



GS 130-11

Guidance for Specification 130-11

SPECIFICATION FOR OIL AND GAS METERING SYSTEMS

January 1994

Copyright © The British Petroleum Company p.l.c.

All rights reserved. The information contained in this document is subject to the terms and conditions of the agreement or contract under which the document was supplied to the recipient's organisation. None of the information contained in this document shall be disclosed outside the recipient's own organisation without the prior written permission of Manager, Standards, BP International Limited, unless the terms of such agreement or contract expressly allow.

BP GROUP RECOMMENDED PRACTICES AND SPECIFICATIONS FOR ENGINEERING											
Doc. No. GS 130-11		Issue Date January 1994	Latest Amendment Date								
Document Title SPECIFICATION FOR OIL AND GAS METERING SYSTEMS											
APPLICABILITY Regional Applicability: International											
SCOPE AND PURPOSE This document specifies the minimum requirements for the design of Oil and Gas Metering Systems. Its purpose is for the specification of fit-for-purpose Oil and Gas Metering Systems at minimum cost.											
AMENDMENTS <table border="0" style="width: 100%;"> <tr> <td style="width: 15%;">Amd</td> <td style="width: 20%;">Date</td> <td style="width: 20%;">Page(s)</td> <td style="width: 45%;">Description</td> </tr> <tr> <td colspan="4"> </td> </tr> </table>				Amd	Date	Page(s)	Description				
Amd	Date	Page(s)	Description								
CUSTODIAN (See Quarterly Status List for Contact) Control & Instrumentation											
Issued by:- Engineering Practices Group, BP International Limited, Research & Engineering Centre Chertsey Road, Sunbury-on-Thames, Middlesex, TW16 7LN, UNITED KINGDOM Tel: +44 1932 76 4067 Fax: +44 1932 76 4077 Telex: 296041											

CONTENTS

Section	Page
FOREWORD	ii
1. INTRODUCTION.....	1
1.1 Scope	1
1.2 <i>Functional Specification Guidelines</i>	1
2. SYSTEM REQUIREMENTS.....	1
3. OIL METERING SYSTEM.....	2
4. GAS METERING SYSTEM.....	2
5. PANEL MOUNTED INSTRUMENTATION.....	3
5.1 General	3
5.2 Flow Computers.....	3
6. FIELD MOUNTED EQUIPMENT	4
7. TESTING	4
8. DOCUMENTATION.....	5
APPENDIX A.....	8
DEFINITIONS AND ABBREVIATIONS	8
APPENDIX B.....	9
LIST OF REFERENCED DOCUMENTS.....	9
APPENDIX C	10
<i>FUNCTIONAL SPECIFICATION ATTACHMENTS</i>	10
C1. <i>SYSTEM DESCRIPTION</i>	10
C2. <i>DATA SHEETS</i>	12
C3. <i>ENVIRONMENT, AREA CLASSIFICATION AND UTILITIES</i>	16
C4. <i>FLOW COMPUTER COMMUNICATION REQUIREMENTS</i>	17
C5. <i>PROCESS CONDITIONS</i>	17
C6. <i>APPLICABLE CODES, STANDARDS AND REGULATIONS</i>	18



FOREWORD

Introduction to BP Group Recommended Practices and Specifications for Engineering

The Introductory Volume contains a series of documents that provide an introduction to the BP Group Recommended Practices and Specifications for Engineering (RPSEs). In particular, the 'General Foreword' sets out the philosophy of the RPSEs. Other documents in the Introductory Volume provide general guidance on using the RPSEs and background information to Engineering Standards in BP. There are also recommendations for specific definitions and requirements.

Value of this Guidance for Specification

This Guidance for Specification identifies the minimum requirements for the design of Oil and Gas Metering Systems. The intention is to simplify the purchasing requirements when dealing with a known and mature supplier source.

Application

This Guidance for Specification is intended to guide the purchaser in the use or creation of a fit-for-purpose specification for enquiry or purchasing activity.

Text in *italics* is Commentary. Commentary provides background information which supports the requirements of the Specification, and may discuss alternative options.

This document may refer to certain local, national or international regulations but the responsibility to ensure compliance with legislation and any other statutory requirements lies with the user. The user should adapt or supplement this document to ensure compliance for the specific application.

