

WELDING SPECIFICATION CHARTS FOR PIPING CLASSES

PROJECT : GANDHAR COMPRESSOR PROJECT

CLIENT : GAIL (INDIA) LIMITED

JOB NO. : B240

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GENERAL NOTES

1.1 Scope:

This document covers the Welding Specification for the piping classes covered in the Piping Material Specification (B240-000-83-41-SP-0001-0) WPS and PQR for the field fabrication and erection of piping system shall be made in conformity with this document. No deviations are acceptable unless specifically approved through prescribed deviation permit.

1.2 Reference Standards:

This document shall be read in conjunction with the latest revisions/editions of the following documents:

- a. Job Specification for Non Destructive Examination Requirements of Piping, EIL Spec. No. 6-44-0016
- b. ASME Boiler & Pressure Vessel Code – Sections V, VIII(Div.-1), IX & II-C
- c. ASME B31.3
- d. ASTM E10
- e. Standard Specification for Fabrication & Erection of Piping, EIL Spec.No. 6-44-0012
- f. Welding Specification for Fabrication of Piping, B240-000-02-42-WSP-0001.

1.3 GTAW process can be applied in place of SMAW process with a corresponding suitable filler metal for the application.

1.4 Abbreviations:

GTAW	:	Gas Tungsten Arc Welding
OD	:	Outer Diameter
PQR	:	Procedure Qualification Record
SMAW	:	Shielded Metal Arc Welding
WSC	:	Welding Specification Chart
WPS	:	Welding Procedure Specification

WSC FOR PIPING CLASSES: AA1A, BA1A, DA1A, EA1A				
MATERIAL SPECIFICATIONS	PIPES	ASTM A 333 GR.6, ASTM A106 GR.B, API 5L GR.B PSL2, API 5L GR.X-52 PSL2		
	FITTINGS	ASTM A234 GR.WPB , MSS SP-75 GR.WPHY-52, ASTM A 234 GR.WPB-W		
	FLANGES	ASTM 105, ASTM A694 GR.F-52		
	OTHERS	-		
BASE METAL 'P' NO	1			
WELDING PROCESS	GROOVE JOINTS			
	BUTT		OTHER THAN BUTT	
	ROOT PASS: SMAW/ GTAW (NOTE-1)	FILLERPASS: SMAW/GTAW (NOTE-2)	ROOTPASS: SMAW/ GTAW	FILLER PASS: SMAW/ GTAW
	FILLET JOINTS/ SOCKET JOINTS: SMAW			
WELDING MATERIALS	GROOVE JOINTS			
	BUTT		OTHER THAN BUTT	
	ROOT PASS: E6010/ ER70S-2	FILLER PASS: E7016/ E7018 / ER70S-2	ROOT PASS: E6010/ ER70S-2	FILLER PASS: E7016/ E7018/ ER70S-2
	FILLET JOINT/SOCKET JOINT: E7016/E7018			
	BACKING RING: NA		CONSUMABLE INSERT: NA	
JOINT PREPARATION	ASME B31.8			
GASES	PURGING: -		SHIELDING: ARGON	
GAS COMPOSITION	PURGING: -		SHIELDING: 99.995 %	
PREHEATING	PREHEAT TEMP: +10°C MIN./ 100°C MIN. FOR THK.>25.4 MM (NOTE-3)		INTERPASS TEMP.: ---	
POST HEATING: -				
POST WELD HEAT TREATMENT	HOLDING TEMP: -		HOLDING TIME: -	
	RATE OF HEATING: -		MIN. HOLDING TIME: -	
	METHOD OF COOLING: -		RATE OF COOLING: -	
MECHANICAL PROPERTY REQUIREMENTS	CHARPY 'V' NOTCH VALUE: (NOTE -4)		MIN: 27 J	AVERAGE: ---
	AT TEMPERATURE:		MINUS (-) 29°C	
	HARDNESS: 248 HV 10 MAXIMUM			
CODE OF FABRICATION	ASME B31.8/API 1104/ASME SECTION IX & OISD 226			

TECHNICAL NOTES:

