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TATA METALIKS

TATA

PRAYAS

Dear valued customer,

We at Tata Metaliks endeavor to have a workforce that is competent, engaged and socially sensitive.

The management of Tata Metaliks is guided by business ethics. The Tata Code of Conduct (TCoC) which lays down the principles and standards that should govern the actions of the Company and the employees serves as a binding principle in matters of all legal and ethical behavior. TCoC extends to all our stakeholders - our employees, our customers, our value chain partners, our other business associates, our financial stakeholders, the government of the countries in which we operate and our group companies.

Tata Metaliks has a robust complaint mechanism for employees, suppliers, customers and shareholders. The Company also has in place **'Whistleblower Policy'** governing the actions of the Company and its employees and **'Whistleblower Policy for Vendors'** which guarantees adequate safety to a whistle blower. Details of the same are mentioned at our website.

We, at Tata Metaliks, assure you as our customer, that all our colleagues who interact with you during the course of any transaction, will conduct the business in the most transparent, fair and ethical manner. However, if still there are any issues related to ethics, it may be placed by means of phone calls, letters, e-mail and even meetings with the Ethics Counsellor. Our contact details are as follows- **ethics.counsellor@tatametaliks.co.in** Phone No: +91 - 33 – 65508743.

With warm regards and best wishes for the New Year!

Ratna Sinha
CHRM & Ethics Counsellor.

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Dear Readers,

One of metal casting's strongest selling points is its ability to encompass several parts into one component.

Metal casting process lends itself to complex geometries. At the heart of many of these complex geometries is a core or core assembly. A core is a shaped body, usually made of sand, which forms the interior part of the casting.

In metal casting, the mould provides a space for the molten metal to go, while the core keeps the metal away from filling the entire space. Core making is an important branch in any foundry. Cores allow you to incorporate holes in your design. Cores can take on a variety of angles and shapes and more than one can be used per casting. Sometimes, an assembly of cores is constructed to create a web of internal passageways and chambers. For many seemingly impossible parts, imagination and cores can turn a floundering design into a winning engineered component.

In this issue of PRAYAS, details of cores and core making procedures are explained in steps so that the readers will get detailed knowledge of various technologies of making cores as per requirement of quality in final product. Skill and controlled process of core making gives added cutting edge advantage to the foundries in getting orders with high realization and in control of non-conformities.

We are sure that this issue will enhance your knowledge about core making and assure our technical hand holding in developing core making technologies as per your quality and quantity requirement. To get more in depth knowledge on this topic, please get in touch with our Customer Service Centre.

Regards,

M Sambasiva Rao and Sukhendu Mukherjee.

Editorial Team:

M Sambasiva Rao, Sukhendu Mukherjee and
Munmun Pal.

CORE & CORE MAKING

Cores are sand shapes or forms which make the contour of a casting which is not molded with a pattern. It may be defined as that portion of the mould which forms the hollow interior of the casting or a hole through the casting.

Cores provide the casting process its ability to make the most intricate of shapes, eliminate much machining and produce shapes which would be impossible to machine.

FUNCTIONS OF CORES

1. Create the recesses, undercuts and interior cavities that are part of castings.
2. As inserts in moulds, to form design features that are otherwise extremely difficult to produce.
3. Strengthen the moulds.
4. Make complete moulds simply by assembling the cores.
5. Make gating system of large size moulds.

CHARACTERISTICS OF CORES

1. Cores must have sufficient hardness as well as strength in both dry and green states. Without these properties, the core will not be able to support its own weight and withstand the force of molten metal.
2. Core must be permeable to allow the core gases to escape easily and should produce a minimum amount of gas when in contact with molten metal.
3. Core should have high refractoriness to withstand the high temperature of molten metal.
4. Cores should be collapsible i.e. they should disintegrate and collapse after the metal solidifies.
5. Smooth surface to ensure a smooth casting finish.

