ICC-ES Evaluation Report

ESR-5049

Issued September 2024

Subject to renewal September 2025

DIVISION: 31 00 00—EARTHWORK Section: 31 63 00—Bored Piles	REPORT HOLDER: PRECISION PIERS	EVALUATION SUBJECT: PRECISION HELICAL PIERS	

1.0 EVALUATION SCOPE

Compliance with the following codes:

■ 2024, 2021, 2018 and 2015 *International Building Code®* (IBC)

Property evaluated:

■ Structural

■ Geotechnical

2.0 USES

The Precision Helical Piers are used either to underpin foundations of existing structures or to form deep foundations for new structures; and are designed to transfer compression loads from the supported structure to suitable soil bearing strata. Underpinning of existing foundations is generally achieved by attaching the helical piles to the retrofit/repair brackets (Type A side-load brackets), which support compression loads only. Deep foundations for new construction are generally obtained by attaching the helical piles to new construction brackets (Type B direct-load brackets) that are embedded in concrete pile caps or grade beams, which support compression loads.

3.0 DESCRIPTION

3.1 General:

The Precision Helical Piers consist of a helical pile and a bracket that allows for attachment to support structures. Each helical pile, consisting of a lead shaft section and one or more extension shaft sections, is screwed into the ground by application of torsion and pressure. The helical pile is driven to a depth that conforms to project requirements for avoidance of unsatisfactory subsurface conditions and ensuring a suitable soil or bedrock bearing stratum has been reached. The bracket is then installed to connect the pile to the concrete foundation of the supported structure.

3.2 System Components:

The Precision Helical Pier includes a lead shaft, extension shaft(s), and either a repair bracket or new construction bracket for attachment to concrete foundations. Evaluation of new construction brackets is outside the scope of this evaluation report. The lead shaft and extension shaft(s) are connected by couplers, as described in Section 3.2.3. The helical pile is connected to the foundation bracket, as described in Section 3.2.4.

3.2.1 Helical Pile Lead Shaft and Extensions: The Precision Helical Pier lead shaft and extension shaft sections are available in one shaft size: $2^7/_8$-inch-outside-diameter (73 mm) round steel tubing with a 0.217-inch-wall-thickness (5.51 mm). The helical pile lead shaft consists of one, two or three helical-shaped circular steel plates factory-welded to the steel shaft. The extension shaft sections are similar to the lead shaft section, except that the extensions do not have helical plates. See Figures 1 and 2 for lead shaft and extension of the $2^7/_8$ x 0.217-inch helical pile, respectively. The depth of the helical piles in soil is typically extended by adding one or more steel shaft extensions that are mechanically connected by couplers to form one continuous steel pile. The helical lead shafts come in total lengths of 60 or 84 inches (1524 and 2134 mm) as shown in Figure 1. Extension sections come in total length 66 inches (1676 mm) as shown in Figure 2.

3.2.2 Helix Plates: The helical plates, which are factory welded to the lead shaft near the tip (bottom end), allow advancement into the soil as the pile is rotated. Each circular, helical, steel bearing plate (helix) is split from the center to the outside edge with spiral edge geometry. The helix is press-formed to a clockwise downward spiral with radial sections normal to the shaft's central longitudinal axis and with a 3-inch (76.2 mm) nominal pitch. The pitch is the distance between the leading and trailing edges. Each helix plate is $^3/_8$-inch thick (9.53 mm) and has an outer diameter of 8, 10 or 12 inches (203, 254 or 305 mm). Figure 1 provides details.

3.2.3 Extension Shaft Couplers: The helical pile lead shaft section and extension shaft sections are connected by couplers to allow the multiple shaft sections to be connected during installation. Connection of the extension shaft section to the lead shaft or other extension shaft section is made by through-bolted connection, through the extension shaft coupler segment and the connected lead shaft or other extension shaft. At one end (bottom end) of each $2^7/_8$ x 0.217-inch extension shaft section is a steel coupler that consists of a pipe sleeve, factory-welded to the bottom end of the extension shaft, which allows the upper end of the lead shaft or other extension shaft to be snug-fitted into the welded coupler. The $2^7/_8$ x 0.217-inch extension shaft coupler sleeve is a 3.5-inch-outside diameter (88.9 mm) round steel tubing, having a 0.254-inch (6.45 mm) nominal wall thickness. Four $^7/_8$-inch holes (22.23 mm) are factory drilled in each coupler, at the upper end of extension shaft sections, and at the upper end of the lead shaft section, to allow multiple shaft sections to be through-bolted together during the installation as shown in Figures 1 and 2. For the $2^7/_8$ x 0.217-inch helical piles, each coupler connection includes two 4.5-inch (114 mm) long $^3/_4$"-10 standard hex-head structural bolts and two matching hex nuts complying with Section 3.3.5.

3.2.4 Foundation Attachments (Brackets):

3.2.4.1 Repair Bracket (#101 and #102): Repair brackets are side-load brackets that are used to support existing concrete foundations by transferring axial compressive loads from the existing foundation to the helical pile. This introduces both structure eccentricity (eccentricity between applied loading and reactions acting on the foundation structure) and bracket eccentricity (eccentricity between applied loading and reactions acting on the bracket assembly). Repair brackets are available in two models: #101 (bracket without back plate) and #102 (bracket with back plate), as shown in Figures 3 and 4, respectively. The 101 bracket assembly consists of a $^1/_2$-inch (12.7 mm) thick base plate, six $^1/_2$-inch (12.7 mm) thick gusset plates, and a 12-inch (305 mm) long 3" Sch40 sleeve [3.5-inch-outer-diameter (88.9 mm) and 0.216-inch (5.49 mm) thick] that are factory-welded to each other. The 102 bracket assembly consists of a $^1/_2$-inch (5.49 mm) thick base plate, a $^1/_2$-inch (5.49 mm) thick back plate, six $^1/_2$-inch (5.49 mm) thick gusset plates, and a 16-inch (406 mm) long 3" Sch40 sleeve [3.5-inch-outer-diameter (88.9 mm) and 0.216-inch thick (5.49 mm)] that are factory-fillet-welded to each other.

Each repair bracket comes with a lifting Tee (Part #104) as shown in Figure 5. The lifting Tee consists of two $^3/_8$-inch (9.53 mm) thick base/horizontal plates, two $^3/_8$-inch (9.53 mm) thick gusset/vertical plates, and a 5-inch (127 mm) long tube guide with $2^3/_8$-inch-outer-diameter (60.3 mm) and 0.218-inch-thickness (5.54 mm). The lifting Tee is connected to the bracket main body with two $^7/_8$"-9 steel threaded rods, four matching steel nuts, and matching steel washers.

3.2.4.2 New Construction Pile Cap (Bracket): New construction brackets (Type B) may be used with the helical pile system in new construction where the steel bearing plate of the bracket is cast into new concrete grade beams, footings, or pile caps. The brackets may transfer compression loads between the pile and the concrete foundation. Evaluation of new construction brackets and their connections with the helical piles and concrete foundation is outside the scope of this evaluation report. The brackets and their connections must be designed by a registered design professional in accordance with the applicable codes, and are subject to approval of the code official.

