Controlling Moisture in Moulding Sand

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Skeppshult Gjuteri AB, a foundry based in Skeppshult, Sweden, manufactures household goods. Their speciality is frying pans and similar products that are cast, machined and finished in-house, ready for sale. Total annual production is around 1,000 tonnes of finished goods.

Since 1987 the foundry has been using electric melting, two furnaces (each of 1,400 kg capacity, operating with 750 kW power supply) providing grey iron, produced mainly with local scrap as the raw material. Moulding is by two Match Blomatic 2015 machines, producing on an average 1,100 flaskless moulds per day. The automatic mould handling system can buffer up to 200 moulds before pouring and 1,300 moulds for cooling, which means using the hours of darkness for cooling down the day’s production. As the machines are working with flaskless moulding and sand blowing, high quality sand is essential.

Raising Sand Quality

For sand conditioning, a Speedmullor 66B with a load weight of approximately 500 kg is used. However, the old moisture control on the mixer no longer fulfilled the customer’s quality requirements. The foundry’s production management, therefore, approached HYBE* of Halmstad, Sweden, with whom it had enjoyed a long standing and successful business relationship, and asked the company to develop a concept to help improve the quality of the moulding material. (*HYBE Maskin AB represents Sensor-Control GmbH, Germany in Scandinavian countries. Their website: <www.hybe.se> and email id: <sales@hybe.se>)

The brief was to design a moisture control system for the existing mixer, enabling the foundry to ensure the required constant moisture level in its moulding materials. The control precision in the ready mixed sand was not to exceed ± 0.15%. All measurements were to be archived so that subsequent analyses and evaluations could be carried out.

The used sand is metered into the pre-chamber from three different silos by valve control, using a built-under conveyor belt; the metering being by a gravimetric method. The used sand is transported to the pre-chamber via a screen, conveyor belt, and tunnel/ribbed conveyor belt. The aggregates are fed into the mixer using a time controlled mechanism. The pre-chamber is permanently fixed inside the mixer, making it impossible to weigh it. The humidity of the used sand varies between 0.5% and 3.0% and the temperature ranges from 10 °C to a maximum of 50 °C.

Multi-Function Solution

For the solution to the problem, the following separate functions or tasks were established.

- Measuring the Weight of the Used Sand: For this purpose, the chamber was measured together with the conveyor belt using four built-under weighing cells and evaluation electronics. In this way a constant load weight was ensured.
Measuring the Temperature and the Humidity of the Used Sand: For this purpose, two temperature sensors and two rod probes were installed inside the pre-chamber above the mixer. The positioning of the sensors inside the pre-chamber provides the benefit of static and consequently very precise measuring. By installing the sensors in this way, they are mechanically treated with care and the sensors' lifespan is considerably prolonged.

Calculating the Water Demand: Using the above mentioned measuring method, the measurements for any particular load are already available, even before the moulding sand is fed into the mixer. It is, therefore, possible to calculate in advance the water demand required for the load. This calculation will also compensate for any evaporation losses in the mixer and on the conveyor belt from the mixer to the moulding plant. This so called "evaporation curve" is set during the commissioning of the plant, and where necessary can be subsequently optimised by the customer on the basis of operating data.

Metering Water into the Mixer: For this customer, HYBE used a high precision, computer controlled metering device, the DF-1000 built by Sensor Control, for metering the water into the mixer. According to the customer's requirement, the water is fed into the mixer at the same time as the used sand. The necessary maximum amount of 20 liters of water is metered very quickly at the beginning of the mixing cycle, which consequently produces a high level of homogeneity and conditioning. This will also achieve shorter mixing cycles, and thus greater efficiency in conditioning the sand.

Checking the Ready-to-Use Moulding Sand: On the way from the mixer to the moulding plant, two ready-to-use moulding sand probes are installed for humidity and temperature. These are used for checking the re-conditioned moulding material.

Customer Specific Requirements

In order to solve problems, HYBE's PC system FS-CC6 was chosen. The software was programmed under LabVlear by National Instruments and is based on Windows. When it was commissioned in August 2003, it was possible to make customer specific alterations and take into account any customer requirements.

All relevant measurements are entered into a daily data bank and can be retrieved at any given time. This enables, for example, quality monitoring and tracing within the production. The data obtained can be taken into account in the production planning in order to optimise the production process. The industrial PC with hardware and software used for this purpose offers a high level of security and user-friendliness.

