



Exploration & Production

GENERAL SPECIFICATION

PIPING VALVES VESSELS

GS PVV 150

Valves in cryogenic service

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1. Scope

This specification covers the special requirements for the design, manufacture, and testing of valves (other than control or relief valves) for Cryogenic Services, including these intended to be "tight shut-off".

Although "Cryogenic temperatures" are generally defined as being below minus 150°C, for the purpose of this Specification, "Cryogenic Services" will be for valves operating in the temperature range from minus 50°C to minus 196°C.

2. Reference documents

The reference documents listed below form an integral part of this General Specification. Unless otherwise stipulated, the applicable version of these documents, including relevant appendices and supplements, is the latest revision published at the EFFECTIVE DATE of the CONTRACT.

Conflicting requirements

Any conflicting requirements between this specification and any other relevant document shall be reported to the Engineering Company for decision.

Normally, the following order of precedence should apply:

1. This Specification
2. Valve Data Sheets
3. COMPANY specification no. **GS PVV 142**
4. All other Specifications, Codes and Standards.

In any case, and notwithstanding the final decision of the Engineering Company, the most stringent requirement is always first meant to govern.

Standards

Reference	Title
Not applicable	

Professional Documents

Reference	Title
Not applicable	

Regulations

Reference	Title
Not applicable	



Codes

Reference	Title
Not applicable	

Other documents

Reference	Title
Not applicable	

Total General Specifications

This document applies in addition to the COMPANY General Specification **GS PVV 142**.

Reference	Title
GS PVV 142	Valves

3. Design

3.1 Bonnets/Glands

Valves shall be supplied with extended bonnet/glands. The length of the extension shall be sufficient to maintain the stem packing at a temperature within the normal temperature range of the packing material.

This extension shall be designed in such a way that the stem/plug alignment is kept straight, without torsion and flexion, under the maximum operated torque at the lowest design temperature. For this purpose, particular attention shall be paid to the inside stem guiding devices.

Where necessary, heat transfer fins shall be provided to accomplish this.

Valve bonnets: extended glands shall be bolted type for valve sizes 8 inches and above. Welded or bolted types may be used for valve sizes up to and including 6 inches. Screwed or union bonnets are not permitted.

The Manufacturer shall supply heat transfer calculations for the gland design with its quotation.

Fabricated bonnet/gland extensions shall be constructed from a simple length of seamless tube and shall be inserted into the valve bonnet and fillet or butt welded.

The clearance between the valve stem and bonnet/gland extension bore shall be designed to minimise convection temperature transfer. The cross sectional area of the extension wall shall be minimised, compatible with the rating of the valve and the mechanical strength requirements, in order to reduce conduction temperature transfer.

Material for the extended bonnet/gland and temperature transfer fins shall be suitable for the minimum design temperature of the valve.

3.2 Stems

Valve stems shall be of one piece construction. All rising stem valves shall have a back seating provided, in the region of the gland.

Rising stems shall have a surface rolled finish.

Material for valve stems shall be suitable for the minimum design temperature of the valve.

3.3 Gland/stem packing

Gland design incorporating lantern, rings and/or screwed plugs in the gland body shall not be used, unless specifically requested by the Engineering Company.

Packing glands shall be concentric and parallel to the centreline of the stem.

The surface finish on the packing gland bore shall not exceed 80 R.M.S micro inch.

For rising stem valves, the Manufacturer shall at least quote for both of the following stem packing materials (an evaluation will be made by the Engineering Company before commitment):

- Polytetra fluoroethylene (PTFE) chevron style or cup and cone style packing rings, "John Crane" C-VH, KEL'F' or equal
- Fire Safe graphite, "Union Carbide Grafoil" or Engineering Company approved equal. (Alternates may also be proposed by the Manufacturer).

The valve Manufacturer shall provide with his quotation the following information from the packing Manufacturer:

- Recommendations for use under the operating conditions
- Previous experience for application under operating conditions
- Method to prevent extrusion, if necessary
- The means used to ensure that stem pick-up does not result in increasing coefficient of friction between stem and packing.

3.4 Wedges, discs, seats, etc.

Gate valves shall be solid wedge type.

Globe valves shall have plug type discs; flat seated discs are not permitted.

Balls shall be solid; fabricated or hollow thin shell balls are not permitted.

4. Low temperature testing

4.1 Purpose of the tests

The Manufacturer shall demonstrate, by carrying-out an appropriate number of tests at low temperature, that the design, the materials, and the manufacture of the valves of the related supply are suitable for the service for which they are intended.

4.2 Number of valves to be tested

One valve specimen of each type, design, size, and rating shall be submitted to a low temperature test, under the following considerations:

- A change in design, including a change of the shape of any piece of material, or even a change in the nature of any of the materials, requires a new test at low temperature. (This applies in particular to changes in the soft seal materials).
- A test on any given valve size will also qualify the next standard sizes immediately above or below of the same rating or of the next two standard lower ratings.
- A test on any given valve rating will also qualify the next two standard lower ratings of the same size or of the next standard sizes immediately above or below.
- The Manufacturer shall submit to the Inspection Agency's approval the selection of sizes and ratings which must be tested in order to qualify the whole supply, for each type of design. For each size, rating, and type of design agreed to be tested, the Inspection Agency shall select a specific item, among the supply of the relevant Purchase Order, for low temperature testing purpose.
- The number of tests finally required for a given purchase order may be decreased at the COMPANY discretion, if evidence is obtained from the Manufacturer that the proposed design has already been tested and proved satisfactory. Such a decision, which can lead to a complete waive of all low temperature tests requirements, must be based on sufficiently documented testing certificates, drawings and parts list.

4.3 Categories of valves to be tested and type of testing required

4.3.1 Check valves

Check valves shall only be submitted to body tightness tests described in the testing procedure.

