



MIDWEST VANADIUM PTY LTD

WINDIMURRA VANADIUM PROJECT

PIPING MATERIALS AND VALVES SPECIFICATION

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1.0 SCOPE AND REFERENCED STANDARDS

1.1 General

This specification covers the material requirements for all piping systems and valves to be used within the boundary limits of the specific areas of the Windimurra Vanadium Project designed by Proteus Engineers. These areas are:

- Area 00 – Interconnecting Pipe Racks between facilities (within the agreed termination points)
- Area 19 – Magnetite Feed and Off-Gas Cleaning
- Area 20 – Roasting
- Area 25 – Leaching
- Area 30 – Desilication
- Area 35 – AMV Precipitation and Filtration
- Area 36 – AMV Dryer
- Area 40 – V2O5 Production Facility
- Area 41 – V2O3 Production Facility
- Area 45 – FeV Production Facility
- Area 50 – Plant Services (up to agreed termination points)

Piping and valving in other areas including, but not necessarily limited to crushing, grinding, beneficiation, tailings, decant, borefield, powerstation, administration and amenities are not covered by this specification.

1.2 Project Specifications

The following Standards are referenced within this specification and should be read in conjunction with this specification.

6033-S-00-G-003	Project Numbering Specification
6033-S-00-G-009	Painting and Protective Coatings Specification
6033-S-00-P-002	Supply and Installation of Piping Systems
6033-S-00-P-003	Thermal Insulation
6033-G-00-P-001	Piping Basis of Design
6033-G-00-P-002	Piping Design Criteria

1.3 Australian Standards

The following Australian standards are referenced within this specification.

AS 1074	Steel Tubes and Tubulars for Ordinary Service
AS 1111	ISO Metric Hexagon Commercial Bolts and Screws
AS 1112	ISO Metric Hexagon Nuts

AS 1159	Polyethylene (Polythene) Pipe for Pressure Applications
AS 1214	Hot Dipped Galvanised Coatings on Threaded Fasteners (ISO Metric Coarse Thread Series)
AS 1345	Identification of the Contents of Pipes
AS 1444	Wrought Alloy Steels
AS 1650	Galvanised Coatings
AS 1722	Pipe Threads of Whitworth Form Sealing Pipe Threads
AS 1835	Tubes for Pressure Purposes – Seamless Steel
AS 1836	Tubes for Pressure Purposes – Welded Steel
AS 2129	Flanges for Pipes, Valves and Fittings
AS 2528	Bolts, Studbolts and Nuts for Flanges and other High and Low Temperature Applications
AS 3672	Wrought Steel Threaded Pipe Fittings
AS 3678	Structural Steel – Hot Rolled Plates, Floor Plates and Slabs
AS 4041	Pressure Piping
AS 4129	Fittings for Polyethylene Pipe Pressure Applications
AS 4130	Polyethylene Pipe for Pressure Applications
AS 4131	Polyethylene Compound for Pressure Pipes and Fittings
AS 4343	Pressure Equipment – Hazard Levels
AS 5601	Gas Installations

1.4 American Standards

The following American standards are referenced within this specification.

ASME/ANSI:	B1.20	Pipe Threads
	B16.25	Buttwelding Ends
	B16.28	Wrought Steel Buttwelding Short Radius Elbows and Returns
	B16.3	Malleable iron threaded fittings Classes 150 & 300
	B16.5	Pipe Flanges and Flanged Fittings

	B16.9	Factory Made Wrought Steel Buttwelding Fittings
	B16.10	Face-to-Face and End-to-End Dimensions of Ferrous Valves
	B16.11	Forged Steel Fittings, Socket-Welding and Threaded
	B16.21	Non-metallic Gaskets for Pipe Flanges
	B16.25	Buttwelding Fittings
	B16.34	Steel Valves, Flanged and Buttwelded ends
	B36.10	Carbon steel pipe
	B36.19	Stainless steel pipe
	B46.1	Surface Texture
ASTM:	A53	Pipe, Steel, Black and Hot-dipped, Zinc Coated, Welded and Seamless
	A105	Carbon Steel Forgings for Piping Components
	A106	Seamless Carbon Steel Pipe for High Temperature Service
	A134	Electric Fusion Welded Steel Pipe
	A193	Alloy Steel and Stainless Steel Bolting Materials for High Temperature Service
	A194	Carbon and Alloy Steel Nuts for Bolts for High Pressure and High Temperature Service
	A234	Pipe Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and Elevated Temperatures
	A312	Seamless and Welded Stainless Steel Pipe
	A403	Wrought Austenitic Stainless Steel Pipe Fittings
	API	5L Specification for Line pipe

1.5 British Standards

No British standards are referenced within this specification.

1.6 Codes and Regulations

The work covered by this specification shall, where applicable, conform to the relevant Regulations under Acts of the Western Australian Government. These include, but are not necessarily limited to:

- Mines Safety and Inspection Act, 1994 and Regulations

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- Occupational Health and Safety Act, 1984 and Regulations
 - Gas Standards Act, 1972 and Regulations (1999 and 2000)
 - Dangerous Goods Safety Act, 2004 and Regulations
 - Environmental Protection Act, 1986 and Regulations

In addition, the work shall comply with any other requirements of all statutory bodies (local, state and national) having jurisdiction over the work. These include, but are not necessarily limited to:

- Government of Western Australia, Department of Industry and Resources (DOIR)
- Government of Western Australia, Department of Consumer and Employment Protection (DOCEP), Energy Safety Section (Gas)
- Government of Western Australia, Department of Consumer and Employment Protection (DOCEP), Worksafe Commission
- Government of Western Australia, Office of Energy (Gas Division)
- Government of Western Australia, Environmental Protection Authority

2.0 DESIGN REQUIREMENTS

2.1 General

Detailed piping material specification sheets are contained in Appendix A for each piping material class. The corresponding allowable valve types for these piping material classes are listed and described in Appendix C. Together, these are intended to cover all major piping systems for the Windimurra project. Any specific piping items or valves that do not fully comply with these material classes or valve descriptions shall be designated by the engineer as a piping special item. Piping special items shall be fully specified on the piping drawings or separate data sheets provided.

In general, details specified on the piping drawings or data sheets shall take precedence over the requirements of this document

2.2 Application of AS 4041

For metallic piping, all piping design shall generally be in accordance with AS 4041, unless otherwise noted.

All flanges shall preferably be AS 2129, Table D or E unless otherwise noted. The majority of pipe material specifications described in this document use Table E flanges.

All piping component wall thickness' specified in the individual piping material specification sheets are calculated in accordance with AS 4041 based on the specified maximum internal design pressure, maximum design temperature, corrosion allowance, manufacturing under-tolerance, threading allowance and the nominated class of construction (i.e. NDT and QA/QC requirements).

The wall thickness, design conditions and corrosion allowance's indicated in Appendix A include only a nominal allowance for external loads on pipework (e.g. wind and seismic, point loads from supports, bending stress between supports, shock loads, etc) or any other sustained or occasional loads (other than internal pressure). For critical or hazardous piping, systems with poor flexibility and systems where these other loads are significant, the engineer shall perform a pipe stress and flexibility analysis in accordance with AS 4041 (See also Section 2.17 and 2.18 of this document for guidance on this issue).

Except for particular cases where a specific corrosion or wear life has been agreed with the client, all piping systems shall be designed for an indefinite design life with an unlimited number of full pressure and temperature cycles.

2.3 Material Requirements

The piping material specification sheets (Appendix A) provide details of material specifications and types of construction for the various pipe material classes. All pipework shall conform to these material classes wherever it is safe and practical to do so. No material substitution or other deviations shall be allowed unless specifically designated on the drawings as a piping special item and/or the deviation has been approved by the engineer.

All materials shall be new and of best quality, free of rust, scale and other foreign material.

2.4 Operating Conditions

Maximum allowable design pressure and temperature conditions are specified for each piping material class in Appendix A. The engineer may specify a lower design pressure and/or temperature for a particular system if a higher corrosion allowance is required and/or based on the results of a pipe stress and flexibility analysis. However, these particular design conditions shall be clearly stated on the drawings.

Maximum operating conditions in the plant must not be allowed to exceed design values without prior approval of the engineer.

2.5 Test Pressures

Test pressures specified for each piping material class are the maximum allowed for piping systems using that class. Lower test pressure limits may be set for an individual case to suit a particular in-line component, but in no way shall be less than 110% of maximum design pressure or that test pressure calculated in accordance with AS 4041 Appendix U.

2.6 Corrosion and Erosion Allowances

Pipe is normally purchased to a commercially available wall thickness. As a result, the wall thickness furnished is always greater than that required for the actual line design condition as well as any additional stresses resulting from any external mechanical loads on the pipework system. This thickness provides a residual corrosion/erosion allowance.

The corrosion allowance listed for each piping material class in Appendix A applies to the maximum allowable design conditions nominated for each material class together with a nominal allowance for other mechanical loads. However, these other mechanical loads can only be defined by a full pipe stress and flexibility analysis for each particular system. Therefore, the stated corrosion allowances in Appendix A should only be used as a guide.

The actual available corrosion allowance for each case will depend on the actual maximum operating conditions and the magnitude of any sustained and occasional external mechanical loads (additional to internal pressure). Therefore, where necessary the actual available corrosion allowance shall be calculated by the engineer for particular systems to achieve the agreed corrosion life. For all pipework subject to corrosion, the corrosion allowance shall not be less than 1 mm.

Piping systems subject to erosion shall be lined with suitable wear resistant materials or their wall thickness increased to achieve the agreed design life.

2.7 Preferred Pipe Diameters

Nominal diameters DN32, DN90 and DN125 in ferrous materials are non-preferred and shall be avoided wherever practical. Where equipment is supplied by the manufacturer with connections in any of the above sizes, the equipment manufacturer shall be requested to provide connections with suitable reduction or expansion to pipe of a preferred size.

2.8 Branch Connections

Branch connections shall be in accordance with each of the piping material specification branch connection tables.

2.9 Process Thermal Insulation

Safety Showers

All above ground potable water lines supplying safety shower and eye wash stations shall be insulated to avoid the water temperature at the delivery point exceeding 35°C. Some possible exceptions are:

- Where safety showers are supplied by a continuously circulating ring main, only the branch line from the ring main requires insulation.
- The safety shower is fitted with a thermostatic relief valve which is regularly checked and serviced.

Insulation for safety shower lines shall be 25mm glasswool wrapped in 24 gauge (0.6mm) galvanised sheet using pop rivet connections, unless otherwise specified. Flanged joints shall be left exposed with insulation tapered out to flanges. Sheet wrap bends shall be lobster-back type.

Process Temperature Maintenance

Wherever piping is required to be insulated for process reasons, the thickness of insulation, insulating materials, cladding materials and method of fixing shall depend on the temperature difference required as well as other site conditions. In such cases specific design is required by the engineer in consultation with the insulation manufacturer and the design shall be fully specified on the drawings.

Refer to Specification 6033-S-00-P-003 for general requirements for thermal insulation.

2.10 Insulation for Personnel Protection

It is highly recommended that any piping with external surface temperature above 50°C and that can be readily accessed by personnel should be fitted with insulation or be isolated with a physical barrier. In such cases specific design is required by the engineer and the design shall be fully specified on the drawings.

2.11 Flange Guards

For critical lines containing high pressure, high temperature, poisonous, flammable, acidic, and caustic or other hazardous fluids, the number of flange joints should be minimised to reduce the risk of injury to personnel from uncontrolled leakage. Fully welded joints are preferred as far as is practical.

In the case of fluids, the danger zone during a gasket blow-out may extend 20 metres from the flange. To reduce this potential hazard, wherever flange joints are unavoidable the use of proprietary spray guards is highly recommended. A variety of proven types are commercially available, including:

- Rigid, wrap around type, polypropylene or stainless steel spray guards
- Rigid, heat shrinkable, transparent spray guards
- Flexible, wrap around, draw string type spray guards manufactured from Teflon coated fibreglass cloth or equivalent.

Flange guards shall be regarded as piping special items. The location and type of flange guards shall be nominated on the piping drawings or determined on site to the satisfaction of the engineer.

2.12 Buried Piping

When required, buried, carbon steel piping (incl. galvanised) shall be protected against external corrosion by applying DENSO MP primer followed by two layers of DENSYL Tape or approved equivalent and then overwrapped with DENSO MPHD PVC self adhesive tape or approved equivalent. The coating should continue at least 200mm above ground.

Above ground pipe markers (of a type acceptable to the engineer) shall be located at discrete intervals along the pipe route.

2.13 Painting of Above Ground Pipework

In general, stainless steel, galvanised carbon steel, non-ferrous metallic piping (e.g. brass/bronze fittings) and all non-metallic piping shall not require any external surface protection unless noted otherwise.

Carbon steel piping shall be painted externally in accordance with painting specification 6033-S-00-G-009, system S2, except in the Leaching and Desilication areas where system S3 shall apply.

2.14 Colour Coding and Flow Coding of Pipework

For all unpainted (e.g. site run) pipework, line service designations shall be displayed using colour coded adhesive bands (Flo-code type pipe markers or equivalent) located at discrete intervals along the route of the service line, all in accordance with AS 1345.

Above ground, shop fabricated carbon steel pipework shall be painted externally with a colour top coat to AS 1345.

2.15 Gaskets

The piping material specification sheets contained in Appendix A specify acceptable gasket types for the range of chemicals and temperatures anticipated on the Windimurra project. Other gasket materials, thicknesses and gasket manufacturers may also be suitable. However, for fluids other than water it is recommended that the engineer always check with the gasket manufacturer for chemical compatibility.

Gaskets are generally not required when one or both of the mating flange faces is rubber lined. However, when rubber lined flanges are subject to frequent disassembly and reassembly a 1.5 mm PTFE gasket may be used to avoid cold sticking of the lining on the faces.

