ASTM D3612 Dissolved Gases In Transformer Oil By GC TOGA

Transformer oil is a specially refined mineral oil used in electrical transformers, valued for its superior insulating properties, ability to suppress arcing and corona, and its role as a coolant. During electrical faults, the oil decomposes into gases, the composition of which can indicate the type and severity of the fault. This data is crucial for an effective preventive maintenance program.

IES-3612 GC for Analysis of Dissolved Gases in Transformer Oil (TOGA)

Introduction

IES-3612 TOGA conforms to *ASTM D3612 Standard Test Method for Analysis of Gases Dissolved in Electrical Insulating Oil by Gas Chromatography*. It is used for the measurement of gases dissolved in electrical insulating oil having a viscosity of 20 cSt (100SUS) or less at 40℃ (104°F).
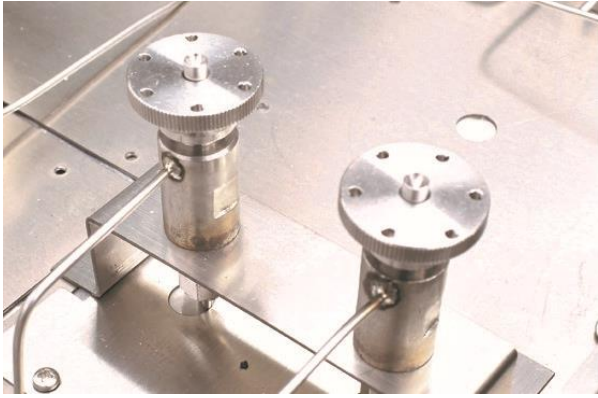
Oil and oil-immersed electrical insulation materials may decompose under the influence of thermal and electrical stresses, and in doing so, generated gaseous decomposition products of varying composition which dissolve in the oil. The nature and amount of the individual component gases that may be recovered and analyzed may be indicative of the type and degree of the abnormality responsible for the gas generation of specific gases over time are also used to evaluate the condition of the electric apparatus.

Background

Electrical and thermal loads are applied to transformers, the insulator oil and various components can undergo decomposition, the byproducts of which are dissolved into the transformer oil as gaseous compounds. Analysis of these gases, called dissolved gas analysis (DGA), is a common analysis performed on insulator oil sampled from electrical transformers that can indicate the health, longevity, and potential error states of transformers. Given the large and growing number of transformers associated with modern electrical infrastructure, limited throughput for the large number of samples received is a common issue faced by testing labs. ASTM D3612 Method C specifies the use of automated headspace sampling of the transformer oil, which allows for higher throughput over other sampling methods for DGA analysis, such as vacuum extraction or the use of a stripper column (e.g., ASTM D3612 Methods A and B, respectively).

Features

1. TOGA adopts Ethernet communication interface, which can easily form a local area network to achieve long-distance data transmission, remote control and remote diagnosis.
2. It has powerful and perfect power-on self-diagnosis function, intuitive display of fault information, power failure storage protection function and anti-power interference function.
3. Adopts transformer oil special anti-pollution composite column technology greatly improves the service life of the column.
4. The instrument has undergone strict aging tests before leaving the factory, and the parameters have been set, and the user only needs to perform a simple start-up operation.

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Small dead volume Injection system	**High-precision gas flow control system**

Parameters

1. 1ml Injection volume, the minimum detected concentration (ul/L)

Component	H_2	O_2	N_2	CO	CO_2	CH_4	C_2H_4	C_2H_6	C_2H_2
Minimum Concentration (ul/L)	2	10	20	≤5	5	0.06	0.06	0.06	0.06

2. Ambient requirements: 0~40℃
3. Accuracy: ±0.1℃
4. Temperature control range: Ambient+5℃~450℃
5. Analysis cycle: 7min
6. Power: 1.9KW
7. Dimension: 660*560*480mm

High efficiency conversion device	**FID (High sensitivity and low noise)**

Main technical parameters:

1. **Real-time computer control and data processing**

The TOGA can expand the 10/100M Ethernet interface and can be connected to the TOGA through the computer in the local area network to realize remote data acquisition and management. Increases the freedom of the device and promotes efficient application in the laboratory.

Through the user-friendly software operation interface, it is very convenient for users to set parameters including temperature, range rise, event, detector and so on; Intuitive operation includes functions such as FID automatic ignition, TCD switching bridge flow, turning on and off temperature control, turning on and off the rise and closing of the range and various time events.

2. **The unique design of the gasification chamber and detector ensures stability and convenient maintenance of the TOGA**

The unique inlet design solves injection bias, and the dual-column compensation function not only solves the baseline drift caused by the program heating, but also reduces the influence of background noise, which can achieve lower detection limits.

Unique vaporization chamber design, smaller dead volume; The replacement of injection pads, liners, polarizing poles, collecting poles, nozzles and other accessories can be replaced easily; Filling columns, capillary injectors, TCD, FID detectors and other main replacements can be completely disassembled with only one wrench, which is very convenient for maintenance.

3. **High precision and stable temperature control system**

The main control circuit adopts advanced microprocessor, large-capacity FLASH and EEPROM memory, so that the data preservation is more reliable; The integrated design of the circuit board integrating measurement, control and power supply improves the anti-interference and reliability of the TOGA.

Adopts the temperature control circuit of the microprocessor, the temperature accuracy of the controlled object in each heating zone reaches 0.1℃.

