

## PIPING CLASS: AC1S3D-FH

### SECTION 1.0 – GENERAL

<b>PIPE CLASS:</b>	<b>AC1S3D-FH</b>	<b>DESIGN CODE:</b>	ASME B31.3
<b>RATING:</b>	150	<b>PWHT:</b>	NOTE 5
<b>FLANGE FACE:</b>	RF	<b>VALVE TRIM:</b>	ALLOY 625
<b>BASIC MATERIAL:</b>	CARBON STEEL (GROUP 1.1)	<b>SOUR:</b>	YES (NOTE 4 & 13)
<b>CORROSION ALLOWANCE:</b>	3.0 MM	<b>SPECIAL REQUIREMENT:</b>	NACE

### TEMPERATURE (DEG.C) AND PRESSURE (BARG) RATING - (NOTE-22)

<b>TEMP.</b>	-29	0	50	100	150	200	250	300	350	400
<b>PRESS.</b>	19.6	19.6	19.2	17.7	15.8	13.8	12.1	10.2	8.40	6.5

### SERVICE

REFER TO PIPING CLASS INDEX

### SIZE RANGE, PIPE WALL THICKNESS (MM) TABLE – (NOTE-80)

<b>NPS</b>	½	¾	1	1 ½	2	3	4	6	8	10	12
<b>SCHEDULE</b>	XXS	160	160	160	160	80	80	40	30	30	30
<b>THICKNESS</b>	7.47	5.56	6.35	7.14	8.74	7.62	8.56	7.11	7.04	7.80	8.38

<b>NPS</b>	14	16	18	20	24	30	36	42	48	52	56
<b>SCHEDULE</b>	20	20	20	20	20	-	-	-	-	-	-
<b>THICKNESS</b>	7.92	7.92	7.92	9.53	9.53	CALC	CALC	CALC	CALC	CALC	CALC

