CS Part 14. Tunnels, Shafts, Caissons, and Cofferdams
Compared With
1926.800 Underground construction,
1926.801 Caissons,
1926.802 Cofferdams, &
1926.803 Compressed Air

Summary: The significant differences between CS Part 14 Tunnels, Shafts, Caissons, and Cofferdams and 1926.800 Underground construction, 1926.801 Caissons, 1926.802 Cofferdams, & 1926.803 Compressed Air are in the following:

- Advance notice of tunnel excavation
- Safety generally
- Emergency provisions; plans; equipment; rescue crews
- Communication system, location, signals
- Protective clothing or equipment
- Electrical requirements
- Fire prevention and protection
- Guards for power transmissions and hot surfaces
- Ground support; inspections; repairs
- Shafts; supports; inspections; lifelines
- Drilling; inspection; jumbos
- Blasting
- Haulage; inspection; braking; riding
- Stationary hoists generally
- Stationary material hoists
- Personnel hoists
- Flooding; safety screens; runways
- Caisson excavation; employee protection

The comparisons show only those provisions where MIOSHA rules are different than OSHA or where MIOSHA rules are not included in 29 C.F.R.

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R 408.41461 Advance notice of tunnel excavation. **Rule 1461**. (1) Before the start of a tunnel, as defined in R 408.41456, which is 24 inches or more in diameter, height or width, and which will be occupied by an employee, a report prepared by the employer performing the tunnel excavation shall be sent to the Michigan Department of Consumer and Industry Services, Construction Safety Division, 7150 Harris Drive, P.O. Box 30645, Lansing, Michigan 48909-8145, in addition to the following civil authorities in the area: hospital, police department, fire department, and sheriff department. The report shall contain all of the following information: (a) Name of contractor or contractors. (b) Starting date. (c) Length of tunnel. (d) Diameter of cut. (e) Finished diameter.	**No comparable OSHA provisions**

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(f) Number of shafts. (g) Depth of shafts. (h) Location of shafts. (i) Method of tunneling. (j) Maximum working pressure in tunnel or shaft. (k) Type of primary liner. (l) Number of shifts. (m) Projected completion date. (n) Projected maximum work force within tunnel. (2) Parties notified pursuant to subrule (1) of this rule shall be notified when the work has been completed. (3) If, after the start of any tunnel project, a tunnel or shaft that the employer has shown to be constructed, modified, or repaired under atmospheric conditions requires the tunnel to be pressurized, then the employer shall notify the Construction Safety Division at the Michigan Department of Consumer and Industry Services, 7150 Harris Drive, P.O. Box 30645, Lansing, Michigan 48909-8145, 24 hours before allowing employees to enter the tunnel. (4) If the work operations of any occupied tunnel projects are discontinued for 30 consecutive days or longer, then the employer shall notify the Construction Safety Division at the Michigan Department of Consumer and Industry Services, 24 hours before resuming work operations on the tunnel project.	
R 408.41462 Safety generally. **Rule 1462**. (1)**** (3) Form scrap material, lumber that has protruding nails, and all other debris shall be kept cleared from the work areas, passageways, stairs, locks, and change houses. (4) Combustible debris shall be removed daily during the course of construction. (5) If a haulage roadbed consists of track and ties, then the employer shall provide a walkway. The walkway shall be a minimum of 2 2-inch planks, side by side, abutted, joined, and secured to a tie or other equivalent means. If space is not adequate for 2 2-inch by 10-inch planks, then the walkway shall be as wide as space permits. (6)**** (8) Construction of a trench, manhole, or other opening for use in a tunnel or shaft operation shall be as prescribed in R 408.40901 et seq., construction safety standard Part 9. Excavation, Trenching, and Shoring and R 408.44501 et seq., construction safety standard Part 45. Fall Protection. (9) The power source to a tunneling machine shall be disconnected or locked out when an employee is working in the area of the cutting head or performing maintenance work on the tunneling machine where motion could cause an injury. (10) An area subject to subsidence that is hazardous to an employee shall be fenced and appropriately posted. (11)**** (12) A ladder or stairway that is provided in a shaft, caisson, or steep incline shall be as prescribed in R 408.41101 et seq., construction safety standard Part 11. Fixed and Portable Ladders and R 408.42101 et seq., construction safety standard Part 21. Guarding of Walking and Working Areas.	**No comparable OSHA provision except:** **1926.800(B)(3) The** employer shall control access to all openings to prevent unauthorized entry underground. Unused chutes, manways, or other openings shall be tightly covered, bulkheaded, or fenced off, and shall be posted with warning signs indicating “Keep Out” or similar language. Completed or unused sections of the underground facility shall be barricaded.