2.16 Support Spacing

The recommended spacing of supports for long horizontal runs of steel pipe shall comply with Table 3.28.2 of AS 4041. Under normal circumstances experience has shown these spacings to be satisfactory. However, these spacings are only a normative guide and should always be checked by the engineer for particular circumstances. For example, additional pipe loads other than self weight and hydrotest weight may be significant (e.g. valves, insulation, SG of contents).

Polyethylene pipe shall be continuously supported in cable ladder (galvanised or stainless) of sufficient load carrying capacity (depending on maximum unsupported span required) and of sufficient width to allow for thermal movement (snaking) of the pipe. Mining hose and other flexible piping may also require cable ladder support.

2.17 Requirement for HAZOP

The design team shall determine the criticality of each piping system to assist in deciding whether a rigorous pipe stress and flexibility analysis is required (see also Section 2.18 of this document).

In accordance with AS 4041 Clause 3.6.2, all piping containing lethal or very harmful fluids should be subject to a formal Hazard and Operability Study (HAZOP). Refer to AS 4343 for guidance on Hazard Levels for different chemicals.

In the absence of a HAZOP, other systematic methods of risk analysis may be used to determine the criticality of piping.

2.18 Requirement for Pipe Stress & Flexibility Analysis

To comply with AS 4041 Table 1.5, all piping (Incl. Class 1, 2A, 3) requires a flexibility assessment by the engineer in accordance with AS4041 Clause 3.27.2.2 to determine if the system requires a more rigorous formal analysis. This is an empirical approach based only on system geometry and flexibility and should be applied with judgement.

For critical systems, especially those containing hazardous, lethal or very harmful fluids a formal analysis is normally recommended, regardless of the results of the AS 4041 flexibility assessment.

3.0 LINE SERVICE (FLUID) DESIGNATIONS

The table below is an alphabetical listing of the line service designations for the Windimurra project and the corresponding pipe material classes and valve types that may normally be used. Any deviations (piping special items) shall be approved by the engineer and fully detailed on the drawings or separate data sheets provided.

FLUID	CODE	MATERIAL CLASSES PERMITTED	VALVE TYPES PERMITTED
<u>Compressed Air</u> 1000 kPag @ Ambient	AC	SC1/E Carbon Steel, Table E	V1120 V1121 V1301 V1302 V1305 V1313 V1323 V1612 V1621 V1723 V1726
<u>Instrument Air</u> 1000 kPag @ Ambient, -40°C PDP	AI	SC1/E Carbon Steel, Table E	V1301 V1302 V1305 V1313 V1323 V1612 V1621 V1723 V1726
Conveying Air Pressurised	CAP	SC6/E Carbon Steel, Table E	V1120 V1121 V1723
Conveying Air Vacuum	CAV	SC6/E Carbon Steel, Table E	V1120 V1121
<u>Natural Gas</u> 700 – 900 kPa -20 ^o C- 60 ^o C	GN	SC5/1 Carbon Steel, ANSI 150#	V2303 V2706 V2707
Nitrogen	GNT	SC5/1 Carbon Steel, ANSI 150#	V2303 V2706 V2707 V9925
<u>Ammonium Sulphate Liquor</u> (Mixed AMSUL), 1.1% w/w @ 15 – 50°C, pH = 6 - 8	LA	P1/6.3-12.5/E Polyethylene, Table E	V1122 V1123
		SS1/E Stainless Steel 304L, Table E	V1311 V1328
		HM1/E Material Handling (Mining) Hose	V1501 V1721
<u>Barren Liquor</u> (Aqueous) 1.19 SG @ 25 – 35°C, pH = 6 - 8	LB	P1/6.3-12.5/E Polyethylene, Table E	V1122 V1123
		SC1/E Carbon Steel, Table E	V1301 V1328 V1501
		HM1/E Material Handling (Mining) Hose	V1625 V1723 V1726

FLUID	CODE	MATERIAL CLASSES PERMITTED	VALVE TYPES PERMITTED
<u>Pregnant Liquor (Aqueous)</u> 1.01 SG @ 85 – 95°C, pH = 14	LP	P1/6.3-12.5/E Polyethylene, Table E	V1122 V1123 V1301 V1328
		SC1/E Carbon Steel, Table E	V1723 V1311 V1312
		HM1/E Material Handling (Mining) Hose	
		SS1/E Stainless Steel 304L, Table E	V1122 V1123 V1311 V1312 V1721
<u>Leach Slurry</u> C _w = 1 – 5% w/w @ 45 – 98°C, pH = 14	LS	P1/6.3-12.5/E Polyethylene, Table E	V1122 V1123
		SC1/E Carbon Steel, Table E	V1301 V1305 V1311
		HM1/E Material Handling (Mining) Hose	V1723 V9920 V1726
Lube Oil	OL	SC1/E Carbon Steel, Table E	V1301
Oxygen	GOX	SC5/1 Carbon Steel, ANSI 150#	V2303* V2706* V2708* V9925* (* Special clean required)
<u>Aluminium Sulphate Liquid</u> @ 20 – 35°C,	RAL	P1/6.3-12.5/E Polyethylene, Table E	V1305 V1122 V1123 V1328 V1721 V1734 V1311
		SS2/E Stainless Steel 316L, Table E	V1122 V1123 V1311 V1328 V1501 V1721 V1305
<u>Dilute Sulphuric Acid</u> 2 – 10% w/w @ 15 – 50°C, pH<1	RSD	P1/12.5/E Polyethylene, Table E	V1425 V1734 V2705
<u>Sulphuric Acid</u> >98% w/w @ 15 – 30°C, pH<1	RSA	SC5/1 Carbon Steel, ANSI 150#	V2405 V2501 V2705

FLUID	CODE	MATERIAL CLASSES PERMITTED	VALVE TYPES PERMITTED
<u>Dense Slurry</u> 5 – 40% w/w solids @ 25 – 35°C, pH 7 - 8	SD	P1/6.3-12.5/E Polyethylene, Table E	V1301 (Drain) V1423 V1432 V1734 V1822 V1823 V1824 V9920
		SC1/E Carbon Steel, Table E	V1301 (Drain) V1423 V1432 V1734 V1822 V1823 V1824 V9920 V1726
		SR1/E Rubber Lined CS, Table E	
		SR2/E Rubber Lined CS, Table E	
<u>Slurry Desiccation</u> $C_w = 2 - 6\%$ @ 75°C, pH = 8.3	SDS	SS2/E Stainless Steel 316L, Table E	V1122 (Drain) V1311 (Drain) V1823
		SR1/E Rubber Lined CS, Table E	V1432 V1301 V1734
		SR2/E Rubber Lined CS, Table E	
		HM1/E Material Handling (Mining) Hose	
<u>Slurry Medium</u> $C_w = 2 - 6\%$ @ 30 – 85°C, pH = 14	SM	SC1/E Carbon Steel, Table E	V1122 (Drain) V1301 (Drain) V1822
		SR1/E Rubber Lined CS, Table E	V1824 V1432 V1734
		SR2/E Rubber Lined CS, Table	
		HM1/E Material Handling (Mining) Hose	
<u>Demineralised Water</u>	WDM	SS2/E Stainless Steel 316L, Table E	V1122 V1123 V1311 V1328 V1501 V1721 V1305
<u>Fire Water</u> 1.0 SG @ 20 – 30°C, pH = 7-8	WF	SC2/E Carbon Steel, Table E	V1120 V1121 V1301 V1723
<u>Potable Water</u> 1.0 SG @ 20 – 30°C, pH = 7	WPT	P1/6.3-12.5/E Polyethylene, Table E	V1201 V1222
		SG1/E Galvanised CS, Table E	V1122 V1301 V1305 V1602 V1625 V1704 V1723 V1610

FLUID	CODE	MATERIAL CLASSES PERMITTED	VALVE TYPES PERMITTED
<u>Raw Water</u> 1.0 SG @ 20 – 30°C, pH = 7-8	WR	P1/6.3-12.5/E Polyethylene, Table E	V1120 V1121 V1122 V1301 V1625 V1723 V1610
		SC1/E Carbon Steel, Table E	
<u>Cooling Water</u> 1.0 SG @ 20 – 30°C, pH = 7	WS	P1/6.3-12.5/E Polyethylene, Table E	V1120 V1121 V1122 V1201 V1222 V1301 V1704 V1721 V1926
		SC1/E HF1 Carbon Steel, Table E Flexible Hose	
Waste Water	WW	P1/6.3-12.5/E Polyethylene, Table E	V1120 V1121 V1122 V1201 V1222 V1301 V1704 V1721 V1926
		SC1/E Carbon Steel, Table E	
Vacuum	VA	SC1/E Carbon Steel, Table E	V1120 V1121 V1723

4.0 LINE NUMBERS

The following is reproduced from Section 4.0 of the Project Numbering Specification:

Pipeline numbers shall have the following structure:

XX5YY-ZZZ-BBB/1-dn-IH

Where:

- XX:** Two digit area identifier as per Section 2.0.
- 5:** One digit number which identifies the Originator, Proteus.
- YY** Line number as defined by Originator.
- ZZZ:** Fluid Code Identification shall be as set out in relevant Project Piping Material Specifications.
- BBB/1:** Pipeline Material Specification as set out in relevant Project Piping Material Specifications.
- dn :** Nominal pipe size in mm (two or three digits).
- IH :** **(OPTIONAL)**. Additional two alpha designation that specifies the type of insulation on the line. If there is no insulation, it is left blank. Typical insulation specifications are:
- IH – Hot Insulation
 - IC – Cold Insulation
 - PP – Personnel Protection
 - ET – Electrical Trace
 - ST – Steam Trace

The combination **XX5YY-ZZZ** shall define a unique process line, which by definition, is a line between two significant pieces of equipment or from a branch. A line may be made up of a number of pipes.

XX is the number of the plant area in which the line originates. The area designation shall stay the same for all pipes in the process line, no matter where the pipe may actually be located. The area designation for a line originating from a branch shall be the area in which the branch is located.

5.0 VALVE DESIGNATIONS

The following is reproduced from Section 5.0 of the Project Numbering Specification:

Valve numbering shall have the following structure:

dnVabcc

Where:

- dn :** Nominal diameter, which shall be the nominal valve size in mm (two or three digits).
- V :** "V" to signify valve.
- a :** "a" to differentiate between Australian Standards and American Standards, i.e, Australian = 1, American = 2.
- b :** "b" is used to distinguish between valve types (see table below)

cc : “cc” indicates the sequential type of valve type required. Each connection type starts at 01, with a maximum value of 19. Table E connection types, however, start at 21, with a maximum value of 39.

An example of a valve number is:

80V1101 This indicates an 80mm, Australian Standard, Table D, butterfly valve

80V1121 An 80mm, Australian Standard, Table E, butterfly valve

80V2101 An 80mm, American Standard (ANSI), butterfly valve

For control in-line valves, the valve body number (as above) will be denoted in brackets. In addition the valve will be allocated an instrument number. An example of a control valve number is:

(350V2100)

Valve Types

'b'	VALVE TYPE
1	Butterfly Valves
2	Gate Valves
3	Ball Valves
4	Diaphragm & Pinch Valves
5	Globe Valves
6	Safety Relief & Float Valves
7	Non-Return / Check Valves & Backflow Prevention Devices
8	Knifegate Valves
9	Special Valves, Bursting Discs, etc.

6.0 ABBREVIATIONS USED

ANSI	American National Standards Institute
API	American Petroleum Institute
AWWA	American Water Works Association
ASME	American Society for Mechanical Engineers
ASTM	American Society for Testing and Materials
BE	Bevel Ended
BW	Butt Welded
BSP	British Standard Pipe
CS	Carbon Steel
EOL	End of Line
ERW	Electric Resistance Welded
FF	Flat Faced
GR	Grade
GALV	Galvanised
HDPE	High Density Polyethylene
PE	Plain Ended
RBC	Roust-a-bout Coupling
RF	Raised Face
RTFE	Reinforced Polytetrafluoroethylene
SCH	Schedule
SCR	Screwed
SMLS	Seamless
SO	Slip On
SS	Stainless Steel
STD WT	Standard Weight
SW	Socket Welded
WN	Weldneck
XOX	Hexagon head, round shank, hexagon nut
XS	Extra Strong
XXS	Double Extra Strong

APPENDIX A: PIPING MATERIAL CLASSES

PIPING CLASS HF1

MAXIMUM DESIGN CONDITIONS:	Temperature: -10 to 60°C Pressure: 1.6 MPa @ 20°C up to DN50, 0.5 MPa for DN50 to DN150(See Note 4) Test Pressure: 1.5 x Working Pressure			
CODE	FLANGES	MATERIAL	CORROSION ALLOWANCE	
-	-	Flexible Utility Hose (Air/Water)	Not Applicable	
	SIZE	DESCRIPTION	MATERIAL SPECIFICATION	DIMENSIONAL SPECIFICATION
HOSE (Note 1,2)	DN15 – DN50	PVC Hose – Safety Yellow. Black PVC Inner, Yellow PVC Outer, Internal Braided Polyester Yarn Reinforcing	PVC/Polyester	Nominal ID (mm) Available : DN6, DN10, DN15, DN20, DN25, DN32, DN40, DN50
	DN65 – DN150	Black SBR Rubber Tube, Nylon Cord Reinforcement Steel Wire Helix, Black SBR Rubber Cover	Rubber/Nylon	
COUPLINGS (Note 3)	DN50 & Smaller	Minsup Surelock Claw Coupling with male barbed hose tail c/w stainless steel hose clamps	SG Iron with NR seal	Available Sizes : DN10, DN15, DN20, DN25 & DN32, DN40, DN50
	Larger than DN50	Male Camlock, Type E (c/w male barbed hose tail & stainless steel hose clamps)	316 stainless	DIN 2828 Available Sizes : DN40, DN50, DN65, DN80, DN100, DN150
JOINTING	All	Stainless steel hose adapters, male hose barb x BSPM Thread c/w stainless steel hose clamps		
BRANCH CONNECTIONS		Not Applicable		
INSPECTION / TESTING REQ.		Service Test Only Unless Otherwise Specified Elsewhere		
ACCEPTABLE SUPPLIERS		Hose (up to DN50): Barfell Super Ultraflex Hose (DN65 to DN150): Oz Hoze RS21 (10 Bar) or equivalent		

Notes:

1. For compressed air service use size range DN15 to DN50.
2. For water service use size range DN15 to DN150.
3. Camlock fittings not to be used for compressed air service.
4. Pressure rating of DN65 – DN150 water hose assembly is limited to 500 kPa because of Camlock Couplings. Hose is rated for 1000 kPa.

