



Exploration & Production

GENERAL SPECIFICATION

PIPELINES - RISERS

GS EP PLR 502

Precommissioning of gas pipelines

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Contents

1. Scope	4
2. Reference documents.....	4
3. Definitions.....	5
4. Precommissioning philosophy	6
4.1 General.....	6
4.2 Precommissioning phases.....	7
4.3 Precommissioning plan.....	8
4.4 Safety.....	8
5. Pipeline Cleaning	9
5.1 General.....	9
5.2 Monitoring of pig trains	10
5.3 Mechanical cleaning and caliper run.	10
6. Pipeline dewatering and swabbing.....	12
6.1 General.....	12
6.2 Dewatering and swabbing principles	12
6.3 Dewatering.....	12
6.4 Final documentation	13
7. Pipeline drying	14
7.1 General.....	14
7.2 Vacuum drying.....	14
7.3 Drying by circulation of dry air or nitrogen	16
7.4 Drying by circulation of natural gas.....	17
8. Selection of the drying method.....	18
8.1 Key factors.....	18
8.2 Selection criteria	18
9. Other references	19
Appendix 1 Preparation of initial dewatering	20
Appendix 2 Typical layout of instrumentation and water pumping equipment.....	21



Appendix 3	Typical layout of vacuum plant.....	22
Appendix 4	Factors affecting the choice of drying method	23
Appendix 5	Selection chart of drying methods.....	24
Appendix 6	Commissioning form	25
Appendix 7	Decision table model	26
Appendix 8	Decision table - Example of Alwyn - Frigg gas pipeline	27
Appendix 9	Dew point of natural gas	28
Appendix 10	Instrumentation requirements	29
Appendix 11	Corrosion Resistant Alloys.....	30
Appendix 12	Calculation methods	31



1. Scope

This general specification for the precommissioning of gas pipelines gives the minimum requirements of Company for cleaning, dewatering and drying the pipeline.

The precommissioning will start soon after successful completion of the hydrostatic pressure test of the pipeline and will allow the subsequent commissioning and operation of the pipeline, without risk of internal corrosion or fluid contamination.

This specification applies to gas pipelines, either onshore or offshore, in carbon steel with or without flow coating. For CRA (Corrosion Resistant Alloy) or clad pipelines, additional requirements are set for in Appendix 11.

This general specification must be completed by a PPS (Particular Project Specification), which detail the acceptance criteria of each of the precommissioning phases.

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.

All work specified in the present document must be in conformance or in accordance with the following codes and regulations.

In addition, the Contractor must perform his work in accordance with the PPS requirements.

Standards

Reference	Title
BGC/PS/PCI	British Gas Engineering Standard

Professional Documents

Reference	Title
DOE	Submarine pipelines guidance notes
IP6	Institute of Petroleum Code of Safe Practice in the Petroleum Industry

Regulations

Reference	Title
Not applicable	



Codes

Reference	Title
BSI CP 8010	British Standard Code of Practice - Pipelines - Parts 1 and 2 Gas Transmission and Distribution Piping System Submarine pipeline systems
ANSI B 31-8	
DNV-OS-F101	

Other documents

Reference	Title
Not applicable	

Total General Specifications

Reference	Title
GS EP COR 560	Physical and chemical treatment of hydrostatic test water
GS EP PLR 501	Hydrostatic testing of pipelines

3. Definitions

In the present specification, and for its application, the following definitions will be used:

Precommissioning All tasks and operations performed on the pipeline subsequent to the pipeline construction and prior to the introduction of hydrocarbon gas.

Commissioning All tasks and operations performed on the pipeline subsequent to precommissioning and which concern the initial introduction of hydrocarbon gas in the pipeline. It should be noted that precommissioning is a construction activity whereas commissioning is an operator activity

Operator Entity of the Company who will receive the installations after precommissioning and will operate them with a view to commercial production

Pipeline The pipeline is a section of a system or the entire system, used for the transport of hydrocarbon gas. It can be onshore or offshore, and extends from pig trap to pig trap, including:

- Risers and their supports, when they exist
- All permanent items, such as header, piping, pig trap, valves, isolating joints, etc., when they exist

The system limits are identified in the Particular Project Specification.