Specification Ready for Application

A Specification (BP Spec 130-11) is available which may be suitable for enquiry or purchasing without modification. It is derived from this BP Group Guidance for Specification by retaining the technical body unaltered but omitting all commentary, omitting the data page and inserting a modified Foreword.

Feedback and Further Information

Users are invited to feed back any comments and to detail experiences in the application of BP RPSE's, to assist in the process of their continuous improvement.

For feedback and further information, please contact Standards Group, BP International or the Custodian. See Quarterly Status List for contacts.



1. INTRODUCTION

1.1 Scope

This specification, details the basic minimum requirements for the design of shutdown systems. For system procurement, this specification will need to be supplemented by details of the functional requirements for the specific application.

1.2 *Functional Specification Guidelines*

A functional specification should cover the following areas:-

Introduction

Scope of Supply:-

General

Testing

Documentation

Work by Others

Commissioning

Applicable Codes, Standards and Regulations

Special Requirements

Information Required with Quotation

Price and Delivery

Quality Verification

Attachments:-

System Description (See Appendix C1)

Data Sheets (see Appendix C2)

Environment, Area Classification and Utilities (see Appendix C3)

Flow Computer Communications Requirements (see Appendix C4)

Process Conditions (see Appendix C5)

Applicable Codes, Standards and Regulations (see Appendix C6)

It may also be necessary to include any relevant project specifications to cover such areas as piping, structural steel, lagging and cladding, painting etc. the amount of additional specs. should be minimised, however, to only those where project specific requirements are to be imposed.

2. SYSTEM REQUIREMENTS

- 2.1 The metering systems shall be supplied as a fully piped, cabled and instrumented packages.



- 2.2 The supplier shall provide uncertainty calculations (including primary and secondary instruments) to demonstrate compliance with the performance requirement.
- 2.3 The design shall meet the requirements necessary to gain approval of any appropriate third party or regulatory authorities together with any testing requirements.

3. OIL METERING SYSTEM

- 3.1 Where a prover system is supplied and is fitted with four detector switches they should be positioned such that all 4 alibratable sections of the prover differ from each other by more than 0.10% volume.

The requirement for an asymmetric limit switch arrangement ensures that the calibrated volumes can be referred to limit switch pairs, with minimal risk of transposition.

- 3.2 The location of the prover calibration connections will take into account the location of the area set aside for the mobile calibration equipment. The system design shall allow the easy hook-up of the mobile calibration equipment (piping, electrical and instruments).

4. GAS METERING SYSTEM

- 4.1 The supplier shall provide in his tender document, calculations to show that the meter tube design is in accordance with this specification and the listed codes and standards, and that the requirements of differential pressure, Reynolds no. and beta ratio are met for orifice plate applications.

The limits placed on differential pressure, Reynolds no. and beta ratio by local codes and standards are frequently more onerous than those specified in ISO 167.

- 4.2 The design of the inlet and outlet headers shall provide an even flow distribution when two or more streams are in operation.

The use of tees (not elbows) to connect outside streams to the inlet and outlet headers is normally necessary to achieve an even flow distribution.



5. PANEL MOUNTED INSTRUMENTATION

5.1 General

The metering system shall use up to date proven microprocessor based flow computers. The use of standard software shall be maximised. Any necessary custom software shall be identified with the proposal.

The system shall comprise individual flow computers. The proving functions may be incorporated in the stream instruments or the data base instruments. The system configuration shall be such that metering can continue in the event of loss of the database computer.

Test sockets and isolating terminals shall be provided, at the front of panel, for the easy connection of test equipment used in routine calibration procedures.

Each stream, prover and database computer shall meet the following requirements:-

- A security system consisting of key switches, passwords and lead seals to prevent unauthorised adjustment of information held within the metering instruments.
- When calibration mode is selected and the stream outlet/prover valves are closed flow totalisation and transmission of flow rate values external to the metering system shall be suppressed for the particular stream.
- The flow rate shall be set to zero and flow totalisation stopped when the meter pulse frequency is less than the keypad entered cut off value.
- Totalised information and critical coefficients shall be stored in such a way that limited memory failures are detected and corrected.
- All abnormal conditions, and conditions that could potentially affect the integrity or accuracy of the metering system shall be alarmed.

