DOCUMENT NO: 0000-TS-L007

GATE, GLOBE, CHECK, BUTTERFLY AND NEEDLE VALVES SPECIFICATION

Prepared By:

Chevron Niugini Project Services Limited

Rev	Date	Description	By	Chk	Proj Eng	Appd	CNPSL Appd
2	28 Feb 02	Approved for Purchase	SAC	MGB	PRW	PRW	LRF
1	01 May 01	Approved for Purchase	SAC	MGB	RST	PRW	LRF
0	7 Mar 01	Approved for Purchase	SAC	MGB	RST	PRW	LRF
C	22 Dec 00	Approved for Bid	SAC	MGB	RST	RST	LRF
B	17 Oct 00	Approved for Bid	MGB	RST	RST	PRW	LRF
A	30 May 00	Issued for IDC/FRC	MGB	JRC	PDT	PRW	

TABLE OF CONTENTS

1.0 INTRODUCTION 2

1.1 Scope 2

1.2 Definitions 2

2.0 CODES AND STANDARDS 2

2.1 References 2

2.2 Codes, Standards and Regulations 2

2.2.1 American National Standards Institute (ANSI) / American Society of Mechanical Engineers (ASME) 2

2.2.2 American Petroleum Institute (API) 2

2.2.3 American Society for Testing and Materials (ASTM) 2

2.2.4 Manufacturers Standardisation Society of the Valve and Fittings Industry (MSS) 2

2.2.5 National Association of Corrosion Engineers (NACE) 2

2.3 Precedence 2

3.0 DESIGN AND CONSTRUCTION 2

3.1 General Requirements 2

3.2 Gate Valves 2

3.3 Globe Valves 2

3.4 Butterfly Valves 2

3.5 Pressure and Temperature Design Range 2

3.6 Manual Valve Operators 2

3.7 Impact Wheels 2

3.8 Inspection Requirements for Valve Castings 2

3.9 Bolting 2

3.10 Flange Finish 2

4.0 PAINT AND PROTECTIVE COATINGS 2

5.0 IDENTIFICATION AND MARKING 2

6.0 DOCUMENTATION REQUIREMENTS 2

7.0 QUALITY ASSURANCE PROVISIONS 2

8.0 PREPARATION FOR SHIPPING AND STORAGE 2

APPENDIX 1

DETAILED GATE VALVE SPECIFICATIONS

APPENDIX 2

DETAILED GLOBE VALVE SPECIFICATIONS

APPENDIX 3

DETAILED CHECK VALVE SPECIFICATIONS

APPENDIX 4

DETAILED BUTTERFLY VALVE SPECIFICATIONS

APPENDIX 5

DETAILED NEEDLE 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 gate, globe, check, butterfly and needle valves. Valve tag numbers and technical descriptions are included in Appendices 1 to 5. 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-J005	On/Off Actuated Valves 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-M004	General Equipment 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 Ferrous Valves.
B16.11	Forged Steel Fittings, Socket-Welding and Threaded.
B16.20	Metallic Gaskets for Pipe Flanges – Ring Joint Sprial-wound and Jacketed.
B16.21	Non-metallic Flat Gaskets for Pipe Flanges.
B16.34	Valves – Flanged 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.

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 600	Steel Gate Valves – Flanged and Butt-Welding Ends.
STD 602	Compact Steel Gate Valves – Flanged, Threaded, Welding and Extended Body Ends.
STD 607	Fire Test for Soft-Seated Quarter-Turn Valves.
STD 609	Butterfly Valves – Double Flanged and Lugged Type.

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 Suitable 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.
A536	Standard Specification for Ductile Iron Castings.
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 Flanages and Connecting-End Flanges of Valves and Fittings.
SP 25	Standard Marking System for Valves, Fittings, Flanges and Unions.
SP53	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

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) Gate, globe and check valves shall be field repairable. Disc and seats shall be replaceable without welding or cutting, except as approved by the COMPANY.

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) 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.

h) All valves, except check valves, shall be capable of sealing with design pressure applied from either end of the valve.

i) Valves for hydrocarbon liquid service shall be designed to avoid trapping liquids in the valve body.

j) All valves shall have blowout proof stems.

k) All soft seated valves shall be of anti-static design.

l) Valve stem/shaft materials shall be of high strength (hardened) alloy or stainless steel suitable for the service conditions specified.

m) Rising stem gate and globe valves shall be provided with a back seating feature.

n) Where specified, valves shall be furnished with their packing glands drilled and tapped at the lantern ring for future installation of lubricator and isolating valves. The threaded openings shall be plugged with a solid type metal plug that is compatible with valve body material.

o) The direction of flow shall be cast or stamped on the valve body. Riveted tags are acceptable.

p) Coiled packing and split-ring packing is not acceptable. Packing systems shall be designed to operate without the need for lubrication.

