

157 – OTHER EQUIPMENT

SECTION 157

OTHER EQUIPMENT

157.1 REBAR INSERTION EQUIPMENT

a. Drilling Equipment. Use equipment that complies with the following requirements:

- Hydraulic driven
- Capable of operation in a clockwise direction;
- Truck or trailer mounted;
- Adjustment in transverse and longitudinal directions;
- Capable of operating at a pitch of 45°;
- A power system to raise and lower the bit; and
- Removal of loose material by drill shaft vacuum extraction during drilling.

b. Epoxy Pump. Use a pump system that the manufacturer has certified to deliver a proper mixture of specific material properties and a given resin to hardener ratio. The given ratio is supplied by the epoxy manufacturer.

The pump may be adaptable for variable mixture ratios. It shall maintain the ratio set for a temperature range of 40 to 120°F and a pressure range of 20 to 100 pounds per square inch. The pump shall include the separate A and B supply hoses along with their respective back-flow prevention valves.

c. Epoxy Mixer. Provide epoxy mixer with adequate elements to thoroughly mix the resin and hardener components and be capable of operating within the same temperature and pressure ranges as the pump system. Use an easy to clean mixer constructed of semi-transparent materials in order to observe the mixing operation.

d. Injection Nozzle Assembly. Provide an injection nozzle capable of temporarily locking into the 1 inch diameter hole in the concrete and holding a minimum sustained pressure of 100 pounds per square inch without significant surface leakage. A design for a suitable assembly is available from the Bureau of Materials and Research.

157.2 PILE DRIVING EQUIPMENT

a. General. Pile driving hammers other than drop hammers shall be of the size needed to develop the energy required to drive piles at a penetration rate of not less than 0.10 in. per blow at the minimum driving resistance according to the appropriate pile driving formula in **TABLE 704-1**.

In addition to all other requirements, single and double acting diesel hammers and air/steam hammers require the following.

(1) Open-End (Single Acting) Diesel Hammer. Equip open-end (single acting) diesel hammers with a device such as rings on the ram or a scale (jump stick) extending above the ram cylinder, to permit the Engineer to visually determine hammer stroke at all times during pile driving operation. Also, provide the Engineer a chart from the hammer manufacturer equating stroke and blows per minute for the open-end diesel hammer to be used.

(2) Closed-End (Double Acting) Diesel Hammer. Equip closed-end (double acting) diesel hammers with a bounce chamber pressure gauge, mounted near ground level so as to be easily read by the Engineer. Also, provide the Engineer a chart, calibrated to actual hammer performance, equating bounce chamber pressure to either equivalent energy or stroke for the closed-end diesel hammer to be used.

(3) The weight of the striking part of air/steam hammers used shall be a minimum of 1/3 the weight of the pile and drive cap, and in no case shall the striking part have a weight less than 2,750 pounds.

b. Hammers for Steel Piles, Steel Sheet Piles and Shells for Cast-in-Place Concrete Piles. If a gravity hammer is used for driving steel piles, steel sheet and shells for cast-in-place concrete piles, use one with a minimum weight of 3,500 pounds. In no case may the weight of the gravity hammer be less than the pile being driven plus the weight of the driving cap. In lieu of weighing the hammer, a certification may be provided by the Contractor. Equip all gravity hammers with hammer guides to maintain concentric impact on the drive head or pile cushion. Regulate the fall to avoid injury to the piles. The fall shall be a maximum of 15 feet. If steam or diesel

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hammers are used, its rated gross energy in foot-pounds shall be a minimum of 2 ½ times the weight of the pile in pounds. The hammer shall develop a minimum of 6,000 foot-pounds of energy per blow.

c. Hammers for Pre-stressed Concrete Piles. Unless otherwise provided, drive pre-stressed concrete piles with a diesel or air/steam hammer that can develop an energy per blow at each full stroke of the piston of a minimum of 1 foot-pound for each pound of weight driven. The hammer shall develop a minimum of 6,000 foot-pounds of energy per blow.

