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GP 64-05

Implementing Measurement Aspects of Multiphase and Wet Gas Meters

Group Practice

**BP GROUP
ENGINEERING TECHNICAL PRACTICES**

Foreword

This is the first issue of Engineering Technical Practice (ETP) GP 64-05.

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Introduction

As a general rule the company shall seek to utilize single-phase measurement where achievable for all purposes and especially where there may be a financial impact. However, it is understood that there are instances where multiphase flow measurement (MPFM) is used in the course of BP's business. The design and operation of MPFM systems are not fully standardized within industry or within internal engineering practices. The technology is relatively immature and new innovations are relatively frequent. Furthermore, there is generally an inability to verify flow measurement performance of MPFM systems in actual operation. For these reasons the following requirements and recommendations apply to the implementation of the measurement aspects of multiphase and wet gas metering systems on BP operated facilities and to the extent enforceable, on facilities where BP maintains a working interest but does not operate.

This document provides requirements and recommendations concerning the measurement engineering aspects of the decision process concerning MPFM systems, so that ultimately proper assurance is provided in this non-standardized area. Furthermore guidance is given on various aspects to address throughout the CVP stages for projects and continuing into operating modes. The key points made here are to develop a strategy for the use and validation of the MPFM system in the operational and commercial context it is intended and to establish a performance expectation such that operations may make appropriate plans for the confidence level of flow measurement results that shall likely be encountered. As such this document concentrates on the measurement (or assurance of measurement performance) aspects and does not address physical configuration, communication capabilities, electrical requirements, or reliability assurances of MPFM systems. These areas are of equal importance and should continue to be addressed within the context of each project.

Please note that MPFM systems is used as a general term throughout this document to refer to multiphase and wet gas metering systems of any design whether for liquid dominant flows (sometime referred to specifically as multiphase meters) or wet gas metering systems, which are designed for gas dominant flows.



1. Scope

- a. This document addresses the process of implementing the flow measurement aspects of multiphase and wet gas meters. It sets out the requirements and recommendations regarding engineering authority (EA), technical authority (TA), and subject matter expert (SME) roles and accountabilities. These are broadly in alignment with the guidance given in GP 64-01. Considerations concerning the subject matter are given for the recognized project stages.
- b. This document is centred on providing proper assurance around flow measurement capability. There are often other parameters such as reliability, materials of construction, pressure and temperature rating, etc. that are not fully addressed here. Therefore, this document should not be used as an authoritative document in regards to other engineering parameters beyond flow measurement.

In particular for subsea applications beyond the measurement performance aspects of the multiphase and/or wet gas metering system attention should also be given to aspects such as:

- *Subsea hardware.*
- *Controls (power/communications).*
- *Installation (connector, ROV tooling).*

- c. The related guidance note [GN 64-051](#) goes into detail on the basic operating principles of the various MPFM systems currently available. The GN follows on from this GP document in that it provides the engineers needing to deal with the subject a basis for relating the particular technical principles to the application in question. The two documents together are designed to set a procedural framework for approaching the decision making process associated with MPFM applications and additionally to provide an understanding of the technology in order to relate it to the actual operation.

2. Normative references

The following referenced documents may, to the extent specified in subsequent clauses and normative annexes, be required for full compliance with this GP:

- For dated references, only the edition cited applies.
- For undated references, the latest edition (including any amendments) applies.

BP

BP E&P MPcp engineering and quality management guideline

<http://pelib.bpweb.bp.com/view/ViewDocumentFrameSet.jsp?native=true&docType=epp&docID=0900a8668028a65a>.

GP 30-01 - Temperature Instruments.

GP 30-05 - Pressure Instruments.

GP 30-10 - Non-Fiscal Flow Instruments (Class 2 and 3).

GP 64-00 - Measurement Management.

GP 64-01 - Fluid Measurement Management.

GP 64-02 - Dynamic Measurement.

[GN 64-002 - Measurement Systems Terms and Definitions.](#)

[GN 64-051, Technology Basis and Evaluation of Multiphase and Wet Gas Meter Systems.](#)

GP 78-06, Qualification of Technology for Subsea Projects.



Others - Industry

Handbook of Multiphase Metering. The Norwegian Society for Oil and Gas Measurement (NFOGM) <http://www.nfogm.no/>.

