unless otherwise agreed upon).
- Acceptance Norms for all the activities shall be as per PO/PR/STANDARDS referred there in Job specification / Approved Documents.
- For orders placed on stockist, items shall be accepted based on manufacturer's TC with EN10204 type 3.2 certification from client approved suppliers.
- For welded fittings, it is recommended to use low hydrogen consumable for AS, SS 410 fittings & HIC resistant consumable for HIC service fittings.
- TPIA reserves the right to check raw material consumption and traceability records.
- 100% Visual & 10% dimensional checks of each size, pressure rating and type of component at vendors' works by Third Party Inspection (TPI) and surprise checks by PMC/OWNER.

			PROJECT	Standby SRU & Additional Tanks IOCL- Paradip Refinery				
			CLIENT	INDIAN OIL CORPORATION LIMITED				
INSPECTION AND TEST PLAN FOR PIPING BULK ITEMS AND SPECIALITIES		Project No. 080557C001	Document No. 080557C-000-ITP-1300-001		Rev. No. B	Page 1 of 1		
Annexure - 4								
INSPECTION AND TESTING REQUIREMENTS FOR FLANGES								
SL NO.	STAGE/ACTIVITY	CHARACTERISTICS	QUANTUM OF CHECK	RECORD	SCOPE OF INSPECTION			
					SUPPLIER	CONTRACTOR/TPIA	PMC	OWNER
1.0	Procedure							
1.1	Heat Treatment, NDT and other Procedures	Documented Procedures	100%	Procedure Documents	P	R		
1.2	WPS,PQR & WPQ	Welding Parameters & Qualification Record	100%	WPS, PQR & WPQ	P	R		
2.0	Material Inspection							
2.1	Raw Material Inspection	Chemical, & Mechanical Properties	100%	Test Certificates	P	R		
3.0	In Process Inspection							
3.1	Welding / Forging	Forging & Welding Parameters	100%	Inspection report	P	RW		
3.2	Heat Treatment	Stress Relieving, Normalizing, Tempering, Solution Annealing, Stabilization Heat treatment etc as applicable	100%	HT Chart	P	RW		
3.3	Identification of test Samples	Product Chemical, Tensile, Hardness, Impact, IGC and other test as applicable	100%	Test Reports	P	RW		
3.4	Corrosion & Metallurgical testing	Intergranular corrosion	Lot as per specification	Test Report	P	W		
3.5	Product Analysis (As applicable)	Chemical composition	PR / Purchase Specification	Test Reports	P	RW		
3.6	Destructive Testing	Mechanical, Impact, IGC and Other test as applicable	100%	Test Report	P	W		
3.7	NDT As applicable	Surface & Internal Imperfections	PR / Purchase Specification	NDT Reports	P	RW		
3.8	Machining and Drilling	Visual & Dimensional check	Lot as per specification	Inspection report	P	R		
3.8	Galvanizing (If Applicable)	Integrity Of Galvanized Coating	100%	Inspection Report	P	W		
4.0	Final Inspection							
4.1	Final Inspection	1.Visual 2. Dimesnions 3. Hardness 4. Marking etc	100%	Inspection Report	P	W (Note-4)		
4.3	PMI Check(If applicable)	Chemical check	As Applicable	Inspection Report	P	W		
4.4	Final Stamping	Stamping of Accepted Items	Stamping of items which are witnessed by PMC / OWNER	Inspection Report	P	P		
5.0	Painting							
5.1	Rust Preventive Coating & color Coding	Visual & Color Coding as applicable	100%	Inspection Report	P	W		
6.0	Documentation & IC							
6.1	Final documents	Review of Stage Inspection report / Test Reports	100%	Supplier TC & IC	P	H	R	
6.2	Inspection release certificate	Issue of Inspection release certificate	100%	Supplier TC & IC	-	H	R	

Legend: H-Hold (Do not proceed with approval), P-Perform, RW-Random Witness (As specified or 10% (min. 1 no. of each size and type of Bulk item)), R-Review, W-Witness (Give due notice, work may proceed after scheduled date).

NOTES (As applicable)



- For Non NACE & Non Hydrogen service Carbon Steel Flanges, Spectacle Blinds & Drip rings upto 24" - 300 ANSI Class will be accepted on review of Supplier Test Certificates. Supplier Test Certificates to be reviewed by TPIA.
- This document describes the generic test requirements. Any additional test or inspection scope if specified in contract documents shall also be applicable (unless otherwise agreed upon).
- Acceptance Norms for all the activities shall be as per PO/PR/STANDARDS referred there in Job specification / Approved Documents.
- 100% Visual & 10% dimensional checks of each size, pressure rating and type of component at vendors' works by Third Party Inspection (TPI) and surprise checks by PMC/OWNER..