3.2 Gate Valves

a) Welded-end gate valves manufactured to ANSI B16.34, Valves - Flanged and Buttwelding End Steel, Nickel Alloy, and Other Special Alloys, may be substituted for API standard 600 weld end valves listed in Appendix 1 if the manufacturer provides certification of the following:

- The gate closure system will not be damaged by the hydrostatic test pressure when the valve is closed;
- The pressure-containing components are designed in accordance with ASME B31.3;
- The seats were tested in accordance with API standard 598, Valve Inspection and Test.

b) The manufacturer shall guarantee that the body and weld ends of gate valves have the required corrosion allowances.

c) Gate valves shall meet the high-pressure closure test requirements of API Standard 598.

3.3 Globe Valves

a) Globe valves shall have a bolted bonnet with confined gasket. Teflon gasket material is not permitted.

b) Globe valves having conventional plug and seat rings shall meet the following minimum requirements:

- Single-seated valves shall be top and bottom guided or top guided only, providing the guide post has sufficient diameter to provide lateral stability to the valve plug.
- Plug and seat rings shall be martensitic or precipitation hardened stainless steel with a hardness suitable for the intended service, or Stellite.
- For services other than those containing hydrogen sulfide, guide material shall be 350 HB (Brinell Hardness) minimum, with a differential hardness not less than 50 HB between sliding surfaces.
- The valve stem shall be threaded and pinned to the valve plug.

3.4 Butterfly Valves

a) Butterfly valves in flammable service shall be of the ‘high performance’ type with flanged ends or fully lugged bodies.

b) Butterfly valves shall be of fire safe design. ‘High performance’ butterfly valves shall meet the requirements of API Standard 607, ‘Fire Test for Soft Seated Quarter Turn Valves’.

c) ‘High performance’ butterfly valves shall be designed in accordance with API 609.

d) Provision shall be made for shaft bearing lubrication.

3.5 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. Valve seats and seals shall be effective throughout the pressure class at the design temperatures specified.

b) Valve pressure-class ratings shall be in accordance with ANSI B16.34, API Specification 6A or API Specification 6D.

3.6 Manual Valve Operators

Manual gear operators shall be provided for all 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.

3.7 Impact Wheels

- Impact wheels shall be supplied in accordance with the valve manufacturers recommendations;
- Impact wheels shall be supplied with all steel gate valves DN 150 and larger if operated with chain wheels;
- Impact wheels shall not be used on cast iron valves or on valves with cast iron wheels.

3.8 Inspection Requirements for Valve Castings

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 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 Brinnel 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 Control 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 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.

3.9 Bolting

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

3.10 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.

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 3.8);
- SELLER'S reference list (of major projects) for valves with similar design conditions;
- Valve breakaway torque figures at maximum DP (pressure differential);
- Valve performance charts.

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, foundary or mill certificates and firesafe certificates;
- The foundary 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 GATE VALVE SPECIFICATIONS

GATE VALVE SPECIFICATION			
Valve Tag Data Sheets[1]	**DN**	**Temperature**	**Description**
VG-40 (A1, A3, A5, A7, B1, B6, C1, C5, C7)	15 to 40	-29°C to 400°C	ANSI Class 800, Conforming to API 602, SW ends, solid wedge disc; BODY AND BONNET - ASTM A105 forged carbon steel; STEM, DISC, AND SEATS - ASTM A182 F6, 11.5 to 13.5% chromium steel; PACKING – flexible graphite with braided carbon/graphite end rings; bolted bonnet, OS&Y- rising stem, reduced port.
VG-42 (A4)	15 to 40	-29°C to 150°C	ANSI Class 800, Conforming to API 602, NPT screwed ends, solid wedge disc; BODY AND BONNET – ASTM A105 forged carbon steel; STEM, DISC AND SEATS - ASTM A182 F6, 11.5 to 13.5% chromium steel; PACKING - flexible graphite with braided carbon/graphite end rings; bolted bonnet, OS&Y - rising stem, reduced port.
VG-46 (D1, D4, D5, D6, E1, E4, E6)	15 to 40	-29°C to 400°C	ANSI Class 1500, Conforming to API 602, RTJ flanged ends, solid wedge disc; BODY AND BONNET – ASTM A105 forged carbon steel; STEM, DISC, AND SEATS - ASTM A182 F6, 11.5 to 13.5% chromium steel; PACKING - flexible graphite with braided carbon/Graphite end rings; bolted bonnet, OS&Y - rising stem, full port.
VG-47 (A10, B10, C10, D10)	15 to 25	-46°C to 400°C	ANSI Class 1500, Conforming to API 602, SW ends, solid wedge disc; BODY AND BONNET - ASTM A182 F316 forged stainless steel; STEM, DISC, AND SEATS - ASTM A182 F316 forged stainless steel; PACKING - flexible graphite with braided carbon/graphite end rings; bolted bonnet, OS&Y - rising stem, reduced port.
VG-60 (A1, A3, A4,A5, A7)	50 to 600	-29°C to 400°C	ANSI Class 150, Conforming to API 600, RF flanged ends, solid wedge disc; BODY AND BONNET – ASTM A216 WCB cast carbon steel; STEM, DISC, AND SEATS - ASTM A182 F6, 11.5 to 13.5% chromium steel; PACKING - flexible graphite with braided carbon/graphite end rings; Bevel gear operator DN 400 and above, bolted bonnet, OS&Y - rising stem, full port.
VG-61 (A10)	40 to 600	-46°C to 400°C	ANSI Class 150, Conforming to API 600, RF flanged ends, solid wedge disc; BODY AND BONNET – ASTM A351 CF8 cast stainless steel; STEM, DISC, AND SEATS - ASTM A182 F316 forged stainless steel; PACKING - flexible graphite with braided carbon/graphite end rings; Bevel gear operator 400 DN and above, bolted bonnet, OS&Y - rising stem, full port.

