SELECTED

GROUND CONTROL PRODUCTS

Coal and Hard Rock Mining • Tunneling • Civil Construction

JM USA® JENNMAR

GLOBAL HEADQUARTERS
258 Kappa Drive
Pittsburgh, PA 15238

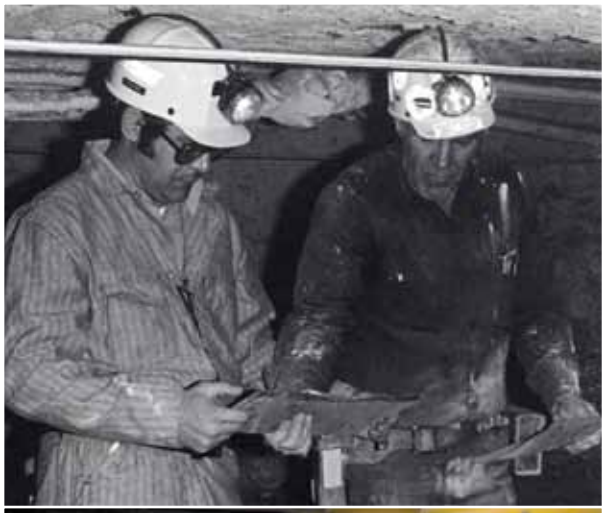
www.jennmar.com • (412) 963-9071

LEADING THE WAY IN GROUND CONTROL TECHNOLOGY!

JIM USA®
JENNMAR

REFER TO THE INSIDE BACK COVER FOR CONTACT INFORMATION FOR SPECIFIC LOCATIONS.

SAFETY. INNOVATION. SERVICE.



Frank Calandra, Jr.
President

We're JENNMAR, a multi-national, family-owned company that is leading the way in ground control technology for the mining, tunneling and civil construction industries. Mary and Frank Calandra, Sr., parents of JENNMAR's two common stockholders, Jack Calandra and Frank Calandra, Jr., originated Frank Calandra, Inc. in 1922 as a proprietorship, engaged in various businesses related to the coal mining industry.

JENNMAR was born in 1965 and by 1972 our mission had become focused on developing and manufacturing roof control products. Today we make a broad range of quality ground control products, from bolts and beams, to channels and trusses, to resin and rebar. We're proud to make products that make mining safer and more efficient. And with manufacturing plants and distribution networks around the world, we are uniquely positioned to react to ground control needs anywhere, anytime.

We now operate eleven manufacturing plants throughout the United States. Of these eleven facilities, ten are related to manufacturing ground control products, and the eleventh is a steel service center that supplies a steady flow of flat steel products. Globally, we operate eight manufacturing facilities, with three located in Australia and the others in China, Chile, Canada, Poland and the Czech Republic. J-LOK, our resin manufacturing affiliate, has two domestic manufacturing locations with another one in Australia.

JENNMAR continues to grow, but our focus will always be on the customer. We feel it is essential to develop a close working relationship with every customer so we can understand their unique challenges and ensure superior customer service. Our commitment to the customer is guided by three words; SAFETY, INNOVATION and SERVICE. It's these words that form the foundation of our business. It's who we are.

WATCH THE VIDEO

Our Affiliates

Our network of affiliates ensures quality, efficiency and availability providing complementary products and engineering solutions. This gives our customers a complete resource for all their ground control requirements, not to mention reduced costs and lead time!

J-LOK RESINS www.j-lok.com

J-LOK manufactures state-of-the-art resin anchorage systems that are designed to complement JENNMAR products and provide an optimum bolt and resin system. J-LOK equipment is among the most technologically advanced in the resin industry.

JENNCHEM www.jennchem.com

JENNCHEM designs and delivers chemical roof support, rock stabilization and ventilation sealing products to the mining and underground construction industries. JENNCHEM's lab and test facility conducts meticulous and ongoing testing to ensure reliability and consistency of all products.

KMS www.keystonemining.com

KMS (Keystone Mining Services) is JENNMAR's engineering affiliate company that provides advanced engineering services such as structural analysis, numerical modeling and 3-D modeling. KMS is also responsible for conducting research and development of new products.

JENNMAR SPECIALTY PRODUCTS www.jm-specialty.com

JENNMAR Specialty Products provides custom steel fabrication services to the mining, tunneling and civil construction industries. Products include Square Sets, Impact Resistant Arch Sets, Bent Arch Sets and Long Radius Arch Sets.

JM STEEL www.jm-steel.com

JM Steel's ultra-modern 120,000 sq. ft steel processing facility is located on Nucor Steel's industrial campus near Charleston, SC. JM Steel has the processing capability and extensive inventory to provide a variety of flat rolled steel products including master coils, slit coils, blanks, beams, sheets, flat bars and panels.

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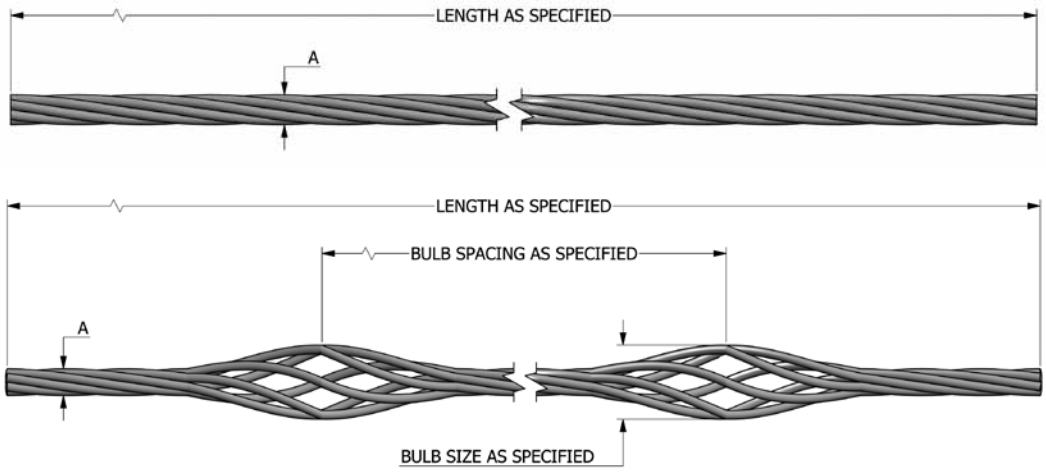
About Our Cable Bolts

Since 1995 JENNMAR® has been producing cable bolts utilizing geotechnical input from around the globe. The JENNMAR product line has progressed from the initial introduction of a resin point anchored, non-tensioned cable bolt through tensioned cable bolts to today's fully grouted cable bolt. The multi-bulb technology offers excellent anchorage in resins or grouts. The number, spacing, and diameter can be adjusted for individual customer needs. With J-LOK™ resins and JENNCHEM® grouts and pumpable resins, a fully customized installation can be provided.

INSTALLATION



Technical Data – Bright Cable

	0.6 in. (15 mm) CABLE BOLT	0.7 in. (18 mm) CABLE BOLT
CABLE DESCRIPTION*	Uncoated 7 strand low relaxation strand	
GRADE	270K – 270,000 psi (1862 MPa) ultimate strength	
ULTIMATE STRENGTH, MINIMUM	58,600 lb (261 kN)	79,400 lb (353 kN)
LOAD @ 1% EXTENSION, MINIMUM	52,740 lb (235 kN)	71,500 lb (318 kN)
ELONGATION, MINIMUM	3.5%	
SPECIFICATION	ASTM A416	

*Galvanized cable also available

Dimensions – Bright Cable

	0.6 in. (15 mm) CABLE BOLT	0.7 in. (18 mm) CABLE BOLT
STRAND DIAMETER (A)	0.600 in. (15 mm)	0.700 in. (18 mm)
BULB SIZE		
1 in. (25 mm) BOREHOLE, MINIMUM	0.813 in. (21 mm)	0.813 in. (21 mm)
1 in. (25 mm) BOREHOLE, MAXIMUM	0.995 in. (25 mm)	0.995 in. (25 mm)
1-3/8 in. (35 mm) BOREHOLE, MINIMUM	1.000 in. (25 mm)	1.000 in. (25 mm)
1-3/8 in. (35 mm) BOREHOLE, MAXIMUM	1.500 in. (38 mm)	1.500 in. (38 mm)

JM CABLE® Non-Tensioned Cable Bolt (NT)

Description

Non-Tensioned Cable Bolt (NT) is manufactured using 0.6 or 0.7 in. cable with pre-set housing and wedge and 1-1/8 in. square drive nut. Stiffener tube and resin mixing bulbs suitable for desired borehole diameter are incorporated. Various lengths are available to suit mine conditions.

Function

Non-Tensioned Cable Bolt (NT) is the most commonly used cable bolting system. Normally used as a secondary bolting system, it can also be used as a center bolt in three bolt patterns and is also being trialed in four bolt patterns. This bolting system is a passive, non-tensioned system used to support the primary bolting system after forming an effective beam with the primary bolts.

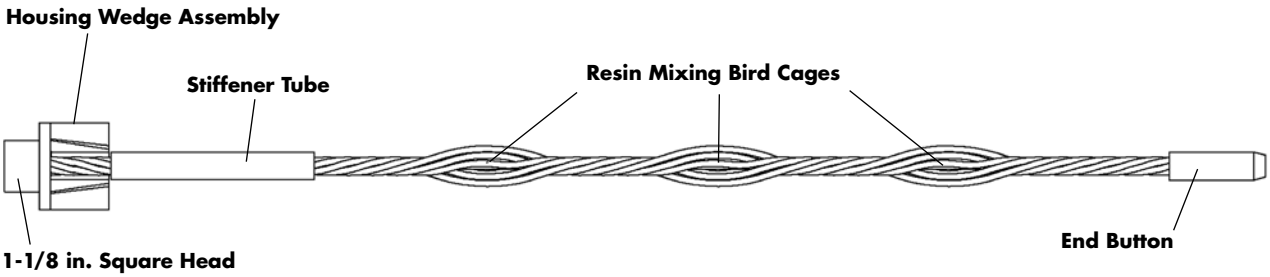
Conditions

New mining, old works, outby, generally anywhere cable support is needed.

Locations

Entries, belt rehabilitations, intersection support, intersections for pillar recovery, longwall recovery and set-up entries, and longwall headgate entries.

JM CABLE Non-tensioned Cable Bolts



JM CABLE® Non-Tensioned Cable Bolt (NT)	0.6 in. (15 mm)	0.7 in. (18 mm)
JENNMAR ID NO.	KW608*	KW708*
STRAND DIAMETER	0.6 in. (15 mm)	0.7 in. (18 mm)
NUMBER OF STRANDS	7	
STRAND GRADE	270	
CABLE LENGTH, MINIMUM	8 ft (2.4 m)	
BOLT STIFFENER TUBE LENGTH, MINIMUM	18 in. (457 mm)	
RESIN TYPE	J-LOK™	

* this code will be on samples made in WV.

JM CABLE® INSTáL® Tensionable Cable Bolt (CB)

Description

INSTáL® Tensionable Cable Bolt (CB) is manufactured using 0.6 or 0.7 in. cable with pre-set housing and wedge and 1-1/8 in. square drive nut. A threaded tube with attached shell is set on the cable separately above the stiffener tube and below the resin mixing bulb. Bolt rotation engages shell with borehole and sets tension on the bolt.

Function

INSTáL CB Cable Bolt is used for primary and secondary support. The CB Cable Bolt is part of the INSTáL family of tensionable cable bolts and is the only tensionable system approved by MSHA as primary support. It is most commonly used when primary system is supplemented with cable bolts in the normal bolting pattern. Using CB bolts, the primaries can be replaced and no additional secondary bolting is needed. This system is used primarily at the working face and installed in a timely manner during development just like an INSTáL Bolt.

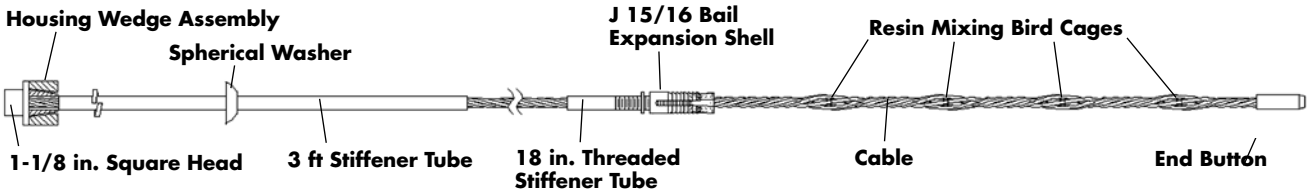
Conditions

New mining, at working face.

Locations

Longwall headgate entries, intersections, belt entries.

JM CABLE® INSTáL® Cable Bolt (CB)



JM CABLE® INSTáL® Tensionable Cable Bolt (CB)	0.6 in. (15 mm)	0.7 in. (18 mm)
JENNMAR ID NO.	KWB610*	KWB710*
STRAND DIAMETER	0.6 in. (15 mm)	0.7 in. (18 mm)
NUMBER OF STRANDS	7	
STRAND GRADE	270	
CABLE LENGTH, MINIMUM	8 ft (2.4 m)	
BOLT STIFFENER TUBE LENGTH, MINIMUM	3 ft (0.9 m)	
STIFFENER TUBE LENGTH WITH THREADS, MINIMUM	1 ft (0.3 m)	
THREAD LENGTH ON STIFFENER TUBE, NOMINAL	6 in. (152 mm)	
THREAD STRENGTH ON STIFFENER TUBE SHELL, MINIMUM	19,000 lb (85 kN)	
SHELL	Bail type shell for 1-3/8 in. (35 mm) hole with threads to match tube	
TENSION RANGE, MINIMUM	6000 lb (27 kN)	
RESIN TYPE	J-LOK™	

* this code will be on samples made in WV.

METHOD OF DETERMINING TENSION: Tension gauge mounted on roof bolting machine to comply with Section 75.204(f) 30 CFR. Reliability of tension to be checked according to the mine Roof Control Plan. It is the intention of this mine to establish a strong relationship between the installed torque and the resulting installed load of the aforementioned JENNMAR™ INSTáL® CB Cable Bolt. As a result of this relationship, the reliability of the tension can be checked just as it is currently with the approved Roof Control Plan. During the test, a logbook will be kept of the torque and hydraulic pressure on each bolter boom for each shift that the cable bolts are installed. Where spinners occur, another bolt shall be installed. However, when slight spring back is noted and there is no significant loss of tension, installation is acceptable.

JM CABLE® INSTáL® Tensionable Cable Bolt (CC)

Description

INSTáL® Tensionable Cable Bolt (CC) is manufactured using 0.6 or 0.7 in. cable with pre-set housing and wedge and 1-1/8 in. square drive nut. A threaded stiffener tube with attached shell is set on the cable at the housing end and resin mixing bulbs are incorporated at the opposite end. Bolt rotation engages shell with borehole and sets tension on the bolt.

Function

INSTáL® CC Cable Bolt is used for primary and secondary support. The CC cable bolt is part of the INSTáL family of tensionable cable bolts and is the only tensionable system approved by MSHA as primary support. It is most commonly used when primary system is supplemented with cable bolts in the normal bolting pattern. Using CC bolts, the normal primary support can be replaced and no additional secondary bolting is needed. This system is used primarily at the working face and installed in a timely manner during development just like an INSTáL Bolt.

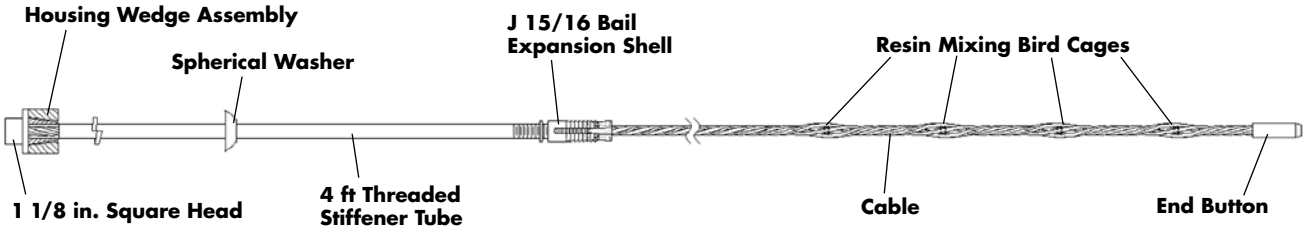
Conditions

New mining, at working face.

Locations

Longwall headgate entries, intersections, belt entries.

JM CABLE® INSTáL® CC Cable Bolt (CC)



JM CABLE® INSTáL® Tensionable Cable Bolt (CC)	0.6 in. (15 mm)	0.7 in. (18 mm)
JENNMAR ID NO.	KWC610*	KWC710*
STRAND DIAMETER	0.6 in. (15 mm)	0.7 in. (18 mm)
NUMBER OF STRANDS	7	
STRAND GRADE	270	
CABLE LENGTH, MINIMUM	8 ft (2.4 m)	
STIFFENER TUBE LENGTH WITH THREADS, MINIMUM	3 ft (0.9 m)	
THREAD LENGTH ON STIFFENER TUBE, NOMINAL	6 in. (152 mm)	
THREAD STRENGTH ON STIFFENER TUBE SHELL, MINIMUM	19,000 lb (85 kN)	
SHELL	Bail type shell for 1-3/8 in. (35 mm) hole with threads to match tube	
TENSION RANGE, MINIMUM	6000 lb (27 kN)	
RESIN TYPE	J-LOK™	

* this code will be on samples made in WV.

METHOD OF DETERMINING TENSION: Tension gauge mounted on roof bolting machine to comply with Section 75.204(f) 30 CFR. Reliability of tension to be checked according to the mine Roof Control Plan. It is the intention of this mine to establish a strong relationship between the installed torque and the resulting installed load of the aforementioned JM CABLE® INSTáL® CC Cable Bolt. As a result of this relationship, the reliability of the tension can be checked just as it is currently with the approved Roof Control Plan. During the test, a logbook will be kept of the torque and hydraulic pressure on each bolter boom for each shift that the cable bolts are installed. Where spinners occur, another bolt shall be installed. However, when slight spring back is noted and there is no significant loss of tension, installation is acceptable.

JM CABLE® Post-Tensioned Cable Bolt (PT)

Description

Post-Tensioned Cable Bolt (PT) is manufactured using 0.6 or 0.7 in. cable and incorporates resin mixing bulbs and a stiffener tube. The housing and wedge is inserted onto the cable but is not set. A pigtail extends below the housing to allow mixing and attachment of the tensioning unit which sets the housing and wedge.

Function

Post-Tensioned Cable Bolt (PT) is normally utilized when high tensionable loads are required in highly unstable and fractured strata. The PT bolt is installed by applying direct tension to the cable pigtail and the load is normally the highest applicable among the cable bolt systems. It stiffens the bolted horizon to allow little movement of the system and has normally been utilized as a secondary bolting system.

Installation is more time consuming and not recommended for full time installation during normal production. A 6 -12 in. protrusion from the roof, including the barrel, wedge and cable pig tail occurs for all installations. Height restraints should be considered when implementing this system.

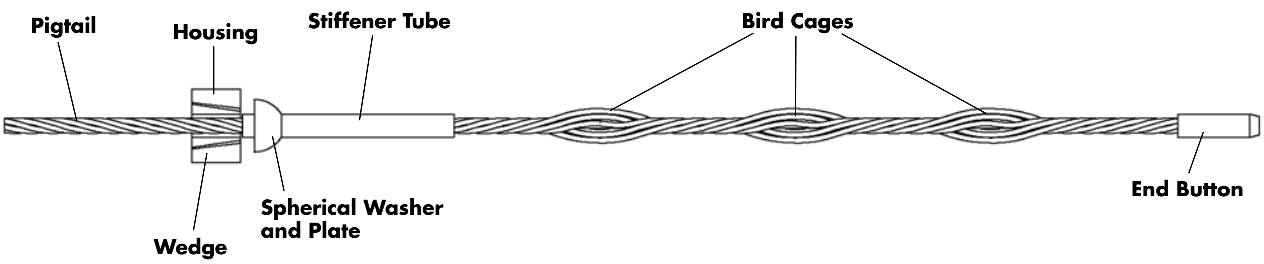
Conditions

Old works, outby, after areas have set, highly fractured and broken strata, areas that require stiff systems with little room for movement.

Locations

Outby areas, belt entries, belt rehabilitations, intersection support, longwall recovery and set-up entries, and longwall headgate entries.

JM CABLE® Post-tensioned Cable Bolt (PT)



JM CABLE® Post-Tensioned Cable Bolt (PT)	0.6 in. (15 mm)	0.7 in. (18 mm)
JENNMAR ID NO.	KWB610*	KWB710*
STRAND DIAMETER	0.6 in. (15 mm)	0.7 in. (18 mm)
NUMBER OF STRANDS	7	
STRAND GRADE	270	
CABLE LENGTH, MINIMUM	8 ft (2.4 m)	
BOLT STIFFENER TUBE LENGTH, MINIMUM	18 in. (457 mm)	
TENSION RANGE, MINIMUM	6000 lb (27 kN)	
RESIN TYPE	J-LOK™	

* this code will be on samples made in WV.

METHOD OF DETERMINING TENSION: Cable Tensioning Unit (CTU) calibrated to pressure gauge mounted on hydraulic supply line to comply with Section 75.204(f) 30 CFR. Reliability of tension to be checked according to the mine Roof Control Plan. It is the intention of this mine to establish a strong relationship between the CTU hydraulic pressure and the resulting installed load of the aforementioned JM CABLE PT Cable Bolt. As a result of this relationship, the reliability of the tension can be checked just as it is currently with the approved Roof Control Plan. During the test area, a logbook will be kept of the hydraulic pressure on CTU each bolter for each shift that the cable bolts are installed.

JM CABLE® Fully-Grouted Cable Bolt (FGCB)

The Fully-Grouted Cable Bolt (FGCB) was developed by KMS (Keystone Mining Services) and JENNMAR through key customer input and extensive lab and field testing. The FGCB allows for a standard cable bolt to be fully encapsulated during installation or post-installation with polyurethane (PUR). A fully encapsulated cable bolt is better protected than a traditional bolt from corrosive elements that may be in a mine roof which could affect the cable bolt's structural properties, especially if the cable bolt is subjected to these elements for prolonged periods of time. FGCB is available as a non-tensioned (FGNT) and INSTáL® Tensionable Cable Bolt (CB) and (CC) models.

