



MINOVA CANADA PRODUCT CATALOGUE.

SECURING PERFORMANCE. TOGETHER.

We are an international producer of high-performance ground support products for the mining, construction and energy industries.

Our products are engineered to provide safety, efficiency and certainty to your operations wherever you are.

We can provide you with tailored solution offerings for a variety of applications whatever it takes.

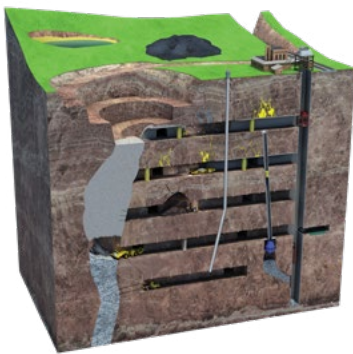
We can help you increase project performance and overcome application challenges through a flexible product portfolio with a wide range of differing characteristics, wherever you go.

OUR INDUSTRIES.

We serve the mining, construction and energy sectors.

COAL MINING

We are a leader in providing safe environments in extremely fractured and fluid ground conditions. We understand that safety and efficiency are the key requirements of coal production.



HARD ROCK MINING

We support underground hard rock mines across the primary commodities. Our products are designed to provide safety, improve efficiency and include automated solutions.

CONSTRUCTION

Stemming from our mining expertise, we have a wide range of products that are used in the construction industry. Our solutions are utilised in both above and below ground assets to secure, repair, restore and rehabilitate.



ENERGY

We support many types of geostabilisation and structural repair projects in the energy sector. Our products and services include solutions in the oil & gas and renewable energy sectors.

CONSTRUCTION

ANCHORTITE

FAST SETTING POLYESTER RESIN ANCHORING GROUT

DESCRIPTION

Anchortite is a dual component, fast setting and free flowing polyester resin anchoring grout, consisting of a specially formulated liquid resin and hardener. It is designed specifically for anchoring bolts and dowels in concrete, rock, brick and masonry. Always perform pull out testing to determine the performance in each situation. Anchortite resists oil, grease, fats, mild acids, alkalies, fresh and salt water. Where exposure to a specific chemical is anticipated, consult Minova USA, Inc. directly.

USES

Anchortite is used for grouting high strength anchor bolts and starter bars in concrete, and anchors in rock. Suggested applications for Anchortite include light and heavy rail track anchoring, setting of highway lighting standards, anchoring of precast median barriers and signs on highways. Handrails, guardrails and pipe protection stands around safety areas are excellent applications for Anchortite.

ADVANTAGES

- Fast setting – pot life in as little as 5 minutes
- High strength – 14,000 psi
- Chemically resistant – to attack by many chemicals



Anchortite Fast Kit.



Anchortite Slow Kit.

APPLICATION METHOD

Anchor bolt holes should be drilled using air or water flushed rotary percussive equipment. If diamond core or non-percussive drills are used, the hole must be thoroughly scoured using a coarse wire flue brush. Anchor bolt holes less than 36 inches deep should not be more than 1/2 inch larger in diameter than the bolt diameter. Anchor bolts longer than 36 inches can have a hole diameter 3/4 inches larger than the bolt diameter. Minova Lokset® Resin Cartridges may be considered for long bolt application.

To obtain the proper consistency, the correct ratio of filler/hardener-to-resin must be used. The ratio is two parts of filler/hardener to one-part resin by volume.

1. Place a measured volume of resin into a clean container, then gradually add hardener to the resin, stirring constantly to obtain uniformity.
2. Place Anchortite into prepared hole such that little or no air is trapped.
3. Insert the bolt or bar with a twisting action for maximum contact between the resin compound and anchor.

TECHNICAL DATA

The data below is laboratory data only. It may vary in practice due to thermal exchange between resin and strata, surface properties of the stone, humidity, pressure and other factors.

