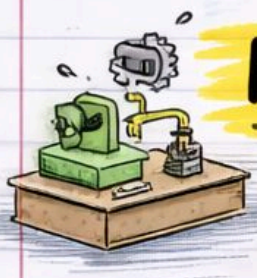

Manufacturing Practices Module-4 Notes

by pyqfort.com

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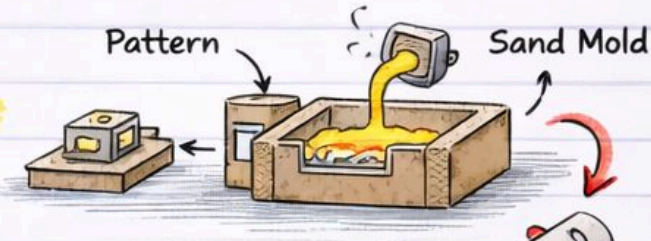
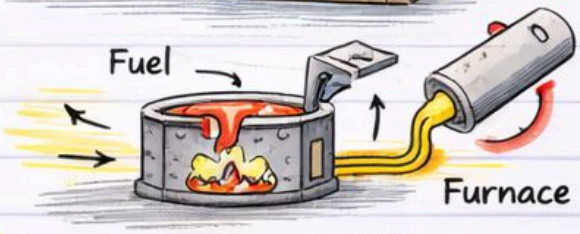
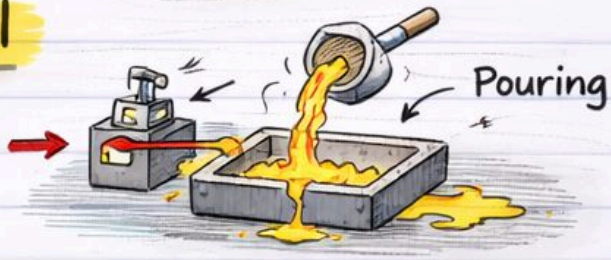


- Melting Furnances



- Pouring of Molten Metal



- Cleaning of Castings
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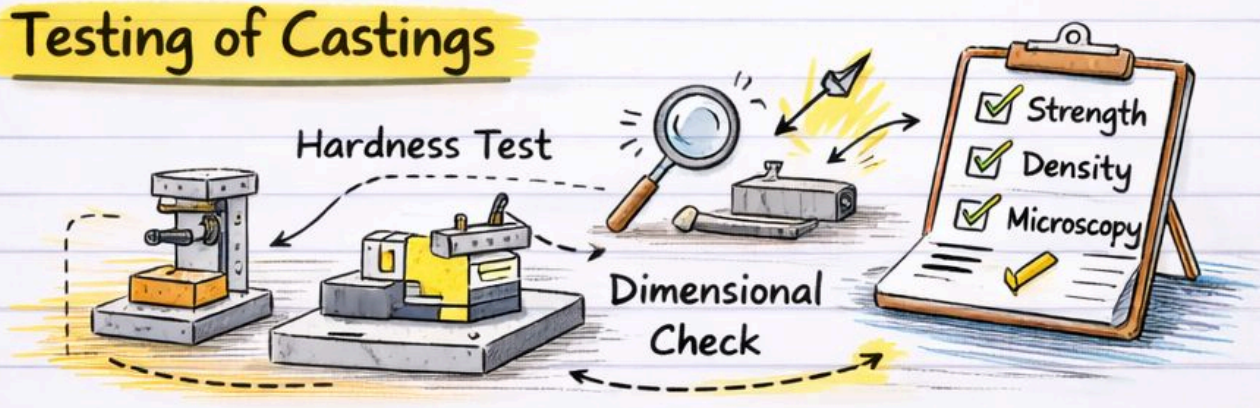


CASTING PRACTICES : INTRODUCTION

2.1. Introduction:

- The casting process consists of charging a furnace, melting, pouring the metal into moulds, solidification, removal of casting, fettling and inspection.

- The process is divided into steps:
  1. Metal melting, 2. Metal pouring, 3. Solidification, 4. Removal of casting, 5. fettling, 6. Inspection

2.1.1. Metal Melting:

- Furnace is charged with hard coke and fired.
- Crucible is heated, then charged with the desired quantity of metal.
- Covered with hard coke and a lid. Air blower is switched on.
- Metal is converted into molten state.

2.1.2. Metal Pouring:

- Remove crucible with tongs, transfer to a carrier.
- Pour metal into the mould with correct pouring rate.
- Place additional weight over the cope to avoid lifting during pouring.

2.1.3. Solidification:

- Wait for sufficient time for metal to cool off and completely solidified.

2.1.4. Removal of Casting:

- Break the sand mould, extract the casting.
- Remove adhering sand, collect sand for reuse.

2.1.5. Fettling:

- Remove dry sand core, cut off gate and riser.
- Remove unwanted projections, pins, nails, etc., and clean adhering sand.

