



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

Filed with the Secretary of State on June 6, 1972 (as amended March 29, 1974) (as amended August 31, 1976) (as amended November 15, 1989) (as amended February 18, 1997)

These rules take effect 15 days after filing with the Secretary of State

(By authority conferred on the director of the department of consumer and industry services by sections 16 and 21 of Act No. 154 of the Public Acts of 1974, as amended, and Executive Reorganization Order No. 1996-2, being §§408.1016, 408.1021, and 445.2001 of the Michigan Compiled Laws)

R 408.14221 and R 408.14225 are rescinded

PART 42. FORGING

TABLE OF CONTENTS

R 408.14201 Scope.....	1	R 408.14245 Hammer cylinder heads and fasteners.....	3
R 408.14203 Definitions; A to C.....	1	R 408.14246 Steam and pneumatic hammers.....	3
R 408.14204 Definitions; F, G.....	1	R 408.14247 Mechanically operated hammers and forging presses.....	4
R 408.14205 Definitions; H to P.....	1	R 408.14248 Point of operation device.....	4
R 408.14207 Definitions; R and S.....	2	R 408.14249 Board drop hammers.....	4
R 408.14208 Definitions; T to W.....	2	R 408.14251 Forging presses.....	4
R 408.14222 Aisles.....	2	R 408.14252 Inspection.....	5
R 408.14223 Platforms.....	2	R 408.14261 Trim presses.....	5
R 408.14224 Lighting and controls.....	2	R 408.14263 Bulldozers.....	5
R 408.14226 Use of lead.....	2	R 408.14265 Bolthead and rivet-making machines.....	5
R 408.14227 Scale removers, oil swabs, and tongs.....	2	R 408.14267 Power shears.....	5
R 408.14231 Guards, general.....	2	R 408.14268 Material-handling equipment.....	5
R 408.14232 Personal protective equipment.....	2	R 408.14269 Tumbling barrels and shot blasts.....	5
R 408.14241 Guards, hammers, and forge presses.....	3	R 408.14271 Upsetting machines.....	5
R 408.14242 Hammer installation.....	3	R 408.14273 Billet heating furnaces.....	5
R 408.14243 Ram props and blocks.....	3		
R 408.14244 Hammer die keys.....	3		

GENERAL PROVISIONS

R 408.14201 Scope.

Rule 4201. This part provides safety for life, limb, and health in or about places of employment and applies to all classes of power-forging machinery both for drop forging and flat-die forging, including steam hammers, pneumatic hammers, mechanically operated hammers, forging presses, forging rolls, trimming presses, bulldozers, upsetting machines, bolt-heading and rivet-making machines and power shears, and incidental operations and equipment in connection with such machinery. Excluded are cold forging operations.

R 408.14203 Definitions; A to C.

- Rule 4203. (1) "Aisle"** means a path of travel for vehicles and employees and which is not used for work and storage space.
- (2) **"Board drop hammer"** means a hammer equipped with boards attached to the ram which when

propelled by motor driven friction rolls raises the ram and attachments.

- (3) **"Cylinder head"** means a cover attachment for the top of a steam cylinder.

R 408.14204 Definitions; F, G.

- Rule 4204. (1) "Forging press"** means a mechanically or hydraulically operated press using closed or flat dies.
- (2) **"Forging rolls (reducing rolls)"** means rolls used as equipment for forging or swaging operations. Forging rolls are required essentially for reducing short, thick stock sections into long, slender sections and to perform or reduce cross-sectional areas of billets before the finished forging operation.
- (3) **"Guide bolt"** means a bolt which passes through the hammer columns and secures the ram guides in the pocket.

R 408.14205 Definitions; H to P.

- Rule 4205. (1) "Hammer"** means a machine designed to shape forgings by means of impact between dies.

The force of the impact is by gravity or power supplied by steam, air or mechanical means.

