Specifications

Standard methods: ASTM D3612 part C

Configuration: One channel instrument based on Thermo Trace 1300 GC or CompactGC,
using microTCD, methaniser and FID.
Automated injection, closed loop principle, using:
- Teledyne Tekmar Versa (20 vials of 22ml) or
- Thermo Triplus 300 (120 vials of 10, 20 or 22 ml)
Carrier gas: Argon

Application: Custom configured analyser for the analysis of dissolved gases in transformer oil.
Components: H_2, O_2, N_2, CH_4, CO, CO_2, C_2H_2, C_2H_4, C_2H_6. C_3 and C_4 components optional.

Sample requirements: The oil sample must be offered to the analyser using the appropriate 10 or 20 sample vials. Vials are purged with Argon before sampling.

Analysis Time: 20 minutes.

Minimum Detectability:

Component	Detection limit G A S (ppm)
CO_2	0.4
Acetylene	0.2
Ethylene	0.4
Ethane	0.6
Hydrogen	2
Oxygen	<25
Nitrogen	<25
Methane	0.2
CO	0.3

TOGA

Dynamic Range: 4 decades for TCD, 7 decades for FID.

Repeatability: Better than 5% RSD at 100ppm concentration level for all analytes specified, measured over at least 10 consecutive runs.

Optional configurations: Additional gas sampling valve for injection of gas samples without autosampler

Data systems: Chromeleon, ChromCard, OpenLab and EZChrom Elite/ChromQuest datasystems.

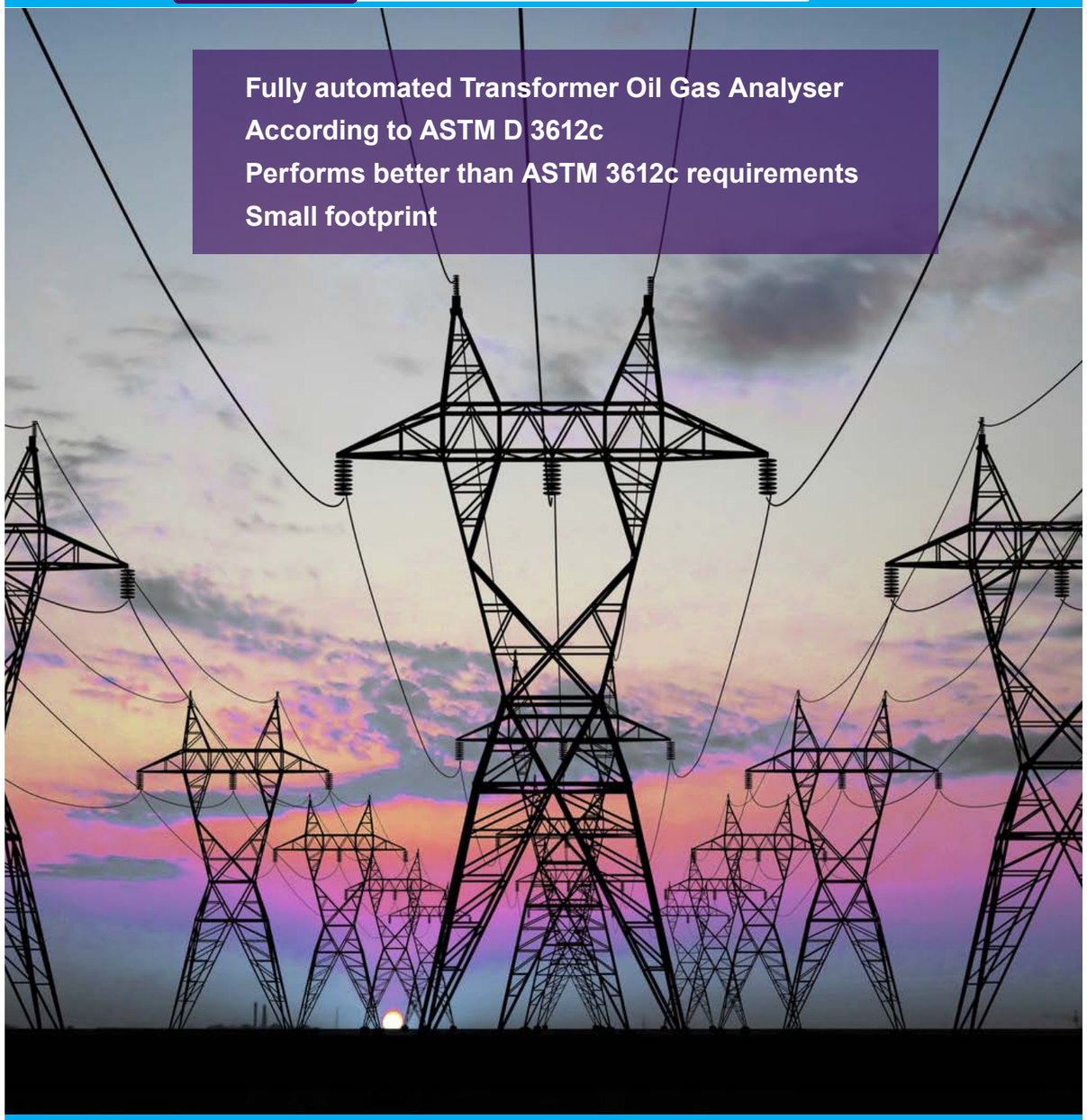
For more information:

G·A·S is an INTERSCIENCE company

G·A·S is the preferred solution partner of

P.O. Box 2148, 4800 CC Breda, The Netherlands
T: +31 (0)76 5411800 F: +31 (0)842 206757 info@gas-site.com www.gas-site.com

GLOBAL™ ANALYSER SOLUTIONS G·A·S



APPLICATION NOTE 211WA0813B

TOGA

ASTM D3612c D2945

G·A·S offers custom configured GC analysers for complex separations, data processing and reporting. We have over 35 years of experience in designing and building turnkey analysers for many application fields. Our analysers are designed to meet many accepted standard methods (like GPA, ASTM, UOP, ISO, etc.) in the Oil and Gas industry. The efficient configurations are based on proven GC technology, resulting in robust instruments with an optimal return on investment.

Transformer oil is a highly refined mineral oil used in electrical transformers. It has excellent insulating properties, suppresses corona and arcing, and serves as a coolant. In case of electrical errors, the oil breaks down to gases, which identity and content can be related to the type and severity of the electrical fault. This information is very useful in the preventative maintenance program.
ASTM D 3612 describes three procedures for the extraction and determination of gases in transformer oil. This application note is based on part C, using head space sampling. The TOGA analyser from Global Analyser Solutions is based on Thermo Trace 1300 GC or CompactGC.

