

DEPARTMENT OF LICENSING AND REGULATORY AFFAIRS

DIRECTOR'S OFFICE

CONSTRUCTION SAFETY STANDARDS

(By authority conferred on the director of the department of licensing and regulatory affairs by sections 19 and 21 of 1974 pa 154, mcl 408.1019 and 408.1021, and executive reorganization order nos. 1996-2, 2003-1, 2008-4, and 2011-4, mcl 445.2001, 445.2011, 445.2025, and 445.2030)

PART 25. CONCRETE CONSTRUCTION

R 408.42501 Scope.

Rule 2501. This standard pertains to all of the following:

- (a) The reinforcing, pouring, stressing, lifting, and floating of concrete.
- (b) The construction of forms and shoring used in connection with concrete construction.
- (c) Prestressed and poststressed operations.
- (d) Precast, tilt-up, and lift-slab operations.

History: 1979 AC; 1980 AACS; 1989 AACS; 1993 AACS; 2003 AACS; 2016 AACS.

R 408.42502 Adoption of standards.

Rule 2502.(1) The following standards are adopted by reference in these rules and are available from Global Engineering Documents, 15 Inverness Way East, Englewood, Colorado, 80112, telephone number 1-800-854-7179, website: www.global.ihs.com, at a cost as of the time of adoption of these rules, as stated in this rule:

(a) American National Standard Institute standard ANSI A10.9, "Concrete Construction and Masonry Work," 1983 edition. Cost: \$20.00.

(b) American Welding Society standard AWS D1.1/D1.1M, "Structural Welding Code Steel," 2002 edition. Cost: \$468.00.

(2) The following standard is adopted by reference in these rules, American Welding Society standard AWS B1.10, "Guide for the Nondestructive Examination of Welds," 1999 edition. This standard is available from The AWS Store Customer Service, 13301 NW 47 Avenue, Opa-Locka, Florida 33054 USA; telephone number: 305-826-6192; or via the internet at website: www.aws.org; at a cost as of the time of adoption of these rules of \$104.00.

(3) The standards adopted in these rules are available for inspection at the Michigan Department of Licensing And Regulatory Affairs, MIOSHA Regulatory Services Section, 530 West Allegan Street, P.O. Box 30643, Lansing, Michigan 48909-8143.

(4) Copies of these standards may be obtained from the publisher or may be obtained from the Department of Licensing and Regulatory Affairs, MIOSHA Regulatory

Services Section, 530 West Allegan Street, P.O. Box 30643, Lansing, Michigan, 48909-8143, at the cost charged in this rule, plus \$20.00 for shipping and handling.

History: 2003 AACCS; 2013 AACCS; 2016 AACCS.

R 408.42503 Reference of standards.

Rule 2503. The following Michigan occupational safety and health standards (MIOSHA) are referenced in these rules. Up to 5 copies of these standards may be obtained at no charge from the Michigan Department of Licensing And Regulatory Affairs, MIOSHA Regulatory Services Section, 530 West Allegan Street, P.O. Box 30643, Lansing, Michigan, 48908-8143, or via the internet at website: www.michigan.gov/mioshastandards. For quantities greater than 5, the cost, at the time of adoption of these rules, is 4 cents per page.

(a) Construction Safety Standard Part 12 "Scaffolds and Scaffold Platforms," R 408.41201 to R 408.41264.

(b) Construction Safety Standard Part 21 "Guarding of Walking and Working Areas," R 408.42101 to R 408.42160.

(c) Construction Safety Standard Part 45 "Fall Protection," R 408.44501 to R 408.44502.

History: 2003 AACCS; 2013 AACCS; 2016 AACCS.

R 408.42516 Definitions.

Rule 2516. (1) "Bull float" means a tool used to spread out and smooth concrete.

(2) "Formwork" or "falsework" means the total system of support for freshly placed or partially cured concrete, including the mold or sheeting that contacts the concrete and all supporting members, hardware, and necessary bracing.

(3) "Foundation" or "footings" means a natural or built-up solid ground or base upon which shoring or reshoring is supported, including all underlying ground strata.