PIPING CLASS HM1/E

MAXIMUM DESIGN CONDITIONS:	Temperature: 5 - 95°C Pressure: 700 kPa Test Pressure: 1050kPa (g) hydrostatic			
CODE	FLANGES	MATERIAL	CORROSION ALLOWANCE	
-	Table E, FF	Material Handling (Mining) Hose	Not Applicable	
	SIZE	DESCRIPTION	MATERIAL SPECIFICATION	DIMENSIONAL SPECIFICATION
HOSE (Note 7)	DN 50 -300	Synthetic and steel wire reinforced natural rubber materials handling (mining) hose with abrasion resistant rubber lining. One end shop fitted with beaded end and rotating flange, other end supplied plain for site fitting of muff coupling.	Linatex D808 Isoprene, Natural Rubber (NR). See Note 5	Available Sizes ID OD(mm) 50 78 75 103 100 128.5 125 156.5 150 182 200 234.5 250 286.5 300 344.5
BENDS	All	Hose shall be capable of being bent to a minimum radius of 10D. Preformed Bends (by special order) typically 1.5D or 5D radius.	Linatex D808	
FLANGES (Notes 3, 6, 8)	All	One End - Split, bolt-on drilled cast iron muff coupling to suit hose OD. Other End – Integral moulded beaded (swivel or rotating flange) with hot dipped galvanised carbon steel flange ring.	Linatex D808	AS2129 Table E
REDUCERS	All	Available by Special Order	Linatex D808	
GASKETS	All	6mm Natural rubber, full face	Linatex NR	AS2129 Table E
BOLTING (Note 1)	All	Hex machine bolts metric thread or metric studbolts Hex nuts; metric thread	AS 1111 Gr4.6 AS 1112 Gr 5	AS 2528 AS 2528
BRANCHES		Not Applicable		
TESTING REQ.		Service Test Only Unless Otherwise Specified Elsewhere		
SUPPLIERS		Linatex Diamond D801 Muff Coupling Hose & Fittings		

Notes:

- All bolting to be hot dipped galvanised to AS 1214. Loctite Nevasieze or approved equal to be used.
- Muff couplings can be used up to a maximum DN300 suitable for a pressure rating of 700kPa, for sizes larger than DN300 refer to manufacturer for details.
- In-built expanded flanged couplings & inbuilt flanges with split metal backing rings (non-rotating) also available by special order.
- Linatex wear indicator system (transmitter) not required unless specified elsewhere.
- Natural rubber not compatible with hydrocarbon fluids. For services containing trace amounts of fuels, oils, solvents or other hydrocarbons consult the manufacturer for advice on alternative synthetic rubber compounds.
- Assemble muff couplings on site to manufacturer's instructions.
- Hose lengths up to 12 metres available.
- Muff couplings also available in cast aluminium alloy.

PIPING CLASS P1/6.3/E

DESIGN CONDITION:	Temperature: 20 30 40 50 60 °C Pressure: 630 550 470 410 350 kPa (g) Test Pressure: 760 kPa (g) hydrostatic @ 17 – 25 deg C			
CODE	FLANGES	MATERIAL	CORROSION ALLOWANCE	
	Table E	Polyethylene PE100	Not Applicable	
	PIPE SIZE (Note 13)	DESCRIPTION	MATERIAL SPECIFICATION	DIMENSIONAL SPECIFICATION
PIPE (Note 1)	20 - 800	Polyethylene, PE100, PN6.3 (SDR 26)	AS 4131	AS 4130
COUPLINGS (Note 15)	20 - 90	Polyethylene metric compression fittings, or butt fusion weld		AS 4129
	110 - 800	Butt-Fusion Welded Pipe, PE100		
FITTINGS (Notes 2,3,7,10, 12, 15)	20 - 110	Polyethylene metric compression fittings or butt fusion welded, PE100, Plain Ends		
	125 - 800	Butt Fusion Welded, PE100, Plain Ends		
FLANGES (Note 6,13)	63 & Larger	Polyethylene stub flange, butt weld, c/w Table E Galv Backing Ring		AS 2129
VICTAULIC JOINTS (Note 11,16)	50 - 315	Victaulic Part No S995 Plain End HDPE, 2-Bolt Coupling		
GASKETS (Note 8)	All Flanges	1.5 mm thk, Non-Asbestos Fibre, Ring Type, Klingersil C4430 or Equiv.		
BOLTING (Note 4)	All Flanges	Hex machine bolts; metric thread or metric studbolts	AS 1111, Gr 4.6	AS 2528
		Hexagonal nuts; metric thread	AS 1112, Gr.5	AS 2528
BRANCHES	All	Refer Piping Class P1/6.3/E Branch Connection Table		
TESTING	All	100% Visual and Hydrotest		

Notes:

- Exposed above ground sections shall be de-rated according to the manufacturers recommendations or supplied in co-extruded white material if specified on the drawings.
- Reducers & Transition Pieces: 6° included angle for discharge lines, 10 to 12° included angle for suction lines.
- Not Used
- All bolting to be hot dipped galvanised to AS 1214. Loctite Nevasieze or approved equal to be used.
- Not Used
- In slurry service, pipe flange spacing shall not exceed 20 metres, except in tailings lines where the maximum spacing for flanges or other connector types shall not exceed 80 metres.
- For slurry piping, long radius sweep bends (min 3D) shall be used. Elbows are not permitted.
- For HCl acid service, 3mm EPDM gasket shall be used.
- All buried pipe joints shall be Butt Fusion Welded. Coiled small bore pipes are acceptable up to 110 mm OD to reduce the number of joints required.
- Pipe fittings that include any brass components are not permitted.

11. Butt Fusion Welding (BFW) or BFW flanged joints and fittings are preferred. Victaulic Couplings should only be used for sizes 315 mm and smaller where quick disconnection is required.
12. The use of metric compression joiners and fittings shall be limited to water services, for pipe sizes up to and including 110 mm OD.
13. Pipe size refers to the outside diameter of the pipe in mm. For corresponding flange sizes and equivalent steel pipe sizes refer to table below.
14. Maintain Pipe PN Rating for all Fittings.
15. Compression Fittings are rated PN16 up to 63 mm OD, PN12.5 for 75 mm – 110 mm OD.
16. Victaulic Style 77 clamps allowable up to 315mm OD and have PN8 pressure rating only.
- 17 For Butterfly Valves, include MDPE spacer rings.

PIPE SIZE EQUIVALENTS

PE Pipe OD (mm)	AS 2129 Table E Flange Size	Equiv. Steel Pipe Size (ANSI B36.10)	Comments
20	DN15	DN15	
25	DN20	DN20	
32	DN25	DN25	
40	DN32	DN32	DN32 is Non-Preferred Size
50	DN40	DN40	
63	DN50	DN50	
75	DN65	DN65	DN65 is Non-Preferred Size
90	DN80	DN80	
110	DN100	DN100	
125	DN125	DN125	
140	DN125	DN125	DN125 is Non-Preferred Size
160	DN150	DN150	
200	DN200	DN200	
225	DN200	DN200	
250	DN250	DN250	
280	DN250	DN250	
315	DN300	DN300 & DN250	
355	DN350	DN350 & DN300	
400	DN400	DN400 & DN350	
450	DN450	DN450 & DN400	
500	DN500	DN500 & DN550	

PIPING CLASS P1/8/E

DESIGN CONDITION:	Temperature: 20 30 40 50 60 °C Pressure: 800 700 600 520 450 kPa (g) Test Pressure: 1100 kPa (g) hydrostatic @ 17-25 deg C			
CODE	FLANGES	MATERIAL	CORROSION ALLOWANCE	
	Table E	Polyethylene PE100	Not Applicable	
	PIPE SIZE (Note 13)	DESCRIPTION	MATERIAL SPECIFICATION	DIMENSIONAL SPECIFICATION
PIPE (Note 1)	20 - 800	Polyethylene, PE100, PN8 (SDR 21)	AS 4131	AS 4130
COUPLINGS (Note 15)	20 - 110	Polyethylene metric compression fittings, or butt fusion weld		AS 4129
	125 - 800	Butt-Fusion Welded Pipe, PE100		
FITTINGS (Note 2, 3, 7,10, 12, 15)	20 - 110	Polyethylene metric compression fittings or butt fusion welded, PE100, Plain Ends		
	125 - 800	Butt Fusion Welded, PE100, Plain Ends		
FLANGES (Note 6,13)	63 & Larger	Polyethylene stub flange, butt weld, c/w Table E Galv Backing Ring		AS 2129
VICTAULIC JOINTS (Note 11,16)	50 - 315	Victaulic Part No S995 Plain End HDPE, 2-Bolt Coupling		
GASKETS (Note 8)	All Flanges	1.5 mm thk, Non-Asbestos Fibre, Ring Type, Klingersil C4430 or Equiv.		
BOLTING (Note 4)	All Flanges	Hex machine bolts; metric thread or metric studbolts	AS 1111, Gr 4.6	AS 2528
		Hexagonal nuts; metric thread	AS 1112, Gr.5	AS 2528
BRANCHES	All	Refer Piping Class P1/8/E Branch Connection Table		
TESTING	All	100% Visual and Hydrotest		

Notes:

1. Exposed above ground sections shall be de-rated according to the manufacturers recommendations or supplied as co-extruded white material if specified on the drawings.
2. Transition Pieces: 6° included angle for discharge lines, 10 to 12° included angle for suction lines.
3. Not Used.
4. All bolting to be hot dipped galvanised to AS 1214. Loctite Nevasieze or approved equal to be used.
5. Not Used
6. In slurry service, pipe flange spacing shall not exceed 20 metres, except in tailings lines where the maximum spacing for flanges or other connector types shall not exceed 80 metres.
7. For slurry piping, long radius sweep bends (min 3D) shall be used. Elbows are not permitted.
8. For HCl acid service, 3mm EPDM gasket shall be used.
9. All buried pipe joints shall be Butt Fusion Welded. Coiled small bore pipes are acceptable up to 110 mm OD to reduce the number of joints required.
10. Pipe fittings that include any brass components are not permitted.

11. Butt Fusion Welding (BFW) or BFW flanged joints and fittings are preferred. Victaulic Couplings should only be used for sizes 315 mm and smaller where quick disconnection is required.
12. The use of metric compression joiners and fittings shall be limited to water services, for pipe sizes up to and including 110 mm OD.
13. Pipe size refers to the outside diameter of the pipe in mm. For corresponding flange sizes and equivalent steel pipe sizes refer to table below.
14. Maintain Pipe PN Rating for all Fittings.
15. Compression Fittings are rated PN16 up to 63 mm OD, PN12.5 for 75 mm – 110 mm OD.
16. Victaulic Style 77 clamps allowable up to 315mm OD and have PN8 pressure rating only.
17. For Butterfly Valves, include MDPE spacer rings.

PIPE SIZE EQUIVALENTS

PE Pipe OD (mm)	AS 2129 Table E Flange Size	Equiv. Steel Pipe Size (ANSI B36.10)	Comments
20	DN15	DN15	
25	DN20	DN20	
32	DN25	DN25	
40	DN32	DN32	DN32 is Non-Preferred Size
50	DN40	DN40	
63	DN50	DN50	
75	DN65	DN65	DN65 is Non-Preferred Size
90	DN80	DN80	
110	DN100	DN100	
125	DN125	DN125	
140	DN125	DN125	DN125 is Non-Preferred Size
160	DN150	DN150	
200	DN200	DN200	
225	DN200	DN200	
250	DN250	DN250	
280	DN250	DN250	
315	DN300	DN300 & DN250	
355	DN350	DN350 & DN300	
400	DN400	DN400 & DN350	
450	DN450	DN450 & DN400	
500	DN500	DN500 & DN550	

PIPING CLASS P1/10/E

DESIGN CONDITION:	Temperature: 20 30 40 50 60 °C Pressure: 1000 880 750 650 560 kPa (g) Test Pressure: 1400 kPa (g) hydrostatic @ 17-25 deg C			
CODE	FLANGES	MATERIAL	CORROSION ALLOWANCE	
	Table E	Polyethylene PE100	Not Applicable	
	PIPE SIZE (Note 13)	DESCRIPTION	MATERIAL SPECIFICATION	DIMENSIONAL SPECIFICATION
PIPE (Note 1)	20 - 800	Polyethylene, PE100, PN10 (SDR 17)	AS 4131	AS 4130
COUPLINGS (Note 15)	20 - 110	Polyethylene metric compression fittings, or butt fusion weld		AS 4129
	125 - 800	Butt-Fusion Welded Pipe, PE100		
FITTINGS (Note 2, 3, 7, 10, 12, 15)	20 - 110	Polyethylene metric compression fittings or butt fusion welded, PE100, Plain Ends		
	125 - 800	Butt Fusion Welded, PE100, Plain Ends		
FLANGES (Notes 6, 13)	63 & Larger	Polyethylene stub flange, butt weld, c/w Table E Galv Backing Ring		AS 2129
GASKETS (Note 8)	All Flanges	1.5 mm thk, Non-Asbestos Fibre, Ring Type, Klingersil C4430 or Equiv.		
BOLTING (Note 4)	All Flanges	Hex machine bolts; metric thread or metric studbolts	AS 1111, Gr 4.6	AS 2528
		Hexagonal nuts; metric thread	AS 1112, Gr.5	AS 2528
BRANCHES	All	Refer Piping Class P1/10/E Branch Connection Table		
TESTING		100% Visual and Hydrotest		

Notes:

1. Exposed above ground sections shall be de-rated according to the manufacturer's recommendations or supplied as co-extruded white material if specified on the drawings.
2. Transition Pieces: 6° included angle for discharge lines, 10 to 12° included angle for suction lines.
3. Not Used.
4. All bolting to be hot dipped galvanised to AS 1214. Loctite Nevasieze or approved equal to be used.
5. Not Used
6. In slurry service, pipe flange spacing shall not exceed 20 metres, except in tailings lines where the maximum spacing for flanges or other connector types shall not exceed 80 metres.
7. For slurry piping, long radius sweep bends (min 3D) shall be used. Elbows are not permitted.
8. For HCl acid service, 3mm EPDM gasket shall be used.
9. All buried pipe joints shall be Butt Fusion Welded. Coiled small bore pipes are acceptable up to 110 mm OD to reduce the number of joints required.
10. Pipe fittings that include any brass components are not permitted.
11. Not Used
12. The use of compression joiners and fittings shall be limited to water services, for pipe sizes up to and including 110 mm OD.

