INTERNATIONAL STANDARD

ISO 8943

First edition
1991-11-15

Refrigerated light hydrocarbon fluids — Sampling of liquefied natural gas — Continuous method

Hydrocarbures liquides légers réfrigérés — Échantillonnage de gaz naturel liquéfié — Méthode continue

Reference number
ISO 8943:1991(E)

Contents

		Page
1	Scope	1
2	Normative references	1
3	Definitions	1
4	Outline of sampling system	2
5	Precautions	2
5.1	Precautions to be taken in handling LNG	2
5.2	Partial evaporation of the LNG sample	2
5.3	Supervision during continuous sampling	2
6	Apparatus	2
6.1	Materials	2
6.2	Sample probe	2
6.3	LNG sample vaporizer	5
6.4	Gasified-LNG transfer compressor	5
6.5	Pressure regulator	6
6.6	Gas sample holder	6
6.7	Gas sample compressor	6
6.8	Gas sample container	6
6.9	Piping arrangement	6
7	Sampling procedure	8
7.1	Sampling period	8
7.2	Operation of filling the gas sample holder with gasified LNG	8
7.3	Filling the gas sample container	9
8	Sampling report	9

International Organization for Standardization
Case Postale 56 • CH-1211 Genève 20 • Switzerland

Printed in Switzerland

Annex

A Example of calculation of degree of subcooling 10

Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

International Standard ISO 8943 was prepared by Technical Committee ISO/TC 28, *Petroleum products and lubricants*, Sub-Committee SC 5, *Measurement of light hydrocarbon fluids*.

Annex A of this International Standard is for information only.

Introduction

In the custody transfer of liquefied natural gas, hereinafter referred to as LNG, it is common practice to determine the quantity transferred on a calorific-content basis.

The total calorific content of quantities of LNG quoted in the custody transfer is determined by the liquid volume, liquid density and gross calorific value of the LNG delivered.

A knowledge of the composition of the LNG is required in order to calculate the density and the calorific content of quantities of LNG. Therefore, precise sampling is a prerequisite for precise analysis.

LNG is a complex mixture of low-molecular-weight hydrocarbons with nitrogen as a principal inert impurity. Typically, methane is the major component. Minor-component concentrations vary with the source of the raw gas, the liquefaction pre-treatment, the liquefaction process and the storage conditions.

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Refrigerated light hydrocarbon fluids — Sampling of liquefied natural gas — Continuous method

1 Scope

This International Standard specifies a method of continuous sampling of LNG whilst it is being transferred through an LNG transfer line.

2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this International Standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this International Standard are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

ISO 6712:1982, *Gas analysis — Sampling and transfer equipment for gases supplying an analytical unit.*

ISO 6578:—[1], *Refrigerated hydrocarbon liquids — Static measurement — Calculation procedure.*

3 Definitions

For the purposes of this International Standard, the following definitions apply.

3.1 accumulator: Storage vessel provided to absorb pressure pulsations of gasified LNG and to homogenize the same.

3.2 bubbling: Procedure to saturate the seal water of a gas sample holder with gasified LNG in order to suppress the effect of the seal water on the gas sample.

3.3 continuous sampling: Sampling in which the sample is drawn continuously, during the total stable-transfer time, from the source.

3.4 gas sample compressor: Compressor used for charging the gas sample collected in a gas sample holder into a gas sample container.

3.5 gas sample container: Sample container used for the retention of the gas sample and for its transfer to an analysing instrument.

3.6 gas sample holder: Holder used for collecting gasified LNG at the LNG sample vaporizer in order to obtain a representative gas sample.

3.7 gasified-LNG transfer compressor: Compressor used for boosting the pressure of gasified LNG when gasified LNG in the LNG sample vaporizer cannot be transferred to the gas sample holder by its inherent pressure.