5.2 Flow Computers

The following data shall be accessible from the flow computers (stream, prover where supplied, database where supplied):-

- All raw input values (mA, frequency etc.)
- All scaled inputs in engineering units
- All constants used in the flow calculations
- All intermediate results in the flow calculations



- All results of flow calculations (mass, volume etc.)
- All constants used in the proving calculations
- All intermediate results in the proving calculations
- All results of the proving calculations

All field inputs should be capable of being manually set from a keypad. Reporting and displays shall clearly identify any manually set or overridden data.

The prover functions when initiated will automatically carry out the proving sequences as defined in the codes and standards. During the proving the computer will monitor all signals for fault or out of tolerance conditions. If a fault or out of tolerance condition is detected the proving sequence shall be aborted and the calculations suspended.

The prover base volume shall be by manual selection with status indication to the prover computer. Following a successful prove sequence the new K-factor will only be down loaded to the appropriate flow computer on receiving operator confirmation.

6. FIELD MOUNTED EQUIPMENT

- 6.1 All enclosures for field mounted electrical and instrument equipment shall be weather proofed to IP 55, [IEC 529](#) classifications as a minimum.
- 6.2 Adequate provision shall be made for removal, in situ maintenance, calibration and operational access of all major components and instruments.
- 6.3 Spool pieces and spectacle blinds shall be supplied to facilitate inspection and removal of equipment, where required. Spool pieces shall be provided for replacement of in-line instruments during pipe flushing and pressure testing.

7. TESTING

Detailed test procedures covering all phases of the work shall be produced, which will demonstrate design integrity along with the correct and accurate operation of each of the system elements. The test procedure shall ensure that on-site testing and remedial work is minimised.

Testing shall satisfy regulatory requirements.

Test procedures should be produced by the supplier to cover but not be limited to the following areas:-

Mechanical Integrity

- *Hydrostatic pressure testing*



- Spark testing of coated tube sections
- Relief valve testing
- Valve leakage tests
- Valve stroke tests

Electrical Integrity

- Cable insulation tests
- Circuit breaker checks

Instrument Tests

- Instrument calibration checks
- Heat soak tests
- Turbine meter tests
- Flow computer checks
- Prover and database computer checks
- Communication and interface checks

The control panels shall be demonstrated to be immune to electromagnetic interference using project specific sources for test purposes.

8. DOCUMENTATION

Documentation shall be provided to enable assessment of design. This shall be limited to that essential to verify conformance with specified functionality and as necessary to permit installation, operation, calibration and maintenance of the system.

Requirements should be detailed in the Functional Specification and would consist typically of the following:-

(i) Information Required With Quotation

- Detailed description of proposed system including details of micro-processor systems.
- List of deviations from the specification or Codes and Standards.
- Statement of capabilities and proposals for providing installation supervision (on/offshore) and testing/commissioning (on/offshore).
- Programme for construction, testing and delivery.
- Flow Diagrams and P&ID's
- Proposals for testing.
- Spares and test equipment proposals and prices.

(ii) Documentation Required During Design Build and Test

Documentation must be limited to the minimum required to design the installation and to operate and maintain the equipment.



It should be recognised that it is the responsibility of the vendors to approve the detailed design drawings and not the design contractor. This is a new approach and will substantially reduce the volume of documentation required.

The specific documentation requirements will need to be defined by the design contractor for each particular application.

The prime objective is to eliminate unnecessary documentation, reformatting and approvals, thereby realising large savings in vendor and contractor costs.

The document approval category requirements for the above will need definition for specific applications. The requirement for approval before continuation of manufacture should be minimised.

It is suggested that the following is used as a basis for agreeing the documentation requirements:-

8 weeks after confirmation of order:

- *General arrangement and layout drawings.*
- *Front of panel layout drawings.*
- *Panel power and heat load estimates.*
- *Wiring, electrical distribution, earthing, inter-connection and termination drawings.*
- *Installation and terminal point details.*
- *Equipment lists, schedules and data sheets for input to operational maintenance database systems (where specified).*
- *Detailed spares and test equipment listings to cover two year's operation.*
- *Weight and Centre of Gravity estimates.*

8 weeks prior to Factory Test:

- *Detailed procedure, programme and test sheets for system testing at the factory, on site commissioning and for subsequent routine operation and maintenance. These are to include for the system, field equipment and any sub-vendor or ancillary equipment.*
- *Equipment safety certification dossier.*
- *Metering dossier containing all the information required by the approval authority.*
- *Certification manual demonstrating the validity of all information used in flow calculations. This document shall be capable of easy updating when required.*
- *Operations and maintenance manuals covering all additional information necessary for continued operation during the life of the installation.*



On delivery

- *As built documentation*
- *Confirmed weight and Centre of Gravity (offshore only or as specified)*



DEFINITIONS AND ABBREVIATIONS

Definitions

Standardised definitions may be found in the BP Group RPSEs Introductory Volume.