Automated TOGA analysis

Figure 1. TOGA using Trace 1300 GC with Versa autosampler

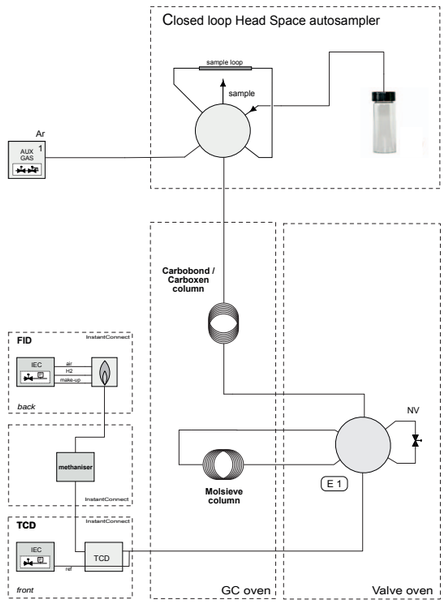


Figure 2. Diagram TOGA

Transformer Oil Gas Analyser - Principle

The headspace autosampler injects the gas sample on the first column (Carbobond). After H_2, O_2, N_2, CH_4 and CO have reached the Molsieve column, these components are isolated by switching valve E1. Next CO_2, C_2H_2, C_2H_4 and C_2H_6 are eluting from the Carbobond column directly to the detectors via the needle valve (NV). When valve E1 is switched back, the components on Molsieve column are transferred to the detectors. When C_3 and C_4 component need to be analysed as well, an additional valve is used. CO and CO_2 are analysed at low ppm level by using a methaniser which converts these components to CH_4, enabling sensitive FID detection. Diaphragm valves and InstantConnect detector technology result in a robust and flexible instrument.

Robust Reliable

Figure 3. G·A·S diaphragm valve

Flexible High uptime

Figure 4. InstantConnect detector modules

Transformer Oil Gas Analyser

Headspace sampling

20 oil samples are automatically analysed using Teledyne Tekmar Versa headspace autosampler. This system uses the closed loop injection principle, so loss of components or false air values are omitted. Each sample is individual equilibrated at 70 °C. The required equilibration time is minimised by using the mixer function of the instrument. The headspace is transferred to the sample loop by pressurising the sample vial (see figure 5, red line). The resulting pressure forces the components to the sample loop, followed by transfer to the GC after switching the injection valve. For high sample capacity and integrated instrument control with Chromeleon, ChromCard or OpenLab data systems, the Thermo Triplus 300 HS autosampler with 120 position sample tray is available.

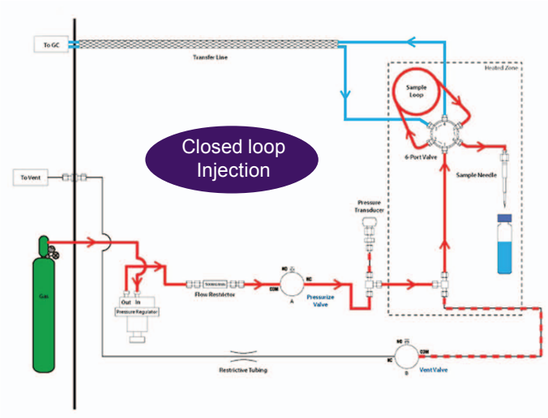
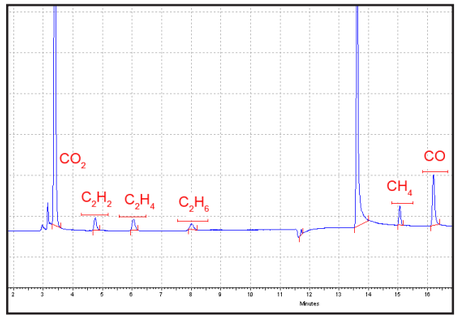
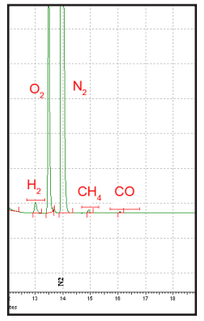


Figure 5. Versa headspace autosampler, vial pressurising phase

Results



chromatogram 1: FID
10 ppm Morgan Schaffer oil standard



chromatogram 2: TCD
100 ppm Morgan Schaffer oil standard

Component	Detection limit ASTM (ppm)	Detection limit G·A·S (ppm)	Detected on
CO_2	25	0.4	Methaniser-FID
Acetylene	1	0.2	FID
Ethylene	1	0.4	FID
Ethane	1	0.6	FID
Hydrogen	5	2	TCD
Oxygen	50	<25	TCD
Nitrogen	50	<25	TCD
Methane	1	0.2	FID
CO	25	0.3	Methaniser-FID

table 1: LODs better than ASTM D3612c

Small footprint

Figure 6: Small footprint of 60 cm with TOGA-CompactGC

Full instrument control, 120 samples

Figure 7: Full instrument control with optional Thermo Triplus 300 headspace autosampler