



Exploration & Production

GENERAL SPECIFICATION

PIPING VALVES VESSELS

GS EP PVV 175

Cleaning of piping and vessels

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1. Scope

This Specification applies to cleaning of piping systems and/or vessels or equipment, which would normally be performed on site, but which may also be required to be performed at Manufacturer's facilities in special occasions (Manufacturer skid mounted equipment, for instance).

This Specification integrates requirements of **GS EP COR 460** which is withdrawn.

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.

Unless otherwise specifically indicated in writing, the Contractor or Vendor shall work in accordance with the requirements of this specification and those of the latest editions at the time of call for tender of the document listed hereafter.

Standards

Reference	Title
ASTM A 380	Cleaning , Descaling, and Passivation of Stainless Steel Parts, Equipment and Systems
ASTM A 967	Chemical Passivation Treatments of Stainless Steel Parts

Professional Documents

Reference	Title
API Std 614	Lubrication, shaft-sealing and control-oil systems for special purpose applications

Regulations

Reference	Title
Not applicable	

Codes

Reference	Title
Not applicable	

Other documents

Reference	Title
Not applicable	

Total General Specifications

Reference	Title
GS EP EXP 105	Precommissioning execution

3. Cleanliness requirements

3.1 Classification

Two classes of internal cleanliness are defined as follows:

- Class 1: Removal of all loose material, mill scale, rust, welding slag, grease, protective coatings and any adhering foreign material, which could be detached during plant operation
- Class 2: Removal of all loose material and adherent material, which could become detached during plant operation.

3.2 Extent

All process lines and associated vessels, exchangers and equipment shall at least meet the Class 2 requirements.

Class 1 requirements shall apply to the following:

- a) Suction piping, inter-stage piping, inter-coolers and by-pass piping of all compressors.
- b) Suction piping of gas expanders.
- c) Suction piping of all pumps. When a strainer is fitted, Class 1 requirements apply only downstream of the strainer.
- d) All lube oil, seal gas, control oil piping.

Utility lines, other than those listed in d) above, together with any associated vessels, exchangers and equipment shall meet the Class 2 requirements.

4. Main cleaning methods

The following methods could be used depending on the various situations which could be met:

- cleaning with air (blowing or air flushing)
- cleaning with steam
- cleaning with water (water flushing)
- mechanical cleaning
- chemical cleaning.

4.1 Cleaning with air (blowing or air flushing)

Two main methods may be used:

4.1.1 Continuous blowing of air

Air is continuously blown from a source (Air Compressor of a large capacity) at a high velocity through the lines (and vessels) to carry away the foreign matters. Due to the high velocity of the air, light erosion of the walls generally occurs during the air blowing, which is beneficial with regards to cleaning.

4.1.2 Quick decompression

A network is filled with compressed air up to the setting pressure of a rupture disk. When the rupture disk blows out, the source of air is stopped and the pressure inside the network decreases quickly. This operation is in fact generally made with a "quick opening valve" after having pressurised the network at the desired level of pressure. The quick decompression causes a high velocity of airflow in the pipes, thus removing foreign matters and performing a light erosion on the walls, which eliminates rust and scale as seen here above.

4.2 Cleaning with steam

Wherever steam is available, it can be used like the air for continuous blowing, provided that the lines and vessels are designed to withstand the steam temperature (thermal expansion and material quality). The advantage of steam is the following: between two steam blowing operations, the pipes and vessels cool down, and this variation of temperature embrittles the rust and scale which are more easily removed during the next blowing.

4.3 Cleaning with water (water flushing)

Three main methods may be used:

4.3.1 Circulation of water

The cleaning is made by a circulation of water at high velocity (3-4 m/s) through the pipes. To obtain such a velocity, a special pump has generally to be used (large flow, small pressure).

This method is only efficient to remove foreign matters, but not the rust or scale if their incrustation is important.

Attention is drawn to the fact that water can corrode the pipes walls (chloride ions on stainless steel, seawater on carbon steel) and that special qualities of water have to be used.

A circuit to be treated by circulation must be such that the dynamic and that the metallurgy is uniform throughout. All elements made of an incompatible metallurgy or with an incompatible coating must be removed and treated separately. Similarly, equipment that is incompatible with any of the treatment products or that includes a risk of non-drainable retention or that is unsuited to the dynamic cleaning conditions (low mechanical strength, significant pressure losses, etc.) shall be isolated. If, however, the circuit to be treated includes a number of different materials or coatings, the chemical treatment and inspection conditions must be rigorously adapted accordingly.

4.3.2 Water spray

If there is only dust on the walls of a large vessel, a water spray from a hosepipe might be sufficient.

Note: In some particular cases, air flushing and water flushing can be applied simultaneously: air (3 bar g) is injected in water in order to increase the turbulence. As the monitoring of such a method is not easy, it should be used with great care and only on special occasions.

4.3.3 High pressure water

This process may be used to remove solid particles of foreign matters from inside walls or inside parts of equipment, in particular where access is a problem.

