

## GREEN SAND MOULDING: STATE OF THE ART

Moulding is the operation that allows to give shape to green sand in order to obtain impressions as equal as possible to the pattern.

This is one of the most important functions of the production process and deserves a particular attention both from a technical point of view (selection of the type of moulding) and from the point of view of the customization of the plant.

### Moulding (goals)

- Production of castings with a high dimensional accuracy
- Castings with an excellent surface finish
- Castings of a constant weight
- Repeatability of performances
- Low operating cost
- Maximum efficiency of the machines.

In order to produce quality castings it is necessary to produce quality moulds. This is possible by integrating a first-rate moulding sand (see previous chapter) with a moulding process that exploits its physical features.

Moulding sand has to be used at the best of its distinctive features: compactability and strength.

### Quality moulding

Quality moulding means:

Production of moulds with a constant hardness on the whole surface of the flask

Moulds with highly defined particulars

Ability of extracting difficult cores

Use of pattern plates of different materials (wood, resin, metal)

Economicity of the system.

### Multi-pistons moulding Belloi & Romagnoli

Since 1980 Belloi & Romagnoli has developed the high pressure moulding with multi-piston head as a moulding technology for its complete lines and machines.

The initial idea that brought to current moulding machines was to supply the foundry worker with a versatile and efficient machine able to adapt to the various production conditions: variability of patterns and features of the sand.

## Operating principle

The operating principle of moulding machines BELLOI & ROMAGNOLI consists of two well-distinct phases:

- **Precompaction**
- **Moulding with pistons with differentiated pressures**

**1- The precompaction** of the sand is extremely useful for uniforming the layer of sand near the pattern. The easiest and cheapest method of compacting sand is to make it fall, exploiting the force of gravity and turning potential energy into kinetic energy. As this phenomenon is regulated by the following laws:

Potential energy = mass x gravity x pouring height

Kinetic energy =  $\frac{1}{2}$  mass  $V^2$

(Impact force) Force x Time = Mass x Speed

it is obvious that the higher the pouring height, the higher the impact force and, consequently, the compaction effect of the sand on the pattern.

In order to obtain the above-mentioned effect, moulding machines of Belloi & Romagnoli are equipped with the pre-loading hopper at about 2-meter height from the pattern.

## 2- Moulding with pistons with differentiated pressures

The operation of the multi-piston head Belloi & Romagnoli has been designed and developed in order to obtain moulds with a constant hardness on all horizontal and vertical surfaces, also nearest to the flask edge.

To achieve this result, pistons are driven by two differentiated hydraulic circuits: one for inner pistons and one for outer pistons. By setting two proportional valves, it is possible to differentiate pressures in both circuits.

When the squeeze cylinder brings the sand in contact with pistons, sand compaction on the pattern takes place as if the sand between every single piston and the pattern itself were divided into several zones, in a number equal to the number of pistons. Each one of these columns compresses according to depth, sand compactability and pressure exerted by every single piston.

When the compaction of the sand reaches a value greater than the pressure of the piston, the piston begins to withdraw. The different behaviour of the sand near the walls of the flask is adjusted by differentiating the pressure values of inner pistons compared with outer pistons, giving higher specific pressures to outer pistons. (The surface of outer pistons is different from the surface of inner piston, in order to obtain higher specific pressures.)

Once all pistons have been activated and have reached their final position according to the pattern profile, their position is kept and the squeeze cylinder continues its stroke to obtain the maximum uniformity as to hardness of the mould.

