

	<b>PROJECT</b>		<b>Standby SRU &amp; Additional Tanks IOCL Paradip Refinery</b>		
	<b>CLIENT</b>		<b>INDIAN OIL CORPORATION LIMITED</b>		
<b>WELDING SPECIFICATION CHARTS FOR PIPING CLASSES</b>	<b>Project No.</b> 080557C001	<b>Document No.</b> 080557C-000-PP-815		<b>Rev. No.</b> 2	Page 1 of 5

## WELDING SPECIFICATION CHARTS FOR PIPING CLASSES

2	10.03.2020	ISSUED FOR IMPLEMENTATION	TB	GM	GM	JMC
1	27.11.2019	ISSUED FOR IMPLEMENTATION	TB	GM	LA	JMC
0	16.10.2019	ISSUED FOR IMPLEMENTATION	NVK	PKP	LA	JMC
<b>REV.</b>	<b>DATE</b>	<b>DESCRIPTION</b>	<b>PREPARED</b>	<b>CHECKED</b>	<b>APPROVED</b>	<b>AUTHORIZED</b>



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

CONFIDENTIAL – Not to disclose without Authorization

 	PROJECT	Standby SRU & Additional Tanks IOCL Paradip Refinery		
	CLIENT	INDIAN OIL CORPORATION LIMITED		
WELDING SPECIFICATION CHARTS FOR PIPING CLASSES	Project No. 080557C001	Document No. 080557C-000-PP-815	Rev. No. 2	Page 2 of 5

## TABLE OF CONTENTS

1. INTRODUCTION .....	3
2. DEFINITIONS .....	3
3. SCOPE.....	4
4. REFERENCES .....	4
5. LIST OF SPECIFICATIONS CHARTS (Attached as Annexure-A).....	5

 	PROJECT	Standby SRU & Additional Tanks IOCL Paradip Refinery		
	CLIENT	INDIAN OIL CORPORATION LIMITED		
WELDING SPECIFICATION CHARTS FOR PIPING CLASSES	Project No. 080557C001	Document No. 080557C-000-PP-815	Rev. No. 2	Page 3 of 5

## 1. INTRODUCTION

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

## 2. DEFINITIONS

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

**“OWNER or IOCL”** shall mean INDIAN OIL CORPORATION LIMITED

**“CONSULTANT or PMC”** shall mean TECHNIP INDIA LIMITED

**“CONTRACTOR”** shall mean the bidder selected by the OWNER for performing the scope of works specified in the tender documents.

**“AUTHORISED REPRESENTATIVE”** shall mean OWNER's/ CONSULTANT's representative authorized to act for and on behalf of OWNER/ CONSULTANT, as the case may be

**“VENDOR”** shall mean any third party supplying any of the equipment/materials for setting up the Plant.

**“PROJECT”** shall mean Sulphur Recovery Unit and Additional Tanks Project, Paradip Refinery



**“PLANT”** shall mean the units and facilities comprised in the project, and if divided into different packages for the award of Contracts.

**“UNIT”** shall mean a particular process unit etc. which forms a distinct operating system and a part of the plant.

**“Sub- Contractor”** shall mean Sub-Contractor engaged by Contractor

## 2.2 ABBREVIATIONS

a. GTAW - Gas Tungsten Arc Welding

 	<b>PROJECT</b>		<b>Standby SRU &amp; Additional Tanks IOCL Paradip Refinery</b>		
	<b>CLIENT</b>		<b>INDIAN OIL CORPORATION LIMITED</b>		
<b>WELDING SPECIFICATION CHARTS FOR PIPING CLASSES</b>	<b>Project No.</b> 080557C001	<b>Document No.</b> 080557C-000-PP-815		<b>Rev. No.</b> 2	Page 4 of 5



- b. SMAW - Shielded Metal Arc Welding
- c. FCAW – Flux Cored Arc Welding
- d. SAW – Submerged Arc Welding
- e. WPS - Welding Procedure Specification
- f. PQR - Procedure Qualification record.
- g. AWS - American Welding Society
- h. QA/QC - Quality Assurance / Quality Control
- i. QAP - Quality Assurance Plan
- j. QCP - Quality Control Plan
- k. FQCP - Fabrication Quality Control Plan
- l. TPIA - Third Party Inspection Agency

### 3. SCOPE

This document describes the Welding Specifications for the piping classes covered by the Piping Material Specification issued for this Project. Contractor shall carry out Procedure Qualification under witnessing by PMC and submit the WPS with qualified PQR to OWNER /PMC for approval. Contractor shall consult with PMC for any additional essential variables to be considered or any additional qualification tests required over and above the normal qualification test requirements covered by ASME Section IX. Any deviation from this shall be approved through a deviation request specifically issued by Contractor and approved by PMC.