3.3 Material Specifications:

3.3.1 Helical Pile Lead Shaft and Extensions: The $2^7/_8$ x 0.217-inch lead shafts and extensions are made from API 5 CT Grade L80 Type 1 carbon steel with a minimum yield strength of 80,000 psi (552 MPa) and a minimum tensile strength of 95,000 psi (655 MPa). The lead shafts (including their helix plates) and extensions (including their couplers) can either be base steel or hot-dipped galvanized in accordance with ASTM A123.

3.3.2 Helix Plates: The helical plates used in the $2^7/_8$ x 0.217-inch lead shaft are carbon steel plates conforming to ASTM A572 Grade 50 with a minimum yield strength of 50,000 psi (344 MPa) and a minimum tensile strength of 65,000 psi (448 MPa). The helical plates are factory-welded to the lead shaft with double sided 0.375-inch (9.53 mm) fillet weld, Grade E71T1.

3.3.3 Extension Shaft Couplers: The extension shaft coupler for the $2^7/_8$ x 0.217-inch helical pile is made from API 5 CT Grade L80 Type 1 carbon steel with a minimum yield strength of 80,000 psi (552 MPa) and a minimum tensile strength of 95,000 psi (655 MPa). The coupler is factory-welded to the extension shaft with all around 0.25-inch (6.35 mm) fillet weld, Grade E71T1.

3.3.4 Foundation Attachments:

3.3.4.1 Repair Brackets (#101 and #102): The plates (base plate and gusset plates) used to fabricate the repair brackets in Figures 3 and 4, except the back plate in Repair Bracket #102, conform to ASTM A572 Grade 50 with a minimum yield strength of 50 ksi (344 MPa) and a minimum tensile strength of 65,000 psi (448 MPa). The back plate in Repair Bracket #102 (Figure 4) is made from ASTM A36 steel with a minimum yield strength of 36,000 psi (250 MPa) and a minimum tensile strength of 58,000 psi (400 MPa). The bracket's sleeve conforms to ASTM A500 Grade B steel with a minimum yield strength of 46,000 psi (315 MPa) and a minimum tensile strength of 58,000 psi (400 MPa).

Top and bottom plates of the lifting Tee in Figure 5 are made from ASTM A36 steel with a minimum yield strength of 36,000 psi (250 MPa) and a minimum tensile strength of 58,000 psi (400 MPa). Side plates of the lifting Tee are made from steel complying with ASTM A36 and ASTM A529 Grade 50 with a minimum yield strength of 50 ksi (344 MPa) and a minimum tensile strength of 65,000 psi (448 MPa). The tube guide in the lifting Tee conforms to ASTM A500 Grade B/C with a minimum yield strength of 50,000 psi (345 MPa) and a minimum tensile strength of 62,000 psi (425 MPa). Repair brackets and lifting Tee can either be base steel or hot-dipped galvanized in accordance with ASTM A123.

3.3.5 All Other Fastening Assemblies: The threaded rods for repair brackets conform to ASTM F1554 Grade 55. The threaded rods' nuts conform to ASME B18.2.2 and ASTM A194 Grade 2H, and their compatible washers conform to ASTM F436. Through-bolts used to connect shaft extension to the lead shaft or other extension conform to ASME B18.2.6 and ASTM F3125 Grade A325 and their nuts conform to ASME B18.2.2 and ASTM A194 Grade 2H.

4.0 DESIGN AND INSTALLATION

4.1 Design:

4.1.1 General: Engineering calculations (analysis and design) and drawings, prepared by a registered design professional, must be submitted to the code official for each project, must be based on accepted engineering principles as described in IBC Section 1604.4, and must conform to IBC Section 1810. The applied loads must not exceed the published capacities shown in this report for the helical pile foundation system and devices. The load capacities shown in this report are based on the Allowable Stress Design (ASD) described in IBC Section 202. Bracket capacities are included in Table 1, shaft capacities are included in Table 2B, helix capacities are included in Table 3, and soil capacities are described in Section 4.1.5. The engineering analysis must address helical foundation system performance related to structural and geotechnical requirements.

The calculations must address the ability (considering strength and stiffness) of the supported foundation and structure to transmit the applied loads to the helical foundation system and the ability of the helical piles and surrounding soils to support the loads applied by the supported foundation and structure. The design method for steel components is either the Load and Resistance Factor Design (LRFD) or the Allowable Strength Design (ASD) as specified in AISC 360 Section B3. The design method for concrete components is the LRFD as described in ACI 318. The design method for soil is the ASD prescribed in IBC Sections 202 and 1802.1.

The structural analysis must consider all applicable internal forces (axial, shear, bending moments, and torsional moments, if applicable) due to applied loads, eccentricity between applied loads and reactions acting on the pile-supported structure, the forces/moments exerted on the concrete foundations by the brackets, load transfer between the bracket and the pile segments (leads and extensions), and maximum span(s) between helical foundations. The result of the analysis and the structural capacities must be used to select a helical 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; a site-specific geotechnical investigation report; and site-specific load tests, if applicable.

The geotechnical analysis must address the suitability of the helical foundation system for the specific project. It must also address the center-to-center spacing of the helical piles, considering both effects on the supported foundation and structure, and group effects on the pile soil capacity. The analysis must include estimates of the axial compression capacities of the helical piles, and the expected total and differential foundation movements due to single pile or pile group, as applicable.

A soil investigation report (geotechnical 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 is not limited to, all the following:

1. A plot showing the location of the soil investigation.
2. A complete record of the soil boring and penetration test legs and soil samples.
3. A record of soil profile.
4. Information on groundwater table, frost depth, and corrosion-related parameters, as described in Section 5.6 of this report.
5. Soil design parameters, such as: shear strength, soil allowable bearing pressure, unit weight of soil, soil deformation characteristics, and other parameters affecting pile support conditions as defined in IBC Section 1810.2.1.
6. Confirmation of the suitability of helical foundation systems for the specific project.
7. Recommendations for design criteria, including, but not limited to: mitigation of effects of differential settlement, varying soil strength, and effects of adjacent loads.
8. Recommended center-to-center spacing of helical pile foundations, if different from spacing noted in Section 5.15 of this report; and reduction of allowable loads due to the group action, if necessary.
9. Field inspection and reporting procedures to include procedures for verification of the installed bearing capacity, when required.
10. Load test requirements.
11. Any questionable soil characteristics and special design provisions, as necessary.
12. Expected total and differential settlements.
13. The axial compression load soil capacities, if values cannot be determined from this evaluation report.
14. Minimum helical pile depth, if any, based on local geologic hazards such as frost, expansive soil, or other conditions.

4.1.2 Bracket Capacity (P1): Repair brackets entail eccentric connection to the pile-supported structure. The effects of this eccentricity can be divided into two components: bracket eccentricity and structural eccentricity. The structural eccentricity relates to the offset distance between the applied loads and the reactions, including reactions from the brackets acting on the pile-supported structure. The bracket eccentricity is resisted by the pile shaft, the bracket, the connection between the shaft and the bracket, and the connection between the bracket and the pile-supported structure. The connections of the building structure to the helical pile brackets are outside the scope of this evaluation report and must be designed by a registered design professional and included in the construction documents. The concrete foundation must be designed and justified to the satisfaction of the code official with due consideration to the eccentricity of applied loads (structural eccentricity), acting on the concrete foundation.

