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Rock Bolt Anchoring Systems

CONSOLIDATION ROCK BOLT:
- ARCRB
  - Upward Grouting

HOLLOW DEFORMED REBAR:
- HDR
  - Upward Thixotropic Grouting
  - Inclined Grouting

SOLID CONTINUOUS
- THREADED UNIFIED: SCT-N

ALL THREADED BAR:
- B-7

SOLID SMOOTH THREADED:
- SST
  - and Stop Coupling

SOLID CONTINUOUS
- THREADED LAG: SCT-L

MESH PIN:
- ARMP
  - (also available in all-thread)

SOLID DEFORMED REBAR:
- SDR

SOLID SMOOTH THREADED:
- SST

Additional hardware options:
- Single Hole Bearing Plate
- Single Key Bearing Plate
- Double Key Bearing Plate
- Centralizer
- Beveled Washer
- Type K Lifting Eye
- Special Eye Nut
### Rod Size and Ultimate Tensile Strength

<table>
<thead>
<tr>
<th>Thread Diameter - TPI</th>
<th>HDR</th>
<th>SDR</th>
<th>SCT-N</th>
<th>SCT-L</th>
<th>SST</th>
<th>B-7</th>
</tr>
</thead>
<tbody>
<tr>
<td>½&quot; - 13 UNC</td>
<td>96 kN (12,700 lbs.)</td>
<td>80 kN (18,000 lbs.)</td>
<td>80 kN (18,000 lbs.)</td>
<td>80 kN (18,000 lbs.)</td>
<td>80 kN (18,000 lbs.)</td>
<td></td>
</tr>
<tr>
<td>5/8&quot; - 11 UNC</td>
<td>90 kN (20,300 lbs.)</td>
<td>133 kN (30,000 lbs.)</td>
<td>169 kN (38,000 lbs.)</td>
<td>169 kN (38,000 lbs.)</td>
<td>186 kN (42,000 lbs.)</td>
<td></td>
</tr>
<tr>
<td>¾&quot; - 10 UNC</td>
<td>133 kN (30,000 lbs.)</td>
<td>169 kN (38,000 lbs.)</td>
<td>169 kN (38,000 lbs.)</td>
<td>169 kN (38,000 lbs.)</td>
<td>186 kN (42,000 lbs.)</td>
<td></td>
</tr>
<tr>
<td>7/8&quot; - 9 UNC</td>
<td>185 kN (41,850 lbs.)</td>
<td>225,000 kN (500,000 lbs.)</td>
<td>237,500 kN (525,000 lbs.)</td>
<td>250,000 kN (550,000 lbs.)</td>
<td>262,500 kN (585,000 lbs.)</td>
<td></td>
</tr>
<tr>
<td>1&quot; - 8 UN</td>
<td>320 kN (72,000 lbs.)</td>
<td>334 kN (75,000 lbs.)</td>
<td>334 kN (75,000 lbs.)</td>
<td>334 kN (75,000 lbs.)</td>
<td>337 kN (76,000 lbs.)</td>
<td></td>
</tr>
<tr>
<td>1 ¼&quot; - 8 UN</td>
<td>314 kN (70,600 lbs.)</td>
<td>334 kN (75,000 lbs.)</td>
<td>334 kN (75,000 lbs.)</td>
<td>334 kN (75,000 lbs.)</td>
<td>337 kN (76,000 lbs.)</td>
<td></td>
</tr>
<tr>
<td>1 ½&quot; - 8 UN</td>
<td>387 kN (87,200 lbs.)</td>
<td>534 kN (120,000 lbs.)</td>
<td>534 kN (120,000 lbs.)</td>
<td>534 kN (120,000 lbs.)</td>
<td>534 kN (120,000 lbs.)</td>
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<tr>
<td>1 ¾&quot; - 8 UN</td>
<td>447 kN (100,000 lbs.)</td>
<td>600 kN (135,000 lbs.)</td>
<td>600 kN (135,000 lbs.)</td>
<td>600 kN (135,000 lbs.)</td>
<td>600 kN (135,000 lbs.)</td>
<td></td>
</tr>
<tr>
<td>2&quot; - 8 UN</td>
<td>596 kN (134,000 lbs.)</td>
<td>796 kN (178,000 lbs.)</td>
<td>820 kN (184,000 lbs.)</td>
<td>820 kN (184,000 lbs.)</td>
<td>820 kN (184,000 lbs.)</td>
<td></td>
</tr>
<tr>
<td>*1 ¾&quot; - 5 UNC</td>
<td>663 kN (149,000 lbs.)</td>
<td>833 kN (186,000 lbs.)</td>
<td>1,000 kN (224,000 lbs.)</td>
<td>1,000 kN (224,000 lbs.)</td>
<td>1,000 kN (224,000 lbs.)</td>
<td></td>
</tr>
<tr>
<td>1 ½&quot; - 8 UN</td>
<td>760 kN (171,000 lbs.)</td>
<td>1,100 kN (249,000 lbs.)</td>
<td>1,155 kN (250,000 lbs.)</td>
<td>1,155 kN (250,000 lbs.)</td>
<td>1,155 kN (250,000 lbs.)</td>
<td></td>
</tr>
<tr>
<td>1 ¾&quot; - 8 UN</td>
<td>833 kN (186,900 lbs.)</td>
<td>1,370 kN (301,000 lbs.)</td>
<td>1,539 kN (346,000 lbs.)</td>
<td>1,539 kN (346,000 lbs.)</td>
<td>1,539 kN (346,000 lbs.)</td>
<td></td>
</tr>
<tr>
<td>2&quot; - 8 UN</td>
<td>964 kN (216,900 lbs.)</td>
<td>1,709 kN (380,000 lbs.)</td>
<td>1,539 kN (346,000 lbs.)</td>
<td>1,539 kN (346,000 lbs.)</td>
<td>1,539 kN (346,000 lbs.)</td>
<td></td>
</tr>
</tbody>
</table>

**Note:** The values listed are based on the product comparison table provided. The table compares different thread specifications with their respective tensile strengths in kN and lbs.
The above table indicates acceptable ranges of rock quality for which an engineer should consider using mechanical anchors. Mechanical anchors offer immediate compression between rock and shell anchor and therefore, allow for immediate prestressing. Anchors should be fully grouted for permanent applications. Cement grout protects against bolt corrosion and transfers load to the rock mass or concrete. Mechanical expansion anchors automatically center the bolt at the bottom of drilled hole.
AR Cone Shell Expansion Anchors

The AR Cone Shell Expansion Anchors are designed to develop the full tensile capacities of the Rod Series offered in this manual. Mechanical anchors are activated immediately. This feature is of major benefit to the installation of prestressed anchors. Saving the time associated with cement grout bonded zone anchorages. The patented AR Cone Shell design has a “Ridge-Groove” system that allows each size anchor to operate to the holding capacity of the high strength rods in the widest possible variety of rock conditions.

The wide application range is possible due to the combination of a large smooth surface contact area between the shell and drill hole wall as a result of carefully chosen shell length and drill hole diameters and the spacing and orientation of Ridge-Groove system.

Loads are transferred to the rock by putting the rock in compression on the smooth areas of the shell and the ridges are stress raisers to activate the shear strength of the rock. The grooves that follow the ridges allow rock points to be activated in shear without crushing and in the case of extremely hard rock, a place for the ridge metal to translate as full compression between rock and shell is achieved by rotating the anchor rod.

The approximate 45° orientation of ridges allows for both antirotational effect of the shell in the hole when setting the anchor and the vertical holding capacity of the anchor to be maximized.

AR Cones are offered with Channels through the shell which allows for passage of grout past the anchorage contact zone. The Cones are tapped through their entire length to accept the various thread series. The AR Cones are offered with Channels through the shell which allows for passage of grout past the anchorage contact zone. The Cones are tapped through their entire length to accept the various thread series.

岩軸受動の保存が可能な各サイズのアノンを操作するための持続力は、最強の鉄を最も幅広い種類の岩に適用が可能です。岩とリッジは、岩の強さを増加させるスリープを高い強度で使用した。線が配列されるインターリッジシステムが、リッジが岩を圧縮することを可能にします。

**Features and Benefits**

<table>
<thead>
<tr>
<th>FEATURES</th>
<th>BENEFITS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anchors are set from surface by rotation of rod.</td>
<td>Outer threaded end of rod does not change in elevation when setting anchor. Minimal deflection when tensioning.</td>
</tr>
<tr>
<td>A tapped cone expands shell against the drill hole wall as the anchor rod is rotated.</td>
<td>Immediate verification of anchor holding capacity without waiting for grouts to cure.</td>
</tr>
<tr>
<td>Versatile one-size anchor assembly for each drill hole diameter.</td>
<td>Allows for simplicity of design of rock bolt.</td>
</tr>
<tr>
<td>Smooth cylinder shell with 45 degree “Ridge-Groove” shell design.</td>
<td>Greatest shell to rock stress distribution of any mechanical expansion anchor on the market. Ridge-Groove orientation gives anchor an anti-rotation aspect as well as enhanced performance in the vertical direction.</td>
</tr>
</tbody>
</table>

**TRATION SHELL**

**EXPANSION**

**AR Cone Shell Expansion Anchors**

<table>
<thead>
<tr>
<th>Shell Length</th>
</tr>
</thead>
<tbody>
<tr>
<td>AR45</td>
</tr>
<tr>
<td>AR50</td>
</tr>
<tr>
<td>AR55</td>
</tr>
<tr>
<td>AR65</td>
</tr>
<tr>
<td>AR76</td>
</tr>
<tr>
<td>AR65</td>
</tr>
<tr>
<td>AR65</td>
</tr>
</tbody>
</table>

**RIDGE-GROOVE**

**NOTE:** All thread products require a stud adaptor with anchor assembly.

**KING SHELL**

**EXPANSION**

**AR Cone Shell Expansion Anchors**

**TABLE CS2 CONE & SHELL EXPANSION ANCHORS**

<table>
<thead>
<tr>
<th>Shell Length</th>
</tr>
</thead>
<tbody>
<tr>
<td>AR45</td>
</tr>
<tr>
<td>AR50</td>
</tr>
<tr>
<td>AR55</td>
</tr>
<tr>
<td>AR65</td>
</tr>
<tr>
<td>AR76</td>
</tr>
<tr>
<td>AR65</td>
</tr>
</tbody>
</table>

**HOLE DIAMETERS OF THE CONE-SHELL ANCHORS SHOWN PERMIT THE USE OF STOP COUPLINGS WITH GROUT TUBES IN THE SDR, SST, SCL, AND SCT-N SERIES.**

**RIDGE-GROOVE**

**NOTE:** All thread products require a stud adaptor with anchor assembly.
Hollow Deformed Rebar (HDR)

Originally developed by engineers working on the Snowy Mountain Hydro Electric project in Australia for permanent corrosion protected rock anchors. Hollow core steel guarantees an uninterrupted passage for grout from the surface to the distal end of the drill hole. May be used for supplying or returning grout as orientation dictates.

Portland cement based grouts provide a pH environment which renders the steel rod protected from the corrosive effects of oxidation. The process of pumping fluid cement grout with a hollow core rod will provide complete encapsulation of the steel in the drill hole as well as consolidating cracks and fissures of the rock strata. Major benefits are obtained when producing long bolts in poor ground conditions with heavily fractured zones and water infiltration problems.

Applications

Hollow Deformed Reinforcing Bars allow positive grouting to distal end of drill hole through difficult conditions such as fracture zones and over long lengths. This produces a permanent corrosion protected anchor.

Vertical Downward

For vertically downward orientations expansive cement grout is pumped to bottom of drill hole and fully encapsulates rebar while consolidation grouting of strata takes place.

Inclined Horizontal

Horizontal applications inclined by 10º either up or down to facilitate grout pumping. Pump grout according to whether inclined up or down in accordance with up or down grouting procedures.

Vertical Upward

Fluid grouts can be pumped in the annular space around bolt.

