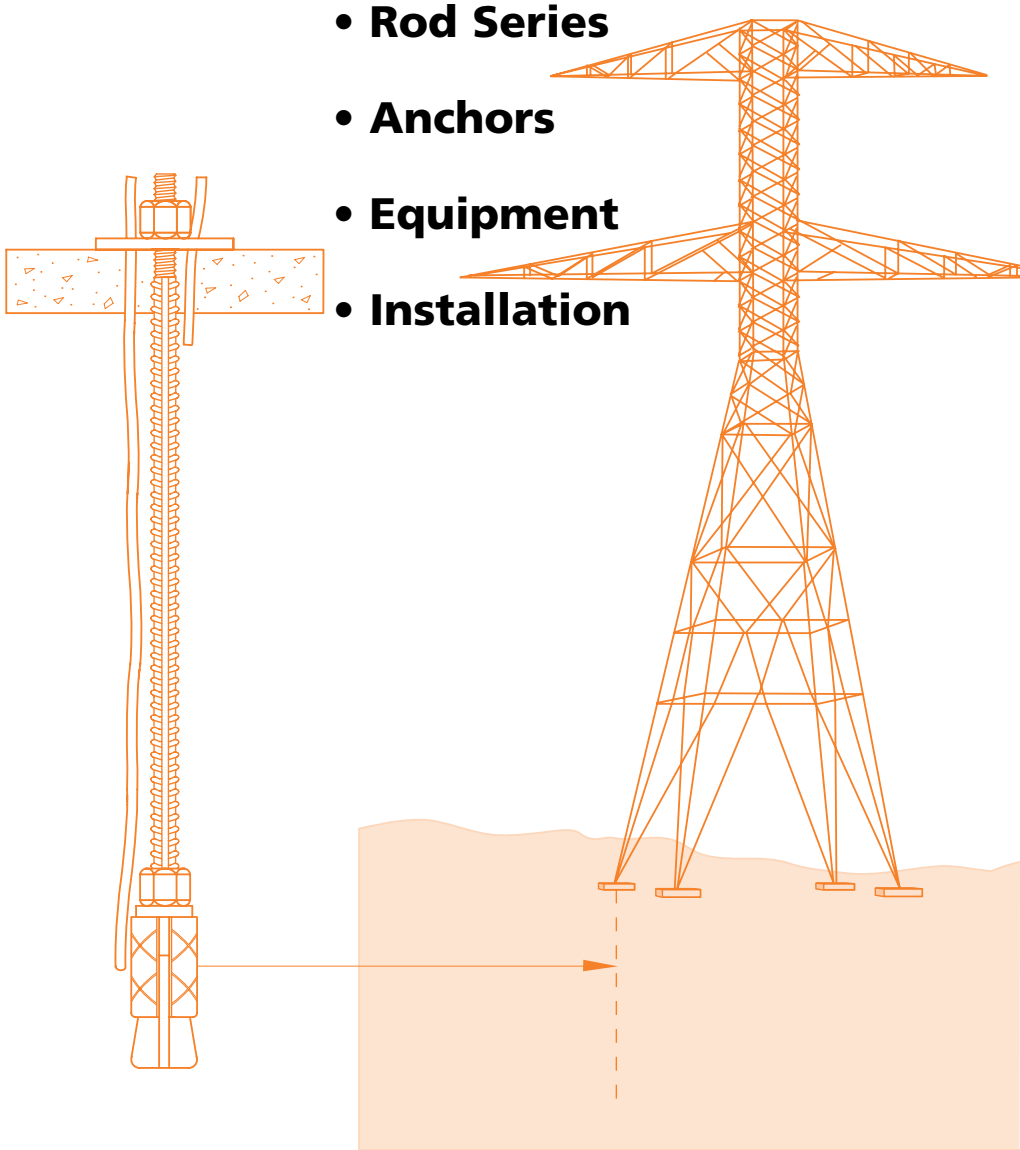
NATIONAL
Concrete Accessories

Rock Anchoring and Bolt Systems

ONSITE SOLUTIONS IN
CONCRETE
CONSTRUCTION

- Concrete Forming Systems
- Bridge Deck Forming and Hanging Systems
- Precast Concrete Products
- Reinforcing Bar Supports
- Concrete Anchoring Systems
- Rock Anchoring and Bolt Systems

- **Rod Series**
- **Anchors**
- **Equipment**
- **Installation**



NATIONAL
Concrete Accessories

For catalogue

updates visit

our web site at

www.nca.ca.

GENERAL INFORMATION

1. A qualified person must accurately calculate the applied loads and select the appropriate products and determine compatible spacings. Refer to installation instructions beginning on page 21.
2. For anchoring and form tying operations, proper installation practices must be maintained. Guidelines for setting mechanical anchors and tensioning procedures for rock bolts are detailed in this publication. Failure to follow approved practices, may result in failure.
3. The applied safety factor for a product will depend on the degree of hazard or risk involved in the product application. This safety factor is governed by national codes, local codes and/or by design professionals. Onsite conditions such as poor installation practices or inproper use of equipment could increase the degree of risk. If such conditions exist, the user must increase the safety factor to compensate. For most applications NCA suggests a minimum 2:1 safety factor for hanging accessories and stresses that this safety factor should be strictly adhered to or the application be reviewed by a design professional. The material included in this publication provides the ultimate capacities so other safety factors may be used where applicable.

   WARNING : Improper, careless and/or haphazard use of the products shown in this document can expose workers to extreme danger, injury and death. If uncertain about installations or use of any NCA product, contact the nearest NCA Sales office or Technical Department for explanations and/or recommendations.

   National Concrete Accessories products are manufactured according to strict specifications and are subject to numerous tests under a stringent quality control program. These products are designed to be capable of meeting or exceeding all necessary safety requirements for the concrete construction, anchoring and forming industry. All product test data shown, were obtained through an independent testing facility or tests conducted by NCA. However, the performance of a quality product can be affected by the manner in which it is used in

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the field. Therefore, the following precautions should be taken by all involved persons.

4. Any welding required should be performed by a certified welder. Bending or welding of high tensile steel products should not be permitted.

   Note: NCA does not warrant any product that has been welded, altered or modified in any way after leaving an NCA plant or warehouse.

5. Never exceed listed product safe working loads. Note that all product load ratings shown in this bulletin are ratings for new or "as new" products only. Extreme caution must be exercised when using any product that is in other than new condition. Any reusable product that shows wear, misuse, overloading, corrosion or any other factor that would compromise its safe working load should be discarded. It is the user's responsibility to continually inspect working hardware for wear, and to discard the parts when wear is noted. DO NOT straighten bent bolts, rather discard and replace.

6. NCA products are not to be applied or installed until the user and/or the installer has a clear understanding of the information contained within the appropriate product publication. All contractors must instruct their employees in the appropriate use and installation of NCA products.

   To avoid injury and possible form tie problems DO NOT CLIMB ON FORM TIES.

8. Do not interchange products supplied by other manufacturers with those supplied by NCA. NCA cannot guarantee that products supplied by others will be compatible and/or interchangeable with NCA's quality concrete accessories.

9. Drawings and/or sketches shown in this bulletin are for illustrative purposes only. Check actual conditions for specific applications. Metric values listed are a soft conversion of imperial values.

The information contained herein supersedes all previous versions printed prior to this edition and is based on data and knowledge considered true and accurate. NCA reserves the right to update information without notice.

Please read all statements, recommendations or suggestions in conjunction with NCA's condition of sale which apply to all goods supplied by NCA. No statement, recommendations or suggestions is intended for any use that would infringe any patent or copyright.

NOTE: For applications not specifically identified herein, approval in writing is required by the NCA Technical Department for special applications and uses of NCA products.

Hollow Deformed Rebar (HDR)

NCA High Strength ASTM-A615

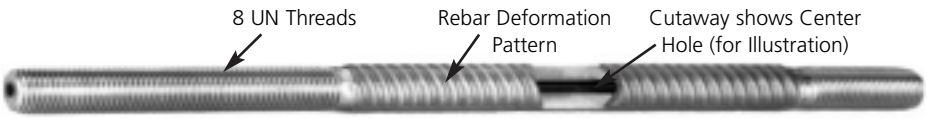
NOTE: To activate AR Mechanical Expansion Anchors apply steady torque (not impact) until anchor rod stops rotating or maximum allowable applied torque value is reached. Fully support hex nut, do not cause bending.

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.

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 or in poor ground conditions with heavily fractured zones and water infiltration problems.



HDR: Hollow Deformed Rebar.
Thread length as required. Specify coupled lengths if bolt greater than 6.2m (20 ft,).

HDR-25 Shipping Assembly
complete with an AR6525 coneshell anchor

HDR Site Assembly
Ready for insertion into drilled hole

TABLE CS3 HDR TECHNICAL INFORMATION

Product Number	HDR Bar Diameter	Thread Diameter - TPI	Effective Tensile Stress Area	Max. Working Load to Yield	Ultimate Tensile Strength	Mechanical Anchor Assembly	Drill Hole Diameter	Recommended Allowable Applied Torque*
HDR25	25 mm (1")	(1" - 8UN)	339 sq. mm (0.526 sq. in.)	234 kN (52,600 lbs.)	320 kN (72,000 lbs.)	AR4525-M**	45 mm (1¾")	675 Nm (500 ft-lbs.)
						AR5525-N	57 mm (2¼")	
						AR6525-N	65 mm (2½")	
HDR35	35 mm (1⅜")	(1⅜" - 8UN)	702 sq. mm (1.089 sq. in.)	484 kN (108,900 lbs.)	663 kN (149,000 lbs.)	Consult NCA***	57 mm (2¼")	2,000 Nm (1,500 ft-lbs.)
						AR6535-N	65 mm (2½")	
						AR7635-N	76 mm (3")	
HDR50	50 mm (2")	(2" - 8UN)	1,621 sq. mm (2.513 sq. in.)	1,118 kN (251,300 lbs.)	1,512 kN (340,000 lbs.)	AR9050-N	90 mm (3½")	5,400 Nm (4,000 ft-lbs.)

** For hard rock installation contact your local NCA Sales Representative for further information.*
*** Couplings cannot be used with the modified cone shell anchor AR4525-M due to the hole diameter*

***Consult NCA for mechanical anchor assembly requirements.

Consult your local NCA Sales Representative or the NCA Technical Department for additional information.

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

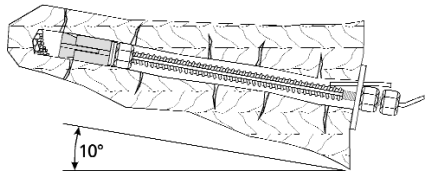
Horizontal applications inclined by 10° either up or down to facilitate grout pumping. Pump grout according to whether inclined up or down in accordance with up or down grouting procedures.

Vertical Upward

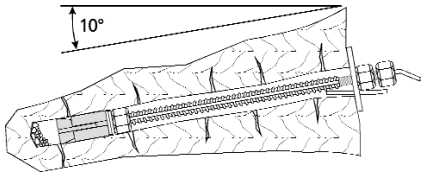
Fluid grouts can be pumped in the annular space around bolt.

Thixotropic Grouting

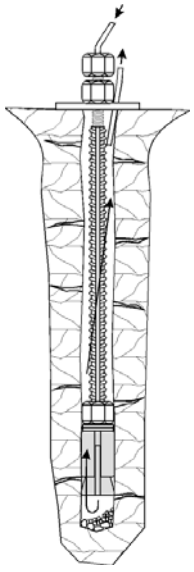
Thixotropic grouts can be pumped through the hollow core of the bolt and return through vent. Neat expansive cement grouts of a 0.3 to 1 water/cement ratio can be pumped. Pumping is performed with thixotropic grout pump-mixers available from National Concrete Accessories.



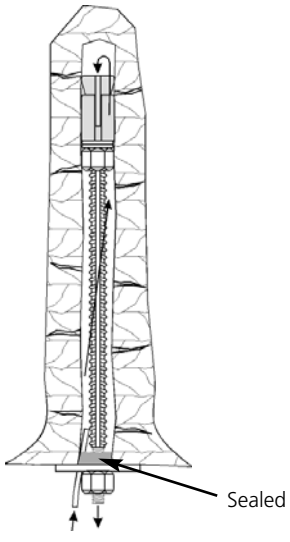
HDR Inclined Upward Grouting



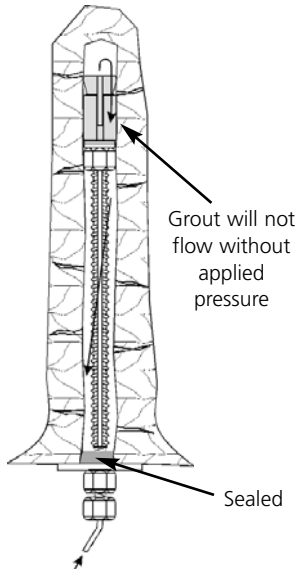
HDR Inclined Downward



HDR Downward Grouting



HDR Upward Grouting



HDR Upward Thixotropic Grouting

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.

Heavy plate thicknesses are recommended for HDR bolts (see table on page 27 for Bearing Plates).

Consult your local NCA Sales Representative or the NCA Technical Department for additional information.

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.

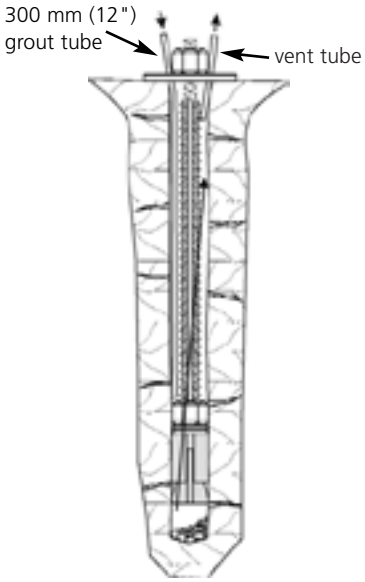
SDR: Solid Deformed Rebar.
Specify thread length and rod lengths for couplings.

