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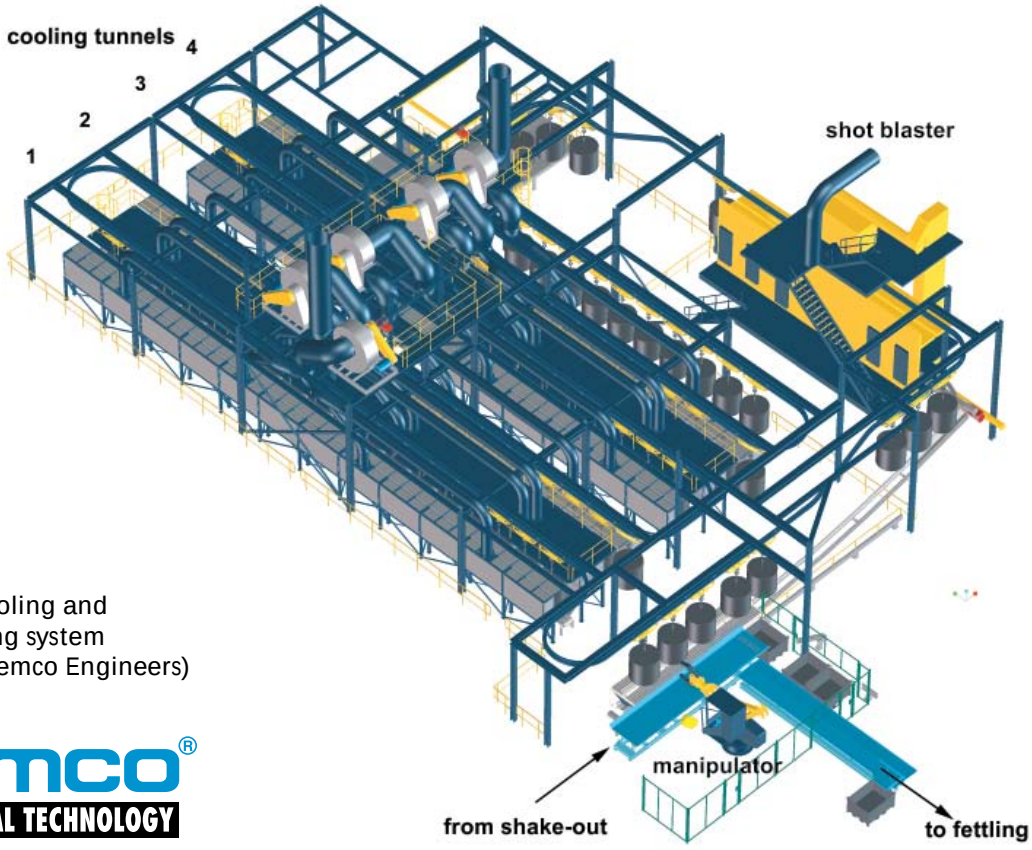

Casting cooling and shotblasting system (Photos: Gemco Engineers)

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One operator from shake-out to fettling

A flexible and cost efficient solution for handling, cooling and shot blasting of safety parts

Often, when engineering a foundry, the emphasis is on the melt plant and the moulding line, which are considered the “core” of the foundry. The surrounding systems, both upstream and downstream, usually draw less attention. Disregarding these systems often results in increased manning and equipment as well as unnecessary monopolizing of valuable space. Furthermore, it may also negatively affect the efficiency of the new plant.

Developing a foundry’s downstream section

Within a recent project, Gemco Engineers B.V., Eindhoven, The Netherlands, was assigned to develop the downstream section of the foundry. Products included both main series of one “family” of castings as well as smaller series of a variety of products. The downstream process includes castings cooling and shot blasting up to fettling. Due to temperature, weight and size, a manipulator is most appropriate to take out the castings from shake-out. In order to minimize handling, optimize time and reduce damage to the castings, the handling of castings consists of just one single hook-up and hook-off. After cooling and shotblasting, the castings must be sufficiently cooled down for control, fettling and sorting.

The layout of the system is such that castings, after leaving the shake-out conveyor, are picked up by the manipulator and hooked to the power & free conveyor system. This power & free system runs through the casting cooling section and subsequently through the shot blaster. After that the casting clusters return to the manipulator where they are put onto a conveyor system for grinding and other finishing process steps (**see figure above**).

Power & free chain conveyor

The transfer of the castings through the cooling line and shot blaster by means of a power & free chain conveyor runs fully automated without operator’s intervention. Space consuming storage of black castings is made redundant. Moreover, the system eases quality control and traceability during

each process step. This is especially important and a prerequisite when producing safety parts.

