



Exploration & Production

GENERAL SPECIFICATION

ROTATING MACHINERY

GS EP MEC 275

Multi-Phase pumps

01	01/2012	Update
00	01/2011	First issue
Rev.	Date	Notes

Owner: DEV/TEC

Managing entity: DEV/TEC/MTH



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1. Scope

The purpose of this specification is to define the minimum requirements for the design, construction, inspection, testing and delivery of a rotodynamic multiphase pump to be installed on the sea floor.

The purpose of this specification is to clarify the requirements of [API Std 610](#) 11th ed, when applied to multiphase pumps. This document modifies or complements some requirements of [API Std 610](#), when deemed necessary considering Company experience.

The paragraph numbering is identified in the same way as in [API Std 610](#) except for additional requirements, which may be presented with new paragraph numbers.

This specification also defines the minimum functional requirements for the key auxiliary components that are fully part of the pump system, which are the barrier fluid system, the control system, the preservation system, the minimum flow protection valve, the discharge non return valve, the inlet flow mixer, the outlet flow splitter, and the ROV panel.

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
API Std 610	Centrifugal Pumps for Petroleum, Petrochemical and Natural Gas Industries
ASME VIII Div 1	Boiler and Pressure Vessel Design code, div 1
ASME VIII Div 2	Boiler and Pressure Vessel Design code, div 2
BS EN 10204	Test certificates for stainless steel products
BS PD 5500	Specification for unfired fusion welded pressure vessels
DNV RP B401	Cathodic Protection Design
DNV RP F112	Design of stainless steel subsea equipment exposed to cathodic protection
ISO 10441	Flexible couplings for mechanical power transmission - special purpose applications
ISO 13628 (Parts 1; 8)	Petroleum and natural gas industries - Design and operation of subsea production systems - (Parts 1; 8)
TD 0153	Requirements for wet mateable electrical and cable jumper assembly

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**Professional Documents**

Reference	Title
Not applicable	

Regulations

Reference	Title
Not applicable	

Codes

Reference	Title
IEC 60034-1 IEC 62271-200	Rotating Electrical Machines - Rating and Performances High-voltage switchgear and controlgear - Part 200: AC metal-enclosed switchgear and controlgear for rated voltages above 1 kV and up to and including 52 kV

Other documents

Reference	Title
Not applicable	

Total General Specifications

Reference	Title
GS EP INS 110	Instrumentation for package units
GS EP PVV 146	Bolting for piping
GS EP PVV 611	Welding of pressure containing piping and equipment
GS EP PVV 614	Welding of duplex and superduplex stainless steel
GS EP PVV 619	Piping or pressure vessel components in duplex and superduplex stainless steel
GS EP SPS 002	Design of subsea structures
GS EP SPS 016	Subsea insert chokes and associated running and retrieval tools
GS EP SPS 019	Subsea production control system
GS EP STR 201	Materials for offshore steel structures

3. Terms and definitions

Helico-axial Multiphase Pump

Helico-axial or so-called rotodynamics pumps have several stages that progressively compress the mixture dynamically, i.e. the rotational speed of the shaft generates the required head or pressure. Shaft torque is converted into fluid angular momentum. If the GVF increases, speed has to be increased to produce the required head. Each compression stage consists of an open type impeller, mounted on a rotating shaft, and a fixed diffuser. Profile of the impeller blades, helical, and the diffuser vanes are specifically designed to prevent separation of phases in the compression process.

MPP unit

Pump and motor assembly.

MPP system

MPP unit with all its subsea auxiliary system, which are the barrier fluid system, the control system, the preservation system, the minimum flow protection valve, the discharge non return valve, the inlet flow mixer, the outlet flow splitter, and the ROV panel.

Barrier Fluid system

System composed of topside barrier fluid HPU, topside and subsea accumulators, subsea Feed and Dump valves.

HPU

Hydraulic Power Unit.

GVF

Gas Volume Fraction

Q_{gas} = gas flow at pump suction conditions

Q_{total} = total flow (oil + liquid + gas) at pump suction conditions

MPFM

Multiphase Flow Meter.

ROV

Remotely operated vehicle.

VSD

Variable Speed Drive.

PCM

Power and Control Module installed on the FPSO topside.

All topside equipment shall be fitted into a Power and Control Module (PCM), designed as a container module. It shall be built as one unit for single lift by fixed facilities. The PCM shall contain necessary control equipment to drive one MPP station, including control systems, hydraulic generation, VSD and local HVAC functions.

A typical subsea pumping station holds two MPP units, therefore the PCM shall include:

- Two off VSDs for individual HV power supply and speed control of the two subsea MPP motors.
- Internal LV power distribution, comprising Miniature Circuit Breakers (MCB), cabling, etc. for internal power supply of all LV and UPS consumers inside the PCM.





- 1 off barrier fluid HPU for supply of the barrier fluid System for the two Subsea MPPs. Local control room with HMI for control of the two Subsea MPPs and associated equipment.
- HVAC system.

Note: The PCM may also hold 1 off control fluid HPU to provide control fluid to operate the subsea valves (architecture more relevant for brown field application).

UCP

Unit Control Panel, It ensures the following functions:

- MPP control and process shutdown logic functions.
- Subsea Control Unit Part (via the SCU)
- Subsea Power and Communication Unit Part (via the SPCU)
- Control Fluid HPU control (if any)
- Barrier Fluid HPU control.

SCU

Subsea Control Unit

SPCU

Subsea Power and Communication Unit

SCM

Subsea Control Module. The SCM gathers instruments data, and send them topsides to the UCP. Commands for the valves are initiated topsides by the UCP and sent to the SCM for executive action.

LV

Low voltage

HV

High voltage

UPS

Uninterruptible Power Supply

HMI

Human Machine Interface

FPSO

Floating Production Storage & Offloading.

FAT

Factory Acceptance Test.

EFAT

Extended Factory Acceptance Test.

CDT

Cool Down Test.

SWT

Shallow Water Test.

4. Comments to API Std 610 11th Edition

API	GS
5. Requirements	
5.1 Units	
The purchaser shall specify whether data, drawings, and maintenance dimensions of pumps shall be in the SI or US Customary (USC) system of measurements. Use of an SI data sheet (see N.3.1) indicates the International Standard System of measurements shall be used. Use of a USC data sheet (see N.3.2) indicates the USC system of measurements shall be used.	Pumps shall have SI dimensions and comply with applicable ISO standard.
6 Basic design	
6.1 General	
6.1.1	(Modification and Addition) The equipment (including auxiliaries) covered by this International Standard shall be designed for at least 5 years of uninterrupted operation. The whole MPP system shall have a System Engineering approach, and not a component approach. MPP shall be designed by taking into account the environmental conditions as for instance: - Design pressure - Design temperature - Fluid composition and data - Design life time - Ambient temperature (subsea) - Flow line inner diameter - Water depth - Pump location - Sand concentration - Transportation - Main conditions of storage, i.e.: - Storage area: indoor or outdoor

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