MATERIAL DATA

Parameter	Time / Value
Compressive Strength ASTM C109	5 times pot life @ 75°F / 10,000 psi (69.0 MPa) 7 days @ 75°F / 14,000 psi (96.5 MPa)
Tensile Strength ASTM C307	5 times pot life @ 75°F / 1,400 psi (9.7 MPa) 7 days @ 75°F / 2,000 psi (13.8 MPa)
Heat Distortion Temperature ASTM D648	212°F (100°C)
Coefficient of Linear Expansion	2.55 x 10 ⁻⁵ /°C

SAFETY INSTRUCTIONS AND LIMITATIONS

Do not mix more grout than can be applied within the pot life of the material. (See Anchortite Slow and Fast Resin Speeds Chart). Do not add other materials to Anchortite.

PACKAGING and TRANSPORTATION

CONTAINER TYPE	ANCHORTITE COMPONENT A	ANCHORTITE COMPONENT B
Gal (Can)	9 lbs (4.1 kg)	
Bag		27 lbs (12.3 kg)
Anchortite Fast Kit	36 lbs (16.4 kg)	
Anchortite Slow Kit	36 lbs (16.4 kg)	

Other packing units available on request.

STORAGE AND SHELF LIFE

Anchortite has a shelf life of 6 months if stored in unopened containers under recommended conditions. Unused quantities of resin and filler/hardener may be tightly resealed and stored in a cool dry place 60°F - 80°F (15°C – 26.6°C).

DISPOSAL

If Anchortite Component A as supplied becomes a waste, it meets the criteria of a hazardous waste exhibiting characteristic ignitability as defined under the Resource Conservation and Recovery Act (RCRA) 40 CFR 261. If Anchortite Component B as supplied becomes a waste, it does not meet the criteria of a hazardous waste as defined under the Resource Conservation and Recovery Act (RCRA) 40 CFR 261. Dispose of material in accordance with all applicable federal, state/provincial and local laws and regulations. Regulations may vary in different locations. Waste characterizations and compliance with applicable laws are the responsibility solely of the waste generator.

APPROVALS AND CERTIFICATES

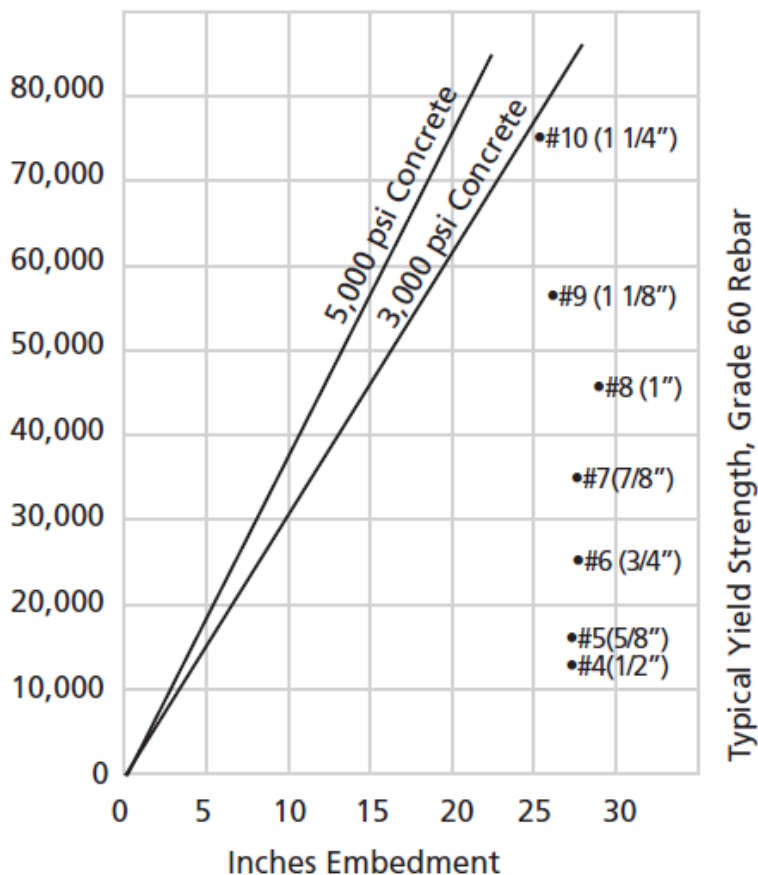


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Anchortite – Slow and Fast Resin Speeds

