

**REGULATIONS RELATING TO MEASUREMENT OF PETROLEUM  
FOR FISCAL PURPOSES AND FOR CALCULATION OF CO<sub>2</sub>-TAX  
(THE MEASUREMENT REGULATIONS)**

**1 November 2001**

(Last amended: 7 December 2009)

**The Norwegian Petroleum Directorate (NPD)**

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## PREFACE

The purpose of these regulations is to ensure that accurate measurements form the basis of the calculation of taxes, royalties and fees etc. to the Norwegian state, including the CO<sub>2</sub> tax, and the income of the licensees. The regulations contain supplementary provisions to the requirements of the Petroleum Act and the CO<sub>2</sub> Tax Act relating to measurement of petroleum and stipulate framework requirements concerning the organisation, planning and implementation of the activity as referred to in the Petroleum Act and the CO<sub>2</sub> Tax Act. It defines functional and specific requirements to the design and operation of the metering equipment, elaborates on the responsibility of the individual participant to comply with requirements laid down in or pursuant to applicable law and shall contribute to ensuring that the metering equipment and method at all times comply with the requirements of these regulations relating to accumulated measuring uncertainty. The regulations stipulate requirements with regard to how the quantities of fuel and flare gas are to be reported and documented. Furthermore the regulations provide for suitable supervision of the activities. Put into force 30 October 2006, the requirements for measuring systems for liquids other than water are changed to be in conformance with the Directive 2004/22/EU, Measuring Instruments Directive (MID) and are harmonized with the Regulation of 21 December 2007 no. 1738, "Requirements for measuring systems for liquids other than water" adopted by Department for Industry and Trade (NHD) and Norwegian Metrology Service cf. remarks to Section 13a. Practically this applies to measuring systems for Liquid Petroleum and NGL.

These regulations replace the previous Regulations for fiscal measurement of oil and gas etc. and the previous Regulations relating to measurement of fuel and flare gas for calculation of CO<sub>2</sub> tax in the petroleum activities. Particular points relating to CO<sub>2</sub> tax measurement are dealt with in comments re. Section 14. If provisions contained in these regulations apply to either fuel gas or flare gas this will appear from the text.

The regulations provide for a practice whereby not all documentation needs to be submitted to the Norwegian Petroleum Directorate, but may instead be available from the operator and be submitted to the Norwegian Petroleum Directorate on request. Furthermore provision is made for transfer of information electronically.

Comments have been prepared to the individual provisions of these regulations. The comments provide explanation and guidance in relation to the provisions of the regulations. Examples are given to show how the requirements of regulations can be complied with, or reference is made to recognised standards, including industry standards, as one way in which the requirements of the authorities may be complied with. Trading in petroleum takes place across national borders with international actors. Technical standards should therefore be internationally accepted. Reference is further made to comments re. Section 4.

Guidelines to Plan for development and operation of a petroleum deposit, PDO, and Plan for installation and operation of facilities for transport and utilisation of petroleum, PIO, of 18 May 2000 contain details on the information which should be contained in a PDO/PIO with regard to fiscal measurement systems.

**REGULATIONS RELATING TO MEASUREMENT OF PETROLEUM FOR FISCAL  
PURPOSES AND FOR CALCULATION OF CO<sub>2</sub> TAX  
(THE MEASUREMENT REGULATIONS)**

**Regulations relating to measurement of petroleum for fiscal purposes and for calculation of CO<sub>2</sub> tax, issued by the Norwegian Petroleum Directorate 1 November 2001 pursuant to Section 86 of Regulations to Act relating to petroleum activities issued by Royal Decree 27 June 1997 No. 653, cf. Act of 29 November 1996 No. 72 relating to petroleum activities, Section 4-9 and Section 5 of Act of 21 December 1990 No.72 relating to tax on discharge of CO<sub>2</sub> in connection with petroleum activities on the continental shelf, cf. Decision on delegation issued by the Ministry of Petroleum and Energy 28 June 1985 and 27 December 1990. Last amended 7 December 2009.**

**CHAPTER 1  
INTRODUCTORY PROVISIONS**

**Section 1  
Scope**

These regulations are applicable to the petroleum activities in areas comprised by Section 1-4 of the Act of 29 November 1996 No. 72 relating to petroleum activities and Section 2 of the Act of 21 December 1990 No. 72 relating to tax on discharge of CO<sub>2</sub> in connection with petroleum activities on the continental shelf, specifically:

- a) in planning, design, construction and operation of metering systems for measuring produced, transported and sold quantities of oil and gas (fiscal measurement systems)
- b) in planning, design, construction and operation of metering systems and metering equipment for determination and reporting of quantities used for fuel and flare gas in petroleum activities.

