



Exploration & Production

GENERAL SPECIFICATION

PIPING VALVES VESSELS

GS PVV 173

Pneumatic testing of above ground piping systems

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1. Scope

This specification covers the pneumatic leak testing of above ground piping systems. It describes the requirements for the testing procedure and the precautions to be taken.

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.

Standards

Reference	Title
Not applicable	

Professional Documents

Reference	Title
BS 1780	Specification for bourdon tube pressure and vacuum gauges

Regulations

Reference	Title
Not applicable	

Codes

Reference	Title
ASME B 31.3	Code for Pressure Piping. Chemical plant and petroleum refinery piping

Other documents

Reference	Title
Not applicable	

Total General Specifications

Reference	Title
GS PVV 171	Steel piping fabrication



3. Caution

Pneumatic testing is potentially hazardous, due to the possibility of sudden release of considerable stored energy. It is therefore important that the precautions described in this document are complied with. However, compliance with this specification does not relieve the Contractor of his responsibilities under the local regulations.

4. Preparation for testing

4.1 Equipment and materials

The Contractor shall provide all pressure gauges, temperature measuring devices, recording instruments, valves, pipework and hoses for each test.

Each test assembly shall be instrumented to provide a permanent record of internal pressure and metal temperature (on a combined chart) for the duration of the test.

Additional Pressure gauges shall be of the Bourdon tube type, complying with **BS 1780**. The nominal diameter of each gauge shall be 100 mm.

Pressure gauges and recorders shall be chosen such that the required test pressure is within the middle second-third of the reading range.

A valid certificate of calibration shall be available for every gauge and instrument used.

Each test assembly shall be equipped with a relief valve (or relief valve supplemented by a bursting disc), set at a pressure not exceeding 1.1 times the required test pressure. This shall be sized to suit the higher of the delivery rate of the compressed air source and the pressure increase which may occur due to a rise in temperature of 1°C per minute.

The Contractor shall provide an oil-free air compressor capable of providing clean, dry compressed air with capacity and pressure to suit the requirements of the test. Under certain circumstances, as authorised by the COMPANY, the Contractor may be permitted to utilise the Instrument Air facility on plant. Alternatively, clean nitrogen may be used, provided that it can be supplied to the test assembly at ambient temperature or above. In any case, the Contractor shall be responsible for the provision of adequate, safe piping between the compressed air source and the test assembly.

The Contractor shall supply a globe valve for depressuring the assembly after test. This shall be of suitable design and materials to withstand low temperatures generated by depressurisation and shall be fitted with a vent silencer, as necessary to meet plant noise limits.

Soapy water for detection of leaks shall be prepared in clean containers, using fresh water and an approved detergent. Preferably, an approved proprietary solution, such as "SNOOP", shall be used. The maximum chloride content of the solution shall be 15 ppm.

4.2 Documentation

The Contractor shall submit for the COMPANY approval a pneumatic testing procedure which fully describes the methods, equipment and precautions to be used. The procedure document shall include the proposed format for the authorisation form and the pneumatic test certificate. Pneumatic testing operations shall not commence until approval of the procedure document has been given by the COMPANY.



For each test assembly, the Contractor shall prepare an authorisation form which lists all pipe lengths and joints. These shall be marked on a drawing which accompanies the form. The Contractor shall verify that the following tests have been undertaken and have been accepted:

- 100% shop hydrostatic testing of each pipe length at a pressure equal to or exceeding 1.5 times the maximum design pressure for the spool (shop certificate issued by the pipe Supplier)
- 100% radiographic examination of circumferential butt welds made by the pipe Supplier (for "joints")
- 100% radiographic examination of all other butt welds (including "field" welds)
- 100% magnetic particle (or dye penetrant, as appropriate) examination of all attachment welds.

The appropriate test certificates and NDE reports shall be cross-referenced on the authorisation form. The Contractor shall sign the latter form to confirm that the check has been made.

For each test assembly, the Contractor shall enter the serial numbers and calibration certificate numbers of all pressure gauges, temperature instruments and recorders on the authorisation form.

The authorisation form shall additionally contain the following information for each line:

- Line Number(s)
- Maximum operating pressure and temperature
- Maximum design pressure and temperature
- Required test pressure.

The completed authorisation form shall be submitted to the COMPANY for review and approval. The pneumatic test on any test assembly may not proceed until the Contractor is in possession of the authorisation form for that assembly, signed by the COMPANY QC engineer and QA representative.

A suitable format for the authorisation form is shown in Appendix 1.

