2.5 The push pier foundation systems have not been evaluated for use in soil conditions that are indicative of a potential pier deterioration or corrosion situation 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.

2.6 Zinc-coated steel and bare steel components shall not be combined in the same system, except where the sacrificial thickness (Ti) for the zinc-coated components is taken as that given for bare steel components. All push pier foundation components shall be galvanically isolated from concrete reinforcing steel, building structural steel, or any other metal building components.

2.7 The push pier shafts shall be installed at a maximum angle of 3.0 ± 1.0-degrees from the vertical.

2.8 Special inspection is provided in accordance with Section 3.4 of this report.

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

2.10 The adequacy of the concrete structures that are connected to the brackets shall be verified by a registered design professional, in accordance with applicable code provisions, such as Chapter 15 of ACI 318 and Chapter 18 of IBC, and subject to the approval of the building official.

2.11 A geotechnical investigation report for each project site shall be provided to the building official for approval in accordance with Section 3.2.1 of this report.

2.12 When using the alternative basic load combinations prescribed in Section 1605.2 of the 2021 IBC and Section 1605.3.2 of the 2018, 2015, 2012, and 2009 IBC, the allowable stress increases permitted by material chapters of the IBC (including Chapter 18) or the referenced standards are prohibited.

2.13 Evaluation of compliance with Chapter 18 of the IBC for buildings assigned to Seismic Design Category C, and with Section 1810.3.6 of the IBC for all buildings, is outside the scope of this evaluation report. Such compliance shall be addressed by a registered design professional for each site, and the work of the design professional shall be subject to approval of the building official.

2.14 Settlement of push piers is beyond the scope of this evaluation report and shall be determined by a registered design professional as required in Section 1810.2.3 of the IBC.
2.15 Allowable lateral load resistance capacities of the system are outside the scope of this report.

2.16 The Model PP288 push pier foundation system components are manufactured at the following facilities: Behlen Manufacturing Company, Columbus, Nebraska; PowerBrace, Des Moines, Iowa; and TSA Manufacturing, Omaha, Nebraska. The Model PP237 push pier foundation system components are manufactured at the following facilities: Behlen Manufacturing Company, Columbus, Nebraska; and TSA Manufacturing, Omaha, Nebraska.

3.0 PRODUCT USE

3.1 General: Supportworks, Inc. Models PP288 and PP237 push pier systems are used to support foundations of existing structures or to provide additional axial compression capacity to existing foundation systems. The systems are alternatives to driven piles described in IBC Section 1810.3.1.4.

3.2 Design: Structural calculations (analysis and design) and drawings, prepared by a registered design professional, shall be approved by the building official for each project, and shall be based on accepted engineering principles as described in IBC Section 1604.4, and shall conform to IBC Section 1810. The design methods for the steel components are Allowable Strength Design (ASD), described in the IBC and AISC 360 Section B3.4. The structural analysis shall consider all applicable internal forces due to applied loads, structural eccentricity and maximum span(s) between push pier foundations. The structural analysis, the IBC, and this report shall be used to select an appropriate push pier system.

The ASD capacities of push pier system components are indicated in Table 2 of this report. The geotechnical investigation shall address the suitability of the push pier system for the specific project. The requirements for deep foundations in IBC Section 1803.5.5 shall be considered. In addition, effects on the supported foundation and structure and group effects on the pile-soil capacity shall be considered. The investigation shall provide estimates of the axial compression capacities for the push piers, and the expected total and differential settlements due to single pier or pier group, as applicable.

3.2.1 A written report of the geotechnical investigation shall be submitted to the building official as one of the required submittal documents, prescribed in IBC Section 107, at the time of the permit application. The geotechnical report shall comply with provisions in IBC Section 1803.6 and also include, but need not be limited to, the following information:

1. Information on groundwater table, frost depth and corrosion-related parameters, as described in Section 2.5 of this report.
2. Soil properties, including those affecting the design such as support conditions for the piers.
3. Recommendations for design criteria.
4. Any questionable soil characteristics and special design provisions, as necessary.

