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ICC-ES Evaluation Report

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ESR-3533

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DIVISION: 31 00 00—EARTHWORK
Section: 31 63 00—Bored Piles

REPORT HOLDER:

GRIP-TITE MANUFACTURING CO., LLC

EVALUATION SUBJECT:

GRIP-TITE® HELICAL FOUNDATION SYSTEMS

1.0 EVALUATION SCOPE

Compliance with the following codes:

- 2021, 2018, 2015 and 2012 *International Building Code®* (IBC)

Properties evaluated:

- Structural
- Geotechnical

2.0 USES

Grip-Tite Helical Pile Systems include a helical steel pile (screw) system used to transfer compressive, tension, and lateral loads from a new or existing structure to a soil bearing strata. Brackets are used to transfer the loads from the structure to the helical pile systems.

3.0 DESCRIPTION

3.1 General:

The Grip-Tite Helical Pile Foundation System consists of helical piles connected to brackets that are in contact with the structure's load-bearing foundation or wall. Each helical pile, consisting of a lead section and one or more extension sections, are screwed into the ground by application of torsion to a depth that conforms to project requirements for avoidance of unsatisfactory subsurface conditions and ensures a suitable soil or bedrock bearing stratum has been reached. The bracket is then installed to connect the pile to the concrete foundation or wall of the supported structure.

3.2 System Components:

3.2.1 RDS2875 Lead Section and Extensions: The lead shafts and extensions consist of 2⅞-inch (73 mm) outside diameter (OD) structural steel tubing having a nominal shaft thickness of 0.262-inch (6.6 mm). Helical-shaped discs, welded to the shaft, advance the helical piles into the soil when the piles are rotated. The extensions and lead sections are made from the same shafts and the extensions can be constructed with or without helical plates. The helical pile lead sections and extensions are connected to each other using an external coupler factory-welded to the leading end of each extension. Each extension consists of a factory-welded coupler and three (3) 3/4-inch-diameter (19.0 mm) structural bolts. The lead shafts, extensions and bolts are available bare steel or offered with an optional galvanization coating complying with ASTM A123 as described in the approved quality documentation. See Figure 1 and Table 1 provide details for RDS2875 lead sections and Figure 2 and Table 2 provide details for RDS2875 extension sections.

3.2.2 RDS2875 Helical Plates: The helical plates (helices or discs) are 8, 10, 12 or 14-inches (203, 254, 305 or 356 mm) in diameter, and are cut from minimum ⅜-inch (9.5 mm) thick steel plate conforming to ASTM A36, having a minimum yield strength of 36 ksi (248 MPa) and a minimum ultimate tensile strength of 58 ksi (400MPa). The helical plates are deformed using a hydraulic press and die, to achieve a 3-inch +/- 1/4-inch (76 +/- 6.4mm) helical pitch, and are then factory-welded to the helical lead shaft or extension in accordance with the manufacturers approved quality documentation. The helical plates are available bare steel or galvanized in accordance with ASTM A123.

3.2.3 RDS2875 Couplers: The external coupler consist of 3½-inch (89 mm) OD ASTM A500, Grade B structural steel tubing having a nominal shaft thickness of 0.300 inch (7.6 mm) having a minimum yield strength of 50 ksi (345MPa) and a minimum tensile strength of 58 ksi (400MPa). The coupler is factory welded to the extension in accordance with the approved quality control documentation.

3.2.4 Brackets: Brackets are constructed from steel plate and round structural steel tubing components which are factory- welded together. The different brackets are described in the following subsections. Bracket assemblies are available in bare steel and with an optional galvanization coating complying with ASTM A123 as described in the approved quality documentation.

3.2.4.1 Standard Duty Bracket GTFP3BA (FP3BA): This retrofit or repair bracket is used on existing structures and existing foundations. The bracket is constructed from two (2) ½-inch (12.7 mm) thick steel plates factory-welded to achieve a 90-degree angle. The L-shaped bracket measures 10-inches (254 mm) wide by 8-inches (203 mm) long. The L-shaped seat is factory-welded to a bracket sleeve consisting of a 12-inch (305 mm) long structural tube with an OD of 3⅞-inch (98 mm) and a 3⅛-inch (79 mm) inside diameter (ID). A bracket plate consisting of a 5-inch (127 mm) by 9½-inch (241 mm) by ¾-inch (19.1 mm) thick flat plate is factory-welded to the top of the bracket sleeve and onto the back side of the vertical face of the L-shaped seating angle. Two gusset wedges made from ⅜-inch (9.5 mm) thick plate steel are factory-welded to the bottom of the L-shaped seat and the side of the bracket sleeve. An 8-inch (203 mm) by 4-inch (102 mm) by 1-inch (25.4 mm) thick cap plate is centered on top of the pile and is attached to the bracket sleeve with two 12-inch (305 mm) long ¾-inch (19 mm) all-thread bolts and matching nuts (longer rods are available). Figure 3 along with Tables 4 and 5 provides additional FP3BA details.

3.2.4.2 New Construction Brackets GT2875-NCB: The new construction brackets are used in the new construction of concrete foundations where the steel bearing plate of the bracket is cast into the new concrete foundations (grade beam, footing or pile cap). The brackets are available to transfer compression, tension and lateral loads between the pile and the concrete foundation. The new construction brackets come with a 1-inch thick-by-4-inch-wide-by-8-inch-long (25.4, 102 and 203 mm) bearing steel plate. Each steel bearing steel plate comes with three (3) 13/16-inch (20.6 mm) diameter predrilled holes and is factory welded to a 3½-inch (89 mm) OD, 0.3-inch-thick (7.6 mm) and 7-inch (178 mm) long steel tube (sleeve) with three 13/16-inch (20.6 mm) pre-drilled holes used to fasten bracket to helical pile shaft. The steel plate is made from steel components as indicated in approved quality documentation. The bracket is attached to the pile shaft with either one (1), two (2) or three (3) ¾-inch (19 mm) structural bolts with matching nuts, as shown in Figure 4 of this report along with Tables 4 and 6.