SDR with a 45° End Cut
For use with Adhesive Anchoring Systems such as Polyester Resin or Cementitious Cartridges (see page 17)
NOTE: Blunt rebar is acceptable for use in very soft rocks where sidewall abrasion is a concern.

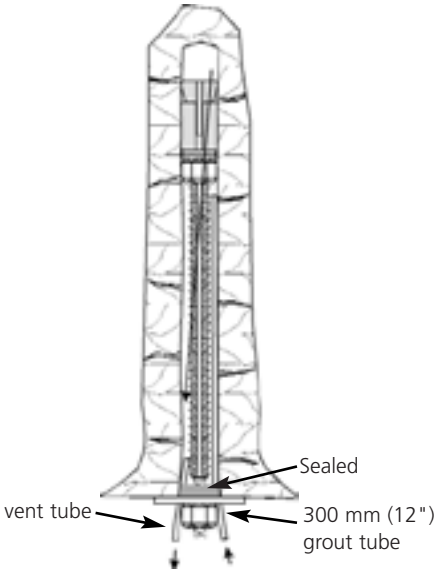
SOLID DEFORMED REBAR (SDR) APPLICATIONS

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



SDR Upward grouting
with thixotropic cementitious grouts
for permanent grouting

Consult your local NCA Sales Representative or the NCA Technical Department for additional information.

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.

SDR Shipping Assembly
with an AR6525 Cone Shell Expansion Anchor

SDR Site Assembly

TABLE CS4 SDR TECHNICAL INFORMATION

Product Number	SDR Bar Size	Thread Diameter - TPI	Effective Tensile Stress Area	Grade 400 MPa		Mechanical Anchor Assembly	Drill Hole Size	Recommended Allowable Applied Torque
				Max. Working Load to Yield	Ultimate Tensile Strength			
SDR-12	15M	½"-13UNC	92 sq. mm (0.1419 sq. in.)	36 kN (8,200 lbs)	56 kN (12,700 lbs)	AR4512-N	45 mm (1¾")	70 Nm (50 ft-lbs)
SDR-16	15M	⅝" - 11UNC	145 sq. mm (0.226 sq. in.)	60 kN (13,500 lbs.)	90 kN (20,300 lbs.)	AR4516-N	45 mm (1¾")	110 Nm (80 ft-lbs)
SDR-20	20M	¾" - 10UNC	215 sq. mm (0.334 sq. in.)	86 kN (19,400 lbs.)	133 kN (30,000 lbs)	AR4520-N	45 mm (1¾")	230 Nm (170 ft-lbs)
SDR-22	25M	⅞" - 9UNC	297 sq. mm (0.462 sq. in.)	123 kN (27,700 lbs.)	185 kN (41,580 lbs.)	AR4522-N	45 mm (1¾")	360 Nm (265 ft-lbs)
SDR-25	25M	1" - 8UN	391 sq. mm (0.606 sq. in.)	156 kN (35,200 lbs.)	242 kN (54,500 lbs)	AR4525-M*	45 mm (1¾")	550 Nm (400 ft-lbs)
						AR5025-N	51 mm (2")	
						AR5525-N	57 mm (2¼")	
						AR6525-N	65 mm (2½")	
SDR-29	30M	1⅛" - 8UN	512 sq. mm (0.790 sq. in.)	203 kN (45,600 lbs.)	314 kN (70,600 lbs.)	AR5529-N	57 mm (2¼")	825 Nm (600 ft-lbs)
						AR6529-N	65 mm (2½")	
SDR-32	35M	1¼" - 8UN	645 sq. mm (1.000 sq. in.)	258 kN (58,100 lbs.)	387 kN (87,200 lbs.)	Consult NCA**	57 mm (2¼")	1,015 Nm (750 ft-lbs)
						AR6532-N	65 mm (2½")	
SDR-35	35M	1⅜" - 8UN	796 sq. mm (1.233 sq. in.)	325 kN (73,000 lbs)	493 kN (110,000 lbs)	Consult NCA**	57 mm (2¼")	1,100 Nm (800 ft-lbs)
						AR6535-N	65 mm (2½")	
						AR7635-N	76 mm (3")	
SDR-38	45M	1½" - 8UN	963 sq. mm (1.492 sq. in.)	395 kN (89,000 lbs)	596 kN (134,000 lbs.)	AR7638-N	76 mm (3")	1,650 Nm (1,200 ft-lbs)
SDR-45	45M	1¾" - 5UN	1225 sq. mm (1.900 sq. in.)	501 kN (112,800 lbs)	760 kN (171,000 lbs)	AR9045-N	90 mm (3½")	2,000 Nm (1,500 ft-lbs)
	55M	1¾" - 8UN	1342 sq. mm (2.080 sq. in.)	536 kN (120,600 lbs)	833 kN (187,200 lbs)	AR9045-N	90 mm (3½")	
SDR-48	55M	1⅞" - 8UN	1555 sq. mm (2.410 sq. in.)	643 kN (144,600 lbs)	964 kN (216,900 lbs)	AR9048-N	90 mm (3½")	3,300 Nm (2,450 ft-lbs)
SDR-55	55M	2" - 8UN	1787 sq. mm (2.770 sq. in.)	716 kN (160,900 lbs)	1,109 kN (249,300 lbs)	AR9050-N	90 mm (3½")	4,000 Nm (3,000 ft-lbs)

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

**Consult NCA for mechanical anchor assembly requirements.

Consult your local NCA Sales Representative or the NCA Technical Department for additional information.

Solid Continuous Threaded Unified (SCT-N)

SCT-N Shipping Assembly
with an AR Cone Shell.

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 FJ series mechanical expansion anchors. May also be used in through-bolting applications. Suitable for field cutting to any length.

TABLE CS5 SCT-N TECHNICAL INFORMATION

Product Number	SCT-N Rod Diameter	Thread Diameter - TPI	Effective Tensile Stress Area	Maximum Working Load to Yield	Ultimate Tensile Strength	Mechanical Anchor Assembly	Drill Hole Diameter	Recommended Allowable Applied Torque*
SCT-N-12	13 mm (½")	½" 13UNC	92 sq. mm (0.1419 sq. in.)	57 kN (13,000 lbs.)	80 kN (18,000 lbs.)	AR4512-N-SA	45 mm (1¾")	95 Nm (70 ft-lbs.)
SCT-N-20	19 mm (¾")	¾" 10UNC	215 sq. mm (0.334 sq. in.)	133 kN (30,000 lbs.)	169 kN (38,000 lbs.)	AR4520-N-SA	45 mm (1¾")	340 Nm (250 ft-lbs.)
SCT-N-25	25 mm (1")	1" 8UN	391 sq. mm (0.606 sq. in.)	266 kN (60,000 lbs.)	334 kN (75,000 lbs.)	AR4525-M-SA	45 mm (1¾")	810 Nm (600 ft-lbs.)
						AR5525-N-SA	57 mm (2¼")	
						AR6525-N-SA	65 mm (2½")	
SCT-N-32	32 mm (1¼")	1¼" 8UN	645 sq. mm (1.000 sq. in.)	400 kN (90,000 lbs.)	534 kN (120,000 lbs.)	Consult NCA**	57 mm (2¼")	1,625 Nm (1,200 ft-lbs.)
						AR6532-N-SA	65 mm (2½")	

Electro plated or hot dipped galvanized available.

*Consult NCA for mechanical anchor assembly requirements.

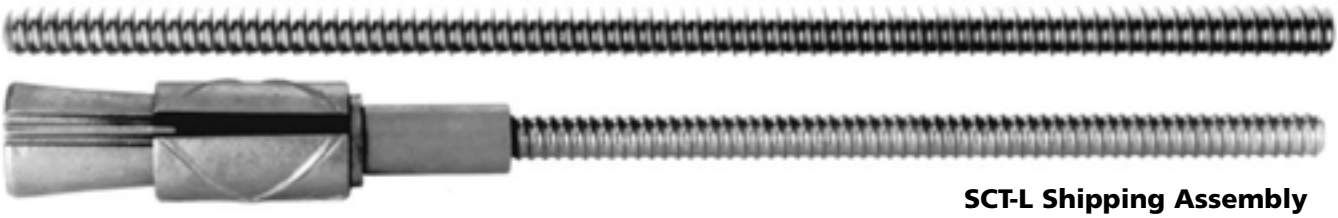
NOTE: To activate AR Mechanical Expansion Anchors apply steady torque (not impact) until anchor rod stops rotating or maximum allowable applied Torque value is reached.

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.

Consult your local NCA Sales Representative or the NCA Technical Department for additional information.

Solid Continuous Threaded Lag (SCT-L)



SCT-L Shipping Assembly
with AR cone shell anchor
Ready for protective storage sleeve

Lag stud bolts of the same carbon steel as the SCT and SST series utilizes both AR and FJ mechanical expansion anchor series for blind hold installation. 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.

TABLE CS6 SCT-L TECHNICAL INFORMATION

Product Number	SCT-L Rod Diameter	Thread Diameter - TPI	Effective Tensile Stress Area	Maximum Working Load to Yield	Ultimate Tensile Strength*	Mechanical Anchor Assembly	Drill Hole Diameter	Recommended Allowable Applied Torque
SCT-L-12	13 mm (½")	½" 6 LAG	90 sq. mm (0.139 sq. in.)	57 kN (13,000 lbs)	80 kN (18,000 lbs)	AR4512-L-SA	45 mm (1¾")	95 Nm (70 ft-lbs)
SCT-L-20	19 mm (¾")	¾" 4.5 LAG	198 sq. mm (0.307 sq. in.)	133 kN (30,000 lbs)	169 kN (38,000 lbs)	AR4520-L-SA	45 mm (1¾")	340 Nm (250 ft-lbs)
SCT-L-25	25 mm (1")	1" 3.5 LAG	349 sq. mm (0.541 sq. in.)	266 kN (60,000 lbs)	334 kN (75,000 lbs)	AR4525-L-SA	45 mm (1¾")	810 Nm (600 ft-lbs)
						AR5525-L-SA	57 mm (2¼")	
						AR6525-L-SA	65 mm (2½")	
SCT-L-32	32 mm (1¼")	1¼" 3.5 LAG	591 sq. mm (0.916 sq. in.)	400 kN (90,000 lbs)	534 kN* (120,000 lbs)	Consult NCA**	57 mm (2¼")	1,625 Nm (1,200 ft-lbs)
						AR6532-L-SA	65 mm (2½")	

**Double nut required to obtain full Rod capacity.*

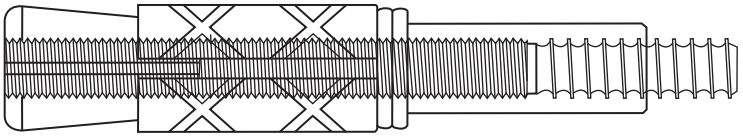
****Consult NCA for mechanical anchor assembly requirements.**

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.

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.



Consult your local NCA Sales Representative or the NCA Technical Department for additional information.

SCT-N-B7 All Thread Bar

NCA 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 NCA SCT-N-B7 products are commonly used in high pressure and extreme service requirements are a consideration in cold temperature.

NCA SCT-N-B7 all thread products can be supplied with a AR Anchor using a stud assembly or Bail Anchor.

Mechanical Properties of ASTM A193 B7

Strain Gauge Load Cells Standard Dimensions					
Diameter	**Tensile (Psi)**	**Yield (Psi)**	**Elongation**	**Reduction**	**Hardness**
Up to 63 mm (2½")	125,000	105,000	16	50	35 HRC max.
63 mm (2½") to 100 mm (4")	115,000	95,000	16	50	33 HRC max

Mechanical Properties of ASTM A193 B7

Product Number	SCT-N-B7 Diameter	Thread Diameter - TPI	Effective Tensile Stress Area	Maximum Working Load to Yield	Ultimate Tensile Strength	Mechanical Anchor Assembly*	Drill Hole Diameter	Recommended Allowable Applied Torque
SCT-N-B7 - 13	13 mm (½")	13 UNC	92 sq mm. (0.1419 sq in)	66.6 kN (15,000 lbs)	80 kN (18,000 lbs)	AR4512-N-SA	45 mm (1¾")	95 Nm (70 ft-lbs)
SCT-N-B7 - 20	20 mm (¾")	10 UNC	215 sq mm (0.334 sq in)	160 kN (36,000 lbs)	186 kN (42,000 lbs)	AR4520-N-SA	45 mm (1¾")	340 Nm (250 ft-lbs)
SCT-N-B7 - 25	25 mm (1")	8 UN	391 sq mm (0.606 sq in)	285 kN (64,000 lbs)	337 kN (76,000 lbs)	AR4525-M-SA AR5525-N-SA AR6525-N-SA	65 mm (1¾") 57 mm (2¼") 65 mm (2½")	810 Nm (600 ft-lbs)
SCT-N-B7 - 32	32 mm (1¼")	8 UN	645 sq mm (1.000 sq in)	467 kN (105,000 lbs)	556 kN (125,000 lbs)	Consult NCA** AR6532-N-SA	57 mm (2¼") 65 mm (2½")	1,625 Nm (1,200 ft-lbs)
SCT-N-B7 - 35	35 mm (1⅜")	8 UN	796 sq mm (1.233 sq in)	573 kN (129,000 lbs)	684 kN (154,000 lbs)	Consult NCA** AR6535-N-SA AR7635-N-SA	65 mm (2¼") 57 mm (2½") 76 mm (3")	2,170 Nm (1,600 ft-lbs)
SCT-N-B7 - 38	38 mm (1½")	8 UN	963 sq mm (1.492 sq in)	695 kN (156,660 lbs)	828 kN (186,500 lbs)	AR7638-N-SA	76 mm (3")	2,700 Nm (2,000 ft-lbs)
SCT-N-B7 - 45	45 mm (1¾")	8 UN	1,342 sq mm (2.080 sq in)	970 kN (218,400 lbs)	1,155 kN (260,000 lbs)	AR9045-N-SA	90 mm (3½")	4,067 Nm (3,000 ft-lbs)
SCT-N-B7 - 50	50 mm (2")	8 UN	1,787 sq mm (2.770 sq in)	1,293 kN (290,850 lbs)	1,539 kN (346,000 lbs)	AR9050-N-SA	90 mm (3½")	6,100 Nm (4,500 ft-lbs)

**Transition coupler required.*

****Consult NCA for mechanical anchor assembly requirements.**

Consult your local NCA Sales Representative or the NCA Technical Department for additional information.