Resin Speed		Ratios		Pot Life in Minutes				
Specify Resin Speed When Ordering	Consistency	Filler to Resin by Volume	Filler to Resin by Weight	30°F(-1°C)	45°F (7°C)	60°F (15.5°C)	75°F (24°C)	90°F (32°C)
Slow	Pourable	2:1	3:1	206 (not recommended)	130	60	30	15
Fast	Pourable	2:1	3:1	45	25	12	7	3

Anchortite Polyester Resin Anchor Pull-Out Strength Chart



On-site tests should be carried out to verify anchorage performance of various steel components used with Anchortite. This chart represents typical anchorages with Grade 60 rebar in 3,000- and 5,000-pound concrete (un-reinforced), for threaded and deformed 1/2 inch to 1-1/4-inch diameter bars anchored into concrete.

ADDITIONAL DOCUMENTATION

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If further information is required consult Minova Americas website: www.minovaglobal.com.

- Anchortite Component A Safety Data Sheet (SDS)
- Anchortite Component B Safety Data Sheet (SDS)
- Minova Anchortite Product Specification

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CONSTRUCTION

LOKSET® RESIN CARTRIDGES TUNNELING

REINFORCED POLYESTER RESIN ANCHOR

DESCRIPTION

The Lokset® Resin Cartridge consists of a filled polyester mastic and a catalyst paste, contained in a heat-sealed tube of polyester film. A film barrier prevents premature chemical reaction until the anchor bolt ruptures and mixes the contents. Available in numerous gel times, the cartridge is manufactured in six diameters and length up to 64” long.

The system permits the placing of bolts in any position or angle above or below the horizon, in rock or concrete structures. Drill holes with rotary-percussive equipment to provide for the essential hole profile. Holes must be flushed with air or water so that they are clear of cuttings and debris.

Hole diameters should be within the range of borehole diameters permitted with a specific bolt diameter. To facilitate installation of long, coupled bolts, a larger diameter hole is drilled in the grout zone with a reduction in hole diameter carried out with the last section of drill steel. (Refer to Lokset® Resin Usage Chart).

USES

Rock bolting in mines and tunnels, permanent rock reinforcement on highway rock cuts, dams and underground rock structures, vibration-resistant anchorages for attachment of critical equipment to concrete or rock, uplift anchorages for near surface structures, and immediate post-tensioning steel reinforcements in rock concrete structures.



ADVANTAGES

- Permanence – The durable resin protects the embedded bolt from corrosion.
- Speed – The fast-gelling Lokset® Resin Cartridges enable rapid installation to be carried out, with application of load in minutes
- Vibration – Lokset® Resin Cartridges are not affected by vibration and require no re-tensioning, even after close-proximity blasting
- Safety – Millions of Lokset® Resin Cartridges are used every year for permanent rock reinforcement in mines, tunnels, and foundations.
- Very Low Insertion Force - Cartridges specially formulated for easier penetration when hand held equipment is in use.

ANCHORAGE

The anchorage achieved varies from 2-1/2 tons per inch in granite and other very high strength rocks to 1/2 ton per inch in mudstone and other very weak rock formations. Lokset® resin achieves full strength in less than one hour.

APPLICATION METHOD

General Installation Instructions for Fully Grouted Systems:

1. Before use, read the installation and safety information provided to include the product Safety Data Sheet (SDS).
2. To obtain a consistent set time, make sure the Lokset® Resin Cartridge and bolt are at tunnel temperature before use, preferably 50 °F (10 °C) and 70 °F (21.1 °F).
3. Drill the borehole to the correct diameter at a depth equal to the length of the bolt plus 1-inch. Mark the drill steel to use as a guide.
4. Insert the appropriate Minova resin cartridge(s) slowly rotating the bolt as you push through the resin column.
5. Push the bolt into the hole. Slow rotation of the bolt as it passes through the cartridge is suggested but not required. Ensure each cartridge is completely punctured.
6. Just prior to the bolt head contacting the rock, stop and spin the bolt a minimum 100 rpm to mix the cartridge. Approximately 30 revolutions are recommended.
7. Stop rotation and push the bolt upward with full thrust until the resin sets.

SAFETY INSTRUCTIONS AND LIMITATIONS

Do not over-spin the bolt. If bolt rotation continues through the gel time, damage to the anchor may occur.

