

Government of Maharashtra
Directorate of Industrial Safety and Health

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Subject: Safety Norms to be followed in foundries

Introduction:

In the current situation of Covid-19 lockdown, the inspection of all the factories may not be possible by this directorate. Hence all such type of factories are hereby directed to follow the following safety measures in addition to the provisions of The Factories Act, 1948 and The Maharashtra Factories Rules, 1963.

The given guide lines are not exhaustive in nature; any additional precaution as may be necessary based on specific requirement should be adopted by the factory management for safe manufacturing operation of the factory based on the nature of manufacturing activity

“Foundry” : Foundry is a building or works where metal castings are produced.

“Casting” : A metal object cast to required shape by pouring or otherwise injecting liquid metal into mould, as distinct from one shaped by mechanical process.

Or

An act of pouring molten-metal into mould is known as casting.

Occupier and Manager shall ensure following safety measures in Foundry industry and furnaces.

1) Moulding boxes, loam plates, ladles, patterns, pattern plates, frames, boards, box weights, and other heavy articles shall be so arranged and placed as to enable work to be carried on without unnecessary risk.

2) A material shall not be used as a parting material if it is a material containing compounds of silica calculated as silica to the extent more than five per cent, by weight of the dry material.

3) Where there is bulk storage of sand, fuel, metal scrap or other materials or residues, suitable bins, bunkers or other receptacles shall be provided for the purpose of such storage.

4) The precinct in which induction furnace is installed shall be of adequate strength and shall be segregated from the other parts of the factory in such a way so that minimum number of workers are exposed to the risk of any fire or explosion at any time;

- 5) Furnace shed shall be well ventilated.
- 6) All the fitting and attachment of Induction furnace shall be of good construction, sound material and adequate strength.
- 7) The refractory material of the induction furnace shall be strong at high temperature, resistant to thermal shock, chemically inert, low thermal conductivity and coefficient of expansion and it shall be of adequate uniform thickness.
- 8) The lining of the induction furnace shall be checked by qualified supervisor every week for any wear and tear and damage as per relevant Bureau of Indian Standards.
- 9) Adequate precautions shall be taken during repair of induction furnace as per relevant bureau of Indian Standards.
- 10) There shall be at least two ways of escape with adequate width at opposite ends of the furnace platforms.
- 11) Notice regarding non-use of water, etc. near induction furnace shall be displayed at conspicuous place in the factory.
- 12) No scrap material with close cavities shall be charged in the induction furnace. Scrap to be charged shall be dry and shall not contain oil or any other liquid or moisture.
- 13) No scrap material shall be fed into induction furnace unless it is thoroughly checked in the presence of qualified Supervisor.
- 14) No closed container scrap like shock absorber, hermetically sealed compressor, deodorant bottle, close cylinder, close pipe etc. shall be fed into the furnace unless it is cut into pieces.
- 15) No wet scrap material shall be charged into the induction furnace.
- 16) Scrap received in the form of pressed bundle should be opened, sorted and only then fed into furnace.
- 17) The charging material shall be preheated to ensure that no wet scrap material is fed to the furnace.
- 18) To avoid catastrophic explosion during scrap melting in furnace following precaution should be taken.
 - a) Every new lining shall be of right refractory material based on the operating temperature of the furnace and type of metal to be melted.
 - b) New furnace lining and sintering cycle should be done as per manufacturer's manual and with supervision.
 - c) Monitor the lining condition visually for any abnormal erosion, daily.
 - d) Monitor and record the inner lining dimensions of the crucible weekly.

