

GENERAL SPECIFICATION

INSTRUMENTATION

GS EP INS 120

Control and Choke Valves

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1. Scope

This specification describes the minimum requirements for the design, sizing, selection and installation of:

- Control valves
- Choke valves
- Self-acting pressure regulators

for use on TOTAL Exploration & Production offshore and onshore facilities.

Both manual and actuated choke valves for surface production facilities are covered by this specification. However, this specification is not applicable to subsea choke valves and choke valves which are part of a wellhead assembly.

This specification shall be applied in conjunction with:

- [GS EP PVV 112](#)
- [GS EP PVV 142](#)

The PVV general specifications as referenced throughout this specification provide the mandatory requirements related to metallurgy, casting, welding, machining and material examinations. This specification provides additional requirements to the referenced PVV specifications.

2. Reference documents

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

External Documents

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

Reference	Title
API 609	Lug and Wafer Type Butterfly Valves
API 6A / ISO 10423	Specification for Wellhead and Christmas Tree Equipment
API 6D / ISO 14313	Specification for Pipeline Valves (Gate, Plug, Ball, Check Valves)
ASME B16.10	Face-to-Face and End-to-End Dimensions of Valves
ASME B16.34	Valves - Flanged, Threaded and Welded End
ASME B16.5	Pipe Flanges and Flanged Fittings
ASME B31.3	Process Piping
ASTM A 352	Steel Castings, Ferritic and Martensitic, for Pressure-Containing Parts, Suitable for Low-Temperature Service
ASTM A 703	Steel Castings, General Requirements for Pressure Containing Parts

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Reference	Title
Class Society Rules	Particular design rules as per selected Class Society may be applicable for equipment installed on the hull of floating facilities and may require Class Society type approval
EN 10204	Metallic Products - Type of Inspection Documents
European Directive 94/9/EC dated 23 March 1994	Directive of the European Parliament and of the Council on the approximation of the Laws of the Member States concerning equipment and protective systems intended for use in potentially explosive atmospheres (ATEX)
European Directive 97/23/EC dated 29 May 1997	Directive of the European Parliament and of the Council on the approximation of the Laws of the Member States concerning pressure equipment (PED)
FCI 70-2	Control Valve Seat Leakage
IEC 60034-1	Rotating electrical machines - Part 1: Rating and performance
IEC 60534-2-1	Industrial-Process Control Valves - Part 2.1: Flow Capacity - Sizing equations for fluid flow under installed conditions
IEC 60534-2-3	Industrial-Process Control Valves - Part 2.3: Flow Capacity - Test Procedures
IEC 60534-3-1	Industrial-Process Control Valves - Part 3-1: Dimensions - Face-To-Face Dimensions for Flanged, Two-Way, Globe-Type, Straight Pattern and Centre-To-Face Dimensions for Flanged, Two-Way, Globe-Type, Angle Pattern Control Valves
IEC 60534-3-2	Industrial-Process Control Valves - Part 3-2: Dimensions - Face-to-Face Dimensions for Rotary Control Valves Except Butterfly Valves
IEC 60534 (Parts 4; 5)	Industrial-Process Control Valves - Parts 4; 5
IEC 60534-8-3	Industrial-Process Control Valves - Part 8: Noise Considerations - Section 3: Aerodynamic Noise Prediction
IEC 60534-8-4	Industrial-Process Control Valves - Part 8: Noise Considerations - Section 4: Hydrodynamic Noise Prediction
IECEX	IEC System for Certification to Standards relating to Equipment for use in Explosive Atmospheres (IECEX System)
ISA Guide (ISBN 1-55617-565-5)	Control Valves, Practical Guide for Measurement and Control
ISA 75.01.01	Flow Equations for Sizing Control Valves
ISA 75.05 - All parts	Control Valve Terminology
ISA 75.19.01	Hydrostatic Testing of Control Valves
ISA RP75.23	Considerations for Evaluating Control Valve Cavitation

