TETREON TECHNOLOGIES LIMITED

Tetreon Technologies Product Specification for Thermco Horizontal Furnace Systems

PRODUCT SPECIFICATION

Specification Number: F-HTR45/49

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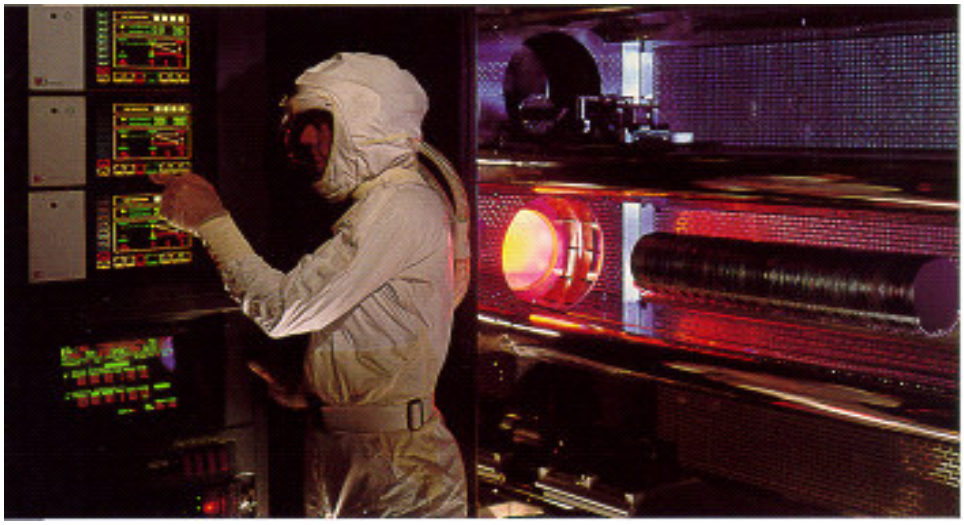

Models HTR-4500 and HTR-4900 Horizontal Furnace Systems

APPLICATION

Thermco model 4500/4900 diffusion furnaces are four-process chamber systems used primarily for processing semiconductor substrates up to 125 mm in diameter. The only difference between the two models is the length of available flat zone, with the 4900 series having greater wafer processing capacity. Each chamber can accommodate process tubes up to 8.5 inches (216 mm) in diameter. The furnace main frame is compatible with Thermco load stations, source cabinets, and certain types of automation such as cantilever boat loader mechanisms and elevators that place the boats onto the cantilever paddle.

The following processes are standard for the 4500 and 4900 furnace systems

- *Silicon nitride*
- *Ramped temperature poly*
- *Uniform grain poly (flat temp)*
- *TEOS*
- *VLTO*
- *BPSG*
- *High temperature oxide (with or without external torch)*
- *5 or 6 loop pyro with DCE (TCA) or HCL*
- *3 or 4 loop liquid dopant (POCL3 or BBR3)*
- *2 loop forming gas anneal*
- *High temp high flow anneal*
- *Low temp anneals or cure*

CONTROL SYSTEM

The 4500/4900 furnace is controlled by the industry leading Thermco TMX controller, recognised as one of the most flexible and reliable furnace control systems available and with a user installed base of thousands of units. The TMX PC-MUX controller combines the tried and trusted recipe and system control formats of earlier generation TMX products but with reliable PC based hardware and a user friendly Windows interface. The system comprises one computer per tube and one MUX computer for recipe generation and management in a free-standing console.

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PHYSICAL DESCRIPTION

Materials and Construction

The furnace frame is constructed of welded and formed cold rolled steel painted with industrial grade water based enamel paint. Parts and components that are subjected to elevated temperatures are constructed from stainless steel. A refractory blanket material with a reflective coating is used on the inside walls of the structure to reduce the temperature of the outer skin to ambient levels. Each heating element winding inside the canister is constructed from an appropriate Kanthal wire material depending on the temperature application. The canister around the element has an aluminium or stainless steel outer skin with ultra high purity alumina refractory materials around the element winding and at each end. Electrical connections are made to each element temperature zone via taps that protrude from the element through the side of the canister.

