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Internal Assessment Test 3 – November 2018

Sub:	METAL CASTING AND WELDING					Sub Code:	15ME35A	Branch:	MECHANICAL
Date:	20/09/2018	Duration:	90 min's	Max Marks:	50	Sem/Sec:	3rd Sem B		OBE

	Answer any FIVE FULL Questions	MARKS	CO	RBT
1.	Briefly describe the different pattern allowance.	[10]	CO2	L1
2.	Explain with a neat sketch investment moulding process.	[10]	CO1	L2
3.	Explain with a neat sketch Jolt-Squeeze moulding machine.	[10]	CO2	L2
4. (a)	Explain the different types of pattern materials.	[06]	CO2	L2
(b)	Write a short note on binders.	[04]	CO2	L1
5.	Explain with a neat sketch steps involved in green sand moulding.	[10]	CO1	L2
6.	Explain with the neat sketch mould making process using CO_2.	[10]	CO1	L2
7.	Define solidification. Explain different solidification variables.	[10]	CO5	L2
8.	Briefly explain different methods to achieve directional solidification.	[10]	CO5	L2

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Scheme of Evaluation Internal Assessment Test 3 – November. 2018

Sub:	METAL CASTING AND WELDING					Sub Code:	15ME35A	Branch:	ME
Date:	20/11/2018	Duration:	90 min's	Max Marks:	50	Sem / Sec:	3rd B		

	Answer any 5 question	Split up	Max. MARKS
1	Briefly describe the different pattern allowance. **Explaining 5 pattern allowance - Each pattern allowance carries 2 Marks**	**2*5M**	[10]
2	Explain with a neat sketch investment moulding process. **Diagrams- 4 marks** ` **Construction and Working- 4 Marks** **Advantages and disadvantages-2 Marks**	**4M** **4M** **2M**	[10]
3	Explain with a neat sketch Jolt-Squeeze moulding machine. **Diagram- 4 Marks** **Construction and Working- 4 Marks** **Advantages and disadvantages-2 Marks**	**4M** **4M** **2M**	[10]
4	(a) Explain the different types of pattern materials. (b) Write a short note on binders **(a) Explaining 3 materials (advantages and disadvantages)- 6 mark** **(b) Explaining binders with examples- 4 Marks**	**6M** **4M**	[10]
5	Explain with a neat sketch steps involved in green sand moulding. **Diagram- 4 Marks** **Construction and Working- 4 Marks** **Advantages and disadvantages-2 Marks**	**4M** **4M** **2M**	[10]
6	Explain with the neat sketch mould making process using CO2. **Diagram- 4 Marks** **Construction and Working- 4 Marks** **Advantages and disadvantages-2 Marks**	**4M** **4M** **2M**	[10]
7	Define solidification. Explain different solidification variables. **Definition- 2 Marks** **Stating and Explaining the same- 2 Marks each**	**2M** **2*4M**	[10]
8	Briefly explain different methods to achieve directional solidification. **Explaining 5 methods- Each method carries- 2 Marks**	**2*5M**	[10]

SOLUTION OF 3rd INTERNALS

1. Pattern allowance is a vital feature as it affects the dimensional characteristics of the casting. Thus, when the pattern is produced, certain allowances must be given on the sizes specified in the finished component drawing so that a casting with the particular specification can be made. The selection of correct allowances greatly helps to reduce machining costs and avoid rejections. The allowances usually considered on patterns and core boxes are as follows:

- Shrinkage or Contraction allowance
- Draft or Taper allowance
- Machining or Finish allowance
- Distortion or Camber allowance
- Rapping or Shaking allowance

Shrinkage or Contraction Allowance

In casting process, solidification of the molten metal takes place. All the metals or alloys undergo decrease in volume during solidification. This change in volume is known as **shrinkage**. Shrinkage of molten metal takes place in three stages. First stage, period in which temperature falls from the pouring temperature to the liquids temperature called ***Liquid contraction***. Second stage, period in temperature falls from liquids temperature to solidus temperature called ***Solidifying contraction***. Third stage, period from solidus temperature to the temperature reaches to room condition called ***Solid contraction***.

The contraction of metal during first and second stage is taken care of by providing proper gating and risering. But contraction of metal at third stage is taken care by providing positive shrinkage allowance to the pattern.

"Shrinkage allowance is an allowance added to the pattern, to compensate for the metal shrinkage that takes place while the metal solidifies"

Shrinkage allowance for various metals

MATERIALS	**SHRINKAGE METALS**
Grey cast iron	1.5 mm per 100 mm length
White cast iron	1.6 to 2.3 mm per 100 mm length
Aluminium	1.3 mm per 100 mm length
Brass	1.55 mm per 100 mm length
Copper	1.6 mm per 100 mm length
Lead	2.6 mm per 100 mm length
Magnesium	1.3 mm per 100 mm length

Draft Allowance

Draft is meant the taper provided by the pattern maker on all vertical surfaces of the pattern so that pattern can be removed from the sand without tearing away the sides of the sand mold. Figure a. shows a pattern without draft allowance being removed from the pattern. In this case, till the pattern is completely lifted out, its sides will remain in contact with the walls of the mold, thus tending to break it. Figure b. is an illustration of a pattern with proper draft allowance. Here, the moment pattern lifting commences, all of its surfaces are well away from the sand surface.

Draft allowance varies with the complexity of the sand job. But in general inner surface details of the pattern require higher draft than outer surfaces. The amount of taper varies from 0.5^0 to 1.5^0. It may be reduced to less than 0.5^0 for larger castings. The wooden pattern required more taper than metal patterns because of the greater fractional resistance.

