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(f) *Personal protective equipment.* No employee shall be permitted to apply a cement, sand, and water mixture through a pneumatic hose unless the employee is wearing protective head and face equipment.

[53 FR 22643, June 16, 1988, as amended at 59 FR 40730, Aug. 9, 1994]

§ 1926.702 Requirements for equipment and tools.

(a) *Bulk cement storage.* (1) Bulk storage bins, containers, and silos shall be equipped with the following:

- (i) Conical or tapered bottoms; and
- (ii) Mechanical or pneumatic means of starting the flow of material.

(2) No employee shall 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 to be operated.

(b) *Concrete mixers.* Concrete mixers with one cubic yard (.8 m³) or larger loading skips shall be equipped with the following:

(1) A mechanical device to clear the skip of materials; and

(2) Guardrails installed on each side of the skip.

(c) *Power concrete trowels.* Powered and rotating type concrete troweling machines that are manually guided shall be equipped with a control switch that will automatically shut off the power whenever the hands of the operator are removed from the equipment handles.

(d) *Concrete buggies.* Concrete buggy handles shall not extend beyond the wheels on either side of the buggy.

(e) *Concrete pumping systems.* (1) Concrete pumping systems using discharge pipes shall be provided with pipe supports designed for 100 percent overload.

(2) Compressed air hoses used on concrete pumping system shall be provided with positive fail-safe joint connectors to prevent separation of sections when pressurized.

(f) *Concrete buckets.* (1) Concrete buckets equipped with hydraulic or pneumatic gates shall have positive safety latches or similar safety devices installed to prevent premature or accidental dumping.

(2) Concrete buckets shall be designed to prevent concrete from hanging up on top and the sides.

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

(h) *Bull floats.* Bull float handles, used where they might contact energized electrical conductors, shall be constructed of nonconductive material or insulated with a nonconductive sheath whose electrical and mechanical characteristics provide the equivalent protection of a handle constructed of nonconductive material.

(i) *Masonry saws.* (1) Masonry saws shall be guarded with a semicircular enclosure over the blade.

(2) A method for retaining blade fragments shall be incorporated in the design of the semicircular enclosure.

(j) *Lockout/Tagout Procedures.* (1) No employee shall be permitted to perform maintenance or repair activity on equipment (such as compressors, mixers, screens or pumps used for concrete and masonry construction activities) where the inadvertent operation of the equipment could occur and cause injury, unless all potentially hazardous energy sources have been locked out and tagged.

(2) Tags shall read *Do Not Start* or similar language to indicate that the equipment is not to be operated.

§ 1926.703 Requirements for cast-in-place concrete.

(a) *General requirements for formwork.*

(1) Formwork shall be designed, fabricated, erected, supported, braced and maintained so that it will be capable of supporting without failure all vertical and lateral loads that may reasonably be anticipated to be applied to the formwork. Formwork which is designed, fabricated, erected, supported, braced and maintained in conformance with the appendix to this section will be deemed to meet the requirements of this paragraph.

(2) Drawings or plans, including all revisions, for the jack layout, formwork (including shoring equipment), working decks, and scaffolds, shall be available at the jobsite.

(b) *Shoring and reshoring.* (1) All shoring equipment (including equipment used in reshoring operations) shall be

inspected prior to erection to determine that the equipment meets the requirements specified in the formwork drawings.

(2) Shoring equipment found to be damaged such that its strength is reduced to less than that required by § 1926.703(a)(1) shall not be used for shoring.

(3) Erected shoring equipment shall be inspected immediately prior to, during, and immediately after concrete placement.

(4) Shoring equipment that is found to be damaged or weakened after erection, such that its strength is reduced to less than that required by § 1926.703(a)(1), shall be immediately reinforced.

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

(6) All base plates, shore heads, extension devices, and adjustment screws shall be in firm contact, and secured when necessary, with the foundation and the form.

(7) Eccentric loads on shore heads and similar members shall be prohibited unless these members have been designed for such loading.

(8) Whenever single post shores are used one on top of another (tiered), the employer shall comply with the following specific requirements in addition to the general requirements for formwork:

(i) The design of the shoring shall be prepared by a qualified designer and the erected shoring shall be inspected by an engineer qualified in structural design.

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

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

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

(9) Adjustment of single post shores to raise formwork shall not be made after the placement of concrete.

(10) Reshoring shall be erected, as the original forms and shores are removed, whenever the concrete is required to support loads in excess of its capacity.

(c) *Vertical slip forms.* (1) The steel rods or pipes on which jacks climb or by which the forms are lifted shall be—

(i) Specifically designed for that purpose; and

(ii) Adequately braced where not encased in concrete.