Solid Smooth Threaded (SST)

SST Shipping Assembly
with AR Cone Shell anchor Ready for protective storage sleeve

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 National Concrete Accessories 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 tie-through applications.

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.

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.

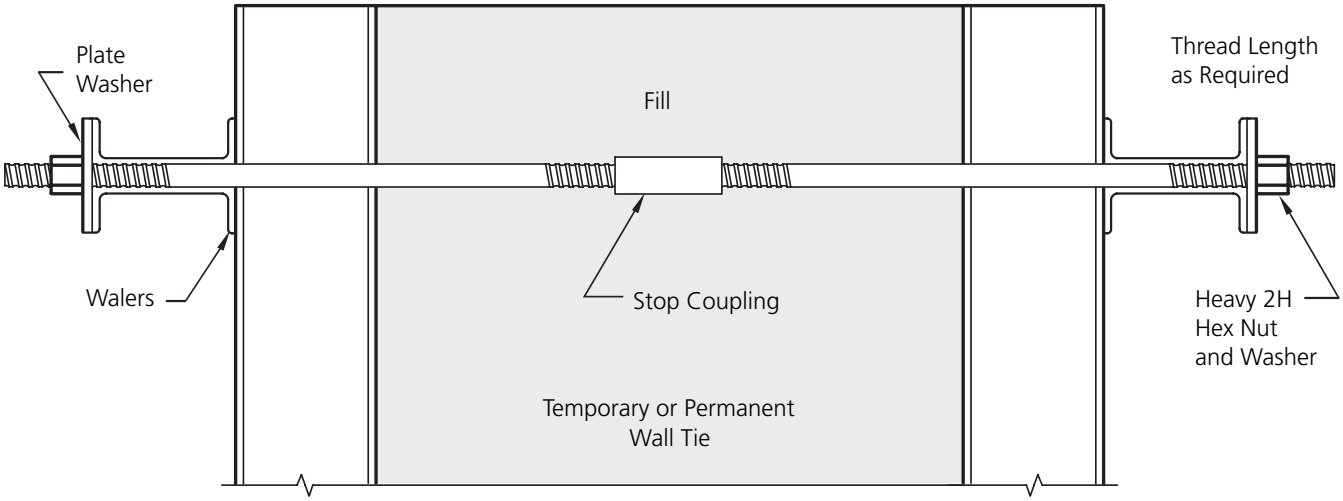
TABLE CS7 SST TECHNICAL INFORMATION

Product Number	SST Rod Diameter	Thread Diameter - TPI	Effective Tensile Stress Area	Maximum Working Load to Yield	Ultimate Tensile Strength	Mechanical Anchor Assembly	Drill Hole Diameter	Recommended Allowable Applied Torque
SST-12	11 mm (7/16")	½" - 13UNC	92 sq. mm (0.1419 sq. in.)	57 kN (13,000 lbs)	80 kN (18,000 lbs)	AR4512-N	45 mm (1¾")	95 Nm (70 ft-lbs)
SST-20	18 mm (11/16")	¾" - 10UNC	215 sq. mm (0.334 sq. in.)	133 kN (30,000 lbs)	169 kN (38,000 lbs)	AR4520-N	45 mm (1¾")	340 Nm (250 ft-lbs)
SST-25	24 mm (15/16")	1" - 8UN	391 sq. mm (0.606 sq. in.)	266 kN (60,000 lbs)	334 kN (75,000 lbs)	AR4525-M	65 mm (1¾")	810 Nm (600 ft-lbs)
						AR5525-N	57 mm (2¼")	
						AR6525-N	65 mm (2½")	
SST-32	30 mm (1 3/16")	1¼" - 8UN	645 sq. mm (1.000 sq. in.)	400 kN (90,000 lbs)	534 kN (120,000 lbs)	Consult NCA**	57 mm (2¼")	1,625 Nm (1,200 ft-lbs
						AR6532-N	65 mm (2½")	
SST-35	33 mm (1 5/16")	1 3/8" - 8UN	796 sq. mm (1.233 sq. in.)	489 kN (110,000 lbs)	600 kN (135,000 lbs)	Consult NCA**	65 mm (2¼")	2,170 Nm (1,600 ft-lbs)
						AR6535-N	57 mm (2½")	
						AR7635-N	76 mm (3")	
SST-38	37 mm (1 7/16")	1½" - 8UN	963 sq. mm (1.492 sq. in.)	596 kN (134,000 lbs)	796 kN (179,000 lbs)	AR7638-N	76 mm (3")	2,700 Nm (2,000 ft-lbs)
SST-45	43 mm (1 11/16")	1¾" - 8UN	1342 sq. mm (2.08 sq. in.)	830 kN (187,000 lbs)	1,100 kN (249,000 lbs)	AR9045-N	90 mm (3½")	4,067 Nm (3,000 ft-lbs)
SST-50	49 mm (1 15/16")	2" - 8UN	1787 sq. mm (2.770 sq. in.)	1150 kN (260,000 lbs)	1,370 kN (310,000 lbs)	AR9050-N	90 mm (3½")	6,100 Nm (4,500 ft-lbs)

*Consult NCA for mechanial anchor assembly requirements.

Consult your local NCA Sales Representative or the NCA Technical Department for additional information.

Through Wall Ty Bar



All NCA bar products in this publication can be considered for Through Wall Ty applications. NCA 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.

NCA engineered approach provides an innovative method to achieve the full working load requirement.

When design loads exceed published values, consult the NCA Technical Department.

All Thread Bar

NCA 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 NCA Technical Department for available bar diameters.

NCA Corrosion Protection Products

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

Consult your local NCA Sales Representative or the NCA Technical Department for additional information.

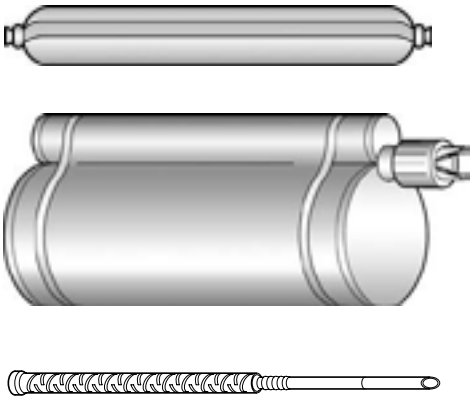
Adhesive Anchoring System

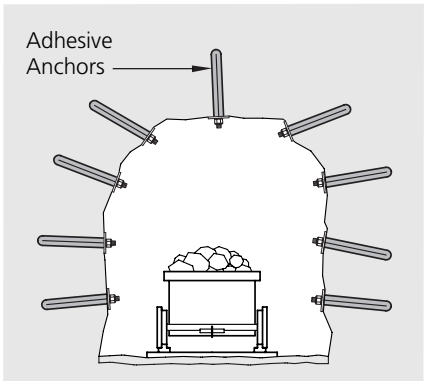
NCA provides a wide range of two component chemical adhesives ideally suited for anchoring deform reinforcement bar or thread rod. Typical applications include machine bases, base plates, hand rails, dowels and rock bolts for mining and tunnelling.

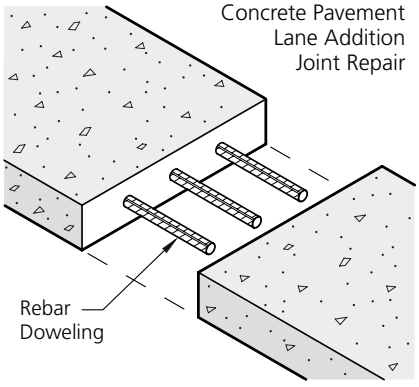
Adhesive Anchoring products are available as injection cartridges with a plastic mixing head and a two component self contained sausage.

Adhesive Anchoring products can be used with a screen tube or plastic cone to anchor into or through hollow masonry construction or directly to solid materials such as rock or concrete.

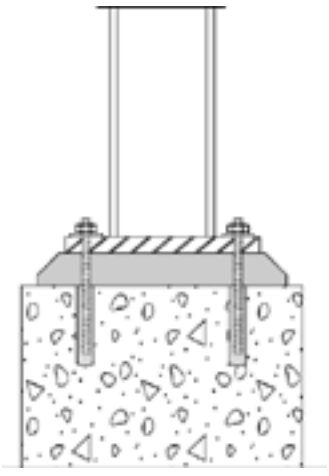
Contact your NCA Sales Representative or NCA Technical Department for assistance in your product selection and technical information.



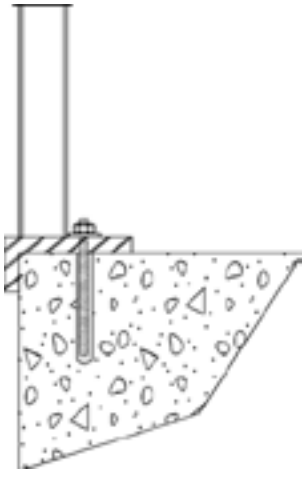




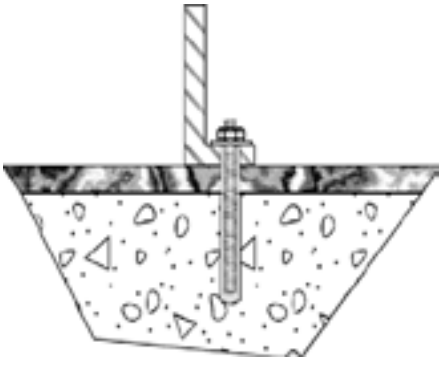
Adhesive Anchoring systems are available in cartridges, tubes and bulk quantities.



Base Plate Anchoring



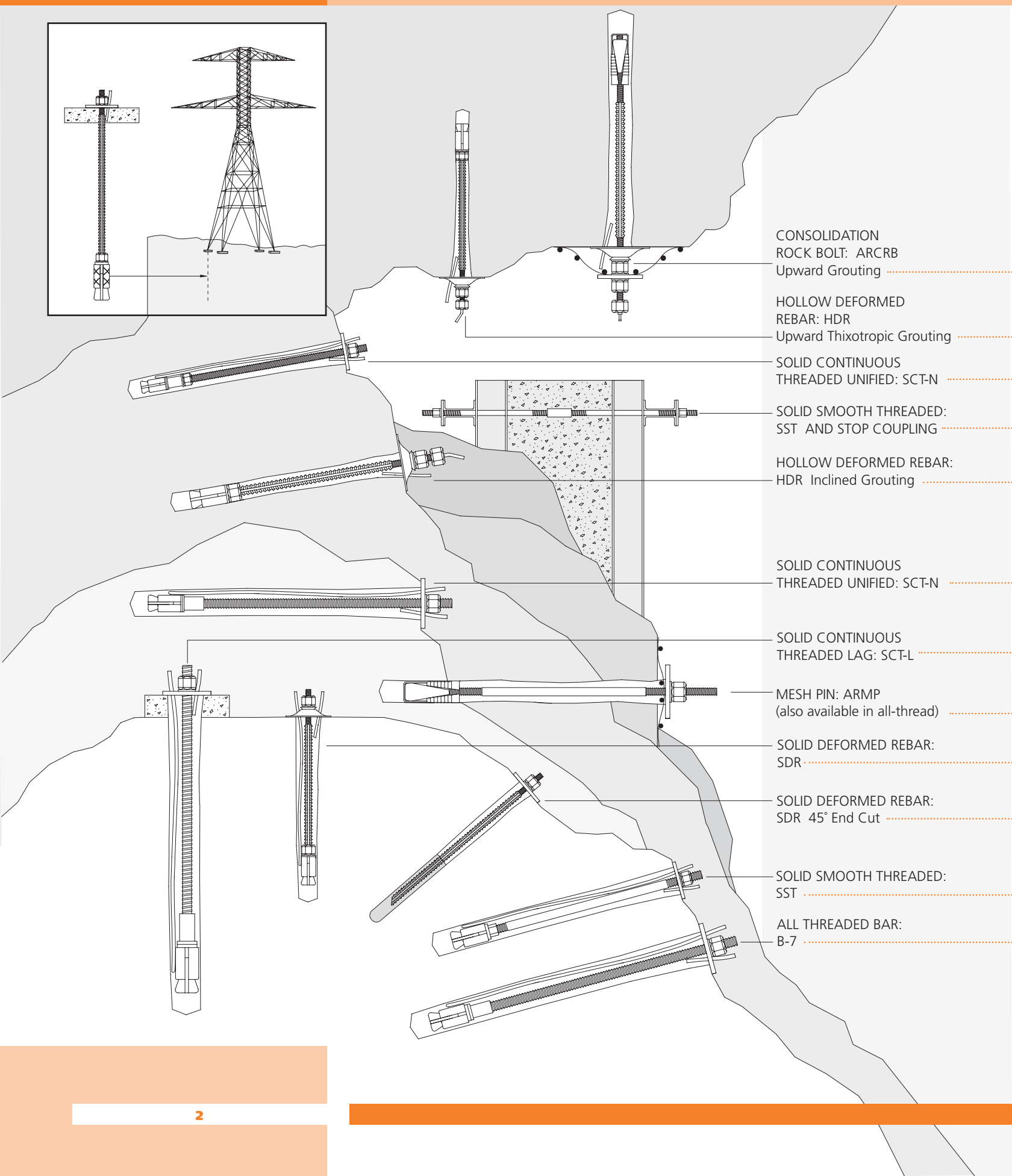
Hand Rail Anchoring



Machinery Base Anchoring

Consult your local NCA Sales Representative or the NCA Technical Department for additional information.