13. Pipe size refers to the outside diameter of the pipe in mm. For corresponding flange sizes and equivalent steel pipe sizes refer to table below.
14. Maintain Pipe PN Rating for all Fittings.
15. Compression Fittings are rated PN16 up to 63 mm OD, PN12.5 for 75 mm – 110 mm OD.
16. Victaulic Style 77 clamps are PN8 pressure rating only and must not be used with PN10 pipe system.
17. For Butterfly Valves, include MDPE spacer rings.

PIPE SIZE EQUIVALENTS

PE Pipe OD (mm)	AS 2129 Table E Flange Size	Equiv. Steel Pipe Size (ANSI B36.10)	Comments
20	DN15	DN15	
25	DN20	DN20	
32	DN25	DN25	
40	DN32	DN32	DN32 is Non-Preferred Size
50	DN40	DN40	
63	DN50	DN50	
75	DN65	DN65	DN65 is Non-Preferred Size
90	DN80	DN80	
110	DN100	DN100	
125	DN125	DN125	
140	DN125	DN125	DN125 is Non-Preferred Size
160	DN150	DN150	
200	DN200	DN200	
225	DN200	DN200	
250	DN250	DN250	
280	DN250	DN250	
315	DN300	DN300 & DN250	
355	DN350	DN350 & DN300	
400	DN400	DN400 & DN350	
450	DN450	DN450 & DN400	
500	DN500	DN500 & DN550	

PIPING CLASS P1/12.5/E

DESIGN CONDITION:	Temperature: 20 30 40 50 60 °C Pressure: 1250 1090 940 810 700 kPa (g) Test Pressure: 1700 kPa (g) hydrostatic @ 17-25 deg C			
CODE	FLANGES	MATERIAL	CORROSION ALLOWANCE	
	Table E	High Density Polyethylene PE100	Not Applicable	
	PIPE SIZE (Note 13)	DESCRIPTION	MATERIAL SPECIFICATION	DIMENSIONAL SPECIFICATION
PIPE (Note 1)	20 - 800	Polyethylene, PE100, PN12.5 (SDR 13.6)	AS 4131	AS 4130
COUPLINGS (Note 15)	20 - 110	Polyethylene metric compression fittings or butt fusion weld		AS 4129
	125 - 800	Butt fusion weld pipe		
FITTINGS (Note 2, 3, 7, 10, 12, 15)	20 - 110	Polyethylene metric compression fittings or butt fusion welded, PE100, Plain Ends		
	125 - 800	Butt Fusion Welded, PE100, Plain Ends		
FLANGES (Notes 6, 13)	63 & Larger	Polyethylene stub flange, butt weld, c/w Table E Galv Backing Ring		AS 2129
GASKETS (Note 8)	All Flanges	1.5 mm thk, Non-Asbestos Fibre, Ring Type, Klingersil C4430 or Equiv.		
BOLTING (Note 4)	All Flanges	Hex machine bolts; metric thread or metric studbolts	AS 1111, Gr 4.6	AS 2528
		Hexagonal nuts; metric thread	AS 1112, Gr.5	AS 2528
BRANCHES	All	Refer Piping Class P1/12.5/E Branch Connection Table		
TESTING	All	100% Visual and Hydrotest		

Notes:

1. Exposed above ground sections shall be de-rated according to the manufacturer's recommendations or supplied as co-extruded white material if specified on the drawings.
2. Transition Pieces: 6° included angle for discharge lines, 10 to 12° included angle for suction lines.
3. Not Used.
4. All bolting to be hot dipped galvanised to AS 1214. Loctite Nevasieze or approved equal to be used.
5. Not Used.
6. In slurry service, pipe flange spacing shall not exceed 20 metres, except in tailings lines where the maximum spacing for flanges or other connector types shall not exceed 80 metres.
7. For slurry piping, long radius sweep bends (min 3D) shall be used. Elbows are not permitted.
8. For dilute Sulphuric Acid service 1.5mm Klinger SIL C8200 or Garlock Gylon 3545 gasket shall be used, and for HCl acid service, 3mm EPDM gasket shall be used.
9. All buried pipe joints shall be Butt Fusion Welded or Electro-Fusion Welded. Coiled small bore pipes are acceptable up to 110 mm OD to reduce the number of joints required.
10. Pipe fittings that include any brass components are not permitted.
11. Not Used.

12. The use of compression joiners and fittings shall be limited to water services, for pipe sizes up to and including 110 mm OD.
13. Pipe size refers to the outside diameter of the pipe in mm. For corresponding flange sizes and equivalent steel pipe sizes refer to table below.
14. Maintain Pipe PN Rating for all Fittings.
15. Compression Fittings rated PN16 up to 63 mm OD, PN12.5 for 75 mm – 110 mm OD.
16. Victaulic Style 77 clamps are PN8 pressure rating only and must not be used with PN12.5 system.
17. For Butterfly Valves, include MDPE spacer rings.

PIPE SIZE EQUIVALENTS

PE Pipe OD (mm)	AS 2129 Table E Flange Size	Equiv. Steel Pipe Size (ANSI B36.10)	Comments
20	DN15	DN15	
25	DN20	DN20	
32	DN25	DN25	
40	DN32	DN32	DN32 is Non-Preferred Size
50	DN40	DN40	
63	DN50	DN50	
75	DN65	DN65	DN65 is Non-Preferred Size
90	DN80	DN80	
110	DN100	DN100	
125	DN125	DN125	
140	DN125	DN125	DN125 is Non-Preferred Size
160	DN150	DN150	
200	DN200	DN200	
225	DN200	DN200	
250	DN250	DN250	
280	DN250	DN250	
315	DN300	DN300 & DN250	
355	DN350	DN350 & DN300	
400	DN400	DN400 & DN350	
450	DN450	DN450 & DN400	
500	DN500	DN500 & DN550	

PIPING CLASS SC1/E

MAXIMUM DESIGN CONDITIONS:	Temperature: 20-100°C			
	Pressure: 750 kPag (Note 11 for air)			
	Test Pressure: 1125 kPag hydrostatic			
CODE	FLANGES	MATERIAL	CORROSION ALLOWANCE	
AS 4041, Class 3	Table E, FF	Carbon Steel	DN15 – DN50, c = 1 mm DN65 – DN400, c = 3 mm (Note 12)	
	SIZE	DESCRIPTION	MATERIAL SPECIFICATION	DIMENSIONAL SPECIFICATION
PIPE (Note 8, 9)	DN 15-50	Carbon Steel, SMLS; XS; threaded and coupled	API 5L GR B ASTM A106B ASTM A53B	ANSI B36.10
	DN 65-80	Carbon Steel, SMLS; Std Wt; BE	API 5L GR B ASTM A106B ASTM A53B	ANSI B36.10
	DN 100-400	Carbon Steel, ERW; Std Wt; BE	API 5L GR B ASTM A106B ASTM A53B	ANSI B36.10
FITTINGS (Notes 1, 2)	DN 15-50	Forged; Class 3000; Threaded BSP	ASTM A105	ANSI B16.11
	DN 65-400	Forged or SMLS; Std Wt; BW	ASTM A234 WPB	ANSI B16.9 ANSI B16.28
'OLETS	DN 15-50	Forged; Class 3000; Threaded BSP	ASTM A105	ANSI B16.11
	DN 65-80	Forged; Std Wt; BW	ASTM A105	
FLANGES	DN 15-50	Carbon Steel, Forged, Threaded BSP, Table E, FF	ASTM A105	AS 2129
	DN 65 - 400	Carbon Steel, Plate or Forged, Table E, FFSO or WN	ASTM A105 AS 3678 Gr. 250	AS 2129
GASKETS (Note 10)	All	1.5 mm thk, Non-Asbestos Fibre, FF, Klingersil C4430 or Equiv.		
BOLTING (Note 3)	All	Hex machine bolts metric thread or metric studbolts	AS 1111 Gr 4.6	AS 2528
		Hex nuts; metric thread	AS 1112 Gr 5	AS 2528
BRANCHES	All	Refer Piping Class SC1/E Branch Connection Table		
TESTING		To AS 4041 Class 3 (100% Visual, No Hydrotest Required)		

Notes:

1. Thread seal tape is not permitted. A universal thread seal compound shall be used.
2. Welding ends bevelled to ANSI B16.25. Welding ends to suit pipe schedule.
3. All bolting to be hot dipped galvanised to AS 1214. Loctite Nevasieze or approved equal to be used.
4. Refer to valve data sheets for valve descriptions. Valve material selections vary with process solutions.
5. Where required, insulation shall be in accordance with Section 2.9 of this document..
6. Above ground piping to be painted and marked in accordance with Section 2.13 and 2.14 of this document.
7. Underground piping shall be protected in accordance with Section 2.12 of this document.
8. DN150 is maximum size allowable for Very Harmful Fluids - Liquid or Gas (AS 4041 Class 3 Construction).
9. This Pipe Spec (AS 4041 Class 3) is not to be used for Lethal Fluids - Liquid or Gas.
10. Check with gasket manufacturer for compatibility with chemicals other than hot water, steam, oils and hydrocarbons.
11. Pressure 1000 kPag for Compressed Air and Instrument Air
12. Corrosion allowance for Compressed and Instrument Air is 1 mm.

PIPING CLASS SC2/E

MAXIMUM DESIGN CONDITIONS:	Temperature: 20-100°C Pressure: 1400 kPag Test Pressure: 2100kPag hydrostatic			
CODE	FLANGES	MATERIAL	CORROSION ALLOWANCE	
AS 4041, Class 3	Table E, FF	Carbon Steel	DN15 – DN50, c = 1 mm DN65 – DN400, c = 3 mm	
	SIZE	DESCRIPTION	MATERIAL SPECIFICATION	DIMENSIONAL SPECIFICATION
(Note 7)	DN 15-50	Carbon Steel, SMLS; XS; PE	API 5L GR B ASTM A106B ASTM A53B	ANSI B36.10
	DN 65-80	Carbon Steel, SMLS; XS; BE	API 5L GR B ASTM A106B ASTM A53B	ANSI B36.10
	DN 100-400	Carbon Steel, ERW; XS; BE	API 5L GR B ASTM A106B ASTM A53B	ANSI B36.10
FITTINGS (Note 1)	DN 15-50	Forged; Class 3000; SW		
	DN 65-400	Forged or SMLS; XS; BW	ASTM A234 WPB	ANSI B16.9 ANSI B16.28
'OLETS	DN 15-50	Forged; Class 3000; SW	ASTM A105	ANSI B16.11
	DN 65-80	Forged; XS; BW	ASTM A105	
FLANGES	DN 15-50	Carbon Steel, Forged, SW, Table E, FF	ASTM A105	AS 2129
	DN 65 - 400	Carbon Steel, Plate or Forged, Table E, FF or WN	ASTM A105 AS 3678 Gr. 250	AS 2129
GASKETS (Note 8)	All	1.5 mm thk, Non-Asbestos Fibre, FF, Klingersil C4430 or Equiv.		
BOLTING (Note 2)	All	Hex machine bolts metric thread or metric studbolts	AS 1111 Gr 4.6	AS 2528
		Hex nuts; metric thread	AS 1112 Gr 5	AS 2528
BRANCHES	All	Refer Piping Class SC2/E Branch Connection Table		
TESTING	All	To AS 4041 Class 3 (100% Visual, No Hydrotest Required)		

Notes:

1. Welding ends bevelled to ANSI B16.25. Welding ends to suit pipe schedule.
2. All bolting to be hot dipped galvanised to AS 1214. Loctite Nevasieze or approved equal to be used.
3. Refer to valve data sheets for valve descriptions. Valve material selections vary with process solutions.
4. Where required, insulation shall be in accordance with Section 2.9 of this document.
5. Above ground piping to be painted and marked in accordance with Section 2.13 and 2.14 of this document.
6. Underground piping shall be protected in accordance with Section 2.12 of this document.
7. Check with gasket manufacturer for compatibility with chemicals other than hot water, steam, oils and hydrocarbons.
8. DN150 is maximum size allowable for Very Harmful Fluids - Liquid or Gas (AS 4041 Class 3 Construction).
9. This Pipe Spec (AS 4041 Class 3) is not to be used for Lethal Fluids - Liquid or Gas.