			PROJECT		Standby SRU & Additional Tanks IOCL- Paradip Refinery			
			CLIENT		INDIAN OIL CORPORATION LIMITED			
INSPECTION AND TEST PLAN FOR PIPING BULK ITEMS AND SPECIALITIES		Project No. 080557C001	Document No. 080557C-000-ITP-1300-001		Rev. No. B	Page 1 of 1		
Annexure - 5								
INSPECTION AND TESTING REQUIREMENTS FOR VALVES								
SL NO.	STAGE/ACTIVITY	CHARACTERISTICS	QUANTUM OF CHECK	RECORD	SCOPE OF INSPECTION			
					SUPPLIER	CONTRACTOR/TPIA	PMC	OWNER
1.0	Procedure							
1.1	Hydrostatic Test, Heat Treatment, NDT, Helium Leak Test and other Procedures	Documented Procedures	100%	Procedure Documents	P	R		
1.2	WPS,PQR & WPQ	Welding Parameters & Qualification Record	100%	WPS, PQR & WPQ	P	R, W - For New		
1.3	Pre-Qualification Tests	Fire safe Parameters & Qualification Record	PR / Purchase Specification	Acceptance Report	P	W		
2.0	Material Inspection							
2.1	Cating & Forgings (Body, Bonnet, Disc, Stem, Body ring	Chemical, Mechanical, Heat Treatment, NDT, IGC & Other Properties as applicable	100%	Test Certificates	H	H		
2.2	Cating & Forgings (Body, Bonnet, Disc, Stem, Body ring	Visual & Dimensions	100%	Inspection Report	H	H		
2.3	Body and Bonnet Castings	Radiography Examination	PR / Purchase Specification	Films and report	H	R		
2.4	Bars for Trim Material	Chemical Analysis	Each Heat	Test Certificates & Lab report	H	R		
2.5	Corrosion & Metallurgical testing (as applicable)	Intergranular corrosion	Lot as per specification	Test Report	P	W		
2.6	Magnetic particle testing /Dye penetrant testing	As per NDE specification	100%	Test Report	P	W		
2.7	Gaskets, Gear units, Fasteners, Gland, Packings, etc	Physical / Chemical Properties	100%	Test Certificates & Lab report	H	R		
2.8	Actuators as applicable	Performance, Statutory Certificates as applicable	100%	Test Certificates, Inspection reports	H	H		
3.0	In Process Inspection							
3.1	Welding	Welding Parameters as per WPS / PQR	100%	Inspection report	P	RW		
3.2	Machining of components	Visual / Dimension	100%	Inspection report	W	R		
4.0	Final Inspection							
4.1	Hydrostatic / Pneumatic Test and Helium Leak Test as applicable	Leak Check	PR / Purchase Specification	Test Report	P	RW (Note-1)		
4.2	Visual / Dimension	Surface & Dimension Check	100%	Test Report	P	W (Note-4)		
4.3	Functional test for Actuator Operated Valves	Satisfactory Performance	100%	Test Report	P	RW		
4.4	PMI Check (as applicable)	Chemical	As Applicable	Inspection report	P	RW		
4.5	Strip Check (As applicable)	Verify Components & Differential hardness if applicable	PR / Purchase Specification	Inspection report	P	RW (Note-1)		
4.6	Final Stamping	Stamping of Accepted Valves	Stamping of items which are witnessed by PMC / OWNER	Inspection report	P	P		
5.0	Painting							
5.1	Painting & color Coding as applicable	Visual / DFT Check	100%	Inspection Report	P	W		
6.0	Documentation & IC							
6.1	Final documents	Review of Stage Inspection report / Test Reports	100%	Supplier TC & IC	P	H	R	
6.2	Inspection release certificate	Issue of Inspection release certificate	100%	Supplier TC & IC	-	H	R	

Legend: H-Hold (Do not proceed with approval), P-Perform, RW-Random Witness (As specified or 10% (min.1 no. of each size and type of Bulk item)), R-Review, W-Witness (Give due notice, work may proceed after scheduled date).