1. THE ROOT PASS FOR SINGLE SIDE WELDING SHALL BE DONE BY GTAW PROCESS.
2. FOR PIPING SIZES 2" OD AND BELOW SHALL BE ENTIRELY WELDED BY GTAW PROCESS.
3. PRE-HEAT TEMPERATURE OF ATLEAST 50°C SHALL BE PROVIDED FOR THE FIRST TWO PASSES FOR THK.>=12.5 mm & ≤ 25 mm.
4. DURING WELDING PROCEDURE QUALIFICATION, WELD METAL AND HAZ SHALL SHOW MINIMUM IMPACT VALUE OF 27 J AT MINUS TWENTY NINE DEGREE CELSIUS AND CROSS SECTIONAL HARDNESS OF 248 HV10.

WSC FOR PIPING CLASSES: DA1A				
MATERIAL SPECIFICATIONS	PIPES	API 5L GR.X70 PSL-2, API 5L GR.X60 PSL-2		
	FITTINGS	---		
	FLANGES	ASTM A694 GR.F-70, ASTM A694 GR.F-60		
	OTHERS	-		
BASE METAL 'P' NO	1			
WELDING PROCESS	GROOVE JOINTS			
	BUTT		OTHER THAN BUTT	
	ROOT PASS: SMAW/ GTAW	FILLERPASS: SMAW	ROOTPASS: SMAW/ GTAW	FILLER PASS: SMAW
	FILLET JOINTS/ SOCKET JOINTS: SMAW			
WELDING MATERIALS	GROOVE JOINTS			
	BUTT		OTHER THAN BUTT	
	ROOT PASS: E6010/ ER70S-2	FILLER PASS: E8018-G/ E8010-P1 (NOTE-1)	ROOT PASS: E6010/ ER70S-2	FILLER PASS: E8018-G/ E8010-P1 (NOTE-1)
	FILLET JOINT/SOCKET JOINT: E8018-G (NOTE-1)			
	BACKING RING: NA		CONSUMABLE INSERT: NA	
JOINT PREPARATION	ASME B31.8			
GASES	PURGING: -		SHIELDING: ARGON	
GAS COMPOSITION	PURGING: -		SHIELDING: 99.995 %	
PREHEATING	PREHEAT TEMP: +10°C MIN./ 100°C MIN. FOR THK.>25.4 MM (NOTE-2)		INTERPASS TEMP.: ---	
POST HEATING: -				
POST WELD HEAT TREATMENT	HOLDING TEMP: -		HOLDING TIME: -	
	RATE OF HEATING: -		MIN. HOLDING TIME: -	
	METHOD OF COOLING: -		RATE OF COOLING: -	
MECHANICAL PROPERTY REQUIREMENTS	CHARPY 'V' NOTCH VALUE: (NOTE-3)		MIN: 27 J	AVERAGE: ---
	AT TEMPERATURE:		MINUS (-) 29°C	
	HARDNESS: 248 HV 10 MAXIMUM			
CODE OF FABRICATION	ASME B31.8/API 1104/ASME SECTION IX & OISD 226			

TECHNICAL NOTES:

- EACH BATCH OF ELECTRODES SHALL MEET THE MINIMUM TENSILE AND YIELD STRENGTH OF API 5L GR.X70 PSL2 MATERIAL.
- PRE-HEAT TEMPERATURE OF ATLEAST 50°C SHALL BE PROVIDED FOR THE FIRST TWO PASSES FOR THK.>=12.5 mm & ≤ 25 mm.
- DURING WELDING PROCEDURE QUALIFICATION, WELD METAL AND HAZ SHALL SHOW MINIMUM IMPACT VALUE OF 27 J AT MINUS TWENTY NINE DEGREE CELSIUS AND CROSS SECTIONAL HARDNESS OF 248 HV10.
- DURING WELDING OF API 5L GR.X-70/60 PSL2/EQUIVALENT MATERIAL TO ANY OTHER MATERIAL GRADE GIVEN IN AA1A/BA1A/DA1A/EA1A PIPING CLASS, WELDING CONSUMABLES SPECIFIED IN THIS CHART SHALL BE USED.

