**INTERNATIONAL ASSOCIATION OF PLUMBING AND MECHANICAL OFFICIALS**

**UNIFORM EVALUATION SERVICE**

**EVALUATION CRITERIA FOR**

**HELICAL FOUNDATIONS FOR USE UNDER THE INTERNATIONAL RESIDENTIAL CODE**

**EC027-xxxx**

**(DATE)**

1. **INTRODUCTION**

Helical foundations are widely used in residential construction regulated under the International Residential Code (IRC) as foundation elements to transfer loads from new and existing structures to the ground below. These foundations are installed to support residential structures, additions to residential structures, and ancillary and accessory structures such as sheds, decks, and porches.

* 1. **Purpose:** The intent of this criteria is to provide an acceptable path to justify recognition of helical foundations in evaluation reports reviewed and issued by an independent evaluation agency as an alternative to the 2018, 2015, and 2012 IRC prescriptive foundation and footing requirements. This criteria provides for determination of the support capacity of helical foundations in residential applications when supplemental geotechnical evaluation is available, and for increased safety factor (FS) adjustments when no evaluation is available. In either case, a registered design professional shall review the relevant information and determine safe bearing capacities for the helical foundations using appropriate factors of safety. When supplemental geotechnical information is considered in the design, the higher degree of certainty of sub-surface conditions allows for a lower safety factor to be used for geotechnical capacity in the foundation design. When supplemental geotechnical evaluation is not available, a degree of certainty nonetheless exists for bearing capacity determination, but in this case a higher safety factor may be appropriate. In both cases, soil bearing capacity that is based on the correlation with installation torque is acquired by the installation technician, analyzed by a design professional, and provided to the building official for approval.

Helical foundations may be considered by building officials, in accordance with IRC Sections R403.1 and R104.11, as other approved structural systems for use as foundations to support loads, determined in accordance with IRC Section R301, and to transmit these loads to the ground. Building officials may approve helical foundations based on test data, calculations, and other documentation, such as evaluation reports, relating to their load carrying capacity.

* 1. **Scope:** This evaluation criteria applies to helical foundations with one or more helix plates and with nominal shaft diameters of maximum 4 ½ -inch (114 mm) O.D. The evaluation criteria provide for evaluation for conformance to the 2018, 2015, and 2012 IRC for recognition in an evaluation report issued by an approved evaluation agency accredited in accordance with ISO/IEC 17065. The foundation systems under this criteria are limited to vertical helical foundations subject to 45 kips (200 kN) maximum allowable axial loading. The vertical seismic load carrying capacity of the helical foundations under this criteria is limited to loads in Seismic Design Categories (SDC) A, B, and C unless design calculations and details are submitted justifying the seismic load bearing capacity of the helical foundations under SDC D0, D1, and D2, and E. The allowable lateral load resistance capacity of the helical foundations shall be determined by a registered design professional in a manner acceptable to the building official.
  2. **Definitions**: For terms not defined in this section, applicable codes, or referenced standards shall have the ordinary accepted definition for the context for which they are intended.
     1. **Helical Foundation (HF):** An in-ground steel support column (or shaft) with one or more soil bearing plates welded near its base, and a cap or bracket at the top for connection to the supported structure. The column may be extended using couplings to connect column sections together. The column is pushed down and rotated using a drive head, which causes the helix shaped bearing plates to pull the column into the ground until resistance to torque indicates that its base has reached adequate depth or bearing strata to support the load. Adequate torque resistance is determined by applying a known torque correlation factor to the shaft’s resistance to rotation that is measured during installation.
     2. **HF Cap:** A device that connects the HF to the supported structure. The cap is bolted, welded, screwed, encased in concrete, or otherwise attached to the HF and supported structure such that the HF is loaded concentrically. Generally, HF caps are used for new construction applications.
     3. **HF Bracket:** A device that connects the HF to the supported structure. The bracket is bolted, welded, screwed, or otherwise attached to the HF and structure such that eccentric axial loads may be applied to the HF and/or structure. HF brackets are generally used for repair or strengthening of existing structures where placement to achieve concentric loading may not be possible.
     4. **Conventional Design:** Determination of HF design capacities using accepted engineering standards and methods such as ACI 318, AISC 360, or the NDS.
     5. **Torque Correlation**: An empirical relationship between installation energy and HF capacity, whereby the HF ultimate geotechnical bearing capacity is proportional to the installation torque needed to advance (or screw) the HF into the ground. The torque correlation factor, also known as the torque-to-capacity ratio, is determined for each HF system in accordance with Section 4.2.5.
     6. **Final installation Torque:** Final installation torque is the measured torque value at the end of the HF installation procedure that is used as the basis to determine HF support capacity. The torque correlation factor and applicable factor of safety are applied to the final installation torque to determine allowable bearing and hold down capacities for the foundation element. Final installation torque shall be determined in accordance with the manufacturer’s installation instructions.