Thixotropic Grouting

Thixotropic grouts can be pumped through the hollow core of the bolt and return through vent. Neat expansive cement grouts of a 0.3 to 1 water/cement ratio can be pumped. Pumping is performed with thixotropic grout pump-mixers available from AR.

TABLE CS3 HDR TECHNICAL INFORMATION

<table>
<thead>
<tr>
<th>PRODUCT NUMBER</th>
<th>HDR BAR DIAMETER</th>
<th>THREAD DIAMETER - TPI</th>
<th>EFFECTIVE TENSILE STRESS AREA</th>
<th>MAX. WORKING LOAD TO YIELD</th>
<th>ULTIMATE TENSILE STRENGTH</th>
<th>MECHANICAL ANCHOR ASSEMBLY</th>
<th>DRILL HOLE DIAMETER</th>
<th>RECOMMENDED ALLOWABLE APPLIED TORQUE*</th>
</tr>
</thead>
<tbody>
<tr>
<td>HDR25</td>
<td>25 mm</td>
<td>1  (8UN)</td>
<td>339 sq. mm (0.526 sq in.)</td>
<td>200 kN (45,000 lbs)</td>
<td>320 kN (72,000 lbs)</td>
<td>AR4525-M**</td>
<td>45 mm (1¾”)</td>
<td>675 Nm (500 ft-lbs)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>AR5025-N</td>
<td>51 mm (2”)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>AR6525-N</td>
<td>65 mm (2½”)</td>
<td></td>
</tr>
<tr>
<td>HDR35</td>
<td>35 mm (1 3/8”)</td>
<td>8UN</td>
<td>702 sq. mm (1.089 sq in.)</td>
<td>484 kN (108,900 lbs)</td>
<td>663 kN (149,000 lbs)</td>
<td>AR5535-N</td>
<td>57 mm (2¼”)</td>
<td>2,000 Nm (1,500 ft-lbs)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>AR6535-N</td>
<td>65 mm (2½”)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>AR7635-N</td>
<td>76 mm (2½”)</td>
<td></td>
</tr>
</tbody>
</table>

NOTE: HDR bolts are made from high strength steel alloy with a minimum elongation of 15% in a 2 inch gauge length. Good engineering practice must be utilized so that the nut is fully supported by the base plate and bending is not induced at the root of the threads.

** Couplings cannot be used with the modified cone shell anchor AR4525-M due to the hole diameter.

Hollow Deformed Rebar (HDR)

Applications

Hollow Deformed Reinforcing Bars allow positive grouting to distal end of drill hole through difficult conditions such as fracture zones and over long lengths. This produces a permanent corrosion protected anchor.

Vertical Downward

For vertically downward orientations expansive cement grout is pumped to bottom of drill hole and fully encapsulates rebar while consolidation grouting of strata takes place.

Inclined Horizontal

Horizontal applications inclined by 10º either up or down to facilitate grout pumping. Pump grout according to whether inclined up or down in accordance with up or down grouting procedures.

Vertical Upward

Fluid grouts can be pumped in the annular space around bolt.

Thixotropic Grouting

Thixotropic grouts can be pumped through the hollow core of the bolt and return through vent. Neat expansive cement grouts of a 0.3 to 1 water/cement ratio can be pumped. Pumping is performed with thixotropic grout pump-mixers available from AR.
Solid Deformed Rebar (SDR)

Made from reinforcing that meets CSA standard G30.18 M-92 and ASTM 615. An economical, medium strength rod used for tie downs, and rock reinforcement. Use AR Expansion cone shell anchor series for blind hole and prestressed rebar anchor applications. Use 2 tubes for complete grouting. One tube pumps grout to the back of the borehole and the other acts as a vent. The grouting tube is affixed to the rod to a point just above the anchor and the vent tube just passes through the plate to the drilled hole.

**NOTE:** To activate AR Mechanical Expansion Anchors apply steady torque (not impact) until anchor rod stops rotating or maximum allowable applied torque value is reached. Anchor rods can be hot dipped galvanized, full length or partial. DO NOT EXCEED MAXIMUM ALLOWABLE APPLIED TORQUE. TORSIONAL SHEAR FAILURE AT ROOT OF THREADS MAY OCCUR. Recommended minimum Safe Working (Design) Load is 2 to 1 against ultimate.

**Solid Deformed Rebar (SDR) Applications**

Two tubes are utilized when pumping fluid cementitious grouts in vertically downward or near horizontal orientations. Pumping vertically upwards is best achieved by using a hollow deformed rebar. Thixotropic grouts may be used by pumping through a tube to the back of the drill hole.

**SDR Downward Grouting** and **SDR Upward Grouting** with thixotropic cementitious grouts for permanent grouting.

---

**Product Number**

<table>
<thead>
<tr>
<th>SDR Bar Size</th>
<th>Thread Diameter - TPI</th>
<th>Effective Tensile Stress Area</th>
<th>Max. Working Load to Yield</th>
<th>Ultimate Tensile Strength</th>
<th>Mechanical Anchor Assembly</th>
<th>Drill Hole Diameter</th>
<th>Recommended Allowable Applied Torque*</th>
</tr>
</thead>
<tbody>
<tr>
<td>SDR-12 15M</td>
<td>1/2&quot; - 13UNC</td>
<td>92 sq. mm (0.1419 sq. in.)</td>
<td>36 kN (8,200 lbs)</td>
<td>56 kN (12,700 lbs)</td>
<td>AR4512-N</td>
<td>45 mm (1¾&quot;)</td>
<td>76 Nm (50 ft-lbs)</td>
</tr>
<tr>
<td>SDR-16 15M</td>
<td>5/8&quot; - 11UNC</td>
<td>145 sq. mm (0.226 sq. in.)</td>
<td>60 kN (13,500 lbs)</td>
<td>90 kN (20,300 lbs)</td>
<td>AR4516-N</td>
<td>45 mm (1¾&quot;)</td>
<td>110 Nm (80 ft-lbs)</td>
</tr>
<tr>
<td>SDR-20 20M</td>
<td>3/4&quot; - 10UNC</td>
<td>215 sq. mm (0.334 sq. in.)</td>
<td>86 kN (19,400 lbs)</td>
<td>133 kN (30,000 lbs)</td>
<td>AR4520-N</td>
<td>45 mm (1¾&quot;)</td>
<td>230 Nm (170 ft-lbs)</td>
</tr>
<tr>
<td>SDR-22 25M</td>
<td>7/8&quot; - 9UNC</td>
<td>295 sq. mm (0.462 sq. in.)</td>
<td>123 kN (27,700 lbs)</td>
<td>185 kN (41,500 lbs)</td>
<td>AR4522-N</td>
<td>45 mm (1¾&quot;)</td>
<td>360 Nm (265 ft-lbs)</td>
</tr>
<tr>
<td>SDR-25 20M</td>
<td>1&quot; - 8UN</td>
<td>391 sq. mm (0.606 sq. in.)</td>
<td>156 kN (35,200 lbs)</td>
<td>242 kN (54,500 lbs)</td>
<td>AR4525-M*</td>
<td>45 mm (1¾&quot;)</td>
<td>550 Nm (400 ft-lbs)</td>
</tr>
<tr>
<td>SDR-29 30M</td>
<td>1 1/8&quot; - 8UN</td>
<td>512 sq. mm (1.009 sq. in.)</td>
<td>203 kN (45,400 lbs)</td>
<td>314 kN (69,600 lbs)</td>
<td>AR5029-N</td>
<td>57 mm (2¼&quot;)</td>
<td>550 Nm (400 ft-lbs)</td>
</tr>
<tr>
<td>SDR-32 35M</td>
<td>1 1/8&quot; - 8UN</td>
<td>645 sq. mm (1.600 sq. in.)</td>
<td>203 kN (45,400 lbs)</td>
<td>314 kN (69,600 lbs)</td>
<td>AR5529-N</td>
<td>57 mm (2¼&quot;)</td>
<td>625 Nm (480 ft-lbs)</td>
</tr>
<tr>
<td>SDR-35 35M</td>
<td>1 3/8&quot; - 8UN</td>
<td>796 sq. mm (1.235 sq. in.)</td>
<td>203 kN (45,400 lbs)</td>
<td>314 kN (69,600 lbs)</td>
<td>AR5535-N</td>
<td>57 mm (2¼&quot;)</td>
<td>755 Nm (570 ft-lbs)</td>
</tr>
<tr>
<td>SDR-38 45M</td>
<td>1 1/2&quot; - 8UN</td>
<td>963 sq. mm (1.492 sq. in.)</td>
<td>203 kN (45,400 lbs)</td>
<td>314 kN (69,600 lbs)</td>
<td>AR6538-N</td>
<td>65 mm (2½&quot;)</td>
<td>1,015 Nm (750 ft-lbs)</td>
</tr>
<tr>
<td>SDR-45 50M</td>
<td>1 1/4&quot; - 8UN</td>
<td>1,225 sq. mm (1.991 sq. in.)</td>
<td>203 kN (45,400 lbs)</td>
<td>314 kN (69,600 lbs)</td>
<td>AR7645-N</td>
<td>65 mm (2½&quot;)</td>
<td>1,100 Nm (800 ft-lbs)</td>
</tr>
<tr>
<td>SDR-48 55M</td>
<td>1 1/4&quot; - 8UN</td>
<td>1,525 sq. mm (2.080 sq. in.)</td>
<td>203 kN (45,400 lbs)</td>
<td>314 kN (69,600 lbs)</td>
<td>AR7648-N</td>
<td>65 mm (2½&quot;)</td>
<td>1,100 Nm (800 ft-lbs)</td>
</tr>
<tr>
<td>SDR-55 55M</td>
<td>2&quot; - 8UN</td>
<td>1,787 sq. mm (2.770 sq. in.)</td>
<td>203 kN (45,400 lbs)</td>
<td>314 kN (69,600 lbs)</td>
<td>AR9055-N</td>
<td>90 mm (3½&quot;)</td>
<td>4,000 Nm (3,000 ft-lbs)</td>
</tr>
</tbody>
</table>

* Couplings cannot be used with the modified Cone Shell AR4525-M, AR5025-N due to the hole diameter.

**SDR Shipping Assembly**

- With an AR6525 Cone Shell Expansion Anchor
- SDR Site Assembly
- SDR Rod Series
## Solid Continuous Threaded Unified (SCT-N)

Available in 8-UN thread forms for thread sizes 25mm (1”) and over. UNC thread forms for thread sizes less than 25 mm (1”). Material is a ductile carbon steel. SCT-N utilizes both the AR and bail mechanical expansion anchors. May also be used in bail anchor applications. Suitable for field cutting to any length.

### Solid Continuous Threaded Lag (SCT-N)

**SCT-N Shipping Assembly**

with an AR cone shell.