### 4. REFERENCES



- a. Indian Boiler Regulations
- b. ASME B31.3 – Refinery Piping
- c. ASME B31.1 – Power Piping
- d. ASME Sec IX – Qualification Standard for Welding, Brazing, and Fusing Procedures
- e. ASME Sec IIC - Specifications for Welding Rods, Electrodes, and Filler Metals



 	<b>PROJECT</b>		<b>Standby SRU &amp; Additional Tanks IOCL Paradip Refinery</b>		
	<b>CLIENT</b>		<b>INDIAN OIL CORPORATION LIMITED</b>		
<b>WELDING SPECIFICATION CHARTS FOR PIPING CLASSES</b>	<b>Project No.</b> 080557C001	<b>Document No.</b> 080557C-000-PP-815		<b>Rev. No.</b> 2	Page 5 of 5



- f. ASME Sec V – Non Destructive Examination
- g. AWS D 10.8 – Recommended Practices for Welding of Chromium-Molybdenum Steel Piping and Tubing
- h. API RP 582 - Welding Guidelines for the Chemical, Oil, and Gas Industries
- i. NACE MR0103 – Petroleum, petrochemical and natural gas industries — Metallic materials resistant to sulfide stress cracking in corrosive petroleum refining environments
- j. NACE SP0472 - Methods and Controls to Prevent In-Service Environmental Cracking of Carbon Steel Weldments in Corrosive Petroleum Refining Environments
- k. NACE TM0284 -Evaluation of Pipeline and Pressure Vessel Steels for Resistance to Hydrogen-Induced Cracking
- l. 080557C-000-JSD-1300-002 - Piping Material Specification
- m. 080557C-000-JSC-1300-001 - Standard Specification for Fabrication & Erection of Piping
- n. 080557C-000-PP-814 - Welding & NDE Specification for Fabrication of Piping

## 5. LIST OF SPECIFICATIONS CHARTS (Attached as Annexure-A)



1. WELDING CHART FOR CLASSES A3A, A17A, A23A, A29A, A30A, A53G
2. WELDING CHART FOR CLASSES A1A, A12A, A15A, A52A, A95A, B1A, B12A, D3A
3. WELDING CHART FOR CLASSES A2A, B2A, A31A, B31A, D2A, D31A
4. WELDING CHART FOR CLASSES A13A
5. WELDING CHART FOR CLASSES A8A, B19A
6. WELDING CHART FOR CLASSES A28A, A49A, B28A, B49A
7. WELDING CHART FOR CLASSES A1K
8. WELDING CHART FOR CLASSES A21N
9. WELDING CHART FOR CLASSES D9D
10. WELDING CHART FOR CLASSES D9L



 		PROJECT		Standby SRU & Additional Tanks, IOCL Paradip Refinery				
		CLIENT		INDIAN OIL CORPORATION LIMITED				
WELDING SPECIFICATION SHEET		NO :	PMS / 1300 / 01		Rev.	2	Date 27-Nov-19	
PIPING CLASS <b>A3A, A17A, A23A, A29A, A30A, A53G</b>								
MATERIAL SPECIFICATIONS		PIPES	ASTM A106Gr.B, IS - 3589 GR. 330 , GR.410, API 5L GR.B PSL2					
		FITTINGS	ASTM A 105, ASTM A 234 GR. WPB, ASTM A 234 GR. WPBW					
		FLANGES	ASTM A105N					
		OTHERS						
BASE METAL 'P' NO.		1						
WELDING PROCESS AND MATERIALS				GROOVE JOINTS ( NOTE 1 )				
BUTT				OTHER THAN BUTT				
PROCESS	GTAW	SMAW	FCAW		PROCESS	GTAW	SMAW	FCAW
PASS					PASS			
ROOT PASS (Note 2)	ER70S2	E 6010	NA		ROOT PASS (Note 3)	ER 70 S 2	E7018	NA
FILLER PASS	ER70S2	E 7016 / E 7018	E 71 T1		FILLER PASS	ER 70 S 2	E 7016 / E 7018	E 71 T1
WELDING PROCESS AND METALS				FILLET JOINTS/SW JOINTS				
PROCESS	GTAW	SMAW	FCAW					
PASS								
ROOT PASS (Note 2)	ER70S2	E7016/ E7018	NA					
FILLER PASS	ER70S2	E7016 / E7018	E 71 T1					
JOINT PREPARATION <b>ASME B 31.3</b>								
GASES		PURGING			SHIELDING			
PROCESS	GTAW	FCAW		PROCESS	GTAW	FCAW		
PURGING	NA	NA		SHIELDING	YES	Yes		
PURGING GAS NAME	NA	NA		GAS NAME	ARGON	Ar + CO2		
GAS COMPOSITION	NA	NA		GAS COMPOSITION	99.995	80% + 20%		
PREHEATING	PREHEAT TEMP	10° C MIN.	POST HEATING	NA				
CONTINUITY OF WELDING AND PREHEAT	YES		INTERPASS	250° C Max.				
POST WELD HEAT	HOLDING TEMP	NA	HOLDING TIME	NA				
TREATMENT	RATE OF HEATING	NA	MIN. HOLDING TIME	NA				
	METHOD OF COOLING	NA	RATE OF COOLING	NA				
MECHANICAL PROPERTY REQUIREMENTS				TEMP	MIN	AVERAGE		
CHARPY 'V' NOTCH IMPACT TEST VALUE				NA	NA	NA		
HARDNESS				NA				
CODE OF FABRICATION <b>ASME B 31.3</b>								
TECHNICAL NOTES								
NOTE 1: Any combination of welding process for groove weld can be used subject to qualification of the Welding Procedure								
NOTE 2: Entire welding of small bore piping, 2"NB and smaller shall be performed with GTAW.								
GTAW - GAS TUNGSTEN ARC WELDING FCAW - FLUX CORED ARC WELDING SMAW - SHIELDED METAL ARC WELDING								
(Prepared By)	(Checked By)	(Approved By)	CLIENT APPROVAL					



