

## Specifications for the CHN and Sulphur Elemental Analyser

### General Specifications

- 1) The Elemental Analyzer should be able to achieve rapid and precise results for Carbon, Hydrogen, Nitrogen (CHN) and Sulphur in diverse organic matrices according to AOAC, ASTM, ISO, AACC, AOCS, and ASBC approved methods of analysis.
- 2) The Elemental Analyzer shall utilize a combustion technique with independent detectors optimized for each element (thermal conductivity for nitrogen; infrared for carbon, hydrogen and sulphur) for measurement of all elements of interest, speeding up the analysis time and eliminating the need for combustion gas separation techniques.
- 3) The Elemental Analyzer should be available in Helium carrier gas models for the analytical flow path leading to the thermal conductivity cell.
- 4) The Elemental Analyzer should operate using Oxygen, Helium and Compressed Air of the following gas purities:
  - a. Oxygen - 99.99% pure
  - b. Helium - 99.99% pure
  - c. Compressed air - source must be oil and water free.
- 5) The Elemental Analyzer must have automatic temperature and barometric pressure compensation allowing it to operate at high altitude of at least 2500 meters above sea level.
- 6) The Elemental Analyzer must utilize an external high temperature furnace for Sulfur determination.
- 7) The Elemental Analyzer should be able to analyze samples for Carbon, Hydrogen and Nitrogen in the internal furnace and samples for Sulfur in the external furnace simultaneously.
- 8) The Elemental Analyzer must provide compatibility to an external balance, printer, and Laboratory Information Management System (LIMS).
- 9) The Elemental Analyzer must provide compatibility to an external pyrolysis furnace capable of operating at 1300° C for micro Oxygen determination either as standard or as an optional future upgrade.
- 10) All chemical reagents utilized in the Elemental Analyzer must have a minimum lifetime of 500 analyses before reagent change is required, maximizing the uptime and reducing the operator time requirement related to routine instrument maintenance.

- 11) The Elemental Analyzers supplied must be manufactured by a recognized and reputable instrument manufacturer with an established user base (user list must be attached). All sales, support, and service must be directly available from the manufacturer and not a third party distributor.
- 12) Specify if any similar scientific laboratory equipment has earlier been supplied for soil testing (must attach the relevant documents as an evidence)
- 13) Submit a list of CHN and Sulphur analyser that has so far been supplied to the regions preferably neighbouring countries. Supplier is also required to specify both the volume and weight of the equipment.
- 14) No parts or accessories which are locally fabricated will be accepted other than the genuine parts from the equipment manufacturer.

### **Detection Method**

- 15) Carbon/Hydrogen/Sulfur: Non-Dispersive Infrared (IR) Absorption
- 16) Nitrogen: Thermal Conductivity (TC Cell) Detector

### **Sample Mass**

- 17) The Elemental Analyzer must be able to analyze the maximum specified sample mass of the instrument regardless of the carbon content or matrix of the sample.
  - a. CHN: Up to 250 mg, 100 mg nominal.
  - b. S: Up to 350 mg, 250 mg nominal.

### **Instrument Range**

- 18) Carbon: 0.02 to 175 mg (0.02% to 100% at nominal weight of 100mg)
- 19) Hydrogen: 0.1 to 12 mg (0.1% to 12% at nominal weight of 100mg)
- 20) Nitrogen: 0.04 to 50 mg (0.04% to 50% at nominal weight of 100mg)
- 21) Sulfur: 0.01 to 20 mg (0.004% to 8% at nominal weight of 250mg)

### **Precision**

- 22) Carbon: 0.01 mg or 0.5% RSD, whichever is greater.
- 23) Hydrogen: 0.05 mg or 1.0% RSD, whichever is greater.
- 24) Nitrogen: 0.02 mg or 0.5% RSD, whichever is greater.

25) Sulfur: 0.005 mg or 1% RSD, whichever is greater.

### **Analysis Time**

26) The Elemental Analyzer must be capable of performing an analysis for Carbon, Hydrogen, Nitrogen and Sulfur simultaneously within 4.5 minutes.

### **Automation**

27) Instrument automation must use a low-maintenance, rotating carousel that has a standard capacity of 30 samples, but can be optionally increased up to 120 samples without changing sample mass capability.

### **Internal Furnace**

28) The Elemental Analyzer must ensure complete combustion of macro samples by providing an internal two-stage combustion furnace that is capable of independent temperature control up to 1050°C.

29) The furnace must provide a 100% oxygen environment with additional oxygen being supplied above the sample using a quartz lance to ensure complete combustion without manipulating sample size. The furnace shall not utilize oxygen injection/mixing techniques.

30) The furnace shall only utilize oxygen for the combustion process and carrier gas in the furnace and contain no reagent chemical or metal oxides within the primary furnace.

### **External Furnace**

31) The external furnace shall utilize a horizontal combustion tube capable of temperature control up to 1450°C for Sulfur determination.

32) The external high temperature Sulfur furnace must be capable of performing analyses on macro samples up to 350 mg in a reusable ceramic sample container.

33) The furnace must be concentric in design to ensure complete combustion of the evolved gases with all evolved gases passing through the hottest portion of the combustion tube twice ensuring maximum exposure to the hottest portion of the combustion tube.

