



DEPARTMENT OF LICENSING AND REGULATORY AFFAIRS
DIRECTOR'S OFFICE
GENERAL INDUSTRY SAFETY STANDARDS

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PART 44. FOUNDRIES
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R 408.14401 Scope.

Rule 4401. This part applies to manufacturing and maintenance operations relating to the safety of employees engaged in making of ferrous and nonferrous castings, including smelting operations when applicable, but excluding die casting operations.

R 408.14405 Definitions A to C.

Rule 4405. (1) "Aisle" means a passageway between molds leading from a gangway, and its width shall be understood to be the clear distance between molds, machinery and equipment, posts, partitions, or other obstructions on one side of a passageway and similar objects on the other side.

- (2) **"Charging box or bucket"** means a container which transports, to a cupola or furnace, scrap, coke, limestone, pig iron, ingots, alloys, briquets and any other material to be melted.
- (3) **"Chipping"** means a process of removing excess metal, flash, fins and other unwanted material from a casting.
- (4) **"Coreblower"** means a pneumatic machine which makes cores.

- (5) **"Crucible"** means a vessel of refractory material used to hold or transport molten metal.
- (6) **"Crucible furnace"** means a device which encloses a crucible in which metal is melted by gas, oil or electric heat.
- (7) **"Cupola"** means a vertical furnace used for melting metals and having tuyeres and a tapping spout.

R 408.14406 Definitions D to I.

- Rule 4406. (1) "Draw furnace"** means a device designed to heat treat or anneal metals.
- (2) **"Ferrous foundry"** means a place where malleable iron, grey iron, nodular iron, or steel or a combination of these metals are melted and poured into molds in the making of castings.
 - (3) **"Foot candles"** means a standard measurement of light.
 - (4) **"Foot protection"** means a protective cap worn on an employee's foot designed to protect against probable injury.
 - (5) **"Gangway"** means a well defined passageway dividing or bordering working areas, but does not include an aisle.

- (6) “**Interlock**” means a device or method of controlling the source of power so that if a guard, gate or similar protective device is removed or out of place, the equipment becomes inoperative.

R 408.14407 Definitions L to R.

- Rule 4407. (1) “Ladle”** means a vessel used for transporting and pouring molten metals.
- (2) “**Melting furnace**” means a device used to melt metals or hold molten metals.
- (3) “**Non-ferrous foundry**” means a place where brass, aluminum, lead, copper, tin, zinc, gold, silver or combination of metals are melted or poured into molds in the making of castings.
- (4) “**Oven**” means a chamber designed to bake, heat or dry.
- (5) “**Overhead crane**” means a machine for lifting and lowering which moves on a bridge and travels under power on a fixed overhead runway.
- (6) “**Reverberatory**” means a furnace in which heat is radiated from the roof onto the material to be melted.

R 408.14408 Definitions S.

- Rule 4408. (1) “Safety factor”** means the ratio of the breaking strength of a piece of material or object to the actual load or stress when in use.
- (2) “**Sampling cone**” means a cup with an attached handle used to collect a sample of sand.
- (3) “**Service**” means the repair or adjustment of equipment or machinery.
- (4) “**Shell or hot box core making**” means a process of making cores of sand and resin mix that is cured in a heated box or pattern.
- (5) “**Shell molding**” means a process of making a mold of sand and resin mix and curing on a heated pattern.
- (6) “**Single stroke mechanism**” a method or device which prevents action or cycling of a part of a machine more than once when the control is continuously held down.
- (7) “**Slag or dross**” means the refuse from melting of metals.
- (8) “**Smelting**” means to separate metals by melting.

R 408.14409 Definitions T to W.

- Rule 4409. (1) “Two-hand control”** means an actuating device that requires the concurrent use of both hands of an operator to trip or control the equipment.
- (2) “**Trunnion**” means the support attached to the sides of a ladle, flask or other device to facilitate the tilting or rotation of the device.
- (3) “**Walkway**” means a path of travel for personnel only.