d. Vibratory Hammers. Vibratory hammers may only be used when specifically allowed by the Contract Documents or in writing by the Engineer. If approved, vibratory hammers shall be used in combination with pile load testing and re-tapping with an impact hammer. In addition, 1 of every 10 piles driven with a vibratory hammer shall be re-tapped with an impact hammer of suitable energy to verify that acceptable load capacity was achieved.

e. Additional Equipment. The plant and equipment provided for air/steam hammers shall have sufficient capacity to maintain, under working conditions, the pressure at the hammer specified by the manufacturer. In case the required penetration or bearing is not obtained by the use of a hammer complying with the above minimum requirements, provide a hammer of greater energy or when permitted, resort to jetting or pre-drilling at Contractor expense. Use of the pile driving analyzer may be required when minimum requirements are not obtained or results are doubtful.

f. Leads. Construct pile-driving leads to afford freedom of movement for the hammer. Hold them in position with guys or stiff braces to support the pile during driving. Except where piles are driven through water, use leads of sufficient length that the use of a follower shall not be necessary. Leads shall be of sufficient length to allow them to be spiked into the ground at the onset of driving.

g. Hammer Cushion. Equip all impact pile driving equipment except gravity hammers with a suitable thickness of hammer cushion material to prevent damage to the hammer or pile and to maintain uniform driving behavior. Use hammer cushions made of durable, manufactured material that shall retain uniform properties during driving. All wood, wire rope and asbestos hammer cushions are prohibited. Place a striking plate on the hammer cushion to maintain uniform compression of the cushion material. Inspect the hammer cushion in the presence of the Engineer when beginning pile driving at each structure or after each 100 hours of pile driving, whichever is more frequent. Replace the hammer cushion whenever there is a reduction of hammer cushion thickness exceeding 25% of the original thickness, before continuing driving.

h. Pile Driving Head. Fit piles driven with impact hammers with an adequate driving head to distribute the hammer blow to the pile head. Axially align the driving head with the hammer and the pile. The driving head is guided by the leads and shall not be free swinging. The driving head shall fit around the pile head in a manner that prevents transfer of torsional force during driving while maintaining proper alignment of hammer and pile.

i. Water Jets. When jets are permitted, the number of jets and the volume and pressure of water at the jet nozzle shall be sufficient to freely erode the material adjacent to the pile. Use a plant with sufficient capacity to deliver a minimum of 100 pounds per square inch pressure at ¾ inch jet nozzles at all times. At a minimum of 5 feet before the desired penetration is reached, withdraw the jets and drive the piles to secure the final penetration with an approved hammer.

157.3 UNDERSEALING EQUIPMENT

a. Grout Plant. Provide a grout plant consisting of a positive displacement cement injection pump and a high speed colloidal mixing machine. Provide a mixing machine that operates between 800 and 2000 RPM, creating a high-shearing action with a subsequent pressure release to make a homogeneous mixture. Provide a pressure measuring gauge in the grout supply hose.

b. Drill. Provide an air compressor and rock drills or other devices capable of drilling the injection holes through the PCCP.

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157.4 JOINT AND CRACK SEALING PCCP AND HMA EQUIPMENT

a. Air Compressor. Use an air compressor with a minimum capacity of 100 cubic feet per minute at 90 psi with a $\frac{3}{8}$ inch hose (minimum). Use oil-free compressed air.

b. Applicator. For concrete pavement, use a sealant applicator head that completely fills the joints and cracks.

For asphalt pavement, use a sealant applicator head that completely fills the cracks.

c. Heating Pot. Prepare the material in a heating pot (400 gallon minimum capacity) equipped with an agitator that shall provide a proper mixing pattern to keep a consistent percent of fiber and maintain the heat distribution throughout the pot. Use equipment recommended by the sealant manufacturer.

d. Heat Lance. Use a heat lance manufactured by SEAL-ALL, L.A. HEAT LANCE, or another brand approved by the Engineer.