Table 1 describes the allowable bracket capacity for repair brackets (#101 and #102). Only localized limit states of steel and supporting concrete foundation bearing have been considered in this evaluation report. Other limit states are outside the scope of this evaluation report and must be determined by the registered design professional. Refer to Section 5.4 of this report for bracing requirements.

4.1.3 Pile Shaft Capacity (P2): The shaft capacity including maximum installation torque is the lowest capacity of its components, which include a lead section, one or more extension sections, and coupling connecting lead section to extension section, or connecting two extension sections together. Table 2A describes the mechanical properties of the shafts, which are based on a 50-year corrosion effect in accordance with Section 3.9 of AC358. Table 2B describes the shaft allowable capacity. The top of the 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 5 feet (1524 mm) when embedment is into firm soil, or an additional 10 feet (3048 mm) when embedment is into soft soil. Firm soils must be defined as any soil with a Standard Penetration Test (SPT) blow count of five or greater. Soft soils must be defined as any soil with a SPT blow count greater than zero and less than five. Fluid soils must be defined as any soil with a SPT blow count of zero [weight of hammer (WOH) or weight of rods (WOR)]. Standard Penetration Test blow count must be determined in accordance with ASTM D1586. The shaft capacity and coupler deflection of the helical foundation systems in air, water or fluid soils are not addressed in this evaluation report and must be determined by a registered design professional using parameters in Table 2A with due consideration of lateral support provided by the surrounding soil and/or structure.

For the purpose of this report and the values provided in Table 2B, shaft support condition for resisting axial compressive loads is classified as pinned condition at the top, where the top of the pile/bracket is fully restrained against translation, but not against rotation, by the concrete foundation, and fixed at the bottom due to soil confinement. The piles must be embedded at least 5 feet (1524 mm) into firm soil, and 10 feet (3048 mm) into soft soil.

4.1.4 Helix Plate Capacity (P3): Table 3 describes the allowable helical bearing plate capacity. For helical pile with more than one helix plate, 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 plate.

4.1.5 Soil Capacity (P4): The design axial compressive capacities of the helical piles based on soil resistance (P4) must be determined by a registered design professional and must be the least of Method 1, Method 2, and Torque Correlation Method as follows:

- Method 1: The allowable axial capacity is determined in accordance with a site-specific geotechnical report, as described in Section 4.1.1. It is calculated from the sum of the individual areas of the helical bearing plates times the ultimate bearing capacities of the soil or rock comprising the respective bearing stratum for the plates, divided by a safety factor of 2.0 (base capacity divided by a safety factor of 2) as follows:

$$Q_{all} = \frac{\sum(A_h q_u)}{2.0} \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots \quad (Equation\ 1)$$

  where,

  Q_{all} = Allowable axial compressive or tensile capacity (lbf or N) of helical pile.

  A_h = Area of individual helix bearing plate (in.^{2} or mm^2).

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

  Under the 2024 and 2021 IBC (Section 1810.3.3.1.9), the allowable axial capacity is equal to (base capacity + shaft resistance) / 2.0 safety factor. The shaft resistance is equal to the surface area of the shaft above the uppermost helical bearing plate times the ultimate skin resistance.

- Method 2: The allowable axial capacity is determined from field loading tests conducted under the supervision of a registered design professional for each site-specific condition. It is calculated by dividing the ultimate capacity from load tests by a safety factor of 2.0. Under the 2024 and 2021 IBC, the load must comply with IBC Section 1810.3.3.1.2.

- Torque Correlation Method: Allowable axial capacity of helical pile in soil, determined from well-documented correlations with installation torque. Table 4 describes the geotechnical related properties of the piles. 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 are equal to or greater than what is predicted by Method 1 or 2, described above. The predicted ultimate capacity (Q_{ult}) of the pile based on the minimum installation torque is calculated from Equation 2. A factor of safety of 2 must be applied to the ultimate capacity to determine the allowable soil capacity (Q_{all}) of the pile (Equation 3).

$$Q_{ult} = K_t . T \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad (Equation\ 2)$$

$$Q_{all} = 0.5\ Q_{ult} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad (Equation\ 3)$$

where,

Q_{ult} = Ultimate axial compressive capacity (lbf or N) of helical pile, which must be limited to the maximum ultimate values noted in Table 4.

Q_{all} = Allowable axial compressive capacity (lbf or N) of helical pile, which must be limited to the maximum allowable values noted in Table 4.

K_t = Torque correlation factors are described in Table 4.

T = Final installation torque in (ft-lbf or N-m). The final installation torque is defined as the last torque reading taken during the pile installation, using, for example, the torque reading instruments connected to the installation equipment. The final installation torque must not exceed the maximum installation torque rating specified in Table 4.

The allowable lateral soil capacity is 1,067 lbf (4.746 kN) for the 2$^7/_8$ x 0.217-inch helical pile with helix plate diameters ranging between 8 and 12 inches (203 and 305 mm) based on field testing in a clay soil, having an average standard penetration test blow count of 17 and a minimum embedment of 15 ft (4.57 m). For soil conditions other than the above, the lateral capacity of the pile must be determined by a registered design professional on a project-by-project basis and subjected to approval of the code official.

4.1.6 Foundation System: The overall allowable capacity of the Precision Helical Pier depends upon the analysis of interaction of brackets, shafts, helical plates, and soils. The overall allowable lateral capacity of the Precision Helical Pier depends upon the analysis of interaction of brackets, shafts, and soil; and must be the lowest value of those for bracket allowable capacity, shaft allowable capacity, and allowable soil capacity.

For all design methods permitted under Section 4.1.1 of this report, the allowable axial compressive load of the helical pile system must be based on the least of the following conditions in accordance with IBC Section 1810.3.3.1.9:

- P1: Allowable axial capacity of the bracket. Section 4.1.2 of this report includes bracket capacities.
- P2: Allowable axial capacity of pile shaft and couplers. Section 4.1.3 of this report includes pile shaft and couplers capacities.
- P3: Allowable axial capacity of helical bearing plate(s) affixed to pile. Section 4.1.4 of this report includes helical plate axial capacities.
- P4: Allowable axial capacity of helical pile based on soil resistance. Section 4.1.5 of this report includes soil capacity of helical piles.

4.1.7 Settlement Analysis: The pile head vertical movement at the allowable load of the Precision Helical Pier 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. The corresponding equation is described below:

$$\Delta_{total} = \Delta_{helix} + \Delta_{shaft} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad (Equation\ 4)$$

where,

Δ_{total} = Total pile head vertical movement, in. (mm)

Δ_{helix} = Movement of helix plates within soil, in. (mm)

Δ_{shaft} = Shaft elastic shortening, in. (mm)

The reliability of 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

4.1.7.1 Helix Movement: The evaluation of helix movement due to helix deformation, soil deformation, and the helix-soil interaction, is beyond the scope of this evaluation report.

4.1.7.2 Shaft Elastic Shortening: Elastic shortening of the Precision Helical Pier 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:

$$\Delta_{shaft} = \frac{PL}{EA} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad (Equation\ 5)$$

where,

Δ_{shaft} = Length change of shaft resulting from elastic shortening, in. (mm).

P = Applied axial load, lbf (N).

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

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

A = Cross-sectional area of the shaft, in.^{2} (mm^2). See Table 2A.