### Products Table

<table>
<thead>
<tr>
<th>Product Number</th>
<th>SDR</th>
<th>Bar Size</th>
<th>Thread Diameter - TPI</th>
<th>Effective Tensile Stress Area</th>
<th>Max. Working Load to Yield</th>
<th>Ultimate Tensile Strength</th>
<th>Mechanical Anchor Assembly</th>
<th>Drill Hole Diameter</th>
<th>Recommended Allowable Applied Torque*</th>
</tr>
</thead>
<tbody>
<tr>
<td>SCT-N-12</td>
<td>15 mm (½”)</td>
<td>1/2” - 13UNC</td>
<td>92 sq. mm (0.1419 sq. in.)</td>
<td>57 kN (13,200 lbs)</td>
<td>80 kN (18,000 lbs)</td>
<td>AR4512-N-SA</td>
<td>45 mm (1 1/4”)</td>
<td>95 Nm (70 ft-lbs)</td>
<td></td>
</tr>
<tr>
<td>SCT-N-20</td>
<td>19 mm (¾”)</td>
<td>¾” - 10UNC</td>
<td>215 sq. mm (0.334 sq. in.)</td>
<td>133 kN (30,000 lbs)</td>
<td>169 kN (38,000 lbs)</td>
<td>AR4520-N-SA</td>
<td>45 mm (1 1/4”)</td>
<td>340 Nm (250 ft-lbs)</td>
<td></td>
</tr>
<tr>
<td>SCT-N-25</td>
<td>25 mm (1”)</td>
<td>1” - 8UN</td>
<td>391 sq. mm (0.606 sq. in.)</td>
<td>260 kN (58,000 lbs)</td>
<td>334 kN (75,000 lbs)</td>
<td>AR5025-N-SA</td>
<td>57 mm (2”)</td>
<td>810 Nm (600 ft-lbs)</td>
<td></td>
</tr>
<tr>
<td>SCT-N-32</td>
<td>32 mm (1¼”)</td>
<td>1¼” - 6UNC</td>
<td>645 sq. mm (1.000 sq. in.)</td>
<td>203 kN (45,000 lbs)</td>
<td>534 kN (120,000 lbs)</td>
<td>AR5532-N-SA</td>
<td>65 mm (2”)</td>
<td>1,625 Nm (1,200 ft-lbs)</td>
<td></td>
</tr>
</tbody>
</table>

### Notes

1. To activate AR Mechanical Expansion Anchors apply steady torque (not impact) until maximum allowable applied torque value is reached. DO NOT EXCEED MAXIMUM ALLOWABLE APPLIED TORQUE. TORSIONAL SHEAR FAILURE AT ROOT OF THREADS MAY OCCUR.
2. Recommended minimum Safe Working (Design) Load is 2 to 1 against ultimate.

---

## Solid Continuous Threaded Lag (SCT-L)

### Lag Stud bolts of the same carbon steel as the SCT and SST series

### SCT-L Shipping Assembly with AR cone shell anchor

Ready for protective storage sleeve utilizes both AR and bail mechanical expansion anchor series. Also used in through bolting applications without mechanical anchors. Suitable for field cutting to any length. The lag stud thread form is typically used with concrete forming hardware. Use AR mechanical cone shell anchors to provide maximum holding power with minimum rod deflection.

### Products Table

<table>
<thead>
<tr>
<th>Product Number</th>
<th>SDR</th>
<th>Bar Size</th>
<th>Thread Diameter - TPI</th>
<th>Effective Tensile Stress Area</th>
<th>Max. Working Load to Yield</th>
<th>Ultimate Tensile Strength</th>
<th>Mechanical Anchor Assembly</th>
<th>Drill Hole Diameter</th>
<th>Recommended Allowable Applied Torque*</th>
</tr>
</thead>
<tbody>
<tr>
<td>SCT-L-12</td>
<td>13 mm (½”)</td>
<td>1/2” - 6 LAG</td>
<td>90 sq. mm (0.139 sq. in.)</td>
<td>57 kN (13,000 lbs)</td>
<td>80 kN (18,000 lbs)</td>
<td>AR4512-L-SA</td>
<td>45 mm (1 1/4”)</td>
<td>95 Nm (70 ft-lbs)</td>
<td></td>
</tr>
<tr>
<td>SCT-L-20</td>
<td>19 mm (¾”)</td>
<td>¾” - 4.5 LAG</td>
<td>198 sq. mm (0.307 sq. in.)</td>
<td>133 kN (30,000 lbs)</td>
<td>169 kN (38,000 lbs)</td>
<td>AR4520-L-SA</td>
<td>45 mm (1 1/4”)</td>
<td>340 Nm (250 ft-lbs)</td>
<td></td>
</tr>
<tr>
<td>SCT-L-25</td>
<td>25 mm (1”)</td>
<td>1” - 3.5 LAG</td>
<td>349 sq. mm (0.541 sq. in.)</td>
<td>266 kN (58,000 lbs)</td>
<td>334 kN (75,000 lbs)</td>
<td>AR5025-L-SA</td>
<td>57 mm (2”)</td>
<td>810 Nm (600 ft-lbs)</td>
<td></td>
</tr>
<tr>
<td>SCT-L-32</td>
<td>32 mm (1¼”)</td>
<td>1¼” - 3.5 LAG</td>
<td>591 sq. mm (0.916 sq. in.)</td>
<td>400 kN (90,000 lbs)</td>
<td>534 kN (90,000 lbs)</td>
<td>AR5532-L-SA</td>
<td>65 mm (2”)</td>
<td>1,625 Nm (1,200 ft-lbs)</td>
<td></td>
</tr>
</tbody>
</table>

### Notes

1. To activate AR Mechanical Expansion Anchors apply steady torque (not impact) until maximum allowable applied torque value is reached. DO NOT EXCEED MAXIMUM ALLOWABLE APPLIED TORQUE. TORSIONAL SHEAR FAILURE AT ROOT OF THREADS MAY OCCUR. Recommended minimum Safe Working (Design) Load is 2 to 1 against ultimate.

---

## AR Anchor with Stud Assembly for SCT-L ROD Series

The AR Anchor with Stud Assembly comes with a transition coupler to provide the AR mechanical cone shell anchors the ability to be used with all thread rods such as lagstud, a coil or rope thread, SCT-N, SST, B7 for single sided forming or rock bolting applications.
**SCT-N-B7 All Thread Bar**

AR SCT-N-B7 All Thread Bar products are manufactured from heat treated alloy steel in conformance to ASTM A193 using a roll thread process. The AR SCT-N-B7 products are commonly used in high pressure and extreme service requirements. AR SCT-N-B7 all thread products can be supplied with a AR Anchor using a stud assembly or Bolt Anchor.

**Mechanical Properties of ASTM A193 B7**

<table>
<thead>
<tr>
<th>DIAMETER</th>
<th>TENSILE STRESS AREA</th>
<th>EFFECTIVE STRESS AREA</th>
<th>WORKING LOAD TO YIELD</th>
<th>ULTIMATE TENSILE STRENGTH</th>
<th>MECHANICAL ANCHOR ASSEMBLY</th>
<th>DRILL HOLE DIAMETER</th>
<th>RECOMMENDED ALLOWABLE APPLIED TORQUE*</th>
</tr>
</thead>
<tbody>
<tr>
<td>11/16” (1.750 sq. in.)</td>
<td>394 sq. mm (6,960 sq. in.)</td>
<td>295 sq. mm (4,602 sq. in.)</td>
<td>285 kN (4,100 lbs)</td>
<td>327 kN (4,770 lbs)</td>
<td>AR5525-N-SA</td>
<td>57 mm (2 1/4”)</td>
<td>1,625 Nm (2,200 ft-lbs)</td>
</tr>
<tr>
<td>5/8” (1.250 sq. in.)</td>
<td>197 sq. mm (3,372 sq. in.)</td>
<td>145 sq. mm (2,295 sq. in.)</td>
<td>197 kN (2,850 lbs)</td>
<td>237 kN (3,430 lbs)</td>
<td>AR6525-N-SA</td>
<td>65 mm (2 1/2”)</td>
<td>2,170 Nm (2,900 ft-lbs)</td>
</tr>
<tr>
<td>1” (1.500 sq. in.)</td>
<td>79 sq. mm (1,372 sq. in.)</td>
<td>59 sq. mm (883 sq. in.)</td>
<td>79 kN (1,120 lbs)</td>
<td>90 kN (1,290 lbs)</td>
<td>AR7525-N-SA</td>
<td>76 mm (3”)</td>
<td>2,700 Nm (3,600 ft-lbs)</td>
</tr>
</tbody>
</table>

**Solid Smooth Threaded (SST)**

For High Strength (structural) bolting applications. Solid Smooth Cold Drawn high tensile carbon steel for assurance of quality. Cold Rolled threaded with the 8UN thread series for sizes 25 mm (1”) & greater originally developed for high pressure bolting installations. Standard UNC thread series for sizes less than 25 mm (1”). Suitable for use with AR mechanical expansion anchors for prestressed and blind hole bolting applications. Also available in all diameters of specified rods with thread lengths at each end for tiebolt applications.

**TABLE CST SST TECHNICAL INFORMATION**

<table>
<thead>
<tr>
<th>PRODUCT NUMBER</th>
<th>SST ROD DIAMETER</th>
<th>THREAD DIAMETER - TPI</th>
<th>EFFECTIVE TENSILE STRESS AREA</th>
<th>WORKING LOAD TO YIELD</th>
<th>ULTIMATE TENSILE STRENGTH</th>
<th>MECHANICAL ANCHOR ASSEMBLY</th>
<th>RECOMMENDED ALLOWABLE APPLIED TORQUE*</th>
</tr>
</thead>
<tbody>
<tr>
<td>SST-12</td>
<td>11 mm (7/16”)</td>
<td>15/16” - 8 UN</td>
<td>92 sq. mm (1,419 sq. in.)</td>
<td>57 kN (8,300 lbs)</td>
<td>80 kN (11,400 lbs)</td>
<td>AR4512-N-SA</td>
<td>45 mm (1 3/4”)</td>
</tr>
<tr>
<td>SST-20</td>
<td>19 mm (11/16”)</td>
<td>15/16” - 10 UN</td>
<td>215 sq. mm (3,233 sq. in.)</td>
<td>133 kN (19,400 lbs)</td>
<td>169 kN (25,300 lbs)</td>
<td>AR4520-N-SA</td>
<td>45 mm (1 3/4”)</td>
</tr>
<tr>
<td>SST-25</td>
<td>24 mm (15/16”)</td>
<td>1” - 8 UN</td>
<td>391 sq. mm (6,066 sq. in.)</td>
<td>266 kN (39,000 lbs)</td>
<td>334 kN (50,800 lbs)</td>
<td>AR5025-M-SA</td>
<td>65 mm (2 1/2”)</td>
</tr>
<tr>
<td>SST-32</td>
<td>30 mm (1 1/4”)</td>
<td>1½” - 8 UN</td>
<td>645 sq. mm (10,000 sq. in.)</td>
<td>400 kN (60,000 lbs)</td>
<td>500 kN (75,000 lbs)</td>
<td>AR5525-N-SA</td>
<td>65 mm (2 1/2”)</td>
</tr>
<tr>
<td>SST-35</td>
<td>33 mm (1 3/8”)</td>
<td>1 3/8” - 8 UN</td>
<td>796 sq. mm (12,333 sq. in.)</td>
<td>489 kN (72,000 lbs)</td>
<td>600 kN (90,000 lbs)</td>
<td>AR6532-N-SA</td>
<td>76 mm (3”)</td>
</tr>
<tr>
<td>SST-38</td>
<td>37 mm (1 1/2”)</td>
<td>1½” - 8 UN</td>
<td>963 sq. mm (15,400 sq. in.)</td>
<td>596 kN (90,000 lbs)</td>
<td>796 kN (117,000 lbs)</td>
<td>AR7638-N-SA</td>
<td>76 mm (3”)</td>
</tr>
<tr>
<td>SST-45</td>
<td>43 mm (1 1/4”)</td>
<td>1½” - 8 UN</td>
<td>1,342 sq. mm (2,080 sq. in.)</td>
<td>830 kN (120,000 lbs)</td>
<td>1,100 kN (165,000 lbs)</td>
<td>AR8404-N-SA</td>
<td>90 mm (3”)</td>
</tr>
<tr>
<td>SST-50</td>
<td>49 mm (1 1/2”)</td>
<td>2” - 8 UN</td>
<td>1,787 sq. mm (2,770 sq. in.)</td>
<td>1,150 kN (170,000 lbs)</td>
<td>1,370 kN (205,000 lbs)</td>
<td>AR9605-N-SA</td>
<td>90 mm (3”)</td>
</tr>
</tbody>
</table>

NOTE: To activate AR Mechanical Expansion Anchors apply steady torque (not impact) until maximum allowable applied torque value is reached. DO NOT EXCEED MAXIMUM ALLOWABLE APPLIED TORQUE. TORSIONAL SHEAR FAILURE AT ROOT OF THREADS MAY OCCUR. Recommended minimum Safe Working (Design) Load is 2 to 1 against ultimate.
All Thread Bar

AR All Thread Bars conform to ASTM A722 and ACI 318. The deformation complies with ASTM A615. All Thread Bars are available in grade 60, 75, 95 and 150 to satisfy requirements for tyback, reinforcing connections and rock bolting. All Thread Bars can be supplied as plain, hot dipped galvanized or epoxy coated. Consult the AR Technical Department for available bar diameters.