R 408.14421 Personal protective equipment.,

- Rule 4421. (1)** An employer shall provide, and an employee shall use, eye protection as prescribed in general industry safety standard, Part 33. Personal Protective Equipment, being R 408.13301 et seq. of the Michigan Administrative Code.
- (2) Where there is a probability of foot injury, an employee shall use foot protection as prescribed in rules 3383 to 3386 of general industry safety standard, Part 33. Personal Protective Equipment, being R 408.13383 to R 408.13386 of the Michigan Administrative Code.

- (3) An employee performing hydrostatic testing shall be protected in accordance with rule 3394 of general industry safety standard, Part 33, Personal Protective Equipment, being R 408.13394 of the Michigan Administrative Code.
- (4) The initial issue of personal protective equipment required in this rule shall be provided by the employer at no expense to the employee. Any replacement equipment necessary due to wear and tear or loss due to the environment of the work shall also be provided by the employer, unless covered by a collective bargaining agreement.
- (5) To protect an employee from burns while handling molten metal, an employee shall use leggings, spats, an apron, or other equivalent personal protective equipment.
- (6) To protect an employee assigned to handle hot cores, hot shell molds, or hot castings, an employee shall be provided with and use heat-resistant gloves.

R 408.14223 Rescinded.

R 408.14425 Rescinded.

R 408.14426 Rescinded.

R 408.14427 Rescinded.

R 408.14431 Rescinded.

R 408.14433 Gangways and aisles.

- Rule 4433. (1)** An gangway or aisle in which molten metal is being transported shall be clear of obstructions and water.
- (2) A gangway shall be not less than 4 feet wide or shall be 3 feet wider than the widest load for which it is used.
- (3) A work station shall be not less than 2 feet from aisles and gangways, except when protected by a standard barrier as specified in general industry safety standard, part 2. Floor and Wall Openings, Stairways, and Skylights, being R 408.10201 et seq., of the Michigan Administrative Code.
- (4) Access to and from a work station shall be free of obstructions.

R 408.14434 Aisles.

- Rule 4434. (1)** An aisle shall be not less than 24 inches wide where molten metal is poured from hand or bull ladles or crucibles carried by 1 or 2 employees. However if a mold is 20 inches or more in height, an aisle shall be not less than 36 inches wide.
- (2) An aisle shall be not less than 36 inches wide where molten metal is poured by more than 2 employees.

R 408.14436 Metal platforms, ladders, and steps.

- Rule 4436. (1)** A metal platform shall be provided at a cupola and a furnace for preparation of tap holes, runner spouts, and slagholes.
- (2) A metal platform and ladder or steps shall be provided at a furnace or oven where employees go on refractory roofs.
- (3) A platform used at a crucible or similar type furnace shall be of metal and not less than 3 feet wide. Railings shall be installed according to general industry safety standard, Part 2. Floor and Wall Openings, Stairways, and Skylights, being

R 408.10201 et seq., of the Michigan Administrative Code.

R 408.14438 Rescinded.

R 408.14439 Wire rope and chain.

- Rule 4439. (1)** A wire rope or chain on a crane, lift or hoist used to lift or carry molten metal shall:
- (a) Be inspected weekly for wear or defects and shall be replaced if worn or defective.
 - (b) Have a designed safety factor of not less than 8.
- (2)** A wire rope shall have an independent wire rope core.

R 408.14441 Charge boxes.

Rule 4441. A charge box shall be free of moisture, including ice or snow when a furnace is charged.

R 408.14443 Cupolas.

- Rule 4443. (1)** A skip hoist or charging machine, unless completely enclosed, shall be equipped with:
- (a) A warning device to announce movement.
 - (b) An interlocking gate across the bucket loading opening.
- (2)** An employee working in a cupola shall be protected from falling objects by an overhead guard.
- (3)** A cupola bottom shall be:
- (a) Supported by 2 or more metal props of structural strength with overall safety factor of not less than 10 to support a full capacity load and adjusted to proper height by wedges or screw jacks.
 - (b) Dropped only after a general warning has been sounded and all persons are removed to a safe distance or protected by a permanent or movable enclosure or screen.
 - (c) Dropped into an area free of water.
- (4)** A slag hole shall be shielded to protect an employee from spattering slag.
- (5)** Where oxygen is used to blow or cut tapping holes, a screen or guard shall be used to protect nearby employees from hot blown material.
- (6)** An employee not wearing light attenuating goggles or shields shall be protected by a screen or wall from the arc of an electric furnace.