4.3 Test assembly

The extent of the test assembly, the number of pressure gauges and the required test pressure shall be identified from the drawings provided by the Engineering COMPANY. Preparation of the assembly for test shall be made by the Contractor.

The Contractor shall inspect the test assembly to verify the following:

- Fabrication work is complete and the test assembly is completely and adequately supported.
- All necessary end caps, blind flanges and plugs are correctly fitted and bolted.
- Pressure temperature recorder and pressure gauges are fitted at appropriate locations, where they can be seen and read easily, remote from the test assembly. Metal temperature shall be monitored at each pressure gauge location and also at the vent connection.
- All welds are clean and free from paint, grease, scale or any obstructions which could prevent them from being easily seen. The only exceptions shall be those longitudinal

welds which have been made by the pipe Manufacturer and have been already pressure tested prior to despatch from his works.

- All necessary piping and valves are correctly fitted between the air source and the test assembly, and that depressurising and relief facilities are in place.
- The test assembly is clean and dry, internally.

The Contractor shall verify that the area around the test assembly, to a minimum distance of 100 m from any part subjected to the test pressure, is suitably delimited by red and white barrier tapes. The Contractor shall verify that all unauthorised personnel are excluded from that area, before the test is commenced. In this respect, the test should preferably be carried out at a time when a minimum of construction or operating personnel are present (e.g. weekends, etc.).

5. Test procedure

Testing shall not take place in rain or if the ambient temperature is below 5°C. If possible, testing should not be undertaken when the weather conditions may give rise to large temperature fluctuations in a short time. The schedule for testing shall preferably be arranged accordingly, particularly for large test assemblies.

After evacuation of all personnel from the test area, air shall be slowly admitted to the test assembly until the pressure attains the lesser of one-half of the required test pressure or 1.5 barg.

All joints, flanges and welds shall be tested by applying the soapy water. Flanged joints and any weld areas which may be difficult to inspect may be tested by wrapping with a suitable adhesive tape and applying the soap solution to a pin-hole in the tape. The tape shall not be pressed down on to the weld.

The test assembly shall be held at this preliminary pressure for sufficient time to permit a thorough inspection of all joints, flanges and welds to determine the location of any leaks. If any leaks are found, the test shall be aborted and the leaks repaired before recommencing the test. The test assembly shall not be subjected to any shock loading, such as a hammer testing.

If no leaks are found at this stage, the pressure shall be slowly increased in increments of approximately 1 bar. The pressure shall be held for sufficient time at each stage to permit piping strains to equalise.

When the required test pressure is attained, the test assembly shall be isolated from the air source (but not from the relief valve) and the pressure shall be held for 20 minutes to observe any fall in pressure indicative of a major leak. Consideration shall be given to the effects of ambient/metal temperature changes during this period. Personnel shall not approach the test assembly at this stage or during pressurisation. Monitoring of pressure and temperature shall be made from a remote location.

If no leaks are indicated at the test pressure, the pressure within the test assembly shall be slowly released, down to the atmospheric pressure.

Pressure shall be released by means of a suitable valve. Pressure release shall not be achieved by loosening of flange bolts or plugs or via a line ball valve or gate valve. Care shall be taken to avoid metal temperatures falling below 0°C, particularly near the vent connection during depressurising.



6. Repairs

If any leaks are found in a welded joint, they shall be repaired (after depressurisation) using an approved weld repair procedure and proved acceptable by radiographic testing prior to repeating the pneumatic test.

Any leaks at flanged joints shall be investigated prior to remedial action. Care shall be taken not to apply excessive torque to bolting to achieve a leak-tight seal.

Following repair of any leaks, the full pneumatic test procedure of Section 5 shall be followed in repeating the test.

7. Certification

Following successful test, the Contractor shall provide a test certificate for each test assembly. The appropriate authorisation form and the permanent pressure/temperature recordings shall be attached to each test certificate. Any previous leaks and their causes shall be noted upon the final test certificate. The Contractor shall report any undue flexing, distortion or banging which may have occurred during testing.

Completed test certificates shall be incorporated into the final documentation for submission to the COMPANY.



Appendix 1 Authorisation for pneumatic testing

Line No.:				Drawing No.:			
Extent of Test assembly:		From:		To:			
		To:		To:			
Pipe length Identification	Hydrostatic test			Butt weld Identification	Radiographic examination		
	By	Pressure	Cert no.		By	Result	Cert no.
Pressure instruments to be used: Type(s) Serial no.(s) Calibration Cert no.(s)				Maximum design pressure: Temperature: Maximum operating pressure: Temperature: Test pressure			
For Contractor Signed Approved				COMPANY Authorisation to proceed: Q.C. Eng: Q.A. Man:			