Through Wall Ty Bar

All AR bar products in this publication can be considered for Through Wall Ty applications. AR Standard Deform Bar (SDR) Continuous Threaded Lag (SCT-L) and our Solid Smooth Threaded (SST) products provide a wide range of economical solutions for tie back requirements. Refer to SDR, SCT-L or SST for material selection. AR engineered approach provides an innovative method to achieve the full working load requirement. When design loads exceed published values, consult the AR Technical Department.

AR Corrosion Protection Products

AR provides a wide range of corrosion protection systems and sealants. They include sealants, profiling mastics and tapes. Consult the AR Technical Department for application recommendations and details.

Through Wall Ty Bar

Cold Rolled Threaded Bar – Grade 75 – ASTM A 615

<table>
<thead>
<tr>
<th>Bar Designation</th>
<th>Nominal Diameter in (mm)</th>
<th>Min. Net Area Through Threads in² (mm²)</th>
<th>Min. Ultimate Strength in kips (kN)</th>
<th>Min. Yield Strength in kips (kN)</th>
<th>Nominal Weight in lb/ft (kg/m)</th>
<th>Approx. Major Thread Diameter in (mm)</th>
<th>Thread Orientation</th>
<th>Max. Length ft (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>#8</td>
<td>0.790  (51.0)</td>
<td>78  (514)</td>
<td>2.70  (4.0)</td>
<td>1 1/8 (28.5)</td>
<td>Left Hand 60 (18.3)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>#9</td>
<td>1 0.790  (51.0)</td>
<td>100  (644.8)</td>
<td>3.40  (5.1)</td>
<td>1 1/2 (38.1)</td>
<td>Left Hand 60 (18.3)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>#10</td>
<td>1 1/8 (28)</td>
<td>127  (864.9)</td>
<td>4.30  (6.4)</td>
<td>1 3/8 (35.0)</td>
<td>Left Hand 60 (18.3)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>#11</td>
<td>1 3/8 (35)</td>
<td>156  (1006.0)</td>
<td>5.30  (7.6)</td>
<td>1 7/8 (38.1)</td>
<td>Left Hand 60 (18.3)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>#14</td>
<td>2 (64)</td>
<td>225  (1420.5)</td>
<td>7.65  (11.4)</td>
<td>1 1/4 (32.0)</td>
<td>Right Hand 60 (18.3)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>#18</td>
<td>2 1/8 (55)</td>
<td>400  (2581.0)</td>
<td>13.60  (20.2)</td>
<td>2 1/2 (70.0)</td>
<td>Right Hand 60 (18.3)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>#20</td>
<td>2 1/4 (57)</td>
<td>491  (3134.5)</td>
<td>22.3  (32.0)</td>
<td>3 1/2 (84.2)</td>
<td>Right Hand 60 (18.3)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>#24</td>
<td>3 1/4 (89)</td>
<td>707  (4417.0)</td>
<td>36.8  (52.0)</td>
<td>3 3/4 (96.5)</td>
<td>Right Hand 60 (18.3)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>#28</td>
<td>4 1/2 (89)</td>
<td>707  (4417.0)</td>
<td>36.8  (52.0)</td>
<td>3 3/4 (96.5)</td>
<td>Right Hand 60 (18.3)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Cold rolled threaded bars to conform to the physical and chemical requirements of ASTM A 615 Grade 75 ksi

Cold Rolled Threaded Bar – Grade 150 – ASTM A 722

<table>
<thead>
<tr>
<th>Nominal Diameter in (mm)</th>
<th>Min. Net Area Through Threads in² (mm²)</th>
<th>Min. Ultimate Strength in kips (kN)</th>
<th>Min. Yield Strength in kips (kN)</th>
<th>Nominal Weight in lb/ft (kg/m)</th>
<th>Approx. Major Thread Diameter in (mm)</th>
<th>Thread Orientation</th>
<th>Max. Length ft (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>#8</td>
<td>0.850  (54.9)</td>
<td>128  (867.0)</td>
<td>2.70  (4.0)</td>
<td>1 1/8 (28.5)</td>
<td>Left Hand 60 (18.3)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>#9</td>
<td>1 0.790  (51.0)</td>
<td>156  (1006.0)</td>
<td>3.40  (5.1)</td>
<td>1 1/2 (38.1)</td>
<td>Left Hand 60 (18.3)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>#10</td>
<td>1 3/8 (36)</td>
<td>189  (1234.0)</td>
<td>4.30  (6.4)</td>
<td>1 3/8 (35.0)</td>
<td>Left Hand 60 (18.3)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>#11</td>
<td>2 1/8 (55)</td>
<td>237  (1554.0)</td>
<td>9.3  (423.9)</td>
<td>1 7/8 (38.1)</td>
<td>Right Hand 60 (18.3)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>#14</td>
<td>2 1/4 (57)</td>
<td>400  (2581.0)</td>
<td>13.60  (20.2)</td>
<td>2 1/2 (70.0)</td>
<td>Right Hand 60 (18.3)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>#18</td>
<td>3 (75)</td>
<td>707  (4417.0)</td>
<td>24.0  (35.7)</td>
<td>3 1/2 (84.2)</td>
<td>Left Hand 60 (18.3)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1 inch to 1.3/8 inch diameter, ASTM A 722; 1 1/4 inch to 3 inch diameter bar manufactured in accordance with ASTM A 722 physical and chemical requirements. *Additional lengths available upon request.
FJ Series Rock Anchors

Double leaf bail-type anchors are suitable for light to moderate load applications up to a 35mm (13/8”) 8UN thread size.

Anchors are positioned by inserting to final depth and using a moderate torque at 20 ft-lbs. (hand tight) to pre-expand anchors. Final fit-up is achieved by tensioning the anchor rod against the bearing plate. Available in Lag and UN/UNC series threads as shown.

### Table CS8: FJ Series Technical Information

<table>
<thead>
<tr>
<th>PRODUCT NUMBER</th>
<th>THREAD DIAMETER - TPI</th>
<th>DRILL HOLE DIAMETER</th>
<th>SHELL LENGTH</th>
<th>WEDGE LENGTH</th>
<th>WEDGE PEARLICIT (P) OR MALLEABLE (M)</th>
<th>NON-SEIZURE LOAD (lbs)</th>
</tr>
</thead>
<tbody>
<tr>
<td>5/8&quot; UNC</td>
<td>(35mm) 1 3/8&quot;</td>
<td>(35mm) 1 3/8&quot;</td>
<td>(35mm) 1 3/8&quot;</td>
<td>M</td>
<td>75.5 kN (17,000 lbs)</td>
<td></td>
</tr>
<tr>
<td>3/4&quot; UNC</td>
<td>(35mm) 1 3/8&quot;</td>
<td>(37mm) 2 7/8&quot;</td>
<td>(35mm) 1 3/8&quot;</td>
<td>P</td>
<td>133 kN (30,000 lbs)</td>
<td></td>
</tr>
<tr>
<td>1/2&quot; LAG HT*</td>
<td>(35mm) 1 3/8&quot;</td>
<td>(37mm) 2 7/8&quot;</td>
<td>(35mm) 1 3/8&quot;</td>
<td>M</td>
<td>80 kN (18,000 lbs)*</td>
<td></td>
</tr>
<tr>
<td>3/4&quot; LAG HT*</td>
<td>(35mm) 1 3/8&quot;</td>
<td>(37mm) 2 7/8&quot;</td>
<td>(35mm) 1 3/8&quot;</td>
<td>P</td>
<td>160 kN (36,000 lbs)*</td>
<td></td>
</tr>
</tbody>
</table>

*NOTE: Coupling of 1 1/2” O.D. to be used with D20-N-25 and AR5025 Anchor due to the hole diameter of 2”

---

Consolidation Rock Bolt (ARCRB)

Square Nut ARSN

Hard Washer ARHRW

Bearings Plate ARBPH

95 mm x 95 mm x 8 mm

All Thread Rod

5/8” Left Hand Thread

Application of a Consolidation Rock Bolt

<table>
<thead>
<tr>
<th>PRODUCT NUMBER</th>
<th>THREAD DIAMETER</th>
<th>MAXIMUM WORKING LOAD TO YIELD</th>
<th>MECHANICAL ANCHOR ASSEMBLY</th>
<th>DRILL-HOLE DIAMETER</th>
<th>RECOMMENDED ALLOWABLE APPLIED TORQUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>HDR-CB-25</td>
<td>25 mm (1”)</td>
<td>200 kN (32,000 lbs)</td>
<td>AR5025-N</td>
<td>45 mm (1 1/4”)</td>
<td>675 Nm (500 ft-lb)</td>
</tr>
<tr>
<td>HDR-CB-35</td>
<td>35 mm (1 3/8”)</td>
<td>484 kN (108,900 lbs)</td>
<td>AR7535</td>
<td>76 mm (3”)</td>
<td>2,000 Nm (1,500 ft-lb)</td>
</tr>
</tbody>
</table>

*NOTE: Coupling of 1 1/2” O.D. to be used with D20-N-25 and AR5025 Anchor due to the hole diameter of 2”
### Heavy Hex Nut (ARHHN)

<table>
<thead>
<tr>
<th>ARHHN Thread Diameter - TPI</th>
<th>Height</th>
<th>Across Flats</th>
<th>Across Corners</th>
</tr>
</thead>
<tbody>
<tr>
<td>1/8&quot;-6 LAG</td>
<td>12.3 mm (0.49&quot;)</td>
<td>22 mm (0.87&quot;)</td>
<td>25 mm (1&quot;)</td>
</tr>
<tr>
<td>5/32&quot;-12UNC</td>
<td>12.3 mm (0.49&quot;)</td>
<td>22 mm (0.87&quot;)</td>
<td>25 mm (1&quot;)</td>
</tr>
<tr>
<td>3/32&quot;-14UNC</td>
<td>15.4 mm (0.61&quot;)</td>
<td>26.9 mm (1.06&quot;)</td>
<td>30.9 mm (1.2&quot;)</td>
</tr>
<tr>
<td>7/64&quot;-16UNC</td>
<td>18.7 mm (0.74&quot;)</td>
<td>32 mm (1.26&quot;)</td>
<td>37 mm (1.46&quot;)</td>
</tr>
<tr>
<td>1/4&quot;-14 LAG</td>
<td>21.8 mm (0.86&quot;)</td>
<td>34.5 mm (1.36&quot;)</td>
<td>42 mm (1.66&quot;)</td>
</tr>
<tr>
<td>1/4&quot; 3.5 LAG</td>
<td>25 mm (0.98&quot;)</td>
<td>41 mm (1.61&quot;)</td>
<td>48 mm (1.89&quot;)</td>
</tr>
<tr>
<td>1/4&quot; 8UN</td>
<td>25 mm (0.98&quot;)</td>
<td>41 mm (1.61&quot;)</td>
<td>48 mm (1.89&quot;)</td>
</tr>
<tr>
<td>5/8&quot;-11UNC</td>
<td>25.4 mm (1.00&quot;)</td>
<td>46.0 mm (1.82&quot;)</td>
<td>53.3 mm (2.11&quot;)</td>
</tr>
<tr>
<td>11/8&quot; 8UN</td>
<td>31 mm (1.22&quot;)</td>
<td>51 mm (2.00&quot;)</td>
<td>59 mm (2.32&quot;)</td>
</tr>
<tr>
<td>13/8&quot; 8UN</td>
<td>34.1 mm (1.34&quot;)</td>
<td>56 mm (2.20&quot;)</td>
<td>64 mm (2.52&quot;)</td>
</tr>
<tr>
<td>13/8&quot; BUN</td>
<td>37.3 mm (1.47&quot;)</td>
<td>60 mm (2.36&quot;)</td>
<td>70 mm (2.76&quot;)</td>
</tr>
<tr>
<td>1&quot;-14 LAG</td>
<td>43.7 mm (1.72&quot;)</td>
<td>70 mm (2.76&quot;)</td>
<td>81 mm (3.19&quot;)</td>
</tr>
<tr>
<td>1¼&quot; 8UN</td>
<td>43.7 mm (1.72&quot;)</td>
<td>70 mm (2.76&quot;)</td>
<td>81 mm (3.19&quot;)</td>
</tr>
<tr>
<td>1½&quot;-10UNC</td>
<td>46.5 mm (1.83&quot;)</td>
<td>74.6 mm (2.94&quot;)</td>
<td>86.5 mm (3.41&quot;)</td>
</tr>
<tr>
<td>2&quot;-12UNC</td>
<td>50 mm (1.97&quot;)</td>
<td>79 mm (3.11&quot;)</td>
<td>92 mm (3.62&quot;)</td>
</tr>
</tbody>
</table>