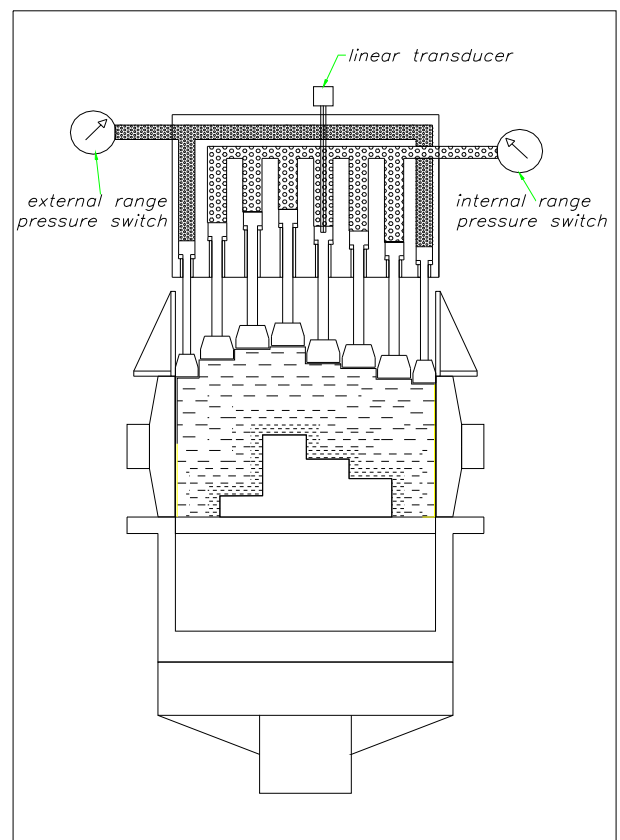
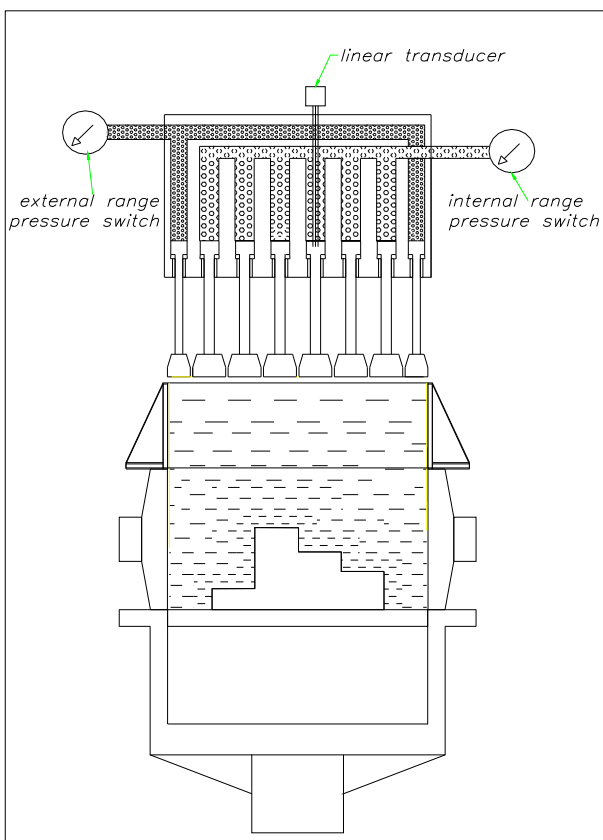
The last moulding phase is obviously adjustable and allows to obtain the desired hardness.

## Controlling The Process

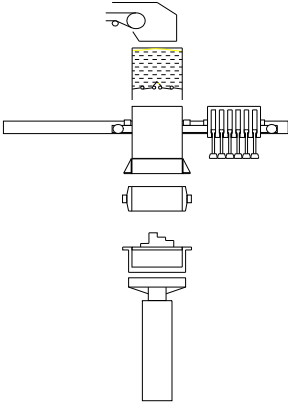
The percentualista of compaction desired is entered directly into the controls

The amount of sand to fill the flask is adjusted automatically

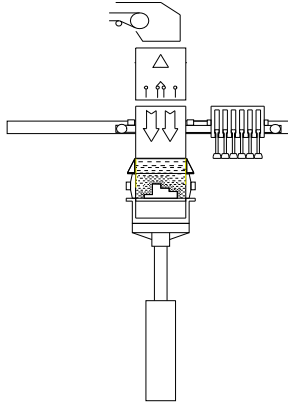
The setup requirements for the different patterns are automatically stored in the controls.



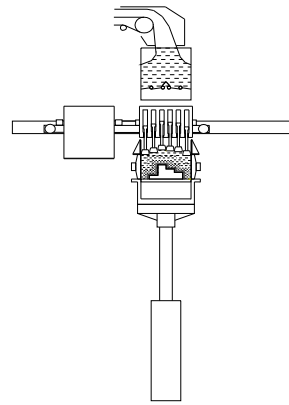
STARTING POSITION



PRE-COMPACTION



MULTIPISTONS  
MOULDING



DRAWING