ROCK BOLT ANCHORING SYSTEMS



CONSOLIDATION
ROCK BOLT: ARCRB
Upward Grouting

HOLLOW DEFORMED
REBAR: HDR
Upward Thixotropic Grouting

SOLID CONTINUOUS
THREADED UNIFIED: SCT-N

SOLID SMOOTH THREADED:
SST AND STOP COUPLING

HOLLOW DEFORMED REBAR:
HDR Inclined Grouting

SOLID CONTINUOUS
THREADED UNIFIED: SCT-N

SOLID CONTINUOUS
THREADED LAG: SCT-L

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

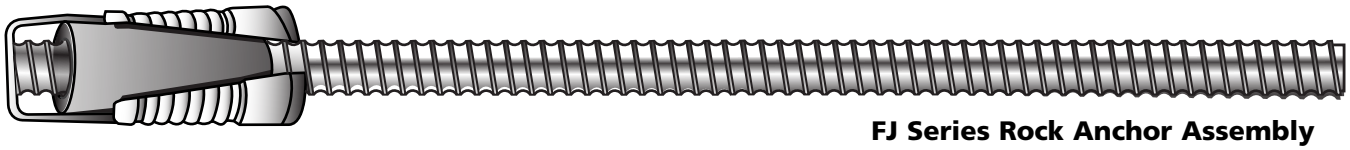
SOLID DEFORMED REBAR:
SDR

SOLID DEFORMED REBAR:
SDR 45° End Cut

SOLID SMOOTH THREADED:
SST

ALL THREADED BAR:
B-7

FJ Series Rock Anchors



FJ Series Rock Anchor Assembly

Double leaf bail-type anchors are suitable for light to moderate load applications up to a 35mm (1⅜") 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.

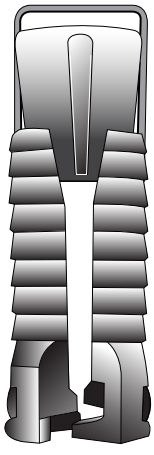
Final fit-up is achieved by tensioning the anchor rod against the bearing plate. Available in Lag and UN/UNC series threads as shown.

Type D33 FJ Series Rock Anchor

TABLE CS8: FJ SERIES TECHNICAL INFORMATION

Part Number	Thread Diameter - TPI	Drill Hole Size	Shell Length	Wedge Length	Non-Seizure Load*
D2-L-12	½" 6 LAG	35 mm (1⅜")	65 mm (2½")	80 mm (3⅛")	60 kN (13,500 lbs)
D51-L-20	¾" 4.5 LAG	45 mm (1¾")	75 mm (3")	80 mm (3⅛")	133 kN (30,000 lbs)
D51-L-25	1" 3.5 LAG	45 mm (1¾")	75 mm (3")	80 mm (3⅛")	162 kN (36,500 lbs)
D20-N-20	¾" 10UNC	50 mm (2")	100 mm (4")	98 mm (3⅞")	178 kN (40,000 lbs)
D20-N-25	1" 8UN	50 mm (2")	100 mm (4")	98 mm (3⅞")	222 kN (50,000 lbs)
D33-N-32	1¼" 8UN	65 mm (2½")	100 mm (4")	98 mm (3⅞")	311 kN (70,000 lbs)
D33-N-35	1⅜" 8UN	65 mm (2½")	100 mm (4")	98 mm (3⅞")	312 kN (70,000 lbs)
D51-N-25	1" 8UN	45 mm (1¾")	75 mm (3")	80 mm (3⅛")	162 kN (36,500 lbs)

**Non-Seizure Load: The load at which the mine roof support anchor can be taken to, while in compression, without thread seizure.*



F2B

F2B - NCA

Thread Size	Drill Hole Size (in.)	Shell Length (in.)	Wedge Length (in.)	Wedge Pearlitic (P) or Malleable	Non-Seizure Load (Lbs.)
⅝" UNC	(35mm) 1⅜"	(73mm) 2⅞"	(35mm) 1⅜"	M	75.5kN (17,000)
¾" UNC	(35mm) 1⅜"	(73mm) 2⅞"	(35mm) 1⅜"	P	133kN (30,000)
½" LAG HT*	(35mm) 1⅜"	(73mm) 2⅞"	(35mm) 1⅜"	M	80kN (18,000*)
¾" LAG HT*	(35mm) 1⅜"	(73mm) 2⅞"	(35mm) 1⅜"	P	160kN (36,000*)

HT Based upon testing using High Tensile Continuous Lag Threaded bar.*
Each application should be tested utilizing interded threaded bar.

Consult your local NCA Sales Representative or the NCA Technical Department for additional information.

INSTALLATION INSTRUCTIONS FOR AR CONE SHELL MECHANICAL EXPANSION ANCHORS

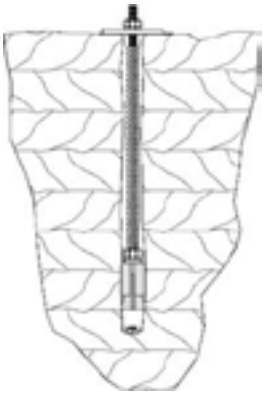
Hole Preparation

Mechanical expansion anchors require a hole drilled into the rock or concrete with attention paid to the length, diameter and straightness. Rotary percussion 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 downpressure 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. Trying 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 pre-set 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.

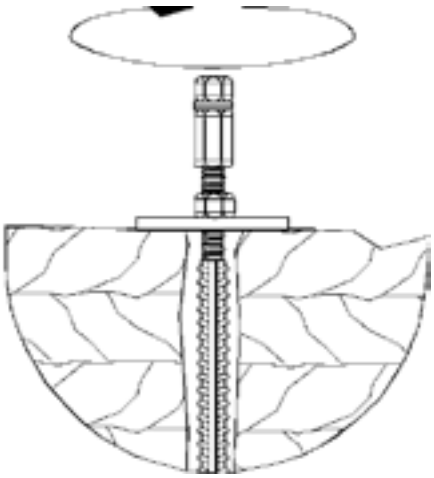


The ideal final elevation of the bolt should be when an equal length of thread exists both above and below the bearing plate. Under ideal conditions when the full torque required to expand the shell of the anchor assembly has been delivered to the anchor, tensioning the bolt will cause the anchor rod to extend only by the elastic deformation of the length of rod for a given axial tensile load. Practically, their 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 swivelling 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 overdrilled 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.



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 anti-rotational force on the body of the spin adapter, with a wrench, when releasing the top bolt.

NCA 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: FJ Series Anchors are set by tensioning the rod). Torque measuring equipment accuracy values should also be verified. NCA recommends that the maximum torque be applied to a given

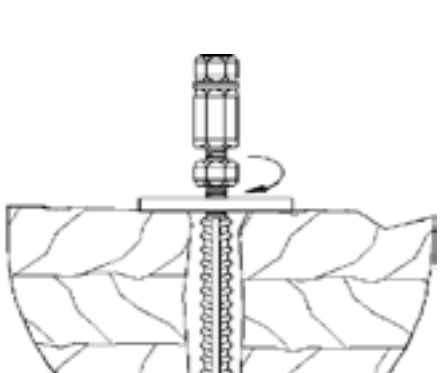
Consult your local NCA Sales Representative or the NCA Technical Department for additional information.

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.

TENSIONING PROCEDURE FOR A PRETENSIONED ROCK BOLT

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

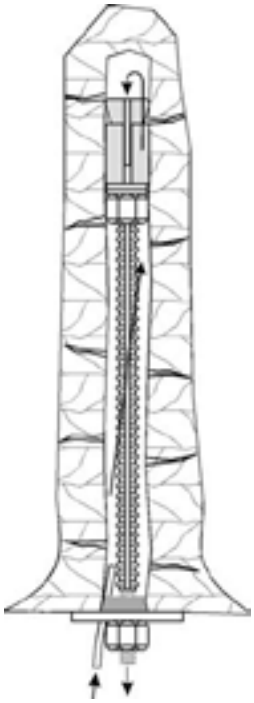
The ram of the centre hole jack is positioned directly over the rock bolt rod exposed through the bearing plate. Since most often the bolt end is not long enough to extend through the ram a coupling and an extension rod is required to give a threaded section above the top end of the ram. A bearing plate 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.

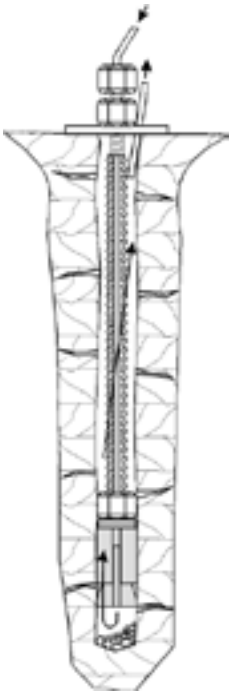
Pressure is applied by the hydraulic pump supplied. Manual pumps may be reliably used but for cost efficiency for “production” operations either an electric or pneumatic powered pump is available.

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 micro-cracking 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.

Consult your local NCA Sales Representative or the NCA Technical Department for additional information.





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 rock bolts 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. NCA 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.

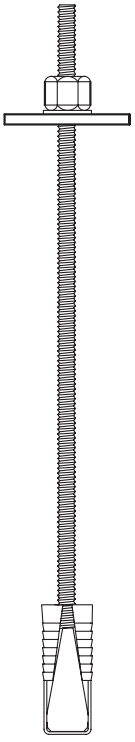
Equipment

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 volumous 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.

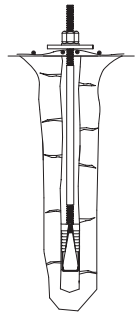
Bolts should be grouted the same day they have been placed. Compressed air should be used to verify the open circuit along the length of the bolt prior to grouting. Supply of the grout should be done in accordance with the application drawing associated with the rod series and orientation chosen. Grout 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.

Consult your local NCA Sales Representative or the NCA Technical Department for additional information.

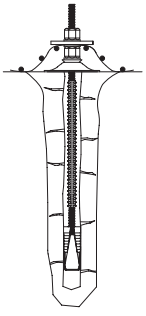
Consolidation Rock Bolt (ARCRB)



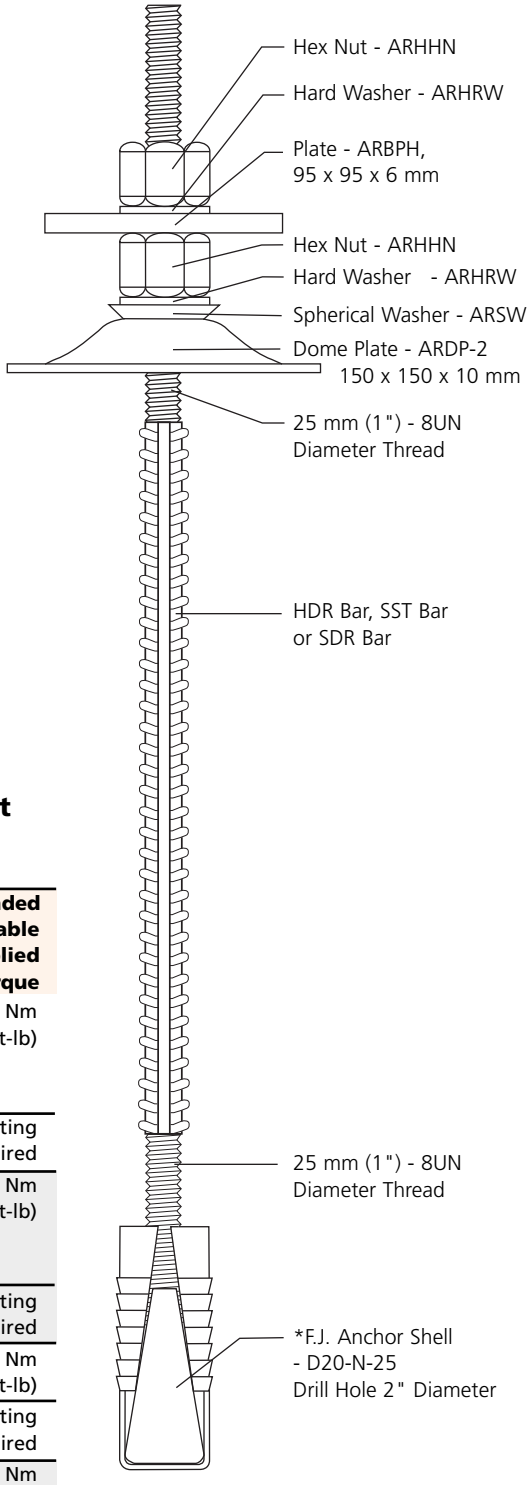
MESH PIN (ARMP)



Mesh Pin Application



Application of a Consolidation Rock Bolt



*NOTE: Coupling of 1½" O.D. to be used with D20-N-25 Anchor due to the hole diameter of 2"

TABLE CRB1 CONSOLIDATION ROCK BOLT

Product Number	Thread Diameter	Maximum Working Load to Yield	Mechanical Anchor Assembly	Drill Hole Diameter	Recommended Allowable Applied Torque
HDR-CB-25	25 mm (1")	234 kN (52,600 lbs)	AR4525-M	45 mm (1¾")	675 Nm (500 ft-lb)
	1" - 8UN	234 kN (52,600 lbs)	AR6525	65 mm (2½")	
		222 kN (50,000 lbs)	D20-N-25	50 mm (2")	Field testing required
SST-CB-25	25 mm (1")	266 kN (60,000 lbs)	AR4525-M	45 mm (1¾")	810 Nm (600 ft-lb)
	1" - 8UN	266 kN (60,000 lbs)	AR6525	65 mm (2½")	
		222 kN (50,000 lbs)	D20-N-25	50 mm (2")	Field testing required
HDR-CB-35	35 mm (1 3/8")	484 kN (108,900 lbs)	AR7535	76 mm (3")	2,000 Nm (1,500 ft-lb)
	1 3/8" - 8UN	312 kN (70,000 lbs)	D33-N-35	65 mm (2½")	Field testing required
SST-CB-35	35 mm (1 3/8")	489 kN (110,000 lbs)	AR7635	76 mm (3")	2,170 Nm (1,600 ft-lb)
	1 3/8" - 8UN	312 kN (70,000 lbs)	D33-N-35	65 mm (2½")	Field testing required

Consult your local NCA Sales Representative or the NCA Technical Department for additional information.