NOTES (As applicable)



- For Non NACE & Non Hydrogen service Carbon Steel valves upto 12" will be accepted on review of Supplier Test Certificates. Supplier Test Certificates to be reviewed by TPIA.
- This document describes the generic test requirements. Any additional test or inspection scope if specified in contract documents shall also be applicable (unless otherwise agreed upon).
- Acceptance Norms for all the activities shall be as per PO/PR/STANDARDS referred there in Job specification / Approved Documents.
- 100% Visual & 10% dimensional checks of each size, pressure rating and type of component at vendors' works by Third Party Inspection (TPI) and surprise checks by PMC/OWNER.

			PROJECT	Standby SRU & Additional Tanks IOCL- Paradip Refinery				
			CLIENT	INDIAN OIL CORPORATION LIMITED				
INSPECTION AND TEST PLAN FOR PIPING BULK ITEMS AND SPECIALITIES		Project No. 080557C001	Document No. 080557C-000-ITP-1300-001		Rev. No. B	Page 1 of 1		
Annexure - 6								
INSPECTION AND TESTING REQUIREMENTS FOR GASKETS								
SL NO.	STAGE/ACTIVITY	CHARACTERISTICS	QUANTUM OF CHECK	RECORD	SCOPE OF INSPECTION			
					SUPPLIER	CONTRACTOR/TPIA	PMC	OWNER
1.0	Procedure							
1.1	HT & Test Procedure	Documented Procedures	100%	Procedure Documents	P	R		
2.0	Material Inspection							
2.1	Raw Material Inspection	Chemical, Physical and other Properties as per applicable material specification	100%	Test Certificates	P	R		
3.0	In Process Inspection							
3.1	Punching & Finishing	Finish & Dimension	100%	Inspection Report	P	H		
3.2	Heat Trement for RTJ Gaskets (As applicable)	Time & Temperature	100%	HT Chart	P	H		
3.3	Corrosion & Metallurgical testing	Intergranular corrosion	Lot as per specification	Test Report	P	W		
4.0	Final Inspection							
4.1	Final Visual, Dimension & Testing	Compressibility, Recovery, Seal ability, Groove Hardness for Ring & Tongue Joint etc as applicable and Visual / Dimension	100%	Inspection Report	P	W (Note-3)		
4.2	Final Stamping	Stamping Of Accepted Gaskets	100%	Inspection Report	P	W		
4.3	PMI Check	Chemical Check	As Applicable	Inspection Report	P	W		
5.0	Painting							
5.1	Rust Prevention & Color Coding (As applicable)	Visual & Color Coding as applicable	100%	Inspection Report	P	W		
6.0	Documentation & IC							
6.1	Final documents	Review of Stage Inspection report / Test Reports	100%	Supplier TC & IC	P	H	R	
6.2	Inspection release certificate	Issue of Inspection release certificate	100%	Supplier TC & IC	-	H	R	

Legend: H-Hold (Do not proceed with approval), P-Perform, RW-Random Witness (As specified or 10% (min.1 no.of each size and type of Bulk item)), R-Review, W-Witness (Give due notice, work may proceed after scheduled date).

NOTES (As applicable)

1. This document describes the generic test requirements. Any additional test or Inspection scope if specified in contract documents shall also be applicable (unless otherwise agreed upon).
2. Acceptance Norms for all the activities shall be as per PO/PR/STANDARDS referred there in Job specification / Approved Documents.
3. 100% Visual & 10% dimensional checks of each size, pressure rating and type of component at vendors' works by Third Party Inspection (TPI) and surprise checks by PMC/OWNER.



