

NORSOK STANDARD
SYSTEM REQUIREMENT
ON-LINE GAS CHROMATOGRAPH

I-SR-106

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Please note that every effort has been made to ensure the accuracy of the NORSOK standards neither OLF nor TBL or any of their members will assume liability for any use thereof.

1 FOREWORD

NORSOK (The competitive standing of the Norwegian offshore sector) is the industry initiative to add value, reduce cost and lead time and remove unnecessary activities in offshore field developments and operations.

The NORSOK standards are developed by the Norwegian petroleum industry as a part of the NORSOK initiative and are jointly issued by OLF (The Norwegian Oil Industry Association) and TBL (The Federation of Norwegian Engineering Industries). NORSOK standards are administered by NTS (Norwegian Technology Standards Institution).

The purpose of this industry standard is to replace the individual oil company specifications for use in existing and future petroleum industry developments, subject to the individual company's review and application.

The NORSOK standards make extensive references to international standards. Where relevant, the contents of this standard will be used to provide input to the international standardization process. Subject to implementation into international standards, this NORSOK standard will be withdrawn.

2 SCOPE

The scope of this standard is to establish technical requirements for on-line gas chromatograph system (OGC) for the purpose of continuous quantitative analysis of natural gas from a process stream.

The analysis is limited to the following main components: Nitrogen, carbon dioxide, methane, ethane, propane, iso-butane, normal-butane, iso-pentane, normal-pentane and the C6+ fraction.

The requirements shall be sufficient for a quality of the OGC to quantify the concentrations of the main components for the purpose of gas accounting, calculation of calorific value and reference density for fiscal purposes and for check of gas quality conformity with gas quality specifications defined by commercial gas agreements .

3 NORMATIVE REFERENCES

ISO/DIS 6974 1/5	Natural gas - Determination of composition with defined uncertainty by gas chromatography
ISO 6976	Natural gas - Calculation of calorific value - density and relative density
ISO 6568	Natural gas - Simple analysis by gas chromatography
ISO/DIS10715	Natural gas - Sampling guidelines
ASTMD1945	Analysis of natural gas by gas chromatography
NORSOK I-CR-100	Fiscal measurement systems
NORSOK Z-CR-010	Installation of Electrical, Instrument & Telecommunication

4 DEFINITIONS AND ABBREVIATIONS

4.1 Definitions

Normative references	Shall mean normative in the application of NORSOK standards.
Informative references	Shall mean informative in the application of NORSOK standards.
Shall	Shall is an absolute requirement which shall be followed strictly in order to conform with the standard.
Should	Should is a recommendation. Alternative solutions having the same functionality and quality are acceptable.
May	May indicates a course of action that is permissible within the limits of the standard (a permission).
Can	Can-requirements are conditional and indicates a possibility open to the user of the standard.
% REL	Number given as % relative to the concentration.
Group of component	Group of components with so low concentrations that their measurement as individual would be difficult or require excessive time. Hydrocarbons heavier than Pentanes (denoted as C6+) is example of such a group
X	Non-normalised concentration in mol fraction (X, is concentration of component i).
X ^x	Normalised concentration in mol fraction.
Column	Tubes inside the temperature controlled oven of the GC packed with material suitable for separating the components of natural gas when flowing the sample through using carrier gas.
Carrier gas	Gas used to transport sample through the columns, normally Helium, Hydrogen or mix-mixture of Helium and Hydrogen.
Calibration	Determination of the response of the detector for a given component with known concentration given on the certificate of the calibration gas or comparing the reading from OGC with values given on the certificate of the WGM.
U _{XI}	Total uncertainty of X _i , $U_{Xi} = (U_{RXI}^2 + U_{LXI}^2)^{0.5}$.
U _{RXI}	Uncertainty of X, due to lack of repeatability. Determined from repeatability test. Expressed in mol fraction and calculated as one standard deviation from the repeatability test.
U _{LXI}	Uncertainty of X, due to lack of linearity. Determined from linearity test. Expressed in mol fraction and calculated as one standard deviation taken every averageresults from MLC.

4.2 Abbreviations

GC	Gas Chromatograph, a device which separates the components in a gas mixture and measure them individually with a detector.
OGC	On-line Gas Chromatograph, GC fed continuously and automatically with process gas.
TCD	Thermal Conductivity Detector, most commonly used detector to measure the main components in natural gas.
WGM	Working Gas Mixture, also called calibration gas, used for regular calibration of the OGC. Normally prepared by gravimetric method and supplied with a certificate listing the concentrations of all component and the uncertainty of the concentrations.
SPC	Single Point Calibration. Calibration using only one WGM with concentration as close as possible to the process gas or as close as necessary found by multi-level calibration).
MLC	Multi Level Calibration. Calibration using nor WGMs to either determine the uncertainty due to linearity of the GC for all components within actual range or to determine the response curves of the detector of each component. MLC may only be performed before installation or during commissioning.

5 GENERAL DESIGN

5.1 Design consideration

The OGC shall be of sufficient accuracy to fulfill the requirements in this standard. The system downtime for maintenance etc. must be kept to a minimum.

The OGC should be kept under sufficient controlled environment i.e. providing protection against cold, heat, rain, wind etc.

5.2 Sampling system

To ensure that the sample to the OGC is representative for the process stream and suitable for the OGC recommendations as specified in this document, by the analyser supplier and in the ISO/OIS 10715 Natural gas - Sampling guidelines shall be followed.

The following basic requirements shall apply:

The shortest practical sampling route between sampling point and analyser should be taken. The sampled gas shall reach the analyser within a 2 minute timelag. Time lag calculations shall be presented.

Slope of at least 1:12 shall be maintained along the sample line.

All fitting should be accessible for maintenance.