(2) Forms shall be designed to prevent excessive distortion of the structure during the jacking operation.

(3) All vertical slip forms shall be provided with scaffolds or work platforms where employees are required to work or pass.

(4) Jacks and vertical supports shall be positioned in such a manner that the loads do not exceed the rated capacity of the jacks.

(5) The jacks or other lifting devices shall be provided with mechanical dogs or other automatic holding devices to support the slip forms whenever failure of the power supply or lifting mechanism occurs.

(6) The form structure shall be maintained within all design tolerances specified for plumbness during the jacking operation.

(7) The predetermined safe rate of lift shall not be exceeded.

(d) *Reinforcing steel.* (1) Reinforcing steel for walls, piers, columns, and similar vertical structures shall be adequately supported to prevent overturning and to prevent collapse.

(2) Employers shall take measures to prevent unrolled wire mesh from recoiling. Such measures may include, but are not limited to, securing each end of the roll or turning over the roll.

(e) *Removal of formwork.* (1) Forms and shores (except those used for slabs on grade and slip forms) shall not be removed until the employer determines that the concrete has gained sufficient strength to support its weight and superimposed loads. Such determination shall be based on compliance with one of the following:

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

(ii) The concrete has been properly tested with an appropriate ASTM standard test method designed to indicate the concrete compressive strength, and the test results indicate that the concrete has gained sufficient

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strength to support its weight and superimposed loads.

(2) Reshoring shall not be removed until the concrete being supported has attained adequate strength to support its weight and all loads in place upon it.

APPENDIX TO § 1926.703(a)(1)

GENERAL REQUIREMENTS FOR FORMWORK

(This appendix is non-mandatory.)

This appendix serves as a non-mandatory guideline to assist employers in complying with the formwork requirements in § 1926.703(a)(1). Formwork which has been designed, fabricated, erected, braced, supported and maintained in accordance with Sections 6 and 7 of the American National Standard for Construction and Demolition Operations—Concrete and Masonry Work, ANSI A10.9-1983, shall be deemed to be in compliance with the provision of § 1926.703(a)(1).

[53 FR 22643, June 16, 1988, as amended at 61 FR 5510, Feb. 13, 1996]

§ 1926.704 Requirements for precast concrete.

(a) Precast concrete wall units, structural framing, and tilt-up wall panels shall be adequately supported to prevent overturning and to prevent collapse until permanent connections are completed.

(b) Lifting inserts which are embedded or otherwise attached to tilt-up precast concrete members shall be capable of supporting at least two times the maximum intended load applied or transmitted to them.

(c) 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 four times the maximum intended load applied or transmitted to them.

(d) Lifting hardware shall be capable of supporting at least five times the maximum intended load applied or transmitted to the lifting hardware.

(e) No employee shall be permitted under precast concrete members being lifted or tilted into position except those employees required for the erection of those members.

[53 FR 22643, June 16, 1988, as amended at 54 FR 41088, Oct. 5, 1989]

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§ 1926.705 Requirements for lift-slab construction operations.

(a) Lift-slab operations shall be designed and planned by a registered professional engineer who has experience in lift-slab construction. Such plans and designs shall be implemented by the employer and shall include detailed instructions and sketches indicating the prescribed method of erection. These plans and designs shall also include provisions for ensuring lateral stability of the building/structure during construction.

(b) Jacks/lifting units shall be marked to indicate their rated capacity as established by the manufacturer.

(c) Jacks/lifting units shall not be loaded beyond their rated capacity as established by the manufacturer.

(d) Jacking equipment shall be capable of supporting at least two and one-half times the load being lifted during jacking operations and the equipment shall not be overloaded. For the purpose of this provision, jacking equipment includes any load bearing component which is used to carry out the lifting operation(s). Such equipment includes, but is not limited, to the following: threaded rods, lifting attachments, lifting nuts, hook-up collars, T-caps, shearheads, columns, and footings.

(e) Jacks/lifting units shall be designed and installed so that they will neither lift nor continue to lift when they are loaded in excess of their rated capacity.

(f) Jacks/lifting units shall have a safety device installed which will cause the jacks/lifting units to support the load in any position in the event any jack/lifting unit malfunctions or loses its lifting ability.

(g) Jacking operations shall be synchronized in such a manner to ensure even and uniform lifting of the slab. During lifting, all points at which the slab is supported shall be kept within 1/2 inch of that needed to maintain the slab in a level position.

(h) If leveling is automatically controlled, a device shall be installed that will stop the operation when the 1/2 inch tolerance set forth in paragraph (g) of this section is exceeded or where there is a malfunction in the jacking (lifting) system.