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BALL VALVES SPECIFICATION

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DETAILED BALL VALVE SPECIFICATIONS

1.0 INTRODUCTION

1.1 Scope

This general specification covers the minimum technical requirements for the design, selection, application and service classifications of ball valves. Valve tag numbers and technical descriptions are included in Appendix 1. This specification shall be used in conjunction with the relevant project specifications and data sheets. Any exceptions to the requirements of this specification shall be submitted in writing for resolution by the COMPANY.

1.2 Definitions

The most recent issue of the applicable standards and codes, issued by the following associations and approval bodies, shall be considered as part of this specification.

SAA	Standards Association of Australia.
ANSI	American National Standards Institute.
API	American Petroleum Institute.
ASME	American Society of Mechanical Engineers.
ASTM	American Society for Testing and Materials.
MSS	Manufacturers Standardisation Society of the Valve and Fittings Industry.
NACE	National Association of Corrosion Engineers.
PNGS	Papua New Guinea Standards.

2.0 CODES AND STANDARDS

2.1 References

- 0000-TS-M004 General Equipment Specification.
- 0000-TS-L001 Piping – General Specification.
- 0000-TS-L002 Piping – Materials and Service Specification.
- 0000-TS-L003 Process Equipment Skids – Piping Specification.
- 0000-TS-J005 On/Off Actuated Valves Specification.

2.2 Codes, Standards and Regulations

2.2.1 American National Standards Institute (ANSI) / American Society of Mechanical Engineers (ASME)

- B1.1 Unified Inch Screw Threads (UN and UNR Thread Form).
- B16.5 Pipe Flanges and Flanged Fittings.
- B16.10 Face-to-Face and End-to-End Dimensions of Valves.
- B16.11 Forged Steel Fittings, Socket-welding and Threaded.
- B16.20 Metallic Gaskets for Pipe Flanges – Ring Joint, Spiral-wound and Jacketed.
- B16.21 Non-metallic Flat Gaskets for Pipe Flanges.
- B16.34 Valves – Flanged, Threaded and Buttwelding End.
- B18.2.1 Square and Hex Bolts and Screws Inch Series Including Hex Cap Screws and Lag Screws.
- B18.2.2 Square and Hex Nuts.
- B31.3 Process Piping.

ASME Boiler and Pressure Vessel Code:

Sect VIII Div 1 Rules for Construction of Pressure Vessels.

2.2.2 American Petroleum Institute (API)

- SPEC 6A Specification for Wellhead Equipment.
- SPEC 6D Specification for Pipeline Valves, End Closures, Connectors and Swivels.
- STD 598 Valve Inspection and Testing.
- STD 607 Fire Test for Soft-Seated Quarter-turn Valves.

2.2.3 American Society for Testing and Materials (ASTM)

A105	Specification for Forgings, Carbon Steel, for Piping Components.
A123	Specification for Zinc Coating (Hot-Dip) on Iron and Steel Products.
A182	Specification for Forged or Rolled Alloy-Steel Pipe Flanged, Forged Fittings, and Valves and Parts for High-Temperature Service.
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.
A216	Specification for Carbon-Steel Castings Suitable for Fusion Welding for High-Temperature Service.
A217	Specification for Steel Castings, Martensitic Stainless and Alloy for Pressure Containing Parts for High Temperature Service.
A234	Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and Elevated Temperature.
A350	Specification for Forgings, Carbon and Low-Alloy Steel, Requiring Notch Toughness Testing for Piping Components.
A351	Specification for Austenitic Steel Castings for High-Temperature Service.
A352	Specification for Ferritic Steel Castings for Pressure-Containing Parts Suitable for Low-Temperature Service.
B62	Specification for Composition Bronze or Ounce Metal Castings.
E446	Standard Reference Radiographs for Steel Castings up to 51 mm in Thickness.
F104	Classification System for Non-metallic Gasket Materials.

2.2.4 Manufacturers Standardisation Society of the Valve and Fittings Industry (MSS)

SP 6	Standard Finishes for Contact Faces of Pipe Flanges and Connecting-End Flanges of Valves and Fittings.
SP 25	Standard Marking System for Valves, Fittings, Flanges and Unions.
SP 53	Quality Standard for Steel Castings for Valves, Flanges and Fittings and Other Piping Components.

2.2.5 National Association of Corrosion Engineers (NACE)

MR-01-75	Sulfide Stress Cracking Resistant Metallic Material for Oil Field Development.
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2.3 Precedence

The precedence of documents and requirements is defined in specification 0000-TS-M004.