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

4.2 Installation:

The Precision Helical Piers must be installed by certified and trained installers approved by Precision Piers. The Precision Helical Piers must be installed in accordance with this section; IBC Section 1810.4.11; approved site-specific construction documents; and the manufacturer's published installation instructions, which must be available at the jobsite at all times during installation. In case of a conflict, the most stringent requirement governs.

4.2.1 Helical Pile Installation: The helical piles must be installed and located in accordance with the approved plans and specifications. The helical piles are typically installed using hydraulic rotary motors. In conjunction with rotating the pile, an axial force [sufficient to cause the pile to penetrate the earth at a rate of approximately 2.5 – 3.0 inches (63.5 – 76.2 mm) per revolution] is also applied. The installation speeds must be limited to less than 25 revolutions per minutes (rpm). The installation torque must not exceed the Maximum Installation Torque Rating, as described in Table 4. Helical piles must be installed vertically into the ground with a maximum allowable angle of inclination of ±1 degree from vertical. The helical piles must be rotated clockwise in a continuous manner with the lead shaft section advancing at the helix pitch. Extensions are selected based on the approved plans as specified per the site conditions by a registered design professional. The extensions and the lead shaft section must be connected by the use of the designed number of coupler bolts and nuts as described in Section 3.2.3. Coupler bolts must be snug-tightened as defined in Section J3 of AISC 360. Care shall be taken not exceed the maximum installation torque rating, as shown in Table 4, of the helical pile during installation. Helical piles must be advanced until axial capacity is verified by achieving the required final installation torque as indicated by the torque correlation method described in Section 4.1.5, and the minimum depth, if any, as specified by the geotechnical report and the approved plans (Section 4.1.1).

4.2.2 Foundation Attachments:

4.2.2.1 Repair Bracket: The repair bracket must be installed as specified in the approved plans, while considering the following:

1. The repair bracket is installed by excavating the bottom of the footing or foundation, large enough to provide access for bracket installation. The excavation is extended under the footing for 14 inches (356 mm) below the footing. Excavation width is 26 inches (660 mm).
2. The footing should be prepared prior to installing the helical pier. Soil attached to the bottom of the footing or grade beam must be removed. The footing or grade beam must be prepared by chipping away irregularities from the bottom and side faces. Notching the footing or grade beam is recommended to allow the bracket to mount directly and adjacent to the load bearing wall, but must be performed with the approval of the registered design professional and the code official. Reinforcing steel within the footing must not be cut without the approval of the registered design professional and the code official.
3. The vertical and horizontal surfaces of the footing or grade beam must be flat and reasonably smooth before the bracket is mounted. The surfaces must be free of all soil, debris and loose concrete, so as to provide a firm bearing surface for the repair bracket.

4. After the helical pile installation per Section 4.2.1, any excess length must be cut off to allow for mounting to the bracket. The pile shaft is cut off squarely at least 8 inches (203 mm) up from bottom of footing, which may change depending on the amount of lift. All field-cut or drilled pilings may be protected from corrosion as recommended by the registered design professional and approved by the code official.
5. The bracket is installed by placing the bracket collar around the pile shaft and rotating it to set in line with the underside of the stem or basement wall. Place non-shrink grout in any small voids between bracket seat and concrete footing to provide a uniform load bearing substrate.
6. Two $^5/_8$x5" THDB62500HMG Simpson Strong-Tie® Titen HD® Screw Anchors, which are addressed in ESR-2713, must be used to attach the back plate of the 102 repair bracket (FBB14121235) to the foundation/grade beam side. Anchors installation shall be in accordance with ESR-2713.
7. The lifting Tee is then placed in the pile shaft, and threaded rods, nuts and washers are added to hold the bracket in position. Lifting jacks/devices are installed to raise the foundation to the desired elevation. Any lifting of the existing structure must be verified by a registered design professional and is subject to approval of the code official to ensure that the foundation, superstructure, and helical piles are not overstressed. The bracket can be lifted only after the non-shrink grout placed during bracket installation has cured.
8. Once the foundation has been stabilized or raised to its desired elevation and the hex nuts over the lifting cap are snug-tightened in accordance with Section J3 of AISC 360, then the lifting jacks are removed.
9. The excavation must be backfilled with properly compacted soil in accordance with IBC Section 1804. Excess soil and debris must be removed.

4.2.2.2 New Construction Pile Cap (Bracket): Design and installation of new construction brackets are outside the scope of this evaluation report and must be determined by a registered design professional in accordance with the applicable codes.

4.3 Special Inspection:

Continuous special inspection in accordance with IBC Section 1705.9 must be provided for the installation of the helical 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 recorded and confirmed by the special inspector must include, but are not necessarily limited to, the following:

1. Verification of product manufacturer and the manufacturer's certification of the installers.
2. Verification of product types and configurations for helical pile lead shaft sections, extensions, brackets, bolts, threaded rods, nuts, and washers as specified in this report and the construction documents.
3. Installation procedures and installation equipment used.
4. Verification that the actual, as-constructed pile tip embedment and effective torsional resistances are within the limits specified in the construction documents.
5. Field cutting, bolting, and welding as specified in the approved construction documents and this evaluation report.
6. Inclination and position of helical piles.
7. Verification that the top plate of the bracket is in full contact with the top of the pile shaft.
8. Tightness of all bolts and threaded rods.
9. Verification of absence of cracks in the foundation in the vicinity of the bracket.
10. Compliance of the installation with the approved geotechnical report, construction documents, and this evaluation report.
11. Other pertinent installation data as required by the registered professional in charge.

5.0 CONDITIONS OF USE:

The Precision Helical Piers described in this report comply with, or are 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 Precision Helical Piers have been evaluated for support of structures assigned to Seismic Design Categories A, B and C in accordance with the IBC. Helical foundation systems that support structures assigned to Seismic Design Categories D, E or F in accordance with the IBC are outside the scope of this evaluation report, and are subject to the approval of the code official based upon submission of a design in accordance with the code by a registered design professional.

5.2 Evaluation of compliance with IBC Section 1810.3.11 for buildings assigned to Seismic Design Category (SDC) C through F, and with IBC Section 1810.3.6 for all buildings, is outside the scope of this evaluation report. Such compliance must be addressed by a registered design professional for each site, and is subject to approval by the code official.

5.3 Type A (Side Load) brackets are limited to compression loads only.

5.4 Brackets must be used only to support structures that are laterally braced as defined in IBC Section 1810.2.2. Shaft couplers must be located within firm or soft soil as defined in Section 4.1.3.

5.5 Installations of brackets and pile caps are limited to regions of concrete members where analysis indicates no cracking at service load levels.

5.6 Use of Precision Helical Piers in exposure 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 landfill; or (6) soil containing mine waste is beyond the scope of the evaluation report.

5.7 Zinc-coated steel and bare steel components must not be combined in the same system, except where the sacrificial thickness for the zinc-coated components is taken as that for bare steel components (0.036 inch or 915 µm). All helical foundation components must be galvanically isolated from concrete reinforcing steel, building structural steel, or any other metal building components.

5.8 The helical piles must be installed vertically into the ground with a maximum allowable angle of inclination of 1 degree from vertical. To comply with the requirements found in IBC Section 1810.3.1.3, the superstructure must be designed to resist the effects of helical pile eccentricity.