For flow meters for liquids other than water the Regulation of 26 April 2006 no. 466 concerning requirements (for liquids other than water) issued by Department of Industry and Trade (NHD) and Norwegian Metrology Service, with the clarifications pursuant to this regulation, is prevailing.

**Section 2  
Definitions**

For the purpose of these regulations, the following definitions shall apply:

*Accreditation:*

An official recognition to the effect that an organisation is operating in accordance with a documented quality assurance system and that it has demonstrated its competency to carry out specified tasks.

*Allocation:*

Apportionment of petroleum between various owner groups and owner companies.

*Recognised standard:*

Standards, guidelines and similar which within a technical sphere are internationally and/or nationally recognised. Acts or regulations which are not directly applicable but which regulate corresponding or neighbouring areas may equally be recognised standard.

*Fuel:*

Natural gas, oil, condensate or diesel used for operation of combustion machinery such as turbines and similar.

*Place of operation:*

Facility or terminal where the metering system is in service.

*Place of manufacture:*

Place where fabrication, assembly and testing of one or more of the metering system's main components takes place.

*Computer part:*

That part of the metering system which consists of computers and receives metering signals from A/D converters or from digital instrument loops.

*Flare gas:*

Natural gas burnt off or vented to the atmosphere.

*Fiscal metering:*

Metering carried out in connection with purchase and sale and the calculation of taxes and royalties.

*Sensing element:*

A device that responds to the condition which is to be measured, so that the device produces a signal proportional to this condition.

*Flow meter for liquids other than water:*

An instrument for continuous measurement, registration and display of the amount of liquid which flows in a liquid filled pipe under defined conditions.

*Instrument:*

An assembly consisting of a transducer and one or more sensing elements. The signal from an instrument represents a physical condition.

A technical device used to measure a physical parameter.

*Instrument part:*

Part of the metering system from and including the instrument to the digital input of the computer part.

*Calibration:*

Establishment of relationship between measured value and reference value with known uncertainty.

*Calibration factor, K-factor:*

Relationship between the measured value coming from a meter and the measured value from a reference measurement system.

*Calibration factor for flow meter:*

Designated or non-designated value which indicates the relationship between the recording of the flow meter and actual flow volume. In these regulations this term is intended to cover the international terms 'meter factor' and 'K-factor'.

*Calibration mode:*

Selectable condition of the computer part to carry out verification whilst the associated meter tubes are

closed.

*Control:*

Monitoring, supervision, inspection and similar of conditions, processes, products etc. to ensure that they comply with specifications.

*Linearity:*

- 1) Deviation between a calibration curve for a device and a straight line.
- 2) Correlation between variables where a change in one causes a precise and proportional change for the other.

*Liquefied Natural Gas (LNG):*

Natural gas mainly consisting of methane (CH<sub>4</sub>) refrigerated to liquefied form at about minus 160 degrees C, with density at atmospheric pressure of around 430 – 460 kg/m<sup>3</sup>. Standard density is typically in the area 0,67 – 0,74 kg/Sm<sup>3</sup>.

*Mechanical part:*

All mechanical equipment included in an oil or gas metering system.

*Meter tube:*

Straight pipe section where a flow meter is installed.

*Instrument loop:*

Assembly of all equipment and computer links etc. from sensor input to the visual representation in the computer part.

*Metering station:*

Assembly of metering equipment dedicated to the determination of measured quantities.

*Measurement uncertainty:*

An expression of the result of a measured value which characterises the range within which true value is expected to lie.

*Metering system:*

Consists of a mechanical part, an instrument part and a computer part, as well as appurtenant documentation and procedures.

*Resolution:*

Indicates the least variation in signal level which produces a noticeable change in the displayed value.

*Petroleum products:*

Marketable products fractionated from crude oil or natural gas. Examples are: Ethane, propane, petrol, paraffin.

*Prover:*

Device for calibration of dynamic flow meter, based on displacement of a body through a calibrated tube.

*Conformity marking*

A marking of a flow meter with a "CE" mark, additional metrological marking and identification number for the relevant notified body as described in the Regulation for flow meters (for liquids other than water).

### *Conformity declaration*

A declaration that a product comply with the technical requirements which are issued for flow meters in the Regulation for flow meters (for liquids other than water).

### *Flow meter (Gas):*

Equipment located in or clamped to a pipe with associated signal transformer providing a primary signal proportional to the amount of flow through the pipe.