1. **REFERENCED STANDARDS**

Standards shall be applied consistent with the specific edition of the code(s) for which the Evaluation Report is prepared unless otherwise approved by UES.

# American Concrete Institute

* + - Building Code Requirements for Structural Concrete, ACI 318
    - Building Code Requirements and Specification for Masonry Structures, ACI 530/TMS 402/ASCE 5

# American Society for Testing and Materials

* + - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products, ASTM A123
    - Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel, ASTM B633pecification for Coatings of Zinc Mechanically Deposited on Iron and Steel, ASTM B695
    - Standard Test Methods for Deep Foundations Under Static Axial Compressive Load, ASTM D1143
    - Standard Test Methods for Deep Foundations Under Static Axial Tensile Load, ASTM D3689

# International Code Council

* + - International Residential Code, IRC – 2018, 2015, 2012

# American Institute of Steel Construction

* + - Specification for Structural Steel Buildings, AISC 360

# American Wood Council

* + - National Design Specification (NDS) for Wood Construction, ANSI AWC NDS

# American Iron and Steel Institute

* + - North American Specification for The Design of Cold-Formed Steel Structural Members, AISI S100

1. **BASIC INFORMATION**
   1. **Description:** The following information and data shall be submitted for review and evaluation for recognition of HF systems in an evaluation report:
      1. **Product Description:** A complete description of the helical foundations and accessories shall be submitted. The description shall include all models and specifications such as shaft lengths and diameters, helix sizes, helix pitches and leading-edge configurations, as well as extension and coupler descriptions and specifications, and models and specifications for the HF caps and brackets. The applicable steel standards and specifications such as steel thicknesses, galvanization specifications, and welding specifications shall also be provided.
      2. **Installation Instructions:** The manufacturer’s published installation instructions shall be provided. The description shall include all applicable installation requirements and descriptions of the installation machinery. The instructions shall require that installers be trained and approved by the HF system manufacturer.
      3. **Packaging and Identification:** The method of identifying the HF systems shall be submitted. At minimum, the company name, product name, model number, evaluation report number and evaluation agency mark of conformity shall be included in the product identification.
   2. **Test Reports:** Reports shall be provided justifying the geotechnical capacities of the HF systems based on the torque correlation factors achieved in field-testing. Tests may also be used as alternatives to engineering calculations to justify the capacities of various structural elements in the systems. Test reports shall include all relevant data in accordance with the standards and the testing and performance requirements in Section 4.0 of this criteria. A testing plan shall be submitted to the evaluation agency for approval.
   3. **Testing Laboratories:** Laboratories shall be accredited as complying with ISO/IEC Standard 17025 for the testing conducted and reported (i.e. the laboratory’s scope of accreditation shall include HF quality and capacity determination). The laboratory’s accreditation shall be issued by an accreditation body conforming to ISO/IEC 17011 and that is a signatory of the International Laboratory Accreditation Cooperation (ILAC) Mutual Recognition Arrangement (MRA).
   4. **Product Sampling:** The test specimens shall be sampled and verified by an accredited inspection agency or testing laboratory. The sampled product shall be representative of the production ongoing after the sampling has taken place. The product specifications shall be within the tolerance limits reported in the quality documentation and the relevant standards.
2. **TESTING AND ANALYSIS REQUIREMENTS**
   1. **General:** Testing and analysis shall be carried out on the HF systems to determine their capacity to withstand the forces applied during installation and their capacity to perform as intended to support the structures once installed. The load from the supported structure is transferred to each element of the HF system, in turn, beginning with the HF cap or bracket connecting the structure to the HF shaft, then through the shaft and couplings or extensions (if any), to the weld connecting the helix to the foundation shaft, through the helix, and finally to the supporting soil. This load path is valid whether the loads are in tension or in compression. The capacity of the HF shall be based on the capacity of the weakest of the load transfer elements in the HF system load path. Testing shall be performed and reported by testing agencies specifically accredited for the types of tests required by this criteria. Testing shall be provided in accordance with Section 1.3.1.3.2 of ASCE-7, and analysis shall be provided by registered design professionals in accordance with Section 1.3.1.3.1 of ASCE 7. The maximum allowable capacity of each of the elements of the system shall be determined and included in the evaluation report, for use by the installer, and for verification by the building official.