<b>NPS</b>	60
<b>SCHEDULE</b>	-
<b>THICKNESS</b>	CALC

## PIPING CLASS: AC1S3D-FH

### SECTION 2.0 - NOTES

#### GENERAL NOTES

1. IN LINE WITH AGES-GL-08-001 (PROCESS DESIGN BASIS) THE MINIMUM PIPING SIZE IS NPS 1. HOWEVER, THE LINE SIZE IN THIS CLASS NPS 3/4 & NPS 1/2 ARE INCLUDED FOR INSTRUMENT CONNECTIONS ONLY.
2. ALL BUTT-WELDED COMPONENT THICKNESSES SHALL MATCH THE PIPE THICKNESS.
3. FOR SPECTACLE BLINDS (FIG-8 FLANGES) & BLINDS REFER TO SPECIFICATION AGES-SP-09-002.
4. ALL MATERIAL FOR SOUR SERVICE SHALL CONFORM TO THE REQUIREMENTS FOR MATERIAL SELECTION GUIDELINES AGES-GL-07-001, REQUIREMENTS FOR MATERIALS IN SEVERE SERVICE AGES-SP-07-003 AND NACE MR0175/ISO 15156 (FOR UPSTREAM) & NACE MR0103/ISO 17945 (FOR REFINERY SERVICE).
5. PWHT SHALL BE BASED ON ASME B31.3 AND THE REQUIREMENTS OF SPECIFICATION AGES-SP-09-002 PIPING MATERIAL SPECIFICATION INDEX. FOR SOUR SERVICE PWHT REQUIREMENT SHALL BE ALSO GOVERNED BY HARDNESS CRITERIA AS PER NACE MR0175 / ISO 15156 (FOR UPSTREAM) & NACE MR0103/ISO 17945 (FOR REFINERY SERVICE).
13. FOR SOUR/ LETHAL SERVICE 100%RT,100%MT/PT HAS TO BE CONSIDERED IRRESPECTIVE OF RATING IN LINE WITH REQUIREMENT FOR MATERIALS IN SEVERE SERVICE AGES-SP-07-003.
16. ALL VALVES IN SOUR OR TOXIC OR HYDROCARBON SERVICE SHALL MEET FUGITIVE EMISSION TESTING REQUIREMENTS AS PER BS EN ISO 15848 PART-1 & PART-2 WITH LEAKAGE CLASS 'BH' (REFER TO VALVE SPECIFICATION AGES-SP-09-003).
22. ALL PIPING COMPONENTS UPTO NPS 24 SHALL BE DESIGNED FOR VACUUM CONDITION AT AMBIENT TEMPERATURE. FOR HIGHER SIZES VACUUM DESIGN SHALL BE APPLICABLE IF INDICATED IN THE LINELIST.
27. CS PIPE AND PIPE COMPONENTS WITH NOMINAL THICKNESS GREATER THAN 5.08 MM SHALL BE IMPACT TESTED AT -29 °C OR LTCS MATERIAL MAY BE USED INSTEAD.
31. FOR CS & LTCS WELDED PIPE USED IN DOWNSTREAM SOUR & SEVERE SERVICE APPLICATION I.E. NACE MR0103/ISO 17945, ASTM A671-CC65 CLASS 32 & ASTM A672-C65 CLASS 32 SHALL BE USED RESPECTIVELY IN PLACE OF ASTM A671-CC65 CLASS 22 & ASTM A672-C65 CLASS 22.
33. TO BE USED FOR FLANGED CLASS 300 RF CONNECTION.
39. DELETED.
43. THREADED JOINTS ARE NOT PERMITTED.
54. COMPLETE ORIFICE ASSEMBLY SHALL BE SUPPLIED WITH PAIR OF ORIFICE FLANGES EACH HAVING ONE NPS 1/2 FLANGED TAP (RATING SAME AS PIPE CLASS).
70. LOW STRESS SPIRAL WOUND GASKET.
71. TO BE USED ONLY WHEN INDICATED ON THE P&ID.
73. NIPOFLANGE SHALL BE USED FOR THERMOWELL CONNECTION FOR HEADER NPS 4 AND ABOVE.
74. FOR BOLT COATING ABOVE 200 DEG C SUITABLE PROPRIETARY COATINGS WITH PRIOR COMPANY APPROVAL SHALL BE PROPOSED.
80. THE PIPE THICKNESS ARE CALCULATED BASED ON P-T RATING TABLE FOR THIS CLASS, HOWEVER FOR SIZES NPS 26 AND ABOVE THICKNESS SHALL BE CALCULATED BASED ON PROJECT PROCESS DESIGN PARAMETER.
81. PIPING CLASS COVERS ALL TYPES OF VALVES NORMALLY USED IN THE INDUSTRY. HOWEVER, VALVE TYPE SELECTION SHALL BE AS PER PROCESS ISOLATION PHILOSOPHY (AGES-PH-08-001, AGES-SP-09-003) AND P&ID.
82. WELDED PIPES AND WELDED FITTINGS SHALL BE 100% RADIOGRAPHED. WALL THICKNESS NEGATIVE TOLERANCES OF WELDED FITTINGS SHALL NOT BE LESS THAN WELDED PIPE.
83. WHEN SMALL END OF REDUCER IS NPS 16 & BELOW THE REDUCER SHALL BE SEAMLESS.
85. SMALL BORE PIPE THE MINIMUM SCHEDULE SHALL BE AS PER AGES-SP-09-001 APPENDIX A1.
86. DISSIMILAR FLANGE MATERIAL SHALL BE SEPERATED USING INSULATING GASKET, ONLY TO BE USED WHEN STATED IN CORROSION REPORT AND IN P&ID OR OTHERWISE WITH COMPANY APPROVAL. FOR HYDROCARBON SERVICE FIRE SAFE INSULATING GASKET IS MANDATORY (REFER AGES-SP-09-005 FOR INSULATING GASKET DETAILS).

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- 87. ALL BUTTERFLY VALVES IN HYDROCARBON & CRITICAL SERVICE SHALL BE TRIPLE OFFSET TYPE. FOR TRIPLE OFFSET BUTTERFLY VALVE, SHORT / LONG PATTERN SHALL BE DECIDED BASED ON LAYOUT REQUIREMENTS. FOR UTILITY SERVICES DOUBLE OFFSET BUTTERFLY CAN BE CONSIDERED.
- 90. PIPING TO INSTRUMENT IDBB, FLANGED ON BOTH PROCESS SIDE AND INSTRUMENT SIDE. TO BE USED IN SOUR, TOXIC, SULPHURIC ACID AND VIBRATING SERVICE.
- 93. 45 DEGREE BRANCH TABLE INCLUDED IS GENERIC FOR FLARE SERVICE ONLY. REQUIREMENT FOR REINFORCEMENT PAD SHALL BE CHECKED AGAINST RESPECTIVE PROJECT DESIGN DATA.
- 95. ADDITIONAL REINFORCEMENT IF ANY DUE TO AIV/FIV/STRESS SHALL BE CONSIDERED DURING THE PROJECT STAGE.

