|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | | | | | PLANT AND PIPING | | | | | | |  | | | | |
| **管道等级表**  **PIPING SPECIFICATION** | | | | | | | | | | | | 项目名 / Project Name: | | | DIG COSMO | |
| 项目号 / Project No.: | | | 61105 | |
| 文件号 / Document No.: | | | 60-01-PP-501002 | |
| 版本号 / Rev. : | | | 1 | |
| * **INTERNAL** | | | | | | | | | | | | | | | | |
| **Classification: ●INTERNAL**  **Bussiness Owner: Engineering & Technologu Department** | | | | | | | | | | | | | | | | |
| FRONT PAGE | | | | | | | | | | | | | | | | |
| 序号 | 等级/ Class | | 0 | 1 | 2 | 3 |  | 序号 | 等级/ Class | | 0 | 1 | 2 | 3 |  |  |
| 1 | A01AB1SAX | | X |  |  |  |  | 19 |  | |  |  |  |  |  |  |
| 2 | A01DA1C | | X |  |  |  |  | 20 |  | |  |  |  |  |  |  |
| 3 | A01DA1CA | | X |  |  |  |  | 21 |  | |  |  |  |  |  |  |
| 4 | A01DA1E | | X |  |  |  |  | 22 |  | |  |  |  |  |  |  |
| 5 | A01DA1EA | | X |  |  |  |  | 23 |  | |  |  |  |  |  |  |
| 6 | A01SC1B | | X | X |  |  |  | 24 |  | |  |  |  |  |  |  |
| 7 | A01SC1BA | | X |  |  |  |  | 25 |  | |  |  |  |  |  |  |
| 8 | A01SC1BX | | X |  |  |  |  | 26 |  | |  |  |  |  |  |  |
| 9 | A01SC1SAX | | X | X |  |  |  | 27 |  | |  |  |  |  |  |  |
| 10 | A01SC1SX | | X | X |  |  |  | 28 |  | |  |  |  |  |  |  |
| 11 | A01SC2C | | X |  |  |  |  | 29 |  | |  |  |  |  |  |  |
| 12 | ~~A03AB1SX~~ | | ~~X~~ |  |  |  |  | 30 |  | |  |  |  |  |  |  |
| 13 | A03AB1SAX | | X |  |  |  |  | 31 |  | |  |  |  |  |  |  |
| 14 | A03DA1C | | X |  |  |  |  | 32 |  | |  |  |  |  |  |  |
| 15 | A03SC1B | | X |  |  |  |  | 33 |  | |  |  |  |  |  |  |
| 16 | ~~A03SC1SX~~ | | ~~X~~ |  |  |  |  | 34 |  | |  |  |  |  |  |  |
| 17 | A03SC1SAX | | X |  |  |  |  | 35 |  | |  |  |  |  |  |  |
| 18 | A06DA1C | | X |  |  |  |  | 36 |  | |  |  |  |  |  |  |
|  | | | | | | | | | | | | | | | | |
|  |  |  | |  | |  | |  | |  | |  | | | | |
| 1 | 2024.04.22 | SC | | CYJ | | XWJ | | - | | AFD | | Approved for Design | | | | |
| 0 | 2024.01.04 | SC | | CYJ | | XWJ | | - | | RFR | | Ready for Review | | | | |
| **版本** | **日期** | **设计** | | **校核** | | **审核** | | **批准** | | **状态** | | **版本修改** | | | | |
| **Rev.** | **Date** | **Prepared** | | **Checked** | | **Audited** | | **Approved** | | **Status** | | **Revision description** | | | | |
|  | | | | | | | | | | | | | | | | |

**CONFIDENTIAL BUSINESS**

**Air Liquide Global E&C Solutions Hangzhou Co., Ltd**

**access by third parties who are not bound by professional secrecy**

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| Rev. | Date | Prepared by | Checked By | Approved By | Description |
| 0 | 19/08/2022 | YJ Chen | C Shen |  | First issue |

Disclamer:

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|  |  |
| --- | --- |
| **DESIGN CODE:** | ASME B31.3 Latest Edition / Addenda - Normal Fluid Service |
| **RATING CLASS:** | 150 |
| **MATERIAL:** | Carbon Steel High Temperature |
| **SERVICE:** | General |
| **FLANGE FACING:** | Raised Face |
| **NOMINAL CORROSION ALLOWANCE:** | 0.0625 in (1.6 mm) |
| **MATERIAL GROUP:** | ASME B16.5-2017, 1.1 |
| **TRIM:** | Trim 8 |
| **FLUID CODE:** | AA / AC / AD / AG / AI / AIN / AS / NG / NS / NW |
| **CALCULATION NO:** | AL\_CORP\_502\_16\_branch\_120\_PO |

**DESIGN PRESSURE-TEMPERATURE RATING:**

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **From NPS 0.5 to 48in** | | | | | | | | | |
| **Temp. DegC** | -29 | 38 | 50 | 100 | 150 | 200 | 250 | 300 |  |
| **Pressure BarG** | 19.6 | 19.6 | 19.2 | 17.7 | 15.8 | 13.8 | 12.1 | 10.2 |
| **Temp. DegF** | -20 | 100 | 122 | 212 | 302 | 392 | 482 | 572 |
| **Pressure Psig** | 285 | 285 | 278 | 257 | 229 | 200 | 175 | 147 |
| **Full Vacuum NPS 0.5 to 48in** | | | | | | | | | |
| **Temp. DegC** | 200 |  | | | | | | | |
| **Pressure BarG** | -1 |
| **Temp. DegF** | 392 |
| **Pressure Psig** | -14.5 |

**PIPE WALL THICKNESS:**

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NPS** | **.5** | **.75** | **1** | **1.25** | **1.5** | **2** | **2.5** | **3** | **3.5** | **4** | **5** |
| **DN** | 15 | 20 | 25 | 32 | 40 | 50 | 65 | 80 | 90 | 100 | 125 |
| **SCH** | S-XS | S-XS | S-XS | S-XS | S-XS | S-STD | S-STD | S-STD | S-STD | S-STD | S-STD |
| **THK (in)** | 0.147 | 0.154 | 0.179 | 0.191 | 0.2 | 0.154 | 0.203 | 0.216 | 0.226 | 0.237 | 0.258 |
| **THK (mm)** | 3.73 | 3.91 | 4.55 | 4.85 | 5.08 | 3.91 | 5.16 | 5.49 | 5.74 | 6.02 | 6.55 |
| **OD (mm)** | 21.3 | 26.7 | 33.4 | 42.2 | 48.3 | 60.3 | 73 | 88.9 | 101.6 | 114.3 | 141.3 |
| **NPS** | **6** | **8** | **10** | **12** | **14** | **16** | **18** | **20** | **24** | **26** | **28** |
| **DN** | 150 | 200 | 250 | 300 | 350 | 400 | 450 | 500 | 600 | 650 | 700 |
| **SCH** | S-STD | S-STD | S-STD | S-STD | S-STD | S-STD | S-STD | S-STD | S-STD | S-STD | S-STD |
| **THK (in)** | 0.28 | 0.322 | 0.365 | 0.375 | 0.375 | 0.375 | 0.375 | 0.375 | 0.375 | 0.375 | 0.375 |
| **THK (mm)** | 7.11 | 8.18 | 9.27 | 9.53 | 9.53 | 9.53 | 9.53 | 9.53 | 9.53 | 9.53 | 9.53 |
| **OD (mm)** | 168.3 | 219.1 | 273 | 323.8 | 355.6 | 406.4 | 457 | 508 | 610 | 660 | 711 |
| **NPS** | **30** | **32** | **34** | **36** | **38** | **40** | **42** | **44** | **46** | **48** |  |
| **DN** | 750 | 800 | 850 | 900 | 950 | 1000 | 1050 | 1100 | 1150 | 1200 |
| **SCH** | S-STD | S-STD | S-STD | S-STD | 0.406" | 0.438" | 0.438" | 0.469" | S-XS | S-XS |
| **THK (in)** | 0.375 | 0.375 | 0.375 | 0.375 | 0.406 | 0.438 | 0.438 | 0.469 | 0.5 | 0.5 |
| **THK (mm)** | 9.53 | 9.53 | 9.53 | 9.53 | 10.31 | 11.13 | 11.13 | 11.91 | 12.7 | 12.7 |
| **OD (mm)** | 762 | 813 | 864 | 914 | 965 | 1016 | 1067 | 1118 | 1168 | 1219 |

**GENERAL NOTES:**

1. All buttwelded components wall thickness shall match PIPE WALLTHICKNESS.
2. Non-standard pipe sizes NPS 1.25", 2.5", 3.5", 5" etc. shall not be used except for connection to the equipment or in special circumstances.

BX Piping Class Specification has been calculated to withstand Full Vacuum, max. buckling length 6m [19.68 ft].

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Notes** | **NPS/DN**  **(in)** | **Sch** | **Description** | **Commodity Code** | **Short Code** | **Rev** |
| **NIPPLES** | | | | | | |
|  | .5-1.5 | S-XS | Nipple, B36.10 M,(100mm), Plain - NPT, Seamless, ASTM A106 Gr B | APPN1DF5H0EA | NPTG1 |  |
|  | .5-1.5 | S-XS | Nipple, B36.10 M,(180mm) ,Plain - NPT, Seamless, ASTM A106 Gr B | APPN1DF5H0EB | NPTG3 |  |
|  | .5-1.5 | S-XS | Nipple, B36.10 M(100mm), NPT – NPT, Seamless, ASTM A106 Gr B | APPN1DF6H0EA | NTTG1 |  |
|  | .5-1.5 | S-XS | Nipple, B36.10 M,(180mm), NPT - NPT, Seamless, ASTM A106 Gr B | APPN1DF6H0EB | NTTG3 |  |
| **PIPE** | | | | | | |
|  | .5-1.5 | S-XS | Pipe, B36.10 M, Plain end, Seamless, ASTM A106 Gr B | APPP1DF2H0EE | P |  |
|  | 2-6 | S-STD | Pipe, B36.10 M, Beveled end, API 5L Gr. B, SAWL, E=0.9 |  | P |  |
|  | 8-20 | S-STD | Pipe, B36.10 M, Beveled end, API 5L Gr. B, SAWL, E=0.9 |  | P |  |
|  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |
| **FORGED FITTINGS** | | | | | | |
|  | .5-1.5 |  | 90Deg. Elbow, B16.11, SW, CL 3000, ASTM A105N | APKA1DD130EA | 9E |  |
|  | .5-1.5 |  | Equal Tee, B16.11, SW, CL 3000, ASTM A105N | APKB1DD130EA | T |  |
|  | .5-1.5 |  | 45Deg. Elbow, B16.11, SW, CL 3000, ASTM A105N | APKC1DD130EA | 4E |  |
|  | .5-1.5 |  | Cap, B16.11, SW, CL3000, ASTM A105N | APKF1DD130EA | C |  |
|  | .5-1 |  | CAP, B16.11, Threaded NPT, CL 3000, ASTM A105N | APKF1DD230EA | CT |  |
|  | .5-1 |  | Plug, B16.11, Threaded NPT, CL3000, ASTM A105N | APKP1DD230EA | PL |  |
|  | .5-1.5 |  | Full Coupling, B16.11, SW, CL3000, ASTM A105N |  | FCL |  |
|  | .5-1.5 |  | Reduced Tee, B16.11, SW, CL 3000, ASTM A105N | APKQ1DD130EA | RT |  |
|  | 2-20  .5-1.5 |  | Sockolet, MSS SP-97, SW, B16.11, CL 3000, ASTM A105N | APKM7DD130EB | SOL |  |
|  | 2-16  .75-1 |  | Threadolet, MSS SP-97, Threaded NPT, B16.11, CL 3000, ASTM A105N | APKN7DD230EB | TOL |  |

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| --- | --- | --- | --- | --- | --- | --- |
| **Notes** | **NPS/DN**  **(in)** | **Sch** | **Description** | **Commodity Code** | **Short Code** | **Rev** |
| **WELDED FITTINGS** | | | | | | |
|  | .5-1.5  . | S-XS | Swage Nipple Conc, MSS SP-95, Beveled End, ASTM A234 Gr WPB | APWT5DH1XXEA | CBB |  |
|  | .5-1.5 | S-XS | Swage Nipple Ecc, MSS SP-95, Beveled End,  ASTM A234 Gr WPB | APWU5DH1XXEA | EBB |  |
|  | 2-20 | S-STD | 90Deg LR Elbow, B16.9, BW, ASTM A234 Gr WPBW | APWA1DH7XXEA | 9E |  |
|  | 2-20 | S-STD | 45Deg LR Elbow, B16.9, BW , ASTM A234 Gr WPBW | APWB1DH7XXEA | 4E |  |
|  | 2-20 | S-STD | Equal Tee, B16.9, BW, ASTM , ASTM A234 Gr WPBW | APWD1DH7XXEA | T |  |
|  | 2-20 | S-STD | Cap, B16.9, BW, ASTM A234 Gr WPBW | APWF1DH7XXEA | C |  |
|  | 2-20 | S-STD | Concentric Reducer, B16.9, BW, ASTM A234 Gr WPBW | APWG1DH7XXEA | CR |  |
|  | 2-20 | S-STD | Eccentric Reducer, B16.9, BW, ASTM A234 Gr WPBW | APWH1DH7XXEA | ER |  |
|  | 2.5-20 | S-STD | Reducing Tee, B16.9, BW, ASTM A234 Gr WPBW | APWE1DH7XXEA | RT |  |
|  |  |  |  |  |  |  |
| **FLANGES** | | | | | | |
|  | .5-20 |  | Flange, Blind, B16.5, RF, CL 150, ASTM A105N | APFA2DD101EA | BF |  |
| 59 | .5-16 |  | Flange, Blind, B16.5, RF, CL 300, ASTM A105N | APFA2DD103EA | BF3 |  |
| 53 | .5-.5 |  | Flange, Threaded, B16.5, RF, CL 150, ASTM A105N | APFK2DD101EA | TF |  |
|  | .5-14 |  | Flange, Spectacle Figure 8, B16.48, RF, CL 150, ASTM A516 Gr 70N | APFM6DG101EA | F8 |  |
|  | .5-1.5 |  | Flange, SW, B16.5, RF, CL 150, ASTM A105N | APFS2DD101EA | SF |  |
| 59 | .5-1.5 |  | Flange, SW, B16.5, RF, CL 300, ASTM A105N | APFS2DD103EA | SF3 |  |
| 402 | .75-2  .5-.5 |  | Flange, Blind with Thd Bore, B16.5, 1/2" NPT, RF, CL 150, ASTM A105N | APFG2DD101EB | BFI |  |
| 402  59 | .75-2  .5-.5 |  | Flange, Blind with Thd Bore, B16.5, 1/2" NPT, RF, CL 300, ASTM A105N,,, | APFG2DD103EB | BFI3 |  |
|  | 2-20 | See Note A | Flange, WN, B16.5, RF, CL 150, ASTM A105N | APFL2DD101EA | WN |  |
|  | 2-16 | See Note A | Flange, WN, B16.5, RF, CL 300, ASTM A105N | APFL2DD103EA | WN3 |  |
|  | 16-16 |  | Paddle Blank, B16.48, RF, CL 150, ASTM A516 Gr 70N | APFN6DG101EA | PB |  |
|  | 16-16 |  | Paddle Spacer, B16.48, RF, CL 150, ASTM A516 Gr 70N | APFP6DG101EA | PS |  |
|  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |
| **ORIFICE FLANGE** | | | | | | |
|  | 12-12 | See Note A | Orif Flg, WN 0.5 NPT + jack scr. B16.36, RF, CL 300,  ASTM A105N | APOA1DD103EA | OF |  |

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| --- | --- | --- | --- | --- | --- | --- |
| **Notes** | **NPS/DN**  **(in)** | **Sch** | **Description** | **Commodity Code** | **Short Code** | **Rev** |
| **GASKETS** | | | | | | |
|  | .5-10 |  | Gasket, Flat Ring, 1.5 mm Thk, CL 150, Expanded graphite 98% with metallic reinforcement | APGF2GN001AC | G |  |
|  | .5-16 |  | Gasket, Spiral Wound, 4.5 mm Thk, CL 300, Filler graphite 98%, spiral 316SS, IR 316SS, OR CS | APGS1GB003EB | G3 |  |
|  | .5-20 |  | Gasket, Flat Ring, 3.0 mm Thk, CL 150, Expanded graphite 98% with metallic reinforcement | APGF2GN001AD | G |  |
| **BOLTING** | | | | | | |
|  | .5-20 |  | Stud Bolt w/2-Heavy Hex Nuts, SA193 Gr B7 / SA194 Gr 2H, Coating | APBA1CB000EB | BT |  |
|  | .5-16 |  | Stud Bolt w/2-Heavy Hex Nuts, SA193 Gr B7 / SA194 Gr 2H, Coating | APBA1CB000EB | BT3 |  |
| **VALVES** | | | | | | |
| 407 | .5-2 |  | Ball Valve, Float Ball, Thrd, NPT, RB, ASTM A182 Gr. F316/316L, 316SS Ball, PTFE, Oval Handle | APVB1QW333EH | BV |  |
|  | .5-1.5 |  | Check Valve, API602, piston type, horiz. and vert, SW, CL800, ASTM A105N, Trim No. 8, BC | APVC6DC208EV | CH |  |
| 413 | .5-1.5 |  | Gate Valve, API 602, SWxNPT, CL800, ASTM A105N, Trim No. 8, BB, OS & Y | APVG4DC008EJ | GA1 |  |
|  | .5-1.5 |  | Gate Valve, API 602, SW, CL800,,ASTM A105N, Trim No. 8, BB, OS & Y | APVG4DC208ER | GA |  |
| 60 | .5-1.5 |  | Gate Valve, API 602, Flanged, RF, CL150, ASTM A105N, Trim No. 8, BB, OS & Y | APVG4DC401FL | GAF |  |
| 59, 60 | .5-1.5 |  | Gate Valve, API 602, Flanged, RF, CL300, ASTM A105N, Trim No. 8, BB, OS & Y | APVG4DC403FL | GAF3 |  |
| 405 | .5-1.5 |  | Globe Valve, API 602, Straight seat, SW, CL800, ASTM A105N, Trim No. 8, BB, OS & Y | APVL5DC208EA | GL |  |
|  | .5-1.5 |  | Globe Valve, API 602, Straight seat, SWxNPT, CL800, ASTM A105N, Trim No. 8, BB, OS & Y |  | GL1 |  |
|  | 2-4 |  | Check Valve, API 602, Swing Check, Bolted cover, RF, CL150, ASTM A216 Gr WCB, Trim No. 8, | APVC4DD401EW | CH |  |
|  | 2-16 |  | Check Valve, API 594, Dual Plate Check, Bolted, Wafer, RF, CL150, ASTM A216 Gr WCB, Trim No. 8, | APVC4DD601EF | CHW |  |
|  | 2-16 |  | Check Valve, API 594, Dual Plate Check, Bolted, Wafer, RF, CL300, ASTM A216 Gr WCB, Trim No. 8, | APVC4DD603EF | CHW3 |  |
|  | 2-12 |  | Gate Valve, API 600, flex. wedge, Flanged, RF, CL150, ASTM A216 Gr WCB, Trim No. 8, BB, OS & Y | APVG3DD401ES | GA |  |
| 59, 60 | 2-2 |  | Gate Valve, API 600, flex. wedge, Flanged, RF, CL300, ASTM A216 Gr WCB, Trim No. 8, BB, OS & Y, | APVG3DD403ES | GA3 |  |
|  |  |  |  |  |  |  |

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| --- | --- | --- | --- | --- | --- | --- |
| **Notes** | **NPS/DN**  **(in)** | **Sch** | **Description** | **Commodity Code** | **Short Code** | **Rev** |
| **VALVES** | | | | | | |
| 405 | 2-4 |  | Globe Valve, API 623, Flanged, RF, CL150, ASTM A216 Gr WCB, Trim No. 8, BB, OS & Y | APVL7DD401EL | GL |  |
| 405 | 6-12 |  | Globe Valve, API 623, Flanged, RF, CL150, ASTM A216 Gr WCB, Trim No. 8, BB, OS & Y, Gear OP | APVL7DD401EM | GL |  |
|  | 14-16 |  | Gate Valve, API 600, flex. wedge, Flanged, RF, CL150, ASTM A216 Gr WCB, Trim No. 8, BB, OS & Y, Gear OP | APVG3DD401ET | GA |  |
|  | 3-4 |  | Butterfly Valve, API 609, Double ecc, Bolted, Wafer, RF, CL150, ASTM A216 Gr WCB, Disc SS, Seat PTFE, Lever OP | APVF2DD601EH | BU |  |
|  | 6-20 |  | Butterfly Valve, API 609, Double ecc, Bolted, Wafer, RF, CL150, ASTM A216 Gr WCB, Disc SS, Seat PTFE, Gear OP | APVF2DD601EA | BU |  |
|  |  |  |  |  |  |  |
| **FILTERS / STRAINERS** | | | | | | |
|  | .5-1.5 |  | Y-Strainer, SW, CL800, ASTM A105N, Screen retainer: CS / Screen: SS316-Filtering 0.3mm, Gasket Spir SS and Graphite | APVY3DC208EC | STY |  |
|  | 2-3 |  | Y Strainer, Flanged, RF, CL150, ASTM A216 Gr WCB, Screen retainer: CS / Screen: SS316-Filtering 0.3mm, Gasket Spir SS and Graphite | APVY3DD401GD | STY |  |
|  | 4-16 |  | Conical filter, G-DS-5-4-2 ,Wafer, CL150, all fluids except oxygen and water | APMN0QA701EA | CFR |  |

**SPEC ITEM NOTES:**

53 For orifice flange tapping

1. To use only if necessary
2. For connection PN/class > rating pipe class
3. For connection to equipments

401 For insulated pressure testing vents (see G-DS-5-0-1)

402 For instrument connection (PI, TI, etc.)

403 For non-insulated pressure testing vents (see G-DS-5-0-1)

404 For vents

|  |  |
| --- | --- |
| 405 | For regulation only |
| 407 | To be used for automatic valve connection |
| 413 | For instrument connection : Pressure, flow transmitters, analysers, vents and orifice tappings |
| 10007 | To be used as option of B16.9 fitting (default) |

**LEGEND:**

2 - Reducing Tee

230 - Class 3000

2 - Reducing Tee

2XX - -

1 - Equal Tee

130 - Class 3000

1 - Equal Tee

1XX - -

0 - No Branch

**BRANCH CHART (Preference 1)**

3 - Stub-on

3 - Stub-on

31 - Welded Connection

32 - Reinforcing Pad

5 - Sockolet

530 - Class 3000

Branch Diameter

Header Diameter

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | 0,5 | 0,75 | 1 | 1,25 | 1,5 | 2 | 2,5 | 3 | 3,5 | 4 | 5 | 6 | 8 | 10 | 12 | 14 | 16 | 18 | 20 | 24 |
| 0,5 | 130 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 0,75 | 230 | 130 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 1 | 230 | 230 | 130 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 1,25 | 230 | 230 | 230 | 130 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 1,5 | 230 | 230 | 230 | 230 | 130 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 2 | 530 | 530 | 530 | 530 | 530 | 1XX |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 2,5 | 530 | 530 | 530 | 530 | 530 | 2XX | 1XX |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 3 | 530 | 530 | 530 | 530 | 530 | 2XX | 2XX | 1XX |  |  |  |  |  |  |  |  |  |  |  |  |
| 3,5 | 530 | 530 | 530 | 530 | 530 | 31 | 2XX | 2XX | 1XX |  |  |  |  |  |  |  |  |  |  |  |
| 4 | 530 | 530 | 530 | 530 | 530 | 31 | 31 | 2XX | 2XX | 1XX |  |  |  |  |  |  |  |  |  |  |
| 5 | 530 | 530 | 530 | 530 | 530 | 31 | 31 | 31 | 2XX | 2XX | 1XX |  |  |  |  |  |  |  |  |  |
| 6 | 530 | 530 | 530 | 530 | 530 | 31 | 31 | 31 | 31 | 2XX | 2XX | 1XX |  |  |  |  |  |  |  |  |
| 8 | 530 | 530 | 530 | 530 | 530 | 31 | 31 | 31 | 31 | 31 | 2XX | 2XX | 1XX |  |  |  |  |  |  |  |
| 10 | 530 | 530 | 530 | 530 | 530 | 31 | 31 | 31 | 31 | 31 | 31 | 2XX | 2XX | 1XX |  |  |  |  |  |  |
| 12 | 530 | 530 | 530 | 530 | 530 | 31 | 31 | 31 | 31 | 31 | 31 | 31 | 2XX | 2XX | 1XX |  |  |  |  |  |
| 14 | 530 | 530 | 530 | 530 | 530 | 31 | 31 | 31 | 31 | 31 | 31 | 31 | 31 | 2XX | 2XX | 1XX |  |  |  |  |
| 16 | 530 | 530 | 530 | 530 | 530 | 31 | 31 | 31 | 31 | 31 | 31 | 31 | 31 | 31 | 2XX | 2XX | 1XX |  |  |  |
| 18 | 530 | 530 | 530 | 530 | 530 | 31 | 31 | 31 | 31 | 31 | 31 | 31 | 31 | 31 | 31 | 2XX | 2XX | 1XX |  |  |
| 20 | 530 | 530 | 530 | 530 | 530 | 31 | 31 | 31 | 31 | 31 | 31 | 31 | 31 | 31 | 31 | 31 | 2XX | 2XX | 1XX |  |
| 24 | 530 | 530 | 530 | 530 | 530 | 32 | 32 | 32 | 32 | 32 | 32 | 32 | 32 | 32 | 32 | 32 | 32 | 2XX | 2XX | 1XX |

|  |  |  |  |  |  |
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| Rev. | Date | Prepared by | Checked By | Approved By | Description |
| 0 | 19/08/2022 | YJ Chen | C Shen |  | First issue |

Disclamer:

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|  |  |
| --- | --- |
| **DESIGN CODE:** | B31.3 Latest Edition / Addenda - Normal Fluid Service |
| **RATING CLASS:** | 150 |
| **MATERIAL:** | Carbon Steel High Temperature |
| **SERVICE:** | General |
| **FLANGE FACING:** | Raised Face |
| **NOMINAL CORROSION ALLOWANCE:** | 0.0625 in (1.6 mm) |
| **MATERIAL GROUP:** | B16.5-2017, 1.1 |
| **TRIM:** | Trim 8 |
| **FLUID CODE:** | AA / AC / AD / AE / AG / AI / AIN / AS / AU / AW / ND / NG / NH / NS / NW |
| **CALCULATION NO:** | AL\_CORP\_D\_502\_16\_S\_300/400 |

**DESIGN PRESSURE-TEMPERATURE RATING:**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **From NPS 0.5 to 48in** | | | | | | | | |
| **Temp. DegC** | -29 | 38 | 50 | 100 | 150 | 200 | 300 |  |
| **Pressure BarG** | 10 | 10 | 10 | 10 | 10 | 10 | 6.9 |
| **Temp. DegF** | -20 | 100 | 122 | 212 | 302 | 392 | 572 |
| **Pressure Psig** | 145 | 145 | 145 | 145 | 145 | 145 | 100 |
| **Full Vacuum NPS 0.5 to 18in** | | | | | | | | |
| **Temp. DegC** | 200 |  | | | | | | |
| **Pressure BarG** | -1 |
| **Temp. DegF** | 392 |
| **Pressure Psig** | -14.5 |

**PIPE WALL THICKNESS:**

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NPS** | **.5** | **.75** | **1** | **1.25** | **1.5** | **2** | **2.5** | **3** | **3.5** | **4** | **5** |
| **DN** | 15 | 20 | 25 | 32 | 40 | 50 | 65 | 80 | 90 | 100 | 125 |
| **SCH** | S-XS | S-XS | S-XS | S-XS | S-XS | S-STD | S-STD | S-STD | S-STD | S-STD | S-STD |
| **THK (in)** | 0.147 | 0.154 | 0.179 | 0.191 | 0.2 | 0.154 | 0.203 | 0.216 | 0.226 | 0.237 | 0.258 |
| **THK (mm)** | 3.73 | 3.91 | 4.55 | 4.85 | 5.08 | 3.91 | 5.16 | 5.49 | 5.74 | 6.02 | 6.55 |
| **OD (mm)** | 21.3 | 26.7 | 33.4 | 42.2 | 48.3 | 60.3 | 73 | 88.9 | 101.6 | 114.3 | 141.3 |
| **NPS** | **6** | **8** | **10** | **12** | **14** | **16** | **18** | **20** | **24** | **26** | **28** |
| **DN** | 150 | 200 | 250 | 300 | 350 | 400 | 450 | 500 | 600 | 650 | 700 |
| **SCH** | S-STD | S-20 | S-20 | S-20 | S-10 | S-10 | S-10 | S-10 | S-10 | S-10 | S-10 |
| **THK (in)** | 0.28 | 0.25 | 0.25 | 0.25 | 0.25 | 0.25 | 0.25 | 0.25 | 0.25 | 0.312 | 0.312 |
| **THK (mm)** | 7.11 | 6.35 | 6.35 | 6.35 | 6.35 | 6.35 | 6.35 | 6.35 | 6.35 | 7.92 | 7.92 |
| **OD (mm)** | 168.3 | 219.1 | 273 | 323.8 | 355.6 | 406.4 | 457 | 508 | 610 | 660 | 711 |
| **NPS** | **30** | **32** | **34** | **36** | **38** | **40** | **42** | **44** | **46** | **48** | **52** |
| **DN** | 750 | 800 | 850 | 900 | 950 | 1000 | 1050 | 1100 | 1150 | 1200 | 1300 |
| **SCH** | S-10 | S-10 | S-10 | S-STD | S-STD | S-STD | S-STD | S-STD | S-STD | S-STD | 0.375" |
| **THK (in)** | 0.312 | 0.312 | 0.312 | 0.375 | 0.375 | 0.375 | 0.375 | 0.375 | 0.375 | 0.375 | 0.375 |
| **THK (mm)** | 7.92 | 7.92 | 7.92 | 9.53 | 9.53 | 9.53 | 9.53 | 9.53 | 9.53 | 9.53 | 9.53 |
| **OD (mm)** | 762 | 813 | 864 | 914 | 965 | 1016 | 1067 | 1118 | 1168 | 1219 | 1321 |
|  | **56** | **60** |  | | | | | | | | |
| 1400 | 1500 |  | | | | | | | | |
| 0.375" | 0.500" |
| 0.375 | 0.5 |
| 9.53 | 12.7 |
| 1422 | 1524 |

**GENERAL NOTES:**

1. All buttwelded components wall thickness shall match PIPE WALLTHICKNESS.
2. Non-standard pipe sizes NPS 1.25", 2.5", 3.5", 5" etc. shall not be used except for connection to the equipment or in special circumstances.

BX Piping Class Specification has been calculated to withstand Full Vacuum, max. buckling length 6m [19.68 ft].