Capacity determination shall consider the effects of corrosion on the system. The helical foundations shall be designed so that the effects of corrosion shall not reduce the base steel integrity to less than 67 percent of the original at the end of a 50-year projected service life of the structure.

# Capacity determined by testing: The following aspects of the HF system are required to be determined through testing, when applicable: the retrofit bracket capacity, the strength of the helix, the maximum installation torque rating for the HF system, and the HF system torque correlation factor (see Section 4.2.5). Where testing is used to qualify these elements, the testing shall be in accordance with a testing plan approved by the evaluation agency.

* + 1. **Coupling Rigidity:** Coupling rigidity shall be determined by examining the difference between the average deflection for a minimum of three to a maximum of six tests (per Section 1.3.1.3.2 of ASCE-7), of HF shafts containing couplings, to one single shaft without couplings. All test specimens shall be at least 10 feet (3 m) in length. Shafts with couplings shall have the maximum number of couplings that could occur in use for this length of foundation element. One end of the shafts shall be connected to achieve a near fixed-end condition, and a test load equal to at least 0.4 percent of the tested allowable HF axial capacity shall be applied perpendicular to the shaft axis at the opposite (free) end. If applicable, additional tests shall be conducted with different orientations (set-up) of the coupler with respect to the direction of the applied load to produce the largest deflection possible. This deflection shall be used in the determination of coupling eccentricity. The coupling eccentricity shall be equal to the difference between the average deflection of samples with couplings to the sample without couplings. Couplings fully welded to the shafts in accordance with the applicable codes, or other similar couplings that are proven by rational analysis to achieve full bending strength and stiffness, shall be considered to develop no significant eccentricity to the HF shaft.
    2. **Bracket Capacity:** Brackets shall be evaluated by testing. A minimum of three tests shall be performed for each bracket system. If each individual test result is within 15% of the average of the test results, the helix ultimate capacity shall be the average of the test results. If any test result differs by more than 15% from the average, the least test result shall be used as the ultimate capacity or additional tests, up to a maximum of six tests, may be performed and the average result may then be used. The ASD allowable capacity of the bracket system shall be determined using a minimum safety factor of 2.0.

The test setup shall include the bracket, a five-foot-long minimum section of shaft, a coupling, and external or internal sleeve, as applicable. The bracket capacity shall be evaluated by bearing against a concrete cube having a concrete yield strength of 2,500 psi (17 MPa) ±10 percent or the ACI 318 equations shall be used to normalize the results. Concrete testing shall be performed no more than 24 hours prior to bracket testing to ensure that the concrete compressive strength is within 15 percent of 2,500 psi (17 MPa) ±10 percent or the ACI 318 equations shall be used to normalize the results. The test shall be performed by applying an axial load to the foundation in load increments no greater than 20% of the anticipated allowable capacity of the bracket system.