[1] For applicable COMPANY piping material classification refer to Specification 0000-TS-L002

GATE VALVE SPECIFICATION			
Valve Tag Data Sheets[1]	**DN**	**Temperature**	**Description**
VG-66 (B1, B6)	50 to 600	-29°C to 400°C	ANSI Class 300, Conforming to API 600, RF flanged ends, solid wedge disc; BODY AND BONNET - ASTM A216 WCB cast carbon steel; STEM, DISC, AND SEATS - ASTM A182 F6, 11.5 to 13.5% chromium steel; PACKING - flexible graphite with braided carbon/graphite end rings; Bevel gear operator 350 DN and above, bolted bonnet, OS&Y - rising stem, full port.
VG-67(B10)	40 to 300	-46°C to 400°C	ANSI Class 300, Conforming to API 600, RF flanged ends, solid wedge disc; BODY AND BONNET - ASTM A351 CF8 cast stainless steel, STEM, DISC, AND SEATS - ASTM A182 F316 forged stainless steel; PACKING - flexible graphite with braided carbon/graphite end rings; Bevel gear operator 350 DN and above, bolted bonnet, OS&Y - rising stem, full port.
VG-70 (C1, C5, C7)	50 to 600	-29°C to 400°C	ANSI Class 600, Conforming to API 600, RF flanged ends, solid wedge disc; BODY AND BONNET – ASTM A216 WCB cast carbon steel; STEM, DISC, AND SEATS - ASTM A182 F6, 11.5 to 13.5% chromium steel; PACKING - flexible graphite with braided carbon/graphite end rings; Bevel gear operator 300 DN and above, bolted bonnet, OS&Y - rising stem, full port.
VG-71(C10)	40 to 200	-46°C to 400°C	ANSI Class 600, Conforming to API 600, RF flanged ends, solid wedge disc; BODY AND BONNET – ASTM A351 CF8 cast stainless steel; STEM, DISC, AND SEATS - ASTM A182 F316 forged stainless steel; PACKING - flexible graphite with braided carbon/graphite end rings; Bevel gear operator 300 DN and above, bolted bonnet, OS&Y - rising stem, full port.
VG-74 (D1, D4, D5, D6)	80 to 600	-29°C to 400°C	ANSI Class 900, Conforming to API 600, RTJ flanged ends, solid wedge disc; BODY AND BONNET – ASTM A216 WCB cast carbon steel; STEM, DISC, AND SEATS - ASTM A182 F6, 11.5 to 13.5% chromium steel; PACKING - flexible graphite with braided carbon/graphite end rings; Bevel gear operator 250 DN and above, bolted bonnet, OS&Y - rising stem, full port.
VG-75 (D10)	80 to 200	-46°C to 400°C	ANSI Class 900, Conforming to API 600, RTJ flanged ends, solid wedge disc; BODY AND BONNET – ASTM A351 CF8 cast stainless steel; STEM, DISC, AND SEATS - ASTM A182 F316 forged stainless steel; PACKING - flexible graphite with braided carbon/graphite end rings; Bolted bonnet, OS&Y - rising stem, full port.

GATE VALVE SPECIFICATION			
Valve Tag Data Sheets[1]	**DN**	**Temperature**	**Description**
VG-78 (E1, E4, E6) (D1, D4, D5, D6 and D7 – 50 only)	50 to 400	-29°C to 400°C	ANSI Class 1500, Conforming to API 600, RTJ flanged ends, solid wedge disc; BODY AND BONNET – ASTM A216 WCB cast carbon steel; STEM, DISC, AND SEATS - ASTM A182 F6, 11.5 to 13.5% chromium steel; PACKING - flexible graphite with braided carbon/graphite end rings; Bevel gear operator 150 DN and above, bolted bonnet, OS&Y - rising stem, full port.
VG-79 (D10, 40 and 50 only)	40 to 150	-46°C to 400°C	ANSI Class 1500, Conforming to API 600, RTJ flanged ends, solid wedge disc; BODY AND BONNET – ASTM A351 CF8 cast stainless steel; STEM, DISC, AND SEATS - ASTM A182 F316 forged stainless steel; PACKING - flexible graphite with braided carbon/graphite end rings; Bevel gear operator 150 DN and above, bolted bonnet, OS&Y - rising stem, full port.
VG-83 (A5)	50 to 600	-29°C to 400°C	ANSI Class 150, Conforming to API 600, BW ends, solid wedge disc; BODY AND BONNET - ASTM A216 WCB cast carbon steel; STEM, DISC, AND SEATS – ASTM A182 F6, 11.5 to 13.5% chromium steel; PACKING - flexible graphite with braided carbon/graphite end rings; Bevel gear operator 400 DN and above, bolted bonnet, OS&Y - rising stem, full port.
VG-85 (C5)	50 to 600	-29°C to 400°C	ANSI Class 600, Conforming to API 600, BW ends, solid wedge disc; BODY AND BONNET - ASTM A216 WCB cast carbon steel; STEM, DISC, AND SEATS – ASTM A182 F6, 11.5 to 13.5% chromium steel; PACKING - flexible graphite with braided carbon/graphite end rings; Bevel gear operator 300 DN and above, bolted bonnet, OS&Y - rising stem, full port.
VG-86 (E4) (D4 and D5 - 50 only)	50 to 400	-29°C to 400°C	ANSI Class 1500, Conforming to API 600, BW ends, solid wedge disc; BODY AND BONNET - ASTM A216 WCB cast carbon steel; STEM, DISC, AND SEATS - ASTM A182 F6, 11.5 to 13.5% chromium steel; PACKING - flexible graphite with braided carbon/graphite end rings; Bevel gear operator 150 DN and above, bolted bonnet, OS&Y - rising stem, full port.
VG-87 (D4, D5)	80 to 600	-29°C to 400°C	ANSI Class 900, Conforming to API 600, BW ends, solid wedge disc; BODY AND BONNET - ASTM A216 WCB cast carbon steel; STEM, DISC, AND SEATS – ASTM A182 F6, 11.5 to 13.5% chromium steel; PACKING - flexible graphite with braided carbon/graphite end rings; Bevel gear operator 250 and above, bolted bonnet, OS&Y - rising stem, full port.