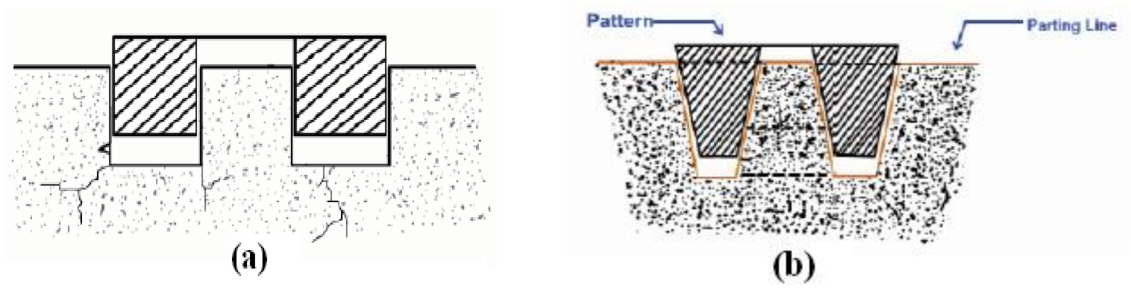


Fig- Draft allowance in pattern

Machining Allowance

For good surface finish, machining of casting is required. The dimensions gets reduces after machining. Hence the size of the pattern is made larger than the required. For machining extra metals are needed. This extra metal is called machining allowance. This allowance is given in addition to shrinkage allowance. The amount of this allowance varies from 1.6 to 12.5 mm which depends upon the following

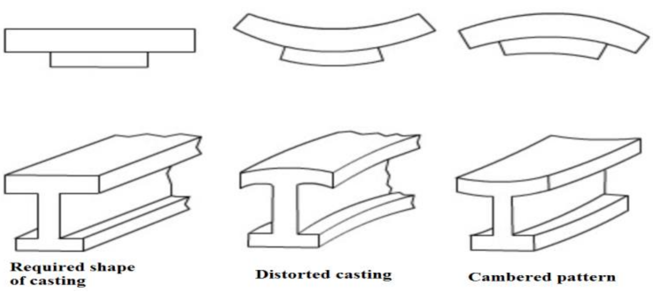
1. Type of casting metal
2. Size and shape of casting
3. Method of casting used
4. Method of machining employed
5. Degree of finish.

Distortion Allowance

Sometimes castings get distorted, during solidification, due to their typical shape. For example, if the casting has the form of the letter U, V, T, or L etc. It will tend to contract at the closed end causing the vertical legs to look slightly inclined outward. This can be prevented by making the legs of the U, V, T, or L shaped pattern converge slightly (inward) so that the casting after distortion will have its sides vertical.

The distortion in casting may occur due to internal stresses. These internal stresses are caused on account of unequal cooling of different section of the casting and hindered contraction. Measure taken to prevent the distortion in casting includes:

- Modification of casting design
- Providing sufficient machining allowance to cover the distortion affect
- Providing suitable allowance on the pattern, called camber or distortion allowance (inverse reflection)



Rapping or Shaking Allowance

To remove the pattern from the mould cavity, pattern is rapped with the help of draw spike so that they can be detached from the mould. But due to excessive rapping the size of the cavity in mould gets enlarged. Therefore the size of the pattern is made smaller than the casting, which is known as rapping allowance. In small and medium size casting, this allowance can be neglected. But in larger casting this allowance is considered by making the part slightly smaller than required size. This is negative allowance.

2. This process is also known as **low wax process** or **precision casting**. In this process a disposal type of pattern is used like wax pattern which subsequently melted from the mould, leaving a cavity having all the details of the original pattern. In this process, refractory sand slurry is prepared by using -325 mesh **silica flour** with a binder **ethyl silicate** or **colloidal silica** etc., **accelerator (HCL)** and **water**.

Steps involved in process

1. ***Pattern making*****:** The investment casting process begins with the production of wax pattern of the desired casting. Pattern is prepared by injecting molten wax into the metallic mould and allows cooling for some time as shown in **Fig a.** After solidification the wax takes the shape of the cavity. Metallic mould gives a smooth surface finish and long life.
2. ***Assemble the wax patterns:*** Depending on the application multiple wax patterns may be created and then assembled into one complex pattern so that they can all be cast at once. These multiple patterns are attached to a common wax sprue, and gating system which forms the **cluster** or **tree** of patterns as shown in **Fig.b.**
3. ***Investment*****:** The ceramic mould, known as the *investment*, is produced by three repeating steps: coating, stuccoing, and hardening.

I. The first step involves dipping the cluster of patterns into slurry of fine refractory material and then letting any excess drain off, so a uniform surface is produced. This fine material is used first to give a smooth surface finish and reproduce fine details.

II. In the second step, the cluster is *stuccoed* with a coarse ceramic particle, by dipping it into a fluidized bed, placing it in a rainfall-sander, or by applying by hand.