PIPING CLASS SC5/1

MAXIMUM DESIGN CONDITIONS:	Temperature: -29-100°C Pressure: 1770 kPag Test Pressure: 2655 kPag hydrostatic			
CODE	FLANGES	MATERIAL	CORROSION ALLOWANCE	
AS 4041, Class 2A	Class 150, RF	Carbon Steel	DN15 – DN50, c = 1 mm DN65 – DN400, c = 3 mm (Note 20)	
	SIZE	DESCRIPTION	MATERIAL SPECIFICATION	DIMENSIONAL SPECIFICATION
PIPE (Note 15)	DN 15-50	Carbon Steel, SMLS, XS, BE	API 5L GR B ASTM A106B ASTM A53B	ANSI B36.10
	DN 65 - 400	Carbon Steel, SMLS, XS, BE	API 5L GR B ASTM A106B ASTM A53B	ANSI B36.10
FITTINGS (Note 1)	DN 15-50	Carbon steel, SMLS, XS, BW	ASTM A234 WPB	ANSI B16.9
	DN 65 - 400	Carbon steel, SMLS, XS, BW	ASTM A234 WPB	ANSI B16.9
'OLETS	DN 15-50	Forged, XS, BW	ASTM A105	
	DN 65-80	Forged, XS, BW	ASTM A105	
FLANGES (Notes 5, 6, 11, 12)	All	Carbon Steel, Forged, 150#, XS, Raised Face, WN	ASTM A105	ANSI B16.5
GASKETS (Note 14)	All	1.5mm thk, Non-Asbestos Fibre, Klinger SIL C8200		
BOLTING (Note 2)	All	Metric Studbolts (Equiv to UNC Sizes for ANSI 150# Flanges)	ASTM A193 Gr B7	AS 2528
		Hex nuts; metric thread	ASTM A194 Gr 2H	AS 2528
BRANCHES	All	Refer Piping Class SC5/1 Branch Connection Table		
TESTING (Notes 9, 10)	All	To AS 4041 Class 2A (10% Radiographic NDT required, 100% Visual Inspection, Hydrostatic test)		

Notes:

1. Welding ends bevelled to ANSI B16.25. Welding ends to suit pipe schedule.
2. All bolting to be hot dipped galvanised to AS 1214. Loctite Nevasieze or approved equal to be used.
3. Refer to valve data sheets for valve descriptions. Valve material selections vary with process solutions.
4. Where required, insulation shall be in accordance with Section 2.9 of this document.
5. Flat face flanges shall be used for connection to flat face valves, flat face flanges on equipment and all non-metallic flanged connections.
6. Flat face flanges shall utilise full face gaskets.
7. Underground piping shall be protected in accordance with Section 2.12 of this document.
8. Above ground piping to be painted and marked in accordance with Section 2.13 and 2.14 of this document.
9. Natural gas and Sulphuric Acid lines shall have 100% Radiographic NDT (equivalent to AS 4041 Class 1 Construction).
10. Natural Gas and Sulphuric Acid piping to be thoroughly dried internally to the satisfaction of the engineer prior to use. Sulphuric Acid piping shall not be hydrostatically tested.

11. Natural Gas and Sulphuric Acid piping shall be fully welded to the maximum practical extent. The number of flange joints shall be minimised as far as is practical. Flanges should only be used at locations of valves and for terminal interfaces with equipment.
12. All Sulphuric Acid piping shall slope towards suitable drainage points. Long flat horizontal runs, dead legs and vertical pockets are not acceptable.
13. All flanges on Sulphuric Acid piping shall be protected by a flange spray guard of a type and make acceptable to the engineer.
14. Klinger SIL C8200 is specifically for sulphuric acid duty.
15. This Pipe Spec (AS 4041 Class 2A) is not to be used for Lethal Fluids - Liquid or Gas.
16. Natural Gas piping shall comply with AS 5601 and any other requirements of the regulator (DOCEP, Energy Safety Section - Gas). The regulator may request to review the piping design or request evidence of third party verification of the design before approving the installation for use.
17. The installation of Natural Gas piping shall be supervised by a licensed gas fitter who shall provide a notice of completion to the gas supplier, all as per the requirements of the regulator (DOCEP, Energy Safety Section – Gas).
18. Oxygen piping shall be pickled, passivated, capped and tagged oxygen service.
19. All welds of Sulphuric acid piping shall be stress relieved if velocity of sulphuric acid is greater than 0.6 m/sec. Should the design drawings not show that the design velocity is below 0.6 m/sec assume all the welds to be stress relieved.
20. For Natural gas corrosion allowance is 1 mm.

PIPING CLASS SC6/E

MAXIMUM DESIGN CONDITIONS:	Temperature: 20-100°C Pressure: 700 kPag & Full Vacuum Test Pressure: 1050kPag hydrostatic			
CODE	FLANGES	MATERIAL	CORROSION ALLOWANCE	
AS 4041, Class 3	Table E, FF	Carbon Steel	3 mm	
	SIZE	DESCRIPTION	MATERIAL SPECIFICATION	DIMENSIONAL SPECIFICATION
PIPE (Notes 8, 9)	DN 65-80	Carbon Steel, SMLS; XS; BE	API 5L GR B ASTM A106B ASTM A53B	ANSI B36.10
	DN 100-600	Carbon Steel, ERW; XS; BE	API 5L GR B ASTM A106B ASTM A53B	ANSI B36.10
FITTINGS (Notes 1, 2, 11, 12)	DN 65-400	Forged or SMLS; XS; BW	ASTM A234 WPB	ANSI B16.9 ANSI B16.28
	DN 450-600	Welded; XS; BW	API 5L GR B ASTM A106B ASTM A53B	ANSI B16.9 ANSI B16.28
FLANGES	DN 65 - 600	Carbon Steel, Plate or Forged, Table E, FFSO or WN	ASTM A105 AS 3678 Gr. 250	AS 2129
GASKETS (Note 10)	All	1.5 mm thk, Non-Asbestos Fibre, FF, Klingsil C4430 or Equiv.		
BOLTING (Note 3)	All	Hex machine bolts metric thread or metric studbolts	AS 1111 Gr 4.6	AS 2528
		Hex nuts; metric thread	AS 1112 Gr 5	AS 2528
BRANCH CONNECTIONS		Refer Piping Class SC6/E Branch Connection Table		
INSPECTION / TESTING REQ.		To AS 4041 Class 3 (100% Visual Inspection, No Hydrotest)		

Notes:

1. Thread seal tape is not permitted. A universal thread seal compound shall be used.
2. Welding ends bevelled to ANSI B16.25. Welding ends to suit pipe schedule.
3. All bolting to be hot dipped galvanised to AS 1214. Loctite Nevasieze or approved equal to be used.
4. Refer to valve data sheets for valve descriptions. Valve material selections vary with process solutions.
5. Where required, insulation shall be in accordance with Section 2.9 of this document.
6. Underground piping shall be protected in accordance with Section 2.12 of this document.
7. Above ground piping to be painted and marked in accordance with Section 2.13 and 2.14 of this document.
8. DN150 is maximum size allowable for Very Harmful Fluids – Liquid or Gas (AS 4041 Class 3 Construction).
9. This Pipe Spec (AS 4041 Class 3) is not to be used for Lethal Fluids – Liquid or Gas.
10. Check with gasket manufacturer for compatibility with chemicals other than hot water, steam, oils and hydrocarbons.
11. Sweep Bends on pneumatic conveying lines shall have a minimum radius of 10D.
12. Bends in positive pressure pneumatic conveying systems shall be “boxed bends” with DN10 tapped hole (threaded and plugged) in the outer casing.

PIPING CLASS SG1/E

MAXIMUM DESIGN CONDITIONS:	Temperature: 20-100°C Pressure: 750 kPag Test Pressure: 1120kPag hydrostatic			
CODE	FLANGES	MATERIAL	CORROSION ALLOWANCE	
AS 4041, Class 3	Table E, FF	Galvanised Carbon Steel	Nil	
	SIZE	DESCRIPTION	MATERIAL SPECIFICATION	DIMENSIONAL SPECIFICATION
(Notes 8, 9)	DN 15-50	Carbon Steel, Galvanised, SMLS; XS	API 5L GR B ASTM A106B ASTM A53B	ANSI B36.10
	DN 65-80	Carbon Steel, SMLS; Std Wt; BE	API 5L GR B ASTM A106B ASTM A53B	ANSI B36.10
	DN 100-600	Carbon Steel, ERW; Std Wt; BE	API 5L GR B ASTM A106B ASTM A53B	ANSI B36.10
FITTINGS (Notes 1, 2)	DN 15-50	Forged; Class 3000; Galvanised, Threaded BSP	ASTM A105	ANSI B16.11
	DN 65-400	Forged or SMLS; Std Wt; BW	ASTM A234 WPB	ANSI B16.9 ANSI B16.28
	DN 450-600	Welded; Std Wt; BW	API 5L GR B ASTM A106B ASTM A53B	ANSI B16.9 ANSI B16.28
'OLETS	DN 15-50	Forged; Class 3000; Threaded BSP	ASTM A105	ANSI B16.11
	DN 65-80	Forged; Std Wt; BW	ASTM A105	
FLANGES	DN 15-50	Carbon Steel, Forged, Threaded BSP, Table E, FF	ASTM A105	AS 2129 AS 1722
	DN 65 - 600	Carbon Steel, Plate or Forged, Table E, FF, SO or WN	ASTM A105 AS 3678 Gr. 250	AS 2129
GASKETS (Note 10)	All	1.5 mm thk, Non-Asbestos Fibre, FF, Klingsil C4430 or Equiv.		
BOLTING (Note 3)	All	Hex machine bolts metric thread or metric studbolts	AS 1111 Gr 4.6	AS 2528
		Hex nuts; metric thread	AS 1112 Gr 5	AS 2528
BRANCHES	All	Refer Piping Class SG1/E Branch Connection Table		
TESTING		To AS 4041 Class 3 (100% Visual Inspection, No Hydrotest)		

Notes:

1. Thread seal tape is not permitted. A universal thread seal compound shall be used.
2. Welding ends bevelled to ANSI B16.25. Welding ends to suit pipe schedule.
3. All bolting to be hot dipped galvanised to AS 1214. Loctite Nevasieze or approved equal to be used.
4. Refer to valve data sheets for valve descriptions. Valve material selections vary with process solutions.
5. Where required, insulation shall be in accordance with Section 2.9 of this document.
6. Above ground piping to be painted and marked in accordance with Section 2.13 and 2.14 of this document.
7. Underground piping shall be protected in accordance with Section 2.12 of this document.
8. DN150 is maximum size allowable for Very Harmful Fluids - Liquid or Gas (AS 4041 Class 3 Construction).
9. This Pipe Spec (AS 4041 Class 3) is not to be used for Lethal Fluids - Liquid or Gas.
10. Check with gasket manufacturer for compatibility with chemicals other than hot water, steam, oils & hydrocarbons.

PIPING CLASS SR1/E

MAXIMUM DESIGN CONDITIONS:	Temperature: 20-50°C Pressure: 1400 kPag Test Pressure: 2100kPag hydrostatic			
CODE	FLANGES	MATERIAL	CORROSION ALLOWANCE	
AS 4041, Class 3	Table E, FF	Natural Rubber Lined Carbon Steel	Nil	
	SIZE	DESCRIPTION	MATERIAL SPECIFICATION	DIMENSIONAL SPECIFICATION
PIPE (Notes 1, 14, 15)	DN 80 - DN600	Carbon Steel, Std Wt; ERW; bevel ends, lined with 6mm thick natural rubber	API 5L GR B ASTM A106B ASTM A53B	ANSI B36.10
FITTINGS (Notes 4, 9)	DN 80 - DN600	Carbon steel, Std Wt; butt weld, lined with 6mm thick natural rubber	ASTM A234 WPB	ANSI B16.9
FLANGES (Notes 2, 3)	DN 80 - DN600	Carbon Steel, Plate or Forged, Table E, FFSSO or FFWN, bore to be lined with 6mm thick natural rubber, flange face to be lined with 3mm thick natural rubber	ASTM A105 AS 3678 Gr. 250	AS 2129
GASKETS	All	See note 7		
BOLTING (Note 6)	All	Hex machine bolts metric thread or metric studbolts	AS 1111 Gr 4.6	AS 2528
		Hex nuts; metric thread	AS 1112 Gr 5	AS 2528
BRANCHES	All	Refer Piping Class SR1/E Branch Connection Table		
TESTING		100% Visual Inspection		

Notes:

1. Straight spools shall be fabricated in standard flanged lengths of 6000 mm, face to face unless otherwise indicated on drawings.
2. Pipe lining thickness to be 6mm. The pipe lining shall extend over the face of the flange. The flange face cover thickness for all line sizes shall be 3 mm. The compressed thickness of flange face cover lining after bolt-up shall be 60% of nominal thickness.
3. FF flanges shall be used.
4. Equal tees shall be preferred UON. Fabricated offset tees shall be used for slurry service
5. Refer to valve data sheets for valve descriptions. Valve material selections vary with process slurries and solutions.
6. All bolting to be hot dipped galvanised to AS 1214. Loctite Nevasieze or approved equal to be used.
7. Gaskets are not normally required for rubber lined flanged joints. However, where flanged joints are frequently dismantled use 1.5mm PTFE gaskets to avoid cold sticking of rubber lining on face of flanges.
8. Spacer rings normally required both sides of butterfly valves to allow full disc rotation.
9. Bends, where specified on the drawings, shall be hot formed sweep bends, 3D minimum radius, flanged and rubber lined.
10. All branch connections shall be flanged.
11. All interior welds shall be ground smooth for rubber lining.
12. Pipe shall be prepared for rubber lining by removing all oil and grease, dry abrasive blasted to a near white finish and primed within 24 hours in accordance with the lining manufacturer's standards.
13. Lining shall be applied to provide an uninterrupted seal over the entire surface such that no air is trapped between the lining and the pipe wall and a continuous bond exists between them. Air pockets shall be removed in an approved manner compatible with retaining the full integrity of the lining.
14. DN150 is maximum size allowable for Very Harmful Fluids - Liquid or Gas (AS 4041 Class 3 Construction).
15. This Pipe Spec (AS 4041 Class 3) is not to be used for Lethal Fluids - Liquid or Gas.

