

# TOGA-3007i

## Transformer Oil Gas Analysis



EPCC / PRODUCTS / APPLICATION / SOFTWARE / ACCESSORIES / CONSUMABLES / SERVICES

**Analytical Technologies Limited**

An ISO 9001 Certified Company

[www.analyticalgroup.net](http://www.analyticalgroup.net)

- The TOGA GC Systems are designed to analyze oil from electrical insulation materials that may have decomposed under thermal, or electrical stresses. The gaseous decomposition products indicate the type of fault inside the transformer. The TOGA GC Systems separate all 11 components in one injection; Hydrogen, Oxygen, Nitrogen, Methane, Carbon Monoxide, Ethane, Carbon Dioxide, Ethylene, Propane, Acetylene, and Propylene. All compounds are detected with the sensitive and universal Helium Ionization Detector (HID). Our innovative 2 column and valve configuration simplifies this analysis. The TOGA GC Systems follows ASTM 3612C for gas analysis using headspace injection. The headspace sample can be injected using a multi-vial autosampler, or a single sample headspace accessory can be built into our Series 3007i Lab GC, or the Portable Companion 2, allowing you to take the analyzer with you into the field. Only a small tank of Helium is need to operate the GC System. The fast heating and rapid cooling column oven in every TOGA GC assures rapid sample turnaround. The fully integrated TOGA GC Analyzer Systems are small and lightweight and all TOGA systems are modular for expandability, upgrades, and easy service.

## ►► Available Configurations Include:

3007i-C-078 - Series 3007i TOGA GC Analyzer (HID, Headspace Concentrator, 2 Columns)

3007i-C-082 - Series 3007i TOGA GC Analyzer (HID, FID/Methanizer, Headspace Concentrator, etc.)

3500-C2-078 - Companion 2 Portable TOGA GC Analyzer (HID, Headspace Concentrator, 2 Columns)

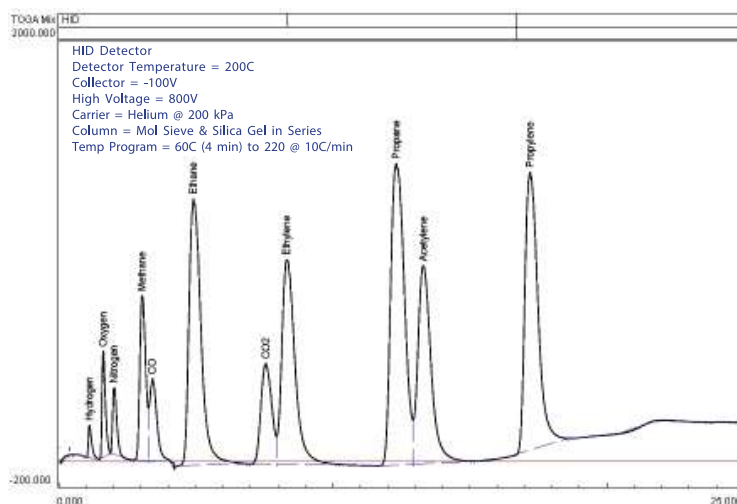
3500-C2-082 - Companion 2 Portable TOGA GC Analyzer (HID, FID/Methanizer, Headspace Concentrator, etc.)