## 90° BRANCH CONNECTIONS

[illegible]

<b>C</b>	CALCULATION IN ACCORDANCE WITH ASME B31.3
<b>E</b>	EQUAL TEE
<b>T</b>	REDUCING TEE
<b>TR</b>	REDUCING TEE + REDUCER
<b>W</b>	WELDOLET

### 45° BRANCH CONNECTIONS (NOTE -93 & 95)

BRANCH PIPE (NPS)	60																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
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**A** EQUAL LATERAL TEE  
**B** REDUCING LATERAL TEE  
**LR** REDUCING LATERAL TEE + REDUCER  
**L** LATEROLET

## PIPING CLASS: AC1S3D-FH

### SECTION 4.0 – PIPING COMPONENTS

COMPONENT (TYP)	NPS (INCH)		END	DESCRIPTION	DIM/ MFG STD.	MATERIAL STD.	NOTES
	FROM	TO					
PIPE							
PIPE	½	16	BE	SEAMLESS	B36.10	ASTM A106 GR B, SOUR SERVICE	1,27,85
PIPE	18	60	BE	WELDED	B36.10	ASTM A672 GR.C65 CL.22, SOUR SERVICE	27,31, 82
NIPPLE	2	2	BE	AS PIPE, L=100mm	B36.10	ASTM A106 GR B, SOUR SERVICE	27,85
FITTINGS							
ELBOW	½	16	BE	90 DEGREE, LR, WROUGHT, SEAMLESS	B16.9	ASTM A234 GR. WPB-S, SOUR SERVICE	2,27
ELBOW	18	48	BE	90 DEGREE, LR, WROUGHT, WELDED	B16.9	ASTM A234 GR. WPB-W, SOUR SERVICE	2,27,82
ELBOW	52	60	BE	90 DEGREE, LR, WROUGHT, WELDED	MSS SP 75	ASTM A234 GR. WPB-W, SOUR SERVICE	2,27,82
ELBOW	½	16	BE	45 DEGREE, LR, WROUGHT, SEAMLESS	B16.9	ASTM A234 GR. WPB-S, SOUR SERVICE	2,27
ELBOW	18	48	BE	45 DEGREE, LR, WROUGHT, WELDED	B16.9	ASTM A234 GR. WPB-W, SOUR SERVICE	2,27,82
ELBOW	52	60	BE	45 DEGREE, LR, WROUGHT, WELDED	MSS SP 75	ASTM A234 GR. WPB-W, SOUR SERVICE	2,27,82
REDUCER	¾	16	BE	CONCENTRIC, WROUGHT, SEAMLESS	B16.9	ASTM A234 GR. WPB-S, SOUR SERVICE	2,27
REDUCER	18	48	BE	CONCENTRIC, WROUGHT, WELDED	B16.9	ASTM A234 GR. WPB-W, SOUR SERVICE	2,27,82, 83
REDUCER	52	60	BE	CONCENTRIC, WROUGHT, WELDED	MSS SP 75	ASTM A234 GR. WPB-W, SOUR SERVICE	2,27,82
REDUCER	¾	16	BE	ECCENTRIC, WROUGHT, SEAMLESS	B16.9	ASTM A234 GR. WPB-S, SOUR SERVICE	2,27
REDUCER	18	48	BE	ECCENTRIC, WROUGHT, WELDED	B16.9	ASTM A234 GR. WPB-W, SOUR SERVICE	2,27,82, 83

