

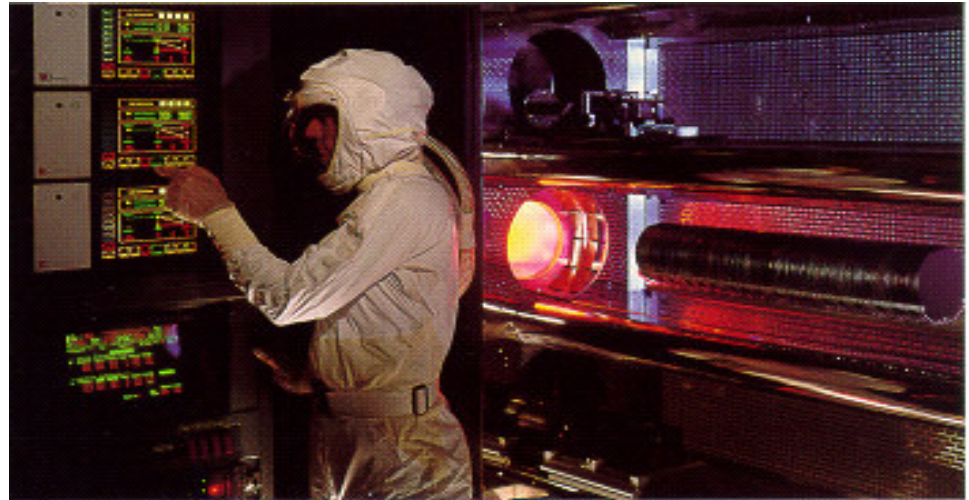


# Tetreon Technologies Product Specification for Thermco Horizontal Furnace Systems

## PRODUCT SPECIFICATION

Specification  
Number: F-HTR51/52

May 2005



## Models HTR-5100 and HTR-5200 Horizontal Furnaces

### APPLICATION

The Thermco Model 5100 / 5200 Diffusion Furnace is a four chamber systems used primarily for processing semiconductor substrates up to 150 mm in diameter. The only difference between the two models is the length of the available flat zone with the 5200 series having a greater wafer processing capacity. Each chamber can accommodate process tubes up to 10 inches (251 mm) in diameter. The furnace 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 5100 and 5200 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 furnace is controlled by the industry-leading Thermco TMX controller, recognised as one of the most flexible and reliable furnace control systems available, 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 new updated and very reliable PC based hardware. It 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 from 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 of the specific element. 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 of the element. 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 used to hold the thermocouples in the correct location and seal the thermocouple hole in the canister. Dust stop collars and end plates are used to achieve a thermal seal between the process tube and the vestibule blocks at each end of the canister.

Each tube level includes a 12" X 12" round stainless steel exhausted 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 gauge for adjusting and reading scavenger exhaust pressure.

Overall Dimensions	5200 series	5100 series
Furnace Length	84.00 inches (213.36 cm)	72.00 inches (182.88 cm)
Furnace Depth	29.50 inches (73.66 cm)	29.50 inches (73.66cm)
Furnace Height	104.25 inches (240.67 cm)	104.25 inches (240.67cm)
Weight	3200 lbs.	2900 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 air supply 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 the air through the furnace from the lower area up through the canister area and out through the heat exchanger.

The dimension from the floor to the tube centre lines are:

Top Tube	83.75 inches (212.73 cm)
Second Tube	66.50 inches (168.91 cm)
Third Tube	49.25 inches (125.10 cm)
Bottom Tube	32.00 inches ( 81.39 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



# Tetreon Technologies

## Product Specification for

### Thermco Horizontal Furnace Systems

#### PERFORMANCE SPECIFICATIONS

##### **Operating Temperature Range:**

200 to 1250°C (1300°C with APM wire heater)

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

Temperature flat zone for process tubes up to 10.0" (251mm) OD:

5200 series	750-1250°C	38-42 inches
	400-750°C	36-40 inches

5100 Series	750-1250°C	26-30 inches
	400-750°C	24-28 inches

##### **Cold Start Ramp Rate:**

Average ramp-up rate is 18°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  $\pm 0.25^\circ\text{C}$  or better

##### **Recovery:**

With a 7,500 gram 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 on uniform heated zone

##### **Tube Interaction:**

$\pm 0.1^\circ\text{C}$  interaction between tubes because of the compensated temperature thermocouple junction and 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 utilizing individual three-phase element transformers for each furnace tube. Transformers are rated for 100% duty cycle.

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

#### FACILITY REQUIREMENTS

##### **Power:**

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

##### **Control:**

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

##### **Water:**

8GPM at 60°F

#### SERVICEABILITY

- Field support by trained technical representatives provided on an as required basis.
- Easy access to all components by simple removal of panels or opening of access doors.
- All internal and control electronics are directly serviceable from furnace front.
- On delivery Tetreon issues a spare parts lists for customer logistics planning.
- Unit is completely tested, checked and pre-wired for ease of installation. The only required customer wiring is the connection to the input terminal blocks.

The furnace system includes an excess temperature switch in the furnace cabinet as well as internal excess temperature controls for each temperature zone of the element. The element zone temperature is sensed by a redundant thermocouple in each zone and controlled by a special "smart" over temperature card.