High-temperature Graphite Furnace

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High-temperature Pusher Furnace for Tungsten Carbide Production

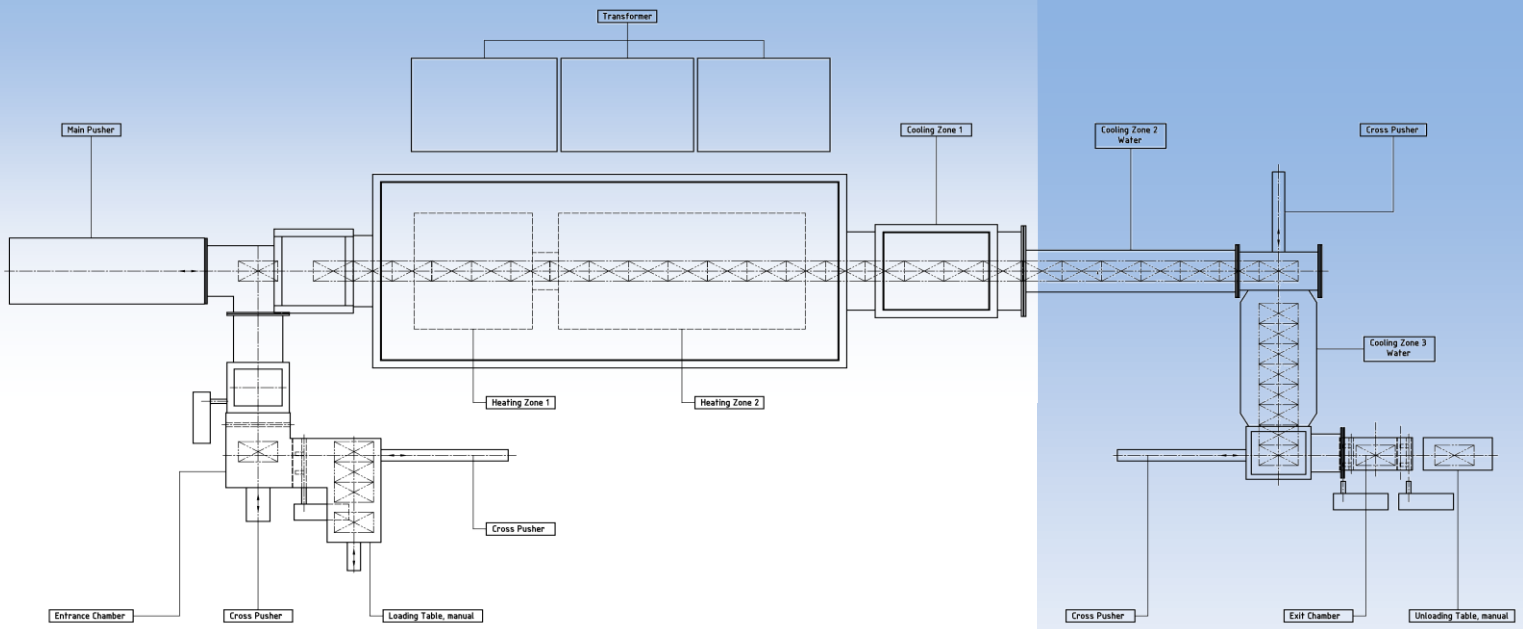
The fully automatic high-temperature pusher furnace is equipped with graphite muffle, graphite heating system and graphite insulating blankets.

The product to be treated is pushed through the furnace and its peripheral equipment in graphite trays. Robust motors or pneumatic cylinders operate the pushing machines for indexing conveying operation.

The sophisticated gas flow regime in the high-temperature section ensures a low oxygen content and thus reliable operation and long service life of graphite muffle and insulation under H_2atmosphere.

High-precision pyrometers are used for temperature control, ensuring the long-term temperature accuracy and consistency required for a stable process.

Available options include peripheral filling and emptying devices as well as product weighing stations.



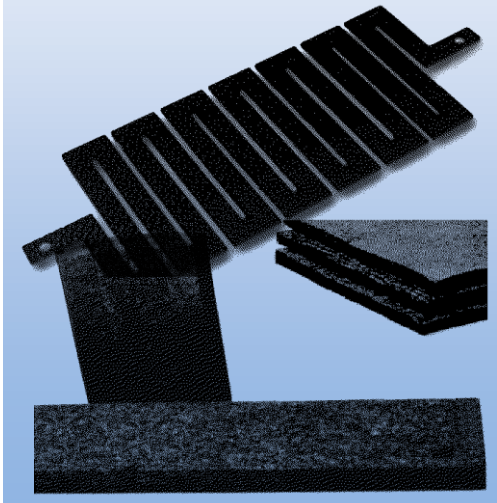
Specific features:

- Operating temperature up to 2,200 °C
- Temperature accuracy± 15 K
- 3 independent heating zones with graphite meander heaters
- Indirect water cooling zone
- Product entry and exit through vacuum lock chambers
- Throughput up to 30 annual tonnes

The high-temperature graphite furnace is essentially made up of following modules:

1. Entry lock chamber

A small pusher moves the product trays from the loading table into the entry lock chamber. Vacuum-tight entry and exit doors seal the lock chamber hermetically. Several pressure swing purge cycles replace the O_2-containing air by pure hydrogen before the trays are pushed from the lock chamber into the furnace.



2. Three-zone graphite heating module

Heat treatment of the product takes place inside the graphite muffle which is heated by meander-shaped external graphite heating elements in three separate zones. The heating elements can be replaced without having to remove the muffle.

In the first heating zone the product is heated continuously up to the final process temperature. The main zone in the middle holds the product at temperature according to the residence time required. The third heating zone assists in holding the temperature throughout the main zone and prevents any cooling effect from the adjacent cooling zone.

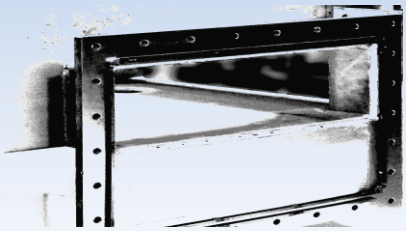
Most of the hydrogen required for the process enters the muffle at the exit and flows in countercurrent direction inside the muffle to the entry. A small part of the hydrogen also flows towards the exit.

3. Cooling zone 1 (soak zone)

Overall length and insulation of cooling zone 1 are designed to meet the user-specific process requirements so as to determine the soak time and the gradient of initial cooling.

4. Cooling zones 2 and 3 (water cooling)

The muffles of cooling zones 2 and 3 are fabricated from high-grade stainless steel and surrounded by water-carrying heat exchanger plates. In cooling zone 2 the product trays are cooled primarily by radiation and in cooling zone 3 increasingly by H_2 convection depending on temperature.



5. Exit lock chamber

A small cross pusher transfers the trays from the tray column in cooling zone 3 at right angles into the exit lock chamber. Vacuum-tight entry and exit doors seal the lock chamber hermetically. Then the lock chamber is evacuated and purged with N_2 to replace the H_2 atmosphere completely by nitrogen before the trays are discharged from the lock chamber to the unloading station.