Function

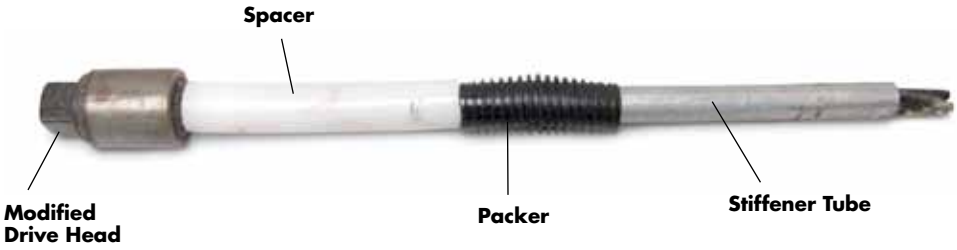
Although initially developed for corrosion protection, field trials demonstrated that the FGCB can act as a traditional PUR injectable bolt. The FGCB is proven to be a very versatile roof support due to its ability to control many different ground conditions, from increasing the lifespan of standard cable bolt supports in long-term main entry systems to stopping the ingress of water and allowing access to previously unattainable reserves. The FGCB is a very effective and economical roof support option.

Conditions

Fractured, laminated conditions, old works, outby, inby, generally anywhere cable support is needed.

Locations

Outby areas, belt entries, belt rehabilitations, intersection support, intersections for pillar recovery, longwall recovery and set-up entries, and longwall headgate entries.



JM CABLE® Fully Grouted Cable Bolt (FGCB)	0.6 in. (15 mm) 30 TON NOMINAL	0.7 in. (18 mm) 40 TON NOMINAL
JENNMAR ID NO.	KW608*	KW708*
STRAND DIAMETER	0.6 in. (15 mm)	0.7 in. (18 mm)
NUMBER OF STRANDS	7	
STRAND GRADE	270 ksi (1862 MPa)	
CABLE LENGTH, MINIMUM	8 ft (2.4 m)	
STIFFENER TUBE LENGTH, MINIMUM	18 in. (457 mm)	
RESIN TYPE	J-LOK™	

* this code will be on samples made in WV.

DO Bolt – Sheathed Cable Bolt

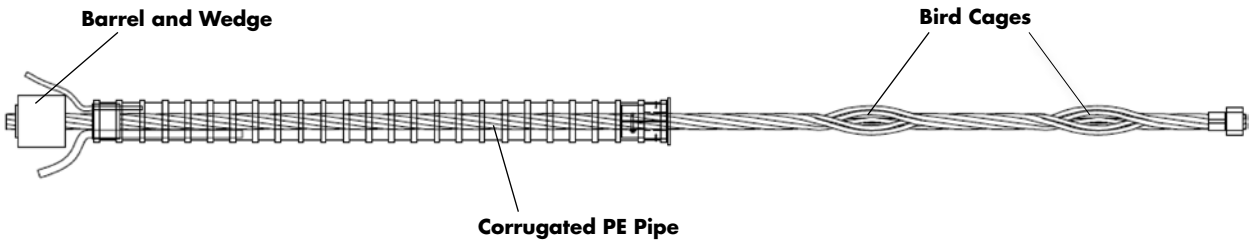
Description

The DO Bolt is a sheathed cable bolt that is resin anchored and post grouted to provide double corrosion protection for the civil construction and tunneling industries. The DO Bolt is designed with bird cages and double buttons to assist in shredding the resin cartridges along with a corrugated sheath that allows grout to anchor into the ridges.

Features

- Resin anchored and post grouted for double corrosion protection
- Double buttons to assist in shredding of resin cartridges
- Corrugated sheath that allows grout to anchor into ridges
- Through holes at top of sheath allow grout to exit into bore hole
- Plastic split collar is attached to sheath above cable clamp to allow cable to rotate independently from sheath during installation
- Resin compression ring compresses resin into top of bore hole and keeps resin out of grout exit holes in sheath
- Resin cartridges along with injection of JennFoam and grout provide a fully grouted cable bolt.

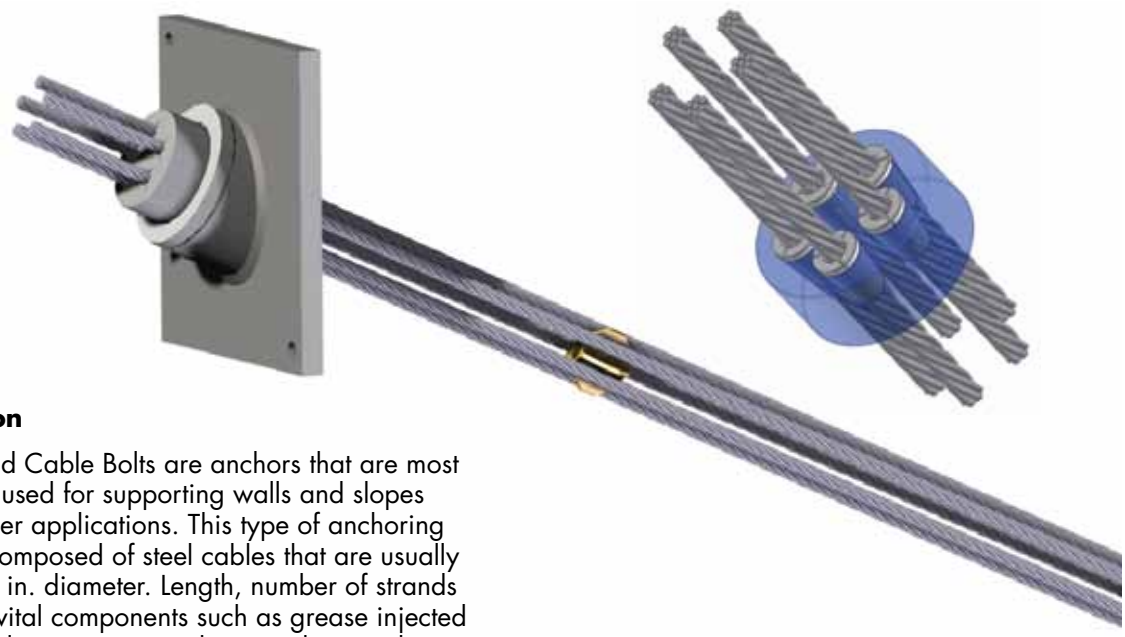
DO Bolt – Sheathed Cable Bolt



DO Bolt – Sheathed Cable Bolt

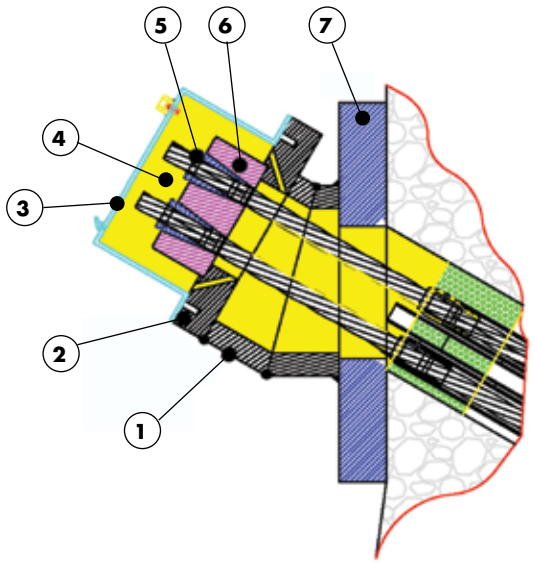
STRAND DIAMETER	0.7 in. (18 mm)
CABLE LENGTH	32 ft (9.75 m)
CORRUGATED SHEATH LENGTH	26.5 ft (8.08 m)
CORRUGATED SHEATH DIAMETER	1.5 in. (38 mm)

Multi Strand Cable Bolt



Description

Multi Strand Cable Bolts are anchors that are most commonly used for supporting walls and slopes among other applications. This type of anchoring system is composed of steel cables that are usually 0.5 or 0.6 in. diameter. Length, number of strands and other vital components such as grease injected protective sleeves, injection hoses, release valves, spacers and others are included and configured depending on project requirements. Birdcaging is also available in different sizing and spacing upon customer requirement.



1. **Wedge compensation**
2. **Brush head Plate**
3. **Protective Cap (Optional)**
4. **Protective Grease (Optional)**
5. **Wedge**
6. **Multi Strand Head**
7. **Base Plate**

Technical Data – Multi Strand Cable Bolt

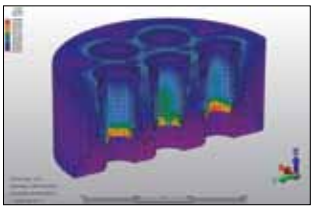
CABLE BOLT DIAMETER, in. (mm)	0.5 (12.70)	0.6 (15.24)
WEIGHT, lb/ft (kg/m)	0.521 (0.775)	0.741 (1.102)
BREAK, ton (metric ton)	20.6 (18.7)	30.5 (27.7)
ELONGATION	6.5%	6.5%
STEEL GRADE	ASTM A416-80 Grade 270	
STRUCTURE	6 wire strands steel core	

Multi Strand Cable Bolt

ACCESSORIES

Multi Strand Head Plate

Jennmar has developed heads for 2 to 19 strands according to customer requirements. The heads that are most commonly required are 3, 4, 5, 7, 9 and 12 strands. Finite element analysis is used to determine the best possible distribution of wedge holders and optimal loads for obtaining the best product performance.

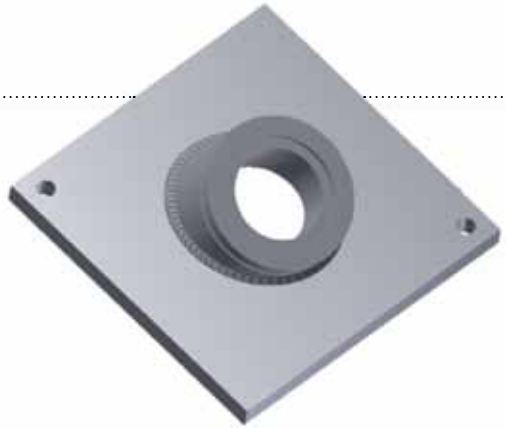


Technical Data – Multi Strand Head Plate

TENSILE STRENGTH, psi (MPa)	134,885 – 149,389 (930 – 1030)
YIELD STRENGTH, psi (MPa)	84,122 – 105,152 (580 – 725)
ELONGATION	10 – 18%

Multi Strand Head Adaptor

The multi strand head adaptor is used in cable anchoring systems for aligning the multi strand head plate with the drill hole in which the system will be installed. When ready, it is anchored into its final position.



Technical Data – Multi Strand Head Adapter

TENSILE STRENGTH, psi (MPa)	84,122 (580)
YIELD STRENGTH, psi (MPa)	51,198 (353)
ELONGATION	12%

Compensation Wedge:
Manufactured using 4 LM Steel (Ovako 280) in angle from 10 to 40°.

Base Plate:
Manufactured using ASTM A36 Steel according to customer specifications.

Spacers & Centering Pieces

These accessories are made using reinforced plastic and allow for cables to maintain an equal distance from each other without contact, as well as away from the rock surface while installing and grouting. Spacers are available from two to six strands, but can be made to customer requirements.

Technical Data – Wedges

RESISTANCE LIMIT, psi (MPa)	85,862 (592)
FLUENCY LIMIT, psi (MPa)	82,672 (570)
ELONGATION	55.4%

CABLE-LOK™ Shell

Description

The CABLE-LOK™ Shell is a spring-loaded shell that can be automatically set on installation. The CABLE-LOK Shell can be used for the following medium soft to very hard rock applications:

- Pre-stressed cable bolting in large span areas
- Pre-stressed cable bolting in hanging wall
- Cable lacing anchors and others.

Features

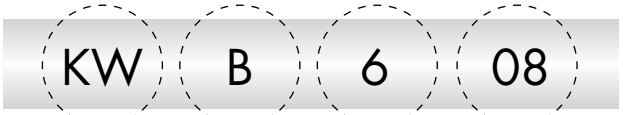
- Cable can be tensioned immediately
- Easy & quick installation
- Tensioned cable provides immediate long tendon ground support
- Cable can provide pre-tensioned active support throughout its length
- Greatly improves installation & cycle time, whether pre or post grouted.

Technical Data – CABLE-LOK Shell

APPLICATIONS	Medium soft to very hard rocks
SHELL DIAMETER, in. (mm)	2 (51)
SHELL LENGTH, in. (mm)	10 (254)
CABLE DIAMETER, in. (mm)	0.6 or 0.7 (15.24 or 17.78)
DRILL HOLE DIAMETER, in. (mm)	2 – 2½ (51 – 64)
ANCHORING CAPACITY	Exceeds ultimate strength of cable

Bolt Markings - Cable Bolts

Cable housings and/or drive nut will be marked with a 4-7 character alpha-numeric identification.



PLANT IDENTITY	
KW	West Virginia
KK	Kentucky
KV	Virginia
KU	Utah
K	Pennsylvania
KC	East Virginia
KE	West Kentucky

TYPE OF BOLT	
A	INSTáL® with expansion shell on top end
B	INSTáL with expansion shell at bottom birdcage
C	INSTáL with expansion shell on stiffener tube
P	Post installation tensioned system (no expansion shell)

CABLE DIAMETER	
5	0.5 in. (13 mm)
6	0.6 in. (15 mm)
7	0.7 in. (18 mm)
8	0.8 in. (20 mm)

BOLT LENGTH	
08	8 ft. (2.4 m)

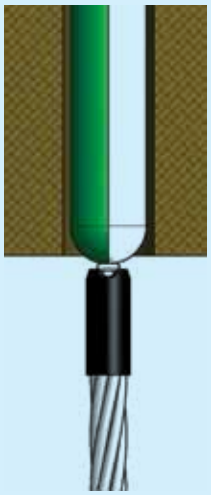
Note:

An additional character "G" will be added at the end to designate galvanized cable or an "E" if epoxy coated (CABLEOX®).

No character will be shown for regular (bright) cable.

Cable Bolt SAFE-T-CAP®

Old vs New SAFE-T-CAP

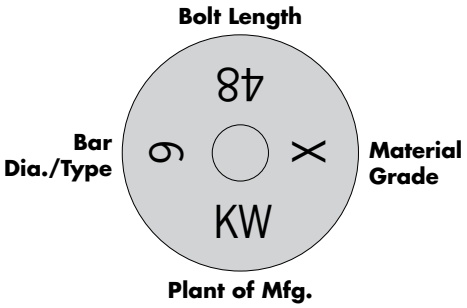


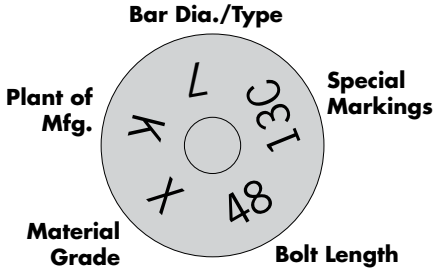
Enhanced Centering

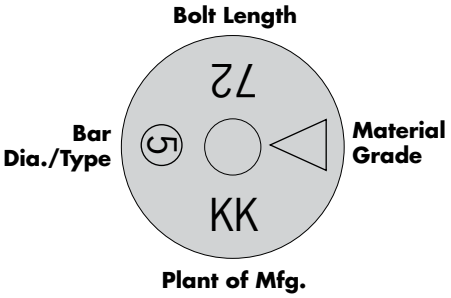
Improved Resin Mixing

JENNMAR is committed to continually improving the safety and performance of its products. JENNMAR has replaced the steel conduit end button on its cable bolts with the new custom designed Cable Bolt SAFE-T-CAP.

Bolt Head Markings and Recommended Torque







BAR DIAMETER/TYPE		
CODE	BAR DIAMETER, in. (mm)	BAR TYPE
5	5/8 (16)	Smooth
5	5/8 (16)	Rebar
6	3/4 (19)	Smooth
6	3/4 (19)	Rebar/J-BAR
7	7/8 (22)	Smooth
7	7/8 (22)	Rebar/J-BAR
8	1 (25)	Smooth
8	1 (25)	Rebar/J-BAR
9	1-1/8 (29)	Smooth
9	1-1/8 (29)	Rebar/J-BAR

GRADE	
CODE	GRADE
	GR 40
*	GR 55
△	GR 60
X	GR 75
XS	GR 90
□	GR 100
2	GR 120
4	GR 140

SPECIAL MARKINGS	
CODE	DESCRIPTION
A	w/ Paddle Wedge
C	Compression
I	INSTáL®
P	Combination
I2	INSTáL® II
I3	INSTáL® III
IB	INSTáL® B

MANUFACTURING PLANT	
CODE	DESCRIPTION
KA	Australia
KK	Kentucky
KE	West Kentucky
K	Cresson, PA
KU	Utah
KV	Virginia
KC	East Virginia
KW	West Virginia

RECOMMENDED TORQUE					
	BOLT DIAMETER, in. (mm)				
BOLT TYPE	5/8 (16)	3/4 (19)	7/8 (22)	0.914 (23)	Others
	RECOMMENDED TORQUE, ft-lb (N·m)				
TORQUE/TENSION	150 – 250 (203 – 339)	175 – 325 (237 – 441)	200 – 350 (271 – 475)	----	----
INSTáL 1A C	----	200 – 350 (271 – 475)	250 – 400 (339 – 542)	----	----
INSTáL II & INSTáL II C	----	200 – 350 (271 – 475)	250 – 400 (339 – 542)	----	----
INSTáL II & INSTáL III	----	----	----	250 – 400 (339 – 542)	----
INSTáL III & INSTáL III C	----	200 – 350 (271 – 475)	250 – 400 (339 – 542)	----	----
INSTáL B	----	----	----	----	#5, 150 – 250 (203 – 339)
COMBINATION	----	200 – 350 (271 – 475)	250 – 400 (339 – 542)	----	----
MECHANICAL BOLT	125 – 225 (170 – 305)	200 – 350 (271 – 475)	250 – 400 (339 – 542)	----	----

Conventional Bolts

J80

D1L

J2B

J8

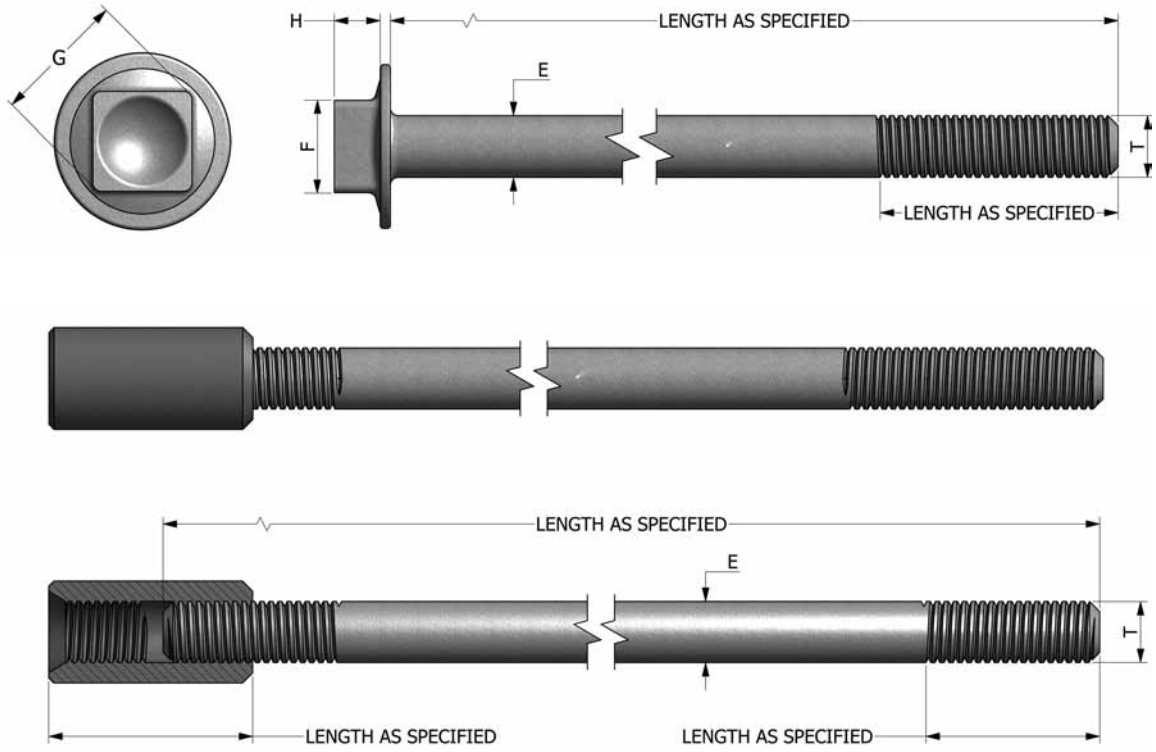
INSTALLATION

JENNMAR's conventional bolts consist of a shell anchor headed smooth bar with a consistent threaded end. A bearing plate is also used to provide increased strata control. JENNMAR offers several types of shell anchorage systems. Our bail anchors have full shell-length contact (less contact pressure) and work well in weak strata conditions. Like all of our products, each system is inspected upon arrival from the mill and then re-inspected upon shipment from our manufacturing facilities.

All systems are configured with high strength bar:

- Grade 55 (55,000 psi minimum yield)
- Grade 75 (75,000 psi minimum yield)

FORGED HEAD, 1-1/8 in. (29mm) SQUARE



Dimensions	BAR TYPE	BOLT SIZE, in. (mm)			
		5/8 (16)	3/4 (19)	7/8 (22)	1 (25)
BODY DIAMETER (E), NOMINAL, in. (mm)	SMOOTH	0.563 (14)	0.680 (17)	0.797 (20)	0.906 (23)
HEAD ACROSS FLATS (F), in. (mm)		1.088 – 1.125 (27.64 – 28.58)			
HEAD ACROSS CORNERS (G), in. (mm)		1.425 – 1.591 (36.20 – 40.41)			
HEAD HEIGHT (H), MIN., in. (mm)		0.476 (12.09)			
THREAD SIZE (T), LH OR RH		5/8 in. - 11 UNC	3/4 in. - 10 UNC	7/8 in. - 9 UNC	1 in. - 8 UNC

All dimensions and thread sizes in accordance with ASTM F432.