GATE VALVE SPECIFICATION			
Valve Tag Data Sheets[1]	**DN**	**Temperature**	**Description**
VG-150 (-)	15 to 40	-29°C to 400°C	ANSI Class 1500, Conforming to API 602, SW ends, solid wedge disc; BODY AND BONNET - ASTM A105 forged carbon steel; STEM, DISC AND SEATS - ASTM A182 F6, 11.5 to 13.5 % chromium steel; PACKING - flexible graphite with braided carbon/graphite end rings; bolted bonnet, OS&Y - rising stem, reduced port.

APPENDIX 2

DETAILED GLOBE VALVE SPECIFICATIONS

GLOBE VALVE SPECIFICATION			
Valve Tag Data Sheets[1]	**DN**	**Temperature**	**Description**
VGL-40 (A1, A3, A5, A7, B1, B6, C1, C5, C7)	15 to 40	-29°C to 400°C	ANSI Class 800, SW ends, plug or semi-plug disc, replaceable disc and seat; BODY AND BONNET – ASTM A105 forged carbon steel; STEM, DISC AND SEAT - ASTM A182 F6, 11.5 to 13.5% chromium steel; PACKING - flexible graphite with braided carbon/graphite end rings; bolted bonnet, OS&Y-rising stem.
VGL-41 (A10, B10, C10)	15 to 25	-46°C to 400°C	ANSI Class 800, SW ends, plug or semi-plug disc, replaceable disc and seat; BODY AND BONNET – ASTM A182 F316 forged stainless steel; STEM, DISC AND SEAT - ASTM A182 F316 forged stainless steel; PACKING - flexible graphite with braided carbon/graphite end rings; bolted bonnet, OS&Y-rising stem.
VGL-46 (A4)	15 to 40	-29°C to 150°C	Class PN 32, NPT screwed ends, replaceable disc; BODY AND DISC PLATE - ASTM B62 bronze; STEM - brass; SEAT - Teflon; PACKING - Teflon; rising stem, union bonnet.
VGL-47 (A4)	50 to 80	-29°C to 150°C	Class PN 32, NPT screwed ends, replaceable disc; BODY AND DISC PLATE - ASTM B62 bronze; STEM - brass; SEAT - Teflon; PACKING - Teflon; rising stem, bolted bonnet.
VGL-52 (D4, D5, E1,E4, E6)	15 to 40	-29°C to 400°C	ANSI Class 1500, RTJ flanged ends, plug or semi-plug disc, replaceable disc and seat; BODY AND BONNET – ASTM A105 forged carbon steel; STEM, DISC AND SEAT - ASTM A182 F6, 11.5 to 13.5% chromium steel; PACKING - flexible graphite with braided carbon/graphite end rings; bolted bonnet, OS&Y-rising stem.
VGL-53 (D10)	15 to 25	-46°C to 400°C	ANSI Class 1500, SW ends, plug or semi-plug disc, replaceable disc and seat; BODY AND BONNET – ASTM A182 F316 forged stainless steel; STEM, DISC AND SEAT - ASTM A182 F316 forged stainless steel; PACKING - flexible graphite with braided carbon/graphite end rings; bolted bonnet, OS&Y-rising stem.

[1] For applicable COMPANY piping material classification refer to Specification 0000-TS-L002.