3.0 DESIGN AND CONSTRUCTION

3.1 General Requirements

- a) All valve components shall be sourced from COMPANY approved manufacturing locations as specified in the Purchase Order.
- b) A valve manufacturer with whom an order has been placed shall not suborder assembled valves from other sources without COMPANY approval.
- c) Substitution of specified valves may only be made with the approval of the COMPANY.
- d) Ball valves shall be field repairable. Balls, seals, and seats shall be replaceable without welding or cutting, except as approved by the COMPANY. Threaded bonnets are not acceptable.
- e) Valve dimensions shall be identical to the dimensions specified in ANSI B16.10, Face-to-Face and End-to-End Dimensions of Ferrous Valves, or API SPEC 6D, Specification for Pipeline Valves, End Closures, Connectors and Swivels.
- f) In the absence of a specified test procedure, API Standard 598, Valve Inspection and Test, or API Specification 6D, Pipeline Valves, shall be used as a basis.
- g) Ball valves shall be of fire safe design. Fire safe valves with soft, non-metal seats shall meet the requirements of API Standard 607, "Fire Test for Soft Seated Quarter Turn Valves".
- h) Where socket weld valves require postweld heat treating of the pipe-to-socket weld, the valves shall be furnished with 150 mm stubs welded into the sockets and heat treated by the manufacturer prior to finish machining.
- i) All valves shall be capable of sealing with design pressure applied from either end of the valve.
- j) If single-stop valves are specified for block and bleed service, a double-seated valve with a suitable bleed tapping between the seats shall be provided.
- k) Valves for hydrocarbon liquid service shall be designed to avoid trapping liquids in the valve body.
- l) The sealing characteristics of ball valves shall not be impaired by rapid temperature changes.
- m) All valves shall have blowout proof stems.
- n) All valves shall be of anti-static design.
- o) Valve stem materials shall be of high strength (hardened) alloy or stainless steel suitable for the service conditions specified.

3.2 Pressure and Temperature Design Range

- a) The valve assembly and all components shall be suitable for oil, water and gas service throughout the temperature range of the pressure class as indicated in 0000-TS-L002 and the valve technical description.
- b) Valve pressure-class ratings shall be in accordance with ASME/ANSI B16.34.
- c) Valve design shall be in accordance with API Specification 6A or API Specification 6D.

3.3 Manual Valve Operators

Manual gear operators shall be provided for all ball valves where specified in the valve technical descriptions or in any situation where break-away torque requirements exceed 500 Nm or a force 50 mm from the end of the lever "greater than" 500 N.

3.4 Inspection Requirements for Valve Castings

ASME/ANSI Class 900, 1500 and 2500 valve bodies, including flanges, shall be inspected per the following:

- a) Carbon Steel and Low Alloy Valve Castings

Manufacturer's certification of the following inspection is required. Castings and test bars shall be heat-treated together. Critical body and bonnet casting sections, typically defined by ASME/ANSI B 16.34, shall be radiographed and shall meet ASTM E-446 (up to 2 inches thick); Category A, B, & CA = Level 2, Category CB, CC & CD = Level 3, Category D, E, F & G = Level 0. Bend test and magnetic particle inspection of the entire surface of body and bonnet castings shall be in accordance with ASTM A-216 for carbon steel and ASTM A-217 for low alloy steel, with supplemental requirements S3 and S4. Evaluation of magnetic particle inspection shall be in accordance with MSS SP-53 except that no lineal discontinuities shall be allowed. The Brinell hardness of heat-treated castings shall not exceed 225. Repairs to defective castings shall be outlined in writing to the COMPANY before repair commences. Repair methods shall be approved by the COMPANY prior to welding. Inspections and repairs shall be witnessed by COMPANY's inspectors. Castings shall be pre-heated to a minimum 205°C prior to welding and all chromium-molybdenum alloys shall be post-weld heat treated after welding is complete.

- b) Stainless Steel Valve Castings

Manufacturer's certification of the following inspection is required. Castings and test bars shall be heat-treated together. Castings shall be in the solution heat-treated and pickled condition. Critical body and bonnet castings sections, typically defined by ASME/ANSI B16.34, shall be radiographed and shall meet ASTM E-446 (up to 2-inches thick); Category A, B & CA = Level 2, Category CB, CC & CD = Level 3, Category D, E, F & G = Level 0. The entire surface of all castings shall be liquid penetrant inspected after pickling. Interpretation shall be in accordance with Appendix 8 of the ASME Boiler and Pressure Vessel Code, Section VIII, Division 1, except that all bright red indications, regardless of size, and clusters of pink indications (potential porosity) shall be cause for removal of metal until further dye examination indicates no indications or only isolated pink indications. Repairing methods shall be approved by COMPANY prior to welding. Welds shall be 100% radiographed and evaluated in accordance with Paragraph 344.5 of ANSI/ASME B31.3 with a minimum casting quality factor of 0.95. Inspections and repairs shall be witnessed by COMPANY's inspectors.

