• Consistent performance in high & low strength concrete
• Nominal bit size matches anchor diameter; anchor can be installed through standard fixture holes
• High shear load capacity

Power-Bolt+ (PB+)
Heavy Duty Sleeve Anchor

CODE LISTED
ICC-ES ESR-3260

NEW!
**PRODUCT DESCRIPTION**

The Power-Bolt+ anchor is a torque controlled, heavy duty sleeve style anchor which is designed for consistent performance in cracked and uncracked concrete. Suitable base materials include normal-weight concrete and sand-lightweight concrete. The anchor is manufactured with a zinc plated carbon steel bolt, sleeve, cone and expansion clip. The PB+ has a finished hex head.

**GENERAL APPLICATIONS AND USES**

- Structural connections, i.e., beam and column anchorage
- Safety-related attachments and tension zone applications
- Interior applications / low level corrosion environment
- Heavy duty applications

**FEATURES AND BENEFITS**

- Consistent performance in high and low strength concrete
- Nominal drill bit size is the same as the anchor diameter
- Anchor can be installed through standard fixture holes
- Length ID code and identifying marking stamped on head of each anchor
- Anchor design allows for follow-up expansion after setting under tensile loading
- High shear load capacity

**APPROVALS AND LISTING**

- International Code Council, Evaluation Service (ICC-ES), ESR-3260 for cracked and uncracked concrete - 1/2” and 5/8” diameters (3/4” pending)
- Tested in accordance with ACI 355.2 and ICC-ES AC193 (including ASTM E 488) for use in structural concrete under the design provisions of ACI 318 (Strength Design method using Appendix D)
- Evaluated and qualified by an accredited independent testing laboratory for recognition in cracked and uncracked concrete including seismic and wind loading (Category 1 anchors), 1/2” and 5/8” diameters. (3/4” pending)

**GUIDE SPECIFICATIONS**

CSI Divisions: 03 16 00 - Concrete Anchoring and 05 05 19 - Post-Installed Concrete Anchors

Expansion anchors shall be PB+ as supplied by Powers Fasteners, Inc., Towson, MD. Anchors shall be installed in accordance with published instructions and requirements of the Authority Having Jurisdiction.

**MATERIAL SPECIFICATIONS**

<table>
<thead>
<tr>
<th>Anchor component</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bolt</td>
<td>Medium carbon steel (Grade 8 equivalent)</td>
</tr>
<tr>
<td>Washer</td>
<td>Conforms to ASTM F844</td>
</tr>
<tr>
<td>Cone</td>
<td>AISI C1035-C1040</td>
</tr>
<tr>
<td>Expansion Clip</td>
<td>AISI C1040-C1050</td>
</tr>
<tr>
<td>Metal Sleeve</td>
<td>Medium carbon steel tubing (seamless)</td>
</tr>
<tr>
<td>Compression Ring &amp; Retainer Nut</td>
<td>Engineered plastic</td>
</tr>
<tr>
<td>Plating</td>
<td>Zinc plating according to ASTM B 633, SC1 Type III (Fe/Zn 5). Minimum plating requirements for Mild Service Condition.</td>
</tr>
</tbody>
</table>
1. Using the proper drill bit size, drill a hole into the base material to the required depth. The tolerances of the drill bit used should meet the requirements of ANSI Standard B212.15.

2. Remove dust and debris from the hole using a hand pump, compressed air or a vacuum. Ensure the cone is snug and uniformly under the expansion wedge (clip) with the clip fingers overlapping the anchor cone, prior to installation using the retention nut (see photo below).

3. Drive anchor through the fixture into the hole. Be sure the anchor is driven to the minimum required embedment depth, $h_{nom}$.

4. Tighten the anchor with a torque wrench by applying the required installation torque, $T_{inst}$.

**Length Identification**

<table>
<thead>
<tr>
<th>Mark</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
<th>F</th>
<th>G</th>
<th>H</th>
<th>I</th>
<th>J</th>
<th>K</th>
<th>L</th>
<th>M</th>
<th>N</th>
<th>O</th>
<th>P</th>
<th>Q</th>
<th>R</th>
</tr>
</thead>
<tbody>
<tr>
<td>From</td>
<td>1-1/2&quot;</td>
<td>2&quot;</td>
<td>2-1/2&quot;</td>
<td>3&quot;</td>
<td>3-1/2&quot;</td>
<td>4&quot;</td>
<td>4-1/2&quot;</td>
<td>5&quot;</td>
<td>5-1/2&quot;</td>
<td>6&quot;</td>
<td>6-1/2&quot;</td>
<td>7&quot;</td>
<td>7-1/2&quot;</td>
<td>8&quot;</td>
<td>8-1/2&quot;</td>
<td>9&quot;</td>
<td>9-1/2&quot;</td>
<td>10&quot;</td>
</tr>
<tr>
<td>Up to but not including</td>
<td>2&quot;</td>
<td>2-1/2&quot;</td>
<td>3&quot;</td>
<td>3-1/2&quot;</td>
<td>4&quot;</td>
<td>4-1/2&quot;</td>
<td>5&quot;</td>
<td>5-1/2&quot;</td>
<td>6&quot;</td>
<td>6-1/2&quot;</td>
<td>7&quot;</td>
<td>7-1/2&quot;</td>
<td>8&quot;</td>
<td>8-1/2&quot;</td>
<td>9&quot;</td>
<td>9-1/2&quot;</td>
<td>10&quot;</td>
<td></td>
</tr>
</tbody>
</table>