### Hardened Round Washer (ARHRW)

<table>
<thead>
<tr>
<th>ARHRW Nominal Size</th>
<th>Thickness</th>
<th>Inside Diameter</th>
<th>Outside Diameter</th>
</tr>
</thead>
<tbody>
<tr>
<td>1/8&quot;</td>
<td>2 mm (0.08&quot;)</td>
<td>13 mm (0.51&quot;)</td>
<td>27 mm (1.06&quot;)</td>
</tr>
<tr>
<td>5/32&quot;</td>
<td>3 mm (0.12&quot;)</td>
<td>17.4 mm (0.69&quot;)</td>
<td>33.3 mm (1.31&quot;)</td>
</tr>
<tr>
<td>3/32&quot;</td>
<td>4 mm (0.16&quot;)</td>
<td>23.8 mm (0.94&quot;)</td>
<td>44.4 mm (1.75&quot;)</td>
</tr>
<tr>
<td>7/64&quot;</td>
<td>4 mm (0.16&quot;)</td>
<td>29 mm (1.14&quot;)</td>
<td>51 mm (2&quot;)</td>
</tr>
<tr>
<td>1/16&quot;</td>
<td>4 mm (0.16&quot;)</td>
<td>31.7 mm (1.25&quot;)</td>
<td>57.1 mm (2.26&quot;)</td>
</tr>
<tr>
<td>1/18&quot;</td>
<td>4 mm (0.16&quot;)</td>
<td>33 mm (1.30&quot;)</td>
<td>64 mm (2.52&quot;)</td>
</tr>
<tr>
<td>1 3/8&quot;</td>
<td>4 mm (0.16&quot;)</td>
<td>38 mm (1.50&quot;)</td>
<td>70 mm (2.76&quot;)</td>
</tr>
<tr>
<td>1 1/8&quot;</td>
<td>5 mm (0.20&quot;)</td>
<td>41 mm (1.61&quot;)</td>
<td>76 mm (3&quot;)</td>
</tr>
<tr>
<td>1 1/4&quot;</td>
<td>5 mm (0.20&quot;)</td>
<td>48 mm (1.89&quot;)</td>
<td>89 mm (3.50&quot;)</td>
</tr>
<tr>
<td>2&quot;</td>
<td>5 mm (0.20&quot;)</td>
<td>54 mm (2.13&quot;)</td>
<td>95 mm (3.74&quot;)</td>
</tr>
</tbody>
</table>

### Beveled Washer (ARBW)

<table>
<thead>
<tr>
<th>ARBW Nominal Size A</th>
<th>Inside Diameter B</th>
<th>Outside Diameter C</th>
<th>Minimum Thickness D</th>
<th>Minimum Thickness E</th>
<th>Width</th>
</tr>
</thead>
<tbody>
<tr>
<td>1/8&quot;</td>
<td>14 mm (0.55&quot;)</td>
<td>N/A</td>
<td>3 mm (0.12&quot;)</td>
<td>8 mm (0.31&quot;)</td>
<td>32 mm (1.26&quot;)</td>
</tr>
<tr>
<td>1/4&quot;</td>
<td>21 mm (0.83&quot;)</td>
<td>N/A</td>
<td>5 mm (0.20&quot;)</td>
<td>11 mm (0.44&quot;)</td>
<td>44 mm (1.73&quot;)</td>
</tr>
<tr>
<td>1/4&quot; 3.5 LAG</td>
<td>29 mm (1.14&quot;)</td>
<td>51 mm (2.01&quot;)</td>
<td>6 mm (0.24&quot;)</td>
<td>14 mm (0.55&quot;)</td>
<td>N/A</td>
</tr>
<tr>
<td>1/4&quot; 8UN</td>
<td>39 mm (1.53&quot;)</td>
<td>66 mm (2.60&quot;)</td>
<td>7 mm (0.28&quot;)</td>
<td>16 mm (0.63&quot;)</td>
<td>N/A</td>
</tr>
<tr>
<td>1 1/8&quot;</td>
<td>53 mm (2.09&quot;)</td>
<td>93 mm (3.66&quot;)</td>
<td>14 mm (0.55&quot;)</td>
<td>22 mm (0.86&quot;)</td>
<td>N/A</td>
</tr>
<tr>
<td>1&quot;</td>
<td>53 mm (2.09&quot;)</td>
<td>93 mm (3.66&quot;)</td>
<td>14 mm (0.55&quot;)</td>
<td>22 mm (0.86&quot;)</td>
<td>N/A</td>
</tr>
</tbody>
</table>

### Single Hole Bearing Plate (ARBPH)

<table>
<thead>
<tr>
<th>ARBPH Nominal Size</th>
<th>Width</th>
<th>Length</th>
<th>Across Corners</th>
</tr>
</thead>
<tbody>
<tr>
<td>1/8&quot;</td>
<td>95 mm (3.74&quot;)</td>
<td>95 mm (3.74&quot;)</td>
<td>6 mm (0.24&quot;)</td>
</tr>
<tr>
<td>5/32&quot;</td>
<td>152 mm (6&quot;)</td>
<td>152 mm (6&quot;)</td>
<td>10 mm (0.39&quot;)</td>
</tr>
<tr>
<td>1/4&quot;</td>
<td>203 mm (8&quot;)</td>
<td>203 mm (8&quot;)</td>
<td>10 mm (0.39&quot;)</td>
</tr>
<tr>
<td>1 1/8&quot; Heavy</td>
<td>203 mm (8&quot;)</td>
<td>203 mm (8&quot;)</td>
<td>13 mm (0.51&quot;)</td>
</tr>
<tr>
<td>1 3/8&quot;</td>
<td>203 mm (8&quot;)</td>
<td>203 mm (8&quot;)</td>
<td>13 mm (0.51&quot;)</td>
</tr>
<tr>
<td>1 1/4&quot; Heavy</td>
<td>203 mm (8&quot;)</td>
<td>203 mm (8&quot;)</td>
<td>13 mm (0.51&quot;)</td>
</tr>
<tr>
<td>1 1/2&quot;</td>
<td>203 mm (8&quot;)</td>
<td>203 mm (8&quot;)</td>
<td>19 mm (0.75&quot;)</td>
</tr>
<tr>
<td>1 1/4&quot;</td>
<td>305 mm (12&quot;)</td>
<td>305 mm (12&quot;)</td>
<td>25 mm (1&quot;)</td>
</tr>
<tr>
<td>1 1/2&quot; Heavy</td>
<td>305 mm (12&quot;)</td>
<td>305 mm (12&quot;)</td>
<td>25 mm (1&quot;)</td>
</tr>
</tbody>
</table>

### Single Key Bearing Plate (ARBP)

<table>
<thead>
<tr>
<th>ARBP Nominal Size</th>
<th>Width</th>
<th>Length</th>
<th>Across Corners</th>
</tr>
</thead>
<tbody>
<tr>
<td>1/8&quot;</td>
<td>95 mm (3.74&quot;)</td>
<td>95 mm (3.74&quot;)</td>
<td>6 mm (0.24&quot;)</td>
</tr>
<tr>
<td>1/4&quot;</td>
<td>152 mm (6&quot;)</td>
<td>152 mm (6&quot;)</td>
<td>10 mm (0.39&quot;)</td>
</tr>
<tr>
<td>1&quot;</td>
<td>203 mm (8&quot;)</td>
<td>203 mm (8&quot;)</td>
<td>13 mm (0.51&quot;)</td>
</tr>
<tr>
<td>1 1/8&quot; Heavy</td>
<td>203 mm (8&quot;)</td>
<td>203 mm (8&quot;)</td>
<td>13 mm (0.51&quot;)</td>
</tr>
<tr>
<td>1 3/8&quot; Heavy</td>
<td>203 mm (8&quot;)</td>
<td>203 mm (8&quot;)</td>
<td>13 mm (0.51&quot;)</td>
</tr>
<tr>
<td>1 1/4&quot; Heavy</td>
<td>203 mm (8&quot;)</td>
<td>203 mm (8&quot;)</td>
<td>19 mm (0.75&quot;)</td>
</tr>
<tr>
<td>1 1/2&quot; Heavy</td>
<td>305 mm (12&quot;)</td>
<td>305 mm (12&quot;)</td>
<td>25 mm (1&quot;)</td>
</tr>
<tr>
<td>1 1/4&quot;</td>
<td>305 mm (12&quot;)</td>
<td>305 mm (12&quot;)</td>
<td>25 mm (1&quot;)</td>
</tr>
</tbody>
</table>

### Double Key Bearing Plate (ARBPD)

<table>
<thead>
<tr>
<th>ARBPD Nominal Size</th>
<th>Width</th>
<th>Length</th>
<th>Across Corners</th>
</tr>
</thead>
<tbody>
<tr>
<td>1/8&quot;</td>
<td>95 mm (3.74&quot;)</td>
<td>95 mm (3.74&quot;)</td>
<td>6 mm (0.24&quot;)</td>
</tr>
<tr>
<td>1/4&quot;</td>
<td>152 mm (6&quot;)</td>
<td>152 mm (6&quot;)</td>
<td>10 mm (0.39&quot;)</td>
</tr>
<tr>
<td>1&quot;</td>
<td>203 mm (8&quot;)</td>
<td>203 mm (8&quot;)</td>
<td>10 mm (0.39&quot;)</td>
</tr>
<tr>
<td>1 1/8&quot; Heavy</td>
<td>203 mm (8&quot;)</td>
<td>203 mm (8&quot;)</td>
<td>13 mm (0.51&quot;)</td>
</tr>
<tr>
<td>1 3/8&quot; Heavy</td>
<td>203 mm (8&quot;)</td>
<td>203 mm (8&quot;)</td>
<td>13 mm (0.51&quot;)</td>
</tr>
<tr>
<td>1 1/4&quot; Heavy</td>
<td>203 mm (8&quot;)</td>
<td>203 mm (8&quot;)</td>
<td>19 mm (0.75&quot;)</td>
</tr>
<tr>
<td>1 1/2&quot; Heavy</td>
<td>203 mm (8&quot;)</td>
<td>203 mm (8&quot;)</td>
<td>19 mm (0.75&quot;)</td>
</tr>
<tr>
<td>1 1/4&quot;</td>
<td>305 mm (12&quot;)</td>
<td>305 mm (12&quot;)</td>
<td>25 mm (1&quot;)</td>
</tr>
<tr>
<td>1 1/2&quot; Heavy</td>
<td>305 mm (12&quot;)</td>
<td>305 mm (12&quot;)</td>
<td>25 mm (1&quot;)</td>
</tr>
</tbody>
</table>

---

ASTM A-194 Grade 2H

ASTM F-436
1" Dome Plate (ARDP-2)

The Dome Plate (ARDP-2) comes in a standard size of 10 mm x 150 mm x 150 mm (3/8" x 6" x 6").