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| **Notes** | **NPS/DN**  **(in)** | **Sch** | **Description** | **Commodity Code** | **Short Code** | **Rev** |
| **NIPPLES** | | | | | | |
| 53 | .5-1.5 | S-XS | Nipple, B36.10 M,(100mm), Plain - NPT, Seamless, ASTM A106 Gr B | APPN1DF5H0EA | NPTG1 |  |
| 53 | .5-1.5 | S-XS | Nipple, B36.10 M,(180mm), Plain - NPT, Seamless, ASTM A106 Gr B | APPN1DF5H0EB | NPTG3 |  |
| 53 | .5-1.5 | S-XS | Nipple, B36.10 M,(100mm), NPT - NPT, Seamless, ASTM A106 Gr B | APPN1DF6H0EA | NTTG1 |  |
| 53 | .5-1.5 | S-XS | Nipple, B36.10 M,(180mm), NPT - NPT, Seamless, ASTM A106 Gr B | APPN1DF6H0EB | NTTG3 |  |
| **PIPE** | | | | | | |
|  | .5-1.5 | S-XS | Pipe, B36.10 M, Plain end, Seamless, ASTM A106 Gr B | APPP1DF2H0EE | P |  |
|  | 2-6 | S-STD | Pipe, B36.10 M, Beveled end, API 5L Gr. B, SAWL, E=0.9 |  | P |  |
|  | 8-12 | S-20 | Pipe, B36.10 M, Beveled end, API 5L Gr. B, SAWL, E=0.9 |  | P |  |
|  | 14-24 | S-10 | Pipe, B36.10 M, Beveled end. API 5L Gr. B, SAWL, E=0.9 |  | P |  |
|  | 26-34 | S-10 | Pipe, B36.10 M, Beveled end, EFW (E=0.85), ASTM A672 Gr C60 Cl 13 | APPP1FR1D0EE | P |  |
|  | 36-48 | S-STD | Pipe, B36.10 M, Beveled end, EFW (E=0.85), ASTM A672 Gr C60 Cl 13 | APPP1FR1D0EE | P |  |
|  | 52-52 | 0.375” | Pipe, B36.10 M, Beveled end, EFW (E=0.85), ASTM A672 Gr C60 Cl 13 | APPP1FR1D0EE | P |  |
|  |  |  |  |  |  |  |
| **FORGED FITTINGS** | | | | | | |
| 58 | .5-1.5 |  | 90Deg. Elbow, B16.11, SW, CL 3000,ASTM A105N | APKA1DD130EA | 9E |  |
|  | .5-1.5 |  | Equal Tee, B16.11, SW, CL 3000, ASTM A105N | APKB1DD130EA | T |  |
| 58 | .5-1.5 |  | 45Deg. Elbow, B16.11, SW, CL 3000, ASTM A105N | APKC1DD130EA | 4E |  |
|  | .5-1.5 |  | Cap, B16.11, SW, CL3000, ASTM A105N | APKF1DD130EA | C |  |
| 404 | .5-1 |  | Plug, B16.11, Threaded NPT, CL 3000, ASTM A105N | APKP1DD230EA | PL |  |
| 401 | .5-1 |  | Cap, B16.11, Threaded NPT, CL3000, ASTM A105N | APKF1DD230EA | CT |  |
|  | .5-1.5 |  | Full Coupling, B16.11, SW, CL3000, ASTM A105N |  | FCL |  |
|  | .75-1.5  .5-1.25 |  | Reduced Tee, B16.11, SW, CL 3000, ASTM A105N | APKQ1DD130EA | RT |  |
|  | 2-48  .5-1.5 |  | Sockolet, MSS SP-97, SW, B16.11, CL 3000, ASTM A105N | APKM7DD130EB | SOL |  |
| 403 | 2-52  .75-1 |  | Threadolet, MSS SP-97, Threaded NPT, B16.11, CL 3000, ASTM A105N | APKN7DD230EB | TOL |  |

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| **Notes** | **NPS/DN**  **(in)** | **Sch** | **Description** | **Commodity Code** | **Short Code** | **Rev** |
| **WELDED FITTINGS** | | | | | | |
|  | .75-1.5  .5-1.25 | S-XS | Swage Nipple Conc. MSS SP-95, Beveled end,  ASTM A234 Gr WPB | APWT5DH1XXEA | CBB |  |
|  | .75-1.5  .5-1.25 | S-XS | Swage Nipple Ecc. MSS SP-95, Beveled end,  ASTM A234 Gr WPB | APWU5DH1XXEA | EBB |  |
|  | 2-48 | See Note A | 90Deg LR Elbow, B16.9, BW, ASTM A234 Gr WPBW | APWA1DH7XXEA | 9E |  |
|  | 2-48 | See Note A | 45Deg LR Elbow, B16.9, BW, ASTM A234 Gr WPBW | APWB1DH7XXEA | 4E |  |
|  | 2-48 | See Note A | Equal Tee, B16.9, BW, ASTM A234 Gr WPBW | APWD1DH7XXEA | T |  |
|  | 2-48 | See Note A | Cap, B16.9, BW ends, ASTM A234 Gr WPBW | APWF1DH7XXEA | C |  |
|  | 2-48  .75-46 | See Note A | Concentric Reducer, B16.9, BW, ASTM A234 Gr WPBW | APWG1DH7XXEA | CR |  |
|  | 2-48  .75-46 | See Note A | Eccentric Reducer, B16.9, BW, ASTM A234 Gr WPBW | APWH1DH7XXEA | ER |  |
|  | 2.5-48  2-46 | See Note A | , Reducing Tee, B16.9 ,BW, ASTM A234 Gr WPBW | APWE1DH7XXEA | RT |  |
| **FLANGES** | | | | | | |
|  | .5-24 |  | Flange, Blind, B16.5, RF, CL 150, ASTM A105N | APFA2DD101EA | BF |  |
| 59 | .5-24 |  | Flange, Blind, B16.5, RF, CL 300, ASTM A105N | APFA2DD103EA | BF3 |  |
| 53 | .5-.5 |  | Flange, Threaded, B16.5, RF, CL 150, ASTM A105N | APFK2DD101EA | TF |  |
|  | .5-14 |  | Flange, Spectacle Figure 8, B16.48, RF, CL 150, ASTM A516 Gr 70N | APFM6DG101EA | F8 |  |
|  | .5-1.5 |  | Flange, SW, B16.5, RF, CL 150, ASTM A105N | APFS2DD101EA | SF |  |
| 59 | .5-1.5 |  | Flange, SW, B16.5, RF, CL 300, ASTM A105N | APFS2DD103EA | SF3 |  |
| 402 | .75-2  .5-.5 |  | Flange, Blind with Thd bore, B16.5, 1/2" NPT, RF, CL 150, ASTM A105N | APFG2DD101EB | BFI |  |
| 402,  59 | .75-2  .5-.5 |  | Flange, Blind with Thd bore, B16.5, 1/2" NPT, RF, CL 300, ASTM A105N | APFG2DD103EB | BFI3 |  |
|  | 2-24 | See Note A | Flange, WN, B16.5, RF, CL 150, ASTM A105N | APFL2DD101EA | WN |  |
| 59 | 2-24 | See Note A | Flange, WN, B16.5, RF, CL 300, ASTM A105N | APFL2DD103EA | WN3 |  |
|  | 16-24 |  | Paddle Blank, B16.48, RF, CL 150, ASTM A516 Gr 70N | APFN6DG101EA | PB |  |
|  | 16-24 |  | Paddle Spacer, B16.48, RF, CL 150, ASTM A516 Gr 70N | APFP6DG101EA | PS |  |
|  | 26-48 |  | Flange, Blind, B16.47 B, RF, CL 150, ASTM A105N | APFA4DD101EA | BF |  |
|  | 26-52 | See Note A | Flange, WN, B16.47 B, RF, CL 150, ASTM A105N | APFL4DD101EA | WN |  |
|  | 26-48 |  | Paddle, Blank, G-DS-5-2-6, RF, CL 150, ASTM A516 Gr 70N | APFN0DG101ER | PB |  |
|  | 26-48 |  | Paddle, Spacer, G-DS-5-2-6, RF, CL 150, ASTM A516 Gr 70N | APFP0DG101ER | PS |  |
|  | 4-18 | See Note A | Flange, WN, B16.5, FF, CL 150, ASTM A105N |  | WNF |  |
| **ORIFICE FLANGE** | | | | | | |
|  | 1-24 | See Note A | ASME Orif Flg, WN 0.5NPT+jacl scr, B16.36, RF, CL 150, ASTM A105N | APOADD101EA | OF1 |  |

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| **Notes** | **NPS/DN**  **(in)** | **Sch** | **Description** | **Commodity Code** | **Short Code** | **Rev** |
| **GASKETS** | | | | | | |
|  | .5-10 |  | Gasket, Flat Ring, 1.5 mm Thk, CL 150, Expanded graphite 98% with metallic reinforcement | APGF2GN001AC | G |  |
| 59 | .5-24 |  | Gasket, Spiral Wound, 4.5 mm Thk, CL 300, Filler graphite 98%, spiral 316SS, IR 316SS, OR CS | APGS1GB003EB | G3 |  |
|  | 12-24 |  | Gasket, Flat Ring, 3.0 mm Thk, CL 150, Expanded graphite 98% with metallic reinforcement | APGF2GN001AD | G |  |
|  | 26-52 |  | Gasket, Spiral Wound, B16.47 B, 4.5 mm Thk, CL 150, Filler graphite 98%, spiral 316SS, IR 316SS, OR CS | APGS5GB001EB | G |  |
|  | 38-52 |  | Gasket, ASME B16.47-B, for Full Face Flange, 3.0 mm Thk, CL 150, Expanded graphite 98% with metallic reinforcement. |  | GF |  |
| **BOLTING** | | | | | | |
|  | .5-52 |  | Stud Bolt w/2-Heavy Hex Nuts, SA193 Gr B7 / SA194 Gr 2H, Coating | APBA1CB000EB | BT |  |
|  | .5-48 |  | Stud Bolt w/2-Heavy Hex Nuts, SA193 Gr B7 / SA194 Gr 2H, Coating | APBA1CB000EB | BT3 |  |
|  | 4-18 | Bolt size : 추후 제공 예정임 | Stud Bolt w/2-Heavy Hex Nuts, SA193 Gr B7 / SA194 Gr 2H, Metric Bolt / Nuts |  | BTM |  |
| **VALVES** | | | | | | |
| 407 | .5-2 | See Note A | Ball Valve, Float Ball, Thrd, NPT, RB, ASTM A182 Gr. F316/316L, 316SS Ball, PTFE, Oval Handle | APVB1QW333EH | BV |  |
|  | .5-1.5 | See Note A | Check Valve, API 602, Piston Type, Horiz and Vert, SW, CL800, ASTM A105N, Trim No. 8, BC | APVC6DC208EV | CH |  |
|  | .5-1.5 | See Note A | Check Valve, API 602, Swing Type, SW, CL800, ASTM A105N, Trim No. 8, BC |  | CH1 |  |
|  | .5-1.5 | See Note A | Gate Valve, API 602, SW, CL800, ASTM A105N, Trim No. 8, BB, OS & Y | APVG4DC208ER | GA |  |
| 60 | .5-1.5 | See Note A | Gate Valve, API 602, Flanged, RF, CL150, ASTM A105N, Trim No. 8, BB, OS & Y | APVG4DC401FL | GAF |  |
| 59, 60 | .5-1.5 | See Note A | Gate Valve, API 602, Flanged, RF, CL300, ASTM A105N, Trim No. 8, BB, OS & Y | APVG4DC403FL | GAF3 |  |
| 405 | .5-1.5 | See Note A | Globe Valve, API 602, straight seat, SW, CL800, ASTM A105N, Trim No. 8, BB, OS & Y | APVL5DC208EA | GL |  |
|  | .5-1.5 | See Note A | Globe Valve, API 602, straight seat, SWxNPT, CL800, ASTM A105N, Trim No. 8, BB, OS & Y | APVL5DC208ET | GL1 |  |
|  | 2-4 |  | Check Valve, API 602, Swing Check, Bolted cover, RF, CL150, ASTM A216 Gr WCB, Trim No. 8, | APVC4DD401EW | CH |  |
|  | 2-24 | See Note A | Check Valve, API 594, Dual Plate Check, Bolted, Wafer, RF,  CL150, ASTM A216 Gr WCB, Trim No. 8 | APVC4DD601EF | CHW |  |
|  | 2-12 | See Note A | Gate Valve, API 600, Flex. Wedge, Flanged, RF, CL150, ASTM A216 Gr WCB, Trim No. 8, BB, OS & Y | APVG3DD401ES | GA |  |
| 59, 60 | 2-2 | See Note A | Gate Valve, API 600,Flex. Wedge, Flanged, RF, CL300, ASTM A216 Gr WCB, Trim No. 8, BB, OS & Y | APVG3DD403ES | GA3 |  |

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| **Notes** | **NPS/DN**  **(in)** | **Sch** | **Description** | **Commodity Code** | **Short Code** | **Rev** |
| **VALVES** | | | | | | |
| 405 | 2-4 | See Note A | Globe Valve, API 623, Flanged, RF, CL150, ASTM A216 Gr WCB, Trim No. 8, BB, OS & Y | APVL7DD401EL | GL |  |
|  | 1.5-4 |  | Butterfly Valve, API 609, Double ecc, Bolted, Wafer, RF, CL150, ASTM A216 Gr WCB, Disc SS, Seat PTFE, Lever OP | APVF2DD601EH | BU |  |
|  | 6-24 |  | Butterfly Valve, API 609, Double ecc, Bolted, Wafer, RF, CL150, ASTM A216 Gr WCB, Disc SS, Seat PTFE, Gear OP | APVF2DD601EA | BU |  |
| 405 | 6-12 | See Note A | Globe Valve, API 623, Flanged, RF, CL150, ASTM A216 Gr WCB, Trim No. 8, BB, OS & Y, Gear OP | APVL7DD401EM | GL |  |
|  | 14-24 | See Note A | Gate Valve, API 600, Flex. Wedge, Flanged, RF, CL150, ASTM A216 Gr WCB, Trim No. 8, BB, OS & Y, Gear OP | APVG3DD401ET | GA |  |
|  | 26-48 |  | Butterfly Valve, Double Flanged - fire safe design, B16.47-B Flanged, RF, CL150, A216-WCB, Disc A351-CF8M, Graphite Gasket, Gear OP | APVF0DD401FF | BU |  |
|  | 0.5-0.5 |  | Needle Valve, Integral Bonnet, Screwed NPT, Manufacturer Std., Forged Carbon Steel Body, SS316 Trim |  | NI |  |
| **FILTERS / STRAINERS** | | | | | | |
|  | .5-1.5 |  | Y Strainer, SW. CL800, ASTM A105N, Screen Retainer: CS / Screen: SS316-Filtering 0.3mm, Gasket spir SS and Graphite | APVY3DC208EC | STY |  |
|  | 2-3 |  | Y Strainer, Flanged,RF, CL150, ASTM A216 Gr WCB,Screen Retainer: CS / Screen: SS316-Filtering 0.3mm, Gasket spir SS and Graphite | APVY3DD401GD | STY |  |
|  | 4-24 |  | Conical filter, G-DS-5-4-2,Wafer,CL150, all fluid except oxygen and water | APMN0QA701EA | CFR |  |
| **FABRICATED ITEMS** | | | | | | |
| 10007 | 52-52  38-38 | See Note A | Fabricated Concentric reducer, Beveled end ,Electric fusion straight weld pipe (E=1), ASTM A516 Gr 70N L=1000 | APSP0DC1G0EB | FCR | 1 |
| 10007 | 24-48  14-32 | See Note A | Fabricated Eccentric reducer, Beveled end, Electric fusion straight weld pipe (E=1), ASTM A516 Gr 70N | APSQ0DC1G0EB | FER | 1 |
|  | 24-24  2-10 | See Note A | ASME Fabricated Item, weld with Reinf., B36.10 M, Seamless (E=1), ASTM A106 Gr B | APSY1DF0H0EA | RPAD |  |
| 414 | 24-24  12-14 | See Note A | ASME Fabricated Item, RH Run Reduc., B31.3, Beveled end acc. ASME B16.25, ASTM A106 Gr B | APSX9DF1X0EE | RPAD1 |  |
|  | 30-32  2-16 | See Note A | ASME Fabricated Item, weld with Reinf., B36.10 M, Electric fusion straight weld pipe (E=0.85), ASTM A672 Gr C60 Cl 13 | APSY1FR0D0EA | RPAD |  |
|  |  |  |  |  |  |  |

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| **Notes** | **NPS/DN**  **(in)** | **Sch** | **Description** | **Commodity Code** | **Short Code** | **Rev** |
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|  |  |  |  |  |  |  |

**SPEC ITEM NOTES:**

53 For orifice flange tapping

1. To use only if necessary
2. For connection PN/class > rating pipe class
3. For connection to equipments
4. For insulated pressure testing vents (see G-DS-5-0-1)
5. For instrument connection (PI, TI, etc.)
6. For non-insulated pressure testing vents (see G-DS-5-0-1)
7. For vents
8. For regulation only

407 To be used for automatic valve connection

414 On Project level TSH may be recalculated via Sec. VIII Div. 1 or Div. 2, see also rules defined within G-EP-5-2-4

10007 To be used as option of B16.9 fitting (default)

**LEGEND:**

2 - Reducing Tee

230 - Class 3000

2 - Reducing Tee

2XX - -

1 - Equal Tee

130 - Class 3000

1 - Equal Tee

1XX - -

0 - No Branch

**BRANCH CHART (Preference 1)**

3 - Stub-on

3 - Stub-on

31 - Welded Connection

32 - Reinforcing Pad

3 - Stub-on

34 - Reinforced Header Run (TSH) Reducing

5 - Sockolet

530 - Class 3000

Branch Diameter

Header Diameter

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | 0,5 | 0,75 | 1 | 1,5 | 2 | 2,5 | 3 | 3,5 | 4 | 5 | 6 | 8 | 10 | 12 | 14 | 16 | 18 | 20 | 24 | 26 |
| 0,5 | 130 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 0,75 | 230 | 130 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 1 | 230 | 230 | 130 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 1,5 | 230 | 230 | 230 | 130 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 2 | 530 | 530 | 530 | 530 | 1XX |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 2,5 | 530 | 530 | 530 | 530 | 2XX | 1XX |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 3 | 530 | 530 | 530 | 530 | 2XX | 2XX | 1XX |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 3,5 | 530 | 530 | 530 | 530 | 31 | 2XX | 2XX | 1XX |  |  |  |  |  |  |  |  |  |  |  |  |
| 4 | 530 | 530 | 530 | 530 | 31 | 31 | 2XX | 2XX | 1XX |  |  |  |  |  |  |  |  |  |  |  |
| 5 | 530 | 530 | 530 | 530 | 31 | 31 | 31 | 2XX | 2XX | 1XX |  |  |  |  |  |  |  |  |  |  |
| 6 | 530 | 530 | 530 | 530 | 31 | 31 | 31 | 31 | 2XX | 2XX | 1XX |  |  |  |  |  |  |  |  |  |
| 8 | 530 | 530 | 530 | 530 | 31 | 31 | 31 | 31 | 31 | 2XX | 2XX | 1XX |  |  |  |  |  |  |  |  |
| 10 | 530 | 530 | 530 | 530 | 31 | 31 | 31 | 31 | 31 | 31 | 2XX | 2XX | 1XX |  |  |  |  |  |  |  |
| 12 | 530 | 530 | 530 | 530 | 31 | 31 | 31 | 31 | 31 | 31 | 31 | 2XX | 2XX | 1XX |  |  |  |  |  |  |
| 14 | 530 | 530 | 530 | 530 | 31 | 31 | 31 | 31 | 31 | 31 | 31 | 31 | 2XX | 2XX | 1XX |  |  |  |  |  |
| 16 | 530 | 530 | 530 | 530 | 31 | 31 | 31 | 31 | 31 | 31 | 31 | 31 | 31 | 2XX  32 | 2XX | 1XX |  |  |  |  |
| 18 | 530 | 530 | 530 | 530 | 31 | 31 | 31 | 31 | 31 | 31 | 31 | 31 | 31 | 31 | 2XX | 2XX | 1XX |  |  |  |
| 20 | 530 | 530 | 530 | 530 | 31 | 31 | 31 | 31 | 31 | 31 | 31 | 31 | 31 | 31  32 | 31 | 2XX | 2XX | 1XX |  |  |
| 24 | 530 | 530 | 530 | 530 | 32 | 32 | 32 | 32 | 32 | 32 | 32 | 32 | 32 | 34 | 34 | 2XX | 2XX | 2XX | 1XX |  |
| 26 | 530 | 530 | 530 | 530 | 31 | 31 | 31 | 31 | 31 | 31 | 31 | 31 | 31 | 31 | 31 | 31 | 31 | 2XX | 2XX | 1XX |
| 28 | 530 | 530 | 530 | 530 | 31 | 31 | 31 | 31 | 31 | 31 | 31 | 31 | 31 | 31 | 31 | 31 | 31 | 2XX | 2XX | 2XX |
| 30 | 530 | 530 | 530 | 530 | 32 | 31 | 31 | 31 | 31 | 31 | 31 | 32 | 32 | 32 | 32 | 2XX | 2XX | 2XX | 2XX | 2XX |
| 32 | 530 | 530 | 530 | 530 | 32 | 32 | 32 | 32 | 32 | 32 | 32 | 32 | 32 | 32 | 32 | 32 | 2XX | 2XX | 2XX  32 | 2XX |
| 34 | 530 | 530 | 530 | 530 | 32 | 32 | 32 | 32 | 32 | 32 | 32 | 32 | 32 | 32 | 32 | 32 | 34 | 34 | 34 | 34 |
| 36 | 530 | 530 | 530 | 530 | 31 | 31 | 31 | 31 | 31 | 31 | 31 | 31 | 32 | 32 | 32 | 32 | 32 | 32 | 32 | 32 |
| 38 | 530 | 530 | 530 | 530 | 32 | 32 | 32 | 32 | 32 | 32 | 32 | 32 | 32 | 32 | 32 | 32 | 32 | 34 | 34 | 34 |
| 40 | 530 | 530 | 530 | 530 | 32 | 32 | 32 | 32 | 32 | 32 | 32 | 32 | 32 | 32 | 32 | 32 | 32 | 32 | 34 | 34 |
| 42 | 530 | 530 | 530 | 530 | 32 | 32 | 32 | 32 | 32 | 32 | 32 | 32 | 32 | 32 | 32 | 32 | 32 | 32 | 34 | 34 |
| 44 | 530 | 530 | 530 | 530 | 32 | 32 | 32 | 32 | 32 | 32 | 32 | 32 | 32 | 32 | 32 | 32 | 32 | 32 | 34 | 34 |
| 46 | 530 | 530 | 530 | 530 | 32 | 32 | 32 | 32 | 32 | 32 | 32 | 32 | 32 | 32 | 32 | 32 | 32 | 32 | 34 | 34 |
| 48 | 530 | 530 | 530 | 530 | 32 | 32 | 32 | 32 | 32 | 32 | 32 | 32 | 32 | 32 | 32 | 32 | 32 | 32 | 31 | 34 |
| 52 | 530 | 530 | 530 | 530 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 31 | - |

**LEGEND:**

0 - No Branch

2 - Reducing Tee

230 - Class 3000

2 - Reducing Tee

2XX - -

1 - Equal Tee

130 - Class 3000

1 - Equal Tee

1XX - -

3 - Stub-on

3 - Stub-on

31 - Welded Connection

32 - Reinforcing Pad

3 - Stub-on

34 - Reinforced Header Run (TSH) Reducing

5 - Sockolet

530 - Class 3000

Branch Diameter

Header Diameter

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | 28 | 30 | 32 | 34 | 36 | 38 | 40 | 42 | 44 | 46 | 48 |
| 0,5 |  |  |  |  |  |  |  |  |  |  |  |
| 0,75 |  |  |  |  |  |  |  |  |  |  |  |
| 1 |  |  |  |  |  |  |  |  |  |  |  |
| 1,5 |  |  |  |  |  |  |  |  |  |  |  |
| 2 |  |  |  |  |  |  |  |  |  |  |  |
| 2,5 |  |  |  |  |  |  |  |  |  |  |  |
| 3 |  |  |  |  |  |  |  |  |  |  |  |
| 3,5 |  |  |  |  |  |  |  |  |  |  |  |
| 4 |  |  |  |  |  |  |  |  |  |  |  |
| 5 |  |  |  |  |  |  |  |  |  |  |  |
| 6 |  |  |  |  |  |  |  |  |  |  |  |
| 8 |  |  |  |  |  |  |  |  |  |  |  |
| 10 |  |  |  |  |  |  |  |  |  |  |  |
| 12 |  |  |  |  |  |  |  |  |  |  |  |
| 14 |  |  |  |  |  |  |  |  |  |  |  |
| 16 |  |  |  |  |  |  |  |  |  |  |  |
| 18 |  |  |  |  |  |  |  |  |  |  |  |
| 20 |  |  |  |  |  |  |  |  |  |  |  |
| 24 |  |  |  |  |  |  |  |  |  |  |  |
| 26 |  |  |  |  |  |  |  |  |  |  |  |
| 28 | 1XX |  |  |  |  |  |  |  |  |  |  |
| 30 | 2XX | 1XX |  |  |  |  |  |  |  |  |  |
| 32 | 2XX | 2XX | 1XX |  |  |  |  |  |  |  |  |
| 34 | 34 | 2XX | 2XX | 1XX |  |  |  |  |  |  |  |
| 36 | 32 | 32 | 2XX | 2XX | 1XX |  |  |  |  |  |  |
| 38 | 34 | 34 | 34 | 2XX | 2XX | 1XX |  |  |  |  |  |
| 40 | 34 | 34 | 34 | 34 | 2XX | 2XX | 1XX |  |  |  |  |
| 42 | 34 | 34 | 34 | 34 | 34 | 2XX | 2XX | 1XX |  |  |  |
| 44 | 34 | 34 | 34 | 34 | 34 | 34 | 2XX | 2XX | 1XX |  |  |
| 46 | 34 | 34 | 34 | 34 | 34 | 34 | 34 | 2XX | 2XX | 1XX |  |
| 48 | 34 | 34 | 34 | 34 | 34 | 34 | 34 | 34 | 2XX | 2XX | 1XX |
| 52 | - | - | - | - | - | - | - | - | - | - | - |

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| Rev. | Date | Prepared by | Checked By | Approved By | Description |
| 0 | 19/08/2022 | YJ Chen | C Shen |  | First issue |

Disclamer:

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|  |  |
| --- | --- |
| **DESIGN CODE:** | B31.3 - 2016 |
| **RATING CLASS:** | 150 |
| **MATERIAL:** | Carbon Steel High Temperature |
| **SERVICE:** | General and Water |
| **FLANGE FACING:** | Raised Face |
| **NOMINAL CORROSION ALLOWANCE:** | 0.0625 in (1.6 mm) |
| **MATERIAL GROUP:** | B16.5-2017, 1.1 |
| **TRIM:** | Trim 8 and EPDM |
| **FLUID CODE:** | DWC / DWR / WC / WCR / WCS / WER / WES / WF / WG / WGR / WGS / WH / WHH /  WHP / WPW / WPZ / WR / WSR / WSS / WT / WU / WWD / WWG / WWS / WWT |
| **CALCULATION NO:** | AL\_CORP\_502\_16\_300/400 |

**DESIGN PRESSURE-TEMPERATURE RATING:**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **From NPS 0.5 to 48in** | | | | | |
| **Temp. DegC** | -29 | 38 | 50 | 80 |  |
| **Pressure BarG** | 19.6 | 19.6 | 19.2 | 18.3 |
| **Temp. DegF** | -20 | 100 | 122 | 176 |
| **Pressure Psig** | 285 | 285 | 278 | 265 |
| **Full Vacuum NPS 0.5 to 48in** | | | | | |
| **Temp. DegC** | 80 |  | | | |
| **Pressure BarG** | -1 |
| **Temp. DegF** | 176 |
| **Pressure Psig** | -14.5 |

**PIPE WALL THICKNESS:**

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NPS** | **.5** | **.75** | **1** | **1.25** | **1.5** | **2** | **2.5** | **3** | **3.5** | **4** | **5** |
| **DN** | 15 | 20 | 25 | 32 | 40 | 50 | 65 | 80 | 90 | 100 | 125 |
| **SCH** | S-XS | S-XS | S-XS | S-XS | S-XS | S-STD | S-STD | S-STD | S-STD | S-STD | S-STD |
| **THK (in)** | 0.147 | 0.154 | 0.179 | 0.191 | 0.2 | 0.154 | 0.203 | 0.216 | 0.226 | 0.237 | 0.258 |
| **THK (mm)** | 3.73 | 3.91 | 4.55 | 4.85 | 5.08 | 3.91 | 5.16 | 5.49 | 5.74 | 6.02 | 6.55 |
| **OD (mm)** | 21.3 | 26.7 | 33.4 | 42.2 | 48.3 | 60.3 | 73 | 88.9 | 101.6 | 114.3 | 141.3 |
| **NPS** | **6** | **8** | **10** | **12** | **14** | **16** | **18** | **20** | **24** | **26** | **28** |
| **DN** | 150 | 200 | 250 | 300 | 350 | 400 | 450 | 500 | 600 | 650 | 700 |
| **SCH** | S-STD | S-STD | S-STD | S-STD | S-STD | S-STD | S-STD | S-STD | S-STD | S-STD | S-STD |
| **THK (in)** | 0.28 | 0.322 | 0.365 | 0.375 | 0.375 | 0.375 | 0.375 | 0.375 | 0.375 | 0.375 | 0.375 |
| **THK (mm)** | 7.11 | 8.18 | 9.27 | 9.53 | 9.53 | 9.53 | 9.53 | 9.53 | 9.53 | 9.53 | 9.53 |
| **OD (mm)** | 168.3 | 219.1 | 273 | 323.8 | 355.6 | 406.4 | 457 | 508 | 610 | 660 | 711 |
| **NPS** | **30** | **32** | **34** | **36** | **38** | **40** | **42** | **44** | **46** | **48** |  |
| **DN** | 750 | 800 | 850 | 900 | 950 | 1000 | 1050 | 1100 | 1150 | 1200 |
| **SCH** | S-STD | S-STD | S-STD | S-STD | 0.406" | 0.438" | 0.438" | 0.469" | 0.469" | S-XS |
| **THK (in)** | 0.375 | 0.375 | 0.375 | 0.375 | 0.406 | 0.438 | 0.438 | 0.469 | 0.469 | 0.5 |
| **THK (mm)** | 9.53 | 9.53 | 9.53 | 9.53 | 10.31 | 11.13 | 11.13 | 11.91 | 11.91 | 12.7 |
| **OD (mm)** | 762 | 813 | 864 | 914 | 965 | 1016 | 1067 | 1118 | 1168 | 1219 |

**GENERAL NOTES:**

1. All buttwelded components wall thickness shall match PIPE WALLTHICKNESS.
2. Non-standard pipe sizes NPS 1.25", 2.5", 3.5", 5" etc. shall not be used except for connection to the equipment or in special circumstances.

BX Piping Class Specification has been calculated to withstand Full Vacuum, max. buckling length 6m [19.68 ft].

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Notes** | **NPS/DN**  **(in)** | **Sch** | **Description** | **Commodity Code** | **Short Code** | **Rev** |
| **NIPPLES** | | | | | | |
| 53 | .5-1.5 | S-XS | Nipple, B36.10 M,(100mm), Plain - NPT, Seamless, ASTM A106 Gr B | APPN1DF5H0EA | NPTG1 |  |
| 53 | .5-1.5 | S-XS | Nipple, B36.10 M,(180mm), Plain - NPT, Seamless, ASTM A106 Gr B | APPN1DF5H0EB | NPTG3 |  |
| 53 | .5-1.5 | S-XS | Nipple, B36.10 M,(100mm), NPT - NPT, Seamless), ASTM A106 Gr B | APPN1DF6H0EA | NTTG1 |  |
| 53 | .5-1.5 | S-XS | Nipple, B36.10 M,(180mm), NPT - NPT, Seamless, ASTM A106 Gr B | APPN1DF6H0EB | NTTG3 |  |
| **PIPE** | | | | | | |
|  | .5-1.5 | S-XS | Pipe, B36.10 M, Plain end, Seamless, ASTM A106 Gr B | APPP1DF2H0EE | P |  |
|  | 2-6 | S-STD | Pipe, B36.10 M, Beveled end, API 5L Gr. B, SAWL, E=0.9 |  | P |  |
|  | 8-24 | S-STD | Pipe, B36.10 M, Beveled end, API 5L Gr. B, SAWL, E=0.9 |  | P |  |
|  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |
| **FORGED FITTINGS** | | | | | | |
| 58 | .5-1.5 |  | 90Deg. Elbow, B16.11, SW, CL 3000, ASTM A105N | APKA1DD130EA | 9E |  |
|  | .5-1.5 |  | Equal Tee, B16.11, SW, CL 3000, ASTM A105N | APKB1DD130EA | T |  |
| 58 | .5-1.5 |  | 45Deg. Elbow, B16.11, SW, 3000, ASTM A105N | APKC1DD130EA | 4E |  |
|  | .5-1.5 |  | Cap, B16.11, SW, CL3000, ASTM A105N | APKF1DD130EA | C |  |
| 401 | .75-1 |  | Cap, B16.11, Threaded NPT, CL3000, ASTM A105N | APKF1DD230EA | CT |  |
| 404 | .75-1 |  | Plug, B16.11, Threaded NPT, CL3000, ASTM A105N | APKP1DD230EA | PL |  |
|  | .5-1.5 |  | Full Coupling, B16.11, SW, CL3000, ASTM A105N |  | FCL |  |
|  | .5-1.5 |  | Full Coupling, B16.11, SWxNPT, CL3000, ASTM A105N |  | FCL1 |  |
|  | .75-1.5  .5-1.25 |  | Reduced tee, B16.11, SW, CL 3000, ASTM A105N | APKQ1DD130EA | RT |  |
|  | 2-24  .5-1.5 |  | Sockolet, MSS SP-97, SW, B16.11, CL3000, ASTM A105N | APKM7DD130EB | SOL |  |
| 403 | 2-24  .75-1 |  | Threadolet, MSS SP-97, Threaded ---- NPT, B16.11, CL 3000, ASTM A105N | APKN7DD230EB | TOL |  |

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| **Notes** | **NPS/DN**  **(in)** | **Sch** | **Description** | **Commodity Code** | **Short Code** | **Rev** |
| **WELDED FITTINGS** | | | | | | |
|  | .75-1.5  .5-1.25 | See Note A | Swage Nipple Conc, MSS SP-95, Beveled end,  ASTM A234 Gr WPB | APWT5DH1XXEA | CBB |  |
|  | .75-1.5  .5-1.25 | See Note A | Swage Nipple Ecc., MSS SP-95, Beveled end,  ASTM A234 Gr WPB | APWU5DH1XXEA | EBB |  |
|  | 2-24 | See Note A | 90Deg LR Elbow, B16.9, BW, ASTM A234 Gr WPBW | APWA1DH7XXEA | 9E |  |
|  | 2-24 | See Note A | 45Deg LR Elbow, B16.9, BW, ASTM A234 Gr WPBW | APWB1DH7XXEA | 4E |  |
|  | 2-24 | See Note A | Equal Tee, B16.9, BW, ASTM A234 Gr WPB | APWD1DH7XXEA | T |  |
|  | 2-24 | See Note A | Cap, B16.9, BW, ASTM A234 Gr WPBW | APWF1DH7XXEA | C |  |
|  | 2-24  .75-24 | See Note A | Concentric Reducer, B16.9, BW, ASTM A234 Gr WPBW | APWG1DH7XXEA | CR |  |
|  | 2-24  .75-24 | See Note A | Eccentric Reducer, B16.9, BW, ASTM A234 Gr WPBW | APWH1DH7XXEA | ER |  |
|  | 2.5-24  2-24 | See Note A | Reducing Tee, B16.9, BW, ASTM A234 Gr WPBW | APWE1DH7XXEA | RT |  |
| **FLANGES** | | | | | | |
|  | .5-24 |  | Flange, Blind, B16.5, RF, CL 150, ASTM A105N | APFA2DD101EA | BF |  |
| 59 | .5-24 |  | Flange, Blind, B16.5, RF, CL 300, ASTM A105N | APFA2DD103EA | BF3 |  |
| 53 | .5-.5 |  | Flange, Threaded, B16.5, RF, CL 150, ASTM A105N | APFK2DD101EA | TF |  |
|  | .5-14 |  | Flange, Spectacle Figure 8, B16.48, RF, CL 150, ASTM A516 Gr 70N | APFM6DG101EA | F8 |  |
|  | .5-1.5 |  | Flange, SW, B16.5, RF, CL 150, ASTM A105N | APFS2DD101EA | SF |  |
| 59 | .5-1.5 |  | Flange, SW, B16.5, RF, CL 300, ASTM A105N | APFS2DD103EA | SF3 |  |
| 402 | .75-2  .5-.5 |  | Flange, Blind with Thd Bore, B16.5, 1/2" NPT, RF, CL 150, ASTM A105N | APFG2DD101EB | BFI |  |
| 402,  59 | .75-2  .5-.5 |  | Flange, Blind with Thd Bore, B16.5, 1/2" NPT, RF, CL300, ASTM A105N | APFG2DD103EB | BFI3 |  |
|  | 2-24 | See Note A | Flange, WN, B16.5, RF, CL 150, ASTM A105N | APFL2DD101EA | WN |  |
| 59 | 2-24 | See Note A | Flange, WN, B16.5, RF, CL 300, ASTM A105N | APFL2DD103EA | WN3 |  |
|  | 16-24 |  | Paddle, Blank, B16.48, RF, CL 150, ASTM A516 Gr 70N | APFN6DG101EA | PB |  |
|  | 16-24 |  | Paddle, Spacer, B16.48, RF, CL 150, ASTM A516 Gr 70N | APFP6DG101EA | PS |  |
|  |  |  |  |  |  |  |
| **ORIFICE FLANGE** | | | | | | |
|  | 1-24 | See Note A | Orif Flg, WN 0.5 NPT + jack scr. B16.36, RF, CL 300,  ASTM A105N | APOA1DD103EA | OF |  |