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

5.10 A soil investigation (geotechnical report) in accordance with Section 4.1.1 of this report must be submitted to the code official for approval under the IBC.

5.11 The load combinations prescribed in 2024 and 2021 IBC Section 1605.1 (2018 and 2015 IBC Section 1605.3.1) must be used to determine the applied loads. When using the alternative basic load combinations prescribed in the 2024 and 2021 IBC Section 1605.2 (2018 and 2015 IBC Section 1605.3.2), the allowable stress increases permitted by material chapters of the IBC (Chapters 19 through 23, as applicable) or the referenced standards are prohibited.

5.12 Engineering calculations and drawings must be in accordance with recognized engineering principles as described in IBC Section 1604.4, in compliance with Section 4.1 of this report, prepared by a registered design professional, and approved by the code official.

5.13 The applied loads must not exceed the allowable capacities described in Section 4.1 of this report.

5.14 The adequacy of the concrete structures that are connected to the brackets must be verified by a registered design professional in accordance with applicable code provisions, and is subject to the approval of the code official.

5.15 The minimum helical pile center-to-center spacing upon which this evaluation report is based is four times the largest helical bearing plate diameter. For piles with closer spacing, the pile 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 pile design by a registered design professional, and subject to the approval of the code official.

5.16 Requirements described in footnotes of tables in this report must be satisfied.

5.17 Settlement of helical piles is beyond the scope of this evaluation report and must be determined by a registered design professional as required in IBC Section 1810.2.3 based on shaft (including coupler) information prescribed in this evaluation report and in consultation with the pile manufacturer.

5.18 The Precision Helical Piers are manufactured in Everett, Washington, 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 Pile Systems and Devices (AC358), dated June 2020 (editorially revised February 2024).

7.0 IDENTIFICATION

7.1 The ICC-ES mark of conformity, electronic labeling, or the evaluation report number (ICC-ES ESR-5049) along with the name, registered trademark, or registered logo of the report holder (Precision Piers) must be included in the product label.

7.2 In addition, the Precision Helical Pier system (including lead shafts, extensions, brackets, and boxed hardware) are identified by a tag or label bearing the address of Precision Piers and parts' model/size.

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

PRECISION PIERS
3411 HAYES STREET
EVERETT, WASHINGTON 98201
(833) 641-7111
www.precisionpiers.com

TABLE 1—BRACKET CAPACITY (P1) [1,4]

PRODUCT [Model No.]	DESCRIPTION	SHAFT SIZE. (inches)	ALLOWABLE ASD COMPRESSION CAPACITY (kips)	
			Bare Steel [2]	Zinc-Coated Steel [3]
101 Bracket [FB141212350]	Repair Bracket Without Back Plate	$2^7/_8$ x 0.217	29.50	29.50
102 Bracket [FBB14121235]	Repair Bracket With Back Plate[5]	$2^7/_8$ x 0.217	22.56	22.56

For **SI** Units: 1 inch = 25.4 mm, 1 kip (1000 lbf) = 4.448 kN.

[1] The capacities listed in Table 1 assume the pile foundation system is sidesway braced per IBC Section 1810.2.2.
[2] Allowable capacities are based on bare steel losing 0.036-inch (915 µm) steel thickness due to corrosion as indicated in Section 3.9 of AC358 for a 50-year service life.
[2] Allowable capacities are based on zinc-coated steel losing 0.013-inch (318 µm) steel thickness due to corrosion as indicated in Section 3.9 of AC358 for a 50-year service life.
[4] Load capacity is based on full scale load tests per AC358 with an installed 5'-0" unbraced pile length having a maximum of one coupler per IBC Section 1810.2.1. Repair brackets must be concentrically loaded and the bracket plate must be fully engaged with bottom of concrete foundation. Only localized limit states such as mechanical strength of steel components and concrete bearing have been evaluated. Minimum specified compressive strength of concrete is 2,500 psi (17.24 MPa).
[5] Two anchors must be used to attach the back plate of the 102 Bracket to the foundation as specified in Item 6 in Section 4.2.2.1 of this evaluation report.

TABLE 2A—MECHANICAL PROPERTIES OF HELICAL PILE SHAFT AFTER CORROSION LOSS

MECHANICAL PROPERTIES	SHAFT SIZE	
	$2^7/_8$ x 0.217-inch	
Steel Yield Strength, F_y (ksi)	80	
Steel Ultimate Strength, F_u (ksi)	95	
Modulus of Elasticity, E (ksi)	29,000	
Nominal Wall Thickness (inch)	0.217	
Steel Finish	Bare Steel [1]	Zinc-Coated Steel [2]
Design Wall Thickness (inch)	0.129	0.152
Outside Diameter (inch)	2.799	2.822
Inside Diameter (inch)	2.542	2.519
Cross Sectional Area ($inch^2$)	1.08	1.27
Moment of Inertia, I ($inch^4$)	0.96	1.14
Radius of Gyration, r (inch)	0.95	0.95
Section Modulus, S ($inch^3$)	0.69	0.81
Plastic Section Modulus, Z ($inch^3$)	0.92	1.08

For **SI** Units: 1 inch = 25.4 mm; 1 ksi = 6.895 MPa.

[1] Dimensional properties are based on bare steel losing 0.036-inch (915 µm) steel thickness as indicated in Section 3.9 of AC358 for a 50-year service life.
[2] Dimensional properties are based on zinc-coated steel losing 0.013-inch (318 µm) steel thickness as indicated in Section 3.9 of AC358 for a 50-year service life.

TABLE 2B—SHAFT ALLOWABLE CAPACITY (P2) WITH COUPLER(S) ECCENTRICITY (kips) [1]

SHAFT SIZE	UNBRACED SHAFT LENGTH, L_u (ft) [2]	ALLOWABLE ASD COMPRESSION CAPACITY (kips) [3]					
		Bare Steel [4]			Zinc-Coated Steel [5]		
		0 Coupler	1 Coupler[6]	2 Couplers[6]	0 Coupler	1 Coupler[6]	2 Couplers[6]
2^7/$_8$ x 0.217-inch	0	51.25	51.25	51.25	60.42	60.42	60.42
	5	17.39	14.21	9.21	20.20	16.47	10.63
	10	7.92	7.19	5.64	9.21	8.35	6.53
	15	4.22	4.00	3.47	4.92	4.66	4.04
	20	2.63	2.55	2.32	3.08	2.97	2.71

For **SI** Units: 1 inch = 25.4 mm; 1 ft = 0.305 m; 1 kip (1000 lbf) = 4.448 kN.

[1] The capacities shown in Table 2B are for helical piles installed with a maximum 1 degree of inclination and the assumption that the pile shaft is concentrically loaded. Tension and lateral capacities are outside the scope of this evaluation report.

[2] L_u=Total unbraced pile length per IBC Section 1810.2.1, including the length in air, water or in fluid soils, and the embedment length into firm or soft soil (non-fluid soil). For other unbraced lengths, the shaft capacity of the helical foundations must be determined by a registered design professional.

[3] Provided values are based on an effective length factor (k) of 0.8. Refer to Section 4.1.3 of this report for description of the pile's end conditions. For other conditions, the pile shaft capacity must be determined by a registered design professional and subjected to approval of the code official.

[4] Allowable capacities are based on bare steel losing 0.036-inch (915 µm) steel thickness due to corrosion as indicated in Section 3.9 of AC358 for a 50-year service life.