III. Finally, the coating is allowed to harden.

These steps are repeated (6-8 times) until enough layers (5-15 mm thickness) must be formed to build a shell strong enough to with stand subsequent operations as shown in **Fig c.**

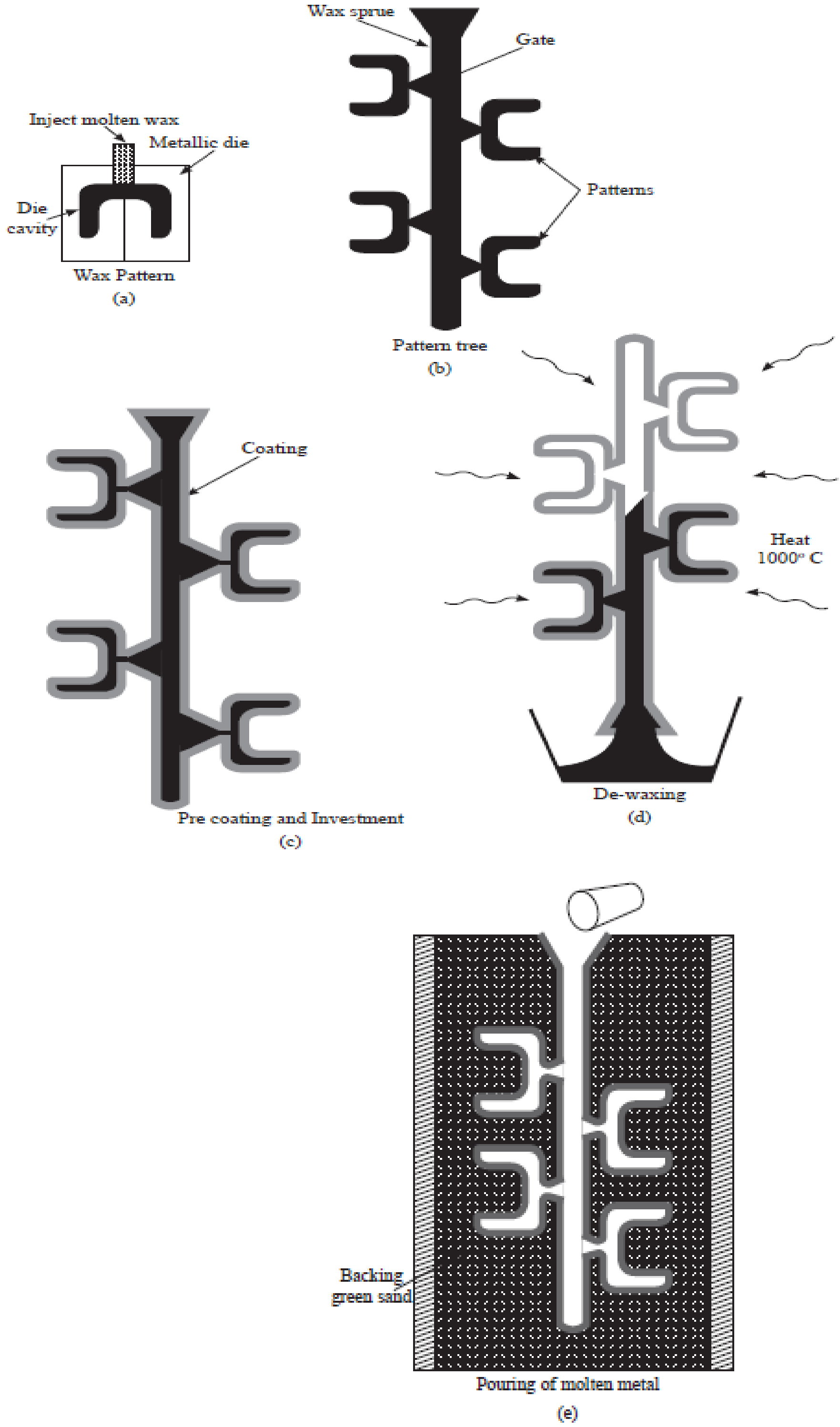
4. ***Dewaxing*****:** The investment is then allowed to completely dry, which can take 16 to 48 hours. Drying can be enhanced by applying a vacuum or minimizing the environmental humidity. The coated wax assembly is inverted and the shell is heated around 1000^0C to 1200^0C to remove wax as well as to improve the strength of shell as shown in **Fig d.** The collected wax is then reused.
5. **Mould preparation:** The prepared investment mould shell is placed in a flask and the backing sand material is rammed around the shell to give support in a flask. Now the mould is completely ready to receive the molten metal.
6. ***Pouring:*** The molten metal is poured into the shell through a funnel- shaped pour cup and flows down by gravity, through the gates and into the part cavities as shown in **Fig e.** As the metal cools, the parts, gates, sprue and pouring cup become one solid casting. After the casting has cooled, the ceramic shell is broken off and the parts are cut from the sprue.

Advantages

1. Gives smooth surface finish
2. High dimensional accuracy.
3. All metals or alloys can be cast.
4. Completely machining is eliminated
5. Casting produces are defect free
6. Very thin sections and complex shape can be easily produced

Dis-advantages

1. Suitable only for small size casting and expensive.
2. Process is relatively slow
3. Process is expensive
4. Difficult to separate the refractory from the casting



3. Jolt squeeze machine is a combination of the operating principle of ‘jolt’ and ‘squeeze’ machine. Due to combined jolting and squeezing action, gives uniform sand compaction in all portions of the moulds. The machine makes use of a match plate Molding. The Fig shows the arrangement of Jolt-Squeeze machine.

The match plate mould box assembly is placed on the table. The table is actuated by two pistons in air cylinder, one inside the other. One piston for the jolting action called ‘jolt piston’ and other for squeezing action called ‘squeeze piston’. Both jolting action and squeezing operations are performed simultaneously.