4.3.2 Gate valves and Globe valves

Gate valves and Globe valves shall be submitted to body tightness tests and to functional tests described in the testing procedure.

4.3.3 Ball valves and butterfly valves

Ball valves and butterfly valves shall be submitted to the complete testing procedure (i.e. body tightness tests, functional tests, and full pressure seat tightness tests).

4.4 Testing facilities

Testing shall be carried-out at the Manufacturer 's premises, or at a testing facility approved by the Inspection Agency on the basis of certified past experience and capability of such a testing organisation to satisfactorily perform the required tests according to the specified procedures.

4.5 Testing procedure

Prior to being submitted to these low temperature tests, all related valves shall have passed successfully all tests (including pressure tests at ambient temperature) requested in the COMPANY specification [GS PVV 142](#).

4.5.1 Test temperature

The test temperature shall be the minimum design temperature shown on the Valve Data Sheet. During testing, the skin temperature should never be lower than the minimum temperature acceptable for that type of material. Thermal shocks shall be avoided at all times.

4.5.2 Test preparation

Suitable thermocouple connections shall be made to valves to enable the valve body and bonnet temperatures to be monitored throughout the test. Thermocouples shall be attached to the internals of the valves.

In case of immersion in a low temperature liquid for testing purpose, the valve shall be secured to ensure that the valve gland is positioned clear of the cold boil-off gas in the top of the tank, but making sure that the level of the liquid shall cover at least the top of the valve body/bonnet joint.

4.5.3 Initial body tightness test at ambient temperature

An initial valve body test at 1.5 times the maximum service pressure corresponding to the cold rating of the valve shall be made at ambient temperature using a mixture of 99% Nitrogen and 1% Helium gas to ensure that the valve is in a suitable condition for the test to proceed. The test duration shall be 15 minutes. External leakage shall not exceed the values shown in table 3 of Appendix 7 of the COMPANY specification [GS PVV 142](#).

4.5.4 Full pressure seat test at ambient temperature

The body test shall then be followed by a full pressure seat test at 1.1 times the seat rating pressure of the valve for 15 minutes, on each side, under the same mixture of Nitrogen and Helium, at ambient temperature. The leakage rate as measured at the flowmeter (i.e. downstream of the valve) shall not exceed the values shown in table 3 of Appendix 7 of the COMPANY specification [GS PVV 142](#).

4.5.5 Cooling down

The valve shall then be cooled down to the required test temperature, which must be equal to the minimum design temperature of the valve. Cooling down shall be performed by steps of 20°C maximum. Throughout the cooling operation, a purge of a mixture of Nitrogen and Helium gas (99%/1%) shall be maintained to prevent the ingress of moisture. The dew point of the test medium shall be measured during the test and shall be kept below the test temperature by a minimum of 5 deg. C differential temperature. In order to achieve this, the valve may have to be dismantled and carefully dried prior to start the test.

4.5.6 Body tightness test at low temperature

When at the required test temperature, the following operation shall be carried out:

- Soak at the test temperature for at least 30 minutes, until all temperatures have stabilised
- With the valve in half open position, the valve body shall then be pressurised to the seat test pressure. This pressure is maintained for a period of 15 minutes and the gland and bonnet shall be checked for leak tightness. External leakage shall not exceed the values shown on table 3 of Appendix 7 of the COMPANY specification [GS PVV 142](#).

4.5.7 Functional test

The valve shall be opened and closed ten times. The open and close torques shall be measured for the first and last operation by simple means, such as a pressure gauge reading at the actuator air inlet.

4.5.8 Full pressure seat tightness at low temperature

The valve shall then be subjected to a seat test in the normal flow direction of the valve. For valves which are capable of sealing in both directions, each seat shall be tested separately.

The pressure shall be raised in increments, as shown below, up to the rated seat test pressure for the valve:

Pressure class	Increments (bar)
150	3.5
300	7.5
600	20.0
900 and above	30.0

The leakage rate at each pressure stage shall be measured and recorded. The maximum allowable leakage rate, as measured at the flowmeter (i.e. downstream of the valve), shall not exceed the values shown in table 3 of Appendix 7 of the COMPANY specification **GS PVV 142**.

4.5.9 Body tightness test at ambient temperature

After returning to ambient temperature, the Nitrogen/Helium gas mixture body test shall be repeated as previously defined in paragraph 4.5.3 here above.

4.5.10 Torque measurement

The valve opening and closing torques shall be measured by simple means, such as a pressure gauge reading at the actuator air inlet.

4.5.11 Full pressure seat test at ambient temperature

The full pressure seat tests shall then be repeated as previously defined in paragraph 4.5.4 here above.

4.6 Inspection

After completion of the test, the valve shall be examined for wear and damage, without disassembly (examination of seat/ball damage, possible extrusion of the packing, any bolting deformation, etc.).

4.7 Reporting

A test report shall include, as a minimum, a record of the following:

- Condition of parts examined after test
- Torque applied to valve body, bonnet and gland bolts during assembly
- Leakage rates for all stages of the testing procedure



- Opening and closing torque
- Any other measurements or observations
- Acceptance (or otherwise) of each test result
- Summary listing of all unacceptable test results.

5. Acceptance

5.1 Extent of the Inspection Agency witnessing

The Inspection Agency shall witness the type tests on all valves.

5.2 Test failure, re-work, re-test

In case a test fails, the reasons for failure must be thoroughly examined and explained by the Manufacturer to the Inspection Agency and to the Engineering Company. No re-test will be permitted unless specifically agreed by the Engineering Company. Failure for the second time of a given valve type and size entitles the COMPANY to reject the related supply, on the basis that the proposed design for the related valves is not suitable for the service for which it is intended.