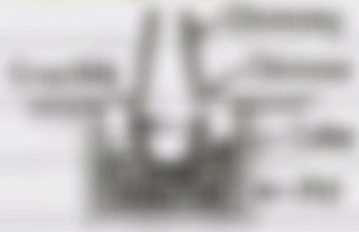
2.1.6. Inspection:

- Inspect for defects, analyze causes, and make a list of preventive measures.

MELTING FURNACES

1. **Crucible Furnaces**
   - *Simplest of all the furnaces.*
   - *Used in most of the* **small foundries** *where* **melting is not continuous** *and a large variety of metals is to be melted in* **small quantities.**
   - *Melting takes place inside a* **melting pot**, *called* **crucible**, *made of* **clay** *and* **graphite.**

(i) **Coke-fired Furnaces** (Fig. 3.1):
   - *Generally installed in a* **formed pit.**
   - *Used for melting small quantities of* **ferrous metals** *for producing* **iron castings** *and also for* **non-ferrous metals.**
   - *Provided with* **refractory lining** *inside and a* **chimney** *at the top.*
   - **Coke** *is used as fuel.*

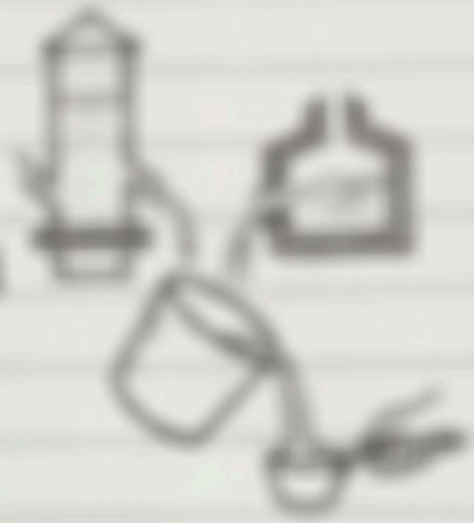


(ii) **Oil and Gas Fired Furnaces** (Fig. 3.2):
   - *Utilise* **oil** *or* **gas** *as a fuel.*
   - *Mixture of fuel and air is fed into the furnace, which burns inside to produce heat.*
   - *Furnace essentially consists of a* **cylindrical steel shell**, *with* **refractory lining** *inside.*
   - *The crucible is seated on a pad formed at the bottom.*

2. **Cupola Furnace** (Fig. 3.3):
   - *Used for* **melting of cast iron** *in foundry.*
   - *Has a construction in the form of a* **hollow vertical cylinder** *made of strong* **mild steel plates.**

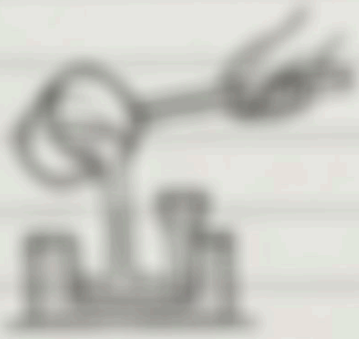
POURING OF MOLTEN METAL

The molten metal from the cupola (ferrous metals) or the furnace (non-ferrous metal) is run into a large receiving ladle.
From large ladle, metal is distributed into small pouring ladles.



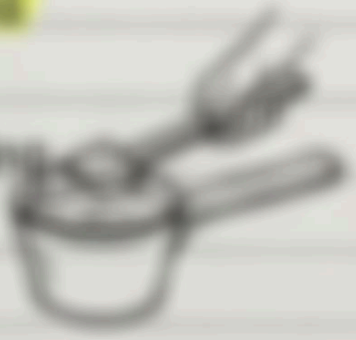
Precautions during pouring:

1. The pouring should be done continuously at a constant rate until moulds, gates and risers are full.



2. The pouring should be done when metal is at right temperature. Temperature is checked with an optical pyrometer.

3. The floating slag should be skimmed back with the help of a skimming bar by an assistant before discharging the metal into the mould.



CLEANING OF CASTINGS

After cooling and solidification in the mould, the mould is broken and casting is taken out of the sand.

1. The sand is removed by hand, hammers, tongs and shovels or on a vibrating steel grid.

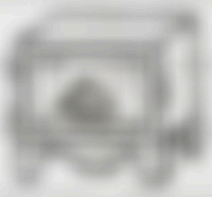
2. The sand is shaken out of the mould and collected for reuse on a conveyor.

3. The casting after freeing from the sand is cleaned with a wire brush.

4. The runners and feeders are removed by using hammers, chisels, hacksaw, grinders, files, etc. .

5. For large steel castings, gas cutters may be used.

6. All traces of sand are removed by shot blasting machines.



7. All remains of runners, risers, joints of the mould and cors and other irregularities are removed by the use of files, portable fiors, flexible grinders, chisels and other hand tools.

Casting Defects

Sand castings are subject to certain defects which are controllable by proper foundry practice.

