

SECTION 31 66 15
HELICAL SCREW FOUNDATION PILES

PART 1 - GENERAL

1.1 SUMMARY

- A. Furnish all labor, materials, tools, equipment, and services for Helical Screw Foundation Piles (HSF), as indicated, in accordance with provisions of Contract Documents.
- B. The basis of design for the helical screw foundation piles is the helical pulldown micropile by Chance, distributed by Foundation Technologies, Inc.
- C. Completely coordinate with work of other trades.
- D. Prior to installing piles, all existing utilities, existing piles, and other obstructions shall be located within 10 FT of the new enclosures by using ground penetrating radar (or other approved methods). If conditions are found to be different than those depicted on the Contract Documents, or other obstructions exist, notify the Engineer for corrective action.

1.2 QUALITY ASSURANCE

- A. Subsurface soils investigations have been made at project site.
 - 1. Soils information was obtained for use in preparing foundation design.
 - 2. Geotechnical Report, including logs of soil borings as shown on boring location plan, shall be considered representative of subsurface conditions likely to be encountered on project site.
 - 3. Examine site and soils report and determine character of materials to be encountered.
 - 4. Contractor shall perform their own Geotechnical Analysis to complete the HSF Design.
- B. Contractor shall visit, inspect and evaluate site and familiarize self with existing site conditions affecting work.
- C. Contractor shall verify location of underground utilities prior to HSF installation.
- D. Assume complete responsibility for design and installation of the HSF piles, including connection to pile cap and existing foundation elements as well as damage resulting from installation of piles. A factor of safety of at least 2 is required for the helical pile system.
- E. Qualifications of HSF Pile Contractor:
 - 1. HSF pile contractor shall be fully experienced in all aspects of HSF pile design, construction and load testing.
 - 2. Contractor must have successfully completed at least five (5) projects in last five (5) years of similar scope and size.
 - 3. Contractor shall provide names and written verification of relevant experience of all key on-site personnel involved with work. Key personnel shall include foreman, machine operator and project engineer/manager in charge of supervising work with experience on at least five (5) projects of similar scope over last five (5) years.
 - 4. Contractor shall retain services of a Registered Professional Engineer, currently licensed to practice Structural Engineering in the State of Alabama.
 - 5. HSF Pile contractor shall be a certified installer for HSF pile manufacturer. Certification documents shall be submitted for approval.
- F. Design Criteria:
 - 1. HSF piles shall achieve a minimum capacity as listed on Contract Drawings.
 - 2. Indicated minimum required capacities are ASD combination factored loads per ASCE 7-10.
- G. Tolerances:
 - 1. Centerline of HSF Pile shall not be more than 3 IN from indicated plan location.

2. HSF Pile plumbness shall be within 2 degrees of design alignment.
 3. Top of HSF Pile shall be within plus +1 IN or -3 IN of design vertical elevation.
- H. All HSF Piles shall be installed in presence of Geotechnical Engineer and Special Inspector.
- I. Site Tests:
1. Pre-production pile tests
 - a. Load Test Procedures: ASTM D1143.
 - b. Conduct load tests to verify design torque and embedment depth.
 - c. Test one sacrificial pile to twice design load.
 - d. Conduct test prior to installation of production piles.
 - e. Use quick load test method.
 - f. Test deemed acceptable if test load can be maintained for 30 minutes and no more than 0.3 IN. of net settlement has occurred. Net settlement is that which remains after test load has been removed.
 2. Production pile tests.
 - a. Conduct proof load tests on four production piles.
 - b. Piles to be tested shall be selected by geotechnical engineer.
 - c. Test to design load.
 - d. Test deemed acceptable if no more than 0.15 IN net settlement occurs.
 - e. Production pile tests may be waived if in opinion of geotechnical engineer, pre-production test pile satisfactorily represents all production piles.
- J. Corrosion protection:
1. Design for aggressive corrosion environment.
 2. Galvanize central lead shaft and helical extensions.
 3. Galvanize central shaft extensions.
- K. Referenced Standards
1. American Society for Testing and Materials (ASTM):
 - a. ASTM A29/A29M Standard Specification for Steel Bars, Carbon and Alloy, Hot-Wrought and Cold-Finished,
 - b. ASTM A36/A36M Standard Specification for Carbon Structural Steel.
 - c. ASTM A53 Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
 - d. ASTM A153 Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
 - e. ASTM A500 Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes.
 - f. ASTM D1143 Standard Test Method for Piles Under Static Axial Compressive Load.
 - g. ASTM D3689 Standard Test Method for Individual Piles Under Static Axial Tensile Load.
 2. American Welding Society (AWS)
 - a. AWS D1.1 Structural Welding Code – Steel

1.3 SUBMITTALS

- A. Shop Drawings:
1. Provide drawings prepared, signed and sealed by Contractor's Registered Professional Engineer, indicating profiles and product components and accessories and indicate the following:
 - a. HSF number, location and pattern by assigned identification number.
 - b. HSF design load.
 - c. Type and size of central steel shaft.
 - d. Helix configuration (number and diameter of helix plates).
 - e. Minimum effective installation torque.
 - f. Minimum overall length.
 - g. Inclination of HSF.
 - h. Cutoff elevation.