 		PROJECT		Standby SRU & Additional Tanks, IOCL Paradip Refinery			
		CLIENT		INDIAN OIL CORPORATION LIMITED			
WELDING SPECIFICATION SHEET		NO	PMS / 1300 / 02		Rev.	2	Date 27-Nov-19
PIPING CLASS      A1A, A12A, A15A, A52A, A95A, B1A, B12A, D3A							
MATERIAL SPECIFICATIONS		PIPES	ASTM A106Gr.B, ASTM A672Gr.C65 Cl.12,				
		FITTINGS	ASTM A234 WPB, ASTM A105N				
		FLANGES	ASTM A105N				
		OTHERS					
BASE METAL 'P' NO.		1					
WELDING PROCESS AND CONSUMABLES				GROOVE JOINTS (NOTE 1)			
BUTT				OTHER THAN BUTT			
PROCESS	GTAW	SMAW	FCAW	PROCESS	GTAW	SMAW	FCAW
PASS				PASS			
ROOT PASS (Note 2)	ER 70 S 2	E 6010	NA	ROOT PASS (Note 2)	ER 70S 2	E7018	NA
FILLER PASS	ER 70 S 2	E 7016 / E 7018	E 71 T1	FILLER PASS	ER 70S 2	E 7016 / E 7018	E 71 T1
WELDING PROCESS AND METALS				FILLET JOINTS/SW JOINTS			
PROCESS	GTAW	SMAW	FCAW				
PASS							
ROOT PASS (Note 3)	ER 70S2	E7016/ E7018	NA				
FILLER PASS	ER 70S2	E7016/ E7018	E 71 T1				
JOINT PREPARATION		ASME B 31.3					
GASES		PURGING		SHIELDING			
PROCESS	GTAW	FCAW		PROCESS	GTAW	FCAW	
PURGING	NA	NA		SHIELDING	YES	YES	
PURGING GAS NAME	NA	NA		GAS NAME	ARGON	Ar + CO2	
GAS COMPOSITION	NA	NA		GAS COMPOSITION	99.995	80% + 20%	
PREHEATING (NOTE 3)	PREHEAT TEMP	10° C MIN./ 100° C For thk. >25mm		POST HEATING	NA		
CONTINUITY OF WELDING AND PREHEAT		YES		INTERPASS	250° C Max.		
POST WELD HEAT TREATMENT	HOLDING TEMP	NA		HOLDING TIME	NA		
	RATE OF HEATING	NA		MIN. HOLDING TIME	NA		
(Note 4)	METHOD OF COOLING	NA		RATE OF COOLING	NA		
MECHANICAL PROPERTY REQUIREMENTS				TEMP	MIN	AVERAGE	
CHARPY 'V' NOTCH IMPACT TEST VALUE				NA	NA	NA	
HARDNESS				200 BHN Max , for PWHT Joints			
CODE OF FABRICATION		ASME B 31.3					
TECHNICAL NOTES							
NOTE 1: Any combination of welding process for groove weld can be used subject to qualification of the Welding Procedure							
NOTE 2: Entire welding of small bore piping, 2"NB and smaller shall be performed with GTAW.							
NOTE 3: Preheat Temperature of 50° C Shall be provided for the Root and next passes for thickness greater than 12.7mm and less than 25.4 mm							
NOTE 4 : Post Weld Heat treatment shall be performed as per ASME B31.3 for pipe wall thickness more than 19 mm at 620 +/- 20° C							
SMAW - SHIELDED METAL ARC WELDING				GTAW - GAS TUNGSTEN ARC WELDING			
FCAW - FLUX CORED ARC WELDING							
(Prepared By)	(Checked By)	(Approved By)	CLIENT APPROVAL				



