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## **SPECIFICATION FOR**

**Transformers oil gas analyzer according to ASTM D3612-02 Method C .**

Part I : Technical requirements

Part II : Special requirements

Part III : Data to be supplied with the offer.

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**SYSTEM FOR THE ANALYSIS OF DISSOLVED GASES IN THE  
TRANSFORMER OIL WITH HEAD SPACE TYPE EXTRACTION  
EQUIPMENT.**

**Part I : Technical requirements.**

System Gas Chromatograph –Head Space proper for the qualitative and quantitative analysis of the dissolved gases in the transformer oil for the determination of possible faults and the reasons which caused them.

**1. General characteristics of the system.**

The system must delivered in PPC's laboratory complete and ready for operation(voltage 220 AC and 50Hz) and it must include the followings:

- 1.1. Gas Chromatography(according to paragraph 2.)
- 1.2. Headspace sampler(according to paragraph 3)
- 1.3.P/C (according to paragraph 4.11)
- 1.4.Printer (according to paragraph 4.11.)
- 1.5.All the required by the method gases(with the standard gas mixture). Each container should be supplied with all the necessary pieces of equipment for the regulation and indication of the pressures and flow (manometers, flowmeters, etc).Also they must be supplied with all the necessary pipes and connections for the transfer of the gases to the G/C or whenever is needed. The container must be equipped with proper transparent filters for filtering humidity and hydrocarbons.
- 1.6.All the necessary tools for use and service of the system and for the gas proofing .
- 1.7.The gases detected by the system and the minimum required quantity of the detected gases must be in accordance with ASTM D3612 C (2009).
- 1.8.Both the offered system and the offered method must be in use with success in similar laboratories around the world(according to Part III ,paragraph 4.).

**Technical specifications for the transformers oil gas analyzer according to the ASTM D 3612 C (2009), consisting of a Gas Chromatograph and Headspace sampler :**

**2. Gas Chromatograph ( G/C )**

- 2.1. All the control and analysis parameters will be given to the G/C through a P/C or through a keyboard placed on the G/C .All the analysis parameters will be displayed on an incorporated CRT.
- 2.2. The oven must be large enough (at least 13.5 lt) for easy placing or removal of the necessary columns for the analysis and enough space for two columns at least.
- 2.3. The oven must be equipped with multilinear temperature programming for 10 oven ramps positive or negative at least 450° C .The minimum achievable temperature ramp rate must be 60° C/min and the oven cool-down time from 450° C to 50°C in 5 min.
- 2.4. Full electronic pneumatic and flow control. Pressure set points must be adjusted to an accuracy at third decimal position.
- 2.5. Retention time repeatability to an accuracy third decimal position.
- 2.6. It must have the ability of inert flow path, low dead volume, leak absence ,fast thermal response, reliable and easy to use.
- 2.7. It must preinstalled one valve and columns according to ASTM D 3612 C (2009).
- 2.8. It must preinstalled METHANIZER for converting the CO and CO<sub>2</sub> in CH<sub>4</sub> and detected in FID .
- 2.9. It must be equipped with at least two sample injectors thermostated separately ,proper and complete to accommodate packed (1/4 & 1/8 ) , capillary and PLOT columns.
- 2.10. GC must have two detectors (FID and TCD ) .TCD and FID will be single channel and ready to accommodate all types of columns and be thermostated independently.
- 2.11. FID detector must have the following features:
  - 2.11.1. Operating temperature must be 450 C .
  - 2.11.2. Linearity  $10^7$ .
  - 2.11.3. Electronic pneumatic control with accuracy in pressure at third decimal point .
  - 2.11.4. It must have makeup gas supply
  - 2.11.5. It must have flameout detection and automatic reignition system .
  - 2.11.6. Detection limit 1.5 pg C/s.
  - 2.11.7. Frequency 500 Hz at least.
- 2.12. TCD detector must have the following features:
  - 2.12.1. Linearity  $10^5$  .
  - 2.12.2. It must have makeup gas supply
  - 2.12.3. Detection limit the lower possible.
  - 2.12.4. Operating temperature must be 400° C..
- 2.13. A/X must have the ability to operate with HeadSpace of the same manufacture.

- 2.14. It must have the ability to connect to automatic Solid Phase Extraction (SPE) system.
- 2.15. It must have the ability to be connected to a series of detectors such as FPD, ECD, PFPD, FPD, NPD, ELCD, PID, AED, SCD and to use three detectors simultaneously.
- 2.16. It must be upgradeable with MS detector .

### **3. Headspace sampler**

- 3.1. It must have a capacity of 50 vials at least.
- 3.2. Vial oven ,capable of controlling the temperature of 10 samples simultaneously .
- 3.3. It must have vial shaker with choice of off,low,high .
- 3.4. It must be capable of accepting 10ml and 20 ml vials (adaptor-free)
- 3.5. Heating time for each vial must be constant .
- 3.6. Sample introduction should be done via one loop. (according to ASTM D3612 C ,2009). It must be able to accept 1 ml and 3 ml loops.
- 3.7. It must have the ability to control independently the oven temperature up to 300° C, the loop and the transfer line temperature up to 300° C.
- 3.8. The sample flow path must be inert.
- 3.9. Full electronic pneumatic and flow control. Pressure set points must be adjusted to an accuracy at third decimal position .
- 3.10. Full monitoring and control of the instrument , from a built-in keypad with multiline display and software.
- 3.11. It must have been presented both setpoints and actual operation parameters on the built-in display.
- 3.12. It must be able to store up to 4 methods .
- 3.13. Possibility of automatic check for leaks in the system and in vial separately.
- 3.14. It must be capable of the following operation modes:
  - 3.14.1. Single extraction
  - 3.14.2. Multiple Headspace extraction
  - 3.14.3. Multiple Headspace concentration