*Length identification mark indicates overall length of anchor.*

**Head Marking**

‘PB+’ Symbol = Power-Bolt+ Strength Design Compliant (see ordering information)

Letter Code = Length Identification Mark
## INSTALLATION SPECIFICATIONS

### Power-Bolt+ (PB+) Anchor Installation Specifications

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Anchor outside diameter</td>
<td>d</td>
<td>in. (mm)</td>
<td>0.250 (6.4)</td>
<td>0.375 (9.5)</td>
<td>0.500 (12.7)</td>
<td>0.625 (15.9)</td>
<td>0.750 (19.1)</td>
</tr>
<tr>
<td>Internal Bolt Diameter (UNC)</td>
<td>-</td>
<td>4</td>
<td>#8 (4)</td>
<td>1/4 (6.4)</td>
<td>3/8 (9.5)</td>
<td>7/16 (11.1)</td>
<td>9/16 (14.3)</td>
</tr>
<tr>
<td>Nominal drill bit diameter</td>
<td>d&lt;sub&gt;bit&lt;/sub&gt;</td>
<td>in. (mm)</td>
<td>1/4 ANSI</td>
<td>3/8 ANSI</td>
<td>1/2 ANSI</td>
<td>5/8 ANSI</td>
<td>3/4 ANSI</td>
</tr>
<tr>
<td>Minimum diameter of hole clearance in fixture</td>
<td>d&lt;sub&gt;h&lt;/sub&gt;</td>
<td>in. (mm)</td>
<td>5/16(8)</td>
<td>7/16 (11)</td>
<td>9/16 (14)</td>
<td>11/16 (17)</td>
<td>13/16 (21)</td>
</tr>
<tr>
<td>Minimum nominal embedment depth</td>
<td>h&lt;sub&gt;nom&lt;/sub&gt;</td>
<td>in. (mm)</td>
<td>1-1/4 (32)</td>
<td>2 (51)</td>
<td>2-1/2 (64)</td>
<td>2-3/4 (70)</td>
<td>3 (76.2)</td>
</tr>
<tr>
<td>Minimum hole depth</td>
<td>h&lt;sub&gt;h&lt;/sub&gt;</td>
<td>in. (mm)</td>
<td>1-1/2 (38)</td>
<td>2-1/4 (57)</td>
<td>3 (76)</td>
<td>3-1/4 (83)</td>
<td>3-5/8 (92)</td>
</tr>
<tr>
<td>Minimum member thickness</td>
<td>h&lt;sub&gt;min&lt;/sub&gt;</td>
<td>in. (mm)</td>
<td>3-1/2 (89)</td>
<td>4-1/2 (114)</td>
<td>5 (127)</td>
<td>6-1/2 (165)</td>
<td>7 (178)</td>
</tr>
<tr>
<td>Minimum edge distance</td>
<td>c&lt;sub&gt;min&lt;/sub&gt;</td>
<td>in. (mm)</td>
<td>1-3/4 (44)</td>
<td>2-3/4 (70)</td>
<td>3-1/4 (83)</td>
<td>4-1/2 (114)</td>
<td>6 (152)</td>
</tr>
<tr>
<td>Minimum spacing distance</td>
<td>s&lt;sub&gt;min&lt;/sub&gt;</td>
<td>in. (mm)</td>
<td>2 (51)</td>
<td>3-1/2 (89)</td>
<td>4-1/2 (114)</td>
<td>6 (152)</td>
<td>6 (152)</td>
</tr>
<tr>
<td>Installation torque</td>
<td>T&lt;sub&gt;inst&lt;/sub&gt;</td>
<td>ft.-lbf. (N-m)</td>
<td>4 (5)</td>
<td>20 (27)</td>
<td>40 (54)</td>
<td>60 (81)</td>
<td>110 (149)</td>
</tr>
<tr>
<td>Torque wrench/socket size</td>
<td>-</td>
<td>in.</td>
<td>3/8</td>
<td>1/2</td>
<td>5/8</td>
<td>3/4</td>
<td>15/16</td>
</tr>
<tr>
<td>Bolt Head Height</td>
<td>-</td>
<td>in. (mm)</td>
<td>1/8 (3)</td>
<td>13/64 (5)</td>
<td>9/32 (7)</td>
<td>5/16 (8)</td>
<td>3/8 (10)</td>
</tr>
</tbody>
</table>

For SI: 1 inch = 25.4 mm, 1 ft-lbf = 1.356 N-m.
### Ultimate Load Capacities in Normal-Weight Concrete