**PIPING CLASS: AC1S3D-FH**

COMPONENT (TYP)	NPS (INCH)		END	DESCRIPTION	DIM/ MFG STD.	MATERIAL STD.	NOTES
	FROM	TO					
FITTINGS-CONT, D							
REDUCER	52	60	BE	CONCENTRIC, WROUGHT, WELDED	MSS SP 75	ASTM A234 GR. WPB-W, SOUR SERVICE	2,27,82
CAP	½	48	BE	WROUGHT, SEAMLESS	B16.9	ASTM A234 GR. WPB-S, SOUR SERVICE	2.27
CAP	52	60	BE	WROUGHT, SEAMLESS	MSS SP 75	ASTM A234 GR. WPB-S, SOUR SERVICE	2.27
BRANCH FITTINGS							
TEE	½	16	BE	EQUAL, WROUGHT, SEAMLESS	B16.9	ASTM A234 GR. WPB-S, SOUR SERVICE	2,27
TEE	18	48	BE	EQUAL WROUGHT, WELDED	B16.9	ASTM A234 GR. WPB-W, SOUR SERVICE	2,27,82
TEE	52	60	BE	EQUAL WROUGHT, WELDED	MSS SP 75	ASTM A234 GR. WPB-W, SOUR SERVICE	2,27,82
TEE	¾	16	BE	REDUCING, WROUGHT, SEAMLESS	B16.9	ASTM A234 GR. WPB-S, SOUR SERVICE	2,27
TEE	18	48	BE	REDUCING, WROUGHT, WELDED	B16.9	ASTM A234 GR. WPB-W, SOUR SERVICE	2,27,82
TEE	52	60	BE	REDUCING, WROUGHT, WELDED	MSS SP 75	ASTM A234 GR. WPB-W, SOUR SERVICE	2,27,82
LATERAL	½	16	BE	EQUAL LATERAL TEE 45 DEG, WROUGHT, SEAMLESS	MANF. STD	ASTM A234 GR. WPB-S, SOUR SERVICE	2,27,82, 93
LATERAL	18	60	BE	EQUAL LATERAL TEE 45 DEG, WROUGHT, WELDED	MANF. STD	ASTM A234 GR. WPB-W, SOUR SERVICE	2,27,82, 93
LATERAL	¾	16	BE	REDUCING LATERAL TEE 45 DEG, WROUGHT, SEAMLESS	MANF. STD	ASTM A234 GR. WPB-S, SOUR SERVICE	2,27,82, 93
LATERAL	18	60	BE	REDUCING LATERAL TEE 45 DEG, WROUGHT, WELDED	MANF. STD	ASTM A234 GR. WPB-W, SOUR SERVICE	2,27,82, 93

**PIPING CLASS: AC1S3D-FH**

COMPONENT (TYP)	NPS (INCH)		END	DESCRIPTION	DIM/ MFG STD.	MATERIAL STD.	NOTES
	FROM	TO					
BRANCH FITTINGS- CONT'D							
WELDOLET	½	8	BE	FORGED, SCH AS PIPE	MSS SP-97	ASTM A105N, SOUR SERVICE	27
LATROLET	½	8	BE	FORGED, SCH AS PIPE	MSS SP-97	ASTM A105N, SOUR SERVICE	27,93
FLANGES							
WELDNECK	½	24	RF	CL.150	B16.5	ASTM A105N, SOUR SERVICE	2,27
WELDNECK	30	60	RF	CL.150	B16.47- A	ASTM A105N, SOUR SERVICE	2,27
WELDNECK	½	24	RF	CL.300	B16.5	ASTM A105N, SOUR SERVICE	2,27,33
WELDNECK	30	60	RF	CL.300	B16.47- A	ASTM A105N, SOUR SERVICE	2,27,33
NIPOFLANGE	1	2	RF	CL.150, L=150 MM	B16.5	ASTM A105N, SOUR SERVICE	2,27,73
BLIND	½	24	RF	CL.150	B16.5	ASTM A105N, SOUR SERVICE	27
BLIND	30	60	RF	CL.150	B16.47 – A	ASTM A105N, SOUR SERVICE	27
ORIFICE	2	24	RF	CL.300	B16.36	ASTM A105N, SOUR SERVICE	2,27,54
LINE BLINDS							
LINE BLIND	½	10	RF	CL.150, SPECTACLE BLIND	B16.48	ASTM A516 GR.70, SOUR SERVICE	3,27
LINE BLIND	12	24	RF	CL.150, SPADE & SPACER	B16.48	ASTM A516 GR.70, SOUR SERVICE	3,27
LINE BLIND	30	60	RF	CL.150, SPADE & SPACER	MFG STD.	ASTM A516 GR.70, SOUR SERVICE	3,27