WSC FOR PIPING CLASSES: AA3A				
MATERIAL SPECIFICATIONS	PIPES	ASTM A106 GR.B		
	FITTINGS	ASTM A234 GR.WPB		
	FLANGES	ASTM 105		
	OTHERS	-		
BASE METAL 'P' NO	1			
WELDING PROCESS	GROOVE JOINTS			
	BUTT		OTHER THAN BUTT	
	ROOT PASS: SMAW	FILLERPASS: SMAW	ROOTPASS: SMAW	FILLER PASS: SMAW
	FILLET JOINTS/ SOCKET JOINTS: SMAW			
WELDING MATERIALS	GROOVE JOINTS			
	BUTT		OTHER THAN BUTT	
	ROOT PASS: E6010	FILLER PASS: E6013/ E7018/E7016	ROOT PASS: E6010	FILLER PASS: E6013/ E7018/E7016
	FILLET JOINT/SOCKET JOINT: E6013/E7018/E7016			
	BACKING RING: NA		CONSUMABLE INSERT: NA	
JOINT PREPARATION	ASME B31.8			
GASES	PURGING: -		SHIELDING: ---	
GAS COMPOSITION	PURGING: -		SHIELDING: ---	
PREHEATING	PREHEAT TEMP: +10°C MIN./ 100°C MIN. FOR THK.>25.4 MM (NOTE-1)		INTERPASS TEMP.: ---	
POST HEATING: -				
POST WELD HEAT TREATMENT	HOLDING TEMP: -		HOLDING TIME: -	
	RATE OF HEATING: -		MIN. HOLDING TIME: -	
	METHOD OF COOLING: -		RATE OF COOLING: -	
MECHANICAL PROPERTY REQUIREMENTS	CHARPY 'V' NOTCH VALUE:		MIN: ---	AVERAGE: ---
	AT TEMPERATURE:		----	
	HARDNESS: ---			
CODE OF FABRICATION	ASME B31.8/API 1104/ASME SECTION IX & OISD 226			

TECHNICAL NOTES:

1. PRE-HEAT TEMPERATURE OF ATLEAST 50°C SHALL BE PROVIDED FOR THE FIRST TWO PASSES FOR THK>=12.5 mm & ≤ 25 mm.

WSC FOR PIPING CLASSES: AA4A, BA4A, DA4A, EA4A				
MATERIAL SPECIFICATIONS	PIPES	ASTM A 333 GR.6		
	FITTINGS	ASTM A 420 GR.WPL6, ASTM A 420 GR.WPL6-W		
	FLANGES	ASTM A 350 GR.LF2 CL.1		
	OTHERS	-		
BASE METAL 'P' NO	1			
WELDING PROCESS	GROOVE JOINTS			
	BUTT		OTHER THAN BUTT	
	ROOT PASS: GTAW	FILLERPASS: SMAW/GTAW (NOTE-1)	ROOTPASS: GTAW	FILLER PASS: SMAW/GTAW
	FILLET JOINTS/ SOCKET JOINTS: SMAW			
WELDING MATERIALS	GROOVE JOINTS			
	BUTT		OTHER THAN BUTT	
	ROOT PASS: ER80S-Ni1 (NOTE-2)	FILLER PASS: E7016-1/ E7018-1 / ER80S-Ni1 (NOTE-2)	ROOT PASS: ER80S-Ni1 (NOTE-2)	FILLER PASS: E7016-1/ E7018-1 / ER80S-Ni1 (NOTE-2)
	FILLER JOINT/SOCKET JOINT: E7016-1/E7018-1 (NOTE-2)			
	BACKING RING: NA		CONSUMABLE INSERT: NA	
JOINT PREPARATION	ASME B31.8			
GASES	PURGING: -		SHIELDING: ARGON	
GAS COMPOSITION	PURGING: -		SHIELDING: 99.995 %	
PREHEATING	PREHEAT TEMP: +10°C MIN./ 100°C MIN. FOR THK.>25.4 MM (NOTE-3)		INTERPASS TEMP.: 315°C MAX.	
POST HEATING: -				
POST WELD HEAT TREATMENT	HOLDING TEMP: -		HOLDING TIME: -	
	RATE OF HEATING: -		MIN. HOLDING TIME: -	
	METHOD OF COOLING: -		RATE OF COOLING: -	
MECHANICAL PROPERTY REQUIREMENTS	CHARPY 'V' NOTCH VALUE: (NOTE-4)		MIN: 27 J	AVERAGE: ---
	AT TEMPERATURE:		-45°C	
	HARDNESS: 200 BHN MAX.			
CODE OF FABRICATION	ASME B31.8/API 1104/ASME SECTION IX & OISD 226			