1" Spherical Washer (ARSW)

The Spherical Washer (ARSW) is designed to fit with the AR Dome Plate (ARDP-2). Maximum deflection angle 26º.

Manual Grout Pump (ARMGP)

Pump Rate: 0.256L/stroke (15.63 cu.in.)

Grout Tube Adapter (ARGTA)

Grout Tube Adapter used with HDR Rod Series.

Grout Tube (ARGT)

<table>
<thead>
<tr>
<th>Outside Diameter</th>
<th>Inside Diameter</th>
<th>Quantity per roll</th>
</tr>
</thead>
<tbody>
<tr>
<td>½&quot;</td>
<td>3/8&quot;</td>
<td>500 ft per roll</td>
</tr>
<tr>
<td>5/8&quot;</td>
<td>½&quot;</td>
<td>500 ft per roll</td>
</tr>
<tr>
<td>¾&quot;</td>
<td>5/8&quot;</td>
<td>500 ft per roll</td>
</tr>
</tbody>
</table>

Expansive Type Cement Grout (ARECG)

Cementitious Pumpable Grouts for Anchoring
AR Expansive Type Cement Grout is to be used where net drying shrinkage is of concern. The material is a Portland cement based product without sand which has been tested to pump 10 m (32 feet) in a 9 mm (¼") diameter hole at 280 kPa (40 PSI). Packaged in 22.7 kg (50 lbs) bag size.

Dispersion Stabilized Cement Grout (ARSCG)

AR Dispersion Stabilized Cement Grout is suitable for pumping into drilled holes when subjected to water flow as the grout gels immediately when pumping ceases. It will become fluid when pumping resumes. The thickening of the grout has the appearance of grout that has reached initial set. Dispersion Stabilized Cement Grout is a blend of high strength Portland Cement, water and high molecular-weight polymers. This combination allows the grout to have the strength gain and the alkali protection of cement particles in a stable polymer matrix. This matrix functions as a protective coating for the unhydrated cement particles, preventing water washout when the grout is in the plastic state. Available in a sulphate resistant formulation — ARSCG-S.

NOTE: Packaged in 22.7 kg (50 lbs) bag size, yields 13 litres (0.454 ft³).

TABLE CS9: Typical Compressive Strength

<table>
<thead>
<tr>
<th>Time</th>
<th>24 hours</th>
<th>7 days</th>
<th>28 days</th>
</tr>
</thead>
<tbody>
<tr>
<td>MPa</td>
<td>15.0</td>
<td>40.0</td>
<td>54.0</td>
</tr>
<tr>
<td>PSI</td>
<td>2,180</td>
<td>5,800</td>
<td>7,830</td>
</tr>
</tbody>
</table>

TABLE CS10: Typical Compressive Strength

<table>
<thead>
<tr>
<th>Time</th>
<th>16 hours</th>
<th>24 hours</th>
<th>7 days</th>
<th>28 days</th>
</tr>
</thead>
<tbody>
<tr>
<td>MPa</td>
<td>10.0</td>
<td>22.0</td>
<td>49.0</td>
<td>51.0</td>
</tr>
<tr>
<td>PSI</td>
<td>1,450</td>
<td>3,190</td>
<td>7,100</td>
<td>7,400</td>
</tr>
</tbody>
</table>

Setting time: 8 hours
**1" Stop Coupler (ARSC)**

**ARSC Stop Coupler**

<table>
<thead>
<tr>
<th>Thread Diameter - TPI</th>
<th>Overall Length</th>
<th>Outside Diameter</th>
<th>Tap Depth End</th>
</tr>
</thead>
<tbody>
<tr>
<td>½&quot; 6 LAG</td>
<td>51 mm (2&quot;)</td>
<td>29 mm (1 1/8&quot;)</td>
<td>19 mm (¾&quot;)</td>
</tr>
<tr>
<td>¼&quot; 4.5 LAG</td>
<td>76 mm (3&quot;)</td>
<td>29 mm (1 1/8&quot;)</td>
<td>32 mm (1¼&quot;)</td>
</tr>
<tr>
<td>1&quot; 3.5 LAG</td>
<td>102 mm (4&quot;)</td>
<td>51 mm (2&quot;)</td>
<td>44 mm (1¾&quot;)</td>
</tr>
<tr>
<td>1½&quot; 3.5 LAG</td>
<td>127 mm (5&quot;)</td>
<td>51 mm (2&quot;)</td>
<td>57 mm (2¼&quot;)</td>
</tr>
<tr>
<td>1¾&quot; 3.5 LAG</td>
<td>152 mm (6&quot;)</td>
<td>51 mm (2&quot;)</td>
<td>64 mm (2½&quot;)</td>
</tr>
<tr>
<td>2&quot; 11 UNC</td>
<td>76 mm (3&quot;)</td>
<td>28 mm (1 1/8&quot;)</td>
<td>32 mm (1¼&quot;)</td>
</tr>
<tr>
<td>9/16&quot; 10 UNC</td>
<td>76 mm (3&quot;)</td>
<td>28 mm (1 1/8&quot;)</td>
<td>32 mm (1¼&quot;)</td>
</tr>
<tr>
<td>7/8&quot; 9 UN</td>
<td>76 mm (3&quot;)</td>
<td>51 mm (2&quot;)</td>
<td>19 mm (¾&quot;)</td>
</tr>
<tr>
<td>1&quot; 8 UN</td>
<td>76 mm (3&quot;)</td>
<td>51 mm (2&quot;)</td>
<td>19 mm (¾&quot;)</td>
</tr>
<tr>
<td>1½&quot; 8 UN</td>
<td>152 mm (6&quot;)</td>
<td>51 mm (2&quot;)</td>
<td>70 mm (2¼&quot;)</td>
</tr>
<tr>
<td>1¾&quot; 8 UN</td>
<td>152 mm (6&quot;)</td>
<td>76 mm (3&quot;)</td>
<td>70 mm (2¼&quot;)</td>
</tr>
<tr>
<td>1 1/8&quot; 8 UN</td>
<td>152 mm (6&quot;)</td>
<td>76 mm (3&quot;)</td>
<td>70 mm (2¼&quot;)</td>
</tr>
<tr>
<td>2&quot; 2 UN</td>
<td>152 mm (6&quot;)</td>
<td>76 mm (3&quot;)</td>
<td>70 mm (2¼&quot;)</td>
</tr>
</tbody>
</table>

**ARSC Transition Coupler**

<table>
<thead>
<tr>
<th>Thread Transition - TPI</th>
<th>Overall Length</th>
<th>Outside Diameter</th>
<th>Tap Depth End</th>
</tr>
</thead>
<tbody>
<tr>
<td>½&quot; 6 LAG ½&quot; 6 LAG</td>
<td>89 mm (3½&quot;)</td>
<td>29 mm (1 1/8&quot;)</td>
<td>38 mm (1¼&quot;)</td>
</tr>
<tr>
<td>¾&quot; 4.5 LAG ¾&quot; 4.5 LAG</td>
<td>88 mm (3½&quot;)</td>
<td>29 mm (1 1/8&quot;)</td>
<td>38 mm (1¼&quot;)</td>
</tr>
<tr>
<td>1&quot; 3.5 LAG 1&quot; 3.5 LAG</td>
<td>114 mm (4½&quot;)</td>
<td>51 mm (2&quot;)</td>
<td>51 mm (2&quot;)</td>
</tr>
<tr>
<td>1½&quot; 3.5 LAG 1½&quot; 3.5 LAG</td>
<td>140 mm (5½&quot;)</td>
<td>51 mm (2&quot;)</td>
<td>64 mm (2½&quot;)</td>
</tr>
</tbody>
</table>

**Spin Adaptors (ARSA)**

The ARSA Spin Adaptor allows rotation of rod to set anchor without damaging threads on rods.

**Centralizer (ARC)**

The Centralizer is used to centre an anchor rod in a drilled hole when a mechanical anchor is not preset.

To order, specify the drill hole diameter, the rod size or outer diameter of sleeve when used over bar.

**Swivel/Pivot Lift Plate (ARSLP)**

Swivel/Pivot Lift Plate allows for lifting and positioning of long heavy rock bolts by crane. Available for 3/4", 1", 1 1/4", and 1 1/2" diameters. Contact AR for others sizes.
**Type K Lifting Eye**

The AR Type K Lifting Eye consists of a ring, base and base plate welded together. Available in the size shown, the Type K Lifting Eye is designed for use with a single bolt to engage any single lifting insert.

<table>
<thead>
<tr>
<th>Diameter (mm)</th>
<th>Ring Diameter (mm)</th>
<th>Straight Tension Ultimate Strength</th>
<th>90° Tension Ultimate Strength</th>
</tr>
</thead>
<tbody>
<tr>
<td>13 mm (⅜”)</td>
<td>20 mm (⅜”)</td>
<td>80 kN (18,000 lbs*)</td>
<td>6.2 kN (1,400 lbs*)</td>
</tr>
<tr>
<td>20 mm (¼”)</td>
<td>20 mm (⅜”)</td>
<td>150 kN (34,000 lbs*)</td>
<td>6.2 kN (1,400 lbs*)</td>
</tr>
<tr>
<td>25 mm (⅜”)</td>
<td>25 mm (⅝”)</td>
<td>333 kN (75,000 lbs*)</td>
<td>14.7 kN (3,266 lbs*)</td>
</tr>
<tr>
<td>32 mm (1¼”)</td>
<td>32 mm (1⅛”)</td>
<td>422 kN (95,000 lbs*)</td>
<td>31 kN (6,975 lbs*)</td>
</tr>
</tbody>
</table>

*Recommended minimum Safe Working Load should be 4 to 1 against ultimate.

Refer to ASTM A 489 for load reduction calculation off vertical pull.

Not available in hot dip galvanized.

**Special Eye Nut (AREN)**

The AR Special Eye Nut consist of a wire ring welded to a left hand hex or square nut. The Special Eye Nut can be placed on a AR Mesh Pin or other threaded rod to support light loads in mining or tunneling applications.

<table>
<thead>
<tr>
<th>Diameter (mm)</th>
<th>Internal Thread</th>
<th>Width A</th>
<th>Width B</th>
<th>Width C</th>
</tr>
</thead>
<tbody>
<tr>
<td>13 mm (⅜”)</td>
<td>6 Lag</td>
<td>50 mm</td>
<td>75 mm</td>
<td>140 mm</td>
</tr>
<tr>
<td>20 mm (¼”)</td>
<td>4.5 Lag</td>
<td>50 mm</td>
<td>75 mm</td>
<td>140 mm</td>
</tr>
<tr>
<td>25 mm (⅜”)</td>
<td>3.5 Lag</td>
<td>50 mm</td>
<td>75 mm</td>
<td>140 mm</td>
</tr>
<tr>
<td>32 mm (1¼”)</td>
<td>3.5 Lag</td>
<td>100 mm</td>
<td>115 mm</td>
<td>213 mm</td>
</tr>
</tbody>
</table>

**Dial Indicator (ARDI)**

Dial Indicator with magnetic base. Measures bolt deflection to nearest 0.001 inch.

<table>
<thead>
<tr>
<th>Number</th>
<th>Description</th>
<th>Applicable Stem Diameter</th>
</tr>
</thead>
<tbody>
<tr>
<td>7010S</td>
<td>Magnetic Support</td>
<td>ø 6 mm, ø 8 mm*, ø 9.53 mm (⅜”)</td>
</tr>
</tbody>
</table>

**Bolt Tension Calibrator**

Lightweight design, 126,000 lb capacity - will do 1¼” A490 bolts. No need for dowel pins. Holes predrilled for torque reaction kits.
Manual Torque Wrench

Robust construction gives accurate results, to ±4%, even in arduous working conditions. The large break angle improves accuracy by reducing the possibility of over torquing. Cam control of the mechanism gives a controlled break which will not throw the operator off balance. Dual scaled, N.m and lbf.ft.