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| --- | --- | --- | --- | --- | --- | --- |
| **Notes** | **NPS/DN**  **(in)** | **Sch** | **Description** | **Commodity Code** | **Short Code** | **Rev** |
| **GASKETS** | | | | | | |
|  | .5-10 |  | Gasket, Flat Ring, 1.5 mm Thk, CL 150, Synthetic Fiber with NBR / HNBR binder | APGF2PB001EC | G |  |
| 59 | .5-24 |  | Gasket, Spiral Wound, 4.5 mm Thk, CL 300, Filler Graphite 98%, Spiral 316SS, IR 316SS, OR CS | APGS1GB003EB | G3 |  |
|  | 12-24 |  | Gasket, Flat Ring, 3.0 mm Thk, CL 150, Synthetic Fiber with NBR / HNBR binder | APGF2PB001ED | G |  |
| **BOLTING** | | | | | | |
|  | .5-24 |  | Stud Bolt w/2-Heavy Hex Nuts, SA193 Gr B7 / 194 Gr 2H, Coating | APBA1CB000EB | BT |  |
|  | .5-24 |  | Stud Bolt w/2-Heavy Hex Nuts, SA193 Gr B7 / 194 Gr 2H, Coating | APBA1CB000EB | BT3 |  |
| **VALVES** | | | | | | |
|  | .5-1.5 | See Note A | Check Valve, API 602, piston type, horiz. and vert, SW, CL800, ASTM A105N, Trim No. 8, BC | APVC6DC208EV | CH |  |
| 413 | .5-1.5 | See Note A | Gate Valve, API 602, SWxNPT, CL800, ASTM A105N, Trim No. 8, BB, OS & Y | APVG4DC008EJ | GA1 |  |
|  | .5-1.5 | See Note A | Gate Valve, API 602, SW, CL800, ASTM A105N, Trim No. 8, BB, OS & Y | APVG4DC208ER | GA |  |
| 60 | .5-1.5 | See Note A | Gate Valve, API 602, Flanged, RF, CL150, ASTM A105N, Trim No. 8, BB, OS & Y | APVG4DC401FL | GAF |  |
| 59, 60 | .5-1.5 | See Note A | Gate Valve, Aapi 602, Flanged, RF, CL300, ASTM A105N, Trim No. 8, BB, OS & Y | APVG4DC403FL | GAF3 |  |
| 405 | .5-1.5 | See Note A | Globe Valve, API 602, straight seat, SW, CL800, ASTM A105N, Trim No. 8, BB, OS & Y | APVL5DC208EA | GL |  |
|  | 2-24 | See Note A | Check Valve, API 594, Dual Plate Check, Bolted, Wafer, RF, CL150, ASTM A216 Gr WCB, Trim No. 8 | APVC4DD601EF | CHW |  |
| 204 | 2-24 | See Note A | Check Valve, API 594, Dual Plate Check, Bolted, Wafer, RF, CL150, ASTM A216 Gr WCB, Trim No. 8, Plates drilled | APVC4DD601EG | CHW1 |  |
|  | 2-4 | See Note A | Gate Valve, API 600, flex. wedge, Flanged, RF, CL150, ASTM A216 Gr WCB, Trim No. 8, BB, OS & Y | APVG3DD401ES | GA |  |
| 59, 60 | 2-2 | See Note A | Gate Valve, API 600, flex. wedge, Flanged, RF, CL300, ASTM A216 Gr WCB, Trim No. 8, BB, OS & Y | APVG3DD403ES | GA3 |  |
| 405 | 2-4 | See Note A | Globe Valve, API 623, Flanged, RF, CL150, ASTM A216 Gr WCB, Trim No. 8, BB, OS & Y | APVL7DD401EL | GL |  |

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| --- | --- | --- | --- | --- | --- | --- |
| **Notes** | **NPS/DN**  **(in)** | **Sch** | **Description** | **Commodity Code** | **Short Code** | **Rev** |
| **VALVES** | | | | | | |
|  | 4-4 |  | Butterfly Valve, API 609, center lined (Cat.A), Bolted, Lug RF, CL150, ASTM A216 Gr WCB, Disc SS, Liner EPDM, adj. Lever | APVF2DD601EL | BU |  |
|  | 6-24 |  | Butterfly Valve, API 609, center lined (Cat.A), Bolted, Lug RF, CL150, ASTM A216 Gr WCB, Disc SS, Liner EPDM, Gear OP | APVF2DD601EK | BU |  |
| 405 | 6-12 | See Note A | Globe Valve, API 623, Flanged, RF, CL150, ASTM A216 Gr WCB, Trim No. 8, BB, OS & Y, Gear OP | APVL7DD401EM | GL |  |
|  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |
| **FILTERS / STRAINERS** | | | | | | |
|  | .5-1.5 |  | Y Strainer, SW, CL800, ASTM A105N, screen retainer: CS/Screen: SS316 - Filtering 0,8mm, Gasket spir SS and graphite | APVY3DC208EA | STY |  |
|  | 2-3 |  | Y Strainer, Flanged, RF, CL150, ASTM A216 Gr WCB, screen retainer: CS/Screen SS316-Filtering 0,8mm, Gasket spir SS and graphite | APVY3DD401EB | STY |  |
|  | 4-24 | See Note A | T-Strainer, Type TB, Blind Fl. TYPE 2, Flanged, RF, CL150, ASTM A234 Gr.WPB, Flanges ASTM A105N, Perfor. plate: SS304 or SS316, Wire Mesh: SS304 or SS316, mesh size 2, B/N: SA193 Gr. B7/SA194 Gr. 2H | APVT0DJ401EH | STT |  |

|  |  |  |  |  |  |  |
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| **Notes** | **NPS/DN**  **(in)** | **Sch** | **Description** | **Commodity Code** | **Short Code** | **Rev** |
| **FABRICATED ITEMS** | | | | | | |
|  | .5-1.5 | S-XS | Pipe bend, R=5xOD, Plain end, ,Seamless (E=1), ASTM A106 Gr B | APSR1DF2H0EA | 9B5D |  |
|  |  |  |  |  |  |  |
| 10007 | 6-24  2-22 | See Note A | Fabricated Concentric reducer, Beveled end, Electric fusion straight weld pipe (E=1), ASTM A516 Gr 70N | APSP0DC1G0EB | FCR |  |
| 10007 | 6-24  2-22 | See Note A | Fabricated Eccentric reducer, Beveled end, Electric fusion straight weld pipe (E=1), ASTM A516 Gr 70N | APSQ0DC1G0EB | FER |  |
|  | 24-24  2-16 | See Note A | ASME Fabricated Item, weld with Reinf., B36.10 M, Seamless (E=1), ASTM A106 Gr B, Permissible Substitution | APSY1DF0H0EC | RPAD |  |
|  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |

**SPEC ITEM NOTES:**

53 For orifice flange tapping

1. To use only if necessary
2. For connection PN/class > rating pipe class
3. For connection to equipments

204 Drilled plates check valves for water pumps

1. For insulated pressure testing vents (see G-DS-5-0-1)
2. For instrument connection (PI, TI, etc.)
3. For non-insulated pressure testing vents (see G-DS-5-0-1)
4. For vents
5. For regulation only

413 For instrument connection : Pressure, flow transmitters, analysers, vents and orifice tappings

414 On Project level TSH may be recalculated via Sec. VIII Div. 1 or Div. 2, see also rules defined within G-EP-5-2-4 10007 To be used as option of B16.9 fitting (default)

**LEGEND:**

2 - Reducing Tee

230 - Class 3000

2 - Reducing Tee

2XX - -

1 - Equal Tee

130 - Class 3000

1 - Equal Tee

1XX - -

0 - No Branch

**BRANCH CHART (Preference 1)**

3 - Stub-on

3 - Stub-on

31 - Welded Connection

32 - Reinforcing Pad

3 - Stub-on

34 - Reinforced Header Run (TSH) Reducing

5 - Sockolet

530 - Class 3000

Branch Diameter

Header Diameter

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | 0,5 | 0,75 | 1 | 1,25 | 1,5 | 2 | 2,5 | 3 | 3,5 | 4 | 5 | 6 | 8 | 10 | 12 | 14 | 16 | 18 | 20 | 24 |
| 0,5 | 130 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 0,75 | 230 | 130 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 1 | 230 | 230 | 130 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 1,25 | 230 | 230 | 230 | 130 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 1,5 | 230 | 230 | 230 | 230 | 130 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 2 | 530 | 530 | 530 | 530 | 530 | 1XX |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 2,5 | 530 | 530 | 530 | 530 | 530 | 2XX | 1XX |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 3 | 530 | 530 | 530 | 530 | 530 | 2XX | 2XX | 1XX |  |  |  |  |  |  |  |  |  |  |  |  |
| 3,5 | 530 | 530 | 530 | 530 | 530 | 31 | 2XX | 2XX | 1XX |  |  |  |  |  |  |  |  |  |  |  |
| 4 | 530 | 530 | 530 | 530 | 530 | 31 | 31 | 2XX | 2XX | 1XX |  |  |  |  |  |  |  |  |  |  |
| 5 | 530 | 530 | 530 | 530 | 530 | 31 | 31 | 31 | 2XX | 2XX | 1XX |  |  |  |  |  |  |  |  |  |
| 6 | 530 | 530 | 530 | 530 | 530 | 31 | 31 | 31 | 31 | 2XX | 2XX | 1XX |  |  |  |  |  |  |  |  |
| 8 | 530 | 530 | 530 | 530 | 530 | 31 | 31 | 31 | 31 | 31 | 2XX | 2XX | 1XX |  |  |  |  |  |  |  |
| 10 | 530 | 530 | 530 | 530 | 530 | 31 | 31 | 31 | 31 | 31 | 31 | 2XX | 2XX | 1XX |  |  |  |  |  |  |
| 12 | 530 | 530 | 530 | 530 | 530 | 31 | 31 | 31 | 31 | 31 | 31 | 31 | 2XX | 2XX | 1XX |  |  |  |  |  |
| 14 | 530 | 530 | 530 | 530 | 530 | 31 | 31 | 31 | 31 | 31 | 31 | 31 | 31 | 2XX | 2XX | 1XX |  |  |  |  |
| 16 | 530 | 530 | 530 | 530 | 530 | 31 | 31 | 31 | 31 | 31 | 31 | 31 | 31 | 31 | 2XX | 2XX | 1XX |  |  |  |
| 18 | 530 | 530 | 530 | 530 | 530 | 31 | 31 | 31 | 31 | 31 | 31 | 31 | 31 | 31 | 31 | 2XX | 2XX | 1XX |  |  |
| 20 | 530 | 530 | 530 | 530 | 530 | 31 | 31 | 31 | 31 | 31 | 31 | 31 | 31 | 31 | 31 | 31 | 2XX | 2XX | 1XX |  |
| 24 | 530 | 530 | 530 | 530 | 530 | 32 | 31 | 32 | 32 | 32 | 32 | 32 | 32 | 32 | 32 | 32 | 32 | 2XX | 2XX | 1XX |

|  |  |  |  |  |  |
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| Rev. | Date | Prepared by | Checked By | Approved By | Description |
| 0 | 19/08/2022 | YJ Chen | C Shen |  | First issue |

Disclamer:

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|  |  |
| --- | --- |
| **DESIGN CODE:** | B31.3 Latest Edition / Addenda - Normal Fluid Service |
| **RATING CLASS:** | 150 |
| **MATERIAL:** | Carbon Steel High Temperature |
| **SERVICE:** | General and Water |
| **FLANGE FACING:** | Raised Face |
| **NOMINAL CORROSION ALLOWANCE:** | 0.0625 in (1.6 mm) |
| **MATERIAL GROUP:** | B16.5-2017, 1.1 |
| **TRIM:** | Trim 8 and EPDM |
| **FLUID CODE:** | WCR / WCS |
| **CALCULATION NO:** | AL\_CORP\_D2\_502\_16\_300/400 |

**DESIGN PRESSURE-TEMPERATURE RATING:**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **From NPS 0.5 to 76in** | | | | | |
| **Temp. DegC** | -29 | 38 | 50 | 80 |  |
| **Pressure BarG** | 10.0 | 10.0 | 10.0 | 10.0 |
| **Temp. DegF** | -20 | 100 | 122 | 176 |
| **Pressure Psig** | 145 | 145 | 145 | 145 |
| **Full Vacuum NPS 0.5 to 76in** | | | | | |
| **Temp. DegC** | 80 |  | | | |
| **Pressure BarG** | -1 |
| **Temp. DegF** | 176 |
| **Pressure Psig** | -14.5 |

**PIPE WALL THICKNESS:**

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NPS** | **.5** | **.75** | **1** | **1.25** | **1.5** | **2** | **2.5** | **3** | **3.5** | **4** | **5** |
| **DN** | 15 | 20 | 25 | 32 | 40 | 50 | 65 | 80 | 90 | 100 | 125 |
| **SCH** | S-XS | S-XS | S-XS | S-XS | S-XS | S-STD | S-STD | S-STD | S-STD | S-STD | S-STD |
| **THK (in)** | 0.147 | 0.154 | 0.179 | 0.191 | 0.2 | 0.154 | 0.203 | 0.216 | 0.226 | 0.237 | 0.258 |
| **THK (mm)** | 3.73 | 3.91 | 4.55 | 4.85 | 5.08 | 3.91 | 5.16 | 5.49 | 5.74 | 6.02 | 6.55 |
| **OD (mm)** | 21.3 | 26.7 | 33.4 | 42.2 | 48.3 | 60.3 | 73 | 88.9 | 101.6 | 114.3 | 141.3 |
| **NPS** | **6** | **8** | **10** | **12** | **14** | **16** | **18** | **20** | **24** | **26** | **28** |
| **DN** | 150 | 200 | 250 | 300 | 350 | 400 | 450 | 500 | 600 | 650 | 700 |
| **SCH** | S-STD | S-20 | S-20 | S-20 | S-10 | S-10 | S-10 | S-10 | S-10 | S-10 | S-10 |
| **THK (in)** | 0.28 | 0.25 | 0.25 | 0.25 | 0.25 | 0.25 | 0.25 | 0.25 | 0.25 | 0.312 | 0.312 |
| **THK (mm)** | 7.11 | 6.35 | 6.35 | 6.35 | 6.35 | 6.35 | 6.35 | 6.35 | 6.35 | 7.92 | 7.92 |
| **OD (mm)** | 168.3 | 219.1 | 273 | 323.8 | 355.6 | 406.4 | 457 | 508 | 610 | 660 | 711 |
| **NPS** | **30** | **32** | **34** | **36** | **38** | **40** | **42** | **44** | **46** | **48** |  |
| **DN** | 750 | 800 | 850 | 900 | 950 | 1000 | 1050 | 1100 | 1150 | 1200 |
| **SCH** | S-10 | S-10 | S-10 | S-STD | S-STD | S-STD | S-STD | S-STD | S-STD | S-STD |
| **THK (in)** | 0.312 | 0.312 | 0.312 | 0.375 | 0.375 | 0.375 | 0.375 | 0.375 | 0.375 | 0.375 |
| **THK (mm)** | 7.92 | 7.92 | 7.92 | 9.53 | 9.53 | 9.53 | 9.53 | 9.53 | 9.53 | 9.53 |
| **OD (mm)** | 762 | 813 | 864 | 914 | 965 | 1016 | 1067 | 1118 | 1168 | 1219 |

**GENERAL NOTES:**

1. All buttwelded components wall thickness shall match PIPE WALLTHICKNESS.
2. Non-standard pipe sizes NPS 1.25", 2.5", 3.5", 5" etc. shall not be used except for connection to the equipment or in special circumstances.

VB Piping Class Specification has been calculated to withstand Full Vacuum, max. buckling length 6m [19.68 ft] up to NPS 76 except NPS 24, 34 and 52 to 64 withstand Full Vacuum, max. buckling length 4m [13.12 ft].

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Notes** | **NPS/DN**  **(in)** | **Sch** | **Description** | **Commodity Code** | **Short Code** | **Rev** |
| **NIPPLES** | | | | | | |
| 53 | .5-1.5 | S-XS | Nipple, B36.10 M,(100mm), Plain – NPT, Seamless ASTM A106 Gr B | APPN1DF5H0EA | NPTG1 |  |
| 53 | .5-1.5 | S-XS | Nipple, B36.10 M,(180mm), Plain - NPT, Seamless, ASTM A106 Gr B | APPN1DF5H0EB | NPTG3 |  |
| 53 | .5-1.5 | S-XS | Nipple, B36.10 M,(100mm), NPT - NPT, Seamless, ASTM A106 Gr B | APPN1DF6H0EA | NTTG1 |  |
| 53 | .5-1.5 | S-XS | Nipple, B36.10 M,(180mm), NPT - NPT, Seamless, ASTM A106 Gr B | APPN1DF6H0EB | NTTG3 |  |
| **PIPE** | | | | | | |
|  | .5-1.5 | S-XS | Pipe, B36.10 M, Plain end, Seamless, ASTM A106 Gr B | APPP1DF2H0EE | P |  |
|  | 2-6 | S-STD | Pipe, B36.10 M, Beveled end, API 5L Gr. B, SAWL, E=0.9 |  | P |  |
|  | 8-12 | S-20 | Pipe, B36.10 M, Beveled end, API 5L Gr. B, SAWL, E=0.9 |  | P |  |
|  | 14-24 | S-10 | Pipe, B36.10 M, Beveled end, API 5L Gr. B, SAWL, E=0.9 |  | P |  |
|  | 26-32 | S-10 | Pipe, B36.10 M, Beveled end, EFW (E=0.85), ASTM A672 Gr C60 Cl 13 | APPP1FR1D0EE | P |  |
| **FORGED FITTINGS** | | | | | | |
| 58 | .5-1.5 |  | 90Deg. Elbow, B16.11, SW, CL 3000, ASTM A105N | APKA1DD130EA | 9E |  |
|  | .5-1.5 |  | Equal Tee, B16.11, SW, CL 3000, ASTM A105N | APKB1DD130EA | T |  |
| 58 | .5-1.5 |  | 45Deg. Elbow, B16.11, SW, CL 3000, ASTM A105N | APKC1DD130EA | 4E |  |
|  | .5-1.5 |  | Cap, B16.11, SW, CL3000, ASTM A105N | APKF1DD130EA | C |  |
| 404 | .5-1 |  | Plug, B16.11, Threaded NPT, CL 3000, ASTM A105N | APKP1DD230EA | PL |  |
| 401 | .5-1 |  | Cap, B16.11, Threaded NPT, CL3000, ASTM A105N | APKF1DD230EA | CT |  |
|  | .5-1.5 |  | Full Coupling, B16.11, SW, CL3000, ASTM A105N |  | FCL |  |
|  | .75-1.5  .5-1.25 |  | Reduced tee, B16.11, SW, CL 3000, ASTM A105N | APKQ1DD130EA | RT |  |
|  | 2-24  .5-1.5 |  | Sockolet, MSS SP-97, SW,B16.11,CL 3000, ASTM A105N | APKM7DD130EB | SOL |  |
| 403 | 2-24  .75-1 |  | Threadolet, MSS SP-97, Threaded NPT, B16.11, CL 3000, ASTM A105N | APKN7DD230EB | TOL |  |
| **WELDED FITTINGS** | | | | | | |
|  | .75-1.5  .5-1.25 | See Note A | Swage Nipple Conc,MSS SP-95,  Beveled end, ASTM A234 Gr WPB | APWT5DH1XXEA | CBB |  |
|  | .75-1.5  .5-1.25 | See Note A | Swage Nipple Ecc,MSS SP-95,Beveled end,  ASTM A234 Gr WPB | APWU5DH1XXEA | EBB |  |
|  | 2-24 | See Note A | 90Deg LR Elbow, B16.9, BW, ASTM A234 Gr WPBW | APWA1DH7XXEA | 9E |  |
|  | 2-24 | See Note A | 45Deg LR Elbow, B16.9, BW, ASTM A234 Gr WPBW | APWB1DH7XXEA | 4E |  |
|  | 2-24 | See Note A | Equal Tee, B16.9, BW, ASTM A234 Gr WPBW | APWD1DH7XXEA | T |  |
|  | 2-24 | See Note A | Cap, B16.9, BW, ASTM A234 Gr WPBW | APWF1DH7XXEA | C |  |

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| **Notes** | **NPS/DN**  **(in)** | **Sch** | **Description** | **Commodity Code** | **Short Code** | **Rev** |
| **WELDED FITTINGS** | | | | | | |
|  | 2-24  .75-22 | See Note A | Concentric Reducer, B16.9, BW, ASTM A234 Gr WPBW | APWG1DH7XXEA | CR |  |
|  | 2-24  .75-22 | See Note A | Eccentric Reducer, B16.9, BW, ASTM A234 Gr WPBW | APWH1DH7XXEA | ER |  |
|  | 2.5-24  2-22 | See Note A | Reducing Tee, B16.9, BW, ASTM A234 Gr WPBW | APWE1DH7XXEA | RT |  |
| **FLANGES** | | | | | | |
|  | .5-24 |  | Flange, Blind, B16.5, RF,CL 150, ASTM A105N | APFA2DD101EA | BF |  |
| 59 | .5-24 |  | Flange, Blind, B16.5, RF,CL 300, ASTM A105N | APFA2DD103EA | BF3 |  |
| 53 | .5-.5 |  | Flange, Threaded, B16.5, RF,CL 150, ASTM A105N | APFK2DD101EA | TF |  |
|  | .5-14 |  | Flange, Spectacle Figure 8, B16.48, RF,CL 150, ASTM A516 Gr 70N | APFM6DG101EA | F8 |  |
|  | .5-1.5 |  | Flange, SW, B16.5, RF,CL 150, ASTM A105N | APFS2DD101EA | SF |  |
| 59 | .5-1.5 |  | Flange, SW, B16.5, RF,CL 300, ASTM A105N | APFS2DD103EA | SF3 |  |
| 402 | .75-2  .5-.5 |  | Flange, Blind with Thd Bore, B16.5, 1/2" NPT, RF, CL 150, ASTM A105N | APFG2DD101EB | BFI |  |
| 402,  59 | .75-2  .5-.5 |  | Flange, Blind with Thd Bore, B16.5, 1/2" NPT, RF, CL 300, ASTM A105N | APFG2DD103EB | BFI3 |  |
|  | 2-6 | S-STD | Flange, WN, B16.5, RF,CL 150, ASTM A105N | APFL2DD101EA | WN |  |
|  | 8-12 | S- 20 | Flange, WN, B16.5, RF,CL 150, ASTM A105N | APFL2DD101EA | WN |  |
|  | 14-24 | S-10 | Flange, WN, B16.5, RF,CL 150, ASTM A105N | APFL2DD101EA | WN |  |
| 59 | 2-6 | S-STD | Flange, WN, B16.5, RF,CL 300, ASTM A105N | APFL2DD103EA | WN3 |  |
| 59 | 8-12 | S- 20 | Flange, WN, B16.5, RF,CL 300, ASTM A105N | APFL2DD103EA | WN3 |  |
| 59 | 14-24 | S-10 | Flange, WN, B16.5, RF,CL 300, ASTM A105N | APFL2DD103EA | WN3 |  |
|  | 26-32 |  | Flange, Blind, B16.47 B, RF, CL 150, ASTM A105N | APFA4DD101EA | BF |  |
|  | 26-32 | See Note A | Flange, WN, B16.47 B, RF, CL 150, ASTM A105N | APFL4DD101EA | WN |  |
|  | 16-24 | S-10 | Paddle, Blank, B16.48, RF, CL 150, ASTM A516 Gr 70N | APFN6DG101EA | PB |  |
|  | 16-24 | S-10 | Paddle, Spacer, B16.48, RF, CL 150, ASTM A516 Gr 70N | APFP6DG101EA | PS |  |
| **ORIFICE FLANGE** | | | | | | |
|  | 1-24 | See Note A | Orif Flg, WN 0.5 NPT+jack scr. B16.36, RF, CL 300, A STM A105N | APOA1DD103EA | OF |  |
| **GASKETS** | | | | | | |
|  | .5-10 |  | Gasket, Flat Ring, 1.5 mm Thk, CL 150, Synthetic fiber with NBR / HNBR binder | APGF2PB001EC | G |  |
| 59 | .5-24 |  | Gasket, Spiral Wound, 4.5 mm Thk, CL 300, Filler graphite 98%, spiral 316SS, IR 316SS, OR CS | APGS1GB003EB | G3 |  |
|  | 12-24 |  | Gasket, Flat Ring, 3.0 mm Thk, CL 150, Synthetic fiber with NBR / HNBR binder | APGF2PB001ED | G |  |
|  | 26-32 |  | Gasket, Flat Ring, B16.47 B, 3.0 mm Thk, CL 150, Synthetic fiber with NBR / HNBR binder | APGF6PB001ED | G |  |
| **BOLTING** | | | | | | |
|  | .5-32 |  | Stud Bolt w/2-Heavy hex Nuts, SA193 Gr B7 / SA194 Gr 2H, Coating | APBA1CB000EB | BT |  |
|  | .5-32 |  | Stud Bolt w/2-Heavy hex Nuts, SA193 Gr B7 / SA194 Gr 2H, Coating | APBA1CB000EB | BT3 |  |

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| **Notes** | **NPS/DN**  **(in)** | **Sch** | **Description** | **Commodity Code** | **Short Code** | **Rev** |
| **VALVES** | | | | | | |
|  | .5-1.5 | See Note A | Check Valve, API602, piston type, horiz. and vert, SW, CL800, ASTM A105N, Trim No. 8, BC | APVC6DC208EV | CH |  |
|  | .5-1.5 | See Note A | Gate Valve, API 602, SW, CL800, ASTM A105N, Trim No. 8, BB, OS & Y | APVG4DC208ER | GA |  |
|  | .5-1.5 | See Note A | Gate Valve, API 602, SWxNPT, CL800, ASTM A105N, Trim No. 8, BB, OS & Y | APVG4DC008EJ | GA1 |  |
| 60 | .5-1.5 | See Note A | Gate Valve, API 602, Flanged, RF, CL150, ASTM A105N, Trim No. 8, BB, OS & Y | APVG4DC401FL | GAF |  |
| 59, 60 | .5-1.5 | See Note A | Gate Valve, API 602, Flanged, RF, CL300, ASTM A105N, Trim No. 8, BB, OS & Y | APVG4DC403FL | GAF3 |  |
| 405 | .5-1.5 | See Note A | Globe Valve, API 602, straight seat, SW, CL800, ASTM A105N, Trim No. 8, BB, OS & Y | APVL5DC208EA | GL |  |
| 413 | .5-1.5 | See Note A | Globe Valve, API 602, straight seat, SWxNPT, CL800, ASTM A105N, Trim No. 8, BB, OS & Y | APVL5DC208ET | GL1 |  |
|  | 2-24 | See Note A | Check Valve, API 594, Dual Plate Check, Bolted, Wafer RF, CL150, ASTM A216 Gr WCB, Trim No. 8 | APVC4DD601EF | CHW |  |
| 204 | 2-24 | See Note A | Check Valve, API 594, Dual Plate Check, Bolted, Wafer RF, CL150, ASTM A216 Gr WCB, Trim No. 8, Plates drilled | APVC4DD601EG | CHW1 |  |
|  | 2-3 | See Note A | Gate Valve, API 600, flex. wedge, Flanged, RF, CL150, ASTM A216 Gr WCB, Trim No. 8, BB, OS & Y | APVG3DD401ES | GA |  |
| 59, 60 | 2-2 | See Note A | Gate Valve, API 600, flex. wedge, Flanged, RF, CL300, ASTM A216 Gr WCB, Trim No. 8, BB, OS & Y | APVG3DD403ES | GA3 |  |
| 405 | 2-4 | See Note A | Globe Valve, API 623, Flanged, RF, CL150, ASTM A216 Gr WCB, Trim No. 8, BB, OS & Y | APVL7DD401EL | GL |  |
|  | 3-4 |  | Butterfly Valve, API 609, center lined (Cat.A), Bolted,Lug, RF, CL150, ASTM A216 Gr WCB, Disc SS, Liner EPDM, adj. Lever | APVF2DD601EL | BU |  |
|  | 6-24 |  | Butterfly Valve, API 609, center lined (Cat.A), Bolted,Lug, RF, CL150, ASTM A216 Gr WCB, Disc SS, Liner EPDM, Gear OP | APVF2DD601EK | BU |  |
| 405 | 6-12 | See Note A | Globe Valve, API 623, Flanged, RF, CL150, ASTM A216 Gr WCB, Trim No. 8, BB, OS & Y, Gear OP | APVL7DD401EM | GL |  |

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Notes** | **NPS/DN**  **(in)** | **Sch** | **Description** | **Commodity Code** | **Short Code** | **Rev** |
| **VALVES** | | | | | | |
|  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |
| **FILTERS / STRAINERS** | | | | | | |
|  | .5-1.5 |  | Y Strainer, SW, CL800, ASTM A105N, screen retainer: CS/Screen SS316 - Filtering 0.8mm, Gasket spir SS and Graphite | APVY3DC208EA | STY |  |
|  | 2-3 |  | Y Strainer, Flanged, RF , CL150, ASTM A216 Gr WCB, Screen retainer: CS, Screen SS316-Filtering 0.8mm, Gasket spir SS and Graphite | APVY3DD401EB | STY |  |
|  | 4-24 | See Note A | Tee Strainer, Type TB, Blind Fl. Type 2, Flanged, RF, CL150, ASTM A234 Gr WPB, Flange ASTM A105N, Perfor. Plate SS304 or SS316, Wire mesh SS304 or SS316, Mesh size 2, B/N: ASME SA193 Gr.B7/SA194 Gr. 2H | APVT0DJ401EH | STT |  |
| **FABRICATED ITEMS** | | | | | | |
|  | .5-1.5 | S-XS | Pipe bend, R=5xOD, Plain end, Seamless (E=1), ASTM A106 Gr B | APSR1DF2H0EA | 9B5D |  |
|  |  |  |  |  |  |  |
| 10007 | 6-32  2-30 | See Note A | Fabricated Concentric reducer, Beveled end, Electric fusion straight weld pipe (E=1), ASTM A516 Gr 70N | APSP0DC1G0EB | FCR |  |
| 10007 | 6-32  2-30 | See Note A | Fabricated Eccentric reducer, Beveled end, Electric fusion straight weld(E=1), ASTM A516 Gr 70N | APSQ0DC1G0EB | FER |  |
| 414 | 24-24  12-16 | See Note A | ASME Fabricated Item, RH Run Reduc., B31.3, Beveled end acc. ASME B16.25, ASTM A106 Gr B | APSX9DF1X0EC | RPAD1 |  |

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Notes** | **NPS/DN**  **(in)** | **Sch** | **Description** | **Commodity Code** | **Short Code** | **Rev** |
| **FABRICATED ITEMS** | | | | | | |
|  | 0.5-0.5 |  | Needle Valve, API#800, Screwed |  | NI |  |
|  |  |  |  |  |  |  |

**SPEC ITEM NOTES:**

53 For orifice flange tapping

1. To use only if necessary
2. For connection PN/class > rating pipe class
3. For connection to equipments

204 Drilled plates check valves for water pumps

1. For insulated pressure testing vents (see G-DS-5-0-1)
2. For instrument connection (PI, TI, etc.)
3. For non-insulated pressure testing vents (see G-DS-5-0-1)
4. For vents
5. For regulation only

413 For instrument connection : Pressure, flow transmitters, analysers, vents and orifice tappings

414 On Project level TSH may be recalculated via Sec. VIII Div. 1 or Div. 2, see also rules defined within G-EP-5-2-4 10007 To be used as option of B16.9 fitting (default)

**LEGEND:**

2 - Reducing Tee

230 - Class 3000

2 - Reducing Tee

2XX - -

1 - Equal Tee

130 - Class 3000

1 - Equal Tee

1XX - -

0 - No Branch

**BRANCH CHART (Preference 1)**

3 - Stub-on

3 - Stub-on

31 - Welded Connection

32 - Reinforcing Pad

3 - Stub-on

34 - Reinforced Header Run (TSH) Reducing

5 - Sockolet

530 - Class 3000

Branch Diameter

Header Diameter

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | 0,5 | 0,75 | 1 | 1,25 | 1,5 | 2 | 2,5 | 3 | 3,5 | 4 | 5 | 6 | 8 | 10 | 12 | 14 | 16 | 18 | 20 | 24 |
| 0,5 | 130 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 0,75 | 230 | 130 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 1 | 230 | 230 | 130 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 1,25 | 230 | 230 | 230 | 130 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 1,5 | 230 | 230 | 230 | 230 | 130 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 2 | 530 | 530 | 530 | 530 | 530 | 1XX |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 2,5 | 530 | 530 | 530 | 530 | 530 | 2XX | 1XX |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 3 | 530 | 530 | 530 | 530 | 530 | 2XX | 2XX | 1XX |  |  |  |  |  |  |  |  |  |  |  |  |
| 3,5 | 530 | 530 | 530 | 530 | 530 | 31 | 2XX | 2XX | 1XX |  |  |  |  |  |  |  |  |  |  |  |
| 4 | 530 | 530 | 530 | 530 | 530 | 31 | 31 | 2XX | 2XX | 1XX |  |  |  |  |  |  |  |  |  |  |
| 5 | 530 | 530 | 530 | 530 | 530 | 31 | 31 | 31 | 2XX | 2XX | 1XX |  |  |  |  |  |  |  |  |  |
| 6 | 530 | 530 | 530 | 530 | 530 | 31 | 31 | 31 | 31 | 2XX | 2XX | 1XX |  |  |  |  |  |  |  |  |
| 8 | 530 | 530 | 530 | 530 | 530 | 31 | 31 | 31 | 31 | 31 | 2XX | 2XX | 1XX |  |  |  |  |  |  |  |
| 10 | 530 | 530 | 530 | 530 | 530 | 31 | 31 | 31 | 31 | 31 | 31 | 2XX | 2XX | 1XX |  |  |  |  |  |  |
| 12 | 530 | 530 | 530 | 530 | 530 | 31 | 31 | 31 | 31 | 31 | 31 | 31 | 2XX | 2XX | 1XX |  |  |  |  |  |
| 14 | 530 | 530 | 530 | 530 | 530 | 31 | 31 | 31 | 31 | 31 | 31 | 31 | 31 | 2XX | 2XX | 1XX |  |  |  |  |
| 16 | 530 | 530 | 530 | 530 | 530 | 31 | 31 | 31 | 31 | 31 | 31 | 31 | 31 | 31 | 2XX | 2XX | 1XX |  |  |  |
| 18 | 530 | 530 | 530 | 530 | 530 | 31 | 31 | 31 | 31 | 31 | 31 | 31 | 31 | 31 | 31 | 2XX | 2XX | 1XX |  |  |
| 20 | 530 | 530 | 530 | 530 | 530 | 31 | 31 | 31 | 31 | 31 | 31 | 31 | 31 | 31 | 31 | 31 | 2XX | 2XX | 1XX |  |
| 24 | 530 | 530 | 530 | 530 | 530 | 31 | 31 | 31 | 31 | 31 | 31 | 31 | 31 | 31 | 34 | 34 | 34 | 2XX | 2XX | 1XX |
| 26 | 530 | 530 | 530 | 530 | 530 | 31 | 31 | 31 | 31 | 31 | 31 | 31 | 31 | 31 | 31 | 31 | 31 | 31 | 2XX | 2XX |
| 28 | 530 | 530 | 530 | 530 | 530 | 31 | 31 | 31 | 31 | 31 | 31 | 31 | 31 | 31 | 31 | 31 | 31 | 31 | 31 | 2XX |
| 30 | 530 | 530 | 530 | 530 | 530 | 31 | 31 | 31 | 31 | 31 | 31 | 31 | 31 | 31 | 31 | 31 | 34 | 34 | 34 | 34 |
| 32 | 530 | 530 | 530 | 530 | 530 | 31 | 31 | 31 | 31 | 31 | 31 | 31 | 31 | 31 | 31 | 31 | 31 | 34 | 34 | 34 |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Rev. | Date | Prepared by | Checked By | Approved By | Description |
| 0 | 19/08/2022 | YJ Chen | C Shen |  | First issue |