Heavy Hex Nut (ARHHN)

ASTM A-563
Grade 2H

ARHHN Thread Diameter - TPI		Height		Across Flats		Across Corners	
½"	6 LAG	12.3 mm	(31/64")	22 mm	(7/8")	25 mm	(1")
½"	13UNC	12.3 mm	(31/64")	22 mm	(7/8")	25 mm	(1")
5/8"	11UNC	15.4 mm	(39/64")	26.9 mm	(1 1/16")	30.9 mm	(1 7/32")
¾"	4.5 LAG	18.7 mm	(47/64")	32 mm	(1¼")	37 mm	(1 7/16")
¾"	10UNC	18.7 mm	(47/64")	32 mm	(1¼")	37 mm	(1 7/16")
7/8"	9UNC	21.8 mm	(55/64")	36.5 mm	(1 7/16")	42 mm	(1 21/32")
1"	3.5 LAG	25 mm	(63/64")	41 mm	(1 5/8")	48 mm	(1 7/8")
1"	8UN	25 mm	(63/64")	41 mm	(1 5/8")	48 mm	(1 7/8")
1 1/8"	8UNC	25.4 mm	(1 7/64")	46.0 mm	(1 13/16")	53.2 mm	(2 3/32")
1¼"	3.5 LAG	31 mm	(1 7/32")	51 mm	(2")	59 mm	(2 5/16")
1¼"	8UN	31 mm	(1 7/32")	51 mm	(2")	59 mm	(2 5/16")
1 3/8"	8UN	34.1 mm	(1 11/32")	56 mm	(2 3/16")	64 mm	(2½")
1 3/8"	8UN	34.1 mm	(1 11/32")	56 mm	(2 3/16")	64 mm	(2½")
1½"	8UN	37.3 mm	(1 15/32")	60 mm	(2 3/8")	70 mm	(2¾")
1¾"	5UN	43.7 mm	(1 23/32")	70 mm	(2¾")	81 mm	(3 3/16")
1¾"	8UN	43.7 mm	(1 23/32")	70 mm	(2¾")	81 mm	(3 3/16")
1 7/8"	8UN	46.8 mm	(1 27/32")	74.6 mm	(2 15/16")	86.1 mm	(3 25/64")
2"	8UN	50 mm	(1 31/32")	79 mm	(3 1/8")	92 mm	(3 5/8")

Hardened Round Washer (ARHRW)

ASTM F-436

ARHRW Nominal Size	Thickness		Inside Diameter		Outside Diameter	
½"	2 mm	(3/32")	13 mm	(17/32")	27 mm	(1 1/16")
5/8"	3 mm	(1/8")	17.4 mm	(11/16")	33.3 mm	(1 5/16")
¾"	3 mm	(1/8")	20 mm	(13/16")	37 mm	(1 15/32")
7/8"	4 mm	(9/64")	23.8 mm	(1 5/16")	44.4 mm	(1¾")
1"	4 mm	(9/64")	29 mm	(1 1/8")	51 mm	(2")
1 1/8"	4 mm	(9/64")	31.7 mm	(1¼")	57.1 mm	(2¼")
1¼"	4 mm	(9/64")	35 mm	(1 3/8")	64 mm	(2½")
1 3/8"	4 mm	(9/64")	38 mm	(1½")	70 mm	(2¾")
1½"	5 mm	(13/64")	41 mm	(1 5/8")	76 mm	(3")
1¾"	5 mm	(13/64")	48 mm	(1 61/64")	89 mm	(3½")
2"	5 mm	(3/16")	54 mm	(2 1/8")	95 mm	(3¾")

Beveled Washer (ARBW)

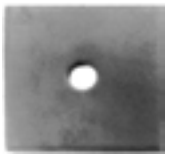
ARBW Nominal Size A	Inside Diameter B	Outside Diameter C	Minimum Thickness D	Maximum Thickness E	Width
½"	14 mm (0.56")	N/A	3 mm (0.12")	9 mm (0.34")	32 mm (1.25")
¾"	21 mm (0.81")	N/A	5 mm (0.19")	11 mm (0.44")	38 mm (1.50")
1"	29 mm (1.16")	51 mm (2.00")	6 mm (0.25")	14 mm (0.55")	N/A
*1¼"	39 mm (1.52")	66 mm (2.60")	7 mm (0.28")	16 mm (0.63")	N/A
*1 3/8"	39 mm (1.52")	66 mm (2.60")	7 mm (0.28")	16 mm (0.63")	N/A
1½"	39 mm (1.52")	66 mm (2.60")	7 mm (0.28")	16 mm (0.63")	N/A
*1¾"	53 mm (2.10")	93 mm (3.67")	14 mm (0.54")	22 mm (0.86")	N/A
2"	53 mm (2.10")	93 mm (3.67")	14 mm (0.54")	22 mm (0.86")	N/A

Non stock item

Consult your local NCA Sales Representative or the NCA Technical Department for additional information.

Single Hole Bearing Plate (ARBPH)

ARBPH Nominal Size	Width		Length		Thickness	
½"	95 mm	(3¾")	95 mm	(3¾")	6 mm	(¼")
¾"	152 mm	(6")	152 mm	(6")	10 mm	(⅜")
1"	203 mm	(8")	203 mm	(8")	10 mm	(⅜")
1" Heavy	203 mm	(8")	203 mm	(8")	13 mm	(½")
1¼"	203 mm	(8")	203 mm	(8")	13 mm	(½")
1⅜"	203 mm	(8")	203 mm	(8")	13 mm	(½")
1⅜" Heavy	203 mm	(8")	203 mm	(8")	19 mm	(¾")
1½"	203 mm	(8")	203 mm	(8")	19 mm	(¾")
1½" Heavy	229 mm	(9")	229 mm	(9")	25 mm	(1")
1¾"	305 mm	(12")	305 mm	(12")	25 mm	(1")
2"	305 mm	(12")	305 mm	(12")	25 mm	(1")



Single Key Bearing Plate (ARBP)

ARBP Nominal Size	Width		Length		Thickness	
½"	95 mm	(3¾")	95 mm	(3¾")	6 mm	(¼")
¾"	152 mm	(6")	152 mm	(6")	10 mm	(⅜")
1"	203 mm	(8")	203 mm	(8")	10 mm	(⅜")
1" Heavy	203 mm	(8")	203 mm	(8")	13 mm	(½")
1¼"	203 mm	(8")	203 mm	(8")	13 mm	(½")
1⅜"	203 mm	(8")	203 mm	(8")	13 mm	(½")
1⅜" Heavy	203 mm	(8")	203 mm	(8")	19 mm	(¾")
1½"	203 mm	(8")	203 mm	(8")	19 mm	(¾")
1½" Heavy	229 mm	(9")	229 mm	(9")	25 mm	(1")
1¾"	305 mm	(12")	305 mm	(12")	25 mm	(1")
2"	305 mm	(12")	305 mm	(12")	25 mm	(1")

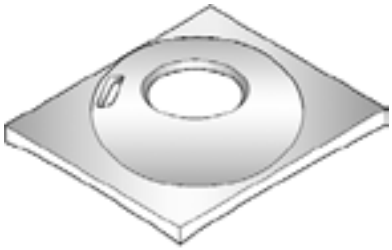
Double Key Bearing Plate (ARBPD)

ARBPD Nominal Size	Width		Length		Thickness	
½"	95 mm	(3¾")	95 mm	(3¾")	6 mm	(¼")
¾"	152 mm	(6")	152 mm	(6")	10 mm	(⅜")
1"	203 mm	(8")	203 mm	(8")	10 mm	(⅜")
1" Heavy	203 mm	(8")	203 mm	(8")	13 mm	(½")
1¼"	203 mm	(8")	203 mm	(8")	13 mm	(½")
1⅜"	203 mm	(8")	203 mm	(8")	13 mm	(½")
1⅜" Heavy	203 mm	(8")	203 mm	(8")	19 mm	(¾")
1½"	203 mm	(8")	203 mm	(8")	19 mm	(¾")
1½" Heavy	229 mm	(9")	229 mm	(9")	25 mm	(1")
1¾"	305 mm	(12")	305 mm	(12")	25 mm	(1")
2"	305 mm	(12")	305 mm	(12")	25 mm	(1")

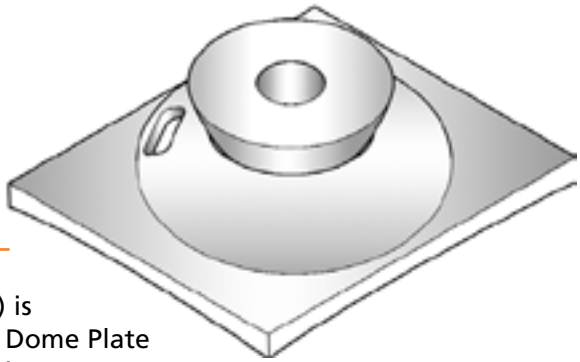
Note: Drill holes may be substituted for key holes on heavy plates.

Consult your local NCA Sales Representative or the NCA Technical Department for additional information.

Dome Plate (ARDP-2)



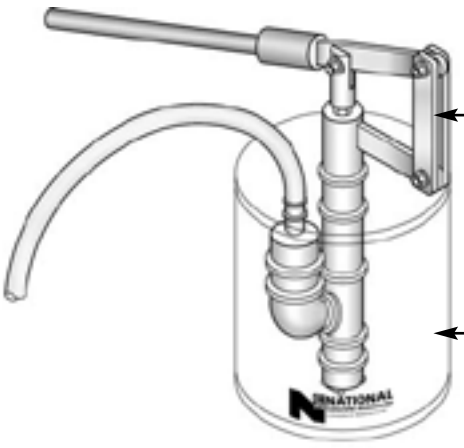
The Dome Plate (ARDP-2) comes in a standard size of 10 mm x 150 mm x 150 mm (3/8" x 6" x 6"). Other sizes are available upon request.



Spherical Washer (ARSW)

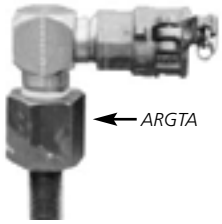
The Spherical Washer (ARSW) is designed to fit with the NCA Dome Plate (ARDP-2). Available in other sizes on request.

Manual Grout Pump (ARMGP)



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

Grout Tube Adaptor Assembly (ARGTAA)



Grout Tube Adapter Assembly with Cam and groove hose connector.

Consult your local NCA Sales Representative or the NCA Technical Department for additional information.

Grout Tube Adapter (ARGTA)

Grout Tube Adapter used with HDR Rod Series.

Grout Tube (ARGT)

Heavy duty Grout Tube for thixotropic grout.

Outside Diameter	Inside Diameter	Quantity per roll
½"	⅜"	500 ft per roll
⅝"	½"	500 ft per roll
¾"	⅝"	500 ft per roll

Expansive Type Cement Grout (ARECG)

Cementitious Pumpable Grouts for Anchoring

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

TABLE CS9: Typical Compressive Strength
w/c 0.45 @ 78.6°F (26°C) moist cured.

Time	24 hours	7 days	28 days
Compressive Strength			
MPa	15.0	40.0	54.0
PSI	2,180	5,800	7,830

Expansion : 0.5% - 1.0%

Dispersion Stabilized Cement Grout (ARSCG)

Prevents wash out by flowing water

NCA 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.