<table>
<thead>
<tr>
<th>Nominal Anchor Diameter in.</th>
<th>Minimum Embed. Depth in. (h束)</th>
<th>Tension (lbs. (kN))</th>
<th>Shear (lbs. (kN))</th>
</tr>
</thead>
<tbody>
<tr>
<td>1/4</td>
<td>1-1/4 (32)</td>
<td>1,245 (5.5)</td>
<td>1,670 (7.4)</td>
</tr>
<tr>
<td>1/2</td>
<td>1/2-1/4 (64)</td>
<td>3,880 (17.3)</td>
<td>7,420 (33.0)</td>
</tr>
<tr>
<td>3/8</td>
<td>2/3-4/7 (104)</td>
<td>4,745 (21.1)</td>
<td>9,490 (44.4)</td>
</tr>
<tr>
<td>5/8</td>
<td>3/4-3/7 (117)</td>
<td>6,955 (31.1)</td>
<td>12,950 (58.5)</td>
</tr>
<tr>
<td>7/8</td>
<td>4-3/7 (117)</td>
<td>7,870 (35.7)</td>
<td>1,000 (4.4)</td>
</tr>
<tr>
<td>3</td>
<td>3/4-3/7 (117)</td>
<td>6,955 (31.1)</td>
<td>12,950 (58.5)</td>
</tr>
<tr>
<td>3/4</td>
<td>3-3/7 (117)</td>
<td>10,870 (48.4)</td>
<td>18,635 (82.9)</td>
</tr>
<tr>
<td>7</td>
<td>4-3/7 (117)</td>
<td>18,145 (80.7)</td>
<td>24,190 (108.0)</td>
</tr>
</tbody>
</table>

### Allowable Load Capacities in Normal-Weight Concrete

<table>
<thead>
<tr>
<th>Nominal Anchor Diameter in.</th>
<th>Minimum Embed. Depth in. (h束)</th>
<th>Tension (lbs. (kN))</th>
<th>Shear (lbs. (kN))</th>
</tr>
</thead>
<tbody>
<tr>
<td>1/4</td>
<td>1-1/4 (32)</td>
<td>310 (1.4)</td>
<td>420 (1.9)</td>
</tr>
<tr>
<td>1/2</td>
<td>1-1/4 (32)</td>
<td>805 (3.0)</td>
<td>1,000 (4.4)</td>
</tr>
<tr>
<td>3/8</td>
<td>2/3-4/7 (104)</td>
<td>970 (4.3)</td>
<td>1,855 (8.3)</td>
</tr>
<tr>
<td>5/8</td>
<td>3-3/7 (117)</td>
<td>1,300 (5.8)</td>
<td>2,010 (8.9)</td>
</tr>
<tr>
<td>7/8</td>
<td>4-3/7 (117)</td>
<td>1,780 (7.9)</td>
<td>2,010 (8.9)</td>
</tr>
<tr>
<td>3</td>
<td>3/4-3/7 (117)</td>
<td>1,855 (8.3)</td>
<td>1,855 (8.3)</td>
</tr>
<tr>
<td>3/4</td>
<td>3-3/7 (117)</td>
<td>2,265 (10.1)</td>
<td>2,010 (8.9)</td>
</tr>
</tbody>
</table>

1. The tabulated load values are applicable to single anchors installed in uncracked concrete with no edge or spacing considerations.

2. Allowable load capacities listed are calculated using an applied safety factor of 4.0. Consideration of safety factors of 10 or higher may be necessary depending on the applications, such as life safety or overhead.

3. Allowable load capacities are multiplied by reduction factors when anchor spacing or edge distances are less than critical distances.
### Spacing Reduction Factors - Tension ($F_{ts}$)

<table>
<thead>
<tr>
<th>Diameter (in)</th>
<th>1/4</th>
<th>3/8</th>
<th>1/2</th>
<th>5/8</th>
<th>3/4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nominal Embedment $h_{nom}$ (in)</td>
<td>1-1/4</td>
<td>2</td>
<td>2-1/2</td>
<td>2-3/4</td>
<td>3</td>
</tr>
<tr>
<td>Minimum Spacing $s_{min}$ (in)</td>
<td>2</td>
<td>3-1/2</td>
<td>4-1/2</td>
<td>6</td>
<td>5</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Spacing Distance (inches)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
</tr>
<tr>
<td>2-1/2</td>
</tr>
<tr>
<td>3</td>
</tr>
<tr>
<td>3-1/2</td>
</tr>
<tr>
<td>4</td>
</tr>
<tr>
<td>4-1/2</td>
</tr>
<tr>
<td>5</td>
</tr>
<tr>
<td>5-1/2</td>
</tr>
<tr>
<td>6</td>
</tr>
<tr>
<td>6-1/2</td>
</tr>
<tr>
<td>7</td>
</tr>
<tr>
<td>7-1/2</td>
</tr>
<tr>
<td>8</td>
</tr>
<tr>
<td>8-1/2</td>
</tr>
<tr>
<td>9</td>
</tr>
<tr>
<td>9-1/2</td>
</tr>
<tr>
<td>10</td>
</tr>
<tr>
<td>10-1/2</td>
</tr>
</tbody>
</table>

### Edge Distance Reduction Factors - Tension ($F_{tc}$)

<table>
<thead>
<tr>
<th>Diameter (in)</th>
<th>1/4</th>
<th>3/8</th>
<th>1/2</th>
<th>5/8</th>
<th>3/4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nominal Embedment $h_{nom}$ (in)</td>
<td>1-1/4</td>
<td>2</td>
<td>2-1/2</td>
<td>2-3/4</td>
<td>3</td>
</tr>
<tr>
<td>Minimum Edge Distance $c_{min}$ (in)</td>
<td>1-3/4</td>
<td>2-3/4</td>
<td>3-1/4</td>
<td>4-1/2</td>
<td>6</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Edge Distance (inches)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-3/4</td>
</tr>
<tr>
<td>2</td>
</tr>
<tr>
<td>2-1/2</td>
</tr>
<tr>
<td>3</td>
</tr>
<tr>
<td>3-1/4</td>
</tr>
<tr>
<td>3-1/2</td>
</tr>
<tr>
<td>4</td>
</tr>
<tr>
<td>4-1/2</td>
</tr>
<tr>
<td>5</td>
</tr>
<tr>
<td>5-1/2</td>
</tr>
<tr>
<td>6</td>
</tr>
<tr>
<td>6-1/2</td>
</tr>
<tr>
<td>7</td>
</tr>
<tr>
<td>7-1/2</td>
</tr>
<tr>
<td>8</td>
</tr>
</tbody>
</table>