Abbreviations

IEC	International Electrotechnical Commission
IP	Ingress Protection
ISO	International Organisation for Standardisation



LIST OF REFERENCED DOCUMENTS

A reference invokes the latest published issue or amendment unless stated otherwise.

Referenced standards may be replaced by equivalent standards that are internationally or otherwise recognised provided that it can be shown to the satisfaction of the purchaser's professional engineer that they meet or exceed the requirements of the referenced standards.

[IEC 529](#) Degrees of protection provided by enclosures

[ISO 5167](#) *Measurement of fluid flow by means of pressure differential devices.*



FUNCTIONAL SPECIFICATION ATTACHMENTS

C1. SYSTEM DESCRIPTION

C1.1 General

-- HOLD --

(Note: Description of the project, location and application)

C1.2 System Layout

-- HOLD --

(Note: Summary of the system and any particular features/requirements for the application)

C1.3 Approval Authority

-- HOLD --

(Note: Detail all approval authorities that may require to approve design and testing.)

C1.4 Display and Operator Interface Arrangement

Vendor to advise optimum solution.

C1.5 Integration with Other Systems

-- HOLD --

(Note: Describe functional requirements and request supplier to propose optimum solutions. Any requirements for integration of database computing facilities into the main platform control systems should also be detailed.)

C1.6 Special to Project Metering/Sampling Requirements

(Note: Detail any known special requirements not covered by standard installation requirements.)



C1.7 *Special to Project Maintenance Facilities*

-- HOLD --

(Note: Agree any special requirements with the Operator.)

C1.8 *Device and Equipment/Panel Tag Numbering*

-- HOLD --

*(Note: Detail to fit project philosophy but with due regard to
supplier system capability.)*

C1.9 *Panel Maximum Noise Levels*

Control Room Panels: -- HOLD --

(Note: Consider requirements for continuous manning.)

Equipment Room Panels: -- HOLD --

*(Note: Should be less onerous as usually not normally
manned.)*

C1.10 *Configuration of Pipework Upstream of Skid*

-- HOLD --

*(Note: Details will need to be provided to allow suppliers to
estimate pipe run lengths allowing for upstream bends
and any induced swirl effects.)*



C2. DATA SHEETS

ITEM	REQUIREMENT	OPTIONS	COMMENTS
OIL METERING			
Meter Type			
Prover Type			
Meter Line Size			
Prover Line Size			
No. of Meter Streams			
No. of Operational Streams			
Piping Class			
Piping Specification			
Total System Uncertainty			
Repeatability Turbine/Prover			
Main Line Size			
Maximum Dimensions			
GAS METERING			
No. of Meter Streams			
No. of Operational Streams			
Meter Tube Size			
Piping Class			
Piping Specification			
Total System Uncertainty			
Main Line Size			
PANEL INSTRUMENTS			
No. of Printers			
No. of Keyboards/VDU Units			
Chart Recorders			

General



[illegible]

Oil Metering - Detailed Requirements



C3. ENVIRONMENT, AREA CLASSIFICATION AND UTILITIES

Field equipment

Field equipment will be subjected to a marine environment with a salt laden atmosphere.

Max. ambient temperature	°C
Min. ambient temperature	°C
Max. Rel. Humidity	%

Area Classification	Zone
Gas Group	II
Temperature Class	T

Central control/Field equipment rooms

The control/equipment rooms shall be classified as a safe area and suitable for general purpose equipment such as control panels and printers.

