# Quickly informed, targeted response

## Infrared sensor as early warning system

So-called backfires at hoppers for feeding fuel to boilers were a nuisance that a district heating plant in Berlin was repeatedly confronted with. An infrared sensor from ipf electronic is now being used as an effective early warning system. Fernheizwerk Neukölln AG is the local heating supplier for Berlin-Neukölln. Heat has been generated in a striking industrial building on Weigandufer since 1911 and electricity since 2006. With a network length of around 90 kilometers and more than 1,100 transfer stations, the district heating plant (FHW) supplies more than 36,000 households and public facilities.

### Traveling grate supplies boiler with fuel

The FHW uses two of the existing boilers, each with an output of approx. 18 MW, to generate thermal energy. The two boilers are each permanently supplied with fuel via a metal conveyor belt around three meters wide and four meters long. "A feed hopper for the fuel is located directly on the boiler via this conveyor belt, also known as a moving grate. This hopper is used to fill the entire width of the grate with fuel, either coal or wood pellets. These fuels ignite automatically as a result of outgassing and the temperature in the boiler. This is a continuous process. We control the speed at which the moving grate moves and thus transports the fuel to the boiler via our control system," explains Karsten Schliwa, maintenance foreman at FHW Neukölln AG.

The feed hopper for the fuel is located directly in front of the boiler (in the background) via the traveling grate.

### Problem of backfires in low-load operation

The system in the heating plant is actually designed for burning coal. However, wood pellets are also used as fuel during the heating period, and these ignite much faster than coal. "If we run the boilers at low load, we need less fuel for the boilers and therefore reduce the speed of the moving grate. When operating with wood pellets, however, there is the problem that the fire from the fuel on the moving grate can burn back into the feed hopper," reports Karsten Schliwa.

### High time expenditure due to maintenance

This can mean a lot of work for the staff, as a backfire in the feed hopper, which is open at the top for filling with fuel, can damage other system parts under certain circumstances. "Backfires are extremely rare, at most twice per heating season. But if it does happen, we have to shut off the entire fuel supply and shut down the system." According to Karsten Schliwa, this is "very annoying" because such a situation always means the failure of a boiler and another boiler may have to be put into operation. After all, it can take up to three hours before a boiler is restarted after the residues from the burnback have been removed. If system components have also been damaged by the heat of the burnback, the foreman and his team have to carry out repairs from time to time, which takes up even more valuable time. Parts of the feed hopper can also be deformed and damaged by the heat generated by a backfire.

### Early warning system needed for the control center

In order to get a handle on the rare but recurring problems, FHW Neukölln decided to install a kind of early warning system. Karsten Schliwa explains: "We were specifically looking for a system that detects a temperature difference at the feed hoppers and issues a warning via the control system when the temperature rises to a certain level, so that the employees in the control room can react in good time."

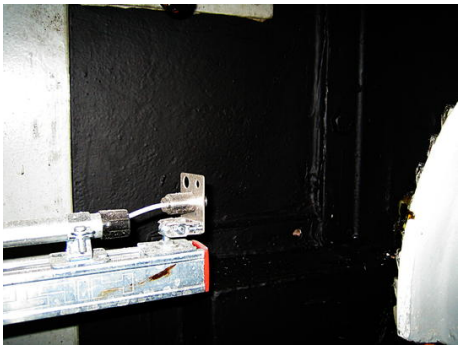
### Special applications require specialists

It is well known that systems for applications as specialized as those at FHW Neukölln are not simply available "off the shelf". Instead, a specialist is required who is able to find an ideal solution for a very specific application thanks to their wide-ranging experience and expertise. One such specialist is the sensor supplier ipf electronic. The company, based in Lüdenscheid (North Rhine-Westphalia), has earned an excellent reputation in a wide range of industries with the development and implementation of individual sensor solutions for a wide variety of applications, some of which are highly specialized. And the engineers at ipf electronic also found a solution to the problem at FHW Neukölln - in the form of an infrared sensor of the type **OI98A920.**

### Can be used up to +180°C without cooling

The **OI98A920** with a degree of protection of IP65 is one of the smallest infrared sensors in the world and has a high optical resolution of 22:1. The robust device can be used at ambient temperatures of up to +180°C without cooling. The separate electronics, which are connected to the sensor via a cable tail, integrate an illuminated LCD display with easily accessible diffuse reflection sensors for parameterization. The temperature measuring ranges, which are scalable via these parameterization buttons or software, extend 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.

The infrared measuring head of the sensor system mounted on a profile **OI98A920** with a degree of protection of IP65 is one of the smallest in the world (center image, below) and measures the temperature of the wall at the feed hopper at a distance of 300 mm at FHW Neukölln in a contactless manner with a resolution of 22:1.



Detailed view of the measuring head, which was attached to the front section of an aluminum profile and can be used at ambient temperatures of up to +180°C without cooling.

### Signal output as visual and acoustic warning message

For the specific application at FHW Neukölln, a total of four infrared sensors with an optical resolution of 22:1 were required for the two boilers. Two of these devices were installed on the right and left side of the feed hopper for the traveling grate so that each sensor can scan a side wall of the hopper at a distance of 300 mm in a contactless manner. The sensors record the external temperatures of the hopper walls and transmit them to the separate evaluation unit. It converts this information into analog current signals, which are read out via I/O modules and output to the system control in the control station as a warning or alarm, depending on the temperature curve. The warnings or alarms are transmitted separately for each boiler both as visual messages on a monitor and as acoustic signals to the control station.

Karsten Schliwa explains: "Different temperatures occur on each side of the feed hopper, so 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 where no burn-back occurs, but the walls are already heating up extremely. A maximum temperature was set for each side based on our previous experience."

The infrared sensors and separate evaluation units were installed on the lateral side of the moving grate (left in the picture).

The separate evaluation unit is connected to the sensor via a cable tail and integrates an illuminated LCD display with easily accessible diffuse reflection sensors for programming.

As different temperatures are generated on each side of the feed hopper, an infrared sensor was installed on each side of the hopper (here on the left) for monitoring purposes.

The sensors record the external temperatures of the hopper walls and transmit their measurement signal to the separate evaluation unit. It converts this information into analog current signals, which are read out via I/O modules and output to the system controller in the control room as an advance warning or alarm, depending on the temperature curve.

### Timely alerting through advance warning

If, for example, the preset temperature values are overrun during low-load operation, the employees are alerted in good time by the advance warnings and can initiate appropriate countermeasures. Karsten Schliwa describes what such measures can look like: "In the event of a warning message and thus an impending burnback in the feed hopper, we can, for example, increase the speed of the moving grate. This pulls the embers of the fuel, which may have already reached the hopper, back into the boiler. This means we can now effectively prevent the fuel from burning up into the hopper and efficiently prevent possible consequential damage caused by burn-back in the future."

The warnings or alarms are transmitted separately for each boiler both as visual messages on a monitor and as acoustic signals to the control station (photo).