3.2.2 Bracket Capacity (P1): Only localized limit state of concrete bearing strength in compression has been evaluated in this evaluation report for compliance with IBC Chapter 19 and ACI 318. All other structural requirements in IBC Chapter 19 and ACI 318 applying to the concrete foundation, such as those limit states described in ACI 318 [anchorage per Appendix D, punching (two-way) shear, beam (one-way) shear, and flexural (bending) related limit states], have not been evaluated in this evaluation report. The concrete foundation shall be designed and justified to the satisfaction of the building official with due consideration to structural detailing, applicable limit states, and the direction and eccentricity of applied loads, including reactions provided by the brackets, acting on the concrete foundation.

3.2.3 Shaft Capacity (P2): The top of shafts shall be braced as prescribed in Section 1810.2.2 of the IBC. In accordance with Section 1810.2.1 of the IBC, any soil other than fluid soil shall be deemed to afford sufficient lateral support to prevent buckling of systems that are braced. When piers are standing in air, water, or fluid soils, the unbraced length is defined as the length of piers that is standing in air, water, or fluid soils plus an additional 5 feet (1524 mm) when embedded into firm soil or an additional 10 feet (3048 mm) when embedded into soft soil. Firm soils shall be defined as any soil with a Standard Penetration Test (SPT) blow count of five or greater. Soft soil shall be defined as any soil with a SPT blow count greater than zero and less than five. Fluid soils shall be defined as any soil with a SPT blow count of zero [weight of hammer (WOH) or weight of rods (WOR)]. The SPT blow counts shall be determined in accordance with ASTM D1586. For fully braced conditions where the pier is installed in accordance with Section 1810.2.2 of the IBC, and piers do not stand in air, water, or fluid soils, the shaft capacities shall not exceed the ASD shaft compression capacities shown in Table 2 of this report. Shaft capacities of push pier foundation systems in air, water, or fluid soils, shall be determined by a registered design professional.

The elastic shortening/lengthening of the pier shaft will be controlled by the variation of applied loads from the pier lock-off load and the mechanical and geometrical properties of the 27/8-inch (73 mm) and 215/8-inch (60 mm) round structural tubing. The shaft elastic shortening may be determined from equation Eq.-1:

1. Information on groundwater table, frost depth and corrosion-related parameters, as described in Section 2.5 of this report.
2. Soil properties, including those affecting the design such as support conditions for the piers.
3.3.2 Retrofit Bracket Installation:

1. An area shall be excavated approximately 3 feet (914 mm) square and to a depth approximately 9 to 13 inches (229 to 330 mm) below the bottom of footing at the push pier location. The soil shall be removed below the bottom of footing to about 9 inches (229 mm) from the footing face in the area where the bracket bearing plate will be placed. The vertical and bottom faces of the footing shall, to the extent possible, be smooth and at right angles to each other for the mounting of the support bracket. The concrete surfaces shall be free of all soil, debris, and loose concrete so as to provide a full and firm contact of the retrofit bracket.

2. Notching of the footings may be needed to place the retrofit bracket directly under the wall/column. Notching shall be performed, however, only with the acceptance of the registered design professional and the approval of the building official.

3. The bracket shall be placed under the footing and raised into position with the horizontal and vertical bearing plates in full contact with the concrete surfaces. The bracket shall be temporarily held in place using wood cribbing or other mechanical means. The under-footing brackets do not require mechanical anchorage to the concrete foundation.

4. The external sleeve shall be placed over the starter tube and both the external sleeve and starter tube shall be inserted through the bracket from the top. Care shall be taken that the sleeve and starter are properly aligned and extend past both the top and bottom plates of the bracket.

5. The drive stand shall be secured to the bracket, the hydraulic drive cylinder attached to the drive stand and connected to the hydraulic operating system.