3.2.5 Threaded Rods, Bolts and Nuts:

3.2.5.1 Helical Lead Shaft and Extensions Coupler Bolts and Nuts: The 3/4-in (19 mm) bolts used to connect helical lead shafts and extensions must conform to SAE J429, Grade 8 specification, having a minimum yield tensile stress of 130 ksi (897 MPa) and a minimum ultimate tensile stress of 150 ksi (1034 MPa) with matching nuts conforming to SAE J995.

3.2.5.2 Repair Brackets Threaded Rod: The standard 3/4-in (19 mm) and 7/8-in (22 mm) all-thread rods and matching nuts must conform to ASTM A193 having a minimum yield tensile stress of 105 ksi (725 MPa) and a minimum ultimate tensile stress of 125 ksi (863 MPa) with matching nuts complying with ASTM A194, Grade 2H. The bolts and all-thread rods and matching nuts must be either zinc coated in accordance to ASTM B633 or hot-dip galvanized in accordance to ASTM A153, as required by the registered design professional.

3.2.5.3 New Construction Bracket Bolts and Nuts: The 3/4-in (19 mm) bolts used to connect helical pile shaft to GT2875-NCB sleeve must conform to SAE J429, Grade 8 specification having a minimum yield tensile stress of 130 ksi (897 MPa) and a minimum ultimate tensile stress of 150 ksi (1034 MPa) with matching nuts conforming to SAE J995.

3.2.5.4 Repair Brackets Anchor Bolts: Each repair bracket must be installed by connecting the brackets to the concrete foundations. The vertical face of the repair bracket includes four (4) 9/16-inch (14.3 mm) holes in order to utilize up to four (4) ½-inch or 5/8-inch (12.7 mm or 15.9 mm) diameter with 5-inch (114 mm) effective embedment, Simpson Strong-Tie Company, Inc. Titen HD Screw Anchors (ESR-2713) or equivalent as determined by a registered the structural engineer design professional. The concrete anchors may be factory zinc coated or hot-dip galvanized complying with ASTM B633 or ASTM A153.

4.0 DESIGN AND INSTALLATION

4.1 Design:

4.1.1 General: Structural calculations and drawings prepared by a registered design professional must be submitted to the code official for each project based on accepted engineering principles, as described in IBC Section 1604.4 and must conform to IBC Section 1810. The design method for steel components is Allowable Strength Design (ASD), described in IBC Section 1602 and AISC 360 Section B3.4. The structural analysis must consider all applicable internal forces (shear, bending moments and torsional moments, if applicable) due to applied loads, structural eccentricity and maximum span(s) between helical pile foundations. The result of the analysis and the structural capacities must be used to select a helical pile foundation system. The minimum embedment depth for various loading conditions must be included based on the most stringent requirements of the following: engineering analysis, tested conditions described in this report, site-specific geotechnical investigation report, and site-specific load tests, if applicable. For helical pile foundation systems subject to combined lateral and axial (compression or tension) loads, the allowable strength under combined loads must be determined using the interaction equation prescribed in Chapter H of AISC 360.

A soils investigation report must be submitted to the code official as part of the required submittal documents, prescribed in IBC Section 107, at the time of permit application. The geotechnical report must include, but not be limited to, all of the following (as applicable):

1. A plot showing the location of the soil investigation.
2. A complete record of the soil boring and penetration test logs and soil samples.
3. A record of soil profile.
4. Information on groundwater table, frost depth and corrosion-related parameters, as described in Section 5.5 of this report.
5. Soil properties, including those affecting the design such as support conditions for the piles.
6. Recommendations for design criteria, including but not limited to mitigations of effects of differential settlement and varying soil strength, and effects of adjacent loads.
7. Field inspection and reporting procedures (to include procedures for verification of the installed bearing capacity when required).
8. Any questionable soil characteristics and special design provisions, as necessary.

4.1.2 Foundation System: The Grip-Tite helical pile system described in this report complies with IBC Section 1810.3.1.5. The allowable axial design load of helical piles shall comply with IBC Section 1810.3.3.1.9. The overall capacity of the Grip-Tite helical pile foundation system (in tension and compression) depends upon the analysis of interaction of brackets, shafts, helical plates and soils, and

must be the lowest value of the bracket capacity (P1), the shaft capacity (P2), the helical bearing plate capacity (P3) and the allowable soil capacity (P4), and the allowable capacity must be limited to no more than 60 kips (267 kN).

4.1.3 Bracket Capacity (P1): The concrete foundation must be designed and justified to the satisfaction of the code official with due consideration to the eccentricity of applied loads, including reactions provided by the brackets, acting on the concrete foundation. Only localized limit states of supporting concrete including punching (two-way) shear and concrete breakout have been evaluated in this evaluation report. All other limit states described in Chapter 17 of ACI 318-19 under the 2021 IBC, Chapter 17 of ACI 318-14 under the 2018 and 2015 IBC and Appendix D of ACI 318-11 under the 2012 IBC for anchors in shear (such as concrete breakout and pry out), beam (one-way) shear, and flexural (bending) related limit states, and all limit states related to bending moment transfer among pile shaft/new construction pile cap/and concrete footing, have not been evaluated in this evaluation report and must be determined by registered design professional, as applicable. The concrete foundation and interaction of pile shaft, new construction pile cap and concrete footing for moment transfer, as applicable, must be designed and justified to the satisfaction of the code official, with due consideration to all applicable limit states and the direction and eccentricity of applied loads, including reactions provided by the brackets, acting on the concrete foundation. Refer to Tables 5 and 6 for selected allowable bracket capacity ratings.