- i. Splice and coupling details.
 - j. HSF attachment to pile cap, etc.
 - k. Steel Casing for Micropile
 - 2. Grout mix designs, including details of all materials to be incorporated, and procedure for mixing and placing grout. Submittal shall include certified test results verifying acceptability of proposed mix designs.
 - 3. Detailed plans for method proposed for testing HSF piles. Include all drawings and details to clearly describe test method and equipment proposed.
- B. Product Data:
 - 1. Submit manufacturer's product data and installation instructions.
- C. Project Information:
 - 1. Design Data: Design data and calculations prepared, signed and sealed by Contractor's Registered Engineer registered in the State of Alabama.
 - 2. Certificates:
 - a. Manufacturer's certification of products meeting or exceeding specified requirements.
 - 3. Submit copies of HSF installation records within 24 hours after each installation is completed. Include, at a minimum, the following information.
 - a. Name of project and Contractor.
 - b. Name of Contractor's supervisor during installation.
 - c. Date and time of installation.
 - d. Name and model of installation equipment.
 - e. Type of torque indicator used.
 - f. Location of HSF by assigned identification number.
 - g. Actual HSF type and configuration - including lead section (number and size of helix plates), number and type of extension sections (manufacturer's SKU numbers).
 - h. HSF installation duration and observations.
 - i. Total length of installed HSF.
 - j. Cutoff elevations.
 - k. Inclination of HSF.
 - l. Installation torque at 1-foot intervals for the final 10 feet.
 - m. Comments pertaining to interruptions, obstructions or other relevant information.
 - n. Rated load capacities.
 - 4. As-built drawings showing location of piles, their depth and inclination, and details of their composition shall be submitted within 21 calendar days of pile installation
 - 5. Submit copies of field test reports within 24 hours after completion of the load tests. Include, at a minimum, the following information:
 - a. Name of project and Contractor.
 - b. Name of Contractor's supervisor during installation.
 - c. Name of third party test agency, if required.
 - d. Date, time and duration of test.
 - e. Location of HSF pile by assigned identification number.
 - f. Type of test (i.e., tension or compression).
 - g. Description of calibrated testing equipment and test setup.
 - h. Actual HSF type and configuration - including lead section, number and type of extension sections (manufacturer's SKU numbers).
 - i. Steps and duration of each load increment.
 - j. Cumulative pile-head movement at each load step.
 - k. Comments pertaining to test procedure, equipment adjustments or other relevant information.
 - l. Signed by third party test agency representative, registered professional engineer or as required by local jurisdiction.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Helical Screw Foundation Piles
 - 1. Base:
 - a. AB Chance Company Helical Pulldown Micropile
 - 2. Optional:
 - a. Helical Pier Systems, LTD.
 - b. MacLean – Dixie.
 - c. Grip-Tite Foundation Systems.
 - d. Ideal Group.
 - e. Or approved equal

2.2 MATERIALS

- A. Central Steel Shaft:
 - 1. Hot rolled Round-Cornered-Square (RCS) solid steel bars.
 - 2. Comply with ASTM A29. High Strength Low Alloy (HSLA), low to medium carbon steel.
 - 3. Minimum yield strength 90 ksi.
- B. Helix Bearing Plate:
 - 1. SS 175 Material.
 - 2. Comply with ASTM A656 or ASTM A1018.
 - 3. Minimum yield strength of 80 ksi.
 - 4. Minimum Plate thickness shall be 3/8 IN.
 - 5. Provide a lead section consisting of 10 IN, 12 IN, and 14 IN diameter triple helix or an approved equal.
- C. Bolts used to connect central steel shaft sections:
 - 1. 7/8 IN diameter bolts per ASTM A193 A320 Grade B7L7.
- D. Couplings:
 - 1. Formed as integral part of plain and helical extension material.
 - 2. For Type SS material, couplings shall be hot upset forged sockets.
- E. Plates, Shapes or Pier Caps for structural steel plates and shapes for HSF top attachments:
 - 1. Conform to ASTM A36 or ASTM A572, Grade 50.
 - 2. Minimum size for compression shall be 6 IN by 6 IN x 1/2 IN thick.
- F. Pipe / Casing:
 - 1. The casing/pipe shall meet or exceed the physical and general requirements of ASTM A53 Type E or S Grade B, A252 Grade 2, A500 Grade B or ASTM A618.
 - 2. Steel Casing shall be 6" SCH 40, Fy = 50 KSI.
 - 3. Steel Casing shall be fixed into the pile cap
 - 4. Steel casing or an approved equal is necessary to achieve the desired 2 KIP Lateral Load.
 - 5. Steel Casing filled with grout is required for the top 15' of the helical pile system.
- G. Corrosion Protection:
 - 1. Hot dip galvanize all materials in accordance with ASTM A153, after fabrication.
- H. Grout
 - 1. Minimum 28 day unconfined compressive strength of 4000 PSI when tested in accordance with ASTM C 109.
 - 2. Test Cylinders: 1 set of 3 cubes per pile