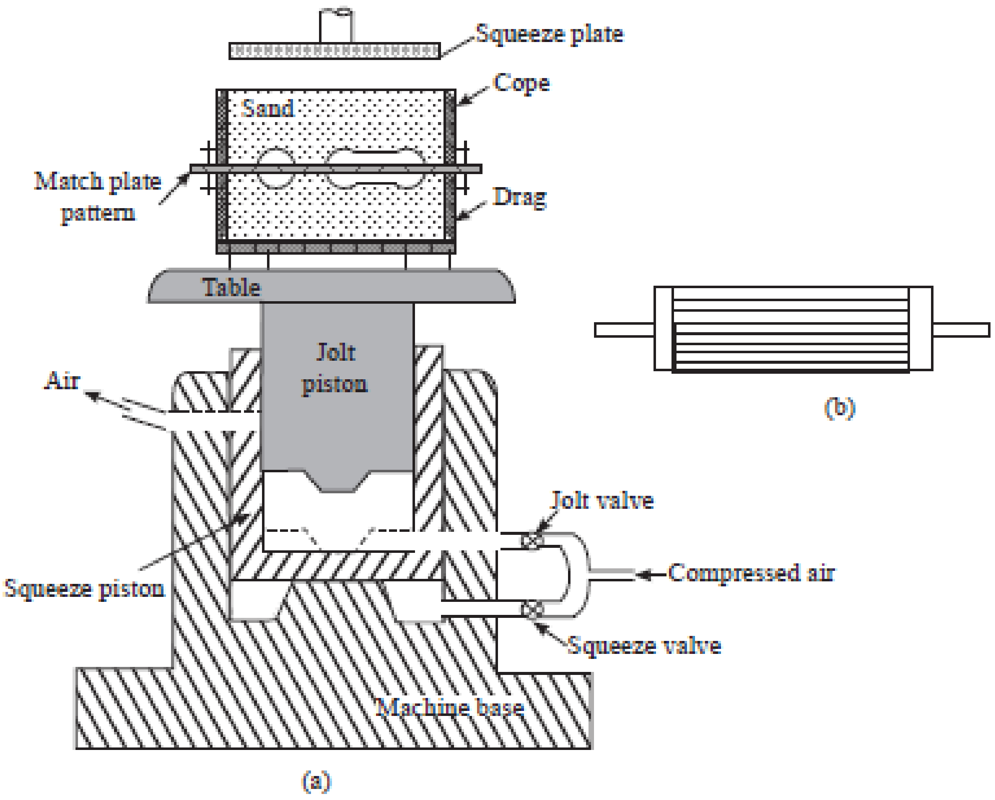
In operation, first sand is filled in the drag box and is kept on the table. Jolting operation is performed, by supplying compressed air to the jolt piston cylinder, results the compaction of sand around the pattern. After jolting, the complete mould assembly is rolled over by 1800 by hand and other part of match plate pattern with cope part is positioned. The cope is now filled with sand and compressed air is supplied to the squeeze cylinder, causes the squeeze piston to raises up and compact the sand around the pattern against the squeeze plate. By the end of this operation, the sand in the mould box is uniformly packed as shown in fig. The match plate is now vibrated and removed. The mould is finished and made ready for pouring.

Advantages:

1. More compactness of sand
2. Can achieve required hardness of sand.

Disadvantages:

1. Expensive
2. Skilled labor is employed



4 (a). The following materials are generally used for making pattern

1. Wood
2. Plastic
3. Plaster
4. Wax
5. Metal

1. Wood

Wood is the most popularly and widely used material for making pattern because it satisfies many of the desired requirements. Wood used for making pattern should be properly dried, straight grained, free from knots. Its life is short, after some use it tends to wraps and wears quickly because of moisture in the molding sand. Wood can preserve its surface by application of a shellac coating for longer life of the pattern. It cannot withstand rough handling and used for smaller number of castings.

Nowadays plywood, plastic filled wood laminates and laminated boards are having wider application in making patterns. These give additional benefits like strength, hardness and resistance to wear.

Ex: Teak, Mahogany, Sal, Shisham, Pine, Deodar etc.

Advantages

1. Easy available in plenty
2. Can be shaped easily
3. Light in weight
4. Cheaper than other material
5. Complex and large shape can easily fabricated

Dia-advantages

1. Poor strength
2. Less wear resistance
3. Not suitable for mass production

2. Plastic

Thermosetting and thermoplastic materials are commonly used as pattern materials during casting process. The thermosetting used for making long durable patterns, where thermoplastics are used for short durable patterns. These are originally in liquid form and get solidified when heated to a specified temperature. The various plastics used for the production of patterns are the compositions based on **epoxy, phenol formaldehyde and polyester resins; polyacrylates, polyethylene, polyvinyl chloride**, etc. thermosetting resin; phenolic resin plastics are most commonly used. Now a day's foam plastic material is widely using for pattern making.

Advantages

1) Lighter and stronger than wood pattern.
2) High resistance to corrosion.
3) Have high moisture and wear resistant,
4) Not affected by the moisture in the molding sand.
5) Smooth pattern surface.
6) Molding sand sticks less to plastics than to wood.

Dis-Advantages

1) It cannot be reused.
2) Difficult to cast thin sections.
3) Not too much strong
4) High investment during pattern preparation

3. Plaster

Gypsum plaster can be used for making pattern. It can easily work and intricate pattern can be made. Plaster readily mixes with correct quantity of water, when allowed to sets and become hard. Normally plaster is used for producing master dies and moulds.

Advantages

1. Light in weight, Cheap and easily available
2. Gypsum can be easily formed, has plasticity and can be easily repaired.
3. Produces intricate patterns with close tolerance.
4. Provide good surface finish.

Dis-advantages

1. Expands on solidification.
2. Has less strength than that of metal.

3. Suitable for to produce small castings.

(b). BINDERS

It is the material, which impart sufficient strength and cohesiveness to the mouding sand. Sand when mixed with a binder is capable of taking a shape of the pattern and retains it. Binders should be added in optimum quantity as they reduce refractoriness and permeability. An optimal quantity of binders is needed, as further increases have no effect on properties of foundry sand. The common binders used in molding sand are given below:

Organic binders: Organic binders find their specific use in core making. Examples are:

1. Linseed oil (Vegetable oil)
2. Mineral oil (used as diluting oil)
3. Whale oil (Marine animal) etc.

Inorganic binder: The commonly used binders are:

1. Fire clay
2. Bentonite
3. Sodium silicate
4. Portland cement

Out of all binders, clay binder is commonly used.