- (2) **“Mechanical hammer”** means a gravity hammer which uses hydraulic or mechanical devices, such as friction rolls with boards, belts, or ropes to raise the ram and attachments.
- (3) **“Point of operation”** means the area of a machine, die, or tool where material is actually worked.
- (4) **“Power shear”** means a machine equipped with opposing shear blades and which cuts bar stock.

R 408.14207 Definitions; R and S.

Rule 4207. (1) “Rod gland” means a sleeve at the bottom of a cylinder through which a piston rod passes.

- (2) **“Safety factor”** means the ratio of the breaking strength of a piece of material or object to the actual safe load or working stress when in use.
- (3) **“Steam or pneumatic hammer”** means a hammer using steam or air to provide energy in a cylinder to raise the hammer for a gravity drop and in case of a double action hammer to increase the force of the impact on the forging.

R 408.14208 Definitions; T to W.

Rule 4208. (1) “Tie plate” means a plate located and attached to the upper structure of hammer columns and on which the steam cylinder is mounted.

- (2) **“Trained and authorized”** means to have received instructions regarding specified duties and to have permission to perform those duties.
- (3) **“Trim press”** means a class of auxiliary forging equipment which removes flash or excess metal from a forging.
- (4) **“Upsetting machine”** means a horizontal forging machine employing a set of gripper dies that holds stock while the ram or header slide forces the stock into shape and size.
- (5) **“Walkway”** means a path of travel for foot traffic only.

R 408.14221 Rescinded.

R 408.14222 Aisles.

Rule 4222. An aisle for vehicular traffic shall be not less than the width of the widest vehicle or load plus 3 feet. An aisle shall be outlined by marking.

R 408.14223 Platforms.

Rule 4223. A platform used on the floor in front of a machine shall be designed to hold the weight imposed on it without creating a tripping hazard.

R 408.14224 Lighting and controls.

Rule 4224. (1) Machinery and equipment shall be provided with a minimum of 15 footcandles light intensity to fall upon the general area. When natural light is insufficient, artificial light shall be provided. Direct or reflected glare and shadows, including moving shadows, should be avoided.

- (2) A manually operated valve or switch for power forging equipment shall be identified as to function and accessible to the operator.

R 408.14225 Rescinded.

R 408.14226 Use of lead.

Rule 4226. The following safety requirements apply to lead casts or other use of lead in a forge shop or die shop:

- (a) Thermostatic control of heating elements shall be provided to maintain melting temperature at not more than 750 degrees Fahrenheit.
- (b) A covered container shall be provided to store dross skimmings.
- (c) Equipment shall be kept clean, particularly from accumulations of lead oxide.
- (d) A sign shall be posted in the work area prohibiting eating in the area and calling attention to dangers of oral ingestion of lead dust from hands and clothing.

R 408.14227 Scale removers, oil swabs, and tongs.

Rule 4227. (1) If an oil swab, scale brush, or other device is required to remove scale, it shall be long enough to enable the employee to perform the jobs without placing his hands within the point of operation.

- (2) Tongs shall be of sufficient length to clear the body of the worker in case of kickback, and shall not have sharp handle ends. The worker should be instructed in the proper body position when using tongs. Tongs should be checked periodically to see that they remain at the proper hardness level for the job. When rings or equivalent devices for locking tongs are used, they should be inspected periodically to ensure safe condition.

R 408.14231 Guards, general.

Rule 4231. (1) A press, hammer, upsetter, bolt header, riveting machine or bulldozer having a flywheel, shaft, clutch and gears not confined within the frame shall be arranged with guards as prescribed in the general industry safety standards commission standard, Part 7, Guards for Power Transmission.

- (2) An overhead part which may fall or fly off shall be secured or by other means prevented from falling.

R 408.14232 Personal protective equipment.