Disclamer:

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|  |  |
| --- | --- |
| **DESIGN CODE:** | B31.3 - 2016 |
| **RATING CLASS:** | 150 |
| **MATERIAL:** | SS 304 / 304 L Dual Certified |
| **SERVICE:** | General |
| **FLANGE FACING:** | Raised Face |
| **NOMINAL CORROSION ALLOWANCE:** | 0 in (0 mm) |
| **MATERIAL GROUP:** | B16.5-2017, 2.1 |
| **TRIM:** | Trim 10 |
| **FLUID CODE:** | AA / AC / AD / AG / AI / AIN / AS / NG / NS / NW |
| **CALCULATION NO:** | AL\_CORP\_613\_16\_300/400 |

**DESIGN PRESSURE-TEMPERATURE RATING:**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **From NPS 0.5 to 24in** | | | | | | | |
| **Temp. DegC** | -45 | 38 | 50 | 100 | 150 | 200 |  |
| **Pressure BarG** | 19.0 | 19.0 | 18.3 | 15.7 | 14.2 | 13.2 |
| **Temp. DegF** | -49 | 100 | 122 | 212 | 302 | 392 |
| **Pressure Psig** | 275 | 275 | 265 | 228 | 205 | 191 |
| **Full Vacuum (NPS 0.5 to 24in)** | | | | | | | |
| **Temp. DegC** | 200 |  | | | | | |
| **Pressure BarG** | -1 |
| **Temp. DegF** | 392 |
| **Pressure Psig** | -14.5 |

**PIPE WALL THICKNESS:**

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NPS** | **.5** | **.75** | **1** | **1.25** | **1.5** | **2** | **2.5** | **3** | **3.5** | **4** | **5** |
| **DN** | 15 | 20 | 25 | 32 | 40 | 50 | 65 | 80 | 90 | 100 | 125 |
| **SCH** | S-10S | S-10S | S-10S | S-10S | S-10S | S-10S | S-10S | S-10S | S-10S | S-10S | S-10S |
| **THK (in)** | 0.083 | 0.083 | 0.109 | 0.109 | 0.109 | 0.109 | 0.12 | 0.12 | 0.12 | 0.12 | 0.134 |
| **THK (mm)** | 2.11 | 2.11 | 2.77 | 2.77 | 2.77 | 2.77 | 3.05 | 3.05 | 3.05 | 3.05 | 3.4 |
| **OD (mm)** | 21.3 | 26.7 | 33.4 | 42.2 | 48.3 | 60.3 | 73 | 88.9 | 101.6 | 114.3 | 141.3 |
| **NPS** | **6** | **8** | **10** | **12** | **14** | **16** | **18** | **20** | **24** |  | |
| **DN** | 150 | 200 | 250 | 300 | 350 | 400 | 450 | 500 | 600 |
| **SCH** | S-10S | S-10S | S-10S | S-10S | S-10S | S-10S | S-10 | S-10 | S-10 |
| **THK (in)** | 0.134 | 0.148 | 0.165 | 0.18 | 0.188 | 0.188 | 0.25 | 0.25 | 0.25 |
| **THK (mm)** | 3.4 | 3.76 | 4.19 | 4.57 | 4.78 | 4.78 | 6.35 | 6.35 | 6.35 |
| **OD (mm)** | 168.3 | 219.1 | 273 | 323.8 | 355.6 | 406.4 | 457 | 508 | 610 |

**GENERAL NOTES:**

1. All buttwelded components wall thickness shall match PIPE WALLTHICKNESS.
2. Non-standard pipe sizes NPS 1.25", 2.5", 3.5", 5" etc. shall not be used except for connection to the equipment or in special circumstances.

BX Piping Class Specification has been calculated to withstand Full Vacuum, max. buckling length 6m [19.68 ft].

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Notes** | **NPS/DN**  **(in)** | **Sch** | **Description** | **Commodity Code** | **Short Code** | **Rev** |
| **NIPPLES** | | | | | | |
| 53 | .5-1.5 | S-40S | Nipple, B36.19 M,(100mm), Plain - NPT, Seamless, ASTM A312 Gr TP304/TP304L, Dual Certified | APPN2QP5H0EA | NPTG1 |  |
| 53 | .5-1.5 | S-40S | Nipple, B36.19 M,(180mm), Plain - NPT, Seamless, ASTM A312 Gr TP304/TP304L, Dual Certified | APPN2QP5H0EB | NPTG3 |  |
| 53 | .5-1.5 | S-40S | Nipple, B36.19 M,(100mm), NPT - NPT, Seamless, ASTM A312 Gr TP304/TP304L, Dual Certified | APPN2QP6H0EA | NTTG1 |  |
| 53 | .5-1.5 | S-40S | Nipple, B36.19 M,(180mm ), NPT - NPT, Seamless, ASTM A312 Gr TP304/TP304L, Dual Certified | APPN2QP6H0EB | NTTG3 |  |
| **PIPE** | | | | | | |
|  | .5-1.5 | S-10S | Pipe, B36.19 M, Plain end, Seamless, ASTM A312 Gr TP304/TP304L, Dual Certified | APPP7QP2H0EE | P |  |
|  | 2-16 | S-10S | Pipe, B36.19 M, Beveled end, EFW(E=0.80), ASTM A312 Gr TP304/TP304L, Dual Certified | APPP7QP1C0EE | P |  |
|  | ~~18-24~~ | ~~S-10S~~ | ~~Pipe, B36.19 M, Beveled end, EFW(E=0.80), ASTM A312 Gr TP304/TP304L Dual Certified~~ | ~~APPP7QP1C0EE~~ | ~~P~~ |  |
| **FORGED FITTINGS** | | | | | | |
| 58 | .5-1.5 |  | 90Deg. Elbow, B16.11, SW, CL 3000, ASTM A182 Gr F304/304L, Dual Certified | APKA1QC130EA | 9E |  |
|  | .5-1.5 |  | Equal Tee, B16.11, SW, CL 3000, ASTM A182 Gr F304/304L, Dual Certified | APKB1QC130EA | T |  |
| 58 | .5-1.5 |  | 45Deg. Elbow, B16.11, SW, CL 3000, ASTM A182 Gr F304/304L, Dual Certified | APKC1QC130EA | 4E |  |
|  | .5-1.5 |  | Cap, B16.11, SW, CL3000, ASTM A182 Gr F304/304L, Dual Certified | APKF1QC130EA | C |  |
| 404 | .5-1 |  | Plug, B16.11, Threaded NPT, CL3000, ASTM A182 Gr F304/304L, Dual Certified | APKP1QC230EA | PL |  |
| 401 | **.5**-1 |  | Cap, B16.11, Threaded NPT, CL3000, ASTM A182 Gr F304/304L, Dual Certified | APKF1QC230EA | CT |  |
|  | .5-1.5 |  | Full Coupling, B16.11, SW, CL3000, ASTM A182 Gr F304/304L, Dual Certified |  | FCL |  |
|  | .75-1.5  .5-1.25 |  | Reduced tee, B16.11, SW, CL 3000, ASTM A182 Gr F304/304L, Dual Certified | APKQ1QC130EA | RT |  |
|  | 2-16  .5-1.5 |  | Sockolet, MSS SP-97, SW, CL 3000, ASTM A182 Gr F304/304L, Dual Certified | APKM7QC130EB | SOL |  |
| 403 | 2-16  .75-1 |  | Threadolet, MSS SP-97, Threaded NPT, CL 3000, ASTM A182 Gr F304/304L, Dual Certified | APKN7QC230EB | TOL |  |
| **WELDED FITTINGS** | | | | | | |
|  | .75-1.5  .5-1.25 | S-10S | Swage Nipple Conc, MSS SP-95, BW, ASTM A403 Gr WP304/304L, Dual Certified -S | APWT5SH1XXEA | CBB |  |
|  | .75-1.5  .5-1.25 | S-10S | Swage Nipple Ecc, MSS SP-95, BW, ASTM A403 Gr WP304/304L, Dual Certified -S | APWU5SH1XXEA | EBB |  |
|  | 2-16 | See Note A | 90Deg LR Elbow, B16.9, BW,  ASTM A403 Gr WP304/304L,Dual Certified -S/WX | APWA1SG7XXEA | 9E |  |
|  | 2-16 | See Note A | 45Deg LR Elbow, B16.9, BW,  ASTM A403 Gr WP304/304L,Dual Certified -S/WX | APWB1SG7XXEA | 4E |  |
|  | 2-16 | See Note A | Equal Tee, B16.9, BW,ASTM A403 Gr WP304/304L,  Dual Certified -S/WX | APWD1SG7XXEA | T |  |

|  |  |  |  |  |  |  |
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| **Notes** | **NPS/DN**  **(in)** | **Sch** | **Description** | **Commodity Code** | **Short Code** | **Rev** |
| **WELDED FITTINGS** | | | | | | |
|  | 2-16  1.25-14 | See Note A | Reducing Tee, B16.9, BW, ASTM A403 Gr WP304/304L, Dual Certified -S/WX | APWE1SG7XXEA | RT |  |
|  | 2-16 | See Note A | Cap, B16.9, BW,ASTM A403 Gr WP304/304L,  Dual Certified -S/WX | APWF1SG7XXEA | C |  |
|  | 2-16  .75-14 | See Note A | Concentric Reducer, B16.9, BW,ASTM A403 Gr WP304/304L,Dual Certified -S/WX | APWG1SG7XXEA | CR |  |
|  | 2-16  .75-14 | See Note A | Eccentric Reducer, B16.9, BW, ASTM A403 Gr WP304/304L,Dual Certified -S/WX | APWH1SG7XXEA | ER |  |
| **FLANGES** | | | | | | |
|  | .5-16 |  | Flange, Blind, B16.5, RF,CL 150, ASTM A182 Gr F304/304L, Dual Certified | APFA2QC101EA | BF |  |
| 59 | .5-16 |  | Flange, Blind, B16.5, RF,CL 300,ASTM A182 Gr  F304/304L,Dual Certified | APFA2QC103EA | BF3 |  |
| 53 | .5-.5 |  | Flange, Threaded, B16.5, RF, CL 150, ASTM A182 Gr F304/304L, Dual Certified | APFK2QC101EA | TF |  |
|  | .5-14 |  | Flange, Spectacle Figure 8, B16.48, RF,CL 150, ASTM A240 Type 304/304 L, Dual Certified | APFM6RL101EA | F8 |  |
|  | .5-1.5 |  | Flange, SW, B16.5, RF, CL 150, ASTM A182 Gr F304/304L, Dual Certified | APFS2QC101EA | SF |  |
| 59 | .5-1.5 |  | Flange, SW, B16.5, RF, CL 300, ASTM A182 Gr F304/304L, Dual Certified | APFS2QC103EA | SF3 |  |
| 402 | .75-2  .5-.5 |  | Flange, Blind with Thd Bore, B16.5, 1/2" NPT, RF, CL 150, ASTM A182 Gr F304/304L, Dual Certified | APFG2QC101EB | BFI |  |
| 402,  59 | .75-2  .5-.5 |  | Flange, Blind w Thd Bore, B16.5, 1/2" NPT, RF, CL 300, ASTM A182 Gr F304/304L, Dual Certified | APFG2QC103EB | BFI3 |  |
|  | 2-16 | See Note A | Flange, WN, B16.5, RF, CL 150, ASTM A182 Gr F304/304L, Dual Certified | APFL2QC101EA | WN |  |
| 59 | 2-16 | See Note A | Flange, WN, B16.5, RF, CL 300, ASTM A182 Gr F304/304L, Dual Certified | APFL2QC103EA | WN3 |  |
|  | 16-16 |  | Paddle, Blank, B16.48, RF, CL 150, ASTM A240 Type 304/304 L, Dual Certified | APFN6RL101EA | PB |  |
|  | 16-16 |  | Paddle, Spacer, B16.48, RF, CL 150, ASTM A240 Type 304/304 L, Dual Certified | APFP6RL101EA | PS |  |
| **ORIFICE FLANGE** | | | | | | |
|  | 1-16 | See Note A | Orif Flg, WN 0.5 NPT+jack scr. B16.36, RF, CL 300, ASTM A182 Gr F304/304L, Dual Certified | APOA1QC103EA | OF |  |
| **GASKETS** | | | | | | |
|  | .5-10 |  | Gasket, Flat Ring, 1.5 mm Thk, CL 150, Modified PTFE | APGF2PA001EN | G |  |
| 59 | .5-16 |  | Gasket, Spiral Wound, 4.5 mm Thk, CL 300, Filler graphite 98%, spiral 316SS, IR 316SS, OR CS | APGS1GB003EB | G3 |  |
|  | 12- 16 |  | Gasket, Flat Ring, 3.0 mm Thk, CL 150, Modified PTFE | APGF2PA001EP | G |  |
| **BOLTING** | | | | | | |
|  | .5-16 |  | Stud Bolt w/2-Heavy hex Nuts, ASTM A193 Gr B8 Cl 2 / A194 Gr 8M | APBA1SG000EF | BT |  |
|  | .5-16 |  | Stud Bolt w/2-Heavy hex Nuts, ASTM A193 Gr B8 Cl 2 / A194 Gr 8M | APBA1SG000EF | BT3 |  |
| **VALVES** | | | | | | |
| 407 | .5-2 | See Note A | Ball Valve, Float Ball, Thrd, NPT, RB, ASTM A182 Gr F316/316L, 316SS Ball, PTFE, Oval Handle | APVB1QW333EH | BV |  |

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| **Notes** | **NPS/DN**  **(in)** | **Sch** | **Description** | **Commodity Code** | **Short Code** | **Rev** |
| **VALVES** | | | | | | |
|  | .5-1.5 | See Note A | Check Valve, API602, piston type, horiz. and vert, SW, CL800, ASTM A182 Gr F316/316L, Trim No. 10, BC | APVC6QW208EU | CH |  |
|  | .5-1.5 | See Note A | Gate Valve, API 602, SW, CL800, ASTM A182 Gr F316/316L Trim No. 10, BB, OS & Y | APVG4QW208EH | GA |  |
| 60 | .5-1.5 | See Note A | Gate Valve, API 602, Flanged, RF, CL150, ASTM A182 Gr F316/316L, Trim No. 10, BB, OS & Y | APVG4QW401EJ | GAF |  |
| 59, 60 | .5-1.5 | See Note A | Gate Valve, API 602, Flanged, RF, CL300, ASTM A182 Gr F316/316L, Trim No. 10, BB, OS & Y | APVG4QW403EJ | GAF3 |  |
| 413 | .5-1.5 | See Note A | Globe Valve,API 602, SWxNPT, CL800, RB, ASTM A182 Gr F316/316L, Trim No. 12, Graphite | APVL5QW008FT | GL1 |  |
| 405 | .5-1.5 | See Note A | Globe Valve, API 602, straight seat, SW, CL800, ASTM A182 Gr F316/316L, Trim No. 10, BB, OS & Y | APVL5QW208ED | GL |  |
|  | 2-16 | See Note A | Check Valve, API 594, Type B, swing check - horiz. and vert. pos., Flanged, RF, CL150, ASTM A351 Gr CF3, Trim No. 10, BC, hinge pin inside | APVC4QH401EB | CH |  |
|  | 2-14 | See Note A | Gate Valve, API 600, flex. wedge, Flanged, RF, CL150, ASTM A351 Gr CF3, Trim No. 10, BB, OS & Y | APVG3QH401ED | GA |  |
| 59, 60 | 2-2 | See Note A | Gate Valve, API 600, flex. wedge, Flanged, RF, CL300, ASTM A351 Gr CF3, Trim No. 10, BB, OS & Y | APVG3QH403ED | GA3 |  |
| 405 | 2-4 | See Note A | Globe Valve, API 623, straight seat, Flanged, RF, CL150, ASTM A351 Gr CF3, Trim No. 10, BB, OS & Y | APVL7QH401EE | GL |  |
| 405 | 6-12 | See Note A | Globe Valve, API 623, straight seat, Flanged, RF, CL150, ASTM A351 Gr CF3, Trim No. 10, BB, OS & Y, Gear OP | APVL7QH401EB | GL |  |
|  | 16-16 | See Note A | Gate Valve, API 600, flex. wedge, Flanged, RF, CL150, ASTM A351 Gr CF3, Trim No. 10, BB, OS & Y, Gear OP | APVG3QH401EB | GA |  |
|  | .5-1 |  | Ball Valve, Flanged, RF, CL 150, A182 F304 Body, Full Bore |  | BA |  |
|  | .5-1 |  | Ball Valve, API 800 SW x Serewed NPT, FULL PORT |  | BA1 |  |
| **FILTERS / STRAINERS** | | | | | | |
|  | .5-1.5 |  | Y Strainer, SW, CL800, ASTM A182 Gr F316/316L, Screen retainer SS316, Screen SS316, Filtering 0.3mm, Gasket spir SS and Graphite | APVY3QW208EG | STY |  |

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Notes** | **NPS/DN**  **(in)** | **Sch** | **Description** | **Commodity Code** | **Short Code** | **Rev** |
| **FILTERS / STRAINERS** | | | | | | |
|  | 2-3 |  | Y Strainer, Flanged, RF, CL150, ASTM A351 Gr CF3, Screen retainer: SS316, Screen SS316, Filtering 0.3mm, Gasket spir SS and Graphite | APVY3QH401EL | STY |  |
|  | 4-16 |  | Conical filter, G-DS-5-4-2, Wafer, CL150, all fluids except oxygen and water | APMN0QA701EA | CFR |  |
| **FABRICATED ITEMS** | | | | | | |
|  | .5-1.5 | S-10S | Pipe bend, R=3xOD, Plain end, Seamless (E=1), ASTM A312 Gr TP304/TP304L, Dual Certified | APSR2QP2H0EB | 9B3D |  |
|  |  |  |  |  |  |  |
| 10007 | 6-16  2-14 | See Note A | Fabricated Concentric reducer, Beveled end, Electric fusion straight weld pipe (E=1), ASTM A240 Type 304/304L | APSP0QD1G0EB | FCR |  |
| 10007 | 6-16  2-14 | See Note A | Fabricated Eccentric reducer, Beveled end, Electric fusion straight weld(E=1), ASTM A240 Type 304/304L | APSQ0QD1G0EB | FER |  |
|  | 12-16  2-14 | See Note A | ASME Fabricated Item, weld with Reinf., B36.19 M / B36.10 M, EFW pipe(E=0.8), ASTM A312 Gr TP304/TP304L Dual Certified | APSY7QP0C0EA | RPAD |  |
| 414 | 16-16  12-14 | See Note A | ASME Fabricated Item, RH Run Reduc., B31.3, BE acc. ASME B16.25, ASTM A312 Gr TP304/TP304L Dual Certified | APSX9QP1X0EF | RPAD1 |  |

**SPEC ITEM NOTES:**

53 For orifice flange tapping

1. To use only if necessary
2. For connection PN/class > rating pipe class
3. For connection to equipments
4. For insulated pressure testing vents (see G-DS-5-0-1)
5. For instrument connection (PI, TI, etc.)
6. For non-insulated pressure testing vents (see G-DS-5-0-1)
7. For vents
8. For regulation only

407 To be used for automatic valve connection

413 For instrument connection : Pressure, flow transmitters, analysers, vents and orifice tappings

414 On Project level TSH may be recalculated via Sec. VIII Div. 1 or Div. 2, see also rules defined within G-EP-5-2-4 10007 To be used as option of B16.9 fitting (default)

**LEGEND:**

2 - Reducing Tee

230 - Class 3000

2 - Reducing Tee

2XX - -

1 - Equal Tee

130 - Class 3000

1 - Equal Tee

1XX - -

0 - No Branch

**BRANCH CHART (Preference 1)**

3 - Stub-on

3 - Stub-on

31 - Welded Connection

32 - Reinforcing Pad

3 - Stub-on

34 - Reinforced Header Run (TSH) Reducing

5 - Sockolet

530 - Class 3000

Branch Diameter

Header Diameter

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | 0,5 | 0,75 | 1 | 1,25 | 1,5 | 2 | 2,5 | 3 | 3,5 | 4 | 5 | 6 | 8 | 10 | 12 | 14 | 16 |
| 0,5 | 130 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 0,75 | 230 | 130 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 1 | 230 | 230 | 130 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 1,25 | 230 | 230 | 230 | 130 |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 1,5 | 230 | 230 | 230 | 230 | 130 |  |  |  |  |  |  |  |  |  |  |  |  |
| 2 | 530 | 530 | 530 | 530 | 530 | 1XX |  |  |  |  |  |  |  |  |  |  |  |
| 2,5 | 530 | 530 | 530 | 530 | 530 | 2XX | 1XX |  |  |  |  |  |  |  |  |  |  |
| 3 | 530 | 530 | 530 | 530 | 530 | 2XX | 2XX | 1XX |  |  |  |  |  |  |  |  |  |
| 3,5 | 530 | 530 | 530 | 530 | 530 | 31 | 2XX | 2XX | 1XX |  |  |  |  |  |  |  |  |
| 4 | 530 | 530 | 530 | 530 | 530 | 31 | 31 | 2XX | 2XX | 1XX |  |  |  |  |  |  |  |
| 5 | 530 | 530 | 530 | 530 | 530 | 31 | 31 | 31 | 2XX | 2XX | 1XX |  |  |  |  |  |  |
| 6 | 530 | 530 | 530 | 530 | 530 | 31 | 31 | 31 | 31 | 2XX | 2XX | 1XX |  |  |  |  |  |
| 8 | 530 | 530 | 530 | 530 | 530 | 32 | 32 | 32 | 32 | 32 | 2XX | 2XX | 1XX |  |  |  |  |
| 10 | 530 | 530 | 530 | 530 | 530 | 32 | 32 | 32 | 32 | 32 | 32 | 2XX | 2XX | 1XX |  |  |  |
| 12 | 530 | 530 | 530 | 530 | 530 | 32 | 32 | 32 | 32 | 32 | 32 | 32 | 2XX | 2XX | 1XX |  |  |
| 14 | 530 | 530 | 530 | 530 | 530 | 32 | 32 | 32 | 32 | 32 | 32 | 32 | 32 | 2XX | 2XX | 1XX |  |
| 16 | 530 | 530 | 530 | 530 | 530 | 32 | 32 | 32 | 32 | 32 | 32 | 32 | 32 | 32 | 2XX | 2XX | 1XX |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Rev. | Date | Prepared by | Checked By | Approved By | Description |
| 0 | 19/08/2022 | YJ Chen | C Shen |  | First issue |

Disclamer:

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|  |  |
| --- | --- |
| **DESIGN CODE:** | B31.3 - 2016 |
| **RATING CLASS:** | 150 |
| **MATERIAL:** | SS 304 / 304 L Dual Certified |
| **SERVICE:** | O2 |
| **FLANGE FACING:** | Raised Face |
| **NOMINAL CORROSION ALLOWANCE:** | 0 in (0 mm) |
| **MATERIAL GROUP:** | B16.5-2017, 2.1 |
| **TRIM:** | Trim 9 |
| **FLUID CODE:** | OG / ORG / OW |
| **CALCULATION NO:** | - |

**DESIGN PRESSURE-TEMPERATURE RATING:**

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **From NPS 0.5 to 24in** | | | | | | | | | |
| **Temp. DegC** | -45 | 38 | 50 | 100 | 150 | 200 | 250 | 300 |  |
| **Pressure BarG** | 19.0 | 19.0 | 18.3 | 15.7 | 14.2 | 13.2 | 12.1 | 10.2 |
| **Temp. DegF** | -49 | 100 | 122 | 212 | 302 | 392 | 482 | 572 |
| **Pressure Psig** | 275 | 275 | 265 | 228 | 205 | 191 | 175 | 147 |
| **Full Vacuum (NPS 0.5 to 24in)** | | | | | | | | | |
| **Temp. DegC** | 200 |  | | | | | | | |
| **Pressure BarG** | -1 |
| **Temp. DegF** | 392 |
| **Pressure Psig** | -14.5 |

**PIPE WALL THICKNESS:**

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NPS** | **.5** | **.75** | **1** | **1.25** | **1.5** | **2** | **2.5** | **3** | **3.5** | **4** | **5** |
| **DN** | 15 | 20 | 25 | 32 | 40 | 50 | 65 | 80 | 90 | 100 | 125 |
| **SCH** | S-10S | S-10S | S-10S | S-10S | S-10S | S-10S | S-10S | S-10S | S-10S | S-10S | S-10S |
| **THK (in)** | 0.083 | 0.083 | 0.109 | 0.109 | 0.109 | 0.109 | 0.12 | 0.12 | 0.12 | 0.12 | 0.134 |
| **THK (mm)** | 2.11 | 2.11 | 2.77 | 2.77 | 2.77 | 2.77 | 3.05 | 3.05 | 3.05 | 3.05 | 3.4 |
| **OD (mm)** | 21.3 | 26.7 | 33.4 | 42.2 | 48.3 | 60.3 | 73 | 88.9 | 101.6 | 114.3 | 141.3 |
| **NPS** | **6** | **8** | **10** | **12** | **14** | **16** | **18** | **20** | **24** | **26** | **28** |
| **DN** | 150 | 200 | 250 | 300 | 350 | 400 | 450 | 500 | 600 | 650 | 700 |
| **SCH** | S-10S | S-10S | S-10S | S-10S | S-10S | S-10S | S-10 | S-10 | S-20 | S-10 | S-10 |
| **THK (in)** | 0.134 | 0.148 | 0.165 | 0.18 | 0.188 | 0.188 | 0.25 | 0.25 | 0.375 | 0.312 | 0.312 |
| **THK (mm)** | 3.4 | 3.76 | 4.19 | 4.57 | 4.78 | 4.78 | 6.35 | 6.35 | 9.53 | 7.92 | 7.92 |
| **OD (mm)** | 168.3 | 219.1 | 273 | 323.8 | 355.6 | 406.4 | 457 | 508 | 610 | 660 | 711 |
|  | **30** |  | | | | | | | | | |
| 750 |  | | | | | | | | | |
| S-STD |
| 0.375 |
| 9.53 |
| 762 |

**GENERAL NOTES:**

1. All buttwelded components wall thickness shall match PIPE WALLTHICKNESS.
2. Non-standard pipe sizes NPS 1.25", 2.5", 3.5", 5" etc. shall not be used except for connection to the equipment or in special circumstances.

BX Piping Class Specification has been calculated to withstand Full Vacuum, max. buckling length 6m [19.68 ft].

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Notes** | **NPS/DN**  **(in)** | **Sch** | **Description** | **Commodity Code** | **Short Code** | **Rev** |
| **NIPPLES** | | | | | | |
| 53 | .5-1.5 | S-40S | Nipple, B36.19 M,(100mm), Plain - NPT, Seamless, ASTM A312 Gr TP304/TP304L, Dual Certified | APPN2QP5H0EA | NPTG1 |  |
| 53 | .5-1.5 | S-40S | Nipple, B36.19 M,(180mm), Plain - NPT, Seamless, ASTM A312 Gr TP304/TP304L, Dual Certified | APPN2QP5H0EB | NPTG3 |  |
| 53 | .5-1.5 | S-40S | Nipple, B36.19 M,(100mm), NPT - NPT, Seamless, ASTM A312 Gr TP304/TP304L, Dual Certified | APPN2QP6H0EA | NTTG1 |  |
| 53 | .5-1.5 | S-40S | Nipple, B36.19 M,(180mm ), NPT - NPT, Seamless, ASTM A312 Gr TP304/TP304L, Dual Certified | APPN2QP6H0EB | NTTG3 |  |
| **PIPE** | | | | | | |
|  | .5-1.5 | S-10S | Pipe, B36.19 M, Plain end, Seamless, ASTM A312 Gr TP304/TP304L, Dual Certified | APPP7QP2H0EE | P |  |
|  | 2-16 | S-10S | Pipe, B36.19 M, Beveled end, EFW (E=0.8), ASTM A312 Gr TP304/TP304L, Dual Certified | APPP7QP1C0EE | P |  |
|  |  |  |  |  |  |  |
| **FORGED FITTINGS** | | | | | | |
| 58 | .5-1.5 |  | 90Deg. Elbow, B16.11, SW, CL 3000, ASTM A182 Gr F304/304L, Dual Certified | APKA1QC130EA | 9E |  |
|  | .5-1.5 |  | Equal Tee, B16.11, SW, CL 3000, ASTM A182 Gr F304/304L, Dual Certified | APKB1QC130EA | T |  |
| 58 | .5-1.5 |  | 45Deg. Elbow, B16.11, SW, CL 3000, ASTM A182 Gr F304/304L, Dual Certified | APKC1QC130EA | 4E |  |
|  | .5-1.5 |  | Cap, B16.11, SW, CL3000, ASTM A182 Gr F304/304L, Dual Certified | APKF1QC130EA | C |  |
| 404 | .5-1 |  | Plug, B16.11, Threaded NPT, CL3000, ASTM A182 Gr F304/304L, Dual Certified | APKP1QC230EA | PL |  |
| 401 | .75-1 |  | Cap, B16.11, Threaded NPT, CL3000, ASTM A182 Gr F304/304L, Dual Certified | APKF1QC230EA | CT |  |
|  | .5-1.5 |  | Full Coupling, B16.11, SW, CL 3000, ASTM A182 Gr F304/304L, Dual Certified |  | FCL |  |
|  | .75-1.5  .5-1.25 |  | Reduced tee, B16.11, SW, CL 3000, ASTM A182 Gr F304/304L, Dual Certified | APKQ1QC130EA | RT |  |
|  | 2-16  .5-1.5 |  | Sockolet, MSS SP-97, SW, CL 3000, ASTM A182 Gr F304/304L, Dual Certified | APKM7QC130EB | SOL |  |
| 403 | 2-16  .75-1 |  | Threadolet, MSS SP-97, Threaded NPT, CL 3000, ASTM A182 Gr F304/304L, Dual Certified | APKN7QC230EB | TOL |  |
|  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Notes** | **NPS/DN**  **(in)** | **Sch** | **Description** | **Commodity Code** | **Short Code** | **Rev** |
| **WELDED FITTINGS** | | | | | | |
|  | .75-1.5  .5-1.25 | S-10S | Swage Nipple Conc, MSS SP-95, BW, ASTM A403 Gr WP304/304L, Dual Certified -S | APWT5SH1XXEA | CBB |  |
|  | .75-1.5  .5-1.25 | S-10S | Swage Nipple, Ecc, MSS SP-95, BW, ASTM A403 Gr WP304/304L, Dual Certified -S | APWU5SH1XXEA | EBB |  |
|  | 2-16 | S-10S | 90Deg LR Elbow, B16.9, BW,  ASTM A403 Gr WP304/304L,Dual Certified -S/WX | APWA1SG7XXEA | 9E |  |
|  | 2-16 | S-10S | 45Deg LR Elbow, B16.9, BW,  ASTM A403 Gr WP304/304L,Dual Certified -S/WX | APWB1SG7XXEA | 4E |  |
|  | 2-16 | S-10S | Equal Tee, B16.9, BW,ASTM A403 Gr WP304/304L,  Dual Certified -S/WX | APWD1SG7XXEA | T |  |
|  | 2-16  1.25-14 | S-10S | Reducing Tee, B16.9, BW, ASTM A403 Gr WP304/304L, Dual Certified -S/WX | APWE1SG7XXEA | RT |  |
|  | 2-16 | S-10S | Cap, B16.9, BW,ASTM A403 Gr WP304/304L,  Dual Certified -S/WX | APWF1SG7XXEA | C |  |
|  | 2-16  .75-14 | S-10S | Concentric Reducer, B16.9, BW,ASTM A403 Gr WP304/304L,Dual Certified -S/WX | APWG1SG7XXEA | CR |  |
|  | 2-16  .75-14 | S-10S | Eccentric Reducer, B16.9, BW, ASTM A403 Gr WP304/304L,Dual Certified -S/WX | APWH1SG7XXEA | ER |  |
| **FLANGES** | | | | | | |
|  | .5-16 |  | Flange, Blind, B16.5, RF,CL 150, ASTM A182 Gr F304/304L, Dual Certified | APFA2QC101EA | BF |  |
| 59 | .5-16 |  | Flange, Blind, B16.5, RF,CL 300,ASTM A182 Gr  F304/304L,Dual Certified | APFA2QC103EA | BF3 |  |
| 53 | .5-.5 |  | Flange, Threaded, B16.5, RF, CL 150, ASTM A182 GrF304/304L, Dual Certified | APFK2QC101EA | TF |  |
|  | .5-14 |  | Flange, Spectacle Figure 8, B16.48, RF,CL 150, ASTM A240 Type 304/304 L, Dual Certified | APFM6RL101EA | F8 |  |
|  | .5-1.5 |  | Flange, SW, B16.5, RF, CL 150, ASTM A182 Gr F304/304L, Dual Certified | APFS2QC101EA | SF |  |
| 59 | .5-1.5 |  | Flange, SW, B16.5, RF, CL 300, ASTM A182 Gr F304/304L, Dual Certified | APFS2QC103EA | SF3 |  |
| 402 | .75-2  .5-.5 |  | Flange, Blind w Thd Bore, B16.5, 1/2" NPT, RF, CL 150, ASTM A182 Gr F304/304L, Dual Certified | APFG2QC101EB | BFI |  |
| 402,  59 | .75-2  .5-.5 |  | Flange, Blind w Thd Bore, B16.5, 1/2" NPT, RF, CL 300, ASTM A182 Gr F304/304L, Dual Certified | APFG2QC103EB | BFI3 |  |
|  | 2-16 | S-10S | Flange, WN, B16.5, RF, CL 150, ASTM A182 Gr F304/304L, Dual Certified | APFL2QC101EA | WN |  |
| 59 | 2-16 | S-10S | Flange, WN, B16.5, RF, CL 300, ASTM A182 Gr F304/304L, Dual Certified | APFL2QC103EA | WN3 |  |
|  | 16-16 |  | Paddle, Blank, B16.48, RF, CL 150, ASTM A240 Type 304/304 L, Dual Certified | APFN6RL101EA | PB |  |
|  | 16-16 |  | Paddle, Spacer, B16.48, RF, CL 150, ASTM A240 Type 304/304 L, Dual Certified | APFP6RL101EA | PS |  |
|  |  |  |  |  |  |  |
| **ORIFICE FLANGE** | | | | | | |
|  | 1-16 | See Note A | Orif Flg, WN 0.5 NPT+jack scr. B16.36, RF, CL 300, ASTM A182 Gr F304/304L, Dual Certified | APOA1QC103EA | OF |  |
|  | 1-16 | See Note A | Orif Flg, WN 0.5 NPT+jack scr. B16.36, RF, CL 150, ASTM A182 Gr F304/304L, Dual Certified | APOA1QC101EA | OF1 |  |