### Spacing Reduction Factors - Shear ($F_{sh}$)

<table>
<thead>
<tr>
<th>Diameter (in)</th>
<th>1/4</th>
<th>3/8</th>
<th>1/2</th>
<th>5/8</th>
<th>3/4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nominal Embedment $h_{nom}$ (in)</td>
<td>1-1/4</td>
<td>2</td>
<td>2-1/2</td>
<td>2-3/4</td>
<td>3</td>
</tr>
<tr>
<td>Minimum Spacing $s_{min}$ (in)</td>
<td>2</td>
<td>3-1/2</td>
<td>4-1/2</td>
<td>6</td>
<td>5</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Spacing Distance (inches)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
</tr>
<tr>
<td>2-1/2</td>
</tr>
<tr>
<td>3</td>
</tr>
<tr>
<td>3-1/2</td>
</tr>
<tr>
<td>4</td>
</tr>
<tr>
<td>4-1/2</td>
</tr>
<tr>
<td>5</td>
</tr>
<tr>
<td>5-1/2</td>
</tr>
<tr>
<td>6</td>
</tr>
<tr>
<td>6-1/2</td>
</tr>
<tr>
<td>7</td>
</tr>
<tr>
<td>7-1/2</td>
</tr>
<tr>
<td>8</td>
</tr>
<tr>
<td>8-1/2</td>
</tr>
<tr>
<td>9</td>
</tr>
<tr>
<td>9-1/2</td>
</tr>
<tr>
<td>10</td>
</tr>
<tr>
<td>10-1/2</td>
</tr>
</tbody>
</table>

### Edge Distance Reduction Factors - Shear ($F_{sc}$)

<table>
<thead>
<tr>
<th>Diameter (in)</th>
<th>1/4</th>
<th>3/8</th>
<th>1/2</th>
<th>5/8</th>
<th>3/4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nominal Embedment $h_{nom}$ (in)</td>
<td>1-1/4</td>
<td>2</td>
<td>2-1/2</td>
<td>2-3/4</td>
<td>3</td>
</tr>
<tr>
<td>Minimum Edge Distance $c_{min}$ (in)</td>
<td>1-3/4</td>
<td>2-3/4</td>
<td>3-1/4</td>
<td>4-1/2</td>
<td>6</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Edge Distance (inches)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-3/4</td>
</tr>
<tr>
<td>2</td>
</tr>
<tr>
<td>2-1/2</td>
</tr>
<tr>
<td>3</td>
</tr>
<tr>
<td>3-1/4</td>
</tr>
<tr>
<td>3-1/2</td>
</tr>
<tr>
<td>4</td>
</tr>
<tr>
<td>4-1/2</td>
</tr>
<tr>
<td>5</td>
</tr>
<tr>
<td>5-1/2</td>
</tr>
<tr>
<td>6</td>
</tr>
<tr>
<td>6-1/2</td>
</tr>
<tr>
<td>7</td>
</tr>
<tr>
<td>7-1/2</td>
</tr>
<tr>
<td>8</td>
</tr>
</tbody>
</table>
## Power-Bolt+ Anchor Installation Specifications

### Anchor Property/Setting Information

<table>
<thead>
<tr>
<th>Notation</th>
<th>Units</th>
<th>Nominal Anchor Diameter (in.)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>1/2</td>
</tr>
<tr>
<td>d₀</td>
<td>in. (mm)</td>
<td>0.500 (12.7)</td>
</tr>
<tr>
<td>dₙ</td>
<td>in. (mm)</td>
<td>9/16 (14.3)</td>
</tr>
<tr>
<td>dₘ</td>
<td>in. (mm)</td>
<td>3/8 (9.5)</td>
</tr>
<tr>
<td>hₙₚ</td>
<td>in. (mm)</td>
<td>3-1/4 (83)</td>
</tr>
<tr>
<td>hₙ</td>
<td>in. (mm)</td>
<td>2-5/8 (67)</td>
</tr>
<tr>
<td>hₚₚ</td>
<td>in. (mm)</td>
<td>3-1/4 (84)</td>
</tr>
<tr>
<td>hₚ</td>
<td>in. (mm)</td>
<td>3 (76)</td>
</tr>
<tr>
<td>lₚₚ</td>
<td>in. (mm)</td>
<td>3-1/2 (89)</td>
</tr>
<tr>
<td>cₚₚ</td>
<td>in. (mm)</td>
<td>3-1/4 (83)</td>
</tr>
<tr>
<td>cₚ</td>
<td>in. (mm)</td>
<td>4-1/2 (114)</td>
</tr>
<tr>
<td>Tₚₚ</td>
<td>ft-lbf. (N-m)</td>
<td>8 (203)</td>
</tr>
<tr>
<td>cₚ</td>
<td>in. (mm)</td>
<td>8 (203)</td>
</tr>
<tr>
<td>Tₚ</td>
<td>ft-lbf. (N-m)</td>
<td>40 (54)</td>
</tr>
<tr>
<td>Torque wrench/socket size</td>
<td>-</td>
<td>3/4</td>
</tr>
</tbody>
</table>

For SI: 1 inch = 25.4 mm, 1 ft-lbf = 1.356 N-m.