**PIPING CLASS: AC1S3D-FH**

COMPONENT (TYP)	NPS (INCH)		END	DESCRIPTION	DIM/ MFG STD.	MATERIAL STD.	NOTES
	FROM	TO					
GASKETS							
GASKET	½	24	-	CL.150, SPIRAL WOUND, 4.5MM THK.	B16.20/ B16.5	SP. WINDING + INNER RING: SS316, FILLER: GRAPHITE, CS OUTER RING, LOW STRESS, SOUR SERVICE	70
GASKET	30	60	-	CL.150, SPIRAL WOUND, 4.5MM THK	B16.20/ 16.47 – A	SP. WINDING + INNER RING: SS316, FILLER: GRAPHITE, CS OUTER RING, LOW STRESS, SOUR SERVICE	70
GASKET	½	24	-	CL.300, SPIRAL WOUND, 4.5MM THK.	B16.20/ B16.5	SP. WINDING + INNER RING: SS316, FILLER: GRAPHITE, CS OUTER RING, SOUR SERVICE	33
GASKET	30	60	-	CL.300, SPIRAL WOUND, 4.5MM THK	B16.20/ 16.47 – A	SP. WINDING + INNER RING: SS316, FILLER: GRAPHITE, CS OUTER RING, SOUR SERVICE	33
INSULATING GASKET	2	24	-	CL.150, RF FLANGE INSULATING GASKET SET, FULL FACE	MANF. STD.	GASKETS AND WASHERS SS316 CORE LAMINATED WITH DIELECTRIC COATING SUITABLE FOR DESIGN CONDCTIONS	86
BOLTS							
STUD BOLT & NUTS	½	60	-	STUD BOLT C/W 2 HEAVY HEX. NUTS	B18.2.1/ B18.2.2	STUD: ASTM A193 GR. B7M, ASTM A194 GR. 2HM	74

## PIPING CLASS: AC1S3D-FH

### SECTION 5.0 - VALVES

COMPONENT (TYP)	NPS (INCH)		END	DESCRIPTION	DIM/ MFG STD.	MATERIAL STD.	NOTES
	FROM	TO					
VALVES (NOTE-81)							
CHECK	½	1 ½	RF	CL.150, FLGD TO B16.5, SPRING LOADED LIFT CHECK, BOLTED COVER, SOUR SERVICE	BS 1868 + ASME B16.34	BODY: ASTM A105N TRIM: ALLOY 625 +HF	
CHECK	2	48	RF	CL.150, DUAL PLATE, TYPE A, RF DOUBLE FLGD TO B16.5 / B16.47-A, SOUR SERVICE	API 594	BODY: ASTM A216 GR.WCB TRIM: ALLOY 625 +HF	
CHECK	52	60	RF	CL.150, DUAL PLATE, TYPE A, RF DOUBLE FLGD TO B16.47-A, SOUR SERVICE	API 594 + MANU. STD	BODY: ASTM A216 GR.WCB TRIM: ALLOY 625 +HF	
CHECK	2	24	RF	CL.150, SWING CHECK FLGD TO B16.5, SOUR SERVICE	API 6D	BODY: ASTM A216 GR.WCB TRIM: ALLOY 625 +HF	
GATE	½	1 ½	RF	CL.150, FLGD TO B16.5, SOLID WEDGE, STD PORT, OS & Y, BOLTED BONNET, HANDWHEEL, SOUR SERVICE	API 602 + ASME B16.34	BODY: ASTM A105N TRIM: ALLOY 625 +HF	16
GATE	2	24	RF	CL.150, FLGD TO B16.5, FLEXIBLE WEDGE, STD PORT, OS & Y, BOLTED BONNET, HANDWHEEL / GEAR, SOUR SERVICE	API 600 + ASME B16.34	BODY: ASTM A216 GR.WCB TRIM: ALLOY 625 +HF	16
GLOBE	½	1 ½	RF	CL.150, FLGD TO B16.5, SWIVEL PLUG DISC, OS & Y, BOLTED BONNET, HANDWHEEL, SOUR SERVICE	API 602 + ASME B16.34	BODY: ASTM A105N TRIM: ALLOY 625 +HF	16
GLOBE	2	12	RF	CL.150, FLGD TO B16.5, SWIVEL PLUG DISC, OS & Y, BOLTED BONNET, HANDWHEEL / GEAR, SOUR SERVICE	API 623 + ASME B16.34	BODY: ASTM A216 GR.WCB TRIM: ALLOY 625 +HF	16