[5] Allowable capacities are based on zinc-coated steel losing 0.013-inch (318 µm) steel thickness due to corrosion as indicated in Section 3.9 of AC358 for a 50-year service life.

[6] Number of couplers within L_u.

TABLE 3—HELICAL BEARING PLATE CAPACITY (P3)

SHAFT SIZE	HELIX DIAMETER (inches)	HELIX THICKNESS (inch)	HELIX PITCH (inches)	ALLOWABLE ASD CAPACITY (kips) [1]
2^7/$_8$ x 0.217-inch	8	^{3}/$_8$	3.0	38.33
	10	^{3}/$_8$	3.0	40.95
	12	^{3}/$_8$	3.0	33.62

For **SI:** 1 inch = 25.4 mm, 1 kip = 4.448 kN.

[1] Allowable capacities are based on bare steel losing 0.036-inch (915 µm) steel thickness due to corrosion as indicated in Section 3.9 of AC358 for a 50-year service life.

TABLE 4—SOIL CAPACITY (P4) – AXIAL COMPRESSION[1]

HELICAL PILE SIZE	GEOTECHNICAL RELATED PROPERTIES	ALLOWABLE ASD CAPACITY (kips)
		Compression
2^7/$_8$ x 0.217-inch	Mechanical Torsion Rating of shaft (ft-lbs) [2]	6,843
	Maximum Torque per Soil Tests (ft-lbs) [3]	6,893
	Maximum Installation Torque Rating (ft-lbs) [4]	6,843
	Torque Correlation Factor, K_t (ft^{-1})	9
	Maximum Ultimate Soil Capacity / Maximum Allowable Soil Capacity (P4) from Torque Correlations (kips) [5]	61.59 / 30.79

For **SI:** 1 foot = 0.305 m, 1 lbf = 4.448 N, 1 lbf-ft = 1.356 N-m.

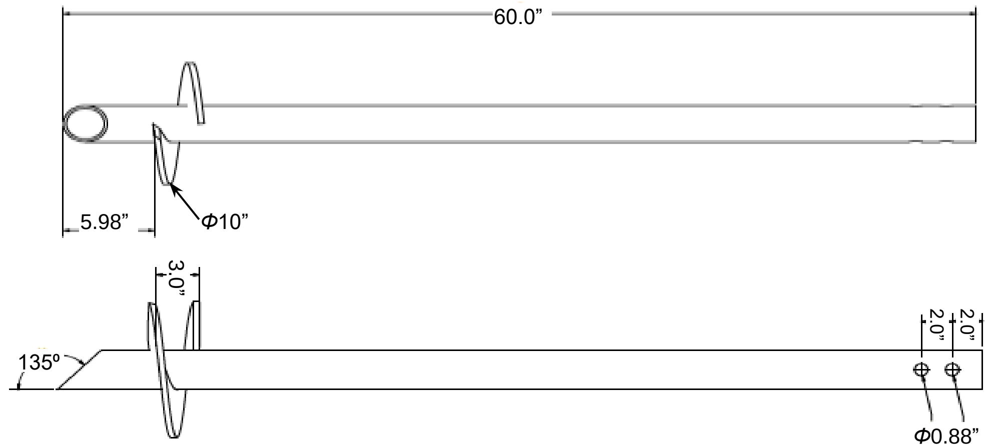
[1] Soil capacity (P4) must be determined per Section 4.1.5 of this report.

[2] Mechanical torsion rating is the maximum torsional resistance of the steel shaft.

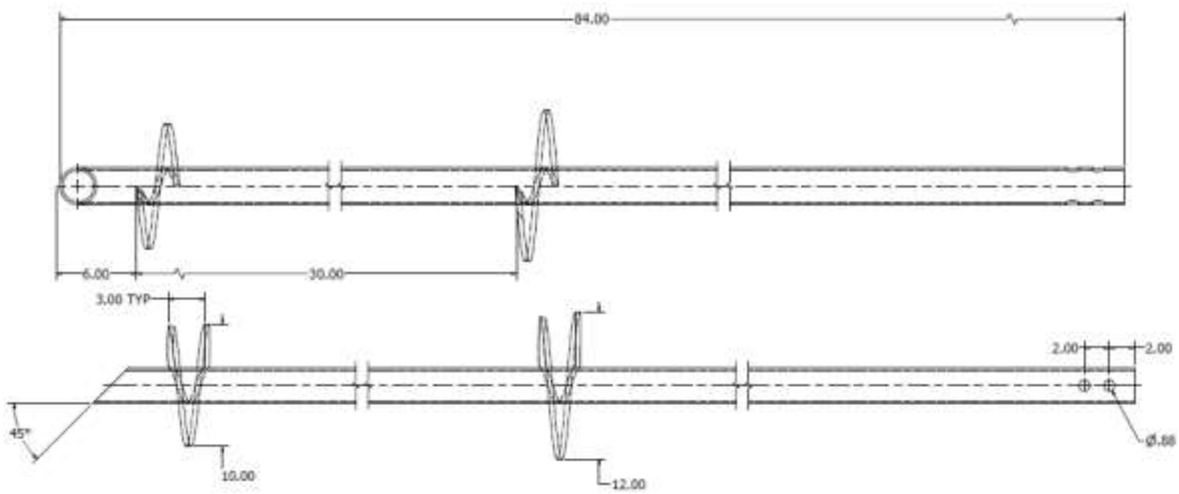
[3] Maximum torque per soil tests is the maximum torque achieved during field axial verification testing that was conducted to verify the pile axial capacity related to pile-soil interaction.

[4] Maximum installation torque rating is the lower of the "mechanical torsion rating" and the "maximum torque per soil tests".

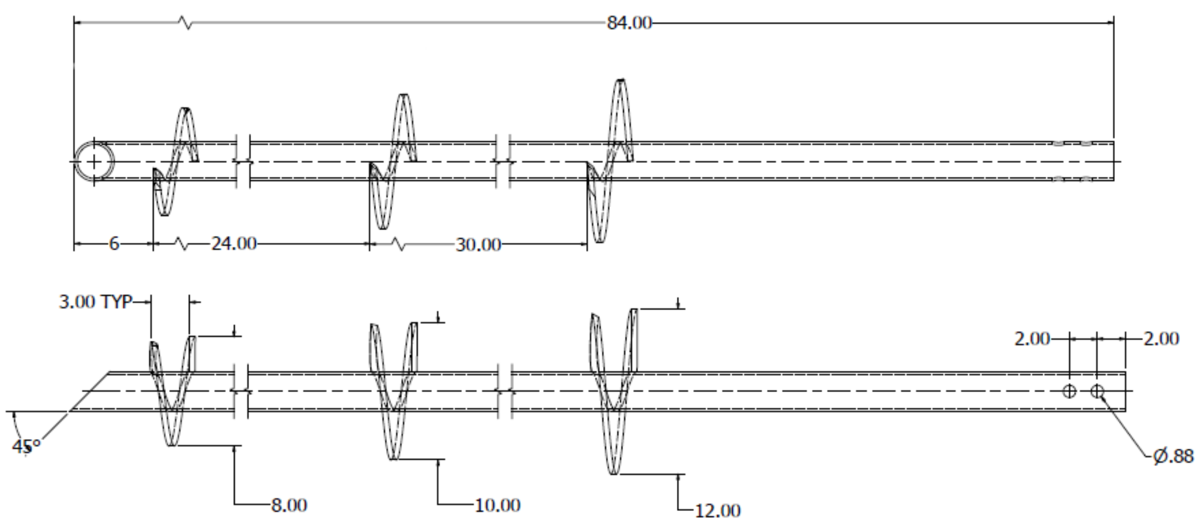
[5] Maximum ultimate soil capacity is determined from $Q_{ult} = K_t \times T$ based on the corresponding maximum installation torque rating for the specific pile model. Allowable soil capacity is determined from $Q_{all} = Q_{ult} /2.0$ based on the corresponding maximum installation torque rating for the specific pile model. See Section 4.1.5 for additional information.