According to information given in early January by the production manager, Erik von Dijk, the entire plant is meeting all the customer's requirements. The control precision in the water content is ± 0.1 % of the set value.

The quality of the moulding material to be processed in the moulding plant has clearly improved and stabilised so that it was possible to increase content of active bentonite in the used sand from previously 4.5 - 5.0 % to currently 7.0 - 7.5 %.

In practice, this means a better and stronger mould with lower water content. As a result, it was possible to considerably reduce the amount of scrap in the moulding as well as the casting process; particular improvement being noticeable in complex castings. An important aspect of progress is also that the sand's injection pressure, when the sand is injected into the mould in the moulding plant, was reduced from 4.5 kp / cm² to 2.5 kp / cm², which, in turn, means less wear on the pattern plates. The stable sand quality also facilitates production planning in terms of the weight ratio between sand and casting.

Fore more information about this system, please contact M/s. Sensor Control GmbH, or their agent in India:
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Business News.....
Sundaram-Clayton Ltd., Chennai

Shri Suresh Krishna, Chairman, Sundaram-Clayton Ltd presented the following observations at the 42nd AGM of the company.

- The company's castings export would double to Rs.100 crore in the next two years. It will continue to increase further in the coming years.
- Yet, at present there are signs of slowdown in the 2nd quarter (as also 2nd half) of the current year (04-05).
- The company is moving towards becoming a "Total System Solutions Provider to Global Customers".
- The Castings Division has bagged new orders from Visteon, Tata Holset and Ford India in India.
- Price pressure from the customers, due to fierce competition in the vehicle market, is likely to result in reduced margins.

(Source: Business News, The Economic Times, A'dab, 18-9-04)

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Measurement: While the old sand is being metered, the remaining moisture and temperature are measured by suitable high-precision, low-wear measured value sensors with additional bulk density compensation in the case of gravimetric metering of the old sand. (Sandmaster-principle) - LIPPKE

Calculation: The water required for the batch concerned is calculated even as the measurement is still in progress. This ensures that the required amount of water has been defined before the sand enters the mixer.

Metering: The calculated amount of water is added in direct chronological sequence as the mixer is charged, i.e. either immediately after or immediately before the old sand and additives reach the mixer.

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FOUNDARY 50 NOVEMBER/DECEMBER, 2004
IIT Bombay Successfully Conducts a 4-day Course on "Casting Design and Analysis"

This year too*, an intensive residential certificate course on Casting Design and Analysis was conducted during 10-14 September 2004 at IIT Bombay. The limited seats were filled up several days before the start of the course. Participants representing OEMs, Foundries, Tool-Makers, Consultants, Teachers and Researchers came from different parts of India, some as far as Chandigarh, Chennai and Kolkata. (* Similar course was conducted last year during 11-15 September 2003. There were over 30 participants.)

Besides lecture sessions on Design and Analysis of Patterns, Feeders and Gating System, newer developments such as Rapid Tooling Development, Design for Manufacture and Web-based Engineering were also uncovered. Participants greatly enjoyed the practical sessions, including Touch-based Solid Modelling, Casting Simulation and Rapid Prototyping of Lord Ganesha modelled at IIT. Solid models of industrial castings brought by participants were also analysed by simulation to illustrate the scientific principles involved.

The course material comprised 100+ page lecture notes by Prof. B. Ravi and a Casting Resource CD containing Technical Papers, presentation slides, casting software, links to worldwide web resources and photos of the course itself.

The participants stayed at Vanvihar Guest House near Powai lake, relishing morning and evening walks in the campus made lush green with the rains. The certificates were presented in the concluding session presided by Dr. Dion Fernandes, Executive Director, Tool and Gauge Manufacturers Association (TAGMA).

Participants' Feedback: Participants were generous with their appreciation. Some feedback is reproduced below:

1. "The training was a great experience with a perfect blend of education and information combined with the friendliest environment you can ever find. I believe that each one of us will carry back with us an enhanced knowledge database and some very fine memories about IIT Bombay and the CEP team."
2. "Thank you for your user-friendly CD containing course material, software and group picture."
3. "Registration, hospitality and time management were simply superb."
4. "The arrangements were great and the course far beyond expectations."

The valuable feedback from the participants is being compiled and analysed to improve the next version of the course, scheduled in September 2005.

(Source: Email information from Prof. B. Ravi, IIT, Mumbai)