

The T-Gage temperature sensors are installed along the production line under the running rail of the crane that transports the ladles



Less is More

Temperature sensors from Turck have enabled the iron foundry of Friedrich Wilhelms-Hütte Eisenguss GmbH to reduce its annual gas consumption for preheating the iron ladles by 25 percent

When a company has been established in the market for over 200 years, it knows with some certainty when it's time to make changes in order to continue staying competitive. Otherwise the company would probably not have lived to see its 200th anniversary. This is also the case with the Friedrich Wilhelms-Hütte (FWH) casting foundry in Mülheim an der Ruhr. Iron and steel have been produced at the plant on the banks of the Ruhr since 1811 – currently with over 700 employees.

The steel and iron casting are separated into two companies because the two production processes are considerably different. The steel casting area has a series production of cast components weighing up to around five tons. The smallest cast products in the iron casting area start at ten tons with the heaviest weighing 200 tons and over. The cast iron parts such as cast steel molds or other components for the steelworks are usually produced as individual pieces or in small series. A recently cast 140 ton machine component for a mineral grinding plant is one of the larger castings produced.

Energy-intensive iron casting

Obviously, iron casting is an energy-intensive industrial sector. Steel scrap is melted in induction furnaces and smelted to iron through the addition of carbon. The liquid metal is poured into so-called ladles from the furnaces, transported with a crane and poured into the cast molds. This results in the produced components which weigh several tons. To ordinary people the ladles look like large cauldrons. In order to withstand the exposure to the hot liquid iron with a temperature of 1,200 degrees they are lined with fireclay. The ceramic stones are able to withstand high temperatures. However, this is only possible if the temperature rise is slow, otherwise the fireclay lining of the ladles would be damaged. The steelworkers must therefore

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It is often the simple solutions that have the greatest effect. The cast iron foundry at the Friedrich Wilhelms-Hütte in Mülheim was thus able to reduce its annual gas consumption for preheating cast iron ladles by 25 percent – simply by using the right temperature measuring technology from Turck. Instead of using complicated and expensive pyrometer measuring devices to measure the ladle temperature, the solution was based on the infra-red measuring of the ladle exterior.

Gas burner XXL:
The ladles (right)
weighing several
tons are heated in
front of the white
gas burners



ensure that they never pour 1,200 degree hot iron into a cold ladle. The ladles are consequently preheated with gas burners to between 800 and 1,000 degrees before the iron is poured.

Potential savings with ladle heating

The ladles had long been preheated according to empirical values and estimates. "The foreman would put his hand on the ladle and guess how much more preheating was required. And if he wasn't there, a ladle would also be kept for several hours under the heater before casting and kept warm," Guido Günther, plant manager for technical support and smelting, explains the previous practice in the iron foundry. This resulted in a monthly consumption of enough natural gas to supply hot water and heating to 50 small families living in 100 square meter apartments for a year.

"We saw that we could make considerable savings here and therefore looked for a solution that was precisely matched to the casting process and the temperatures of the individual ladles, so that any unnecessary preheating or warming of the ladles is kept to a minimum," Günther adds. FWH looked for a system that would show ongoing and upcoming production, and also monitor all the ladles in the iron foundry, including their location and temperature.

The engineers responsible at FWH initially thought of pyrometer measuring in order to measure the tem-

perature of the ladles. The devices compare the color of an object electronically with a color chart and thus determine its temperature. With glowing ceramic material this functions very reliably and precisely. However, the pyrometers for the application in the iron casting process were relatively expensive and involved some difficult installation. The sensors would have to be fitted so that they could look inside the ladle in order to determine the temperature.

Alternative infra-red sensor

Turck presented FWH with an alternative solution using an infra-red temperature sensor. Instead of inside the casting ladle, the T-Gage temperature sensor from the Turck portfolio looks at the outside surface of the ladle and measures the temperature there. The attached software uses the outer temperature to determine the temperature on the inside surface of the ladle. This extrapolation of the temperature is accurate to within 15 degrees, which for this application is absolutely sufficient. Besides the simple implementation, the key benefit of the Turck solution was a considerably more affordable price: For each measuring point, the infra-red sensors cost around 700 euros less than the corresponding pyrometers. "The infra-red sensors from Turck gave us a much more efficient temperature measuring than the expensive and more cumbersome pyrometer solution," says the plant manager delighted.



Heavy caliber: The current location of all ladles can be called up on the production management system



The ultrasonic sensor triggers the temperature measuring of the infra-red sensor (left)



The crane driver in the control cabin (top right) sees all the temperatures of the relevant ladles

Six M18TIP14Q T-Gage infra-red sensors are installed on the casting line. They are fitted so that the crane with the ladles always moves past one of the sensors when they are required. A Turck ultrasonic sensor (T30UXD-BQ8) is also located next to each temperature sensor. This detects the ladle in passing and triggers the temperature measuring process. The crane driver uses the ladle numbers and his control panel in the driver cabin to identify the ladle currently in the crane. The operator panel displays all the ladles with their locations and temperatures. This therefore gives the crane driver all the information required in order to avoid any unnecessary heating of the ladles.

25 % less gas consumption each month

The analog signal of the temperature sensors and the switch signal of the adjacent ultrasonic sensors are transmitted using Turck's BL20 fieldbus gateway via Modbus TCP to the host computer at FWH, where it is processed by the production management system. The system knows exactly when a ladle is needed. The crane driver has the temperature of all ladles in view and can decide which ladle needs to be heated and when. A cold ladle needs accordingly more time than one that has just been used.

This optimized process enables FWH to reduce its gas consumption for the heating of ladles by 25 percent just for the iron casting. The savings potential also

impressed the Federal Environment Ministry that funded this project in 2012 within the scope of its environmental innovation scheme. The application and approval of the funds took some time. "The actual technical clarification was completed quickly and smoothly with the support of Turck sales," Günther recalls. "When selecting the right ultrasonic sensor, we somewhat incorrectly estimated the distance between the sensor and the ladle. After I called Turck, an alternative device that was suitable for the distance was already on my desk within two days." When selecting the sensor, the project designers had not taken into account that with smaller ladles, the distance between the sensor and the ladle would increase.

Turck also supplied directly the right maintenance accessories for the T-Gage temperature sensor. A special metal sleeve is fitted around the sensor. This can be filled with compressed air in order to blow the dust off the front of the sensor. With optical sensors dust removal is a vital operation.

Outlook

There are other potential savings in the foundry plants of the Friedrich Wilhelms-Hütte. It is possible that the steel smelting process will also be more intensively automated in future. If an efficient temperature measuring is needed then, the good experience gained in the iron casting production will be useful. ■



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**Guido Günther,
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