

Barrier gas heating system with limiter cascade

Heating in ex-proof atmospheres

Small spark – big effect. That applies not only (but here in particular) to the oil and gas industry. For such applications, Elmess Thermosystemtechnik has developed a modular system of thermal cut-outs for control systems in the process industry which comply i.a. with the requirements of the ATEX Directive 94/9/EC. The cut-outs from the eBR6000 Series can be used in electrical factory equipment for temperature monitoring, for example to monitor the heaters in areas with a gas or dust explosion hazard, but also in non-electric equipment. The device proper is installed in the safe zone, and only the measuring lines are located in the potentially explosive zone.

Heating without the bang

Operators of barrier gas systems for turbochargers have to rely on particularly precise temperature-controlled barrier gas preparation in order to be able to operate delicate and complex shaft leadthrough systems reliably and with a long service life. As the manufacturer of the cut-out also produces the heating systems required for this, the company can develop and manufacture perfectly balanced systems. When operating these systems in potentially explosive atmospheres, an additional demand is for reliable protection against existing ignition hazards emanating from the system proper. The manufacturer's solutions meet these demands: The cut-out temperature is oriented to a value specified by the operator and is preset on delivery. It thus represents a manipulation-proof parameter for the operation. A special feature of the model series is the use of an optional integrated temperature controller within a cascade control system – with the same overall device dimensions as for the cut-out variant. The option for the temperature control is fed by the same sensor input as the thermal cut-out – in other words limiting and control effectively take place at the same measuring point. In the cascade control system, the device functions as a slave controller and in its Remote mode is remotely controlled by the degree of adjustment of an upline master controller installed in the same power and temperature control system which is linked to an additional separately located process temperature sensor. The compressor operator installs this directly at the barrier gas seal. The whole control system is thus divided into smaller and more easily controlled sections. The advantage of the cascade control is that the measurement, monitoring and control of the temperature takes place where the heat is generated. In addition, the system controls heat losses between the heater and the process temperature sensor. Standby operation of the heater in order to avoid cold barrier gas during start-up mode is also possible with this operating mode. The cascade control designed here as a cut-out cascade allows the operator to set a temperature curve geared precisely to the respective demands. There is never the risk of an uncontrolled shutdown of the equipment under control (EUC) with the thermal cut-out. Instead the device keeps the system in a stable control state just before the tripping threshold. For the user this results in a high plant availability and long service life for the barrier gas seal.

All-in-one solution

In one concrete case, a customer who produces compressor systems for the oil and gas industry, demanded that the instrumentation of the heating system be designed to comply with the "intrinsically safe" ignition protection type to EN 60079-11 (Ex ib). As the user can also use the thermal cut-out directly as an interface to the intrinsically-safe power circuits, he no longer requires additional barriers or isolation amplifiers. Particularly in the context of this protection type, an Ex i adapter supplied with the device simplifies the power supply to the device. The cut-out also performs the power supply to a measuring transducer in the heater. That makes the use of an additional power source for the supply to the 4...20 mA loop superfluous – and ultimately saves costs, minimises sources or faults and improves the power loss balance of the power and temperature controller. The manufacturer does not have to monitor the measuring loop separately, as the cut-out also performs this function – irrespective of whether – as in the application described – it evaluates a current loop indirectly or a Pt100 resistance thermometer or thermocouples directly.

Tamper-proof safety feature

Furthermore, the risk assessment carried out by the customer for the same project came to the conclusion that the shutdown of the heater had to be qualified to SIL2 in the event of a fault. This had to be taken into consideration in the design of the power and temperature controller and the instrumentation of the heater. The thermal cut-out used centrally could be employed by the company without modifications, however, as it satisfies the requirements of EN 61508-1. Should a critical overheating of the system occur in the event of a fault such that the thermal cut-out can no longer compensate this, the barrier gas heater is shut down and signalled to the operator's process control system. In accordance with the ATEX Directive 94/9/EC, this shut-down status is maintained permanently; the operator can only restart the system after a significant cooling down of the heating system by means of a deliberate and authorised action. The control system stores this event and is thus 'tamper-proof' in that even switching the system off completely and switching on again or a preventive reset command does not cancel this status. In order to fully exploit the potential of the heating system with the cut-out cascade control and to adapt it to the process engineering conditions, the manufacturer carried out commissioning and optimisation on site in the customer's works.

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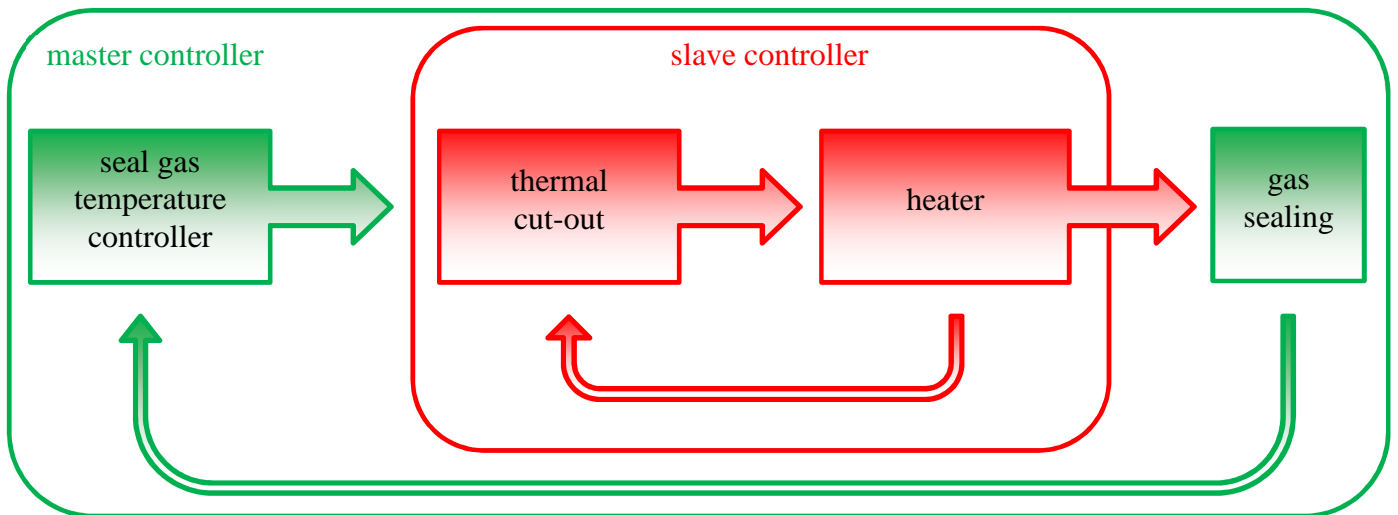
Guide for professionals:

For operators:

- The thermal cut-outs meet the demands of the ATEX Directive 94/9/EC and are suitable for monitoring heating systems in areas with a gas or dust explosion hazard.
- The cascade control system allows the measurement, monitoring and control of the temperature where the heat is generated.
- The cut-out acts as a direct interface to intrinsically-safe power circuits; additional barriers or isolation amplifiers are therefore not required.



Thermal cut-out eBR6000



Principle of Cascade Control System