### *Transducer:*

Technical device which changes the nature of the measured signal. Used in these regulations solely in respect of ultrasonic meters.

## **Section 3**

### **Responsibility according to these regulations**

The licensee and other parties participating in petroleum activities comprised by these regulations are responsible according to the regulations and individual administrative decisions issued by virtue of the regulations.

In addition the licensee has a duty to see to it that anyone carrying out work for him, either personally, by employees, contractors or sub-contractors, complies with these regulations and individual administrative decisions issued by virtue of the regulations.

## **Section 4**

### **Requirements to the petroleum activities in general**

Activities as mentioned in Section 1 of the present regulations shall be carried out in accordance with requirements stipulated by or pursuant to these regulations, and in accordance with recognised standards for such activities.

When technology or methods not described in recognised standards are used, criteria for development, testing and operation are required to be produced.

## **CHAPTER II**

### **REQUIREMENTS RELATING TO MANAGEMENT CONTROL SYSTEM ETC.**

## **Section 5**

### **Management control system**

The licensee and others participating in the petroleum activities shall establish, follow up and assure the development of a management control system which shall include organisation, processes, procedures and resources necessary to ensure compliance with the requirements of the present regulations.

A management control system for metering shall be prepared and maintained in a systematic and controlled manner. Update and revision shall be announced within the organisation itself, to the Norwegian Petroleum Directorate and other parties concerned. The management control system shall ensure that relevant experience and information is conveyed from one shift of personnel to the next and from the construction phase to the operational phase.

Executive responsibility for, and supervision of, the management control system shall be placed with the

unit responsible for the other management control systems of the enterprise.

A quality assurance manual for the operation of metering systems shall be prepared.

### **Section 6 Organisation and competence**

The functional scope and areas of responsibility of personnel who carry out supervision of or tasks in connection with the metering system shall be documented in the organisation chart of the licensee. The duties, responsibilities and authority of the personnel shall be described.

The licensee shall nominate the person responsible for the metering system. The nominated person shall be responsible to see that procedures relating to operation, maintenance, calibration and control are followed.

All personnel carrying out tasks related to the metering systems shall possess documented qualifications within the relevant technical sphere. A system shall be established to show that updating and skills/competence advancement is ensured.

### **Section 7 Verification**

When planning, designing, purchasing, building and operating fiscal measurement systems as mentioned in these regulations, the licensee shall be able to verify that the provisions of the regulations or individual administrative decisions have been complied with. Independent verification of critical parameters may be required.

The licensee shall see to verification of fiscal figures and calibration reports for equipment comprised by these regulations.

## **CHAPTER III GENERAL REQUIREMENTS RELATING TO MEASURING AND THE MEASUREMENT SYSTEM**

### **Section 8 Allowable measurement uncertainty**

<b>Measurement system</b>	<b>Uncertainty limit at 95 percent (%) confidence level</b> <i>(expanded uncertainty with coverage factor k=2)</i>
Oil metering for sale and allocation purposes	± 0.30 % of standard volume
Gas metering for sale and allocation purposes	± 1.0 % of mass
Sales measurement of LNG	± 0.50 % of measured energy contents per ship load
Fuel gas metering	± 1.8 % of standard volume
Flare gas metering	± 5.0 % of standard volume

It shall be possible to document the total uncertainty of the measurement system. An uncertainty analysis

shall be prepared for the measurement system within a 95 percent confidence level. In the present regulations a confidence interval equal to  $\pm 2 \sigma$ , i.e. coverage factor  $k=2$ , is used. This gives a confidence level slightly higher than 95 percent.

LNG shall be measured and analyzed at the place of loading. The operator is responsible for, and shall be able to document, that the measurement system is in accordance with recognized norms.

LNG volumes may be determined in connection with loading by use of traceable measured vessel tanks and calibrated level gauges.

In respect of the measurement system's individual components the following maximum limits apply:

<b>Component</b>	<b><i>Circuit uncertainty limits</i></b>	<b><i>Linearity limits (band)</i></b>	<b><i>Uncertainty limits component</i></b>	<b><i>Repeatability limits (band)</i></b>
Meter prover oil	NA	NA	$\pm 0,04$ % for all 4 volumes	0,02 % for all 4 volumes
Turbin meter oil	1 puls of 100000, 0,001 %	0,50 % in working range (10:1) 0,30 % in working range (5:1)	$\pm 0,25$ % in working range(10:1)	0,04 % in working range (10:1)
Ultrasonic flow meter oil	1 puls of 100000, 0,001 %, at puls transmission of signal	0,30 % in working range (10:1)	$\pm 0,20$ % in working range (10:1)	0,07 % in working range (10:1)
Turbine meter gas (sales – allocation)	1 puls of 100 000	1,0 % in working range (10:1)	$\pm 0,70$ % in working range (10:1)	0,28 % in working range (10:1)
Ultrasonic flow meter gas (sales – allocation)	1 puls of 100 000, 0,001 %, at puls transmission of signal	1,0 % in working range (20:1). Deviation from reference in calibration shall be less than $\pm 1,50$ % in working range (20:1) before use of calibration factor	$\pm 0,70$ % in working range (20:1) after zero point control	0,50 % in working range (20:1) after zero point control
Pressure measuring	$\pm 0,30$ % of measured value in working range	NA	$\pm 0,10$ % of measured value in working range	NA
Pressure measuring fuel gas, flare gas	$\pm 0,50$ % of measured value in working range	NA	$\pm 0,20$ % of measured value in working range	NA
Temperature measuring oil, gas	$\pm 0,30$ °C	NA	$\pm 0,20$ °C	NA
Temperature measuring fuel gas, flare gas	$\pm 0,50$ °C	NA	$\pm 0,30$ °C	NA

<b>Component</b>	<b><i>Circuit uncertainty limits</i></b>	<b><i>Linearity limits (band)</i></b>	<b><i>Uncertainty limits component</i></b>	<b><i>Repeatability limits (band)</i></b>
Density measuring oil	$\pm 0,50 \text{ kg/m}^3$	NA	$\pm 0,30 \text{ kg/m}^3$	NA
Density measuring gas	$\pm 0,30 \%$ of measured value	NA	$\pm 0,20 \%$ of measured value	NA
Differential pressure measuring	$\pm 0,30 \%$ of measured value in working range	NA	$\pm 0,10 \%$ of measured value in working range	NA
Water in oil measuring		NA	$\pm 0,05 \text{ volume\%}$ absolute for 0 to 1,0 volume% water content, $\pm 5,0 \%$ of measured value over 1,0 volume% water content	0,50 % of measured value at water content over 0,01 volum%
Density measurement LNG	N/A	N/A	$\pm 0,30 \%$ of measured value	N/A
Volume measurement LNG	N/A	N/A	$\pm 0,30 \%$ of measured value	N/A
Online GC	NA	NA	0,30 % of calorific value ( $\pm 0,15 \%$ of calorific value for $k = 1$ )	NA
Calorific value gas	NA	NA	0,30 % of calorific value ( $\pm 0,15 \%$ of calorific value for $k = 1$ )	NA
Uncertainty computer part for oil and gas	NA	NA	$\pm 0,001 \%$	NA
Uncertainty computer part for fuel and flare gas	NA	NA	$\pm 0,1 \%$	NA
With regard to fuel gas: cf. comment re. Section 14.				

### **Section 8a**

#### **Allowable measurement uncertainty for measuring systems for liquids other than water**

For measuring systems for liquids other than water, cf. this Regulation section 13 a, the minimum requirements for uncertainty limits as included into the Regulation of 21 December 2007 no. 1738, section 29, cf. this Regulation section 3. The equivalent requirements apply to modules of a measuring system if pursuant to requirements stated in the Regulation concerning requirements for measuring systems for (liquids other than water).

### **Section 9 Units of measurement**

The measuring system shall give readings in SI units. Reporting of fiscal figures to the Norwegian Petroleum Directorate shall be in SI units.

Reporting of fuel and flare gas to the Norwegian Petroleum Directorate shall be in standard cubic meters in respect of natural gas and liters in respect of diesel or other hydrocarbons in liquid phase.

Determination of the critical parameters of the measuring system by measurements shall be in SI units.

### **Section 10**

#### **Reference conditions**

Standard reference conditions for pressure and temperature shall in measuring oil and gas be 101.325 kPa and 15 °C. In the measuring of petroleum products other reference pressure may be used.

### **Section 11**

#### **Determination of energy content etc.**

Gas composition from continuous flow proportional gas chromatography or from automatic flow proportional sampling shall be used for determination of energy content.

With regard to sales gas metering stations two independent systems shall be installed.

When oil or gas is analysed to determine physical and/or chemical properties and the analysis results are used for sale or allocation purposes, this shall be carried out by a competent laboratory.

### **Section 12**

#### **Bypassing the metering system**

Bypassing of the metering system is not permitted.

## **CHAPTER IV**

### **REQUIREMENTS TO DESIGN OF THE METERING SYSTEM**

### **Section 13**

#### **General requirements to the measuring system**

The measuring system shall be planned according to the requirements in this regulation and according to recognised standards for such measuring systems, with those exemptions which are according to measuring systems for liquid (other than water), and are further described in 13 a).