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(13) An employer shall establish and coordinate with the employees an accident prevention program and a safety training program as prescribed in R 408.40101 et seq., construction safety standard Part 1. General Rules. (14)***** (19) An occupied auger or pipe jacking tunnel shall be monitored for air quality immediately before entering the tunnel and during the period of occupancy in the tunnel.	
R 408.41463 Emergency provisions; plans; equipment; rescue crews. **Rule 1463**. (1) The employer shall develop a plan to evacuate a tunnel in an emergency and the procedures to carry out the plan shall be made known to the employees and to the rescue team. (2)**** (8) Escape-only respirator that is a self-contained breathing apparatus shall be maintained in good operating condition. Employees shall be trained in its use. (9) There shall be a rescue crew for each shift of all underground operations. The rescue crew shall be trained in rescue procedures, the use and limitations of a breathing apparatus, and the use of firefighting equipment. The crews shall be retrained at least once each year. Local fire and police personnel may be used as rescue teams for tunnel operations. If local personnel are to be used, then the employer shall arrange for assistance before the start of the project. (10) The following minimum rescue equipment shall be provided at the top of the shaft: (a) Four units of 1/2-hour-rated, self-contained breathing apparatus. (b) Four additional units of 1/2-hour-rated air bottles. (c) Four Bureau of Mines flashlights or lanterns with additional batteries for each light. The flashlights shall be as prescribed in part 20 of subchapter B of the provisions of 30 C.F.R. Parts 1-199, Mineral Resources, revised July 1, 2000, which is adopted by reference in R 408.41410. (d) Two 2A-10BC fire extinguishers. (e) One stretcher, wire basket type or equivalent with slings attached. (f) One fire blanket. (g) One 10-ton hand hydraulic rescue kit. (h) One first aid kit as prescribed in R 408.40101 et seq., construction safety standard Part 1. General Rules.	**No comparable OSHA provisions**
R 408.41464 Communication system; location; signals. **Rule 1464**.(1) In a tunnel that is more than 225 feet long, a communication system shall be provided at all of the following locations: (a) The working face. (b) The top of the shaft. (c) The bottom of the shaft. (d) The hoisting station, if provided. (e) Each 1,000 feet of tunnel.	**1926.400(f) Communications.** (1) When natural unassisted voice communication is ineffective, a power-assisted means of voice communication shall be used to provide communication between the work face, the bottom of the shaft, and the surface. (2) Two effective means of communication, at least one of which shall be voice communication, shall be provided in all shafts which are being developed or used either for personnel access or for hoisting. Additional requirements

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(f) The office, if provided. A public telephone or other communication system shall be provided or available to each tunnel project to secure outside emergency help. (2)**** (4) Communication systems shall be tested upon initial entry of each shift to the underground, and as often as necessary thereafter, to ensure that they are in working order. (5)**** (6) For an occupied pipe jacking tunnel that is more than 225 feet long, there shall be a telephone or other signal communication system established between the working face, the shaft tunnel portal, and at least 1 location on the surface. (7) When a hoist house is provided, there shall be a second independent method of signaling, either audibly or visibly, to the hoist engineer from all landings in the shaft or slope. (8) A signal code for hoisting shall be posted prominently in the engine house and at all places where signals are given. The signal code shall be as prescribed in R 408.41001 et seq., construction safety standard, Part 10. Lifting and Digging Equipment. (9) If a gassy condition exists, then all phones that are located within the tunnel shall conform to the United States Bureau of Mines Schedule 9b, Part 23 of the provisions of 30 C.F.R. Parts 1-199, Mineral Resources, revised July 1, 2000, which is adopted by reference in R 408.41410. The telephone or other signal communication systems shall be independent of the tunnel power supply and shall be installed so that the use or disruption of any one phone or signal location will not disrupt the operation of the system from any other location.	for hoist operator communication are contained in paragraph (t)(3)(xiv) of this section. (3) Powered communication systems shall operate on an independent power supply and shall be installed so that the use of or disruption of any one phone or signal location will not disrupt the operation of the system from any other location. (4) Communication systems shall be tested upon initial entry of each shift to the underground, and as often as necessary at later times, to ensure that they are in working order. (5) Any employee working alone underground in a hazardous location, who is both out of the range of natural unassisted voice communication and not under observation by other persons, shall be provided with an effective means of obtaining assistance in an emergency.
R 408.41465 Protective clothing or equipment. **Rule 1465**. (1) Protective clothing or equipment shall be required to be used as prescribed in R 408.40601 et seq., construction safety standard, Part 6. Personal Protective Equipment. (2) An employee working in a wet shaft, tunnel, or caisson shall wear safety toe rubber boots which have flat gripper-type soles and which are provided by the employer, at no expense to the employee. (3) An employee working in a shaft, tunnel, or caisson shall wear a protective helmet, which shall be provided for and as prescribed in R 408.40601 et seq., construction safety standard, Part 6. Personal Protective Equipment.	**No comparable OSHA provisions**
R 408.41466 Electrical requirements. **Rule 1466**. (1)*** (5) The regular system of illumination shall be supplemented by lighting that can be activated upon the failure of the regular system. Supplemental lighting, such as approved flashlights or lanterns, shall be sufficient to allow all employees to evacuate the tunnel. (6) A tunnel excavating machine that is built and designed after 1977 shall conform to the provisions of the	**No comparable OSHA provision except:** **1926.800(g)(4) Emergency lighting.** Each employee underground shall have an acceptable portable hand lamp or cap lamp in his or her work area for emergency use, unless natural light or an emergency lighting system provides adequate illumination for escape.

