Quickly informed – targeted response
Infrared sensor as early warning system

So-called burn-backs on hoppers for supplying fuel to boilers were an annoyance with which a district heating plant in Berlin was confronted time and again. An infrared sensor from ipf electronic is now used as an effective early warning system.

Fernheizwerk Neukölln AG is the local heat supplier for Berlin-Neukölln. Heat has been produced since 1911 in a distinctive industrial building located on Weigandufer and power has again been produced since 2006. With a network length of approximately 90 kilometers and more than 1,100 transfer stations, the district heating plant (FHW) supplies more than 36,000 households as well as public facilities.

Traveling grate supplies boiler with fuel
For the generation of thermal energy, the FHW uses two of the existing heating boilers, each of which has a capacity of approximately 18 MW. The two heating boilers are each constantly supplied with fuel via a three-meter-wide and approximately four-meter-long metal conveyor belt. "Located above this conveyor belt, which is also called a traveling grate, there is feed hopper for the fuel directly at the heating boiler. This hopper is used to fill the grate with fuel over its entire length, either with coal or wood pellets. These fuels ignite on their own as a result of outgassing and due to the temperature in the heating boiler. This is a continuous process. We control the speed with which the traveling grate moves and, thus, transports the fuel to the heating boiler via our control system," explains Karsten Schliwa, maintenance foreman at FHW Neukölln AG.

Problem with burn-backs during low-load operation
The system in the heating plant is actually designed for the burning of coal. During the heating periods, however, wood pellets are also used as fuel, and these ignite significantly faster than coal. "When we operate the heating boiler at low load, we need less fuel for the boiler and therefore reduce the speed of the traveling grate. When operating with wood pellets, the problem then arises that the fire can burn back to the wandering grate into the feed hopper," reports Karsten Schliwa.

More time spent on maintenance
For the personnel, such a case involves a great deal of work, since a burn-back into the feed

hopper, which is open at the top for filling with fuel, can – under certain circumstances – damage other system parts. "Burn-backs are, however, extremely rare, occurring no more than twice per heating season. Should one nevertheless occur, we need to block the entire fuel supply and shut down the system." According to statements from Karsten Schliwa, that is "very annoying," because such a situation also always means that a heating boiler is out of operation and, in some cases, another boiler must go into operation. It can take up to three hours before the residues from the burn-back are cleaned up and the boiler can be started again. If system components are affected by the heat of the burn-back, the foreman and his team must be called upon and perform repairs, which also take valuable time. Parts of the feed hopper can be deformed by the heat generated by a burn-back and thereby damaged.

Early warning system for the control station wanted

To deal with the seldom yet recurring problems, it was decided at FHW Neukölln to install a type of early warning system. Going into greater detail, Karsten Schliwa says: "In concrete terms, we were looking for a system that detects a temperature difference at the feed hoppers and, above a certain increase in temperature, outputs a warning to the control system so that the employees in the control station can respond in good time."

Special applications need specialists

It is generally known that systems for such specialized applications as at FHW Neukölln are not available simply "off the shelf." Rather, a specialist is called upon here who, due to his wide-ranging experience and his know-how, is able to find an ideal solution, even for a very specific application. One such specialist is the sensor provider ipf electronic. The company, which is headquartered in Lüdenscheid (North Rhine-Westphalia), has earned an outstanding reputation in a wide variety of industries with the development and realization of custom sensor solutions for various and - in some cases - highly specialized applications. And, for the problem at FHW Neukölln, the engineers from ipf electronic found a solution as well – in the form of a type OI98A920 infrared sensor.

Usable without cooling to up to +180°C

The OI98A920, with degree of protection IP65, is among the smallest infrared measuring heads worldwide and has an optical resolution of 22:1. The robust device can be used without cooling in ambient temperatures of up to +180°C. The separate electronics, which are connected to the sensor via a cable, integrate an illuminated LCD display with easily accessible buttons for

configuring. The temperature measurement ranges, which can be scaled using these configuration buttons or a software program, span from -40°C to +900°C with a resolution of 22:1 and from -40°C to +600°C with a resolution of 15:1 or 2:1.

Signal output as optical and warning message

For the specific application at FHW Neukölln, a total of four infrared sensors with optical resolution of 22:1 were needed for the two heating boilers. Two of these devices were installed on both the right as well as left side of the feed hopper for the wandering grate so that each sensor can contactlessly scan one side wall of the hopper at a distance of 300mm. Here, the sensors detect the external temperatures of the hopper walls and pass this information on to the separate evaluation unit. The evaluation unit converts this information to analog current signals, which are read out via I/O assemblies and output to the system controller in the control station as either a prewarning or alarm depending on the temperature profile. The warnings or alarms are signaled separately here for each heating boiler both as optical messages on a monitor as well as acoustic signals in the controls station.