GLOBE VALVE SPECIFICATION			
Valve Tag Data Sheets[1]	**DN**	**Temperature**	**Description**
VGL-54 (F6, F7)	15 to 40	-46°C to 400°C	ANSI Class 2500, SW ends, plug disc, replaceable disc, integral seat; BODY AND BONNET – ASTM A350 LF3 forged carbon steel; STEM, DISC AND SEAT – ASTM A182 F6, 11.5 to 13.5% chromium steel; stellite-faced seat; PACKING – flexible graphite with anti-extrusion rings; bolted bonnet, Y-pattern body, OS&Y-rising stem.
VGL-60 (A1, A3, A4, A5, A7)	50 to 200	-29°C to 400°C	ANSI Class 150, RF flanged ends, plug or semi plug disc, replaceable disc and seat; BODY AND BONNET - ASTM A216 WCB cast carbon steel; STEM, DISC AND SEAT - ASTM A182 F6, 11.5 to 13.5% chromium steel; PACKING - flexible graphite with braided carbon/graphite end rings; bolted bonnet, OS&Y-rising stem.
VGL-61 (A10)	40 to 200	-46°C to 400°C	ANSI Class 150, RF flanged ends, plug or semi plug disc, replaceable disc and seat; BODY AND BONNET - ASTM A351 CF8 cast stainless steel; STEM, DISC AND SEAT - ASTM A182 F316 forged stainless steel; PACKING - flexible graphite with braided carbon/graphite end rings; bolted bonnet, OS&Y-rising stem.
VGL-66 (B1, B6)	50 to 200	-29°C to 400°C	ANSI Class 300, RF flanged ends, plug or semi-plug disc, replaceable disc and seat; BODY AND BONNET - ASTM A216 WCB cast carbon steel; STEM, DISC AND SEAT - ASTM A182 F6, 11.5 to 13.5% chromium steel; PACKING - flexible graphite with braided carbon/graphite end rings; Bevel gear operator 200 DN and above, bolted bonnet, OS&Y-rising stem.
VGL-67 (B10)	40 to 200	-46°C to 400°C	ANSI Class 300, RF flanged ends, plug or semi-plug disc, replaceable disc and seat; BODY AND BONNET - ASTM A351 CF8 cast stainless steel; STEM, DISC AND SEAT - ASTM A182 F316 forged stainless steel; PACKING - flexible graphite with braided carbon/graphite end rings; Bevel gear operator 200 DN and above, bolted bonnet, OS&Y-rising stem.
VGL-70 (C1, C5, C7)	50 to 200	-29°C to 400°C	ANSI Class 600, RF flanged ends, plug or semi-plug disc, replaceable disc and seat; BODY AND BONNET - ASTM A216 WCB cast carbon steel; STEM, DISC AND SEAT - ASTM A182 F6, 11.5 to 13.5% chromium steel; PACKING - flexible graphite with braided carbon/graphite end rings; Bevel gear operator 150 DN and above, bolted bonnet, OS&Y-rising stem.

GLOBE VALVE SPECIFICATION			
Valve Tag Data Sheets[1]	**DN**	**Temperature**	**Description**
VGL-71 (C10)	40 to 200	-46°C to 400°C	ANSI Class 600, RF flanged ends, plug or semi-plug disc, replaceable disc and seat; BODY AND BONNET - ASTM A351 CF8 cast stainless steel; STEM, DISC AND SEAT - ASTM A182 F316 forged stainless steel; PACKING - flexible graphite with braided carbon/graphite end rings; Bevel gear operator 150 DN and above, bolted bonnet, OS&Y-rising stem.
VGL-74 (D1, D4, D5, D6)	80 to 200	-29°C to 400°C	ANSI Class 900, RTJ flanged ends, plug or semi-plug disc, replaceable disc and seat; BODY AND BONNET - ASTM A216 WCB cast carbon steel; STEM, DISC AND SEAT - ASTM A182 F6, 11.5 to 13.5% chromium steel; PACKING - flexible graphite with braided carbon/graphite end rings; Bevel gear operator 100 DN and above, bolted bonnet, OS&Y-rising stem.
VGL-75 (D10)	80 to 200	-46°C to 400°C	ANSI Class 900, RTJ flanged ends, plug or semi-plug disc, replaceable disc and seat; BODY AND BONNET - ASTM A351 CF8 cast stainless steel; STEM, DISC AND SEAT - ASTM A182 F316 stainless steel; PACKING - flexible graphite with braided carbon/graphite end rings; Bevel gear operator 100 DN and above, bolted bonnet, OS&Y-rising stem.
VGL-78 (E1, E4, E6) (D1, D4, D5 and D6 - 50 only)	50 to 200	-29°C to 400°C	ANSI Class 1500, RTJ flanged ends, plug or semi-plug disc, replaceable disc and seat; BODY AND BONNET - ASTM A216 WCB cast carbon steel; STEM, DISC AND SEAT - ASTM A182 F6, 11.5 to 13.5% chromium steel; PACKING - flexible graphite with braided carbon/graphite end rings; Bevel gear operator 100DN and above, bolted bonnet, OS&Y-rising stem.
VGL-79 (D10, 40 and 50 only)	40 to 150	-46°C to 400°C	ANSI Class 1500, RTJ flanged ends, plug or semi-plug disc, replaceable disc and seat; BODY AND BONNET - ASTM A351 CF8 cast stainless steel; STEM, DISC AND SEAT - A182 F316 forged stainless steel; PACKING - flexible graphite with braided carbon/graphite end rings; Bevel gear operator 100DN and above, bolted bonnet, OS&Y-rising stem.
VGL-80 (D1, D4, D5, D6, E1, E4, E6)	15 to 40	-29°C to 400°C	ANSI Class 1500, SW ends, plug or semi-plug disc, replaceable disc and seat; BODY AND BONNET - ASTM A105 forged carbon steel; STEM, DISC AND SEAT - ASTM A182 F6, 11.5 to 13.5% chromium steel; PACKING - flexible graphite with braided carbon/graphite end rings; bolted bonnet, OS&Y-rising stem.