The column chamber has a double overtemperature protection device. If the temperature exceeds the setting, the instrument stops heating up and reports the fault on the display.

The intelligent double rear door technology ensures that the TOGA can have good temperature control accuracy when the column chamber temperature is close to room temperature and can quickly cool down.

Twenty-step programmed heating to accommodate the analysis of complex samples with wide boiling points.

4. **Simple operation interface**

Adopts 7-inch LCD display and supports capacitive touch, which is intuitive and easy to operate;

Self-diagnosis function and display of the fault site;

Data power-off protection function, the operating data set by the TOGA can be stored for a long time after the power failure.

5. **Protection**

Will stop heating when there is no carrier gas, so as to protect the column and thermal conductivity cell.

6. **Auto ignition**

It can set the time for automatic ignition, and at the same time has the function of fire extinguishing hydrogen protection.

Main technical parameter

Temperature control parameter

1. Column Oven: Ambient+5℃~450℃, Accuracy: ±0.1℃
2. Injector: Ambient+5℃~450℃, Accuracy: ±0.1℃
3. Detector: Ambient+5℃~450℃, Accuracy: ±0.1℃
4. Maximum control 7 paths temperature

Column Oven parameter

1. Column Oven: Ambient+5℃~450℃, Accuracy: ±0.1℃
2. Volume：260mm*270mm*230mm
3. Programmed heating: 20 steps
4. Programmed heating rate: 1~80℃/min (0.1℃ increment)
5. Retention time of each step: 0~655min (1min increment)
6. Automatic rear opening design to guarantee the fast-cooling speed,
   It will only cost within 7min to cool from 350℃ to 50℃
7. Fan with big power and low noise to guarantee the uniformity of the temperature

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Detector

FID

1. Adopts unique and stable amplifier technology, the signal amplification board has been specially treated to maintain stable operation in harsh conditions
2. Be suitable for packed column and capillary column
3. Operation temperature: 450℃
4. Minimum limit of detection: ＜5pg c/s (n-Hexadecane)
5. Linear dynamic range (LDR): $10^7(\pm 10\%)$
6. Data acquisition frequency: 100Hz
7. Automatic ignition: Auto hydrogen cut off after fire extinguished

TCD

1. Be suitable for packed column and capillary column
2. Fast stabilization time, small dead volume, short equilibrium time
3. Operation temperature: 400℃
4. Data acquisition frequency: 100Hz
5. Linear dynamic range (LDR): $10^5(\pm 10\%)$
6. Minimum limit of detection: ＜800pg propane/ml (Helium)

Others

1. Dimension: 586*500*530mm
2. Weight: 46g
3. Rated voltage: 220V±50Hz, Power≤2.5Kw

Chromatogram
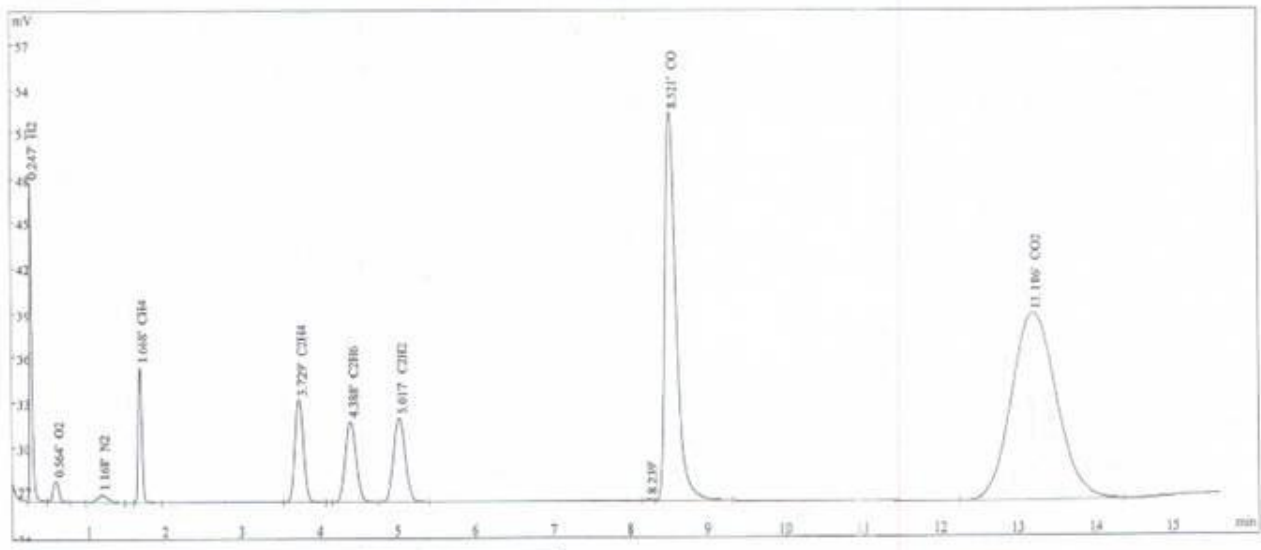
No.	Retention time	Name	Concentration	Peak Area
1	0.247	H2	2242	36315
2	0.564	O2	3463	6517
3	1.168	N2	2399	4891
4	1.668	CH4	47.43	25650
5	3.729	C2H4	49.33	49749
6	4.388	C2H6	49.55	48860
7	5.017	C2H2	50.62	54912
8	8.521	CO	460.7	244782
9	13.186	CO2	952.4	500395
Total			9714	972071