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AMERICAN STEP COMPANY, INCORPORATED
MANHOLE STEP INSTALLATION
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ATTITUDE OF AWARENESS

Manhole Step Discussion

Preface: This presentation provides a brief overview of manhole steps including the testing and standards for them. The main focus is the installation of plastic steps by the "press fit" or mechanical lock installation method (friction fit).

Our goal is that you will take back and implement in your organization an **attitude of awareness** for everyone about manhole step safety. Each employee should know what is correct and incorrect concerning installation. The lines of communication in your Organization must be open to enable each employee the ability to report or correct a potential problem prior to shipment. This will help ensure your customer's safety when climbing on manhole steps.

I. TYPES AVAILABLE:

- Cast iron
- Aluminum
- Plastic (steel reinforced)

II. OSHA:

There is not an official or published manhole step regulation. Information is available @ http://www.osha.gov. When lacking it's own standard OSHA is required to follow recognized industry consensus safety standards, for manhole steps this is ASTM C 478, Paragraph 16.

III. ASTM C 478, PARAGRAPH 16

A) Synopsis of Requirements:

- 10 inches minimum tread width
- 3 inches minimum embedment into concrete
- 4 inches minimum projection
- 18 inches minimum clearance from outside face of rung to opposite wall
- 400 pounds minimum pullout force
- 800 pounds vertical load with maximum permanent deflection 1/2 inch

B) Materials:

1) **ASTM C 478**, P16 is a performance standard, it does not specify material.

2) **Copolymer Polypropylene**: high impact resistance to cracking at low temperatures while maintaining a high flex modulus of elasticity or stiffness.

3) **Steel Reinforcement**: 1/2 inch conforming to ASTM A 615 Grade 60 or 1/2 inch deformed steel wire conforming to ASTM A 496 D20

C) TESTING:
1) ASTM C 478 P16.6.1.2 and P16.6.2.4 allow the use of certified test results.
2) If certified test results are not available the testing parameters and methods are established in ASTM C478 P16 and ASTM C497 P10

3) **PULLOUT TEST**: Easy test to conduct.

- Place a hydraulic ram (with gauge in the circuit) between the wall and the rung of the step.
- Load is applied across a 31/2 inch area.
- Apply a force of 400 pounds.
- No movement or pullout should occur.

4) **VERTICAL LOAD:** also accomplished with a gauged hydraulic ram.

- A simple way to apply this load utilizing a section with the steps already installed is to flip the manhole section up-side down. This places the rung's tread facing the floor. Measure this distance.
- Place the ram between the floor and the rung. Apply hydraulic force across 31/2 inches until a total load of 800 pounds is applied.
- Release load and re-measure distance between floor and rung.
- The maximum allowable permanent set is ½ inch.

5) **TEST FREQUENCY:**
ASTM C 478 & C 497 do not establish frequency of tests. However, it is prudent to test whenever production parameters change. Such as:

- Mix design changes
- Curing changes
- New forms and step pins are put into production
- New personnel are installing the steps

IV. INSTALLATION METHODS

- Mortared
- Cast in place
- Friction (Mechanical Lock or "Press Fit") the basis of this discussion.

CONCRETE STRENGTH MINIMUM OF 3,000 PSI

A) **WET CAST TOOLING**

- Obtain from your step manufacturer
- Obtain from form manufacturer-verify dimensions when received
- Make or have made locally with dimensions obtained from your step manufacturer-verify dimensions when received.

1) **WET CAST PRODUCTION**

- Educate personnel to clean pins.
- Correctly and securely attach to forms prior to pouring
- Use only appropriate form release agents
- **NEVER USE GREASE**

B) DRYCAST

- Hydraulic or mechanically actuated rams form initial hole.
- Ensure proper depth so as not to fracture wall when sizing pins are used.
- Sizing pins should be clean, free of debris and without excessive wear.
- Re-size with sizing pins after piece is moved from machine to curing area.
- Diesel Fuel swells polypropylene pins which will enlarge step holes.

1) DRY CAST PRODUCTION

a) Using Sizing Pins

- Educated production personnel to place themselves in a safe position where they are in a natural position to put pins straight into concrete without any angles or elongation of the holes.
- Insert pins with a slight twisting motion to avoid internal gouging of the hole.
- If pins can not be inserted proper depth with minimal force, check hydraulic rams on equipment or visually inspect holes for reason of deformation.
- Forcing pins full depth where a hole has not been formed in the concrete can fracture the wall, leading to leakage.
- After use; wipe sizing pins free of debris and place in solution of water and water soluble form release.

C) DRILLING.

- Obtain dimensions from your step manufacturer.
- If possible identify re-bar location for avoidance.
- Drill holes parallel
- Allow extra hole depth for debris so as not to restrict driving step in full depth.

D) INSERTS

Install inserts and steps per the manufacturer's recommendations.

V. INSTALLING STEPS:

- Personnel should be trained and authorized.
- Authorized step installers need to thoroughly understand the use of steps, and the consequences of improperly installed steps-liability.
- Educate installers what holes are acceptable or unacceptable.
- Educated installers to evenly drive steps until they can not be driven further. Use an **8 pound** minimum hammer.
- Installers should be educated to recognize problems or inconsistencies with step installations.

Examples:

- Step will not drive to normal depth.
- Improperly shaped or sized holes.
- Improper alignment of holes (must be parallel).
- Do not install steps if grease or debris is present in installation holes.
- Steps should drive in without bending on either leg (unparallel holes).

VI. ATTITUDE OF AWARENESS

- All employees should be vigilant while walking throughout plant or yard and be on a constant lookout for improperly installed steps.
- Truck drivers or loaders should maintain same vigilance
- Steps projecting too far out
- Rings exposed on one or both step legs
- Steps installed at an angle
- Legs installed unevenly
- Damaged steps

<u>SIX SIMPLE RULES FOR MANHOLE STEPS</u>

1. STEPS ARE NOT LIFTING DEVICES
2. STEPS ARE NOT TO BE REUSED.
3. INSTALL STEPS ONLY IN PROPERLY FORMED AND SIZED HOLES.
4. CONCRETE MUST BE OF SUFFICIENT STRENGTH.
5. STEPS MUST BE DRIVEN TO FULL DEPTH.
6. NEVER USE GREASE ON STEP TOOLING OR STEPS