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Determination of mixing ratio of SF₆ gas mixture

六氟化硫混合绝缘气体混气比检测方法

(English Translation)

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Foreword

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

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.

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1 Scope

This standard specifies the sensor method and chromatographic method for determining the mixing ratio of sulfur hexafluoride (SF₆) mixed insulating gas.

This standard applies to the detection of gas mixture ratio in SF₆/CF₄, SF₆/N₂ mixed gas insulation equipment, and other SF₆ mixtures Insulating gas mixture ratio detection 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.

DL/T 1032 Sulfur hexafluoride (SF₆) gas sampling method for electrical equipment

3 Terms and definitions

The following terms and definitions apply to this document.

SF₆ gas mixture

SF₆ gas is an insulating gas mixed with another gas in a certain proportion.

SF₆ gas mixture insulated equipment Electrical equipment that uses SF₆ mixed gas as an insulating medium.

Gas mixture rate

The volume fraction of SF₆ in the SF₆ mixed gas.

4 Sampling

4.1

On-site analysis and sampling Connect the pipeline according to the requirements of the testing instrument, adopt the lead-in sampling, flush the pipeline for 3 to 5 minutes, and then sample for testing.

4.2 Laboratory analysis and sampling

Follow the relevant regulations in DL/T 1032.

5.1.1 Method summary

Use thermal conductivity or infrared sensor to detect the difference in thermal conductivity or infrared absorption characteristics between SF₆ and another gas the mixing ratio of the mixed gas; at the same time, an electrochemical sensor is used to detect the O₂ content in the gas. The detection process is shown in Figure 1.

5.1.3 Environmental conditions

a) Temperature. -10°C ~ 40°C;

b) Humidity. ≤85%RH.

5.1.4 Test steps

Operate as follows.

a) Turn on the power of the instrument and perform the corresponding settings according to

the instructions after the instrument has been warmed up;

- b) Confirm that the air inlet valve of the instrument is in the closed state, connect the air inlet of the air source and the sampling port of the instrument, and connect the exhaust gas collection device Connect to the exhaust port of the instrument;
- c) During measurement, keep the oxygen sensor protection valve in a closed state, slowly open the gas flow regulating valve, and open the side Valve, flush the pipeline for 3 min~5 min, then adjust the gas flow to the setting range and open the protection valve to start After the test data is stable, record the SF6 and O2 test results;
- d) After the measurement is completed, the instrument should be purged with dry nitrogen for 3 min~5 min, first close the oxygen sensor protection valve, and then Turn off the instrument;
- e) Recycle the gas in the exhaust gas collection device.

5.1.5 Test results

Take the arithmetic mean of two parallel determination results as the test result, and the test result is expressed in volume fraction.

5.1.6 Precision

The absolute deviation of the two test results is $SF_6 \leq 1\%$, $O_2 \leq 0.1\%$.

5.2.1 Method summary

The chromatographic column is used to separate SF6, CF4, N2, O2 and other components, and the gas of each component is entered through a thermal conductivity detector (TCD).

Line testing. The test result is expressed in volume fraction.

5.2.2 Apparatus and materials

a) Gas chromatograph. It should be equipped with a TCD detector, which can detect SF6, CF4, N2, O2 and other components, and can be used Data analysis is carried out by external standard method and calibration standardization method. See Table 1 for typical gas path flow.

5.2.3 Environmental conditions

- a) Temperature. $-10^{\circ}\text{C} \sim 40^{\circ}\text{C}$;
- b) Humidity. $\leq 85\%RH$.

5.2.4 Detection steps

Operate as follows.

- a) Set the working parameters of the chromatograph according to the requirements of the instrument, and wait until the instrument is stable for use;
- b) Use external standard method to quantitatively calibrate the chromatograph. The calibration working conditions of the instrument should be the same as the detection conditions.

The specified repeatability should not be greater than $\pm 3\%$;

- c) Connect the gas inlet of the gas source to be tested and the sampling port of the chromatograph, and control the flow of the gas to be tested according to the conditions of use of the chromatograph Flush the sampling pipeline and the loop for no less than 3 minutes, close the sampling port of the chromatograph, switch the loop valve, and quickly Sample injection
- d) Record the peak area (or peak height) of each component and analyze the data;
- e) After the test is completed, turn off the chromatograph according to the instrument operation procedure, and turn off the power and all gas sources.

5.2.5 Sample chromatogram

Typical chromatograms are shown in Figure 2 and Figure 3.

5.2.6.2 Calculating gas mixture ratio by external standard method

According to the peak area (or peak height) of each component, calculate the SF₆, CF₄, N₂, O₂ in the mixed gas according to formula (3) Etc. content

5.2.7 Precision

The absolute deviation of the two test results is SF₆, N₂, CF₄ $\leq 0.5\%$, O₂ $\leq 0.05\%$.