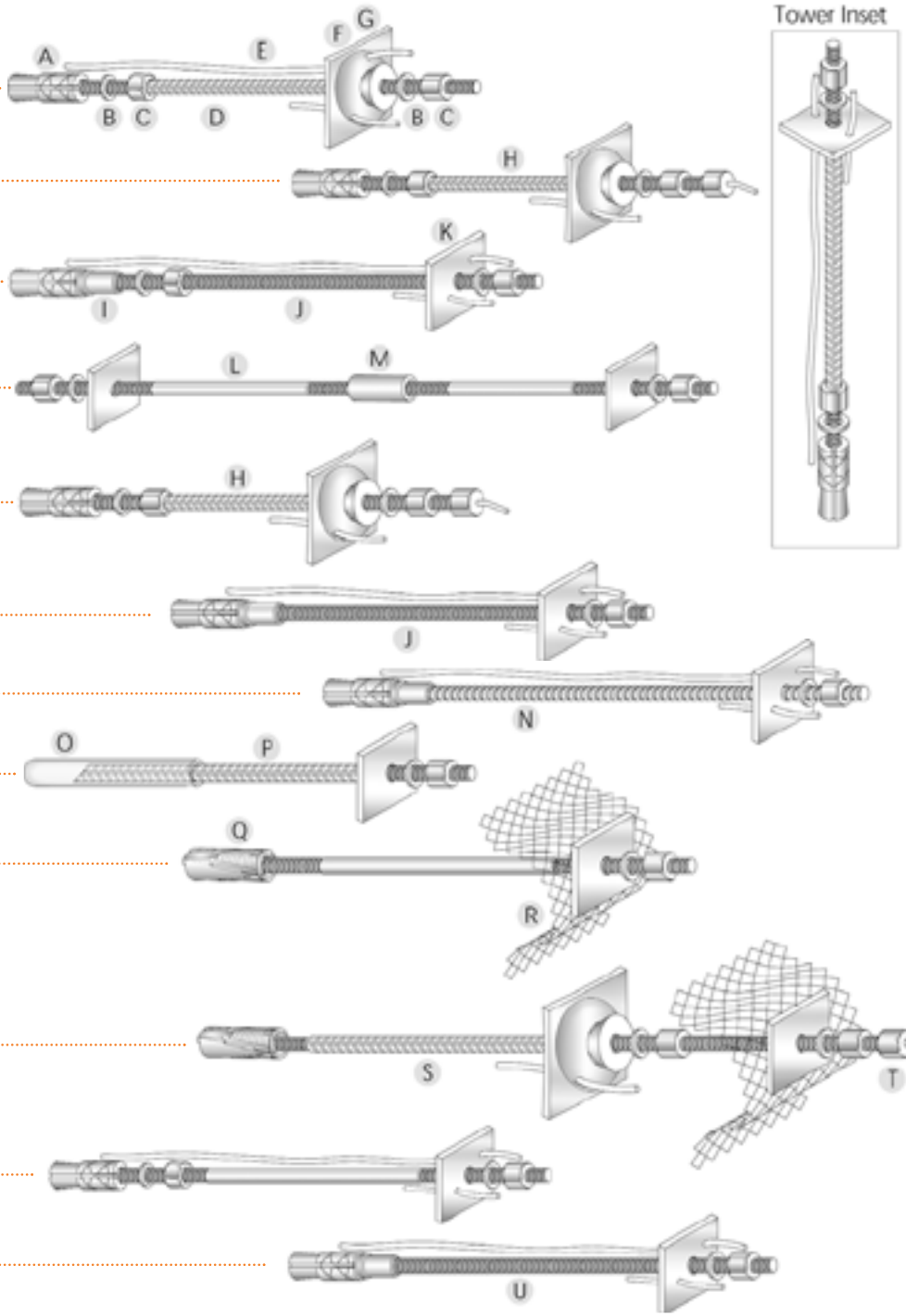
NOTE: Packaged in 22.7 kgs (50 lbs) bag size, yields 13 litres (0.454 ft^3).

TABLE CS10: Typical Compressive Strength
w/c 0.45 @ 70°F (21°C) moist cured.

Time	16 hours	24 hours	7 days	28 days
Compressive Strength				
MPa	10.0	22.0	49.0	51.0
PSI	1,450	3,190	7,100	7,400

Setting Time : 8 hours

Consult your local NCA Sales Representative or the NCA Technical Department for additional information.



Tower Inset

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Consult your local NCA Sales Representative or the NCA Technical Department for additional information.

High Density Corrugated Ducting (PCT)

For corrosion protection.

ARTC Transition Coupler

Part Number	Nominal Diameter
PCT-201	38 mm (1½")
PCT-202	50 mm (2")
PCT-203	75 mm (3")
PCT-204	100 mm (4")

Stop Coupler (ARSC)

FY 105 Ksi
FU 125 Ksi

NOTE: Through Coupler available as a special order.

ARSC Stop Coupler

ARSC Thread Diameter - TPI	Overall Length	Outside Diameter	Tap Depth Each End
½" 6 LAG	51 mm (2")	29 mm (1⅛")	19 mm (¾")
¾" 4.5 LAG	76 mm (3")	29 mm (1⅛")	32 mm (1¼")
1" 3.5 LAG	102 mm (4")	51 mm (2")	44 mm (1¾")
1¼" 3.5 LAG	127 mm (5")	51 mm (2")	57 mm (2¼")
½" 13UNC	51 mm (2")	29 mm (1⅛")	19 mm (¾")
⅝" 11UNC	76 mm (3")	29 mm (1⅛")	19 mm (1¼")
¾" 10UNC	76 mm (3")	28 mm (1⅛")	32 mm (1¼")
⅞" 9UNC	76 mm (3")	51 mm (2")	19 mm (1¼")
1" 8UN	76 mm (3")	38 mm (1½")	32 mm (1¼")
1" 8UN	76 mm (3")	51 mm (2")	32 mm (1¼")
1⅛" 8UN	102 mm (4")	51 mm (2")	44 mm (1¾")
1¼" 8UN	102 mm (4")	51 mm (2")	44 mm (1¾")
1⅜" 8UN	102 mm (4")	64 mm (2½")	44 mm (1¾")
1½" 8UN	152 mm (6")	64 mm (2½")	70 mm (2¾")
1¾" 5UN	152 mm (6")	76 mm (3")	70 mm (2¾")
1¾" 8UN	152 mm (6")	76 mm (3")	70 mm (2¾")
1⅞" 8UN	152 mm (6")	76 mm (3")	70 mm (2¾")
2" 8UN	152 mm (6")	76 mm (3")	70 mm (2¾")

ARTC Transition Coupler

ARTC Thread Transition - TPI	Overall Length	Outside Diameter	Tap Depth Each End
½" - 13UNC to ½" - 6LAG	89 mm (3½")	29 mm (1⅛")	38 mm (1½")
¾" - 10UNC to ¾" - 4.5LAG	89 mm (3½")	29 mm (1⅛")	38 mm (1½")
1" - 8UN to 1" - 3.5 LAG	114 mm (4½")	51 mm (2")	51 mm (2")
1¼" 8UN to 1¼" - 3.5 LAG	140 mm (5½")	51 mm (2")	64 mm (2½")

Consult your local NCA Sales Representative or the NCA Technical Department for additional information.

Spin Adaptors (ARSA)

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

Non rental item

Rod Type	Thread Diameter - TPI		Hex Stud & Nut Across Flats	
SCT-L	½"	6 LAG	37 mm	(1½")
	¾"	4.5 LAG	37 mm	(1½")
	1"	3.5 LAG	62 mm	(2½")
	1¼"	3.5 LAG	62 mm	(2½")
HDR/SDR/SST/ SCT-N/B-7	½"	13UNC	37 mm	(1½")
	5/8"	11UNC	37 mm	(1½")
	¾"	10UNC	37 mm	(1½")
	7/8"	9UNC	62 mm	(2½")
	1"	8UN	62 mm	(2½")
	1¼"	8UN	62 mm	(2½")
	1 1/8"	8UN	62 mm	(2½")
	1 3/8"	8UN	83 mm	(3¼")
	1½"	8UN	83 mm	(3¼")
	1¾"	5UN	83 mm	(3¼")
	1¾"	8UN	83 mm	(3¼")
	1 7/8"	8UN	83 mm	(3¼")
	2"	8UN	83 mm	(3¼")

Swivel Lift Plate (ARSLP)

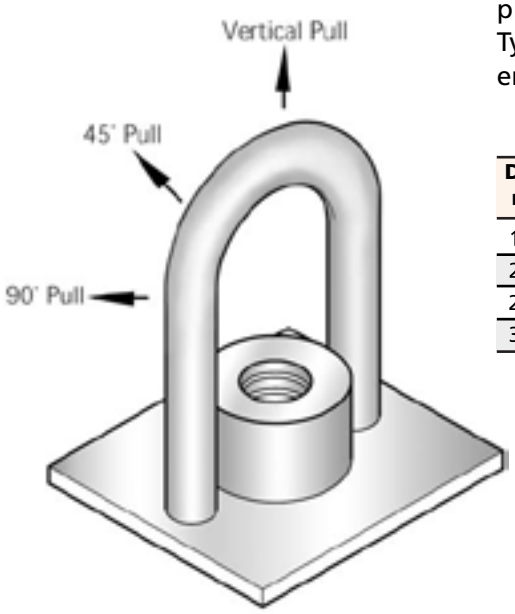
Swivel Lift Plate allows for lifting and positioning of long heavy rock bolts by crane. Available for ¾", 1", 1¼" and 1½" diameters. Contact NCA for other sizes.

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.

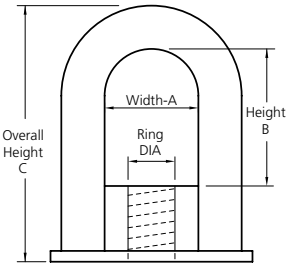
Consult your local NCA Sales Representative or the NCA Technical Department for additional information.

Type K Lifting Eye



The **NCA 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.

Diameter mm	(")	Ring Diameter		Straight Tension Ultimate Strength	90° Tension Ultimate Strength
13 mm	(½")	20 mm	(¾")	80 kN (18,000 lbs*)	6.2 kN (1,400 lbs*)
20 mm	(¾")	20 mm	(¾")	150 kN (34,000 lbs*)	6.2 kN (1,400 lbs*)
25 mm	(1")	25 mm	(1")	333 kN (75,000 lbs*)	14.7 kN (3,326 lbs*)
32 mm	(1¼")	32 mm	(1¼")	422 kN (95,000 lbs*)	31 kN (6,975 lbs*)



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

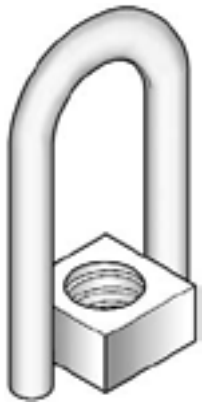
Refer to ASTM A 489 for load reduction calculation off vertical pull.

Not available in hot dip galvanized.

4:1 Safety Factor

Diameter mm	(")	Internal Thread	Width A		Height B		Height C	
13 mm	(½")	6 Lag	50 mm	(2")	75 mm	(3")	140 mm	(5½")
20 mm	(¾")	4.5 Lag	50 mm	(2")	75 mm	(3")	140 mm	(5½")
25 mm	(1")	3.5 Lag	50 mm	(2")	75 mm	(3")	140 mm	(5½")
32 mm	(1¼")	3.5 Lag	100 mm	(2")	115 mm	(4½")	213 mm	(8⅜")

Special Eye Nut (AREN)



The NCA 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 NCA Mesh Pin or other threaded rod to support light loads in mining or tunneling applications.

Diameter Left Hand Nut	Ring Diameter	Straight Tension* Ultimate Strength
⅝" Heavy Square Nut	25 mm (1")	23,000 lbs.
¾" Heavy Square Nut	25 mm (1")	23,000 lbs.

**Refer to ASTM A489 for load reduction calculation off vertical pull.*

Other sizes and strengths available on request.

Consult your local NCA Sales Representative or the NCA Technical Department for additional information.

Dial Indicator (ARDI)

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

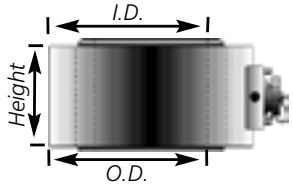
Strain Gauge Load Cells

SGA Specifications

Strain Gauge Load Cell Specifications		
Capacity:	22.5 to 1067 kN	(5,000 to 2,400,000 lbs)
Hole Size:	16 mm to 280 mm	(5/8" to 11") as required
Material:	Stainless steel elements	or high strength steel
Temperature Compensation:	-40 to + 40 degrees C	(-40 to +170 degrees F)
Overrange	100% FS	
Sensitivity	plus/minus 2.0mV/V	

SGA-100 with ME-350 Strain Indicator

Ancillary Equipment: Digital strain indicator Cable, Load and bearing plates, Terminal stations and Centralizer bushings if required



SGA Dimensions

Strain Gauge Load Cells Standard Dimensions				
Model	**Capacity**	**I.D.**	**O.D.**	**Height**
SGA-50-1	223 kN (50 Kips)	25 mm (1.0")	102 mm (4.0")	76 mm (3.0")
SGA-100-1	445 kN (100 Kips)	25 mm (1.0")	102 mm (4.0")	76 mm (3.0")
SGA-136-1.4	605 kN (136 Kips)	36 mm (1.4")	114 mm (4.5")	89 mm (3.5")
SGA-200-1.75	890 kN (200 Kips)	44 mm (1.75")	127 mm (5.0")	127 mm (5.0")
SGA-255-2.0	1,135 kN (255 Kips)	51 mm (2.0")	140 mm (5.5")	133 mm (5.25")
SGA-300-2.0	1,334 kN (300 Kips)	51 mm (2.0")	140 mm (5.5")	133 mm (5.25")
SGA-300-3.0	1,334 kN (300 Kips)	76 mm (3.0")	152 mm (6.0")	159 mm (6.25")
SGA-400-2.5	1,779 kN (400 Kips)	63 mm (2.5")	152 mm (6.0")	159 mm (6.25")
SGA-400-3.5	1,779 kN (400 Kips)	89 mm (3.5")	178 mm (7.0")	184 mm (7.25")
SGA-600-3.0	2,669 kN (600 Kips)	76 mm (3.0")	178 mm (7.0")	190 mm (7.5")
SGA-600-4.0	2,669 kN (600 Kips)	102 mm (4.0")	197 mm (7.75")	216 mm (8.5")

Ordering Information Please provide the following criteria: 1) Particular application. 2) Tensile or compressive type. 3) Maximum capacity and smallest increment required 4) Size limitations 5) Cable connection and length

Consult your local NCA Sales Representative for information on sales or rental of manual and airpowered grouting equipment.