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Notes** | **NPS/DN**  **(in)** | **Sch** | **Description** | **Commodity Code** | **Short Code** | **Rev** |
| **GASKETS** | | | | | | |
|  | .5-10 |  | Gasket, Flat Ring, 1.5 mm Thk, CL 150, Approved for ox. Service, Expanded graphite 98% with metallic reinforcement | APGF2GN001ES | G |  |
| 59 | .5-16 |  | Gasket, Spiral Wound, 4.5 mm Thk, CL 300, Approved for ox. Service, Filler graphite 98%, spiral 316SS, IR 316SS, OR CS | APGS1GB003EV | G3 |  |
|  | 12-16 |  | Gasket, Flat Ring, 3.0 mm Thk, CL 150, Approved for ox. Service, Expanded graphite 98% with metallic reinforcement | APGF2GN001ET | G |  |
|  |  |  |  |  |  |  |
| **BOLTING** | | | | | | |
|  | .5-16 |  | Stud Bolt w/2-Heavy Hex Nuts, ASTM A193 Gr B8 Cl 2 / A194 Gr 8M | APBA1SG000EF | BT |  |
|  | .5-16 |  | Stud Bolt w/2-Heavy Hex Nuts, ASTM A193 Gr B8 Cl 2 / A194 Gr 8M | APBA1SG000EF | BT3 |  |
| **VALVES** | | | | | | |
|  | .5-2 | See Note A | Check Valve, API 602, Piston check, SW, CL800, ASTM A182 Gr  F316/316L, Disc monel , spg monel, ,Gasket spir SS and graph, Cleaned & degreased for oxygen service | APVC6QW208GM | CH |  |
| 413 | .5-.5 | See Note A | Globe Valve, Service range -46°C to 300°C, Thrd, Female NPT, CL1500, RB, ASTM A182 Gr F316L, Plug SS, Graph packing,Gasket graph/metal, UB, inside screw, HW, Non metal. Int. parts agreed for oxygen, Cleaned & degreased for oxygen service,, | APVL1QF315GQ | GL |  |
|  | 3-16 | See Note A | Check Valve, API 594, Dual Plate Check, Bolted, Wafer RF, CL150, ASTM A351 Gr CF8M, Plates monel , int. Monel, Equipot. Connect. acc. to AL std. CPY- EP-5-2-002 - Non metal. Int. parts agreed for oxygen, Cleaned & degreased for oxygen service,, | APVC4QN601FU | CHW |  |
| **FILTERS / STRAINERS** | | | | | | |
| 233 | 2-16 |  | Conical filter,G-DS-5-4-10,CL 150, liquid oxygen | APMN0QA701EG | CFR |  |
| **FABRICATED ITEMS** | | | | | | |
|  | .5-1.5 | S-10S | Pipe bend, R=5xOD, Plain end, Seamless (E=1), ASTM A312 Gr TP304/TP304L, Dual Certified | APSR2QP2H0ED | 9B5D |  |
|  |  |  |  |  |  |  |
| 10007 | 6-16  2-12 | See Note A | Fabricated Concentric reducer, Beveled end, Electric fusion straight weld pipe (E=1), ASTM A240 Type 304/304L | APSP0QD1G0EB | FCR |  |
| 10007 | 6-16  2-12 | See Note A | Fabricated Eccentric reducer, Beveled end, Electric fusion straight weld pipe (E=1), ASTM A240 Type 304/304L | APSQ0QD1G0EB | FER |  |
|  | 12-16  2-12 | See Note A | ASME Fabricated Item, weld with Reinf., B36.19 M / B36.10 M, EFW pipe (E=0.80), ASTM A312 Gr TP304/TP304L Dual Certified | APSY7QP0C0EA | RPAD |  |
|  |  |  |  |  |  |  |

**SPEC ITEM NOTES:**

53 For orifice flange tapping

1. To use only if necessary
2. For connection PN/class > rating pipe class

|  |  |
| --- | --- |
| 233 | Heat Fusion Joining (Thermoplastic): Requirements of ASTM F2620, Standard Practice for Heat Fusion Joining of PE Pipe and |
| 401 | For insulated pressure testing vents (see G-DS-5-0-1) |
| 402 | For instrument connection (PI, TI, etc.) |
| 403 | For non-insulated pressure testing vents (see G-DS-5-0-1) |
| 404 | For vents |
| 413 | For instrument connection : Pressure, flow transmitters, analysers, vents and orifice tappings |
| 414 | On Project level TSH may be recalculated via Sec. VIII Div. 1 or Div. 2, see also rules defined within G-EP-5-2-4 |
| 10007 | To be used as option of B16.9 fitting (default) |

**LEGEND:**

2 - Reducing Tee

230 - Class 3000

2 - Reducing Tee

2XX - -

1 - Equal Tee

130 - Class 3000

1 - Equal Tee

1XX - -

0 - No Branch

**BRANCH CHART (Preference 1)**

3 - Stub-on

3 - Stub-on

31 - Welded Connection

32 - Reinforcing Pad

3 - Stub-on

34 - Reinforced Header Run (TSH) Reducing

5 - Sockolet

530 - Class 3000

Branch Diameter

Header Diameter

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | 0,5 | 0,75 | 1 | 1,25 | 1,5 | 2 | 2,5 | 3 | 3,5 | 4 | 5 | 6 | 8 | 10 | 12 | 14 | 16 |
| 0,5 | 130 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 0,75 | 230 | 130 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 1 | 230 | 230 | 130 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 1,25 | 230 | 230 | 230 | 130 |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 1,5 | 230 | 230 | 230 | 230 | 130 |  |  |  |  |  |  |  |  |  |  |  |  |
| 2 | 530 | 530 | 530 | 530 | 530 | 1XX |  |  |  |  |  |  |  |  |  |  |  |
| 2,5 | 530 | 530 | 530 | 530 | 530 | 2XX | 1XX |  |  |  |  |  |  |  |  |  |  |
| 3 | 530 | 530 | 530 | 530 | 530 | 2XX | 2XX | 1XX |  |  |  |  |  |  |  |  |  |
| 3,5 | 530 | 530 | 530 | 530 | 530 | 31 | 2XX | 2XX | 1XX |  |  |  |  |  |  |  |  |
| 4 | 530 | 530 | 530 | 530 | 530 | 31 | 31 | 2XX | 2XX | 1XX |  |  |  |  |  |  |  |
| 5 | 530 | 530 | 530 | 530 | 530 | 31 | 31 | 31 | 2XX | 2XX | 1XX |  |  |  |  |  |  |
| 6 | 530 | 530 | 530 | 530 | 530 | 31 | 31 | 31 | 31 | 2XX | 2XX | 1XX |  |  |  |  |  |
| 8 | 530 | 530 | 530 | 530 | 530 | 32 | 32 | 32 | 32 | 32 | 2XX | 2XX | 1XX |  |  |  |  |
| 10 | 530 | 530 | 530 | 530 | 530 | 32 | 32 | 32 | 32 | 32 | 32 | 2XX | 2XX | 1XX |  |  |  |
| 12 | 530 | 530 | 530 | 530 | 530 | 32 | 32 | 32 | 32 | 32 | 32 | 32 | 2XX | 2XX | 1XX |  |  |
| 14 | 530 | 530 | 530 | 530 | 530 | 32 | 32 | 32 | 32 | 32 | 32 | 32 | 32 | 2XX | 2XX | 1XX |  |
| 16 | 530 | 530 | 530 | 530 | 530 | 32 | 32 | 32 | 32 | 32 | 32 | 32 | 32 | 32 | 2XX | 2XX | 1XX |

3 - Stub-on

34 - Reinforced Header Run (TSH) Reducing

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Rev. | Date | Prepared by | Checked By | Approved By | Description |
| 0 | 19/08/2022 | YJ Chen | C Shen |  | First issue |

Disclamer:

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|  |  |
| --- | --- |
| **DESIGN CODE:** | B31.3 Latest Edition / Addenda - Normal Fluid Service |
| **RATING CLASS:** | 150 |
| **MATERIAL:** | SS 304 / 304 L Dual Certified |
| **SERVICE:** | General Cryogenic |
| **FLANGE FACING:** | Raised Face |
| **NOMINAL CORROSION ALLOWANCE:** | 0 in (0 mm) |
| **MATERIAL GROUP:** | B16.5-2017, 2.1 |
| **FLUID CODE:** | AD / AG / AL / DK / KAC / KAD / KAG / KAL / KHN / KXL / KXP / KXR / KXS / KXT / NG /  NL / NLO / NW / OG / OL / ON / ONV / ORG / ORL / OW |
| **CALCULATION NO:** | - |

**DESIGN PRESSURE-TEMPERATURE RATING:**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **From NPS 0.5 to 48in** | | | | | | |
| **Temp. DegC** | -196 | -29 | 38 | 50 | 100 |  |
| **Pressure BarG** | 10 | 10 | 10 | 10 | 10 |
| **Temp. DegF** | -321 | -20 | 100 | / | 212 |
| **Pressure Psig** | 145 | 145 | 145 | / | 145 |
| **Full Vacuum NPS 0.5 to 24in** | | | | | | |
| **Temp. DegC** | 100 |  | | | | |
| **Pressure BarG** | -1 |
| **Temp. DegF** | 212 |
| **Pressure Psig** | -14.5 |

**PIPE WALL THICKNESS:**

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NPS** | **.5** | **.75** | **1** | **1.25** | **1.5** | **2** | **2.5** | **3** | **3.5** | **4** | **5** |
| **DN** | 15 | 20 | 25 | 32 | 40 | 50 | 65 | 80 | 90 | 100 | 125 |
| **SCH** | S-10S | S-10S | S-10S | S-10S | S-10S | S-10S | S-10S | S-10S | S-10S | S-10S | S-10S |
| **THK (in)** | 0.083 | 0.083 | 0.109 | 0.109 | 0.109 | 0.109 | 0.12 | 0.12 | 0.12 | 0.12 | 0.134 |
| **THK (mm)** | 2.11 | 2.11 | 2.77 | 2.77 | 2.77 | 2.77 | 3.05 | 3.05 | 3.05 | 3.05 | 3.4 |
| **OD (mm)** | 21.3 | 26.7 | 33.4 | 42.2 | 48.3 | 60.3 | 73 | 88.9 | 101.6 | 114.3 | 141.3 |
| **NPS** | **6** | **8** | **10** | **12** | **14** | **16** | **18** | **20** | **22** | **24** | **26** |
| **DN** | 150 | 200 | 250 | 300 | 350 | 400 | 450 | 500 | 550 | 600 | 650 |
| **SCH** | S-10S | S-10S | S-10S | S-10S | S-10S | S-10S | S-10S | S-10S | S-10S | S-10S | S-10 |
| **THK (in)** | 0.134 | 0.148 | 0.165 | 0.18 | 0.188 | 0.188 | 0.188 | 0.218 | 0.218 | 0.25 | 0.312 |
| **THK (mm)** | 3.4 | 3.76 | 4.19 | 4.57 | 4.78 | 4.78 | 4.78 | 5.54 | 5.54 | 6.35 | 7.92 |
| **OD (mm)** | 168.3 | 219.1 | 273 | 323.8 | 355.6 | 406.4 | 457 | 508 | 559 | 610 | 660 |
| **NPS** | **28** | **30** | **32** | **34** | **36** | **38** | **40** | **42** | **44** | **46** | **48** |
| **DN** | 700 | 750 | 800 | 850 | 900 | 950 | 1000 | 1050 | 1100 | 1150 | 1200 |
| **SCH** | S-10 | S-10 | S-10 | S-10 | S-10 | 0.312" | 0.312" | S-STD | S-STD | S-STD | S-STD |
| **THK (in)** | 0.312 | 0.312 | 0.312 | 0.312 | 0.312 | 0.312 | 0.312 | 0.375 | 0.375 | 0.375 | 0.375 |
| **THK (mm)** | 7.92 | 7.92 | 7.92 | 7.92 | 7.92 | 7.92 | 7.92 | 9.53 | 9.53 | 9.53 | 9.53 |
| **OD (mm)** | 711 | 762 | 813 | 864 | 914 | 965 | 1016 | 1067 | 1118 | 1168 | 1219 |

**GENERAL NOTES:**

1. All buttwelded components wall thickness shall match PIPE WALLTHICKNESS.
2. Non-standard pipe sizes NPS 1.25", 2.5", 3.5", 5" etc. shall not be used except for connection to the equipment or in special circumstances.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Notes** | **NPS/DN**  **(in)** | **Sch** | **Description** | **Commodity Code** | **Short Code** | **Rev** |
| **NIPPLES** | | | | | | |
|  | .5-1.5 | S-40S | Nipple, B36.19 M,(100mm), Plain - NPT, Seamless, ASTM A312 Gr TP304/TP304L, Dual Certified | APPN2QP5H0EA | NPTG1 |  |
|  | .5-1.5 | S-40S | Nipple, B36.19 M,(180mm), Plain - NPT, Seamless, ASTM A312 Gr TP304/TP304L, Dual Certified | APPN2QP5H0EB | NPTG3 |  |
|  | .5-1.5 | S-40S | Nipple, B36.19 M,(100mm), NPT - NPT, Seamless, ASTM A312 Gr TP304/TP304L, Dual Certified | APPN2QP6H0EA | NTTG1 |  |
|  | .5-1.5 | S-40S | Nipple, B36.19 M,(180mm), NPT - NPT, Seamless, ASTM A312 Gr TP304/TP304L, Dual Certified | APPN2QP6H0EB | NTTG3 |  |
| **PIPE** | | | | | | |
|  | .5-12 | S-10S | Pipe, B36.19 M, Bevel end, Seamless, ASTM A312 Gr TP304/TP304L, Dual Certified | APPP2QP2H0EE | P |  |
|  | 14-24 | S-10S | Pipe, B36.19 M, Bevel end, EFW (E=1), ASTM A358 Gr 304/304L Cl 1, Dual Certified | APPP7RY2G0EE | P |  |
|  |  |  |  |  |  |  |
| **FORGED FITTINGS** | | | | | | |
|  | .5-1.5 |  | Full Coupling, B16.11, Threaded NPT, CL 3000, ASTM A182 Gr F304/304L, Dual Certified | APKD1QC230EM | FCL1 |  |
|  | .5-1.5 |  | Cap, B16.11, Threaded NPT, CL3000, ASTM A182 Gr F304/304L, Dual Certified | APKF1QC230EA | CT |  |
|  | .5-1.5 |  | Plug, B16.11, Threaded NPT, CL3000, ASTM A182 Gr F304/304L ,Dual Certified | APKP1QC230EM | PL |  |
| 902 | 3-24  .5-.75 |  | Threadolet, MSS SP-97, Threaded NPT, CL 3000, ASTM A182 Gr F304/304L, Dual Certified | APKN7QC230EA | TOL |  |
| **WELDED FITTINGS** | | | | | | |
|  | .5-1.5 | S-10S | 90Deg LR Elbow, B16.9, BW, ASTM A403 Gr WP304/304L, Dual Certified -S/WX | APWA1SG1XXEU | 9E |  |
|  | .5-1.5 | S-10S | 45Deg LR Elbow, B16.9, BW , ASTM A403 Gr WP304/304L, Dual Certified -S/WX | APWB1SG1XXEU | 4E |  |
|  | .5-24 | S-10S | Equal Tee, B16.9, BW, ASTM A403 Gr WP304/304L, Dual Certified - S/WX | APWD1SG1XXEU | T |  |
|  | .5-24 | S-10S | Cap, B16.9, BW, ASTM A403 Gr WP304/304L, Dual Certified -S/WX | APWF1SG1XXEU | C |  |
|  | .75-24  .5-22 | S-10S | Reducing Tee, B16.9, BW, ASTM A403 Gr WP304/304L, Dual Certified -S/WX | APWE1SG1XXEU | RT |  |
|  | .75-24  .5-22 | S-10S | Concentric Reducer, B16.9, BW, ASTM A403 Gr WP304/304L, Dual Certified -S/WX | APWG1SG1XXEU | CR |  |
|  | .75-24  .5-22 | S-10S | Eccentric Reducer, B16.9, BW, ASTM A403 Gr WP304/304L, Dual Certified -S/WX | APWH1SG1XXEU | ER |  |

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Notes** | **NPS/DN**  **(in)** | **Sch** | **Description** | **Commodity Code** | **Short Code** | **Rev** |
| **WELDED FITTINGS** | | | | | | |
|  | .75-24  .5-22 | S-10S | Eccentric Reducer, B16.9, BW, ASTM A403 Gr WP304/304L, Dual Certified -S/WX | APWH1SG1XXEU | ER |  |
|  | 2-24 | S-10S | 90Deg LR Elbow, B16.9, BW, ,ASTM A403 Gr WP304/304L, Dual Certified -S/WX | APWA1SG1XXEU | 9E |  |
|  | 2-24 | S-10S | 45Deg LR Elbow, B16.9, BW, ASTM A403 Gr WP304/304L, Dual Certified -S/WX | APWB1SG1XXEU | 4E |  |
|  | 2-24 | S-10S | 90Deg SR Elbow, B16.9, BW , ASTM A403 Gr WP304/304L, Dual Certified -S/WX | APWC1SG1XXEU | 9ES |  |
| **FLANGES** | | | | | | |
|  | .5-24 |  | Flange, Blind, B16.5, RF, CL 150, ASTM A182 Gr F304/304L, Dual Certified, Serrated Spiral 125/250 | APFA2QC101EZ | BF |  |
|  | .5-24 | S-10S | Flange, WN, B16.5, RF, CL 150, ASTM A182 Gr F304/304L, Dual Certified, Serrated spiral 125/250 | APFL2QC101EZ | WN |  |
| 59 | .5-24 | S-10S | Flange, WN, B16.5, RF, CL 300, ASTM A182 Gr F304/304L, Dual Certified, Serrated spiral 125/250 | APFL2QC103EZ | WN3 |  |
|  | .5-14 |  | Flange, Spectacle Figure 8, B16.48, RF, CL 150, ASTM A240 Type 304/304L, Dual Certified, Serrated spiral 125/250 | APFM6RL101EZ | F8 |  |
|  | 16-24 |  | Paddle, Blank, B16.48, RF, CL 150, ASTM A240 Type 304/304L, Dual Certified, Serrated spiral 125/250 | APFN6RL101EZ | PB |  |
|  | 16-24 |  | Paddle, Spacer, B16.48, RF, CL 150, ASTM A240 Type 304/304L, Dual Certified, Serrated spiral 125/250 | APFP6RL101EZ | PS |  |
|  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |
| **ORIFICE FLANGE** | | | | | | |
|  | 1-24 | See Note A | Orif Flg, WN 0.5NPT+jack scr, B16.36, RF, CL 300, ASTM A182 Gr F304/304L, Dual Certified | APOA1QC103EF | OF |  |
| **GASKETS** | | | | | | |
|  | .5-10 |  | Gasket, Flat Ring, 1.5 mm Thk, CL 150, Approved ox. Service, Expanded praphite 98% with metallic reinforcement | APGF2GN001ES | G |  |
| 59 | .5-10 |  | Gasket, Flat Ring, 1.5 mm Thk, CL 300, Approved ox. Service, Expanded praphite 98% with metallic reinforcement | APGF2GN003ES | G3 |  |
|  | 12-24 |  | Gasket, Flat Ring, 3.0 mm Thk, CL 150, Approved ox. Service, Expanded praphite 98% with metallic reinforcement | APGF2GN001ET | G |  |
| 59 | 12-24 |  | Gasket, Flat Ring, 3.0 mm Thk, CL 300, Approved ox. Service, Expanded praphite 98% with metallic reinforcement | APGF2GN003ET | G3 |  |
|  |  |  |  |  |  |  |

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| --- | --- | --- | --- | --- | --- | --- |
| **Notes** | **NPS/DN**  **(in)** | **Sch** | **Description** | **Commodity Code** | **Short Code** | **Rev** |
| **BOLTING** | | | | | | |
|  | .5-24 |  | Stud Bolt w/2-Heavy Hex Nuts, SA320 Gr B8 Cl 2 / SA194 Gr 8 | APBA1SC000XX | BT |  |
|  | .5-24 |  | Stud Bolt w/2-Heavy Hex Nuts, SA320 Gr B8 Cl 2 / SA194 Gr 8 | APBA1SC000XX | BT3 |  |
|  | .5-2 |  | Stud Bolt w/2-Heavy Hex Nuts, SA320 Gr B8 Cl 2 / SA194 Gr 8 Flat Washer for Bolting, Stainless Steel, 17.7 PH | APBB3SD000EF | BTFW |  |
|  | .5-2 |  | Stud Bolt w/2-Heavy Hex Nuts, SA320 Gr B8 Cl 2 / SA194 Gr 8 Spring Washer for Bolting, Stainless Steel 17.7 PH | APBH0SD000EF | BTSW |  |
| **VALVES** | | | | | | |
|  | .5-2 | See Note A | Check Valve, Service range -196°C to 100° C, Piston check, Welded, BW, CL300, FB, ASTM A351 Gr CF8, Disc SS-PTFE insert, Spg SS, PTFE, Non metal. Int. parts agreed for oxygen, Cleaned & degreased for oxygen service, | APVC1QM103FP | CH3 |  |
| 210,  298 | .5-10 | See Note A | Gate Valve, Service range -196°C to 150°C- pressure Design : PN10, Welded, BW, CL150, FB, ASTM A182 Gr F304L, Graph packing,Gasket spir SS and graph,Cryo ASU ext. BB acc.to AL std G-GS-5-4-1 (replaces CPY-GS-5-4-1), HW, Cleaned & degreased for oxygen service,, | APVG1QC101GV |  |  |
| `211,  298 | .5-10 | See Note A | Gate Valve, Service range -196°C to 150°C- pressure Design : PN10, Welded, BW, CL150, FB, ASTM A182 Gr F304L, Graph packing,Gasket spir SS and graph,Cryo ext. BB acc. manufac. Std, HW, Cleaned & degreased for oxygen service,, | APVG1QC101HT | GA |  |
|  | .5-.5 | See Note A | Globe Valve, Service range -196°C to 100°C, SW, CL300, ASTM A182 Gr F316L, Disc SS-PTFE insert, Bellow seal, Gasket : Copper, BB, HW, Non metal. Int. parts agreed for oxygen | APVL1QF203JY | GL |  |
| 211 | .5-4 | See Note A | Globe Valve, Service range -196°C to 100°C, Welded, BW, CL300, FB, ASTM A351 Gr CF8, Disc SS-PTFE insert, PTFE packing & Live loaded, PTFE, Cryo ext. BB, acc. manufac. Std, inside screw, HW, Non metal. Int. parts agreed for oxygen, Cleaned & degreased for oxygen service | APVL1QM103GV | GL3 |  |
| 210 | .5-4 | See Note A | Globe Valve, Service range -196°C to 100°C, Welded, BW, CL300, FB, ASTM A351 Gr CF8, Disc SS-PTFE insert, PTFE packing & Live loaded, PTFE, Cryo ASU ext. BB acc.to AL std G-GS-5-4-1 (replaces CPY-GS- 5-4-1), inside screw, HW, Non metal. Int. parts agreed for oxygen, Cleaned & degreased for oxygen service | APVL1QM103GW |  |  |
| 212 | .5-2 | See Note A | Globe Valve, Service range -196°C to 100°C, Welded, BW, CL300, FB, ASTM A351 Gr CF8, Disc SS-PTFE insert, PTFE packing & Live loaded, PTFE, Top entry bonnet acc. to AL std G-GS-5-4-1 (replaces CPY-GS- 5-4-1), inside screw, HW, Non metal. Int. parts agreed for oxygen, Cleaned & degreased for oxygen service | APVL1QM103GX |  |  |
| 413 | .5-.5 | See Note A | Globe Valve, Service range -196°C to 100°C, Thrd, Female NPT, CL300, FB, ASTM A351 Gr CF8, Disc SS-PTFE insert, PTFE packing & Live loaded, PTFE, BB, inside screw, HW, Non metal. Int. parts agreed for oxygen, Cleaned & degreased for oxygen service | APVL1QM303GY | GLT |  |
| 404 | .5-.5 | See Note A | Globe Valve, API 602, BWxNPT, CL800, ASTM A182 Gr F304/304L, Trim No. 12, PTFE, PTFE,ext. BB, OS & Y, HW, Cleaned & degreased for oxygen service | APVL5QY008FZ | GL1 |  |
|  | 3-24 | See Note A | Check Valve, API 594,, Service range -196°C to 100°C, Dual Plate Check, Bolted, Wafer RF, CL150, ASTM A351 Gr CF8M, Plates SS, Spg inconel, Cleaned & degreased for oxygen service,, | APVC4QN601FQ | CHW |  |

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| --- | --- | --- | --- | --- | --- | --- |
| **Notes** | **NPS/DN**  **(in)** | **Sch** | **Description** | **Commodity Code** | **Short Code** | **Rev** |
| **VALVES** | | | | | | |
| 211 | 3-24 |  | Butterfly Valve, API 609,, Service range-196°C to 100°C, high performance, Bolted, Lug RF, CL150, ASTM A351 Gr CF8M, Disc SS, Seat PCTFE, Viton O-ring - vent hole, Cryo ext. acc. to manufact. Std, Gear OP, Cleaned & degreased for oxygen service | APVF2QN601ED | BU |  |
| 210 | 3-24 |  | Butterfly Valve,API 609, Service range-196°C to 100°C,high performance, Bolted, Lug RF, CL150, ASTM A351 Gr CF8M, Disc SS, Seat PCTFE, Viton O-ring - vent hole, Cryo ext. acc. to AL std G-DS-5-3-3 (replaces CPY-DS-5-3-3), Gear OP, Cleaned & degreased for oxygen service |  |  |  |
| **FILTERS / STRAINERS** | | | | | | |
| 224 | 1-16 |  | Conical filter, G-DS-5-4-10, Wafer, CL 150, liquid oxygen | APMN0QA701EF | CFR2 |  |
| 319 | 2-24 |  | Conical filter, G-DS-5-4-2, Wafer, CL150, all fluids except oxygen and water | APMN0QA701EA | CFR |  |
| **FABRICATED ITEMS** | | | | | | |
|  | .5-1.5 | S-10S | Pipe bend, R=5xOD, Plain end, Seamless (E=1), ASTM A312 Gr TP304/TP304L, Dual Certified | APSR2QP2H0ED | 9B5D |  |
|  |  |  |  |  |  |  |
| 10007 | 6-24  2-22 | See Note A | Fabricated Concentric reducer, Beveled end, Electric fusion straight weld pipe (E=1), ASTM A240 Type 304/304L | APSP0QD1G0EB | FCR |  |
| 10007 | 6-24  2-22 | See Note A | Fabricated Eccentric reducer, Beveled end, Electric fusion straight weld pipe (E=1), ASTM A240 Type 304/304L | APSQ0QD1G0EB | FER |  |
|  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |
|  | 26-48 | See Note A | Fabricated Item, Miter 3P/2W, B31.3, acc. G-DS-5-2-5,,30 deg - Miter Bend R=1 D,Beveled end acc. B16.25, , Electric fusion straight weld pipe (E=1),ASTM A240 Type 304/304L Dual Certified,,, , , - |  |  |  |
|  | 26-48 | See Note A | Fabricated Item, Miter 3P/2W, B31.3, acc. G-DS-5-2-5,,45  deg - Miter Bend R=1 D,Beveled end acc. B16.25, , Electric fusion straight weld pipe (E=1),ASTM A240 Type 304/304L Dual Certified,,, , , - |  |  |  |
|  | 26-48 | See Note A | Fabricated Item, Miter 3P/2W, B31.3, acc. G-DS-5-2-5,,60  deg - Miter Bend R=1 D,Beveled end acc. B16.25, , Electric fusion straight weld pipe (E=1),ASTM A240 Type 304/304L Dual Certified,,, , , - |  |  |  |
|  | 26-48 | See Note A | Fabricated Item, Miter 4P/3W, B31.3, acc. G-DS-5-2-5,,90  deg - Miter Bend R=1 D,Beveled end acc. B16.25, , Electric fusion straight weld pipe (E=1),ASTM A240 Type 304/304L Dual Certified,,, , , - |  |  |  |

**SPEC ITEM NOTES:**

59 For connection PN/class > rating pipe class

1. Valve inside cold box.
2. Valve outside cold box.
3. Valve top entry inside cold box.

224 Liquid with Enriched Oxygen Only

298 For bottom tank line PS 10 bar

319 All fluids except Oxygen & Water

|  |  |
| --- | --- |
| 404 | For vents |
| 413 | For instrument connection : Pressure, flow transmitters, analysers, vents and orifice tappings |
| 902 | For thermowell connection in cryogenic insulation casing only |
| 10007 | To be used as option of B16.9 fitting (default) |

**LEGEND:**

3 - Stub-on

31 - Welded Connection

2 - Reducing Tee

2XX - -

1 - Equal Tee

1XX - -

0 - No Branch

**BRANCH CHART (Preference 1)**

3 - Stub-on

32 - Reinforcing Pad

Branch Diameter

Header Diameter

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | 0,5 | 0,75 | 1 | 1,25 | 1,5 | 2 | 2,5 | 3 | 3,5 | 4 | 5 | 6 | 8 | 10 | 12 | 14 | 16 | 18 | 20 | 24 |
| 0,5 | 1XX |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 0,75 | 2XX | 1XX |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 1 | 2XX | 2XX | 1XX |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 1,25 | 2XX | 2XX | 2XX | 1XX |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 1,5 | 2XX | 2XX | 2XX | 2XX | 1XX |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 2 | 31 | 2XX | 2XX | 2XX | 2XX | 1XX |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 2,5 | 31 | 31 | 2XX | 2XX | 2XX | 2XX | 1XX |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 3 | 31 | 31 | 31 | 2XX | 2XX | 2XX | 2XX | 1XX |  |  |  |  |  |  |  |  |  |  |  |  |
| 3,5 | 31 | 31 | 31 | 31 | 2XX | 2XX | 2XX | 2XX | 1XX |  |  |  |  |  |  |  |  |  |  |  |
| 4 | 31 | 31 | 31 | 31 | 31 | 2XX | 2XX | 2XX | 2XX | 1XX |  |  |  |  |  |  |  |  |  |  |
| 5 | 31 | 31 | 31 | 31 | 31 | 31 | 31 | 31 | 31 | 2XX | 1XX |  |  |  |  |  |  |  |  |  |
| 6 | 31 | 31 | 31 | 31 | 31 | 31 | 31 | 31 | 31 | 31 | 2XX | 1XX |  |  |  |  |  |  |  |  |
| 8 | 31 | 31 | 31 | 31 | 31 | 31 | 31 | 31 | 31 | 31 | 31 | 2XX | 1XX |  |  |  |  |  |  |  |
| 10 | 31 | 31 | 31 | 31 | 31 | 31 | 31 | 31 | 31 | 31 | 31 | 31 | 2XX | 1XX |  |  |  |  |  |  |
| 12 | 31 | 31 | 31 | 31 | 31 | 31 | 31 | 31 | 31 | 31 | 31 | 31 | 31 | 2XX | 1XX |  |  |  |  |  |
| 14 | 31 | 31 | 31 | 31 | 31 | 31 | 31 | 31 | 31 | 31 | 31 | 31 | 31 | 31 | 2XX | 1XX |  |  |  |  |
| 16 | 31 | 31 | 31 | 31 | 31 | 31 | 31 | 31 | 31 | 31 | 31 | 31 | 31 | 31 | 31 | 2XX | 1XX |  |  |  |
| 18 | 31 | 31 | 31 | 31 | 31 | 31 | 31 | 31 | 31 | 31 | 31 | 31 | 31 | 31 | 31 | 31 | 2XX | 1XX |  |  |
| 20 | 31 | 31 | 31 | 31 | 31 | 31 | 31 | 31 | 31 | 31 | 31 | 31 | 31 | 31 | 31 | 31 | 31 | 2XX | 1XX |  |
| 24 | 31 | 31 | 31 | 31 | 31 | 31 | 31 | 31 | 31 | 31 | 31 | 31 | 31 | 31 | 31 | 31 | 31 | 31 | 2XX | 1XX |

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| Rev. | Date | Prepared by | Checked By | Approved By | Description |
| 0 | 19/08/2022 | YJ Chen | C Shen |  | First issue |

Disclamer:

AIR LIQUIDE CONFIDENTIAL INFORMATION

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|  |  |
| --- | --- |
| **DESIGN CODE:** | B31.3 Latest Edition / Addenda - Normal Fluid Service |
| **RATING CLASS:** | 150 |
| **MATERIAL:** | SS 304 / 304 L Dual Certified |
| **SERVICE:** | General Cryogenic |
| **FLANGE FACING:** | Raised Face |
| **NOMINAL CORROSION ALLOWANCE:** | 0 in (0 mm) |
| **MATERIAL GROUP:** | B16.5-2017, 2.1 |
| **FLUID CODE:** | AD / AG / AL / DK / KAC / KAD / KAG / KAL / KHN / KXL / KXP / KXR / KXS / KXT / NG /  NL / NLO / NW / OG / OL / ON / ONV / ORG / ORL / OW |
| **CALCULATION NO:** | AL\_CORP\_613\_16\_120\_PO |

**DESIGN PRESSURE-TEMPERATURE RATING:**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **From NPS 0.5 to 48in** | | | | | | |
| **Temp. DegC** | -196 | -29 | 38 | 50 | 100 |  |
| **Pressure BarG** | 19.0 | 19.0 | 19.0 | 18.3 | 15.7 |
| **Temp. DegF** | -321 | -20 | 100 | / | 212 |
| **Pressure Psig** | 275 | 275 | 275 | / | 227 |
| **Full Vacuum NPS 0.5 to 24in** | | | | | | |
| **Temp. DegC** | 100 |  | | | | |
| **Pressure BarG** | -1 |
| **Temp. DegF** | 212 |
| **Pressure Psig** | -14.5 |

**PIPE WALL THICKNESS:**

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NPS** | **.5** | **.75** | **1** | **1.25** | **1.5** | **2** | **2.5** | **3** | **3.5** | **4** | **5** |
| **DN** | 15 | 20 | 25 | 32 | 40 | 50 | 65 | 80 | 90 | 100 | 125 |
| **SCH** | S-10S | S-10S | S-10S | S-10S | S-10S | S-10S | S-10S | S-10S | S-10S | S-10S | S-10S |
| **THK (in)** | 0.083 | 0.083 | 0.109 | 0.109 | 0.109 | 0.109 | 0.12 | 0.12 | 0.12 | 0.12 | 0.134 |
| **THK (mm)** | 2.11 | 2.11 | 2.77 | 2.77 | 2.77 | 2.77 | 3.05 | 3.05 | 3.05 | 3.05 | 3.4 |
| **OD (mm)** | 21.3 | 26.7 | 33.4 | 42.2 | 48.3 | 60.3 | 73 | 88.9 | 101.6 | 114.3 | 141.3 |
| **NPS** | **6** | **8** | **10** | **12** | **14** | **16** | **18** | **20** | **22** | **24** | **26** |
| **DN** | 150 | 200 | 250 | 300 | 350 | 400 | 450 | 500 | 550 | 600 | 650 |
| **SCH** | S-10S | S-10S | S-10S | S-10S | S-10S | S-10S | S-10 | S-10 | S-20 | S-20 | S-10 |
| **THK (in)** | 0.134 | 0.148 | 0.165 | 0.18 | 0.188 | 0.188 | 0.25 | 0.25 | 0.375 | 0.375 | 0.312 |
| **THK (mm)** | 3.4 | 3.76 | 4.19 | 4.57 | 4.78 | 4.78 | 6.35 | 6.35 | 9.53 | 9.53 | 7.92 |
| **OD (mm)** | 168.3 | 219.1 | 273 | 323.8 | 355.6 | 406.4 | 457 | 508 | 559 | 610 | 660 |
| **NPS** | **28** | **30** | **32** | **34** | **36** | **38** | **40** | **42** | **44** | **46** | **48** |
| **DN** | 700 | 750 | 800 | 850 | 900 | 950 | 1000 | 1050 | 1100 | 1150 | 1200 |
| **SCH** | S-10 | S-STD | S-STD | S-STD | S-STD | S-XS | S-XS | S-XS | S-XS | S-XS | S-XS |
| **THK (in)** | 0.312 | 0.375 | 0.375 | 0.375 | 0.375 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 |
| **THK (mm)** | 7.92 | 9.53 | 9.53 | 9.53 | 9.53 | 12.7 | 12.7 | 12.7 | 12.7 | 12.7 | 12.7 |
| **OD (mm)** | 711 | 762 | 813 | 864 | 914 | 965 | 1016 | 1067 | 1118 | 1168 | 1219 |

**GENERAL NOTES:**

1. All buttwelded components wall thickness shall match PIPE WALLTHICKNESS.
2. Non-standard pipe sizes NPS 1.25", 2.5", 3.5", 5" etc. shall not be used except for connection to the equipment or in special circumstances.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Notes** | **NPS/DN**  **(in)** | **Sch** | **Description** | **Commodity Code** | **Short Code** | **Rev** |
| **NIPPLES** | | | | | | |
|  | .5-1.5 | S-40S | Nipple, B36.19 M,(100mm), Plain - NPT, Seamless, ASTM A312 Gr TP304/TP304L, Dual Certified | APPN2QP5H0EA | NPTG1 |  |
|  | .5-1.5 | S-40S | Nipple, B36.19 M,(180mm), Plain - NPT, Seamless, ASTM A312 Gr TP304/TP304L, Dual Certified | APPN2QP5H0EB | NPTG3 |  |
|  | .5-1.5 | S-40S | Nipple, B36.19 M,(100mm), NPT - NPT, Seamless, ASTM A312 Gr TP304/TP304L, Dual Certified | APPN2QP6H0EA | NTTG1 |  |
|  | .5-1.5 | S-40S | Nipple, B36.19 M,(180mm ), NPT - NPT, Seamless, ASTM A312 Gr TP304/TP304L, Dual Certified | APPN2QP6H0EB | NTTG3 |  |
| **PIPE** | | | | | | |
|  | .5-12 | S-10S | Pipe, B36.19 M, Bevel end, Seamless, ASTM A312 Gr TP304/TP304L, Dual Certified | APPP2QP2H0EE | P |  |
|  | 14-16 | S-10S | Pipe, B36.19 M, Bevel end, EFW (E=1), ASTM A358 Gr 304/304L Cl 1, Dual Certified | APPP7RY2G0EE | P |  |
|  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |
| **FORGED FITTINGS** | | | | | | |
|  | .5-1.5 |  | Full Coupling, B16.11, Threaded NPT, CL 3000, ASTM A182 Gr F304/304L, Dual Certified | APKD1QC230EM | FCL1 |  |
|  | .5-1.5 |  | Cap, B16.11, Threaded NPT,CL3000, ASTM A182 Gr F304/304L, Dual Certified | APKF1QC230EA | CT |  |
|  | .5-1.5 |  | Plug, B16.11, Threaded NPT,CL3000, ASTM A182 Gr F304/304L, Dual Certified | APKP1QC230EM | PL |  |
| 902 | 3-16  .5-.75 |  | Threadolet, MSS SP-97, Threaded NPT, CL 3000, ASTM A182 Gr F304/304L, Dual Certified | APKN7QC230EA | TOL |  |
| **WELDED FITTINGS** | | | | | | |
|  | .5-1.5 | S-10S | 90Deg LR Elbow, B16.9, BW, ASTM A403 Gr WP304/304L, Dual Certified -S/WX | APWA1SG1XXEU | 9E |  |
|  | .5-1.5 | S-10S | 45Deg LR Elbow, B16.9, BW , ASTM A403 Gr WP304/304L, Dual Certified -S/WX | APWB1SG1XXEU | 4E |  |
|  | .5-16 | S-10S | Equal Tee, B16.9, BW, ASTM A403 Gr WP304/304L, Dual Certified - S/WX | APWD1SG1XXEU | T |  |
|  | .5-16 | S-10S | Cap, B16.9, BW, ASTM A403 Gr WP304/304L, Dual Certified -S/WX | APWF1SG1XXEU | C |  |
|  | .75-16  .5-14 | S-10S | Reducing Tee, B16.9, BW, ASTM A403 Gr WP304/304L, Dual Certified -S/WX | APWE1SG1XXEU | RT |  |
|  | .75-16  .5-14 | S-10S | Concentric Reducer, B16.9, BW, ASTM A403 Gr WP304/304L, Dual Certified -S/WX | APWG1SG1XXEU | CR |  |

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Notes** | **NPS/DN**  **(in)** | **Sch** | **Description** | **Commodity Code** | **Short Code** | **Rev** |
| **WELDED FITTINGS** | | | | | | |
|  | .75-16  .5-14 | S-10S | Eccentric Reducer, B16.9, BW, ,,ASTM A403 Gr WP304/304L, Dual Certified -S/WX | APWH1SG1XXEU | ER |  |
|  | 2-16 | S-10S | 90Deg LR Elbow, B16.9, BW, ,ASTM A403 Gr WP304/304L, Dual Certified -S/WX | APWA1SG1XXEU | 9E |  |
|  | 2-16 | S-10S | 45Deg LR Elbow, B16.9, BW, ASTM A403 Gr WP304/304L, Dual Certified -S/WX | APWB1SG1XXEU | 4E |  |
|  | 2-16 | S-10S | 90Deg SR Elbow, B16.9, BW , ASTM A403 Gr WP304/304L, Dual Certified -S/WX | APWC1SG1XXEU | 9ES |  |
|  |  |  |  |  |  |  |
| **FLANGES** | | | | | | |
|  | .5-16 |  | Flange, Blind, B16.5, RF, CL 150, ASTM A182 Gr F304/304L, Dual Certified, Serrated spiral 125/250 | APFA2QC101EZ | BF |  |
|  | .5-16 | S-10S | Flange, WN, B16.5, RF, CL 150, ASTM A182 Gr F304/304L, Dual Certified, Serrated spiral 125/250 | APFL2QC101EZ | WN |  |
| 59 | .5-16 | S-10S | Flange, WN, B16.5, RF, CL 300, ASTM A182 Gr F304/304L, Dual Certified, Serrated spiral 125/250 | APFL2QC103EZ | WN3 |  |
|  | .5-14 |  | Flange, Spectacle Figure 8, B16.48, RF, CL 150, ASTM A240 Type 304/304L, Dual Certified, Serrated spiral 125/250 | APFM6RL101EZ | F8 |  |
|  | 16-16 |  | Paddle, Blank, B16.48, RF, CL 150, ASTM A240 Type 304/304L, Dual Certified, Serrated spiral 125/250 | APFN6RL101EZ | PB |  |
|  | 16-16 |  | Paddle, Spacer, B16.48, RF, CL 150, ASTM A240 Type 304/304L, Dual Certified, Serrated spiral 125/250 | APFP6RL101EZ | PS |  |
|  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |
| **ORIFICE FLANGE** | | | | | | |
|  | 1-16 | See Note A | Orif Flg, WN 0.5 NPT+jack scr. B16.36, RF, CL 300, ASTM A182 Gr F304/304L, Dual Certified | APOA1QC103EF | OF |  |
| **GASKETS** | | | | | | |
|  | .5-10 |  | Gasket, Flat Ring, 1.5 mm Thk, CL 150, Approved ox. Service, Expanded graphite 98% with metallic reinforcement | APGF2GN001ES | G |  |
|  | .5-10 |  | Gasket, Flat Ring, 1.5 mm Thk, CL 300, Approved ox. Service, Expanded graphite 98% with metallic reinforcement | APGF2GN003ES | G3 |  |
|  | 12-16 |  | Gasket, Flat Ring, 3.0 mm Thk, CL 150, Approved ox. Service, Expanded graphite 98% with metallic reinforcement | APGF2GN001ET | G |  |
|  | 12-16 |  | Gasket, Flat Ring, 3.0 mm Thk, CL 300, Approved ox. Service, Expanded graphite 98% with metallic reinforcement | APGF2GN003ET | G3 |  |
|  |  |  |  |  |  |  |

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| **Notes** | **NPS/DN**  **(in)** | **Sch** | **Description** | **Commodity Code** | **Short Code** | **Rev** |
| **BOLTING** | | | | | | |
|  | .5-16 |  | Stud Bolt w/2-Heavy Hex Nuts, SA320 Gr B8 Cl 2 / SA194 Gr 8 | APBA1SC000XX | BT |  |
|  | .5-16 |  | Stud Bolt w/2-Heavy Hex Nuts, SA320 Gr B8 Cl 2 / SA194 Gr 8 | APBA1SC000XX | BT3 |  |
|  | .5-2 |  | Stud Bolt w/2-Heavy Hex Nuts, SA320 Gr B8 Cl 2/ SA194 Gr 8, Flat Washer for Bolting, Stainless Steel, 17.7 PH | APBB3SD000EF | BTFW |  |
|  | .5-2 |  | Stud Bolt w/2-Heavy Hex Nuts, SA320 Gr B8 Cl 2/ SA194 Gr 8, Spring Washer for Bolting, Stainless Steel, 17.7 PH | APBH0SD000EF | BTSW |  |
| **VALVES** | | | | | | |
|  | .5-2 | See Note A | Check Valve, Service range -196°C to 100° C, Piston check, Welded, BW, CL300, FB, ASTM A351 Gr CF8, Disc SS-PTFE insert , Spg SS, PTFE, Non metal. Int. parts agreed for oxygen, Cleaned & degreased for oxygen service | APVC1QM103FP | CH3 |  |
| 210,  298 | .5-10 | See Note A | Gate Valve, Service range -196°C to 150°C- pressure Design : PN10, Welded, BW, CL150, FB, ASTM A182 Gr F304L, Graph packing, Gasket spir SS and graph, Cryo ASU ext. BB acc.to AL std G-GS-5-4-1 (replaces CPY-GS-5-4-1), HW, Cleaned & degreased for oxygen service | APVG1QC101GV |  |  |
| 211,  298 | .5-10 | See Note A | Gate Valve, Service range -196°C to 150°C- pressure Design : PN10, Welded, BW, CL150, FB, ASTM A182 Gr F304L, Graph packing, Gasket spir SS and graph, Cryo ext. BB acc. manufac. Std, HW, Cleaned & degreased for oxygen service | APVG1QC101HT | GA |  |
|  | .5-.5 | See Note A | Globe Valve, Service range -196°C to 100°C, SW, CL300, ASTM A182 Gr F316L, Disc SS-PTFE insert, Bellow seal, Gasket:Copper, BB, HW, Non metal. Int. parts agreed for oxygen | APVL1QF203JY | GLS |  |
| 211 | .5-4 | See Note A | Globe Valve, Service range -196°C to 100°C, Welded, BW, CL300, FB, ASTM A351 Gr CF8, Disc SS-PTFE insert, PTFE packing & Live loaded, PTFE, Cryo ext. BB acc. manufac. Std ,inside screw, HW, Non metal. Int. parts agreed for oxygen, Cleaned & degreased for oxygen service | APVL1QM103GV | GL |  |
| 210 | .5-4 | See Note A | Globe Valve, Service range -196°C to 100°C, Welded, BW, CL300, FB, ASTM A351 Gr CF8, Disc SS-PTFE insert, PTFE packing & Live loaded, PTFE, Cryo ASU ext. BB acc.to AL std G-GS-5-4-1 (replaces CPY-GS- 5-4-1), inside screw, HW, Non metal. Int. parts agreed for oxygen, Cleaned & degreased for oxygen service |  |  |  |
| 212 | .5-2 | See Note A | Globe Valve, Service range -196°C to 100°C, Welded, BW, CL300, FB, ASTM A351 Gr CF8, Disc SS-PTFE insert, PTFE packing & Live loaded, PTFE, Top entry bonnet acc. to AL std G-GS-5-4-1 (replaces CPY-GS- 5-4-1), inside screw, HW, Non metal. Int. parts agreed for oxygen, Cleaned & degreased for oxygen service |  |  |  |
| 413 | .5-.5 | See Note A | Globe Valve, Service range -196°C to 100°C, Thrd, Female NPT, CL300, FB, ASTM A351 Gr CF8, Disc SS-PTFE insert, PTFE packing & Live loaded, PTFE, BB, inside screw, HW, Non metal. Int. parts agreed for oxygen, Cleaned & degreased for oxygen service,, | APVL1QM303GY | GLT |  |
| 404 | .5-.5 | See Note A | Globe Valve, API 602, BWxNPT, CL800, ASTM A182 Gr F304/304L, Trim No. 12, PTFE, PTFE,ext. BB, OS & Y, HW, Cleaned & degreased for oxygen service | APVL5QY008FZ | GL1 |  |
|  | 3-16 | See Note A | Check Valve, API 594,, Service range -196°C to 100°C, Dual Plate Check, Bolted, Wafer RF, CL150, ASTM A351 Gr CF8M, Plates SS, Spg inconel, Cleaned & degreased for oxygen service | APVC4QN601FQ | CHW |  |

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| --- | --- | --- | --- | --- | --- | --- |
| **Notes** | **NPS/DN**  **(in)** | **Sch** | **Description** | **Commodity Code** | **Short Code** | **Rev** |
| **VALVES** | | | | | | |
| 211 | 3-16 |  | Butterfly Valve, API 609, Service range-196°C to 100°C,high performance, Bolted, Lug RF, CL150, ASTM A351 Gr CF8M, Disc SS, Seat PCTFE, Viton O-ring - vent hole, Cryo ext. acc. to manufact. Std, Gear OP, Cleaned & degreased for oxygen service | APVF2QN601ED | BU |  |
| 210 | 3-16 |  | Butterfly Valve, API 609, Service range -196°C to 100°C, high performance, Bolted, Lug RF, CL150, ASTM A351 Gr CF8M, Disc SS, Seat PCTFE, Viton O-ring - vent hole, Cryo ext. acc. to AL std G-DS-5-3-3 (replaces CPY-DS-5-3-3), Gear OP, Cleaned & degreased for oxygen service |  |  |  |
| **FILTERS / STRAINERS** | | | | | | |
| 224 | 1-16 |  | Conical filter, G-DS-5-4-10, Wafer, CL 150, liquid oxygen | APMN0QA701EF | CFR2 |  |
| 319 | 2-16 |  | Conical filter, G-DS-5-4-2, Wafer, CL150, all fluids except oxygen and water | APMN0QA701EA | CFR |  |
| **FABRICATED ITEMS** | | | | | | |
|  | .5-1.5 | S-10S | Pipe bend, R=5xOD, Plain end, Seamless (E=1), ASTM A312 Gr TP304/TP304L, Dual Certified | APSR2QP2H0ED | 9B5D |  |
|  |  |  |  |  |  |  |
| 10007 | 6-16  2-14 | See Note A | Fabricated Concentric reducer, Beveled end, Electric fusion straight weld pipe (E=1), ASTM A240 Type 304/304L | APSP0QD1G0EB | FCR |  |
| 10007 | 6-16  2-14 | See Note A | Fabricated Eccentric reducer, Beveled end, Electric fusion straight weld pipe (E=1), ASTM A240 Type 304/304L | APSQ0QD1G0EB | FER |  |
|  | 12-16  2-12 | See Note A | ASME Fabricated Item, weld with Reinf., B36.19 M, acc. G-DS-5-2-4 | APSY2QA0X0EA | RPAD |  |
|  | 14-16  .75-1.5 | See Note A | ASME Fabricated Item, weld with Reinf., B36.19 M, calculated | APSY2QA0X0EL | RPAD |  |
|  | 26-48 | See Note A | Fabricated Item, Miter 3P/2W, B31.3, acc. G-DS-5-2-5,,30 deg - Miter Bend R=1 D,Beveled end acc. B16.25, , Electric fusion straight weld pipe (E=1),ASTM A240 Type 304/304L Dual Certified,,, , , - |  |  |  |
|  | 26-48 | See Note A | Fabricated Item, Miter 3P/2W, B31.3, acc. G-DS-5-2-5,,45  deg - Miter Bend R=1 D,Beveled end acc. B16.25, , Electric fusion straight weld pipe (E=1),ASTM A240 Type 304/304L Dual Certified,,, , , - |  |  |  |
|  | 26-48 | See Note A | Fabricated Item, Miter 3P/2W, B31.3, acc. G-DS-5-2-5,,60  deg - Miter Bend R=1 D,Beveled end acc. B16.25, , Electric fusion straight weld pipe (E=1),ASTM A240 Type 304/304L Dual Certified,,, , , - |  |  |  |
|  | 26-48 | See Note A | Fabricated Item, Miter 4P/3W, B31.3, acc. G-DS-5-2-5,,90  deg - Miter Bend R=1 D,Beveled end acc. B16.25, , Electric fusion straight weld pipe (E=1),ASTM A240 Type 304/304L Dual Certified,,, , , - |  |  |  |

**SPEC ITEM NOTES:**

59 For connection PN/class > rating pipe class

1. Valve inside cold box.
2. Valve outside cold box.
3. Valve top entry inside cold box.

224 Liquid with Enriched Oxygen Only

298 For bottom tank line PS 10 bar

319 All fluids except Oxygen & Water

|  |  |
| --- | --- |
| 404 | For vents |
| 413 | For instrument connection : Pressure, flow transmitters, analysers, vents and orifice tappings |
| 902 | For thermowell connection in cryogenic insulation casing only |
| 10007 | To be used as option of B16.9 fitting (default) |

|  |  |
| --- | --- |
| 404 | For vents |
| 413 | For instrument connection : Pressure, flow transmitters, analysers, vents and orifice tappings |
| 902 | For thermowell connection in cryogenic insulation casing only |
| 10007 | To be used as option of B16.9 fitting (default) |

**LEGEND:**

3 - Stub-on

31 - Welded Connection

2 - Reducing Tee

2XX - -

1 - Equal Tee

1XX - -

0 - No Branch

**BRANCH CHART (Preference 1)**

3 - Stub-on

32 - Reinforcing Pad

Branch Diameter

Header Diameter

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | 0,5 | 0,75 | 1 | 1,25 | 1,5 | 2 | 2,5 | 3 | 3,5 | 4 | 5 | 6 | 8 | 10 | 12 | 14 | 16 |
| 0,5 | 1XX |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 0,75 | 2XX | 1XX |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 1 | 2XX | 2XX | 1XX |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 1,25 | 2XX | 2XX | 2XX | 1XX |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 1,5 | 2XX | 2XX | 2XX | 2XX | 1XX |  |  |  |  |  |  |  |  |  |  |  |  |
| 2 | 31 | 2XX | 2XX | 2XX | 2XX | 1XX |  |  |  |  |  |  |  |  |  |  |  |
| 2,5 | 31 | 31 | 2XX | 2XX | 2XX | 2XX | 1XX |  |  |  |  |  |  |  |  |  |  |
| 3 | 31 | 31 | 31 | 2XX | 2XX | 2XX | 2XX | 1XX |  |  |  |  |  |  |  |  |  |
| 3,5 | 31 | 31 | 31 | 31 | 2XX | 2XX | 2XX | 2XX | 1XX |  |  |  |  |  |  |  |  |
| 4 | 31 | 31 | 31 | 31 | 31 | 2XX | 2XX | 2XX | 2XX | 1XX |  |  |  |  |  |  |  |
| 5 | 31 | 31 | 31 | 31 | 31 | 31 | 31 | 31 | 31 | 2XX | 1XX |  |  |  |  |  |  |
| 6 | 31 | 31 | 31 | 31 | 31 | 31 | 31 | 31 | 31 | 31 | 2XX | 1XX |  |  |  |  |  |
| 8 | 31 | 31 | 31 | 31 | 31 | 31 | 31 | 31 | 31 | 31 | 31 | 2XX | 1XX |  |  |  |  |
| 10 | 31 | 31 | 31 | 31 | 31 | 31 | 31 | 31 | 31 | 31 | 31 | 31 | 2XX | 1XX |  |  |  |
| 12 | 31 | 31 | 31 | 31 | 31 | 31 | 31 | 32 | 32 | 32 | 32 | 32 | 32 | 2XX | 1XX |  |  |
| 14 | 31 | 32 | 31 | 31 | 32 | 32 | 32 | 32 | 32 | 32 | 32 | 32 | 32 | 32 | 2XX | 1XX |  |
| 16 | 32 | 32 | 32 | 32 | 32 | 32 | 32 | 32 | 32 | 32 | 32 | 32 | 32 | 32 | 32 | 2XX | 1XX |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Rev. | Date | Prepared by | Checked By | Approved By | Description |
| 0 | 04/01/2024 | SC | CYJ | XWJ | Approved for Design |

Disclamer:

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|  |  |
| --- | --- |
| **DESIGN CODE:** | B31.3 – Latest Edition/Addenda-Normal Setvice |
| **RATING CLASS:** | 150 |
| **MATERIAL:** | SS 304 / 304 L Dual Certified |
| **SERVICE:** | FT |
| **FLANGE FACING:** | Raised Face |
| **NOMINAL CORROSION ALLOWANCE:** | 0 in (0 mm) |
| **MATERIAL GROUP:** | B16.5-2017, 2.1 |
| **TRIM:** | Trim 10 |
| **FLUID CODE:** | XGO/XL/XO |
| **CALCULATION NO:** | AL\_CORP\_613\_14\_300/350 |

**DESIGN PRESSURE-TEMPERATURE RATING:**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **From NPS 0.5 to 24in** | | | | | | | |
| **Temp. DegC** | -29 | 100 | 200 | 300 | 400 | 425 |  |
| **Pressure BarG** | 19.0 | 15.7 | 13.2 | 10.2 | 6.5 | 5.5 |
| **Temp. DegF** | -20 | 212 | 392 | 572 | 752 | 797 |
| **Pressure Psig** | 275 | 227 | 191 | 147 | 94 | 79 |
| **Full Vacuum (NPS 0.5 to 24in)** | | | | | | | |
| **Temp. DegC** | 200 |  | | | | | |
| **Pressure BarG** | -1 |
| **Temp. DegF** | 392 |
| **Pressure Psig** | -14.5 |

**PIPE WALL THICKNESS:**

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NPS** | **.5** | **.75** | **1** | **1.25** | **1.5** | **2** | **2.5** | **3** | **3.5** | **4** | **5** |
| **DN** | 15 | 20 | 25 | 32 | 40 | 50 | 65 | 80 | 90 | 100 | 125 |
| **SCH** | S-40S | S-40S | S-40S | S-40S | S-40S | S-10S | S-10S | S-10S | S-10S | S-10S | S-10S |
| **THK (in)** | 0.109 | 0.113 | 0.133 | 0.14 | 0.145 | 0.109 | 0.12 | 0.12 | 0.12 | 0.12 | 0.134 |
| **THK (mm)** | 2.11 | 2.11 | 2.77 | 2.77 | 2.77 | 2.77 | 3.05 | 3.05 | 3.05 | 3.05 | 3.4 |
| **OD (mm)** | 21.3 | 26.7 | 33.4 | 42.2 | 48.3 | 60.3 | 73 | 88.9 | 101.6 | 114.3 | 141.3 |
| **NPS** | **6** | **8** | **10** | **12** | **14** | **16** | **18** | **20** | **24** |  | |
| **DN** | 150 | 200 | 250 | 300 | 350 | 400 | 450 | 500 | 600 |
| **SCH** | S-10S | S-10S | S-10S | S-10S | S-10S | S-10S | S-10 | S-10 | STD |
| **THK (in)** | 0.134 | 0.148 | 0.165 | 0.18 | 0.188 | 0.188 | 0.25 | 0.25 | 0.375 |
| **THK (mm)** | 3.4 | 3.76 | 4.19 | 4.57 | 4.78 | 4.78 | 6.35 | 6.35 | 6.35 |
| **OD (mm)** | 168.3 | 219.1 | 273 | 323.8 | 355.6 | 406.4 | 457 | 508 | 610 |

**GENERAL NOTES:**

1. All buttwelded components wall thickness shall match PIPE WALLTHICKNESS.
2. Non-standard pipe sizes NPS 1.25", 2.5", 3.5", 5" etc. shall not be used except for connection to the equipment or in special circumstances.

BX Piping Class Specification has been calculated to withstand Full Vacuum, max. buckling length 6m [19.68 ft].

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Notes** | **NPS/DN**  **(in)** | **Sch** | **Description** | **Commodity Code** | **Short Code** | **Rev** |
| **NIPPLES** | | | | | | |
| 53 | .5-1.5 | S-40S | Nipple, B36.19 M,(100mm), Plain - NPT, Seamless, ASTM A312 Gr TP304/TP304L, Dual Certified | APPN2QP5H0EA | NPTG1 |  |
| 53 | .5-1.5 | S-40S | Nipple, B36.19 M,(180mm), Plain - NPT, Seamless, ASTM A312 Gr TP304/TP304L, Dual Certified | APPN2QP5H0EB | NPTG3 |  |
| 53 | .5-1.5 | S-40S | Nipple, B36.19 M,(100mm), NPT - NPT, Seamless, ASTM A312 Gr TP304/TP304L, Dual Certified | APPN2QP6H0EA | NTTG1 |  |
| 53 | .5-1.5 | S-40S | Nipple, B36.19 M,(180mm ), NPT - NPT, Seamless, ASTM A312 Gr TP304/TP304L, Dual Certified | APPN2QP6H0EB | NTTG3 |  |
| **PIPE** | | | | | | |
|  | .5-1.5 | S-40S | Pipe, B36.19 M, Plain end, Seamless, ASTM A312 Gr TP304/TP304L, Dual Certified | APPP7QP2H0EE | P |  |
|  | 2-6 | S-10S | Pipe, B36.19 M, Beveled end, EFW(E=0.80), ASTM A312 Gr TP304/TP304L, Dual Certified | APPP7QP1C0EE | P |  |
|  |  |  |  |  |  |  |
| **FORGED FITTINGS** | | | | | | |
|  | .5-1.5 |  | 90Deg. Elbow, B16.11, SW, CL 3000, ASTM A182 Gr F304/304L, Dual Certified | APKA1QC130EA | 9E |  |
|  | .5-1.5 |  | Equal Tee, B16.11, SW, CL 3000, ASTM A182 Gr F304/304L, Dual Certified | APKB1QC130EA | T |  |
|  | .5-1.5 |  | 45Deg. Elbow, B16.11, SW, CL 3000, ASTM A182 Gr F304/304L, Dual Certified | APKC1QC130EA | 4E |  |
|  | .5-1.5 |  | Cap, B16.11, SW, CL3000, ASTM A182 Gr F304/304L, Dual Certified | APKF1QC130EA | C |  |
| 404 | .5-1 |  | Plug, B16.11, Threaded NPT, CL3000, ASTM A182 Gr F304/304L, Dual Certified | APKP1QC230EA | PL |  |
| 401 | **.5**-1 |  | Cap, B16.11, Threaded NPT, CL3000, ASTM A182 Gr F304/304L, Dual Certified | APKF1QC230EA | CT |  |
|  | .5-1.5 |  | Full Coupling, B16.11, SW, CL3000, ASTM A182 Gr F304/304L, Dual Certified |  | FCL |  |
|  | .75-1.5  .5-1.25 |  | Reduced tee, B16.11, SW, CL 3000, ASTM A182 Gr F304/304L, Dual Certified | APKQ1QC130EA | RT |  |
|  | 2-6  .5-1.5 |  | Sockolet, MSS SP-97, SW, CL 3000, ASTM A182 Gr F304/304L, Dual Certified | APKM7QC130EB | SOL |  |
| 403 | 2-6  .75-1 |  | Threadolet, MSS SP-97, Threaded NPT, CL 3000, ASTM A182 Gr F304/304L, Dual Certified | APKN7QC230EB | TOL |  |
| **WELDED FITTINGS** | | | | | | |
|  | .75-1.5  .5-1.25 | S-40S | Swage Nipple Conc, MSS SP-95, BW, ASTM A403 Gr WP304/304L, Dual Certified -S | APWT5SH1XXEA | CBB |  |
|  | .75-1.5  .5-1.25 | S-40S | Swage Nipple Ecc, MSS SP-95, BW, ASTM A403 Gr WP304/304L, Dual Certified -S | APWU5SH1XXEA | EBB |  |
|  | 2-6 | See Note A | 90Deg LR Elbow, B16.9, BW,  ASTM A403 Gr WP304/304L,Dual Certified -S/WX | APWA1SG7XXEA | 9E |  |
|  | 2-6 | See Note A | 45Deg LR Elbow, B16.9, BW,  ASTM A403 Gr WP304/304L,Dual Certified -S/WX | APWB1SG7XXEA | 4E |  |
|  | 2-6 | See Note A | Equal Tee, B16.9, BW,ASTM A403 Gr WP304/304L,  Dual Certified -S/WX | APWD1SG7XXEA | T |  |

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Notes** | **NPS/DN**  **(in)** | **Sch** | **Description** | **Commodity Code** | **Short Code** | **Rev** |
| **WELDED FITTINGS** | | | | | | |
|  | 2-6  1.25-4 | See Note A | Reducing Tee, B16.9, BW, ASTM A403 Gr WP304/304L, Dual Certified -S/WX | APWE1SG7XXEA | RT |  |
|  | 2-6 | See Note A | Cap, B16.9, BW,ASTM A403 Gr WP304/304L,  Dual Certified -S/WX | APWF1SG7XXEA | C |  |
|  | 2-6  .75-4 | See Note A | Concentric Reducer, B16.9, BW,ASTM A403 Gr WP304/304L,Dual Certified -S/WX | APWG1SG7XXEA | CR |  |
|  | 2-6  .75-4 | See Note A | Eccentric Reducer, B16.9, BW, ASTM A403 Gr WP304/304L,Dual Certified -S/WX | APWH1SG7XXEA | ER |  |
| **FLANGES** | | | | | | |
|  | .5-6 |  | Flange, Blind, B16.5, RF,CL 150, ASTM A182 Gr F304/304L, Dual Certified | APFA2QC101EA | BF |  |
| 59 | .5-6 |  | Flange, Blind, B16.5, RF,CL 300,ASTM A182 Gr  F304/304L,Dual Certified | APFA2QC103EA | BF3 |  |
| 53 | .5-.5 |  | Flange, Threaded, B16.5, RF, CL 150, ASTM A182 Gr F304/304L, Dual Certified | APFK2QC101EA | TF |  |
|  | .5-6 |  | Flange, Spectacle Figure 8, B16.48, RF,CL 150, ASTM A240 Type 304/304 L, Dual Certified | APFM6RL101EA | F8 |  |
|  | .5-1.5 |  | Flange, SW, B16.5, RF, CL 150, ASTM A182 Gr F304/304L, Dual Certified | APFS2QC101EA | SF |  |
| 59 | .5-1.5 |  | Flange, SW, B16.5, RF, CL 300, ASTM A182 Gr F304/304L, Dual Certified | APFS2QC103EA | SF3 |  |
| 402 | .75-2  .5-.5 |  | Flange, Blind with Thd Bore, B16.5, 1/2" NPT, RF, CL 150, ASTM A182 Gr F304/304L, Dual Certified | APFG2QC101EB | BFI |  |
| 402,  59 | .75-2  .5-.5 |  | Flange, Blind w Thd Bore, B16.5, 1/2" NPT, RF, CL 300, ASTM A182 Gr F304/304L, Dual Certified | APFG2QC103EB | BFI3 |  |
|  | 2-6 | See Note A | Flange, WN, B16.5, RF, CL 150, ASTM A182 Gr F304/304L, Dual Certified | APFL2QC101EA | WN |  |
| 59 | 2-6 | See Note A | Flange, WN, B16.5, RF, CL 300, ASTM A182 Gr F304/304L, Dual Certified | APFL2QC103EA | WN3 |  |
|  |  |  |  |  |  |  |
| **ORIFICE FLANGE** | | | | | | |
|  | 1-6 | See Note A | Orif Flg, WN 0.5 NPT+jack scr. B16.36, RF, CL 300, ASTM A182 Gr F304/304L, Dual Certified | APOA1QC103EA | OF |  |
| **GASKETS** | | | | | | |
|  | .5-6 |  | Gasket, Flat Ring, 2.0 mm Thk, CL 150, pure graphite 98%-impregnated inlet perforated plate 316SS-inlet cover 316SS | APGF2GF001EA | G |  |
| 59 | .5-6 |  | Gasket, Spiral Wound, 4.5 mm Thk, CL 300, Filler graphite 98%, spiral 316SS, IR/OR 316SS | APGS1GC003EB | G3 |  |
|  |  |  |  |  |  |  |
| **BOLTING** | | | | | | |
|  | .5-6 |  | Stud Bolt w/2-Heavy hex Nuts, ASTM A193 Gr B8 Cl 2 / A194 Gr 8M | APBA1SG000EF | BT |  |
|  | .5-6 |  | Stud Bolt w/2-Heavy hex Nuts, ASTM A193 Gr B8 Cl 2 / A194 Gr 8M | APBA1SG000EF | BT3 |  |