Type 'R' or type 'B' spike thermocouples are used to sense the element temperature and feed the signal back to the temperature control system. Special clamp brackets are designed to hold the thermocouples in the proper location and seal the thermocouple hole in the canister. Special dust stop collars and end plates are used to achieve a thermal seal between the process tube and the vestibule end blocks at each end of the canister.

Each tube level includes a 12 inch deep by 12 inch round stainless steel exhaust scavenger box at the load end of the furnace. The scavenger box has continuously welded seams and is passivated and electro-polished to reduce susceptibility to corrosion. The scavenger box is connected to an individually exhausted plenum. Each plenum includes an adjustable damper and differential pressure gage for adjusting and reading scavenger exhaust pressure.

Overall Dimensions	**4900 series**	**4500 series**
Furnace Length	84 inches (213.3 cm)	72 inches (183.0 cm)
Furnace Depth	28 inches (70.0 cm)	28 inches (70.0 cm)
Furnace Height	87 inches (219.0 cm)	87 inches (219.0 cm)
Weight	2,700 lbs	2,400 lbs

General Layout of Components

The lower frame area of the furnace contains the element transformers, power circuit breakers, SCR firing circuits and heat sink modules, cooling fans, and electrical power cabling. The upper chamber area houses the element canisters and element support structure along with the power cables and thermocouple wire and junction terminals. The water cooled heat exchanger that cools the furnace cooling air before it is returned to the room is located in the top of the chamber area. 250 CFM muffin fan type blowers are located in the box area above the heat exchanger to pull air through the furnace from the lower area up through the canister area and out the top through the heat exchanger.

The dimension from the floor to the tube centrelines are :

Bottom Tube	30.50 inches (77.5 cm)
Third Tube	44.75 inches (113.6 cm)
Second Tube	59.00 inches (149.8 cm)
Top Tube	73.25 inches (186.0 cm)

Compatible Modules

- Laminar flow load station module, model 5000LS

- Boat loader mechanisms, models D1 and D2

- Gas/source cabinet module, model 5000SC

- TMX computer control module and PC-Mux

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PERFORMANCE SPECIFICATIONS

Operating Temperature Range:

200 to 1250°C (1300°C with APM wire)

Uniform heated zone with up to 15.0 litres per minute gas flow, depending on wafer load size and shielding/ baffling at the load end of the process tube.

Temperature flat zone for process tubes up to 8.5" (216 mm) max OD.

4900 Series	750-1250°C	=	38-42"
	400-750°C	=	36-40"
4500 Series	750-1250°C	=	26-30"
	400-750°C	=	24-28"

Cold Start Ramp Rate:

Average ramp rate is 15°C per minute.

Cool *Down Rate:*

Furnace will cool from 1200 to 900°C at a linear rate of at least 3°C per minute.

Long Term Stability:

Furnace temperature will be stable within ± 0.25° C or better.

Recovery:

With a full wafer load, typical flat zone recovery at 900°C occurs within 18 minutes.

Fast Response:

Step changes of 100° C can be made with no change in control settings and minimal effect in uniform heated zone

Tube Interaction:

No interaction occurs between tubes as a result of the use of compensated temperature thermocouple junctions and the unique direct convection cooling system.

Power System:

Maximum reliability with secondary operated, zero-crossover fired SCR power controllers. SCR devices are specially selected for high overload ratings. Highly efficient direct convection or forced air cooling of all SCRs'.

Efficient power transfer and balance by utilising individual three phase element transformers for each furnace tube. Transformers are rated for 100% duty cycle.

Circuit breakers are used throughout system for maximum protection and ease of operation.

FACILITY REQUIREMENTS

Power:
440/460/480 volts, 3 phase. 60 Hz **or**
380/400/415 volts, 3 phase, 50 Hz

Control:
120 volts, 1 phase, 50/60 Hz by customer **or** optional transformer

Water:
8 GPM at 68°F (20°C)

SERVICEABILITY

- Easy access to all components by simple removal of panels or opening of access doors.
- All internal and control electronics are directly serviced from furnace front.
- Tetreon provide a spare parts lists for customer logistics planning.
- Unit is completely tested, checked and pre-wired for ease of installation.