4.1.4 Pile Shaft Capacity (P2): The top of shaft must be braced as described in IBC Section 1810.2.2. In accordance with IBC Section 1810.2.1, any soil other than fluid soil must be deemed to afford sufficient lateral support to prevent buckling of the systems that are braced, and the unbraced length is defined as the length of piles standing in air, water, or in fluid soils plus an additional five (5) feet (1524 mm) when embedded into firm soil or an additional ten (10) feet (3054 mm) when embedded into soft soil. Firm soils must be defined as any soil with a Standard Penetration Test blow count (SPT N value) of five (5) or greater. Soft soils must be defined as any soil with SPT N value greater than zero (0) and less than five (5). Fluid soils must be defined as any soil with a SPT N value of zero (0) [weight of hammer (WOH) or weight of rods (WOR)]. The SPT N value must be conducted under the supervision of a registered design professional in accordance with ASTM D1586. The allowable stress design (ASD) shaft capacities are provided in Table 3.

4.1.5 Helix Plate Capacity(P3): The allowable helix compression (+) and tension (-) load capacities (P3) are listed below. For helical piles with more than one helix, the allowable helix capacity (P3) for the helical foundation system may be taken as the sum of the least allowable capacity of each individual helix:

- 8-inches by ⅜-inch thick: ±84.97 kips (378 kN)
- 10-inches by ⅜-inch thick: ±68.37 kips (304 kN)
- 12-inches by ⅜-inch thick ±66.00 kips (293 kN)
- 14-inches by ½-inch thick: ±74.44 kips (331 kN)

4.1.6 Soil Capacity (P4): The design axial compressive and tensile load capacities of helical piles based on soil resistance (P4) must be conducted under the supervision of a registered design professional in accordance with a site-specific geotechnical report, as described in Section 4.1.1 of this report, combined with the individual helix bearing method (Method 1), or from field loading tests conducted under the supervision of a registered design professional (Method 2). For either Method 1 or Method 2, the predicted axial load capacities must be confirmed during the site-specific production installation, such that the axial load capacities predicted by the torque correlation method must be equal to or greater that that predicted by Method 1 or Method 2, described above. With the individual helix bearing method, the total nominal axial load capacity of the helical pile is determined as the sum of the individual areas of the helical bearing plats times the ultimate bearing capacities of the soil or rock comprising the respective bearing strata for the plates, as follows:

$$Q_{tot} = \sum(A_n q_u) \quad \text{(Equation 1)}$$

Where:

Q_{tot} = Predicted nominal axial tensile or compressive capacity of the helical pile, lbf (N).

A_n = Net area of an individual helix bearing plate, in^2, (mm^2).

q_u = Ultimate unit bearing capacity of the soil or rock comprising the bearing stratum for the individual helix bearing plate, psf (MPa).

The unit bearing capacity of the bearing stratum for each helix plate can be estimated using the general bearing capacity equation for deep foundations as follows:

$$qu = cNc + q'Nq \quad \text{(Equation 2)}$$

where:

c = Undrained shear strength parameter, considering the effect of soil disturbance due to the helix pile installations, psf (MPa).

Nc, Nq = Bearing capacity factors.

q' = Effective overburden pressure at helix plate foundation depth, psf (MPa).

Either the bearing capacity factors (Nc and Nq) and the soil parameters needed to estimate the ultimate/allowable soil bearing capacities of the major soil types or the recommended ultimate/allowable soil bearing capacities for the major soil types must be obtained from the site-specific geotechnical report.

The design allowable axial load must be determined by dividing the total ultimate axial load capacity predicted by either Method 1 or Method 2, above, by a safety factor of at least two (2).

The Foundation Design Documentation must include documentation of the derivation of the design allowable capacity and the minimum effective torsional resistance pile termination criterion, derived using the torque correlation method. With the torque correlation method, the total ultimate axial load capacity of the helical pile is predicted as follows:

$$Qult = Kt(T) \quad \text{(Equation 3)}$$

$$Qall = 0.5(Qult) \quad \text{(Equation 4)}$$

Qult = Ultimate axial tensile or compressive capacity, lbf (N), of the helical pile.

Qall = Allowable axial tensile or compressive capacity, lbf (N), of the helical pile.

Kt = Maximum torque correlation factors of 9 ft-1 and 7 ft-1 should be used for compression and tension piles, respectively.

T = Effective torsional resistance, which is defined as follows: For single-helix piles supporting axial compression loads, it is the installation torque measured when the pile reaches its final tip embedment; for all piles supporting axial tension loads and for multi-helix piles supporting axial compression

loads, it is the average of the last three (3) installation torque measurements. Such torque measurements, in-lbf (N-m), must be made at one (1) foot (305 mm) increments of tip embedment as the lead helix moves from a position, which is two (2) feet (710 mm) prior to the final tip embedment, to the final tip embedment.

The minimum effective torsional resistance pile termination criterion is calculated as follows:

Treq = (F.S.)(Qall)/(Kt) (Equation 5)

Where:

Treq = Minimum effective torsional resistance pile termination criterion, in lbf-ft (N-m).

F.S. = An appropriate factor of safety for the project, but not less than two (2).