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| --- | --- | --- | --- | --- | --- | --- |
| **Notes** | **NPS/DN**  **(in)** | **Sch** | **Description** | **Commodity Code** | **Short Code** | **Rev** |
| **VALVES** | | | | | | |
|  | .5-1.5 | See Note A | Check Valve, API602, piston type, horiz. and vert, SW, CL800, ASTM A182 Gr F316/316L, Trim No. 10, BC | APVC6QW208EU | CH |  |
| 406 | .5-1.5 | See Note A | Gate Valve, API 602, SW/NPT, CL800, ASTM A182 Gr F316/316L Trim No. 10, BB, OS & Y | APVG4QW008FN | GA1 |  |
|  | .5-1.5 | See Note A | Gate Valve, API 602, SW, CL800, ASTM A182 Gr F316/316L, Trim No. 10, BB, OS & Y | APVG4QW208FM | GA |  |
| 60 | .5-1.5 | See Note A | Gate Valve, API 602, Flanged, RF, CL150, ASTM A182 Gr F316/316L, Trim No. 10, BB, OS & Y | APVG4QW401FP | GAF |  |
| 59,60 | .5-1.5 | See Note A | Gate Valve, API 602, Flanged, RF, CL300, ASTM A182 Gr F316/316L, Trim No. 10, BB, OS & Y | APVG4QW403FP | GAF3 |  |
|  | .5-1.5 | See Note A | Globe Valve,API 602, straight seat, SWxNPT, CL800, ASTM A182 Gr F316/316L, Trim No.10, BB, OS & Y |  | GL1 |  |
| 405 | .5-1.5 | See Note A | Globe Valve, API 602, straight seat, SW, CL800, ASTM A182 Gr F316/316L, Trim No. 10, BB, OS & Y | APVL5QW208FH | GL |  |
|  | 2-6 | See Note A | Check Valve, API 594, Type B, swing check - horiz. and vert. pos., Flanged, RF, CL150, ASTM A351 Gr CF3, Trim No. 10, BC, hinge pin inside | APVC4QH401EB | CH |  |
|  | 2-6 | See Note A | Gate Valve, API 600, flex. wedge, Flanged, RF, CL150, ASTM A351 Gr CF3, Trim No. 10, BB, OS & Y | APVG3QH401FQ | GA |  |
| 59,60 | 2-2 | See Note A | Gate Valve, API 600, flex. wedge, Flanged, RF, CL300, ASTM A351 Gr CF3, Trim No. 10, BB, OS & Y | APVG3QH403FQ | GA3 |  |
| 405 | 2-4 | See Note A | Globe Valve, API 623, Flanged, RF, CL150, ASTM A351 Gr CF3, Trim No. 10, BB, OS & Y | APVL7QH401FD | GL |  |
| 405 | 6-6 | See Note A | Globe Valve, API 623, Flanged, RF, CL150, ASTM A351 Gr CF3, Trim No. 10, BB, OS & Y, Gear OP | APVL7QH401FE | GL |  |
|  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |
| **FILTERS / STRAINERS** | | | | | | |  |  |  |  |  |  |
|  | .5-1.5 |  | Y Strainer, SW, CL800, ASTM A182 Gr F316/316L, Screen retainer SS316, Screen SS316, Filtering 0.8mm, Gasket spir SS and Graphite | APVY3QW208FG | STY |  |

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Notes** | **NPS/DN**  **(in)** | **Sch** | **Description** | **Commodity Code** | **Short Code** | **Rev** |
| **FILTERS / STRAINERS** | | | | | | |
|  | 2-3 |  | Y Strainer, Flanged, RF, CL150, ASTM A351 Gr CF3, Screen retainer: SS316, Screen SS316, Filtering 0.8mm, Gasket spir SS and Graphite | APVY3QH401FH | STY |  |
|  | 4-6 |  | T Strainer, Type TA, Blind Fl Type 1, Welded for Tee, CL150, ASTM A403 WP-S/WX304/304L,Perfor plate, Wire mesh : SS304 or SS316, Mesh size 1 B/N | APVT0QU101FC | STT |  |
| **FABRICATED ITEMS** | | | | | | |
|  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |

**SPEC ITEM NOTES:**

53 For orifice flange tapping

59 For Connection PN/Class > rating pipe class

1. For Connection to Equipments

401 For insulated pressure testing vents (see G-DS-5-0-1)

402 For instrument connection (PI, TI, etc.)

403 For non-insulated pressure testing vents (see G-DS-5-0-1)

1. For vents
2. For regulation only

406 For instrument Connection (PI, TI, etc.) vents and orifice tappings

10007 To be used as option of ASME B16.9 fitting (default)

**LEGEND:**

2 - Reducing Tee

230 - Class 3000

2 - Reducing Tee

2XX - -

1 - Equal Tee

130 - Class 3000

1 - Equal Tee

1XX - -

0 - No Branch

**BRANCH CHART (Preference 1)**

3 - Stub-on

3 - Stub-on

31 - Welded Connection

32 - Reinforcing Pad

3 - Stub-on

34 - Reinforced Header Run (TSH) Reducing

5 - Sockolet

530 - Class 3000

Branch Diameter

Header Diameter

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | 0,5 | 0,75 | 1 | 1,25 | 1,5 | 2 | 2,5 | 3 | 3,5 | 4 | 5 | 6 | 8 |
| 0,5 | 130 |  |  |  |  |  |  |  |  |  |  |  |  |
| 0,75 | 230 | 130 |  |  |  |  |  |  |  |  |  |  |  |
| 1 | 230 | 230 | 130 |  |  |  |  |  |  |  |  |  |  |
| 1,25 | 230 | 230 | 230 | 130 |  |  |  |  |  |  |  |  |  |
| 1,5 | 230 | 230 | 230 | 230 | 130 |  |  |  |  |  |  |  |  |
| 2 | 530 | 530 | 530 | 530 | 530 | 1XX |  |  |  |  |  |  |  |
| 2,5 | 530 | 530 | 530 | 530 | 530 | 2XX | 1XX |  |  |  |  |  |  |
| 3 | 530 | 530 | 530 | 530 | 530 | 2XX | 2XX | 1XX |  |  |  |  |  |
| 3,5 | 530 | 530 | 530 | 530 | 530 | 31 | 2XX | 2XX | 1XX |  |  |  |  |
| 4 | 530 | 530 | 530 | 530 | 530 | 31 | 31 | 2XX | 2XX | 1XX |  |  |  |
| 5 | 530 | 530 | 530 | 530 | 530 | 31 | 31 | 31 | 2XX | 2XX | 1XX |  |  |
| 6 | 530 | 530 | 530 | 530 | 530 | 31 | 31 | 31 | 31 | 2XX | 2XX | 1XX |  |
| 8 | 530 | 530 | 530 | 530 | 530 | 32 | 32 | 32 | 32 | 32 | 2XX | 2XX | 1XX |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Rev. | Date | Prepared by | Checked By | Approved By | Description |
| 0 | 19/08/2022 | YJ Chen | C Shen |  | First issue |

Disclamer:

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|  |  |
| --- | --- |
| **DESIGN CODE:** | B31.3 - 2016 |
| **RATING CLASS:** | 300 |
| **MATERIAL:** | Carbon Steel High Temperature |
| **SERVICE:** | General |
| **FLANGE FACING:** | Raised Face |
| **NOMINAL CORROSION ALLOWANCE:** | 0.0625 in (1.6 mm) |
| **MATERIAL GROUP:** | B16.5-2013, 1.1 |
| **TRIM:** | Trim 8 |
| **FLUID CODE:** | AA / AC / AD / AE / AG / AI / AIN / AS / AU / ND / NG / NH / NS / NW |
| **CALCULATION NO:** | AL\_CORP\_521\_14\_120\_PO |

**DESIGN PRESSURE-TEMPERATURE RATING:**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **From NPS 0.5 to 48in** | | | | | |
| **Temp. DegC** | -29 | 38 | 50 | 100 |  |
| **Pressure BarG** | 51.1 | 51.1 | 50.1 | 46.6 |
| **Temp. DegF** | -20 | 100 | 122 | 212 |
| **Pressure Psig** | 741 | 741 | 726 | 676 |

**PIPE WALL THICKNESS:**

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NPS** | **.5** | **.75** | **1** | **1.25** | **1.5** | **2** | **2.5** | **3** | **3.5** | **4** | **5** |
| **DN** | 15 | 20 | 25 | 32 | 40 | 50 | 65 | 80 | 90 | 100 | 125 |
| **SCH** | S-XS | S-XS | S-XS | S-XS | S-XS | S-STD | S-STD | S-STD | S-STD | S-STD | S-STD |
| **THK (in)** | 0.147 | 0.154 | 0.179 | 0.191 | 0.2 | 0.154 | 0.203 | 0.216 | 0.226 | 0.237 | 0.258 |
| **THK (mm)** | 3.73 | 3.91 | 4.55 | 4.85 | 5.08 | 3.91 | 5.16 | 5.49 | 5.74 | 6.02 | 6.55 |
| **OD (mm)** | 21.3 | 26.7 | 33.4 | 42.2 | 48.3 | 60.3 | 73 | 88.9 | 101.6 | 114.3 | 141.3 |
| **NPS** | **6** | **8** | **10** | **12** | **14** | **16** | **18** | **20** | **24** | **26** | **28** |
| **DN** | 150 | 200 | 250 | 300 | 350 | 400 | 450 | 500 | 600 | 650 | 700 |
| **SCH** | S-STD | S-STD | S-STD | S-40 | S-40 | S-XS | S-40 | S-40 | S-40 | 0.750" | 0.812" |
| **THK (in)** | 0.28 | 0.322 | 0.365 | 0.406 | 0.438 | 0.5 | 0.562 | 0.594 | 0.688 | 0.75 | 0.812 |
| **THK (mm)** | 7.11 | 8.18 | 9.27 | 10.31 | 11.13 | 12.7 | 14.27 | 15.09 | 17.48 | 19.05 | 20.62 |
| **OD (mm)** | 168.3 | 219.1 | 273 | 323.8 | 355.6 | 406.4 | 457 | 508 | 610 | 660 | 711 |
| **NPS** | **30** | **32** | **34** | **36** | **38** | **40** | **42** | **44** | **46** | **48** |  |
| **DN** | 750 | 800 | 850 | 900 | 950 | 1000 | 1050 | 1100 | 1150 | 1200 |
| **SCH** | 0.812" | 0.875" | 0.938" | 1.000" | 1.062" | 1.062" | 1.125" | 1.188" | 1.250" | 1.250" |
| **THK (in)** | 0.812 | 0.875 | 0.938 | 1 | 1.062 | 1.062 | 1.125 | 1.188 | 1.25 | 1.25 |
| **THK (mm)** | 20.62 | 22.23 | 23.83 | 25.4 | 26.97 | 26.97 | 28.58 | 30.18 | 31.75 | 31.75 |
| **OD (mm)** | 762 | 813 | 864 | 914 | 965 | 1016 | 1067 | 1118 | 1168 | 1219 |

**GENERAL NOTES:**

1. All buttwelded components wall thickness shall match PIPE WALLTHICKNESS.
2. Non-standard pipe sizes NPS 1.25", 2.5", 3.5", 5" etc. shall not be used except for connection to the equipment or in special circumstances.

BX Piping Class Specification has been calculated to withstand Full Vacuum, max. buckling length 6m [19.68 ft].

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| --- | --- | --- | --- | --- | --- | --- |
| **Notes** | **NPS/DN**  **(in)** | **Sch** | **Description** | **Commodity Code** | **Short Code** | **Rev** |
| **NIPPLES** | | | | | | |
| 53 | .5-1 | S-160 | Nipple, B36.10 M,(100mm), Plain - NPT, Seamless, ASTM A106 Gr B | APPN1DF5H0EA | NPTG1 |  |
| 53 | .5-1 | S-160 | Nipple, B36.10 M,(180mm), Plain - NPT, Seamless, ASTM A106 Gr B | APPN1DF5H0EB | NPTG3 |  |
| 53 | .5-1 | S-160 | Nipple, B36.10 M,(100mm), NPT - NPT, Seamless, ASTM A106 Gr B | APPN1DF6H0EA | NTTG1 |  |
| 53 | .5-1 | S-160 | Nipple, B36.10 M,(180mm), NPT - NPT, Seamless, ASTM A106 Gr B | APPN1DF6H0EB | NTTG3 |  |
| 53 | 1.25-1.5 | S-XS | Nipple, B36.10 M,(100mm), Plain - NPT, Seamless, ASTM A106 Gr B | APPN1DF5H0EA | NPTG1 |  |
| 53 | 1.25-1.5 | S-XS | Nipple, B36.10 M,(180mm), Plain - NPT, Seamless, ASTM A106 Gr B | APPN1DF5H0EB | NPTG3 |  |
| 53 | 1.25-1.5 | S-XS | Nipple, B36.10 M,(100mm), NPT - NPT, Seamless, ASTM A106 Gr B | APPN1DF6H0EA | NTTG1 |  |
| 53 | 1.25-1.5 | S-XS | Nipple, B36.10 M,(180mm), NPT - NPT, Seamless, ASTM A106 Gr B | APPN1DF6H0EB | NTTG3 |  |
| **PIPE** | | | | | | |
|  | .5-1.5 | S-XS | Pipe, B36.10 M, Plain end, Seamless, ASTM A106 Gr B | APPP1DF2H0EE | P |  |
|  | 2-6 | S-40 | Pipe, B36.10 M, Beveled end, Seamless, ASTM A106 Gr B | APPP1DF1H0EE | P |  |
|  | 8-10 | S-40 | Pipe, B36.10 M, Beveled end, Seamless, ASTM A106 Gr B, Permissible Substitution | APPP1DF1H0EG | P |  |
|  | 12-16 | S-40 | Pipe, B36.10 M, Beveled end. Seamless, ASTM A106 Gr B, Permissible Substitution | APPP1DF1H0EG | P |  |
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| **Notes** | **NPS/DN**  **(in)** | **Sch** | **Description** | **Commodity Code** | **Short Code** | **Rev** |
| **FORGED FITTINGS** | | | | | | |
| 58 | .5-1.5 |  | 90Deg. Elbow, B16.11, SW, CL 3000, ASTM A105N | APKA1DD130EA | 9E |  |
|  | .5-1.5 |  | Equal Tee, B16.11, SW, CL 3000, ASTM A105N | APKB1DD130EA | T |  |
| 58 | .5-1.5 |  | 45Deg. Elbow, B16.11, SW, CL 3000, ASTM A105N | APKC1DD130EA | 4E |  |
|  | .5-1.5 |  | Cap, B16.11, SW, CL3000, ASTM A105N | APKF1DD130EA | C |  |
| 401 | .5-1 |  | CAP, B16.11, Threaded NPT, CL 3000, ASTM A105N | APKF1DD230EA | CT |  |
| 404 | .5-1 |  | ASME, Plug, B16.11, Threaded NPT, CL3000, ASTM A105N | APKP1DD230EA | PL |  |
|  | .5-1.5 |  | Full Coupling, B16.11, SW, CL 3000, ASTM A105N |  | FCL |  |
|  | .75-1.5  .5-1.25 |  | Reduced Tee, B16.11, SW, CL 3000, ASTM A105N | APKQ1DD130EA | RT |  |
|  | 2-16  .5-1.5 |  | Sockolet, MSS SP-97, SW, B16.11, CL 3000, ASTM A105N | APKM7DD130EB | SOL |  |
| 403 | 2-16  .75-.75 |  | Threadolet, MSS SP-97, Threaded NPT, B16.11, CL 3000, ASTM A105N | APKN7DD230EB | TOL |  |
|  | 14-16  .5-1.5 |  | Sockolet, MSS SP-97, SW, B16.11, CL 6000, ASTM A105N | APKM7DD160EB | SOL6 |  |
| 403 | 14-16  .75-1 |  | Threadolet, MSS SP-97, Threaded NPT, B16.11, CL 6000, ASTM A105N | APKN7DD260EB | TOL6 |  |
| **WELDED FITTINGS** | | | | | | |
|  | .75-1.5  .5-1.25 | S-XS | BW, Swage Nipple Conc, MSS SP-95, Beveled End, ASTM A234 Gr WPB | APWT5DH1XXEA | CBB |  |
|  | .75-1.5  .5-1.25 | S-XS | Swage Nipple Ecc, MSS SP-95, Beveled End,  ASTM A234 Gr WPB | APWU5DH1XXEA | EBB |  |
|  | 2-10 | S-40 | 90Deg LR Elbow, B16.9, BW, ASTM A234 Gr WPB | APWA1DH7XXEA | 9E |  |
|  | 12-16 | S-40 | 90Deg LR Elbow, B16.9, BW, ASTM A234 Gr WPB | APWA1DH7XXEA | 9E |  |
|  | 2-10 | S-40 | 45Deg LR Elbow, B16.9, BW, ASTM A234 Gr WPB | APWB1DH7XXEA | 4E |  |
|  | 12-16 | S-40 | 45Deg LR Elbow, B16.9, BW, ASTM A234 Gr WPB | APWB1DH7XXEA | 4E |  |
|  | 2-10 | S-40 | Equal Tee, B16.9, BW, ASTM A 234 Gr WPB | APWD1DH7XXEA | T |  |
|  | 12-16 | S-40 | Equal Tee, B16.9, BW, ASTM A 234 Gr WPB | APWD1DH7XXEA | T |  |
|  | 2-10 | S-40 | Cap, B16.9, BW, ASTM A234 Gr WPB | APWF1DH7XXEA | C |  |
|  | 12-16 | S-40 | Cap, B16.9, BW, ASTM A234 Gr WPB | APWF1DH7XXEA | C |  |
|  | 2-10  .75-8 | S-40 | Concentric Reducer, B16.9, BW, ASTM A234 Gr WPB | APWG1DH7XXEA | CR |  |
|  | 12-16  .75-14 | S-40 | Concentric Reducer, B16.9, BW, ASTM A234 Gr WPB | APWG1DH7XXEA | CR |  |
|  | 2-10  .75-8 | S-40 | Eccentric Reducer, B16.9, BW, ASTM A234 Gr WPB | APWH1DH7XXEA | ER |  |
|  | 12-16  .75-14 | S-40 | Eccentric Reducer, B16.9, BW, ASTM A234 Gr WPB | APWH1DH7XXEA | ER |  |
|  | 2.5-10  2-12 | S-40 | Reducing Tee, B16.9, BW, ASTM A234 Gr WPB | APWE1DH7XXEA | RT |  |
|  | 12-16  2-14 | S-40 | Reducing Tee, B16.9, BW, ASTM A234 Gr WPB | APWE1DH7XXEA | RT |  |
|  | 16-16  3-3 | S-STD | Weldolet, MSS SP-97, BW, B16.25, STD. SCH., ASTM A105N. |  | WOL |  |

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| **Notes** | **NPS/DN**  **(in)** | **Sch** | **Description** | **Commodity Code** | **Short Code** | **Rev** |
| **FLANGES** | | | | | | |
|  | .5-16 |  | Flange, Blind, B16.5, RF,CL 300, ASTM A105N | APFA2DD103EA | BF |  |
| 59 | .5-16 |  | Flange, Blind, B16.5, RF,CL 600, ASTM A105N | APFA2DD106EA | BF6 |  |
| 53 | .5-.5 |  | Flange, Threaded, B16.5, RF, CL 300, ASTM A105N | APFK2DD103EA | TF |  |
|  | .5-10 |  | Flange, Spectacle Figure 8, B16.48, RF,CL 300, ASTM A516 Gr 70N | APFM6DG103EA | F8 |  |
|  | .5-1.5 |  | Flange, SW, B16.5, RF,CL 300, ASTM A105N | APFS2DD103EA | SF |  |
| 59 | .5-1.5 |  | Flange, SW, B16.5, RF,CL 600, ASTM A105N | APFS2DD106EA | SF6 |  |
| 402 | .75-2  .5-.5 |  | Flange, Blind with Thd Bore, B16.5, 1/2" NPT, RF, CL 300, ASTM A105N | APFG2DD103EB | BFI |  |
| 402,  59 | .75-2  .5-.5 |  | Flange, Blind with Thd Bore, B16.5, 1/2" NPT, RF, CL 600, ASTM A105N | APFG2DD106EB | BFI6 |  |
|  | 2-10 | S-40 | Flange, WN, B16.5, RF,CL 300,ASTM A105N | APFL2DD103EA | WN |  |
|  | 12-16 | S-40 | Flange, WN, B16.5, RF,CL 300,ASTM A105N | APFL2DD103EA | WN |  |
| 59 | 2-10 | S-40 | Flange, WN, B16.5, RF,CL 600,ASTM A105N | APFL2DD106EA | WN6 |  |
| 59 | 12-16 | S-40 | Flange, WN, B16.5, RF,CL 600,ASTM A105N | APFL2DD106EA | WN6 |  |
|  | 12-14 |  | Paddle, Blank, B16.48, RF,CL 300, ASTM A516 Gr 70N | APFN6DG103EA | PB |  |
|  | 12-14 |  | Paddle, Spacer, B16.48, RF,CL 300, ASTM A516 Gr 70N | APFP6DG103EA | PS |  |
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| **ORIFICE FLANGE** | | | | | | |
|  | 1-14 | See Note A | Orif Flg, WN 0.5 NPT+jack scr. B16.36, RF, CL 300, ASTM A105N | APOA1DD103EA | OF |  |
| **GASKETS** | | | | | | |
|  | .5-16 |  | Gasket, Spiral Wound, 4.5 mm Thk, CL 300, Filler graphite 98%, spiral 316SS, IR 316SS, OR CS | APGS1GB003EB | G |  |
| 59 | .5-16 |  | Gasket, Spiral Wound, 4.5 mm Thk, CL 600, Filler graphite 98%, spiral 316SS, IR 316SS, OR CS | APGS1GB006EB | G6 |  |
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| **Notes** | **NPS/DN**  **(in)** | **Sch** | **Description** | **Commodity Code** | **Short Code** | **Rev** |
| **BOLTING** | | | | | | |
|  | .5-16 |  | Stud Bolt w/2-Heavy Hex Nuts, SA193 Gr B7 / SA194 Gr 2H | APBA1CB000EA | BT |  |
|  | .5-16 |  | Stud Bolt w/2-Heavy Hex Nuts, SA193 Gr B7 / SA194 Gr 2H | APBA1CB000EA | BT6 |  |
|  | 12-12 | Bolt Chart : 추후제공예정임 | Stud Bolt w/2-Heavy Hex Nuts, SA193 Gr B7 / SA194 Gr 2H  Metric Bolt /Nuts for Butterfly valve |  | BTM |  |
|  | 12-12 | Bolt Chart : 추후제공예정임 | Stud Bolt w/2-Heavy Hex Nuts, SA193 Gr B7 / SA194 Gr 2H  Metric Bolt /Nuts for Butterfly valve |  | BTM1 |  |
| **VALVES** | | | | | | |
|  | .5-1.5 | See Note A | Check Valve, API602, piston type, horiz. and vert, SW, CL800, ASTM A105N, Trim No. 8, BC | APVC6DC208EV | CH |  |
| 413 | .5-1.5 | See Note A | Gate Valve, API 602, SWxNPT, CL800, ASTM A105N, Trim No. 8, BB, OS & Y | APVG4DC008EJ | GA1 |  |
|  | .5-1.5 | See Note A | Gate Valve, API 602, SW, CL800, ASTM A105N, Trim No. 8, BB, OS & Y | APVG4DC208ER | GA |  |
| 60 | .5-1.5 | See Note A | Gate Valve, API 602, Flanged, RF, CL300, ASTM A105N, Trim No. 8, BB, OS & Y | APVG4DC403FL | GAF |  |
| 59, 60 | .5-1.5 | See Note A | Gate Valve, API 602, Flanged, RF, CL600, ASTM A105N, Trim No. 8, BB, OS & Y | APVG4DC406FL | GA6 |  |
| 405 | .5-1.5 | See Note A | Globe Valve, API 602, straight seat, SW, CL800, ASTM A105N, Trim No. 8, BB, OS & Y | APVL5DC208EA | GL |  |
|  | .5-1.5 | See Note A | Globe Valve, API 602, straight seat, SWxNPT, CL800, ASTM A105N, Trim No. 8, BB, OS & Y | APVL5DC208ET | GL1 |  |
|  | 2-14 | See Note A | Check Valve, API 594, Type B, swing check - horiz. and vert. pos. Flanged, RF, CL300, ASTM A216 Gr WCB, Trim No. 8, BC, hinge pin inside | APVC4DD403EW | CH |  |
|  | 2-16 | See Note A | Check Valve, API 594, Dual Plate Check, Bolted, Wafer, RF, CL300, ASTM A216 Gr WCB, Trim No. 8, | APVC4DD603EF | CHW |  |
|  | 2-12 | See Note A | Gate Valve, API 600, flex. wedge, Flanged, RF, CL300, ASTM A216 Gr WCB, Trim No. 8, BB, OS & Y | APVG3DD403ES | GA |  |
| 59, 60 | 2-2 | See Note A | Gate Valve, API 600, flex. wedge, Flanged, RF, CL600, ASTM A216 Gr WCB, Trim No. 8, BB, OS & Y | APVG3DD406ES | GA6 |  |
| 405 | 2-5 | See Note A | Globe Valve, API 623, Flanged, RF, CL300, ASTM A216 Gr WCB, Trim No. 8, BB, OS & Y | APVL7DD403EL | GL |  |
| 405 | 6-12 | See Note A | Globe Valve, API 623, Flanged, RF, CL300, ASTM A216 Gr WCB, Trim No. 8, BB, OS & Y, Gear OP | APVL7DD403EM | GL |  |
|  | 14-14 | See Note A | Gate Valve, API 600, flex. wedge, Flanged, RF, CL300, ASTM A216 Gr WCB, Trim No. 8, BB, OS & Y, Gear OP | APVG3DD403ET | GA |  |
|  | 8-16 |  | Butterfly Valve, API 609, Wafer, RF, CL300, ASTM A216 Gr WCB, Disc SS, Seat PTFE, Gear OP |  | BU |  |

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| **Notes** | **NPS/DN**  **(in)** | **Sch** | **Description** | **Commodity Code** | **Short Code** | **Rev** |
| **FILTERS / STRAINERS** | | | | | | |
|  | .5-1.5 |  | Y Strainer, SW, CL800, ASTM A105N, Screen retainer: CS/Screen: SS316 - Fileing 0.8mm, Gasket spir SS and Graphite | APVY3DC208EA | STY |  |
| 10009 | 2-14 |  | Conical filter,G-DS-5-4-2,Wafer,CL300, all fluids except oxygen and water | APMN0QA703EA | CFR |  |
|  | 2-3 |  | Y Strainer, Flanged, RF, CL300, ASTM A216 Gr WCB, screen retainer: CS / Screen SS316 - Filtering 0.8mm, Gasket spir SS and Graphite | APVY3DD403EB | STY |  |
|  | 4-14 | See Note A | Tee Strainer, Body Type TA, Blind Fl. Type 2, CL300, ASTM A420 Gr. WPL6, Flange ASTM A350 Gr. LF2 Cl.1, Perfor. Plate SS304 or SS316, Wire mesh SS304 or SS316-Mesh size 2B/N | APVT0DJ103EQ | STT |  |
|  |  |  |  |  |  |  |
| **FABRICATED ITEMS** | | | | | | |
|  | 8-14  2-8 | See Note A | ASME Fabricated Item, weld with Reinf., B36.10 M, Seamless (E=1), ASTM A106 Gr B, Permissible Substitution | APSY1DF0H0EC | RPAD |  |
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**SPEC ITEM NOTES:**

53 For orifice flange tapping

1. To use only if necessary
2. For connection PN/class > rating pipe class
3. For connection to equipments

401 For insulated pressure testing vents (see G-DS-5-0-1)

402 For instrument connection (PI, TI, etc.)

403 For non-insulated pressure testing vents (see G-DS-5-0-1)

404 For vents

|  |  |
| --- | --- |
| 405 | For regulation only |
| 413 | For instrument connection : Pressure, flow transmitters, analysers, vents and orifice tappings |
| 10007 | To be used as option of B16.9 fitting (default) |
| 10009 | To be used as option. |

**LEGEND:**

2 - Reducing Tee

230 - Class 3000

2 - Reducing Tee

2XX - -

1 - Equal Tee

130 - Class 3000

1 - Equal Tee

1XX - -

0 - No Branch

**BRANCH CHART (Preference 1)**

3 - Stub-on

32 - Reinforcing Pad

5 - Sockolet

530 - Class 3000

5 - Sockolet

560 - Class 6000

4 – Weldolet

401 – STANDARD

Branch Diameter

Header Diameter

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | 0,5 | 0,75 | 1 | 1,25 | 1,5 | 2 | 2,5 | 3 | 3,5 | 4 | 5 | 6 | 8 | 10 | 12 | 14 | 16 |
| 0,5 | 130 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 0,75 | 230 | 130 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 1 | 230 | 230 | 130 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 1,25 | 230 | 230 | 230 | 130 |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 1,5 | 230 | 230 | 230 | 230 | 130 |  |  |  |  |  |  |  |  |  |  |  |  |
| 2 | 530 | 530 | 530 | 530 | 530 | 1XX |  |  |  |  |  |  |  |  |  |  |  |
| 2,5 | 530 | 530 | 530 | 530 | 530 | 2XX | 1XX |  |  |  |  |  |  |  |  |  |  |
| 3 | 530 | 530 | 530 | 530 | 530 | 2XX | 2XX | 1XX |  |  |  |  |  |  |  |  |  |
| 3,5 | 530 | 530 | 530 | 530 | 530 | 32 | 2XX | 2XX | 1XX |  |  |  |  |  |  |  |  |
| 4 | 530 | 530 | 530 | 530 | 530 | 32 | 32 | 2XX | 2XX | 1XX |  |  |  |  |  |  |  |
| 5 | 530 | 530 | 530 | 530 | 530 | 32 | 32 | 32 | 2XX | 2XX | 1XX |  |  |  |  |  |  |
| 6 | 530 | 530 | 530 | 530 | 530 | 32 | 32 | 32 | 32 | 2XX | 2XX | 1XX |  |  |  |  |  |
| 8 | 530 | 530 | 530 | 530 | 530 | 32 | 32 | 32 | 32 | 32 | 2XX | 2XX | 1XX |  |  |  |  |
| 10 | 530 | 530 | 530 | 530 | 530 | 32 | 32 | 32 | 32 | 32 | 32 | 2XX | 2XX | 1XX |  |  |  |
| 12 | 530 | 530 | 530 | 530 | 530 | 32 | 32 | 32 | 32 | 32 | 32 | 32 | 2XX | 2XX | 1XX |  |  |
| 14 | 530 | 530 | 530 | 530 | 530 | 32 | 32 | 32 | 32 | 32 | 32 | 32 | 2XX | 2XX | 2XX | 1XX |  |
| 16 | 530 | 530 | 530 | 530 | 530 | 32 | 32 | 32/401 | 32 | 32 | 32 | 32 | 32 | 32 | 2XX | 2XX | 1XX |

SEP. 19. 2024 REVISION 14”x 8” : 32-WELDED CONNECTION 🡪2XX-REDUCING TEE

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Rev. | Date | Prepared by | Checked By | Approved By | Description |
| 0 | 22/04/2024 | SC | CYJ | XWJ | Approved for Design |

Disclamer:

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|  |  |
| --- | --- |
| **DESIGN CODE:** | B31.3 Latest Edition / Addenda – Normal Fluid Service |
| **RATING CLASS:** | 300 |
| **MATERIAL:** | SS 304 / 304 L Dual Certified |
| **SERVICE:** | General |
| **FLANGE FACING:** | Raised Face |
| **NOMINAL CORROSION ALLOWANCE:** | 0 in (0 mm) |
| **MATERIAL GROUP:** | B16.5-2013, 2.1 |
| **FLUID CODE:** | AG / AL / BOG / BOL / DK / KAC / KAD / KAG / KAL / KHN / KXP / KXR / KXS / KXT / NG / NL / NLO / NW / OG / OL / ON / ONV / ORG / OW |
| **CALCULATION NO:** | - |

**DESIGN PRESSURE-TEMPERATURE RATING:**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **From NPS 0.5 to 24in** | | | | | | |
| **Temp. DegC** | -196 | -29 | 38 | 50 | 100 |  |
| **Pressure BarG** | 35 | 35 | 35 | 35 | 35 |
| **Temp. DegF** | -321 | -20 | 100 | / | 212 |
| **Pressure Psig** | 507 | 507 | 507 | / | 507 |