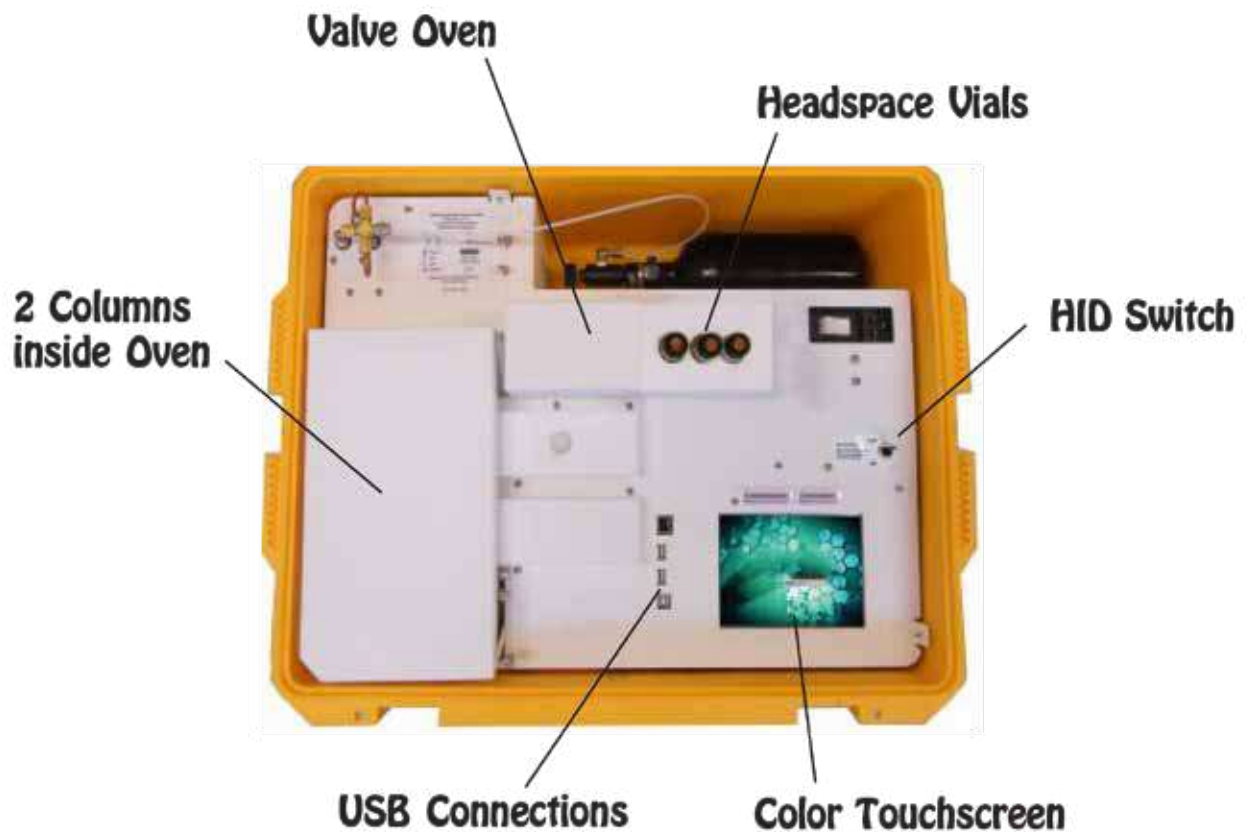
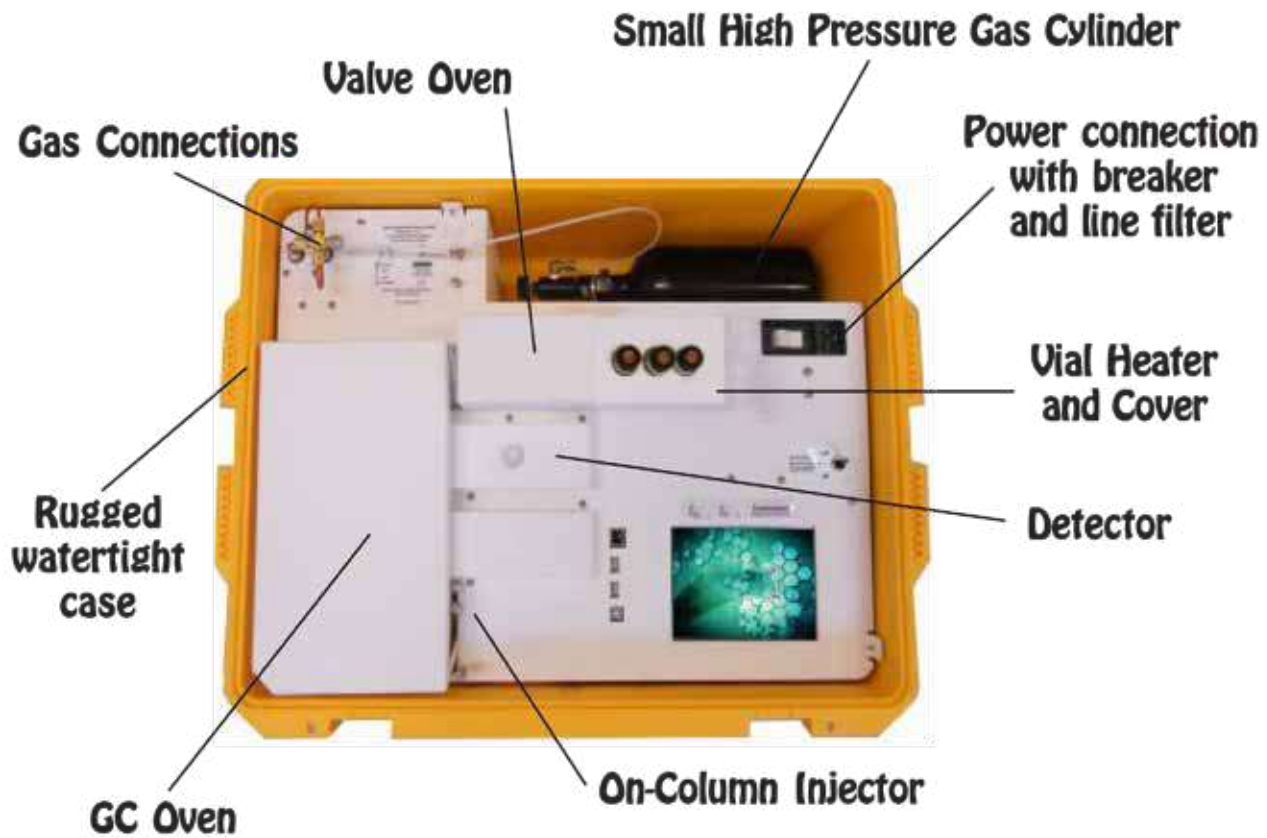
Companion 2 portable GC  
(with Headspace Concentrator)