PIPING CLASS SR2/E

MAXIMUM DESIGN CONDITIONS:	Temperature: 20-90°C Pressure: 1400 kPag Test Pressure: 2100kPag hydrostatic			
CODE	FLANGES	MATERIAL	CORROSION ALLOWANCE	
AS 4041, Class 3	Table E, FF	Butyl Rubber Lined Carbon Steel	Nil	
	SIZE	DESCRIPTION	MATERIAL SPECIFICATION	DIMENSIONAL SPECIFICATION
PIPE (Note 1, 14, 15)	DN 80 - DN600	Carbon Steel, Std Wt; ERW; bevel ends, lined with 3mm thick Butyl rubber	API 5L GR B ASTM A106B ASTM A53B	ANSI B36.10
FITTINGS (Notes 4, 9)	DN 80 – DN600	Carbon steel, Std Wt; butt weld, lined with 3mm thick butyl rubber	ASTM A234 WPB	ANSI B16.9
FLANGES (Notes 2, 3)	DN 80 - DN600	Carbon Steel, Plate or Forged, Table E, FFSSO or FFWN, bore to be lined with 3mm thick butyl rubber, flange face to be lined with 3mm thick butyl rubber	ASTM A105 AS 3678 Gr. 250	AS 2129
GASKETS	All	See note 7		
BOLTING (Note 6)	All	Hex machine bolts metric thread or metric studbolts	AS 1111 Gr4.6	AS 2528
		Hex nuts; metric thread	AS 1112 Gr 5	AS 2528
BRANCHES	All	Refer Piping Class SR2/E Branch Connection Table		
TESTING		100% Visual Inspection		

Notes:

1. Straight spools shall be fabricated in standard flanged lengths of 6000 mm, face to face unless otherwise indicated on drawings.
2. Pipe lining thickness to be 3mm. The pipe lining shall extend over the face of the flange. The flange face cover thickness for all line sizes shall be 3 mm. The compressed thickness of flange face cover lining after bolt-up shall be 60% of nominal thickness.
3. FF flanges shall be used.
4. Equal tees shall be preferred UON. Fabricated offset tees shall be used for slurry service
5. Refer to valve data sheets for valve descriptions. Valve material selections vary with process slurries and solutions.
6. All bolting to be hot dipped galvanised to AS 1214. Loctite Nevasieze or approved equal to be used.
7. Gaskets are not normally required for rubber lined flanged joints. However, where flanged joints are frequently dismantled use 1.5mm PTFE gaskets to avoid cold sticking of rubber on face of flanges..
8. Spacer rings normally required both sides of butterfly valves to allow full disc rotation.
9. Bends, where specified on the drawings, shall be hot formed sweep bends, 3D minimum radius, flanged and rubber lined.
10. All branch connections shall be flanged.
11. All interior welds shall be ground smooth for rubber lining.
12. Pipe shall be prepared for rubber lining by removing all oil and grease, dry abrasive blasted to a near white finish and primed within 24 hours in accordance with the lining manufacturer's standards.
13. Lining shall be applied to provide an uninterrupted seal over the entire surface such that no air is trapped between the lining and the pipe wall and a continuous bond exists between them. Air pockets shall be removed in an approved manner compatible with retaining the full integrity of the lining.
14. DN150 is maximum size allowable for Very Harmful Fluids - Liquid or Gas (AS 4041 Class 3 Construction).
15. This Pipe Spec (AS 4041 Class 3) is not to be used for Lethal Fluids - Liquid or Gas.

PIPING CLASS SS1/E

MAXIMUM DESIGN CONDITIONS:	Temperature: 20-120°C Pressure: 700 kPag Test Pressure: 1050kPag hydrostatic			
CODE	FLANGES	MATERIAL	CORROSION ALLOWANCE	
AS 4041, Class 3	Table E, FF	Stainless Steel (Gr 304)	Nil	
	SIZE	DESCRIPTION	MATERIAL SPECIFICATION	DIMENSIONAL SPECIFICATION
PIPE (Notes 6, 7)	DN 15-50	Stainless steel, Grade 304L, Sch 10s, seamless, plain ends	ASTM A312 GR TP 304L	ANSI B36.19
	DN 65 - DN600	Stainless steel, Grade 304L, Sch 10s, ERW, bevel ends	ASTM A312 GR TP 304L	ANSI B36.19
FITTINGS	DN 15-50	Stainless steel, 3000# Grade 304L, socket weld	ASTM A182 GR F 304L	ANSI B16.11
	DN 65 - DN600	Stainless steel, Grade 304L, Sch 10s, butt weld	ASTM A403 GR WP 304L	ANSI B16.9
'OLETS	DN15 - 50	Sockolet, Forged Class 3000#	ASTM A182 GR F 316L	
FLANGES (Notes 1, 2)	DN 15 - DN600	Stainless steel, Grade 304L, flat face slip on plate, Table E	ASTM A312 GR F 304L	AS2129
GASKETS (Note 4)	All	1.5 mm thk, Non-Asbestos Fibre, Full Face, Klingersil C4430 or Equiv.		
BOLTING (Note 5)	All	Hex machine bolts, stud bolts & nuts, metric thread	AS 1444 Gr 304	AS 2528
BRANCHES	All	Refer Piping Class SS1/E Branch Connection Table		
TESTING		To AS 4041 Class 3 (100% Visual Inspection, No Hydrotest)		

Notes:

1. Blind, slip-on (SO) or weld neck (WN) flanges. SO flanges shall be used as preference.
2. WN Flanges shall be used against BW fittings only.
3. Welding ends bevelled to ANSI/ASME B16.25. Welding ends to suit pipe schedule.
4. Gasket material shall be chemically compatible for service.
5. Loctite Nevasieze or approved equal to be used.
6. DN150 is maximum size allowable for Very Harmful Fluids - Liquid or Gas (AS 4041 Class 3 Construction).
7. This Pipe Spec (AS 4041 Class 3) is not to be used for Lethal Fluids - Liquid or Gas.

PIPING CLASS SS2/E

MAXIMUM DESIGN CONDITIONS:	Temperature: 20-120°C Pressure: 700 kPag Test Pressure: 1050kPag hydrostatic			
CODE	FLANGES	MATERIAL	CORROSION ALLOWANCE	
AS 4041, Class 3	Table E, FF	Stainless Steel (Gr 316)	Nil	
	SIZE	DESCRIPTION	MATERIAL SPECIFICATION	DIMENSIONAL SPECIFICATION
PIPE (Notes 6, 7)	DN 15-50	Stainless steel, Grade 316L, Sch 10s, seamless, plain ends	ASTM A312 GR TP 316L	ANSI B36.19
	DN 65 - DN600	Stainless steel, Grade 316L, Sch 10s, ERW, bevel ends	ASTM A312 GR TP 316L	ANSI B36.19
FITTINGS	DN 15-50	Stainless steel, 3000# Grade 316L, socket weld	ASTM A182 GR F 316L	ANSI B16.11
	DN 65 – DN600	Stainless steel, Grade 316L, Sch 10s, butt weld	ASTM A403 GR WP 316L	ANSI B16.9
'OLETS	DN15 - 50	Socket Forged Class 300#	ASTM A182 GR F 316L	
FLANGES (Notes 1, 2)	DN 15 - DN600	Stainless steel, Grade 316L, flat face slip on plate, Table E	ASTM A312 GR F 316L	AS2129
GASKETS (Note 4)	All	1.5 mm thk, Non-Asbestos Fibre, Full Face, Klingersil C4430 or Equiv.		
BOLTING (Note 5)	All	Hex machine bolts, stud bolts & nuts, metric thread	AS 1444 Gr316	AS 2528
BRANCH CONNECTIONS	All	Refer Piping Class SS2/E Branch Connection Table		
INSPECTION / TESTING REQ.		To AS 4041 Class 3 (100% Visual Inspection, No Hydrotest)		

Notes:

1. Blind, slip-on (SO) or weld neck (WN) flanges. SO flanges shall be used as preference.
2. WN Flanges shall be used against BW fittings only.
3. Welding ends bevelled to ANSI/ASME B 16.25. Welding ends to suit pipe schedule.
4. Gasket material shall be chemically compatible for service.
5. Loctite Nevasieze or approved equal to be used.
6. DN150 is maximum size allowable for Very Harmful Fluids - Liquid or Gas (AS 4041 Class 3 Construction).
7. This Pipe Spec (AS 4041 Class 3) is not to be used for Lethal Fluids - Liquid or Gas.
8. Demineralised Water piping weld joints shall be passivated.

APPENDIX B: BRANCH CONNECTION TABLES

PIPING CLASS P1/6.3/E, P1/8/E, P1/10/E, P1/12.5/E

		BRANCH SIZES																	
		25	32	40	50	63	90	110	125	140	160	200	225	250	280	315	355	400	450
H E A D E R S I Z E S	450	D	D	D	D	C	B	B	C	C	B	B	B	B	B	C	C	A	
	400	D	D	D	D	C	B	B	C	C	B	B	B	B	C	C	A		
	355	D	D	D	D	C	B	B	C	C	B	B	B	B	C	C	A		
	315	D	D	D	D	C	B	B	C	C	B	B	C	C	C	A			
	280	D	D	D	D	C	B	B	C	C	B	B	C	C	A				
	250	D	D	D	D	C	B	B	C	C	B	C	C	A					
	225	D	D	D	D	C	B	B	B	C	B	C	A						
	200	D	D	D	D	B	B	B	B	C	B	A							
	160	D	D	D	D	B	B	B	B	C	A								
	140	D	D	D	D	B	B	B	C	A									
	125	D	D	D	D	B	B	C	A										
	110	D	B	D	B	B	C	A											
	90	C	B	D	B	B	A												
	63	C	B	B	B	A													
	50	B	B	B	A														
	40	C	B	A															
	32	B	A																
	25	A																	

Branch Connection Table
Legend:

- A: - Equal Tee
- B: - Reducing Tee
- C: - Equal or Reducing Tee with Reducer
- D: - Tapping Saddle

Notes:

1. Compressions fittings are permitted up to and including PN10 only.
2. Tapping saddles may be used as an alternative for branches up to and including DN 50 for header sizes DN110 and up.
3. BW Tees of moulded or pulled type are preferred, fabricated tees shall only be used when others are not available.

PIPING CLASS SC1/E, SC2/E

		BRANCH SIZES																	
		15	20	25	40	50	65	80	100	125	150	200	250	300	350	400	450	500	600
H E A D E R S I Z E S	600	C	C	C	C	C	D	D	S	S	S	S	S	S	S	S	B	B	A
	500	C	C	C	C	C	D	D	S	S	S	S	S	S	S	B	B	A	
	450	C	C	C	C	C	D	D	S	S	S	S	S	S	B	B	A		
	400	C	C	C	C	C	D	D	S	S	S	S	S	B	B	A			
	350	C	C	C	C	C	D	D	S	S	S	S	B	B	A				
	300	C	C	C	C	C	D	D	S	S	S	B	B	A					
	250	C	C	C	C	C	D	D	S	S	B	B	A						
	200	C	C	C	C	C	D	D	S	B	B	A							
	150	C	C	C	C	C	D	D	B	B	A								
	125	C	C	C	C	C	D	B	B	A									
	100	C	C	C	C	C	B	B	A										
	80	C	C	C	C	C	B	A											
	65	C	C	C	C	C	A												
	50	E	E	B	B	A													
	40	B	B	B	A														
	25	B	B	A															
	20	B	A																
	15	A																	

Branch Connection Table

Legend:

- A: - Equal Tee
- B: - Reducing Tee
- C: - Thredolet / Coupling
- D: - Weldolet
- E: - Tee and Reducer to required size
- S: - Stub-in, pipe to pipe connection

Notes:

1. All stub-in connections shall be checked for reinforcement by the engineer in accordance with the pressure design requirements of AS 4041, and reinforcement shall be provided where found necessary.
2. Reducing Tees are acceptable in lieu of Weldolets for buttweld fittings.

PIPING CLASS SC5/1

		BRANCH SIZES														
		15	20	25	40	50	80	65	100	125	150	200	250	300	350	400
H E A D E R S I Z E S	400	C	C	C	C	C	S	S	S	S	S	S	S	B	B	A
	350	C	C	C	C	C	S	S	S	S	S	S	B	B	A	
	300	C	C	C	C	C	S	S	S	S	S	B	B	A		
	250	C	C	C	C	C	S	S	S	S	B	B	A			
	200	C	C	C	C	C	S	S	B	B	B	A				
	150	C	C	C	C	C	B	B	B	B	A					
	125	C	C	C	C	C	B	B	B	A						
	100	C	C	C	C	B	B	B	A							
	80	C	C	C	B	B	B	A								
	65	C	C	C	B	B	A									
	50	C	C	B	B	A										
	40	B	B	B	A											
	25	B	B	A												
	20	B	A													
	15	A														

Branch Connection Table

Legend:	
A:	- Equal Tee
B:	- Reducing Tee
C:	- Weldolet
S:	- Stub-in, pipe to pipe connection

Notes:

1. All stub-in connections shall be checked in accordance with the pressure design requirements of AS4041, and reinforcement shall be provided where found necessary.
2. Weldolets are acceptable in lieu of reducing tees for butt-weld fittings.

PIPING CLASS SG1/E

		BRANCH SIZES																	
		15	20	25	40	50	65	80	100	125	150	200	250	300	350	400	450	500	600
H E A D E R S I Z E S	600	C	C	C	C	C	D	D	S	S	S	S	S	S	S	B	B	B	A
	500	C	C	C	C	C	D	D	S	S	S	S	S	S	B	B	B	A	
	450	C	C	C	C	C	D	D	S	S	S	S	S	B	B	B	A		
	400	C	C	C	C	C	D	D	S	S	S	S	B	B	B	A			
	350	C	C	C	C	C	D	D	S	S	S	B	B	B	A				
	300	C	C	C	C	C	D	D	S	S	S	B	B	A					
	250	C	C	C	C	C	D	D	S	S	B	B	A						
	200	C	C	C	C	C	D	D	B	B	B	A							
	150	C	C	C	C	C	D	D	B	B	A								
	125	C	C	C	C	C	D	B	B	A									
	100	C	C	C	C	C	B	B	A										
	80	C	C	C	C	C	B	A											
	65	C	C	C	C	C	A												
	50	E	E	B	B	A													
	40	B	B	B	A														
	25	B	B	A															
	20	B	A																
15	A																		

Branch Connection Table

Legend:

- A: - Equal Tee
- B: - Reducing Tee
- C: - Thredolet / Coupling
- D: - Weldolet
- E: - Tee and Reducer to required size
- S: - Stub-in, pipe to pipe connection

Notes:

1. All stub-in connections shall be checked in accordance with the pressure design requirements of AS4041, and reinforcement shall be provided where found necessary.