 		PROJECT		Standby SRU & Additional Tanks, IOCL Paradip Refinery			
		CLIENT		INDIAN OIL CORPORATION LIMITED			
WELDING SPECIFICATION SHEET		NO :	PMS / 1300 / 03	Rev.	2	Date	27-Nov-19
PIPING CLASS <b>A2A, A31A, B2A, B31A, D2A, D31A</b>							
MATERIAL SPECIFICATIONS		PIPES	ASTM A106Gr.B, ASTM A672Gr.C65 Cl.12,				
		FITTINGS	ASTM A234 WPB, ASTM A105N				
		FLANGES	ASTM A105N				
		OTHERS					
BASE METAL 'P' NO. 1							
WELDING PROCESS AND MATERIALS				GROOVE JOINTS (NOTE 1)			
BUTT				OTHER THAN BUTT			
PROCESS	GTAW	SMAW		PROCESS	GTAW	SMAW	
PASS				PASS			
ROOT PASS (Note 2)	ER 70 S 2	E 6010		ROOT PASS (Note 2)	ER 70S 2	E7016 / E7018	
FILLER PASS	ER 70 S 2	E 7016 / E 7018		FILLER PASS	ER 70S 2	E 7016 / E 7018	
WELDING PROCESS AND METALS				FILLET JOINTS/SW JOINTS			
PROCESS	GTAW	SMAW					
PASS							
ROOT PASS (Note 2)	ER 70S2	E7016 / E7018					
FILLER PASS	ER 70S2	E7016 / E7018					
JOINT PREPARATION				ASME B 31.1 + IBR			
GASES		PURGING		SHIELDING			
PROCESS	GTAW			PROCESS	GTAW		
PURGING	NA			SHIELDING	YES		
PURGING GAS NAME	NA			GAS NAME	ARGON		
GAS COMPOSITION	NA			GAS COMPOSITION	99.995		
PREHEATING (Note 3)		PREHEAT TEMP	10° C MIN. / 100° C For thk. >25mm	POST HEATING		NA	
CONTINUITY OF WELDING AND PREHEAT		YES		INTERPASS		250° C Max.	
POST WELD HEAT		HOLDING TEMP	595° C to 620° C	HOLDING TIME		1 Hour/ Inch thk.	
TREATMENT (Note 4)		RATE OF HEATING	200° C / Hr Max.	MIN. HOLDING TIME		1 Hour	
		METHOD OF COOLING	Controlled	RATE OF COOLING		200° C / Hr Max.	
MECHANICAL PROPERTY REQUIREMENTS				TEMP MIN AVERAGE			
CHARPY 'V' NOTCH IMPACT TEST VALUE				NA NA NA			
HARDNESS				200 BHN Max , for PWHT Joints			
CODE OF FABRICATION				ASME B 31.1 & IBR			
TECHNICAL NOTES							
NOTE 1: Any combination of welding process for groove weld can be used subject to qualification of the Welding Procedure							
NOTE 2: Entire welding of small bore piping, 2"NB and smaller shall be performed with GTAW.							
NOTE 3: Preheat Temperature of 50° C Shall be provided for the Root and next passes for thickness greater than 12.7mm and less than 25.4 mm							
NOTE 4: For IBR Service, Post Weld Heat treatment shall be performed for pipe wall thickness more than 20mm							
GTAW - GAS TUNGSTEN ARC WELDING				SMAW - SHIELDED METAL ARC WELDING			
(Prepared By)		(Checked By)		(Approved By)		CLIENT APPROVAL	







 		PROJECT		Standby SRU & Additional Tanks, IOCL Paradip Refinery			
		CLIENT		INDIAN OIL CORPORATION LIMITED			
WELDING SPECIFICATION SHEET		NO	PMS / 1300 / 05		Rev.	3	Date 10-Mar-20
PIPING CLASS <b>A13A</b>							
MATERIAL SPECIFICATIONS (NOTE 5)		PIPES	ASTM A106Gr.B, ASTM A672Gr.C65 Cl.12,				
		FITTINGS	ASTM A234 WPB, ASTM A105N				
		FLANGES	ASTM A105N				
		OTHERS					
BASE METAL 'P' NO.		1					
WELDING PROCESS AND CONSUMABLES		GROOVE JOINTS (NOTE 1, 3)					
		BUTT			OTHER THAN BUTT		
PROCESS	GTAW	SMAW		PROCESS	GTAW	SMAW	
PASS				PASS			
ROOT PASS (Note 2)	ER 70 S 2	NA		ROOT PASS (Note 2)	ER 70S 2	NA	
FILLER PASS	ER 70 S 2	E 7016 / E 7018		FILLER PASS	ER 70S 2	E 7016 / E 7018	
WELDING PROCESS AND CONSUMABLES		FILLET JOINTS/SW JOINTS (NOTE 1, 3)					
PROCESS	GTAW	SMAW					
PASS							
ROOT PASS (Note 2)	ER 70S2	E7016/ E7018					
FILLER PASS	ER 70S2	E7016 / E7018					
JOINT PREPARATION		ASME B 31.3					
GASES		PURGING		SHIELDING			
PROCESS	GTAW			PROCESS	GTAW		
PURGING	NA			SHIELDING	YES		
PURGING GAS NAME	NA			GAS NAME	ARGON		
GAS COMPOSITION	NA			GAS COMPOSITION	99.995		
PREHEATING	PREHEAT TEMP	10° C MIN 100° C For thk. >25mm		POST HEATING	NA		
CONTINUITY OF WELDING AND PREHEAT		YES		INTERPASS	250° C Max.		
POST WELD HEAT	HOLDING TEMP	620 - 650 Deg C		HOLDING TIME	1 Hour/ Inch thk.		
TREATMENT	RATE OF HEATING	200° C / Hr Max.		MIN. HOLDING TIME	1 Hour		
(Note 4)	METHOD OF COOLING	Controlled		RATE OF COOLING	200° C / Hr Max.		
MECHANICAL PROPERTY REQUIREMENTS		TEMP	MIN	AVERAGE			
CHARPY 'V' NOTCH IMPACT TEST VALUE		NA	NA	NA			
HARDNESS		180 BHN Max for Weld deposit , HAZ & Base Metal 237 BHN (22HRC) Max. after PWHT					
CODE OF FABRICATION		ASME B 31.3 + NACE MR0103+NACE SP0472					
TECHNICAL NOTES							
NOTE 1: Any combination of welding process for groove weld can be used subject to qualification of the Welding Procedure							
NOTE 2: Entire welding of small bore piping, 2"NB and smaller shall be performed with GTAW.							
NOTE 3 : Electrodes/Filler metal chemical composition shall have the limitations --> Ni<1%,Mn<1.5%,							
NOTE 4: PWHT is mandatory for all thickness							
NOTE 5: Material shall meet the Applicable Material specifications and NACE MR 0103							
GTAW - GAS TUNGSTEN ARC WELDING				SMAW - SHIELDED METAL ARC WELDING			
(Prepared By)		(Checked By)		(Approved By)		CLIENT APPROVAL	