Shifts (Mismatch)
Causes: Core misplacement. Mismatching of flasks.
Remedies: Proper alignment of pattern, dies, moulding boxes.

Warpage (Undesirable distortion)
Causes: Different rates of solidification. Shrinkage of intersection.
Remedies: Proper casting design. Addition of ribs.

Fin
Causes: Incorrect assembly of moulds. Insufficient weighting.
Remedies: Use sufficient weighting. Correct assembly.

Swell (Enlargement)
Causes: Defective ramming.
Remedies: Proper ramming of sand.

Blowholes (Cavities of holes)
Causes: Excessive moisture. Low sand permeability. Too hard ramming.
Remedies: Adjust moisture content. Use proper grain size. Ensure sufficient venting.

Drop
Causes: Low strength sand. Soft ramming.
Remedies: Avoid the causes.

Dirt (Embedded)
Causes: Crushing of moulds. Slag in ladles metal.
Remedies: Use dirt traps. Proper Gating.

Honeycomb or Sponginess
Causes: Dirt or scarf in metal. Imperfect skimming.
Remedies: Prevent sand wash. proper skimming +

Metal Penetration
Causes: Low sand strength. Large grain size.
Remedies: Avoid causes.

Sand Holes
Causes: Loose sand washing into mould. Rapid pouring.
Remedies: Proper cleaning of mould. Careful pouring.

Pin Holes
Causes: High moisture content. Absorption of H_2 and CO gases.
Remedies: Control moisture. Increase sand permeability.

Scabs (Fins projected)
Causes: Too fine sand. Low permeability.
Remedies: Mix coarse flour into sand.

Shrinkage Cavity (Hard/Magnesium)
Causes: Uncontrolled solidification. High pouring temperature.
Remedies: Use directional solidification. Use chills, padding.

Hot Tears (Cracks)
Causes: Poor design. Abrupt sectional changes.
Remedies: Improve casting design. Proper corner fillets.

Cold Shut and **Misrun**
Causes: Improper filling. Thin sections. Slow pouring.
Remedies: Use high pouring temperature. Proper gating.

Mismatch
Causes: Insufficient metal in the ladle.
Remedies: Sufficient metal in the ladle.

Internal Air Pocket
Causes: Rapid pouring. Poor venting.
Remedies: Use correct pouring temperature. Ensure sufficient venting.

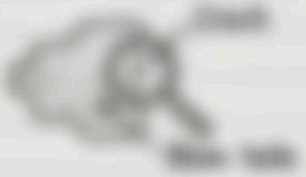
TESTING OF CASTINGS

After cleaning and fettling, the castings are checked for possible defects and flaws. The testing and inspection tests may be classified as follows:

1. Visual inspection
2. Dimensional inspection
3. Mechanical and chemical testing
4. Non-destructure methods of inspection
5. Metallurgical inspection

1. Visual Inspection

- Carried out for possible surface defects such as cracks, blow holes, slag inclusions, incomplete filling of metal, sand inclusion, local collapses of mould and cores.

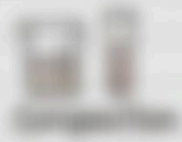


2. Dimensional Inspection

- Carried out to measure the dimensions of the casting table to distortions due to core movement during pouring.
- Very important for investment castings, shell mould casting and die casting.

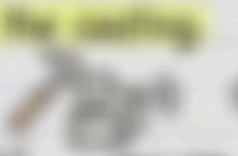
3. Mechanical and Chemical Testing

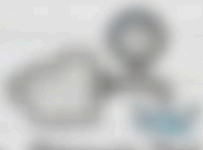
- Mechanical tests include tensile strength, bending strength, fatigue strength, wear resistance and hardness of cast metal.
- Chemical tests include composition, percentage of alloying elements in cast metal.

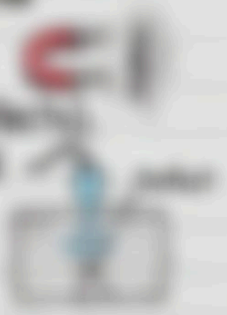


4. Non-destructure Tests

- Used to locate the defects present in the interior of the casting.
- Includes: 1. Sound test (emits sound reflections)
  2. Impact test (striking with a hammer)
  3. Pressure test (to detect leaks or weak spots)
  4. Radiographic tests (using X-rays and γ-rays).
  5. Magnetic particle tests (for steel and iron, particles align to cracks).
  6. Fluorescent dye penetration test (for small surface defects).
  7. Ultrasonic tests (high frequency sound waves reflected from interior cracks).

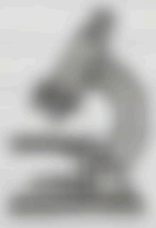






5. Metallurgical Inspection

- Methods used: 1. Etch test
  2. Fracture test
  3. Macro-etching test
  4. Microscopic test
- Carried out by experts in special laboratories.



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