**Particular Project Specification (PPS)**

Gives the specific requirements for execution of the work, subject of a Contract

Golden weld

A weld which has not been hydrotested, and is therefore subject to additional non-destructive testing (NDT)

May

Is used to indicate that a provision is optional

Shall

Is used to indicate that a provision is mandatory

Should

Is used to indicate that a provision is not mandatory, but is recommended as good practice

Equipment

Is used for all ancillary items of the precommissioning, not part of the permanent facilities.

4. Precommissioning philosophy

4.1 General

In all that follows, it will be assumed that the pipeline has been flooded, cleaned, gauged and hydrotested, as per the requirements of **GS EP PLR 501**, and was left full of treated seawater. It may remain in this state for a certain time, though generally not more than six months. The pipeline shall not be left full of air in wet condition, for obvious corrosion reasons.

The dewatering / drying will generally start immediately after the hydrotest, or just before the commissioning.

In case of conflict in requirements between this general specification and the PPS, the latest shall prevail.

In order not to damage the pipelines insulation valves during the pigging operations associated with cleaning/dewatering, those valves shall have been removed prior to the water fill for the hydrotest. Similarly, no pigging associated with cleaning/dewatering shall be performed with the pipeline insulation valves in place. They shall have been replaced by dedicated spool pup pieces, or alternatively, the cleaning/dewatering activities shall be performed separately for the different pipeline sections and these sections then tied in by golden weld prior to the drying phase (see Appendix 1). The pipeline insulation valves shall be re-installed in the pipeline prior to the final drying.

The only exception is for subsea valves, where the removal and reinstallation of valves is not practical. In this case, the valve cavity shall be filled with glycol gel or equivalent (to be approved by PVV valve specialist), before installation subsea, and the valve shall not be operated during all the precommissioning, in order to avoid debris entrapment in the seals.

It should be noted that the effectiveness of pigging, and therefore of cleaning, dewatering and drying activities, is dependent on the condition of the inner pipe wall surface: when the pipes have been stored on land for a long period in a saline environment, the increased surface profile will tend to retain dust and water.

For this reason, internal flow coating of trunk lines is recommended in order to:

- Minimise the corrosion during storage, and therefore the amount of corrosion products in the pipeline
- Improve the performance of the dewatering/drying process.



All the products to be introduced in the pipeline during the precommissioning:

- Shall be free from oil and contaminants
- Nitrogen, methanol, glycol shall have a purity of 99% minimum
- Their temperature when introduced in the pipeline shall be between 0 and 50 deg C, or limited by the pipeline design temperature.

All the measurements and acceptance criteria shall be in SI units and pressure shall be in bar.

Base line survey using an ILI pig (In Line Inspection) could be run during the dewatering phase.

For gas pipeline, it is generally a MFL pig (Magnetic Flux Leakage), so as to be compared in the future with records in operation.

4.2 Precommissioning phases

The different sequential phases of precommissioning shall be:

- Phase 1 - Cleaning the pipeline
- Phase 2 - Dewatering and optional swabbing
- Phase 3 - Drying and flushing the pipeline
- Phase 4 - Stabilisation at the final dew point
- Phase 5 - Filling with nitrogen and inerting (when required).

The first two phases will be performed in accordance with the general procedure described below.

The last three phases will be performed either by vacuum drying or by circulation of dry air, nitrogen or dry hydrocarbon gas.

The two methods make use of the capacity for water evaporation in the pipeline at ambient temperature, in the first case by vacuum evaporation, in the second case by mass transfer to a dry effluent.

The latent vaporisation heat is taken from the ambient environment in the case of vacuum drying, and from both the ambient environment and the drying gas in the second case. This is the reason for possible freezing of the water accumulation in the pipe if vacuum evaporation is too rapid, or of low evaporation process if the ambient temperature is too low.

In all cases, the flushing performed after drying which removes the residual layer of water molecules remaining on the inner pipe wall, may be performed either with dry air, dry gas or nitrogen.

Line swabbing with a chemical is often presented as a drying operation. In fact, it leaves a considerable amount of liquid on the pipe wall and shall be only used when the final water dew point at commissioning stage is not critical. When a combined dewatering/swabbing operation is used with production gas, the liquid left in the pipeline walls will contain water. Criteria on maximum water content in the last batch of liquid received are given in XXX. It should be noted that this is a one shot operation, with no backup solution. The risks associated with this method are hydrate formation and non conformity of water dew point in the sale gas.