Model No. HP287560130: Single Helix (10” Diameter) Lead Section



Model No. PP2870-702: Double Helix (10” & 12” Diameters) Lead Section



Model No. PP2870-703: Triple Helix (8”, 10” & 12” Diameters) Lead Section

FIGURE 1—LEAD SHAFT SECTIONS OF THE 2$^7/_8$ X 0.217-INCH HELICAL PILE

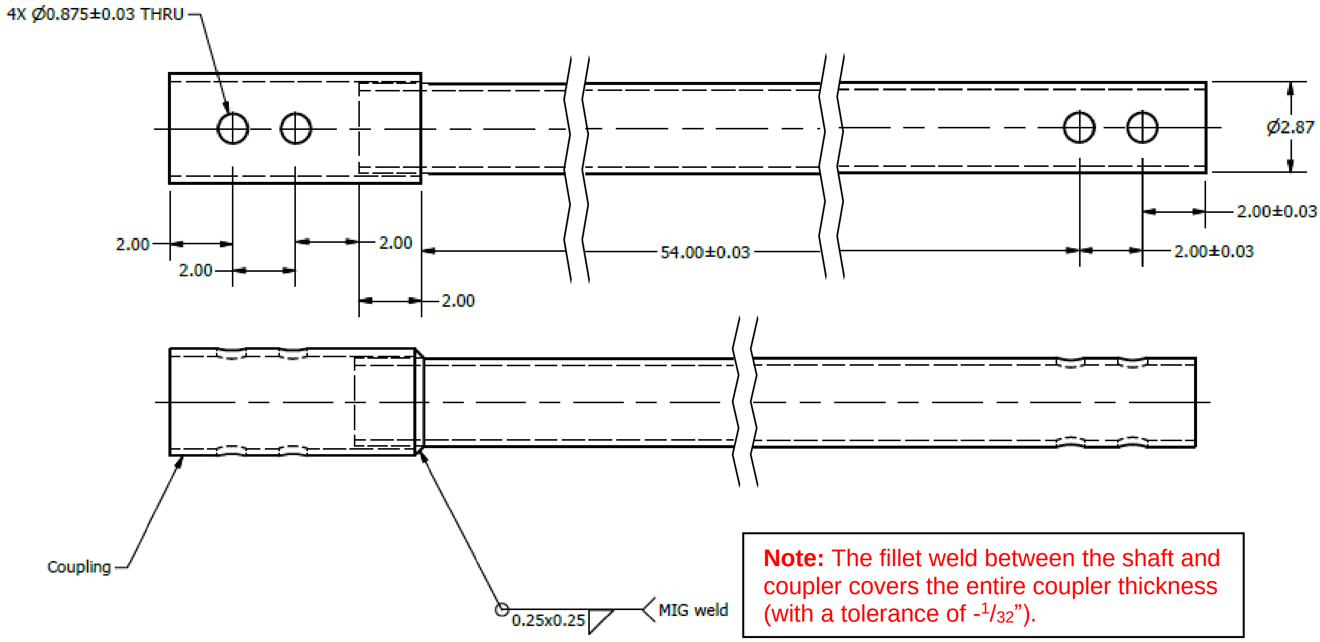


FIGURE 2—EXTENSION SHAFT SECTION OF THE $2^7/_8$ X 0.217-INCH HELICAL PILE (Model No. EXT2882175)

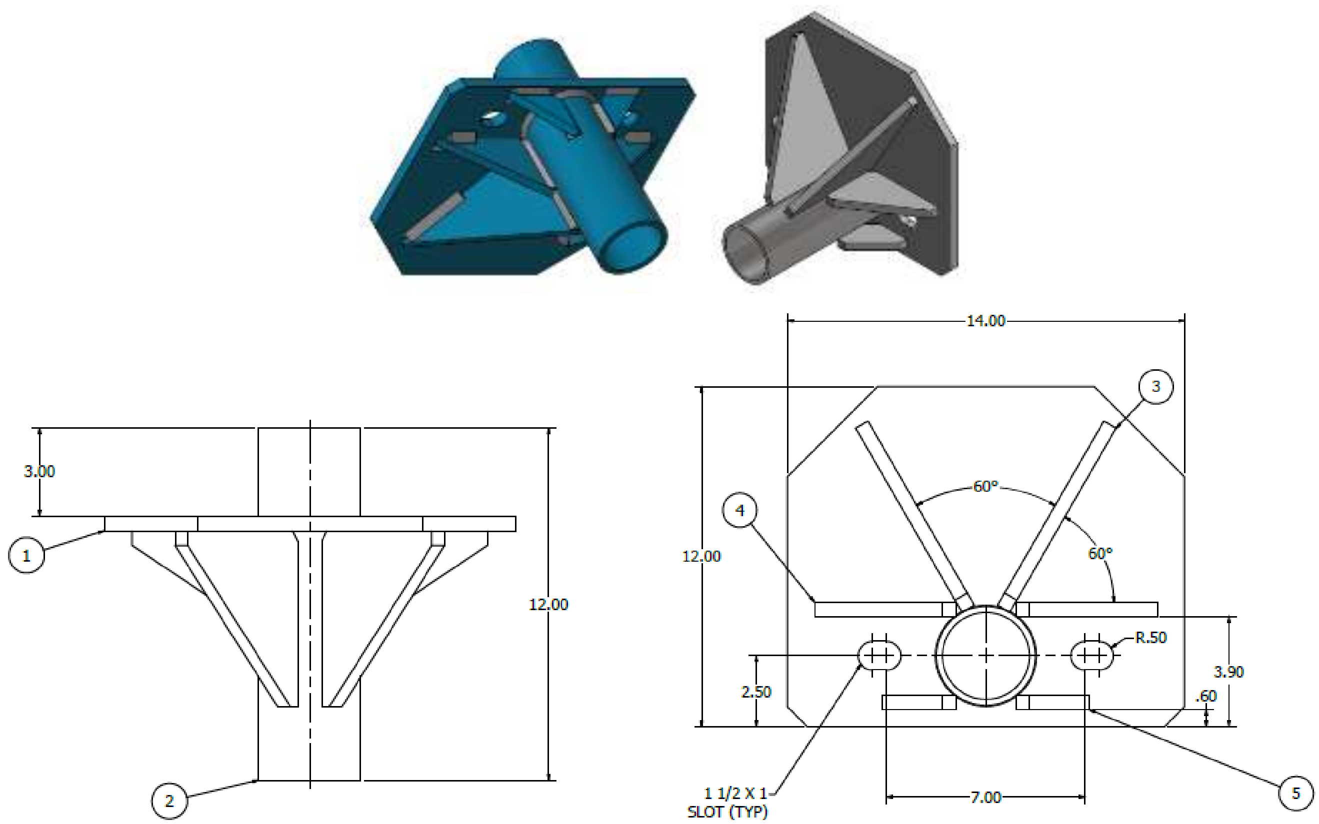


FIGURE 3—101 REPAIR BRACKET WITHOUT BACK PLATE (Model No. FB141212350)