R 408.14445 Scrap.

- Rule 4445. (1)** An alligator shear shall be guarded to prevent injury to an employee by flying particles.
- (2)** Scrap shall not be broken by drops unless employees are protected from flying fragments by a permanent shield of hardwood planks not less than 2 inches thick, 1/4-inch steel plate or material of equal strength.

R 408.14447 Rescinded.

R 408.14448 Conveyors.

Rule 4448. A conveying device introducing stock to a draw furnace or oven in which a flammable or volatile hazard may exist shall be controlled to prevent its operation during preignition or purge. It shall be arranged to stop automatically in case of a ventilation failure.

R 408.14451 Melting furnace pits.

Rule 4451. A melting furnace pit shall comply with all of the following provisions:

- (a) Be free of water during operation.
- (b) Be enclosed with standard railing and toeboard as specified by general industry safety standard, Part 2. Floor and Wall Openings, Stairways, and Skylights, being R 408.10201 et seq., of the Michigan Administrative Code.
- (c) Be clear of employees during tapping or pouring.

R 408.14453 Crucibles.

Rule 4453. A crucible shall:

- (a) Not be used if it shows cracks, thin spots, flaws or dampness.
- (b) Be stored in a dry place and protected from moist air.
- (c) Be carefully charged to prevent damage.
- (d) A crucible made of clay shall not be allowed to cool after being placed in service.
- (e) Be covered while transporting molten metal emitting toxic fumes or be mechanically ventilated.

R 408.14455 Ladles.

Rule 4455. (1) A shield shall be provided between a hand ladle and an employee's hand on a single hand ladle.

- (2)** A ladle not held in the hand shall be equipped with a manually operated or an automatic safety latch or brake.
- (3)** A ladle of 2,000 pounds capacity or more shall be mechanically tilted and equipped with an automatic safety latch or brake which shall hold the ladle at any attitude.

R 408.14457 Molten slag.

Rule 4457. Slag which is not disposed of by conversion to granular form shall be collected in pots, ladles, tubs or sand pigs and allowed to solidify throughout before dumping.

R 408.14461 Sand mullers.

Rule 4461. (1) A sand muller, except for a continuous muller which does not require employee exposure, shall have interlocked enclosures over openings to prevent operation when loading or unloading.

- (2)** For a muller having a sampling door, the employer shall provide, and an employee shall use, a sampling cone (scoop) to obtain a sample.
- (3)** If a sample cone is used to obtain a sample, the sampling cone shall not contact the mixing mechanism and the employee using the sample cone shall not place his or her hand into the opening.

R 408.14463 Sand mixers.

Rule 4463. (1) A bowl or drum-type sand mixer shall have a grating which is made of 3/8-inch rod or a material of equal strength with openings as prescribed in table 1 and which covers the opening and is interlocked to the mixer. When the cover is raised, the motor shall not start again until the cover is closed and the starter button activated.

(2) Table 1 reads as follows:

TABLE 1

DISTANCE OF OPENING FROM POINT OF OPERATION HAZARD (Inches)	MAXIMUM WIDTH OPENING (Inches)
1/2 to 1 1/2	1/4
More than 1 1/2 to 2 1/2	3/8
More than 2 1/2 to 3 1/2	1/2
More than 3 1/2 to 5 1/2	5/8
More than 5 1/2 to 6 1/2	3/4
More than 6 1/2 to 7 1/2	7/8
More than 7 1/2 to 12 1/2	1 1/4
More than 12 1/2 to 15 1/2	1 1/2
More than 15 1/2 to 17 1/2	1 7/8
More than 17 1/2 to 31 1/2	2 1/8

R 408.14465 Molding machine.