The metering system shall be capable of metering the full range of planned hydrocarbon flows without any component involved operating outside its working range.

On sales metering stations the number of parallel meter runs shall be such that the maximum flow of hydrocarbons can be measured with one meter run out of service, whilst the rest of the meter runs operate within their specified operating range.

The metering system shall be suitable for the relevant type of measuring, the given fluid properties and the hydrocarbon volumes to be measured.

If necessary, flow straighteners shall be installed.

In areas where inspection and calibration takes place there shall be adequate protection against the outside climate and vibration.

The metering tube and associated equipment shall be insulated upstream and downstream for a distance sufficient to prevent temperature changes affecting the instruments that provide input signals for the fiscal calculations.

Shutoff valves shall be of the block and bleed type. All valves of significance to the integrity of the metering station shall be accessible for inspection to secure against leakage.

All parts of the metering system shall be easily accessible for maintenance, inspection and calibration.

### **Section 13a**

#### **Liquid flow measurement (for liquids other than water)**

Measurement systems for liquids other than water which are purchased for use in the petroleum industry, or which are put into use after 30 October 2006 within the scope of this regulation, shall be approved by a notified body according to the procedures for conformity declaration, cf. the Regulation for measuring systems for liquids other than water, section 4 and regulation 20 December 2007 no. 1723 “Regulation for measurement units and measurement, chapter 4. Moreover, the same regulation section 8-1 applies. The transitional provisions for measurement equipment covered by the directive 2004/22/EF, apply.

The measuring systems for liquids other than water shall have conformity declaration and conformity marking, which include supplementary metrology marking. This also applies if the measuring system is designed and produced solely for own purposes. The equivalent requirements apply to modules of a measuring system if pursuant to requirements stated in the Regulation for measuring systems for liquids other than water.

When in use the measuring systems for liquids other than water shall as a minimum fulfil the requirements of this regulation section 8 a.

### **Section 14**

#### **The mechanical part of the metering system**

The mechanical part of the metering system shall be designed so that representative measurements are achieved as input signals for the fiscal calculations (cf. Section 8).

Provision shall be made for necessary redundancy and the possibility of verification of the gas and liquid metering devices.

When turbine meters are used for liquid metering, a permanent prover shall be available for calibration of the metering devices.

It shall be possible to calibrate the prover at the place of operation.

If other types of flow meters are used for liquid metering, permanent equipment for calibration of the metering device shall be available.

It shall be documented that surrounding equipment will not affect the measured signals.

## **Section 15**

### **The instrument part of the metering system**

Pressure, temperature density and composition analysis shall be measured in such way that representative measurements are achieved as input signals for the fiscal calculations (cf. Section 8).

## **Section 16**

### **The computer part of the metering system**

The computer part of the metering system shall be designed in such way that the fiscal calculations may be carried out within the stipulated uncertainty range (cf. Section 8).

The computer part of the metering system shall be equipped with various security functions to ensure that the fiscal values cannot be changed as a result of incidents of a technical nature or as a result of a manual fault.

With regard to reports the computer part shall be capable of documenting the various fiscal parameters and the fiscal volumes calculated.

The computer part shall have uninterruptible power supply. It shall be ensured that faults are detected as an alarm and that a back-up system is activated. A power failure shall not be able to cause measured fiscal data to be deleted from the storing unit of the computer.

## **Section 17**

### **Requirements relating to sampling**

Sampling shall be carried out in a manner which ensures that representative amounts are sampled.

Sampling shall be automatic and flow proportional. In addition it shall be possible to carry out manual sampling.

With regard to oil and condensate the necessary mixing equipment shall be installed upstream of the sampling probe.

## **CHAPTER V**

### **REQUIREMENTS RELATING TO CALIBRATION AND VERIFICATION ETC. PRIOR TO STARTUP OF THE METERING SYSTEM**

## **Section 18**

### **Application for consent**

The licensee shall obtain consent from the Norwegian Petroleum Directorate prior to start up of the metering system.

Consent for carrying out major rebuilding or change in the purpose for use for the metering system shall also be obtained.

If the basis for consents granted in accordance with the first paragraph of this section is significantly changed, the Norwegian Petroleum Directorate may require the licensee to obtain a new consent before the activities are continued.

Prior to start up of the metering system, procedures shall be prepared for operation, maintenance, calibration and verification. The procedures shall ensure that the metering system is maintained to the standard to which it is designed.

