



**MODEL SPECIFICATIONS:**

# **Hydraulically Driven Steel Underpinning Pile Specifications**

## SECTION 02255

### HYDRAULICLY DRIVEN STEEL UNDERPINNING PILES

#### PART 1 GENERAL

##### 1.01 SCOPE OF WORK

The work shall consist of the contractor furnishing all labor, tools, equipment and materials to install Ram Jack<sup>®</sup> hydraulically driven steel underpinning piles or equal according to the specifications contained herein. The work shall include, but is not limited to, the following:

- A. All soil excavation and concrete removal required to install steel underpinning piles.
- B. The footing or foundation grade beam shall be chipped back to the face of the wall. The footing or foundation grade beam face shall be smooth and flush as required for the underpinning support bracket to properly engage the footing or foundation grade beam.
- C. Hydraulic jacks used to install the driven steel underpinning piles shall be capable of exerting a minimum installation force of 60,000 lbs to the pile.
- D. All piles shall be installed individually utilizing the maximum resistance of the structure as a reaction force to install each pile.
- E. Pile sections shall be added to the pile during installation as required until one of the following occurs: a minimum of 60,000 lbs of force has been applied to pile or the structure is experiencing excessive flexure.
- F. The structure shall be lifted as much as is practical with hydraulic jacks and mechanically secured in place at its final elevation. The lifting force shall not exceed 1/3 of the driving force required to install the pile.
- G. Replace soil in excavation and provide general site cleanup of work area.

##### 1.02 RELATED REFERENCES

- A. Standard specifications:
  - 1) ASTM-A29 Standard Specification for Steel Bars, Carbon and Alloy, Hot Wrought and Cold Finished
  - 2) ASTM-A36 Standard Specification for Carbon Steel
  - 3) ASTM-A53 Standard Specification for Welded and Seamless Steel Pipe
  - 4) ASTM-A500B Standard Specification for Cold Formed Welded and Seamless Carbon Steel structural Tubing in Rounds and Shapes
  - 5) Welding: Structural Welding Code - Steel, AWS D1.1, by the American Welding Society (AWS Code).

### 1.03 DELIVERY, STORAGE, AND HANDLING

- A. Transport, store, and handle piles in a manner to prevent damage to the piles. Piles shall be stored above the ground surface by pallets, blocking or other means.

### 1.04 QUALITY ASSURANCE

- A. The Contractor performing the Work of this Section shall have been regularly engaged in pile work for a period of not less than 5 years and shall be properly equipped to execute the Work. If directed, furnish a list of projects of a similar type and magnitude executed by the firm.
- B. In lieu of the Contractor achieving 5 years of driven steel underpinning pile experience, a certificate of competency can be provided by the driven steel underpinning pile manufacturer. The certificate should state that the Contractor has been trained and is authorized to install the underpinning pile system or the manufacturer shall provide a letter expressing the ability and intent to provide on-site supervision of the pile installation.

### 1.05 SUBMITTALS

- A. Shop drawings of pile placements, capacities and mark or numbering notations so that each pile can be easily identified.
- B. Copies of certified calibration reports for all hydraulic gages. The calibrations shall have been performed within one (1) year of the proposed starting date of the pile installation.
- C. Provide effective area of hydraulic rams used to install the underpinning piles. Also provide a hydraulic force chart plotting hydraulic pressure verses effective area in 500 psi increments.
- D. Provide steel manufacturer's mill test reports, covering physical and chemical tests, for all steel piles.
- E. Provide strength and properties sections of pile and calculations by a Professional Engineer demonstrating the pile will meet or exceed the strength requirements of the design loads as shown on the construction documents.
  - 1) The calculation(s) shall include the load eccentricity on the pile. The eccentricity shall be measured from the vertical face of the footing to the center of the pile.
  - 2) The allowable load capacity calculation(s) of the pile shall take into consideration the unbraced length of the pile per section 1808 of the International Building Code (IBC).
- F. Installation Records: Within 2 days after pile installation, submit 2 copies of the installation record for each pile installed. (*Reference sample Installation Chart **Figure 2.***)
  - 1) The installation record shall clearly indicate the pile number or mark, installation depth, installation pressure, effective area of hydraulic jacks used to install piles, installation driving force, lifting pressure, effective area of hydraulic jacks used to lift structure (if different than hydraulic jacks used to install piles), final lifting force and the amount of elevation recovery.

## **PART 2 PRODUCTS**

### **2.01 MATERIALS**

#### **A. Pile Bracket:**

- 1) Bracket sleeve (4 ½" O.D. x 0.438 wall thickness) shall be a minimum ten (10") inches long with minimum yield strength ( $F_y$ ) of 65 ksi.
- 2) Gussets and bracket seat shall be fabricated from minimum 3/8" thick structural steel (ASTM-A36). The bracket seat shall have a minimum bearing surface of 90 in<sup>2</sup> against the bottom of the footing and a minimum of 70 in<sup>2</sup> against the vertical face of the foundation.
- 3) Two (2) 1" diameter all thread bolts with nuts (ASTM-193)

#### **B. Extended Guide Sleeve:**

- 1) Guide sleeve shall conform to API-J55 steel tubing with a minimum outside diameter of 3.50 inches, minimum wall thickness of 0.22 inches and minimum yield strength ( $F_y$ ) of 65 ksi.
- 2) Guide sleeve shall be a minimum of 4'-0" long and be installed through the pile bracket sleeve. Longer guide sleeves may be required depending on soil conditions at the site. Reference construction documents to verify if longer guide sleeves are required.

