

GENERAL SPECIFICATION

SUBSEA SYSTEMS

GS EP SPS 018

Subsea Multiphase Flow Meter

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05	11/2018	General revision
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1. Scope

1.1 General

This specification shall apply as a technical specification to be used for procurement of Multiphase Flow Meters for Total E&P subsea projects for offshore facilities.

Any deviations to this specification shall be submitted to Company for approval.

1.2 Health, Safety and Environment

Contractor attention is drawn to Company Health, Safety and Environment Quality Charter.

Company considers safety with regard to operations, human health, respect for the environment and customer satisfaction to be of paramount priority. Assessment of risks to safety, health and environment over the entire life of the project are required.

Company is committed to the compliance with applicable laws and regulations wherever it conducts its business. Company requires its selected Contractors to demonstrate a similar focus and commitment to Health, Safety and Environment issues together with a structured, documented and verifiable HSE management system.

In case of use of a gamma source, Company shall ensure that radiation exposure is compliant with applicable local regulations.

1.3 Purpose

This specification gives the functional requirements for the engineering, fabrication, integration, testing, preservation, load-out, transportation, preparation prior installation and installation of the multi-phase flow meter (MPFM) and field maintenance including in-situ calibration.

This specification shall be considered in conjunction with other Contract documents describing the subsea production system, scope of work, interfacing equipment, operational and installation requirements. These documents will give input to, and supplement this specification with regard to the intend use of the SPS control system, (SPCS) scope of supply, operating conditions, pressure classes, detail testing, etc.

This specification shall apply for conventional multiphase meters.

2. Reference documents

The reference documents listed below form an integral part of this General Specification.

This technical specification is complementary to **GS EP SPS 001** and shall therefore be read in conjunction with said document and the other Company specifications and standards identified herein.

For thermal insulation requirements for subsea stations, reference is made to **GS EP SPS 008**. In general, thermal insulation systems are project specific. Consequently, specific requirements regarding produced fluids (oil, condensate or gas), pressure and temperatures, the required cool down periods etc. shall be extracted from the Project Basis for Design.

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External Documents

Unless otherwise stipulated, the applicable version of these documents, including relevant appendices and addendums, is the latest revision published at the effective date of this document.

Reference	Title
API MPMS 20.3	Manual of Petroleum Measurement Standards - Chapter 20.3: Measurement of Multiphase Flow
API RP 17A	Design and Operation of Subsea Production Systems-General Requirements and Recommendations
API RP 17H	Remotely Operated Vehicle Interfaces on Subsea Production Systems
API RP 17S	Recommended Practice for the Design, Testing, and Operation of Subsea Multiphase Flow Meters
API SPEC 17D	Design and Operation of Subsea Production Systems - Subsea Wellhead and Tree Equipment
API SPEC 17F	Specification for Subsea Production Control Systems
ASME BPVC Section VIII	ASME Boiler and Pressure Vessel Code (BPVC), Section VIII-Rules for Construction of Pressure Vessels – Appendix 8
DNV RP F112	Design of Duplex Stainless Steel Subsea Equipment Exposed to Cathodic Protection
EN 10204	Metallic products - Types of inspection documents
ISO 10423	Petroleum and natural gas industries - Drilling and production equipment - Wellhead and Christmas tree equipment
ISO 11898-3	Road vehicles - Controller area network (CAN) - Part 3: Low-speed, fault-tolerant, medium dependent interface
ISO 15156 (All Parts)	Petroleum and natural gas industries - Materials for use in H ₂ S-containing environments in oil and gas production – All Parts
ISO 9978	Radiation protection. Sealed radioactive sources. Leakage test methods
ISO/IEC 90003	Software engineering - Guidelines for the application of ISO 9001:2008 to computer software
MIL-HDBK-217F	Reliability Prediction of Electronic Equipment
MIL-STD-202G	Test Method Standard, Electronic and Electrical Component Parts
NACE MR 0175	Petroleum and natural gas industries - Materials for use in H ₂ S-containing environments in oil and gas production
NSOGM Handbook	Handbook of Multiphase Flow Metering

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Unless otherwise stipulated, the applicable version of these documents, including relevant appendices and addendums, is the latest revision published.

Reference	Title
GS EP COR 100	Cathodic protection of offshore structures
GS EP COR 221	Three layer polypropylene external coating for pipelines
GS EP COR 560	Physical and chemical treatment of hydrostatic test water
GS EP ECP 103	Process design criteria
GS EP INS 102	Instrumentation Identification
GS EP PVV 614	Welding of duplex and super-duplex stainless steel
GS EP SPS 001	Subsea Production Systems General Design Requirements
GS EP SPS 008	Thermal insulation of subsea stations
GS EP SPS 009	Corrosion protection of subsea stations
GS EP SPS 010	Preservation requirements for subsea package
GS EP SPS 012	Documentation requirements for subsea stations
GS EP SPS 019	Subsea production control system
GS EP SPS 029	Metallic Materials for Subsea Production Facilities

3. Abbreviations

The following abbreviations are used in this document:

Company	Total E&P
CP	Cathodic protection
EFAT	Extended Factory Acceptance Testing
FAT	Factory Acceptance test
GVF	Gas Volume Fraction
HMI	Human machine interface
ICSS	Integrated Control and Safety System
MPFM	Multiphase flow meter
MMS	Multiphase Metering System
MTBF	Mean time between failures
NDE	Non-destructive evaluation
OMM	Operating and Maintenance Manual
ROV	Remotely operated vehicle

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SIT	Site Integration Test
SCM	Subsea control module
SCU	Subsea control unit
SPS	Subsea production system
SPCS	Subsea production control system
SPCU	Subsea production control unit
SRM	Subsea Router Module
SURF	Subsea, umbilical, riser and flow line
WLR	Water Liquid Ratio
XT	Christmas tree

4. System requirements

4.1 General Requirements

System shall be designed to support the project Basis for Design and Operating Strategy in particular.

