# PIPING CLASS: AC1S3A-FH

## SECTION 1.0 – GENERAL

| | | | |
|---|---|---|---|
| **PIPE CLASS:** | **AC1S3A-FH** | **DESIGN CODE:** | ASME B31.3 |
| **RATING:** | 150 | **PWHT:** | NOTE 5 |
| **FLANGE FACE:** | RF | **VALVE TRIM:** | SS316+HF |
| **BASIC MATERIAL:** | CARBON STEEL (GROUP 1.1) | **SOUR:** | YES (NOTE 4 & 13) |
| **CORROSION ALLOWANCE:** | 3.0 MM | **SPECIAL REQUIREMENT:** | NACE |

### TEMPERATURE (DEG.C) AND PRESSURE (BARG) RATING - (NOTE-55)

| **TEMP.** | -29 | 0 | 38 | 50 | 100 | 150 | 200 | 250 | 300 | 350 | 400 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **PRESS.** | 19.6 | 19.6 | 19.6 | 19.2 | 17.7 | 15.8 | 13.8 | 12.1 | 10.2 | 8.4 | 6.5 |

### SERVICE

REFER TO PIPING CLASS INDEX

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

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

| **NPS** | 14 | 16 | 18 | 20 | 24 |
|---|---|---|---|---|---|
| **SCHEDULE** | 20 | 20 | 20 | 20 | 20 |
| **THICKNESS** | 7.92 | 7.92 | 7.92 | 9.53 | 9.53 |

# PIPING CLASS: AC1S3A-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 SPECIFCATION 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.

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).

55. ALL PIPING COMPONENTS UP TO PIPING CLASS RANGE SHALL BE DESIGNED FOR VACUUM CONDITION AT AMBIENT TEMPERATURE.

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.

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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).

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.

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## SECTION 3.0 – BRANCH TABLE

### $90^0$ BRANCH CONNECTIONS

| BRANCH PIPE (NPS) | 1/2 | 3/4 | 1 | 1 ½ | 2 | 3 | 4 | 6 | 8 | 10 | 12 | 14 | 16 | 18 | 20 | 24 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 24 | | | | | | | | | | | | | | | | E |
| 20 | | | | | | | | | | | | | | | E | T |
| 18 | | | | | | | | | | | | | | E | T | T |
| 16 | | | | | | | | | | | | | E | T | T | T |
| 14 | | | | | | | | | | | | E | T | T | T | T |
| 12 | | | | | | | | | | | E | T | T | T | T | T |
| 10 | | | | | | | | | | E | T | T | T | T | T | T |
| 8 | | | | | | | | | E | T | T | T | T | T | T | W |
| 6 | | | | | | | | E | T | T | T | T | T | W | W | W |
| 4 | | | | | | | E | T | T | T | W | W | W | W | W | W |
| 3 | | | | | | E | T | T | W | W | W | W | W | W | W | W |
| 2 | | | | | E | T | T | W | W | W | W | W | W | W | W | W |
| 1 ½ | | | | E | T | T | T | W | W | W | W | W | W | W | W | W |
| 1 | | | E | T | T | W | W | W | W | W | W | W | W | W | W | W |
| 3/4 | | E | T | T | T | W | W | W | W | W | W | W | W | W | W | W |
| 1/2 | E | T | T | T | TR | W | W | W | W | W | W | W | W | W | W | W |
| | 1/2 | 3/4 | 1 | 1 ½ | 2 | 3 | 4 | 6 | 8 | 10 | 12 | 14 | 16 | 18 | 20 | 24 |
| | HEADER PIPE (NPS) | | | | | | | | | | | | | | | |

### LEGEND (STANDARD SYMBOLOGY)

| | |
|---|---|
| **C** | CALCULATION IN ACCORDANCE WITH ASME B31.3 |
| **E** | EQUAL TEE |
| **T** | REDUCING TEE |
| **TR** | REDUCING TEE + REDUCER |
| **W** | WELDOLET |

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## 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 | 24 | 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 | 24 | BE | 90 DEGREE, LR, WROUGHT, WELDED | B16.9 | 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 | 24 | BE | 45 DEGREE, LR, WROUGHT, WELDED | B16.9 | 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 | 24 | BE | CONCENTRIC, WROUGHT, WELDED | B16.9 | ASTM A234 GR. WPB-W, SOUR SERVICE | 2,27,82, 83 |
| REDUCER | ¾ | 16 | BE | ECCENTRIC, WROUGHT, SEAMLESS | B16.9 | ASTM A234 GR. WPB-S, SOUR SERVICE | 2,27 |
| REDUCER | 18 | 24 | BE | ECCENTRIC, WROUGHT, WELDED | B16.9 | ASTM A234 GR. WPB-W, SOUR SERVICE | 2,27,82, 83 |
| CAP | ½ | 24 | BE | WROUGHT, SEAMLESS | B16.9 | ASTM A234 GR. WPB-S, SOUR SERVICE | 2,27 |