3.8 LNG: Liquids composed predominantly of methane.

3.9 LNG sample vaporizer: Apparatus to completely gasify the LNG sample collected from the LNG transfer line.

3.10 LNG-transfer line: Pipeline used for transferring LNG.

3.11 pressure regulator: Pressure-regulating valve and pressure sensor provided to keep the gas pressure constant at the gas sample holder inlet.

3.12 sampling line: The whole line provided to carry the sample to be analysed from the sample probe in the LNG transfer line to the gas sample container, including any flexible or semi-rigid tubing.

3.13 sample probe: Device inserted into the LNG to be sampled from the LNG transfer line or fitted to the LNG transfer line to collect an LNG sample.

1) To be published.

3.14 seal water: Water used in the gas sample holder to preclude contact between the gas sample and the atmosphere.

3.15 subcooling: Lowering the temperature of LNG below its boiling point at a given pressure.

4 Outline of sampling system

The LNG sample collected through the sample probe provided on the LNG transfer line is gasified in the LNG sample vaporizer.

Gasified LNG from the LNG sample vaporizer outlet is continuously fed into the gas sample holder by its inherent pressure when the pressure is sufficiently high, or after its pressure is boosted by the compressor for transferring gasified LNG when the pressure is insufficient. In this process, the gas pressure in the sampling line is controlled by a pressure regulator and the flow into the gas sample holder is maintained by the gas sample holder inlet valve. Excess gas is discharged from the system.

The gas sample collected in the gas sample holder is fed into the gas sample container by the gas sample compressor.

An outline flow process diagram of the sampling system is shown in figures 1 and 2.

5 Precautions

5.1 Precautions to be taken in handling LNG

Because LNG has a very low boiling point, contact of the skin with LNG may cause frostbite and, if the gas diffuses into the air, it will lower the oxygen content which may result in suffocation or, if ignited, fire. Suitable precautions shall be taken against these risks.

5.2 Partial evaporation of the LNG sample

LNG normally exists in a state close to its boiling point. Therefore, partial evaporation readily occurs in the LNG transfer line and sampling line with minute heat input or by pressure variation. For this reason, extreme precautions shall be taken so that the collected gas sample represents transferred LNG with best possible accuracy.

5.3 Supervision during continuous sampling

Pressures, temperatures and flow rates in the LNG transfer line and the sampling system shall be monitored continuously. Frequent inspection of the entire system shall be made, paying particular attention to any leak or failure of the thermal insulation. Defects identified by such inspections shall be remedied immediately.

6 Apparatus

6.1 Materials

The materials of construction of the sampling system shall have sufficient strength and durability to withstand the pressure and temperature conditions to which they will be exposed without failure. The possibility of embrittlement of materials at low temperatures shall be taken into account.

Materials shall neither be affected by exposure to the fluids handled, nor have any effect on the composition of the fluids.

6.2 Sample probe

6.2.1 Sample probes shall be located at points in the pipeline where the LNG is in a subcooled condition.

The degree of subcooling at a sampling point shall be ascertained by observation of the temperature and pressure of the LNG at that point and comparing the temperature with the boiling point of the LNG at the same pressure as calculated from the composition of the LNG (see annex A). In the case of multiple transfer lines, the sample probe shall be located downstream of the manifold, if one exists. Otherwise, each line shall be provided with a sampling point.

