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**NATIONAL STANDARD OF THE
PEOPLE'S REPUBLIC OF CHINA**

GB/T 17283-2014

**Determination of the water dew point of natural gas -- Cooled
surface condensation hygrometers**

天然气水露点的测定 冷却镜面凝析湿度计法

(English Translation)

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Table of Contents

Foreword...	3
1 Scope...	4
2 Principles...	4
3 Performances of apparatus...	5
4 Sources of error - General precautions for operation...	8
5 Elimination of hydrocarbon condensates...	10
6 Accuracy...	11

Foreword

This standard was drafted in accordance with the rules given in GB/T 1.1-2009.

This standard replaces GB/T 17283-1998 "Determination of the water dew point of natural gas - Cooled surface condensation hygrometers". As compared with GB/T 17283-1998, the main technical content the same.

This standard, through re-drafting method, modifies and adopts ISO

6327.1981 "Gas analysis - Determination of the water dew point of natural gas

- Cooled surface condensation hygrometers"; AND ISO 6327 had confirmed this in 2011.

This standard has a greater structural adjustment as compared with ISO 6327.1981, AND in Appendix A it provides the clause number comparison list between this standard and ISO 6327.1981.

The main technical differences between this standard and ISO 6327.1981 and the causes are as follows.

- MODIFY the scope of application of standard; based on the scope of application of ISO 6327.1981 "The water dew point generally ranges from -25 °C ~ 5 °C", ADD that "Under special environment, the water dew point range may be widened"; AND expand the scope of application of this

standard for the purposes of adapting to the actual conditions of the natural gas production in China.

This standard was proposed by China National Petroleum Corporation.

This standard shall be under the jurisdiction of the National Natural Gas Standardization Technical Committee (SAC/TC 244).

The main drafting organizations of this standard. China National Petroleum Corporation Southwest Oil and Gas Field Branch Natural Gas Research Institute, Chengdu Tianke Oil and Gas Engineering Co., Ltd.

1 Scope

This standard specifies the method of using the cooled surface condensation hygrometers to determine the water dew point of natural gas.

This standard applies to the determination of the water dew point of natural gas and similar gases. The water dew point of the treated natural gas is generally in the range of $-25\text{ }^{\circ}\text{C} \sim 5\text{ }^{\circ}\text{C}$. Under the corresponding gas pressure, the water content range (volume fraction) is $50 \times 10^{-6} \sim 200 \times 10^{-6}$. In special circumstances, the water dew point range may also be wider.

2.1 Principle of the apparatus

With this type of apparatus, which determines the water content of a gas by measuring the corresponding dew point, a surface (generally a metallic mirror), the temperature of which may be artificially lowered and accurately measured, is exposed to a sample of the gas being tested. The surface is then cooled to a temperature at which condensation occurs and is observed as dew.

Below this temperature, condensation increases with time, whilst above it, condensation decreases or does not occur. This surface temperature is then (for practical applications) taken as the dew point of the gas flowing through the apparatus.

2.2 Determination of water vapor pressure

The partial water vapor pressure in the gas samples is the saturated vapor pressure corresponding to the observed dew point, provided that the gas in the hygrometer is at the same pressure as the gas at the time of sampling.

REFER to the relevant manual for the relationship between saturated water vapor pressure and temperature.

It shall be noted that if methanol is present, this method determines the methanol in addition to water. However, if the methanol content is known, the manual device can involve observation of condensation with the naked eye; if a photoelectric cell is used, the mirror is illuminated by a light source built into the test cell. The lamp and photoelectric cell can be arranged in various ways, provided that diffusion in the direction of the light source from the mirror is reduced by the polishing of the mirror. In any case, the mirror must be clean before use.

In the absence of any condensation, the diffused light falling on the photocell must be reduced. The effects of light diffused from internal surfaces of the cell can be reduced by blackening these surfaces AND this precaution can be supplemented by an arrangement of the optical system so that only the mirror is illuminated AND the photocell views only the mirror.

3.4.1 General

The following methods are used for reducing and adjusting the mirror temperature. The methods described in 3.4.2 and 3.4.3 require constant attention from the operator AND are not suitable for automatic devices. For automatic devices, two cooling methods are used. indirect contact with a coolant OR cooling by the thermoelectric (Peltier) effect as described in 3.4.4 and 3.4.5. In any case, the rate of cooling of the mirror shall not exceed

3.4.2 Solvent evaporation

A volatile liquid in contact with the rear face of the mirror can be evaporated AND cooled by an air flow. Hand bellows are generally used for this purpose, BUT an adjustable source of low pressure compressed air or any other suitable pressurized gas is preferable. The liquid used can be ethylene oxide, a very efficient liquid giving cooling of the mirror of approximately 30 °C, without effort, when hand bellows are used. However, if toxicity is a risk, acetone can be used to obtain cooling of approximately 20 °C with hand bellows OR even greater cooling with compressed air or other suitable pressurized gas.

3.4.3 Gas cooling by adiabatic expansion

The mirror can be cooled by discharging onto its rear face a gas which has just expanded through a nozzle. Compressed carbon dioxide, available from small cylinders, is often used for this purpose, BUT other gases such as compressed air, compressed nitrogen, propane, or halogenated hydrocarbons can also be used. Mirror temperatures of at least 40 °C below the gas sample temperature can be obtained.

introduced into the test cell, can also induce an observed dew point different from the dew point which would correspond to the actual water vapor content.

4.1.2 Solid impurities

If solid impurities are absolutely insoluble in water, they do not modify the observed condensation temperature, BUT can hinder condensation observation. In an automatic device, without a compensation device for such impurities, these tend to obstruct the operation of the device if the amount of condensate is low. Defects resulting from an excess of solid impurities on the mirror generally result in an unexpected increase of the mirror temperature for a few minutes AND call for dismantling of the device AND cleaning of the mirror.