TECHNICAL NOTES:

- FOR PIPING SIZES 2" OD AND BELOW SHALL BE ENTIRELY WELDED BY GTAW PROCESS.
- EACH BATCH SHALL BE IMPACT TESTED AT SITE AS PER ASME SECTION II PART C. IMACT TESTING SHALL BE CARRIED OUT AT -45°C.
- PRE-HEAT TEMPERATURE OF ATLEAST 50°C SHALL BE PROVIDED FOR THE FIRST TWO PASSES FOR THK>=12.5 mm & ≤ 25 mm.
- DURING PROCEDURE QUALLIFICATION, STANDARD-SIZE CHARPY TEST PIECES SHALL DEMONSTRATE MINIMUM IMPACT VALUE OF 27 J. THE TEST TEMPERATURE SHALL BE MINUS (-) FORTY FIVE DEGREE CELSIUS.

WSC FOR PIPING CLASSES: AA1K, BA1K				
MATERIAL SPECIFICATIONS	PIPES	ASTM A312 TP304		
	FITTINGS	ASTM 182 GR. F304, ASTM A403 GR. WP304-S		
	FLANGES	ASTM A182 GR.F304		
	OTHERS	-		
BASE METAL 'P' NO	8			
WELDING PROCESS	GROOVE JOINTS			
	BUTT		OTHER THAN BUTT	
	ROOT PASS: GTAW	FILLER PASS: GTAW/ SMAW (NOTE-1)	ROOTPASS: GTAW /SMAW	FILLER PASS: GTAW / SMAW
	FILLET JOINTS/ SOCKET JOINTS: SMAW			
WELDING MATERIALS	GROOVE JOINTS			
	BUTT		OTHER THAN BUTT	
	ROOT PASS: ER 308 / ER 308L	FILLER PASS: ER308/ ER 308L / E308-15/16/ E308L-15/16	ROOT PASS: ER 308/ ER 308L / E308-15/16/ E308L-15/16	FILLER PASS: ER 308/ ER 308L / E308-15/16/ E308L-15/16
	FILLET JOINT/SOCKET JOINT: E308-15/16/ E308L-15/16			
	BACKING RING: NA		CONSUMABLE INSERT: NA	
JOINT PREPARATION	ASME B31.8			
GASES	PURGING: - ARGON		SHIELDING: ARGON	
GAS COMPOSITION	PURGING: - 99.995%		SHIELDING: 99.995 %	
PREHEATING	PREHEAT TEMP: 10°C MIN.		INTERPASS TEMP.: 175°C MAX	
POST HEATING: -				
POST WELD HEAT TREATMENT	HOLDING TEMP: -		HOLDING TIME: -	
	RATE OF HEATING: -		MIN. HOLDING TIME: -	
	METHOD OF COOLING: -		RATE OF COOLING: -	
MECHANICAL PROPERTY REQUIREMENTS	CHARPY 'V' NOTCH VALUE:		MIN: ---	AVERAGE: ---
	AT TEMPERATURE:		---	
	HARDNESS:			
CODE OF FABRICATION	ASME B31.8/API 1104/ASME SECTION IX & OISD 226			

TECHNICAL NOTES:

- FOR PIPING SIZES 2" OD AND BELOW SHALL BE ENTIRELY WELDED BY GTAW PROCESS.