Technical Data - Smooth Bar

GRADE	GR55	GR75			
BOLT SIZE, in. (mm)	5/8 (16)	5/8 (16)	3/4 (19)	7/8 (22)	1 (25)
THREAD YIELD STRENGTH, MIN., lb (kN)	12,400 (55)	17,000 (76)	27,800 (124)	38,300 (170)	45,500 (202)
THREAD TENSILE STRENGTH, MIN., lb (kN)	19,200 (85)	22,600 (101)	33,500 (149)	46,200 (206)	60,600 (270)
ELONGATION, MINIMUM	12%	10%			

All mechanical and physical properties in accordance with ASTM F432.

Combination Bolt System

SYSTEM OVERVIEW

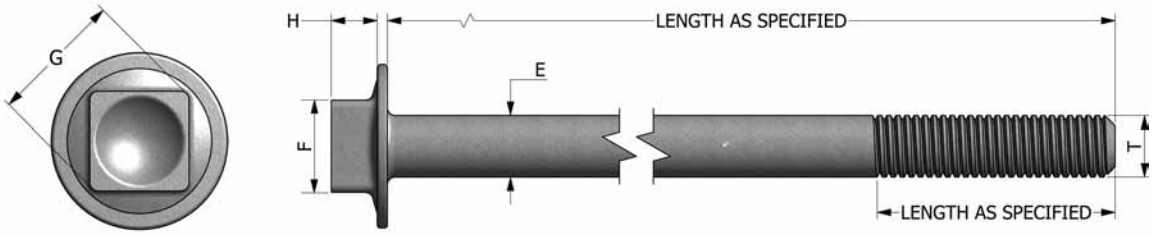
JENNMAR offers the industry's most proven combination bolt system in the mining industry. The Combination Bolt is a two-piece bolt. The upper piece consists of JENNMAR's exclusive J-BAR® for better mixing, stronger threads, and greater anchorage capacity. The lower piece (a headed smooth bar) is connected to the top bolt by a coupler. The Combination Bolt provides ultimate tension in weak strata. The top portion (J-BAR) is encapsulated with resin, while the lower anchor is tensioned to the roof with our bearing plate.

Advantages

- The ultimate tension resin system for all seam heights
- No need to bend for insertion
- Proven Shear Pin system with coupler
- System permits pre-bolting of overcasts for 50% savings
- With mine roof channel or mats savings can range from 25% to 140%
- Proven usage in longwall headgate and tailgate entries as supplemental or primary support
- Prevent roof sag and lateral roof movement

INSTALLATION

FORGED HEAD, 1-1/8 in. (29mm) SQUARE



Dimensions	BAR TYPE	BOLT SIZE, in. (mm)			
		5/8 (16)	3/4 (19)	7/8 (22)	1 (25)
BODY DIAMETER (E), NOMINAL, in. (mm)	SMOOTH	0.563 (14)	0.680 (17)	0.797 (20)	0.906 (23)
HEAD ACROSS FLATS (F), in. (mm)		1.088 – 1.125 (27.64 – 28.58)			
HEAD ACROSS CORNERS (G), in. (mm)		1.425 – 1.591 (36.20 – 40.41)			
HEAD HEIGHT (H), MIN., in. (mm)		0.476 (12.09)			
THREAD SIZE (T), LH OR RH		5/8 in. - 11 UNC	3/4 in. - 10 UNC	7/8 in. - 9 UNC	1 in. - 8 UNC

All dimensions and thread sizes in accordance with ASTM F432.

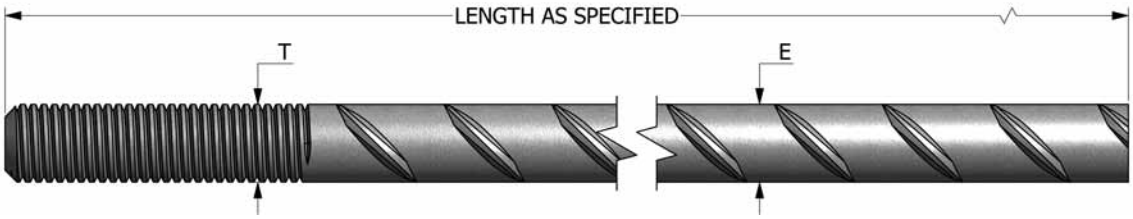
Smooth Bar

Technical Data - Smooth Bar

GRADE	GR55	GR75			
BOLT SIZE, in. (mm)	5/8 (16)	5/8 (16)	3/4 (19)	7/8 (22)	1 (25)
YIELD STRENGTH, MIN., lb (kN)	12,400 (55)	17,000 (76)	27,800 (124)	38,300 (170)	45,500 (202)
TENSILE STRENGTH, MIN., lb (kN)	19,200 (85)	22,600 (101)	33,500 (149)	46,200 (206)	60,600 (270)
ELONGATION, MINIMUM	12%	10%			

All mechanical and physical properties in accordance with ASTM F432.

J-BAR®

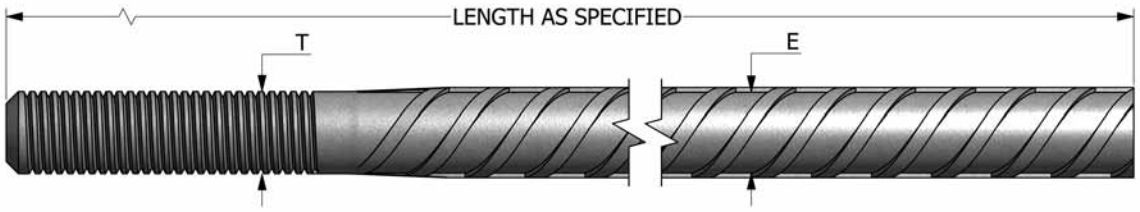


Technical Data - J-BAR

GRADE	GR75		
BOLT SIZE, in. (mm)	3/4 (19)	7/8 (22)	1 (25)
YIELD STRENGTH, MIN., lb (kN)	27,800 (124)	38,300 (170)	45,500 (202)
TENSILE STRENGTH, MIN., lb (kN)	33,500 (149)	46,200 (206)	60,600 (270)
ELONGATION, MINIMUM	10%		

All mechanical and physical properties in accordance with ASTM F432.

Rebar

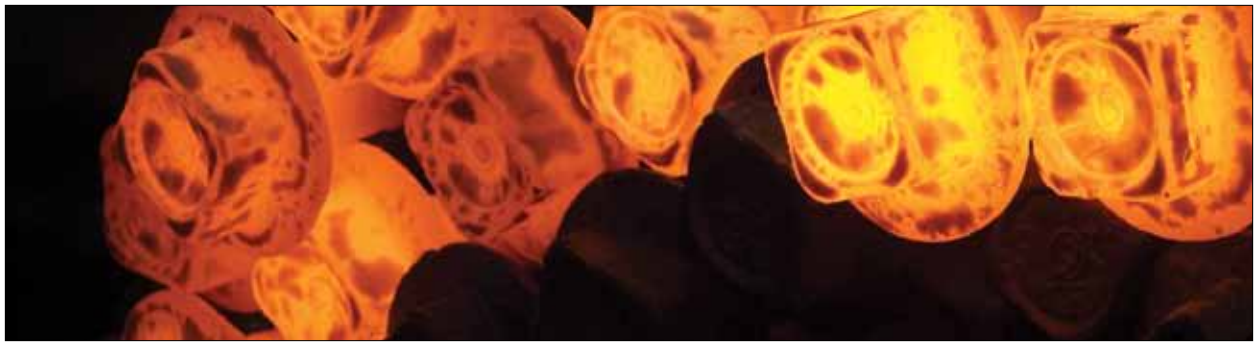


Technical Data - Rebar

GRADE	GR60				GR90
BOLT SIZE, in. (mm)	5/8 (16)	3/4 (19)	7/8 (22)	1 (25)	5/8 (16)
YIELD STRENGTH, MIN., lb (kN)	13,600 (60)	20,000 (89)	27,700 (123)	36,400 (162)	20,300 (90)
TENSILE STRENGTH, MIN., lb (kN)	20,300 (90)	30,100 (134)	41,600 (185)	54,500 (242)	27,100 (121)
ELONGATION, MINIMUM	9%			8%	9%

All mechanical and physical properties in accordance with ASTM F432.

Headed Rebar Bolts



JENNMAR's headed rebar systems are the most cost effective and job proven line of ground control products in the mining and tunneling industries. In order to pass our comprehensive quality assurance program, each system is inspected upon arrival from the mill, and then re-inspected prior to shipment. JENNMAR assures prompt delivery to your mine site by maintaining our own fleet of trucks. Our sales and engineering staff are on call 24 hours a day, 7 days a week, to work with you in developing and testing products for your application.

JENNMAR's rebar is readily available in all standard diameters and grades, inlcluding our special J-BAR®, designed for optimal resin mix.

INSTALLATION

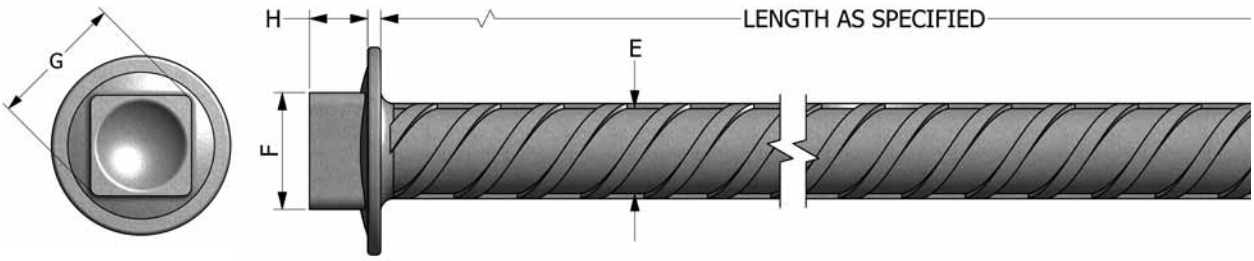
FORGED HEAD, 1-1/8 in. (29mm) SQUARE

Dimensions - Rebar and J-BAR

		BOLT SIZE, in. (mm)			
	BAR TYPE	5/8 (16)	3/4 (19)	7/8 (22)	1 (25)
BODY DIAMETER (E), NOMINAL, in. (mm)	Rebar J-BAR	0.625 (16) NA	0.750 (19) 0.677 (17)	0.875 (22) 0.804 (20)	1.000 (25) 0.914 (23)
HEAD ACROSS FLATS (F), in. (mm)		1.088 – 1.125 (27.64 – 28.58)			
HEAD ACROSS CORNERS (G), in. (mm)		1.425 – 1.591 (36.20 – 40.41)			
HEAD HEIGHT (H), in. (mm)		0.476 (12.09)			

All dimensions in accordance with ASTM F432.

Rebar

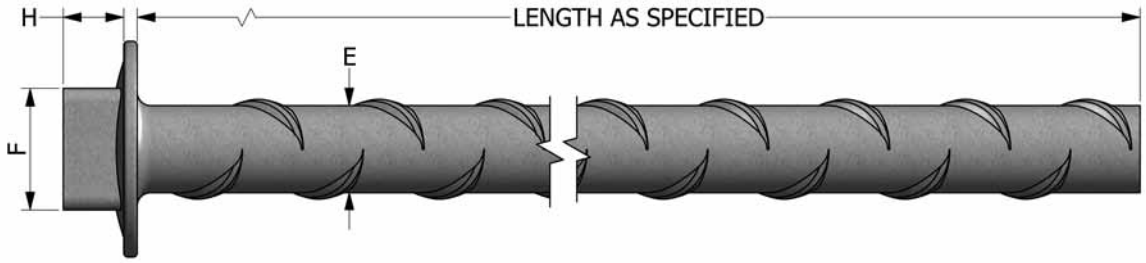


Technical Data - Rebar

GRADE	GR40		GR60				GR90
BOLT SIZE, in. (mm)	3/4 (19)	7/8 (22)	5/8 (16)	3/4 (19)	7/8 (22)	1 (25)	5/8 (16)
YIELD STRENGTH, MIN., lb (kN)	17,600 (78)	24,000 (107)	18,600 (83)	26,400 (117)	36,000 (160)	47,125 (210)	27,900 (124)
TENSILE STRENGTH, MIN., lb (kN)	30,800 (137)	42,000 (187)	27,900 (124)	39,600 (176)	54,000 (240)	71,100 (316)	37,200 (165)
ELONGATION, MIN., in 8 in. (203 mm)	12%	12%	9%			8%	9%

All mechanical and physical properties in accordance with ASTM F432.

J-BAR®



Technical Data - J-BAR

GRADE	GR75		
BOLT SIZE, in. (mm)	3/4 (19)	7/8 (22)	1 (25)
YIELD STRENGTH, MIN., lb (kN)	29,900 (133)	42,100 (187)	49,200 (219)
TENSILE STRENGTH, MIN., lb (kN)	36,000 (160)	50,700 (226)	65,600 (292)
ELONGATION, MIN., IN 8 in. (203 mm)	10%		

All mechanical and physical properties in accordance with ASTM F432.

Tensioned Rebar Bolts

Description

JENNMAR's tensioned rebar bolts have threaded ends and can be used as fully grouted or point anchored systems. Tensioned rebar systems offer simple beam building at an inexpensive price.

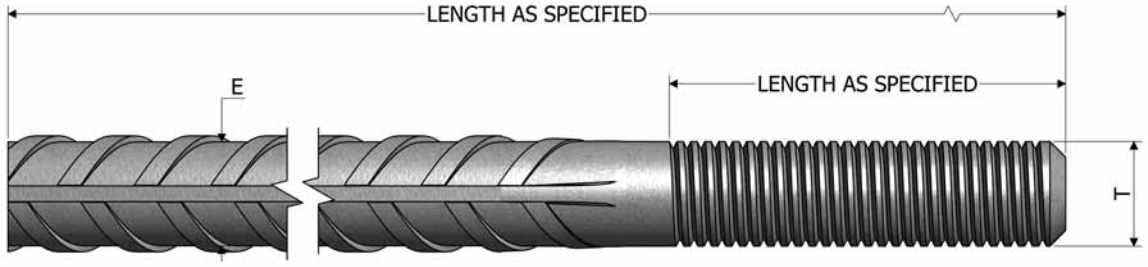
INSTALLATION

Dimensions - Rebar and J-BAR

		BOLT SIZE, in. (mm)			
	BAR TYPE	5/8 (16)	3/4 (19)	7/8 (22)	1 (25)
BODY DIAMETER (E), NOMINAL, in. (mm)	Rebar J-BAR	0.625 (16) —	0.750 (19) 0.677 (17)	0.875 (22) 0.804 (20)	1.000 (25) 0.914 (23)
THREAD SIZE (T), LH or RH		5/8 in. – 11 UNC	3/4 in. – 10 UNC	7/8 in. – 9 UNC	1 in. – 8 UNC

All dimensions and thread sizes in accordance with ASTM F432.

Rebar

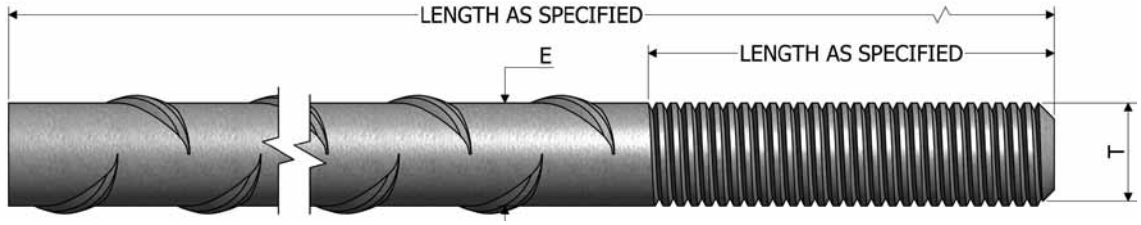


Technical Data - Rebar

GRADE	GR60				GR90
BOLT SIZE, in. (mm)	5/8 (16)	3/4 (19)	7/8 (22)	1 (25)	5/8 (16)
THREAD YIELD STRENGTH, MIN., lb (kN)	13,600 (60)	20,000 (89)	27,700 (123)	36,400 (162)	20,300 (90)
THREAD TENSILE STRENGTH, MIN., lb (kN)	20,300 (90)	30,100 (134)	41,600 (185)	54,500 (242)	27,100 (121)
ELONGATION, MINIMUM	9%			8%	9%

All mechanical and physical properties in accordance with ASTM F432.

J-BAR®



Technical Data - J-BAR

GRADE	GR75		
BOLT SIZE, in. (mm)	3/4 (19)	7/8 (22)	1 (25)
THREAD YIELD STRENGTH, MIN., lb (kN)	27,800 (124)	38,300 (170)	45,500 (202)
THREAD TENSILE STRENGTH, MIN., lb (kN)	33,500 (149)	46,200 (206)	60,600 (270)
ELONGATION IN 8 in. (203 mm) MIN	10%		

All mechanical and physical properties in accordance with ASTM F432.

Tensioned Rebar Bolts

JENNMAR offers the following variations of tensioned rebar systems for specific mining applications:

- JENNMAR SUPER TWIST®
- Torque Tension Dome Nut
- Torque Tension Shear Pin Nut.
- TT Nut Technology.

JENNMAR's SUPER TWIST® is the most efficient and cost effective torque tension system on the market. Simply reverse spin to mix the resin, and then torque the nut. The nut never leaves the bolt due to JENNMAR's specially designed crimped bar. This system provides uniform tensioning, consistent torque and high installed loads.

Other benefits include:

- Minimum amount of bolt protrusion
- Low residual torque.

Super Twist®

Dome Nut

Torque Tension Dome Nut system provides the mining industry with a simple, inexpensive tensioned rebar system utilizing bottom threaded rebar. Resin mixing and torquing is in the same direction.

Torque Tension Shear Pin Nut is an economic and proven system that can be configured to the mine's specific break out torques. This system is installed in a one spin motion and increases the mine's productivity rate. Resin mixing and torquing is in the same direction.

TT Shear Pin Nut

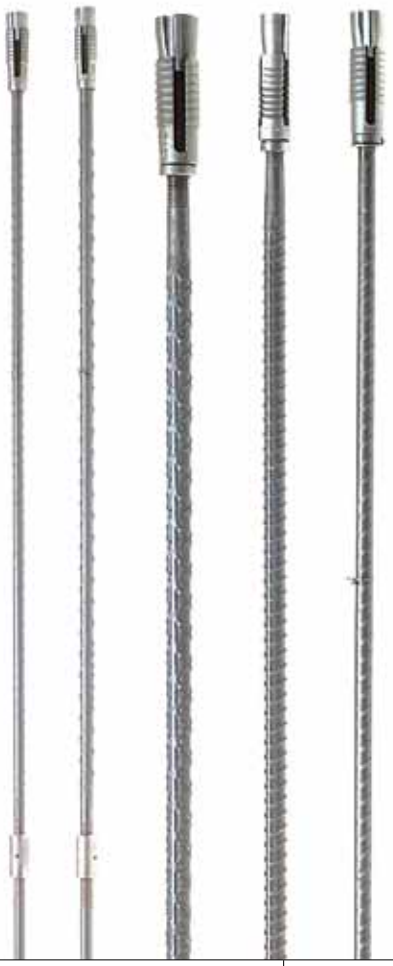
JENNMAR's TT Nut Technology can provide the following benefits over other conventional torque tension systems:

- No external delay mechanism (shear pin, plug, etc.)
- Special thread design in TT Nut provides uniform resin mixing and bolt tensioning
- Minimum amount of bolt protruding from roof
- System can be used fully grouted or point anchored bolts.

TT Nut

INSTáL® Bolt Anchor System

JENNMAR's advanced line of INSTáL Bolt Anchor Systems is the industry's most efficient resin point anchor system. These bolts can be installed in eight seconds or less. The INSTáL systems offered by JENNMAR produce superior anchorage capacity when compared to other resin point anchored products. They provide the support power and fast installation cycle of mechanical bolts with added anchorage capacity by utilizing resin. These bolts are furnished by JENNMAR's experienced sales technicians and engineers to fit your specific mine applications, and designed to your specific seam heights and strata conditions.



Benefits of Utilizing INSTáL Systems

- Prevents roof sag and lateral strata movement
- Consistently outperforms all other systems
- Cost efficient
- Designed specifically for longwall headgate and tailgate entries in low or high coal
- Provides increased holding power utilizing less resin (Compression System Only).
- Available for fully grouted installation.

INSTALLATION

INSTáL Bolt Specifications

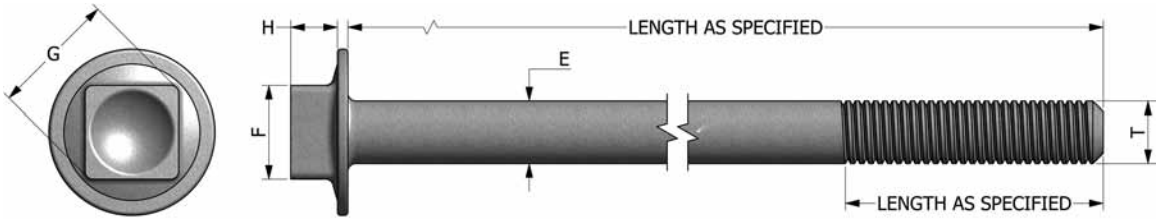
	HOLE DIAMETER, in. (mm)	BAR DIAMETER, in. (mm)	GRADES
INSTáL 1A HT	1-3/8 (35)	3/4, 7/8, 1 (19, 22, 25)	40, 60, 75
INSTáL II HT	1-3/8 (35)	3/4, 7/8, 1 (19, 22, 25)	40, 60, 75
INSTáL III HT	1-3/8 (35)	3/4, 7/8 (19, 22)	40, 60, 75
INSTáL 1A (WITH STANDARD D8 4 PRONG SHELL)	1-3/8 (35)	5/8, 3/4 (16, 19)	60, 75
INSTáL II (WITH STANDARD D8 4 PRONG SHELL)	1-3/8 (35)	5/8, 3/4, 7/8 (16, 19, 22)	40, 60, 75
INSTáL B HT (ONLY INSTáL SYSTEM FOR TRUE 1 IN. DIAMETER HOLE)	1 (25)	5/8, 3/4 (16, 19)	60, 75, 90
INSTáL COMPRESSION BOLT SYSTEM	1-3/8 (35)	5/8, 3/4, 7/8 (16, 19, 22)	40, 60, 75
INSTáL II OR III (WITH J15 EXPANSION SHELL)	1-1/2, 1-5/8 (38, 41)	1 (25)	60, 75

FORGED HEAD, 1-1/8 in. (29mm) SQUARE

Dimensions	BAR TYPE	BOLT SIZE, in. (mm)			
		5/8 (16)	3/4 (19)	7/8 (22)	1 (25)
BODY DIAMETER (E), NOMINAL, in. (mm)	SMOOTH REBAR J-BAR	0.563 (14) 0.625 (16) NA	0.680 (17) 0.750 (19) 0.677 (17)	0.797 (20) 0.875 (22) 0.804 (20)	0.906 (23) 1.000 (25) 0.914 (23)
HEAD ACROSS FLATS (F), in. (mm)		1.088 – 1.125 (27.64 – 28.58)			
HEAD ACROSS CORNERS (G), in. (mm)		1.425 – 1.591 (36.20 – 40.41)			
HEAD HEIGHT (H), MIN., in. (mm)		0.476 (12.09)			
THREAD SIZE (T), LH OR RH		5/8 in. - 11 UNC	3/4 in. - 10 UNC	7/8 in. - 9 UNC	1 in. - 8 UNC

All dimensions and thread sizes in accordance with ASTM F432.