The allowable lateral capacity of the pile is 318 lbf and is based on field testing of the helical pile with a single 8-inch diameter helical plate installed in firm clay soil, having an average standard penetration test blow count of 20, at a minimum embedment of 15 feet. Installation is limited for use with the new construction brackets having minimum concrete edge distance of 4 inches. For soil conditions other than firm clay, the lateral capacity of the pile must be determined by a registered design professional.

4.1.7 Settlement Analysis: The pile head vertical movement at allowable load of a Grip-Tite® helical pile may be estimated as the sum of the following: the movement at helix plates due to soil deformation and helix plate deflection, and the shaft elastic shortening or lengthening. The corresponding equation is described below:

$\Delta total = \Delta helix + \Delta shaft$ (Equation 6)

Where:

$\Delta total$ = Total pile head vertical movement, in (mm).

$\Delta helix$ = Movement of helix plates within the soil, in (mm).

$\Delta shaft$ = Shaft elastic shortening/lengthening, in (mm).

The reliability of the foundation system capacity and settlement predictions may be improved by performing full-scale field tests at the construction site using piles of same configuration as the intended production piles.

4.1.8 Shaft Elastic Shortening and Lengthening: Elastic shortening or lengthening of a Grip-Tite® RDS2875 helical pile shaft may be a significant contributor to overall pile head movement under load for long piles. For loads up to and including the allowable load limits found in the tables of this report, the length change can be estimated as:

$\Delta shaft = PL/AE$

shaft = Length change of shaft resulting from elastic shortening or lengthening, in (mm)

P = Applied axial load, lbf (N).

L = Effective length of the shaft, in (mm).

A = Cross sectional area of the shaft, in2 (mm2), see Tables 1, and 2.

E = Young's modulus of the shaft, may be taken as 29,000 ksi (200,000 MPa).

The effective length of the shaft, L, may be approximated as the average of the distances from the point of load application to each helical plate.

The elastic shortening/lengthening of the pile shaft will be controlled by strength and section properties of the helical shaft and the following:

- Bare Steel
  - Potential elastic shortening due to compression load= 0.012 in/ft of shaft and 0.003 in/coupler.
  - Potential elastic lengthening due to tensile load= 0.007 in/ft of shaft and 0.003 in/coupler.
  - Slip in coupler due to compression of tensile load= 0.197 in/coupler.
- Galvanized Steel
  - Potential elastic shortening due to compression load= 0.012 in/ft of shaft and 0.003 in/coupler.
  - Potential elastic lengthening due to tensile load= 0.008 in/ft of shaft and 0.002 in/coupler.
  - Slip in coupler due to compression of tensile load= 0.151 in/coupler.

4.1.9 Helix Movement: The evaluation of helix movement due to helix deformation, soil deformation, and helix-soil interaction, is beyond the scope of this evaluation report. It is recommended that the user of this report consult with the helical pile manufacture (Grip-Tite® Manufacturing Co., LLC).

4.2 Installation:

The Grip-Tite® Helical Pile Foundation Systems must be installed by Grip-Tite® Manufacturing Co., LLC certified and trained installers. The Grip-Tite® Helical Pile Foundation Systems must be installed in accordance with this section (Section 4.2) and the manufacturer's installation instructions, or the site-specific approved construction documents, whichever is most stringent governs. If galvanized product is used, all field-cut or drilled pilings must be protected from corrosion as recommended by the registered design professional.

4.3 Special Inspections:

Continuous special inspection in accordance with IBC Section 1705.9 must be provided for the installation of foundation piles and foundation brackets. Where on-site welding is required, special inspection in accordance with IBC Section 1705.2 is also required. Items to be confirmed by the special inspector include, but are not limited to, the manufacturer's certification of installers, verification of the product manufacturer, helical pile and bracket configuration and identification, inclination and position of the helical pies, the installation torque and depth of the foundation piles, compliance of the installation with the approved construction documents and this evaluation report.

5.0 CONDITIONS OF USE

The Grip-Tite® Manufacturing Co., LLC Helical Foundation Systems described in this report complies with, or is a suitable alternative to what is specified in, those codes listed in Section 1.0 of this report, subject to the following conditions:

5.1 The Grip-Tite® Manufacturing Co., LLC helical foundation systems are manufactured, identified and installed in accordance with this report, the approved construction documents (engineering drawings and

specifications), and the manufacturer's written installation instructions, which must be available at the jobsite at all times during installation. In case of conflict, the most stringent requirement governs.

5.2 The Grip-Tite® Manufacturing Co., LLC helical foundation systems have been evaluated for support of structures assigned to Seismic Design Categories A, B and C in accordance with IBC Section 1613. Helical foundation systems that support structures assigned to Seismic Design Category D, E or F, or that are located in Site Class E or F, are outside the scope of this report, and are subject to the approval of the building official based upon submission of a design in accordance with the code by a registered design professional.

5.3 Installations of the helical foundation systems are limited to regions of concrete members where analysis indicates no cracking will occur at service load levels.

5.4 Remedial Repair Brackets and New Construction Brackets must be used only to support structures that are laterally braced as defined in IBC Section 1810.2.2. Shaft couplings must be located within firm or soft soil as defined in Section 4.1.3. Table 5 provides the allowable capacities at various unbraced lengths and coupling configurations.

5.5 The helical foundation systems must not be used in conditions that are indicative of potential pile deterioration or corrosion situations as defined by the following: (1) soil resistivity less than 1,000 ohm-cm; (2) soil pH less than 5.5; (3) soils with high organic content; (4) soil sulfate concentrations greater than 1,000 ppm; (5) soils located in a landfill, or (6) soil containing mine waste.