**PIPE WALL THICKNESS:**

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NPS** | **.5** | **.75** | **1** | **1.25** | **1.5** | **2** | **2.5** | **3** | **3.5** | **4** | **5** |
| **DN** | 15 | 20 | 25 | 32 | 40 | 50 | 65 | 80 | 90 | 100 | 125 |
| **SCH** | S-10S | S-10S | S-10S | S-10S | S-10S | S-10S | S-10S | S-10S | S-10S | S-10S | S-10S |
| **THK (in)** | 0.083 | 0.083 | 0.109 | 0.109 | 0.109 | 0.109 | 0.12 | 0.12 | 0.12 | 0.12 | 0.134 |
| **THK (mm)** | 2.11 | 2.11 | 2.77 | 2.77 | 2.77 | 2.77 | 3.05 | 3.05 | 3.05 | 3.05 | 3.4 |
| **OD (mm)** | 21.3 | 26.7 | 33.4 | 42.2 | 48.3 | 60.3 | 73 | 88.9 | 101.6 | 114.3 | 141.3 |
| **NPS** | **6** | **8** | **10** | **12** | **14** | **16** | **18** | **20** | **24** |  | |
| **DN** | 150 | 200 | 250 | 300 | 350 | 400 | 450 | 500 | 600 |
| **SCH** | S-10S | S-20 | S-20 | S-20 | S-20 | S-20 | S-STD | S-STD | S-XS |
| **THK (in)** | 0.134 | 0.25 | 0.25 | 0.25 | .312 | 0.312 | 0.375 | 0.375 | 0.5 |
| **THK (mm)** | 3.4 | 6.35 | 6.35 | 6.35 | 7.92 | 7.92 | 9.53 | 9.53 | 12.7 |
| **OD (mm)** | 168.3 | 219.1 | 273 | 323.8 | 355.6 | 406.4 | 457 | 508 | 610 |

**GENERAL NOTES:**

1. All buttwelded components wall thickness shall match PIPE WALLTHICKNESS.
2. Non-standard pipe sizes NPS 1.25", 2.5", 3.5", 5" etc. shall not be used except for connection to the equipment or in special circumstances.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Notes** | **NPS/DN**  **(in)** | **Sch** | **Description** | **Commodity Code** | **Short Code** | **Rev** |
| **NIPPLES** | | | | | | |
| 53 | .5-1.5 | S-80S | Nipple, B36.19 M, L=100mm, Plain - NPT, Seamless, ASTM A312 Gr TP304/TP304L, Dual Certified | APPN2QP5H0EA | NPTG1 |  |
| 53 | .5-1.5 | S-80S | Nipple, B36.19 M, L=180mm, Plain - NPT, Seamless, ASTM A312 Gr TP304/TP304L, Dual Certified | APPN2QP5H0EB | NPTG3 |  |
| 53 | .5-1.5 | S-80S | Nipple, B36.19 M, L=100mm, NPT - NPT, Seamless, ASTM A312 Gr TP304/TP304L, Dual Certified | APPN2QP6H0EA | NTTG1 |  |
| 53 | .5-1.5 | S-80S | Nipple, B36.19 M, L=180mm, NPT - NPT, Seamless, ASTM A312 Gr TP304/TP304L, Dual Certified | APPN2QP6H0EB | NTTG3 |  |
| **PIPE** | | | | | | |
|  | .5-4 | S-10S | Pipe, B36.19 M / B36.10 M, Plain end, Seamless, ASTM A312 Gr TP304/TP304L Dual Certified | APPP2QP2H0EE | P |  |
|  | 5-6 | S-10S | Pipe, B36.19 M / B36.10 M, Beveled end, EFW(E=1), ASTM A358 Gr TP304/TP304L Cl 1, Dual Certified | APPP7RY2G0EE | P |  |
|  | 8-16 | S-20 | Pipe, B36.19 M / B36.10 M, Beveled end, EFW(E=1), ASTM A358 Gr TP304/TP304L Cl 1, Dual Certified | APPP7RY2G0EE | P |  |
|  |  |  |  |  |  |  |
| **FORGED FITTINGS** | | | | | | |
|  | .5-1.5 |  | Plug, B16.11, Threaded NPT,CL3000, ASTM A182 Gr F304/304L, Dual Certified | APKP1QC230EM | PL |  |
|  |  |  |  |  |  |  |
| **WELDED FITTINGS** | | | | | | |
|  | .5-16 | See Note A | 90Deg LR Elbow, B16.9, BW, ASTM A403 Gr WP304/304L, Dual Certified -S/WX | APWA1SG1XXEU | 9E |  |
|  | .5-16 | See Note A | 45Deg LR Elbow, B16.9, BW, ASTM A403 Gr WP304/304L, Dual Certified -S/WX | APWB1SG1XXEU | 4E |  |
|  | .5-16 | See Note A | Equal Tee, B16.9, BW, ASTM A403 Gr WP304/304L, Dual Certified -S/WX | APWD1SG1XXEU | T |  |
|  | .5-16 | See Note A | Cap, B16.9, BW, ASTM A403 Gr WP304/304L, Dual Certified -S/WX | APWF1SG1XXEU | C |  |
|  | .75-16  .5-14 | See Note A | Reducing Tee, B16.9, BW, ASTM A403 Gr WP304/304L, Dual Certified -S/WX | APWE1SG1XXEU | RT |  |
|  | .75-16  .5-14 | See Note A | Concentric Reducer, B16.9, BW, ASTM A403 Gr WP304/304L, Dual Certified -S/WX | APWG1SG1XXEU | CR |  |
|  | .75-16  .5-14 | See Note A | Eccentric Reducer, B16.9, BW, ASTM A403 Gr WP304/304L, Dual Certified -S/WX | APWH1SG1XXEU | ER |  |
|  | .5-16 | See Note A | 90Deg SR Elbow, B16.9, BW, ASTM A403 Gr WP304/304L, Dual Certified -S/WX | APWC1SG1XXEU | 9ES |  |

|  |  |  |  |  |  |  |
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| **FLANGES** | | | | | | |
|  | .5-16 |  | Flange, Blind, B16.5, RF, CL 300, ASTM A182 Gr F304/304L, Dual Certified | APFA2QC103EZ | BF |  |
|  | .5-16 | See Note A | Flange, Welding Neck, B16.5, RF, CL 300, ASTM A182 Gr F304/304L, Dual Certified | APFL2QC103EZ | WN |  |
| 59 | .5-16 | See Note A | Flange, Welding Neck, B16.5, RF, CL 600, ASTM A182 Gr F304/304L, Dual Certified,,, | APFL2QC106EZ | WN6 |  |
|  | .5-10 |  | Flange, Spectacle Figure 8, B16.48, RF, CL 300, ASTM A240 Type 304/304L, Dual Certified | APFM6RL103EZ | F8 |  |
|  | 12-16 |  | Paddle, Blank, B16.48, RF, CL 300, ASTM A240 Type 304/304 L Dual Certified | APFN6RL103EZ | PB |  |
|  | 12-16 |  | Paddle, Spacer, B16.48, RF, CL 300, ASTM A240 Type 304/304L, Dual Certified | APFP6RL103EZ | PS |  |
| **ORIFICE FLANGE** | | | | | | |
|  | 1-16 | See Note A | Orif Flg, WN 0.5NPT+jack scr, B16.36, RF, CL 300, ASTM A182 Gr F304/304L, Dual Certified | APOA1QC103EF | OF |  |
| **GASKETS** | | | | | | |
|  | .5-10 |  | Gasket, Flat Ring, 1.5 mm Thk, Approved for ox serv., CL 300, Expanded graphite 98% with metallic reinforcement | APGF2GN003ES | G |  |
| 59 | .5-16 |  | Gasket, Spiral Wound, 4.5 mm Thk, Approved ox serv., CL 600, Filler graphite 98%, spiral 316SS, IR 316SS, OR 316SS | APGS1GC006EV | G6 |  |
|  | 12-16 |  | Gasket, Spiral Wound, 4.5 mm Thk, Approved ox serv., CL 300, Filler graphite 98%, spiral 316SS, IR 316SS, OR 316SS | APGF2GN003ET | G |  |
| **BOLTING** | | | | | | |
|  | .5-16 |  | Stud Bolt w/2-Heavy Hex Nuts, ASME SA320 Gr B8 Cl 2 / ASME SA194 Gr 8 | APBA1SC000EA | BT |  |
|  | .5-16 |  | Stud Bolt w/2-Heavy Hex Nuts, ASME SA320 Gr B8 Cl 2 / ASME SA194 Gr 8 | APBA1SC000EA | BT6 |  |
|  | .5-2 |  | Flat Washer, NF.EN.7091, Stainless Steel 17.7PH | APBB3SD000EF | BTFW |  |
|  | .5-2 |  | Spring Washer, Stainless Steel 17.7 PH | APBH0SD000EF | BTSW |  |
| **VALVES** | | | | | | |
|  | .5-2 | See Note A | Check Valve, Service range -196°C to 100° C, Piston check, Welded, BW, CL300, FB, ASTM A351 Gr CF8, Disc SS-PTFE insert, Spg SS, PTFE, Non metal. Int. parts agreed for oxygen, Cleaned & degreased for oxygen service, | APVC1QM103FP | CH |  |
| 211 | .5-6 | See Note A | Globe Valve, Service range -196°C to 100°C, Welded, BW, CL300, FB, ASTM A351 Gr CF8, Disc SS-PTFE insert, PTFE packing & Live loaded, PTFE, Cryo ext. BB, acc. manufac. Std, inside screw, HW, Non metal. Int. parts agreed for oxygen, Cleaned & degreased for oxygen service | APVL1QM103GV | GL |  |
|  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| 202 | .5-.5 | See Note A | Globe Valve, Service range -196°C to 100°C, Thrd, Female NPT, CL300, FB, ASTM A351 Gr CF8, Disc SS-PTFE insert, PTFE packing & Live loaded, PTFE, BB, inside screw, HW, Non metal. Int. parts agreed for oxygen, Cleaned & degreased for oxygen service | APVL1QM303GY | GLT |  |
| 404 | .5-.5 | See Note A | Globe Valve, API 602, BWxNPT, CL800, ASTM A182 Gr F304/304L, Trim No. 12, PTFE, PTFE,ext. BB, OS & Y, HW, Cleaned & degreased for oxygen service | APVL5QY008FZ | GL1 |  |
|  | 3-16 | See Note A | Check Valve, API 594,, Service range -196°C to 100°C, Dual Plate Check, Bolted, Wafer RF, CL300, ASTM A351 Gr CF8M, Plates SS, Spg inconel, Cleaned & degreased for oxygen service,, | APVC4QN603FQ | CHW |  |
| **FILTERS / STRAINERS** | | | | | | |
| 319 | 2-16 |  | Conical Filter, acc. G-DS-S-4-2, Wafer, CL300, all fluid except oxygen & water | APMN0QA703EA | CFR2 |  |
| 224 | 2-16 |  | Conical Filter, acc. G-DS-S-4-2 (replaces CRY-DS-5-4-4), Wafer, CL300, all fluid except oxygen & water | APMN0QA703EF | CFR |  |
| **FABRICATED ITEMS** | | | | | | |
|  | .5-1.5 |  | Pipe bend, R=5xOD, Plain end, Seamless (E=1), ASTM A312 Gr TP304/TP304L, Dual Certified | APSR2QP2H0ED | 9B5D |  |
|  |  |  |  |  |  |  |
| 10007 | 6-16  2-14 | See Note A | Fabricated Concentric reducer, Beveled end, Electric fusion straight weld pipe (E=1), ASTM A240 Type 304/304L, Dual Certified | APSP0QD1G0EB | FCR |  |
| 10007 | 6-16  2-14 | See Note A | Fabricated Eccentric reducer, Beveled end, Electric fusion straight weld pipe (E=1), ASTM A240 Type 304/304L, Dual Certified | APSQ0QD1G0EB | FER |  |

**SPEC ITEM NOTES:**

‘59 For connection PN/class > rating pipe class

‘202 For instrument connection : pressure/flow transmitters and analysers

‘210 Valve inside cold box

‘211 Valve outside cold box

212 Valve top entry inside cold box

224 Liquid with Enriched Oxygen only

319 All fluids except Oxygen & Water

404 For vents

10007 To be used as option of ASME B16.9 fitting (default)

**LEGEND:**

3 - Stub-on

31 - Welded Connection

2 - Reducing Tee

2XX - -

1 - Equal Tee

1XX - -

0 - No Branch

**BRANCH CHART (Preference 1)**

3 - Stub-on

32 - Reinforcing Pad

Branch Diameter

Header Diameter

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | 0,5 | 0,75 | 1 | 1,25 | 1,5 | 2 | 2,5 | 3 | 3,5 | 4 | 5 | 6 | 8 | 10 | 12 | 14 | 16 |
| 0,5 | 1XX |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 0,75 | 2XX | 1XX |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 1 | 2XX | 2XX | 1XX |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 1,25 | 2XX | 2XX | 2XX | 1XX |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 1,5 | 2XX | 2XX | 2XX | 2XX | 1XX |  |  |  |  |  |  |  |  |  |  |  |  |
| 2 | 31 | 2XX | 2XX | 2XX | 2XX | 1XX |  |  |  |  |  |  |  |  |  |  |  |
| 2,5 | 31 | 31 | 2XX | 2XX | 2XX | 2XX | 1XX |  |  |  |  |  |  |  |  |  |  |
| 3 | 31 | 31 | 31 | 2XX | 2XX | 2XX | 2XX | 1XX |  |  |  |  |  |  |  |  |  |
| 3,5 | 31 | 31 | 31 | 31 | 2XX | 2XX | 2XX | 2XX | 1XX |  |  |  |  |  |  |  |  |
| 4 | 32 | 32 | 32 | 32 | 32 | 2XX | 2XX | 2XX | 2XX | 1XX |  |  |  |  |  |  |  |
| 5 | 31 | 31 | 31 | 31 | 31 | 31 | 31 | 31 | 31 | 2XX | 1XX |  |  |  |  |  |  |
| 6 | 31 | 31 | 31 | 31 | 31 | 31 | 31 | 31 | 31 | 31 | 2XX | 1XX |  |  |  |  |  |
| 8 | 31 | 32 | 31 | 32 | 32 | 32 | 32 | 32 | 32 | 32 | 31 | 2XX | 1XX |  |  |  |  |
| 10 | 32 | 32 | 32 | 32 | 32 | 32 | 32 | 32 | 32 | 32 | 32 | 32 | 2XX | 1XX |  |  |  |
| 12 | 32 | 32 | 32 | 32 | 32 | 32 | 32 | 32 | 32 | 32 | 32 | 32 | 32 | 2XX | 1XX |  |  |
| 14 | 32 | 32 | 32 | 32 | 32 | 32 | 32 | 32 | 32 | 32 | 32 | 32 | 32 | 32 | 2XX | 1XX |  |
| 16 | 32 | 32 | 32 | 32 | 32 | 32 | 32 | 32 | 32 | 32 | 32 | 32 | 32 | 32 | 32 | 2XX | 1XX |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Rev. | Date | Prepared by | Checked By | Approved By | Description |
| 0 | 19/08/2022 | YJ Chen | C Shen |  | First issue |

Disclamer:

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|  |  |
| --- | --- |
| **DESIGN CODE:** | B31.3 - 2016 |
| **RATING CLASS:** | 600 |
| **MATERIAL:** | Carbon Steel High Temperature |
| **SERVICE:** | General |
| **FLANGE FACING:** | Raised Face |
| **NOMINAL CORROSION ALLOWANCE:** | 0.0625 in (1.6 mm) |
| **MATERIAL GROUP:** | B16.5-2017, 1.1 |
| **TRIM:** | Trim 8 |
| **FLUID CODE:** | AG / AH / BEL / KA / KAC / KAG / KH / KHN / KK / KKG / KN / KX / KXG / KXP / KXR /  MEI / RF / XGD / ZB / ZH / ZH |
| **CALCULATION NO:** | AL CORP\_541\_16\_WT\_S\_W\_PO |

**DESIGN PRESSURE-TEMPERATURE RATING:**

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **From NPS 0.5 to 24in** | | | | | | | | | | | |
| **Temp. DegC** | -29 | -29 | 38 | 38 | 50 | 50 | 100 | 100 | 150 | 200 |  |
| **Temp. DegC** | 102.1 | 10.0 | 10.0 | 102.1 | 10.0 | 100.2 | 93.2 | 10.0 | 90.2 | 87.6 |
| **Pressure BarG** | -20 | -20 | 100 | 100 | 122 | 122 | 212 | 212 | 302 | 392 |
| **Pressure BarG** | 1480 | 145 | 145 | 1480 | 145 | 1453 | 1351 | 145 | 1308 | 1270 |
| **Temp. DegF** | 250 | 300 | 325 | 350 | 375 | 400 | 425 |  | | | |
| **Temp. DegF** | 83.9 | 79.6 | 77.4 | 75.1 | 72.7 | 69.4 | 57.5 |
| **Pressure Psig** | 482 | 572 | 617 | 662 | 707 | 752 | 797 |
| **Pressure Psig** | 1216 | 1154 | 1122 | 1089 | 1054 | 1006 | 833 |
| **Temp. DegC** |  | | | | | | | | | | |
| **Temp. DegC** |
| **Pressure BarG** |
| **Pressure BarG** |
| **Temp. DegF** |
| **Temp. DegF** |
| **Pressure Psig** |
| **Pressure Psig** |
| **Full Vacuum NPS 0.5 to 24in** | | | | | | | | | | | |
| **Temp. DegC** | 425 |  | | | | | | | | | |
| **Temp. DegC** | 1 |
| **Pressure BarG** | 797 |
| **Pressure BarG** | 14.5 |
| **Temp. DegF** |  | | | | | | | | | | |
| **Temp. DegF** |
| **Pressure Psig** |
| **Pressure Psig** |
| **Temp. DegC** |
| **Temp. DegC** |
| **Pressure BarG** |
| **Pressure BarG** |
| **Temp. DegF** |
| **Temp. DegF** |
| **Pressure Psig** |
| **Pressure Psig** |

**PIPE WALL THICKNESS:**

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NPS** | **.5** | **.75** | **1** | **1.25** | **1.5** | **2** | **2.5** | **3** | **3.5** | **4** | **5** |
| **DN** | 15 | 20 | 25 | 32 | 40 | 50 | 65 | 80 | 90 | 100 | 125 |
| **SCH** | S-XS | S-XS | S-XS | S-XS | S-XS | S-XS | S-XS | S-XS | S-XS | S-XS | S-XS |
| **THK (in)** | 0.147 | 0.154 | 0.179 | 0.191 | 0.2 | 0.218 | 0.276 | 0.3 | 0.318 | 0.337 | 0.375 |
| **THK (mm)** | 3.73 | 3.91 | 4.55 | 4.85 | 5.08 | 5.54 | 7.01 | 7.62 | 8.08 | 8.56 | 9.53 |
| **OD (mm)** | 21.3 | 26.7 | 33.4 | 42.2 | 48.3 | 60.3 | 73 | 88.9 | 101.6 | 114.3 | 141.3 |

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NPS** | **6** | **8** | **10** | **12** | **14** | **16** | **18** | **20** | **24** |
| **DN** | 150 | 200 | 250 | 300 | 350 | 400 | 450 | 500 | 600 |
| **SCH** | S-XS | S-XS | S-80 | S-80 | S-80 | S-80 | S-80 | S-80 | S-80 |
| **THK (in)** | 0.432 | 0.5 | 0.594 | 0.688 | 0.75 | 0.844 | 0.938 | 1.031 | 1.219 |
| **THK (mm)** | 10.97 | 12.7 | 15.09 | 17.48 | 19.05 | 21.44 | 23.83 | 26.19 | 30.96 |
| **OD (mm)** | 168.3 | 219.1 | 273 | 323.8 | 355.6 | 406.4 | 457 | 508 | 610 |

**GENERAL NOTES:**

1. All buttwelded components wall thickness shall match PIPE WALLTHICKNESS.
2. Non-standard pipe sizes NPS 1.25", 2.5", 3.5", 5" etc. shall not be used except for connection to the equipment or in special circumstances.

BX Piping Class Specification has been calculated to withstand Full Vacuum, max. buckling length 6m [19.68 ft].

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Notes** | **NPS/DN**  **(in)** | **Sch** | **Description** | **Commodity Code** | **Short Code** | **Rev** |
| **NIPPLES** | | | | | | |
| 53 | .5-1.5 | S-160 | Nipple, B36.10 M,(100mm), Plain - NPT, Seamless, ASTM A106 Gr B | APPN1DF5H0EA | NPTG1 |  |
| 53 | .5-1.5 | S-160 | Nipple, B36.10 M,(180mm), Plain - NPT, Seamless, ASTM A106 Gr B | APPN1DF5H0EB | NPTG3 |  |
| 53 | .5-1.5 | S-160 | Nipple, B36.10 M,(100mm), NPT - NPT, Seamless, ASTM A106 Gr B | APPN1DF6H0EA | NTTG1 |  |
| 53 | .5-1.5 | S-160 | Nipple, B36.10 M,(180mm), NPT - NPT, Seamless, ASTM A106 Gr B | APPN1DF6H0EB | NTTG3 |  |
| **PIPE** | | | | | | |
|  | .5-1.5 | S-XS | Pipe, B36.10 M, Plain end, Seamless, ASTM A106 Gr B | APPP1DF2H0EE | P |  |
|  | 2-6 | S-XS | Pipe, B36.10 M, Beveled end, Seamless, ASTM A106 Gr B | APPP1DF1H0EE | P |  |
|  | 8-8 | S-XS | Pipe, B36.10 M, Beveled end, Seamless, ASTM A106 Gr B, Permissible Substitution | APPP1DF1H0EG | P |  |
|  | 10-12 | S-80 | Pipe, B36.10 M, Beveled end, Seamless, ASTM A333 Gr 6, Permissible Substitution | APPP1FC1H0EH | P |  |
| **FORGED FITTINGS** | | | | | | |
| 58 | .5-1.5 |  | 90Deg. Elbow, B16.11, SW, CL 3000, ASTM A105N | APKA1DD130EA | 9E |  |
|  | .5-1.5 |  | Equal Tee, B16.11, SW, CL 3000, ASTM A105N | APKB1DD130EA | T |  |
| 58 | .5-1.5 |  | 45Deg. Elbow, B16.11, SW, CL 3000, ASTM A105N | APKC1DD130EA | 4E |  |
|  | .5-1.5 |  | Cap, B16.11, SW, CL3000, ASTM A105N | APKF1DD130EA | C |  |
| 401 | .75-.75 |  | Cap, B16.11, Threaded NPT, CL 3000, ASTM A105N | APKF1DD230EA | CT |  |
| 404 | .75-1 |  | ASME, Plug, B16.11, Threaded NPT, CL3000, ASTM A105N | APKP1DD230EA | PL |  |
|  | .5-1.5 |  | Full Coupling, B16.11, SW, CL 3000, ASTM A105N |  | FCL |  |
|  | .75-1.5  .5-1.25 |  | Reduced Tee, B16.11, SW, CL 3000, ASTM A105N | APKQ1DD130EA | RT |  |
|  | 2-8  .5-1.5 |  | Sockolet, MSS SP-97, SW, B16.11, CL 3000, ASTM A105N | APKM7DD130EB | SOL |  |
| 403 | 2-8  .75-.75 |  | Threadolet, MSS SP-97, Threaded NPT, B16.11, CL 3000, ASTM A105N | APKN7DD230EB | TOL |  |
|  | 10-12  .5-1.5 |  | Sockolet, MSS SP-97, SW,B16.11, CL 6000, ASTM A105N, | APKM7DD160EB | SOL6 |  |
| 403 | 10-12  .75-.75 |  | Threadolet, MSS SP-97,Threaded NPT,B16.11,CL 6000, ASTM A105N | APKN7DD260EB | TOL6 |  |
| **WELDED FITTINGS** | | | | | | |
|  | .75-1.5  .5-1.25 | See Note A | BW, Swage Nipple Conc, MSS SP-95, Beveled End, ASTM A234 Gr WPB | APWT5DH1XXEA | CBB |  |
|  | .75-1.5  .5-1.25 | See Note A | Swage Nipple Ecc, MSS SP-95, Beveled End,  ASTM A234 Gr WPB | APWU5DH1XXEA | EBB |  |
|  | 2-12 | See Note A | 90Deg LR Elbow, B16.9, BW, ASTM A234 Gr WPB | APWA1DH7XXEA | 9E |  |
|  | 2-12 | See Note A | 45Deg LR Elbow, B16.9, BW , ASTM A234 Gr WPB | APWB1DH7XXEA | 4E |  |
|  | 2-12 | See Note A | Equal Tee, B16.9, BW, ASTM A 234 Gr WPB | APWD1DH7XXEA | T |  |
|  | 2-12 | See Note A | Cap, B16.9, BW, ASTM A234 Gr WPB | APWF1DH7XXEA | C |  |
|  | 2-12  1.25-10 | See Note A | Concentric Reducer, B16.9, BW, ASTM A234 Gr WPB | APWG1DH7XXEA | CR |  |
|  | 2-12  1.25-10 | See Note A | Eccentric Reducer, B16.9, BW, ASTM A234 Gr WPB | APWH1DH7XXEA | ER |  |

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Notes** | **NPS/DN**  **(in)** | **Sch** | **Description** | **Commodity Code** | **Short Code** | **Rev** |
| **WELDED FITTINGS** | | | | | | |
|  | 2.5-12  2-10 | See Note A | Reducing Tee, B16.9, BW, ASTM A234 Gr WPB | APWE1DH7XXEA | RT |  |
|  | 3.5-8  2-4 | See Note A | BW, Weldolet, MSS SP-97, BW, B16.25, XS, ASTM A105N | APWJ3DC102EB | WOL |  |
|  | 10-12  2-6 | See Note A | BW, Weldolet, MSS SP-97, BW, B16.25, SCH 160, ASTM A105N | APWJ3DC103EB | WOL |  |
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| **FLANGES** | | | | | | |
|  | .5-8 |  | Flange, Blind, B16.5, RF,CL 600, ASTM A105N | APFA2DD106EA | BF |  |
| 53 | .5-.5 |  | Flange, Threaded, B16.5, RF, CL 600, ASTM A105N | APFK2DD106EA | TF |  |
|  | .5-8 |  | Flange, Spectacle Figure 8, B16.48, RF,CL 600, ASTM A516 Gr 70N | APFM6DG106EA | F8 |  |
|  | .5-1.5 |  | Flange, SW, B16.5 ,RF,CL 600, ASTM A105N | APFS2DD106EA | SF |  |
| 402 | .75-2  .5-.5 |  | Flange, Blind with Thd Bore, B16.5, 1/2" NPT, RF, CL 600, ASTM A105N | APFG2DD106EB | BFI |  |
|  | 2-8 | See Note A | Flange, WN, B16.5, RF,CL 600,ASTM A105N | APFL2DD106EA | WN |  |
|  | 10-12 |  | Flange, Blind, B16.5, RF,CL 600, ASTM A350 Gr LF2 Cl 1 | APFA2FD106EN | BF |  |
|  | 10-12 | See Note A | Flange, WN, B16.5, RF,CL 600, ASTM A350 Gr LF2 Cl 1 | APFL2FD106EN | WN |  |
|  | 10-12 |  | Paddle, Blank, B16.48, RF, CL 600, ASTM A516 Gr 70N | APFN6DG106EA | PB |  |
|  | 10-12 |  | Paddle, Spacer, B16.48, RF, CL 600, ASTM A516 Gr 70N | APFP6DG106EA | PS |  |
| **ORIFICE FLANGE** | | | | | | |
|  | 1-12 | See Note A | Orif Flg, WN 0.5 NPT+jack scr. B16.36, RF, CL 600, ASTM A105N | APOA1DD106EA | OF |  |
| **GASKETS** | | | | | | |
|  | .5-12 |  | Gasket, Spiral Wound, 4.5 mm Thk, CL 600, Filler graphite 98%, spiral 316SS, IR 316SS, OR CS | APGS1GB006EB | G |  |
| **BOLTING** | | | | | | |
|  | .5-12 |  | Bolting, Stud Bolt w/2-Heavy Hex Nuts, SA193 Gr B7 / SA194 Gr 2H | APBA1CB000EA | BT |  |

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| **Notes** | **NPS/DN**  **(in)** | **Sch** | **Description** | **Commodity Code** | **Short Code** | **Rev** |
| **VALVES** | | | | | | |
|  | .5-1.5 | See Note A | Check Valve, API602, piston type, horiz. and vert, SW, CL800, ASTM A105N, Trim No. 8, BC | APVC6DC208EV | CH |  |
| 413 | .5-1.5 | See Note A | Gate Valve, API 602, SWxNPT , CL800, ASTM A105N, Trim No. 8, BB, OS & Y | APVG4DC008EJ | GA1 |  |
|  | .5-1.5 | See Note A | Gate Valve, API 602, SW, CL800, ASTM A105N, Trim No. 8, BB, OS & Y | APVG4DC208ER | GA |  |
| 60 | .5-1.5 | See Note A | Gate Valve, API 602, Flanged, RF, CL600, ASTM A105N, Trim No. 8, BB, OS & Y | APVG4DC406FL | GAF |  |
| 405 | .5-1.5 | See Note A | Globe Valve, API 602, straight seat, SW, CL800, ASTM A105N, - Trim No. 8, BB, OS & Y | APVL5DC208EA | GL |  |
|  | 2-12 | See Note A | Check Valve, API 594, Type B, swing check - horiz. and vert. pos. Flanged, RF, CL600, ASTM A216 Gr WCB, Trim No. 8, BC, hinge pin inside | APVC4DD406EW | CH |  |
|  | 2-6 | See Note A | Gate Valve, API 600, flex. wedge, Flanged, RF, CL600, ASTM A216 Gr WCB, Trim No. 8, BB, OS & Y | APVG3DD406ES | GA |  |
| 405 | 2-4 | See Note A | Globe Valve, API 623, Flanged, RF, CL600, ASTM A216 Gr WCB, Trim No. 8, BB, OS & Y | APVL7DD406EL | GL |  |
| 405 | 6-12 | See Note A | Globe Valve, API 623, Flanged, RF, CL600, ASTM A216 Gr WCB, Trim No. 8, BB, OS & Y, Gear OP | APVL7DD406EM | GL |  |
|  | 8-12 | See Note A | Gate Valve, API 600, flex. wedge, Flanged, RF, CL600, ASTM A216 Gr WCB, Trim No. 8, BB, OS & Y, Gear OP | APVG3DD406ET | GA |  |
| **FILTERS / STRAINERS** | | | | | | |
|  | .5-1.5 |  | Y Strainer, SW, CL800, ASTM A105N, screen retainer: CS/Screen: SS316 – Filtering 0.8mm, Gasket spir SS and Graphite | APVY3DC208EA | STY |  |
|  | 2-3 |  | Y Strainer, Flanged, RF, CL600, ASTM A216 Gr WCB, screen retainer: CS / Screen SS316 – Filtering 0.8mm, Gasket spir SS and Graphite | APVY3DD406EN | STY |  |
|  | 4-12 | See Note A | Tee Strainer, Body Type TA, Blind Fl. TYPE 1,Welded,for Tee BW, CL600, ASTM A234 Gr WPB, Flanges: ASTM A105N Strainer element: Perfor. plate: CS / Wire Mesh: SS316 - mesh size 1 B/N: SA193 Gr. B7/SA194 Gr. 2H, Gasket: CRNI spiral graphite, welding coefficient E=1.0 | APVT0DJ106EW | STT |  |

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| **Notes** | **NPS/DN**  **(in)** | **Sch** | **Description** | **Commodity Code** | **Short Code** | **Rev** |
| **FABRICATED ITEMS** | | | | | | |
|  | .5-1.5 | S-XS | Pipe bend, R=5xOD, Plain end, Seamless (E=1), ASTM A106 Gr B | APSR1DF2H0EA | 9B5D |  |

**SPEC ITEM NOTES:**

53 For orifice flange tapping

58 To use only if necessary

60 For connection to equipments

1. For insulated pressure testing vents (see G-DS-5-0-1)
2. For instrument connection (PI, TI, etc.)
3. For non-insulated pressure testing vents (see G-DS-5-0-1)
4. For vents
5. For regulation only

413 For instrument connection : Pressure, flow transmitters, analysers, vents and orifice tappings

**LEGEND:**

2 - Reducing Tee

230 - Class 3000

2 - Reducing Tee

2XX - -

1 - Equal Tee

130 - Class 3000

1 - Equal Tee

1XX - -

0 - No Branch

**BRANCH CHART (Preference 1)**

4 - Weldolet

402 - EXTRA STRONG

class

4 - Weldolet

403 - 160 SCHEDULE

class

5 - Sockolet

530 - Class 3000

5 - Sockolet

560 - Class 6000

Branch Diameter

Header Diameter

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | 0,5 | 0,75 | 1 | 1,25 | 1,5 | 2 | 2,5 | 3 | 3,5 | 4 | 5 | 6 | 8 | 10 | 12 |
| 0,5 | 130 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 0,75 | 230 | 130 |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 1 | 230 | 230 | 130 |  |  |  |  |  |  |  |  |  |  |  |  |
| 1,25 | 230 | 230 | 230 | 130 |  |  |  |  |  |  |  |  |  |  |  |
| 1,5 | 230 | 230 | 230 | 230 | 130 |  |  |  |  |  |  |  |  |  |  |
| 2 | 530 | 530 | 530 | 530 | 530 | 1XX |  |  |  |  |  |  |  |  |  |
| 2,5 | 530 | 530 | 530 | 530 | 530 | 2XX | 1XX |  |  |  |  |  |  |  |  |
| 3 | 530 | 530 | 530 | 530 | 530 | 2XX | 2XX | 1XX |  |  |  |  |  |  |  |
| 3,5 | 530 | 530 | 530 | 530 | 530 | 402 | 2XX | 2XX | 1XX |  |  |  |  |  |  |
| 4 | 530 | 530 | 530 | 530 | 530 | 402 | 402 | 2XX | 2XX | 1XX |  |  |  |  |  |
| 5 | 530 | 530 | 530 | 530 | 530 | 402 | 402 | 402 | 2XX | 2XX | 1XX |  |  |  |  |
| 6 | 530 | 530 | 530 | 530 | 530 | 402 | 402 | 402 | 402 | 2XX | 2XX | 1XX |  |  |  |
| 8 | 530 | 530 | 530 | 530 | 530 | 402 | 402 | 402 | 402 | 402 | 2XX | 2XX | 1XX |  |  |
| 10 | 560 | 560 | 560 | 560 | 560 | 403 | 403 | 403 | 403 | 403 | 403 | 2XX | 2XX | 1XX |  |
| 12 | 560 | 560 | 560 | 560 | 560 | 403 | 403 | 403 | 403 | 403 | 403 | 403 | 2XX | 2XX | 1XX |