1. The information presented in this table is to be used in conjunction with the design criteria of ACI 318 Appendix D.
2. The listed minimum overall anchor length is based on anchor sizes available at the time of publication compared with the requirements for the minimum nominal embedment depth and fixture attachment.
3. The notation in brackets is for the 2006 IBC.
### Power-Bolt+ (PB+)

#### Tension Design Information for Power-Bolt+ (PB+) Anchor in Concrete

**Design Characteristic** | **Notation** | **Units** | **Nominal Anchor Diameter**
--- | --- | --- | ---
Anchor category | 1,2 or 3 | - | 1/2 | 5/8 | 3/4
Nominal embedment depth | $h_{nom}$ | in. (mm) | 3-1/4 (83) | 3-3/4 (95) | 4-3/8 (111)

### STEEL STRENGTH IN TENSION

| Design Characteristic | Notation | Units | 1/2 | 5/8 | 3/4 |
--- | --- | --- | --- | --- | --- |
Minimum specified yield strength | $f_y$ | ksi (N/mm) | 130 (896) | 130 (896) | 130 (896)
Minimum specified ultimate tensile strength | $f_{u*}$ | ksi (N/mm) | 150 (1034) | 150 (1034) | 150 (1034)
Effective tensile stress area (threads) | $A_{u*}$ | in$^2$ (mm$^2$) | 0.0775 (50) | 0.1063 (68.6) | 0.1820 (116)
Steel strength in tension | $N_{se}$ | lb (kN) | 9,685 (43.1) | 13,285 (59.1) | 27,300 (121.4)
Reduction factor for steel strength | $\phi$ | - | 0.75 |

### CONCRETE BREAKOUT STRENGTH IN TENSION

| Design Characteristic | Notation | Units | 1/2 | 5/8 | 3/4 |
--- | --- | --- | --- | --- | --- |
Effective embedment | $h_{e}$ | in. (mm) | 2.625 (67) | 3.000 (76) | 3.500 (89)
Effectiveness factor for uncracked concrete | $k_{cr}$ | - | 27 | 27 | 24
Effectiveness factor for cracked concrete | $k_{uncr}$ | - | 17 | 17 | 21
Modification factor for cracked and uncracked concrete | $\psi_{cr,uncr}$ | - | 1.0 | 1.0 | 1.0
Critical edge distance (uncracked concrete) | $c_{cr}$ | in. (mm) | 8 (203) | 6 (152) | 8 (203)
Reduction factor for concrete breakout strength | $\phi$ | - | 0.65 (Condition B) |

### PULLOUT STRENGTH IN TENSION (NON-SEISMIC APPLICATIONS)

| Design Characteristic | Notation | Units | 1/2 | 5/8 | 3/4 |
--- | --- | --- | --- | --- | --- |
Characteristic pullout strength, uncracked concrete (2,500 psi) | $N_{p,uncr}$ | lb (kN) | Not Applicable | Not Applicable | Not Applicable
Characteristic pullout strength, cracked concrete (2,500 psi) | $N_{p,cr}$ | lb (kN) | Not Applicable | Not Applicable | Not Applicable
Reduction factor for pullout strength | $\phi$ | - | 0.65 (Condition B) |

### PULLOUT STRENGTH IN TENSION FOR SEISMIC APPLICATIONS

| Design Characteristic | Notation | Units | 1/2 | 5/8 | 3/4 |
--- | --- | --- | --- | --- | --- |
Characteristic pullout strength, seismic (2,500 psi) | $N_{p,seis}$ | lb (kN) | Not Applicable | Not Applicable | Not Applicable
Reduction factor for pullout strength | $\phi$ | - | 0.65 (Condition B) |

---

For SI: 1 inch = 25.4 mm; 1 ksi = 6.894 N/mm; 1 lb = 0.0044 kN.