Never re-spin the bolt. Bolt rotation after the final spin may damage the partially set resin.

Observe the usual precautionary measures for handling chemicals, see Lokset® Resin Cartridge SDS.

PACKAGING AND TRANSPORTATION

Product packaging is dependent upon cartridge length. Please contact a Minova Customer Service Representative for packaging information.

STORAGE AND SHELF LIFE

Lokset® Resin Cartridges can be stored for 12 months in a cool dry, ventilated place. Store away from direct sunlight or other heat sources which can reduce products usability and shelf life. Stock rotation is strongly recommended.

DISPOSAL

If this product as supplied becomes a waste, it does not meet the criteria of a hazardous waste as defined under the Resource Conservation and Recovery Act (RCRA) 40 CFR 261. Dispose of material in accordance with all applicable federal, state/provincial and local laws and regulations. Regulations may vary in different locations. Waste characterizations and compliance with applicable laws are the responsibility solely of the waste generator.

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- Lokset® & Eclipse® Resin Cartridge SDS
- The Minova Guide to Resin-Grouted Rockbolts
- Lokset® Resin Cartridge Anchors for Rock and Concrete Reinforcement Brochure
- Lokset® Resin Cartridges Brochure
- Minova Lokset® Product Specification

Resin Usage Chart

Hole Diameters	25mm (1")	32mm (1-1/4")	35mm (1-3/8")	38mm (1-1/2")	41mm (1-5/8")	38mm (1-1/2")	41mm (1-5/8")	45mm (1-3/4")	48mm (1-7/8")	51mm (2")	57mm (2-1/4")	51mm (2")	57mm (2-1/4")
Cartridge Diameters	23mm (7/8")	28mm (1-1/8")	32mm (1-1/4")		35mm (1-3/8")			40mm (1-9/16")		45mm (1-3/4")			
Bolt Size	Hole Length per Foot (12") of Resin // (Grouted Length of Bolt)												
#5 (5/8" Ø) B-Series	13.7	Not recommended											
#6 (3/4" Ø) A-Series	19.1	12.4	Not recommended										
#7 (7/8" Ø) E-Series		15.6	14.4	Not recommended									
#8 (1" Ø)			18.2	13.0		15.5	11.8	Not recommended					
#9 (1 1/8" Ø)	Not recommended			16.5	11.8	19.7	14.1	14.1	11.2	Not recommended			
#10 (1 1/4" Ø)	Not recommended				15.0		18.0	16.9	13.0	10.4		13.1	
#11 (1 3/8" Ø)	Not recommended								23.0	16.0	12.0		15.2
#14 (1 5/8" Ø)	Not recommended										12.7		16.1

Chart indicates inches of bolt encapsulation based on a 12" length of Lokset® Resin Cartridge for anchoring and grouting rock bolts. This chart is prepared as a guide based on average drilling conditions in concrete or rock. Field trials should be conducted to determine actual resin requirements. (Inches grouted data includes a calculated 15% loss, which is typical.) *Example: When a 1 1/2" hole is drilled using a 1" diameter deformed (rebar type) bolt, one 3512 (1 3/8: Ø x 12" long) cartridge will grout 15.5 linear inches of bolt. Conduct field trials to ensure correct resin requirements for both anchor and grout "zones" for individual bolt lengths and diameters.

-Note: Blank spaces are non-recommended bolt and hole combinations.

MINING / CONSTRUCTION

LOKSET® RESIN CARTRIDGES A SERIES

REINFORCED POLYESTER RESIN ANCHOR

DESCRIPTION

The Lokset® Resin Cartridge A Series is specifically intended to be used in conjunction with a #6 (3/4 inch) steel roof bolt in a 1-inch borehole. Lokset® Resin Cartridges can enhance the performance of your current roof control system. The Lokset® Resin Cartridge A Series consists of two compartments separated by a physical barrier. One compartment contains a polyester resin mastic and the other an organic peroxide catalyst. The rotation of the bolt during installation ruptures the cartridge, shreds the film and mixes the two components, thus causing a chemical reaction which transforms the resin mastic to a solid anchor.