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Reference	Title
ISO 15156-3	Materials for use in H ₂ S-containing environments in oil and gas production - Part 3: Cracking-resistant CRAs (corrosion-resistant alloys) and other alloys
ISO 28079	Hard metals - Palmqvist toughness test
ISO 15848-1	Measurement, test and qualification procedures for fugitive emissions - Part 1: Classification system and qualification procedures for type testing of valves emissions
MSS SP-55	Quality Standard for Steel Castings for Valves, Flanges and Fittings and Other Piping Components - Visual Method for Evaluation of Surface Irregularities
MSS SP-61	Pressure Testing of Steel Valves
USP-NF	United States Pharmacopeia - National Formulary (approved materials for sanitary service equipment)

Total General Specifications

Unless otherwise stipulated, the applicable version of these documents, including relevant appendices and supplements, is the latest revision published in the applicable yearly collection.

Reference	Title
GS EP COR 350	External protection of offshore and coastal structures and equipment by painting
GS EP COR 351	External protection of structures and equipment by painting. Floating structures
GS EP COR 354	External protection of onshore structures and equipment by painting
GS EP ECP 103	Process sizing criteria
GS EP EXP 203	Maintenance and inspection documentation preparation during project phase
GS EP EXP 217	Requirements to Vendors, Suppliers and EPC's for spare parts
GS EP INS 101	Instrumentation engineering, supply and construction general requirements
GS EP INS 107	Design and installation of instrumentation links
GS EP INS 137	On/off valve control panels and actuators functional and construction requirements
GS EP INS 900	Instrument hook-up diagrams
GS EP MEC 253	Anti Surge System for Centrifugal and Axial Compressors
GS EP PVV 112	Piping material classes

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Reference	Title
GS EP PVV 142	Valves
GS EP PVV 150	Valves in cryogenic service
GS EP PVV 611	Welding of pressure containing piping and equipment
GS EP PVV 612	Metallurgical and equipment subject to severe sour service. Metallurgical and welding equipment
GS EP PVV 613	Valves materials requirements for use in sour service
GS EP PVV 622	Piping and equipment subject to intermediate sour service. Metallurgical and welding equipment

3. Definitions

Company: TOTAL E&P or any TOTAL E&P subsidiary.

Contractor: Any party TOTAL E&P has signed a contract with for the Engineering, Procurement, Construction and Installation as part of a project or maintenance contract.

Manufacturer: The party having received a Purchase Order from Company, Contractor or Package Vendor for the manufacturing and supply of control or choke valves.

Package or package unit: Prefabricated process or utility self-contained unit, generally able to operate on its own, supplied fully tested and ready for immediate installation, being supplied by a designated Package Vendor.

4. General requirements

Control and choke valves design shall be based on the requirements of the process application, operating conditions, piping specification (material, class) and environmental conditions.

Control and choke valves are to be used for throttling or modulating service only. Discrete on-off (open/close) service, either control or safety, shall be performed by dedicated on-off ball valves in compliance with [GS EP INS 137](#) and [GS EP PVV 142](#).

Control and choke valves may be equipped with a solenoid valve to force the valve to fully open, closed or locked position during certain process conditions.

As mentioned in [GS EP INS 101](#), the final selection of the Valve Manufacturer upon tender and bid evaluation shall be subject to standardisation for each application type. Therefore, the Contractor shall ensure throughout the facility and subcontracted packages that the number of valve brands and models is reduced to the lowest minimum possible, i.e. preferably to one manufacturer for each application only. The Contractor shall equally coordinate his selection of valve brand and model with all Package Vendors accordingly, in order to avoid a large diversity of valves, accessories, spare parts, etc.

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5. Valve data sheets

An approved dedicated engineering data sheet shall be the basis for procuring the valves. Standard sizing and product data sheets provided by the Valve Manufacturer shall not be used as a substitute for the engineering data sheets.

Engineering data sheets are a collection of specific data provided by multiple disciplines (process, instrumentation, piping, valves, mechanical, etc.).

Engineering data sheets shall be segregated documents for the following applications:

- Regular Service Control Valves (includes steam service)
- Severe Service Control Valves
- Acid / Toxic / Lethal Service Control Valves
- Cryogenic Service Control Valves
- Anti-Surge Valves / Recycle Valves
- Special Design Control Valves
- Choke Valves (manual and actuated may be combined)
- Direct-Operated Self-Acting Pressure Regulators
- Pilot-Operated Self-Acting Pressure Regulators
- Other applications as may be the case.