Smooth Bar

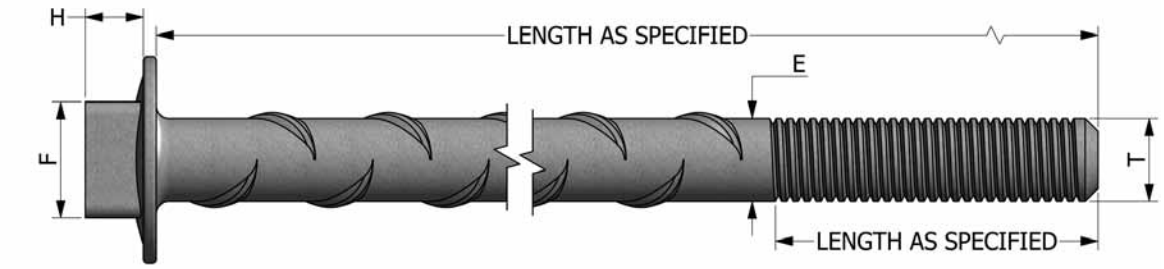


Technical Data - Smooth Bar

GRADE	GR55	GR75			
BOLT SIZE, in. (mm)	5/8 (16)	5/8 (16)	3/4 (19)	7/8 (22)	1 (25)
THREAD YIELD STRENGTH, MIN., lb (kN)	12,400 (55)	17,000 (76)	27,800 (124)	38,300 (170)	45,500 (202)
THREAD TENSILE STRENGTH, MIN., lb (kN)	19,200 (85)	22,600 (101)	33,500 (149)	46,200 (206)	60,600 (270)
ELONGATION, MINIMUM	12%	10%			

All mechanical and physical properties in accordance with ASTM F432.

J-BAR®

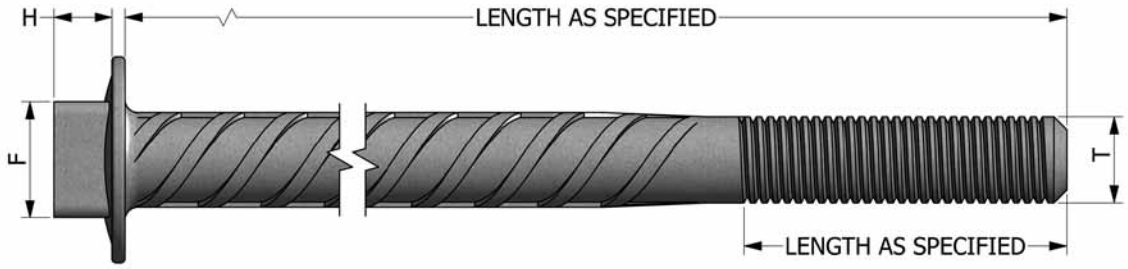


Technical Data - J-BAR

GRADE	GR75		
BOLT SIZE, in. (mm)	3/4 (19)	7/8 (22)	1 (25)
THREAD YIELD STRENGTH, MIN., lb (kN)	27,800 (124)	38,300 (170)	45,500 (202)
THREAD TENSILE STRENGTH, MIN., lb (kN)	33,500 (149)	46,200 (206)	60,600 (270)
ELONGATION, MINIMUM	10%		

All mechanical and physical properties in accordance with ASTM F432.

Rebar



Technical Data - Rebar

GRADE	GR60				GR90
BOLT SIZE, in. (mm)	5/8 (16)	3/4 (19)	7/8 (22)	1 (25)	5/8 (16)
THREAD YIELD STRENGTH, MIN., lb (kN)	13,600 (60)	20,000 (89)	27,700 (123)	36,400 (162)	20,300 (90)
THREAD TENSILE STRENGTH, MIN., lb (kN)	20,300 (90)	30,100 (134)	41,600 (185)	54,500 (242)	27,100 (121)
ELONGATION, IN 8 in. (203 mm) MIN.	9%			8%	9%

All mechanical and physical properties in accordance with ASTM F432.

FULLY GROUTED INSTáL® BOLT ANCHOR SYSTEM

Description

The Fully-Grouted INSTáL® Bolt is the ideal high tension bolt due to the resin that locks bolt tension within the system, while significantly slowing down the weathering process around the bolt hole. The Fully-Grouted INSTáL Bolt combines the benefits of fully-grouted and tensioned bolts, providing the best of both worlds.

The fully-grouted, high-tension bolt is a 7/8 in., 6 ft special grade 75 rebar that is tensioned to nearly 20,000 lb via a mechanical shell before the fully grouted resin column cures. A 60 × 1-1/4 in. J-LOK INSTáL resin cartridge is used to fully grout the 7/8 in. bolt in a 1-3/8 in. hole. Wider and deeper grooves on the shell plug facilitate the initial resin flow around the shell and reduce insertion pressure. Underground observations and laboratory tests indicate that the flow around the shell plug allows the resin to be mixed effectively. Since the shell and hole have an annulus thickness of less than 0.0625 in., glove fingering is not possible.

Advantages

- Fully-Grouted INSTáL bolts have improved performance due to the superior anchorage and stiffness that develops as a result of a full length resin anchor.
- A significant resistance to rock movement is developed both axially and laterally because of the superior stiffness of the fully-grouted INSTáL bolts.
- If roof separation or horizontal shearing forces occur, bolt loads that are developed are quickly transferred back to the rock, and roof separation and shearing are resisted.

JENN-TENSION

Description

JENNMAR offers the JENN-TENSION roof bolt re-tensioning system for a quick and economical alternative to replacement of loose roof plates. The JENN-TENSION system is *designed for fully-groutable bolts only*, and fits up to #7 rebar. JENN-TENSION is capable of re-tensioning roof plates with a minimum 1 in. gap between the plate and roof.

Each JENN-TENSION unit consists of the following items:

- Spherical Washer
- Threaded Spacer (0.5 or 1.0 in.)
- Nut
- Extra Spacers.

Installation is simple!

1. Clean any loose material from the roof to ensure that the plate will fit firmly against the roof after installation.
2. Slide the spherical washer on to the bolt with the slot opening away from you.
3. Select the proper size of threaded spacer (1/2 or 1 in.) dependent upon the gap between the plate and roof. Slide the threaded spacer on to the bolt with the slot facing towards you. If using a spherical washer, make sure that the tab on the washer is in the slot of the threaded spacer.
4. Add blank spacers until the plate is as close to the roof as possible.
5. Slide the nut over the head/washer of the bolt and up to the threaded spacer.
6. Tighten the nut by hand until the plate comes in contact with the roof. Limit rotation of spherical washer by placing a screwdriver in slot of spherical washer.
7. Use a pair of channel locks or a wrench to tighten the nut until the plate is firmly against the roof.

Technical Data - JENN-TENSION

DESCRIPTION	MATERIAL	NOMINAL DIMENSIONS	
		in.	mm
SPHERICAL WASHER	Cast Ductile Iron	3 in. dia x 1-1/4 in. H	76 mm dia x 32 mm H
JENN-TENSION NUT		3-1/2 in. Hex w/ 2-1/4 in. x 8 UNC Thread	89 mm Hex w/ 57 mm x 8 UNC Thread
THREADED SPACER, 1/2 in. (13 mm)		1/2 in. H w/ 2-1/2 in. x 8 UNC Thread	13 mm H w/ 57 mm x 8 UNC Thread
THREADED SPACER, 1 in. (25 mm)		1 in. H w/ 2-1/4 in. x 8 UNC Thread	25 mm H w/ 57 mm x 8 UNC Thread
SPACER, 1/2 in. (13 mm)		2 in. dia x 1/2 in. H	51 mm dia x 13 mm H
SPACER, 1 in. (25 mm)		2 in. dia x 1 in. H	51 mm dia x 25 mm H
SPACER, 2 in. (51 mm)		2 in. dia x 2 in. H	51 mm dia x 51 mm H

Truss Systems

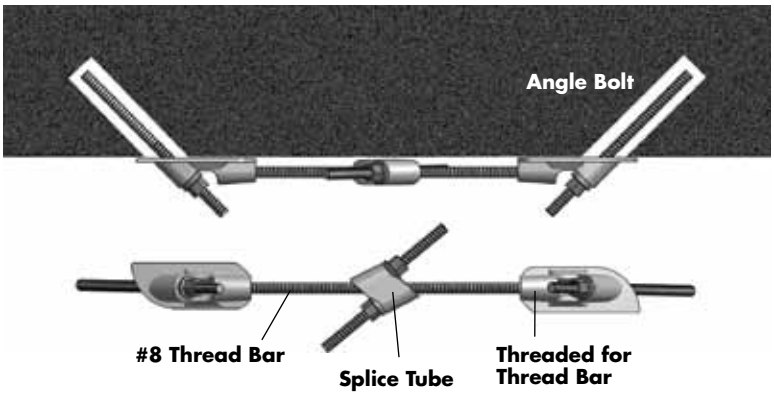
JENNMAR offers the mining and tunneling industries the most reliable, high strength truss systems available. Truss systems can eliminate cribbing expense and labor. KMS, a JENNMAR affiliate, exclusively designs roof control plans with the aid of 3D computer modeling and Auto Cad, to help reduce your overall roof control costs.

INSTALLATION

BYTM® THREAD BAR TRUSS SYSTEM

- Utilizes the #8 threaded rebar as the horizontal tensioning member
- Used in conjunction with our #8 or #9 splice tube
- Rebar is engaged directly into an internally threaded truss shoe

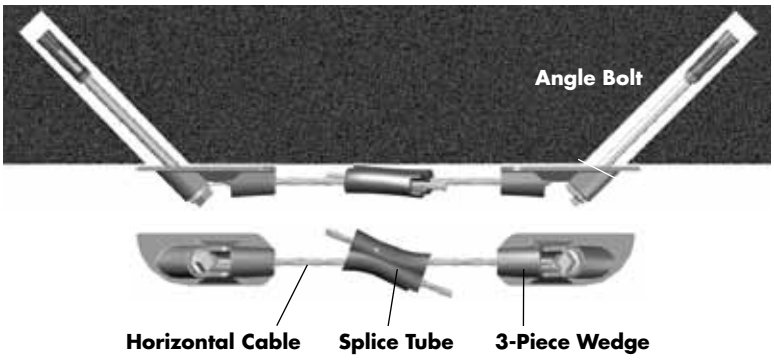
BYTM Thread Bar Truss System



BYTM® CABLE TRUSS SYSTEM

- Fast installation
- 70,000 lb rating
- Uses 0.6 in. or 0.7 in. cable
- Tensioned from center of entry
- Minimum components
- Can be part of primary support

BYTM Cable Truss System

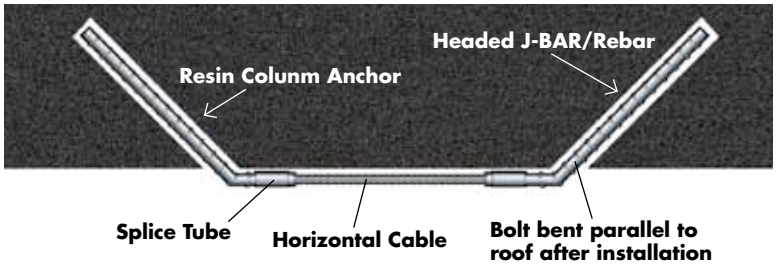


Truss Systems

JMB CABLE TRUSS

- Economical and easy to install off the miner
- Utilizes JENNMAR's unique J-Bar (angle bolts) for better mixing
- Fewer parts than competition
- Very cost effective

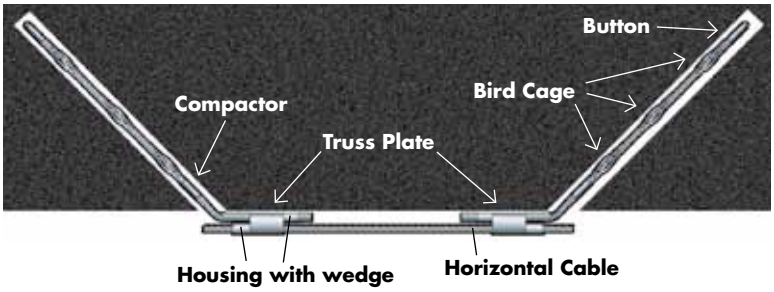
JMB Cable Truss System



JMS CABLE TRUSS

- Great for low seams
- Eliminates cribbing
- Flexibility helps handle later shear
- Easily tensioned
- Custom designed for entry width

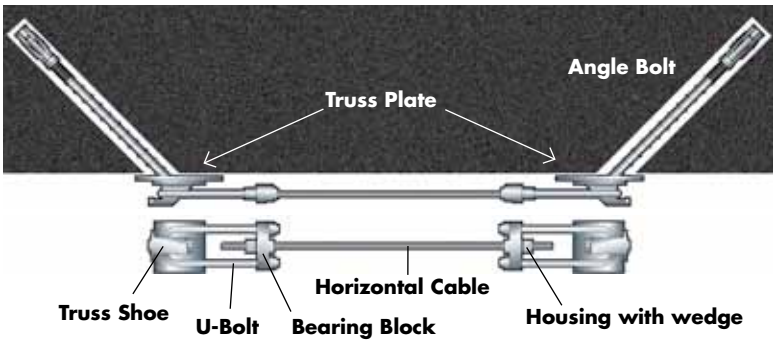
JMS Truss System



JMM CABLE TRUSS

- System provides uplifting force to reduce roof sag
- Ideal for primary support on longwall gate road development
- Fewer parts than other systems
- Less cribbing needed in tailgates, reduces mine cost, and increases ventilation
- Can be part of primary support

JMM Truss System



Let our team of mine engineers/technicians utilize JENNMAR's technology to implement proven, cost effective systems for your mining application.

RIB BONE

Description

The Rib Bone is a polyethylene roof support that is designed for use in highly corrosive areas in both mining and civil construction projects. The Rib Bone is a lightweight product that can be easily handled and assembled. Used with a non-corrosive rib bolt and plate, the Rib Bone provides corrosion resistant and extended life roof support.

Advantages

- Lightweight polyethylene
- Easily handled and assembled
- Corrosion resistant
- Provides extended life of roof supports in highly corrosive environments

Technical Data – Rib Bone

MATERIAL	Polyethylene
MATERIAL THICKNESS, STANDARD, in. (mm)	0.25 (6)
MATERIAL LENGTH, MAX, ft (m)	10 (3.1)
TENSILE STRENGTH, lb (kN)	6000 (27)

FIBERGLASS RIB PAN AND PLATE

Description

JENNMAR offers a cuttable high strength molded fiberglass rib pan and plate for environments requiring corrosion resistance in coal processing plants. The plate must be installed with ribs up against strata surface.

Advantages

- Designed at 1.7 specific gravity for coal processing plants
- Conical hole for angled bolt installation
- 18 in. (457 mm) square for additional surface support
- Center plate design for additional strength.

Fiberglass Rib Pan and Plate

Rib Pan	
DIMENSIONS, SQUARE, in. (mm)	18 (457)
HOLE DIAMETER, in. (mm)	1-3/8 (35)
STRENGTH, (PROPOSED), lb (kN)	10,000 (44)
Plate	
OUTSIDE DIAMETER, in. (mm)	10 (254)
HOLE DIAMETER, in. (mm)	1-3/8 (35)
STRENGTH (PROPOSED ASTM F432), lb (kN)	6000 (27)

MATEENBOLT™

Description

MateenBolt™ is a high quality GFRP rock bolt that provides superior reinforcement for the hard rock, coal mining and tunneling industries. These bolts can be used in either temporary (cuttable) or permanent (corrosion resistant) reinforcement applications. The MateenBolt delivers high performance corrosion resistant reinforcement to stabilize high movement rock and coal seams and dramatically improve mine safety in difficult geotechnical conditions.

Features

- Cuttable and completely non corrosive
- Fully threaded with maximum length of 40 ft (12.2 m)
- Precision machined threads have strongest composite nut pull off strength
- Non-magnetic and non-conductive
- Extremely high strength
- Light weight and easy to handle
- Portion of structure left behind after excavation is durable, long lasting and becomes integral part of overall load bearing structure.

mateenbolt™

Applications

MateenBolts can be used in both mining and tunneling industries. MateenBolts have been installed in the following types of mines: coal, salt, potash, gold, lead, zinc and cobalt. Applications include either temporary or permanent reinforcement.

Differences in performance (both mechanical and durability properties) are attributable to the resin and glass systems used for the temporary and permanent bolt. The permanent bolt is made from a high durability epoxy backboned resin matrix and E-CR glass which makes it perfect for long term installations and/or corrosive environments.

The temporary bolt provides value for the end user who requires a cuttable bolt and not necessarily a highly durable bolt. To accomplish this, the temporary bolt uses a high grade polyester blended resin and e-glass which is suitable for installations that will last less than 2 years.

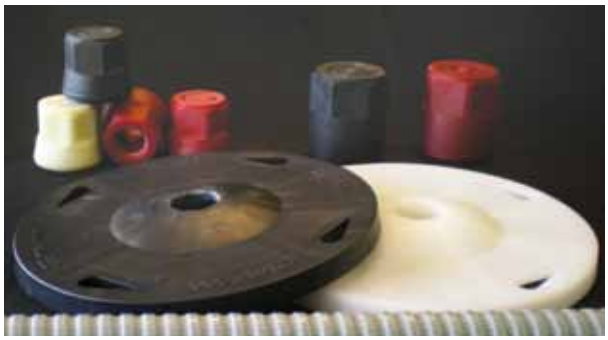
MATEENBOLT™

Temporary Bolts

- Cuttable bolts for temporary ground support
- Temporary support structures such as launch walls (Softeyes) for Tunnel Boring Machines (TBMs)
- NATM/SEM Lunardi Tunneling Method ground support
- Ground support in unstable earth where cutting the bolts is required by rapid excavation equipment
- Temporary coil rod for concrete form ties.

Permanent Bolts

- Used as primary roof support in high Hydrogen Sulfide (H^2S) environments such as combined sewer overflow (CSO) tunnels in lieu of double corrosion protected bolts
- Soil nails used in corrosive (alkali or acidic) soils as a replacement for galvanized, epoxy, stainless, or double corrosion protected bolt
- Hollow bolt can be used as a corrosion resistant self drilling bolt in loose soils.
- Ideal for in-situ permanent reinforcement.



MateenBolt Accessories

HIGH CAPACITY COMPOSITE NUTS, in. (mm)	0.87, 0.98, 1.26 (22, 25, 32)
NON-METALLIC FLAT & SWIVEL BEARING PLATES	Standard – Black > 1.6 Density – Beige

Technical Data – Temporary Bolts

BOLT DIAMETER, in. (mm)	0.87 (22)	0.98 (25)	1.26 (32)
GUARANTEED TENSILE STRENGTH, lb (kN)	> 48,000 (214)	> 58,000 (258)	> 90,000 (400)
SHEAR STRENGTH, lb (kN)	> 11,000 (49)	> 13,000 (58)	> 22,000 (98)
NUT TERMINATION, lb (kN)	> 14,500 (64)	> 20,000 (89)	> 34,000 (151)
WORKING AREA, in^2 (mm^2)	0.44 (284)	0.60 (387)	1.00 (645)
ELASTIC MODULUS*, psi (GPa)	> 7,700,000 (53)	> 7,700,000 (53)	> 7,700,000 (53)

* Elastic modulus is based on working area of bolt

Technical Data – Permanent Bolts

BOLT DIAMETER, in. (mm)	0.87 (22)	0.98 (25)	1.26 (32)	1.26 (32) Hollow
GUARANTEED TENSILE STRENGTH, lb (kN)	> 53,000 (236)	> 63,000 (280)	> 97,000 (431)	> 76,000 (338)
SHEAR STRENGTH, lb (kN)	> 12,000 (53)	> 15,000 (67)	> 24,000 (107)	> 20,000 (89)
NUT TERMINATION, lb (kN)	> 14,500 (64)	> 20,000 (89)	> 34,000 (151)	> 34,000 (151)
WORKING AREA, in^2 (mm^2)	0.44 (284)	0.60 (387)	1.00 (645)	0.82 (529)
ELASTIC MODULUS, psi (GPa)	> 7,700,000 (53)	> 7,700,000 (53)	> 7,700,000 (53)	> 7,700,000 (53)

* Elastic modulus is based on working area of bolt

JM Thread Bar

Description

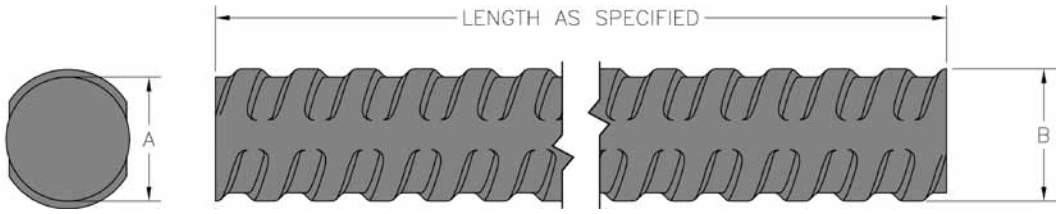
- Grade 75 rebar
- All mechanical and physical properties in accordance with ASTM A615 and CSA G30.18
- JM thread bar is Left Hand (LH) thread only, except No. 14 which is Right Hand (RH) thread
- Complete with BUDDY NUT® for one step installation
- Blunt or tapered ends are available
- Available in galvanized (ASTM A123) or epoxy coated (ASTM A775).