Rule 4232. (1) Protective goggles or spectacles shall be provided to, and used by, all employees where a face and eye hazard exists. Protective goggles and spectacles shall comply with the requirements of general industry safety standard, Part 33. Personal Protective Equipment, being R 408.13301 et seq. of the Michigan Administrative Code.

- (2) Head protection shall be provided to, and used by, all employees where a head hazard exists. Head protection shall comply with the requirements of general industry safety standard, Part 33. Personal Protective Equipment, being R 408.13301 et seq. of the Michigan Administrative Code.
- (3) Foot or toe protection shall be provided to, and used by, all employees in accordance with general industry safety standard, Part 33. Personal Protective Equipment, being R 408.13301 et seq. of the Michigan Administrative Code, where a foot or toe hazard exists.
- (4) Other types of personal protective equipment, such as aprons, spats, sleeves, and specialty gloves other than lightweight cotton or similar types of gloves, shall be provided to, and used by, employees when such personal protective equipment is required for the protection of the employee from hazards.

HAMMER AND FORGE PRESSES

R 408.14241 Guards, hammers, and forge presses.

Rule 4241. (1) The portion of a treadle at the rear of a hammer shall be guarded so that scrap or other material cannot collect below this portion of the treadle and prevent it from returning to normal position.

- (2) A treadle shall be blocked or otherwise secured during the time an employee is exposed under the ram or between the dies.
- (3) A scale guard constructed of not less than 20 gauge sheet steel or equivalent material shall be provided at the back of a hammer, so arranged as to stop flying objects and anchored or secured so that it cannot tip or fall.
- (4) A foot operated device, such as a treadle, pedal, bar, valve, or switch, shall be substantially and effectively protected from unintended operation.

R 408.14242 Hammer installation.

Rule 4242. (1) A hammer shall be installed on or anchored to a foundation of such strength as to support the imposed weight and normal work stress.

- (2) A press shall be installed in a manner that it will remain in position or it shall be anchored to a foundation of such strength as to support the imposed weight and normal work stress.

R 408.14243 Ram props and blocks.

Rule 4243. A ram prop or block shall be provided and used at each hammer when dies are changed or repaired. The prop or block shall have a handle on the side. One of the following shall be used:

- (a) A wooden ram prop or block of hardwood and complying with not less than the specifications of table 1. The ends shall be square.
- (b) A steel ram prop of not less than 2 1/2-inch outside diameter by 2-inch inside diameter, or a structural shape of equal strength, with squared ends.
- (c) Other material which shall be of equal or greater strength as required for steel in subdivision (b).

TABLE 1 Minimum Strength and Dimensions for Wood Ram Props

Size of Timber, In.*	Square Inches in Cross Section	Minimum Allowable Crushing Strength Parallel to Grain, Psi†	Maximum Static Load Within Short Column Range††	Safety Factor	Maximum Recommended Weight of Forging Hammer for Timber Used	Maximum Allowable Length of Timber, In.
4 x 4	16	5000	80000	10	8000	44
6 x 6	36	5000	180000	10	18000	66
8 X 8	64	5000	320000	10	32000	88
10 X 10	100	5000	500000	10	50000	110
12 X 12	144	5000	720000	10	72000	132

* Actual dimension.

† Adapted from U.S. Department of Agriculture Technical Bulletin 479. Hardwoods recommended are those whose ultimate crushing strengths in compression parallel to grain are 5000 psi (pounds per square inch) or greater.

†† Slenderness ratio formula for short columns is $L/d = 11$, where L = length of timber in inches and d = least dimension in inches; this ratio should not exceed 11.

R 408.14244 Hammer die keys.

Rule 4244. (1) A hammer die key and shims shall be made from a grade of material which does not crack or splinter when treated. A die key shall project not more than 3 inches in front or in back of the ram or die.