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National Fire Protection Association Standard NFPA 70: Standard for National Electrical Code, 1999 Edition, which is adopted by reference in R 408.41410. (7) A tunnel excavating machine that is designed and built after 1977 shall be equipped with a limit switch to prevent the accidental rotation of the main structure of the machine. (8) Electrical installation in underground areas where oil, grease, or diesel fuel are stored shall be used only for lighting fixtures. (9) Lighting fixtures in storage areas, or within 25 feet (7.62 meters) of underground areas where oil, grease, or diesel fuel are stored, shall be approved for class I, division 2 locations, as prescribed in R 408.41701 et seq., construction safety standard Part 17. Electrical Installation.	
R 408.41467 Fire prevention and protection. **Rule 1467**. (1)**** (2) Smoking and open flames are prohibited. An employer is responsible for collecting all personal sources of ignition, such as matches and lighters, from all persons. Welding and cutting, where required, shall be in compliance with the provisions of subrules (9), (10), (11), 12), and (13) of this rule. A fire watch shall be maintained when hot work is performed. (3)****	**1926.800(i)** **Gassy operations-additional requirements** **(4)** Smoking shall be prohibited in all gassy operations and the employer shall be responsible for collecting all personal sources of ignition, such as matches and lighters, from all persons entering a gassy operation. **(5)** A fire watch as described in 1926.352(e) shall be maintained when hot work is performed. **1926.800(m) Fire prevention and control**. **1926.800(m)(1)** Open flames and fires are prohibited in all underground construction operations except as permitted for welding, cutting and other hot work operations in paragraph (n) of this section. **1926.800(m)(2)(i)** Smoking may be allowed only in areas free of fire and explosion hazards.
(6) Oil, grease, or diesel fuel that is stored in a tunnel or shaft shall be kept in tightly sealed containers in fire-resistant areas at safe distances from explosives, magazines, electrical installations, and shaft stations. Electrical installations in underground areas where oil, grease, or diesel fuel are stored shall be used only for lighting fixtures. Lighting fixtures in storage areas, or within 25 feet (7.62 meters) of underground areas where oil, grease, or diesel fuel are stored, shall be approved for class I, division 2 locations. (7)****	**1926.800(m)(6)** Oil, grease, and diesel fuel stored underground shall be kept in tightly sealed containers in fire-resistant areas at least 300 feet (91.44m) from underground explosive magazines, and at least 100 feet (30.44m) from shaft stations and steeply inclined passageways. Storage areas shall be positioned or diked so that the contents of ruptured or overturned containers will not flow from the storage area.
(8) An approved 4A:40B:C rating fire extinguisher or equivalent protection shall be provided at the drive pulley of an underground conveyor and at 300-foot intervals along the belt. A minimum of 2 2A-10BC approved fire extinguishers shall be provided at the tunneling machine.	**1926.800(m)(11)** A fire extinguisher of at least 4A:40B:C rating or other equivalent extinguishing means shall be provided at the head pulley and at the tail pulley of underground belt conveyers.

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(9) A pressurized tunnel in which combustible materials are stored or used shall be equipped with a 2-inch minimum diameter water line with an outlet that is connected to a 1 1/2-inch nominal diameter fire hose which is capable of reaching the combustible materials. The water supply shall be of sufficient volume and pressure to efficiently operate the type of nozzle used on the fire hose for a minimum of 1 minute. Fire extinguishers may be substituted for the water and fire hose if they meet the requirements for the water service. (10) All of the following are additional requirements for gassy operations: (a) Only acceptable equipment, maintained in suitable condition, shall be used in gassy operations. (b) Mobile diesel-powered equipment used in gassy operations shall be either approved as prescribed in the requirements of 30 C.F.R. Part 36, Mineral Resources, revised July 1, 2000, which is adopted by reference in R 408.41410 or shall be demonstrated by the employer to be fully equivalent to the Mine Safety and Health Administration approved equipment and shall be operated in accordance with that part. (c) Each entrance to a gassy operation shall be prominently posted with signs notifying all entrants of the gassy classification. (11) A minimum of 1 approved 2A-10BC fire extinguisher shall be provided for each electrical, diesel, or hydraulic powered machine used in a tunnel or shaft. (12) A noncombustible barrier shall be installed below welding or burning operations. (13) In an underground operation, local gas checks shall be made before and during a welding or cutting operation and during a drilling operation that would penetrate the tunnel. (14) If more than .25% of methane by volume or 5% of the LEL, lower explosive limit, of a flammable gas or petroleum vapor is detected, then the welding, cutting, heating, or drilling operation shall cease until the hazard has been eliminated. (15) A fire watch shall be maintained around welding and cutting operations until all possibility of fire is eliminated. The fire watch shall be provided with a minimum of 1 approved 2A-10BC fire extinguisher. (16)**** (17) A head frame shall be constructed of steel or other fire resistant material. A hoist house and other temporary surface building or structures within 100 feet of the shaft, caisson, or tunnel opening shall be built of fire-resistant materials that have a fire resistance rating of not less than 1 hour.	**No comparable OSHA provisions**
R 408.41468 Guards for power transmissions and hot surfaces. **Rule 1468**. (1) A means of power transmission, such as, but not limited to, gears, pulleys, sprockets, belts, chains, and shafts which are exposed to contact by an employee shall be guarded.	**1926.800(i) Gassy operations-additional requirements** **(5)** A fire watch as described in 1926.352(e) shall be maintained when hot work is performed.