 		PROJECT		Standby SRU & Additional Tanks, IOCL Paradip Refinery			
		CLIENT		INDIAN OIL CORPORATION LIMITED			
WELDING SPECIFICATION SHEET		NO	PMS / 1300 / 04		Rev.	2	Date 10-Mar-20
PIPING CLASS <b>A8A,B19A</b>							
MATERIAL SPECIFICATIONS		PIPES	ASTM A106Gr.B, ASTM A672Gr.C65 Cl.12,				
		FITTINGS	ASTM A234 WPB, ASTM A105N				
		FLANGES	ASTM A105N				
		OTHERS					
BASE METAL 'P' NO.		1					
WELDING PROCESS AND CONSUMABLES		GROOVE JOINTS (NOTE 1)					
		BUTT			OTHER THAN BUTT		
PROCESS	GTAW	SMAW		PROCESS	GTAW	SMAW	
PASS				PASS			
ROOT PASS (Note 2)	ER 70 S 2	NA		ROOT PASS (Note 2)	ER 70S 2	NA	
FILLER PASS	ER 70 S 2	E 7016 / E 7018		FILLER PASS	ER 70S 2	E 7016 / E 7018	
WELDING PROCESS AND CONSUMABLES		FILLET JOINTS/SW JOINTS (NOTE 1)					
PROCESS	GTAW	SMAW					
PASS							
ROOT PASS (Note 2)	ER 70S2	E7016 / E7018					
FILLER PASS	ER 70S2	E7016 / E7018					
JOINT PREPARATION		ASME B 31.3					
GASES		PURGING		SHIELDING			
PROCESS	GTAW			PROCESS	GTAW		
PURGING	NA			SHIELDING	YES		
PURGING GAS NAME	NA			GAS NAME	ARGON		
GAS COMPOSITION	NA			GAS COMPOSITION	99.995		
PREHEATING	PREHEAT TEMP	10° C MIN 100° C For thk. >25mm		POST HEATING	NA		
CONTINUITY OF WELDING AND PREHEAT	YES			INTERPASS	250° C Max.		
POST WELD HEAT	HOLDING TEMP	620 - 650 Deg C		HOLDING TIME	1 Hour/ Inch thk.		
TREATMENT	RATE OF HEATING	200° C / Hr Max.		MIN. HOLDING TIME	1 Hour		
(Note 3)	METHOD OF COOLING	Controlled		RATE OF COOLING	200° C / Hr Max.		
MECHANICAL PROPERTY REQUIREMENTS		TEMP	MIN	AVERAGE			
CHARPY 'V' NOTCH IMPACT TEST VALUE		NA	NA	NA			
		HARDNESS	200 BHN Max for Weld deposit , HAZ & Base Metal 237 BHN (22HRC) Max. after PWHT				
CODE OF FABRICATION		ASME B 31.3					
TECHNICAL NOTES							
NOTE 1: Any combination of welding process for groove weld can be used subject to qualification of the Welding Procedure							
NOTE 2: Entire welding of small bore piping, 2"NB and smaller shall be performed with GTAW.							
NOTE 3: PWHT is mandatory for all thickness							
GTAW - GAS TUNGSTEN ARC WELDING				SMAW - SHIELDED METAL ARC WELDING			
(Prepared By)		(Checked By)		(Approved By)		CLIENT APPROVAL	