* + 1. **Helical Plate Capacity:** The strength of the weld connecting the helical plate to the shaft, and the capacity of the helical plate to transfer the allowable loads to the soil, shall be verified. Helical plate capacity shall be tested by applying an axial load, through the shaft, to the helical plate reacting against a specially constructed jig that matches the helix shape. The jig may be constructed assuming that the reaction against the soil is located at approximately 2/3 the helix radius away from the shaft axis. The test may be performed in one axial direction only provided the plate is welded to the shaft symmetrically. The helical plate capacity shall be the maximum applied load resisted by the sample during testing. The test setup including the shape and size of the jig shall be approved by the evaluation agency prior to testing.

For each shaft size, if the helical plate material strength, thickness, weld specification, and helix pitch are substantially similar for all helical plates, then the helix capacity tests may be performed in accordance with one of the following two methods. For helical plates with any specification that is substantially different from those listed above, the capacity tests shall be conducted in accordance with Method 1 in Section 4.2.3.1 of this criteria.

**4.2.3.1** **Method 1**: A minimum of three tests shall be performed for each nominal helix diameter. If each individual test result is within 15 percent of the average ultimate test result, the helical plate ultimate capacity shall be the average of the test results. If any test result differs by more than 15 percent from the average, the lowest test result shall be used as the ultimate capacity or additional tests, up to a maximum of six, may be performed and the average result may be used. Once the ultimate capacity has been determined as stated above, the allowable plate capacity shall be calculated using a minimum safety factor of 2.0.

**4.2.3.2 Method 2**: A minimum of three tests shall be performed using the largest nominal helix diameter plate. If each individual test result is within 15 percent of the average ultimate test result, the helical plate ultimate capacity shall be the average of the test results. If any test result differs more than 15 percent from the average, the lowest test result shall be used as the ultimate capacity or additional tests, up to a maximum of six, may be performed and the average result may be used. Once the ultimate capacity has been determined as stated above, the allowable plate capacity for the largest diameter and any smaller diameter shall be calculated using a minimum safety factor of 3.0.

* + 1. **Validation of Torque Rating:** The torsion capacity of the model specific HF assembly shall be determined through testing to provide a maximum installation torque to which the HF may be subjected in the field. Each test sample shall be a minimum of 5 feet (1.5 m) in length, have one helical plate, a coupling (if couplings are included in the application), and a drive head system representative of that used for manufacturer recommended foundation installation (i.e. drive pins, etc.). The testing laboratory shall record the actual sample dimensions including length, cross-section, shaft and helix diameter and thickness, and yield and tensile strengths as reported in the mill certificates for the steel used to manufacture the HF specimens.

At a minimum, the sample set for each shaft size shall include six test specimens; and at least three test specimens for each nominal helix size, if multiple helix sizes are being evaluated. For each specimen tested, the test-rated torque and failure mechanism shall be recorded. The test-rated torque for each specimen shall be: the torque applied to the specimen that causes 0.25-inch (6.35 mm) bolt-hole deformation at the installation attachment system (i.e. drive pin) or bolted coupling connection, as applicable; the torque that causes permanent shaft rotation of 0.5 revolutions per foot of specimen length; or the maximum torque applied; as applicable, whichever occurs first. The installation torque rating shall be the average of the test results. The maximum installation torque shall be the installation torque rating, reduced by a rational analysis comparing the sample cross-sectional and strength properties to the minimums permitted by the manufacturer’s quality program, and by the spread of data resulting from testing. This analysis may be performed by the testing laboratory, or by a registered or licensed design professional, with results subject to the approval of the evaluation agency.

* + 1. **Geotechnical Load-Bearing Capacity:** Determination of the torque correlation factor, Kt, for each shaft size shall be based on the average of the full-scale load test results using a minimum safety factor of 2.0, where Kt is the ratio of the load test result divided by the final installation torque, and FS is the ratio of the field measured foundation capacity to the predicted allowable capacity based on installation torque. For Kt obtained from the average test results to be valid, FS shall be equal to or greater than 1. If not, then the Kt value shall be reduced until this criteria is met. Shaft sizes conforming to the Industry Accepted Values table shown below shall have Kt values no greater than those listed. For shaft sizes not conforming to the Industry Accepted Values table shown below, the Kt value shall be obtained using the following formula based on the shaft diameter, Ds. Square shafts using the formula shall have an effective diameter (Ds) equal to the diagonal dimension between opposite corners of the cross section.