PIPING CLASS SR1/E, SR2/E

		BRANCH SIZES																		
		15	20	25	40	50	80	100	150	200	250	300	350	400	450	500	600	650	700	750
H E A D E R S I Z E S	750																	B	B	A
	700																	B	B	A
	650																B	B	A	
	600														B	B	A			
	500													B	B	A				
	450												B	B	A					
	400											B	B	A						
	350										B	B	A							
	300									B	B	A								
	250								B	B	A									
	200							B	B	A										
	150						B	B	A											
	100					B	A													
	80				A															
	50																			
	40																			
	25																			
	20																			
15																				

Branch Connection Table

Legend:

- A: - Equal Tee
- B: - Reducing Tee
- C: - Thredolet / Coupling
- D: - Weldolet
- E: - Equal Tee and Reducer to required size
- S: - Stub-in, pipe to pipe connection

Notes:

PIPING CLASS SS1/E, SS2/E

		BRANCH SIZES																	
		15	20	25	40	50	65	80	100	125	150	200	250	300	350	400	450	500	600
H	600	C	C	C	C	C	S	S	S	S	S	S	S	S	S	S	B	B	A
	E	500	C	C	C	C	C	S	S	S	S	S	S	S	S	B	B	A	
A	450	C	C	C	C	C	S	S	S	S	S	S	S	S	B	B	A		
D	400	C	C	C	C	C	S	S	S	S	S	S	S	B	B	A			
E	350	C	C	C	C	C	S	S	S	S	S	S	B	B	A				
R	300	C	C	C	C	C	S	S	S	S	S	B	B	A					
	250	C	C	C	C	C	S	S	S	S	S	B	A						
S	200	C	C	C	C	C	S	S	S	B	B	A							
I	150	C	C	C	C	C	S	S	B	B	A								
Z	125	C	C	C	C	C	S	B	B	A									
E	100	C	C	C	C	C	B	B	A										
S	80	C	C	C	C	B	B	A											
	65	C	C	C	B	B	A												
	50	C	C	C	B	A													
	40	B	B	B	A														
	25	B	B	A															
	20	B	A																
	15	A																	

Branch Connection Table

Legend:

- A: - Equal Tee
- B: - Reducing Tee
- C: - Sockolet / Coupling
- D: - Weldolet
- E: - Equal Tee and Reducer to required size
- S: - Stub-in, pipe to pipe connection

Notes:

1. All stub-in connections shall be checked in accordance with the pressure design requirements of AS4041, and reinforcement shall be provided where found necessary.

APPENDIX C: VALVE TYPES

V11XX - BUTTERFLY VALVES

Valve Type Number	V1120	V1121	V1122	V1123
Valve Type	Butterfly	Butterfly	Butterfly	Butterfly
Body Rating	1600 kPa @ 120°C	1600 kPa @ 120°C	1000 kPa @ 120°C	500 kPa @ 120°C
Shut-Off Rating	1000 kPa	1000 kPa	700 kPa	500 kPa
End Connections/ Rating	Fully Lugged Body, Drilled and Tapped Table E	Wafer Type Table E (Un-lugged, Body Locating Holes Only)	Wafer Type Table E (Un-lugged, Body Locating Holes Only)	Wafer Type Table E (Un-lugged, Body Locating Holes Only)
Body Material	Ductile Iron	Ductile Iron	Cast Iron	Cast Iron
Seat Material	EPDM	EPDM	EPDM	EPDM
Disc	Ductile Iron, ENP Coated	Ductile Iron, ENP Coated	Carbon Steel, EPDM Coated	Carbon Steel, EPDM Coated
Bonnet and Gland	N.A.	N.A.	N.A.	N.A.
Stem	Stainless Steel TP316	Stainless Steel TP316	Stainless Steel TP316	Stainless Steel TP316
Bonnet Gasket	N.A.	N.A.	N.A.	N.A.
Gland Packing	Polyester Shaft Bush, Buna N Seat	Polyester Shaft Bush, Buna N Seat	Acetal Shaft Bush, Buna N Seal	Acetal Shaft Bush, Buna N Seal
Cover	N.A.	N.A.	N.A.	N.A.
Size Range	DN 50 – 300	DN 50 – 350	DN 50 – 300	DN 350 – 500
Operators	Lever (DN40-200) G/box (DN 250-300)	Lever (DN40-200) G/box (DN250-350)	Lever (DN50-200) G/box (DN250-300)	G/box (DN350-500)
Special Features	Not suitable for hydrocarbon	Not suitable for hydrocarbon	Not suitable for hydrocarbon	Not suitable for hydrocarbon
Make/ Figure No.	Keystone F612- DYE2-AE (or equiv)	Keystone F611- DYE2-AE (or equiv)	Keystone F990- CZE2-AE (or equiv)	Keystone F990- CZE2-AE (or equiv)

V12XX - GATE VALVES

Valve Type Number	V1201	V1222	V1232	
Valve Type	Gate Valve – Inside Screw, Non Rising Stem	Gate Valve – Inside Screw, Non Rising Stem	Gate Valve OS&Y for Fire Main	
Body Rating				
Shut-Off Rating	1600 kPa WOG	1600 kPa WOG	2,400kPa	
End Connections/ Rating	BSPP, Female	Flanged Ends, Table E	Flanged Ends table E	
Body Material	Forged Brass	Ductile Iron	Cast Iron	
Seat Material	Brass	Gunmetal		
Disc	Forged Brass	Gunmetal or Ductile Iron	EPDM encapsulated resilient wedge	
Bonnet and Gland	Forged Brass	Ductile Iron	Cast Iron	
Stem	Forged Brass	A431 Stainless		
Bonnet Gasket		EPDM		
Gland Packing	PTFE	Nitrile Rubber O-Ring		
Cover				
Size Range	DN15 – 50	DN80 - 300	DN65 - 300	
Operators	Handwheel	Handwheel	Handwheel	
Special Features			Valves to be locked open	
Make/ Figure No.	Turnflo Fig BGA	Tyco – Fig 600	Tyco fig 172 flanged	

V13XX - BALL VALVES

Valve Type Number	V1301	V1302	V1304	V1305
Valve Type	Ball – Full Port	Ball – Reduced Port	Ball – Reduced Port	Ball – Full Port
Body Rating	4900 kPa WOG 1000 kPa (Sat. Steam)	4900 kPa WOG 1000 kPa (Sat. Steam)	4900 kPa WOG 1000 kPa (Sat. Steam)	4900 kPa WOG 1000 kPa (Sat. Steam)
Shut-Off Pressure				
End Connections	BSPT Female	BSPT Female	BSPT Female	BSPT Female
Body Material	A108 Carbon Steel	A108 Carbon Steel	Stainless Steel TP 316	Stainless Steel TP 316
Seat Material	Teflon	Teflon	Teflon	Teflon
Ball	Stainless Steel TP 316	Stainless Steel TP 316	Stainless Steel TP 316	Stainless Steel TP 316
Bonnet and Gland				
Stem	Stainless Steel TP 316	Stainless Steel TP 316	Stainless Steel TP 316	Stainless Steel TP 316
Bonnet Gasket				
Gland Packing				
Cover				
Size Range	DN 15 – 50	DN 15 – 50	DN 15 – 50	DN 15 – 50
Operators	Lever	Lever	Lever	Lever
Special Features				
Make/Figure No.	Gemini 96 (or equivalent)	Gemini 76 (or equivalent)	Gemini 76 (or equivalent)	Gemini 96 (or equivalent)

V13XX - BALL VALVES (continued)

Valve Type Number	V1311	V1312	V1313	V1314
Valve Type	Ball – Three Piece Full Port	Ball – Three Piece Full Port	Ball – Full Port	Ball – Full Port
Body Rating	7000 kPa @ 38°C	7000 kPa @ 38°C	1,000 kPa (Sat. Steam) 1600 kPa WOG	1,000 kPa (Sat. Steam) 1600 kPa WOG
Shut-Off Rating				
End Connections	ANSI B16.11 Socket Weld Ends	ANSI B16.11 Socket Weld One End/ Screw BSP Other End	Flanged Ends, Table E Drilling	Flanged Ends, Table E Drilling
Body Material	Stainless Steel TP 316	Stainless Steel TP 316	Carbon Steel ASTM A216 WCB	Stainless A351 CF8M
Seat Material	PTFE	PTFE	PTFE	PTFE
Ball	Stainless Steel TP 316	Stainless Steel TP 316	Stainless Steel TP 316	Stainless Steel A351 CF8M
Bonnet and Gland				
Stem	Stainless Steel TP 316	Stainless Steel TP 316	Stainless Steel TP 304	Stainless Steel TP 316
Bonnet Gasket				
Gland Packing				
Cover				
Size Range	DN 15 – 50	DN 15 – 50	DN 15 – 150	DN 15 – 150
Operators	Lever	Lever	Lever	Lever
Special Features			Table E Drilling (non-std)	Table E Drilling (non-std)
Make/Figure No.	Richards R392 (or equivalent)	Richards R392 (or equivalent)	Modentic MD 27 (or equivalent)	Modentic MD 27 (or equivalent)

V13XX & V23XX - BALL VALVES (continued)

Valve Type Number	V1323	V1328	V2302	V2303
Valve Type	Ball – Reduced Port	Ball – Reduced Port	Ball – Reduced Port	Ball – Reduced Port
Body Rating	To ASME B16.34 Class 150	To ANSI B16.34 Class 150	4900 kPa WOG 1000 kPa (Sat. Steam)	2,000 kPa @ 38°C
Shut-Off Rating				
End Connections	Flanged Ends, Table E Drilling	Flanged Ends, Table E	NPT Thread, Female	Flanged Ends, ANSI B16.5 150#
Body Material	Stainless A351 CF8M	Stainless Steel TP 316	Carbon Steel A108	Carbon Steel A216 WCC
Seat Material	PTFE	PTFE	PTFE	PTFE
Ball	Stainless Steel A351 CF8M	Stainless Steel TP 316	Stainless Steel TP 316	Stainless Steel TP 316
Bonnet and Gland				
Stem	Stainless Steel TP 316	Stainless Steel TP 316	Carbon Steel	Stainless Steel TP 316
Bonnet Gasket				
Gland Packing				
Cover				
Size Range	DN 15 – 300	DN 15 – 300	DN 15 – 50	DN 50 – 200
Operators	Lever	Lever	Lever	Lever
Special Features	Table E Drilling (non-std)	Table E Drilling (non-std)		Firesafe & Antistatic
Make/Figure No.	Modentic MD51 (or equivalent)	Modentic MD51 (or equivalent)	Gemini 76 (or equivalent)	Richards R711 (or equivalent)

V13XX & V23XX - BALL VALVES (continued)

Valve Type Number	V2309	V1330	V2304	
Valve Type	Ball – Reduced Port	V- Port	Ball – Full port	
Body Rating	1,900 kPa @ 38°C	4,000kPa @ 60°C	2000 kPa	
Shut-Off Rating				
End Connections	Flanged Ends, ANSI B16.5 150#	Wafer Style	Flanged ends ANSI B16.5 150#	
Body Material	Stainless Steel TP 316	Stainless Steel 316	Carbon Steel	
Seat Material	PTFE	PTFE	PTFE	
Ball	Stainless Steel TP 316	Stainless steel hard Chromed	Stainless Steel 316	
Bonnet and Gland		316 stainless steel		
Stem	Stainless Steel TP 316	316 stainless steel	Stainless Steel 316	
Bonnet Gasket				
Gland Packing		Graphite		
Cover				
Size Range	DN 50 – 200	Dn25 to 100	DN15 40	
Operators	Lever	Lever	Lever	
Special Features	Firesafe & Antistatic	Bolts between flanges	Firesafe and Antistatic	
Make/Figure No.	Richards R711 (or equivalent)	Richards Fig 565	Richards 721	

V14XX & V24XX- DIAPHRAGM VALVES & PINCH VALVES

Valve Type Number	V1423	V1425	V1432	V2404
Valve Type	Diaphragm; straight through type	Diaphragm; weir type	Pinch, Closed Body	Diaphragm; weir type
Pressure Rating	1000 kPa @ 55°C up to DN100 600 kPa @ 55°C for DN125 – DN150 350 kPa @ 55°C for DN200 – DN300 175 kPa @ 550°C for DN350	1600 kPa @ 60°C up to DN50 1000 kPa @ 60°C for DN65 – DN150 600 kPa @ 60°C for DN200 – DN350	1600 kPa @ 100°C (DN80 – 200)	1600 kPa @ 60°C up to DN50 1000 kPa @ 60°C for DN65 – DN150 600 kPa @ 60°C for DN200 – DN350
End Connections/ Rating	DN15-50 BSPF Threaded, Female DN 65-350 Table E Flanged	Table E Flange	Table E Flange	ANSI B16.5 150# Flange
Body Material	Cast Iron	Cast Iron Glass Lined	Cast Iron or Fabricated Carbon Steel	Cast Iron
Lining Material	Natural Rubber (DN15-50 threaded valves unlined)	Glass (1 mm Borosilicate Vitreous Enamel)	Butyl Rubber (100 °C Limit)	Natural Rubber
Diaphragm	Natural Rubber	Teflon Faced		Natural Rubber
Bonnet/Gland				
Stem				
Bonnet Gasket				
Gland Packing				
Cover				
Size Range	DN 15 - 350	DN 25 - 350	DN 25 – 200	DN 15 - 350
Operators	Rising stem (DN 15-150) Handwheel Non Rising stem (DN 200-350) Handwheel	Rising stem (DN 15-150) Handwheel Non Rising stem (DN 200-350) Handwheel	Non Rising stem (DN 50-200) Handwheel	Rising stem (DN 15-150) Handwheel Non Rising stem (DN 200-350) Handwheel
Special Features	Position Indicator	Position Indicator. This Valve Recommended For Sulphuric Acid Service.	16 Bar Sleeve. Opening Tags.	Position Indicator
Make/ Figure No.	Saunders Type KB (or equivalent)	Saunders Type A (or equivalent)	Larox Type PVE (or equivalent)	Saunders Type A (or equivalent)