The chemical used are methanol or glycol. Methanol use has been abandoned for safety reasons in various countries, and can cause damages to internal coating, valves elastomeric



seals, etc. in addition to being toxic. For this reason its selection has to be carefully justified. The residual mixture water/methanol left on the pipe wall prevents hydrate formation and, in certain cases, gas can be introduced without the need for further drying operations. However, with this type of process, it has been observed that during a certain period after dispersion of the methanol, the gas produced still contains large quantities of water and possibly hydrates, rendering it unfit for sale.

Glycol (or MEG, mono ethylene glycol in its most common form) is not as efficient as methanol for drying, but is not as toxic and aggressive to internal coating, valves elastomeric seals, etc.

However, glycol swabbing should be used in conjunction with drying methods such as vacuum drying, circulation of dry air, nitrogen or dry hydrocarbon gas, as the glycol will make the water evaporation increasingly difficult.

4.3 Precommissioning plan

The precommissioning is a complex activity, involving numerous steps, equipments, measurements and acceptance criteria. As such, a precommissioning plan has to be prepared sufficiently in advance by Contractor, listing the following:

- Programme of work, with list of sequence of activities and corresponding planning
- Organisation chart of Contractor, with names and CV of key personnel, and possible Sub-Contractors with their scope
- List of interfaces in the project, with lines of communication
- Risk analysis and corresponding contingency/emergency plans and procedures
- Procedure for each activity, with its description, list and layout of equipment, required personnel, pre-requisites to be completed, certification records of equipment, calculations, record and approval forms
- Quality plan, listing all the points (Hold, Witness or Monitoring) where Company representative will be involved
- The range and accuracy of all the instruments shall follow the requirements in Appendix 10.

This precommissioning package shall be approved by Company before any site activity can be started.

4.4 Safety

The risks associated with the precommissioning activities must be assessed and mitigated.

In particular, the following points are to be addressed:

- Equipment, pipeline under pressure (positive or negative) shall be isolated by warning tapes, preventing unauthorised access
- Handling of chemical
- Risk associated with vacuum operations
- Disposal of contaminated liquids, sludge's or solids shall be managed in an environmentally sound manner and in compliance with local regulations



- Noise emission levels to be kept as low as possible
- All equipment, shall have been inspected, tested and if necessary certified.

The test cabin shall be located at 10 m minimum from pipeline.

5. Pipeline Cleaning

5.1 General

The extent of the cleaning operation and the number of pig run will depend on the quantities of debris obtained or estimated by Company when the pipeline is initially filled (see [GS EP PLR 501](#)).

As a general rule, the cleaning programme includes one of the following combinations of processes:

- Mechanical cleaning with brush pigs or foam pigs coated with brushes. If the pipeline is flow coated, soft brushes are to be used. In addition, the cleaning pigs are to be fitted with magnets, to collect metallic debris.
- Hydraulic cleaning with jetting effect, and/ or special gels
- Combination of mechanical cleaning and/or hydraulic cleaning using various scraper pigs and treated seawater.

Initial cleaning parameters must be carefully recorded during the first water fill, so that the cleanliness of the pipeline can be demonstrated at the end of operations.

Pig shall be capable to pass through the pipeline, including minimum bore tolerance on pipe and bends.

For long pipelines (> 300 km), or for pipe ID variations, the use of solid gel slugs to seal around the pigs may be considered.

The gel slugs shall be compatible with the other fluids used during precommissioning, and with future operation of the pipeline. A procedure shall describe the gel characteristics and its instructions for use.

Foam pigs shall be limited to some special cases: ID variation in excess of 15%, short pipelines etc.

For dual diameter pipelines, or where ID variation exceed 3%, use of dual diameter pigs is required, in order to optimise the dewatering sequence.

Bidirectional pigs (BIDI) fitted with polyurethane disks, shall be preferred to cups, for their sealing performances and general resistance to wear. The hardness of the sealing disks shall be 65 to 75 shore A and their size shall be 102/103% of the ID. For the guiding disks, it shall be respectively 80 to 90 shore A and 100% of ID (ID being the nominal ID)

The actual pig design will vary based on the pipe condition: length of run, flow coating or not, etc. More guiding disks will be introduced for long runs.

Pig with jetting effect shall be included when the debris are likely to sediment in front of the pigs: these pigs are equipped with deflectors aimed at the pipe wall in front of the pig, in order to clean the wall hydraulically by turbulent flow and maintain the debris in suspension.



Seawater or fresh water will be used throughout the precommissioning, after suitable injection of chemical (as per **GS EP COR 560**).

