

Induction heating for graphitizing process furnaces



Smart solution for multi-zone heating control

- Ideal for complex heat treatment processes, unbalanced furnace loading
- Power generator, with several outputs operated in PW mode
- Power factor over 0,92 , maintained on the power range
- Detection of the current leakage in each zone

Induction heating for graphitizing process furnaces is used for «infiltration» process, a thermal process where parts made of carbon-carbon composite materials, are heated at very high-temperatures, under Vacuum or controlled atmosphere conditions.

The standard graphitization process entails heating up a carbon part (porous or nonporous) to between 1,000°C and 2,800°C and infusing it with a humidified gas. The parts undergo long treatments and pressure matrix cycles (vacuum and gas pressure). The treatment is done in a reducing atmosphere (nitrogen or argon atmosphere at atmospheric pressure, reduced pressure or in a vacuum).

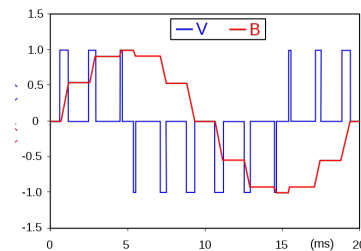
Advantages of the Fives solution

The inductor and the susceptor are placed in a chamber where the required pressure cycle takes place. The startup powers for more modern systems exceed 1,000 kW.

- Controlled and fast raising of the temperature
- Continuous modulation of the temperature in each zone
- Leakage current continuous protection (maximum security)
- Power factor > 0,92 in the entire power range

Operating principle

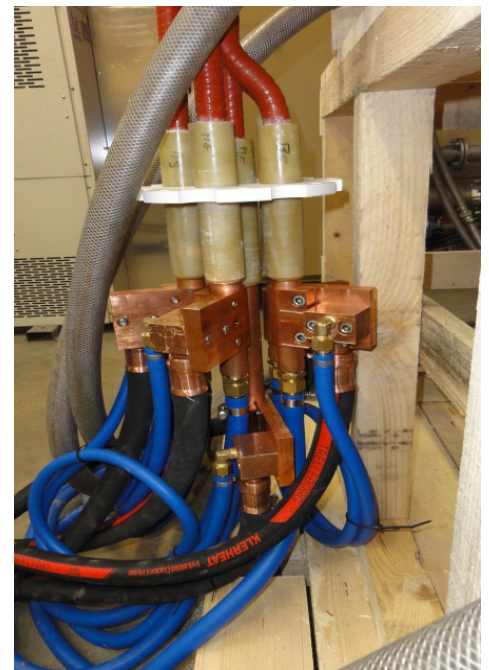
PWM Mode: Modulation of the pulse width according to power
Unlike most circuit oscillating at the resonant frequency, PWM mode aims at changing the average value of the voltage at a given frequency, thus changing the signal's duty cycle.



3 heating zones solenoid inductor

Example (graphitizing furnace)

- Inductor
- Susceptor
- Internal diameter
- Overall height
- Temperature process
- Payload
- Climb speed
- Generator
- Power characteristics
- Dimensions
- 3 heating zones
- pure graphite
- 630 mm
- 1600 mm
- 1000 °C
- ≈400 kg
- 10 °C/min
- Celes IS PWM 50/1.2
- 3x400 V 50/60 Hz
- 210 kVA
- 3200x800x2100 mm



Airtight electric connections