 		PROJECT		Standby SRU & Additional Tanks, IOCL Paradip Refinery			
		CLIENT		INDIAN OIL CORPORATION LIMITED			
WELDING SPECIFICATION SHEET		NO	PMS / 1300 / 05		Rev.	2	Date 27-Nov-19
PIPING CLASS <b>A28A,A49A,B28A,B49A</b>							
MATERIAL SPECIFICATIONS (NOTE 6)		PIPES	ASTM A106Gr.B, ASTM A672Gr.C65 Cl.12,				
		FITTINGS	ASTM A234 WPB, ASTM A105N				
		FLANGES	ASTM A105N				
		OTHERS					
BASE METAL 'P' NO.		1					
WELDING PROCESS AND CONSUMABLES		GROOVE JOINTS (NOTE 1,3 & 4)					
		BUTT			OTHER THAN BUTT		
PROCESS	GTAW	SMAW		PROCESS	GTAW	SMAW	
PASS				PASS			
ROOT PASS (Note 2)	ER 70 S 2	NA		ROOT PASS (Note 2)	ER 70S 2	NA	
FILLER PASS	ER 70 S 2	E 7016 / E 7018		FILLER PASS	ER 70S 2	E 7016 / E 7018	
WELDING PROCESS AND CONSUMABLES		FILLET JOINTS/SW JOINTS (NOTE 1,3 & 4)					
PROCESS	GTAW	SMAW					
PASS							
ROOT PASS (Note 2)	ER 70S2	E7016 / E7018					
FILLER PASS	ER 70S2	E7016 / E7018					
JOINT PREPARATION		ASME B 31.3					
GASES		PURGING			SHIELDING		
PROCESS	GTAW				PROCESS	GTAW	
PURGING	NA				SHIELDING	YES	
PURGING GAS NAME	NA				GAS NAME	ARGON	
GAS COMPOSITION	NA				GAS COMPOSITION	99.995	
PREHEATING	PREHEAT TEMP	10° C MIN 100° C For thk. >25mm		POST HEATING	NA		
CONTINUITY OF WELDING AND PREHEAT	YES			INTERPASS	250° C Max.		
POST WELD HEAT TREATMENT	HOLDING TEMP	620 - 650 Deg C		HOLDING TIME	1 Hour/ Inch thk.		
	RATE OF HEATING	200° C / Hr Max.		MIN. HOLDING TIME	1 Hour		
(NOTE 5)	METHOD OF COOLING	Controlled		RATE OF COOLING	200° C / Hr Max.		
MECHANICAL PROPERTY REQUIREMENTS		TEMP	MIN	AVERAGE			
CHARPY 'V' NOTCH IMPACT TEST VALUE		NA	NA	NA			
		HARDNESS	180 BHN Max for Weld deposit , HAZ & Basemetal 237 BHN (22HRC) Max. after PWHT				
CODE OF FABRICATION		ASME B 31.3 + NACE MR0103 + NACE SP0472+ NACE TM0284					
TECHNICAL NOTES							
NOTE 1: Any combination of welding process for groove weld can be used subject to qualification of the Welding Procedure							
NOTE 2: Entire welding of small bore piping, 2"NB and smaller shall be performed with GTAW.							
NOTE 3 : Electrodes/Fillermetal chemical composition shall have the limitations --> Ni<1%,Mn<1.5%,							
NOTE 4: Welding consumable shall be used with H4 Hydrogen diffusion Designator in order to comply with Licensor requirements							
NOTE 5: PWHT is mandatory for all thickness							
NOTE 6: In addition to compliance to NACE, HIC tested materials shall be used for fabrication.							
SMAW - SHIELDED METAL ARC WELDING				GTAW - GAS TUNGSTEN ARC WELDING			
(Prepared By)	(Checked By)	(Approved By)	CLIENT APPROVAL				

 		PROJECT		Standby SRU & Additional Tanks, IOCL Paradip Refinery			
		CLIENT		INDIAN OIL CORPORATION LIMITED			
WELDING SPECIFICATION SHEET		NO	PMS / 1300 / 08	Rev.	2	Date	10-Mar-20
PIPING CLASS <b>D9D</b>							
MATERIAL SPECIFICATIONS		PIPES	ASTM A335 Gr.P11				
		FITTINGS	ASTM A182 Gr.F11 Cl.2				
		FLANGES	ASTM A182 Gr.F11 Cl.2,				
		OTHERS					
BASE METAL 'P' NO.		4					
WELDING PROCESS AND CONSUMABLES							
BUTT				GROOVE JOINTS (NOTE 1)			
OTHER THAN BUTT							
PROCESS	GTAW	SMAW		PROCESS	GTAW	SMAW	
PASS				PASS			
ROOT PASS (Note 2)	ER 80 S B2	NA		ROOT PASS (Note 2)	ER 80 S B2	NA	
FILLER PASS	ER 80 S B2	E 8018 B2		FILLER PASS	ER 80 S B2	E 8018 B2	
WELDING PROCESS AND CONSUMABLES							
FILLET JOINTS/SW JOINTS (NOTE 1)							
PROCESS	GTAW	SMAW					
PASS							
ROOT PASS (Note 2)	ER 80 S B2	NA					
FILLER PASS	ER 80 S B2	E 8018 B2					
JOINT PREPARATION							
		ASME B 31.3					
GASES							
PURGING		SHIELDING					
PROCESS	GTAW		PROCESS	GTAW			
PURGING			SHIELDING	YES			
PURGING GAS NAME			GAS NAME	ARGON			
GAS COMPOSITION			GAS COMPOSITION	99.995			
PREHEATING							
PREHEAT TEMP	120° C Minimum		POST HEATING	Refer Note 4			
CONTINUITY OF WELDING AND PREHEAT	YES		INTERPASS	315° C Max			
POST WELD HEAT TREATMENT	HOLDING TEMP	650°C to 705°C	HOLDING TIME	1 HOUR / INCH for thickness ≤ 2 Inch			
	RATE OF HEATING	200° C / HOUR MAXIMUM	MIN. HOLDING TIME	120 Minutes			
(NOTE 3)	METHOD OF COOLING	Controlled	RATE OF COOLING	200° C / HOUR MAXIMUM			
MECHANICAL PROPERTY REQUIREMENTS							
CHARPY 'V' NOTCH IMPACT TEST VALUE	TEMP	MIN	AVERAGE				
	NA	NA	NA				
	HARDNESS	225 HBW Maximum					
CODE OF FABRICATION							
		ASME B 31.1 +IBR					
TECHNICAL NOTES							
NOTE 1: Any combination of welding process for groove weld can be used subject to qualification of the Welding Procedure							
NOTE 2: Entire welding of small bore piping, 2"NB and smaller shall be performed with GTAW.							
NOTE 3: PWHT is mandatory for all thickness							
NOTE 4: In the event of any interruption during welding, Clause 131.6 of ASME B31.1 shall be complied							
SMAW - SHIELDED METAL ARC WELDING				GTAW - GAS TUNGSTEN ARC WELDING			
(Prepared By)		(Checked By)		(Approved By)		CLIENT APPROVAL	