<table>
<thead>
<tr>
<th>Model</th>
<th>Part No.</th>
<th>Range</th>
<th>Ratchet Diameter mm</th>
<th>Engagements per revolution</th>
<th>Length mm</th>
<th>Weight Kg</th>
</tr>
</thead>
<tbody>
<tr>
<td>4AR</td>
<td>12007</td>
<td>200 - 800</td>
<td>70</td>
<td>36</td>
<td>1250</td>
<td>6.4</td>
</tr>
</tbody>
</table>

Manual Torque Wrench Multiplier

The Manual Torque Wrench Multiplier with a 19mm (3/4”) square drive input and 25 mm (1”) square drive output has a mechanical advantage multiplier ratio of 5:1 and a capacity of 1694 Nm (1250 ft lbs.)

Pneumatic Torque Wrench

The PTM-52 is engineered to be one of the lightest and fastest tools of its type on the market. The exceptionally compact 52 mm diameter gearbox means that the tool is well balanced, light weight and provides excellent access to bolts.

<table>
<thead>
<tr>
<th>Model</th>
<th>Direction of Operation</th>
<th>Square Drive</th>
<th>Part No.</th>
<th>Range</th>
<th>Free Speed</th>
<th>Length “A”</th>
<th>Tool Weight</th>
<th>Reaction Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>PTM-52-500-F</td>
<td>Forward only</td>
<td>3/4</td>
<td>18100.F06</td>
<td>100-500</td>
<td>74-370</td>
<td>224</td>
<td>284</td>
<td>3.8</td>
</tr>
<tr>
<td>PTM-52-500-B</td>
<td>Bi-directional</td>
<td>3/4</td>
<td>18100.B06</td>
<td>100-500</td>
<td>74-370</td>
<td>224</td>
<td>333</td>
<td>4.1</td>
</tr>
<tr>
<td>PTM-52-800-F</td>
<td>Forward only</td>
<td>3/4</td>
<td>18100.F06</td>
<td>160-800</td>
<td>118-590</td>
<td>148</td>
<td>284</td>
<td>3.8</td>
</tr>
<tr>
<td>PTM-52-800-B</td>
<td>Bi-directional</td>
<td>3/4</td>
<td>18100.B06</td>
<td>160-800</td>
<td>118-590</td>
<td>148</td>
<td>333</td>
<td>4.1</td>
</tr>
</tbody>
</table>

NOTE: AR Pneumatic Torque Equipment comes complete with a Lubro Central Unit, reaction arm and required hex socket.

Lubro Control Unit

The Lubro Control Unit filters, regulates and lubricates the supply of compressed air to the tool. Accompanies each Pneumatic Torque Wrench.

Pneumatic Torquing Assembly

Pneumatic Torque Wrench and Lubro Control Unit shown assembled. Used with bolts 32mm or greater. Production bolting with many units possible. Refer to the Stressing Equipment table on page 36 of the Appendix for more information.

NOTE: Adequate reaction must be supplied with torque wrenches. Hex sockets are required to match spin adaptors used with particular rock bolts.
AR Series Hydraulic Bolt Stressing Equipment

Hollow ram cylinders are used to prestress rock bolts. Calibrated hydraulic gauges give true reading of axial tension applied to bolt. When used with AR Mechanical Expansion Cone and Shell anchors, setting the anchor and stressing are done immediately with no time required for setting of bonded anchors. Bolts are then grouted for permanent stress lockoff and corrosion protection. Stressing assembly consists of pump, gauge, ram hoses and standard jack stand that matches ram capacity. Stress rod hex nut and couplings required to stress bolts must be ordered as required.

<table>
<thead>
<tr>
<th>ARTSR Product Number</th>
<th>Thread Diameter - TPI</th>
<th>ARJS Jack Stand Height</th>
<th>Rod Length</th>
</tr>
</thead>
<tbody>
<tr>
<td>ARSTR-12-N 12 mm (½”)</td>
<td>13 UNC</td>
<td>406 mm (16”)</td>
<td>914 mm (3 ft.)</td>
</tr>
<tr>
<td>ARSTR-12-L 12 mm (½”)</td>
<td>6 LAG</td>
<td>406 mm (16”)</td>
<td>914 mm (3 ft.)</td>
</tr>
<tr>
<td>ARSTR-16-N 16 mm (5/8”)</td>
<td>11 UNC</td>
<td>406 mm (16”)</td>
<td>914 mm (3 ft.)</td>
</tr>
<tr>
<td>ARSTR-20-N 19 mm (¾”)</td>
<td>10 UNC</td>
<td>406 mm (16”)</td>
<td>914 mm (3 ft.)</td>
</tr>
<tr>
<td>ARSTR-20-L 19 mm (¾”)</td>
<td>4.5 LAG</td>
<td>406 mm (16”)</td>
<td>914 mm (3 ft.)</td>
</tr>
<tr>
<td>ARSTR-22-N 22 mm (7/8”)</td>
<td>9 UNC</td>
<td>406 mm (16”)</td>
<td>914 mm (3 ft.)</td>
</tr>
<tr>
<td>ARSTR-25-N 25 mm (1”)</td>
<td>8 UN</td>
<td>610 mm (24”)</td>
<td>914 mm (3 ft.)</td>
</tr>
<tr>
<td>ARSTR-25-L 25 mm (1”)</td>
<td>8 UN</td>
<td>610 mm (24”)</td>
<td>914 mm (3 ft.)</td>
</tr>
<tr>
<td>ARSTR-29-N 28 mm (1-5/8”)</td>
<td>8 UN</td>
<td>610 mm (24”)</td>
<td>914 mm (3 ft.)</td>
</tr>
<tr>
<td>ARSTR-22-N 22 mm (7/8”)</td>
<td>9 UNC</td>
<td>406 mm (16”)</td>
<td>914 mm (3 ft.)</td>
</tr>
<tr>
<td>ARSTR-30-N 25 mm (1-1/4”)</td>
<td>7 UN</td>
<td>610 mm (24”)</td>
<td>914 mm (3 ft.)</td>
</tr>
<tr>
<td>ARSTR-30-L 25 mm (1-1/4”)</td>
<td>3.5 LAG</td>
<td>610 mm (24”)</td>
<td>914 mm (3 ft.)</td>
</tr>
<tr>
<td>ARSTR-35-N 36 mm (1-1/2”)</td>
<td>6 UNC</td>
<td>610 mm (24”)</td>
<td>1,219 mm (4 ft.)</td>
</tr>
<tr>
<td>ARSTR-36-N 36 mm (1-1/2”)</td>
<td>6 UNC</td>
<td>610 mm (24”)</td>
<td>1,219 mm (4 ft.)</td>
</tr>
<tr>
<td>ARSTR-40-N 45 mm (1-5/8”)</td>
<td>5 UN</td>
<td>610 mm (24”)</td>
<td>1,219 mm (4 ft.)</td>
</tr>
<tr>
<td>ARSTR-40-L 45 mm (1-5/8”)</td>
<td>5 UN</td>
<td>610 mm (24”)</td>
<td>1,219 mm (4 ft.)</td>
</tr>
<tr>
<td>ARSTR-45-N 45 mm (1-1/8”)</td>
<td>8 UN</td>
<td>610 mm (24”)</td>
<td>1,219 mm (4 ft.)</td>
</tr>
<tr>
<td>ARSTR-50-N 51 mm (2”)</td>
<td>8 UN</td>
<td>610 mm (24”)</td>
<td>1,219 mm (4 ft.)</td>
</tr>
</tbody>
</table>

**NOTE:** AR Stressing Equipment assembly comes complete with hollow ram, hydraulic jack and pump as indicated, hoses and gauge with jack stand (flush mount) or stressing stool/long internal socket tube (for pocket mount) and stress rod assembly. Specify rock bolt thread form when ordering.

<table>
<thead>
<tr>
<th>Product Number</th>
<th>Capacity</th>
<th>Hollow Ram Diameter</th>
</tr>
</thead>
<tbody>
<tr>
<td>ARHR-20</td>
<td>178 kN (40,000 lbs)</td>
<td>26.5 mm (1-3/32”)</td>
</tr>
<tr>
<td>ARHR-30</td>
<td>267 kN (60,000 lbs)</td>
<td>32 mm (1-1/4”)</td>
</tr>
<tr>
<td>ARHR-60</td>
<td>534 kN (120,000 lbs)</td>
<td>50.8 mm (2-3/8”)</td>
</tr>
<tr>
<td>ARHR-100</td>
<td>890 kN (200,000 lbs)</td>
<td>79 mm (3-1/8”)</td>
</tr>
<tr>
<td>ARHR-150</td>
<td>1,335 kN (300,000 lbs)</td>
<td>79 mm (3-1/8”)</td>
</tr>
</tbody>
</table>
Applied Torque