- (2) A head of a key shall be kept free of mushrooming and splitting by grinding off any flaring.
- (3) A head of a manual key driver shall be kept free of mushrooming by grinding or machining. A cutting torch shall never be used for this. A driver shall be suspended from a securely fastened beam with chain or cable of sufficient size to handle the weight of the driver plus a safety factor of 5. Chain, cable and fasteners shall be kept free of twisted, bent or elongated links. A driver shall be made of steel that will not chip on impact.
- (4) A pneumatic key driver is recommended. The driver shall be made of steel that will not chip on impact.

R 408.14245 Hammer cylinder heads and fasteners.

Rule 4245. Parts, such as, but not limited to, a cylinder head and fasteners for a cylinder head, glands, tie plates and guide bolts, which are subject to failure shall be secured by use of a safety cable strung to them.

R 408.14246 Steam and pneumatic hammers.

Rule 4246. (1) A steam or air hammer shall be equipped with a functional safety cylinder head to act as a cushion if the piston rod breaks or pulls out of the ram.

- (2) A steam hammer shall be provided with a quick access emergency shut-off valve identified by name or color in the supply, sometimes called admission, pipeline at a location within reach of the operator. This valve shall be closed and locked in the "off" position while the hammer is being adjusted, repaired, or serviced, or when the die are being changed, except where necessary to move the ram.
- (3) If the steam hammer cylinder is constructed without a self-draining arrangement, a drain cock shall be provided which shall be piped to a sump or drain pipe.
- (4) A pneumatic hammer shall have a drain cock on the main head cylinder and on the clamp cylinder, if a clamp cylinder is provided.
- (5) Steam or air pressure at the hammer shall be no higher than that for which the hammer is designed. A pressure regulator and safety valve at the source of power or at the equipment, whichever is applicable, shall be used to insure this.
- (6) A steam pipe shall be covered where exposed to contact. Pipe supports or other effective means

shall be provided to prevent failure from vibration, expansion or contraction.

- (7) Steam or air piping shall be as prescribed in ANSI B31.1.0-1967, Power piping, with addenda issued before April 28, 1971, which is incorporated herein by reference and may be inspected at the Lansing office of the Department of Consumer and Industry Services. This standard may be purchased from the American National Standards Institute, 1430 Broadway, New York, New York 10018, or from the Michigan Department of Consumer and Industry Services, State Secondary Complex, 7150 Harris Drive, Box 30643, Lansing, Michigan 48909, at a cost of \$8.00 each.
- (8) Where it is necessary to service a steam cylinder, a fixed platform, as prescribed in R 408.14249(2), shall be provided, or the employee shall wear a safety belt and lanyard, with the lanyard secured to the hammer or a structural member.

R 408.14247 Mechanically operated hammers and forging presses.

Rule 4247. (1) A mechanically operated hammer or forging press shall be provided with a means for disconnecting the power. Acceptable methods include the following:

- (a) A disconnect switch ahead of the starter on the primary line with provision for locking and within reach from the floor. Power shall be locked off when the machine is being repaired or serviced.
 - (b) A tight and loose pulley on a countershaft, with a belt shifter, with a means to lock it in the "off" position. The belt shifter shall be within easy reach of the operator.
 - (c) A clutch or drive pulley, with a clutch handle, with a means to lock it in the "off" position. The clutch handle shall be within easy reach of the operator.
- (2) Springs suspending the ram in a mechanically operated hammer shall be enclosed or restrained from flying in case of breakage.

R 408.14248 Point of operation device.

Rule 4248. Effective August 31, 1974, the following shall pertain to a mechanically operated hammer used for cold restrike operations:

- (a) Where only 1 hand is used for holding the material, a safety stop, dog or catch shall be provided to prevent the ram from descending until this device has been released and is held out of the way by the other hand, or a hand lever instead of a foot treadle shall be provided for tripping the hammer.
- (b) On a hammer where neither hand is used for holding the material, there shall be provided a point of operation device that restrains the operator from inadvertently reaching into the point of operation or which automatically withdraws the operator's hands if they are within the point of operation as the dies close, or a tripping level or safety stop or both that will require concurrent use of both hands to trip the hammer.