 		PROJECT		Standby SRU & Additional Tanks, IOCL Paradip Refinery			
		CLIENT		INDIAN OIL CORPORATION LIMITED			
WELDING SPECIFICATION SHEET		NO	PMS / 1300 / 09	Rev.	2	Date	10-Mar-20
PIPING CLASS <b>D9L</b>							
MATERIAL SPECIFICATIONS		PIPES	ASTM A335 Gr.P91				
		FITTINGS	ASTM A182 Gr.F91				
		FLANGES	ASTM A182 Gr.F91				
		OTHERS					
BASE METAL 'P' NO.		P 15E					
WELDING PROCESS AND CONSUMABLES		GROOVE JOINTS (NOTE 1)					
		BUTT			OTHER THAN BUTT		
PROCESS	GTAW	SMAW		PROCESS	GTAW	SMAW	
PASS				PASS			
ROOT PASS (Note 2)	ER 90 S B9	NA		ROOT PASS (Note 2)	ER 90 S B9	NA	
FILLER PASS	ER 90 S B9	E9018- B91		FILLER PASS	ER 90 S B9	E9018- B91	
WELDING PROCESS AND CONSUMABLES		FILLET JOINTS/SW JOINTS (NOTE 1)					
PROCESS	GTAW	SMAW					
PASS							
ROOT PASS (Note 2)	ER 90 S B9	E9018- B91					
FILLER PASS	ER 90 S B9						
JOINT PREPARATION		ASME B 31.3					
GASES		PURGING			SHIELDING		
PROCESS	GTAW				PROCESS	GTAW	
PURGING	YES				SHIELDING	YES	
PURGING GAS NAME	ARGON				GAS NAME	ARGON	
GAS COMPOSITION	99.995				GAS COMPOSITION	99.995	
PREHEATING	PREHEAT TEMP	200° C Minimum		POST HEATING	Refer Note 4		
CONTINUITY OF WELDING AND PREHEAT		YES		INTERPASS	315° C Max		
POST WELD HEAT TREATMENT	HOLDING TEMP	750 to 775		HOLDING TIME	1 HOUR / INCH		
	RATE OF HEATING	110° C / HOUR MAXIMUM		MIN. HOLDING TIME	120 Minutes		
(NOTE 3 & 5)	METHOD OF COOLING	Controlled		RATE OF COOLING	110° C / HOUR MAXIMUM		
MECHANICAL PROPERTY REQUIREMENTS		TEMP	MIN	AVERAGE			
CHARPY 'V' NOTCH IMPACT TEST VALUE		NA	NA	NA			
		HARDNESS	190 to 250 HBW				
CODE OF FABRICATION		ASME B 31.1+ IBR					
TECHNICAL NOTES							
NOTE 1: Any combination of welding process for groove weld can be used subject to qualification of the Welding Procedure							
NOTE 2: Entire welding of small bore piping, 2"NB and smaller shall be performed with GTAW.							
NOTE 3: PWHT is mandatory for all thickness							
NOTE 4: In the event of any interruption during welding, Clause 131.6 of ASME B31.1 shall be complied							
NOTE 5: Preheat, Interpass temperature and PWHT shall be done only with Electric coil heating with temperature chart recorder							
NOTE 6: Mn + Ni shall be 1.20% max for E9018-B91							
SMAW - SHIELDED METAL ARC WELDING				GTAW - GAS TUNGSTEN ARC WELDING			
(Prepared By)		(Checked By)		(Approved By)		CLIENT APPROVAL	

