



MODEL SPECIFICATIONS:

Helical Pile Specifications

March/2015 v1.1

31 66 00 HELICAL PILE/ANCHOR DEEP FOUNDATIONS

PART 1 GENERAL

1.01 SCOPE OF WORK

The work shall consist of the Helical Pile Contractor furnishing all labor, tools, equipment, materials and supervision to install Helical Piles according to the specifications contained herein and shown on the construction drawings. The Helical Pile Contractor shall install a helical pile which will provide a minimum load capacity as indicated on the construction documents/plans.

1.02 DEFINITIONS

Some of the terms used in this specification may be unfamiliar to the reader, or may be used with a specific meaning not commonly known outside the helical pile industry. In determining the meaning of any term used herein, a definition contained in the following list shall take precedence.

- A. **Bearing Stratum** – The undisturbed soil layer at any pile excavation location which provides a significant portion of the axial resistance of an installed helical pile bearing on one or more of the pile helices.
- B. **Contractor** - The person/firm responsible for performing the helical pile work.
- C. **Crowd** – Axial compressive force applied to the head (top) of the helical pile shaft during installation as required to ensure the pile progresses into the ground with each revolution a distance approximately equal to the helix pitch.
- D. **Extension** – A pile section without helical plates. Extension(s) are installed after the lead section. Each extension is connected with integral couplings which provide a rigid load transferring connection. Their purpose is to extend the lead section with helical plates to a load bearing stratum.
- E. **Helix Driver** – A high torque hydraulic motor used to advance (screw) a helical pile into the soil to a load bearing stratum. Depending on the capacity of the helix driver, it may be either hand held or machine operated.
- F. **Helical Pile** – A steel pile consisting of one or more helical plates which is torqued into the soil until the lead section is embedded into a load bearing stratum. Their purpose is to transfer structural loads (tension and/or compression) to a load bearing stratum.
- G. **Helix Plate** – A round plate formed into a ramped spiral. When rotated into the soil, the helical shape provides thrust along its longitudinal axis thus aiding in pile installation. After installation, the plate transfers axial load into the soil through bearing.

- H. **Installation Torque** – The resistance generated by a helical pile when installed into the soil. The installation resistance is a function of the strength properties of the soil the helical piles are being installed in as well as the shaft geometry of the pile shaft and helical plates.
- I. **Lead Section** - The first helical pile section installed into the soil consisting of one or more helix plates welded to the pile shaft.
- J. **Torque Rating** – The maximum torque energy that can be applied to a helical pile during installation into the soil.

1.03 REFERENCES

- A. American Society of Testing and Materials (ASTM)
 - a. ASTM-A29 Steel Bars, Carbon and Alloy, Hot Wrought and Cold Finished
 - b. ASTM-A36 Structural Carbon Steel
 - c. ASTM-A53 Welded and Seamless Steel Pipe
 - d. ASTM-A500, Grade C, Cold Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes
 - e. ASTM-A307 Carbon Steel bolts and Studs
 - f. ASTM-563 Carbon and Alloy Steel Nuts
- B. American Welding Society (AWS)
 - a. AWS D1.1 Structural Welding Code – Steel
- C. Society of Automotive Engineers (SAE)
 - a. SAE J429 Mechanical and Material Requirements for Externally Threaded Fasteners
- D. International Code Council - Evaluation Services (ICC-ES)
 - a. Acceptance Criteria for Corrosion Protection of Steel Foundation Systems Using Polymer (EAA) Coatings (AC228)
 - b. Acceptance Criteria for Helical Pile Systems and Devices (AC358)
 - c. Evaluation Service Report (ESR)
- E. International Organization for Standardization (ISO)
 - a. ISO 9001:2008 – Quality Management System

1.04 SUBMITTALS

- A. Five (5) sets of site specific shop drawings sealed by a registered professional engineer. Shop drawings to include:
 - a. Helical pile/anchor identification number and location
 - b. Helical pile/anchor design load
 - c. Type and size of helical pile/anchor shaft
 - d. Helical configuration (number and diameter of helical plates)
 - e. Minimum effective torque required

- f. Connection details
- 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 steel manufacturer's mill test reports, covering physical and chemical tests, for all steel piles.
- D. Provide strength and properties sections of pile sections 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.
 - a. If applicable, 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 shaft.
 - b. If the helical pile is deemed laterally unbraced per section 1808.2.5 of the International Building Code (IBC), the allowable load capacity calculation(s) of the pile shall take into consideration the unbraced length of the pile per section 1808.2.9.2 of the International Building Code (IBC).
- E. Installation Records: Within 7 days after pile installation, submit 2 copies of the installation record for each pile installed.
 - a. The installation record shall clearly indicate the pile identification number or mark, pile diameter, helix configuration, installation depth, installation torque, ultimate and allowable capacity of pile.
 - b. Where helical piles are being installed on existing structures provide final lifting force/design load applied to pile, the amount of elevation recovery of each pile.