GLOBE VALVE SPECIFICATION			
Valve Tag Data Sheets[1]	**DN**	**Temperature**	**Description**
VGL-90B (F11)	15 to 40	-29°C to 150°C	ANSI Class 2500, BW ends, replaceable plug disc, replaceable/integral seat; BODY AND BONNET - ASTM A105 forged carbon steel; STEM, DISC AND SEAT - ASTM A182 F6, 11.5 To 13.5% chromium steel; stellite-faced seal; PACKING - flexible graphite with anti-extrusion rings; bolted bonnet, Y-pattern body, OS&Y-rising stem.
VGL-150 (F1, F6, F7)	15 to 40	-101°C to 120°C	ANSI Class 2500, BW ends, replaceable plug disc, replaceable/integral seat; BODY AND BONNET – ASTM A350 LF3 forged carbon steel; STEM, DISC AND SEAT – ASTM A182 F6, 11.5 to 13.5% chromium steel; stellite-faced seat; PACKING – flexible graphite with anti-extrusion rings; bolted bonnet, Y-pattern body, OS&Y-rising stem.
VGL-151 (F1, F6, F7)	50 to 80	-101°C to 120°C	ANSI Class 2500, BW ends, replaceable plug disc, replaceable/integral seat; BODY AND BONNET – ASTM A352 LC3 cast carbon steel; STEM, DISC AND SEAT – ASTM A182 F6, 11.5 to 13.5% chromium steel; stellite-faced seat; PACKING – flexible graphite with anti-extrusion rings; bolted bonnet, OS&Y- rising stem.

APPENDIX 3

DETAILED CHECK VALVE SPECIFICATIONS

CHECK VALVE SPECIFICATION			
Valve Tag Data Sheets[1]	**DN**	**Temperature**	**Description**
VC-39 (A3)	15 to 40	-29°C to 120°C	Class PN27, poppet check type, NPT screwed ends, replaceable disc and seat, BODY AND COVER – ASTM A351 CF8M cast stainless steel; POPPET AND SEAT – PTFE; SPRING – AISI 316 stainless steel; BODY SEAL – Viton O-Ring; CRACKING PRESSURE – 3.4 kPa (0.5 psi). Acceptable valve is BIVCO 1000 SERIES or equivalent.
VC-40 (A1, A3, A5, A7, B1, B6, C1, C5, C7)	15 to 40	-29°C to 340°C	ANSI Class 800, horizontal lift, SW ends, replaceable disc; BODY AND COVER - ASTM A105 forged carbon steel; DISC - ASTM A182 F6, 11.5 to 13.5% chromium steel; SEAT - STELLITE, integral; bolted cover.
VC-40S (A10, B10, C10)	15 to 25	-46°C to 340°C	ANSI Class 800, horizontal lift, SW ends, replaceable disc and seat; BODY AND COVER - ASTM A182 F316 forged stainless steel; DISC AND SEAT - ASTM A182 F316 forged stainless steel; bolted cover.
VC-46 (A4)	15 to 40	-29°C to 150°C	Class PN32, swing type, NPT screwed ends, replaceable disc and seat, BODY, HANGER AND DISC HOLDER – ASTM B62 bronze. hanger, and disc holder.
VC-52 (D4, D5, E1, E4, E6)	15 to 40	-29°C to 340°C	ANSI Class 1500, piston type, RTJ flanged ends, replaceable piston; BODY AND COVER - ASTM A105 forged carbon steel; DISC - ASTM A182 F6, 11.5 to 13.5% chromium steel; SEAT - STELLITE, integral; bolted cover.
VC-53 (D10)	15 to 25	-46°C to 340°C	ANSI Class 1500, piston type, SW ends, replaceable piston; BODY AND COVER - ASTM A182 F316 forged stainless steel; PISTON AND SEAT - ASTM A182 F316 forged stainless steel; bolted cover.
VC-55 (F1, F6, F7)	15 to 40	-101°C to 340°C	ANSI Class 2500, piston type BW ends; replaceable piston; BODY AND COVER – ASTM A352 LC3 cast carbon steel; PISTON – ASTM A182 F6, 11.5 to 13.5% chromium steel; SEAT – stellite, integral; bolted cover.

[1] For applicable COMPANY piping material classification refer to Specification 0000-TS-L002.