6. The drive stand shall be aligned by activating the hydraulics and extending the drive cylinder rod to make slight contact with the starter tube section. A digital level, protractor, or other device shall be used to check alignment of the drive stand, sleeve, starter and bracket. The alignment shall be adjusted as necessary to allow a 3.0 ±1.0-degree installation angle. Temporary cribbing may be used between the drive stand and the foundation wall to set the correct installation angle while advancing the starter tube and external sleeve.

7. The external sleeve and starter tube shall be driven together until the end of the sleeve is seated at the top of the bracket. Pier tubes shall then be coupled and pushed through the external sleeve. When the maximum cylinder stroke has been reached, the cylinder shall be retracted, a drive tube tool shall be set in place, and the push shall be completed to the top of the bracket or external sleeve.

8. The drive pressure at the final stroke of each pier tube section shall be recorded. This process shall continue until the pre-determined drive pressure (final drive force) is achieved or the structure starts to lift. After reaching the final drive force, the pressure shall be released from the hydraulic system and the drive stand and drive cylinder shall be removed from the bracket. The drive process shall be repeated at each of the proposed pier locations. The final drive force shall not exceed the maximum drive force rating of the push pier system as listed in Table 2 (Note #4) of this report.

9. A lift cylinder shall be connected to each retrofit bracket assembly to lift the structure to the desired elevation and/or transfer the designated portion of the foundation loads to the push pier system.

3.4 Special Inspection: Continuous special inspection in accordance with Section 1705.7 of the 2021, 2018, 2015, and 2012 IBC or Section 1704.8 of the 2009 IBC shall be provided for the installation of foundation piers and foundation brackets. 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, push pier bracket and component configuration and identification, inclination and position of the push piers, final drive force, push pier lock-off load, depth of the foundation piers, and compliance of the installation with the approved construction documents and this evaluation report.

In lieu of continuous special inspection, periodic special inspection as defined in IBC Section 202 is permitted, provided that all following requirements identified below, are satisfied: (1) The installers are certified by the manufacturer and the evidence of installer training and certification by the report holder are provided to the building official; (2) Structural observations in accordance with Section 1704.6 of the 2021, 2018, and 2015 IBC, Section 1704.5 of the 2012 IBC, or Section 1710 of the 2009 IBC, are provided; (3) A periodic inspection schedule, as part of the statement of special inspection, prepared by a registered design professional, is submitted to and approved by the building official. As a minimum, the periodic inspection schedule shall include, but not be limited to, the following:

1. **Before the start of work:** Verify manufacturer, verify installer’s certification by the manufacturer, and confirm push pier and bracket configuration compliance with the approved construction documents and this evaluation report.

2. **Installation of the first push pier foundation system:** Verify that the location, inclination, final drive force, push pier lock-off load and depth of the push piers comply with the approved construction documents and this evaluation report. Verify that installers keep an installation log.

3. **First connection to the building structure:** Verify that installation of brackets complies with the approved construction documents and this evaluation report.

4. **End of work:** Verify that the installation log complies with requirements specified in the approved construction documents. Verify that installation of all structural connections complies with approved construction documents and this evaluation report.

### 4.0 PRODUCT DESCRIPTION

#### 4.1 Product Information

Models PP288 and PP237 push pier systems consist of an under-footing bracket (side load), external sleeve, starter tube with friction-reduction collar, and push pier tube sections with slip-fit couplings. The under-footing bracket is secured against and below the existing footing while pier sections are hydraulically driven (pushed) through the bracket and into the soil below using the combined structural weight and any contributory soil load as drive resistance. Pier sections are added and driven until a suitable load bearing stratum is encountered. The weight of the structure is then transferred through the foundation brackets and piers, and to firm load bearing soil or bedrock.