R 408.14249 Board drop hammers.

Rule 4249. (1) On a board drop hammer a guard constructed of 20 gauge sheet steel or stronger

shall be provided around the board above the rolls to prevent the board from falling if the board breaks or comes loose from the ram.

- (2) Where work must be done at or near the rolls of a board hammer, a fixed or portable platform equipped with handrail and toeboards as prescribed in the Occupational Safety Standards Commission standard, Part 2, Floor and Wall Openings, Stairways and Skylights, as amended, being R 408.10201 to R 408.10241 of the Michigan Administrative Code and the general industry safety standards commission standard, Part 3, Fixed Ladders, being R 408.10301 to R 408.10365 of the Michigan Administrative Code, shall be provided and used.
- (3) Roll release levers and front friction rods on a board hammer shall be prevented from falling by being secured to the hammer frame by cable, chain or an equally effective means.

R 408.14251 Forging presses.

Rule 4251. (1) Forging press operating valves shall be located so that the operator will have a clear and unobstructed view of the press when standing in the usual operation position. If this arrangement is impossible, a mirror shall be installed in front of the operator to assist him in obtaining a full view of the press.

- (2) When dies are being changed or maintenance is being performed on a press, the following shall be accomplished:
 - (a) The energy source to a mechanical press shall be locked out, and the flywheel shall be at rest before work begins.
 - (b) The hydraulic pumps and power apparatus of the hydraulic press shall be locked out.
 - (c) Blocking shall be provided and used to prevent the ram from dropping. The material shall equal or exceed specifications in table 1. Die design shall take into consideration the need for a flat spot for the block.
- (3) Location of steam, air, or water headers and scale or splash aprons shall give the operator sufficient clearance at the front of the forging press for any upward or downward movement of the tongs without creation of a pinch point between these facilities and the tongs.
- (4) A hot forging press shall be equipped with a scale guard, as prescribed in R 408.14241(3).
- (5) A forging press shall be provided with a positive means for retaining a piston and head assembly inside the counterbalance cylinder in case of failure or breakage of the piston and rod assembly.
- (6) An electrical motor shall be provided with a disconnect switch, as prescribed in R 408.14247(1). A hydraulic forging press shall be equipped with a positive type lockout disconnecting switch or valve.
- (7) Fire resistant fluids shall be used in a hydraulic press forming hot work.
- (8) Die bolts shall not be worn or damaged, and shall be long enough to permit being threaded into die bolt holes a distance not less than 1 1/2 times the diameter of the bolt. Washers shall not be used in multiple to compensate for excessive lengths of bolt.
- (9) A mechanical foot pedal or foot switch shall be covered on both sides and top with a substantial guard to prevent accidental tripping. The guard shall have rolled, broad or covered edges to prevent

injury or discomfort. The mechanical foot pedal shall be mounted to a press leg or anchored to the floor.

R 408.14252 Inspection

- Rule 4252. (1)** Daily visual observation, without dismantling, shall be made of a forging hammer and forge press to insure the safe condition of bolts, screws, keys, valves and all parts of treadles and clutches and other operating mechanisms that might become loose by vibration.
- (2) A periodic and regular maintenance safety inspection shall be made of forging machinery and equipment, including guards and point of operation protection devices by a trained and authorized employee.
- (3) A record shall be made and maintained to show the date of inspection, equipment number and condition found.

OTHER MACHINES

R 408.14261 Trim presses.

- Rule 4261. (1)** A trim press shall be provided with a main disconnect switch as prescribed in R 408.14247(1).
- (2) A trim press shall be provided with a safety block or prop as prescribed in R 408.14243. Die design shall take into consideration and provide a suitable flat area in the die for locating and using blocking material.
- (3) A device, such as but not limited to tongs, mechanical feeders, shuttles and conveyors, shall be provided and used for feeding material so that the operator's hand shall not be placed in the point of operation at any time.

