

**D: SPECIALISED OPERATIONS**

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**D2. MOLTEN MATERIALS**

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**1.0 Scope**

- 1.1 This standard applies to all activities and equipment involving molten materials.
- 1.2 Molten Materials are for example, molten metals, slags, matte, electrolyte (bath) and liquid pitch.

**2.0 Charge Materials**

- 2.1 There must be a system for the specification, purchase, inspection and storage of materials, including scrap, used to charge furnaces.
- 2.2 The level of moisture and other materials must be such that it does not lead to an explosion or violent reaction.
- 2.3 Bottles, cans and other closed liquid or gas containers must not be charged to the furnaces and there must be a system in place to ensure that this does not happen.

**3.0 Furnaces, ladles, launders, granulation and casting equipment**

- 3.1 All equipment must be designed to prevent the likelihood and implications of spill, “breakout”, “foaming” or splashing of molten material.
- 3.2 Water sumps, drains, piping and potential water accumulation spots should, as far is practicable, be located in areas where contact with molten materials is not possible. To the extent that this cannot be achieved, they must be protected from contact by molten material by suitable heat resistant barriers and diversions.
- 3.3 Electrical and control systems, fuel and oxygen systems should, as far as is practicable, be located in areas where contact with molten material is not possible. To the extent that this cannot be achieved, they must be protected from contact by molten materials by suitable heat resistant barriers and diversions.
- 3.4 The integrity of furnaces, ladles etc must be checked regularly i.e. through the frequent monitoring of surface temperatures and visual checks for wear, cracking and mechanical damage.

- 3.5 The structural elements of furnaces must be kept within their operating temperature design limits. A system must be in place to ensure that these are known and monitored. The system must also include a means of managing factors that could impact control, such as the accumulation of dust or other insulating material.
- 3.6 Furnace binding tie rods will be fitted with retention chains.
- 3.7 All water-cooled casting equipment and water-cooled furnaces must have an assured water supply in the event of power failure, equipment breakdown or other emergency.
- 3.8 Granulation water supply systems must be designed with automatically acting back up supply in the event of failure of the primary water supply.
- 3.9 Equipment must be designed to “fail safely” in the event of a power failure.
- 3.10 Hazard analysis must be used to establish the requirement for explosion containment or vents to allow the controlled release of gases in a low risk direction and to mitigate the effects of explosions.
- 3.11 Standard operating procedures and adequate indicators and alarms are required for both normal and emergency operations and maintenance. Emergency shutdown procedures shall be reviewed at least once every three years, updated where necessary and operating personnel must conduct drills at least annually.

#### **4.0 Process Management**

- 4.1 Hazard analysis must be used to define standard operating conditions and control measures for all molten material processes and take into account risks due to such things as “hot work” explosions, hazardous fumes, “foaming” and spillage.
- 4.2 Operating procedures must exist for inspection, cleaning, blasting and other process maintenance activity.
- 4.3 The operating temperature of molten materials shall be maintained within the defined limits required by the process. Temperature ranges must be established and a system for identifying, recording and managing any deviations must be in place.
- 4.4 Fuel combustion systems must be designed to prevent the potential to produce explosive gas or gas/solid mixtures.
- 4.5 All hazardous fumes and gaseous products must be captured/contained and rendered safe.

**5.0 Molten Material Transfer**

- 5.1 A risk analysis of molten material transport roads must be carried out to identify and modify design (e.g. turns and bends), maintenance (e.g. road cleanliness and roughness requirements) and operational (e.g. speed and vehicle design requirements) issues that could result in metal spillage or loss of vehicle control.
- 5.2 Molten material transport vehicles must be kept away from other vehicles and pedestrians on properly marked roadways with defined traffic rules.
- 5.3 Transport systems, e.g. launders, must be built so that excessive flows will be readily diverted to a designated overflow vessel or receptacle of adequate size to accommodate spills of any size identified during the risk analysis.
- 5.4 There must be a system for inspecting and maintaining equipment used for lifting molten materials e.g. crane cables, brakes, crane rails, wheels, hooks, blocks and controls. The system must be capable of assuring that this equipment continues to function to its design specification.

**6.0 Protective Equipment**

- 6.1 Hazard reviews must be carried out to establish access control and personal protective equipment requirements in areas and for tasks where there is the potential for spillage, emissions of flame or gases, or explosion.
- 6.2 Vehicle cabs and operating positions exposed to splashes must be protected with transparent screens, made from an appropriate material, e.g. Lexan.