Kt,max = 22 x Ds-0.92 ft-1(Kt,max = 1433 x Ds-0.92 m-1) where Ds has units of inches (mm)

[from Helical Piles A Practical Guide To Design and Installation by Howard A. Perko, PhD, PE, John Wiley & Sons, Inc.]

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| Industry Accepted Values | Accepted Value | approximate  metric equivalent |
| Shaft Size and Type |
| 1.5-inch and 1.75-inch (38.1- 44.5 mm) square shafts | Kt = 10 | (Kt = 33) |
| 2.875-inch (73 mm) O.D. round shafts | Kt = 9 | (Kt = 30) |
| 3.0-inch (76 mm) O.D. round shafts | Kt = 8 | (Kt = 27) |
| 3.5-inch (89 mm) O.D. round shafts | Kt = 7 | (Kt = 23) |
| 4.5-inch (114 mm) O.D. round shafts | Kt = 5.5 | (Kt = 18) |

* + 1. **Full Scale Load Testing**: A test plan describing the intended full-scale load testing shall be submitted to the evaluation agency for approval. A minimum of six full scale load tests shall be performed for each shaft size to be recognized. Two of the six shall be verification tests on foundations installed to at least 90 percent of the maximum installation torque. For single-helix foundation recognition, one of the verification foundations shall be tested with the smallest and one with the largest helix size. For recognition of multi-helix foundations, both verification tests shall be performed using the smallest multi-helix configuration offered. The four remaining full-scale load tests of each series shall be installed using a variety of helix size configurations and installation torques representative of the product range offered. Testing shall include both compression and tension directions if both directions are being evaluated, with a minimum of 6 tests in each load direction.

The full-scale load tests may be performed in any soil type (i.e. clay, sand, or weathered bedrock) acceptable to the testing agency. Helix depths shall not be less than 5 feet (1.5 m), or a depth needed to include a coupling, if couplings are included in the application. Testing shall be performed in general agreement with ASTM D1143 and ASTM D3689, respectively, for compression and tension capacity determination. The ultimate foundation capacity shall be determined using the net deflection at 10 percent of the helix diameter. Net deflection is defined as the total deflection minus the shaft elastic shortening or lengthening.

1. Capacity

# determined by calculation: The capacity of certain of the elements may be determined by conventional analysis in lieu of testing. For these elements, the design loads shall be determined using the applicable provisions of the IRC, ASCE 7 and AISC 360, and analysis shall be in accordance with the applicable design standard. These elements include the HF cap and its connection to the supported structure, the shaft in pure compression and tension, the coupling and its connection to both upper and lower shaft sections, and the weld connecting the helix to the shaft. The axial compression capacity analyses shall account for any eccentricity due to manufacturing tolerances in the coupling, and to coupling rigidity.

# HF caps or brackets, connections, shafts, couplings, helices, welds, etc.) in the HF systems shall be based on engineering analysis incorporating the applicable safety factors described in the relevant codes and standards listed below, or equivalent, and in the relevant sections of this criteria. The material standards used for analysis of elements of the support systems described in this criteria, are those incorporated by reference in the IRC, and include AISC 360, ACI 318, ACI 530/TMS 402/ASCE 5, ANSI AWC NDS, AISI S100.

The load bearing capacity of the HF depends on the bearing capacity of the soil at the location where the supported structure is situated, and on the capacity of the foundation assembly itself. The HF systems shall be designed to support loads not exceeding their allowable bearing capacities based on analysis, testing in the lab, and testing in the field. The HF is chosen based on its capacity and the capacity of each element in the HF assembly to support the required (demand) load from the supported structure.