CLAY: Clay is defined as particle whose size is less than 20 microns. It has very large surface area and has very high affinity to absorb large amount of water and it became cohesive. It consists of two ingredients are fine slit and true clay. Fine slit is a sort of mineral deposit and has no bonding power. True clay imparts necessary bonding strength to the mould sand. The following types of clays are commonly used:

1. Kaolinite or Fire clay
2. Illite
3. Limonite
4. Bentonite etc.

Fireclay: It is usually found near coal mines. For use in the foundry, the hard black lumps of fireclay are taken out, weathered and pulverized. Since the size of fireclay particles is nearly 400 times greater than the size of bentonite particles, they give poor bonding strength to foundry sand.

Illite: Illite is found in natural molding sands that are formed by the decomposition of micaceous materials due to weathering. Illite possesses moderate shrinkage and poor bonding strength than bentonite.

Bentonite: It is the most suitable material used in molding sands. Limonite and Kaolinite are not commonly used as binders as they have comparatively low binding properties. Its deposits are Bihar, Rajasthan and Kashmir. The commonly used bentonite binders are:

- Sodium montmorillonite
- Calcium montmorillonite

Other types of binders are

- **Synthetic resins** (thermosetting plastics): Urea formaldehyde, phenol formaldehyde.
- **Cereal binders made from corn**: Examples are

a) Gelatinized starch (made by wet milling contains starch and gluten)
b) Gelatinized corn flour (made by dry milling)
c) Dextrin (made from starch, a water soluble sugar)

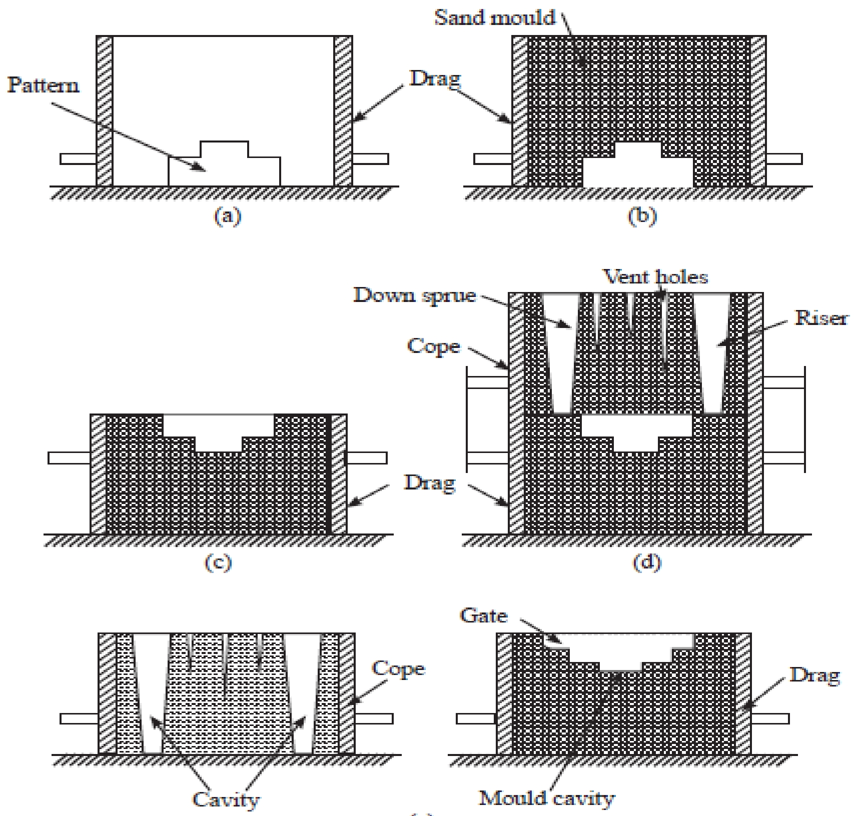
- **Wood products binder:** Natural resin (e.g. rosin, thermoplastic), Sulphite binders (contain lignin, produced in paper-pulp process), water soluble gums, resins and organic chemicals.
- **Protein binders** (Contain nitrogen): Glue, casein.

5. Green sand Molding method is the most widely used process for casting ferrous and non-ferrous metals. Nearly 65% of castings are produced from green sand moulds. In this method, sand is in green state means contain moisture. Generally in sand casting process consists of two mould boxes. One is at bottom or lower side called **drag box** and other top or upper box called **cope box.**

Green sand moulds are prepared by using suitable proportion of silica sand (85%-90%), bentonite binder (6-12%), water (3-5%) and some additives are mixed.