5.6 Hot-dip galvanized steel and bare steel components must not be combined in the same system, unless bare steel capacity is used as the design capacity. All helical foundation components must be isolated from concrete reinforcing steel, building structural steel, or any other metal building components.

5.7 The new construction helical piles (piles with new construction brackets) must be installed vertically into the ground with a maximum allowable angle of inclination of ±1° from the design installation angle. The tops of pile caps must be embedded into the concrete footing with a minimum 4-inch (101.6 mm) vertical embedment and a minimum 4-inch (101.6 mm) side embedment beyond the perimeter of the steel cap plates, except as specifically noted in Table 6 and Figure 5.

5.8 The retrofit helical piles must be installed such that the angle of inclination does not exceed 0° ± 1°.

5.9 Special inspection is provided in accordance with Section 4.3 of this report.

5.10 Engineering calculations and drawings, in accordance with recognized engineering principles as described in IBC Section 1604.4, are prepared by a registered design professional and approved by the code official.

5.11 The adequacy of the concrete structures that are connected to the Grip-Tite® Manufacturing Co., LLC brackets must be verified by a registered design professional in accordance with applicable code provisions such as Chapter 13 of ACI 318-19 under the 2021 IBC, Chapter 13 of ACI 318-14 under the 2018 and 2015 IBC (Chapter 15 of ACI 318-11 under the 2012) and Chapter 18 of the IBC. Verification is subject to the approval of the code official.

5.12 A geotechnical investigation report for each project site must be provided to the code official for approval in accordance with Section 4.1.1 of this report.

5.13 When using the alternative basic load combinations prescribed in IBC Section 1605.3.2, the allowable stress increases permitted by material chapters of the IBC or the referenced standards are prohibited.

5.14 The minimum helical pile center-to-center spacing is three (3) times and eight (8) times the diameter of the largest helical bearing plate for axially and laterally loaded piles, respectively. For piles with closer spacing, the recommended allowable load reductions due to pile group effects must be included in the geotechnical report described in Section 4.1.1 of this report and must be considered in the helical pile design by a registered design professional. Load reductions are subject to the approval of the code official.

5.15 Evaluation of compliance with IBC Section 1810.3.6.1 for buildings assigned to Seismic Design Category (SDC) C, is outside of the scope of this evaluation report. Such compliance must be addressed by a registered design professional for each site, and the work of the design professional is subject to approval by the code official.

5.16 The Grip-Tite® Manufacturing Co., LLC helical foundation systems are manufactured by Grip-Tite® Manufacturing Co., LLC, 115 W. Jefferson St., Winterset, IA 50273; under a quality control program with inspections by ICC-ES.

6.0 EVIDENCE SUBMITTED

Data in accordance with the ICC-ES Acceptance Criteria for Helical Foundation Systems and Devices (AC358), dated June 2020, Revised March 2021.

7.0 IDENTIFICATION

7.1 Product labeling shall include, the name of the report holder, and the ICC-ES mark of conformity. The listing or evaluation report number (ICC-ES ESR-3533) may be used in lieu of the mark of conformity.

7.2 The report holder's contact information is the following:

GRIP-TITE® MANUFACTURING CO., LLC
505 EAST MADISON STREET
WINTERSET, IOWA 50273
(515) 462-1313
www.griptite.com
steve@griptite.com