4.4 Mechanical cleaning

Three main methods may be used:

4.4.1 Hand cleaning

When a man can enter into the network (vessels, large diameter pipes), it is sometimes more efficient to clean the walls with a metallic brush and to remove the rust fallen down with a vacuum cleaner and/or a final blowing.

4.4.2 Pipe cleaning with pigs

When a pipe has been designed to allow pigs to be sent through, a special pig with metallic brushes at its periphery is sent to clean the pipe. This special pig takes rust and scale from the walls but does not remove rust and foreign matters fallen down at the bottom of the pipe; a "normal" pig has then to be sent to remove the rust and the foreign matters which lay at the bottom of the pipe.

4.4.3 Sand blasting

For large vessels, sand blasting may be used to remove rust from the inside walls; in such a case, special instructions shall be given by the Manufacturer.

4.5 Chemical cleaning

Two main methods may be used:

4.5.1 Chemical cleaning without further coating

This type of cleaning is made by chemicals and is mainly used for lubrication lines of rotating equipment. The main steps are:

- Rinsing with water at high velocity
- Alkaline degreasing
- Pickling with inhibited acid
- Rinsing and neutralisation
- Lubricant filling.

4.5.2 Chemical cleaning with final protective coating

This type of cleaning is also made by chemicals and is used mainly for high-pressure boiler network. The main steps are the following:

- Rinsing with water at high velocity
- Alkaline degreasing
- Pickling with inhibited acid
- Rinsing and neutralisation
- Passivation
- Silica chemical removing.

5. Selection of an appropriate cleaning method

5.1 Approval of the cleaning method(s)

The selection of the cleaning method(s) shall be approved by the COMPANY on a case by case basis prior to performing the cleaning of piping and vessels.

5.2 Guidelines

This selection shall be based on the following:

- **The nature of fluids available on site**
Compressed air, steam, seawater, fresh water, inhibited water, etc.
- **The volume of the network**
It determines the quantity of fluid to be used and the time needed to fill in the system at the desired pressure (quick decompression method).
- **The diameter of the lines**
To reach the desired fluid velocity inside the lines, some additional pumps, compressors, or capacities may be necessary.
- **The design conditions of the network**
Some large diameter pipes used for gas service cannot bear their own weight if full of water. Some lines may not withstand the thermal expansion during the steam blowing, etc.
- **The type of dirtiness**
If there is no scale or rust on the walls of a vessel, a brush-type cleaning may not be necessary.
- **The material specification**
For stainless steel systems, an air blowing is preferable (if the other conditions allow it) to water cleaning, in order to avoid the possibility of corrosion by chloride ions. A reactor coated with refractory bricks shall never be washed with water.

- **The process function of the system**

Cryogenic lines, for which water is to be avoided, shall be air blown whenever possible.

In some special cases, cleaning of the network may imply very large quantities of air or water, and/or very large compressors or pumps, which are not available on the site. Accordingly, these special cleaning operations have to be studied and if necessary, the consequences of "cleaning" versus "no-cleaning" shall be evaluated by the COMPANY.

5.3 Rules for cleaning method selection

As a general rule, water flushing method shall be used. Where possible, this should be preceded by mechanical cleaning to remove adherent matters.

As an alternative to the above, and with the COMPANY prior approval on a case-by-case basis, air flushing may be considered if water flushing is deemed undesirable (for example, due to the difficulty of drying out the relevant system). Where possible, this should also be preceded by mechanical cleaning to remove adherent matters.

Plant air and nitrogen systems shall be cleaned by air flushing.

Where Class 1 cleanliness is required, chemical cleaning shall be undertaken after flushing if inspection shows that the required degree of cleanliness cannot be achieved by flushing.

Lubrication oil, seal oil and control oil piping shall be cleaned and proven in accordance with **API Std 614**.

6. Application to a specific network to be cleaned

The following principles shall apply:

- Whenever possible, the cleaning fluid shall flow from top to bottom.
- The diameter of the outlet pipe shall be at least as large as the diameter of the inlet pipe, and, in any case, as large as possible.
- The diameter of the outlet pipe shall be at least two thirds of the diameter of the line to be cleaned.
- Main headers shall be cleaned first (i.e. before their connecting lines).
- Large diameter pipes shall be cleaned before small diameter ones.
- Dead ends shall be avoided or, if not possible, cleaned separately.
- Protection of the devices included in the network (control valves, turbine-type flowmeters, orifice restrictions, etc. shall be carefully studied (see section 7).
- Protection of the devices in the vicinity of the network shall be carefully studied, in particular near the water (or air) outlet, in order not to damage electric motors or instruments with water or dirty air (see section 8).
- Existing block-valves on the lines to be cleaned shall not be used to control an air (or steam) flow as they could be damaged by erosion (due to the high velocity of the fluid).
- A special care shall be taken for vessels designed only for an atmospheric pressure service, in order not to create, during washing, a high pressure due to a water head.