3.5 Lubricated Ball Valves

- a) Lubricated ball valves, where specified, shall be furnished with a combination button head fitting and lubrication screw, such as a Rockwell fitting or a COMPANY approved equivalent.
- b) The valve manufacturer shall supply details of recommended lubricants.

3.6 Emergency Shutdown (ESD) Valves

ESD valves shall be in accordance with Project Specification 0000-TS-J005, On/Off Actuated Valves.

3.7 Bolting

Requirements shall be in accordance with Specification 0000-TS-L002.

3.8 Flange Finish

Requirements shall be in accordance with Specification 0000-TS-L002.

4.0 PAINT AND PROTECTIVE COATINGS

- a) The SELLER'S standard method of treating and protecting surfaces in the environment specified in the requisition shall be documented and submitted for acceptance by the COMPANY. Acceptance will be based on the following criteria:
 - Proper surface treatment by blast cleaning or power tool cleaning;
 - Application of a corrosion-resistant coating, such as epoxy, vinyl, polyurethane, or chlorinated rubber to a total dry film thickness ranging from 50 to 100 micrometres.
- b) Colours for painting will be specified in the purchase order.
- c) Painting and corrosion protection shall be an integral part of the fabrication to prevent damage from the environment.
- d) The following surfaces and items shall not be painted:
 - Non-metallic surfaces;
 - Stainless steel;
 - Machined surfaces;
 - Internal surfaces, coatings, linings;
 - Nameplates;
 - Valve stems;
 - Motor shafts.

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- e) Pressure-containing parts shall not be painted until inspection is completed.
- f) All unpainted finished surfaces and internal surfaces that contact process fluid shall be coated with an easily removable rust preventative that shall protect surfaces for a minimum of six months. All protective coatings (including masking, masking paper, and other required materials) used during painting and coating operations shall be removed from the equipment prior to application of rust preventatives or other final transportation protective materials.
- g) All unpainted instrument bezels, highly-polished surfaces of equipment and components, control levers, flange faces, threaded parts, and parts subject to corrosion shall be suitably coated with a protective medium that can be easily removed during final installation. Special care shall be taken to wash all fingerprints from highly polished machine surfaces prior to application of rust preventatives.

5.0 IDENTIFICATION AND MARKING

- a) Valves shall be marked in accordance with MSS-SP-25, Standard Marking System for Valves, Fittings, Flanges and Unions.
- b) Valves shall have the tag number stamped on a 316 stainless steel tag and attached to the valve with stainless steel wire. Embossed stainless steel bands are acceptable.

6.0 DOCUMENTATION REQUIREMENTS

Documentation shall be provided in accordance with the material requisition.

The following additional information shall be provided with the proposal:

- List of materials for all key valve components. Any proposed alternative trim materials to those specified shall be listed separately for COMPANY review;
- Confirmation that valves and valve components selected are suitable for the full range of process conditions specified;
- SELLER'S valve testing procedures;
- Statement of compliance with valve casting inspection requirements (Section 3.4);
- SELLER'S reference list (of major projects) for valves with similar design conditions;
- Valve breakaway torque figures at maximum DP (pressure differential).

7.0 QUALITY ASSURANCE PROVISIONS

Quality assurance provisions shall be in accordance with the Material Requisition and with the following additional requirements:

- Valves are to be thoroughly tested before despatch. Valves supplied shall be issued with a copy of hydrostatic test certificates, conformity certificates, foundry or mill certificates and firesafe certificates;
- The foundry and mill certificates are to be issued detailing heat numbers, chemical and mechanical properties, the COMPANY reserves the right to request an independent inspection authority to test conformity;
- The carbon content of steel shall not exceed 0.25 percent and/or the carbon equivalent content ($C = \frac{Mn}{6}$) shall not exceed 0.41 percent. The SELLER must supply a ladle analysis of the steel or a certificate of conformity.

8.0 PREPARATION FOR SHIPPING AND STORAGE

- a) Valves shall be adequately packaged for shipping to prevent damage in transit and during storage at the erection site.
- b) The flange face on valves are to be protected with a bolted on wood/fibre or metal flange cover the same size as the flange outside diameter. Socket weld and threaded ends of valves shall be protected with plastic plugs.