- e) Refractory lining material manufacturer's procedure to be followed for cooling and heating furnace during weekly off to avoid furnace lining failure due to sudden or cumulative effect of thermal shocks.
 - f) Over heating of the melt shall be avoided by monitoring and taking the temperature of the liquid metal.
 - g) Excessive temperature and bridging of the scrap in to the furnace shall be avoided by mechanical poking of charge material from the safe distance by using scrap poker machine when liquid metal is 3/4th ready in furnace.
 - h) Scrap size shall be maximum up to 1/3rd of the furnace inside diameter.
 - i) Do not charge bulky scrap in to the empty furnace directly to avoid furnace lining failure due to sudden or cumulative effect of physical shock.
 - j) Furnace shall be emptied out completely in the event of prolong power failure, loss of coolant event and prolonged furnace shut down to avoid furnace lining failure due to sudden or cumulative effect of mechanical stress.
- 19) In the Induction furnace Ground leak detector (GLD) system shall be provided and it shall be checked frequently. Leak detector shall be interlocked electrically as per manual so that power supply to the furnace will be cut off.
- 20) In the Induction furnace demineralised water conductivity shall be checked daily and it shall be maintained below 20mS (Micro moh).
- 21) For every induction furnace spill pit shall be provided to contain any molten metal spilled from the furnace as a result of accident; run out or dumping of furnace in an emergency. Pit capacity shall be large enough to hold 150% of furnace's capacity. Spill pit shall be kept completely dry at all times.
- 22) Back up cooling system for furnace cooling such as diesel pump or a D. G. Set shall be provided, if normal pump fails to operate.
- 23) PPE's such as Fire retardant and heat retardant clothing/apron, face shield, helmet, hand gloves, safety shoes shall be provided to all the workers working on platform of induction furnace.
- 24) It shall be ensured daily that Cooling tower fan is running effectively.
- 25) Charging material shall be free from rust, dirt and sand to avoid furnace lining failure due to slag or Dross build up on the lining.
- 26) Effective cleaning by a suitable method shall be carried out at least once every working day of all accessible parts of the floor of every indoor workplace in which the processes are carried on.
- 27) Any operation involving the carrying by hand of a container holding molten metal shall be performed on a floor.

- 28) Floors or indoor workplaces, the pouring aisles in which the processes are carried on, other than parts which are of sand, shall have an even surface of hard material to avoid risk of flying metal from accidental spillage. The floor area shall be kept, so far as reasonably practicable, free from obstruction.
- 29) If molten metal is carried in hand ladles or bull ladles by not more than two men per ladle, the pouring aisle shall be at least 460 mm wide, but where any moulds alongside the aisle are more than 510 mm above the floor of the aisle, the aisle shall be not less than 600 mm wide;
- 30) If molten metal is carried in hand ladles or bull ladles by more than two men per ladle, the pouring aisle shall be at least 760 mm wide ;
- 31) If molten metal is carried in crane, trolley or truck ladles, the pouring aisle shall be of a width adequate for the safe performance of the work.
- 32) No person shall carry out any work within a distance of four meters from a vertical line passing through the delivery and of any spout of a cupola or furnace, being a spout used for delivering molten metal, or within a distance of 2.4 meters from a vertical line passing through the nearest part of any ladle which is in position at the end of such a spout.
- 33) Open coal, coke or wood fires shall not be used for heating or drying moulds and ladles inside a workroom unless adequate measures are taken to prevent, so far as practicable, fumes or other impurities from entering into or remaining in the atmosphere of the workroom.
- 34) Mould stoves, core stoves and annealing furnaces shall be so designed, constructed, maintained and worked as to prevent, so far as practicable, offensive or injurious fumes from entering into any workroom during any period when a person is employed therein.
- 35) All knock-out operations shall be carried out
- (a) In a separate part of the foundry suitably partitioned off, being a room or part in which, so far as reasonably practicable, effective and suitable local exhaust ventilation and a high standard of general ventilation are provided ; or (b) In an area of the foundry in which, so far as reasonably practicable, effective and suitable local exhaust ventilation is provided, or where compliance with this requirement is not reasonably practicable, a high standard of general ventilation is provided.
- 36) All dressing or fettling operations shall be carried out
- (a) in a separate room or in a separate part of the foundry suitably partitioned off ; or
- (b) in an area of the foundry set apart for the purpose ; and shall, so far as reasonably practicable, be carried out with effective and suitable local exhaust ventilation or other equally effective means of suppressing dust, operating as near as possible to the point of origin of the dust.
- 37) All ventilating plant used for the purpose of extracting, suppressing or controlling dust or fumes shall be properly maintained.

38) The occupier shall provide and maintain suitable protective equipment specified for the protection of workers, an approved respirator for workers carrying out any operations creating a heavy dust concentration which cannot be dispelled quickly and effectively by the existing ventilation arrangements.