CHECK VALVE SPECIFICATION			
Valve Tag Data Sheets[1]	**DN**	**Temperature**	**Description**
VC-56 (F1, F6, F7)	15 to 40	-101°C to 340°C	ANSI Class 2500, piston type SW ends; replaceable piston; BODY AND COVER – ASTM A350 LF3 forged carbon steel; PISTON – ASTM A182 F6, 11.5 to 13.5% chromium steel; SEAT – stellite, integral; bolted cover.
VC-60 (A1, A3, A4, A5, A7)	50 to 600	-29°C to 340°C	ANSI Class 150, swing type, RF flanged ends, replaceable disc and seat; BODY AND COVER - ASTM A216 WCB cast carbon steel; DISC AND SEAT - ASTM A182 F6, 11.5 to 13.5% chromium steel; bolted cover.
VC-70 (B1, B6)	50 to 600	-29°C to 340°C	ANSI Class 300, swing type, RF flanged ends, replaceable disc and seat; BODY AND COVER - ASTM A216 WCB cast carbon steel; DISC AND SEAT - ASTM A182 F6, 11.5 to 13.5% chromium steel; bolted cover.
VC-72 (B10)	40 to 300	-46°C to 340°C	ANSI Class 300, swing type, RF flanged ends, replaceable disc and seat; BODY AND COVER - ASTM A351 CF8 cast stainless steel; DISC AND SEAT - ASTM A182 F316 forged stainless steel; bolted cover.
VC-79 (C1, C5, C7)	50 to 600	-29°C to 340°C	ANSI Class 600, swing type, RF flanged ends, replaceable disc and seat; BODY AND COVER - ASTM A216 WCB cast carbon steel; DISC AND SEAT - ASTM A182 F6, 11.5 to 13.5% chromium steel; bolted cover.
VC-80 (C10)	40 to100	-46°C to 340°C	ANSI Class 600, swing type, RF flanged ends, replaceable disc and seat; BODY AND COVER - ASTM A351 CF8 cast stainless steel; DISC AND SEAT - ASTM A182 F316 forged stainless steel; bolted cover.
VC-87 (D4, D5)	80 to 200	-29°C to 340°C	ANSI Class 900, swing type, RTJ flanged ends, replaceable disc and seat; BODY AND COVER - ASTM A216 WCB cast carbon steel; DISC AND SEAT - ASTM A182 F6, 11.5 to 13.5% chromium steel; bolted cover.
VC-88 (D10)	80 to 250	-46°C to 340°C	ANSI Class 900, swing type, RTJ flanged ends, replaceable disc and seat; BODY AND COVER - ASTM A351 CF8 cast stainless steel; DISC AND SEAT - ASTM A182 F316 forged stainless steel; bolted cover.

CHECK VALVE SPECIFICATION			
Valve Tag Data Sheets[1]	**DN**	**Temperature**	**Description**
VC-93 (E1, E4, E6) (D1, D4, D5 and D6 - 50 only)	50 to 300	-29°C to 340°C	ANSI Class 1500, swing type, RTJ flanged ends, replaceable disc and seat; BODY AND COVER - ASTM A216 WCB cast carbon steel; DISC AND SEAT - ASTM A182 F6, 11.5 to 13.5% chromium steel; bolted cover.
VC-94 (D10, 40 and 50 only)	40 to 150	-46°C to 340°C	ANSI Class 1500, swing type, RTJ flanged ends, replaceable disc and seat; BODY AND COVER - ASTM A351 CF8 cast stainless steel; DISC AND SEAT - ASTM A182 F316 forged stainless steel; bolted cover.
VC-114 (D1, D4, D5, D6)	15 to 40	-29°C to 340°C	ANSI Class 1500, piston type, SW ends, replaceable disc and seat; BODY AND COVER - ASTM A105 forged carbon steel; PISTON - ASTM A182 F6, 11.5 to 13.5% chromium steel; SEAT - STELLITE, integral.
VC-115 (D1, D6)	80 to 600	-29°C to 340°C	ANSI Class 900, swing type, RTJ flanged ends, replaceable disc and seat; BODY AND COVER - ASTM A216 WCB cast carbon steel; DISC AND SEAT - ASTM A182 F6, 11.5 to 13.5% chromium steel; bolted cover.
VC-118 (A5)	50 to 600	-29°C to 340°C	ANSI Class 150, swing type, BW ends, replaceable disc and seat; BODY AND COVER - ASTM A216 WCB cast carbon steel; DISC AND SEAT - ASTM A182 F6, 11.5 to 13.5% chromium steel; bolted cover.
VC-120 (C5)	50 to 600	-29°C to 340°C	ANSI Class 600, swing type, BW ends, replaceable disc and seat; BODY AND COVER - ASTM A216 WCB cast carbon steel; DISC AND SEAT - ASTM A182 F6, 11.5 to 13.5% chromium steel; bolted cover.
VC-122 (D4, D5)	50 to 250	-29°C to 340°C	ANSI Class 900, swing type, BW ends, replaceable disc and seat; BODY AND COVER - ASTM A216 WCB cast carbon steel; DISC AND SEAT - ASTM A182 F6, 11.5 to 13.5% chromium steel; bolted cover.
VC-123 (D4, D5 – 50 only)	50 to 250	-29°C to 340°C	ANSI Class 1500, swing type, BW ends, replaceable disc and seat; BODY AND COVER - ASTM A216 WCB cast carbon steel; DISC AND SEAT - ASTM A182 F6, 11.5 to 13.5% chromium steel; bolted cover.
VC-125 (E4)	50 to 150	-29°C to 340°C	ANSI Class 1500, swing type, RTJ flanged ends, replaceable disc and seat; BODY AND COVER - ASTM A216 WCB cast carbon steel; DISC AND SEAT - ASTM A182 F6, 11.5 to 13.5% chromium steel; bolted cover.