The engineering data sheets for anti-surge valves are considered a joint responsibility of Contractor and Package Vendor, in case these valves are free-issued by the Package Vendor to Contractor for integration in the process piping outside the package battery limits. The Package Vendor shall anticipate possible additional control accessories required for control or monitoring by the Process Control System (PCS) in addition of the Package Unit Control Panel (UCP).

Contractor and Package Vendors shall issue an as-built revision of all engineering data sheets upon installation & commissioning of control valves, with all Vendor specific details completed, in the proper electronic format as per Contract.

6. Calculation and sizing criteria

6.1 General

The Valve Manufacturer shall provide adequate valve sizing calculations for the precise calculation of the flow coefficient Cv, the predicted noise level and the occurrence of flashing and harmful cavitation. In some cases, it may be required that the Valve Manufacturer shall issue sizing data sheets which reflect multiple flow or process conditions, which is typically the case for production choke valves and anti-surge / recycle valves.

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The Valve Manufacturer's designated sizing program shall execute these calculations in compliance with either one of the following referenced methods:

- [IEC 60534-2-1](#) Sizing equations for fluid flow under installed conditions
- [ISA 75.01.01](#) Flow equations for sizing control valves

The selected Cv shall be **at least** 1.1 times the calculated Cv at the worst case conditions (maximum flow and lowest available pressure drop).

Important notes:

- The above-mentioned IEC and ISA sizing methods are only covering single-phase fluids. Sizing methods/formulas for multi-phase fluids are developed by Valve Manufacturers themselves and might result in different sizing results between Valve Manufacturers.
- Valve Manufacturers are only permitted to use sizing software which has been validated in reality on test benches for the valve sizes, trim type and trim sizes (Cv) within the min/max validated range; interpolation of software validation tests outside the validation test limits is only permitted by using advanced computer fluid dynamic (CFD) models, subject to Company review and approval. The Valve Manufacturer shall be able to provide proof of sizing software validation tests.

Different Cv selection criteria may be applied for special cases such as venting and surge control (noise, erosion, etc.), being subject to Company approval.

As per [GS EP ECP 103](#) the pressure drop across a control valve shall be minimum 20% of the system dynamic pressure loss at normal flow rate, or 0.7 bar (10 psi), whichever is greater (this rule does not apply to choke valves).

The valve outlet velocity must remain below the maximum velocity criteria provided in [GS EP ECP 103](#).

In case of multi-phase mixtures, Contractor or Package Vendor shall determine and supply all fluid data as required by the sizing program of the Valve Manufacturer, including solid particles.

The effect of reduced inlet and outlet sizes of adjacent piping (i.e. the Piping Geometry Factor) and the valve pressure recovery shall be taken into account for sizing. For this reason, the piping diameter is mentioned on the engineering data sheets, and the Valve Manufacturer may assume that short-length concentric reducers/expanders will be installed to match the selected control valve, unless stated differently on the engineering data sheet. However, reducers and expanders for choke valves are not permitted; choke valves shall be designed with the same end connection dimensions of the adjacent piping, as per section 8.5.

In case of applications which may imply excessive vibration, cavitation and/or high kinetic energy, the Contractor or Package Vendor shall take into account the entire piping arrangement in joint cooperation with the Valve Manufacturer to ensure the entire piping arrangement is adequately sized, supported and protected against erosion, pipe stress and valve-induced vibrations and noise, meeting the maximum vibration criteria in section 11 of [GS EP ECP 103](#).

The Valve Manufacturer shall specify the reference standards and the calculation basis for all specified operating conditions and guarantee that the selected valves will be free from harmful cavitation and erosion throughout the range of operating conditions.

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Control and injection choke valves shall be sized to have an operating stroke between:

- Minimum 10% opening at minimum flow conditions
- 50% to 75% opening at normal flow conditions
- 85% to 90% opening at maximum flow conditions.

Production choke valves shall be sized with flow range from 10 to 100% opening, and take start-up conditions into account unless a dedicated smaller start-up choke is provided.