<table>
<thead>
<tr>
<th>AR Rock Bolts</th>
<th>Applied Torque</th>
<th>Torque Wrench</th>
</tr>
</thead>
<tbody>
<tr>
<td>HDR-25 Hollow Deformed Rebar</td>
<td>675 Nm</td>
<td>(500 ft.-lbs.)</td>
</tr>
<tr>
<td>HDR-35 Hollow Deformed Rebar</td>
<td>2,000 Nm</td>
<td>(1,500 ft.-lbs.)</td>
</tr>
<tr>
<td>HDR-50 Hollow Deformed Rebar</td>
<td>5,400 Nm</td>
<td>(4,000 ft.-lbs.)</td>
</tr>
<tr>
<td>SDR-12 Solid Deformed Rebar</td>
<td>70 Nm</td>
<td>(50 ft.-lbs.)</td>
</tr>
<tr>
<td>SDR-20 Solid Deformed Rebar</td>
<td>230 Nm</td>
<td>(170 ft.-lbs.)</td>
</tr>
<tr>
<td>SDR-25 Solid Deformed Rebar</td>
<td>550 Nm</td>
<td>(400 ft.-lbs.)</td>
</tr>
<tr>
<td>SDR-29 Solid Deformed Rebar</td>
<td>825 Nm</td>
<td>(600 ft.-lbs.)</td>
</tr>
<tr>
<td>SDR-32 Solid Deformed Rebar</td>
<td>1,015 Nm</td>
<td>(750 ft.-lbs.)</td>
</tr>
<tr>
<td>SDR-35 Solid Deformed Rebar</td>
<td>1,100 Nm</td>
<td>(800 ft.-lbs.)</td>
</tr>
<tr>
<td>SDR-38 Solid Deformed Rebar</td>
<td>1,650 Nm</td>
<td>(1,200 ft.-lbs.)</td>
</tr>
<tr>
<td>SDR-45 Solid Deformed Rebar</td>
<td>2,000 Nm</td>
<td>(1,500 ft.-lbs.)</td>
</tr>
<tr>
<td>SDR-48 Solid Deformed Rebar</td>
<td>3,300 Nm</td>
<td>(2,400 ft.-lbs.)</td>
</tr>
<tr>
<td>SDR-55 Solid Deformed Rebar</td>
<td>4,600 Nm</td>
<td>(3,000 ft.-lbs.)</td>
</tr>
<tr>
<td>SCT-N-12 Solid Continuous Threaded Unified</td>
<td>95 Nm</td>
<td>(70 ft.-lbs.)</td>
</tr>
<tr>
<td>SCT-N-20 Solid Continuous Threaded Unified</td>
<td>340 Nm</td>
<td>(250 ft.-lbs.)</td>
</tr>
<tr>
<td>SCT-N-25 Solid Continuous Threaded Unified</td>
<td>810 Nm</td>
<td>(600 ft.-lbs.)</td>
</tr>
<tr>
<td>SCT-N-32 Solid Continuous Threaded Unified</td>
<td>1,625 Nm</td>
<td>(1,200 ft.-lbs.)</td>
</tr>
<tr>
<td>SCT-L-12 Solid Continuous Threaded Lag</td>
<td>95 Nm</td>
<td>(70 ft.-lbs.)</td>
</tr>
<tr>
<td>SCT-L-20 Solid Continuous Threaded Lag</td>
<td>340 Nm</td>
<td>(250 ft.-lbs.)</td>
</tr>
<tr>
<td>SCT-L-25 Solid Continuous Threaded Lag</td>
<td>810 Nm</td>
<td>(600 ft.-lbs.)</td>
</tr>
<tr>
<td>SCT-L-32 Solid Continuous Threaded Lag</td>
<td>1,625 Nm</td>
<td>(1,200 ft.-lbs.)</td>
</tr>
<tr>
<td>SCT-N-87 All Thread Bar - 13</td>
<td>95 Nm</td>
<td>(70 ft.-lbs.)</td>
</tr>
<tr>
<td>SCT-N-87 All Thread Bar - 20</td>
<td>340 Nm</td>
<td>(250 ft.-lbs.)</td>
</tr>
<tr>
<td>SCT-N-87 All Thread Bar - 25</td>
<td>810 Nm</td>
<td>(600 ft.-lbs.)</td>
</tr>
<tr>
<td>SCT-N-87 All Thread Bar - 32</td>
<td>1,625 Nm</td>
<td>(1,200 ft.-lbs.)</td>
</tr>
<tr>
<td>SCT-N-87 All Thread Bar - 35</td>
<td>2,170 Nm</td>
<td>(1,600 ft.-lbs.)</td>
</tr>
<tr>
<td>SCT-N-87 All Thread Bar - 38</td>
<td>2,700 Nm</td>
<td>(2,000 ft.-lbs.)</td>
</tr>
<tr>
<td>SCT-N-87 All Thread Bar - 45</td>
<td>4,067 Nm</td>
<td>(3,000 ft.-lbs.)</td>
</tr>
<tr>
<td>SCT-N-87 All Thread Bar - 50</td>
<td>6,100 Nm</td>
<td>(4,500 ft.-lbs.)</td>
</tr>
<tr>
<td>SST-12 Solid Smooth Threaded Ends</td>
<td>95 Nm</td>
<td>(70 ft.-lbs.)</td>
</tr>
<tr>
<td>SST-20 Solid Smooth Threaded Ends</td>
<td>340 Nm</td>
<td>(250 ft.-lbs.)</td>
</tr>
<tr>
<td>SST-25 Solid Smooth Threaded Ends</td>
<td>810 Nm</td>
<td>(600 ft.-lbs.)</td>
</tr>
<tr>
<td>SST-32 Solid Smooth Threaded Ends</td>
<td>1,625 Nm</td>
<td>(1,200 ft.-lbs.)</td>
</tr>
<tr>
<td>SST-35 Solid Smooth Threaded Ends</td>
<td>2,170 Nm</td>
<td>(1,600 ft.-lbs.)</td>
</tr>
<tr>
<td>SST-38 Solid Smooth Threaded Ends</td>
<td>2,700 Nm</td>
<td>(2,000 ft.-lbs.)</td>
</tr>
<tr>
<td>SST-45 Solid Smooth Threaded Ends</td>
<td>4,067 Nm</td>
<td>(3,000 ft.-lbs.)</td>
</tr>
<tr>
<td>SST-50 Solid Smooth Threaded Ends</td>
<td>6,100 Nm</td>
<td>(4,500 ft.-lbs.)</td>
</tr>
</tbody>
</table>

Installation Instructions For AR Cone Shell Mechanical Expansion Anchors

**Hole Preparation**

Mechanical expansion anchors require a hole drilled into the rock or concrete with attention paid to the length, diameter and straightness. Rotary percussive or diamond drills both provide acceptable drill hole surfaces for use with the AR series of cone shell expansion anchors. Particular attention must be paid to the diameter. Drill holes cannot be undersized. Drill hole diameter can be up to 10% oversized. Hole straightness must be maintained to allow passage of the mechanical anchor assembly as well as the overall length of the anchor rod over the entire length of the bolt. This is accomplished primarily with the attention of the driller to down pressure feed rate for a given rock type and the amount of wear in the drill steel and bit. Hole length should be in excess of the bolt length by 6 to 12 bolt diameters. This allows for larger pieces of rock dislodged during bolt insertion to be clear of the anchor at the final installation depth.

**Bolt Positioning**

For vertically downwards oriented bolts the completely assembled units including the bearing plates should be lowered down the hole. The bolt must be centralized in the drilling hole during the installation procedure. Having the bearing plate with the hex nut and flat washer above the plate in place prior to lowering the unit downhole precludes the bolt from falling too far down an over drilled hole. Tying to pull vertically upwards on a mechanical expansion anchor already in a drill hole may begin to expand the shell against the drill hole wall and may not be possible. Typically, the desired condition of drill hole diameter and anchor preset expansion will produce a snug but relatively easily inserted anchor down the length of the drill hole. In the event loose rock segments translate into hole and block the passage of the anchor, the outer end of the bolt may be struck with a hammer if the threads are protected with a nut or spin adaptor.

The ideal final elevation of the bolt should be when an equal length of thread exists both above and below the bearing plate. Under ideal conditions where the torque required to expand the shell of the anchor assembly has been delivered to the anchor, tensioning the bolt will cause the anchor rod to extend only by the elastic deformation of the length of rod for a given axial tensile load. Practically, there may be further migration of the cone into the shell and some settling of the bearing plate as point load contacts between steel and rock crush to distribute final lock off loads. These effects will accumulate and may slightly raise the final elevation of the rock bolt. This does not mean that the anchor has slipped against the sides of the drill hole wall. The bolt cannot maintain a known prestress force unless the nut is capable of being in full contact with the bearing plate within the threaded length of the outer end of the bolt. To ensure full bearing between the underside of the hex nut and the bearing plate, a set of two beveled washers should be used*. By swiveling the beveled washers against each other the angle may change from perpendicular to the axis of the bolt rod to 2X the angle of a single beveled washer. When mechanical expansion anchors are used in heavily fractured rock or in lengths greater than 5 or 6 meters, insertion into the hole is best achieved by providing an oversized diameter up to the last 30 bolt diameters of hole length above the anchor. This allows for uninterrupted passage of the anchor to just above the required anchor depth.

Attention to all the previous details pertain to installing an anchor bolt vertically up for roof bolting with the exception of the possibility of loosing a bolt downhole. The opposite is obviously true, and personnel or equipment must be able to push up on the bolt to achieve the desired destination.

**Installation Instructions**

Typically, the desired condition of drill hole diameter and anchor preset expansion begin to expand the shell of the anchor assembly as well as the overall length of the anchor rod over the entire length of the bolt. This is accomplished primarily with the attention of the driller to down pressure feed rate for a given rock type and the amount of wear in the drill steel and bit. Hole length should be in excess of the bolt length by 6 to 12 bolt diameters. This allows for larger pieces of rock dislodged during bolt insertion to be clear of the anchor at the final installation depth.

**Bolt Positioning**

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**Installation Instructions**
Setting Mechanical Expansion Anchors

Torquing
Once the rock bolt has been installed to the desired elevation the anchor Cone Shell assembly is set by applying torsion to the outer end of the rod. This is done by means of a 2 piece spin adaptor which threads onto the end of the rock bolt protecting the threads from damage. The spin adapter is made from hex stock allowing it to be driven with a socket and restrained with a wrench when removing it after torquing the anchor. It is important not to allow the rod to counter rotate during tool removal as this can allow the anchor to loosen and slip under tension. The anchor is set by driving on the body of the spin adapter and released by lifting the socket to continue driving in a right hand direction on the top bolt. The threads are left hand and the tool releases. Maintain an antirotational force on the body of the spin adapter, with a wrench, when releasing the top bolt.

AR bolts are threaded with right hand threads unless specially ordered left hand threads. This means that the anchors are set by rotating clockwise. Torque is applied by means of either manual or pneumatic powered wrenches. The outer end hex nut must be in an elevated position relative to the bearing plate so the rod is free to rotate while expanding the anchor.

The maximum torque values for each rod anchor assembly is listed in the application tables. This value is the safe capacity of the rod in torsion at the root of the threads. Exceeding these values could cause torsional shear failure!

Applied torque-induced tension values are known to be highly variable. (Note: Bail Anchor Series Anchors are set by tensioning the rod). Torque measuring equipment accuracy values should also be verified. AR recommends that the maximum torque be applied to a given rock bolt anchor installation until down hole rotation stops. This does not include the torsional spring of the rod. Rock bolts under 25 mm (1”) in diameter may be installed with calibrated manual torque wrenches. For rock bolts 25 mm (1”) and greater in diameter it is recommended to use Pneumo-hydraulic torque wrenches, available for sale or for rent from National Concrete Accessories.

Stressing Equipment
The principle advantage of using a mechanical anchorage downhole is the ability to immediately tension the rod to a known value of prestress. This causes a reaction on the underside of the bearing plate putting the concrete and/or rock mass into compression. This zone of compression extends to the level of the expansion anchor. The most reliable and accurate method of doing this is by coupling onto the rod and applying tension by means of a center-hole hydraulic jack. Access to the outer end hex nut of the rock bolt can be maintained by using either a ratcheting extension ram adapter or by means of a jack stand.

Procedure
The ram of the centre hole jack is positioned directly over the rock bolt rod exposed through the bearing plate. Since most often the bolt end is not long enough to extend through the ram a coupling and an extension rod is required to give a threaded section above the top end of the ram. A bearing plate and beveled washers, or a spherical seated washer is passed over the rod and a hex nut is then threaded onto the extension rod allowing the vertical extension of the ram under pressure to tension the entire rockbolt rod to the elevation of the mechanical expansion anchor.

Pressure is applied by the hydraulic pump supplied. Manual pumps may be reliably used but for cost efficiency for “production” operations either an electric or pneumatic powered pump is available. Load should be applied in 6 to 10 equal increments with a minute or two between each increment. Extensive time delays are not required with cone shell as with cement grouted anchors which require microcracking to distribute the stress to the surrounding rock. Rod deflection measurements to verify mechanical anchor performance are optional as the mechanical anchors are not as variable as pumping cement grouts for a method of load transfer.

An often used value of design load for an anchor is 50% of the ultimate tensile capacity of the assembly. Where the bolts are required to carry a significant load, it is generally recommended that a tension of approximately 70% of the capacity of the bolt be installed initially. This provides a known load with a reserve in case of additional load being induced by displacements in the rock mass. Test values of 80% and lock off-transfer loads of 70% of ultimate are also typical.
Grouting Procedure For Rock Bolts

In order for a rockbolt to be considered a permanent installation it must be encased in a high quality cement grout. The principle function of the grout is to provide a pH environment which does not permit the oxidation of carbon steels used in the fabrication of rockbolts while in their service condition.

**Materials**
The grout required for rock bolting must be fluid enough to be pumped distances from 1 to several meters through openings as small as 8 mm. When the grout sets and cures it must be shrinkage compensated so that it will not crack. AR Expansive Cement Grout (ARECG) for rock bolting is recommended. The grout must be free of unwetted particles that might block the passages. To ensure the grout is free of lumps thorough mixing then passing the grout through a #8 sieve is recommended.

**Equipment**
The National Concrete Accessories offers several types of grout pumps. A manually operated unit and two air powered units. The air powered ARGTP grout pump provides continuous grout supply for voluminous production grouting for either many bolts with a large diameter or long bolts in rock strata which is being consolidation grouted. The ARAPM has the same pump and offers the advantage of mixing grouts in its 28 imperial gallon holding tank prior to transference.

Bolts should be grouted the same day they have been placed. Compressed air should be used to verify the open circuit along the length of the bolt prior to grouting. Supply of the grout should be done in accordance with the application drawing associated with the rod series and orientation chosen. Grout tube adaptors that can be threaded on to the Hollow Deformed Rebar (HDR) series are illustrated in the Tools, Equipment and Accessories section of this manual.
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sales@nca.ca

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