1.05 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 Contractor.
- B. In lieu of the Contractor achieving 5 years of Helical Pile experience, a certificate of competency can be provided by 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.
- C. Design of the helical piles/anchors shall be performed by a professional engineer licensed in the state of the project in accordance with existing building code requirements.
- D. The helical pile shall be recognized by the International Code Council (ICC) and the manufacturer shall hold a current ICC-ES issued ESR report showing compliance with AC308 and the current International Building Code (IBC).

- E. The manufacturer shall have been issued an International Organization for Standardization – (ISO) 9001:2008 – Quality Management System Certificate and be compliant.

1.06 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.

PART 2 PRODUCTS

2.01 MATERIAL

- A. Manufacturer:

Ram Jack Systems Distribution
13655 County Road 1570
Ada, OK, 74820
Phone: 580.332.9980
Fax: 580.332.9090
Email: info@ramjack.com

Note: Equivalent systems may be substituted. System equivalence will be determined by comparing a manufacturer's current ICC-ES issued ESR report to ESR-1854.

- B. The helical piles/anchors shall have a central shaft that is cold formed welded and seamless carbon steel structural round tubing with a minimum yield strength of 65 ksi and meeting the dimensional and workmanship requirements of ASTM A500 as well as the following properties:

2 ³/₈" diameter piling:

Torsional strength rating = 4,000 ft-lbs
Ultimate resistance capacity = 40,000 lbs

2 ⁷/₈" diameter piling/anchor:

Torsional strength rating = 8,000 ft-lbs
Ultimate resistance capacity = 72,000 lbs

3 ¹/₂" diameter piling/anchor:

Torsional strength rating = 14,000 ft-lbs
Ultimate resistance capacity = 98,000 lbs

4 ¹/₂" diameter piling/anchor:

Torsional strength rating = 23,000 ft-lbs
Ultimate resistance capacity = 138,000 lbs

- C. Helix Plates:

- a. Shall conform to ASTM A-36 and have minimum yield strength (F_y) of 50 ksi.
- b. Shall have a minimum thickness of ³/₈".

- D. All other flat plate steel shall conform to ASTM A-36 unless noted otherwise on the plans.
- E. All coupling connection thru bolts shall be $\frac{3}{4}$ " diameter and conform to SAE J429 Grade 8 or equivalent. (minimum yield strength (F_y) = 130 ksi and minimum tensile strength (F_u) = 150 ksi)
- F. All piling sections and brackets shall be coated with a polymer alloy thermoplastic powder coating, Plascoat PPA 571ES or equal, in compliance with ICC-ES acceptance criteria AC228 for corrosion resistance.

2.02 PERFORMANCE REQUIREMENTS

- A. All helical piles shall be designed to support the design load(s) as shown on the plans.
- B. Except where noted on the plans, all helical pile components shall be selected to provide a minimum factor of safety against ultimate mechanical failure of two (2).
- C. The helical pile design shall take into account pile spacing, soil stratification and strain compatibility issues as are present for the project. See drawings for reference for the project geotechnical report. A copy of the project geotechnical report shall be provided to and reviewed by the Pile Contractor prior to bid submittal.
- D. Where helical piles are subjected to lateral or base shear loads as indicated on the plans, the bending moment and stress from said loads shall be determined using a lateral load analysis program such as LPILE or equal commercially available software. The required soil parameters (c , ϕ , γ and k_s) for use with LPILE or equal shall be provided in the geotechnical report(s). The allowable lateral deflection of the helical pile shall be limited to one (1") inch unless noted otherwise on the plans.
- E. The helical pile bracket shall distribute the design load(s), as indicated on the plans, to the concrete foundation such that the concrete bearing stress does not exceed those in the ACI Building Code and the stress in the steel plate/welds do not exceed AISI allowable stresses for steel members.
- F. Helical piles shall be designed by a licensed professional engineer in accordance with the current International Building Code (IBC) adopted by the local jurisdiction.

PART 3 EXECUTION

3.01 PREPARATION

- A. Before entering the construction site to begin work, the Helical Pile Contractor shall provide proof of insurance coverage as stated in the general specification and/or the contract.
- B. The Helical Pile Contractor shall request markings of underground utilities by an underground utility location service. All efforts shall be made to protect any underground utilities encountered during the excavation and pile installation. Any separations or damage caused to the underground utilities shall be repaired/performed by a licensed professional.