APPENDIX 1

DETAILED BALL VALVE SPECIFICATIONS

BALL VALVE SPECIFICATION		
Valve Tag (Data Sheets) ¹	DN	Description
VB-40 (A4)	15 to 40	ANSI Class 800, NPT screwed ends, replaceable ball and seats, BODY - ASTM A105 forged carbon steel, BALL - ENP carbon steel, SEATS – teflon, fire safe, full port, lever operator. Seat and seals to be suitable for the following range of design conditions: -29°C @ 1965 kPag to 93°C @ 1790 kPag.
VB-44 (A4)	15 to 40	Class PN32 NPT screwed ends, replaceable ball and seats, BODY AND BALL – ASTM B62 bronze, SEATS – teflon, reduced port, top entry, lever operator. Seat and seals to be suitable for the following range of design conditions: -29°C @ 1965 kPag to 93°C @ 1790 kPag.
VB-60 (A1, A3, A4, A5)	50 to 100	ANSI Class 150, RF flanged ends, replaceable ball and seats, BODY - ASTM A105 forged carbon steel, BALL – ENP carbon steel, SEATS - reinforced teflon, fire safe, full port, lever operator. Seat and seals to be suitable for the following range of design conditions: -29°C @ 1965 kPag to 150°C @ 1580 kPag.
VB-62 (A1, A3, A4, A5)	150 to 600	ANSI Class 150, RF flanged ends, replaceable ball and seats, BODY AND COVER – ASTM A216 WCC cast Carbon steel, BALL - ENP carbon steel, SEATS – reinforced teflon, trunnion mounted, fire safe, full port, top entry, gear operator. Seat and seals to be suitable for the following range of design conditions: -29°C @ 1965 kPag to 150°C @ 1580 kPag.
VB-67 (A7)	50 to 100	ANSI Class 150, RF flanged ends, replaceable ball and seats, BODY - ASTM A105 forged carbon steel, BALL - ENP carbon steel, SEATS - PEEK, fire safe, full port, lever operator. Seat and seals to be suitable for the following range of design conditions: -29°C @ 1965 kPag to 200°C @ 1395 kPag.

¹ For applicable Company piping material classification refer to Specification 0000-TS-L002.

BALL VALVE SPECIFICATION		
Valve Tag (Data Sheets) ¹	DN	Description
VB-68 (A7)	150 to 600	ANSI 150, RF flanged ends, replaceable ball and seats, BODY AND COVER - ASTM A216 WCC cast carbon steel, BALL - ENP carbon steel, SEATS – reinforced PEEK, trunnion mounted, fire safe, full port, top entry, gear operator. Seat and seals to be suitable for the following range of design conditions: -29°C @ 1965 kPag to 200°C @ 1395 kPag.
VB-69 (B1)	50 to 100	ANSI Class 300, RF flanged ends, replaceable ball and seats, BODY – ASTM A105 forged carbon steel, BALL – ENP carbon steel, SEATS - reinforced PEEK, fire safe, full port, lever operator. Seat and seals to be suitable for the following range of design conditions: -29°C @ 5100 kPag to 150°C @ 4510 kPag.
VB-70 (B10)	15 to 100	ANSI Class 300, RF flanged ends, replaceable ball and seats, BODY – ASTM A182 F316 stainless steel, BALL – ASTM A182 F316, SEATS – reinforced PEEK, fire safe, full port, lever operator. Seat and seals to be suitable for the following range of design conditions: -46°C @ 4135 kPag to 200°C @ 2880 kPag.
VB-71 (B1)	150 to 600	ANSI Class 300, RF flanged ends, replaceable ball and seats, BODY AND COVER – ASTM A216 WCC cast carbon steel, BALL – ENP carbon steel, SEATS – reinforced teflon, trunnion mounted, fire safe, full port, top entry, gear operator. Seat and seals to be suitable for the following range of design conditions: -29°C @ 5100 kPag to 150°C @ 4510 kPag.
VB-72 (B10)	150 to 300	ANSI Class 300, RF flanged ends, replaceable ball and seats, BODY AND COVER – ASTM A351 CF8 stainless steel, BALL - 316 stainless steel, SEATS – reinforced PEEK, trunnion mounted, fire safe, full port, top entry, gear operator. Seat and seals to be suitable for the following range of design conditions: -46°C @ 4135 kPag to 200°C @ 2880 kPag.