Rule 4465. (1) A manually controlled molding machine shall have a 2-hand control, single-stroke mechanism for the squeeze cycle for each operator assigned to the machine. A 2-hand control shall be installed so as to prevent bridging the control buttons and so it can be operated by 2 hands only. A squeezer head which is so equipped that the operator must hold it in the operating position with one hand and actuate a 1-hand control with the other is acceptable.

- (2) The squeezer head of a molding machine shall be positioned so as to avoid a pinch point with the sand chute.
- (3) Automatic and semiautomatic molding machines shall be in accordance with rule 34 of the general industry safety standard, Part 1. General Rules, being R 408.10034 of the Michigan Administrative Code.

R 408.14466 Shell mold assembly machines.

Rule 4466. A squeeze machine used in shell mold assembly shall be equipped with a 2-hand control.

R 408.14468 Molding machine sand hoppers.

Rule 4468. A sand hopper release door shall be out of reach to the operator or guarded to eliminate the pinch point.

R 408.14471 Core blowing.

Rule 4471. A manually controlled shell, hot box core equipment, and a core blower machine shall be equipped with a 2-hand control as specified in R 408.14465.

R 408.14473 Chipper area shields and enclosures.

Rule 4473. A chipper area shall have shields or enclosures to reduce the hazard of flying objects.

R 408.14474 Rescinded.

R 408.14475 Shake-out.

Rule 4475. An employee on manual shake-out operations shall wear hand, eye and foot guards.

R 408.14476 Cleaning castings in enclosures.

Rule 4476. (1) Sand or abrasive cleaning shall be done in an enclosed machine or room which shall be dust tight or have exhaust systems as prescribed by the state department of public health.

- (2) When a core is blown out of a casting, it shall be done in an enclosure equipped with an exhaust system as prescribed by the state department of public health.

R 408.14477 Rescinded.

R 408.14478 Lost wax or investment casting.

Rule 4478. Manually operated lost wax injection equipment shall be equipped with a 2-hand control.

R 408.14479 Rescinded.

R 408.14481 Rescinded.

R 408.14483 Rescinded.

R 408.14485 Rescinded.

R 408.14486 Rescinded.

R 408.14488 Water testing.

Rule 4488. Water testing equipment shall be designed and maintained to protect the operator and adjacent employees from injuries.

R 408.14491 Reverberatory furnaces.

Rule 4491. A reverberatory furnace in a non-ferrous foundry shall:

- (a) Be charged with dry material.
- (b) Have clear space on the load and unload sides to permit use of material handling equipment in a nonhazardous manner.

R 408.14492 Permanent mold equipment.

Rule 4492. Manually operated permanent mold equipment in a nonferrous foundry shall be equipped with 2 hand controls.

R 408.14493 Crucible and similar type furnaces.

Rule 4493. (1) Where a crucible or similar type furnace in a nonferrous foundry is at floor level or below floor level, a grating shall cover the opening or a tailing shall be installed according to general industry safety standard, Part 2. Floor and Wall Openings, Stairways and Skylights, being R 408.10201 et seq., of the Michigan Administrative Code.

- (2) Where crucible or similar type furnaces are above the floor level, they shall be not less than 3 feet apart.

R 408.14494 Rescinded.

R 408.14495 Chlorine, caustic and acid.

Rule 4495. (1) Liquid chlorine shall be stored in an unoccupied ventilated room. The exhaust pickup shall be at floor level.

- (2) A room used for storage of chlorine gas shall have not less than 2 exits.
- (3) A tank car containing chlorine and connected to a pipe or hose line shall be protected by a derail device and a blue flag.

- (4) A pipe or hose line carrying chlorine, caustic or acid shall be identified by a sign or color label.
- (5) Where chlorine is piped through a wall, shut off valves shall be located on both sides of the wall and at the inlet and outlet.

R 408.14496 Rescinded.

R 408.14497 Pumps.

Rule 4497.A pump suspended by a hoist above a melting pot shall be secured to the hoist hook to prevent it being dropped.

R 408.14498 Powered industrial trucks.

Rule 4498.Where a powered industrial truck is used for loading a furnace, an operator, exposed to splash or splatter, shall be protected by a shield.



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