### **4. Software**

- 4.1. The method ASTM D 3612 C ,2009 for the determination of dissolved gases in transformer oils will be preinstalled .
- 4.2. It must run under Microsoft Windows 7.
- 4.3. Full control of all functions (temperature, pressure) of the system (GC- Autosampler )
- 4.4. Full control of the temperature and the pressure program..
- 4.5. It must be capable of performing integration, quantitative analysis ,manual reintegration, overlay.
- 4.6. It must be capable of creating user-customized reports.
- 4.7. It must be easy to understand via graphics and photos.
- 4.8. It must run according to GPL where all the parameters should be saved automatically with every analysis method.

4.9.It should have self-diagnostic functions , and the ability to expand with advanced detection capabilities of malfunction and maintenance.

4.10.It must be capable of simultaneous reception of four detector signals.

4.11.It should be accompanied by a suitable computer and a printer with the following requirements:

CPU :	INTEL i3 ή i5.
RAM :	4 GB.
HDD :	500 GB at least.
DVD :	CD/DVD Recorder.
VGA :	VGA compatible.
Network :	Ethernet 1000 Mbps.
Monitor :	LCD 19” with resolution 1280 x 1024 at least.
Printer :	Inkjet or Laser printer with USB 2.0 and Ethernet 100 or 1000 Mbps ports.
Input Devices :	Keyboard and mouse.
Gas chromatographer interface:	With PCI Express, or USB 2.0.
Operational System :	Windows Vista or Windows 7 GR.
Office suite :	Microsoft Office 2010 Professional Plus GR. ( Word, Excel, Access )
Security suite :	Internet security and antivirus suite with 3 years subscription.
Gas chromatograph software:	Gas chromatograph software for control and operation of the system in windows network environment and results output to Microsoft Office 2010 compatible format.

## **Part II : Special requirements.**

1. The instrument must be the most recent model of the manufacturer.
2. GC and HeadSpace must be of the same manufacture.
3. Manufacturer must be recognized worldwide and in Greece with proven experience on installing similar systems, training and reliable operation of gas chromatography systems. It must be submitted for review a list of similar systems installed in Greece.
4. The supplier should fully install the system in the laboratory of ADMHE A.E./ DSSM/ TES/ YP. XHMEIO, Agias Annis 70, Aigaleo.
5. The supplier must prove that the system works according to ASTM D 3612 C ,2009 in not more than three months from the data of arrival of the system in ADMHE A.E./ DSSM/ TES/ YP. XHMEIO, Agias Annis 70, Aigaleo.
6. It must prove that the system works according to ASTM D3612 C ,checked for precision (comparison with standard oils known concentration in ten gases H<sub>2</sub>, CO, CO<sub>2</sub>, CH<sub>4</sub>, C<sub>2</sub>H<sub>6</sub>, C<sub>2</sub>H<sub>4</sub>, C<sub>2</sub>H<sub>2</sub>, C<sub>3</sub>H<sub>8</sub>, O<sub>2</sub>, N<sub>2</sub>), and repeatability of the method to sufficient number of oil samples (at least 10 samples) .The results of the analysis must be compared with the results from the system which is in the laboratory.
7. The supplier and the manufacturer must have ISO 9001.
8. The supplier has to install , fully operate the system and train the lab personel on system operation.
9. It must be provided two (2) years of warranty.  
The warranty will cover each failure outsided from the usual instrument failures and it will cover the work hours and the spare parts.
10. The supplier must undertake to supply spare parts for ten years , within a period of 2 months from the data of request.
11. The supplier must provide manuals which fully describe the operation of the system with detailed instructions for service and repairs in case of operational failure.
12. Payment will be made after the successful installation and inspection of the system and it will begin the period of guarantee.  
This guarantee will be covered with a supplier's bank draft corresponding to 10% of the total cost of the system and which will be returned to the supplier after two years of successful operation of the system .

### **Part III : Data to be supplied with the offer.**

1. Description of the proposed system.
2. Description of the proposed method .
3. Leaflets (with pictures ) in which all the technical characteristics of the system will be described.
4. The supplier must include in his technical offer a list of customers (name, addresses, telephones)which use the offered system of analysis in Greece or worldwide.
5. A list of spare parts .This list should not include prices.  
However, the same list with the price of the spare parts must be included in the financial offer. The prices of the spare parts will not be taken into account the evaluation of the offer.
6. All the above mentioned specifications must be replied line by line by the bidder, on pain of exclusion, and must be proved clearly in the manufacturer's brochures and data sheets.
7. The supplier has to declare in his technical offer if the system requires preventive maintenance. If it is required, he must include in his economic and not in his technical offer, separately, the cost of this preventive maintenance for five years. The above cost of preventive maintenance will be included to the cost of purchasing the system for the election of the lowest bidder.

### **Part IV : Additional requirements.**

1. In case of a non accurate translation , the greek text of the specification will prevail.
2. In case of discordance between technical/special requirements and general requirements ,the technical/special requirements will prevail.