			PROJECT	Standby SRU & Additional Tanks IOCL- Paradip Refinery				
			CLIENT	INDIAN OIL CORPORATION LIMITED				
INSPECTION AND TEST PLAN FOR PIPING BULK ITEMS AND SPECIALITIES		Project No. 080557C001	Document No. 080557C-000-ITP-1300-001		Rev. No. B	Page 1 of 1		
Annexure - 7								
INSPECTION AND TESTING REQUIREMENTS FOR BOLTING								
SL NO.	STAGE/ACTIVITY	CHARACTERISTICS	QUANTUM OF CHECK	RECORD	SCOPE OF INSPECTION			
					SUPPLIER	CONTRACTOR/TPIA	PMC	OWNER
1.0	Procedure							
1.1	Heat Treatmetn & NDT Procedures	Documented Procedures	100%	Procedure Documents	P	H		
2.0	Material Inspection							
2.1	Raw Material Inspection	Chemical, Steel making prcess, Macro etch, etc.,	100%	Test Certificates	P	R		
3.0	In Process Inspection							
3.1	Thread Rling, Hot Forging of Nuts/Boll Heads, Machining	Process parameters	100%	Inspection Reports	P	RW		
3.2	Heat Treatment	Normalizing & Tempering, Quenching & Tempering, Solution Annealing, Stabilization Heat Treatment, Strain Hardening, Nitriding etc., as applicable	100%	Inspection Reports	P	RW		
3.3	Corrosion & Metallurgical testing(If applicable)	Intergranular corrosion	Lot as per specification	Test Report	P	W		
3.4	NDT As applicable	Defects detection	100%	Test Reports	P	W		
3.5	Identification of test Samples	Product Chemical, Proof Load Test, Stress Rupture, Tensile, Hardness, Impact, and other test as applicable	Lots as per specification	Test Reports	P	H		
3.6	Destructive Testing	Product Chemical, Proof Load Test, Stress Rupture, Mechanical Impact, and other test as applicable	Lot as per specification	Test Report	P	W		
3.7	Galvanizing (If Applicable)	Integrity Of Galvanized Coating	100%	Inspection Report	P	W		
4.0	Final Inspection							
4.1	Visual & Dimension	Visual Marking & Dimensions	100% by Supplier & Random by PMC/OWNER	Inspection Report	P	W(Note-3)		
4.2	Final Stamping	Stamping of Accepted Bolting Material	Stamping of bolting material which are witness by PMC/OWNER. Others to have suppliers Identification.	Inspection Report	P	W		
4.3	PMI Check(If applicable)	Chemical Check	As Applicable	Inspection Report	P	W		
5.0	Painting							
5.1	Rust Prevention & Color Coding (As applicable)	Visual & Color Coding as applicable	100%	Inspection Report	P	W		
6.0	Documentation & IC							
6.1	Final documents	Review of Stage Inspection report / Test Reports	100%	Supplier TC & IC	P	H	R	
6.2	Inspection release certificate	Issue of Inspection release certificate	100%	Supplier TC & IC	-	H	R	

Legend: H-Hold (Do not proceed with approval), P-Perform, RW-Random Witness (As specified or 10% (min. 1 no. of each size and type of Bulk item)), R-Review, W-Witness (Give due notice, work may proceed after scheduled date).

NOTES (As applicable)

1. This document describes the generic test requirements. Any additional test or Inspection scope if specified in contract documents shall also be applicable (unless otherwise agreed upon).
2. Acceptance Norms for all the activities shall be as per PO/PR/STANDARDS referred there in Job specification / Approved Documents.
3. Final Visual and Dimension shall be checked as per below sampling plan.



Lot Size (Nos.)	Sample Size (Minimum)
Upto 100	2% (Min. 2 Nos.)
101 to 500	1% (Min. 3 Nos.)
501 and above	0.5% (Min. 5 Nos.)

			PROJECT	Standby SRU & Additional Tanks IOCL- Paradip Refinery				
			CLIENT	INDIAN OIL CORPORATION LIMITED				
INSPECTION AND TEST PLAN FOR PIPING BULK ITEMS AND SPECIALITIES		Project No. 080557C001	Document No. 080557C-000-ITP-1300-001		Rev. No. B	Page 1 of 1		
Annexure - 8								
INSPECTION AND TESTING REQUIREMENTS FOR STEAM TRAPS								
SL NO.	STAGE/ACTIVITY	CHARACTERISTICS	QUANTUM OF CHECK	RECORD	SCOPE OF INSPECTION			
					SUPPLIER	CONTRACTOR/TPIA	PMC	OWNER
1.0	Procedure							
1.1	Hydrostatic Test, Heat Treatment, NDT, Helium Leak Test and other Procedures	Documented Procedures	100%	Procedure Documents	P	R		
1.2	WPS,PQR & WPQ	Welding Parameters & Qualification Record	100%	WPS, PQR & WPQ	P	R W - New		
2.0	Material Inspection							
2.1	Raw Material Inspection	Chemical, Mechanical, Heat Treatment, NDT, IGC & Other Properties as applicable	100%	Test Certificates	P	W		
3.0	In Process Inspection							
3.1	Welding	Welding Parameters as per WPS / PQR	100%	Inspection report	P	RW		
3.2	Heat Treatment	PWHT as applicable	100%	HT Chart	P	RW		
3.3	Corrosion & Metallurgical testing(If applicable)	Intergranular corrosion	Lot as per specification	Test Report	P	W		
3.4	RT As Applicable	Weld Defects	PR / Purchase Specification	RT films & Reports	P	R		
3.5	NDT As Applicable	Surface & Internal Imperfections	PR / Purchase Specification	Test Reports	P	RW		
4.0	Final Inspection							
4.1	Hydrostatic Testing	Leak Check	100%	Test Report	P	W		
4.2	Visual and Dimensional Inspection (VDI)	Surface Conditions & Dimension	100%	Inspection report	P	W (Note-3)		
4.3	PMI Check (If applicable)	Chemical Check	As Applicable	Inspection report	P	W		
4.4	Final Stamping	Stamping of Accepted traps	100%	Inspection report	P	W		
5.0	Painting							
5.1	Painting & color Coding	Visual, DFT & Color coding as applicable	100%	Inspection Report	P	W		
6.0	Documentation & IC							
6.1	Final documents	Review of Stage Inspection report / Test Reports	100%	Supplier TC & IC	P	H	R	
6.2	Inspection release certificate	Issue of Inspection release certificate	100%	Supplier TC & IC	-	H	R	