The sizing of butterfly-type control valves with a maximum flow around 85% is based on using a flow efficient disc. Conventional discs have a more narrow control range of a maximum flow at around 50 degrees (55%) opening and should therefore be avoided.

The process design should allow the normal flow condition between 50% and 75% of the maximum flow condition, in order to avoid a too limited control valve opening during normal flow conditions.

The definition of the minimum flow conditions is highly important for the Valve Manufacturer for sizing and adequate trim design; notably the pressure drop can be much higher at minimum flow conditions, therefore implying the worst case scenario for cavitating applications.

For these reasons, the minimum / normal / maximum flow conditions must all be well-defined on the engineering sheets. When upstream and/or downstream static pressures are a function of the flow rate, then this shall be clearly indicated on the data sheets.

In case of additional irregular flow (slugs, pumping, etc.), a second parallel control valve may be considered to ensure that the normal continuous flow is adequately controlled by the first valve only, while the additional flow is adequately controlled by both valves, using split-range control.

The dynamic process model shall take into account the nominal control valve stroking times as defined in section 10.6, i.e. 5 times the valve diameter. When faster stroking times are required, then this should be clearly mentioned on the P&ID and engineering data sheets.

The maximum droop (offset) at maximum flow of self-acting pressure regulators shall be:

- For pilot-operated regulators: less than 5% of the set pressure
- For direct-operated regulators: less than 10% of the set pressure.

6.2 Cavitation and flashing

This section does not apply to production choke valves; it does apply to injection choke valves.

The Contractor or Package Vendor shall provide an adequate solution in case harmful cavitation or flashing problems are indicated during valve sizing and selection by the Valve Manufacturer. Potential cavitation and flashing problems shall firstly be treated by adapting the piping arrangement, secondly by adapting the valve trim design and trim materials.

Therefore, Contractor or Package Vendor shall take into consideration the early sizing information provided by Valve Manufacturer(s) during piping and facility design.

For cavitation terminology and cavitation recommended practices, refer to [ISA RP75.23](#).

In any case, control valves shall not be exposed to Constant Cavitation, σ_c , at maximum operating conditions. Whenever possible, the Valve Manufacturer shall size the valve such that

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it shall not be exposed to Incipient Cavitation, σ_i , at normal operating conditions. When valves are exposed to Incipient Cavitation at normal operating conditions, then flow-exposed trim components shall be made of cavitation resistant materials as per section 7.6.

When the cavitation index $K > 0.7$, or when any pressure drop > 50 bar, or > 30 bar for flashing liquids, then the valve shall be designed as a severe service control valve as per section 6.5.

6.3 Erosion criteria for multi-phase applications

Any valve handling multi-phase flow (e.g. production choke valves) shall be designed on the basis of erosional velocity as defined in section 11 of [GS EP ECP 103](#). The valve outlet fluid velocity shall not surpass the maximum allowable erosional velocity. In case the fluid velocity inside the valve surpasses the maximum allowable erosional velocity, then internal wall protection measures (e.g. weld overlay, protective sleeves) shall be taken.

6.4 Noise control

The maximum allowable noise exposure and sound pressure levels on facilities operated by Company are defined by legislation (European Directives and local regulations) as well as by Company's HSE Directives and GS specifications.

In the absence of a more stringent requirement, the valve-originated noise shall not exceed at any given flow rate:

- 85 dB(A) for continuous service
- 90 dB(A) for intermittent service.

Measured at 1 m downstream of the valve and 1 m away from the outer surface of the pipe, obtained without the use of secondary noise reduction measures.

The engineering data sheets shall clearly mention if the maximum allowable noise levels are at continuous or intermittent service.

The Valve Manufacturer shall perform a noise prediction calculation for each individual control valve, based on [IEC 60534-8-3](#) for gas/vapor service and [IEC 60534-8-4](#) for liquid service. The accuracy of the predicted noise level shall be specified by the Valve Manufacturer and shall not be more than $-5/+5$ dB(A) as per [IEC 60534-8-3/4](#).

