TC 158

International Standard 6570/3

INTERNATIONAL ORGANIZATION FOR STANDARDIZATION•МЕЖДУНАРОДНАЯ ОРГАНИЗАЦИЯ ПО СТАНДАРТИЗАЦИИ•ORGANISATION INTERNATIONALE DE NORMALISATION

Natural gas — Determination of potential hydrocarbon liquid content — Part 3 : Volumetric method

Gaz naturel — Détermination de la teneur en hydrocarbures liquides potentiels — Partie 3 : Méthode volumétrique

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Foreword

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Draft International Standards adopted by the technical committees are circulated to the member bodies for approval before their acceptance as International Standards by the ISO Council.

International Standard ISO 6570/3 was developed by Technical Committee ISO/TC 158, *Analysis of gases*, and was circulated to the member bodies in May 1982.

It has been approved by the member bodies of the following countries :

Belgium
Cuba
Czechoslovakia
France
Germany, F.R.
Ireland
Italy
Korea, Rep. of
Mexico
South Africa, Rep. of
Thailand
United Kingdom
USSR

The member body of the following country expressed disapproval of the document on technical grounds :

Australia

Printed in Switzerland

Natural gas — Determination of potential hydrocarbon liquid content — Part 3 : Volumetric method

1 Scope and field of application

This part of ISO 6570 specifies a volumetric method for the determination of the potential hydrocarbon liquid content of natural gas.

This method permits simultaneous determination of the amount of water that condenses under the conditions of the test.

The principles of, and general requirements for, methods for the determination of potential hydrocarbon liquid content are specified in ISO 6570/1. An alternative weighing method for the determination of potential hydrocarbon liquid is specified in ISO 6570/2.

2 References

ISO 3601/1, *Fluid systems — O-rings — Part 1 : Inside diameters, cross-sections, tolerances and size identification code.*

ISO 6570/1, *Natural gas — Determination of potential hydrocarbon liquid content — Part 1 : Principles and general requirements.*

ISO 6570/2, *Natural gas — Determination of potential hydrocarbon liquid content — Part 2 : Weighing method.*

3 Principle

See ISO 6570/1.

The volumes of hydrocarbon liquid (and water if present) formed from given volumes of gas passed through the installation at a specific temperature and pressure are measured directly and the potential hydrocarbon liquid content is derived from a graphical presentation of the results. The volume of any condensed water may be derived in a similar manner.

4 Apparatus

WARNING — The apparatus shall comply with relevant safety regulations.

The general arrangement of the measuring installation is shown in figure 1.

The measuring installation shall meet the general requirements set out in ISO 6570/1.

The separator specified in 4.2 is intended for use at maximum working pressure of 8 MPa. The actual equipment used shall have been tested to an appropriate higher maximum pressure in accordance with the requirements of national safety regulations and shown to be safe.

In addition, the following equipment is required.

4.1 Cooling coil

The cooling coil shall consist of copper tubing 4 m long, of external diameter 6 mm and internal diameter 4,5 mm, preferably packed with 2 mm phosphor-bronze balls.

4.2 Separator (see figures 2 and 3)

The separator assembly (see figure 2) shall consist of :

An upper small vertical chamber surrounded by a constant temperature bath controlled to ± 0,25 K. The lower end is connected to a sight glass, of polymethyl methacrylate, having a central tube of restricted width half way up which a reference point is marked (see detail figure 3). This in turn is connected to a lower chamber, of appropriate capacity to collect the condensate formed, surrounded by a constant temperature bath controlled to a temperature 5 to 10 K lower than that of the upper chamber.

NOTE — The specified separator and filter designs have been tested at a pressure of 12 MPa.

4.3 Mercury displacement pump

A calibrated mercury displacement pump with a scale graduated in 0,01 ml divisions, with the possibility of estimating to 0,001 ml, shall be used.

4.4 Back pressure regulator

The back pressure regulator shall be suitable for the pressures to be used.

4.5 Equipment for checking of proper functioning (see subclause 5.3 of ISO 6570/1).

5 Sampling

The general conditions for representative sampling set out in ISO 6570/1 shall be complied with.