Legend: H-Hold (Do not proceed with approval), P-Perform, RW-Random Witness (As specified or 10% (min.1 no.of each size and type of Bulk item)), R-Review, W-Witness (Give due notice, work may proceed after scheduled date).

NOTES (As applicable)



- This document describes the generic test requirements. Any additional test or Inspection scope if specified in contract documents shall also be applicable (unless otherwise agreed upon).
- Acceptance Norms for all the activities shall be as per PO/PR/STANDARDS referred there in Job specification / Approved Documents.
- 100% Visual & 10% dimensional checks of each size, pressure rating and type of component at vendors' works by Third Party Inspection (TPI) and surprise checks by PMC/OWNER.

			PROJECT	Standby SRU & Additional Tanks IOCL- Paradip Refinery				
			CLIENT	INDIAN OIL CORPORATION LIMITED				
INSPECTION AND TEST PLAN FOR PIPING BULK ITEMS AND SPECIALITIES		Project No. 080557C001	Document No. 080557C-000-ITP-1300-001		Rev. No. B	Page 1 of 1		
Annexure - 9								
INSPECTION AND TESTING REQUIREMENTS FOR STRAINERS								
SL NO.	STAGE/ACTIVITY	CHARACTERISTICS	QUANTUM OF CHECK	RECORD	SCOPE OF INSPECTION			
					SUPPLIER	CONTRACTOR/TPIA	PMC	OWNER
1.0	Procedure							
1.1	Hydrostatic Test, Heat Treatment, NDT, Helium Leak Test and other Procedures	Documented Procedures	100%	Procedure Documents	P	R		
1.2	WPS,PQR & WPQ	Welding Parameters & Qualification Record	100%	WPS, PQR & WPQ	P	W-New R-Existing		
2.0	Material Inspection							
2.1	Raw Material Inspection	Chemical, Mechanical, Heat Treatment, NDT, IGC & Other Properties as applicable	100%	Test Certificates	P	RW		
3.0	In Process Inspection							
3.1	Welding	Welding Parameters as per WPS / PQR	100%	Inspection report	P	RW		
3.2	Heat Treatment	PWHT as applicable	100%	HT Chart	P	RW		
3.3	Corrosion & Metallurgical testing(If applicable)	Intergranular corrosion	Lot as per specification	Test Report	P	W		
3.4	RT As Applicable	Weld Defects	PR / Purchase Specification	RT films & Reports	P	R		
3.5	NDT As Applicable	Surface & Internal Imperfections	PR / Purchase Specification	Test Reports	P	W		
4.0	Final Inspection							
4.1	Hydrostatic Testing	Leak Check	100%	Test Report	P	W		
4.2	Visual and Dimensional Inspection (VDI)	Surface Conditions & Dimension	100%	Inspection report	P	W (Note-4)		
4.3	PMI Check (if applicable)	Chemical Check	As Applicable	Inspection report	P	W		
4.4	Final Stamping	Stamping of Accepted strainers	Stamping of Strainers which are witnessed by PMC/OWNER	Inspection report	P	W		
5.0	Painting							
5.1	Painting & color Coding	Visual, DFT & Color coding as applicable	100%	Inspection Report	P	W		
6.0	Documentation & IC							
6.1	Final documents	Review of Stage Inspection report / Test Reports	100%	Supplier TC & IC	P	H	R	
6.2	Inspection release certificate	Issue of Inspection release certificate	100%	Supplier TC & IC	-	H	R	

Legend: H-Hold (Do not proceed with approval), P-Perform, RW-Random Witness (As specified or 10% (min.1 no.of each size and type of Bulk item)), R-Review, W-Witness (Give due notice, work may proceed after scheduled date).