- C. 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.
- D. A torque indicator shall be used during helical pile/anchor installation. The torque indicator can be an integral part of the installation system or externally mounted in-line.
- E. A third party inspector shall be retained to oversee all aspects of installation of the helical piles/anchors. The items to be inspected include, but not limited to the following:
 - a. Verify the type of helical pile/anchor being installed is as specified on the shop drawings.
 - b. Verify final embedment depth of helical pile/anchor.
 - c. Verify final installation torque readings as specified on the shop drawings.

3.02 INSTALLATION

- A. The helical pile/anchor installation technique shall be such that it is consistent with the geotechnical, logistical, environmental and load carrying conditions of the project.
- B. The lead section shall be positioned at the location as shown on the construction drawings. Battered helical piles/anchors can be positioned perpendicular to the ground to assist in initial advancement into the soil before the required battered angle shall be established.
- C. The helical pile/anchor sections shall be engaged and advanced into the soil in a smooth, continuous manner at a rate of rotation of 5 to 25 RPM's. Extension sections shall be provided to obtain the required minimum overall length and installation torque as shown on the construction drawings. Connect sections together using coupling bot(s) and nut torqued to snug tight per AISC.
- D. Sufficient down pressure shall be applied to uniformly advance the helical pile/anchor sections approximately 3-inches per revolution. The rate of down pressure (crowd) shall be adjusted for different soil conditions and depths.
- E. The minimum installation torque and minimum overall length criteria as shown on the construction drawings shall be satisfied prior to terminating the helical pile/anchor installation.
- F. If the torsional strength rating of the pile shaft and/or installation equipment has been reached prior to achieving the minimum overall length required, the Contractor shall have the following options:
 - a. Terminate the installation depth obtained subject to the review and acceptance of the Engineer of Record, or:
 - b. Remove the existing helical pile/anchor and install a new one with fewer and/or smaller diameter helix plates. The new helix plate configuration shall be subject to review and acceptance of the Engineer of Record. If re-installing in the same location, the top-most helix of the new helical pile/anchor shall be terminated at least three feet (3'-0) beyond the terminating depth of the original helical pile/anchor.

- G. If the minimum installation torque as shown on the working drawings is not achieved at the minimum overall length and there is no maximum length constraint, the Contractor shall have the following options:
- a. Install the helical pile/anchor deeper using additional extension sections, or:
 - b. Remove the existing helical pile/anchor and install a new one with additional and/or larger diameter helix plates. The new helix plate configuration shall be subject to review and acceptance of the Engineer of Record. If re-installing in the same location, the top-most helix of the new helical pile/anchor shall be terminated at least three feet (3'-0) beyond the terminating depth of the original helical pile/anchor.
 - c. De-rate the load capacity of the helix pile/anchor and install additional helical piles/anchors. The de-rated capacity and additional helical piles/anchors location shall be subject to the review and acceptance of the Engineer of Record.
- H. If the helical pile/anchor is refused or deflected by a subsurface obstruction, the installation shall be terminated and the pile/anchor removed. The obstruction shall be removed, if feasible, and the helical pile/anchor re-installed. If the obstruction can't be removed, the helical pile/anchor shall be installed at an adjacent location, subject to the review and acceptance of the Engineer of Record.
- I. The Contractor shall conduct his construction operations in a manner to insure the safety of persons and property in the vicinity of the work. The Contractor's personnel shall comply with safety procedures in accordance with OSHA standards and any established project safety plan.
- J. The portion of the construction site occupied by the Helical Pile Contractor, his equipment and his material stockpiles shall be kept reasonably clean and orderly.

3.03 FIELD QUALITY CONTROL

- A. The Helical Pile Contractor shall furnish and install all helical piles per the plans and approved pile design documentation. In the event of conflict between the plans and approved pile design documentation, the contractor shall not begin construction on any affected items until such conflict has been resolved.
- B. Centerline of helical piles/anchors shall not be more than three inches (3") from indicated plan location unless approved by the Engineer of Record.
- C. Helical pile/anchor plumbness shall be within 2 degrees of the design alignment.

3.04 CLEAN UP

- A. Within seven (7) days of completion of the work. The Helical Pile Contractor shall remove any and all material, equipment, tools, building materials, concrete forms, debris or other items belonging to the Contractor or used under the Contractor's direction.

END OF SPECIFICATION