1. The data in this table is intended to be used with the design provisions of ACI 318 Appendix D; for anchors resisting seismic load combinations the additional requirements of ACI 318 D.3.3 must apply.
2. Installation must comply with the manufacturer’s published installation instructions.
3. The tabulated value of $\phi$ for steel strength applies when the load combinations of Section 1605.2 of the IBC or ACI 318 Section 9.2 are used. If the load combinations of ACI 318 Appendix C are used, the appropriate value of $\phi$ for steel strength must be determined in accordance with ACI 318-11 D.4.4 (ACI 318-08 and -05 D.4.4). The anchors are ductile steel elements as defined in ACI 318 D.1.
4. The tabulated value of $\phi$ for concrete breakout strength applies when both the load combinations of Section 1605.2 of the IBC or ACI 318 Section 9.2 are used and the requirements of ACI 318-11 D.4.4 (ACI 318-08 and -05 D.4.4) for Condition A are satisfied. If the load combinations of Section 1605.2 of the IBC or ACI 318 Section 9.2 are used and the requirements of ACI 318-11 D.4.3 (ACI 318-08 and -05 D.4.4) for Condition B are satisfied, the appropriate value of $\phi$ for concrete breakout strength must be determined in accordance with ACI 318-11 D.4.3 (ACI 318-08 and -05 D.4.4). If the load combinations of ACI 318 Appendix C are used, the appropriate value of $\phi$ for concrete breakout strength must be determined in accordance with ACI 318-11 D.4.4 (ACI 318-08 and -05 D.4.5).
5. For all design cases use $\psi_{cr,uncr} = 1.0$. The appropriate effectiveness factor for cracked concrete ($k_{cr}$) or uncracked concrete ($k_{uncr}$) must be used.
6. For all design cases use $\psi_{cr,uncr} = 1.0$.
7. Pullout strength will not control design of indicated anchors. Do not calculate pullout strength for indicated anchor size and embedment.
8. Anchors are permitted to be used in sand-lightweight concrete provided that $N_{p,cr}$ replaces $N_{p,uncr}$, $\psi_{cr}$ replaces $\psi_{uncr}$, and $N_{p,seis}$ replaces $N_{p,seis,uncr}$.
9. In accordance with ACI 318 D.5.1.2 and Eq. (D-3) the nominal steel strength in tension is calculated using a limited value of $f_{u*}$ of 125 ksi.
10. For 2003 IBC, $f_{u*}$ replaces $f_y$, $N_{se}$ replaces $N_{se}$, and $\psi_{cr,uncr}$ replaces $\psi_{cr}$ and $N_{p,cr}$ replaces $N_{p,cr,uncr}$.
11. The notation in brackets is for the 2006 IBC.
# Power-Bolt+ (PB+)

## Shear Design Information for Power-Bolt+ (PB+) Anchor in Concrete

(For use with load combinations taken form ACI 318, Section 9.2)

### Design Characteristic

<table>
<thead>
<tr>
<th>Notation</th>
<th>Units</th>
<th>1/2</th>
<th>5/8</th>
<th>3/4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anchor category</td>
<td>1, 2 or 3</td>
<td>-</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Nominal embedment depth</td>
<td>h&lt;sub&gt;nom&lt;/sub&gt;</td>
<td>in.</td>
<td>3-1/4</td>
<td>3-3/4</td>
</tr>
</tbody>
</table>

### STEEL STRENGTH IN SHEAR

- **Minimum specified yield strength**: f<sub>y</sub> (ksi) 130 (896) 130 (896) 130 (896)
- **Minimum specified ultimate strength**: f<sub>u</sub> (ksi) 150 (1034) 150 (1034) 150 (1034)
- **Effective shear stress area**: A<sub>se</sub> (in<sup>2</sup>) 0.1069 (69.0) 0.1452 (93.7) 0.2410 (153)
- **Steel strength in shear**: V<sub>sa</sub> (lb) 6,005 (26.7) 13,415 (59.7) 14,820 (65.9)
- **Reduction factor for steel strength**: φ - 0.65

### CONCRETE BREAKOUT STRENGTH IN SHEAR

- **Load bearing length of anchor**: L<sub>s</sub> (in) 2.625 (67) 3.000 (76) 3.500 (89)
- **Nominal anchor diameter**: d<sub>sa</sub> (in) 0.500 (12.7) 0.625 (15.9) 0.750 (19.05)
- **Reduction factor for concrete breakout**: φ - 0.70 (Condition B)

### PRYOUT STRENGTH IN SHEAR

- **Coefficient for pryout strength**: k<sub>cp</sub> - 2.0 2.0 2.0
- **Effective embedment**: h<sub>emb</sub> (in) 2.625 (67) 3.000 (76) 3.500 (89)
- **Reduction factor for pryout strength**: φ - 0.70 (Condition B)

### STEEL STRENGTH IN SHEAR FOR SEISMIC APPLICATIONS

- **Steel strength in shear, seismic**: V<sub>sa,seis</sub> (lb) 4,565 (20.3) 7,425 (33.0) 14,820 (65.9)
- **Reduction factor for steel strength in shear for seismic**: φ - 0.65

---

For SI: 1 inch = 25.4 mm; 1 ksi = 6.894 N/mm²; 1 lb = 0.0044 kN.