R 408.14263 Bulldozers.

- Rule 4263. (1)** A guard shall be attached to the side of the moving head of a bulldozer and shall extend past the stationary head to prevent persons from stepping between the dies, or another method may be used which offers equal protection.
- (2) A bulldozer shall be provided with a positive-type lockout device as prescribed in R 408.14247(1).

R 408.14265 Boltheadings and rivet-making machines.

- Rule 4265. (1)** A treadle (pedal) of a bolt-heading or rivet-making machine shall be guarded as prescribed in R 408.14251(9).
- (2) A bolthead or rivet-making machine shall be equipped with a positive-type lockout device as prescribed in R 408.14247(1).
- (3) A screen shield shall be installed across point-of-operation on a boltheadings or rivet-making machine to protect against flying pieces.
- (4) Tension or relief springs on a boltheadings or rivet-making machine shall be guarded.
- (5) Safety blocks as prescribed in R 408.14243 shall be used when required while working on, removing, or setting dies.

R 408.14267 Power shears.

- Rule 4267. (1)** A positive-type lockout device for disconnecting the power to a power shear shall be provided as prescribed in R 408.14247(1).
- (2) The maximum size and specification of material being sheared on a power shear, as recommended by the manufacturer of the shear, shall not be exceeded.

- (3) Effective point-of-operation guarding shall be provided at both the feeding end and discharge end of a power shear.

R 408.14268 Material-handling equipment.

- Rule 4268.** Material-handling equipment shall be of such capacity and size as to safely handle the imposed load of the dies and containers.

R 408.14269 Tumbling barrels and shot blasts.

- Rule 4269. (1)** A tumbling barrel shall:
- (a) Have all means of power transmission guarded as prescribed in the Occupational Safety Standards Commission standard, Part 7, Guards for Power Transmission.
- (b) Have fittings to the barrel dust-tight or the barrel shall be enclosed in a booth with an exhaust system as approved by the state department of consumer and industry services.
- (c) Be locked in place while being loaded or unloaded.
- (d) Have an interlocked barrier across the front before it can be started.
- (e) Have a positive type lockout device for disconnecting the power to the barrel, as prescribed in R 408.14247(1).
- (2) A shot blast cleaning chamber shall have doors, curtains including silhouettes or guards to protect the operator.

R 408.14271 Upsetting machines.

- Rule 4271. (1)** An upsetter pedal (treadle) shall be guarded as prescribed in R 408.14251(9).
- (2) A shut-off valve or safety switch for service equipment on an upsetter, such as air lines, electric lines and water and oil lines, shall be located conveniently for the operator, and each shall be distinctly marked for ease of identification.
- (3) A positive type lockout device for disconnecting the power to the upsetter shall be provided as prescribed in R 408.14247(1).
- (4) An upsetting machine shall be installed so that it will remain on its foundation.

R 408.14273 Billet heating furnaces.

- Rule 4273. (1)** A billet heating furnace shall be equipped with an automatic valve on the main fuel line which will shut off in case of electrical or fuel supply failure.
- (2) Radiant heat from a billet furnace shall be controlled by 1 or more of the following methods:
- (a) Reflective shields of aluminum or materials of equal reflectivity.
- (b) Controlled openings.
- (c) Evaporative cooling.
- (d) Water jackets.
- (e) Chain curtains.
- (3) An exhaust system shall be provided as prescribed by the state department of consumer and industry services.



Michigan Occupational Safety and Health Administration
PO Box 30643
Lansing, Michigan 48909-8143
Ph: 517.322.1845

The Department of Licensing and Regulatory Affairs will not discriminate against any individual or group because of race, sex, religion, age, national origin, color, marital status, disability, or political beliefs. Auxiliary aids, services and other reasonable accommodations are available upon request to individuals with disabilities.