For multi-phase and multi-liquid applications, the Valve Manufacturer may apply his own noise prediction calculation method, which shall have been validated in reality on test benches or from measurements taken from identical valves in operation with known fluid composition and process conditions. The Valve Manufacturer shall be able to provide proof of validation for noise prediction from multi-phase/multi-liquid flow.

6.5 Severe service

Control valves identified as severe service control valves shall be separated from regular service control valves (data sheets and procurement) as both type of control valves have dedicated approved Valve Manufacturers as per Company's approved vendor list.

The following criteria apply to single-phase flow applications only. For two-phase flow applications refer to section 6.3.

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Severe service is defined if one or more of the following conditions apply:

- Liquid fluids: cavitation factor K: $(P_1 - P_2) / (P_1 - P_v) > 0.7$ for any given flow rate
- Compressible fluids: critical pressure drop ratio: $(P_1 - P_2) / P_1 > 0.5$ for any given flow rate
- Liquid & compressible fluids: pressure drop > 50 bar for any given flow rate
- Flashing liquid service: pressure drop > 30 bar for any given flow rate.

Where:

- P_1 Upstream absolute pressure, measured at 2xD upstream of the valve
 P_2 Downstream absolute pressure, measured at 6xD downstream of the valve
 P_v Absolute liquid vapor pressure at inlet temperature

As per [ISA Guide](#) "Control Valves, Practical Guides for Measurement and Control", the Valve Manufacturer for severe service control valves shall provide the following calculations.

6.5.1 Liquid service applications

Option 1:

The design shall provide a sufficient number of discrete pressure drop stages, to maintain the liquid velocity exiting the trim below 30 m/sec (100 ft/sec) for single-phase liquids, and 23 m/sec (75 ft/sec) for cavitating, flashing, and/or erosive services. Valve Manufacturer shall specify number of discrete pressure drop stages required and provide body and trim exit velocity calculations.

Option 2:

This option, called 'the Sigma method' based on [ISA RP75.23](#), may only be applied when the Valve Manufacturer can prove that he has performed adequate laboratory testing, i.e. not on empirical data and not by means of interpolation. In this case, the following calculations shall be provided by the Valve Manufacturer in order to obtain:

$$\sigma_{service} \geq \sigma_{valve}$$

The Valve Manufacturer shall provide all relevant parameters used in the calculations, such as σ_{mr} , coefficients a & b , $d_{reference}$, $(P_1 - P_v)_{reference}$ etc.

6.5.2 Gas service applications

The design shall provide a sufficient number of discrete pressure drop stages to maintain the fluid velocity head (V_h), or kinetic energy (KE) exiting the trim, below 480 kPa (70 psi) for continuous and 1030 kPa (150 psi) for intermittent service. Valve trim exit fluid velocity head shall be calculated based on the [ISA Guide](#) as follows:

$$V_h = \text{Kinetic Energy (KE)} = \frac{\rho_0 V_0^2}{2g_c}$$

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Where:

- ρ_0 Valve trim exit fluid density
- V_0 Valve trim exit fluid velocity
- g_c Gravitational constant in unit of measurement

The Valve Manufacturer shall specify the required number of discreet pressure drop stages and also provide body and trim exit fluid velocity head calculations.

6.6 Valve characteristics

This section does not apply to choke valves.

When possible, the definition of the valve's trim characteristic (inherent-characteristic) should be based on a dynamic process simulation, in order to ensure a stable dynamic behavior and accuracy over the full control range. In the absence of a dynamic process simulation, which is required before control valve procurement, the following selection criteria shall be applied.

When the allowable or available pressure losses for the valve and the circuit are known, then the control valve ratio 'R', also referred to as "control valve authority", shall be used as the selection criteria for the control valve characteristic as per Table 1 here-after.

The value of R should remain between 0.2 and 0.5 (preferably close to 0.4 and definitely never below 0.2) in order to ensure that each increment of valve movement will have a proportional effect on the flow rate, without causing unnecessary pressure losses resulting into unnecessary pumping power or separator pressure/level fluctuations (high R value), or poor controllability due to low differential pressure across the valve (low R value).