GTRDS2875
Ø2.875" ROUND SHAFT HELICAL PILES

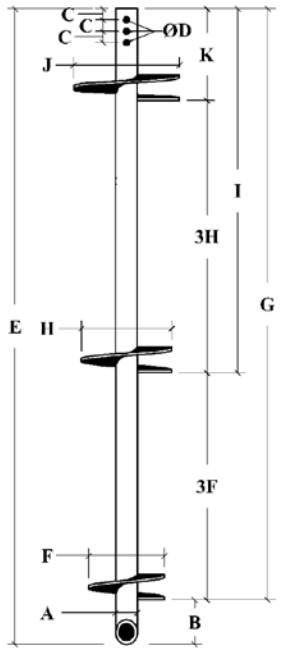

Figure No. 1 -
RDS2875 Lead Sections

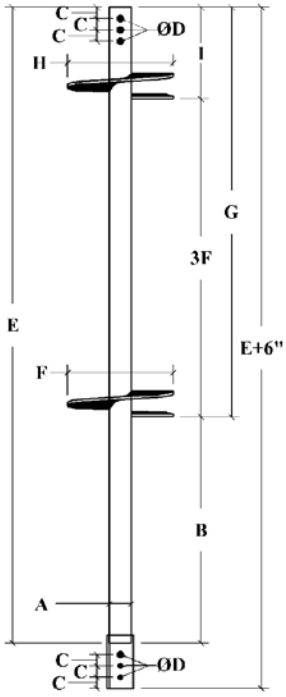

Figure No. 2 -
RDS2875 Extensions

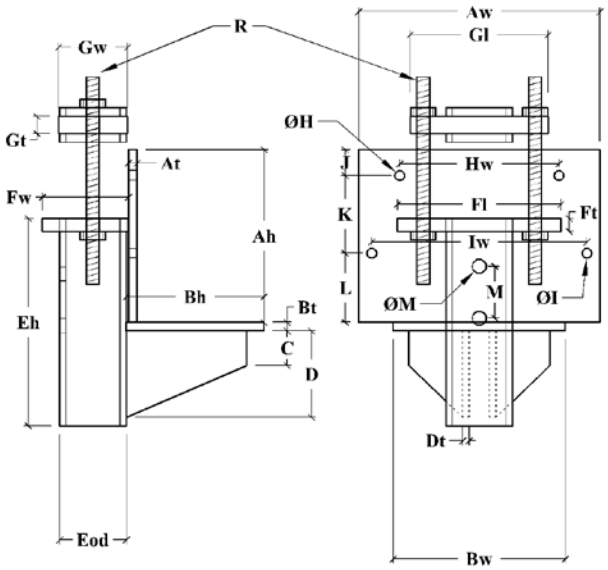

Figure No. 3 - FP3BA
Standard Duty Remedial Repair Bracket

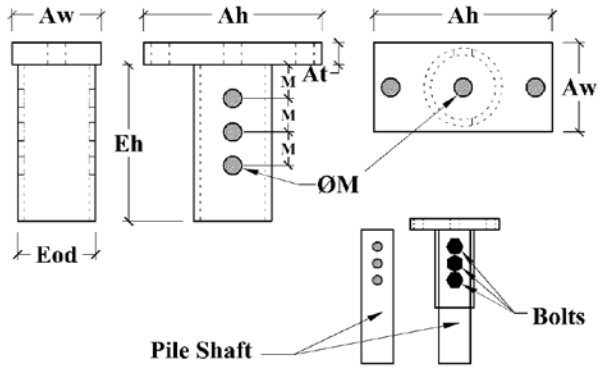

Figure No. 4 - RDS2875-NCB
New Construction Brackets

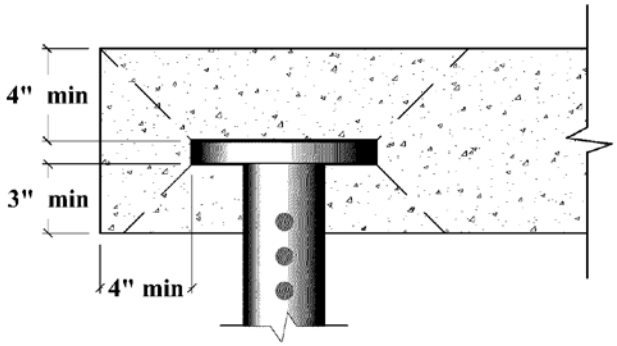

Figure No. 5 - Grade Beam with
RDS2875-NCB New Construction Bracket

TABLE—1 DIMENSIONS OF RDS2875 HELICAL PILE LEAD SECTIONS BY THE PRODUCT CATALOG NUMBER[1]

Helical Pile Lead Steel Material (See Figure 1)	Catalog Number [3]	Shaft Cross-Sectional Area, in^2	Nominal Dimensions, (in) [2]												
			A	B	C	ØD	E	F	3F	G	H	3H	I	J	K
ASTM A500 Grade B Fy=50 ksi Fu=58 ksi	2LS8	1.72 (1.96)	2.839 (2.869)	5.75	1.5	0.8125 (13/16)	24	8		18.125					
	2LS10						24	10		18.125					
	2LS12						24	12		18.125					
	2LS14						24	14		18.125					
	5LS8						60	8		54.125					
	5LS10						60	10		54.125					
	5LS12						60	12		54.125					
	5LS810						60	8	24	54.125	10		30.125		
	5LS14						60	14		54.125					
	5LS1012						60	10	30	54.125	12		24.125		
	5LS1214						60	12	36	54.125	14		18.125		
	7LS8						84	8		78.125					
	7LS10						84	10		78.125					
	7LS12						84	12		78.125					
	7LS810						84	8	24	78.125	10		54.125		
	7LS14						84	14		78.125					
	7LS1012						84	10	30	78.125	12		48.125		
	7LS81012						84	8	24	78.125	10	30	54.125	12	24.125
	7LS1214						84	12	36	78.125	14		42.125		
	7LS101214						84	10	30	78.125	12	36	42.125	14	12.125

For SI: 1 inch = 25.4 mm; 1 in^2 = 645.2 mm^2; 1 psi = 6.89 kPa

[1]Bare steel dimensions (galvanized dimensions): Includes reduced dimensions for corrosion and a 50-year design life in accordance with Section 3.9 of AC358. Helical pile components consist of steel materials as described in Section 3.0 of this report. The helical lead sections and extensions are either bare or hot-dip galvanized steel per ASTM A123.
[2]See Figure No. 1 for dimension designations.
[3]Galvanized product will have a "G" suffix added to the end of the products' catalog number.
i.e. 2LS8 is bare steel and 2LS8G is galvanized steel.

TABLE—2 DIMENSIONS OF RDS2875 HELICAL PILE EXTENSIONS BY THE PRODUCT CATALOG NUMBER[1,4]

Helical Pile Extensions Steel Material (See Figure 2)	Catalog Number[3]	Shaft Cross-Sectional Area, in^2	Nominal Dimensions, (in)[2]									
			A	B	C	ØD	E	F	3F	G	H	I
ASTM500 Grade B Fy= 50 ksi Fu= 58 ksi	3E	1.72 (1.96)	2.839 (2.869)		1.5	0.8125 (13/16)	36	Plain Extensions				
	5E						60	Plain Extensions				
	7E						84	Plain Extensions				
	3E14			11.875			36	14		24.125		
	5E14			11.875			60	14		48.125		
	5E14x			29.875			60	14		30.125		
	7E14			11.875			84	14		72.125		
	7E14x			29.875			84	14		54.125		
	7E1414			11.875			84	14	42	72.125	14	30.125
	7E1414x			29.875			84	14	42	54.125	14	12.125

For SI: 1 inch = 25.4 mm; 1 in^2 = 645.2 mm^2; 1 psi = 6.89 kPa

[1]Bare steel dimensions (galvanized dimensions): Includes reduced dimensions for corrosion and a 50-year design life in accordance with Section 3.9 of AC358. Helical pile components consist of steel materials as described in Section 3.0 of this report. The helical lead sections and extensions are either bare or hot-dip galvanized steel per ASTM A123.
[2]See Figure No. 2 for dimension designations.
[3]Galvanized product will have a "G" suffix added to the end of the products' catalog number.
i.e. 2LS8 is bare steel and 2LS8G is galvanized steel.
[4]Coupler bolts must have a protection, zinc coated per ASTM B633 or ASTM B695.