(4) "Guy" means a line that steadies a high object or structure by pulling against an off-center load.

(5) "Horizontal shoring beams" means beams or trusses used as load-carrying members in shoring systems.

(6) "Jacking operation" means the task of vertically lifting a slab or group of slabs from one location to another, such as from the casting location to a temporary (parked) location, from a temporary location to another temporary location, or to its final location in the structure during the construction of a structure where the lift-slab process is being used.

(7) "Lift slab" means a method of concrete construction in which floor and roof slabs are cast on or at ground level and, using jacks, lifted into position.

(8) "Precast concrete" means a concrete member that is cast and cured at a location other than its final designated location.

(9) "Poststressed concrete" means a concrete member in which internal stresses have been introduced by the stressing of strands after the placement of concrete.

(10) "Prestressed concrete" means a concrete member in which internal stresses have been introduced by the stressing of strands before the placement of the concrete.

(11) "Qualified designer" means a person who, by possession of a degree, certificate, or professional standing, has demonstrated ability in design in the subject area being regulated.

(12) "Qualified person" means a person who, because of education or training, is knowledgeable about the erection methods, materials, and hazards of the work to be performed.

(13) "Reshore" means the vertical or inclined supporting members that are designed to distribute the weight of concrete and construction loads to lower levels until such loads can be supported by the concrete structure.

(14) "Shore" means a vertical or inclined support member that is designed to carry the weight of formwork, concrete, and construction live loads above.

(15) "Slip form" means a form that moves, usually continuously, during the placement of concrete. Movement may be either horizontal or vertical.

(16) "Vertical slip form" means a form that is jacked vertically and continuously during the placing of concrete.

History: 1980 AACCS; 1989 AACCS; 1993 AACCS; 2003 AACCS.

R 408.42517 Construction equipment and material requirements; adoption by reference.

Rule 2517. (1) Equipment and material used in concrete construction and masonry work shall meet the applicable requirements prescribed in American national standard institute standard ANSI A10.9, "Concrete Construction and Masonry Work," 1983 edition, as adopted in R 408.42502.

(2) The minimum safety factors of formwork accessories shall be as prescribed in table 1, as follows:

TABLE 1 MINIMUM SAFETY FACTORS OF FORMWORK ACCESSORIES*		
Accessory	Safety Factor	Type of Construction
Form Tie	1.5	Light formwork, 8 feet or less in height with no hazard to life.
	2.0	All formwork over 8 feet in height or hazardous to life. Formwork for architectural concrete.

Form Anchor	2.0	Formwork supporting form weight and concrete pressures only.
	3.0	Formwork supporting weight of forms, concrete, construction live loads, and impact.
Form Hangers	2.0	All applications.
Anchoring inserts used as form ties.	2.0	Precast concrete panels when used as formwork.
*Safety factors are based on ultimate strength of accessory.		

History: 1980 AACS; 1989 AACS; 2003 AACS; 2016 AACS.

R 408.42518 Reinforcing steel.

Rule 2518. (1) A route designated as a means of access or egress across reinforcing steel for general traffic shall be provided with a walkway.

(2) All protruding reinforcing steel, onto and into which employees could fall, shall be guarded to eliminate the hazard of impalement.

(3) Reinforcing steel or walls, piers, columns, and other similar vertical structures shall be guyed, braced, or otherwise supported to prevent collapse.

(4) Reinforcing steel shall not be used as a scaffolding hook or stirrup or as a load-bearing member in a lifting device.

(5) Reinforcing steel shall not be welded and used as a load-bearing member.

(6) Roll wire mesh shall be secured at each end to prevent dangerous recoiling action.

History: 1980 AACS; 1989 AACS; 1996 AACS; 2003 AACS; 2013 AACS; 2016 AACS.

R 408.42519 Bulk concrete handling.

Rule 2519. A bulk storage bin, container, or silo shall have a conical or tapered bottom with a mechanical or pneumatic means of starting the flow of the material. An employee shall not be permitted to enter storage facilities unless the ejection system has been shut down, locked out, and tagged to indicate that the ejection system is not operable.