Procedures for calibrations and verifications to be carried out in order to prepare the metering station for start up, shall be forwarded to the Norwegian Petroleum Directorate enclosed with the application.

### **Section 19**

#### **General**

Calibrations and verifications as described in this Chapter shall be carried out prior to start up of the metering system at the place of operation.

The Norwegian Petroleum Directorate shall have the opportunity of being present when the activities are carried out.

### **Section 20**

#### **Calibration of mechanical part**

The prover volume shall be calibrated:

- a) before the metering system is delivered from the place of manufacture
- b) prior to start up at the place of operation.

The mechanical parts critical to measurement uncertainty shall be measured or subjected to flow calibration in order to document calibration curve.

The assembled fluid metering system shall be flow tested at the place of manufacture and flow meter calibration shall be carried out.

Statistical methods to provide documentation for repeatability requirements may be used.

### **Section 21**

#### **Calibration of instrument part**

The instrument loops shall be calibrated and the calibration results shall be accessible.

The instrument loops shall be calibrated at a number of values necessary to detect any non linearity errors within its working range. Calibration of the instrument loops shall be carried out using the display reading of the visual signal from the computer part.

### **Section 22**

#### **Verification of computer part**

Verification of the computer part shall be carried out for each metering tube to confirm that all functions are operational.

Each independent program routine shall be verified to show that calculations are carried out with requirements equal to or better than those mentioned in Section 8 of the present regulations. Integration shall be verified with at least three values in the flow range.

The calculations for calibrations as mentioned in Section 20 of these regulations shall be verified. This includes K-factor in respect of the individual calibration and the average value within the predetermined range of variation.

## **CHAPTER VI REQUIREMENTS RELATING TO OPERATION OF THE METERING SYSTEM**

### **Section 23 Maintenance**

The metering system shall be maintained to the standard according to which it is designed.

The equipment which is an integral part of the metering system, and which is of significant importance to the measuring uncertainty, shall be calibrated using traceable equipment before start of operation, and subsequently be maintained to that standard.

Control to ensure that equipment mentioned in the first paragraph of this section is within given limit values shall be carried out regularly by qualified personnel. If during calibration equipment is shown to be outside the given limit values, correction shall be carried out by qualified personnel or by calibration and associated correction in a competent laboratory. Traceable calibration of test instruments shall be carried out regularly by competent laboratories.

### **Section 24 Operating requirements for the prover**

The meter prover volume shall be calibrated annually  
Calibration shall also be carried out if the volume may have changed as a result of equipment failure.

### **Section 25 Operating requirements for flow meters**

Turbine meters for oil shall be calibrated against the permanent meter prover with a repeatability such that 5 consecutive single calibrations in sequence fall within a range of 0.05 % of the average calibration factor.

The calibration factor for the flow meters shall be within the control limits according to recognised standard. Flow meters installed after maintenance, modification or replacement shall immediately be calibrated to verify that they meet the requirements to linearity and repeatability.

After start up of the metering system, calibration of flow meters shall be carried out in order to verify requirements to repeatability and linearity. It shall furthermore be verified to what extent the calibration factor is affected by flow volume, temperature, pressure and crude composition when these vary within their normal operating range.

The calibration of flow meters shall satisfy the following requirements:

- a) If there is a correlation between calibration factor and flow rate, temperature, pressure, density, viscosity or composition, calibration factor limits shall be established.  
A new calibration shall be carried out if the limits are exceeded.
- b) The time interval between calibration of the flow meters shall not exceed four days. Calibration factor for flow meters in use shall be established for each tanker loading.

Statistical methods may be used to document requirements to repeatability.

The orifice plates shall be inspected with regard to edge sharpness, surface roughness and flatness. An inspection shall be carried out at start up and then once a month during the first six months. Subsequently the intervals may be extended, however if at a later time damage or wear-and-tear is detected, the interval between inspections of the orifice plates shall be reduced. The orifice plate shall also be inspected after incidents which may have affected the fiscal measuring quality. The orifice plates shall be certified prior to installation in meter tubes and subsequently if visible damage is detected.

In the case of ultrasonic flow measurement of gas the condition parameters shall be verified.

During orifice plate gas measuring or ultrasonic gas measuring the meter tubes shall be checked if there is indication of change in internal surface.

## **Section 26**

### **Operating requirements for instrument part**

All sensors shall be monitored continually and/or shall be regularly calibrated in accordance with the requirements of Section 8. Calibration shall comprise several values in the sensor's operating range. If the outlet signals from the sensors deviate from the preset limits, necessary maintenance and subsequent new calibration shall be undertaken.