* 1. **Design Loads:** The design of helical foundations begins with determination of the design loads. The design loads shall be determined in accordance with Section R301 of the IRC using appropriate load combinations shown in the code or ASCE 7, as applicable.
  2. **Cap or Bracket Capacity:** The capacity of the HF cap connecting the supported structure to the foundation shaft shall be as determined by testing in accordance with Section 4.2.2.and analysis using accepted engineering standards and practice. Connection of the foundation cap to the supported structure and to the HF shaft shall be considered in the design.
  3. **Shaft Structural Capacity:** The shaft axial ASD capacity shall be determined using accepted engineering analysis and shall account for corrosion loss. The steel used in HF shafts shall not be stressed more than 0.5 Fy at determined allowable capacity.

Portions of HF shafts not buried in the ground, or foundations extending through water or fluid soils shall be designed as unsupported columns. Tops of HF shall be considered free, pinned, or fixed depending on the specific conditions of connections to the structure they support. Any soil other than fluid soil shall be deemed to afford sufficient lateral support to prevent buckling and to permit the design of the column as braced. When shafts extend in air, water, or fluid soils they shall be considered fixed and laterally supported at a point 5 feet (1.5 m) into firm soil or 10 feet (3 m) into soft soil. Distances to fixity shorter than this may be permitted if based upon analysis by a design professional and subject to the approval of the building official.

* 1. **Coupling Capacity:** The capacity of the coupling when subjected to compression, tension, shear, and bending loads shall be determined by conventional analysis using the net section of the steel or by a testing plan accepted by the certification body. For piles that are not fully braced, coupling rigidity shall be considered in axial buckling evaluations. Where applicable, coupling rigidity shall be determined by testing in accordance with Section 4.2.1.
  2. **Soil Bearing Capacity:** The soil in which the helix is installed shall be undisturbed native soils or engineered fill. Where compressible, expansive, or otherwise shifting soils are known to be present at the site, these questionable or unstable soils shall be removed, or the HF shall be extended below the zone of unstable materials. In accordance with IRC Section R401.4, the building official may require a soil test where the presence of questionable soil characteristics is likely.

The allowable axial soil bearing capacity, Pa, of the HF shall not exceed the allowable geotechnical resistance determined as follows:

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| Pa = Pu / FS | Where Pu is the least ultimate capacity determined by torque correlation (i.e., Kt x Final Torque) or the sum of the helix areas times the ultimate bearing capacity of the layers in which they are bearing. |

* + 1. **Capacity determination where supplemental geotechnical information is not available:** Where there is no evidence of questionable soils at the level of the helix in the HF installation, torque correlation alone may be used to provide sufficient evidence of geotechnical compressive capacity when the helical foundations are installed. In these cases, a minimum Safety Factor of 2.5 shall be applied to determine the allowable geotechnical compressive load bearing capacity of the foundation.

**Exception:** Where the helical foundations are installed to support decks, accessory structures, or additions of 600 ft2 (55 m2) or less for light-frame construction, a minimum Safety Factor of 2.0 shall be applied to determine the allowable geotechnical compressive load bearing capacity.

* + 1. **Compression capacity determination where supplemental geotechnical information is available:** Where soil bearing characteristics are known due to the availability of supplemental geotechnical information, and where the choice of helix sizes is based on this information, a minimum Safety Factor of 2.0 shall be applied to determine the allowable geotechnical compressive load bearing capacity.
    2. **Tension capacity determination:** HF allowable tension capacity shall be determined using a Safety Factor of 2.5 or greater. Helices shall be embedded to a minimum depth at which a shallow pull out failure does not control the tension capacity. An uppermost helix depth of 12 times the average helix diameter (12D) shall be considered sufficient embedment to establish a reliable soil bearing capacity for tension loading that is based on installation torque. In cases where the installation depth is less than 12D, the tension capacity shall be determined by a registered design professional based on site-specific conditions, and subject to the approval of the code official.
  1. **Foundation Lateral Capacity:** The allowable lateral load capacity of the foundation is out of the scope of this criteria. The lateral load capacity may be determined by site specific load testing. As an alternative, capacity may be determined using an analysis method acceptable to the building official. Where field tests are required to confirm the capacity of a HF installation, these tests shall be supervised by a registered design professional.
  2. **Required Field Reporting:** HF systems shall be installed by installers who are trained and approved by the HF system manufacturer, using manufacturer-approved equipment. The equipment shall be within verifiable calibration tolerances. Installers shall record all foundation element locations and types including shaft diameters, helix sizes, embedment depths, and final torque readings. All projects shall include at least one foundation element with a full torque profile, recording torque at approximately one-foot intervals. For projects with 10 or more piles, a full torque profile shall be reported for at least 1 out of every 10 piles. A field report containing this information, along with relevant details of the supported structure, the types of HF caps or brackets used, and details of all field connections, including field welds, shall be reviewed by a registered design professional, and submitted to the building official for approval.