History: 1980 AACS; 2003 AACS.

R 408.42520 Concrete mixing, pouring, and floating.

Rule 2520. (1) A concrete mixer that is equipped with a 1-yard or larger loading skip shall be equipped with a mechanical device to clear the skip of material.

(2) A guardrail that is capable of withstanding a 200-pound side thrust shall be provided on each side of a skip on a mixer that has a capacity of 1 or more yards.

(3) The handle on a bull float that is used where it may contact an energized electrical conductor shall be constructed of nonconductive material or shall be insulated with a nonconductive sheath that has electrical and mechanical characteristics which provide the equivalent protection of a handle constructed of nonconductive material.

(4) A powered and rotating-type concrete troweling machine that is manually guided shall be equipped with a control switch that will automatically shut off the power when the operator removes his or her hands from the equipment handles or switch.

(5) The handles of a concrete buggy shall not extend horizontally beyond the wheels on either side of the buggy.

(6) A concrete bucket that is equipped with a hydraulically or pneumatically operated gate shall have a positive safety latch or a similar safety device installed to prevent premature or accidental dumping. The bucket shall be designed to prevent aggregate and loose material from accumulating on the top and sides of the bucket.

(7) An employee shall not be permitted to ride a bucket or walk or work under a bucket that is suspended from a crane or cableway.

(8) A concrete bucket that is positioned by a crane or cableway shall be suspended from an approved swivel safety-type hook.

(9) A pumpcrete or similar system using discharge pipe shall have pipe supports that are designed for a 100% overload. Compression air hoses in the system shall be provided with positive fail-safe joint connectors to prevent the separation of sections when pressurized.

(10) A runway, ramp, or scaffold shall be provided for placement of concrete in areas such as walls, piers, columns, and beams, as prescribed in Construction Safety Standards Part 12 "Scaffolds and Scaffold Platforms," Part 21 "Guarding of Walking and Working Areas," and Part 45 "Fall Protection," as referenced in R 408.42503.

(11) A concrete mixer, or other equipment, such as a compressor, screen, or pumps used for concrete construction activities, where inadvertent operation of the equipment may occur and cause injury, shall be locked out when an employee is performing maintenance or repair. An employee who is inside a concrete mixer performing maintenance or repair shall have the only key to the lock.

(12) Sections of tremies and similar concrete conveyances shall be secured with wire rope, or equivalent materials, in addition to the regular couplings or connections.

History: 1980 AACS; 1982 AACS; 1989 AACS; 1996 AACS; 2003 AACS; 2013 AACS; 2016 AACS.

R 408.42521 Forms and shoring generally.

Rule 2521. (1) Formwork, shoring, and reshoring shall be designed, erected, supported, braced, and maintained so that they will support all vertical and lateral loads that may be imposed upon them during placement of concrete or until the loads can be supported by the concrete structure.

(2) Drawings or plans which are prepared by the qualified person, except as required in R 408.42527(5) and R 408.42533(1), and which show the jack layout, formwork, shoring, working decks, and scaffolding shall be available at the jobsite.

(3) No construction loads shall be placed on a concrete structure or portion of a concrete structure unless the employer determines, based on information received from a person

who is qualified in structural design, that the structure or portion of the structure is capable of supporting the loads.

History: 1980 AACS; 1982 AACS; 1989 AACS; 1996 AACS; 2003 AACS; 2013 AACS.

R 408.42522 Placing and removing forms.

Rule 2522. (1) Forms shall not be completely removed until a determination has been made that the concrete can support its own weight and any currently superimposed load. Such determination shall be based on compliance with either of the following:

(a) The plans and specifications stipulate conditions for removal of forms and shores, and such conditions have been followed.

(b) The concrete has been properly tested with an appropriate ASTM standard test method designed to indicate the concrete compressive strength, and that the test results indicate that the concrete has gained sufficient strength to support its weight and superimposed loads.

(2) Vertical, horizontal, and overhead forms that are being raised or removed by lifting equipment shall be braced or secured before being released from the load line.