39) Persons who for any of their time (a) work at a spout of or attend to, a cupola or furnace in such circumstances that material there from may come into contact with the body, being material at such a temperature that its contact with the body would cause a burn; or

(b) are engaged in, or in assisting with, the pouring of molten metal; or

(c) carry by hand or move by manual power any ladle or mould containing molten metal ; or

(d) are engaged in knocking-out operations involving material at such a temperature that its contact with the body would cause a burn;

shall be provided with Fire retardant and heat retardant clothing/apron, face shield, Helmet, hand gloves, suitable footwear and gaiters which worn by them prevent, so far as reasonably practicable, risk of burns to his feet and ankles.

40) Appropriate, suitable screens or cabins/rooms shall be provided for protection against flying materials (including splashes of molten metal and sparks and chips thrown off in the course of any process).

41) Workers employed for segregation of scrap shall be provided with suitable personal protective equipments.

42) All operations in foundries and furnaces shall be carried out under the supervision of qualified supervisors at all times workers carrying out operations and maintenance activities in foundries and furnaces shall be adequately trained. It shall be ensured that the training given to worker is understood by worker. Refresher training shall be given to all workers after every three year.

43) Dross and skimming's removed from molten metal or taken from a furnace shall be placed forthwith in suitable receptacles.

44) Roadways, aisle or pathways inside the factory shall have a firm and even surface and it shall, so far as reasonably practicable, be kept free from obstruction.

45) Every worker employed in a foundry shall be examined by a Certifying Surgeon within fifteen days of his first employment. Such medical examination shall include pulmonary function tests and chest X- ray. No worker shall be allowed to work after fifteen days of his first employment in the factory, unless certified fit for such employment by the Certifying Surgeon.

46) Every worker employed in the casting processes shall be re- examined by a Certifying Surgeon at least once in every 12 months. Such examination shall, wherever the Certifying Surgeon considers appropriate, tests except chest X-ray which will be once in three years.

- 47) No person who has been found unfit to work shall be re-employed or permitted to work in the said processes unless the Certifying Surgeon, after further examination, again certifies him fit for employment in those processes.
- 48) Before ladle is lifted by the hanger hook, the hook and the crane shall be checked for its rigidity by lifting loaded ladle to smaller height and holding momentarily and checking the breaking effect of both downward and upward movement before it is further transported.
- 49) Person working in pit side should not come beneath the raised load.
- 50) Other activities, viz., cleaning, lancing, relining and de-bricking shall be momentarily stopped during heat movement in the area.
- 51) At pit side, persons shall maintain safe distance at the time of tapping and teeming operations.
- 52) All workmen involved in teeming, shall wear all necessary protective appliances in proper manner, viz., safety helmets, safety shoes, smelter glasses, face shields flame retardant suits, hand gloves, anklets, etc.
- 53) During movement of crane, sound alarm shall be used to caution persons working below.
- 54) Job safety analysis shall be carried out.
- 55) All lifting equipment, tools and tackles shall be load tested and inspected periodically as per Section 29 of Factories Act, 1948 and Rule 64 of Maharashtra Factories Rules, 1963. Load test date and SWL bearing capacity board shall be displayed prominently over the crane.
- 56) Crane shall be provided with cut off limit switches for all movement and maintained in operable condition.
- 57) Whenever molten metal is transferred on track, sufficient clearance shall be provided by the side of railway track. There should not be any obstruction over the tracks.
- 58) At the time of handling and transferring liquid metal, person shall be well trained in signaling operation to guide the Crane Operator.
- 59) Ladles, cranes and locos when handling liquid metal, shall be driven at safe speed.
- 60) Ladle trunion diameter shall be periodically checked for timely replacement.
- 61) Locking devices on casting and transport ladles should be engaged prior to filling to prevent accidental spillage; they should only be released immediately before tipping the ladles.
- 62) Any materials that are suspected to be radioactive should be isolated, and plans for appropriate disposal through the requirements established by the competent authority should be strictly adhered to.
- 63) Safe Operating Procedure (SOP) shall be prepared and it shall be strictly followed.

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