6 Procedure

Connect a nitrogen cylinder to the apparatus using a heated line, and set the thermostat of the bath containing the cooling coil to the desired temperature. Raise the mercury level in the sight glass using the displacement pump, set the back pressure regulator, and pressurize the system with nitrogen. Check for any leaks using soap-solution and carry out any necessary repairs.

NOTE — If a sufficiently large sample is available, it may be used for checking for leaks instead of the nitrogen.

Reduce the mercury level to below the sight glass, and close the valve to the mercury pump. Vent to reduce the pressure in the installation and adjust the temperature of the lower chamber to at least 5 K below that of the cooling coil. Evacuate the system and slowly introduce the sample, allowing the gas to slowly flow through the apparatus (control the gas flow using the back pressure regulator and the fine control valve). Open the valve to the mercury pump, and raise the mercury level in the sight glass by means of the displacement pump.

As gas flows through the installation, adjust in turn the levels of the water-liquid hydrocarbon and liquid hydrocarbon-gas interfaces to the reference level in the sight glass and record the mercury pump and gas-meter readings for each adjustment. Record the temperatures of the bath containing the cooling coil and the gas entering the measuring equipment.

Note the flow rates through the installation and the thermostatically controlled bath and the dew point temperatures of the gas leaving the separator. The gas leaving the separator should be in equilibrium; this may be checked, for example, by measuring the hydrocarbon dew point.

7 Expression of results

Convert the pump readings to liquid volumes and correct the gas volumes to standard conditions (273,15 K and 101 325 Pa). From a series of readings, plot the volumes of gas against the volumes of liquid.

After initial scatter, due to wetting of the walls of the installation, the values should give a straight line, the slope of which gives the volume of liquid, condensate or water, condensed under the conditions in the separator.

Express the results as the ratio of the volume of liquid per unit volume of gas. The recommended unit is cm^3/m^3.

An example of results obtained from a sample in a cylinder is given in annex A and of the results obtained from a sample taken by direct sampling are given in annex B.

8 Sources of error

In addition to the sources of error specified in ISO 6570/1, that of particular concern in the volumetric method is the temperature of the lower liquid container. If this is too high, gassing will occur in the condensed liquid. To avoid this it is essential that the temperature difference between the separator bath and the lower container bath specified in clause 4 be maintained.

9 Test report

The test report shall include the following information :

a) a reference to this part of ISO 6570;

b) all the information necessary for the complete identification of the sample;

c) the results obtained;

d) details of any operation not specified in this part of ISO 6570, or ISO 6570/1, or regarded as optional, together with details of any incidents likely to have affected the results.