History: 1980 AACS; 1989 AACS; 2003 AACS; 2013 AACS.

R 408.42523 Vertical slip forms.

Rule 2523. (1) Field operations for vertical slip forms shall be under the supervision of a qualified person. The qualified person shall be present on the deck during slipping operations.

(2) A lift shall proceed steadily and uniformly and shall not exceed the predetermined rate of lift.

(3) The steel rods or pipe on which the jacks climb or by which the forms are lifted shall be specifically designed for such climbing or lifting. Such rods shall be adequately braced if they are not encased in concrete.

(4) Jacks and vertical supports shall be positioned so that the vertical loads are distributed equally and do not exceed the capacity of the jacks.

(5) The jacks or other lifting devices shall be provided with mechanical dogs or other automatic holding devices to prevent slippage due to the failure of the power supply of the lifting mechanism.

(6) Vertical lift forms shall be provided with scaffolding or work platforms that completely encircle the area of placement. The scaffolds shall be as prescribed in Construction Safety Standard Part 12 "Scaffolds and Scaffold Platforms," as referenced in R 408.42503.

(7) Lateral and diagonal bracing of vertical slip forms shall be provided to prevent excessive distortion of the structure during the jacking operation.

(8) During a jacking operation, a qualified person shall maintain the form structure in line and plumb.

History: 1980 AACS; 1989 AACS; 2003 AACS; 2016 AACS.

R 408.42524 Vertical shoring generally.

Rule 2524. (1) When temporary storage of reinforcing rods, material, or equipment on top of formwork becomes necessary, these areas shall be strengthened to support the intended loads.

(2) The sills for shoring shall be sound, rigid, and capable of carrying the maximum intended load.

(3) When shoring from soil, the soil shall be capable of supporting the load and the soil shall be inspected after each occurrence which could affect its load-bearing capacity. Soil weakened from any occurrence that reduces its load-bearing capacity to less than that required to support a specific load shall be strengthened by compacting or other equivalent means.

(4) Baseplates, shore heads, extension devices, and adjustment screws shall be in firm contact with the footing sill and the form.

(5) Eccentric loads on shore heads and similar members or shoring are prohibited, unless the shore heads are designed for the loading.

(6) Shoring equipment shall be inspected by a qualified person before erection to determine that it is as specified in the shoring drawings or plans. Any equipment found to be damaged shall not be used for shoring.

(7) Before concrete is placed in the forms, all shoring equipment shall be inspected by a qualified person to determine whether it was erected as specified in the shoring drawings or plans.

(8) Erected shoring shall be inspected by a qualified person during and immediately after pouring concrete. Shoring that is found to be damaged or weakened shall be reinforced or reshored.

(9) Only designated employees shall be permitted on the first floor immediately under the forms during concrete placing work.

(10) Shoring equipment shall not be released or removed without the approval and assurance of a qualified person that the remaining equipment will support the load.

(11) Construction or superimposed loads shall not be placed on an uncured concrete pour unless either of the following provisions is complied with:

(a) The strength of the concrete in the previous pour has been determined by testing to be capable of withstanding the load.

(b) A qualified person indicates that the concrete has developed sufficient strength to support the load. This subrule does not apply to slip form operations and slabs built at grade elevation.

(12) Reshoring shall be provided, when necessary, to support slabs and beams after stripping or where the members are subjected to superimposed loads due to the construction work done.

(13) Vertical shoring shall not be adjusted to raise formwork after concrete is in place, unless specifically provided for in the design specifications.

History: 1980 AACCS; 1989 AACCS; 2013 AACCS.

R 408.42525 Metal frame shoring.

Rule 2525. Locking devices on frames and braces shall be in good working order; coupling pins shall align the frame or panel legs; pivoted cross braces shall have their center pivot in place, and all components shall be without defects.

History: 1980 AACCS; 2013 AACCS.

R 408.42526 Tube and coupler shoring.

Rule 2526. (1) The couplers or clamps shall not be used if they are deformed, broken, have defective or missing threads on bolts, or have other defects.

