Cartridge Heaters

High-Density Cartridge Heaters – Medium-Density Cartridge Heaters – Low Voltage Cartridge Heaters

Dear Customer,

we would like to use this opportunity to thank you for buying this product from Friedr. Freek GmbH.

Please read this document carefully before installing the heater in order to learn important facts regarding the product's safety and use.

More information about our products you can find on our website: **freek-heaters.com**.

Content:

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Introduction

Cartridge heaters are reasonably priced, robust and easy to install. As a rule they employ a cylindrical stainless steel tube and thus provide a reasonable resistance to scale, corrosion and other lifetime reducing degeneration even at high temperatures. There is a heating wire inside which is wound onto a ceramic core. The number of coils varies depending on the power. In order to avoid a short-circuit, the cartridge heater is filled with magnesium oxide and compressed afterwards. Highly compacted they are produced with a surface watt density of up to 50 W/cm² and withstand highest stress if properly installed and appropriately controlled.

In the plastics industry cartridge heaters are used in hot runners in order to temper thermoplasts during injection moulding processes. Other areas of applications for process heat are e. g. diecasting or continuous casting in which zinc or aluminium are processed. Further applications are to be found in mechanical as well as medical and laboratory engineering.

Safety

As a manufacturer of heating elements, Freek is not responsible for the conditions in which its heating elements are installed and connected in the various customer-specific applications in which they are used, nor is it responsible for how the heating elements are controlled there. Rather, it is the customer's responsibility to be aware of and observe good engineering practice as it is recognised in the application and business markets in question. For example, many machines and their equipment are subject to the standard EN 60204 "Safety of machinery – Electrical equipment of machines".

Additionally, the customer is responsible for ensuring that electrical heating elements are only ever connected under the responsibility of a qualified electrician. This is because only a qualified electrician will know the risks associated with electrical heating elements, such as fire, explosion, combustion or electric shock, and – even more importantly – will know the safety measures that need to be put in place in order to prevent such events from occurring, even if the heating elements malfunction. Examples of these safety measures include protection against contact, thermal insulation, electrical insulation, temperature control, overtemperature prevention, earthing, residual current operated circuit breakers, overcurrent circuit breakers and miniature circuit breakers.

General Remarks & Handling

- Because of the hygroscopic characteristic of the used ceramic insulation materials they absorb moisture. Therefore we send our cartridge heaters usually in air-tightly closed plastic bags. When stored unprotected in environmental air it is absolutely important to check the insulation resistance before use and – if necessary – to dry the elements (controlled start-up or drying oven). If humidity is inside the heater and operating voltage is applied to it before pre-heating, even a faultless heater is at risk to fail.
- Bending the outside connection points (**exit type N**) could break the termination and must be avoided. Frequent movements of glasfibre isolated leads may cause damage and therefore has to be avoided.
- The temperature stress of max. 750 °C at the sheath is not valid for the connection area. The temperatures arising in the connection area determine decisively the suitability of the available exits.
- The max. temperature load of 750 °C at the cartridge sheath implies the assumption of an optimal heat transition and thus a low temperature gradient to the heating wire. Installation and operation conditions with exceptional superb thermal conduction (e.g. heat exchanger applications using aluminium bodies) increase the temperature gradient considerably and thus result in a higher temperature at the heating wire. Max. temperature at the sheath in such applications must be assessed lower accordingly. This is especially important for the design of the control system (position of thermocouple, control temperature, hysteresis).
- The stated nominal voltage must not be exceeded, otherwise overheat is risked. . For example, 253 V instead of 230 V (+10%) lead to 21% higher power!
- Generally it can be said: the better heat is carried off, or flows into the work piece respectively, the higher the surface watt density on the sheath can be. When calculating the power, the temperature control and the position of the thermocouple must always be taken into consideration.
- Watt densities on the cartridge sheath of up to 50 W/cm² are acceptable only controlled and in ideal thermal installation conditions. Materials with a good thermal conductivity and a narrow tolerated cartridge heater fit are therefore recommended strongly.
- For our ground **high density cartridge heaters** we recommend H7-holes with a surface roughness as small as possible.
- Form errors of the hole, crossing holes or shrinkage cavities obstruct the heat conduction and lead to heat accumulation which could partly overheat the cartridge critically.
- The connection area of cartridge heaters must be protected from lubricants, detergents and solvents, because these could diffuse into the ceramic and lead to short-cuts.
- In a solid combination of materials with different thermal expansion (e.g. steel and aluminium) or for extreme temperature gradients alongside the sheath of the cartridge heater heating wire and terminal pins can be exposed to heavy tensile loading and if worst comes to worst they can tear resp. break. Cause often is e. g. cracking of corrosion protective passive layers or the reduction of thermal tensile strength due to microstructural changes resp. phase transformation at certain temperature ranges. Especially at high operating temperatures and unavoidable mechanical stress alteration extensive load and endurance tests are indispensable before series start-up.
- It is not possible for Freek to perform tightness tests on welded or soldered connections. Coupling flanges, stainless steel corrugated tubes and similar components may be soldered or welded across their full connection seams, but customers themselves must determine whether these connections actually satisfy the tightness requirements that apply at the site in relation to gas or liquid media exposed to various pressure and temperature conditions. Customers must do this at some point either during goods receipt inspection or thereafter, but no later than the point at which their system is commissioned or dispatched.
- In every practice application there are working and environmental parameters which can not be calculated exactly in theory. That is why we recommend generally to test cartridge heaters in the application under real working conditions in advance.

No warranty claims can be derived from these user instructions.