BALL VALVE SPECIFICATION		
Valve Tag (Data Sheets) ¹	DN	Description
VB-75 (C1, C5)	50 to 100	ANSI Class 600, RF flanged ends, replaceable ball and seats, BODY – ASTM A105 forged carbon steel, BALL – ENP carbon steel, SEATS – PEEK, trunnion mounted, fire safe, full port, lever operator. Seat and seals to be suitable for the following range of design conditions: -29°C @ 10205 kPag to 150°C @ 9060 kPag.
VB-76 (C10)	15 to 100	ANSI Class 600, RF flanged ends, replaceable ball and seats, BODY – ASTM A182 F316 stainless steel, BALL – ASTM A182 F316 stainless steel, SEATS – reinforced PEEK, fire safe, full port, lever operator. Seat and seals to be suitable for the following range of design conditions: -46°C @ 8270 kPag to 200°C @ 5735 kPag.
VB-77 (C1, C5)	150 to 600	ANSI Class 600, RF flanged ends, replaceable ball and seats, BODY AND COVER – ASTM A216 WCC cast Carbon steel, BALL - ENP carbon steel, SEATS – PEEK, trunnion mounted, fire safe, full port, top entry, gear operator. Seat and seals to be suitable for the following range of design conditions: -29°C @ 10205 kPag to 150°C @ 9060 kPag.
VB-78 (C10)	150 to 250	ANSI Class 600, RF flanged ends, replaceable ball and seats, BODY AND COVER – ASTM A351-CF8 stainless steel, BALL - 316 stainless steel, SEATS – reinforced PEEK, trunnion mounted, fire safe, full port, top entry, gear operator. Seat and seals to be suitable for the following range of design conditions: -46°C @ 8270 kPag to 200°C @ 5735 kPag.
VB-79 (C7)	50 to 100	ANSI Class 600, RF flanged ends, replaceable ball and seats, BODY - ASTM A105 forged carbon steel, BALL – ENP carbon steel, SEATS - PEEK, trunnion mounted, fire safe, full port, lever operator. Seat and seals to be suitable for the following range of design conditions: -29°C @ 10205 kPag to 200°C @ 8780 kPag.
VB-80 (D1, D4, D5)	80 to 100	ANSI Class 900, RJ flanged ends, replaceable ball and seats, BODY - ASTM A105 forged carbon steel, BALL - ENP carbon steel, SEATS - PEEK, trunnion mounted, fire safe, full port, lever operator. Seat and seals to be suitable for the following range of design conditions: -29°C @ 15305 kPag to 150°C @ 13570 kPag.

BALL VALVE SPECIFICATION		
Valve Tag (Data Sheets) ¹	DN	Description
VB-81 (D10)	80 to 100	ANSI Class 900, RTJ flanged ends, replaceable ball and seats, BODY - ASTM A351 CF8 stainless steel, BALL - ASTM A182 F316, SEATS – reinforced PEEK, trunnion mounted, fire safe, full port, lever operator. Seat and seals to be suitable for the following range of design conditions: -46°C @ 12410 kPag to 200°C @ 8615 kPag.
VB-82 (D1, D4, D5)	150 to 600	ANSI Class 900, RJ flanged ends, replaceable ball and seats, BODY AND COVER - ASTM A216 WCC cast carbon steel, BALL - ENP carbon steel, SEATS - PEEK, trunnion mounted, fire safe, full port, top entry, gear operator. Seat and seals to be suitable for the following range of design conditions: -29°C @ 15305 kPag to 150°C @ 13570 kPag.
VB-83 (D10)	150 to 250	ANSI Class 900, RJ flanged ends, replaceable ball and seats, BODY AND COVER - ASTM A351 CF8 stainless steel, BALL - 316 stainless steel, SEATS - reinforced PEEK, trunnion mounted, fire safe, full port, top entry, gear operator. Seat and seals to be suitable for the following range of design conditions: -46°C @ 12410 kPag to 200°C @ 8615 kPag.
VB-86 (D1, D4, D5, E1, E4)	50 to 100	ANSI Class 1500, RJ flanged ends, replaceable ball and seats, BODY - ASTM A105 forged carbon steel, BALL - ENP carbon steel, SEATS - PEEK, trunnion mounted, fire safe, full port, gear operator 100 DN and above. Seat and seals to be suitable for the following range of design conditions: -29°C @ 25545 kPag to 150°C @ 22600 kPag.
VB-87 (D10)	40 to 50	ANSI Class 1500, RTJ flanged ends, replaceable ball and seats, BODY - ASTM A182 F316 stainless steel, BALL - ASTM A182-F316, SEATS - reinforced PEEK, fire safe, full port, lever operator. Seat and seals to be suitable for the following range of design conditions: -46°C @ 12410 kPag to 200°C @ 8615 kPag.