(2) The interlocking of the tubular members and the tightness of the couplers shall be checked before pouring concrete.

History: 1980 AACCS; 2013 AACCS.

R 408.42527 Single-post shores.

Rule 2527. (1) For stability, a single-post shore shall be horizontally braced in both the longitudinal and transverse directions, and diagonal bracing shall also be installed. The bracing shall be installed as the shores are being erected.

(2) The top of single-post shores shall be restricted from movement by the use of retainers or other equivalent means.

(3) Timber and fabricated single-post shores and the adjusting devices shall be inspected before erection. Timber for single-post shores shall not be used if it contains splits, cuts, rotting, or structural damage.

(4) A metal single-post shore and the adjusting devices shall not be used if the shore or devices are heavily rusted, bent, dented, or rewelded or have broken weldments or other defects.

(5) A single-post shore that is used in more than 1 tier shall be designed by a registered engineer and inspected by a qualified person. All of the following shall apply:

(a) The single post shores shall be vertically aligned.

(b) The single post shores shall be spliced to prevent misalignment.

(c) The single post shores shall be adequately braced in 2 mutually perpendicular directions at the splice level. Each tier shall also be diagonally braced in the same 2 directions.

(6) When formwork is at an angle or is sloping or when the surface shored is sloping, the shoring shall be designed for this loading by a qualified engineer.

History: 1980 AACCS; 1989 AACCS; 2003 AACCS; 2013 AACCS.

R 408.42528 Flying forms.

Rule 2528. (1) Nothing shall be allowed on the forms during movement unless it is securely fastened to the forms.

(2) A person, other than the rigger, shall not be permitted on top of the deck form after rollout operations have been completed.

(3) Rigging of the deck form shall be completed before the line from the crane takes the total load of the form.

History: 1989 AACCS; 2013 AACCS.

R 408.42531 Prestressed and poststressed concrete operations.

Rule 2531. (1) An expendable strand deflection device that is used to pretension concrete members shall have a designed safety factor of not less than 2. A reusable device shall have a safety factor of not less than 3.

(2) Expendable and reusable strand deflection devices shall not be loaded in excess of their maximum intended load.

(3) An employer shall designate a qualified person to inspect all jacking and pulling equipment before each use and during use.

(4) Tensioning strands that have kinks, bends, nicks, and other defects shall not be used.

(5) Welding or cutting is prohibited near strand that has been unrolled, strung, or tensioned or at any other location where strand is stored.

(6) During jacking operations of any tensioning element or group of tensioning elements, the anchor shall be kept turned up close to the anchor plate.

(7) An employee shall not stand in the line of, in back of, or over the jacking equipment during tensioning operations.

(8) Only an employee who is operating tensioning equipment shall be permitted in the immediate vicinity when tensioning is in progress.

(9) Stress members shall be lifted with the lifting devices at points specifically designed. An employee shall not be under stressed members during lifting and erection.

(10) Audible or visual signaling devices shall be operated to warn employees when tensioning operations are under way.

(11) All employees who are not directly involved in the tensioning operations shall be cleared from the area and shall remain clear until tensioning operations are completed and the signaling devices are turned off.

History: 1980 AACCS; 1989 AACCS; 2013 MR 1, Edd. Jan. 16, 2013.

R 408.42532 Precast and tilt-up operations.

Rule 2532. (1) Lifting inserts which are embedded or otherwise attached to tilt-up precast concrete members shall be capable of supporting at least 2 times the maximum intended load applied or transmitted to them. Lifting inserts which are embedded or otherwise attached to precast concrete members, other than the tilt-up members, shall be capable of supporting at least 4 times the maximum intended load applied or transmitted to them. Lifting hardware shall be capable of supporting at least 5 times the maximum intended load applied transmitted to the lifting hardware.

(2) An erection and procedure plan, including placement of connections, shall be prepared by a qualified employee knowledgeable in precast concrete erection and be kept available at the jobsite.