TABLE—3 ALLOWABLE CAPACITIES[4] AND RECOMMENDED MAXIMUM INSTALLATION TORQUE FOR RDS2875 HELICAL PILES [1,2]

Helical Pile Steel Material	Allowable Axial Capacity Limits[4] Bare Steel, (Hot-Dip Galvanized)								Recommended Capacity-Torque Ratio[4], K_t (ft^{-1})	Recommended Max Installation Torque[3], T(ft-lbs)	Ultimate Load at Max Torque Capacity, $Qu=TK_t$ (kips)	Allowable Load at Max Torque Capacity, (kips) $Qu/2=Qa$ [4]
	Compression, (kips)					Tension, (kips)	Shear, (kips)	Bending, (ft-k)				
	Unbraced Length, Lu (ft) [1]	kLu=0	kLu=5	kLu=10	kLu=15							
RDS2875A STM A500 Grade B Fy=50 ksi Fu=58 Ksi	0 Couplings-no eccentricity	55.5 (60.0)	18.1 (19.9)	8.2 (9.0)	4.4 (4.8)	32.1 (37.7)	16.7 (18.4)	2.52 (2.76)	Comp Kt=9 Ten Kt=7	9,000 9,000	67 51	33.5 25.5
	1 Coupling	35.0 (40.8)	15.0 (19.0)	8.1 (8.9)	4.4 (4.8)							
	2 Couplings	22.8 (26.0)	13.4 (15.0)	7.2 (7.9)	4.1 (4.5)							

For SI: 1 inch = 25.4mm; 1 lbf = 1.356 N-m; 1 kip (1000 lbf) = 4.48 kN; 1 in^2 = 645.2mm^2; 1 psi =6.89 kPa

[1]Refer to Section 4.1.4 Pile Shaft Capacity for the description of unbraced length, soft and firm soil conditions.

[2]Capacity ratings include an allowance for corrosion over a minimum 50-year service design life in accordance with Section 3.9 of AC358 and presume the support structure is braced in accordance with IBC Section 1810.2.1 and the lead section will provide sufficient helical capacity to develop the full shaft capacity. See section 4.1.3 entitled Bracket Capacity (P1) for applicable limit states that must be evaluated by a registered design professional.

[3]Maximum useable torque for calculating the pile's ultimate capacity using the equation Q=TK. Maximum torque applied to the helical pile anytime during installation should not exceed 9495 ft-lbs for the RDS2875 helical piles.

[4]The listed capacity-to-torque ratios can be adjusted to lower values on a case-by-case, if necessary. The listed allowable capacity includes a minimum Factor of Safety (FS) of 2. A higher Factor of Safety may be used to estimate the pile's allowable capacity on a case-by-case basis, if necessary.

TABLE—4 REMEDIAL REPAIR AND NEW CONSTRUCTION BRACKET DIMENSIONS BY THE PRODUCT CATALOG NUMBER

Product [4]	Helical Pile	Aw Ah At[1]	Bw Bh Bt[1]	C D Dt	Eh Eod	Fl Fw Ft	Gi Gw Gt	Hw ØH Iw ØI	J K L	M ØM	All-Threaded Rods/Bolts dia-pitch x Length, in (R_1)[2]	Concrete Anchors[3]
Remedial Repair Bracket FP3BA FP3BAG (Figure 3)	RDS2875	14 10 ½	10, 8, ½	2 5 3/8	12 3-7/8	9.5 5 ¾	8 4 1	9.25 9/16 12.15 9/16	1.5 4.5 4	3 13/16	¾ - 10 x 12 ASTM A193 G*r* B7 and ASTM A194 2H Heavy Hex Nuts Fy = 105 Ksi Fu = 125Ksl	Titen HD Screw Anchors 1/2” x 5.5”
New Construction Bracket RDS2875-NCB RDS2875-NCBG (Figure 4)	RDS2875	8 4 1			7 3- ½					1.5 13/16	¾ - 10 x 4 ½ SAE J429 Grade 8	

For SI: 1 inch = 25.4 mm;1 psi = 6.89 kPa

[1]Main plate dimensions in direct contact with foundation.
[2]12-inch long all-thread rods and bolts are provided with the remedial brackets. Longer or additional rods can be used if additional lift is needed, as necessary.
[3]Concrete anchors shall be provided by the installer. Either 1/2” or 5/8” concrete anchors can be used to support the remedial brackets. The brackets were placed under a 2500 psi concrete foundation with 4 post-installed Titen HD screw anchors fastened through the face of the bracket into the side of the foundation. The screw anchors should be installed in accordance to the manufacturer’s recommendations (ICC-ESR-2713).
[4]Galvanized product includes the suffix “G”.