General system requirements shall conform to specifications provided in [GS EP SPS 019](#), [API RP 17A](#), [API RP 17S](#), [API SPEC 17F](#), [API SPEC 17D](#) and [API MPMS 20.3](#). In particular, MPFM shall be fully qualified for use in the project water depth, system design pressure and temperature rating. Both maximum and minimum temperatures shall be considered for the MPFM and material qualification program.

It shall be noted that this specification is based on communication from the MPFM to topside via the SCM. Any change to such communication path shall be presented to Company for approval.

The MPFM solution shall as a minimum include:

- A subsea multiphase meter
- A MPFM processing station as surface equipment
- Any required interface from flowmeter to topsides systems (MPFM, processing station, ICSS, etc.), in order to make available any data from MPFM.

4.1.1 Sizing parameters

The following major parameters shall be taken into consideration for a MPFM selection program:

- WLR (min/max)
- Water salinity range (max/min)
- Well Composition Definition (available PVT data)
- Production Predictions (flowrates max and min for all phases including associated pressures and temperatures)
- Range of operating P & T

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- Chemical products including methanol which are planned injected into the system. Quantities for steady state conditions shall be considered
- Thermodynamic and physical transport **actual** properties (viscosity, density etc.) for the MPFM life
- Maximum liquid and gas rates (in terms of actual flow rates)
- Gas volume fraction
- Sand content and type
- Others like wax, scales, asphaltenes, sulphur and CO₂ content etc.

The above listed parameters, or any information needed to calculate them, will be listed in the project Statement of Requirements, Basis for Design and/or Fluid Data Book to be issued by Company.

General requirements for process equipment design are provided in [GS EP ECP 103](#).

4.1.2 Flow Assurance Issues

For general insulation system requirements reference is made to [GS EP SPS 008](#). For specific requirements related to cool-down period and start-up and shut-down sequences, reference is made to project specific Hydrate Management Plan and Operational Philosophy.

The MPFM insulation requirement shall be directly drawn from the insulation requirements for the specific SPS assembly (e.g. XT, Manifold, jumper) on which the MPFM is installed.

Furthermore, the MPFM shall be designed to minimize cold spots, dead legs and potential water traps where hydrates might form.

4.1.3 Operating and Metering Philosophy

Reference shall be made to the project specific operating and metering philosophy issued by Company.

4.2 Functional Requirements

The multiphase metering system shall comply with the field life as defined in the project specific Statement of Requirements.

4.2.1 Uncertainty

A means shall be provided to calculate and check the configuration parameters in order to guarantee the best performance of MPFM.

The MPFM shall allow the determination of data at standard conditions with the following uncertainties:

- Liquid flow rate: $\pm 2.5\%$ to $\pm 5\%$ of reading (depending on GVF)
- Gas flow rate: $\pm 5\%$ to $\pm 10\%$ of reading (depending on GVF)
- Water in liquid ratio: $\pm 2.5\%$ to $\pm 5\%$ absolute (depending on GVF)

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It shall be noted that above presented accuracies are typical. Where relevant, project specific accuracies shall apply.

These uncertainties shall be demonstrated through an appropriate test program. Test program shall be submitted to Company for approval.

4.2.2 Data

The MPFM shall meet the following data requirements: upload, download data or software.

These data shall be used for:

- Operation
- Diagnostic
- Maintenance mode
- Reprocessing.

Contractor shall, for later procurement activities, detail other data related to MPFM technology such as gamma source (or alternative means used). Such data shall include handling, storage and disposal after source replacement.

4.3 Design Requirements

In addition to the requirements below, the design specifications provided in [API RP 17S](#) & [DNV RP F112](#) shall be applied.

The MPFM system shall be designed with due concern for reliability and availability. Redundancy shall be incorporated to avoid single point of failure. The design shall seek to maximize availability and minimize overall life cycle cost.

System availability (including both electrical and mechanical components): The overall availability of the unit is impacted by the redundancy and sparing philosophies for the unit. In general, the reliability for both the topsides and subsea equipment will be quoted as a mean time between failures (MTBF).

Guidance on reliability implementation is provided in [MIL-HDBK-217F](#).

Contractor shall design the overall organization of the MPFM with a view to maximizing availability. In particular, the proposed design and supporting documentation shall address but shall not be limited to the following:

- Tests
- Modularity
- Temperature of electronic components. Specific emphasis shall be made to any thermal insulation program including cold spot management plan. For specific requirements, reference is made to project specific Design Basis document and [GS EP SPS 008](#)
- Resistance to shock/vibrations. For specific design requirements, reference is made to [API SPEC 17F](#)
- Corrosion protection (philosophy). For specific design requirements, reference is made to [GS EP SPS 009](#)