The pigs are to be run with enough back pressure to control their speed. This back pressure is dependent on the fluid used to propel the pig train (gas or liquid), the difference of elevation along the pipeline route and the number of pigs in the train. Specific pig train behaviour should be modelled when there is significant change of elevation along the pipeline route, using flow simulation software.

The speed shall be maintained constant with no stoppage, nor variations.

5.2 Monitoring of pig trains

During the pig train run, the pig position and ETA (Estimated Time of Arrival) shall be predicted, based on flow meter readings. The pig launcher and receiver shall be fitted with at least one pig indicator, and if so required in the PPS, with a second one working on a different principle, which can be non intrusive.

The first pig of each train shall be fitted with a long range locating device, having a life of two months. The device may be ultrasonic, acoustic, magnetic or radio type, depending if the line is gas or liquid filled and if offshore or not. The last pig of each train is to be fitted with a short range locating device, such as magnetic, isotopic, etc... mainly to confirm arrival in pig receiver.

Stuck pig in the line can be dislodged by increasing the pressure behind, up to half the design pressure, if the line is completely water filled, or up to 10 bars if gas filled. Contingency procedures shall address all the steps to be taken to locate and recover the pig.

These pressures shall not be exceeded, unless proper assessment has been performed, and Company approval granted.

All pigging operations shall be logged in a specific register, listing all the necessary information per train: number of pig in train and type, volume and type of fluid used, time launched and received, condition of pig at arrival, debris collected.

Proper disposal of contaminated liquid, sludge and solids is to be performed in line with local regulations.

5.3 Mechanical cleaning and caliper run.

Mechanical cleaning will involve the separate passage of several pig trains, with at no time more than one train or train section present in the line. For long pipelines (> 100 km) several trains may be acceptable simultaneously in the line, provided the separation between trains allows unloading the pig receiver without reducing the speed of the trains.

The number of trains and number of pigs in them, will depend on multiple parameters, including the initial cleanliness status, the length of the pipeline, etc.

In case of long pipelines, involving long transit time, it is preferable to have long trains with several pigs separated by liquid batches.

For shorter lines, less than 20 km, the preference will be to have shorter trains, with fewer pigs, which allow better monitoring of the cleanliness of the line.

For pipelines with flow coating, the number of pig trains can be significantly reduced from the requirements below.

A calliper pig shall be run as part of this cleaning train or as part of the dewatering train.

As a base case and for average pipelines (20 to 100 km) four trains will be used, as follow:

5.3.1 Train A

Its purpose is to remove large debris, metallic or other. It will be comprised of a set of BIDI pigs with brushes and magnets, separating gel plugs (at least two plugs).

5.3.2 Train B

Its purpose is to remove the small residual debris and scale adhering to the pipe wall, on the assumption that there is no more large debris.

It will be comprised of BIDI pigs pushing sections of treated seawater (at least two sections). The pigs will have fine brushes and/or magnets and shall have jetting effect.

5.3.3 Train C

This train will remove the final debris left behind by train B, and is made of BIDI pigs placed between small gel sections. The final section will contain at least 1 km linear of treated seawater.

5.3.4 Train D

This train will perform the final cleaning operation, sweeping away gel residues from the pipe wall, and in addition will record the pipeline geometry.

It will be made of BIDI pigs, separating treated water and include one calliper pig. For long pipelines, incorporating a second calliper pig as backup is recommended.

5.3.5 Cleanliness acceptance criteria

A cleanliness acceptance criterion is to be developed in the PPS, based on the diameter and length of the pipeline.

The collection of debris is to be performed as follow:

- 50 m before receiving the pig train, the liquid shall be collected in a tank, allowed to settle and the sludge measured. The specific arrangement for the safe collection of sludge shall be discussed with Contractor
- The sludge and debris arriving in the pig trap shall be also collected.

The cleanliness acceptance criteria shall be based on the addition of these two volumes of sludge and solid debris, either as volume or weight.

5.3.6 Evaluation of caliper run results

The data from the caliper pig (s) are to be evaluated for quality as soon as received. Within 48h, a preliminary report is to be provided with main features found, and the final report is to be provided within 2 weeks of the caliper run. All indications in excess of 2% nominal ID are to be reported, located and interpreted.

Unless modified by the PPS, the acceptance criteria will be the same as for the gauging performed during the initial flooding operation (see [GS EP PLR 501](#)).