#### **C. Piling Section:**

- 1) Pilings shall conform to API-J55 steel tubing with a minimum outside diameter of 2.875 inches, minimum wall thickness of 0.22 inches and minimum yield strength ( $F_y$ ) of 65 ksi.
- 2) The piling extensions shall be a minimum of 5'-0" long and be installed through the extended guide sleeve.
- 3) Each piling shall have a slip joint connection on one end of the piling. The slip joint connection shall be 2 3/8" O.D. and be of the same material and thickness as the piling. The slip joint connection shall extend a minimum of 6" from the piling such that it may be inserted into the adjacent piling.
- 4) Piling sections when added shall form a smooth, continuous, homogeneous pile.

#### **D. Pile Lead Section (Starter):**

- 1) The lead section of the pile shall consist of an 8" long pile section.
- 2) The lead section shall have 3 ½" diameter steel expansion ring 1" above the toe of the section. A steel plug shall be welded on the interior of the starter to prevent soil from entering the interior of the pile and shall have the same slip connection as the pile sections.

## PART 3 EXECUTION

### 3.01 PREPARATION

- A. Thoroughly investigate the presence and location of all underground utilities situated at or near the area of work before any excavation is performed. All efforts shall be made to protect any underground utilities encountered during the excavation and pile installation. Any separations or caused to the underground utilities shall be repaired/performed by a licensed professional.
- B. Mark all pile installation locations as shown on the plans or approved shop drawings. The Engineer of Record shall be notified if the piles are relocated more than 12" from the locations shown on the plans or approved shop drawings. Relocation of the piles will not be allowed unless approved by the Engineer of Record.

### 3.02 INSTALLATION *(reference Figure 1 for illustration of pile assembly)*

- A. Exposure of the footing or grade beam:
  - 1) An area shall be excavated immediately adjacent to the building foundation to expose the footing, bottom of grade beam, stem wall or column to a width of at least 24" and at least 12" below the bottom of the footing or grade beam.
  - 2) The vertical and bottom face of the footing shall, to the extent possible, be smooth and at right angles of each other for the mounting of the pile bracket. The surfaces in contact with the support bracket shall be free of all dirt, debris and loose concrete so as to provide firm bearing surfaces for the pile bracket.
  - 3) The spread footing, if applicable, shall be notched to allow the pile bracket seat to mount directly under the bearing load of the stem or basement wall.
  - 4) **DO NOT** cut any reinforcing steel in the footing element without the approval from the engineer of record.
- B. Install the pile bracket beneath the footing or grade beam as shown in **Figure 1**. The vertical face of the pile bracket may be attached to the footing or grade beam with two (2) concrete anchors.
- C. Insert pile lead section, guide sleeve and first pile section through the bracket sleeve. Connect the hydraulic rams to the pile bracket and begin advancing the pile. Pile should not exceed more than a 5 degree angle from vertical.  
**(NOTE: Hydraulic rams used to install the pile shall have the capability of exerting a minimum installation force of 60,000 lbs.)**
- D. Pile sections shall be continuously added as required to advance the pile through unstable soils as required. Advancement of the pile will continue until one of the following occurs: a minimum of 60,000 lbs of force has been applied to pile or the structure is experiencing excessive flexure.

- E. All piles shall be installed individually utilizing the maximum resistance of the structure as a reaction force to install each pile.

### **3.03 LIFTING**

- A. Once the pile has been installed, cut the last pile section off approximately 5" above the pile bracket sleeve.
- B. Install two 1" diameter all-thread bolts to the pile bracket and place a fastening plate 'PL 3/4"x 2"x 0'-5' (ASTM-A36) on top of the pile. The fastening plate shall be secured to the 1" diameter all-threads.
- C. Lifting of the structure or proof loading of the pile can be performed using the hydraulic rams utilized in installing the pile or a three (3) piece lift assembly and a 20 ton hydraulic ram with a known effective area and a calibrated hydraulic gage.
- D. The installation force applied to the pile shall be carefully monitored and documented. The lifting force shall not exceed 1/3 of the installation force.
- E. Once lifting of the structure or proof loading of the pile is completed, secure the fastening plate to the pile with 1" diameter nuts and remove hydraulics.
- F. Submit an installation record which clearly indicates the pile number or mark, installation depth, installation pressure, effective area of hydraulic jacks used to install piles, installation driving force, lifting pressure, effective area of hydraulic jacks used to lift structure (if different than hydraulic jacks used to install piles), final lifting force and the amount of elevation recovery. The installation record shall be submitted to the engineer of record within 2 days of the work completion.

### **3.03 CLEAN UP**

When all the equipment and excess pile sections have been removed, the excavation shall be backfilled using the previously excavated soil. The soil shall be placed in the excavation in a maximum of 8" lifts. Each lift shall be compacted before the next lift is added. Sufficient lifts shall be used to restore the excavated soil to its original elevation and density, to the extent possible. Dispose of all waste in a legal manner.

**END OF SPECIFICATION**

**FIGURE 1**  
**HYDRAULICALLY DRIVEN STEEL PILE ASSEMBLY SECTION DETAIL**