#### 4.2 PP288 Material Information

##### 4.2.1 Retrofit Bracket Assemblies FS288B, FS288BL, and FS288BL2

The FS288B, FS288BL, and FS288BL2 bracket assemblies consist of a FS288B, FS288BL, or FS288BL2 bracket, an external pipe sleeve (FS288ES48), a cap plate (FS288C), two threaded rods, and matching nuts. The assemblies are illustrated in Figure 1 of this report.

##### 4.2.1.1 FS288B, FS288BL, and FS288BL2 Brackets

The FS288B, FS288BL, and FS288BL2 brackets are constructed from factory-welded, 0.250-, 0.3125-, 0.375-, and 0.500-inch-thick (6.35 mm, 7.94 mm, 9.53 mm, and 12.7 mm) steel plates. The steel plates used in the FS288B and FS288BL brackets conform to ASTM A36, with a minimum yield strength of 36 ksi (248 MPa) and a minimum tensile strength of 58 ksi (400 MPa). The steel plates used in the FS288BL2 bracket conform to ASTM A572, Grade 50, with a minimum yield strength of 50 ksi (345 MPa) and a minimum tensile strength of 65 ksi (448 MPa). The bracket finish is either plain steel or hot-dipped galvanized in accordance with ASTM A123.

##### 4.2.1.2 FS288ES48 External Sleeve

The external sleeve (FS288ES48) is manufactured from a 48-inch-long (1219 mm), 3 1/2-inch outside diameter (89 mm) and 0.216-inch (5.49 mm) nominal wall thickness pipe conforming to ASTM A500, as specified in the quality control documentation. One end of the external sleeve has a 1.00-inch long (25.4 mm) section trumpeted to a final outer diameter of 4.00 inches (101.6 mm). The sleeve finish is either plain steel or hot-dipped galvanized in accordance with ASTM A123.

##### 4.2.1.3 FS288C Cap Plate

The FS288C cap plate is manufactured from a 1-inch-thick (25.4 mm), 4-inch-wide (102 mm), 8.25-inch-long (210 mm) steel plate. The steel cap plate conforms to ASTM A572, Grade 65, having a minimum yield strength of 65 ksi (448 MPa) and a minimum tensile strength of 80 ksi (552 MPa). The cap plate assembly finish is either plain steel or hot-dipped galvanized in accordance with ASTM A123.

##### 4.2.1.4 Threaded Rod and Nuts

The cap plate is attached to the retrofit bracket with two 3/4-inch-diameter by 16-inch-long (19.1 mm by 406 mm) threaded rods, and matching 3/4-inch (19.1 mm) heavy hex nuts. The 3/4-inch-diameter (19.1 mm) steel threaded rods conform to ASTM A193, Grade B7, having a minimum yield strength of 105 ksi (724 MPa) and a minimum tensile strength of 125 ksi (862 MPa). The matching 3/4-inch-diameter (19.1 mm) steel heavy hex nuts conform to ASTM A563 Grade DH or DH3, or ASTM A194 Grade 2H. The threaded rods and nuts are zinc-coated in accordance with ASTM B633, with coating classification Fe/Zn 8.
4.2.2 PP288 Starter and Pier Tube Sections: The central steel shaft of the starter and pier tube sections are 2.875-inch outer diameter (73 mm) by 0.165-inch (4.19 mm) nominal wall thickness hollow structural section in conformance with ASTM A500 as specified in the quality control documentation. Mechanical properties are listed in Table 1 of this report. The starter tube includes a 1.00-inch-long (25.4 mm) by 3.375-inch (85.7 mm) outer diameter friction-reduction collar machined from steel conforming to ASTM A36 with a minimum yield strength of 36 ksi (248 MPa) and a minimum tensile strength of 58 ksi (400 MPa). The starter tube and pier tube shaft finishes are triple coated in-line galvanized.

4.2.3 PP288 Shaft Couplings: The shaft coupling material is factory crimped or plug-welded to one end of the tube section and consists of 2.50-inch (63.5 mm) outer diameter by 0.180-inch (4.57 mm) nominal wall thickness hollow structural section in conformance with ASTM A53 Grade B, Type E & S with a minimum yield strength of 35 ksi (241 MPa), and a minimum tensile strength of 60 ksi (413 MPa). The pier tube shaft coupling finish is plain steel.