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(2) The exhaust pipe of an internal combustion engine shall be guarded to prevent contact by an employee with the hot surface.	
TUNNELS AND SHAFTS	
R 408.41471 Ground support; inspections; repairs. **Rule 1471**. (1)**** (5) Tunnel supports shall be designed and installed to prevent pressure from pushing them inward into the excavation. (6) Roof supports shall be used where ground conditions are such that there could be a ground failure ahead of tunnel sets. (7)**** (8) If an employee is required to enter a tunnel less than 3 feet in diameter, then a lifeline for instant rescue shall be securely fastened to his or her ankles. Another employee shall be stationed at the tunnel entrance to operate the lifeline. In addition, ventilation shall be provided with an airline.	**No comparable OSHA provisions**
R 408.41472 Shafts; supports; inspections; lifelines. **Rule 1472.** (1)**** (2) For rescue operations, a lifeline shall be securely fastened to a safety harness on each employee who enters a shaft that is less than 4 feet in diameter. The lifeline and safety harness shall be provided as prescribed in R 408.44501 et seq., construction safety standard Part 45. Fall Protection. (3)**** (5) A shaft or caisson shall be protected with a guardrail system as prescribed in R 408.44501 et seq., construction safety standard Part 45. Fall Protection, or barricaded as prescribed in R 408.42201 et seq., construction safety standard Part 22. Signals, Signs, Tags, and Barricades. A gate opening into the shaft shall be provided and shall be closed at all times, except when necessary to enter or leave the shaft or caisson.	**No comparable OSHA provisions**
R 408.4147 Drilling; inspection; jumbos **Rule 1473**. (1)**** (13) Before commencing a drilling cycle, the face and lifters shall be examined for misfires. If found, the misfired explosive shall be removed before the drilling starts. A lifter shall not be drilled through a blasted muck pile.	**No comparable OSHA provisions**
R 408.41474 Blasting. **Rule 1474.** (1) All blasting and explosives handling shall be conducted as prescribed in R 408.42701 et seq., construction safety standard Part 27. Blasting and Use of Explosives. (2)****	**No comparable OSHA provisions**

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R 408.41475 Haulage; inspection; braking; riding. **Rule 1475**. (1)**** (2) The roadbed, rails, joints, switches, frogs, and other elements of the track of a haulage road shall be constructed, installed, and maintained in a manner that is consistent with the speed and type of the haulage operations to be conducted. (3) A track switch shall be provided with a locking or spring-loaded thrown bridle bar and guardrail. The switch throw, where possible, shall be placed on the clearance side, and the switch throw shall operate parallel to the haulage road. (4)**** (5) Powered mobile haulage equipment that is subject to falling materials shall be equipped with a cab, canopy, or other protective device that is capable of protecting the operator from shifting or falling materials. For cabs where glazing is used, the glass shall be safety glass, or its equivalent, and shall be maintained and cleaned so that vision is not obstructed. (6)**** (7) A trolley wire shall be protected from contact with employees. Energized rails shall not be used, except when used as a ground return for a trolley wire. If rails serve as a return for a trolley circuit, then both rails shall be bonded at every joint and cross bonded every 200 feet (60.96 meters). (8) Backstops or automatic braking shall be installed on an inclined conveyor to prevent the conveyor from running out of control and creating a hazard for the employee. (9) An employee shall not ride on any of the following unless specifically designed or adapted for transporting employees: (b) A dipper. (c) A shovel bucket. (d) Forks. (e) A clamshell. (f) The bed of a dump truck. (10)**** (17) A refuge station shall be provided not more than every 300 feet where a clearance of 2 feet from moving equipment cannot be provided for employees unless the employees are prohibited from walking the haulage route during movement of a haulage train along the route. (18) A train that is used on an incline which would cause the cars to run out of control shall, in addition to couplings, have safety chains, or the equivalent, to connect the cars and the power haulage equipment in a train. The safety chains or other connections shall be capable of maintaining connection between cars in the event of either coupler disconnect, failure, or breakage. (19) When an employee is being transported in a train, the operator shall have clear vision beyond the forward end of the train for safe operation.	**No comparable OSHA provisions**