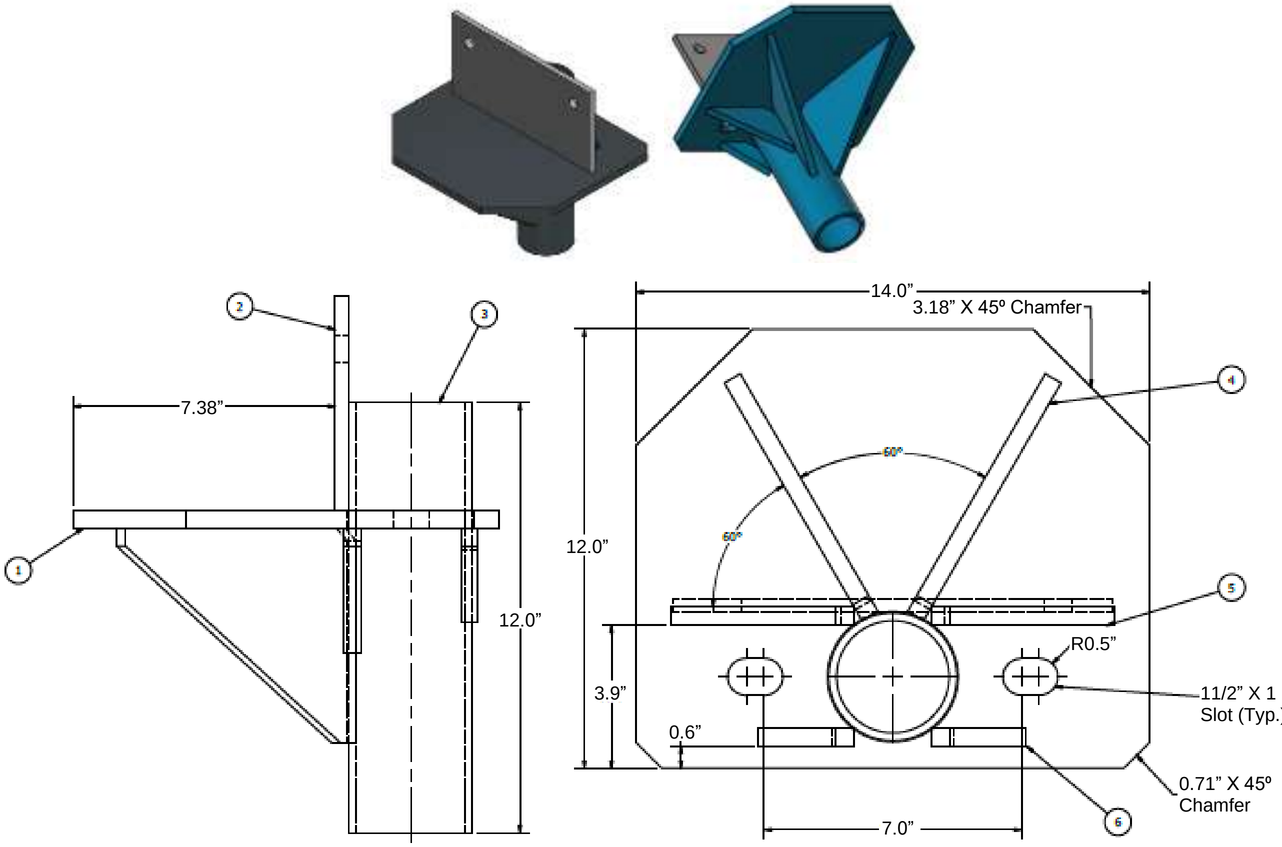


FIGURE 4—102 REPAIR BRACKET WITH BACK PLATE (Model No. FBB14121235)

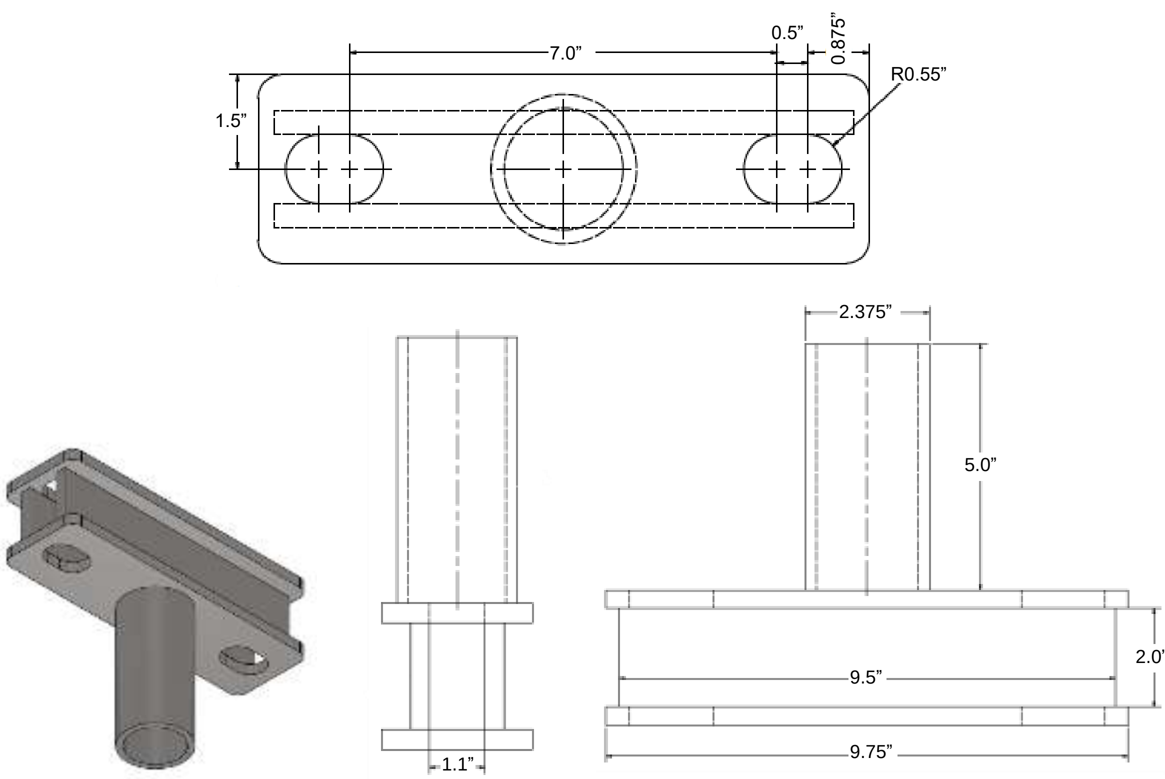


FIGURE 5—TEE PART (Model No. TB10030000) FOR REPAIR BRACKETS (With or Without Back Plate)