(3) Precast concrete wall units and vertical panels shall be braced to prevent collapse. A permanent connection may be used in place of bracing if it is capable of withstanding all loads imposed during construction.

(4) An employee, except for a connector, shall not be permitted under a precast section, wall, or panel during lifting and tilting operations.

History: 1980 AACS; 1989 AACS; 1993 AACS; 2003 AACS; 2013 AACS.

R 408.42533 Lift-slab operations.

Rule 2533. (1) A registered professional engineer who is qualified in lift-slab operations shall design and plan lift-slab operations. An employer shall implement the plans and designs and shall include detailed instructions and sketches that indicate the prescribed method of erection. The plans and designs shall also include provisions for ensuring lateral stability of the building or structure during construction.

(2) An employer shall ensure that jacks are marked to indicate the rated capacity established by the manufacturer.

(3) An employer shall ensure that jacks are not loaded beyond the rated capacity established by the manufacturer.

(4) An employer shall ensure that jacking equipment is not overloaded and the threaded rods and other members that transmit loads to the jacks are capable of supporting not less than 2 1/2 times the load to be applied. Jacking equipment shall include all of the following:

- (a) Jacks and other lifting units.
- (b) Lifting angles.
- (c) Lifting nuts.
- (d) Hook-up collars.
- (e) T-caps.
- (f) Shearheads.
- (g) Columns and footings.

(5) An employer shall ensure that a jack is designed and installed so that it will not lift or continue to lift when it is loaded in excess of its rated capacity.

(6) An employer shall ensure that a jack has a safety device installed that will cause the jack to support the load in any position if the jack malfunctions or loses its lifting ability.

(7) An employer shall ensure that jacking operations are synchronized to ensure even and uniform lifting of the slab. An employer shall ensure, that during lifting, all points of the slab support are kept within 1/2 of an inch of that needed to maintain the slab in a level position.

(8) If leveling is automatically controlled, then an employer shall ensure that a device is installed which will stop the operation when the 1/2-inch tolerance specified in subrule (7) of this rule is exceeded or when there is a malfunction in the jacking system.

(9) An employer shall ensure that the maximum number of manually controlled jacks on 1 slab is limited to a number, which shall not be more than 14, that will permit the operator to maintain the slab level within specified tolerances. The controls shall be located near a qualified person.

(10) An employer shall ensure that an employee, except for an employee who is essential to the jacking operation, is not permitted in the building while any jacking operation is taking place. For the purpose of this subrule, a jacking operation begins when a slab or group of slabs is lifted and ends when the slabs are secured with either temporary connections or permanent connections.

(11) An employer shall ensure that an employee is not permitted under a slab during jacking operations.

(12) An employer shall ensure that all welding on temporary and permanent connections is performed in accordance with the requirements of the American welding society standards AWS D1.1/D1.1M, "Structural Welding Code Steel," 2002 edition, and AWS B1.10, "Guide for the Nondestructive Examination of Welds," 1999 edition. These standards are adopted by reference in R 408.42503. An employer shall ensure that the welders are familiar with the welding requirements specified in the lift-slab plan and specifications.

(13) An employer shall ensure that load transfer from jacks to building columns is not executed until the welds on the column shear plates are cooled to air temperature.

(14) An employer shall ensure that jack-lifting units are positively secured to building columns so that they do not become dislodged or dislocated.

(15) An employer shall ensure that equipment is designed and installed so that the lifting rods cannot slip out of position or the employer shall initiate other measures, such as the use of locking or blocking devices, that will provide attachments and prevent components from disengaging during lifting operations.

(16) Lifting devices, other than jacks covered by subrule (4) of this rule, shall be of sufficient strength and design to provide a safety factor not less than 5 times the working load.

History: 1980 AACS; 1989 AACS; 1993 AACS; 1998-2000 AACS; 2003 AACS; 2013 AACS; 2016 AACS.

R 408.42534 Rescinded.

History: 1989 AACS; 2013 AACS.

R 408.42535 Rescinded.

History: 1989 AACS; 2003 AACS; 2013 MR 1, Eff. Jan 16, 2013.