### TOGA - Gas Analysis

Component	Area	ppm
Hydrogen	831.2	1000
Oxygen	2722.6	1000
Nitrogen	2147.6	1000
Methane	7037.0	1000
CO	3685.2	1000
Ethane	24484.2	1000
CO2	7996.0	1000
Ethylene	19515.4	1000
Propane	30906.7	1000
Acetylene	18363.6	1000
Propylene	27521.3	1000



►► **Companion 2 TOGA Layout**



## ►► Plumbing Diagram

### • TOGA Headspace Concentrator

The Headspace Concentrator for Companion GC's are built right in to provide the shortest possible sample path. The Sample Vial is heated and then consistently Pressurized before loading the Sample Loop. A fixed Sample Loop ensures reproducible sampling and the sample lines are Flushed between analyses to limit any cross over contamination. The entire sequence of the Headspace Concentrator is automated through the Timeline sequence of the GC Control Software for the analysis of one sample at a time, while two other samples are heated to equilibrate.

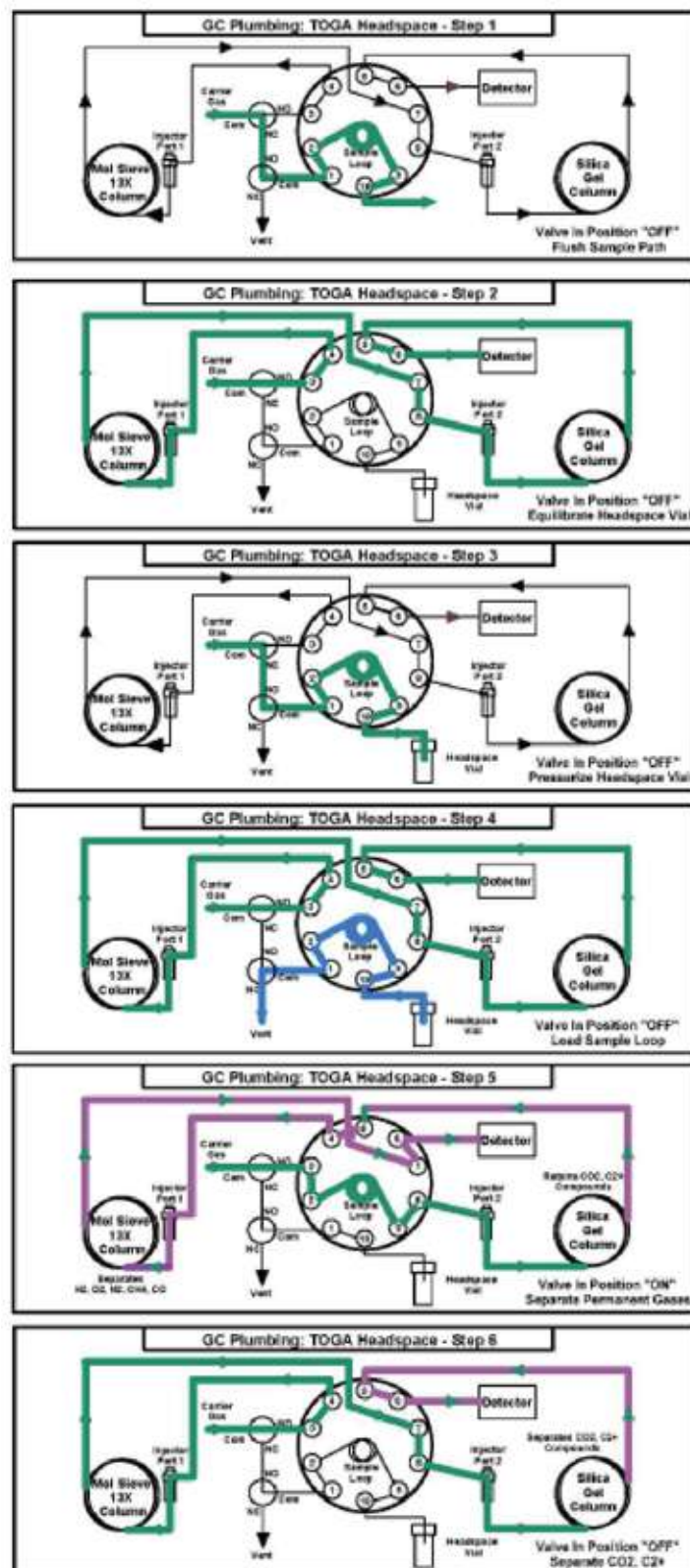
### • TOGA Plumbing Diagram

In the 1st Step the carrier gas is diverted to Flush out the Sample Lines between runs. During the 2nd Step the carrier gas flows to the analytical column and the Headspace Vial is heated with the Vial Heater and allowed to equilibrate. The Sample Probe is then inserted into the Headspace Vial. During the 3rd Step the Headspace Vial is pressurized for a few seconds. In the 4th Step the sample is loaded onto the Sample Loop by releasing the pressure in the headspace vial. In the 5th Step the Sample Valve is rotated to the ON position and the carrier gas sweeps the components from the Sample Loop onto the analytical columns. In the 6th Step the Sample Valve is rotated to the OFF position and the carrier gas sweeps the components from the Sample Loop onto the analytical columns.