Manual Torque Wrench Click Type

The Click Type Manual Torque Wrench with a 19mm (¾") square drive output has an output capacity of 0 - 813 Nm (0 - 600 ft-lbs.)

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.)

PT5 and PT7 Pneumatic Torque Wrench

The PT5 and PT7 Pneumatic Torque Wrench are two-speed with a 25 mm (1") and 38 mm (1½") square drive respectively. The output capacity of the PT5 is 3,400 Nm (2,500 ft-lbs.) and the PT7 is 6,100 Nm (4,500 ft-lbs.)

PT1500 Pneumatic Torque Wrench

The PT1500 Pneumatic Torque Wrench with a 25 mm (1") square drive has an output capacity of 1,500 Nm (1,100 ft-lbs.)

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.

Consult your local NCA Sales Representative for information on sales or rental of manual and airpowered grouting equipment.

AR Series Hydraulic Bolt Stressing Equipment

Hollow ram cylinders are used to prestress rock bolts. Calibrated hydraulic gauges gives true reading of axial tension applied to bolt. When used with NCA 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.

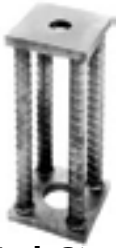
Stressing assembly consists of pump, gauge, ram hoses and standard jack stand that matches ram capacity. Stress rod hex nut and couplings required to stress bolts must be ordered as required.

ARSTR, ARJS and ARHR Complete Assembly

Stress Rod Specifications (ARSTR)

ARTSR Product Number	Thread Diameter - TPI	ARJS Jack Stand Height	Rod Length
ARSTR-12-N	12 mm (½") 13UNC	406 mm (16")	914 mm (3 ft.)
ARSTR-12-L	12 mm (½") 6 LAG	406 mm (16")	914 mm (3 ft.)
ARSTR-16-N	16 mm (⅝") 11UNC	406 mm (16")	914 mm (3 ft.)
ARSTR-20-N	19 mm (¾") 10UNC	406 mm (16")	914 mm (3 ft.)
ARSTR-20-L	19 mm (¾") 4.5 LAG	406 mm (16")	914 mm (3 ft.)
ARSTR-22-N	22 mm (⅞") 9UNC	406 mm (16")	914 mm (3 ft.)
ARSTR-25-N	25 mm (1") 8UN	610 mm (24")	914 mm (3 ft.)
ARSTR-25-L	25 mm (1") 3.5 LAG	610 mm (24")	914 mm (3 ft.)
ARSTR-29-N	28 mm (1⅛") 8UN	610 mm (24")	914 mm (3 ft.)
ARSTR-32-N	32 mm (1¼") 8UN	610 mm (24")	914 mm (3 ft.)
ARSTR-32-L	32 mm (1¼") 3.5 LAG	610 mm (24")	914 mm (3 ft.)
ARSTR-35-N	35 mm (1⅜") 8UN	610 mm (24")	1,219 mm (4 ft.)
ARSTR-38-N	38 mm (1½") 8UN	610 mm (24")	1,219 mm (4 ft.)
ARSTR-45-N	45 mm (1¾") 5UN	610 mm (24")	1,219 mm 4 ft.)
ARSTR-45-N	45 mm (1¾") 8UN	610 mm (24")	1,219 mm (4 ft.)
ARSTR-48-N	48 mm (1⅞") 8UN	610 mm (24")	1,219 mm (4 ft.)
ARSTR-50-N	51 mm (2") 8UN	610 mm (24")	1,219 mm (4 ft.)

Hydraulic Ram (ARHR)



Jack Stand (ARJS)

Hydraulic Ram Specifications (ARHR)

Product Number	Capacity	Hollow Ram Diameter
ARHR-20	178 kN (40,000 lbs)	26.5 mm (1 3/64")
ARHR-30	267 kN (60,000 lbs)	32.9 mm (1 19/64")
ARHR-60	534 kN (120,000 lbs)	50.8 mm (2 3/32")
ARHR-100	890 kN (200,00 lbs)	79 mm (3 1/8")
ARHR-150	1,335 kN (300,000 lbs)	79 mm (3 1/8")

NOTE: NCA 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.

Consult your local NCA Sales Representative for information on sales or rental of manual and airpowered grouting equipment.

Stressing Equipment

Norbar Pneumatic Torque

Model	Torque Capacity		Square Drive
PT-1500	300 - 1,500 Nm	(220 - 1,110 ft. lbs.)	25 mm (1")
PT-2	515 - 1,700 Nm	(380 - 1,250 ft. lbs.)	25 mm (1")
PT-5	880 - 3,400 Nm	(650 - 2,500 ft. lbs.)	25 mm (1")
PT-7	1,762 - 6,000 Nm	(1,300 - 4,500 ft. lbs.)	38 mm (1½")
PT-9	2,710 - 9,500 Nm	(2,000 - 7,000 ft. lbs.)	38 mm (1½")

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

Applied Torque

AR Rock Bolts	Applied Torque		Torque Wrench
HDR-25 Hollow Deformed Rebar	675 Nm	(500 ft.-lbs.)	PT-1500/PT-2
HDR-35 Hollow Deformed Rebar	2,000 Nm	(1,500 ft.-lbs.)	PT-5/PT-7
HDR-50 Hollow Deformed Rebar	5,400 Nm	(4,000 ft.-lbs.)	PT-7
SDR-12 Solid Deformed Rebar	70 Nm	(50 ft.-lbs.)	Manual
SDR-20 Solid Deformed Rebar	230 Nm	(170 ft.-lbs.)	Manual
SDR-25 Solid Deformed Rebar	550 Nm	(400 ft.-lbs.)	PT-1500
SDR-29 Solid Deformed Rebar	825 Nm	(600 ft.-lbs.)	PT-1500/PT-2
SDR-32 Solid Deformed Rebar	1,015 Nm	(750 ft.-lbs.)	PT-1500/PT2
SDR-35 Solid Deformed Rebar	1,100 Nm	(800 ft.-lbs.)	PT-1500/PT-2/PT-5
SDR 38 Solid Deformed Rebar	1,650 Nm	(1,200 ft.-lbs.)	PT-2/PT-5
SDR-45 Solid Deformed Rebar	2,000 Nm	(1,500 ft.-lbs.)	PT-5/PT-7
SDR-48 Solid Deformed Rebar	3,300 Nm	(2,450 ft.-lbs.)	PT-7
SDR-55 Solid Deformed Rebar	4,000 Nm	(3,000 ft.-lbs.)	PT-7
SCT-N-12 Solid Continuous Threaded Unified	95 Nm	(70 ft.-lbs.)	Manual
SCT-N-20 Solid Continuous Threaded Unified	340 Nm	(250 ft.-lbs.)	PT-1500
SCT-N-25 Solid Continuous Threaded Unified	810 Nm	(600 ft.-lbs.)	PT-1500/PT-2
SCT-N-32 Solid Continuous Threaded Unified	1,625 Nm	(1,200 ft.-lbs.)	PT-5
SCT-L-12 Solid Continuous Threaded Lag	95 Nm	(70 ft.-lbs.)	Manual
SCT-L-20 Solid Continuous Threaded Lag	340 Nm	(250 ft.-lbs.)	PT-1500
SCT-L-25 Solid Continuous Threaded Lag	810 Nm	(600 ft.-lbs.)	PT-1500/PT-2
SCT-L-32 Solid Continuous Threaded Lag	1,625 Nm	(1,200 ft.-lbs.)	PT-5
SCT-N-B7 All Thread Bar - 13	95 Nm	(70 ft.-lbs.)	Manual
SCT-N-B7 All Thread Bar - 20	340 Nm	(250 ft.-lbs.)	PT-1500
SCT-N-B7 All Thread Bar - 25	810 Nm	(600 ft.-lbs.)	PT-1500/PT-2
SCT-N-B7 All Thread Bar - 32	1,625 Nm	(1,200 ft.-lbs.)	PT-5
SCT-N-B7 All Thread Bar - 35	2,170 Nm	(1,600 ft.-lbs.)	PT-5/PT-7
SCT-N-B7 All Thread Bar - 38	2,700 Nm	(2,000 ft.-lbs.)	PT-5/PT-7
SCT-N-B7 All Thread Bar - 45	4,067 Nm	(3,000 ft.-lbs.)	PT-7
SCT-N-B7 All Thread Bar - 50	6,100 Nm	(4,500 ft.-lbs.)	PT-9
SST-12 Solid Smooth Threaded Ends	95 Nm	(70 ft.-lbs.)	Manual
SST-20 Solid Smooth Threaded Ends	340 Nm	(250 ft.-lbs.)	PT-1500
SST-25 Solid Smooth Threaded Ends	810 Nm	(600 ft.-lbs.)	PT-1500/PT-2
SST-32 Solid Smooth Threaded Ends	1,625 Nm	(1,200 ft.-lbs.)	PT-5
SST-35 Solid Smooth Threaded Ends	2,170 Nm	(1,600 ft.-lbs.)	PT-5/PT-7
SST-38 Solid Smooth Threaded Ends	2,700 Nm	(2,000 ft.-lbs.)	PT-5/PT-7
SST-45 Solid Smooth Threaded Ends	4,067 Nm	(3,000 ft.-lbs.)	PT-7
SST-50 Solid Smooth Threaded Ends	6,100 Nm	(4,500 ft.-lbs.)	PT-9

Consult your local NCA Sales Representative or the NCA Technical Department for additional information.

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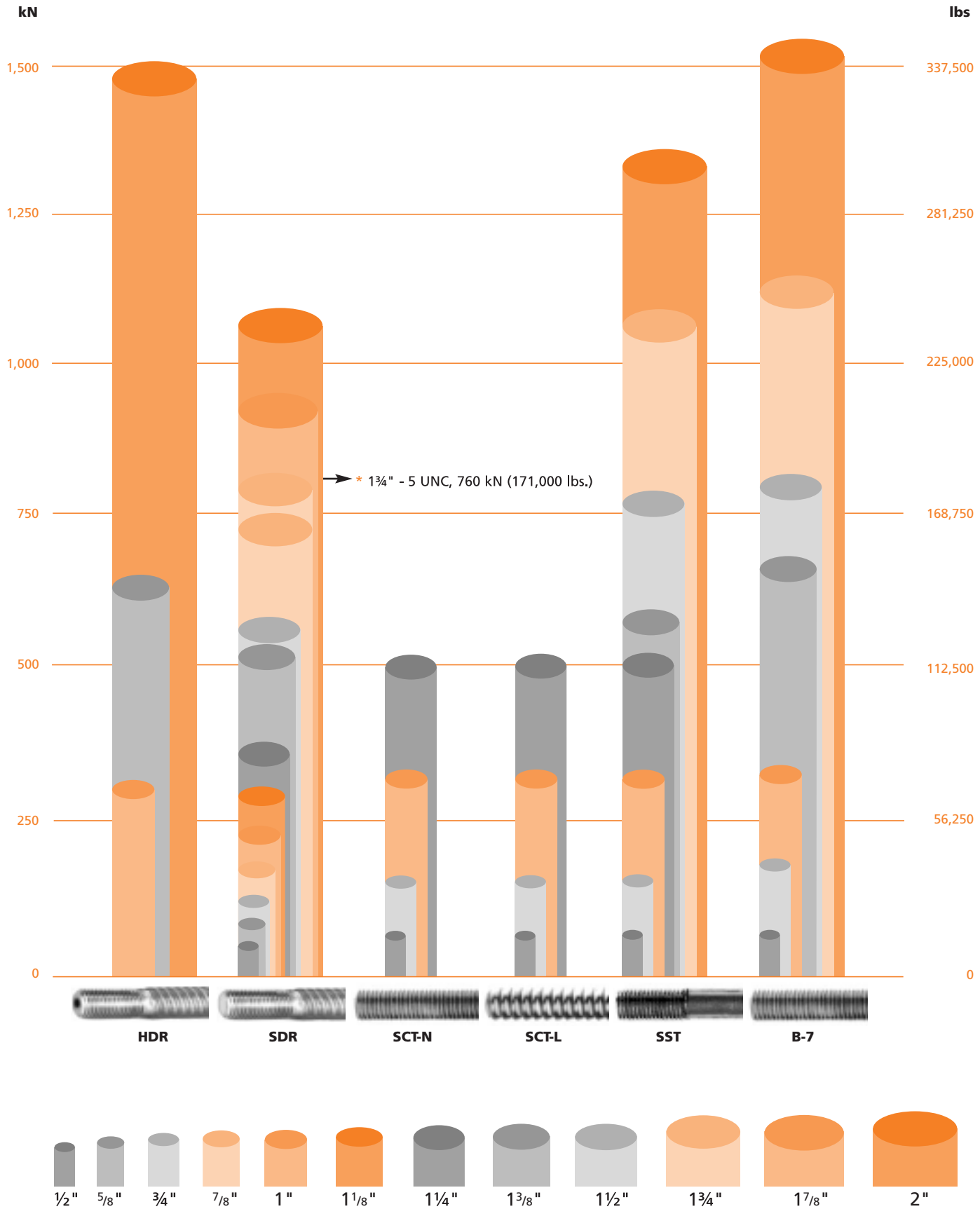
PRODUCT COMPARISON TABLE

Rod Size and Ultimate Tensile Strength

Thread Diameter - TPI	HDR	SDR	SCT-N	SCT-L	SST	B-7
½"- 13 UNC		56 kN (12,700 lbs.)	80 kN (18,000 lbs.)	80 kN (18,000 lbs.)	80 kN (18,000 lbs.)	80 kN (18,000 lbs.)
5/8" - 11 UNC		90 kN (20,300 lbs.)				
¾" - 10 UNC		133 kN (30,000 lbs.)	169 kN (38,000 lbs.)	169 kN 38,000 lbs.)	169 kN 38,000 lbs.)	186 kN (42,000 lbs.)
7/8" - 9 UNC		185 kN (41,850 lbs.)				
1" - 8 UNC	320 kN (72,000 lbs.)	242 kN (54,500 lbs.)	334 kN (75,000 lbs.)	334 kN (75,000 lbs.)	334 kN (75,000 lbs.)	337 kN (76,000 lbs.)
1 1/8" - 8 UNC		314 kN (70,600 lbs.)				
1¼" - 8 UNC		387 kN (87,200 lbs.)	534 kN (120,000 lbs.)	534 kN (120,000 lbs.)	534 kN (120,000 lbs.)	556 kN (125,000 lbs.)
1 3/8" - 8 UNC	663 kN (149,000 lbs.)	493 kN (110,000 lbs.)			600 kN (135,000 lbs.)	684 kN (154,000 lbs.)
1½" - 8 UNC		596 kN (134,000 lbs.)			796 kN (179,000 lbs.)	828 kN (186,500 lbs.)
*1¾" - 5 UNC		760 kN (171,000 lbs.)				
1¾" - 8 UNC		833 kN (187,200 lbs.)			1,100 kN (249,000 lbs.)	1,155 kN (260,000 lbs.)
1 7/8" - 8 UNC		964 kN (216,900 lbs.)				
2" - 8 UNC	1,512 kN (340,000 lbs.)	1,109 kN (249,300 lbs.)			1,370 kN (310,000 lbs.)	1,539 kN (346,000 lbs.)