The calibration methods shall be such that systematic measurement errors are avoided or are compensated for.

Gas densitometers shall be verified against calculated density or other relevant method.

When continuous gas chromatography is used, corrective maintenance and new calibration shall be undertaken regularly.

## **Section 27**

### **Operating requirements for computer part**

Critical data shall be filed regularly. Procedures shall be established for handling of fault messages from the computer part or faults otherwise discovered.

Transmission of signals from sensors to the computer part shall be checked in connection with calibration of the sensors.

In the case of software changes and replacement of computer parts an independent verification shall be carried out of the calculation requirements of the computer part, cf. Section 22 of the present regulations.

## **CHAPTER VII REQUIREMENTS RELATING TO DOCUMENTATION**

### **Section 28**

#### **Documentation prior to start-up of the metering system**

After the Plan for development and operation of petroleum deposits (PDO) and Plan for installation and operation of facilities for transport and utilisation of petroleum (PIO) have been approved and prior to

start-up of the metering system, the operator shall have the following documents available,

- a) technical description of the metering system;
- b) an overview showing the location of the metering system in the process and transportation system;
- c) drawings and description of equipment included in the metering system;
- d) list of documentation for the metering system;
- e) progress plan for the project up to the time of application for consent to use;
- f) description of the operator's and the supplier's management control system for follow-up of the metering system;
- g) uncertainty analysis.

The Norwegian Petroleum Directorate shall on request receive documentation as mentioned in the first paragraph of this Section.

### **Section 29**

#### **Documentation relating to the metering system in operation**

An archive shall be established and maintained which shall contain documentation in respect of the metering system. It shall be possible to document that the quality of measurements are as described in the present regulations and that there is accordance between reported and measured quantities.

Fixed parameters shall be easy to verify.

Correction shall be made for documented measurement errors. Correction shall be carried out if the deviation is larger than 0.02 % of the total volume. If measurement errors have a lower percentage value, correction shall nevertheless be carried out when the total value of the error is considered to be significant.

If there is doubt as to the time at which a measurement error arose, correction shall apply for half of the maximum possible time span since it could have occurred.

Reporting of CO<sub>2</sub> tax metering for payment of the CO<sub>2</sub> tax shall take place every six months as stated in Section 4 of the CO<sub>2</sub> Tax Act and in accordance with the form issued by the Norwegian Petroleum Directorate.

In the event that measured figures are not available for technical reasons, it must be possible to document the reported figures in a manner which is acceptable from a calculation point of view.

Quantities of diesel delivered to the facility during the tax period in question shall be reported as taxable basis for calculation of CO<sub>2</sub> tax. Deduction in respect of diesel which has not been used as fuel shall be documented and reported to the Norwegian Petroleum Directorate as mentioned in the fourth paragraph of this Section.

All measured data comprised by these regulations shall be reported in the Petro Bank system.

### **Section 30**

#### **Information**

When the PDO has been approved, the licensee shall inform the Norwegian Petroleum Directorate about all significant changes that affect the quality of fiscal measurements or figures reported from them

The Norwegian Petroleum Directorate shall be informed about

- a) annual plan for activities within the technical field in question;

- b) procedure for ownership allocation of petroleum between licencees in production licences.
- c) measurement errors;
- d) when fiscal measurement data have been corrected based upon calculations;
- e) change in calibration interval;
- f) change in calculation software;
- g) changes affecting the basis of the consent;
- h) cargo claims procedures applicable for sale of hydrocarbons in liquid phase.

### **Section 31**

#### **Calibration documents**

Description of procedure during calibration and inspection, as well as an overview of results where measurement deviation before and after calibration is shown, shall be documented. The documentation shall be available for verification at the place of operation.

## **CHAPTER VIII GENERAL PROVISIONS**

### **Section 32**

#### **Supervisory authorities - authority to make individual administrative decisions etc**

The Norwegian Petroleum Directorate shall supervise compliance with provisions laid down in or decisions made pursuant to the present regulations. The Norwegian Petroleum Directorate may make such individual administrative decisions as are necessary to implement provisions contained in the present regulations.

### **Section 33**

#### **Exemption**

The Norwegian Petroleum Directorate may in particular cases grant exemption from provisions contained in the present regulations.

### **Section 34**

#### **Penal provision**

Violation of these regulations or of decisions made pursuant to these regulations shall be punishable as stated in the Petroleum Act Section 10-17 and the CO<sub>2</sub> Tax Act Section 7, cf. the Criminal Code Chapter 3a.