TABLE—5 REMEDIAL REPAIR ALLOWABLE CAPACITIES BY THE PRODUCT CATALOG NUMBER

Product [8]	Main Plate Dim., inches[1]		RDS2875 ASTM A500 Fy = 50 ksi Fu = 58 ksi			All-Thread Rods[6]	Concrete Anchors [6,7]	
	Aw, Ah, At[1]	Bw, Bh, Bt[1]	Allowable Capacities, kips [2,3,4, 5]					
			Comp.	Tension	Lateral	Ø – pitch x Length, inches (R_1)		
Remedial Repair Brackets FP3BA FP3BAG (see Figure 3)	14, 10, ½	10, 8, ½	27.2	To be determined by registered design professional		¾ - 10 x 12 AST A193 G*r* B7 and ASTM A194 2H Heavy Hex Nuts Fy = 105 ksi Fu = 125 Ksi	Titen HD Screw Anchors, or equivalent	1/2” x 5.5”

For SI: 1 inch = 25.4 mm; 1 lbf = 1.356 N-m; 1 kip (1000 lbf) = 4.48 kN; 1 in^2 = 645.2 mm^2; 1 psi = 6.89 kPa

[1]Main plate dimensions in direct contact with foundation.
[2]Based on full scale load tests conducted using the Grip-Tite Standard foundation Pier Bracket (GTFP3BA). The allowable capacities include a minimum Factor of Safety of 2. A higher Factor of Safety value may be used on a case-by-case basis, if necessary.
[3]Systems that require uplift capacities must include two (2) Ø3/4”x2” bolts thru the bracket tube sleeve into the existing shaft. One (1) bolt or two (2) Ø3/4”x2” long bolts can be installed utilized. As an alternative, the pile shaft could be welded in the field to the bracket using the two holes in the bracket sleeve, below the bracket tube or by other means as directed by the registered engineer.
[4]Fully braced foundation and shaft conditions.
[5]Lateral capacities are provided by four Titen HD concrete anchors with a minimum embedment of 5 inches.
[6]Corrosion protection, zinc coated per ASTM B633 or ASTM B695.
[7]The brackets were placed under a 2500 psi concrete foundation with four (4) Titen HD screw anchors fastened through the face of the bracket into the side of the foundation. The screw anchors must be installed in accordance with ESR-2713.

TABLE—6 GRIP-TITE NEW CONSTRUCTION BRACKET MINIMUM EMBEDMENT DEPTHS AND ALLOWABLE CAPACITIES BY THE PRODUCT CATALOG NUMBER

Product	Main Plate Dimensions, inches[1]	RDS2875 ASTM A500 Fy = 50 ksi Fu = 58 ksi			
	Aw, Ah, At	Minimum Concrete Cover Below (Tension) and Above (Compression) the Bracket Plate, inches		Allowable Compression and Tension Capacities, kips	Allowable Lateral Capacities, kips
				2500 psi PCC	2500 Psi PCC
New Construction Bracket RDS2875-NCB (see Figure 4)	8 4 1	3 4	Tension Comp	1.4 8.2	2.5
		6	Tension Comp	8.2 14.8	
		8	Tension Comp	14.8 23.0	
		10	Tension Comp	23.0 32.9	
		12	Tension Comp	32.9 40.0	

For SI: 1 inch=25.4mm; 1 lbf=1.356 N-m; 1 kip (1000 lbf) = 4.48 kN; 1 in^2 = 645.2 mm^2; 1 psi=6.89 kPa

[1]Main plate dimensions in direct contact with foundation.
[2]The listed allowable capacities are limited by either the punching shear capacity of the grade beam, bearing or bending capacity of the bracket plate the weld strength between the bearing plate and the bracket sleeve or the shear capacities of the connecting bolts. The allowable capacities include a minimum Factor of Safety of 2. A high Factor of Safety value may be used on a case-by-case basis, if necessary.
[3]Systems that require uplift capacities must include one (1), two (2) or three (3) 3/4"x4$^1/_2$" bolts through the bracket tube sleeve into the existing shaft. As an alternative, the existing pile shaft can be plug-welded to the bracket using the three bolt holes in the bracket sleeve or the New Construction Bracket could be welded to the shaft at the base of the bracket.
[4]Fully braced foundation and shaft conditions.
[5]Corrosion protection, zinc coated per ASTM B633-07 or ASTM B695-04.
[6]Galvanized product includes the suffix "G".

DIVISION: 31 00 00—EARTHWORK
Section: 31 63 00—Bored Piles

REPORT HOLDER:

GRIP-TITE MANUFACTURING CO., LLC

EVALUATION SUBJECT:

GRIP-TITE® HELICAL FOUNDATION SYSTEMS

1.0 REPORT PURPOSE AND SCOPE

Purpose:

The purpose of this evaluation report supplement is to indicate that Grip-Tite Helical Pile Foundation Systems, described in ICC-ES evaluation report ESR-3533, have also been evaluated for compliance with the code noted below.

Applicable code edition:

- 2019 *California Building Code* (CBC)

For evaluation of applicable chapters adopted by the California Office of Statewide Health Planning and Development (OSHPD) and Division of State Architect (DSA), see Sections 2.1.1 and 2.1.2 below.

2.0 CONCLUSIONS

2.1 CBC:

The Grip-Tite Helical Pile Foundation Systems, described in Sections 2.0 through 7.0 of the evaluation report ESR-3533, comply with CBC Chapter 18, provided the design and installation are in accordance with the 2018 *International Building Code*® (IBC) provisions noted in the evaluation report and the additional requirements of CBC Chapters 16, 17 and 18, as applicable.

2.1.1 OSHPD:

The applicable OSHPD Sections and Chapters of the CBC are beyond the scope of this supplement.

2.1.2 DSA:

The applicable DSA Sections and Chapters of the CBC are beyond the scope of this supplement.

This supplement expires concurrently with the evaluation report, reissued May 2022.