CHECK VALVE SPECIFICATION			
Valve Tag Data Sheets[1]	**DN**	**Temperature**	**Description**
VC-129 (A10)	40 to 100	-46°C to 340°C	ANSI Class 150, swing type, RF flanged ends, replaceable disc and seat; BODY AND COVER - ASTM A351 CF8 cast stainless steel; DISC AND SEAT - ASTM A182 F316 forged stainless steel; bolted cover.
VC-131 (F1, F6, F7)	50 to 200	-101°C to 120°C	ANSI Class 2500 swing type BW ends; replaceable disc and seat; BODY AND COVER - ASTM A352 LC3 cast carbon steel; DISC AND SEAT - ASTM A182 F6, 11.5 to 13.5% chromium steel; stellite-faced seat; bolted cover.

APPENDIX 4

DETAILED BUTTERFLY VALVE SPECIFICATIONS

BUTTERFLY VALVE SPECIFICATION			
Valve Tag Data Sheets[1]	**DN**	**Temperature**	**Description**
VBT-20 (A1)	80 to 600	-29°C to 200°C	ANSI Class 150, fully lugged wafer style body to match Class 150 RF flanges; BODY - ASTM A216 WCB cast carbon steel; DISC – ASTM A351 CF8 cast stainless steel; SHAFT - 17-4PH; SEALS AND SEAT - Teflon; double or triple offset design firesafe, gear operator shall be provided for 250 DN and above.
VBT-21 (A3, A4)	50 to 300	-29°C to 150°C	ANSI Class 125/150, fully lugged wafer style body to match Class 150 RF flanges; BODY - ASTM A536 cast ductile iron; DISC AND SHAFT - 316 stainless steel; SEAT MATERIAL – Buna N; gear operator shall be provided for 250 DN and above. Seat and seals to be suitable for the following design conditions: -29^0C at 1000 kPa to 120^0C at 1000 kPa.
VBT-22 (A1)	80 to 500	-29°C to 200°C	ANSI Class 150, fully lugged wafer style body to match Class 150 RF flanges; BODY - ASTM A216 WCB cast carbon steel; DISC – ASTM A351 CF8 cast stainless steel; SHAFT - 17-4PH; METAL SEAL - laminated 316 stainless steel; triple offset design firesafe, zero leakage, gear operator shall be provided for 200 DN and above.
VBT-23 (A1)	80 to 500	-29°C to 200°C	ANSI Class 150, RF flanged ends; BODY - ASTM A216 WCB cast carbon steel; DISC - ASTM A351 CF8 cast stainless steel; SHAFT - 17-4PH; METAL SEAL – laminated 316 stainless steel; triple offset design firesafe, zero leakage, gear operator shall be provided for 200 DN and above.
VBT-30 (-)	50 to 300	-29°C to 150°C	ANSI Class 300, fully lugged wafer style body to match Class 300 RF flanges; BODY - ASTM A216 WCB cast carbon steel; DISC – ASTM A351 CF8 cast stainless steel; SHAFT - 17-4 PH; SEAT – resilient type with secondary metal backup, double or triple offset design firesafe, zero leakage, gear operator shall be provided for 200 DN and above. Seat and seals to be suitable for the following design conditions: -29°C at 5100 kPa to 150°C at 4510 kPa.

[1] For applicable COMPANY piping material classification refer to Specification 0000-TS-L002.

APPENDIX 5

DETAILED NEEDLE VALVE SPECIFICATIONS

NEEDLE VALVE SPECIFICATION			
Valve Tag Data Sheets[1]	**DN**	**Temp**	**Description**
VN-30 (A1, A5, A7, A10, B1, B6, B10, C1, C5, C7, C10, D1, D4, D5, D6, D10, E1, E4, E6)	15 to 25	-46°C to 340°C	Needle valve, 41,000 kPa @ 95°C and 23,000 kPa @ 340°C, MNPT x DN15 FNPT, screwed bonnet with locking pin, inside screw and rising stem; BODY, BONNET, STEM, AND HARD SEAT - ASTM A182 F316 forged stainless steel; PACKING - Graphoil.
VN-61 (A1, A5, A7, A10, B1, B6, B10, C1, C5, C7, C10, D1, D4, D5, D6, D10, E1, E4, E6)	15 to 20	-46°C to 340°C	Needle valve, 41,000 kPa @ 95°C and 23,000 kPa @ 340°C, MNPT x three (3) DN15 FNPT connections, screwed bonnet with locking pin, inside screw and rising stem; BODY, BONNET, STEM AND HARD SEAT - ASTM A182 F316 forged stainless steel; PACKING - Graphoil. Valve shall be assembled with one DN15 heavy hex plug and one VN-30 DN15 bleeder valve.

[1] For applicable COMPANY piping material classification refer to Specification 0000-TS-L002.