Considering the equal % characteristic of a piped system, the installation of an equal % inherent-characteristic control valve will result into a near linear installed-characteristic when R remains between 0.2 and 0.5. Above 0.5, the pressure drop over the control valve becomes dominant and a linear inherent-characteristic control valve is normally required to obtain a near linear installed-characteristic for the overall piped system.

$$R = \text{control valve authority} = \frac{\Delta P_v}{\Delta P_v + \Delta P_c}$$

Where:

- ΔP_v Pressure drop across a fully open control valve
- ΔP_c Pressure drop across the remainder of the circuit
- $\Delta P_v + \Delta P_c$ Pressure across the whole circuit between 2 constant pressure systems, including any pump between the 2 systems

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Table 1 - Valve characteristic selection

		$0.20 < R < 0.5$	$R > 0.5$
Flow Control	Flow measurement proportional to flow linear	Equal %	Linear
	Flow measurement proportional to flow squared	Equal %	Linear
Level Control	Without bypass/return line	Equal %	Linear
	With bypass/return line	Linear	Linear
Pressure Control	Liquid	Equal %	Equal %
	Gas, vapor, steam	Equal %	Linear
	Compressor recycling, surge control	Equal %, Linear, Modified Linear	
Temperature Control	Mixing of 2 liquids having different properties	Equal %	Linear
	Gas, vapor, steam	Equal %	Linear
	Heat exchanger bypass	Linear	Linear
	Other	Equal %	Linear

Notes:

- Linear/squared flow measurement by process control system, not by flow sensor
- Bypass/return lines are considered to be two 2-way valves
- When 3-way valves are approved by Company, they shall always be linear type
- Anti-surge/recycle valve characteristic shall be defined by Package Vendor.

Quick opening type trims shall be avoided and are subject to Company approval.

When the allowable or available pressure losses for the valve and the circuit are not known, then the valve characteristic shall by default be equal % for single valves, and be linear for bypass and 3-way valve applications.

7. Control valve types & selection

Control valves shall meet the following design and selection criteria. For terminology, refer to [ISA 75.05](#).

7.1 Control valve selection order

The following selection order for the type of valve type shall be applied:

- Class 125 thru 600: top-entry or side-entry type control valves
- Class 900 and above with HUB connections: top-entry or side-entry type control valves
- Class 900 and above with RTJ connections: top-entry type control valves only.

Top-entry valves are preferred over side-entry valves for services where potential replacement or modification of internals is required, because they allow in-situ replacement of internals without disassembling the adjacent piping.

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For erosive and severe service, control valves shall always be top-entry type.

7.2 Linear motion control valves

7.2.1 General

Linear motion control valves shall either be globe valve type or axial flow piston type.

Linear motion control valves shall be globe type valves; other types such as plug, gate, piston, diaphragm, pinch or clamp type are not allowed. Globe valves design shall be:

- One-piece cast body with bolted bonnet (split body design is not allowed)
- Single-ported (see 7.2.2 on double-ported design)
- Balanced-plug cage-guided
- Removable cage design to enable in-situ maintenance of cage, plug and seat ring
- Multi-stage trim for severe service and excessive noise applications.

Globe valves shall be multi-hole cage-guided design by default; ported-cage or contoured plug designs may only be applied when it is a heavy top-guided design and only for:

- Valves ≤ 2 inch in case of excessive cavitation or noise, alloy steel or non-ferrous bodies
- Slurry service
- Continue presence of suspended solids
- Cryogenic service
- Sanitary service.

Globe valves shall have straightway type body; however angle type body may be used in special cases when deemed practical for operations or plant design. Angle type valves may provide some advantages for difficult service conditions (suspended solids, erosion, reduced size, etc) comparable with choke valves.

Axial flow valves shall be cage-guided piston type; other types without cage or non-metallic sleeve type are not allowed.

Axial flow valves design shall be:

- One-piece cast body (split body design is not allowed)
- Integral seals or bolted bonnet with packing assembly
- Cage-guided balanced piston
- Linear or rotary actuation.

7.2.2 Double-ported globe valves

The use of double-ported globe valves is subject to Company approval. The inherent higher leakage rate of double-ported valves shall be evaluated and may limit the application.

Double-ported globe valves shall be top & bottom guided.