1. The data in this table is intended to be used with the design provisions of ACI 318 Appendix D; for anchors resisting seismic load combinations the additional requirements of ACI 318 D.3.3 must apply.
2. Installation must comply with the manufacturer’s published installation instructions.
3. The tabulated value of φ for steel strength applies when the load combinations of Section 1605.2 of the IBC or ACI 318 Section 9.2 are used. If the load combinations of ACI 318 Appendix C are used, the appropriate value of φ for steel strength must be determined in accordance with ACI 318-11 D.4.4 (ACI 318-08 and -05 D.4.4). The anchors are ductile steel elements as defined in ACI 318 D.1.
4. The tabulated value of φ for concrete breakout strength applies when both the load combinations of Section 1605.2 of the IBC or ACI 318 Section 9.2 are used and the requirements of ACI 318-11 D.4.3 (ACI 318-08 and -05 D.4.4) for Condition B are satisfied. If the load combinations of Section 1605.2 of the IBC or ACI 318 Section 9.2 are used and the requirements of ACI 318-11 D.4.3 (ACI 318-08 and -05 D.4.4) for Condition A are satisfied, the appropriate value of φ for concrete breakout strength must be determined in accordance with ACI 318-11 D.4.3 (ACI 318-08 and -05 D.4.4). If the load combinations of ACI 318 Appendix C are used, the appropriate value of φ for concrete breakout strength must be determined in accordance with ACI 318-11 D.4.4 (ACI 318-08 and -05 D.4.4). For the 2003 IBC f<sub>y</sub> replaces f<sub>y</sub>, V<sub>s</sub> replaces V<sub>y</sub>, and V<sub>sa</sub> replaces V<sub>sa</sub>.
5. Anchors are permitted to be used in sand-lightweight concrete provided that V<sub>s</sub>, V<sub>sa</sub>, and V<sub>sa,seis</sub> are multiplied by a factor of 0.60.
6. Tabulated values for steel strength in shear are for seismic applications and based on test results in accordance with ACI 355.2, Section 9.6.
7. For the 2003 IBC f<sub>y</sub> replaces f<sub>y</sub>; V<sub>s</sub>, V<sub>sa</sub>, and V<sub>sa,seis</sub> replace f<sub>y</sub>, f<sub>y</sub>, and f<sub>y</sub>, respectively.
8. The notation in brackets is for the 2006 IBC.
# Power-Bolt+ (PB+)

## Strength Design Performance Data

Factored design strength $\phi N_n$ and $\phi V_n$ calculated in accordance with ACI 318 Appendix D. Tested to the International Building Code.

### Tension and Shear Design Strengths in Cracked Concrete

<table>
<thead>
<tr>
<th>Nominal Anchor Diameter (in.)</th>
<th>Nominal Embed. $h_{nom}$ (in.)</th>
<th>$f'_c = 2,500$ (psi)</th>
<th>$f'_c = 3,000$ (psi)</th>
<th>$f'_c = 4,000$ (psi)</th>
<th>$f'_c = 6,000$ (psi)</th>
<th>$f'_c = 8,000$ (psi)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>$\phi N_n$ Tension (lbs.)</td>
<td>$\phi V_n$ Shear (lbs.)</td>
<td>$\phi N_n$ Tension (lbs.)</td>
<td>$\phi V_n$ Shear (lbs.)</td>
<td>$\phi N_n$ Tension (lbs.)</td>
</tr>
<tr>
<td>1/2</td>
<td>3-1/4</td>
<td>2,075</td>
<td>3,325</td>
<td>3,575</td>
<td>3,730</td>
<td>4,205</td>
</tr>
<tr>
<td>3/8</td>
<td>3-3/4</td>
<td>2,870</td>
<td>3,310</td>
<td>3,145</td>
<td>3,625</td>
<td>4,190</td>
</tr>
<tr>
<td>5/8</td>
<td>4-3/8</td>
<td>4,470</td>
<td>4,990</td>
<td>4,895</td>
<td>5,465</td>
<td>5,655</td>
</tr>
</tbody>
</table>

### Tension and Shear Design Strengths in Uncracked Concrete

<table>
<thead>
<tr>
<th>Nominal Anchor Diameter (in.)</th>
<th>Nominal Embed. $h_{nom}$ (in.)</th>
<th>$f'_c = 2,500$ (psi)</th>
<th>$f'_c = 3,000$ (psi)</th>
<th>$f'_c = 4,000$ (psi)</th>
<th>$f'_c = 6,000$ (psi)</th>
<th>$f'_c = 8,000$ (psi)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>$\phi N_n$ Tension (lbs.)</td>
<td>$\phi V_n$ Shear (lbs.)</td>
<td>$\phi N_n$ Tension (lbs.)</td>
<td>$\phi V_n$ Shear (lbs.)</td>
<td>$\phi N_n$ Tension (lbs.)</td>
</tr>
<tr>
<td>1/2</td>
<td>3-1/4</td>
<td>3,730</td>
<td>3,905</td>
<td>4,090</td>
<td>3,905</td>
<td>5,780</td>
</tr>
<tr>
<td>3/8</td>
<td>3-3/4</td>
<td>4,560</td>
<td>4,625</td>
<td>4,995</td>
<td>5,076</td>
<td>7,065</td>
</tr>
<tr>
<td>5/8</td>
<td>4-3/8</td>
<td>5,105</td>
<td>6,985</td>
<td>5,595</td>
<td>7,655</td>
<td>6,460</td>
</tr>
</tbody>
</table>

### Legend

- **Steel Strength Controls**
- **Concrete Breakout Strength Controls**

1. Tabular values are provided for illustration and are applicable for single anchors installed in normal-weight concrete with minimum slab thickness, $h_a = h_{nom}$, and with the following conditions:
   - $c_a1$ is greater than or equal to the critical edge distance, $c_a$ (table values based on $c_a1 = c_a$).
   - $c_a2$ is greater than or equal to 1.5 times $c_a$.
2. Calculations were performed according to ACI 318-11 Appendix D. The load level corresponding to the controlling failure mode is listed. (e.g. For tension: steel, concrete breakout and pullout; For shear: steel, concrete breakout and pryout). Furthermore, the capacities for concrete breakout strength in tension and pryout strength in shear are calculated using the effective embedment values, $h_e$, for the selected anchors as noted in the design information tables. Please also reference the installation specifications for more information.
3. Strength reduction factors ($\phi$) were based on ACI 318 Section 9.2 for load combinations. Condition B is assumed.
4. Tabular values are permitted for static loads only, seismic loading is not considered with these tables.
5. For designs that include combined tension and shear, the interaction of tension and shear loads must be calculated in accordance with ACI 318 Appendix D.
6. Interpolation is not permitted to be used with the tabular values. For intermediate base material compressive strengths please see ACI 318 Appendix D. For other design conditions including seismic considerations please see ACI 318 Appendix D.
### Installation Accessories