4.3 PP237 Material Information

4.3.1 Retrofit Bracket Assembly FS238B: The FS238B bracket assembly consists of an FS238B bracket, an external pipe sleeve (FS238ES48), a cap plate (FS238C), two threaded rods, and matching nuts. The assembly is illustrated in Figure 1 of this report.

4.3.1.1 FS238B Bracket: The FS238B bracket is constructed from factory-welded, 0.250- and 0.375-inch-thick (6.35 mm and 9.53 mm) steel plates. The steel plates conform to ASTM A53, with a minimum yield strength of 36 ksi (241 MPa) and a minimum tensile strength of 58 ksi (400 MPa). The bracket finish is either plain steel or hot-dipped galvanized in accordance with ASTM A123.

4.3.1.2 FS238ES48 External Sleeve: The external sleeve (FS238ES48) is manufactured from a 48-inch-long (1219 mm), 2/16-inch outside diameter (73 mm) and 0.203-inch (5.16 mm) nominal wall thickness pipe with a factory-welded end ring which consists of a 0.75-inch long (19.1 mm), 3/16-inch outside diameter (85.7 mm) and 0.188-inch (4.78 mm) nominal wall thickness pipe. The external sleeve shaft and end-ring conforms to ASTM A500 and ASTM A53, respectively, as specified in the quality control documentation. The sleeve finish is either plain steel or hot-dipped galvanized in accordance with ASTM A123.

4.3.1.3 FS238C Cap Plate: The FS238C cap plate is manufactured from a 0.5-inch-long (12.7 mm), 2/8-inch outside diameter (73 mm) and 0.203-inch (5.16 mm) nominal wall thickness pipe that is factory welded to a 0.75-inch-thick (19.1 mm), 3.75-inch-wide (95 mm), 5.75-inch-long (146 mm) steel plate. The steel pipe conforms to ASTM A53, Grade B, Type E and S, having a minimum yield strength of 35 ksi (241 MPa) and a minimum tensile strength of 60 ksi (413 MPa). The steel cap plate conforms to ASTM A572, Grade 50, having a minimum yield strength of 50 ksi (345 MPa) and a minimum tensile strength of 65 ksi (448 MPa). The cap plate assembly finish is either plain steel or hot-dipped galvanized in accordance with ASTM A123.

4.3.1.4 Threaded Rod and Nuts: The cap plate is attached to the retrofit bracket with two 3/8-inch-diameter by 14-inch-long (15.9 mm by 356 mm) threaded rods, and matching 3/8-inch (15.9 mm) standard hex nuts. The threaded rods conform to ASTM A193, Grade B7, having a minimum yield strength of 105 ksi (724 MPa) and a minimum tensile strength of 125 ksi (862 MPa). The matching standard hex nuts conform to SAE J995 Grade 8. The threaded rods and nuts are zinc-coated in accordance with ASTM B633, with coating classification Fe/Zn 8.

4.3.2 PP237 Starter and Pier Tube Sections: The central steel shaft of the PP237 starter and pier tube sections are 2.375-inch outer diameter (60 mm) by 0.154-inch (3.91 mm) nominal wall thickness hollow structural section in conformance with ASTM A500 as specified in the quality control documentation. Mechanical properties are listed in Table 1 of this report. The starter tube includes a friction reduction collar factory welded to one end. The collar consists of a 1.00-inch-long (25.4 mm), 2/8-inch outside diameter (73 mm) and 0.203-inch (5.16 mm) nominal wall thickness pipe conforming to ASTM A53, Grade B, Type E and S, having a minimum yield strength of 35 ksi (241 MPa) and a minimum tensile strength of 60 ksi (413 MPa). The starter tube and pier tube shaft finishes are either plain steel or hot-dipped galvanized in accordance with ASTM A123.