### • TOGA Column Configuration

The unique 2 column configuration simplifies the compound separation and analysis of the TOGA Headspace sample. The columns are plumbed in series through the same Sample Valve as the Headspace Concentrator.

In Step 5 the Sample Valve is rotated to Inject the sample onto the analytical columns. The Silica Gel column retains CO<sub>2</sub> & the C<sub>2</sub>+ hydrocarbons, while the lighter compounds (H<sub>2</sub>, O<sub>2</sub>, N<sub>2</sub>, CH<sub>4</sub>, & CO) pass through and are further separated on the Molecular Sieve column. Once the lighter compounds have been separated the valve is rotated back in Step 6 separated the valve is rotated back in Step 6 hydrocarbons) are separated on the Silica Gel column.



**TOGA Headspace Plumbing Diagram**

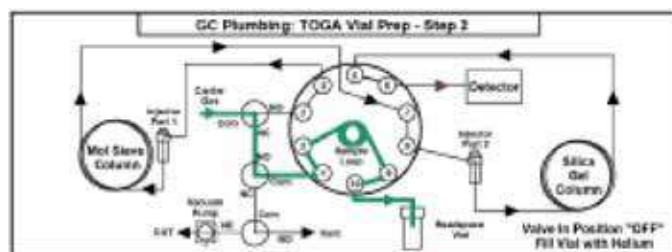
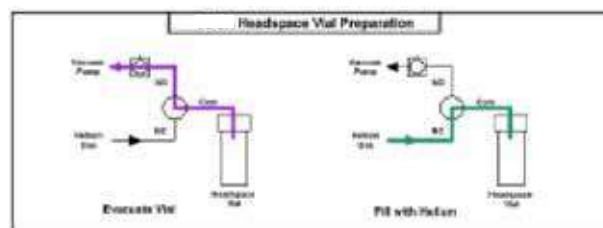


## ►► TOGA Vial Preparation Station

### • Clean Headspace Vials

One of the most difficult parts of the TOGA analyses is the sampling procedure. The first step is taking a gas tight syringe and inserting the needle under the surface of the oil to get a representative sample. The second step is injecting the oil into a clean vial. If either step is not successful, then you will see Oxygen and Nitrogen contamination from the air.