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R 408.41476 Stationary hoists generally. **Rule 1476**. (1)**** (6) Employees who are at the bottom of an excavated shaft shall be protected from the movement of equipment, tools, or materials overhead or the shaft shall be vacated during the operations that may be hazardous to persons below. (7) If an employee is raised or lowered in a shaft, then all other hoisting operations in the shaft shall be stopped until the employee has disembarked at the bottom or top of the shaft. (8) When a stationary hoist is being used, the drum-operating lever shall be of a type that returns automatically to the “stop” position when the operator’s hand is removed, unless, as a substitute, the throttle that controls the drum speed automatically stops the drum and slows the engine to idling speed when the throttle is released. (9) Only wire rope shall be used for hoisting and it shall be properly secured at both the drum and cage or skip ends. When the hoist is in use, not less than 2 full turns shall remain on the conventional drum hoist to protect the end that fastens at the drum from an overload. (10) Wire rope shall not be used when any of the following conditions exist: (a) Six randomly distributed broken wires in 1 rope lay, 3 broken wires in 1 strand in 1 lay, or 1 valley break. A valley break is a wire break that occurs between 2 adjacent strands. (b) Abrasion, scrubbing, flattening, peening, or any severe change that causes the loss of more than 1/3 of the original diameter of the outside wires in any given area. (c) Evidence of any heat damage or any damage that is caused by contact with electrical wires or marked corrosion of the rope. (d) Reduction from nominal diameter of more than 3/64 of an inch for diameters up to and including 3/4 of an inch, 1/16 of an inch for diameters 7/8 to 1-1/8 inches, and 3/32 of an inch for diameters 1-1/4 to 1-1/2 inches. (11) A wire rope that is used for hoisting shall be continuous and shall not have a knot or splice. The hoisting rope shall not be placed around the load. (12) The connection between the hoisting rope and the cage or skip shall be of a type to prevent the cage from spinning. (13)**** (14) Limit switches shall be provided to eliminate 2 blocking.	**No comparable OSHA provisions**

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R 408.41477 Stationary material hoists. **Rule 1477**. (1) A hoist used for raising or lowering materials in a shaft shall have a minimum factor of safety of 5, shall be designed and rated by a qualified engineer, and shall be constructed in accordance with the design. The design shall be constructed so that the hoist cannot exceed the maximum rated speed. (2) The rated capacity of the hoist shall be posted at all working levels. (3) Each hoist assembly shall be load tested to 200% of its rated capacity upon installation, after any repairs or alterations affecting its structural integrity or operation of safety devices, and every 6 months during use. A written record of each test shall be maintained for the duration of the project and shall be made available for inspection by authorized representatives of the director. (4) Hoist equipment and the operator shall be protected from inclement weather by a hoist house with a comfortable temperature maintained. (5) Where glass is used in hoist house windows, the glass shall be safety glass or its equivalent. (6) Hoist controls shall be arranged to make them operable from a single position of the operator. (7) Controls for powered hoists shall be of the deadman-type with a non-locking switch or control. (8) A device to shut off the power shall be installed ahead of the operating control. (9) A hoist machine that has cast metal parts shall be limited to 2,000 pounds single line pull.	**No comparable OSHA provisions**
R 408.41478 Personnel hoists. **Rule 1478.** (1) A personnel hoist shall be used to raise or lower an employee in a tunnel shaft or caisson. A crane may be used to raise or lower an employee, if the crane and the work platform are as prescribed in R 408.41001 et seq., construction safety standard Part 10. Lifting and Digging Equipment. The hoist shall be in compliance with the provisions of 1967 PA 227, MCL 408.801 et seq., Bureau of Construction Codes, Elevator Safety Board, R 408.8511 to R 408.8524 which is referenced in R 408.41410. During the excavation of a shaft or caisson, an employee may be raised or lowered on a work platform if the work platform meets the specifications of subrule (2) of this rule. (2) A work platform that is attached to the load line of a crane which is used to transport, raise, or lower employees shall be in compliance with all of the following provisions: (a) Be designed by a qualified person. All welding shall be in accordance with applicable American Welding Society standards. American Welding Society (AWS) Standard; IHS AWSC AWS--Structural Welding Code, 2000 Edition, which is adopted by reference in R 408.41410. (b) Except for the guardrail system, be of welded mild steel construction that has a minimum safety factor of 5 times the maximum intended load. (c) Have continuous mild steel guardrails (toprails and midrails) and toeboards as prescribed in R 408.44501 et seq., construction safety standard	**1926.800(t) Hoisting unique to underground construction.**. Except as modified by this paragraph (t), the following provisions of Subpart N of this part apply: Requirements for cranes are found in 1926.550 of this part. Paragraph (g) of 1926.550 applies to crane-hoisting of personnel, except that the limitation in paragraph (g)(2) does not apply to the routine access of employees to the underground via a shaft. Requirements for material hoists are found in 1926.552(a) and (b) of this part. Requirements for personnel hoists are found in the personnel hoist requirements of 1926.552(a) and (c) of this part and in the elevator requirement of 1926.552(a) and (d) of this part. **1926.800(t)(1)** General requirements for cranes and hoists. **1926.800(t)(1)(i)** Materials, tools, and supplies being raised or lowered, whether within a cage or otherwise, shall be secured or stacked in a manner to prevent the load from shifting, snagging or falling into the shaft. **1926.800(t)(1)(ii)** A warning light suitably located to warn employees at the shaft bottom and subsurface shaft entrances shall flash whenever a load is above the shaft bottom or subsurface entrances, or the load is being moved in the shaft. This paragraph does not apply to fully enclosed hoistways. **1926.800(t)(1)(iii)** Whenever a hoistway is not fully enclosed and employees