The A Series Cartridge is 23mm or 0.9 inches in diameter. This combination provides the ideal annulus for proper mixing and maximum performance.

The A Series Cartridge is available in lengths ranging from one to eight grouted feet. The cartridge is also available in a variety of speeds including: Super Slow (1530), X-Slow (0510), Slow (-90), Medium (-45), Fast (-35), X-Fast (-20) and Super-Fast (-10). A slow cartridge gels in one minute at 90 degrees F (32.2 degrees C), medium gels in one minute at 45 degrees F (7.2 degrees C), etc. For more information, please refer to the Lokset® Resin Cartridge product line brochure and Resin Usage Chart.

USES

Millions of Lokset® Resin Cartridges are used every year for permanent rock reinforcement in mines, tunnels and foundations.



ADVANTAGES

- Proven – After introducing resin anchors to the United States (1971), Lokset® Resin Cartridges have a proven track record of success
- Speed – The fast-gelling Lokset® Resin Cartridges enable rapid installation to be carried out, with application of load in minutes
- Viscosity – The A series Lokset® Resin Cartridge is available in High, Medium, Low and Very Low Insertion Force (VLIF) viscosities. The VLIF formulation is unique in the industry and provides optimum performance with cable and mechanical assisted resin point anchor rock bolts

APPLICATION METHOD

Contact your local Minova representative if the A Series cartridge is to be used in other applications.

1. Before use, read the installation and safety information provided to include the product Safety Data Sheet (SDS).

2. To obtain a consistent set time, make sure the Lokset® Resin Cartridge and bolt are at mine temperature before use.
3. Drill the borehole to the correct diameter at a depth equal to the length of the bolt plus 1-inch. Mark the drill steel to use as a guide.
4. Insert the appropriate Minova resin cartridge slowly rotating the bolt as you push through resin column.
5. Push the bolt into the hole. Slow rotation of the bolt as it passes through the cartridge is suggested but not required. Ensure each cartridge is completely punctured. For tension rebar applications, rotation is not suggested during bolt insertion.
6. Just below the roof, stop and spin the bolt a minimum of 35 revolutions to mix the cartridge. This should take 3 to 8 seconds.
7. Stop rotation and push the bolt upward with full thrust until the resin sets.

SAFETY INSTRUCTIONS AND LIMITATIONS

Do not over-spin the bolt. If bolt rotation continues through the gel time, damage to the anchor may occur.

Never re-rotate the bolt. Bolt rotation after the final spin may damage the partially set resin.

Observe the usual precautionary measures for handling chemicals, see Lokset® & Eclipse® Resin Cartridge SDS.

PACKAGING AND TRANSPORTATION

Product packaging is dependent upon cartridge length. Please contact a Minova Customer Service Representative for packaging information.

STORAGE AND SHELF LIFE

Lokset® Resin Cartridges can be stored for 12 months in a cool dry, ventilated place. Store away from direct sunlight or other heat sources which can reduce products usability and shelf life. Stock rotation is strongly recommended.

DISPOSAL

If this product as supplied becomes a waste, it does not meet the criteria of a hazardous waste as defined under the Resource Conservation and Recovery Act (RCRA) 40 CFR 261. Dispose of material in accordance with all applicable federal, state/provincial and local laws and regulations. Regulations may vary in different locations. Waste characterizations and compliance with applicable laws are the responsibility solely of the waste generator.

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RESIN USAGE CHART

Hole Diameters	25mm (1")	32mm (1-1/4")	35mm (1-3/8")	38mm (1-1/2")	41mm (1-5/8")	38mm (1-1/2")	41mm (1-5/8")	45mm (1-3/4")	48mm (1-7/8")	51mm (2")	57mm (2-1/4")	51mm (2")	57mm (2-1/4")
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#8 (1" Ø)		18.2	13.0		15.5	11.8	Not recommended						
#9 (1 1/8" Ø)	Not recommended		16.5	11.8	19.7	14.1	14.1	11.2	Not recommended				
#10 (1 1/4" Ø)	Not recommended			15.0		18.0	16.9	13.0	10.4		13.1		
#11 (1 3/8" Ø)	Not recommended						23.0	16.0	12.0		15.2		
#14 (1 5/8" Ø)	Not recommended									12.7		16.1	

