

GENERAL SPECIFICATION

CORROSION

GS EP COR 161

**Internal corrosion and erosion-corrosion monitoring:
Design and installation**

06	06/2012	Update following the EP reorganization, March 2011
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04	10/2009	Add clearance requirement around access fittings
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1. Scope

The present specification defines the minimal requirements applicable to:

- The selection of internal corrosion, erosion, and sand monitoring systems
- The design of the monitoring systems
- The installation and commissioning of the equipment.

The present specification is applicable to surface and subsea installations for oil and gas production. It does not apply to downhole equipment.

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
Not applicable	

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 001	Corrosion control on production facilities: Design and construction
GS EP COR 002	Corrosion control on production facilities: Field operations
GS EP PLR 109	Design, fabrication and testing of submarine unbounded flexible pipes and risers

3. Definitions

Corrosion monitoring: Measurement of the degradation (metal loss) caused by the electrochemical reactions involved in corrosion phenomena.

Erosion monitoring: Measurement of the final degradation (metal loss) due to the mechanical action of either liquids or solids, directly on the metal or on protective layers formed by corrosion reactions. *In practice, erosion monitoring measures the total metal loss resulting from erosion-corrosion due to both mechanical (by liquids or solids) and electromechanical effects.*

Sand monitoring: Technique aiming at detecting and/or quantifying sand production.

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4. Aims

4.1 Corrosion monitoring

Corrosion monitoring shall be carried out:

- To control/verify the corrosive behaviour of produced fluids, when no preventive action is implemented (such as corrosion inhibition, biocide treatment, pH stabilisation)
- To verify the practical application and efficiency of preventive treatments, when they are used.

4.2 Erosion monitoring

Erosion monitoring shall be carried out when the nature of the fluid is such that wear and wall thickness loss by mechanical damage is expected (unpredicted sand production, high flow velocities, etc.). Erosion monitoring is not intended to give quantitative measurements on the amount of sand production in the stream (scope of sand monitoring).

4.3 Sand monitoring

Sand monitoring shall be used when sand production is expected to:

- Quantify continuous sand production if relevant
- Detect massive sand production due to downhole sand control failure and raise alarm.

5. Design

5.1 General requirements

For harmonization, the monitoring system of new facilities shall be selected to be compatible with this used on adjacent assets.

At least, monitoring systems specified as part of the revamping or extension of given facilities shall allow the use of existing retrieval tools (if intrusive monitoring), as well as communication and analysis systems (e.g. software).

Non intrusive monitoring systems (i.e. not requiring the use of HP retrievers) shall particularly be considered for high pressure or hardly accessible conditions.

For intrusive monitoring:

- A 2" access fitting system shall be used. However, 1" access fittings are allowed for systems with operating pressure less than 5 bars. The type of fitting to be used among the two main types currently available on the market (mechanical or hydraulic retrieval type) shall be submitted for Company approval.
- The coupons and probes shall be inserted or removed using a special tool (retriever).
- Access fittings for a given installation shall be standardised and compatible with other access fittings on the market so that only one type of probes and retriever are needed.
- To avoid disruption of production, intrusive coupons and probes shall be mountable and removable at the operating pressure and temperature of the monitored equipment.

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- The retrieval system shall be of the non-telescopic type.
- Intrusive probes and coupons installed on lines subject to pigging shall be systematically flush-mounted.

5.2 Corrosion monitoring

The corrosion monitoring plan shall include a combination of several methods (see **GS EP COR 002** for details).

For each monitoring point one shall clearly defined whether monitoring is aimed at controlling the corrosive behaviour of the produced fluid or at verifying the application/efficiency of anti-corrosion treatments.

For both objectives, the applicable methods shall be:

- Corrosion samples: corrosion coupons (CC), bioprobes and spool pieces
- Corrosion probes: conventional electrical resistance probes (ERP), linear polarisation resistance probes (LPR), hydrogen probes (HP), high sensitivity probes ("CEION" type)
- Bacterial activity monitoring: bioprobes
- Sampling points (SP), chemical analyses, etc.
- A short description of the above techniques is given in Appendix 1
- Corrosion monitoring systems shall be based on typical corrosion monitoring requirements (applicable methods and effluents to be monitored) as summarized in Table 1.

Particular attention shall be given to the optimisation of the monitoring strategy to avoid multiplying unessential monitoring points.

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Table 1 - Key corrosion monitoring points

EQUIPEMENT TO BE MONITORED		FLUID	MONITORING DEVICE	MONITORING LOCATION	COMMENTS
Pipelines	Unprocessed Fluids: Trunklines and long onshore Flowlines (> 1 km)	Multiphase (inhibited)	CC + ERP + SP Bioprobe	Inlet and outlet Outlet	
	Processed Fluids	Oil (stabilized) export	CC + ERP + SP	Inlet	Usually not required, only upon specific request
		Dry gas export	CC + ERP	Inlet	Usually not required, only upon specific request
		Wet gas	CC + ERP + SP	Inlet and outlet	
		condensate, oil water	CC + ERP + SP Bioprobe	Inlet and outlet	
		Gas condensate	CC + ERP + SP	Inlet and outlet	
	Injection	Water injection (SW)	CC + ERP or LPR ^[1] + bioprobe	Injection wells manifold inlet	
	Production	Produced water (PW)	CC + ERP + bioprobe	Inlet and outlet	
Flexible risers	Production	Multiphase	Polymer coupons	Outlet	Mandatory for PA11, on case by case basis for other polymers
Separation Process	1 st stage separator	Produced water	CC + ERP + SP	Water outlet of separator	
	Crude desalter	Produced water	CC + ERP + SP	Water outlet of desalter	
Water injection process	Filtration	Injection water	SP	Downstream filters, outlet of each filter	For bacterial monitoring purpose
	Deaeration	Injection water	CC + ERP or LPR ^[1] + bioprobe + SP	Deaeration tower outlet, upstream HP pump	Bioprobe to be placed upstream biocide injection point
Gas process	Hydrate control	MEG	SP	HP section downstream flash drum Lean and rich MEG	
	Dehydration	TEG	SP	Lean and rich TEG	
Utilities	Cooling/Heating medium	Water	SP	Hot section	

Note [1]: Use of LPR to be assessed at project stage.