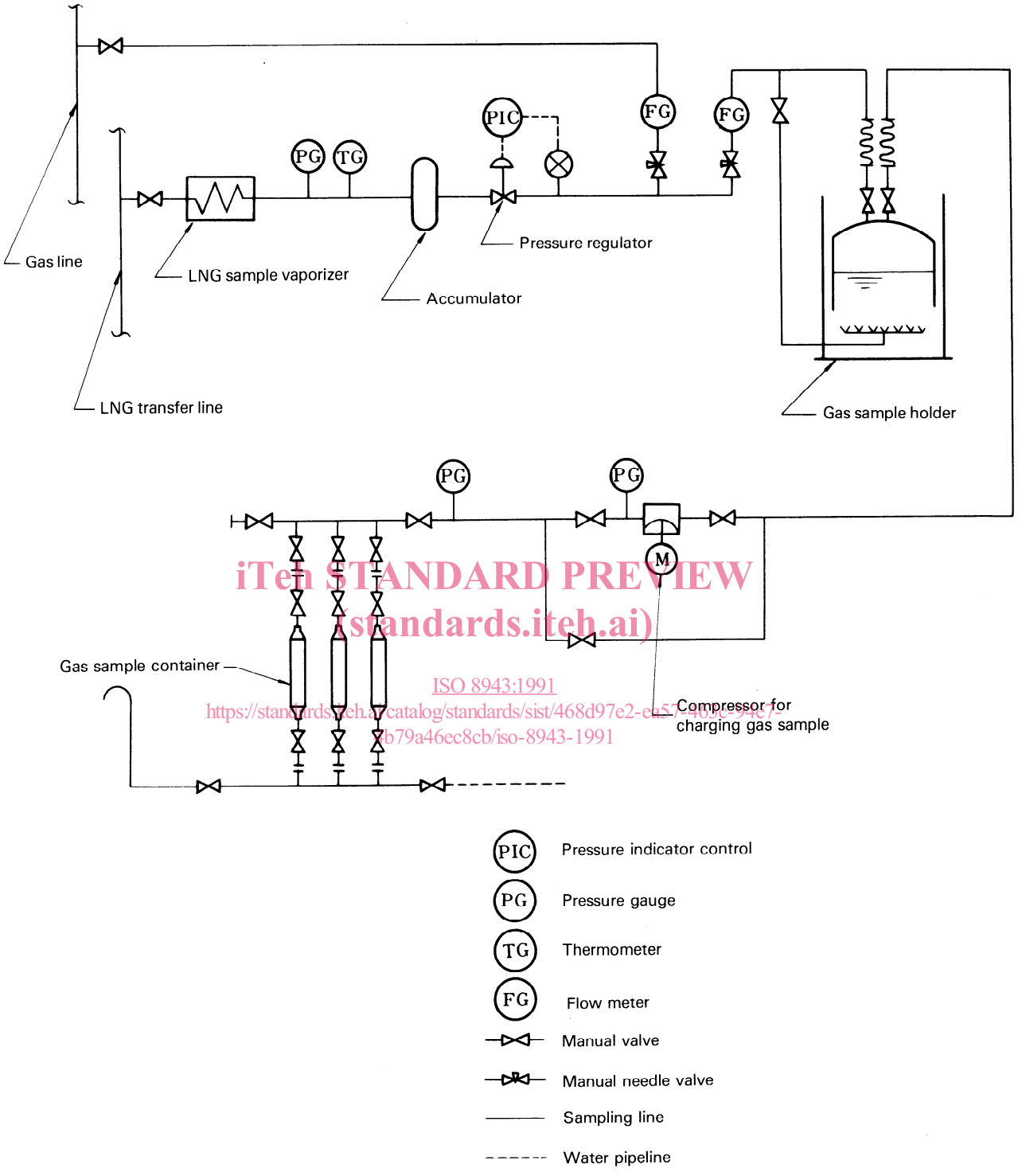

Figure 1 — Sampling system (example 1)