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Part 45. Fall Protection. (d) Have wood planking, steel plate, or grating that is bolted or welded to the bottom of the work platform. (e) Have a 4-point wire suspension system that utilizes wire which is not less than 1/2 of an inch in diameter. Each leg of the suspension system shall be independent wire rope that has hand-tucked eye splices or swedged fittings on each end. Wire rope clips shall not be used. The independent suspension system shall be attached to the work platform using proper size screw pin shackles. (f) Have each leg of the independent 4-point suspension system at a 30-degree angle from the vertical. (g) Be connected to the load line by means of a screw pin shackle or a gated hook. Both ends of a minimum 5/8-inch wire rope safety line shall be installed above the headache ball to a screw pin shackle and pass through the eyes of the work platform suspension system to prevent the platform from falling if disengaged from the gated hook. If a screw pin shackle is used in place of a gated hook, then the 5/8-inch wire rope safety line is not required. (h) Have overhead protection when there is an overhead hazard. (i) Have a permanently affixed sign that specifies the maximum number of passengers, the identification number, and the maximum intended load. (j)Be easily identifiable by high-visibility color or marking. (3) Before a work platform is used on a jobsite, it shall be load-tested to 2 times the maximum intended load. (4) The work platform and the test load shall be raised and lowered to the maximum anticipated change of elevation. (5) A record of the load test shall be maintained on the jobsite. (6) Employees on the work platform shall be provided with, and be required to use, proper safety equipment as prescribed in R 408.44501 et seq., construction safety standard Part 45. Fall Protection. An employee shall wear a personal fall arrest system that has a lanyard affixed to the top rail of the steel guardrail system of the work platform. Standing on the guardrail system is prohibited. (7) Free-spooling is prohibited when using a work platform to lower personnel. The maximum rate of travel shall be 100 feet per minute. (9) The rails on 1 side of personnel cages shall be removed and a chain shall be installed in place of the top rail to provide a door opening. The chain shall be securely fastened during all travel and only be opened during access to, or egress from, the work platform. (10) Only hand and portable powered tools shall be permitted on the work platform. (11) Flammable or combustible liquids or gases shall not be permitted on the work platform if the platform is occupied by an employee or employees. (12) Platforms shall not be used during adverse weather conditions that could affect the safety of employees. (13) There shall be a communication system, which may	are at the shaft bottom, conveyances or equipment shall be stopped at least 15 feet (4.57 m) above the bottom of the shaft and held there until the signalman at the bottom of the shaft directs the operator to continue lowering the load, except that the load may be lowered without stopping if the load or conveyance is within full view of a bottom signalman who is in constant voice communication with the operator. **1926.800(t)(1)(iv)(A)** Before maintenance, repairs, or other work is commenced in the shaft served by a cage, skip, or bucket, the operator and other employees in the area shall be informed and given suitable instructions. **1926.800(t)(1)(iv)(B)** A sign warning that work is being done in the shaft shall be installed at the shaft collar, at the operator's station, and at each underground landing. **1926.800(t)(1)(v)** Any connection between the hoisting rope and the cage or skip shall be compatible with the type of wire rope used for hoisting. **1926.800(t)(1)(vi)** Spin-type connections, where used, shall be maintained in a clean condition and protected from foreign matter that could affect their operation. **1926.800(t)(1)(vii)** Cage, skip, and load connections to the hoist rope shall be made so that the force of the hoist pull, vibration, misalignment, release of lift force, or impact will not disengaged the connection. Moused or latched open-throat hooks do not meet this requirement. **1926.800(t)(1)(viii)** When using wire rope wedge sockets, means shall be provided to prevent wedge escapement and to ensure that the wedge is properly seated. **1926.800(t)(2)** Additional requirements for cranes. Cranes shall be equipped with a limit switch to prevent overtravel at the boom tip. Limit switches are to be used only to limit travel of loads when operational controls malfunction and shall not be used as a substitute for other operational controls. **1926.800(t)(3)** Additional requirements for hoists. **1926.800(t)(3)(i)** Hoists shall be designed so that the load hoist drum is powered in both directions of rotation, and so that brakes are automatically applied upon power release or failure. **1926.800(t)(3)(ii)** Control levers shall be of the "deadman type" which return automatically to their center (neutral) position upon release. **1926.800(t)(3)(iii)** When a hoist is used for both personnel hoisting and material hoisting, load and speed ratings for personnel and for materials shall be assigned to the equipment. **1926.800(t)(3)(iv)** Material hoisting may be performed at speeds higher than the rated speed for personnel hoisting if the hoist and components have been designed for such higher speeds and if shaft conditions permit.