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7.2.3 Three-way globe valves

The use of three-way globe valves is subject to Company approval. Three-way valves shall be avoided; a double two-way valve configuration is strongly preferred. In any case, the use of three-way valves for temperature control applications is not permitted for safety reasons.

In case three-way valves are approved by Company, then the flow paths shall be clearly marked on flange edges (by permanently fixed SS labels) and on P&ID's:

- 'C' to indicate the common flow path
- 'IN-1' and 'IN-2' to indicate the inlets of converging (mixing) three-way valves
- 'OUT-1' and 'OUT-2' to indicate the outlets of diverging three-way valves.

7.3 Rotary motion control valves

7.3.1 General

Rotary motion control valves shall be segmented ball, eccentric disc/plug or butterfly type. Other types, such as plug type valves, are not allowed.

Rotary motion control valves design shall be:

- One-piece cast body with integral or bolted bonnet (split body design is not allowed)
- Trunnion-mounted closure member (floating closure member is not allowed)
- Allow throttling control up to 90 degrees rotation.

The type of rotary motion control valves shall be selected in accordance with the following sections, adequately selected to the designated application as per the recommendations of the Valve Manufacturer.

Rotary motion valves shall be designed such that no part of the valve (e.g. seat retaining ring, bolting, etc) can enter the adjacent piping, regardless the flow direction. In other words, the seat retaining ring must have a diameter larger than the internal diameter of the adjacent piping, while bolting in the process fluid stream is not permitted at all. The use of bolting, locking devices, or lock welding, is not permitted, and not considered a solution to overcome this design rule.

7.3.2 Segmented ball valves

The closure member of segmented ball valves shall be 'V' edge shaped and may be either eccentric or concentric. Special shaped closure members may be used on a case-by-case basis, such as for excessive noise or erosion.

Segmented ball valves are preferred over eccentric disc/plug valves in case of:

- Slurry service
- Erosion
- High viscosity
- High rangeability.

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7.3.3 Eccentric disc and plug valves

Eccentric disc valves shall only be used in case the available pressure drop is lower than 0.2 bar (for example, flow control valves in oil metering skids). Eccentric plug valves may be used when the available pressure drop is above 0.2 bar.

7.3.4 Butterfly valves

Butterfly control valves are not permitted for hydrocarbon and hydraulic service applications, and their application is limited to ASME Class 125 and 150 as per [GS EP PVV 112](#). This rule may be altered for onshore LNG facilities, refer to section 7.5.1.

Butterfly control valves are preferred for seawater, steam and chemical services due to the easy application of a protective lining, small sizes and reduced weight for large-bore piping.

Butterfly control valves shall be designed according [API 609](#). The use of other design standards (e.g. DIN) shall not be allowed without proper compatibility verification, because any control valve shall be suitable for installation in a [ASME B31.3](#) piping system with [ASME B16.5](#) flanges.

Butterfly control valves may be used for:

- Seawater (firewater, cooling water, etc.) and chemical service: all diameters
- Other services: only allowed for large sizes (10 inch and above) when globe and segmented ball valves have proved unsuitable due to low available pressure drop or when excessive noise occurs.

Non-lined butterfly valves shall be eccentric design with metal seats, and have a flow efficient closure member to obtain a control range up to 85% of the operating stroke.

7.4 Special design control valves

Special design valves are sometimes required for particular process control applications. The design of these valves may be (very) different from the above-mentioned standardised linear and rotary motion control valves; for example, Joule-Thompson valves.

Special design valves may also cover non-standard valves such as lined globe valves for chemical service, or non-production related valves such as sanitary service valves, and which are often procured from a separate Valve Manufacturer.

Although the same general design requirements apply (Company's PVV specifications and this specification), special design valves may have different design features, and shall always be subject to an individual assessment and approval by Company's corporate specialists.

7.5 Specific applications

7.5.1 Cryogenic service

Cryogenic service concern all control valves operating in the temperature range from minus 46°C to minus 196°C.

Although the scope of [GS EP PVV 150](#) states that it does not cover control valves, the bonnets / glands / stem / packing design of control valves for cryogenic service shall fully comply with [GS EP PVV 150](#), including the requirements for inspection and testing.