When selecting the overhead chain conveyor, various factors needed consideration in order to determine type, length and transfer speed:

- capacity of the moulding line (moulds/h);
- diverse product mix: depending on product shape and weight, the cooling time of product is very diverse (1 - 3 h without forced convection);
- programmable shot blasting cycle;
- available time for loading and unloading of conveying system;
- available space;
- available budget.

A power & free type conveyor facilitates optimal positioning of the hooks for loading and unloading of the castings by the manipulator. Through-put control guarantees the required cooling time for the castings, while the accurate positioning and rotation of the castings on the conveyor allows for optimized shot blasting of the castings, disqualifying "excess"-shot blasting.

For the cooling capacity, a buffer capacity of 1 h was built in, at maximum speed of the moulding line. For additional cooling capacity, cooling tunnels were designed. This casting cooling concept is based on a gentle flow of air through the clusters. This air is circulated via a low pressure fan and a set of pressure channels. This set of pressure channels is aligned alongside the power & free conveyor. The channel with overpressure blows air through the clusters, towards the low pressure channel on the other side. Here the air is extracted into the low pressure channel and is circulated into the next tunnel. The bottom of this system is completely open and allows for additional fresh air intake and easy cleaning (**Figure 1**).

Back flow cooling principle

A proven concept for efficient cooling is the so called back flow cooling principle. The coolest air is used to cool down the coolest castings, while warmer air flows into the direction of the hottest castings. In the presented concept, the airflow is perpendicular to the direction of the material flow. Every hanger with clusters is directly next to the overpressure tunnel that generates the airflow. The temperature of this air is homogeneous over the entire length of each tunnel. In most other cooling tunnel concepts, the airflow is parallel with the material flow. Air is usually taken out from the middle and flows in from both open ends. In such a system, the air that flows in at the open ends heats up while it flows towards the middle of the tunnel. Additionally, the air tends to flow around the castings rather then through them. Castings tend to create lees for each other, resulting in less effective cooling

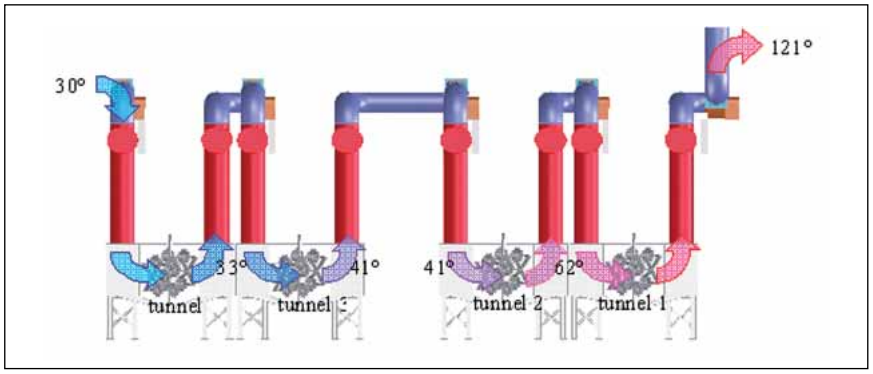

Figure 1: Air temperatures at maximum cooling capacity

Summary

The advantage of this system is its effectiveness for the cooling, its low power consumption and its simplicity. The electro motors from the fans are frequency controlled, so the capacity of the fans can be adapted to the cooling requirements of the castings. This minimizes the energy consumption of the casting cooler. The overall length of the power & free conveyor counts merely 30 % of the length of a conventional continuous chain conveyor.

The shot blaster station (after cooling) is integrated into the power & free conveyor, allowing for fully automated in-line shot blasting. The shot blaster admits different blasting cycles, and makes it possible to optimize the shot blasting intensity and duration, adapted according the castings' requirements. The system minimizes both "excess-blasting" and possible damage, as well as insufficient blasting and repetitive blasting.

The operator of the manipulator at the shake-out selects the required shot blasting program. A selected cycle is being coupled to the ID of the hook on which casting is hooked-up. The shot blaster identifies which program is coupled to which hook, and automatically initiates the corresponding cycle as soon as the particular hook arrives at the shot blaster. Essentially it would be possible to program a shotblasting cycle for each hook/casting, in practice however a number of preset programs have been selected.

After shot blasting the castings are being hooked off by the manipulator and placed on a vibrating conveyor for further processing before being sorted in bins for transport.

The entire process of cooling and shot blasting is automated, manned by one manipulator operator at the beginning and end of this power & free conveyor. Handling of the castings by operators has been reduced to a minimum. At the same time, the suitable cooling and shot blasting conditions for each product have been created. An automated line has been conceived with all the advantages of a dedicated line, yet sufficiently flexible to cost-efficiently process different castings as well.

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