

GENERAL SPECIFICATION

PIPING VALVES VESSELS

GS EP PVV 157

Butterfly Valves

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1. Scope

This specification comes in addition to the requirements given in the piping material class as defined in [GS EP PVV 112](#) as well as the material requisitions and associated valve data sheets. It defines supplementary requirements for the fabrication, inspection and shipment of [API STD 609](#) butterfly valve designs for ASME pressure rating up to Class 900 for offshore and onshore facilities.

This specification also covers butterfly valves with butt-welded end connection, which shall also be designed as per [API STD 609](#). This specification applies to all valves with body material made of ductile cast iron, carbon steel, alloy steel, corrosion resistant alloys, bronze and other copper alloys. Specification also applies to all manual, on-off and control valves.

This specification does not cover PVDF body material valves. PVDF body material valves shall be in accordance with [ISO 16136](#).

Potential use of butterfly valve proprietary design not covered by [API STD 609](#) or at pressure rating above ASME Class 600 is not addressed in this document and shall be subject to supplementary requirements to be agreed with Managing Entity.

This specification applies to all process piping and pipeline valves regardless of the line design code.

The specification does not address any local regulatory requirement.

In addition to the present specification, valves in cryogenic service (i.e. for use at continuous operating temperatures below -41°C) shall also comply with [GS EP PVV 150](#).

Similarly, valves in high temperature service (i.e. with design temperature above 200°C) shall comply with [GS EP PVV 151](#).

Valves used in sour wet service conditions shall also meet the additional requirements of the [NACE MR 0175 / ISO 15156](#) standards.

The specification does not intend to address all the safety concerns associated with its use. It is user responsibility to establish appropriate safety and health practices prior to product use.

2. Reference documents

The reference documents listed below form an integral part of this General Specification.

Any conflicting requirements between this specification and any other relevant documents shall be reported to the Managing Entity for arbitration. In any case, and notwithstanding the final decision of the Company, the most stringent requirement is always first meant to govern.

External Documents

Unless otherwise stipulated, the applicable version of these documents, including relevant appendices and addendums, is the latest revision published at the effective date of this document.

Reference	Title
API STD 598	Valve Inspection and Testing
API STD 607	Fire Test for Quarter-turn Valves and Valves Equipped with Nonmetallic Seats

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Reference	Title
API STD 609	Butterfly Valves: Double-flanged, Lug- and Wafer-type
API STD 622	Type Testing of Process Valve Packing for Fugitive Emissions
ASME B16.25	Buttwelding Ends
ASME B16.34	Valves - Flanged, Threaded and Welding End
ASME B16.47	Large Diameter Steel Flanges: NPS 26 through NPS 60 Metric/Inch Standard
ASME B18.2.2	Nuts for General Applications: Machine Screw Nuts, Hex, Square, Hex Flange, and Coupling Nuts (Inch Series)
ASME B31.3	Process Piping
ASME BPVC Section IX	ASME Boiler and Pressure Vessel Code (BPVC) - Section IX: Qualification Standard for Welding, Brazing, and Fusing Procedures; Welders; Brazers; and Welding, Brazing, and Fusing Operators
ASNT SNT-TC-1A	Recommended practice for personal qualification and certification in nondestructive testing
ASTM A193/A193M	Standard Specification for Alloy-Steel and Stainless Steel Bolting for High Temperature or High Pressure Service and Other Special Purpose Applications
ASTM A194/A194M	Standard Specification for Carbon Steel, Alloy Steel, and Stainless Steel Nuts for Bolts for High Pressure or High Temperature Service, or Both
ASTM A320/A320M	Standard Specification for Alloy-Steel and Stainless Steel Bolting for Low-Temperature Service
ASTM A453/A453M	Standard Specification for High-Temperature Bolting, with Expansion Coefficients Comparable to Austenitic Stainless Steels
ASTM A961	Standard Specification for Common Requirements for Steel Flanges, Forged Fittings, Valves, and Parts for Piping Applications
ASTM B150/B150M	Standard Specification for Aluminum Bronze Rod, Bar, and Shapes
EN 10204	Metallic products - Type of inspection documents
IEC 60529	Degrees of protection provided by enclosures (IP code)
ISO 10497	Testing of valves - Fire type-testing requirements
ISO 15848-1	Industrial valves - Measurement, test and qualification procedures for fugitive emissions - Part 1: Classification system and qualification procedures for type testing of valves
ISO 16136	Industrial valves - Butterfly valves of thermoplastics materials