V14XX - DIAPHRAGM VALVES

Valve Type Number	V2405			
Valve Type	Diaphragm; weir type			
Pressure Rating	1600 kPa @ 60°C up to DN50 1000 kPa @ 60°C for DN65 – DN150 600 kPa @ 60°C for DN200 – DN350			
End Connections/ Rating	ANSI B16.5 150# Flange			
Body Material	Cast Iron			
Lining Material	Glass (1 mm Borosilicate Vitreous Enamel)			
Diaphragm	Teflon Faced			
Bonnet/Gland				
Stem				
Bonnet Gasket				
Gland Packing				
Cover				
Size Range	DN 15 - 350			
Operators	Rising stem (DN 15-150) Handwheel Non Rising stem (DN 200-350) Handwheel			
Special Features	Position Indicator			
Make/ Figure No.	Saunders Type A (or equivalent)			

V15XX - GLOBE VALVES

Valve Type Number	V1501	V2501		
Valve Type	Micro Flow Control Globe Valve	Micro Flow Control Globe Valve		
Pressure Rating	Class 150	Class 150		
End Connections/ Rating	Table E Flange	ANSI B16.5 150# Flange		
Body Material	Stainless Steel TP 316	Stainless Steel TP 316		
Seat Material				
Disc				
Bonnet and Gland	Stainless Steel TP 316	Stainless Steel TP 316		
Stem and Yoke				
Bonnet Gasket				
Gland Packing				
Cover				
Size Range	DN 15-25	DN 15-25		
Operators	Lever or Pneumatic Actuated	Lever or Pneumatic Actuated		
Special Features				
Make/ Figure No.	Samson Type 3510 (or equivalent)	Samson Type 3510 (or equivalent)		

V16XX – SAFETY RELIEF & FLOAT VALVES

Valve Tag No	V1602	V1604	V1610	V1612
Valve Type	Angled Safety Pressure Relief	Angled Safety Pressure Relief	Piston Type – Ball Float	Air System Auto Drain Valve
Pressure Rating			500 kPa	1600 kPa
Relief Pressure	825kPa	600kPa		
End Connections	BSP Female Thread Inlet BSP Female Thread Outlet	BSP Male Thread Inlet Female Thread Outlet DN15 – 50 Flanged ends available DN15 - 50	Female Threaded BSP	Female Threaded BSP
Body Material	Copper	Bronze	Brass	Cast Iron (Armstrong) Epoxy Coated Aluminium (Spirax Sarco)
Seat Material	Copper	Bronze	Brass	Stainless (Armstrong)
Disc / Ball Material			Brass	Stainless (Armstrong) Acetal Plastic (Spirax Sarco)
Stem Material				
Size Range	DN 15 – 50	DN 50 – 100	DN 15 – 50	DN15 – 40
Operators	Automatic Spring Loaded	Direct Acting Spring Loaded	Plastic Ball Float	
Special Features	Factory Set. Supplied with Test Tag	Factory Set. Supplied with Test Tag		
Make/ Figure No.	Herose 90° angle type Model 06 – 380 or equivalent	Leser 90° angle type Model 4412 4562 or equivalent	PSA – Philmac Universal	Armstrong Series BVSU Spirax Sarco Dri-Line Mk2 (DN15 Size Only)

V16XX – SAFETY RELIEF & FLOAT VALVES

Valve Tag No	V1621	V1625	V1631	
Valve Type	Angled Safety Pressure Relief	Float Actuated Butterfly Valve	Needle Type – Ball Float	
Body Rating		1600 kPa @ 150°C		
Shut-Off Rating	1,500 kPa (adjustable up to)	1,000 kPa	1,700 kPa	
End Connections	Flanged, Table E	Wafer Type (Unlugged), Table E	Flanged, Table E	
Body Material	Carbon Steel	Ductile Iron	Cast Iron	
Trim Material	Stainless Steel	EPDM	Bronze	
Needle/Disc Material	Stainless Steel	Stainless Steel, TP 316	Stainless Steel 316	
Stem Material		Stainless Steel, TP 316		
Size Range	DN 25 – 100	DN 25 - 200	DN 80 – 300	
Operators	Automatic Spring Loaded	Lever arm from float	Copper Ball Float	
Special Features	Factory Set. Supplied with Test Tag	Stainless Steel 316 linkages and float		
Make/ Figure No.	Bailey, Fig 746 (or equivalent)	Keystone F611 Valve with F499 float (or equivalent)	John Fig 132	

V17XX - CHECK VALVES

Valve Type Number	V1704	V1705	V1721	V1723
Valve Type	Check – Swing Check	Check – Swing Disk Check	Check – Single Flap	Check – Single Flap
Body Rating	3150 kPa	1,960 kPa	1,600 kPa @ 100°C	1,600 kPa
Shut-Off Rating	2100 kPa WOG @ 99°C			
End Connections/ Rating	BSP Thread, Female	Wafer, Table E	Wafer Type. Suit Table E	Wafer Type. Suit Table E
Body Material	Bronze	Cast Steel	Stainless Steel 316	Cast Iron
Seat Material		13CR/STL	Nitrile	Nitrile
Ball/Disc	Bronze	Cast Steel	Stainless Steel 316	Carbon Steel
Bonnet and Gland				
Hinge Pin			Stainless Steel	Stainless Steel
Bonnet Gasket				
Gland Packing				
Cover				
Size Range	DN 15 – 50	DN 50 - 600	DN 50 - 300	DN 50 – 300
Operators				
Special Features			Lifting Eye Bolt	
Make/ Figure No.	John – Fig 4B (or equivalent)	Heaton Model SC01011XU (Keystone)	Keystone F86 (or equivalent)	Keystone F86 (or equivalent)

V17XX & V27XX- CHECK VALVES (continued)

Valve Type Number	V2706	V2707	V2708	
Valve Type	Check – Dual Type	Check – Swing Disk Check	Check – Swing Disk Check Specially cleaned for oxygen service	
Body Rating	PN40, Class 300 (3580 kPa @ 200°C)	1,200 kPa	1,200 kPa	
Shut-Off Rating				
End Connections/ Rating	Wafer Type. Suit ANSI 150	Flanged ANSI150	Flanged ANSI150	
Body Material	Carbon Steel	Carbon Steel	Carbon Steel	
Seat Material	Buna	Stellite	Stellite	
Ball/Disc /Flap	Carbon Steel	13% CR overlay	13% CR overlay	
Bonnet and Gland				
Hinge Pin	316SS	Carbon Steel	Carbon Steel	
Bonnet Gasket		Graphite	PTFE	
Gland Packing				
Cover				
Size Range	DN 50 - 100	DN 150 – 600	DN 150 – 600	
Operators				
Special Features				
Make/ Figure No.	Crane Duo Check G15 SMF	Crane Swing Check Fig 147XU	Crane Swing Check Fig 147XU	

V17XX & V27XX- CHECK VALVES (continued)

Valve Type Number	V1726	V1732	V1734	V2705
Valve Type	Check – Disc Type	Check – Dual Type	Check – Swing Type	Check – Sleeve Type
Body Rating	PN40, Class 300 (3580 kPa @ 200°C)	1,200 kPa	1,400 kPa @ 20°C	Class 150
Shut-Off Rating				1034 kPa Maximum Backpressure
End Connections/ Rating	Wafer Type. Suit Table E	BSP Thread, Female DN 20 – 50 Flanged DN 65 - 250	Wafer Type. Suit Table E	Flanged, ANSI 150#
Body Material	Stainless Steel 316	DR Brass DN < 50 Cast Iron DN > 65	Moulded Thermoplastic (Solid HDPE) with 316 stainless insert	Cast Iron, Epoxy Lined
Seat Material	Stainless 316 (metal – metal)	Metal		
Ball/Disc /Sleeve	Stainless Steel 316	DR Brass	Elastomeric (Natural Rubber)	Neoprene Rubber
Bonnet and Gland				
Hinge Pin		DR Brass		
Bonnet Gasket				
Gland Packing				
Cover				
Size Range	DN 15 - 50	DN 20 – 250	DN 50 - 150	DN 25 - 150
Operators				
Special Features				With Saddle support
Make/ Figure No.	Flowserve Gestra – Fig RK16A (or equivalent)	RMC – No. 007 DN 20 – 50 RMC – No. 709 DN 65 - 250	GFR Industries Check Master	Red Valve – Series 39

V18XX - KNIFE-GATE VALVES

Valve Type Number	V1822	V1823	V1824	
Valve Type	Knife-gate; rising stem	Knife-gate; rising stem	Knife-gate; rising stem	
Body Rating				
Shut-Off Rating	1,000 kPa @ 50°C	1,000 kPa @ 50°C	1,000 kPa @ 50°C	
End Connections/ Rating	Lugged Body, Drilled and Tapped Table E	Lugged Body, Drilled and Tapped Table E	Wafer Type Table E	
Body Material	SG Iron,	Stainless Steel TP 316,	SG Iron,	
Seat Material	RTFE (150°C Max)	RTFE (150°C Max)	RTFE	
Gate	Stainless Steel TP 316, PTFE Coated	Stainless Steel TP 316, PTFE Coated	Stainless Steel TP 316, PTFE Coated	
Bonnet and Gland				
Stem	Stainless Steel TP 304	Stainless Steel TP 304	Stainless Steel TP 304	
Bonnet Gasket				
Gland Packing				
Cover				
Size Range	DN 50 - 600	DN 50 - 600	DN 50 - 300	
Operators	Handwheel (DN 50-200) Gearbox (DN 250-600) Pneumatic (Keystone F738)	Handwheel (DN 50-200) Gearbox (DN 250-600) Pneumatic (Keystone F738)	Handwheel (DN 50-200) Gearbox (DN 250-300) Pneumatic (Keystone F738)	
Special Features	Urethane Flow Deflector	Urethane Flow Deflector	Urethane Flow Deflector	
Make/ Figure No.	Keystone F952 (or equivalent)	Keystone F952 (or equivalent)	Keystone F951 (or equivalent)	

V19XX - OTHER PIPELINE FITTINGS

Valve Tag No	V1902	V1904	V1926	V2000
Valve Type	Combined Air Release & Vacuum Breaker	'Y' Type strainer	'Y' Type strainer	Flow/check
Pressure Rating	1,050 kPa	1200 kPa	1200 kPa	1500kPa
End Connections	BSP Thread, Male	BSP Thread, Female	Flanged Ends, Table E	BSP Male/Female
Body Material	Cast Iron & Plastic	Cast Iron	Stainless Steel 316	Stainless Steel 304
Seat Material	Rubber	-	-	
Ball	Plastic	-	-	
Screen Material	-	Stainless Steel 316	Stainless Steel 316	
Mesh Size	-	11 – 400 (as appropriate for service)	11 – 400 (as appropriate for service)	
Size Range	DN 20 – 50	DN 20 – 50	DN 20 – 300	DN15 25
Special Features				
Make/ Figure No.	Bermad – C-2 ARC-BP-PN25	Ulbrec series VYS or equivalent	T & S Valves & Fittings Model TS150Y	Maric flow control

V99XX – SPECIAL VALVES AND FITTINGS

Valve Tag No	V9920	V9925	V9930	V9935
Valve Type	Bursting Disc Holder	Needle Valve	Fire Hydrant	Pressure Reducing Valve
Pressure Rating	Class 150 (Holder Only)	Class 150	2,700kPa	1400kPa
End Connections	ANSI B16.5 150# Wafer	ANSI B16.5 150#	2 1/2" BSP	Flange table E
Body Material	Carbon Steel Holder Unit	Carbon Steel	DZR Brass	Cast Iron
Seat Material	Stainless Steel 316	Carbon Steel	Brass	
Code				
Disc/Ball	Stainless Steel 316 Element		N/A	Buna N
Temperature rating				90 ^o C
Notes				
Size Range	DN25 – 100	DN 25 - 100	DN65	DN25 – 150
Operators			Handle	Spring steel
Special Features	Burst Pressure to be Nominated on P&ID Drawing. Signalling Unit (Optional)			Pressure settings unaffected by inlet variations
Make/ Figure No.	Rembe (or equivalent)		BS Fire Hydrant 65 BIC with top b/fly cap	Roma type D Series Fig 212.

V99XX – SPECIAL VALVES AND FITTINGS

Valve Tag No	V9940	V9440		
Valve Type	Pressure Reducing Valve	Globe Control Valve		
Pressure Rating	1400kPa	2000kPa		
End Connections	Flanged ANSI B16.5 150#	Flanged ANSI B16.5 150#		
Body Material	Carbon steel	Stainless steel		
Seat Material		Crnimo Steel		
Code				
Disc/Ball	Buna N	Plug with metal sealing		
Temperature rating	2 – 90deg C	-10 – 220 deg C		
Notes	700 -200 kPa			
Size Range	DN25 – 50	DN15 - 150		
Operators	Spring	Top mounted hand wheel		
Special Features	Spring Pressure Settings	PTFE-carbon spring loaded.		
Make/ Figure No.	Roma D10 or fig 512	Samson Fig 3241		