BALL VALVE SPECIFICATION		
Valve Tag (Data Sheets) ¹	DN	Description
VB-88 (E1, E4)	150 to 300	ANSI Class 1500, RJ flanged ends, replaceable ball and seats, BODY AND COVER - ASTM A216 WCC cast carbon steel, BALL – ENP carbon steel, SEATS - PEEK, trunnion mounted, fire safe, full port, top entry, gear operator. Seat and seals to be suitable for the following range of design conditions: -29°C @ 25545 kPag to 150°C @ 22600 kPag.
VB 90B (F11)	15 to 40	ANSI Class 2500, BW ends, replaceable ball and seats, BODY - ASTM A105 forged carbon steel, BALL – ASTM A182 F316 stainless steel, SEATS - peek, fire safe, full port, lever operator. Seat and seals to be suitable for the following range of design conditions: -29°C at 42540 kPag to 150°C at 37685 kPag.
VB-96 (F1, F6, F7)	15 to 40	ANSI Class 2500, RJ flanged ends, replaceable ball and seats, BODY - ASTM A350 LF3, BALL - ASTM A182 F316 stainless steel, SEATS - stainless steel metal seated, fire safe, full port, lever operator. Seat and seals to be suitable for the following range of design conditions: -101°C @ 43090 kPag to 120°C @ 42495 kPag.
VB-96B (F1, F6, F7)	15 to 40	ANSI Class 2500, buttweld ends, replaceable ball and seats, BODY – ASTM A350-LF3, BALL – ASTM A182-F316 stainless steel, SEATS – stainless steel metal seated, fire safe, full port, lever operator. Seat and seals to be suitable for the following range of design conditions: - 101°C @ 43090 kPag to 120°C @ 42495 kPag.
VB-97 (F1, F6, F7)	50 to 80	ANSI Class 2500, RJ flanged ends, replaceable ball and seats, BODY - ASTM A350 LF3, BALL - ASTM A182-F316 stainless steel, SEATS - stainless steel metal seated, trunnion mounted, fire safe, full port, gear operator. Seat and seals to be suitable for the following range of design conditions: -101°C @ 43090 kPag to 120°C @ 42495 kPag.

BALL VALVE SPECIFICATION		
Valve Tag (Data Sheets) ¹	DN	Description
VB-97B (F1, F6, F7)	50 to 80	ANSI Class 2500, buttweld ends, replaceable ball and seats, BODY – ASTM A350 – LF3, BALL – ASTM A182-F316 stainless steel, SEATS – stainless steel metal seated, trunnion mounted, fire safe, full port, gear operator. Seat and seals to be suitable for the following range of design conditions: - 101°C @ 43090 kPag to 120°C @ 42495 Kpag.
VB-112 (A1, A3, A5, A7, B1, C1, C5, C7)	15 to 40	ANSI Class 800, SW x SCRD (NPT) ends, replaceable ball and seats, BODY - ASTM A105 forged carbon steel, BALL – ENP carbon steel, SEATS – PEEK, fire safe, full port, lever operator. Seat and seals to be suitable for the following range of design conditions: -29°C @ 10205 kPag to 200°C @ 8780 kPag.
VB-112S (A10, B10, C10)	15 to 25	ANSI Class 800, SW x SCRD (NPT) ends, replaceable ball and seats, BODY - A182 F316 stainless steel, BALL – ASTM A182 F316, SEATS – reinforced PEEK, fire safe, full port, lever operator. Seat and seals to be suitable for the following range of design conditions: -46°C @ 8270 kPag to 200°C @ 5735 kPag.
VB-113 (A1, A3, A5, A7, B1, C1, C5, C7)	15 to 40	ANSI Class 800 SW x SW ends, replaceable ball and seats, BODY - ASTM A105 forged carbon steel, BALL – ENP carbon steel, SEATS – PEEK, fire safe, full port, lever operator. Seat and seals to be suitable for the following range of design conditions: -29°C @ 10205 kPag to 200°C @ 8780 kPag.
VB-113S (A10, B10, C10)	15 to 25	ANSI Class 800 SW x SW ends, replaceable ball and seats, BODY – ASTM A182 F316 stainless steel, BALL – ASTM A182 F316, SEATS – reinforced PEEK, fire safe, full port, lever operator. Seat and seals to be suitable for the following range of design conditions: -46°C @ 8270 kPag to 200°C @ 5735 kPag.
VB-114 (C7)	150 to 400	ANSI Class 600 RF flanged ends, replaceable ball and seats, BODY AND COVER - ASTM A216 WCC cast carbon steel, BALL - ENP carbon steel, SEATS - PEEK, trunnion mounted, fire safe, full port, top entry, gear operator. Seat and seals to be suitable for the following range of design conditions: -29°C @ 10205 kPag to 200°C @ 8780 kPag.