4.3.3 PP237 Shaft Couplings: The PP237 shaft coupling material is factory crimped to one end of the tube section and consists of 2-inch (50.8 mm) outer diameter by 0.187-inch (4.75 mm) nominal wall thickness hollow structural section in conformance with ASTM A500 Grade C, with a minimum yield strength of 46 ksi (317 MPa) and a minimum tensile strength of 62 ksi (427 MPa). The pier tube shaft coupling finish is either plain steel or hot-dipped galvanized in accordance with ASTM A123.

5.0 IDENTIFICATION

The push pier foundation system components described in this report are identified by labels that include the report holder’s name (Supportworks, Inc.); the name and address of Behlen Manufacturing Company, PowerBrace, or TSA Manufacturing; the product name, the model number (PP288 or PP237); the part number; and the IAPMO UES evaluation report number (ER-289).
Either of the IAPMO Uniform Evaluation Service Marks of Conformity may also be used as shown below:

![IAPMO UES Marks]

**IAPMO UES ER-289**

**6.0 SUBSTANTIATING DATA**

6.1 Data in accordance with IBC Section 1810.3.1.4.

6.2 Test Reports for compression loading Push Pier Foundation System

6.3 Engineering Calculations

**7.0 STATEMENT OF RECOGNITION**

This evaluation report describes the results of research completed by IAPMO Uniform Evaluation Service on Supportworks, Inc. Model PP288 and PP237 Push Pier Systems to assess conformance to the codes shown in Section 1.0 of this report and serves as documentation of the product certification. Products are manufactured at locations noted in Section 2.16 of this report under a quality control program with periodic inspection under the supervision of IAPMO UES.

For additional information about this evaluation report please visit [www.uniform-es.org](http://www.uniform-es.org) or email us at [info@uniform-es.org](mailto:info@uniform-es.org)
FIGURE 1 - FS288B, FS288BL, FS288BL2, and FS238B Retrofit Bracket System Components
### TABLE 1 - MECHANICAL PROPERTIES OF PUSH PIER SHAFTS

<table>
<thead>
<tr>
<th>Mechanical Properties</th>
<th>Un-corroded</th>
<th>After 50 Year Corrosion Loss</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Plain Steel</td>
<td>Plain Steel</td>
</tr>
<tr>
<td></td>
<td>PP288</td>
<td>PP237</td>
</tr>
<tr>
<td>Steel Minimum Yield Strength, F_y</td>
<td>50 ksi</td>
<td>60 ksi</td>
</tr>
<tr>
<td>Steel Minimum Ultimate Strength, F_u</td>
<td>55 ksi</td>
<td>70 ksi</td>
</tr>
<tr>
<td>Modulus of Elasticity, E</td>
<td>29,000 ksi</td>
<td>29,000 ksi</td>
</tr>
<tr>
<td>Nominal Wall Thickness</td>
<td>0.165 in.</td>
<td>0.154 in.</td>
</tr>
<tr>
<td>Design Wall Thickness</td>
<td>0.153 in.</td>
<td>0.143 in.</td>
</tr>
<tr>
<td>Outside Diameter, OD</td>
<td>2.875 in.</td>
<td>2.375 in.</td>
</tr>
<tr>
<td>Inside Diameter, ID</td>
<td>2.569 in.</td>
<td>2.089 in.</td>
</tr>
<tr>
<td>Cross Sectional Area, A</td>
<td>1.31 in²</td>
<td>1.00 in²</td>
</tr>
<tr>
<td>Moment of Inertia, I</td>
<td>1.22 in⁴</td>
<td>0.63 in⁴</td>
</tr>
<tr>
<td>Radius of Gyration, r</td>
<td>0.96 in.</td>
<td>0.79 in.</td>
</tr>
<tr>
<td>Elastic Section Modulus, S</td>
<td>0.85 in³</td>
<td>0.53 in³</td>
</tr>
<tr>
<td>Plastic Section Modulus, Z</td>
<td>1.14 in³</td>
<td>0.71 in³</td>
</tr>
</tbody>
</table>