**PIPING CLASS: AC1S3D-FH**

COMPONENT (TYP)	NPS (INCH)		END	DESCRIPTION	DIM/ MFG STD.	MATERIAL STD.	NOTES
	FROM	TO					
VALVES CONT, D (NOTE -81)							
BUTTERFLY	14	48	RF	CL.150, TRIPLE OFFSET, DOUBLE FLGD TO B16.5 / B16.47-A, GEAR, SOUR SERVICE	API 609, CAT.B	BODY: ASTM A216 GR.WCB TRIM & SEAT: ALLOY 625 +HF	16,71, 87
BUTTERFLY	52	60	RF	CL.150, TRIPLE OFFSET, DOUBLE FLGD TO B16.47-A, GEAR, SOUR SERVICE	BS EN 593	BODY: ASTM A216 GR.WCB TRIM & SEAT: ALLOY 625 +HF	16,71, 87
BALL	½	1 ½	RF	CL.150, FLGD TO B16.5, FULL BORE, FLOATING BALL, LEVER, SOUR SERVICE	API 6D	BODY: ASTM A105N TRIM & SEAT: ALLOY 625 +HF	16
BALL	2	6	RF	CL.150, FLGD TO B16.5, REDUCED BORE, FLOATING BALL, LEVER /GEAR, SOUR SERVICE	API 6D	BODY: ASTM A216 GR. WCB TRIM & SEAT: ALLOY 625 +HF	16
BALL	8	36	RF	CL.150, FLGD TO B16.5 / B16.47-A, REDUCED BORE, TRUNNION MOUNTED, GEAR, SOUR SERVICE	API 6D	BODY: ASTM A216 GR. WCB TRIM & SEAT: ALLOY 625 +HF	16
BALL	42	60	RF	CL.150, FLGD TO B16.47-A, REDUCED BORE, TRUNNION MOUNTED, GEAR, SOUR SERVICE	API 6D + MANF STD	BODY: ASTM A216 GR. WCB TRIM & SEAT: ALLOY 625 +HF	16
BALL	2	4	RF	CL.150, FLGD TO B16.5, FULL BORE, FLOATING BALL, LEVER, SOUR SERVICE	API 6D	BODY: ASTM A216 GR. WCB TRIM & SEAT: ALLOY 625 +HF	16,71
BALL	6	36	RF	CL.150, FLGD TO B16.5 / B16.47-A, FULL BORE, TRUNNION MOUNTED, GEAR, SOUR SERVICE	API 6D	BODY: ASTM A216 GR. WCB TRIM & SEAT: ALLOY 625 +HF	16 ,71
BALL	42	60	RF	CL.150, FLGD TO B16.47-A, FULL BORE, TRUNNION MOUNTED, GEAR, SOUR SERVICE	API 6D	BODY: ASTM A216 GR. WCB TRIM & SEAT: ALLOY 625 +HF	16 ,71

**PIPING CLASS: AC1S3D-FH**

COMPONENT (TYP)	NPS (INCH)		END	DESCRIPTION	DIM/ MFG STD.	MATERIAL STD.	NOTES
	FROM	TO					
VALVES CONT, D (NOTE -81)							
IDBB VALVE (FLG X FLG)	¾	2	RF	CL. 150, BALL TYPE BLOCK, REDUCING BODY DESIGN, FLOATING BALL AND ½" NEEDLE TYPE BLEED VALVE, LEVER OPERATED, SOUR SERVICE  MIN.14MM BORE	API 6D + MANF STD	BODY: ASTM A105N / ASTM A216 GR. WCB  TRIM & SEAT: ALLOY 625 +HF  BLEED VALVE: BODY- ASTM A105N, TRIM- ALLOY 625 +HF	16,90