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Reference	Title
ISO 9712	Non-destructive testing - Qualification and certification of NDT personnel
MSS SP-55	Quality Standard for Steel Castings for Valves, Flanges, Fittings, and Other Piping Components - Visual Method for Evaluation of Surface Irregularities
NACE MR 0175 / ISO 15156	Petroleum and natural gas industries - Materials for use in H ₂ S-containing environments in oil and gas production

Total General Specifications

Unless otherwise stipulated, the applicable version of these documents, including relevant appendices and addendums, is the latest revision published.

Reference	Title
GS EP COR 350	External protection of offshore and coastal structures and equipment by painting
GS EP COR 354	External protection of onshore structures and equipment by painting
GS EP INS 137	On/Off Valve Control Panels and Actuators
GS EP PVV 112	Piping material classes
GS EP PVV 150	Valves in cryogenic service
GS EP PVV 151	Valves for high temperature service
GS EP PVV 158	Material and special process for valves (MDS & manufacturing processes)
GS EP PVV 611	Welding of pressure containing piping and equipment

3. Terms and Definitions

Technical terms, acronyms and abbreviations of the present specification follow the definitions given in [API STD 609](#).

The following additional terms and definitions are also applicable:

Breakaway torque	Maximum torque required to operate a valve at maximum pressure differential
Inspection Agency	The body in charge of product inspection of the products on behalf of purchaser at the manufacturer (or its subcontractor) premises
ITP	Inspection Test Plan
Managing Entity	Entity identified on the front page of the document

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NFI Notification For Inspection

IOM Installation and Operation Manual

PMC Piping Material Class

VDS Valve Datasheet

YS Material Yield Strength

Pressure Containing part A part whose failure to function as intended results in a release of contained fluid into the environment and as a minimum includes body and stem.

Each valve shall have a dedicated datasheet in accordance with Appendix 2 template.

Butterfly Quality Specification Level are classified in accordance to Table 1.

Table 1 - Quality Specification Level

Design Temperature	Service	Phase	QSL
$-196^{\circ}\text{C} \leq T \leq 200^{\circ}\text{C}$	All (Cryogenic)		3
$-29^{\circ}\text{C} \leq T \leq 90^{\circ}\text{C}$	Utilities and Water systems		1
$-29^{\circ}\text{C} \leq T \leq 90^{\circ}\text{C}$	Chemicals - 150#/300#		1
$-29^{\circ}\text{C} \leq T \leq 200^{\circ}\text{C}$	Chemicals – 600#/900#		2
$-46^{\circ}\text{C} \leq T \leq 200^{\circ}\text{C}$	Hydrocarbon non-Toxic and non- Lethal Service	Liquid	2
$-46^{\circ}\text{C} \leq T \leq 200^{\circ}\text{C}$	Hydrocarbon non-Toxic and non- Lethal Service	Gas	3
$-46^{\circ}\text{C} \leq T \leq 200^{\circ}\text{C}$	Hydrocarbon Toxic or Lethal Service		3
$T > 200^{\circ}\text{C}$	All (High Temperature)		3

4. Pressure Temperature Ratings

The valves shall be designed according to [ASME B16.34](#) standard class pressure rating.

Paragraph 4 of [API STD 609](#) shall apply in full with the exception that all valves shall be rated for any pressure and temperature combinations allowed by the line rating. Pressure/temperature limitations imposed by special soft seats or trim materials shall be subject to specific Managing Entity approval.

5. Design

5.1 General Design Requirements

Valve design shall be in full compliance with both [ASME B16.34](#) and paragraph 5 of [API STD 609](#).

When applicable, valve design shall also comply with paragraph 307 of [ASME B31.3](#).

In addition to the above, design supplementary requirements listed in this specification shall supersede any of the ones given by an international standard.

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For lug-type, design shall prevent bolting direct flame contact along the valve face to face in case of fire.