API RP 86, Recommended Practice for Measurement of Multiphase Flow.

API RP 85, Use of Subsea Wet Gas Flowmeters in Allocation Measurement Systems.

ISO TR 15377, Measurement of fluid flow by means of pressure-differential devices — Guidelines for the specification of orifice plates, nozzles and Venturi tubes beyond the scope of ISO 5167.

DeepStar project 8302, Improved Multiphase Metering for Subsea Tiebacks. April 2008.

Others - Regulatory

Department for Business Enterprise and Regulatory Reform, (formerly DTI), Guidance Notes for Petroleum Measurement, Issue 7, December 2003.
https://www.og.berr.gov.uk/upstream/measurement/MeasGuidelines_V7.pdf.

State of Alaska, Oil and Gas Conservation Commission, Guidelines for Qualification of Multiphase Metering Systems for Well Testing, November 2004 and Principles of Multiphase Measurements, November 2004
<http://www.state.ak.us/admin/ogc/MeterGuidelines113004.pdf>;
<http://www.state.ak.us/admin/ogc/MeterPrinciples113004.pdf>.

3. Terms and definitions

For the purposes of this GP, the following terms and definitions apply:

Gas volume fraction. (GVF)

A parameter that indicates the gas volume flow rate relative to the total multiphase stream volume flow rate (oil + gas + water), at the pressure and temperature prevailing at the measurement section, which is usually expressed as a percentage.

MPFM System

A term used to describe the physical metering unit and all the other sensors, input data, and equations that normally together create a resulting quantities of oil, gas, and water.

Multiphase flow measurement performance test

A test where piping, pumps, and separation vessels are used to flow fluids in a multiphase state through a test device (meter) where reference measurements are made on the single phase flows of gas, liquid (presumably hydrocarbon liquid), and water that make up the multiphase flow.

PVT analysis and predictive models

This terminology means a set of equations that use the compositional analysis of a fluid together with the temperature and pressure information at metering conditions in order to relate the quantities of oil and gas as observed to their respective quantities at another pressure and temperature condition, which is usually at “standards conditions”.

Traceable reference measurement

A term used to reflect that the reference measurement made during a test have been calibrated or validated in a manner that follows recognized standards and with equipment maintaining a validation and/or calibration that is traceable to a national standards laboratory.



4. Symbols and abbreviations

For the purpose of this GP, the following symbols and abbreviations apply:

AOGCC	Alaska Oil and Gas Conservation Commission.
BERR	Department of Business Enterprise and Regulatory Reform.
BLM	Bureau of Land Management.
DECC	Department of Energy and Climate Change.
DTI	Department of Trade and Industry.
EA	Engineering authority.
GVF	Gas volume fraction.
MMS	Mineral management service.
MPFM	Multiphase flow meter (generally also used to refer the Wet Gas meters).
NPD	Norwegian Petroleum Directorate.
PVT	Pressure-volume-temperature (data describing fluid state).
TA	Technical authority.
SETA	Segment engineering technical authority.
SME	Subject matter expert.

5. Engineering requirements

5.1. Roles and accountabilities

5.1.1. General

- a. These roles and accountabilities are given in order to ensure that the proper level of engineering oversight is given to implementing multiphase and wet gas metering solutions on BP facilities. The terms Engineering Authority (EA) and Technical Authority (TA) are used in this document a general sense. However, within the BP engineering departmental structure, EA and TA roles can and are filled in both a project sense as well as a permanent operational sense for any particular PU or SPU.
- b. Therefore, the responsible parties for implementing these metering solutions shall treat these requirements as applying to the context in which they are located. Project engineers who are assigned the task of implementing multiphase or wet gas metering systems shall work via the project EA or TA. Engineers working within operational support teams shall work via the PU or SPU EA or TA.
- c. Naturally this document relates more towards the project scenarios since it relates to implementing the equipment. Therefore, it is expected that project EA and TAs shall be primarily involved in using this guidance. However, unlike other more mature technologies, the performance of multiphase and wet gas metering systems in actual operations may be highly variable and the operations staff may be less prepared to remedy poor performance with such a new and still emerging technology. Therefore, it is advisable

