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**Determination of density of sulphur hexafluoride oscillating
U-tube method**

六氟化硫气体密度测定法 U 型管振荡法 清晰版
(English Translation)

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Foreword

This standard was drafted in accordance with the rules given in GB/T 1.1-2009 "Guidelines for Standardization Work Part 1: Standard Structure and Compilation".

Please note that certain contents of this document may involve patents. The issuing agency of this document is not responsible for identifying these patents.

This standard was proposed by the China Electricity Council.

This standard is under the jurisdiction of the National Electrochemical Standardization Technical Committee.

The main drafting units of this standard. State Grid Fujian Electric Power Co., Ltd. Electric Power Research Institute, State Grid Anhui Electric Power Co., Ltd. Electric Power Section Research Institute, State Grid Hunan Electric Power Co., Ltd. Electric Power Research Institute, State Grid Jiangsu Electric Power Co., Ltd. Electric Power Research Institute, Xi'an Thermal Power Research Institute Co., Ltd.

1 Scope

This standard specifies the outline of the method, instruments and materials, preparations, Instrument calibration, test procedures, calculations, report results and precision.

This standard applies to the determination of the density of sulfur hexafluoride gas, other gases or mixed gases can be implemented by reference.

2 Normative references

The following documents are indispensable for the application of this document. For dated reference documents, only the dated version applies to this document. For undated references, the latest version (including all amendments) applies to this document.

GB/T 6682 Analytical laboratory water specifications and test methods GB/T 8979 pure nitrogen, high-purity nitrogen and ultra-pure nitrogen

3 Method summary

Pass the gas sample into the U-shaped oscillating tube with precise temperature control. The oscillation period of the tube will be caused by the change of the gas quality in the U-shaped oscillating tube.

Also changed, the density of the gas sample is calculated using the oscillation period and the U-shaped oscillation tube constant obtained by calibration.

4 Apparatus and materials

4.1

Digital density meter. It is composed of U-shaped oscillating tube, electronic excitation system, frequency counter, temperature control unit and display.

The resolution is $1 \times 10^{-6} \text{g/cm}^3$, and the temperature control accuracy is $\pm 0.01^\circ\text{C}$;

4.2

Connecting pipe. silicone, PTFE or polyurethane pipe;

4.3

Erlenmeyer flask. 150mL, abrasive plug;

4.4

Float flow meter (with regulating valve). 100mL/min~1000mL/min;

4.5

Hygrometer. accuracy $\pm 1\%RH$, accuracy $\pm 5\%RH$ or higher;

4.6

Precision digital pressure gauge. (0~700) kPa, accuracy $\pm 0.05\%$, resolution 0.01kPa;

4.7

Precision barometric pressure gauge or built-in barometric pressure sensor. absolute pressure (0~130) kPa, accuracy $\pm 0.05\%$, resolution 0.01kPa.

4.8

Pure water. it should meet the requirements of Grade 2 or higher of GB/T 6682. Before use, stop the conical flask and boil it to remove the dissolved air and cool it.

However, plug the bottle mouth with a stopper and seal it for later use. See Appendix A for the water density values at different temperatures.

4.9

High-purity nitrogen. it should meet the requirements of GB/T 8979, with a purity of not less than 99.999%, and the density in Appendix B;

4.10

Anhydrous ethanol. analytically pure;

4.11

Acetone. analytically pure.

5 Preparation

5.1

The measured environmental humidity should not be greater than 85%RH, and there should be no condensation on the surface of the U-shaped oscillating tube.

5.2 Cleaning of U-shaped oscillating tube

Rinse with water, then rinse with absolute ethanol or acetone, and then blow dry with dry air (the instrument can have a built-in drying tube).

5.3 Set the temperature of the U-shaped oscillating tube to 20.00°C.

5.4 Daily inspection. Let air in, if the difference between the air density reading and the standard value exceeds $1 \times 10^{-5} g/cm^3$, continue the inspection with pure water.

If it is still out of tolerance, find out the reason, and re-clean and dry the U-shaped oscillating tube. See Appendix C for the air density.

6 Instrument calibration

6.1

At least two standard materials are required to calibrate the U-shaped oscillating tube. The density of the standard materials should be traceable to national standards or adopt internationally recognized standards.

Numerical value.

6.2

Pass the first standard substance with low density value (usually high-purity nitrogen) into the U-shaped oscillating tube, and wait for it and the U-shaped oscillating tube to reach the setting. After the temperature is stable, record the oscillation period or density reading and the temperature of the U-shaped oscillation tube.

6.3

Inject the second standard substance (commonly used pure water) with a high density value into the U-shaped oscillating tube. There should be no bubbles in the water in the U-shaped oscillating tube.

in. After it and the U-shaped oscillating tube reach the set temperature and stabilize, record the oscillation period or density reading and the temperature of the U-shaped oscillating tube.

6.4

Use the detected oscillation period value of high-purity nitrogen and pure water to calculate the U-shaped oscillation tube constant F . The calculation formula is shown in (1).

6.5

If the instrument has the function of automatically calculating the density from the constant F and the oscillation period T value measured by the sample, follow the calibration of the instrument manufacturer. The normal procedure requires the input of the density values of the two standard materials into the instrument, and then the two standard materials for calibration and automatic calculation.

6.6

After calibration, clean and dry the U-shaped oscillating tube according to the steps given in 5.2.

7 Test procedure

7.1

Turn the sulfur hexafluoride gas cylinder upside down, and use the connecting pipe to