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Site Conditions:

1. Verify site conditions are acceptable for installation of helical screw foundations.
2. Verify that all work of other trades is completed to the point where HSF piles may commence without restriction.
3. Verify that all HSF piles may be installed in accordance with all standards, codes and regulations regarding such items as underground obstructions, right of way limitations, utilities, etc.
4. Do not proceed with installation of HSF piles until unacceptable conditions are corrected.

3.2 INSTALLATION

A. General:

1. The HSF installation technique shall be consistent with geotechnical, logistical, environmental and load carrying conditions of project.
2. Comply with instructions and recommendations of HSF pile manufacturer.

B. Termination Criteria:

1. Satisfy minimum installation torque and minimum overall length criteria as shown on shop drawings and verified by test prior to terminating HSF pile.
2. Torque during installation shall not exceed torsional strength rating of central steel shaft.
3. If torsional strength rating of central steel shaft or installation equipment has been reached prior to achieving the minimum overall length required, installer shall have following options:
 - a. Terminate installation at depth obtained subject to a production pile proof test and review and acceptance of Geotechnical engineer, or:
 - b. Remove existing HSF pile and install a replacement HSF pile with fewer or smaller diameter helix plates. New helix configuration shall be subject to review and acceptance of Geotechnical Engineer. If reinstalling in same location, topmost helix of replacement HSF pile shall be terminated at least 3 feet beyond terminating depth of original HSF.
4. If minimum installation torque as shown on shop drawings is not achieved at minimum overall length, and no maximum length constraint, Contractor shall have following options:
 - a. Install HSF deeper using additional extension sections.
 - b. Remove existing HSF pile and install a replacement HSF pile with additional or larger diameter helix plates. New helix configuration shall be subject to review and acceptance of Geotechnical Engineer. If reinstalling in same location, topmost helix of the replacement HSF pile shall be terminated at least 3 feet beyond terminating depth of original HSF.
 - c. De-rate load capacity of HSF and install additional pile. De-rated capacity and additional pile location shall be subject to a production pile proof test and review and acceptance by Structural Engineer.
5. If HSF is refused or deflected by a subsurface obstruction, terminate installation and remove pile. Remove obstruction, if feasible, and reinstall HSF. If not feasible to remove obstruction, install HSF at adjacent location, subject to review and acceptance by Structural Engineer.
6. If torsional strength rating of central steel shaft or installation equipment has been reached prior to proper positioning of last plain extension section relative to final elevation, Contractor may remove last plain extension and replace it with a shorter length extension. If it is not feasible to remove last plain extension, Contractor may cut extension shaft to correct elevation. Do not reverse helical screw foundation to facilitate extension removal.
7. Average torque for last 3 feet of penetration shall be used as basis of comparison with minimum installation torque as indicated in drawings. Average torque shall be defined as average of last 3 readings recorded at 1 foot intervals.

3.3 FIELD QUALITY CONTROL

A. Site Tests:

1. Pre-production pile tests
 - a. Load Test Procedures: ASTM D1143.

- b. Conduct load tests to verify design torque and embedment depth.
 - c. Test one sacrificial pile to twice design load.
 - d. Conduct test prior to installation of production piles.
 - e. Use the quick load test method.
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2. Production pile tests
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 - b. Piles to be tested shall be selected by geotechnical engineer.
 - c. Test to design load.
 - d. Test deemed acceptable if no more than 0.15 IN of net settlement has occurred.
 - e. Production pile tests may be waived if in opinion of the geotechnical engineer, pre-production test pile satisfactorily represents all production piles.
- B. Document Installation and Submit copies of HSF installation records as specified.

3.4 REJECTED PILES

- A. Replace rejected piles.
- B. Piles may be rejected for following reasons:
- 1. Piles out of horizontal and vertical alignment, in excess of tolerances indicated.
 - 2. Piles of improper size and depth.
 - 3. Installation not complying with specifications.
- C. Pay for additional engineering work required for redesign due to rejected piles.

3.5 PROTECTION

- A. Protect installed work from damage due to subsequent construction activity on site.

END OF SECTION