Advantages

- Wide range of applications including rock bolts, rock dowels, rock spiles, soil nails, micropiles, etc.
- Suitable for use with either resin cartridges or cement grout
- Resin shredder design actively promotes shredding of film, mixing of resin components and allows for centralizing of bolt within borehole
- Minimum parts and wrenches required for mixing resin and tensioning plate.

Accessories

- Various types and sizes of plates can be used in conjunction with JM Thread Bar
- Can be used in conjunction with hex style nut and washer setup or with one piece cast anchor nut
- Couplers are available for applications requiring a coupling device to connect pieces of JM Thread Bar



Technical Data

JM THREAD BAR	NO. 6	NO. 7	NO. 8	NO. 9	NO. 10	NO. 11	NO. 14
YIELD STRENGTH, MIN., lb (kN)	33,000 (147)	45,000 (200)	59,300 (264)	75,000 (334)	95,300 (424)	117,000 (520)	169,000 (752)
TENSILE STRENGTH, MIN., lb (kN)	44,000 (196)	60,000 (267)	79,000 (351)	100,000 (445)	127,000 (565)	156,000 (694)	225,000 (1001)
NOMINAL WEIGHT, lb/ft (kg/m)	1.50 (2.23)	2.04 (3.04)	2.67 (3.97)	3.40 (5.06)	4.30 (6.40)	5.31 (7.90)	7.65 (11.38)

All mechanical and physical properties in accordance with ASTM A615

Dimensions

JM THREAD BAR	NO. 6	NO. 7	NO. 8	NO. 9	NO. 10	NO. 11	NO. 14
NOMINAL BAR SIZE (A), in. (mm)	0.750 (19)	0.875 (22)	1.000 (25)	1.128 (29)	1.270 (32)	1.141 (29)	1.693 (43)
MAXIMUM BAR DIAMETER (B), in. (mm)	0.860 (22)	0.990 (25)	1.120 (28)	1.260 (32)	1.430 (36)	1.610 (41)	1.860 (47)

All dimension in accordance with ASTM A615

Description

JENNMAR's Bendable Bolts are available where bending is necessary to permit installation of bars that are longer than the mine opening height. These bendable bolts can be furnished with or without an altered or notched section at a designated location at which the bar will bend.

Notched Bendable Bolts

Notched Bendable Bolts are available as single or double notched with notch location and bolt length designated by the customer. Bolts are available in the following sizes/grades:

#6 & #7 rebar, grades 40 & 60.

Fully grouted nontensioned bendable bolts shall have reached a load of 23,000 lbf before breaking. Tensioned bendable bolts shall exceed the minimum yield loads in accordance with ASTM Specification A615 or F432, or both, for the grade and diameter of bolt used, plus 6000 lbf.

Non-Notched Bendable Bolts

Non-Notched Bendable Bolts are available in the following sizes and grades:

Technical Data – Non- Notched Bendable Bolts

GRADE	GR40	GR60
BOLT SIZE, in. (mm)	3/4 (19)	5/8 (16)
YIELD STRENGTH, min., lb (kN)	17,600 (78)	18,600 (83)
TENSILE STRENGTH, min., lb (kN)	30,800 (137)	27,900 (124)
ELONGATION, min., in 8 in. (203 mm)	12%	9%

All mechanical and physical properties in accordance with ASTM F432.

FRICTION-LOK® Stabilizer System

Description

The JENNMAR® FRICTION-LOK® Stabilizer System is a strata control system designed to firmly control hard or soft rock. As lateral ground movement increases, the system increases its superior holding power.

INSTALLATION

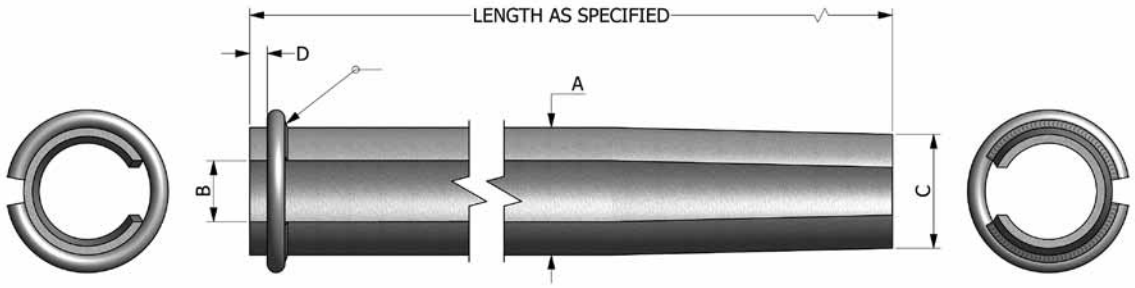
Advantages

- The radial compression of the slotted steel tube inside the borehole provides both radial and axial restraint to rock movement
- Requires no resin mixing or torquing
- Maintains consistent plate load
- Quick and easy installation
- Manufactured by JENNMAR and stocked at company's various strategically located warehouses to provide prompt availability.

Selection

The JENNMAR FRICTION-LOK Stabilizer System is available in Bright or Galvanized steel in the following sizes:

- 1.3 in. (33 mm)
- 1.4 in. (35 mm)
- 1.5 in. (39 mm)
- 1.8 in. (46 mm)



FRICTION-LOK Stabilizer System

	FL-33	FL-35	FL-39	FL-46
RECOMMENDED NOMINAL BIT SIZE, in. (mm)	1-3/16 to 1-5/16 (30 to 33)	1-1/4 to 1-3/8 (32 to 35)	1-3/8 to 1-1/2 (35 to 38)	1-5/8 to 1-3/4 (41 to 44)
TYPICAL BREAKING CAPACITY, ton (metric ton)	12 (10.88)	12 (10.88)	14 (12.70)	20 (18.14)
MINIMUM BREAKING CAPACITY, ton (metric ton)	8 (7.26)	8 (7.26)	10 (9.07)	15 (13.61)
NOMINAL TUBE LENGTHS, ft (m) Available to any specified length	1.5 to 10 (0.5 to 3.1)	1.5 to 10 (0.5 to 3.1)	1.5 to 10 (0.5 to 3.1)	5 to 16 (15 to 4.9)
RECOMMENDED INITIAL ANCHORAGE, ton (metric ton)	3 to 6 (2.72 to 5.44)	3 to 6 (2.72 to 5.44)	3 to 6 (2.72 to 5.44)	6 to 10 (5.44 to 9.07)

Dimensions	FL-33	FL-35	FL-39	FL-46
TUBE DIAMETER (A), in. (mm) ±0.030 in.	1.330 (33)	1.400 (35)	1.530 (39)	1.815 (46)
SLOT WIDTH (B), in. (mm)	0.440 to 0.640 (11 to 16)	0.600 to 0.750 (15 to 19)	0.560 to 0.760 (14 to 19)	0.820 to 0.920 (21 to 23)
TAPER END DIAMETER (C), MAX, in. (mm)	1.180 (30)	1.180 (30)	1.180 (30)	1.620 (41)
RING STANDOFF (D), in. (mm)	0.085 ±0.035 (2 ±1)			

All dimensions in accordance with ASTM A615

PYTHON® Expandable Rock Bolts

PYTHON® expandable rock bolts offer superior quality that responds to the most demanding roof support applications. PYTHON's high load capacity along with excellent elongation properties ensure safer working conditions and faster excavation cycles, effectively reducing costs and increasing production.

PYTHON bolts tie and join fractures because of their ability to withstand high loads. Since the PYTHON bolt has excellent elastic properties, it is able to withstand rock movement without cutting.

Advantages

- Immediate full length support for faster excavation cycles and safer working conditions
- Simple and clean installation
- Adjusts to borehole irregularities
- Excellent elongation properties add to application flexibility
- Reliable installation quality
- Flexible for variations in drill diameter
- Versatile bolting solution for variable ground conditions
- Environmentally friendly installation requiring no grouting or chemicals
- PYTHON bolts can be manufactured to any length up to a maximum of 20 ft (240 in.).

Corrosion Coating

Features of the PYTHON bolt corrosion coating:

- Molecular attachment
- Water-based
- Environmentally friendly
- Ten times better than galvanizing under salt spray testing.

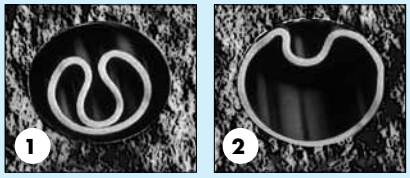
Accessories

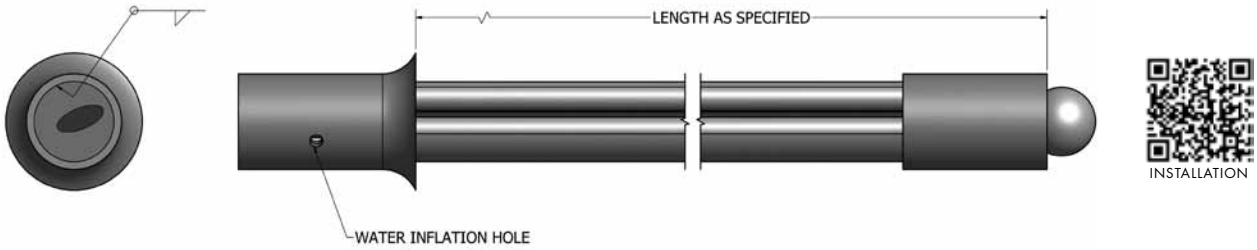
The following accessories for the PYTHON bolt can be provided:

- Full range of pneumatic and electric water pumps
- Load tester
- Dome and Donut Embossed Plates available.

PYTHON Performance

1. *Original shape of the PYTHON bolt when inserted into drill hole. Water is pumped into the bolt, expanding the PYTHON.*
2. *The bolt is then pressed against the rock, which provides high load friction capacity. The water pressure is then removed.*





Technical Data – PYTHON Expandable Rock Bolts

PYTHON BOLT	STANDARD	MIDI	SUPER
TYPICAL BREAKING STRENGTH, ton (kN)	13.5 (120)	18.0 (160)	27 (240)
TYPICAL ELONGATION	25%	25%	25%
PROFILE DIAMETER, NOMINAL, in. (mm)	1.05 (27)	1.42 (36)	1.42 (36)
MATERIAL THICKNESS, NOMINAL, in. (mm)	0.078 (2)	0.078 (2)	0.118 (3)
HOLE DIAMETER RANGE, in. (mm)	1.25 – 1.50 (32 – 38)	1.70 – 2.05 (43 – 52)	1.70 – 2.05 (43 – 52)
OPTIMAL HOLE DIAMETER, in. (mm)	1.38 – 1.50 (35 – 38)	1.75 – 2.00 (44 – 51)	1.75 – 2.00 (44 – 51)
INFLATION PRESSURE, psi (bar)	4350 (300)	3481 (240)	4350 (300)

YIELD-LOK™ Bolt

Description

YIELD-LOK™ Bolt is a new generation of yielding rock bolt that provides reliable ground control in both seismic and convergence ground conditions. YIELD-LOK Bolt is fully grouted with resin or cement in application. Resin mixing is facilitated by deformations on the head of bolt similar to rebar. The bolt provides immediate primary support on installation.

The YIELD-LOK Bolt can be configured to yield either in dynamic condition (YL-Dynamic Bolt) or yield at specified loads in static condition (YL-Static Bolt).

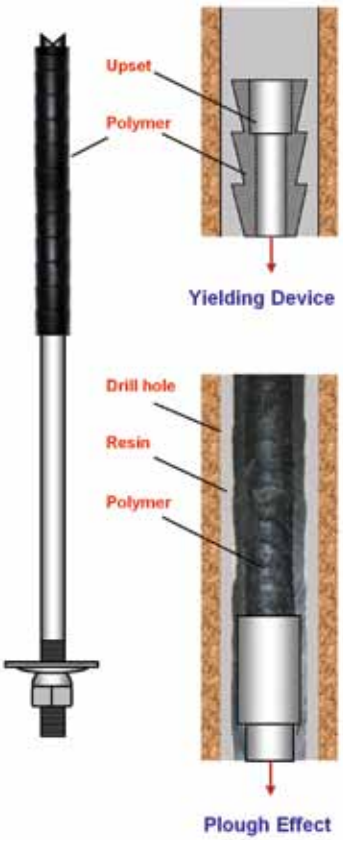
YL-Dynamic Bolt – In static condition, YL-Dynamic Bolt provides stiff support similar to rebar bolt, while in dynamic condition, the bolt yields at a constant load to absorb dynamic energy by pulling the upset through the polymer (i.e. plough effect).

YL-Static Bolt – In convergence condition, YL-Static Bolt provides consistent yield at specified load by pulling upset through the polymer. Static yielding load of bolt is controlled by varying the dimension of upset.

It is recommended to apply the YIELD-LOK Bolt with mine meshes and straps together to build up a yielding support system to reinforce and retain the rock mass that is subjected to large convergence from dynamic or static loads.

Features

- Suitable in static and dynamic load conditions
- Applicable as primary support
- Provides stiff shear resistance in both dynamic and static conditions
- Compatible with existing ground control system and installation machines
- Performance independent of drill hole diameter and resin properties
- Performance characteristics are consistent through multiple and varying amplitude of impacts
- Engineered polymer coating performs down to -94°F (-70°C).



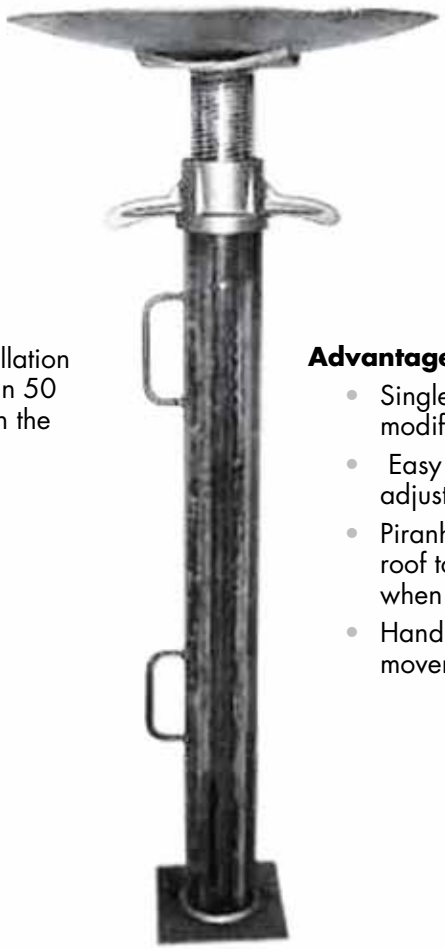
Technical Data – YIELD-LOK Bolt

STEEL GRADE & TYPE	Grade 75 round bar
DIAMETER, NOMINAL, in. (mm)	3/4 (19)
YIELD STRENGTH, MIN., lb (kN)	30,000 (133)
TENSILE STRENGTH, MIN., lb (kN)	40,000 (178)
ELONGATION	8%
DRILL HOLE DIAMETER, RECOMMENDED, in. (mm)	1-1/4 to 1-1/2 (32 – 38)
RESIN CARTRIDGE DIAMETER, RECOMMENDED, in. (mm)	1-1/8 to 1-3/16 (28.6 – 30.2)
POLYMER COATING	
DIAMETER, AVERAGE, in. (mm)	1 (25)
LENGTH, STANDARD OR AS SPECIFIED, in. (mm)	30 (762)
YL - DYNAMIC BOLT	
DYNAMIC YIELD LOAD, lb (kN)	16,000 – 20,000 (71 – 89)
DYNAMIC YIELD DISPLACEMENT	7.87 in. (200 mm) per impact with standard energy input 16.4 kJ
ENERGY ABSORPTION CAPACITY, kJ	Single Impact: 42.6, Accumulative: 50.0
DISPLACEMENT CAPACITY, MAX., in. (mm)	30 (762)
YL – STATIC BOLT	
STATIC YIELD LOAD, lb (kN)	26,000 – 30,000 (116 – 133)
DISPLACEMENT CAPACITY	19.69 in. (500 mm) or more up to length of polymer coating

Rapid Installation Prop (RIP®)

JENNMAR's Rapid Installation Prop (RIP®) is available in 50 or 100 ton supports with the following head devices

- Yieldable Dish
- Channel
- Mini Mat
- Piranha



RIP® with Yieldable Dish Head

Advantages

- Single pipe, height can be modified if necessary
- Easy screw height adjustment
- Piranha top plate engages roof to prevent rotation when tightening
- Handles provide ease of movement.

Channel Head **Mini Mat Head** **Piranha Head**

Rapid Installation Prop RIP - Technical Data

SUPPORT, tons (Metric tons)	TRAVEL, in. (mm)	PIPE, SCH 80, in. (mm)	EXTENSION THREAD, in. (mm)
50 (45.35)	12 (305)	3 (76)	2.0 (51)
100 (90.70)	18 (457)	4 (102)	3.5 (89)

Omni 150 Water Prop

Description

JENNMAR is the exclusive North American Supplier of the Elbroc Omni 150 Water Prop. The Omni 150 is a hydraulic prop that performs in accordance with NIOSH/ CSIR guidelines for rock burst and rock fall conditions.

The Omni 150 is essentially a single stage hydraulic cylinder where water is pumped into the prop using shield emulsion or water. The fluid causes the prop end to extend to the roof line. As pressurized fluid continues to enter the prop, an active roof load up to the yield load rating of the prop can be applied to the mine roof. As roof loading increases and overcomes the setting force, the captured water in the prop increases in pressure, functioning just like a hydraulic cylinder.

The piston in the cylinder includes a yield valve that controls pressure in the cylinder. When the yield pressure is reached, water is relieved though the piston and into the hollow section of pipe on the opposite end of the prop. If the prop is installed with the pressurized cylinder against the mine roof, the relieved water flows into the bottom section and out a small slit in the base of the prop. This action is intended to be a visual sign to indicate that the support is yielding.

ELBROC Mining Products

Features

- 6 in. (150 mm) diameter
- Covers stoping widths up to 19.7 ft (6 m)
- Provides active roof loading with controlled yielding
- Safe remote installation
- Superb energy absorption values
- Load can be varied according to rock conditions, as required
- Only pumping required to set
- Coated cylinder for hydraulic sealing and corrosion resistance
- Unique valve and seal design for constant and continuous loading under all conditions
- Inlet and yield valve are plated for corrosion resistance.

Advantages

- Light, easy and quick to install
- Constant support resistance
- Cannot be overextended
- Resilient in rock burst conditions
- Prop can be re-installed if necessary
- Pump and hoses are only accessories required
- Accommodates numerous seismic events

Elbroc Omni 150 Water Prop

PRODUCT CODE	PROP SIZE, in. (mm)	LABEL	COLOR
OHPEW4759	47-59 (1194-1499)		White
OHPEW5571	55-71 (1397-1803)		Yellow
OHPEW6379	63-79 (1600-2007)		Brown
OHPEW7198	71-98 (1803-2489)		Green
OHPEW91126	91-126 (2311-3200)		Blue
OHPEW102138	102-138 (2591-3505)		Purple
OHPEW142177	142-177 (3607-4496)		Gray
OHPEW181217	181-217 (4597-5512)		Red
OHPEW205236	205-236 (5207-5994)		Black

Additional sizes available upon request.

J-CRIB® Pumpable Crib

QUICK RESPONSE MOBILITY

J-CRIB surface equipment is operated from a flatbed trailer allowing for fast response and relocation. The liquid accelerator is transported and stored in full-size tractor trailer tankers further contributing to the systems mobility.

Description

J-CRIB® is a specialized pumpable cement and containment bag which replaces conventional timber cribs in longwall tailgates and bleeder headings. The state-of-the-art mixing and pumping system, together with the rapid gelling characteristics of the J-CRIB material ensure simple and fast installation. The rapid strength gain provides early resistance to mine roof convergence and bed separation.

J-CRIB is a two part system consisting of Part A and Part B, which when mixed together rapidly react to produce a load bearing mine roof support.

J-CRIB Part A is a non-combustible grey powder which forms an easy to pump slurry when mixed with water.

J-CRIB Part B is a non-combustible low viscosity easy to pump liquid accelerator.

When mixed together, they gel in less than 30 seconds allowing the top of the crib to be pressurized against a stiff base.

Advantages

- High efficiency mixing and pumping equipment
- High yield, approximately 90% by volume water
- Long distance pumping, up to 18,000 ft (5486 m)
- Long pumping life, at least 12 hours
- Consistent performance, pressurization of bags ensures good contact with the mine roof and even load bearing capacity
- Rapid gelling allows bags to be filled completely without additional form work
- Yields controllably to ground pressure

Support

J-CRIB DIAMETER, in. (mm)	SUPPORT, tons (metric tons)
24 (610)	150 (136)
27 (686)	200 (181)
30 (762)	230 (209)

BAGS BY:

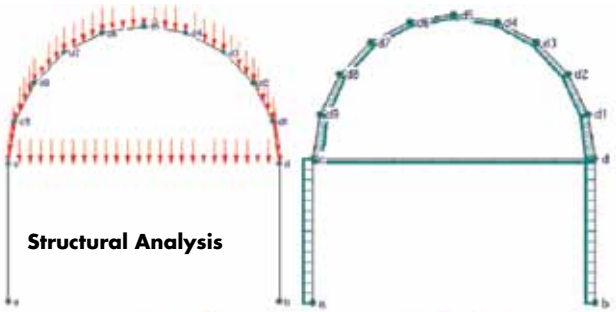
SCHAUENBURG FLEXADUX

Arch Support Systems

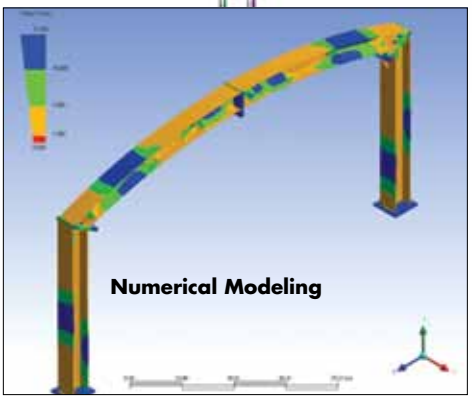
Arch Support Systems

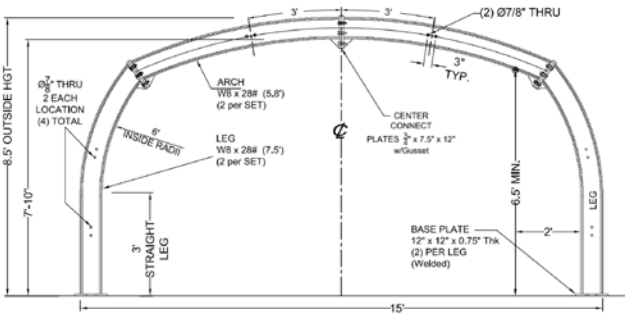
JENNMAR, in conjunction with its affiliate engineering company, Keystone Mining Services can tailor make arch support systems for most applications. Our 3-D modeling enables us to dictate beam sizing and spacing. We can even orientate the configuration of fasteners and butt plates.

