THE EFFICIENT USE OF VIBRATORY EQUIPMENT IN MODERN FOUNDRY PROCESS
VIBROPROCESS

- Introduction: 4
- Mobile Charging Feeders: 6
- Discharging Shakeouts: 8
- Knock-out table: 10
- Casting coolers: 12
- Conveyors: 14
- Fluidized bed sand coolers: 16
INTRODUCTION

Vibroprocess is located in Arcore (Italy) and is a worldwide leading company in designing and manufacturing of Vibratory Equipment used in no-bake and green sand foundries. With over 30 years of experience, Vibroprocess is today the number one solution provider for the supply of Vibratory Equipment in the foundry field thanks to an extensive range of:

- Mobile Charging Feeders for Electric Furnaces.
- Discharging shakeouts for sand / casting separation.
- Knock-out Tables for sand / heavy casting separation.
- Casting Coolers.
- Conveyors.
- Fluidized bed Sand Coolers.

The use of Vibrating Equipment in moulding shops can improve working conditions and throughput. Modern foundries require matched and automated operating sequences in order to achieve continuous material flow and various types of Vibrating Machines can well serve this purpose. Hereunder we illustrate the potential uses of Vibrating equipment in foundries.
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MOBILE CHARGING FEEDERS

*Induction Furnaces are frequently charged by means of Mobile Charging Feeders*

Mobile Charging Feeders guarantee a controlled and safe feeding of the furnace, preventing damage to liners thus incredibly reducing maintenance and downtime costs:

- Nowadays the range can satisfy the demand from 1 ton up to 40 ton batch capacity.
- These Feeders are named Mobile as they are installed on single trolley (for forward / backward movement) or double trolley (for forward / backward and transverse movement) so that the Feeder can travel on rails.
- A load cells weighing system for batch weight control can be part of the supply.
- The Mobile Charging Feeders are driven by Electric Out of Balance Motors (1000 Rpm) and the supply is inclusive of the Electric Cubic Control which incorporates VFD device for frequency adjusting
- Being a travelling equipment, safety devices, such as perimeter cable, audio-visible alarm, emergency push bottom and double switch control, are very important.
DISCHARGING SHAKEOUTS

Sand and castings are separated by means of Discharging Shakeouts
Discharging shakeouts are located underneath or in line of the moulding line punch out station:

- According to the type of castings, these machines can be equipped with longitudinal or transverse gap grids.
- Whilst tapered longitudinal gap grids are used for heavy castings, transverse gap grids are employed for medium – small castings.
- The first part of the grid is generally blind deck suitable for impact.
- The length of Discharging Shakeouts should not be less than 6000 mm.
- The width must be in accordance with the mould dimensions being handled; it is possible to reach 2500 mm width and, in exceptional case, also up to 3000 mm.

Because of their robust design and low maintenance as well as their long life expectancy, the directional force DF Exciters and the Rotational VZ Exciters have proven to be very successful in foundries application.

These are driven by Electric Motor via direct cardan shaft transmission.

Because of the great danger of sand caking, it is advisable to have a separated sand feeder underneath the Shakeout (not an incorporated conveying trough).

The Discharging Shakeout can be available in the following executions:

- The Conventional Shakeout (1000 Rpm, 60° angle of line of force) is still used for not sensitive castings.
- The High Frequency Shakeout (1500 Rpm, 60° angle of line of force) is highly recommended for sensitive type of castings.
- Finally, the latest developments regards the “VARIO” Discharging Shakeout (1200 – 1800 Rpm, 40-80° angle of line of force) which is highly recommended for those foundries which have a production of different type of castings.

The VARIO Discharging Shakeout deserves a specific comment as, although it is the most expensive, it gives quite important advantages and it can be paid back in a short time period.

It is then a PLC controlled equipment which incorporates a specific software for the:

- Angle of line of force adjusting.
- Frequency adjusting.
- Moulding line interfacing.

