

GENERAL SPECIFICATION

INSTRUMENTATION

GS EP INS 111

**Design and supply of liquid custody transfer
metering units**

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1. Scope

This document defines the minimum requirements for the design of liquid metering units intended for installation at custody transfer points for sales, ownership determination or allocation purposes.

This specification describes requirements applicable for continuous transfer (pipeline metering) or for batch transfer (typically off loading...).

2. Reference documents

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

Metering design and supply shall also be in accordance with principles and operational metering requirements described in the project metering philosophy.

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
API MPMS	Manual of Petroleum Measurement Standards
IEC 60079	Parts related to the Electrical apparatus for explosive gas atmospheres
ISO 17025	General requirements for the competence of testing and calibration laboratories
ISO 3171	Petroleum Liquids - Automatic Pipeline Sampling
ISO 4124	Liquid hydrocarbons - Dynamic measurement - Statistical control of volumetric metering systems
ISO 5168	Measurement of fluid flow - Evaluation of uncertainties
ISO 6551	Petroleum Liquids and Gases - Fidelity and Security of Dynamic Measurement - Cabled Transmission of Electric and/or Electronic Pulsed Data
ISO/CEI GUIDE 98-1	Uncertainty of measurement - Part 1: Introduction to the expression of uncertainty in measurement
OIML R117-1	Dynamic measuring systems for liquids other than water - Part 1: Metrological and technical requirements

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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 350	External protection of offshore and coastal structures and equipment by painting
GS EP ELE 079	Electrical apparatus for potentially explosive gas atmospheres
GS EP INS 101	Instrumentation engineering, supply and construction general requirements
GS EP INS 110	Instrumentation for package units
GS EP PVV 112	Piping material classes
GS EP PVV 142	Valves
GS EP PVV 211	Design and fabrication of pressure vessels according to ASME VIII
GS EP PVV 771	Thermal insulation (hot service)

3. Basis for metering system design

Design of liquid custody transfer metering systems shall be performed in compliance with:

- Local regulations
- Contracts and lifting agreement
- Uncertainty target
- Custody transfer mode: continuous transfer (pipeline metering) or batch transfer (typically off loading)
- Process conditions (pressure, temperature, flow rate ranges), pressure drop in the custody transfer metering system
- Fluid properties and analysis (viscosity, water content, BSW, vapor pressure, solids contents or slurries and erosion or deposition risks, etc.)
- Location
- Installation constraints.

4. Standards

API MPMS or ISO shall be used.

5. Units & base conditions

At minimum, the metered volumes shall be STANDARD GROSS & STANDARD NET expressed in US barrels at 60°F/14.696 psi a and in m³ at 15°C/1.01325 bar a.

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6. Metering system uncertainty for measured quantities

The degree of uncertainty on the determination of the delivered STANDARD GROSS quantity shall be less than $\pm 0.1\%$ relative.

On a case by case basis, higher uncertainties may be specified and accepted by Company (reference shall be made to project metering philosophy) to comply with economical conditions and financial risks.

The uncertainty shall never exceed $\pm 0.25\%$.

Uncertainty calculation shall be developed to demonstrate system uncertainty matches with targets.

Recommendations of [ISO 5168](#), [ISO/CEI GUIDE 98-1:2009 \(GUM\)](#) and [API MPMS](#) shall be followed.

Overall uncertainty calculation includes the uncertainties related to:

- Real sensors: flow meter and gross volume, temperature and pressure measuring instruments, on line analyzer like density meter, and water cut meter, and viscosity meter (if any)
- Parameter inputs used in thermal dilatation or compressibility calculation, like density for liquid
- Signal conversion instruments and calculation algorithms
- Calibration system e.g. Volume of the pipe prover loop
- Variations in flow and consistency of the crude (density and viscosity) between two calibrations: meter factor linearization curve
- Characteristics of the flow measurement device.

7. Flow measurement technology

Metering technologies acceptable for custody transfer are:

- Turbine meter
- Positive displacement meter
- Coriolis mass flow meter
- Ultrasonic flow meter.

Recommended flow measurement principle(s) will be defined in the project metering philosophy.

7.1 Measurement of gross volumes

7.1.1 Turbine meter

Turbine flow meter shall be selected for any application until the fluid viscosity and its changes (oil and emulsion) remain compliant to the meter performances and area availability (filters, flow straightener and straight lengths).

Where turbines are selected, they shall be with helical blades.