Steps involved

1. The pattern is placed on a flat surface and the drag box is placed around it.(Fig a)
2. Facing sand is sprinkled on pattern surface for easy release of the pattern from mould and also to give good surface to the casting.
3. Green sand mixture is poured on the pattern and uniform ramming is done. Drag box is filled with sand till its top surface. (Fig b).
4. The drag box is turned over so that the pattern faces the top surface (Fig c). Parting sand is sprinkled over the mould surface, this prevents the cope and drags halves from bonding together while ramming cope.
5. The cope box is placed on top of drag box properly with the help of drag pins and cope holes. Sprue and riser pins are placed at proper place and sand mixture is rammed around it uniformly up to the top surface. (Fig d)
6. The vent holes are made in the cope portion of the mould. The sprue and riser pins are removed from mould.
7. The cope box is then taken out and the pattern is removed out by rapping it carefully to avoid damage to mould cavity.
8. Gates are cut using hand tools to provide passage for the flow of molten metal into the mould cavity. (Fig.e)
9. The cope box is then placed on the drag box and is properly aligned with the help of pins. Finally the mould is ready to receive the molten metal. (Fig f)



(e)

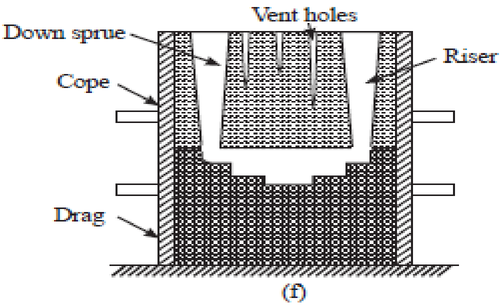


Fig 2.1 Sand Casting Process

Advantages

1. Great flexibility as a production process. Mechanical equipment can be utilized for performing molding and its allied operations.
2. Furthermore, green sand can be reused many times by reconditioning it with water, clay, and ether materials.
3. The molding process can be rapid and repetitive.
4. Suitable to produce small and medium size castings.
5. Usually, the meat direct route from pattern to mold ready for pouring is by green –sand molding.
6. Economy, green sand molding is ordinarily the least costly method of molding.

Limitations in the use of green-sand molding are:

1. Some casting designs require the use of other casting processes. Thin, long projections of green sand in a mold cavity are washed away by the molten metal or may not even be moldable. Cooling fins on air-cooled-engine cylinder blocks and head are an example. Greater strength is then required of the mold.
2. Certain metals and some castings develop defects if poured into molds containing moisture.
3. The dimensional accuracy and surface finish of green-sand castings may not be adequate.
4. Large castings require greater mold strength and resistance to erosion than are available in green sands.

6. This process is widely used for rapid hardening the moulds & cores with the use of sodium silicate. When sodium silicate comes in contact with CO_2, it reacts and forms the gel called silica gel. This gel acts as a binder and forms a strong bond between sand particles.

Steps involved in operation

1. The molding sand mixture consists of **pure dry silica sand** free from clay, 3-5% **sodium silicate** as binder and **moisture** content generally less than 3%. A small amount of starch may be added to improve the green compression strength and a very small quantity of coal dust, sea coal, dextrin, wood floor, pitch, graphite and sugar can also be added to improve the collapsibility of the molding sand.
2. The prepared molding sand mixture is rammed around the pattern in the drag box and Drag box is filled with sand till its top surface. The drag box is turned over so that the pattern faces the top surface

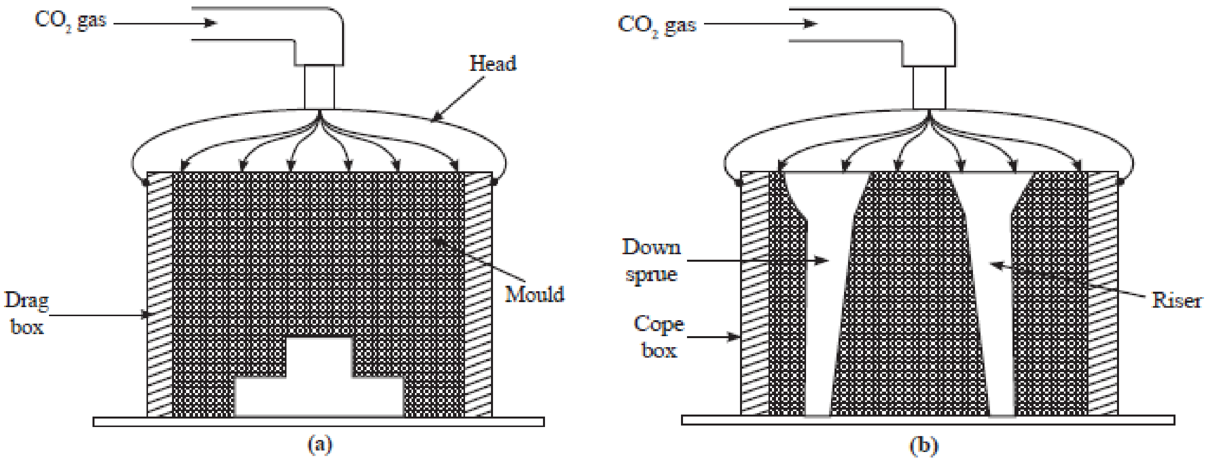


Fig 1.22 Carbon Dioxide Mold Process

3. Then carbon dioxide gas at about 1.3-1.5 kg/cm2 pressure is then forced all-round the mold surface to about 20 to 30 seconds using CO2 head or probe as shown in fig a.
4. Cores can also be baked by this way.
5. The sodium silicate presents in the mould reacts with CO_2 and produce a very hard constituents or substance commonly called as silica gel.

$$Na_2SiO_3 \ \ x\,H2O \ + CO_2 \ \rightarrow \ Na_2CO_3 \ + \ SiO_2 \ x\,H_2O$$

(Sodium silicate) (Carbon dioxide) (Sodium carbonate) (Silica gel)

6. This hard substance is like cement and helps in binding the sand grains.
7. Similarly cope box is prepared which consists of riser and runner as shown in fig b. The cope box is then placed on the drag box and is properly aligned with the help of pins. Finally the mould is ready to receive the molten metal for production of both ferrous and non-ferrous casting.