All this is done in an automatic sequence and gives very important advantages such as:

- Minimum casting damage rate.
- Best sand lamps disintegration.
- Minimum sand adhering to casting surface.
KNOCK-OUT TABLE

*Knock-out tables are often used when a heavy casting has to be handled*

Typical design of a 4 x 4 MT can be used for loads up to 70 ton, therefore, they are very much popular in the no-bake foundry shop:

- According to the type of castings, these equipment can be realized with different openings of the grid.
- Knock-out tables can be designed for rotational vibration (VZ exciters) or for linear vibration (Directional DF exciters).
- Being the resin sand with a temperature around 250-300°C, the exciter oil lubrication is an important added value.
- The Knock-out table has a static chute underneath and a vibrating feeder for the conveying of sand.
- The outlet of vibrating feeder is realized in stainless steel suitable for the magnetic belt installation.
CASTING COOLERS

The Casting Coolers allow the cooling of castings from 650°-700°C to 80°-100°C thus suitable for shot blasting processing.
The Casting Cooler is a resonance vibratory equipment with flat linear vibration, equipped with co-oscillating hood and located in between the Shakeout line and the shot blast Machine:

- Each single unit can have a maximum length up to 30000 mm and a maximum width up to 2500 mm.
- The best isolation of such a long equipment can only be obtained with a ratio of 1 to 2,5 – 3 between the mass of trough and the mass of the isolation frame.
- They are equipped with an exhaust air hood.
- Fans blow the air over the hot castings in a counter flow stream.
- The heat transfers from the casting to the air thanks to the air speed.
- In order to increase the cooling effect, it is possible to have atomized water addition in the stream air, although this is possible only when the casting temperature is below 300°C so that there’s no risk of metallurgic reaction on castings surface.
- Casting Cooler primarily operates on the “stop and go” principle.
- A distributing device at the inlet of Casting Cooler trough allows the densest possible occupation of the cooling section
- The “stop and go” and the water addition are controlled by a specific PLC software.
CONVEYORS

Resonance Conveyors are a connecting module which allows the castings transport and various processes.
Conveyors are located after the Casting Cooler or after the blasting process and they allow easy access and sorting of castings. They reduce the worker fatigue for the various operations which have to be done on castings and increase castings throughput. The Vibrating Cooling Conveyor is a resonance vibratory equipment with flat linear vibration. The working principle is the same as per the Casting Coolers. It has a trough, an isolation frame and is driven by eccentric drive. The trough of conveyor can be designed in different ways according to different required processing such as:

- Sorting of different castings.
- Separation of scraps from castings.
- Fettling.

Each unit can be up to 30000 mm long
- The supply always includes a VFD so that it is possible to vary the frequency (400-600 Rpm) and consequently adjust the casting speed on the conveyor.
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FLUIDIZED BED SAND COOLERS

Fluidized Bed Sand Coolers have their important place in the sand preparation plant

The sand final temperature and moisture, accurately controlled, improves the quality and surface of castings, decreasing the rate of rejects.

- Fluidized Bed Sand Coolers cool and homogenize the sand in continuous operation and provide, independently of sand inlet temperature, an evenly cooled and dampened material of uniform quality.
- The +/- 0.3% tolerance is so little that the intensive mixer will be considerably relieved.
- They are equipped with a special fluid bed stainless steel screen deck which allows the air to pass through the sand layer.
- The automatic moisture control system has the task to ensure the optimum water addition and to avoid over or lower moistening.
- The biggest model in the range is 2500 mm wide and 10000 mm long and can handle 200 ton/h sand reducing the temperature from 140°C down to 40°C with a range of moisture in between 1.8 – 2.5 %.
- Fluidized Bed Sand Coolers are driven by Directional exciter or Unbalance Motors in order to obtain a linear motion vibration and are supplied complete of fan system.
CONCLUSIONS

The above described potential uses of vibratory machines in efficient modern foundries require a high degree of know-how from the equipment manufacturer. For this reason, only manufacturers of vibrating equipment with a proven complete range of products are in the position to offer the best possible solution for each individual application.

Finally, there is a strongly increasing tendency towards the use of vibrating equipment in modern foundries; this is primarily due to the possibility of using these machines and their programmable controls as a contribution to the modernization and rationalization of already existing production plants in order to adapt them to the increased capacity requirements, the necessity of having lower production costs and the necessity of improving the quality of castings.
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