Chart indicates inches of bolt encapsulation based on standard 12" length Lokset® Resin Cartridges for anchoring and grouting rock bolts. This chart is prepared as a guide based on average drilling conditions in concrete or rock. Field trials should be conducted to determine actual resin requirements. (Inches grouted data includes a calculated 15% loss, which is typical.) *Example: When a 1 1/2" hole is drilled using a 1" diameter deformed (rebar type) bolt, one 3512 (1 3/8: Ø x 12" long) cartridge will grout 15.5 linear inches of bolt. Conduct field trials to ensure correct resin requirements for both anchor and grout "zones" for individual bolt lengths and diameters.

Note: Blank spaces are non-recommended bolt and hole combinations.

MINING / CONSTRUCTION

LOKSET[®] RESIN CARTRIDGES ECLIPSE[®]

REINFORCED POLYESTER RESIN ANCHOR

DESCRIPTION

The patented Lokset[®] Eclipse[®] B Series methodology employs an offset head rebar bolt and specially formulated Minova resin to improve resin mixing and minimize glove fingering. The concept is simple; by offsetting the head, the bolt acts as a mixing cam in the borehole, quickly combining the resin components and incorporating the plastic film within the cured resin. The Lokset[®] Resin Cartridge Eclipse[®] is specifically designed to be used in conjunction with a #5 (5/8 inch) rebar roof bolt in a 1-inch borehole.

One of the most critical variables affecting resin bolt performance is the size of the resin annulus, calculated as the difference between the hole and bolt diameters. The optimum annulus (proven to be 1/4 inch), provides for effective mixing of the two polyester resin components and incorporation of the plastic film within the cured resin. Glove fingering occurs when the plastic film is forced against the borehole wall, potentially interfering with the mechanical interlock of the resin and the rock mass.

Glove fingering is not a problem with the optimum 1/4-inch annulus but has been known to occur with the B Series 3/8-inch annulus. The newly formulated Lokset[®] Resin Cartridge Eclipse[®], when combined with a 1/8-inch offset between the bolt head and shaft axes, reduces glove fingering by 70%. The Lokset[®] Resin Cartridge Eclipse[®] is 23mm or 0.9 inches in diameter. This combination has been proven to be an economical and effective roof control solution and is available in lengths ranging from one to five grouted feet. The cartridge is also available in a variety of speeds.



USES

Millions of Lokset[®] Resin Cartridges are used every year for permanent rock reinforcement in mines, tunnels and foundations.

ADVANTAGES

- Proven – After introducing resin anchors to the United States (1971), Lokset[®] Resin Cartridges have a proven track record of success
- Speed – The fast-gelling Lokset[®] Eclipse[®] Resin Cartridges enable rapid installation to be carried out, with application of load in minutes
- Viscosity – The Lokset[®] Eclipse[®] Resin Cartridge is available in High, Medium, Low and Very Low Insertion Force (VLIF) viscosities. The VLIF formulation is unique in the industry and provides optimum performance with cable and mechanical assisted resin point anchor rock bolts

APPLICATION METHOD

Contact your local Minova representative if the Eclipse® cartridge is to be used in other applications.

1. Before use, read the installation and safety information provided to include the product Safety Data Sheet (SDS).
2. To obtain a consistent set time, make sure the Lokset® Eclipse® Resin Cartridge and bolt are at mine temperature before use.
3. Drill the borehole to the correct diameter at a depth equal to the length of the bolt, plus 1-inch. Mark the drill steel to use as a guide.
4. Insert the appropriate Minova resin cartridge slowly rotating the bolt as you push through resin column.
5. Push the bolt into the hole. Slow rotation of the bolt as it passes through the cartridge is suggested but not required. Ensure each cartridge is completely punctured. For tension rebar applications, rotation is not suggested during bolt insertion.
6. Just below the roof, stop and spin the bolt a minimum of 35 revolutions to mix the cartridge. This should take 3 to 8 seconds.
7. Stop rotation and push the bolt upward with full thrust until the resin sets.

SAFETY INSTRUCTIONS AND LIMITATIONS

Do not over-spin the bolt. If bolt rotation continues through the gel time, damage to the anchor may occur.