To insure that the sample vial is clean we have built in a Vial Preparation Station. Using the same technique that cylinder manufacturers employ to clean gas cylinders between uses; we evacuate, then re-fill the vial with helium several times to reduce Oxygen and Nitrogen to low ppm levels. The helium comes from the same supply as the carrier gas. A 2nd Method is loaded in the DPS Software to automatically clean the vials. The sample probe is inserted through the septum and the START button is pressed. The vials are prepared one at a time, but several can be prepared at once to be used throughout the day.



### • Plumbing Diagram

The first diagram is simplified to show that we evacuate and re-fill the vial using carrier gas. The 2nd diagram is the actual plumbing configuration when the Vial Preparation Station is connected to the rest of the TOGA plumbing.



## ►► TOGA Gas Chromatograph Features

- **System Configuration :** A Simple and efficient configuration using two packed columns, one valve, and a single HID Detector. The Silica Gel column separates all of the compounds except it has trouble with the permanent gases. To solve this problem, we have added a Molecular Sieve column in series with the Silica Gel column to separate the permanent gases. Once they are separated we switch the valve back to take the Molecular Sieve column out of the sample path and let the remaining compounds travel through the Silica Gel column to the HID detector.
- **Sample Information :** The eleven most common compounds are included in this analysis scheme which meets ASTM-D3612C methodology. The compounds included in this method are H<sub>2</sub>, O<sub>2</sub>, N<sub>2</sub>, CH<sub>4</sub>, CO, C<sub>2</sub>H<sub>6</sub>, CO<sub>2</sub>, C<sub>2</sub>H<sub>4</sub>, C<sub>2</sub>H<sub>2</sub>, C<sub>3</sub>H<sub>6</sub>, and C<sub>3</sub>H<sub>4</sub>. The results from the analysis of these compounds helps target the underlying fault condition of the transformer. The action levels indicate the concentration levels where the fault is severe and action should be taken to mitigate any possible

### Parts per Million (ppm)

No.	Compound	Detection Limit	High Concentration	Action Level
1	Hydrogen	50	20,000	100-500
2	Oxygen	10	20,000	NA
3	Nitrogen	10	20,000	NA
4	Methane	10	20,000	100-400
5	Carbon Monoxide	10	20,000	100-1000
6	Ethane	10	20,000	100-400
7	Carbon Dioxide	10	20,000	150-3000
8	Ethylene	10	20,000	500-2000
9	Propane	10	20,000	100-500
10	Acetylene	10	20,000	100-400
11	Propylene	10	20,000	100-500

- **Headspace Accessory :** The built-in headspace vial accessory, including vial heater, sample valve, pressure and vent solenoids, and sampling probe help automate the TOGA analysis in either the Companion or Series 3007i GC TOGA Systems. The pre-purged vial containing the oil sample is heated and allowed to equilibrate in the vial heater prior to analysis. There are positions for 3 vials, so once the first has equilibrated, the analysis can proceed one sample after another. The analysis is only manual as far as the user needs to insert the sample probe into the headspace vial. The remainder of the analysis sequence is automated.
- **Headspace Autosampler :** For a completely automated TOGA System the Series 3007i GC can be equipped with a Headspace Autosampler with a 40 vial capacity. Once the vials are loaded the autosampler and Series 3007i TOGA GC System work in unison to analyze and report the sequence of samples.

## ▶▶ TOGA GC Control Software

Easy to learn and master using a Graphical User Interface (GUI) and Color Touch Screen.

Editors let you customize the files associated with the GC Method.



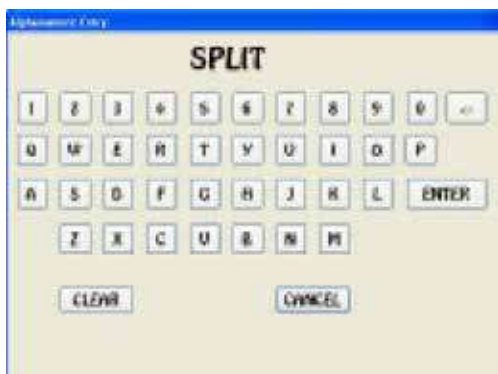
Oven Temp Program Editor



Timeline Editor



Carrier Pressure 1 Editor



Number Pad  
for entering Values



GC Status pages display the parameters in the method, both graphically and as text and values.

Method Editor



Oven Status



Detector Status

System Status



Run Status

System status pages display the health and viability of the GC instrument.