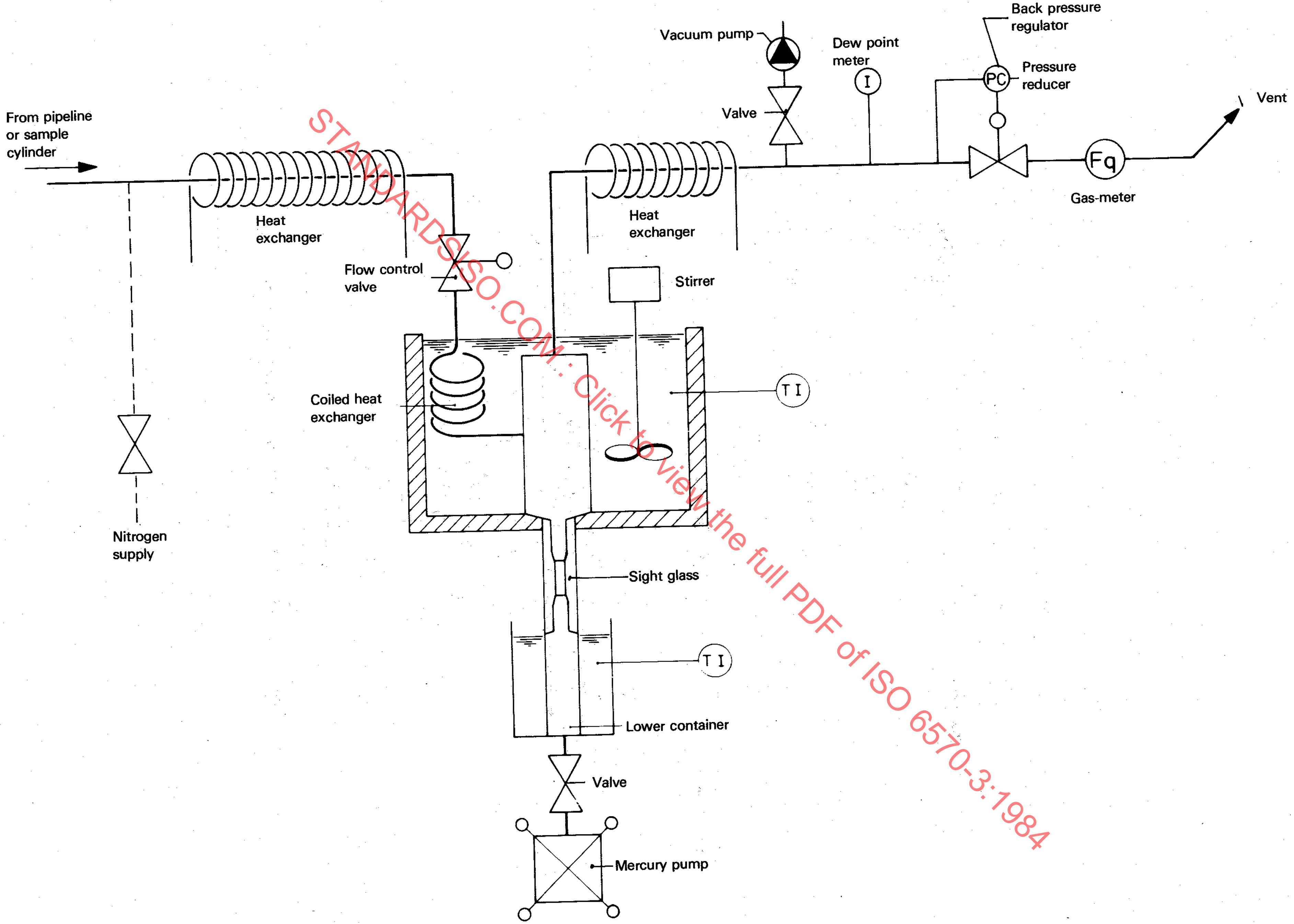


Figure 1 — General