 		PROJECT		Standby SRU & Additional Tanks, IOCL Paradip Refinery			
		CLIENT		INDIAN OIL CORPORATION LIMITED			
WELDING SPECIFICATION SHEET		NO :	PMS / 1300 / 06	Rev.	2	Date	27-Nov-19
PIPING CLASS <b>A1K</b>							
MATERIAL SPECIFICATIONS		PIPES	ASTM A312TYP304L, ASTM A358 Gr.304L Cl.1				
		FITTINGS	ASTM A182F304L, ASTM A403Gr.WP304L				
		FLANGES	ASTM A182F304L				
		OTHERS					
BASE METAL 'P' NO. 8							
WELDING PROCESS AND MATERIALS				GROOVE JOINTS (NOTE 1)			
BUTT				OTHER THAN BUTT			
PROCESS	GTAW	SMAW		PROCESS	GTAW	SMAW	
PASS				PASS			
ROOT PASS (Note 1)	ER 308 L	NA		ROOT PASS (Note 1)	ER 308 L	NA	
FILLER PASS	ER 308 L	E 308L 15/16		FILLER PASS	ER 308L	E 308L 15/16	
WELDING PROCESS AND METALS				SOCKET/FILLET JOINTS			
PROCESS	GTAW	SMAW					
PASS							
ROOT PASS (Note 1)	ER 308 L	NA					
FILLER PASS	ER 308 L	E 308L 15/16					
JOINT PREPARATION		ASME B 31.3					
GASES		PURGING (NOTE 2)			SHIELDING		
PROCESS	GTAW			PROCESS	GTAW		
PURGING	YES			SHIELDING	YES		
PURGING GAS NAME	ARGON			GAS NAME	ARGON		
GAS COMPOSITION	99.995%			GAS COMPOSITION	99.995%		
PREHEATING							
PREHEAT TEMP	10° C MIN.	POST HEATING	NA				
CONTINUITY OF WELDING AND PREHEAT		YES	INTERPASS	150° C Max.			
POST WELD HEAT TREATMENT	HOLDING TEMP	NA	HOLDING TIME	NA			
	RATE OF HEATING	NA	MIN. HOLDING TIME	NA			
	METHOD OF COOLING	NA	RATE OF COOLING	NA			
MECHANICAL PROPERTY REQUIREMENTS				TEMP	MIN	AVERAGE	
CHARPY 'V' NOTCH IMPACT TEST VALUE			NA	NA	NA		
		HARDNESS					
CODE OF FABRICATION ASME B 31.3							
TECHNICAL NOTES							
Note 1: Entire welding of small bore piping, 2"NB and smaller shall be performed with GTAW.							
Note 2 - It is generally recommended that back purge gas shall be maintained for the first two fill pass welds							
<div style="display: flex; justify-content: space-around;"> <span>SMAW - SHIELDED METAL ARC WELDING</span> <span>GTAW - GAS TUNGSTEN ARC WELDING</span> </div>							
(Prepared By)		(Checked By)		(Approved By)		CLIENT APPROVAL	

 		PROJECT		Standby SRU & Additional Tanks, IOCL Paradip Refinery			
		CLIENT		INDIAN OIL CORPORATION LIMITED			
WELDING SPECIFICATION SHEET		NO :	PMS / 1300 / 07	Rev.	2	Date	27-Nov-19
PIPING CLASS <b>A21N</b>							
MATERIAL SPECIFICATIONS		PIPES	ASTM A312TYP316L, ASTM A358 Gr.316L Cl.1				
		FITTINGS	ASTM A182F316L, ASTM A403 Gr.WP316L				
		FLANGES	ASTM A182F316L				
		OTHERS					
BASE METAL 'P' NO.		8					
WELDING PROCESS AND MATERIALS				GROOVE JOINTS (NOTE 1)			
BUTT (NOTE 1)				OTHER THAN BUTT			
PROCESS	GTAW	SMAW		PROCESS	GTAW	SMAW	
PASS				PASS			
ROOT PASS (Note 1)	ER 316 L	NA		ROOT PASS (Note 1)	ER 316 L	NA	
FILLER PASS	ER 316 L 15/16	E 316 L 15/16		FILLER PASS	ER 316 L 15/16	E 316 L 15/16	
WELDING PROCESS AND METALS				SOCKET/FILLET JOINTS			
PROCESS	GTAW	SMAW					
PASS							
ROOT PASS (Note 1)	ER 316 L 15/16	NA					
FILLER PASS	ER 316 L 15/16	E 316 L 15/16					
JOINT PREPARATION		ASME B 31.3					
GASES		PURGING (Note 2)		SHIELDING			
PROCESS	GTAW			PROCESS	GTAW		
PURGING	YES			SHIELDING	YES		
PURGING GAS NAME	ARGON			GAS NAME	ARGON		
GAS COMPOSITION	99.995%			GAS COMPOSITION	99.995%		
PREHEATING		PREHEAT TEMP	10° C MIN.	POST HEATING	NA		
CONTINUITY OF WELDING AND PREHEAT		YES		INTERPASS	150° C Max.		
POST WELD HEAT TREATMENT		HOLDING TEMP	NA	HOLDING TIME	NA		
		RATE OF HEATING	NA	MIN. HOLDING TIME	NA		
		METHOD OF COOLING	NA	RATE OF COOLING	NA		
MECHANICAL PROPERTY REQUIREMENTS				TEMP	MIN	AVERAGE	
CHARPY 'V' NOTCH IMPACT TEST VALUE				NA	NA	NA	
HARDNESS				22 HRC Max. for NACE/H2S Service			
CODE OF FABRICATION		ASME B 31.3					
TECHNICAL NOTES							
NOTE 1: Entire welding of small bore piping, 2"NB and smaller shall be performed with GTAW.							
Note 2 - It is generally recommended that back purge gas shall be maintained for the first two fill pass welds							
<div style="display: flex; justify-content: space-around;"> <span>SMAW - SHIELDED METAL ARC WELDING</span> <span>GTAW - GAS TUNGSTEN ARC WELDING</span> </div>							
(Prepared By)		(Checked By)		(Approved By)		CLIENT APPROVAL	