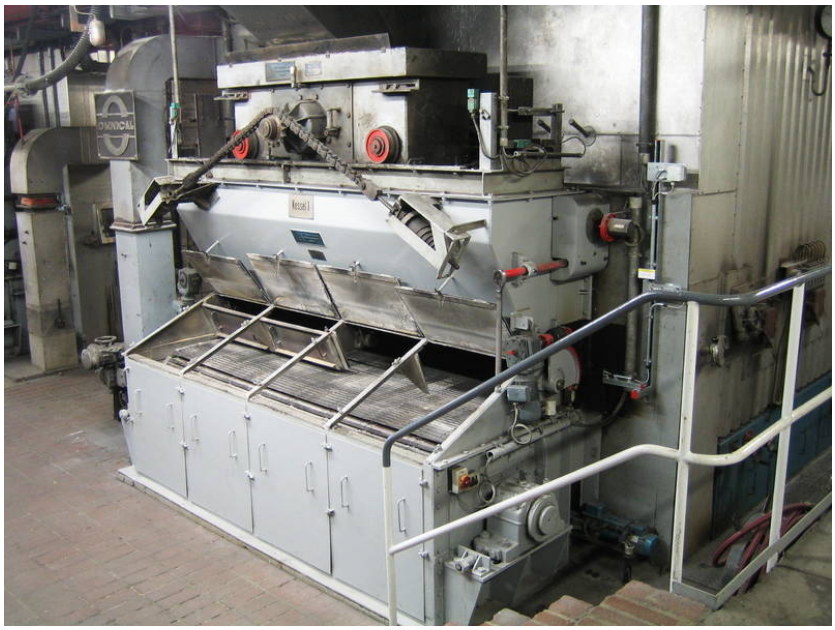
In this regard, Karsten Schliwa says: "Different temperatures arise on each side of the feed hopper. Therefore, each side of the hopper must be monitored with a separate sensor. We determined the values for a warning signal in low-load operation in a temperature range in which no burn-back occurs, but in which the walls become extremely hot. On the basis of our previous experiences, we defined a maximum temperature for each side."

Timely alert through prewarning

If, for example, the preset temperature values were now exceeded in low-load operation, the employees have already been alerted through the prewarnings and can initiate appropriate countermeasures. Karsten Schliwa describes what such measures could entail: "In the event of a warning message and, thus, an imminent burn-back into the feed hopper, we can, e.g., increase the speed of the traveling grate. The glowing embers from the fuel, which may have already made it to the hopper, are thereby drawn back into the heating boiler. As a result, we can now effectively prevent upward burning into the hopper and, in the future, avoid possible consequential damages caused by a burn-back."

Image captions:

ipf_FHW_Neukoelln001: The feed hopper for the fuel is located directly in front of the heating boiler (in background) above the wandering grate.



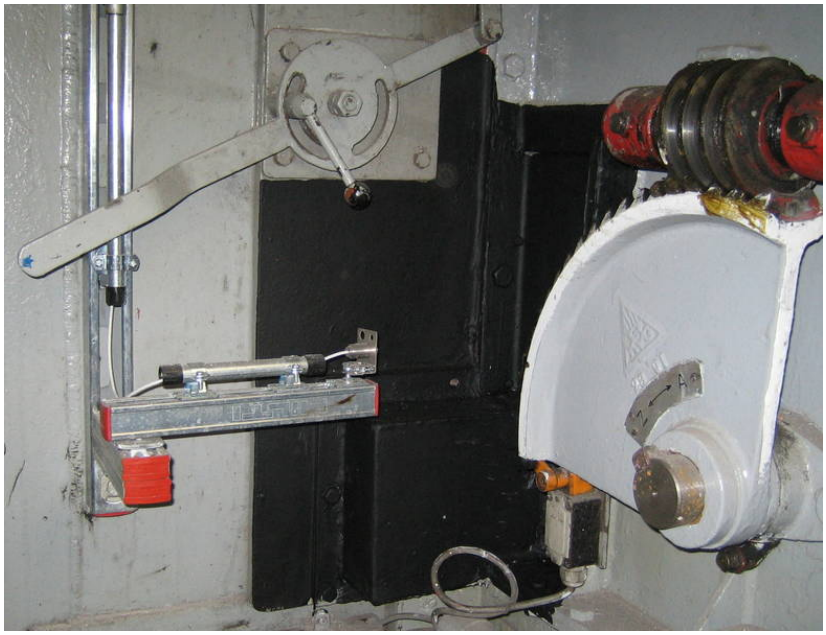
ipf_FHW_Neukoelln002: The infrared sensors and separate evaluation units were installed on the sides of the wandering grate (at left in photo).

ipf_FHW_Neukoelln003: The infrared measuring head of the OI98A920 sensor system with degree of protection IP65, which is fastened to a profile, is among the smallest in the world (at bottom center of photo) and contactlessly detects the temperature on the walls of the feed hopper at FHW Neukölln at a distance of 300mm with a resolution of 22:1.

ipf_FHW_Neukoelln004 and ipf_FHW_Neukoelln005: Close-up of the measuring head, which was fastened to an aluminum profile in the front area and can be used in ambient temperatures of up to +180°C without cooling.

ipf_FHW_Neukoelln006: The separate evaluation unit is connected to the sensor via a cable and integrates an illuminated LCD display with easily accessible buttons for programming.

ipf_FHW_Neukoelln007: Because different temperatures occur on each side of the feed hopper, an infrared sensor was installed on each side of the hopper (at left here) for monitoring.



ipf_FHW_Neukoelln008 and ipf_FHW_Neukoelln009: The sensors detect the external temperatures of the hopper walls and transfer their measurement signal to the separate evaluation unit. The evaluation unit converts this information to analog current signals, which are read out via I/O assemblies and output to the system controller in the control station as either a prewarning or alarm depending on the temperature profile.

ipf_FHW_Neukoelln010: The warnings or alarms are signaled separately for each heating boiler both as optical messages on a monitor as well as acoustic signals in the control station (photo).