arrangement of the measuring installation

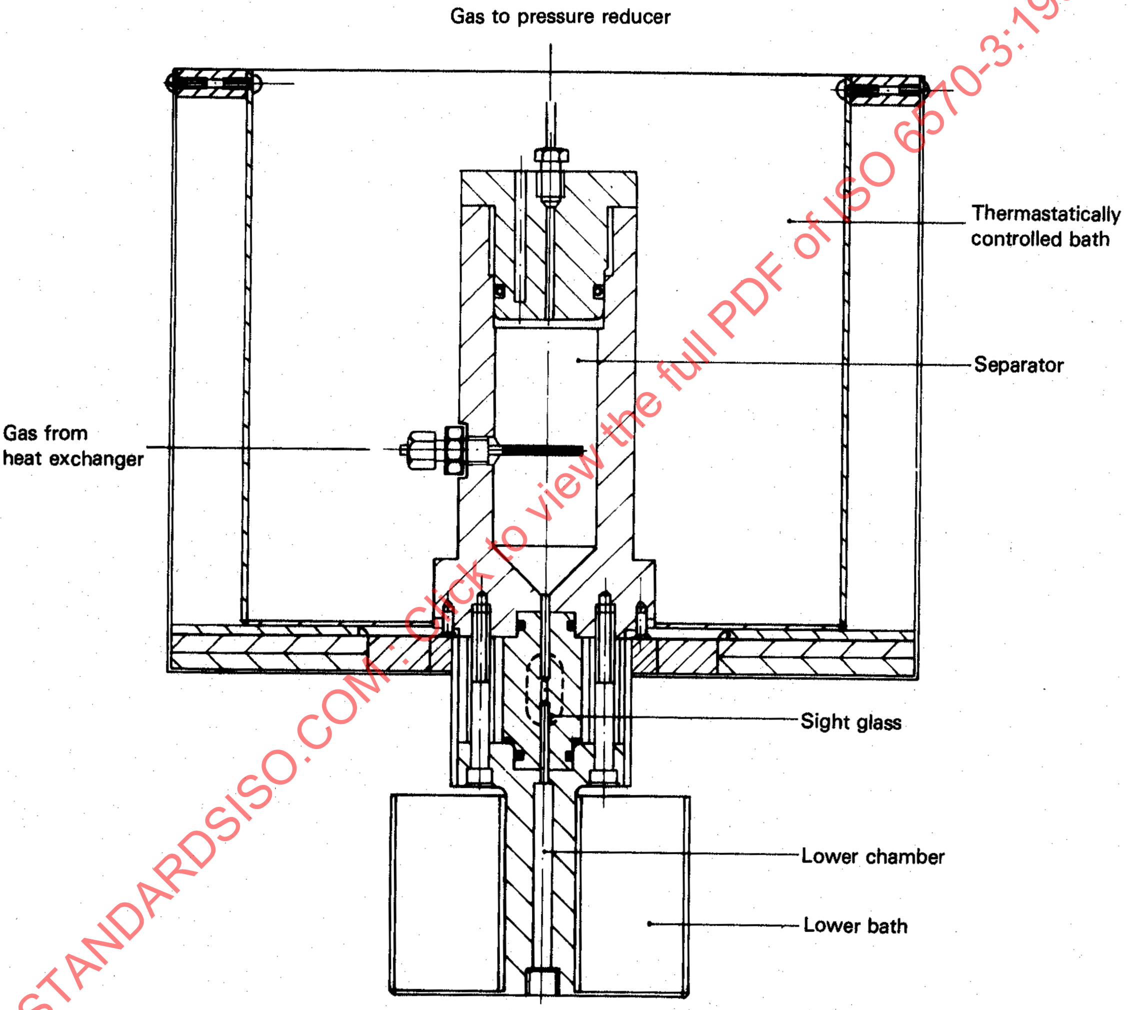