TYPES OF CORES

Cores may be classified according to

1. **The state or condition of core :**
   - Green sand cores
   - Dry sand cores
2. **The nature of core materials employed :**
   - Oil bonded cores
   - Resin bonded cores
   - Shell cores
   - Sodium silicate cores
3. **The type of core hardening process employed :**
   - CO_2 process
   - The Hot Box process
   - The Cold Box process
   - Fluid or Castable Sand process
   - Furan No Bake system
   - Oil No Bake system
4. **The shape and position of the core :**
   - Horizontal Core
   - Hanging or Cover Core
   - Drop Core or Stop Off Core
   - Kiss Core
   - Vertical Core
   - Balanced Core
   - Ram up Core

CORE MAKING PROCEDURE

- Core sand preparation
- Making the cores
- Baking the cores
- Finishing of cores
- Setting the cores

CORE SAND PREPARATION

Core sand mixture consists of sand grains, binders for green and cured strength and additives used for special purposes.

Silica is the basis of most sands used for cores and zircon, olivine, chamotte and carbon, others are also used. The important properties of sand are refractoriness, fusion point, dimensional and chemical stability with temperature change, heat transfer capability and sieve analysis.

Core binder holds the sand grains together, gives strength to cores, makes cores resist erosion and breaking and imparts adequate collapsibility to cores. Core binders are of the following types.

1. Organic Binders : These are combustible and are destroyed by heat; hence they contribute a degree of collapsibility to the core sand mixture. Some of the organic binders are core oil, cereal, pitch, dextrin, molasses, rosin, wood flour, synthetic resins etc.

2. Inorganic Binders : They are not combustible and may have considerable strength at high temperatures, may have resistance to erosion and may be relatively non collapsible depending on their nature. They are fire clay, bentonites, silica flour and iron oxide.

3. Other binders : Portland cement, sodium silicate, water and patented binders.

Core sand mixing is performed in Muller Type Mixers, Paddle Mixers or Kneading Type Mixtures. Because of their efficient mixing action, Muller Type Mixers are usually employed for preparing core mix. Batch or Continuous Mixers can be employed depending on the foundry requirement.

Mixing begins with the addition of weighed sand first and then with dry binders, in weighed quantities to the mixer. The dry ingredients are mixed for a short time and then the liquids in weighed quantities are added. The total mixing time may require 3 to 6 minutes in normal muller and 60 to 90 seconds in centrifugal muller. The objective of mixing is to bring out the best properties of binders added to the sand. To retain prepared sand properties, mixed sands should be protected from drying out.

MAKING THE CORES

Core making is done manually or with machines. Small cores are made by hand filling core boxes with the sand, ramming and struck off, then the core is transferred to a core plate for baking. This is usually done at core benches. Bench core making is limited in production and can be handled by one person. Large work however may be handled by two or more persons with cranes and may shift from bench to the floor.

Core on mass scale are rapidly produced on a variety of core making machines like Jolt Machine, Core Roll over Machine, Sand Slinger, Core Extrusion Machine, Core Blower and Shell Core Machine.

Core Boxes are required to produce cores. Core Box is basically a pattern for making cores. Core Boxes range from simple wooden structures to precision metal assemblies capable of long life under exacting conditions. A few commonly used types of Core Boxes are:

1. **Half Core Box**
2. **Slab or Dump Core Box**
3. **Split Core Box**
4. **Left & Right Hand Core Box**
5. **Strickle Core Box**
6. **Gang Core Box**
7. **Loose Piece Core Box**

BAKING THE CORES

After the cores have been prepared, manually or on a machine, they are placed on supporting plates or core carriers to avoid the flattening, sagging, shape changing and breaking. They are then sent to ovens for baking. Core baking develops the properties of the organic binders, drives off moisture from the cores, oxidizes the oil and polymerizes the binder.

Cores are baked at 325 to 350°C. At 100°C moisture is driven away and at 200 to 260°C, core oil and other organic binders change chemically and molecularly from liquid to solid by oxygen absorption and polymerization.