### **Section 35**

#### **Entry into force and transitional provisions.**

1. These regulations enter into force 1 January 2002.
2. As from the same date, the following amendments shall be made:
  - a) Regulation for fiscal measurement of oil and gas etc. issued by the Norwegian Petroleum Directorate 3 July 1991, No. 532, shall be repealed.
  - b) Regulations relating to measurement of fuel and flare gas for calculation of CO<sub>2</sub> tax in the petroleum activities, issued by the Norwegian Petroleum Directorate 12 August 1993, No. 806, shall be repealed.

- 3 Decisions made pursuant to the regulations mentioned in this section item 2 shall remain in force until such time as they may be repealed or altered by the Norwegian Petroleum Directorate.
- 4
  - a) The general requirements of these regulations and requirements relating to testing and operation of measuring equipment (Chapters I, II, III, V, VI, VII and VIII) are applicable to all metering systems.
  - b) Requirements to design (Chapter IV) apply only to metering systems where the design was commenced after 1 January 2002. The Norwegian Petroleum Directorate may by individual administrative decisions directed at the individual operator make requirements to design fully or partly applicable to measuring equipment or metering systems designed prior to the time mentioned in the preceding sentence, cf. Section 32 of the present regulations.

## LIST OF REFERENCES

- AGA, American Gas Association
  - AGA Report No 8, Natural Gas density and compressibility factor executable program and Fortran Code
  - AGA Report No 9, Measurement of gas by multipath ultrasonic meters
- ASTM 1945, Standard test method for analysis of natural gas by gas chromatography
- API, MPMS, American Petroleum Institute, Manual of Petroleum Measurement Standards
- Håndbok for usikkerhetsberegning CMR/NFOGM/OD
- ISO/OIML The guide to the expression of uncertainty in measurement
- OIML R 117 Measuring systems for liquids other than water, Annex A
- ISO 3171 Petroleum liquids - Automatic pipeline sampling
- ISO 5024 Petroleum liquids and liquefied petroleum gases. Measurement Standard reference conditions
- ISO 5167-1 Measurement of fluid flow by means of orifice plates, nozzles and venturi tubes inserted in circular cross section conduits running full
- ISO 6551 Petroleum Liquids and Gases - Fidelity and Security of Dynamic
- ISO 6976. Natural gas – Calculations of calorific values, density, relative density and Wobbe index from composition
- ISO 7278 Liquid hydrocarbons - Dynamic measurement - Proving system for volumetric meters.
- ISO 9002 Quality systems, Model for quality assurance in production, installation and servicing
- ISO 9951 Measurement of gas flow in closed conduits - Turbine meters
- ISO 1000, SI units and recommendations for the use of their multiples and certain other units
- ISO/IEC 17025 General requirements for the competence of testing and calibration laboratories
- ISO/CD 10715 Natural Gas - Sampling Guidelines
- [NORSOK I-104](#), Fiscal measurement systems for hydrocarbon gas (Rev 3, November 2005)
- [NORSOK I-105](#), Fiscal measurement systems for hydrocarbon liquid (Rev 3, August 2007)
- [NORSOK P-100](#), Process system
- NS 4900
- NS 1024
- LNG Custody Transfer Handbook (CTH), G.I.I.G.N.L. (2001)
- ISO 13398 Refrigerated light hydrocarbon fluids – Liquefied natural gas – Procedure for custody transfer on board ship
- EU directive 71/349/EEC of 12 October 1971. Calibration of tanks of vessels
- Regulations of 21 December 2007 no. 1738 relating to measuring systems for liquids other than water
- Regulations of 20 December 2007 no. 1723 relating to measurement units and measurement
- Regulations of 21 December 2007 no. 1748 relating to calibration of tanks of vessels

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**APPENDIX 1: FORM 1, CO<sub>2</sub>-TAX, HALF-YEARLY PAYMENT**  
**APPENDIX 2: FORM 2, CO<sub>2</sub>-TAX, TAX ASSESSMENT PER PRODUCT**



**FORM 2 - CO<sub>2</sub> TAX  
TAX ASSESSMENT PER PRODUCT**

Half-year period:

Field/install:

Norwegianshare:

Product:

Month	Fuel (Sm <sup>3</sup> /1)	Flare (Sm <sup>3</sup> /1)	Vent (Sm <sup>3</sup> /1)	Total (Sm <sup>3</sup> /1)	Taxrate	Taxamount (NOK)
1						
2						
3						
4						
5						
6						
Sum						
					Prior payment(s)	
					Difference	
					Interest	
					Total	

Date/sign:

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Revised FORM2 to be completed when correcting prior accounts.  
Specification of accrued interest to be enclosed.