For SI: 1 inch = 25.4 mm, 1 kip = 1,000 lbf = 4.448 kN

### TABLE 2 - PP288 AND PP237 (WITH RETROFIT BRACKET) ASD COMPRESSION CAPACITIES

<table>
<thead>
<tr>
<th>Bracket Part No.¹</th>
<th>Sleeve Part No.¹</th>
<th>Bracket Description</th>
<th>Allowable Compression Capacity (kips)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Bracket (P1)²</td>
</tr>
<tr>
<td>FS288B or FS288B-G</td>
<td>FS288ES48 or FS288ES48-G</td>
<td>PP288 Standard Bracket w/48” Sleeve</td>
<td>28.5</td>
</tr>
<tr>
<td>FS288BL or FS288BL-G</td>
<td>FS288ES48 or FS288ES48-G</td>
<td>PP288 Low Profile Bracket w/48” Sleeve</td>
<td>25.4</td>
</tr>
<tr>
<td>FS288BL2 or FS288BL2-G</td>
<td>FS288ES48 or FS288ES48-G</td>
<td>PP288 Low Profile Bracket w/48” Sleeve</td>
<td>24.1</td>
</tr>
<tr>
<td>FS238B or FS238B-G</td>
<td>FS238ES48</td>
<td>PP237 2 3/8” Pier Bracket w/48” Sleeve</td>
<td>12.9</td>
</tr>
<tr>
<td>FS238B-G</td>
<td>FS238ES48-G</td>
<td></td>
<td>15.9</td>
</tr>
</tbody>
</table>

For SI: 1 inch = 25.4 mm, 1 kip = 1,000 lbf = 4.448 kN

¹Part numbers with "G" suffix indicate hot-dip galvanized coating. Part numbers without a "G" suffix indicate plain steel.
²Bracket capacities are based on full-scale load tests and assumes a minimum concrete compressive strength (f’c) of 2,500 psi (17.24 MPa).
³Shaft capacities are applicable only to foundation systems that are fully braced as described in Section 3.2.3 of this report.
⁴Soil capacities are determined by taking the final drive force during installation and dividing it by a minimum factor of safety of 2.0. Maximum drive force shall not exceed 60.0 kips for the PP288 system and 30.0 kips for the PP237 system.
⁵Foundation system allowable capacities are based on the lowest of P1, P2, and P4 listed in this table. Section 3.2.5 of this report describes additional requirements.
INTERNATIONAL RESIDENTIAL CODE® (IRC)

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SUPPORTWORKS
PP288 AND PP237 PUSH PIER SYSTEMS

CSI Section:
31 62 00 Driven Piles

1.0 RECOGNITION

Supportworks, Inc. Models PP288 and PP237 push pier systems recognized in ER-289 comply with the intent of the provisions of the following codes and regulations when subject to the additional requirements of this supplement:


2.0 LIMITATIONS

Use of Models PP288 and PP237 push pier foundation systems recognized in this supplement are subject to the following additional limitations specific to the IRC, when installed in accordance with ER-289:

2.1 When a geotechnical report, as required and defined by Section 2.11 and Section 3.2.1, respectively, of ER-289, is not available, the proof-testing requirements of Section 3.3 of this supplement shall be satisfied. The building official may require a soil test in accordance with the 2021, 2018, 2015, and 2012 IRC Section R401.2 and 2009 IRC Section R401.4, where, based on quantifiable data, the presence of questionable soil characteristics such as expansive, compressible, or shifting soils are likely.

2.2 Special inspections, as required and defined in Section 2.8 and Section 3.4 respectively, of ER-289, are not required when the push piers are installed under the provision of the IRC.

2.3 Installation shall be in accordance with Section 3.3 of ER-289. Proof testing shall be performed by installers certified and trained by Supportworks.