BALL VALVE SPECIFICATION		
Valve Tag (Data Sheets) ¹	DN	Description
VB-116 (F6, F7)	15 to 40	ANSI Class 2500 SW ends, replaceable ball and seats, BODY - ASTM A350 LF3, BALL - ASTM A182 F316 stainless steel, SEATS - stainless steel metal seated, fire safe, reduced port, lever operator. Seat and seals to be suitable for the following range of design conditions: -46°C @ 43090 kPag to 93°C @ 43090 kPag.
VB-118 (B6)	50 to 100	ANSI Class 300 RF flanged ends, replaceable ball and seats, BODY - ASTM A105 forged carbon steel, BALL – ASTM A182 F316, SEATS – stainless steel metal seated, fire safe, full port, lever operator. Seat and seals to be suitable for the following range of design conditions: -29°C @ 5100 kPag to 325°C @ 3755 kPag.
VB-120 (B6)	15 to 40	ANSI Class 800, SW x SCRD (NPT) ends, replaceable ball and seats, BODY – ASTM A105 forged carbon steel, BALL - ASTM A182 F316 stainless steel, SEATS – stainless steel metal seated, fire safe, reduced port, lever operator. Seat and seals to be suitable for the following range of design conditions: -29°C @ 5100 kPag to 325°C @ 3755 kPag.
VB-121 (B6)	15 to 40	ANSI Class 800, SW x SW ends, replaceable ball and seats, BODY- ASTM A105 forged carbon steel, BALL – ASTM A182 F316 stainless steel, SEATS - stainless steel metal seated, fire safe, reduced port, lever operator. Seat and seals to be suitable for the following range of design conditions: -29°C @ 5100 kPag to 325°C @ 3755 kPag.
VB-122 (B6)	150 to 400	ANSI Class 300, RF flanged ends, replaceable ball and seats, BODY - ASTM A216 WCC cast carbon steel, BALL – ASTM A182 F316 stainless steel, SEATS – stainless steel metal seated, trunnion mounted, fire safe, full port, top entry, gear operator. Seat and seals to be suitable for the following range of design conditions: -29°C @ 5100 kPag to 325°C @ 3755 kPag.

BALL VALVE SPECIFICATION		
Valve Tag (Data Sheets) ¹	DN	Description
VB-123 (A5)	50 to 600	ANSI Class 150, buttweld ends, replaceable ball and seats, BODY AND COVER - ASTM A216 WCC cast carbon steel, BALL - ENP carbon steel, SEATS – reinforced teflon, trunnion mounted, fire safe, full port, top entry, gear operator 150 DN and above. Seat and seals to be suitable for the following range of design conditions: -29°C @ 1965 kPag to 120°C @ 1690 kPag.
VB-125 (C5)	50 to 600	ANSI Class 600, buttweld ends, replaceable ball and seats, BODY AND COVER - ASTM A216 WCC cast carbon steel, BALL - ENP carbon steel, SEATS – Nylon, trunnion mounted, fire safe, full port, top entry, gear operator 150 DN and above. Seat and seals to be suitable for the following range of design conditions: -29°C @ 10205 kPag to 120°C @ 9190 kPag.
VB-126 (D4, D5)	80 to 600	ANSI Class 900, buttweld ends, replaceable ball and seats, BODY AND COVER – ASTM A216 WCC cast carbon steel, BALL - ENP carbon steel, SEATS – Nylon, trunnion mounted, fire safe, full port, top entry, gear operator 150 DN and above. Seat and seals to be suitable for the following range of design conditions: -29°C @ 15305 kPag to 120°C @ 13780 kPag.
VB-127 (D1, D4, D5, D6, E1, E4, E6)	15 to 40	ANSI Class 1500, SW ends, replaceable ball and seats, BODY - ASTM A105 forged carbon steel, BALL - ASTM A182 F316, SEATS - PEEK, fire safe, reduced port, lever operated. Seat and seals to be suitable for the following range of design conditions: -29°C @ 25545 kPag to 200°C @ 21915 kPag.
VB-127S (D10)	15 to 25	ANSI Class 1500, SW ends, replaceable ball and seats, BODY - ASTM A182 F316 stainless steel, BALL - ASTM A182 F316, SEATS - reinforced PEEK, fire safe, full port, lever operator. Seat and seals to be suitable for the following range of design conditions: -46°C @ 12410 kPag to 200°C @ 8615 kPag.

BALL VALVE SPECIFICATION		
Valve Tag (Data Sheets) ¹	DN	Description
VB-128 (E4)	50 to 150	ANSI Class 1500, buttweld ends, replaceable ball and seats, BODY - ASTM A105 forged carbon steel, BALL - ENP carbon steel, SEATS - PEEK, trunnion mounted, fire safe, full port, top entry, gear operator, 100 DN and above. Seat and seals to be suitable for the following range of design conditions: -29°C @ 25545 kPag to 150°C @ 22600 kPag.
VB-129 (D1, D4, D5, D6, E1, E4, E6)	15 to 40	ANSI Class 1500, SW x SCRD (NPT) ends, replaceable ball and seats, BODY - ASTM A105 forged carbon steel, BALL - ASTM A182 F316 stainless steel, SEATS – PEEK, fire safe, reduced port, lever operator. Seat and seals to be suitable for the following range of design conditions: -29°C @ 25545 kPag to 200°C @ 21915 kPag.
VB-129S (D10)	15 to 25	ANSI Class 1500, SW x SCRD (NPT) ends, replaceable ball and seats, BODY - ASTM A182 F316 stainless steel, BALL - ASTM A182 F316, SEATS - reinforced PEEK, fire safe, full port, lever operator. Seat and seals to be suitable for the following range of design conditions: -46°C @ 12410 kPag to 200°C @ 8615 kPag.
VB-133 (D6)	80 to 150	ANSI Class 900, RJ flanged ends, replaceable ball and seats, BODY - ASTM A105 forged carbon steel, BALL – ENP carbon steel, SEATS - PEEK, trunnion mounted, fire safe, full port, gear operator 150 DN and above. Seat and seals to be suitable for the following range of design conditions: -29°C @ 15305 kPag to 200°C @ 13135 kPag.
VB-134 (D6)	200 to 400	ANSI Class 900, RJ flanged ends, replaceable ball and seats, BODY AND COVER - ASTM A216 WCC cast carbon steel, BALL - ENP carbon steel, SEATS - PEEK, trunnion mounted, fire safe, full port, top entry, gear operated. Seat and seals to be suitable for the following range of design conditions: -29°C @ 15305 kPag to 200°C @ 13135 kPag.