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be a hand signal, a telephone wire, or a selective frequency radio system, between employees on the work platform and the operator of the crane. The system shall be in compliance with both of the following provisions: (a) If hand signals are being employed and employees are being raised, lowered, or positioned and are not in continuous sight of the operator of the crane at all times, then the employer shall designate an employee, who shall not be on the work platform, to be the signalperson. (b) The signalperson shall not be assigned any other duties while the work platform is in a suspended position with employees on it and shall remain in a position so that both the work platform and the operator can be seen at all times. (14) The crane shall be inspected daily before being used with a work platform. All of the following components shall be inspected: (a) The wire rope. (b) The hook. (c) The brakes. (d) The boom. (e) Any other mechanical and rigging equipment that is vital to the safety of the operation. (15) Any structural or mechanical defect that could adversely affect the safe operation of the crane shall be corrected before an operation that utilizes a work platform begins. (16) Inspections shall be logged and the records maintained on the jobsite. (17) The operator of a crane that is used to raise or lower a work platform shall be authorized by the employer and properly qualified to perform the operation. (18) A qualified crane operator shall not be authorized to raise or lower a platform unless the operator has at least 8 hours of experience in the operation of the specific crane or on a crane of the same type and design. (19) A crane that is used to raise or lower a work platform shall not be within 25 feet of an overhead energized power line at the closest point of contact. (20) When a crane is being used with a work platform, another load shall not be attached to the work platform. (21) Only a crane that is equipped with a boom that has a power control lowering system shall be allowed to raise or lower a work platform. The crane boom shall not be live. (22) The operator of the crane shall remain at the controls with the engine running when an occupied work platform is in a suspended position. (23) The load line of a crane that is used to raise or lower a work platform shall be equipped with a swivel to prevent any rotation of the work platform. The use of nonspin wire rope is prohibited. (24) Neither the load nor the boom shall be lowered below the point where less than 4 full wraps of rope remain on their respective drums. (25) A crawler crane that is used to raise or lower a work platform shall be set on a firm base and chocked to prevent movement. (26) A crane shall not travel in any direction when personnel are on the work platform.	**1926.800(t)(3)(v)** Employees shall not ride on top of any cage, skip or bucket except when necessary to perform inspection or maintenance of the hoisting system, in which case they shall be protected by a body belt/harness system to prevent falling. **1926.800(t)(3)(vi)** Personnel and materials (other than small tools and supplies secured in a manner that will not create a hazards to employees) shall not be hoisted together in the same conveyance. However, if the operator is protected from the shifting of materials, then the operator may ride with materials in cages or skips which are designed to be controlled by an operator within the cage or skip. **1926.800(t)(3)(vii)** Line speed shall not exceed the design limitations of the systems. **1926.800(t)(3)(viii)** Hoists shall be equipped with landing level indicators at the operator's station. Marking the hoist rope does not satisfy this requirement. **1926.800(t)(3)(ix)** Whenever glazing is used in the hoist house, it shall be safety glass, or its equivalent, and be free of distortions and obstructions. **1926.800(t)(3)(x)** A fire extinguisher that is rated at least 2A:10B:C (multi-purpose, dry chemical) shall be mounted in each hoist house. **1926.800(t)(3)(xi)** Hoist controls shall be arranged so that the operator can perform all operating cycle functions and reach the emergency power cutoff without having to reach beyond the operator's normal operating position. **1926.800(t)(3)(xii)** Hoists shall be equipped with limit switches to prevent overtravel at the top and bottom of the hoistway. **1926.800(t)(3)(xiii)** Limit switches are to be used only to limit travel of loads when operational controls malfunction and shall not be used as a substitute for other operational controls. **1926.800(t)(3)(xiv)** Hoist operators shall be provided with a closed-circuit voice communication system to each landing station, with speaker microphones so located that the operator can communicate with individual landing stations during hoist use. **1926.800(t)(3)(xv)** When sinking shafts 75 feet (22.86 m) or less in depth, cages, skips, and buckets that may swing, bump, or snag against shaft sides or other structural protrusions shall be guided by fenders, rails, ropes, or a combination of those means. **1926.800(t)(3)(xvi)** When sinking shafts more than 75 feet (22.86 m) in depth, all cages, skips, and buckets shall be rope or rail guided to within a rail length from the sinking operation. **1926.800(t)(3)(xvii)** Cages, skips, and buckets in all completed shafts, or in all shafts being used as completed shafts, shall be rope or