- Sound structural design
- Cutting edge steel design per national standard American Institute of Steel Construction (AISC)
- Reliable moment connection design, bolt design, and welding design
- Computerized steel manufacture equipment to ensure quality cutting, drilling, and welding
- Complete accessories (V-decking lagging panel, tie rod, beam extension, leg extension, belt hanger, etc)
- Optimal design per actual engineering requirements
- JENNMAR and KMS can quickly turn conceptual design into actual products within designated period
- Full technical support by KMS including design customization and field installation services

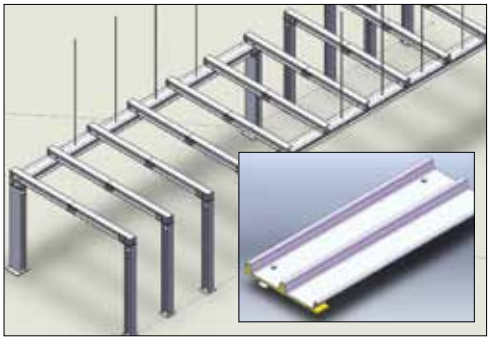


Structural Analysis





Conceptual Engineering

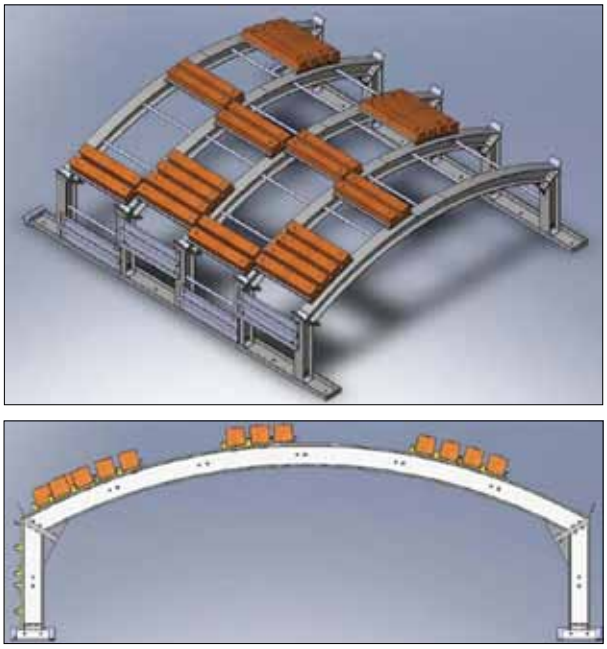


Conceptual 3-D Modeling

IMPACT RESISTANT LAGGING® (IRL™)

Description

To protect mine personnel, belts, moving vehicles and other facilities, mine operators typically install steel structures such as square or arch sets in roof fall areas. Wood lagging is usually installed between the steel sets to enclose the area and protect the entry from recurring falls. JENNMAR, along with KMS our affiliate engineering company, have designed, tested and developed the IMPACT RESISTANT LAGGING® (IRL™) system to protect steel sets. Various steel sets that are protected with IRL panels have been approved by MSHA and installed in several underground roof fall rehabilitation projects.



Impact Resistant Arch Set Design for Roof Fall Rehabilitation

The IRL panel consists of the following components:

V-Deck Panel – Galvanized V-Deck Panel (18 × 46 in. × 12 gage) is used to provide primary flexural strength. Two clips are attached to facilitate easy installation of the lagging panel to the upper flange of the beam.

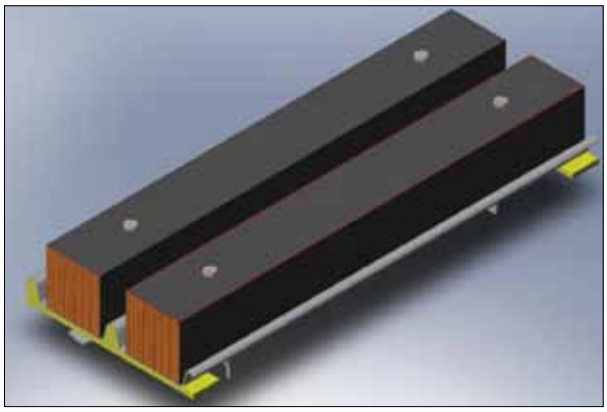
Special Lagging Block (SLB) – Special Lagging Blocks are comprised of two pieces of medium-soft wood (6 × 6 × 46 in.) that are attached to the V-deck panel. The blocks provide additional flexural strength to the system, absorb impact energy, distribute impact load over a larger area of the V-deck panel and extend the duration of impact.

Cushion Inserts – Two pieces of hard foam strip (0.5 in. thick) are installed between the V-deck panel and the flange of the W-beam. The foam strips act as a cushion, increase impact duration and reduce the magnitude of the instantaneous impact load on the system.

Surface Coating – A thin layer of water-proof bonding coating is applied to the surface of the Special Lagging Blocks. The tough-textured coating provides necessary protection against water, acid, chemicals, UV exposure, salt water, abrasion, fire and freeze-thaw. This coating dramatically extends the life span of the SLB when compared with plain wood blocks.

Advantages

- Provides sufficient flexural strength and acceptable cushioning effect
- Corrosion resistant
- Cost effective
- Easy material handling and installation.



IMPACT RESISTANT LAGGING Panel

Lattice Girders

Description

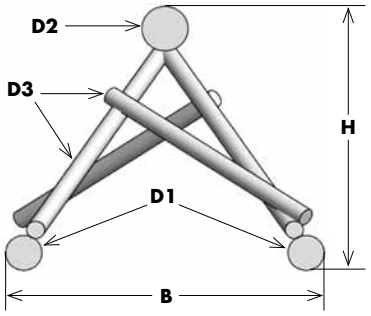
The JENNMAR Lattice Girder support system achieves an excellent level of support when used in conjunction with shotcrete. This union between the lattice girder and shotcrete acts as an armor that provides balanced support and reduced consumption of shotcrete, which in turn lowers cost. This system has been designed to meet the highest mining and tunneling support requirements and the high load capacity delivers immediate support to the stabilized area.

The excellent interaction between the lattice girder and shotcrete derives from the mechanical properties of shotcrete (resistance to compression and pull) along with the geometric characteristics of the lattice girder. The integration of the lattice girder with the layer of shotcrete can be considered under the concept of reinforced concrete.

Since shotcrete does not leave any empty space after application or allow the presence of water, this greatly reduces deformations produced by the rock mass as well as corrosion, thus making the system more durable and resistant.

Advantages

- Base plates: ASTM A36 Steel
- Bars: A66-28H quality
- Reduces weight by lowering quantity of steel, while providing greater compressive strength
- Girder segments can be stacked for shipping
- When used in conjunction with shotcrete, lattice girders allow rapid tunnel advancement to occur as they provide immediate and safe roof support over the excavated area
- Adaptable to irregular terrain
- Reduces concrete bounce to a minimum
- Solution for specific customer requirements
- Low weight facilitates installation process
- Reduces and eliminates empty areas upon shotcrete application
- Immediate support after installed
- Dimensions and characteristics of lattice girders are made according to customer specifications.

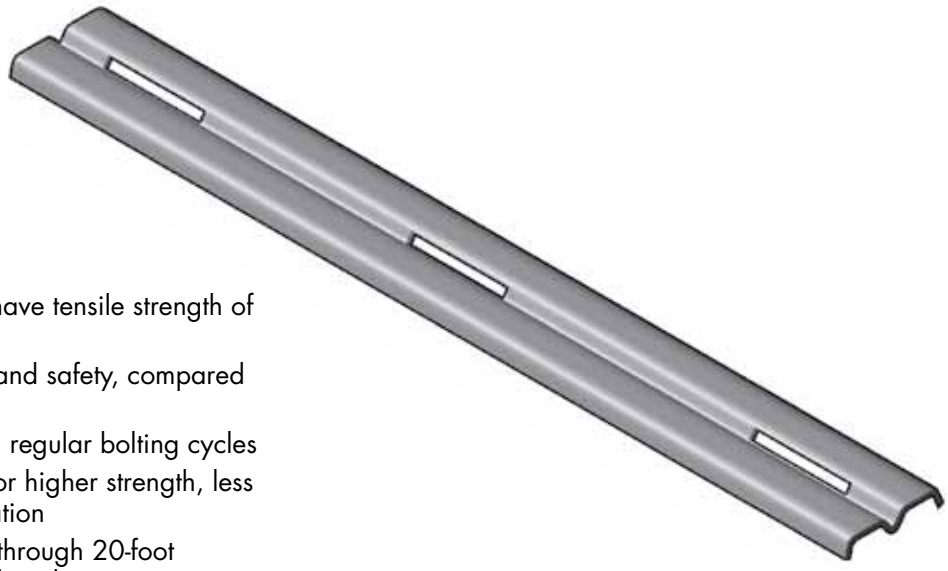


Technical Data - Lattice Girders

Types and sizes are shown for typical Lattice Girders.
Dimensions and characteristics of all JENNMAR Lattice Girders are manufactured according to customer specifications.

TYPE	D1 REBAR	D2 REBAR	D3 REBAR	H, in.	B, in.	A, in.^{2}	W, lb/ft	E, in.	I_x, in.^{4}	S_x, in.^{3}	I_y, in.^{4}	S_y, in.^{3}
50	6	8	4	3.70	3.95	1.67	4.84	2.00	3.40	1.70	2.43	1.23
	6	10	4	4.00	3.95	2.15	6.47	1.86	4.81	2.58	2.66	1.35
70	6	8	4	4.50	5.60	1.67	4.84	2.42	5.54	2.29	5.37	1.92
	6	10	4	4.80	5.60	2.15	6.47	2.19	7.64	3.48	5.60	2.00
	8	11	4	5.15	5.60	3.13	8.65	2.68	12.48	4.65	8.97	3.20
95	6	8	4	5.50	7.10	1.67	4.84	2.95	8.97	3.04	9.08	2.56
	6	10	4	5.75	7.10	2.15	6.47	2.58	11.85	4.59	9.31	2.62
	8	11	4	6.15	7.10	3.13	8.65	3.18	19.44	6.10	15.27	4.30
115	6	8	4	6.30	8.65	1.67	4.84	3.37	12.32	3.65	13.96	3.23
	6	10	4	6.55	8.65	2.15	6.47	2.91	16.13	5.54	14.19	3.28
	8	11	4	6.95	8.65	3.13	8.65	3.59	26.14	7.29	23.64	5.47
130	6	8	4	6.85	8.65	1.67	4.84	3.66	14.92	4.07	13.96	3.23
	6	10	4	7.15	8.65	2.15	6.47	3.16	19.78	6.26	14.16	3.28
	8	11	4	7.55	8.65	3.13	8.65	3.89	31.82	8.19	23.64	5.47

where: Ix = Moment of inertia of cross-section about X-X axis, Iy = Moment of inertia of cross-section about Y-Y axis, Sx = Elastic section modulus about X-X axis, Sy = Elastic section modulus about Y-Y axis.



CHANNELS

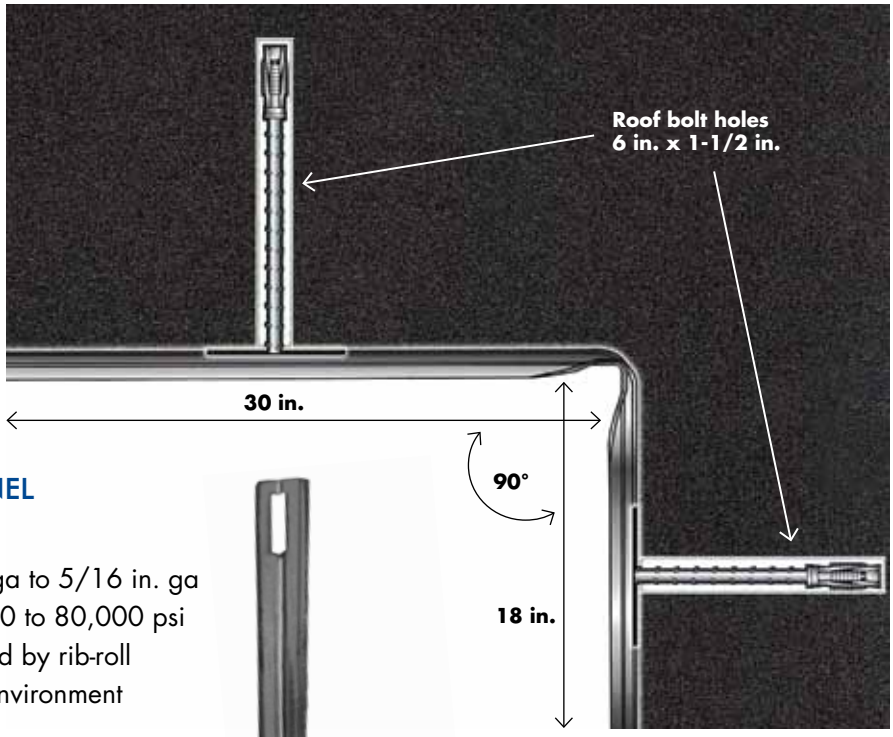
Description

- 7-gauge channels have tensile strength of 60,000 psi
- Increased strength and safety, compared with roof mats
- Easily installed with regular bolting cycles
- #5 steel channels for higher strength, less resistance to ventilation
- Available in 8-foot through 20-foot sections with other lengths on request
- Gauges range from 12 gauge to 5/16 in. Channels have tensile strength of 36,000 to 80,000 psi.
- High beam strength providing resistance to roof sag
- For use with JENNMAR Advanced Channel Plates.

PH® ROOF/RIB SAFETY CHANNEL

Description

- Controls roof/rib sloughage
- Controls “cutter” roof
- Enhances performance of wire mesh
- Easy installation
- Provides active support to roof and rib
- Prevents accidents caused by rib-roll and sloughage
- Promotes safe working environment.



ROOF/RIB SAFETY CHANNEL

Description

- Gauges range from 12 ga to 5/16 in. ga
- Tensile strength of 38,000 to 80,000 psi
- Prevents accidents caused by rib-roll
- Promotes safe working environment
- Easy to install
- Enhances beaming effect
- Provides resistance to roof sag and rib sloughage
- For use with JENNMAR® Channel Plate.

ROOF MATS

Description

- Temporary or permanent preventive for roof deterioration, as addition to roof bolt plan
- Lengths 54 in. to 240 in.; seven widths from 4-1/2 in. to 10-1/2 in.
- Gauges 12, 14, 16
- Hot rolled, cold rolled, galvanized
- Strong and flexible; bolt holes punched to suit your roof bolt plan

J-CHANNEL BEAMS

Description

- J-Channel uses 3/16 in. high strength steel with 50,000 psi yield strength and can replace wooden timber beams from 3 × 6 up to 3 × 10 in.
- Lightweight, weighing only 9.58 lb/ft. Easy to handle reducing handling injuries
- Choice of steels and thicknesses providing a variety of strength
- Compact dimensions allowing larger quantities to be easily stored in mine
- Tabs on each end provide better support of mine props or timbers if required
- Can be installed in mining cycle; other shifts can install yieldable legs or props where needed
- INSTáL® or Combination bolts and resin with flat plates are recommended for cost saving
- Available in 8 through 18 ft sections with other lengths on request.

WIDE FLANGE BEAMS

Description

JENNMAR will fabricate lengths of Wide Flange Beams (W Beams) to customer's individual needs. Wide Flange Beams are available in the following material dimensions:

Wide Flange Beams (W Beams)

NOMINAL DIMENSIONS		NOMINAL WEIGHT	
in.	mm	lb/ft	kg/m
W 14 × 6-3/4	356 × 171	30, 34, 38	45, 51, 57
W 14 × 5	356 × 127	22, 26	33, 39
W 12 × 8	305 × 203	40, 45, 50	60, 67, 74
W 12 × 6-1/2	305 × 165	26, 30, 35	39, 45, 52
W 12 × 4	305 × 102	14, 16, 19, 22	21, 24, 28, 33
W 10 × 8	254 × 203	33, 39, 45	49, 58, 67
W 10 × 5-3/4	254 × 146	22, 26, 30	33, 39, 45
W 10 × 4	254 × 102	12, 15, 17, 19	18, 22, 25, 28
W 8 × 8	203 × 203	48	71
W 8 × 8	203 × 203	31, 35, 40	46, 52, 60
W 8 × 6-1/2	203 × 165	24, 28	36, 42
W 6 × 4	152 × 102	9, 12, 16	13, 18, 24
W 6 × 4	152 × 102	8.5	13
W 5 × 5	127 × 127	16, 19	24, 28
W 4 × 4	102 × 102	13	19
W 8 × 5-1/4	203 × 133	18, 21	27, 33
W 8 × 4	203 × 102	10, 13, 15	15, 19, 22
W 6 × 6	152 × 152	15, 20, 25	22, 30, 37

WIRE MESH

Description

JENNMAR's Welded Wire Mesh is produced with totally trimmed flush edges, assuring an extra measure of worker protection. Wire mesh mats are engineered to give extended and dependable protection in material and surface control applications.

- Available in 2 × 2, 4 × 4, 6 × 6 in. patterns in both sheets and rolls
- Available with galvanized coating
- Ends and sides are flush cut
- Available in the following gauges: 4, 6, 8, 9, 10
- Standard sheet and roll sizes: Width 48 to 96 in.; Length 48 in. to 24 ft.

MINEMESH™

Description

MineMesh™ is a lightweight, easy-to-install grid material for use as a supplemental support in rib control systems, offering unsurpassed strength-to-weight ratio. In addition, MineMesh received acceptance by MSHA as a flame resistant[1] product for use in mines and provides structural strength, exceptional handling and superior protection.

GLEN RAVEN

Structural and Mechanical Properties	UNITS	MD VALUES	XMD VALUES
ULTIMATE TENSILE STRENGTH[2]	lb/ft (kN/m)	2000 (29)	2000 (29)
ROLL WEIGHT*	lbs (lb/10ft)	52 (2.79)	
APERTURE DIMENSIONS	in. (mm)	1.6 (41)	1.6 (41)
MINIMUM RIB THICKNESS	in. (mm)	0.04 (1.0)	0.04 (1.0)
PRODUCT WEIGHT[3]	oz/yd² (g/m²)	5.0,-1/2, (170)	5.0,-1/2, (170)

[1] MineMesh™ carries M.S.H.A. Acceptance number IC-265/01 and passes all requirements of flammability resistance determined from vertical and horizontal flame tests in accordance with 30 CFR, Part 7, Subpart A & B and ASTP5011 - Standardized Small Scale Flame Test Procedure for the Acceptance of Roof-Rib Grid.

[2] Attained via ASTM D 6637, Product will meet or exceed above specification.

[3] Attained via ASTM D 5261, Product will meet or exceed above specification.

*Dimensions and Delivery

MineMesh™ will be delivered with each roll containing unique identification information, UV protective packaging with standard roll dimensions of nominally 2 meters (78 in.) wide and 56.7 meters (186 ft) long. Standard roll will weigh 52 lbs (+/- 5 lbs).

Plates

JENNMAR's engineers have developed a variety of plate products for the mining and tunneling industries. JENNMAR's plate products help distribute the roof bolt load evenly in all directions to prevent loose strata from falling between the roof bolts. Plate products are inspected upon arrival from the mill and then re-inspected prior to shipment promoting a safe underground work environment. All plates are designed to be high strength and lightweight in accordance with ASTM F432.

JENNMAR maintains two steel processing locations that supply all of JENNMAR's U.S. based strata control plants. JM Steel®, located in Huger, SC, began production in 2000 and is next to Nucor Steel's ultra modern 3 million ton/yr hot and cold rolled steel mill. Being located next to a world leader in coil production, JENNMAR is able to provide steel plate to its customers in the most timely and efficient manner.

INSTALLATION

JENNMAR Roof & Rib Plate

- Increased surface area 18 × 18 in.
- Double rib design for extra high strength
- New rolled edge for increased safety, handling and strength
- Lightweight for handling and stacks easily
- Provides increased surface support when used with 6 × 6 or 8 × 8 in. plate
- Standard center hole is 1-3/8 in. diameter with optional 1 in. diameter hole.

Advantages

- High strength, lightweight, low profile plate products
- Plate ratings range from 20,000 to 60,000 lb
- Plates distribute roof bolt load evenly in all directions and will not buckle or dog ear under high load conditions
- Manufactured under rigid quality-control conditions
- Customized sizes and coatings are available upon request.

Channel Plate

- Channel plate systems offer superior performance in mining and tunneling industries
- Designed exclusively for use with JENNMAR's T-2 through T-5 channel
- Distributes bolt tension uniformly over entire plate and channel. Bolt plate and channel work as complete system to resist vertical and lateral movement
- For use with any bolt system. Specifically designed for INSTáL Point Anchor System.

SHADOW PLATE®

- Galvanized or black
- Controlled edge shearing to eliminate sharp jagged edges
- Ideal for added surface coverage with added strength
- Lightweight with large surface area
- 12 × 12 in., 14 Gauge thickness
- Maximum 2 in. hole diameter
- Can be welded to other plates to form combination plate.