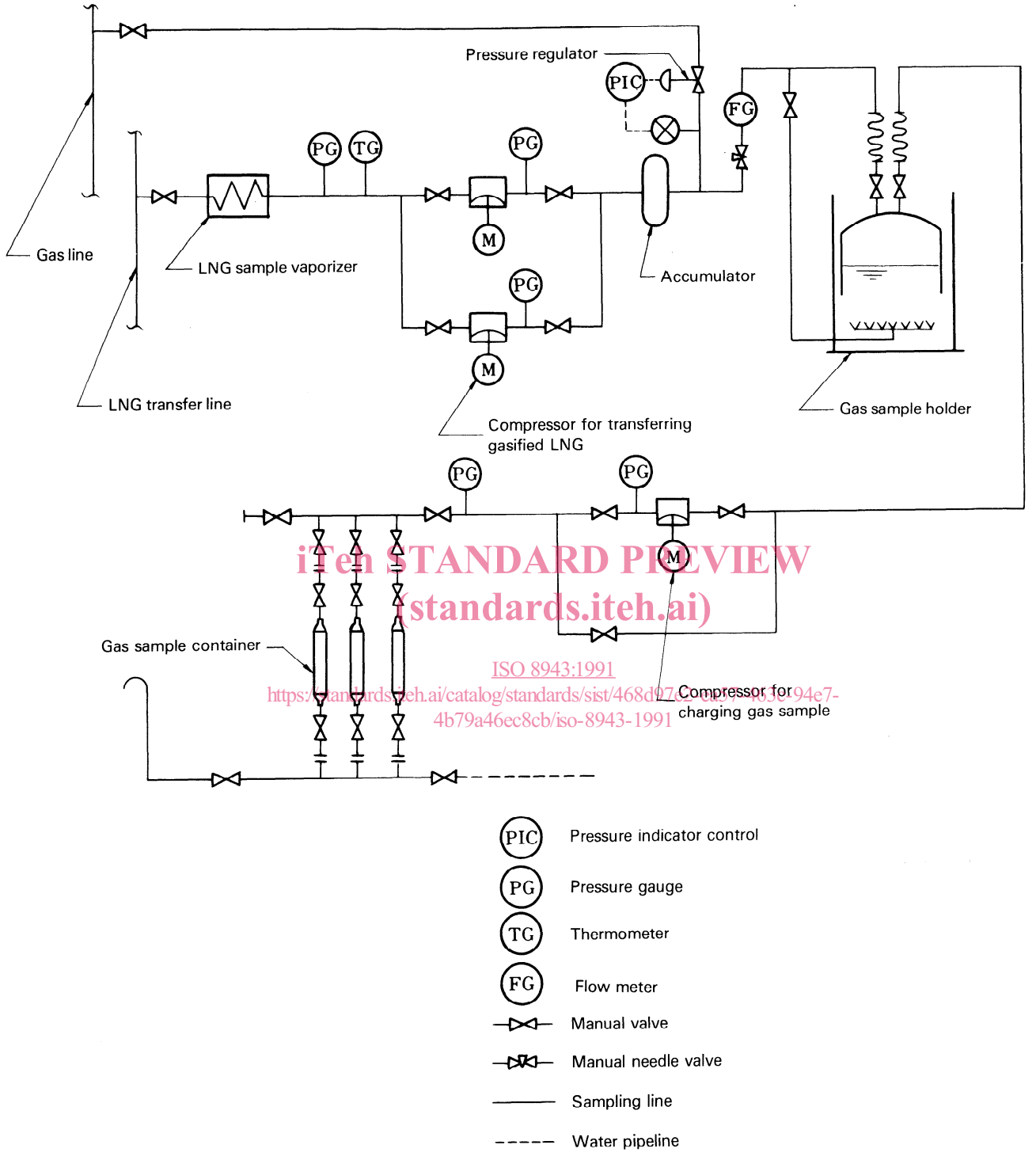

Figure 2 — Sampling system (example 2)

Where multiple lines are provided with individual sampling points and the flow rates in the respective lines differ, the flow rates in each line shall be measured and the sample flows made proportional to these rates.

6.2.2 Sample probes shall be located at a point where the degree of subcooling is high.

6.2.3 Sample probes shall be installed at a right angle to the axis of the LNG transfer line.

6.2.4 The shape of the extreme end of the sample probe is not critical and the end may be a straight tube. Typical sample probes are shown in figure 3.

6.3 LNG sample vaporizer

6.3.1 The heat exchange capacity of the LNG sample vaporizer shall be sufficient to gasify the whole volume of LNG which is being withdrawn for sampling.

