



## Carbon~14 and Tritium Analysis Furnace

Tritium (the third and radioactive isotope of hydrogen) and Carbon~14 have been identified for inclusion on the priority list of notifiable radionuclides for waste destined for storage on site of origin, or at an alternate approved storage area. Therefore, the demand for the analysis of these two isotopes in decommissioning wastes has steadily risen in recent years. In addition, tritium (as tritiated water) and Carbon~14 are discharged to the environment from nuclear operation, so there is also a demand for the analysis of environmental materials for these two nuclides.

The only applicable analytical technique is to combust the sample to completion, aided by a suitable catalyst, and selectively trap the chief combustion products, ie carbon dioxide and water. The concentration of the Carbon~14 and tritium (tritiated water) in the trapping agents can then be assessed by liquid scintillation counting and the sample tritium and Carbon~14 concentrations can be calculated.

Because of the aforementioned process requirements, Carbolite was prompted to design and build a combustion tube furnace specifically designed for Carbon~14 and tritium analysis.

### General Features

- Integral ceramic work tube with external element winding creates furnace chamber.
- Heated chamber is divided into two equal length zones.
- Maximum operating temperature of 1200°C.
- Furnace incorporates low thermal mass ceramic fiber insulation for improved response times.
- Long-life thermocouples are located in a protection tube between the chamber work tube and heating element.
- Furnace controls are built into the furnace supporting base cabinet, providing convenient observation and access to all power and temperature controls.
- The Carbolite Model 3508P1 20 segment programmable control is provided as standard, and allows temperature programming of the sample zone.
- The second furnace zone can be independently controlled by a slave controller tied directly to the primary sample zone through the thermocouple circuitry.
- A standard feature of the furnace control allows direct linkage to a computer via RS 485 digital communications. This feature, when combined with appropriate software, allows control of all instrument parameters from a remote computer.



MTT 12/38/850/3508P1/OTC

- The two furnace zones are protected by two independent over-temperature protection control systems.
- A safety outer mesh guard provides low temperature external surface.

### Glass Ware Features and Benefits

- All process associated and necessary glassware is provided with the furnace system.
- The standard quartz combustion tube is not an integral part of the furnace, facilitating quick and easy replacement.
- The same combustion tube, gas bubbler train and associated connectors are fabricated entirely from glass, which allows these components to be easily decontaminated, thereby avoiding analytical "memory" effects.
- The glassware and combustion tube are relatively inexpensive, allowing replicate sets to be easily retained and used for different classes of sample. This allows a furnace to be used to analyze a diverse range of materials, and would cover those of an environmental origin to those generated by decommissioning operations.
- The Carbolite Carbon~14 and tritium analysis furnace incorporates a uniquely designed manifold which permits oxygen to be delivered to the catalyst to operate at its optimum at all stages of the sample combustion.
- Because the gas delivery tube runs through the heated catalyst, there is no possibility of thermal decomposition products "condensing out" on the outside surface of the gas delivery tube.
- Oxygen is ejected at right angles to the main gas flow, which reduces opportunities for the "back flow" of sample combustion gases/products into the gas delivery tube.

### 1200°C Two Zone Wire-Wound Tube Furnace

Furnace Model	Max. Temp. (°C)	Work Tube Inside Dia. Inches (mm)	Heated Length Inches (mm)	Overall Length Inches (mm)	TC Type	Max. Power	Furnace Voltage (kW)	External Dimensions Inches (mm)			Shipping Weight (lb.)
								Height	Length	Depth	
MTT 12/38/850	1200	1.5 (38)	33.50 (850)	35.50 (900)	N	3.1	208/240	17.00 (430)	35.50 (900)	14.75 (375)	104