BALL VALVE SPECIFICATION		
Valve Tag (Data Sheets) ¹	DN	Description
VB-135 (D6, E6)	50 to 150	ANSI Class 1500, RJ flanged ends, replaceable ball and seats, BODY - ASTM A105 forged carbon steel, BALL – ENP carbon steel, SEATS - PEEK, trunnion mounted, fire safe, full port, gear operator, 100 DN and above. Seat and seals to be suitable for the following range of design conditions: -29°C @ 25545 kPag to 200°C @ 21915 kPag.
VB-137 (E6)	200 to 300	ANSI Class 1500, RJ flanged ends, replaceable ball and seats, BODY AND COVER - ASTM A216 WCC cast carbon steel, BALL - ENP carbon steel, SEATS - PEEK, trunnion mounted, fire safe, full port, top entry, gear operator. Seat and seals to be suitable for the following range of design conditions: -29°C @ 25545 kPag to 200°C @ 21915 kPag.
VB-142 (A10)	15 to 100	ANSI Class 150 RF flanged ends, replaceable ball and seats, BODY - ASTM A182 F316 stainless steel, BALL – ASTM A182 F316, SEATS - reinforced teflon, fire safe, full port, lever operator. Seat and seals to be suitable for the following range of design conditions: -46°C @ 1585 kPag to 200°C @ 1110 kPag.
VB-143 (A10)	150 to 300	ANSI Class 150 RF flanged ends, replaceable ball and seats, BODY AND COVER - ASTM A351 CF8 stainless steel, BALL - 316 stainless steel, SEATS - reinforced teflon, trunnion mounted, fire safe, full port, top entry, gear operator. Seat and seals to be suitable for the following range of design conditions: -46°C @ 1585 kPag to 200°C @ 1110 kPag.
VB-150 (F1, F6, F7)	100 to 250	ANSI Class 2500 RJ flanged ends, replaceable ball and seats, BODY AND COVER - ASTM A352 LC3, BALL - 316 stainless steel, SEATS - stainless steel metal seated, top entry, trunnion mounted, fire safe, full port, gear operator. Seat and seals to be suitable for the following range of design conditions: -101°C @ 43090 kPag to 120°C @ 42495 kPag.

BALL VALVE SPECIFICATION		
Valve Tag (Data Sheets) ¹	DN	Description
VB-150B (F1)	100 to 250	ANSI Class 2500, buttweld end, replaceable ball and seats, BODY AND COVER – ASTM A352-LC3, BALL – 316 stainless steel, SEATS – stainless steel metal seated top entry, trunnion mounted, fire safe, full port, gear operator. Seat and seals to be suitable for the following range of design conditions: -101°C @ 43090 kPag to 120°C @ 42495 kPag.
VB-152 (F6, F7)	100 to 200	ANSI Class 2500, buttweld ends, replaceable ball and seats, BODY AND COVER - ASTM A352 LCC, BALL - 316 stainless steel, SEATS - stainless steel metal seated, top entry, trunnion mounted, fire safe, full port, gear operator. Seat and seals to be suitable for the following range of design conditions: -46°C @ 43090 kPag to 93°C @ 43090 kPag.
VB-160 (B11)	15 to 100	ANSI Class 300, RF flanged ends, replaceable ball and seats, BODY – ASTM A350 LF3, BALL – ASTM A182 316 stainless steel, SEATS – stainless steel metal seated, fire safe, full port, lever operator. Seat and seals to be suitable for the following range of design conditions: -101°C @ 5170 kPag to 120°C @ 5105 kPag.
VB-161 (B11)	150 to 300	ANSI Class 300, RF flanged ends, replaceable ball and seats, BODY AND COVER – ASTM A352 LC3, BALL – 316 stainless steel, SEATS – stainless steel metal seated, top entry, trunnion mounted, fire safe, full port, gear operator. Seat and seals to be suitable for the following range of design conditions: -101°C @ 5170 kPag to 120°C @ 5105 kPag.