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| COMPONENT (TYP) | NPS (INCH) | | END | DESCRIPTION | DIM/ MFG STD. | MATERIAL STD. | NOTES |
|---|---|---|---|---|---|---|---|
| | FROM | TO | | | | | |
| **BRANCH FITTINGS** | | | | | | | |
| TEE | ½ | 16 | BE | EQUAL, WROUGHT, SEAMLESS | B16.9 | ASTM A234 GR. WPB-S, SOUR SERVICE | 2,27 |
| TEE | 18 | 24 | BE | EQUAL WROUGHT, WELDED | B16.9 | 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 | 24 | BE | REDUCING, WROUGHT, WELDED | B16.9 | ASTM A234 GR. WPB-W, SOUR SERVICE | 2,27,82 |
| WELDOLET | ½ | 8 | BE | FORGED, SCH AS PIPE | MSS SP-97 | ASTM A105N, SOUR SERVICE | 27 |
| **FLANGES** | | | | | | | |
| WELDNECK | ½ | 24 | RF | CL.150 | B16.5 | ASTM A105N, SOUR SERVICE | 2,27 |
| WELDNECK | ½ | 24 | RF | CL.300 | B16.5 | 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 |
| 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 |
| **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 |

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| COMPONENT (TYP) | NPS (INCH) | | END | DESCRIPTION | DIM/ MFG STD. | MATERIAL STD. | NOTES |
|---|---|---|---|---|---|---|---|
| | FROM | TO | | | | | |
| **GASKETS – CONT, D** | | | | | | | |
| 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 |
| 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 CONDTIONS, SOUR SERVICE | 86 |
| **BOLTS** | | | | | | | |
| STUD BOLT & NUTS | ½ | 24 | - | STUD BOLT C/W 2 HEAVY HEX. NUTS | B18.2.1/ B18.2.2 | STUD: ASTM A193 GR. B7M, ASTM A194 GR. 2HM | 74 |

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## 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: SS316 +HF | |
| CHECK | 2 | 24 | 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: SS316 +HF | |
| CHECK | 2 | 24 | RF | CL.150, SWING CHECK FLGD TO B16.5, SOUR SERVICE | API 6D | BODY: ASTM A216 GR.WCB TRIM: SS316 +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: SS316 +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: SS316 +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: SS316 +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: SS316 +HF | 16 |
| BUTTERFLY | 14 | 24 | RF | CL.150, TRIPLE OFFSET, DOUBLE FLGD TO B16.5, GEAR, SOUR SERVICE | API 609, CAT.B | BODY: ASTM A216 GR.WCB TRIM & SEAT: SS316 +HF | 16,71, 87 |

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| COMPONENT (TYP) | NPS (INCH) | | END | DESCRIPTION | DIM/ MFG STD. | MATERIAL STD. | NOTES |
|---|---|---|---|---|---|---|---|
| | FROM | TO | | | | | |
| **VALVES – CONT, D (NOTE -81)** | | | | | | | |
| BALL | ½ | 1 ½ | RF | CL.150, FLGD TO B16.5 / B16.47-A, FULL BORE, FLOATING BALL, LEVER, SOUR SERVICE | API 6D | BODY: ASTM A105N<br>TRIM<br>& SEAT: SS316+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<br>TRIM<br>& SEAT: SS316+HF | 16 |
| BALL | 8 | 24 | RF | CL.150, FLGD TO B16.5 / B16.47-A, REDUCED BORE, TRUNNION MOUNTED, GEAR, SOUR SERVICE | API 6D | BODY: ASTM A216 GR. WCB<br>TRIM<br>& SEAT: SS316+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<br>TRIM<br>& SEAT: SS316+HF | 16,71 |
| BALL | 6 | 24 | RF | CL.150, FLGD TO B16.5 / B16.47-A, FULL BORE, TRUNNION MOUNTED, GEAR, SOUR SERVICE | API 6D | BODY: ASTM A216 GR. WCB<br>TRIM<br>& SEAT: SS316+HF | 16,71 |
| 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<br>MIN.14MM BORE | API 6D + MANF STD | BODY: ASTM A105N / ASTM A216 GR. WCB<br>TRIM<br>& SEAT: SS316+HF<br>BLEED VALVE: BODY- ASTM A105N, TRIM- SS316 +HF | 16,90 |