Plates

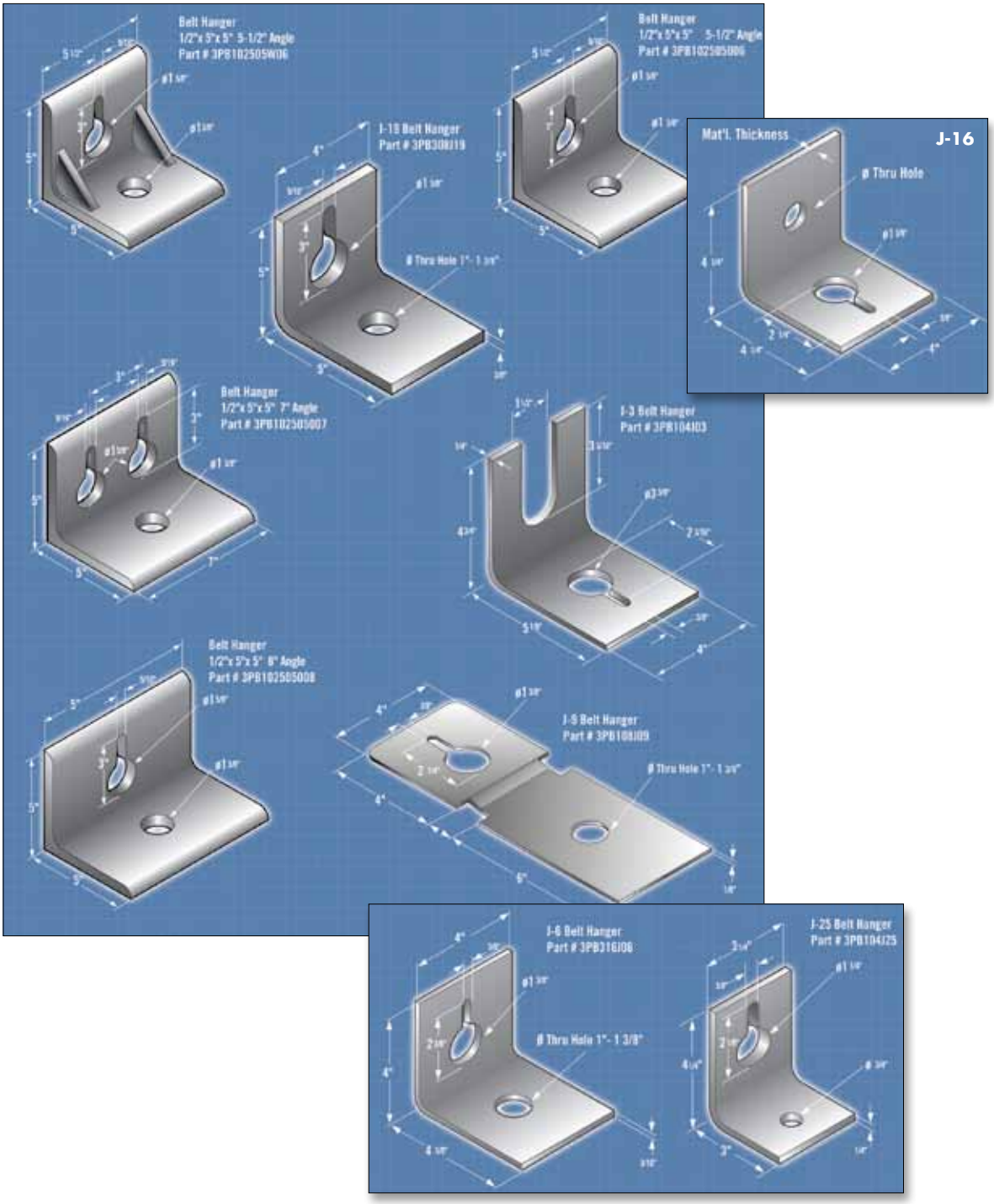
Technical Data – Plate Products

	NOMINAL SIZES, in. (mm)	NOMINAL THICKNESSES, in. (mm)	HOLE DIAMETERS, in. (mm)
DONUT PLATE 	5 × 5 (127 × 127) 6 × 6 (152 × 152) 8 × 8 (203 × 203) 9 × 9 (229 × 229) 12 × 12 (305 × 305)	5/32 (4.0) 3/16 (4.8) 7/32 (5.6) 1/4 (6.4)	13/16 – 1-9/16 (20.7 – 39.7)
FLAT PLATE 	4 × 4 (102 × 102) 5 × 5 (127 × 127) 6 × 6 (152 × 152) 8 × 8 (203 × 203)	1/4 (6.4) 5/16 (8.0) 3/8 (9.5) 1/2 (12.7)	1 – 1-5/8 (25.4 – 41.3)
DOME PLATE 	5 × 5 (127 × 127) 6 × 6 (152 × 152) 8 × 8 (203 × 203)	5/32 (4.0) 3/16 (4.8) 1/4 (6.4) 5/16 (8.0)	7/8 – 1-15/16 (22.2 – 49.2)
VOLCANO PLATE 	6 × 6 (152 × 152) 8 × 8 (203 × 203)	1/4 (6.4) 5/16 (8.0) 3/8 (9.5)	1-3/8 – 1-5/8 (34.9 – 41.3)
CHANNEL PLATE Donut or Domed 	5 × 7-3/8 (127 × 187)	7/32 (5.6)	1 – 1-3/8 (25.4 – 34.9)
HEADER PLATE Bell Style 	6 × 16 (152 × 406)	3/16 (4.8) 7/32 (5.6)	1 - 1-3/8 (25.4 – 34.9)
HEADER PLATE Race Track Style 	6 × 10 (152 × 254) 6 × 16 (152 × 406)	5/32 (4.0) 1/4 (6.4)	13/16 - 1-3/8 (20.7 – 34.9)

*All plate styles except channel plates are available with hanger openings.
**Customized sizes are available upon request.

Belt Hangers

JENNMAR offers a complete line of belt hangers to be used for hanging belt structure within the mine. Below are some common belt hanger assemblies that we are selling throughout the industry. If you need a different assembly let our experienced team of engineers work with you in designing a hanger that fits your needs.



Rail Ties

JENNMAR offers a complete line of steel & iron clad ties to the mining and tunneling industries. We can engineer our ties to meet your specific haulage application. Our ties can be designed for any type of rail and gauge.

Our steel ties feature special riveted rail clips for No. 4 and No. 5 mine ties. They are lightweight and easy to handle. Our quality control standards ensure consistent track gauging, and superior strength steel. Our new shortleg tie adds strength to our previous design.

JENNMAR's iron clad ties have been redesigned to accommodate our new No. 6 shortleg steel tie. The flat section of the top of the tie mates perfectly with the flat section of the top of the wood providing crush resistance exceeding 20,000 lbs.

Steel Mine Tie #6. Shortleg design for superior crush resistance.

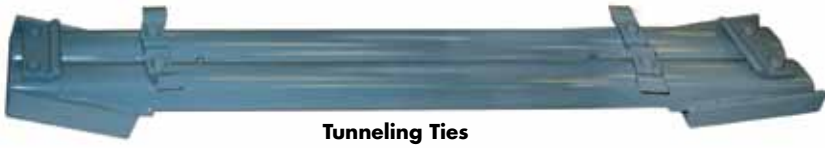
JENNMAR can also provide custom galvanized ties to our customer's specifications. Galvanizing may be completed on assembled ties or on each component and then assembled to meet our customer's needs.

Other advantages you will realize by using JENNMAR ties:

- Designed for easy installation
- Lend themselves to the most punishing main line haulage needs
- Do not require constant inspection and maintenance

Tunneling Ties

Tunneling Ties are specifically designed for use in tunnel projects where the bottom surface is not flat. These tunneling ties are designed to project specifications for tunnel diameter, wheel load and tie spacing. They can be used without blocking and provide engineering support while maintaining proper track gauge. Axle loads of 45,000 lb on 30 in. tie spacing have been successfully implemented.



Tunneling Ties

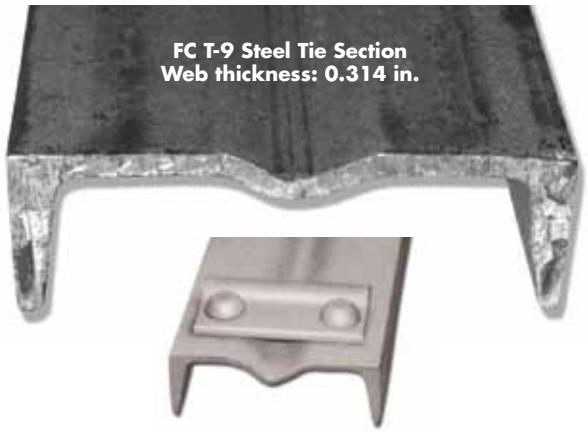
Technical Data – Rail Ties

TIE SECTION	WEIGHT, lb/ft (kg/m)	RAIL SECTION, lb (kg)
T-4	3.85 (5.7)	30 – 60 (14 – 27)
T-5	5.0 (7.4)	30 – 60 (14 -27)
T-6	6.0 (8.9)	40 – 85 (18 – 39)
T-9	10.5 (15.6)	60 – 100 (27 -45)

T-9 STEEL RAIL TIES

JENNMAR now offers a stronger T-9 Steel Rail Tie. This design, can be manufactured for any special application. The T-9 is designed for mining and industrial applications such as: coal, hard rock, factories, mills, quarries, tunnel, and various construction projects. This heavy duty design provides long-life use.

- For 30-lb rail and heavier
- Easily installed; manufactured to fit any track gauge; assures exact and constant track gauge
- Readily available from all JENNMAR locations



FC T-9 Steel Tie Section
Web thickness: 0.314 in.

Galvanized & Coated Products

JENNMAR is capable of providing the following types of coated products:

- **Galvanized Products**
- **Powder Coated Products**
- **Epoxy Coated Products**

GALVANIZED PRODUCTS

Galvanized products use zinc coatings that serve as a sacrificial metal corroding preferentially to steel. Galvanized products have excellent bond characteristics to grout or concrete and do not require as much care in handling as epoxy coated products. However, galvanization of some products such as anchor rods is more expensive than epoxy coating and often has greater lead time. Hot dip galvanizing bars and fasteners should be done in accordance with ASTM A153. Typical galvanized coating thickness for steel bars and components is between 3 and 4 mils. *High strength steel bars (150 ksi) must be mechanically cleaned and never acid washed to avoid problems associated with hydrogen embrittlement.*

POWDER COATED PRODUCTS

Powder coated products use a free-flowing dry powder that does not require a solvent to keep the binder and filler parts in a liquid suspension form. The powder may be a thermoplastic or a thermoset polymer. The coating is applied electrostatically and cured under heat to allow it to flow and form a hard finish that is tougher than conventional paint. Powder coat finishes utilize an extensive pre-treatment process that cleans the metal using iron phosphate to ensure superior performance and adhesion of the powder coating.

EPOXY COATED PRODUCTS

Fusion bonded epoxy coating of steel bars has been successfully employed in many applications to prevent corrosion due to the chemical stability of epoxy resins. Epoxy coating of bars and fasteners should be performed in accordance with ASTM A775 or ASTM A934. Coating thickness is generally specified between 7 to 12 mils. Epoxy coated bars and components are subject to damage if dragged on the ground or mishandled. Heavy plates and nuts are often galvanized even though the bar may be epoxy coated since they are difficult to protect against abrasion in the field. Epoxy coating patch kits can be made available in the field for repairing nicked or scratched epoxy surfaces.

Galvanized & Coated Products

PRODUCT	COATING TYPE		
	GALVANIZED	POWDER COATED	EPOXY COATED
CABLE BOLTS	X		
CABLEOX® CABLE BOLTS			X
THREAD BAR	X		X
FRICTION-LOK STABILIZER SYSTEM	X		
CHANNELS		X	
ROOF, RIB AND CHANNEL PLATES	X	X	
ROOF MATS	X		
RIB MATS	X	X	
WIRE MESH	X		
RAIL TIES	X		
V-DECK LAGGING	X		

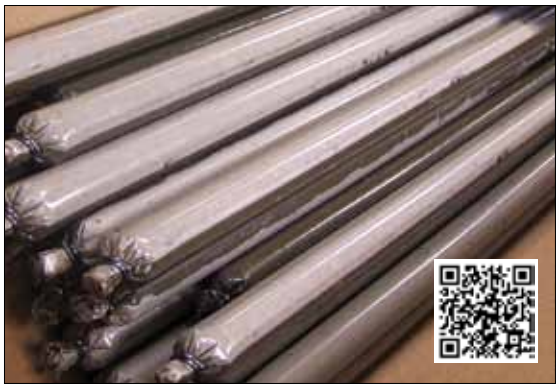
J-LOK® Resin

Description

J-LOK® Resin was developed to allow bolts, in a variety of lengths, to be grouted and anchored in one simple operation, without the need for injection equipment.

J-LOK produces resin products to complement JENNMAR products and provide an optimum system of bolt and resin.

J-LOK equipment is the most modern and technologically advanced in the resin business, equipped with the most accurate system for ratio control of the resin/limestone mixture ensuring that resin/catalyst proportions are consistent. The entire plant is interconnected to provide coordinated control of the entire process.



TWIN-LOK®

- Used with fully grouted torque/tension bolts
- Combines fast setting point anchor resin with slower setting resin for full encapsulation of tensioned zone
- Only one full length TWIN-LOK cartridge per bolt
- Easier to install in difficult conditions
- Easier to control inventory and supply mining sections
- Allows roof bolter to install resin cartridge and bolt from normal operating position for safer installation.

The following tables shows measurements of bolt encapsulation based on the standard 12 in. (305 mm) J-LOK resin cartridge. This data should only be used as a guide based on average drilling conditions. Please contact our resin experts and conduct field tests to determine actual resin requirements.

Resin Usage Guide for Mining

	CARTRIDGE DIAMETER, in. (mm)						
	0.9 (23)	1-1/8 (29)	1-1/4 (32)	1-1/4 (32)	1-1/4 (32)	1-3/8 (35)	1-3/8 (35)
BOLT SIZE	BOLT ENCAPSULATION per ft (305 mm) of Resin, in. (mm)						
#6 (19 mm)	19.1 (485)	12.4 (315)	—	—	—	—	—
#7 (22 mm)	—	15.6 (396)	14.4 (366)	—	—	13.0 (330)	—
#8 (25 mm)	—	22.0 (559)	18.2 (462)	12.9 (328)	11.8 (300)	15.5 (394)	11.8 (300)
#9 (29 mm)	—	—	—	16.5 (419)	15.0 (381)	19.7 (500)	14.1(358)
#10 (32 mm)	—	—	—	—	—	—	18.0 (457)
BOREHOLE DIAMETER, in. (mm)	1 (25)	1-1/4 (32)	1-3/8 (35)	1-1/2 (38)	1-5/8 (41)	1-1/2 (38)	1-5/8 (41)

Resin Usage Guide for Tunneling & Civil Construction

	CARTRIDGE DIAMETER, in. (mm)							
	0.9 (23)	0.9 (23)	1-1/8 (29)	1-1/4 (32)	1-1/4 (32)	1-1/4 (32)	1-3/8 (35)	1-3/8 (35)
BOLT SIZE	BOLT ENCAPSULATION per ft (305 mm) of Resin, in. (mm)							
#6 (19 mm)	19.3 (490)	12.0 (305)	13.2 (335)	—	—	—	—	—
#7 (22 mm)	—	16.9 (429)	16.6 (422)	14.5 (368)	—	—	—	—
#8 (25 mm)	—	—	23.5 (597)	18.3 (465)	13.0 (330)	—	15.8 (401)	12.0 (305)
#9 (29 mm)	—	—	—	26.1 (663)	16.6 (422)	11.9 (302)	20.0 (508)	14.3 (363)
#10 (32 mm)	—	—	—	—	23.7 (602)	15.1 (384)	28.7 (729)	18.3 (465)
BOREHOLE DIAMETER, in. (mm)	1 (25)	1-1/8 (29)	1-1/4 (32)	1-3/8 (35)	1-1/2 (38)	1-5/8 (41)	1-1/2 (38)	1-5/8 (41)

Blank spaces indicate bolt and hole combinations that are Not Recommended. Calculations allow for 15% excess resin for bolt/borehole irregularities.

Technical Data – J-LOK Resin Cartridges

CARTRIDGE DIAMETER, in. (mm)	HOLE DIAMETER, in. (mm)	BOLT TYPE	BOLT DIAMETER, in. (mm)	J-LOK SYSTEM*	PRODUCT USE CLASS	STRENGTH INDEX
0.9 (23)	1 (25)	#6 Rebar	3/4 (19)	**A**	I, II, III	10
0.9 (23)	1 (25)	Point Anchor #6 Tension	3/4 (19)	**A-TA**	I, II, III	10
0.9 (23)	1 (25)	#5 Rebar	5/8 (16)	**B**	I, II, III	10
0.9 (23)	1 (25)	Cable	0.5, 0.6, 0.7 (13, 15, 18)	**CA, A, B**	I, II, III	10
0.9 (23)	1 (25)	INSTaL Resin	5/8 (16)	**BI**	I, II, III	10
1.25 (32)	1-3/8 (35)	#7 Rebar	7/8 (22)	**J, CJ, JI**	I, II, III	10
1.25 (32)	1-3/8 (35)	Cable	0.5, 0.6, 0.7 (13, 15, 18)	**CJ**	I, II, III	10
1.25 (32)	1-3/8 (35)	INSTaL Resin	3/4 – 7/8 (19 – 22)	**JI**	I, II, III	10
1.25 (32)	1-3/8 (35)	Combination	7/8 (22)	**CBJ, J**	I, II, III	10
0.9 (23)	1 (25)	#6 Rebar	3/4 (19)	**TA**	I, II, III	10
0.9 (23)	1 (25)	#5 Rebar	5/8 (16)	**TB**	I, II, III	10

* Designated J-Lok Systems are shown for typical applications and can be used for other bolt types and sizes.

GEL, SPIN AND HOLD TIMES

Gel Time

Generally, the sum of the Spin Time and Hold Time is the Gel Time. The time from the start of mixing until the resin starts to harden is the Gel Time. Gel Time is influenced by temperature of resin, strata and bolt. Additionally, the amount of heat generated in mixing during the spin time also affects Gel Time. Field trials are recommended.

Spin Time

Cartridge contents should be completely mixed to achieve maximum anchorage. The generally accepted mix standard is a minimum of 30 revolutions of the bolt. Spin Time is the time required, at typical bolter rotation of 600 – 800 rpm, to achieve the complete mix.

Hold Time

After the cartridge contents are mixed, the resin must harden to achieve strength. The time required after mixing is completed and the bolt has achieved a firm anchorage is referred to as Hold Time.

Storage

J-LOK resin cartridges should be stored away from direct sunlight in a dry, cool, well ventilated area. Storage under adverse conditions will reduce shelf life. Product should not be subjected to temperatures above 90° F (32° C) for prolonged periods. J-LOK resin is formulated to be used at 55-60° F (13-16° C). At lower temperatures, gel time will be slower than normal and at higher temperatures the gel time will be faster than normal. For best results, pallets and cases of J-LOK resin should be allowed to acclimate to mine temperature.

Gel, Spin and Hold Times

GEL TIME, sec	SPIN TIME, sec	HOLD TIME, sec	COLOR CODE
10	3 to 5	3 to 8	Pink
20	3 to 6	4 to 8	Orange
30	3 to 7	8 to 15	Blue
45	4 to 9	8 to 20	White
60	5 to 10	18 to 28	Green
75 & 90	5 to 10	20 to 40	Green/White
120	5 to 10	25 to 75	Yellow
120 – 240 & higher	5 to 15	45 to 240	Yellow/White
TWIN-LOK, 10	3 to 5	3 to 5	Pink/White
TWIN-LOK, 20	3 to 6	3 to 6	Orange/White

J-CRETE™ Engineered Cementitious Composite

Description

J-CRETE™ is a fiber-reinforced, cementitious material designed to be sprayed on at 1/4 inch (6 mm) and up to 1 inch (24 mm) thick in a single application providing structural support and impermeable protection. It is designed to provide high strength support and stabilization in varied conditions. J-CRETE is extremely versatile and can be used anywhere there is potential for strata deterioration.

Advantages

- Nonflammable
- Designed to hydrate mixture uniformly
- No rebound during application
- Adheres to wet coal, fireclay, black shale, limestone, shale, and galvanized metal
- Contains no polymers, resins, epoxies, or other harmful chemicals
- Can be used at temperature range between 35 to 105°F (2 to 41°C)
- Does not produce dust at nozzle or require personnel working inby to be removed resulting in production loss.
- Designed to produce consistent strength and performance
- Rapid installation rate of 1200 ft^2 (111 m^2) per hour with 4 man crew.

Technical Data – J-CRETE

PROPERTIES	VALUES	CURE AGE	TEST STANDARD
COMPRESSIVE STRENGTH, Average	1548 psi (10.7 MPa) 3513 psi (24.2 MPa) 5498 psi (37.9 MPa) 6845 psi (47.2 MPa) 7362 psi (50.8 MPa)	24 hours 3 days 7 days 14 days 28 days	ASTM C109-08
FLEXURAL STRENGTH, Average (3 point bending)	339 psi (2.3 MPa) 567 psi (3.9 MPa) 728 psi (5.0 MPa) 930 psi (6.4 MPa) 995 psi (6.9 MPa)	24 hours 3 days 7 days 14 days 28 days	ASTM C348-08
SHEAR BOND STRENGTH	291 psi (2.0 MPa)	7 days	ASTM D4501
TENSILE BOND STRENGTH (test in Laboratory, High strength concrete as substrate)	244 psi (1.7 MPa) 300 psi (2.1 MPa) 351 psi (2.4 MPa) 358 psi (2.5 MPa)	3 days 7 days 10 days 28 days	ASTM C1583-04
TENSILE BOND STRENGTH (test in field)	125.3 psi (0.9 MPa) Failure on Sandstone 128 psi (0.9 MPa) Failure on Shale 100 psi (0.7 MPa) Failure on Coal	6 days 6 days 8 days	ASTM C1583-04 & NIOSH Guidelines
FLEXURAL TENSILE STRENGTH	600 psi (4.1 MPa)	28 days	ASTM C78-04
AVERAGE RESIDUAL STRENGTH	740 psi (5.1 MPa) Peak 76 psi (0.5 MPa) Average Residual	14 days	ASTM C1399
PERMEABILITY	$3.4x10^{-9}$ to $6.9x10^{-10}$ cm/sec	—	ASTM D5084-03
FLAMMABILITY	Flame Spread Index = 0.67	—	ASTM E162
FREEZE/THAW	50 cycles, no damage	—	ASTM C1186
POTABLE WATER	Meets or exceeds standards	—	TNI and EPA

Applications

Here are some of the more common applications:

- Coal Mines: Cutters, Rib Reinforcement, Brow Support, Mine Entry Rehabilitation
- Hard Rock Mines: Vent Walls and Pillars
- Highwall Loose Keystone Reinforcement
- Bridge Abutment Rehabilitation
- Canopy Sealing
- Water Diversion with Weep Systems
- Cave Restoration
- Mine Ventilation Shafts.