Max. ambient temperature	°C
Min. ambient temperature	°C
Max. Rel. Humidity	%

Utilities and Services:

Electrical power

1.	Voltage		V AC	V AC
	Frequency		Hz	Hz
	Regulation	-	VTA	
	Harmonic Distortion	-	VTA	
	Switching Transients	-	VTA	
2	Voltage		V DC	V DC
	Regulation	-	VTA	
	Ripple	-	VTA	
	Harmonic Distortion	-	VTA	

Instrument Air

Inst. Air Pressure	barg (max.)	barg. (min.)
Dew Point	°C	

VTA - Vendor to advise with submission



C4. FLOW COMPUTER COMMUNICATION REQUIREMENTS

Reports and Logs

-- HOLD --

(Note: Detail minimum requirements to satisfy operational and authority requirements.)

DCS Communications and Controls

-- HOLD --

(Note: The amount of information to be handed off to other systems directly associated with the facility needs to be detailed together with details of instrumented systems.)

Other Communications

-- HOLD --

(Note: The requirements for any remote communications need to be detailed here together with details of interconnected system, communication method, communication equipment and any inherent communication time delays involved.)

C5. PROCESS CONDITIONS

Process Oil

Design Flow Rate	m^3/h
Normal Flow Rate	m^3/h
Minimum Flow Rate	m^3/h
Design Pressure	bar g
Operating Pressure	bar g
Design Temperature	$^{\circ}C$
Operating Temperature	$^{\circ}C$
Vapour Pressure	bar abs @ $^{\circ}C$ bar abs @ $^{\circ}C$
H ₂ S max.	ppm mol
CO ₂ max.	% mol
Salt max.	mg/l (NaCl, MgCl)
Density (Dry basis)	kg/m ³ @ $^{\circ}C$ kg/m ³ @ $^{\circ}C$
Wax content	%
Pour point	$^{\circ}C$



Viscosity (Dry basis)	cP @ °C
	cP @ °C

Water max. v/v	%
S.G. of Water @ 15.6 C	
Max. allowable diff. pressure bar	

Process Gas

Maximum flow rate	kg/h
Minimum flow rate	kg/h
Design pressure	bar g
Operating pressure	bar
Maximum Temperature	°C
Operating Temperature	°C
Gas composition	
Component	% mol

Water
H₂S
Methiol
Carbnyls
Nitrogen
Carbon Dioxide
Methane
Ethane
Propane
I-Butane
N-Butane
I-Pentane
N-Pentane
C₆+

Density	kg/m ³
Viscosity	cP
CP/CV at cond.	
MW (vapour)	
Max. allowable diff pressure bar	

C6. APPLICABLE CODES, STANDARDS AND REGULATIONS

The equipment shall be designed, fabricated, inspected and tested in accordance with the latest revision of the following National/International Codes, Standards and Regulations.

It is the Vendor's responsibility to ensure his own compliance and that of his sub-suppliers with the applicable Codes, Standards and Regulations.

In the event of conflict between this specification and the data sheets, the data sheets shall govern. In the event of conflict between National/International Codes and



Statutory Regulations, the Vendor must obtain written clarification from Purchaser before proceeding with the work.

The normal order of precedence in descending order shall be:-

Statutory Regulations

Data Sheets

This Specification

National/International Codes and Standards.

The equipment shall satisfy the requirements of the following:-

Oil Metering

API Manual of Petroleum Measurement Standards:-

Chapter 4	-	Section 2	-	Proving Systems
Chapter 5	Metering	-	Section 3	Turbine Meters
Chapter 8	Sampling	-	Section 2	Auto Sampling Of Petroleum and Petroleum Products
Chapter 11.1	Vol. V11 Table 54A	-		Generalised Crude Oils
Chapter 12	-	Section 2	-	Calculations of petroleum properties

Department of Trade and Industry:-

Approved metering Stations. Operating Procedures (Liquid Hydrocarbon Measurement).

Metering Standards for Liquid Petroleum Measurement

The Institute of Petroleum:-

IP 52/76 Petroleum Measurement Manual Part XIII

Fidelity and Security of Measurement - Data Transmission Systems
Section 1 and 3.

IP Petroleum Measurement Manual

Part VI

Sampling	-	Section 2	-	Tentative
Part X	-	Section 1	-	Field Guide to Proving Meters with a Pipe Prover



Gas Metering

International Standards:-

ISO 5167 Measurement of fluid flows by means of orifice plates, nozzles and venturi tubes inserted in circular cross section conduits running full.

ISO 5168 Measurement of fluid flow. Estimation of uncertainty of a flow rate measurement.

Department of Trade and Industry:-

Metering Standards for gaseous petroleum measurement.