The Manufacturer shall confirm in his quotation that disc-to-pipe clearance complies with Annex D of [API STD 609](#) requirement using inside pipe diameter of the connecting pipe or flange indicated in valve datasheet.

Category B Butterfly valves are not allowed below 3".

Category A manual butterfly valves shall be bi-directional up to full pressure rating.

Automated valves shall be designed up to maximum differential pressure indicated in the datasheet.

Valve shall be sized and designed so that bore velocity does not exceed 4 m/s for liquid and 30 m/s for gases.

Supplier design shall also meet site maximum noise level for any disk opening percentage.

Butterfly valve shall be anti-static by design and capable to demonstrate electrical continuity in accordance with [API STD 609](#). Shaft retention design shall not rely on actuator mounting bracket.

Stem to disc connection design shall not permit any movement of the disc relative to the stem that will impact valve tightness performances. Stem to disk connection shall be done through keys. Other alternative attachment systems are not allowed without prior assessment from Managing Entity. Valve design shall consider the various loading combinations and flow conditions under which the valve will be exposed during its service life.

Maintenance door for in-line repairable valve shall not affect valve sealing.

For round door sealing, gasket shall be made by either a spiral wound gasket or a metallic ring joint. Non-round opening gasket material and design shall be subjected to managing entity approval.

5.2 Design Assessment

Design deliverables as listed in Appendix 5 shall include and consider:

- Wall thickness and bolting calculations in accordance with [ASME B16.34](#)
- Lifting lug and valve support calculations when applicable.
- Stem strength calculation and anti blow-out compliance in accordance with [API STD 609](#). Stem strength calculation under the most conservative conditions shall not lead to stem stress exceeding 0.9 YS for any combination loading and 0.52 YS for torsional loading.
- For automated valve, calculation note confirming that stem to actuator key system will always fail prior to the stem to disk key connection under any operational conditions.
- For extended drive train, calculation note confirming no significant deflection that would prevent the obturator from reaching fully closed or fully open position.
- Calculation note confirming that all drive train components are at least two times the valve breakaway torque.

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- Calculation note confirming that all drive train components do not exceed the following stress values under the most conservative conditions:
 - (a) 90% of nominal yield strength for tensile and bearing stresses
 - (b) 90% of nominal yield strength for equivalent stress
 - (c) 45% of nominal yield strength for shear stress
 - (d) 52% of nominal yield strength for torsional stress.

Upon request, manufacturer shall be able to demonstrate, by calculation or test that disc or seat distortion resulting from design pressure, external loading or specific service conditions will not affect valve functionality or sealing capability.

5.3 Fire Safe Design

For valve to be installed in fire rated line, manufacturer shall be in the position to confirm that the valve design is able to pass fire testing requirements in accordance to [ISO 10497](#) or [API STD 607](#).

Supplier shall provide complete fire testing evidence (complete test reports in accordance with one of the recognized standard) upon request.

5.4 Body Dimensions

Body dimensions shall be in full compliance with paragraph 6.1 of [ASME B16.34](#).

Non-standard valve face to face shall be agreed between purchaser and valve manufacturer.

For sizes above DN 600 (NPS 24), body end flanges shall comply with the dimensional requirements of [ASME B16.47](#) Series A.

Flanged ends shall always permit the installation of the valve in the piping system using Hexagonal nuts (Heavy series) of [ASME B18.2.2](#) on the piping and valve sides of the flanged connection. The bolting studs shall exceed the nuts over two threads on the valve side after full bolt tightening.

Unless otherwise agreed with purchaser, end flanges for double-flanged valves shall be drilled for through bolting.

Unless otherwise specified, valve butt-welding ends shall comply with [ASME B16.25](#) with internal diameters matching the connecting pipe.

All butt-welding end valves shall be supplied with pup pieces to allow for transition between the valve body and the connecting pipe. Pup piece dimensional and material requirements as well as associated welding procedure shall be subject to Managing Entity approval.

5.5 Packing and Packing box

For valves in hydrocarbon service, only packing that have successfully gone through [ISO 15848-1](#) or [API STD 622](#) qualification is acceptable. Dedicated report shall be made available upon request. Stem packing shall be suitable for service conditions specified and contain a corrosion inhibitor to prevent stem oxidation, especially in case of extended storage period. All valves stem shall be adjusted ready for service.