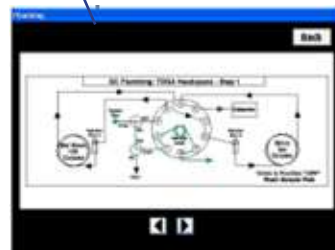
Hardware



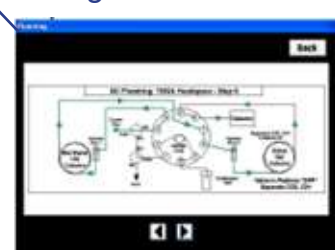
Configure Names



Diagnostics



Plumbing - Steps 1...6





## ►► TOGA GC Specifications:

### • Electronics Module :

- Enter and store GC Methods via Color Touch Screen
- Actual and set-point display of all GC parameters
- Safety Limits on all user entered parameters
- Oven Temperature Programs (OTP) with Multiple Ramps
- Pressure Programs for Carrier Gases with Multiple Ramps
- Timeline for sequencing Relays and Valve
- Detector Control of all Parameters on one page
- Electronic Pressure Controllers (EPC's):
  - Atmospheric Pressure & Temperature Compensation
  - EPC Pressure Control with 0.1 kPa set-point resolution
- Plug and Play GC Control, Oven, and Detector Board
- Microprocessor Controlled
- Proprietary Digital Signal Processing
- Digital Signal Outputs for each Detector

### • Detector :

HID – Helium Ionization Detector (10 ppm detection limit, dependent on sample loop size)

- 400 C Temperature Limit with 0.1 °C set-point resolution
- 24-bit Digital Outputs for the detector via USB
- EPC Pressure Control with 0.1 kPa set-point resolution

### • Columns:

- 1m Molecular Sieve
- 2m Silica Gel

### • Series 3007i Oven Module:

- Ambient to 400° C Column Oven
- Up to 100 °C per/min Oven Ramp
- Fast Cooldown 300 °C to 50° C in 3.5 min
- 1000 watt total Heater Elements
- Temperature Ramps with 0.1 °C set-point resolution
- 23 x 23 x 20 cm area for Glass, SS, or Capillary Columns

### • Companion 2 Oven Module:

- Ambient to 325 °C Column Oven
- Up to 80 °C per/min Oven Ramp
- Fast Cooldown 300° C to 50° C < 4 min
- 200 watt Heater Element
- Temperature Ramps with 0.1 °C set-point resolution
- 12.5 x 10.5 x 12.5 cm area for Packed, or Capillary Columns
- 7 amps at 48 Vdc total power consumption

### • Built-In Accessories:

- Sample Valve - Electronically Actuated
- Heated Valve Oven
- Headspace Concentrator
- Flow Control Solenoids

### • Injector:

- Heated On-column Injector
- Multiple Pressure Ramps with 0.1 kPa set-point resolution

### • Data Communications:

- Bi-directional communication with popular Data System

### • Network Connectivity:

- Enterprise Compatible Network GC running Windows XP
- Ethernet Connection using Windows Network Protocol
- On Board ETX Computer for GC Control and Data Acquisition
- Remote Control of GC and Data Acquisition over LAN

## HPLC Servicing, Validation, Trainings and Preventive Maintenance :

**HPLC Servicing** :HPLC Servicing : We have team of service engineers who can attend to any make of HPLC promptly @the most affordable cost.

**Trainings** :We also take up preventive Maintenance to reduce downtime of HPLC's Trainings.

**AMC's/CMC** :AMC's/CMC :We offer user training both in-House and at customer sites on HPLC principles, operations, trouble-shooting.

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Water purification  
system

## Regulatory compliances



## Corporate Social Responsibility

Analytical Foundation is a nonprofit organization (NGO) found for the purpose of:



**Analytical**  
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1. Research & Innovation Scientist's awards/QC Professional Award : Quality life is possible by innovation only and the innovation is possible by research only, hence ANALYTICAL FOUNDATION is committed to identify such personalities for their contributions across various field of Science and Technology and awarding them yearly. To participate for award, send us your details of research / testing / publication at [Info@analyticalfoundation.org](mailto:Info@analyticalfoundation.org)

2. Improving quality of life by offering YOGA Training courses, Work shops/Seminars etc.

3. ANALYTICAL FOUNDATION aims to DETOXYFY human minds,souls and body by means of yoga, Meditation, Ayurveda, Health Care, Awards, Media, Events, Camps etc.

## Reach us @



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