Advantages

1. Heating process is not required.
2. Mould has high strength and refractoriness.
3. Fast operation
4. Flowability and permeability of sand are improved.
5. It gives high dimensional accuracy.
6. Suitable for ferrous and nonferrous materials.
7. Less floor space is required.

Dis-advantages

1. Sand mixture is costly.
2. Poor collapsibility.
3. Difficult to reuse the used sand.
4. The storage life of the moulds/cores is short.

7.

Solidification Variables.

The following variables influences the Solidification of metals or alloys.

Solidification time – (T_s) (S_T)

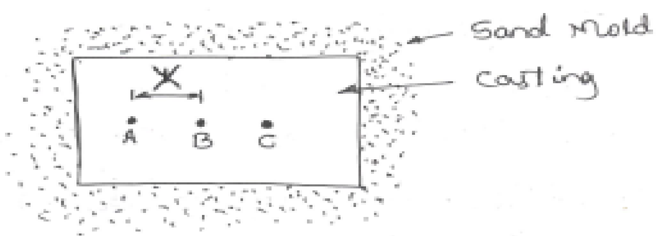
It is the Time taken by the metal or alloy to transform liquid state to Solid state Lesser the solidification time, better will be the properties with reduced shrinkage of the metals. Solidification is expressed in seconds.

Sand molds possess longer solidification time as compared to a metallic mold.

Solidification Rate – S_R

Solidification Rate defined as the rate at which the solidification is progressing from one point to other point. Fig shows Solidification at two places.

Consider different adjacent points A, B and C shown in figure



where

1) where A & B are the two adjacent points

2) t = thickness of metal solidified.

If the solidification between two adjacent points is 't'

Then we can write

$$X = K\sqrt{t} \quad \text{—— (1)}$$

where K = constant, depends on nature of metal

Differentiate eqn (1), we have.

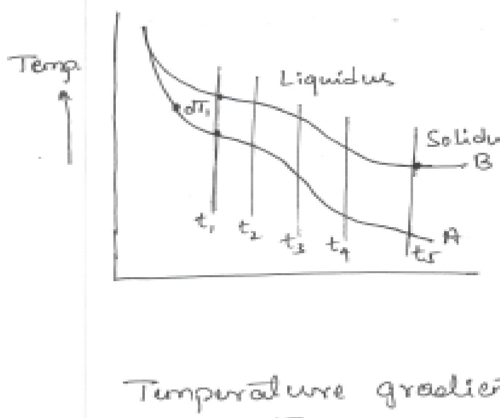
$$\frac{dx}{dt} = \frac{K}{2\sqrt{t}} \quad \text{—— (2)}$$

where $S_R = \frac{dx}{dt}$ is Referred as solidification Rate. ~~Lesser~~ Smaller The solidification time, longer the solidification Rate and vice-versa.

Higher is the solidification Rate better is the properties of the casting. Solidification Rate is expressed as cm/sec.

Temperature Gradient :- (G)

Consider a ~~casting~~ metal solidifying between A & B. The cooling curves corresponding to the two points is shown in Fig.



dx = distance between two adjacent points

dT = difference in Temp between A & B at any given time.

Temperature gradient for time t_1 is $G_1 = \frac{dT_1}{dx}$, for time t_2 is $G_2 = \frac{dT_2}{dx}$

At any Time interval there will be temperature difference between the two points. At any time interval let 'dT' be the temperature difference between points A & B.

Higher the value of G, better will be the casting and higher will be the properties. Temperature Gradient is expressed in °C/cm.

<u>Cooling Rate (CR)</u> -

~~It is the~~ Cooling Rate is the Rate at which the liquid metal is converted to solid metal. It is normally represented as (dx/dt) with units cm/s. Smaller the solidification time larger the cooling rate and vice-versa.

8.

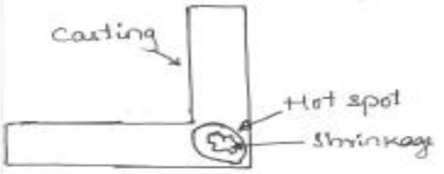
<u>Methods of achieving Directional Solidification</u>

only ~~Throughout~~ through the directional solidification, it is possible to get sound castings. Following are the methods that are employed to achieve directional solidification.

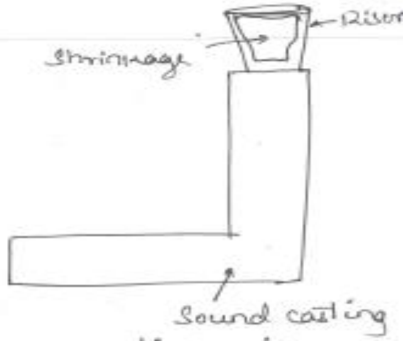
1) ~~By Providing~~ use of riser to the casting
2) By use of insulating material
3) By using Chills.
4) By padding the casting
5) Using Exothermic compounds.
6) Use of an arc over the riser.

<u>Use of proper Riser to the casting</u>

To obtain proper directional solidification ~~within~~ in the casting, is achieved by providing proper riser system in the casting. Riser retains the molten metal for a longer ~~period~~ time than the casting, the surface area through which heat transfer takes place must be minimum for a given volume of the riser. Fig shows this.