1. **QUALITY CONTROL**
   1. Quality documentation complying with the UES Minimum Requirements for Listee’s Quality Assurance System (UES-010) shall be submitted. A complete description shall be provided of the quality management system used in the factory to manufacture the helical foundations to meet minimum specifications and tolerances.
   2. A complete description shall be provided of the quality management system used in the field to achieve a reliable allowable bearing capacity for each foundation, and the oversight mechanisms used by the manufacturer to monitor this system.
   3. The quality management system shall include a method to calibrate the torque indicators and/or verify calibration of the installation equipment to validate the axial capacities of the foundations based on the recognized torque correlation factors determined in accordance with Section 4.2.5.
   4. Inspections of manufacturing facilities are required for product certification under this criteria. The inspection agencies shall be accredited for the required tasks in accordance with ISO/IEC 17020 or ISO/IEC 17065.
2. **EVALUATION REPORT RECOGNITION**

Evaluation reports shall include the following information:

* 1. The evaluation report shall include a statement that the helical foundations shall be installed to a depth sufficient to develop adequate bearing capacity based on torque correlations and with the top helix below the frost line identified by local building codes.
  2. The evaluation report shall include a statement that the allowable load on the helical foundations shall not exceed 45 kips (200 kN).
  3. The evaluation report shall tabulate the maximum allowable capacities and, optionally, LRFD capacities.
  4. The evaluation report shall state that, in accordance with IRC Section R401.4, the building official may require a soil test where the presence of questionable soil characteristics such as expansive, compressible, or shifting soils is likely, based on quantifiable data.
  5. Where helical foundations are installed on or adjacent to slopes, the negative effects of drainage, erosion, and shallow failures shall be avoided in accordance with R403.1.7.
  6. The evaluation report shall include a statement that portions of HF shafts not buried in the ground shall be designed as columns in accordance with the applicable design standard.
  7. The evaluation report shall include a statement that lateral load capacity may be determined by site specific load testing or using another analysis method acceptable to the building official.
  8. The evaluation report shall state that the helical foundations shall be installed in accordance with the manufacturer’s installation instructions by manufacturer trained and approved installers.
  9. The evaluation report shall state that the trained and approved installers shall submit an engineering field report to the building official within 10 days after HF installation. The report shall include a description of the project; the foundation shafts and helix sizes installed; the brackets or caps used; the shaft lengths and final depths of the helices; final torque readings and geotechnical capacities based on torque correlation factor; and other relevant notes or comments as needed, including a sketch or drawing of the support situation with dimensions.
  10. The evaluation report shall state that the supported structure shall be adequately connected to the tops of the helical foundations. For retrofit systems, connection of the bracket to the foundation shall be based on the recommendation of a design professional and approved by the code official.
  11. Unless design calculations and details are submitted justifying use in higher SDC locations, the evaluation report shall state that use of helical foundation systems in locations where seismic conditions exceed Seismic Design Category C, is outside the scope of evaluation, and require that an engineering evaluation be performed by a registered design professional subject to approval of the code official.
  12. The evaluation report shall state that where special field tests are required to confirm the capacity of a HF installation, these tests shall be under the direction of a registered design professional.
  13. The evaluation report shall state that the spacing between helical foundation elements shall be minimum 3 times the diameter of the largest helix in adjacent foundation elements.
  14. The evaluation report shall state that the HF shaft shall be within 3 degrees of vertical , when installation is complete.
  15. The evaluation report shall include a statement informing designers, users, and building officials that the capacity of the supported structure to span the distance between helical foundation elements is outside the scope of the report.