HDR SDR SCT-N SCT-L SST B-7


kN
lbs
1,500
1,250
1,000
750
500
250
0
337,500
281,250
225,000
168,750
112,500
56,250
0
* 1¾" - 5 UNC, 760 kN (171,000 lbs.)
HDR
SDR
SCT-N
SCT-L
SST
B-7
½"
⅝"
¾"
⅞"
1"
1⅛"
1¼"
1⅜"
1½"
1¾"
1⅞"
2"

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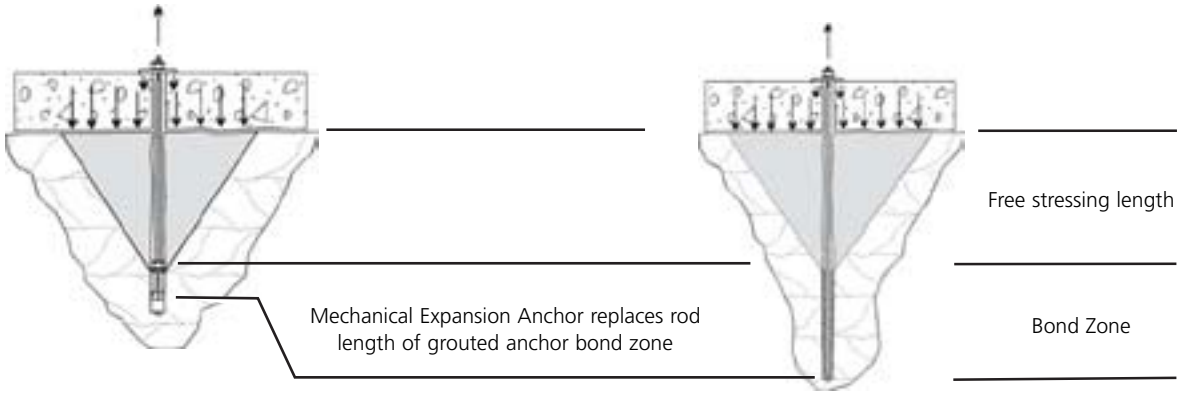
UNIT CONVERSIONS

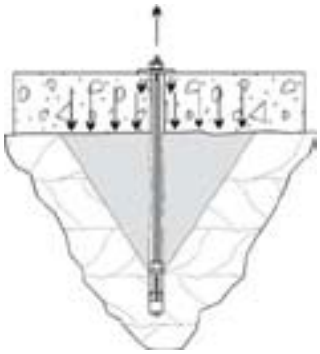
Multiply	**by**	**to obtain**	**Symbol**
Inches	25.4	Millimetres	mm
Feet	0.3048	Metres	m
Pounds per Square Foot	47.8802	Pascals	Pa
Pounds per Square Inch	0.006895	MegaPascals	MPa
Kips per Square Inch	6.89475	MegaPascals	MPa
Kips (1000 lbs.; force)	4.44822	Kilo Newtons	kN
Foot-Pounds (torque)	1.35581	Newton Metres	Nm
Gallons Imperial	4.54609	Litres	l
Gallons US	3.785	Litres	l

MECHANICAL EXPANSION ANCHOR PRINCIPLES

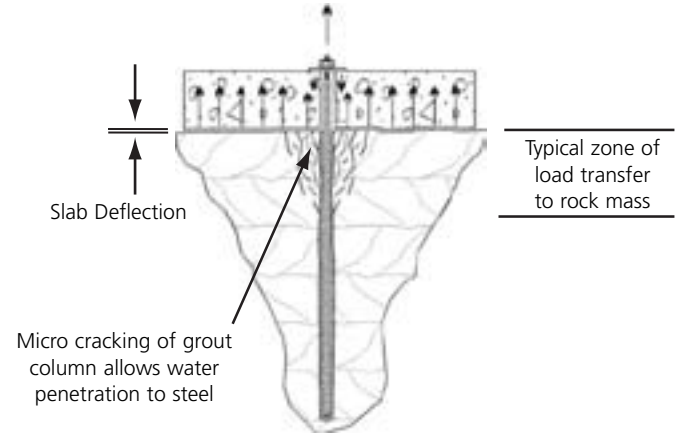


Prestressed Mechanical Expansion Anchor

Prestressed Grouted Anchor



Prestressed Rod with Mechanical Expansion Anchor



Embedded Dowel

TABLE CS1: ACCEPTABLE RANGE OF MECHANICAL EXPANSION ANCHORS IN ROCK

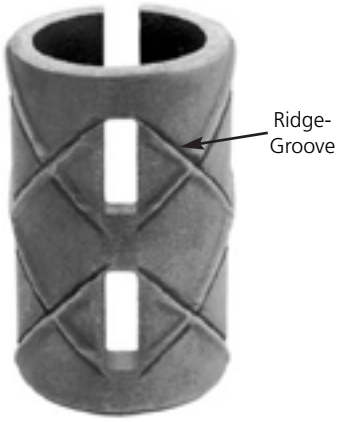
Rock Condition	Gouge Zone Crushed/Shattered	Concrete	RQD 50%	Blocky	Solid/Massive RQD 100%
Rock Quality	Very Poor Rock	Poor Rock	Fair Rock	Good Rock	Very Good Rock
Strength	Very Low Strength	Low Strength	Medium Strength	High Strength	Very High Strength
Uniaxial Compressive Strength	Less than 25 MPa	25 to 50 MPa	50 to 100 MPa	100 to 200 MPa	Greater than 200 MPa

Acceptable Range of AR Shell Series

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.

Consult your local NCA Sales Representative or the NCA Technical Department for additional information.

AR Cone Shell Expansion Anchors



AR SHELL Slot Side

AR CONE Channel Side

PATENTED

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 anti-rotational 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 rods available from NCA. The 8UN thread series is used for all rods, couplings and anchors 25 mm (1") and greater in thread diameter.

Rock classification systems are numerous and include some subjective criteria. A relative scale of the acceptable range of use of AR — Mechanical Expansion Anchors is presented in Table CS1 on page 7.

Always use good engineering practice when designing and installing rockbolts.

FEATURES	BENEFITS
Anchors are set from surface by rotation of rod.	Outer threaded end of rod does not change in elevation when setting anchor. Minimal deflection when tensioning.
A tapped cone expands shell against the drill hole wall as the anchor rod is rotated.	Immediate verification of anchor holding capacity without waiting for grouts to cure.
Versatile one-size anchor assembly for each drill hole diameter.	Allows for simplicity of design of rock bolt.
Smooth cylinder shell with 45 degree "Ridge-Groove" shell design.	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.

Consult your local NCA Sales Representative or the NCA Technical Department for additional information.

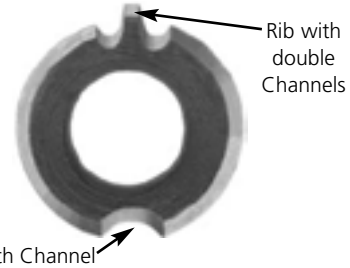
TABLE CS2 CONE & SHELL EXPANSION ANCHORS

Shell Product Number	Cone Product Number	Rod Type	Thread Diameter 8 - TPI	Drill Hole Diameter	Cone Length	Shell Length
AR45	AR4512-L*	SCT-L-SA	½" 6 LAG	45 mm (1¾")	65 mm (2½")	76 mm (3")
	AR4512-N	SDR/SST/SCT-N-SA	½" 13UNC			
	AR-4516-N	SDR	5/8" 11UNC			
	AR4520-L*	SCT-L-SA	¾" 4.5 LAG			
	AR4520-N	SDR/SST/SCT-N-SA	¾" 10UNC			
	AR4522-N	SDR	7/8" 9UNC			
	AR4525-M**	HDR/SDR/ SST/SCT-N-SA	1" 8UN 1" 8UN	45 mm (1¾")	65 mm (2½")	92 mm (3 5/8")
AR50	AR5025	HDR/SDR/ SST/SCT-N-SA	1" 8UN	51 mm (2")	70 mm (2¾")	90 mm (3½")
	AR5029	SDR	1 1/8" 8UN			
AR55	AR5525-N	HDR/SDR/ SST/SCT-N-SA	1" 8UN	57 mm (2¼")	70 mm (2¾")	90 mm (3½")
	AR5529-N	SDR	1 1/8" 8UN			
	AR5532-N	SDR/SST SCT-N-SA	1¼" 8UN	Consult NCA for requirements		
	AR5535-N	HDR/SDR/ SST/SC T-N-SA	1 3/8" 8UN	Consult NCA for requirements		
AR65	AR6525-L*	SCT-L-SA	1" 3.5 LAG	65 mm (2½")	90 mm (3½")	100 mm (4")
	AR6525-N	HDR/SDR/ SST/SCT-N-SA	1" 8UN			
	AR6529-N	SDR	1 1/8" 8UN			
	AR6532-L*	SCT-L-SA	1¼" 3.5 LAG			
	AR6532-N	SDR/SST/SCT-N-SA	1¼" 8UN			
	AR6535-N	HDR/SDR/SST	1 3/8" 8UN			
AR76	AR7635-N	HDR/SDR/SST	1 3/8" 8UN	76 mm (3")	100 mm (4")	130 mm (5")
	AR7638-N	SDR/SST	1½" 8UN			
	AR7645-N	SDR	1¾" 5UN			
AR90	AR9045-N	SST	1¾" 8UN 1¾" 5UN	90 mm (3½")	130 mm (5")	150 mm (6")
	AR9048-N	SDR	1 7/8" 8UN			
	AR9050-N	HDR/SDR/SST	2" 8UN			

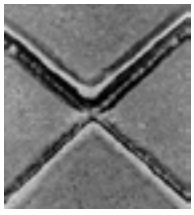
** Hole diameters of the cone-shell anchors shown permit the use of stop couplings with grout tubes in the SDR, SST, SCT-L and SCT-N series. Finished drilled hole diameters vary depending on rock type, quality and method of drilling employed.*

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

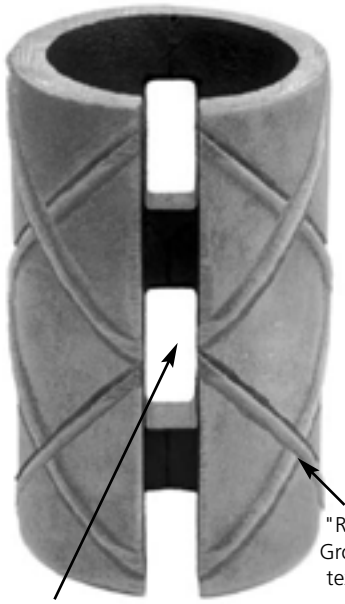
NOTE: All thread products require a stud adaptor with anchor assembly.



AR CONE Top View

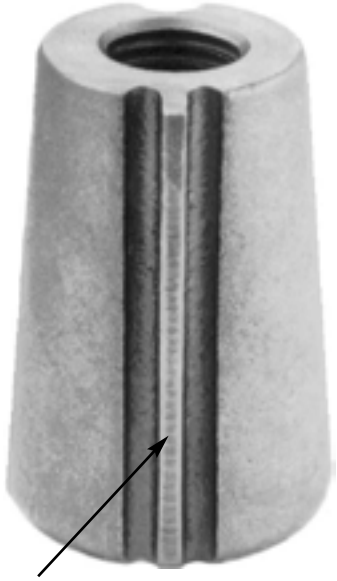


Ridges and Grooves on Shell Contact Surface



Full length Slot to fit Rib and allow uninterrupted grout flow (note "Rib-Groove" texture circumvents Shell)

AR SHELL Slot Side



Full length Rib with double Channels for unimpeded grout flow (larger full length Channel at opposite side)

AR CONE Rib Side

Consult your local NCA Sales Representative or the NCA Technical Department for additional information.

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