<table>
<thead>
<tr>
<th>Cat. No.</th>
<th>Anchor Size</th>
<th>Box Qty.</th>
</tr>
</thead>
<tbody>
<tr>
<td>08466</td>
<td>Adjustable torque wrench with 1/2&quot; square drive (25 to 250 ft.-lbs.)</td>
<td>1</td>
</tr>
<tr>
<td>08280</td>
<td>Hand pump / dust blower</td>
<td>1</td>
</tr>
</tbody>
</table>

### Power-Bolt+ (PB+)

**Power-Bolt+ (Carbon Steel Version Finished Hex Head)**

<table>
<thead>
<tr>
<th>Cat. No.</th>
<th>Anchor Size</th>
<th>Maximum Fixture Thickness</th>
<th>Box Qty.</th>
<th>Carton Qty.</th>
</tr>
</thead>
<tbody>
<tr>
<td>6902SD</td>
<td>1/4&quot; x 1-3/4&quot;</td>
<td>1/2&quot;</td>
<td>100</td>
<td>600</td>
</tr>
<tr>
<td>6906SD</td>
<td>1/4&quot; x 3&quot;</td>
<td>1-3/4&quot;</td>
<td>100</td>
<td>600</td>
</tr>
<tr>
<td>6910SD</td>
<td>3/8&quot; x 2-1/4&quot;</td>
<td>1/4&quot;</td>
<td>50</td>
<td>300</td>
</tr>
<tr>
<td>6913SD</td>
<td>3/8&quot; x 3&quot;</td>
<td>1&quot;</td>
<td>50</td>
<td>300</td>
</tr>
<tr>
<td>6914SD</td>
<td>3/8&quot; x 3-1/2&quot;</td>
<td>1-1/2&quot;</td>
<td>50</td>
<td>300</td>
</tr>
<tr>
<td>6916SD</td>
<td>3/8&quot; x 4&quot;</td>
<td>2&quot;</td>
<td>50</td>
<td>300</td>
</tr>
<tr>
<td>6930SD</td>
<td>1/2&quot; x 2-3/4&quot;</td>
<td>1/4&quot;</td>
<td>50</td>
<td>200</td>
</tr>
<tr>
<td>6932SD</td>
<td>1/2&quot; x 3-1/2&quot;</td>
<td>1/4&quot;</td>
<td>50</td>
<td>200</td>
</tr>
<tr>
<td>6934SD</td>
<td>1/2&quot; x 4-3/4&quot;</td>
<td>1-1/2&quot;</td>
<td>25</td>
<td>150</td>
</tr>
<tr>
<td>6936SD</td>
<td>1/2&quot; x 5-3/4&quot;</td>
<td>2-1/2&quot;</td>
<td>25</td>
<td>150</td>
</tr>
<tr>
<td>6940SD</td>
<td>5/8&quot; x 3&quot;</td>
<td>1/4&quot;</td>
<td>20</td>
<td>120</td>
</tr>
<tr>
<td>6942SD</td>
<td>5/8&quot; x 4&quot;</td>
<td>1/4&quot;</td>
<td>15</td>
<td>90</td>
</tr>
<tr>
<td>6944SD</td>
<td>5/8&quot; x 5&quot;</td>
<td>1-1/4&quot;</td>
<td>15</td>
<td>90</td>
</tr>
<tr>
<td>6945SD</td>
<td>5/8&quot; x 6&quot;</td>
<td>2-1/4&quot;</td>
<td>15</td>
<td>90</td>
</tr>
<tr>
<td>6947SD</td>
<td>5/8&quot; x 8-1/2&quot;</td>
<td>4-3/4&quot;</td>
<td>10</td>
<td>40</td>
</tr>
<tr>
<td>6950SD</td>
<td>3/4&quot; x 3-1/4&quot;</td>
<td>1/4&quot;</td>
<td>15</td>
<td>90</td>
</tr>
<tr>
<td>6952SD</td>
<td>3/4&quot; x 4-1/4&quot;</td>
<td>1-1/4&quot;</td>
<td>10</td>
<td>60</td>
</tr>
<tr>
<td>6954SD</td>
<td>3/4&quot; x 5-1/4&quot;</td>
<td>2-1/4&quot;</td>
<td>10</td>
<td>60</td>
</tr>
<tr>
<td>6956SD</td>
<td>3/4&quot; x 7-1/4&quot;</td>
<td>4-1/4&quot;</td>
<td>10</td>
<td>40</td>
</tr>
<tr>
<td>6958SD</td>
<td>3/4&quot; x 8-1/4&quot;</td>
<td>5-1/4&quot;</td>
<td>10</td>
<td>40</td>
</tr>
</tbody>
</table>

*Shaded catalog numbers denote sizes which are less than the minimum standard anchor length for strength design or not included in ESR-3260.*

*The published size includes the diameter and the length which is measured from below the washer to the end of the anchor.*