2.4 This supplement expires concurrently with ER-289.

3.0 PRODUCT USE

3.1 General: Supportworks, Inc. Models PP288 and PP237 push pier systems are used to support foundations of existing residential structures or to provide additional axial compression capacity to existing foundation systems supporting lightweight construction.

3.2 Design: Design values may be determined in accordance with Section R301 of the IRC or Section 3.2 of ER-289.

3.2.1 System Capacity: The ASD allowable capacity of the push pier foundation system in compression depends upon the analysis of interaction of brackets, shafts, and soils; and shall be the lowest value of P1, P2 as defined in ER-289 and P4 as defined in Section 3.2.2 of this supplement.

3.2.2 Shaft Capacity (P2): When a geotechnical evaluation report is available, the foundation systems shall be considered to be fully braced when installed as defined in Section 3.2.3 of ER-289. When a geotechnical evaluation is not performed, the foundation system shall be considered to be fully braced when piers meet the proof testing requirements of Section 3.3 of this supplement.

3.2.3 Soil Capacity (P4): For determination of allowable soil capacity in axial compression, a minimum factor of safety of 2.0 shall be used.

3.3 Proof Testing: Proof testing, if required, shall be performed on the first push pier installed after the final drive force has been applied and removed. The proof test shall follow the procedure defined in Section 3.3.1 of this supplement and shall meet the acceptance criteria in Section 3.3.2 of this supplement.

3.3.1 Test Procedure: The proof test shall be performed with calibrated equipment. A measuring device consisting of a dial or electronic displacement indicator shall be set up on a reference beam to eliminate pier or foundation movement influence on the displacement indicator readings during testing. The displacement indicator shall be set up to monitor pier head movement upon application of load. The proof test shall maintain the specified loads and hold times shown in the Proof Test Schedule in this section.

<table>
<thead>
<tr>
<th>Proof Test Schedule</th>
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<td>Load Step</td>
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An alignment load (AL) shall be applied prior to the start of the test using a maximum of 5% of the anticipated design service load (DL). After application of the alignment load, the displacement indicator will be reset to zero prior to starting the proof test.
Displacement indicator readings shall be taken at the start and end of each hold time and the specified load must be maintained during the hold time. At the 1.0DL load increment (load step 5), displacement indicator readings shall be taken at 0, 1, 6, and 10 minutes. At the 1.0DL holding time, the displacement during the first log cycle of time is the amount of movement between the 1 and 10 minute readings. If the movement during the first log cycle of time is more than allowed in Section 3.3.2 of this supplement, the load will be maintained to obtain readings for the second log cycle of time, which is defined as the movement between the 6 and 60 minute readings.

3.3.2 Acceptance Criteria of Proof Testing: The proof test shall be acceptable if the total movement during the first log cycle of time (1 and 10 minute readings) at the 1.0DL load increment is 0.040 inch or less. If the movement is more than 0.040 inch, the 1.0DL load increment shall be held for an additional 50 minutes to obtain the movement during the second log cycle of time (6 and 60 minutes). The proof test shall be acceptable if the total movement during the second log cycle of time is 0.080 inch or less. If the total movement is more than 0.080 inch during the second log cycle of time measurement, the pier shall be derated to a design capacity that meets the proof test failure criteria.

3.4 Field Reports: A push pier installation report shall be prepared documenting the design loads, pier locations, bracket and pier types, pier inclinations, drive forces applied during the installation of each pier section, final drive forces, final depths and push pier lock-off loads.

If proof testing is required, a proof-test report shall be prepared documenting the test setup, equipment calibrations, pier head deflection readings at the start and end of all loading intervals and confirmation that the acceptance criteria has been met. Piers that have had the design load decreased based on proof testing shall be detailed in the field reports and the registered design professional’s calculations. The field reports shall be reviewed and sealed by a registered design professional. If required, the proof-test report shall be submitted to the building official for approval within 10 days after the proof testing.