Thick and thin sectioned cores preferably should not be baked in the same batch, because when thin cores get baked, thick ones are still under baked and when thick cores bake, thin ones get over baked. An over baked core is just a heap of loose sand with destroyed binders. Oven temperature should not be too high to over-bake the external surface of the core with its center remaining under baked. An under- baked core will generate mould gases excessively and produce blow holes in the casting.

Core baking equipment may be categorized based on size & quantity as follows:

1. Core Ovens [Batch type(Drawer type & Rack type) & Continuous type]
2. Dielectric Bakers 3. Radiant Bakers

Although a wide variety of resin binder processes are currently used, they can be classified into the following:

- No Bake binder systems
- Heat Cured binder systems
- Cold Box binder systems

In the No Bake & Cold Box processes, the binder is cured at room temperature. In shell moulding, Hot Box and Oven Bake processes, heat cures are applied. The Cold and Heat Cured processes lend themselves exceptionally well to medium and high production applications.

Both Cold and Heat activated cores are cured in the Core Box, thus maintaining excellent dimensional accuracy. Cold processes utilize gases that are forced through the compacted sand mixture to cure the core.

Heat cured processes require the Core Box to be heated to 175 to 290°C, prior to the introduction of the prepared sand.

The No Bake process uses binder systems that consists of chemicals that, when mixed together in sand, cure without the introduction of an external agent, such as heat.

FINISHING OF CORES

After the cores are baked, certain numbers of operations are performed on them before they can be set in the mould. These operations are termed Core Finishing. Core Finishing consists of:

a) Cleaning b) Sizing (making it dimensionally accurate) c) Core assembly

Cleaning involves trimming (removing fins and other sand projections from the cores by rubbing them with file or an abrasive tool), brushing (removing of loose sand from the cores), coating (produce smooth core surfaces and make core resistant to molten metal penetration) and mudding (a localized coating used to make the core surface completely smooth. Graphite moistened with water to putty may be used to fill up any cavities, rough spots, soft rammed areas or the joint lines of assembled cores).

Sizing means making a core dimensionally accurate. Sizing usually involves gauging the core to see if its size is correct and then removing material. Cores can be corrected to size by grinding, filing or scraping.

Core shape and dimensions are checked with the help of templates and gauges.

In Core Assembly, some cores are of one piece and may be set directly into the mould after cleaning and sizing. Other cores are assembled of two or more pieces before they can be set in the mould. Core Assemblies may be held together by pasting, bolting or leading.

SETTING THE CORES

Core setting is the operation of placing the cores in the mould. Cores must be of correct size and positioned properly with respect to the mould cavity so that cavities in the castings are in their required location. Cores are positioned in the mould by core prints and firmly secured so that they can withstand the buoyancy effect of the poured molten metal.

Small cores are placed in the mould by hand whereas large cores may require hoist or crane services.

Sometimes number of cores are assembled and set in at one time. This usually requires core assembly fixture to be held together.

Customer Voice

MR. SAURABH MOHTA
DIRECTOR

M/S TRUFORM TECHNO PRODUCTS LTD.

VILLAGE KAWTHA, NAGPUR 440026
MAHARASHTRA

We have been using pig iron, from several manufacturers over time. However, we have found that by the use of "TATA eFee", we have saved good amount of Coke (nearly 5-8%) required to melt the conventional shaped pig iron and with the application of better foundry practices we can save more. In addition to this, the level of slag and contamination in Tata eFee is negligible which in turn is a major cost saver for us.

With the training sessions in classroom and at site taken by Tata Metaliks' technical team, we can say without doubt that TML has upgraded us to higher level of foundry knowledge. With the implementation of TML's training, we are using the things more efficiently, for e.g. our sand bunker levels have now been increased. The rejection of acid pipe has stopped. We have also improved our sand handling process & sand parameters. Now being technically more aware, we are more competitive from the production side.

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