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(27) A crane that is equipped with outriggers shall have the beams fully extended, the jacks lowered, and each float on a firm base when the work platform is in use.	rail-guided for the full length of their travel. **1926.800(t)(3)(xviii)** Wire rope used in load lines of material hoists shall be capable of supporting, without failure, at least five times the maximum intended load or the factor recommended by the rope manufacturer, whichever is greater. Refer to 1926.552(c)(14)(iii) of this part for design factors for wire rope used in personnel hoists. The design factor shall be calculated by dividing the breaking strength of wire rope, as reported in the manufacturer's rating tables, by the total static load, including the weight of the wire rope in the shaft when fully extended. **1926.800(t)(3)(xix)** A competent person shall visually check all hoisting machinery, equipment, anchorages, and hoisting rope at the beginning of each shift and during hoist use, as necessary. **1926.800(t)(3)(xx)** Each safety device shall be checked by a competent person at least weekly during hoist use to ensure suitable operation and safe condition. **1926.800(t)(3)(xxi)** In order to ensure suitable operation and safe condition of all functions and safety devices, each hoist assembly shall be inspected and load-tested to 100 percent of its rated capacity at the time of installation; after any repairs or alterations affecting its structural integrity; after the operation of any safety device; and annually when in use. The employer shall prepare a certification record which includes the date each inspection and load-test was performed; the signature of the person who performed the inspection and test; and a serial number or other identifier for the hoist that was inspected and tested. The most recent certification record shall be maintained on file until completion of the project. **1926.800(t)(3)(xxii)** Before hoisting personnel or material, the operator shall perform a test run of any cage or skip whenever it has been out of service for one complete shift, and whenever the assembly or components have been repaired or adjusted. **1926.800(t)(3)(xxiii)** Unsafe conditions shall be corrected before using the equipment. **1926.800(t)(4)** Additional requirements for personnel hoists. **1926.800(t)(4)(i)** Hoist drum systems shall be equipped with at least two means of stopping the load, each of which shall be capable of stopping and holding 150 percent of the hoist's rated line pull. A broken-rope safety, safety catch, or arrestment device is not a permissible means of stopping under this paragraph. **1926.800(t)(4)(ii)** The operation shall remain within sight and sound of the signals at the operator's station. **1926.800(t)(4)(iii)** All sides of personnel cages shall be enclosed by one-half inch (12.70 mm) wire mesh (not less than No. 14 gauge or equivalent) to a height of not less than 6 feet 91.83 m).

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	However, when the cage or skip is being used as a work platform, its sides may be reduced in height to 42 inches 1.07 m) when the conveyance is not in motion. **1926.800(t)(4)(iv)** All personnel cages shall be provided with positive locking door that does not open outward. **1926.800(t)(4)(v)** All personnel cages shall be provided with a protective canopy. The canopy shall be made of steel plate, at least 8/16-inch (4.763 mm) in thickness, or material of equivalent strength and impact resistance. The canopy shall be sloped to the outside, and so designed that a section may be readily pushed upward to afford emergency egress. The canopy shall cover the top in such a manner as to protect those inside from objects falling in the shaft. **1926.800(t)(4)(vi)** Personnel platforms operating on guide rails or guide ropes shall be equipped with broken-rope safety devices, safety catches or arrestment devices that will stop and hold 150 percent of the weight of the personnel platform and its maximum rated load. **1926.800(t)(4)(vii)** During sinking operations in shafts where guides and safeties are not yet used, the travel speed of the personnel platform shall not exceed 200 feet (60.96 m) per minute. Governor controls set for 200 feet (60.96 m) per minute shall be installed in the control system and shall be used during personnel hoisting. **1926.800(t)(4)(viii)** The personnel platform may travel over the controlled length of the hoistway at rated speeds up to 600 feet (182.86 m) per minute during sinking operations in shafts where guides and safeties are used. **1926.800(t)(4)(ix)** The personnel platform may travel at rated speeds greater than 600 feet (182.86 m) per minute in completed shafts.
R 408.41479 Flooding; safety screens; runways. **Rule 1479**. If there is a danger of rapid flooding in a tunnel that has a bore of 16 feet or more in diameter, then both of the following shall be provided: (a)**** (b) Metal safety screens or other equivalent means installed with the bottom of the screen 4 feet above the surface of the runway. The first screen shall be located not less than 400 feet from the face of the tunnel.	**No comparable OSHA provisions**

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R 408.41482 Caisson excavation; employee protection. **Rule 1482.** (1) An employee who enters a caisson shall be protected by a steel or concrete casing designed by a qualified employee and approved by a registered engineer. (2) A copy of the design specifications of the casing shall be maintained at the jobsite. (3) In the case of belled-bottom caissons, the steel or concrete casing shall be provided for the full depth of that part of each caisson hole that is above the bell. (4) An employee shall not be permitted to work below the casing in running or unstable soil. (5) The steel or concrete caisson shall extend not less than 12 inches above the ground line. (6) Each employee who is required to enter a caisson excavation shall have a lanyard attached to a body harness and to the load line of a crane. The attachment to the load line shall utilize a screwpin shackle. (7) An employee whose lanyard is attached to the load line of a crane shall be permitted to be lowered to the bottom of the caisson in the muck bucket. (8) The maximum rate of travel when lowering an employee shall be 100 feet per minute. Free-spooling when lowering employees into a caisson is prohibited. (9) All employees shall be removed from the caisson when material is being hoisted from the caisson. (10) A secondary mechanical means that is capable of removing an employee from the caisson shall be readily available in case the crane performing the caisson work breaks down. (11) A top person shall be stationed at the caisson and shall constantly monitor any employees who are in the caisson. (12) A positive means of communication shall be maintained between employees working in the caisson and the top person. (13) The air quality of a caisson shall be tested and maintained in accordance with R 325.50211 to R 325.50214 of the Michigan Administrative Code.	**No comparable OSHA provisions**

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