PUMPING EQUIPMENT

J-CRETE is applied with diesel or electric hydraulic pumping equipment. Diesel equipment is utilized where permissible for higher clearance or surface applications, while the electric hydraulic pump unit is capable of being utilized in low vein mines.

The low vein electric hydraulic pump unit has its own on board air compressor that provides a constant air pressure volume of 130 ft^3/min (3.7 m^3/min) and pressure of 100 psi (6.9 bar) at the nozzle. This air pressure is a key component to a high production application as well as ensuring that J-CRETE is applied with force into small cracks in the strata and for proper verification of the mixture which facilitates curing and proper fiber distribution.

Pump Design

- Hydraulic discharge into hopper
- Weatherproof control panel
- Engineered and designed to minimize problems and maximize output with minimal down-time
- Permissible pumps are available for application at any location in the mine
- Specialty pumps are available
- Optional pumps can be used to reduce pumping distances
- Low profile electric pumps, mixers, and compressors can be utilized as three separate components to allow for easy access and use in low vein seams and facilitate underground transport
- Surface pumps are readily available and can be skid or trailer/rubber tire mounted for surface transportation from multiple sites
- Rental mixers, pumps, and compressors are available for surface applications.

Technical Data – Diesel Pump

PUMP OUTPUT	5 yd^3 (3.6 m^3) per hour
ENGINE	MSHA approved diesel, 46 hp with 10 gal (37.8 L) fuel tank
REMOTE CONTROL	By Operator with 100 ft (30 m) cable
MIXING CAPACITY	10 ft^3 (0.28 m^3)
PUMP PRESSURE	1700 – 2400 psi (117.2 – 165.5 bar)

Technical Data – Low Vein Electric Hydraulic Pump & Compressor

DIMENSIONS	Width: 6 ft (1.8 m) Length: 10 ft (3.1 m) Height: 40 in. (1016 mm)
MOTOR	480 V, 3 Phase
AIR PRESSURE (AT NOZZLE)	Volume: 130 ft^3/min (3.7 m^3/min) Pressure: 100 psi (6.9 bar)

PUR70 Polyurethane Resin

PUR70 Polyurethane Resin is a two-component polyurethane resin system that can be processed through low or high pressure dispensing equipment. When properly mixed at a ratio of one to one, PUR70 cures to a rigid polymer with high physical properties, resistance to water and chemical attack, and long term durability. The fast reactivity of PUR70 is used to stop high water flows and consolidate loose rock strata.

The product's high adhesive strength, outstanding mechanical properties and flexibility create an excellent bond with the strata. When injected into the strata for preventive or curative purposes, the low viscosity mixture remains liquid for several seconds and penetrates into the smallest fissures. The polyurethane then expands, sets and effectively consolidates and seals the threaded zone.

PUR70 can be applied with various types of dual piston pumps.

Applications

Typical applications include:

- Ground consolidation in the event of fractured and unstable ground
- Sealing against water ingress
- Injection of rock bolts (see JM Cable Bolts)
- Ground stabilization
- Storm water systems, tunnels, manholes & underground vaults
- Concrete and earthen dams.

Advantages

- Low viscosity product with good penetration into small fissures
- Non-flammable, non-toxic and does not contain any Volatile Organic Compounds (VOCs)
- Excellent adhesion, resistance and durability
- Ground cohesion quickly re-established under wet or dry conditions
- High flexibility, coherence maintained even in the event of strata movement
- Swells in the presence of water, suitable for stemming water ingress
- Full mechanical strength achieved very quickly, resulting in minimum disruption to workplace.

Storage and Shelf Life

Product is moisture sensitive. Store product in original sealed containers at temperature range of 60 – 90° F (15 – 32°C). Opened containers must be handled properly to prevent moisture contamination. Shelf life is 12 months when properly stored.

Technical Data – Solid Cured PUR70 Polymer Resin

		TEST METHOD
DENSITY, lb/ft³ (kg/m³)	70 (1121)	ASTM D-1622
COMPRESSIVE STRENGTH, psi (MPa)	10,000+ (70+)	ASTM D-1621
TENSILE STRENGTH, psi (MPa)	5100 (35)	ASTM D-638
SHEAR STRENGTH, psi (MPa)	10,000+ (70+)	ASTM D-732
FLEXURAL STRENGTH, psi (MPa)	10,000+ (70+)	ASTM D-790
WATER ABSORPTION (by volume)	<1%	ASTM D-2842
ELONGATION	8%	ASTM D-638
GEL TIME (ratio of 1:1 by volume)		
77°F (25°C)	45 seconds	—
50°F (10°C)	60 seconds	—

Technical Data – PUR70 Polyurethane Resin

PHYSICAL PROPERTIES – LIQUID	RESIN A	RESIN B	TEST METHOD
VISCOSITY, cps	250	500	ASTM D-1638
SPECIFIC GRAVITY	1.23	1.10	ASTM D-1475
COLOR	Dark amber	Light amber	—
FLASH POINT, °F (°C)	>250 (121)	>250 (121)	ASTM D-92

MARISIL® E Pumpable Resin

Description

MARISIL® E Pumpable Resin is a two-component elastic organo mineral resin that comprises a silicate and a modified polyisocyanate intended for:

- Strata consolidation in T-junction area
- Coal face reinforcement.

The two-component resin is delivered by a pump unit and injected in a ratio of 1:1 by volume through a mixing gun. The resulting medium sets to produce an elastic non-foaming mass with outstanding adhesive and compressive strength.

When injected into the strata, the medium flows into the cracks and fissures and rigidifies, thereby creating an elastic bond that is capable of retaining its integrity even after rock movement has occurred. MARISIL Pumpable Resin remains unaffected by water, is non-foaming and can even adhere to damp surfaces.

Component Data – MARISIL E Pumpable Resin

	RESIN	CATALYST
DENSITY AT 77°F (25°C), oz/in.^{3} (g/cm^3)	0.87 (1.5)	0.64 (1.1)
VISCOSITY AT 77°F (25°C), mPa.s	300	110
MIXING RATIO (in volume)	1	1
SHELF LIFE AT 68°F (20°C), months	6	6
STORAGE TEMPERATURE, °F (°C)	41 – 86 (5 – 30)	41 – 86 (5 – 30)

Reaction Data – MARISIL E Pumpable Resin

	59°F (15°C)	77°F (25°C)
SETTING TIME (MIN)	3:30	2:30
COMPRESSIVE STRENGTH AT 50% DEFORMATION, psi (MPa)	>3626 (25)	>3626 (25)
FLEXURAL STRENGTH, psi (MPa)	>1450 (10)	>1450 (10)
ADHESION TEST ON CONCRETE BOND STRENGTH AT 86°F (30°C) AFTER 30 MINUTES, psi (MPa)	>653 (4.5)	>653 (4.5)

Above values were obtained in laboratory tests and may vary according to site application conditions.

J-SEAL® Foam Cement

Description

J-SEAL® is a specialized foaming cement which can be used for backfilling behind steel sets or other general backfilling applications in coal or hard rock mining. JENNCHEM's 120 psi Mainline J-SEAL is MSHA approved* and and can be used with a variety of form designs including wood, concrete block, props and mesh.

The material is designed to be installed with a JENNCHEM continuous placer type pump. The rapid strength gain provides early ground support to the surrounding strata.

Advantages

- Rapid application: 20 cubic yards per hour
- Good flow properties which allows material to penetrate and consolidate broken ground
- Rapid gel, minimizes leakage
- Yieldable, yields to ground pressure
- High volume output: 6-8 bags/yard
- High strength: 100-150 psi and excellent durability
- Acid mine water resistant
- Packaged in 45 lb polyethylene lined paper bags on stretch wrapped pallets with 48 bags/pallet.

Installation

- Calibration and pump set up needs to be carried out by qualified JENNCHEM personnel or authorized contractors
- A minimum of 600 ft of 1-1/4 in. mine spray hose or slick line is required from the placer to the job site
- Underground requirements:
  - Water 20 gpm @ 50 psi (100 psi if water heater required)
  - AC Power @ 460 V.
- Requires only light form work and sealing of large gaps.

J-SEAL Placer Pump Specifications

MOTOR, 20 HP	21 amps @ 460 V 18 amps @ 575 V Cable Size #6
WATER HEATER	90 amps @ 460 V 110 amps @ 575 V Cable Size #2

J-SEAL Placer Pump

*MSHA APPROVAL NUMBER: 120M-15.0

ROCSIL® FOAM

Description

ROCSIL® FOAM is a phenolic foam for injection and cavity filling. It is a two component injection product that is applied using a pump unit and mixing gun. The mixing of resin and catalyst in a volume ratio of 4 to 1 produces an immediate foaming reaction followed by rapid product expansion to as much as 30 times its original volume. After expansion, ROCSIL FOAM sets hard in a few minutes.

The special properties of ROCSIL FOAM include rapid application up to 1413 ft^3/h (40 m^3/h), high expansion rate, instant and uniform compressive strength and excellent antistatic properties. The product also produces a cost-effective, quick and safe cavity filling solution.

ROCSIL FOAM is also classified as fire resistant and therefore suitable for sealing off underground heatings and aiding fire-fighting operations in deep mines.

Advantages

- High expansion rate requiring only small quantities of foam for cavity filling
- Instant foaming action, leak proof formwork not required
- Instant and uniform compressive strength facilitates rapid shield removal
- Good compressibility, adapts readily to strata movement
- No flame propagation, suitable for firefighting applications.

Component Data	RESIN	CATALYST
DENSITY AT 68°F (20°C), oz/in.^{3} (g/cm^3)	0.7 (1.2)	0.9 (1.5)
MIXING RATIO (in volume)	4	1
SHELF LIFE AT 68°F (20°C), months	3	12
STORAGE TEMPERATURE, °F (°C)	41 – 68 (5 – 20)	41 – 104 (5 – 40)

Reaction Data	68°F (20°C)
REACTION TIME (MIN.)	1:30
EXPANSIVE RATIO	25 – 45
COMPRESSIVE STRENGTH AT 10% DEFORMATION, psi (MPa)	8.70 – 4.35 (0.06 – 0.03)
FIRE CLASSIFICATION	No flame propagation

Above values were obtained in laboratory tests and may vary accordingly to site application conditions.

Applications

Remote Seals/Stoppings

- Seals entry 100%, even with objects in entry i.e. beltline
- Air and gas sealing and consolidation of highly fractured strata
- Crossing rock-fall zones in tunnels and mine working
- Safe application and quick set time, immediately after stopping/seal is poured
- Excellent for containing underground heat and mine fires
- Erection of firewalls at safe distances.

Longwall Recovery

- Can be used for entire face or partial recovery of longwall systems
- Injected in between shields to consolidate gob from flushing after shields are removed.

Void Fill

- Filling of cavities and roof fall voids
- Injection of fractured strata and air leakage cavities to create a gas and air-tight seal
- Easy application with mixing wand, quick set time, and fewer personnel required.
- Easily contained with bratis cloth, with no major form work required.

Supplemental Seal

- Prevents breathing around permanent ventilation seals.

KMS - Keystone Mining Services

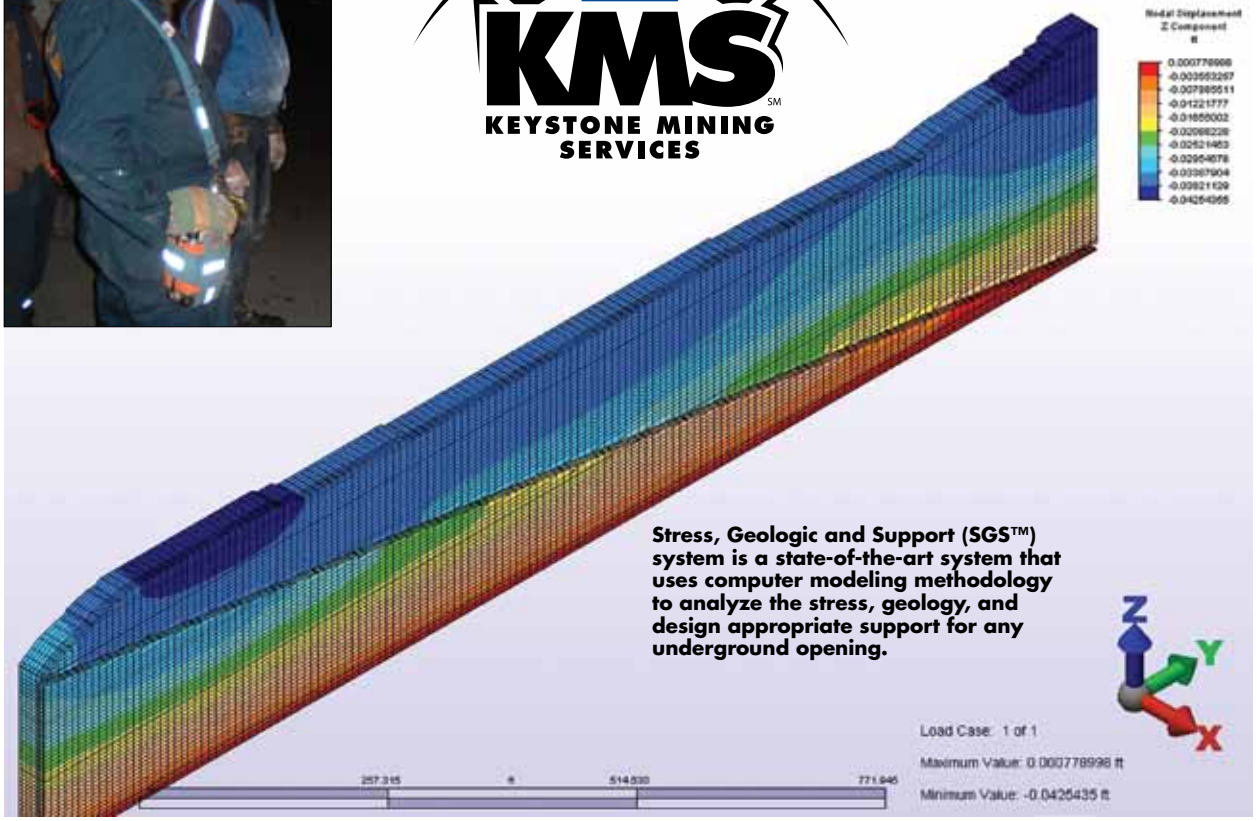
KEYSTONE MINING SERVICES

KMS provides advanced engineering services to the coal, metal, and tunneling markets in a continuing effort to make these industries safer, more efficient and cost effective. KMS uses the Roof Instability Rating (RIR) system as well as the latest in finite element computer modeling in their work. KMS provides precise and accurate stress analysis, pillar design, subsidence prediction, and site specific ground control design.

KMS also has the ability to conduct detailed stress analyses, field observations, and stratascope analyses. By providing analyses to develop supplemental ground support systems to solve unexpected ground control problems or rehabilitate existing entries, KMS is able to provide abundant quality services for both the mining and tunneling industries.

KMS's years of experience ensure our customers not only a successful but also a cost effective solution to tunnel design and mine ground control.

KMS℠
KEYSTONE MINING SERVICES



Stress, Geologic and Support (SGS™) system is a state-of-the-art system that uses computer modeling methodology to analyze the stress, geology, and design appropriate support for any underground opening.

In 2007, the JENNMAR® Specialty Products division opened in Cedar Bluff, VA. JENNMAR Specialty Products was created to perform steel fabrication services for the mining and underground construction industries. In-house equipment includes but is not limited to:

- Roundo beam bender
- Peddinghaus PCD 100 computer controlled drill line
- Durma press brake
- Durma shear
- Koike Millennium Mastergraph computer controlled burn table.

JENNMAR Specialty Products staff includes: Civil, Mechanical, and Mining Engineers, certified welders, quality technicians and an experienced management staff.

Square Sets

JENNMAR Specialty Products Steel Square Sets consist of a straight cross member and two legs, manufactured from a W section beam selected to meet dead load requirements. Square sets are shipped complete with gussets, bolts, nuts, and tension rods. Our steel paneled V-Deck lagging and C-Channel runners are optional.

Impact Resistant Arch Sets

JENNMAR Specialty Products Impact Resistant Arch Sets are the solution for immediate roof support. JENNMAR Specialty also manufactures JENNMAR's RIP® 50 and 100 ton steel props, which can be used with JENNMAR's new lightweight high-strength beam.

Bent Arch Sets

JENNMAR Virginia Specialty Bent Arch Sets are offered for many different clearance and loading conditions. Our bent arches are shipped complete with gussets, bolts, nuts, and tension rods. Our steel paneled V-Deck lagging and C-Channel runners are optional. We are pleased to offer the following types of bent arches:

- One Piece - a continuous bent member
- Two Piece - two separate bent arch members bolted together at the center
- Three Piece - arched cross member supported by two bent legs
- Four Piece - two bent arches serve as the cross member, which are bolted together at the center and supported by two bent legs

Long Radius Arch Sets

Long Radius Arches consist of a slightly bent cross member on two straight legs. Our long radius arches are shipped complete with gussets, bolts, nuts, and tension rods. Our steel paneled V-Deck lagging and C-Channel runners are optional.

JM Steel

JM Steel Corporation is a subsidiary of Frank Calandra, Inc., a global manufacturer of ground control products for the mining, tunneling and civil construction industries. Our parent company is known throughout the world for its ability to provide exceptional products, engineering solutions and customer service.

JM Steel began production in 2000 and is located on Nucor Steel's industrial campus near Charleston, SC. JM Steel's ultra-modern 120,000 sq. ft steel processing facility resides next to Nucor's high quality 3 million ton per year hot and cold rolled steel mill. Our facility has the processing capability and extensive inventory to provide a variety of flat rolled steel products including master coils, slit coils, blanks, beams, sheets, flat bars and panels.

Braner Slitter

Stamco Slitter

Narrow Braner Slitter

24 in. Cut To Length Line

HYD-MECH Structural Beam Saw

Hurricane Panel Roll Form Line

JENNMAR Locations

UNITED STATES

KENTUCKY

Winchester, KY
PHONE: (859) 744-9600
FAX: (859) 745-4028

Earlington, KY
PHONE: (270) 383-3171
FAX: (270) 383-3121

J-LOK Resin

Earlington, KY
PHONE: (270) 383-3660
FAX: (270) 383-3670

PENNSYLVANIA

GLOBAL HEADQUARTERS

Pittsburgh, PA
PHONE: (412) 963-9071
FAX: (412) 963-9767

Cresson, PA
PHONE: (814) 886-4121
FAX: (814) 886-4598

J-LOK Resin

Cresson, PA
PHONE: (814) 886-7590
FAX: (814) 886-7695

UTAH

Clearfield, UT
PHONE: (801) 775-0176
FAX: (801) 775-0188

VIRGINIA

Pounding Mill, VA
PHONE: (276) 964-2107
FAX: (276) 963-5928

Rich Creek, VA
PHONE: (540) 726-2326
FAX: (540) 726-7340

JENNMAR Specialty Products

Cedar Bluff, VA
PHONE: (276) 964-7000
FAX: (276) 964-4752

WEST VIRGINA

Reedsville, WV 26547
PHONE: (304) 864-3601
FAX: (304) 864-416

GLOBAL

AUSTRALIA

JENNMAR Australia

Narellan, NSW
PHONE: 02 4648 7500
FAX: 02 4648 7555

Mackay, Queensland
PHONE: 07 4952 8700
FAX: 07 4952 8777

J-LOK Resin Australia

Narellan, NSW
PHONE: 02 4647 8388
FAX: 2 4648 3444

ASIA

JENNMAR Jining

Jining City, China
PHONE: 011-86-537-2480336
FAX: 011-86-5372480338

CANADA

JENNMAR Canada

Sturgeon Falls, ON
PHONE: 705-753-4872
FAX: 705-753-5061

Sudbury, ON
PHONE: (705) 521-1415
FAX: (705) 521-0804

LATIN AMERICA

JENNMAR Latin America

Santiago, Chile
PHONE: 011 56 2 6805300

Chihuahua, Mexico
PHONE: (614) 259-5439

Lima, Peru
PHONE: 011-51-1-7081600

EUROPE

JENNMAR Spain

Gijón, Spain
PHONE/FAX: 011-34-984-114973

JENNMAR Merol

Stalowa Wola, Poland
PHONE: 011-48-15 842 50 08
FAX: 011-48-15 842 29 38

JENNMAR Multitex

Frýdlant nad Ostravicí,
Czech Republic
PHONE/FAX: 00420 558 675 345

JENNMAR®

1 JENNMAR IS YOUR SINGLE SOURCE FOR COMPLETE GROUND CONTROL SOLUTIONS

- ☑ *THOROUGH INSPECTION*
- ☑ *EXPERT ANALYSIS*
- ☑ *EFFECTIVE, MSHA-APPROVED PLAN*
- ☑ *QUALITY MANUFACTURING*
  From Bolts and Beams to Channels and Trusses to Resin and Rebar!
- ☑ *ON-TIME DELIVERY*
- ☑ *QUALIFIED INSTRUCTION*
- ☑ *ON-GOING SUPPORT*

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GLOBAL HEADQUARTERS
258 Kappa Drive
Pittsburgh, PA 15238

www.jennmar.com • (412) 963-9071