6.3.2 The sample vaporizer shall be so constructed that the heavier components of the LNG shall not remain in the vaporizer.

6.3.3 Where a compressor transferring gasified LNG is provided, the maximum gasifying capacity (heat input) of the LNG sample vaporizer shall be greater than the capacity of the compressor.

6.4 Gasified-LNG transfer compressor

6.4.1 Gasified-LNG transfer compressors shall be of the oil-free type.

6.4.2 Means shall be provided to stabilize the gas discharge flow rate of any installed gasified LNG transfer compressor.

6.4.3 A standby compressor shall be provided for use in the event of a compressor failure.

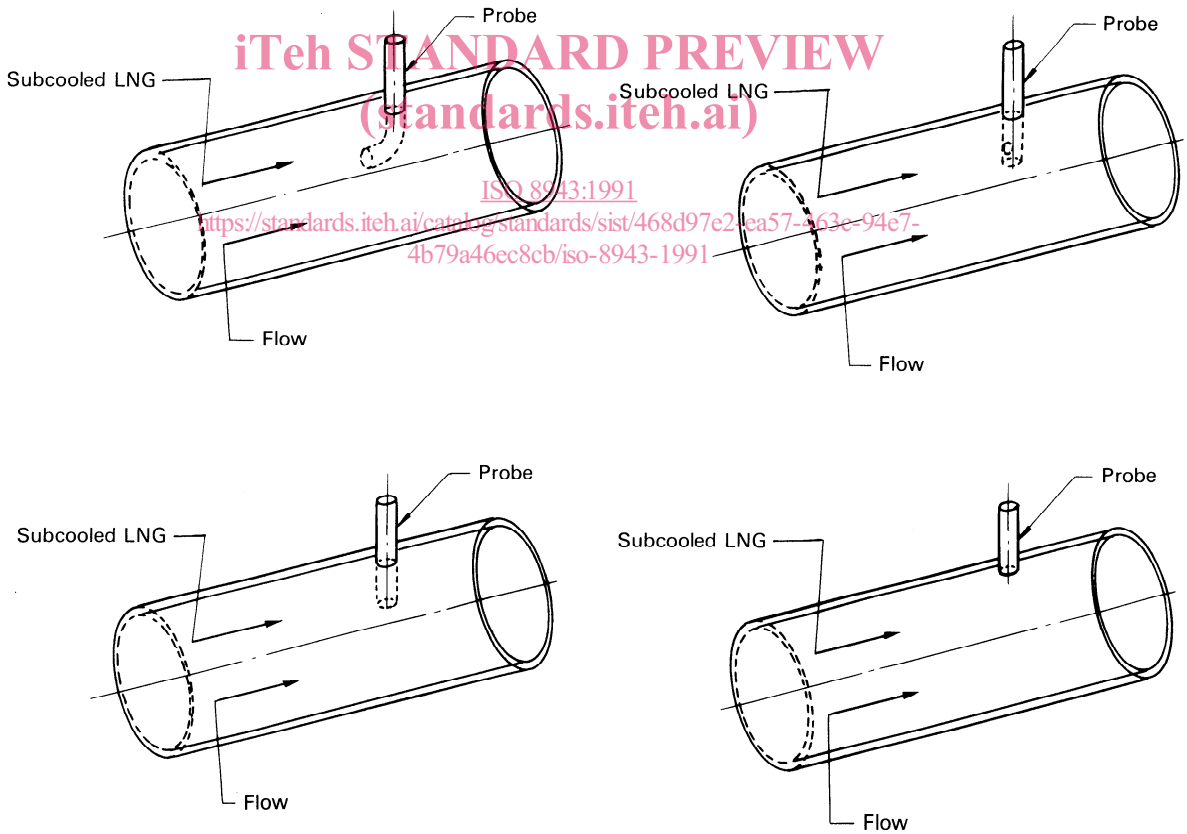

Figure 3 — Sample probe