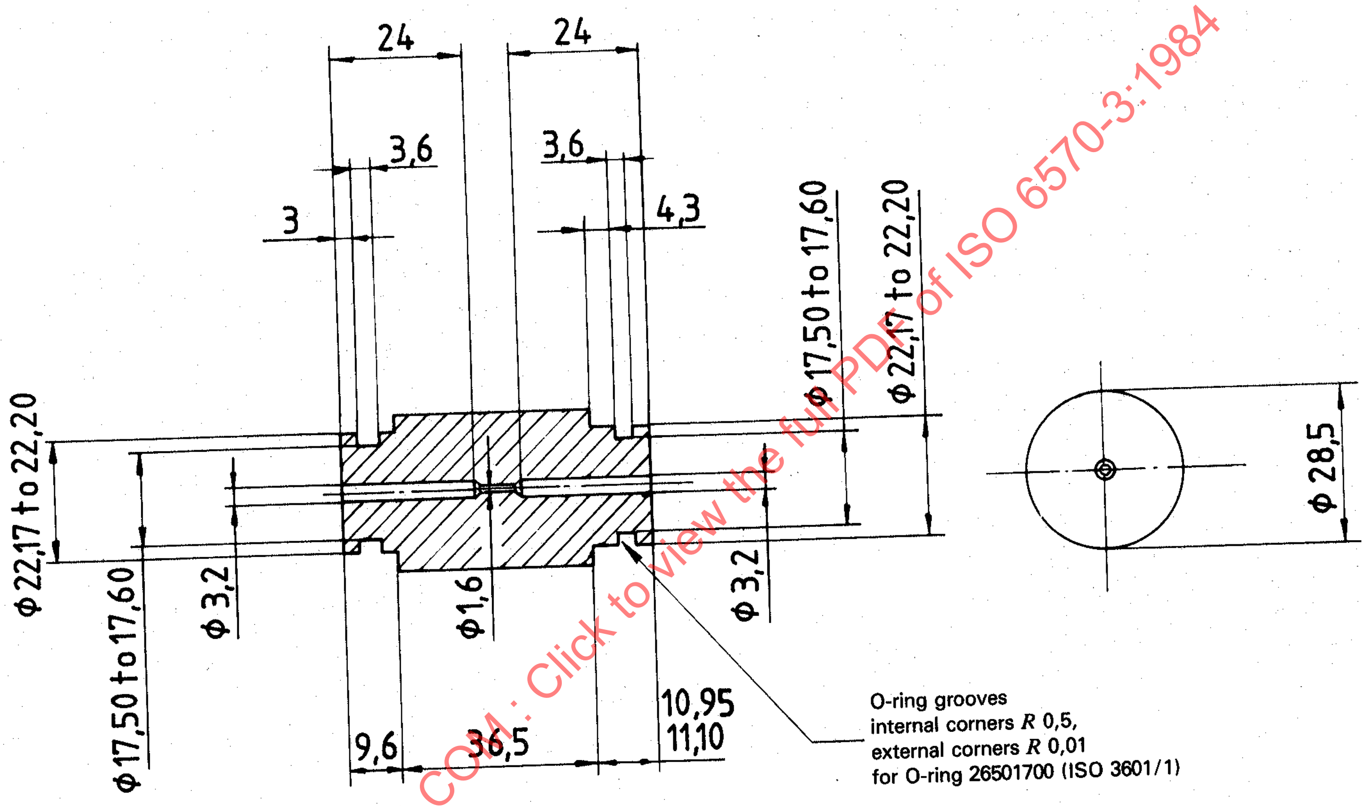