### **Software**

34) The Elemental Analyzer must use a Windows®-based operating software that supports compliance to 21 CFR Part 11 regulations, contain an on-board help manual, and perform wellness checks of the instrument based on user-defined service conditions.

- 35) The Elemental Analyzer software must contain an automated system check that verifies internal network communications, solenoids and switches, system pressures, furnace control, and temperature.
- 36) The Elemental Analyzer software must contain real-time service diagnostics, including ambient charts of instrument temperatures, pressures, and detector signal; manual control of solenoids and switches; automated leak checks; and network and communications diagnostics.
- 37) The instrument software must offer a multilingual user interface.
- 38) The instrument software must have user-definable:
  - a. Counters to aid in the tracking of routine maintenance procedures and reagents or other expendable components.
  - b. Gas conservation mode helping to avoid wasting costly gas.
  - c. Fields for automatic calculations based on the elemental results.
- 39) The instrument manufacturer must be able to provide remote service diagnostics from anywhere in the world with a separate software package designed specifically to connect the user with the instrument's service personnel.

### **Operation and Service Manual**

- 40) A complete operator's instruction and service manual shall be supplied in both hardcopy as well as a searchable PDF softcopy contained within the software.

### **Installation, Commissioning & Training**

- 41) The quoted price shall include installation, start-up and on-site training for 3 days to the purchaser's staff by a qualified company representative. Prior to installation of the product, the purchaser will be contacted to (1) assure that the pre-installation guidelines have been completed and (2) arrange for the installation of the product
- 42) Upon completion of the installation, the purchaser should be presented with a copy of the Acceptance Report.
- 43) Installation and Training must be provided onsite by the manufacturer and not a third party distributor.
- 44) Training shall cover the theory of operation of the Elemental Analyzer, operation, calibration procedures, hands on operation, routine maintenance including basic trouble shooting mechanisms and other essential services.

### **Monthly Maintenance Inspection**

- 45) For the first year after installation the Supplier will conduct on a monthly basis at no additional cost online system and maintenance inspections via internet connection to the

Elemental Analyzer. Online inspection should include diagnostic checks of instrument temperatures, pressures, detector signals; manual control of solenoids and switches; automated leak checks and network communications as well as inspection of blanks, standard and calibrations. On completion of the inspection suggestions/remedies are communicated to onsite operators.

### **Warranty**

- 46) Equipment should be warranted to be free from defects in material and workmanship for a period of twelve months from date of installation, unless otherwise stated in writing. The supplier will repair or replace, free of charge, any part(s) which prove to be defective.
- 47) Equipment manufactured by other company should be covered by supplier to the extent of the warranty provided by the original manufacturer. Complete warranty information should be provided in the preface to the operating manual.

### **Specific Specifications of the Analyzer**

1. CHN and Sulphur Elemental Analyzer package must include the following;  
Model Combustion Furnace, Combustion Gas Handling and Aliquot Dosing System with Carbon, Hydrogen, Nitrogen and Sulphur Detection with 30 Position Autoloader, Sulfur Module, Windows based operating software, PC Tower, 19" Flat Panel Monitor, Operating Supplies
2. **Required Items**  
The required items should not be less than quantity specified below. The supplier should also specify and include any other essential items required for initial testing of the equipment at the time of its installation, in case bidding documents has failed to include them.
  - ✓ Anhydron 1bl./btl,
  - ✓ Reagent Furnace 100g
  - ✓ Lecosorb 500 g/btl. 20-30 Mesh
3. **Operating Supplies**
  - ✓ Kit PmaChn/cn/fp628 With Sulfur
  - ✓ Cup Sample Tin Large 400/pk
  - ✓ Pack Consumable 628 Sml Tin Foil Cup 5k
  - ✓ Boat Crucible Zir 250/pk
4. **Other Accessories**
  - ✓ Nicotinic Acid Standard
  - ✓ Edta Standard 50g/btl
  - ✓ Std Rm Phenylalanine 99% 50g
  - ✓ Std Rm Coal Prox Plus Med 50g
  - ✓ Std Rm Met Coke Prox Plus 50g

- ✓ Std Rm Pet Coke Prox Plus, % Sulfur 5.5, 50g/btl
- ✓ Hot Plate Crucible Tray (requires 606-563 Hot plate Tray liner)
- ✓ Hot Plate Tray Liner
- ✓ Kit Regular Oxygen - Two Stage
- ✓ Inert Gas Regulator Kit - Two Stage
- ✓ Kit Regulator Pressure 2-stage Air Cga 3
- ✓ Kit Printer Officejet Pro Hp6230
- ✓ Sartorius Secura model balance and interface kit, 0.1mg readability, 120g capacity, cables for USB or serial interface

### **Transportation costs**

**The bid should be inclusive of;**

1. Shipping charges
2. Installation charges
3. Charges for delivering to Paro airport or to the laboratory

### **Payment**

The payment will be made only after the equipment is fully installed; its performance tested and accepted by authorised user - Soil and Plant Analytical Laboratory (SPAL). The acceptance certificate will be issued by SPAL following which the payment will be released.