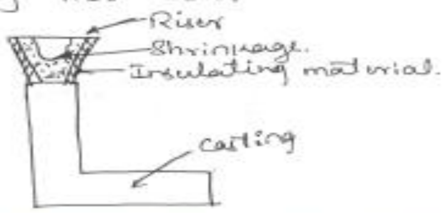
Casting without Riser



casting with Riser

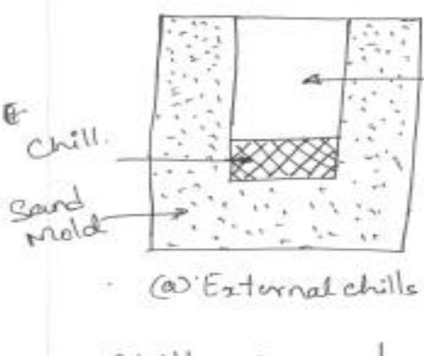
By Use of insulating material

To enhance the directional solidification of the casting, is achieved by providing the riser system with insulating materials. Risers can be made more efficient by ~~employing~~ coating with insulating material which keeps the molten metal more hot compared to the freezing metal. Fig shows Riser with insulating materials.

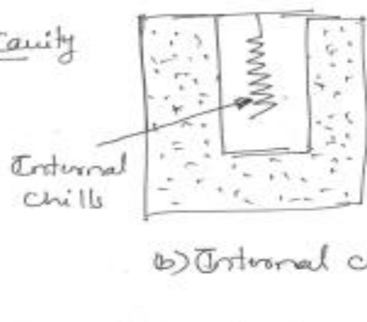


Use of chills.

Some of the castings will not support the riser system, where it is not possible to locate the riser on the castings. To promote directional solidification, ~~a~~ ~~the~~ castings are provided with chills. Chills are placed at an proper location in the mold to speed up the directional solidification. Fig shows this. ~~Chills may be classified a into 2.~~



(a) External chills



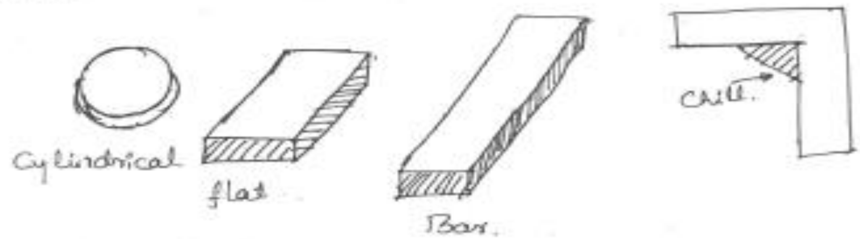
b) Internal chills.

Chills are of two categories

1) External. Chills.
2) Internal Chills.

Externals Chills.

These metal inserts are made of Stee cast iron & copper. It extracts the heat at faster rate. Fig shows the different chills.

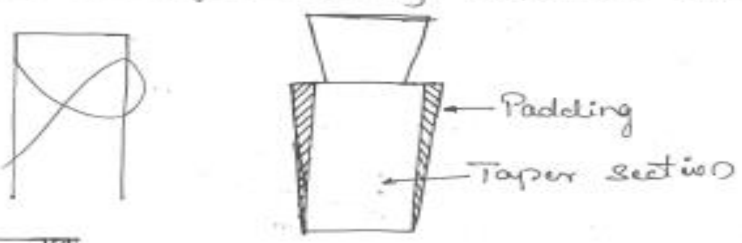


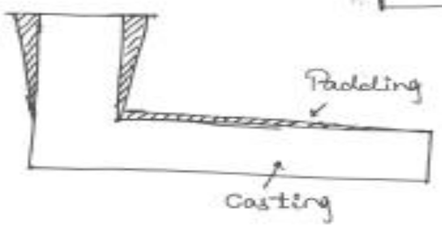
Internal Chills.

If external chills are not possible to locate within the castings internal chills are used and are placed at surface level. Internal chills are made up of same metal as that of casting because chills will fuses and become a part of casting. It alters the physical properties of casting. Fig shows some of the internal chills.

By Padding the Castings.

To speed up the directional solidification castings are provided with extra material. Small taper is provided as extra material to the castings and these extra material are cut off after the solidification. Fig illustrate this.





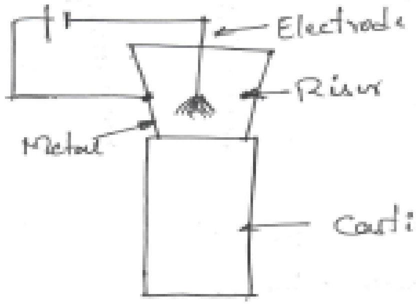
Using Exothermic Compounds.

Exothermic compounds are employed to give out heat due to exothermic reaction results faster directional solidification.

Graphite powder, charcoal, rice hull etc. are used as exothermic compounds.

Use of an Electric arc over the riser

To achieve proper directional solidification an arc is generated in the riser metal to keep the molten metal in the riser hotter for a longer time. Electric arc is generated by generating proper ~~circuit~~ circuit between riser and electrode.



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Internal Assessment Test – November 2018

Sub:	METAL CASTING AND WELDING					Sub Code:	15ME35A	Branch:	MECHANICAL
Date:	20/09/2018	Duration:	90 min's	Max Marks:	50	Sem/Sec:	3rd Sem A		OBE

Answer any FIVE FULL Questions		MARKS	CO	RBT
1.	Briefly describe the different soldering methods.	[10]	CO2	L1
2.	Explain with a neat sketch X Ray diffraction method.	[10]	CO1	L2
3.	Explain with a neat sketch magnetic crack detector.	[10]	CO2	L2
4. (a)	Explain with neat sketch different heat affecting zone.	[06]	CO2	L2
(b)	Explain the effect of carbon content on structure and properties of steel.	[04]	CO2	L2
5.	Briefly describe different brazing methods.	[10]	CO1	L1
6.	Explain with the neat sketch Holography inspection method.	[10]	CO1	L2
7.	Define solidification. Explain different solidification variables.	[10]	CO5	L2
8.	Briefly explain different methods to achieve directional solidification.	[10]	CO5	L2

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