Figure 2 — Detail of separator and associated equipment

Dimensions in millimetres



O-ring grooves
internal corners R 0,5,
external corners R 0,01
for O-ring 26501700 (ISO 3601/1)

NOTE — All surfaces to be finished smooth and free from toolmarks.

Figure 3 — Details of sight glass

Annex A

Example of results obtained for a sample from a cylinder

A.1 Sample details

Bottle A 2492, sampled from separator operating at 0,34 MPa and 345 K.

Dew point of gas leaving cylinder at 0,34 MPa :

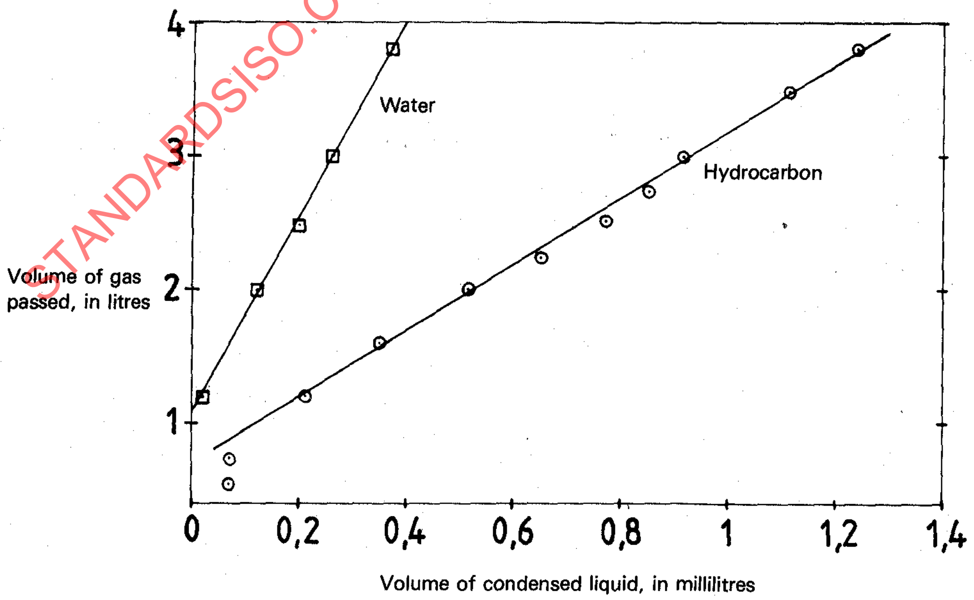
hydrocarbon : 345 K

water : 344 to 345 K

A.2 Results

Time of day	Volume of gas passed[1] l	Bath temperature K	Dew point K	Volume of condensed liquid ml	
				Hydrocarbon	Water
10 : 00	0,55	303,0	303,0	0,07	
	0,75	303,2		0,072	
	1,20	303,1	303,2	0,215	0,02
	1,60	303,0		0,345	
10 : 26	2,00	303,0	303,0	0,515	0,121
	2,25	302,8		0,650	
10 : 32	2,50	302,9	302,8	0,768	0,20
	2,75	303,1		0,853	
10 : 39	3,00	303,0	303,0	0,925	0,263
	3,50	303,0		1,112	
10 : 50	3,80	303,1		1,240	0,365

[1] Corrected to standard conditions.



From the slope of the graph

- potential liquid hydrocarbon content 4,05 × 10^{-4} (V/V)
- potential water (as liquid) content 1,38 × 10^{-4} (V/V)

Annex B

Example of results obtained for a sample taken by direct sampling from a pipeline

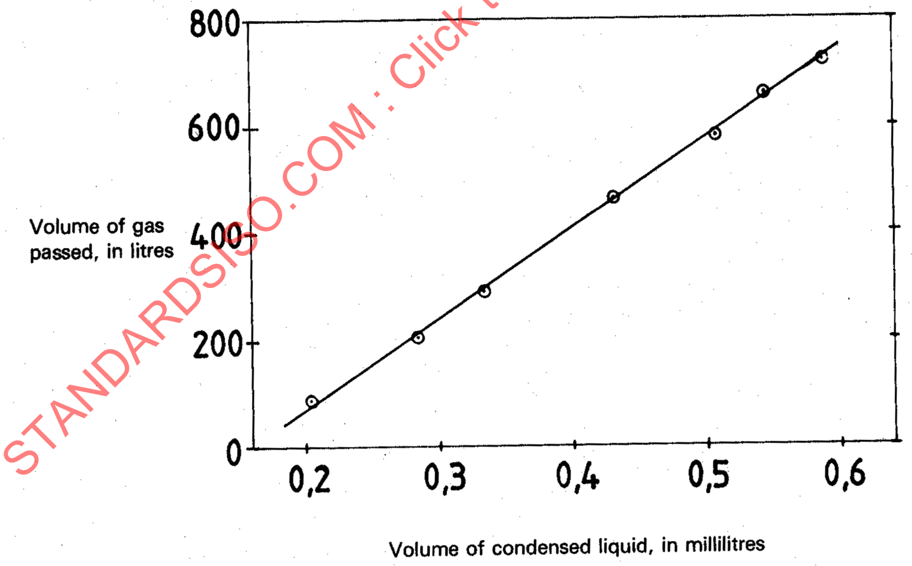
B.1 Sample details

Line pressure : 6,9 MPa.

Gas with a hydrocarbon dew point of 278 K, cooled to a dew point of 273,5 to 274,0 K.

B.2 Results

Time of day	Pressure MPa	Bath temperature K	Dew point K	Volume of liquid ml	Gas-meter reading l	Volume of gas passed l
11 : 04	6,90	260,0		0,181	3 960	
	6,90	260,0	273,5	0,205	4 047	87
	6,90	260,5	274,0	0,283	4 163	203
11 : 25	6,90	260,0	274,0	0,334	4 250	290
	6,90	260,3	273,5	0,433	4 423	463
11 : 47	6,90	260,0	274,0	0,507	4 540	580
	6,90	260,3		0,544	4 625	665
12 : 00	6,90		274,0	0,589	4 680	720



From the slope of the graph, potential liquid hydrocarbon content : $5,9 \times 10^{-7}$ (V/V)