NOTES (As applicable)

- For Non NACE & Non Hydrogen service Strainers upto 6" 300# ANSI will be accepted on review of Supplier Test Certificates duly reviewed by TPIA.
- This document describes the generic test requirements. Any additional test or Inspection scope if specified in contract documents shall also be applicable (unless otherwise agreed upon).
- Acceptance Norms for all the activities shall be as per PO/PR/STANDARDS referred there in Job specification / Approved Documents.
- 100% Visual & 10% dimensional checks of each size, pressure rating and type of component at vendors' works by Third Party Inspection (TPI) and surprise checks by PMC/OWNER..

			PROJECT	Standby SRU & Additional Tanks IOCL- Paradip Refinery				
			CLIENT	INDIAN OIL CORPORATION LIMITED				
INSPECTION AND TEST PLAN FOR PIPING BULK ITEMS AND SPECIALITIES		Project No. 080557C001	Document No. 080557C-000-ITP-1300-001		Rev. No. B	Page 1 of 1		
Annexure - 10								
INSPECTION AND TESTING REQUIREMENTS FOR HOSES(METALLIC) AND COUPLINGS								
SL NO.	STAGE/ACTIVITY	CHARACTERISTICS	QUANTUM OF CHECK	RECORD	SCOPE OF INSPECTION			
					SUPPLIER	CONTRACTOR/TPIA	PMC	OWNER
1.0	Procedure							
1.1	Hydrostatic Test & NDT Procedures	Documented Procedures	100%	Procedure Documents	P	R		
1.2	WPS,PQR & WPQ	Welding Parameters & Qualification Record	100%	WPS, PQR & WPQ	P	W- For New R-Existing		
2.0	Material Inspection							
2.1	Incoming Materials (Rubber hose / SS pipe / SS wire braiding / Flanges / Coupling)	Chemical & Mechanical Properties & IGC (For SS items if applicable)	100%	Test Certificates	P	R		
3.0	In Process Inspection							
3.1	Welding	Welding Parameters as per WPS / PQR	100%	Inspection report	P	RW		
3.2	NDT As Applicable	Weld soundness	100%	Test Reports	P	RW		
4.0	Final Inspection							
4.1	Hydrostatic/Pneumatic Testing	Leak Check	100%	Test Report	P	W		
4.2	Vacuum test, Steam Resistance, Electrical Continuity and other tests as applicable	Leak & Soundness check	100%	Test Report	P	W		
4.3	Visual and Dimensional Inspection (VDI)	Surface Conditions & Dimension	100%	Inspection report	P	W (Note-3)		
4.4	PMI Check	Chemical Check	As Applicable	Inspection report	P	W		
4.5	Final Stamping	Stamping of Accepted items	100%	Inspection report	P	W		
5.0	Painting							
5.1	Painting & color Coding	Visual, DFT & Color coding as applicable	100%	Inspection Report	P	W		
6.0	Documentation & IC							
6.1	Final documents	Review of Stage Inspection report / Test Reports	100%	Supplier TC & IC	P	H	R	
6.2	Inspection release certificate	Issue of Inspection release certificate	100%	Supplier TC & IC	-	H	R	

Legend: H-Hold (Do not proceed with approval), P-Perform, RW-Random Witness (As specified or 10% (min.1 no.of each size and type of Bulk item)), R-Review, W-Witness (Give due notice, work may proceed after scheduled date).

NOTES (As applicable)

- This document describes the generic test requirements. Any additional test or Inspection scope if specified in contract documents shall also be applicable (unless otherwise agreed upon).
- Acceptance Norms for all the activities shall be as per PO/PR/STANDARDS referred there in Job specification / Approved Documents.
- 100% Visual & 10% dimensional checks of each size, pressure rating and type of component at vendors' works by Third Party Inspection (TPI) and surprise checks by PMC/OWNER.