Never re-rotate the bolt. Bolt rotation after the final spin may damage the partially set resin.

Observe the usual precautionary measures for handling chemicals, see Lokset® & Eclipse® Resin Cartridge SDS.

PACKAGING AND TRANSPORTATION

Product packaging is dependent upon cartridge length. Please contact a Minova Customer Service Representative for packaging information.

STORAGE AND SHELF LIFE

Lokset® Eclipse® Resin Cartridges can be stored for 12 months in a cool dry, ventilated place. Store away from direct sunlight or other heat sources which can reduce products usability and shelf life.

DISPOSAL

If this product as supplied becomes a waste, it does not meet the criteria of a hazardous waste as defined under the Resource Conservation and Recovery Act (RCRA) 40 CFR 261. Dispose of material in accordance with all applicable federal, state/provincial and local laws and regulations. Regulations may vary in different locations. Waste characterizations and compliance with applicable laws are the responsibility solely of the waste generator.

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Resin Usage Chart

Hole Diameters	25mm (1")	32mm (1-1/4")	35mm (1-3/8")	38mm (1-1/2")	41mm (1-5/8")	38mm (1-1/2")	41mm (1-5/8")	45mm (1-3/4")	48mm (1-7/8")	51mm (2")	57mm (2-1/4")	51mm (2")	57mm (2-1/4")	
Cartridge Diameters	23mm (7/8")	28mm (1-1/8")	32mm (1-1/4")		35mm (1-3/8")		40mm (1-9/16")		45mm (1-3/4")					
Bolt Size	Hole Length per Foot (12") of Resin // (Grouted Length of Bolt)													
#5 (5/8" Ø) B-Series	13.7	Not recommended												
#6 (3/4" Ø) A-Series	19.1	12.4	Not recommended											
#7 (7/8" Ø) E-Series		15.6	14.4	Not recommended										
#8 (1" Ø)			18.2	13.0		15.5	11.8	Not recommended						
#9 (1 1/8" Ø)	Not recommended			16.5	11.8	19.7	14.1	14.1	11.2	Not recommended				
#10 (1 1/4" Ø)	Not recommended				15.0		18.0	16.9	13.0	10.4		13.1		
#11 (1 3/8" Ø)	Not recommended								23.0	16.0	12.0		15.2	
#14 (1 5/8" Ø)	Not recommended											12.7		16.1

Chart indicates inches of bolt encapsulation based on a 12" length Lokset® Resin Cartridge for anchoring and grouting rock bolts. This chart is prepared as a guide based on average drilling conditions in concrete or rock. Field trials should be conducted to determine actual resin requirements. (Inches grouted data includes a calculated 15% loss, which is typical.) *Example: When a 1 1/2" hole is drilled using a 1" diameter deformed (rebar type) bolt, one 3512 (1 3/8: Ø x 12" long) cartridge will grout 15.5 linear inches of bolt. Conduct field trials to ensure correct resin requirements for both anchor and grout "zones" for individual bolt lengths and diameters.

-Note: Blank spaces are non-recommended bolt and hole combinations

MINING / CONSTRUCTION

LOKSET® RESIN CARTRIDGES E SERIES

REINFORCED POLYESTER RESIN ANCHOR

DESCRIPTION

The Lokset® Resin Cartridge E Series is intended for use in a 1-3/8 inch borehole with a #7 (7/8 inch) bolt. The Lokset® Resin Cartridge E Series include fully grouted rebar, tension rebar, doweling and resin enhanced mechanical anchors.

In most applications, Lokset® Resin Cartridges can enhance the performance of your current roof control system. The Lokset® Resin Cartridge E Series consists of two compartments separated by a physical barrier. One compartment contains a polyester resin mastic and the other an organic peroxide catalyst. The rotation of the bolt during installation ruptures the cartridge, shreds the film and mixes the two components, thus causing a chemical reaction which transforms the resin mastic to a solid anchor.

The E Series Cartridge is 32mm or 1-1/4 inches in diameter. The combination of cartridge and bolt has been proven effective in difficult roof conditions.

The E Series Cartridge is available in lengths ranging from one to seven grouted feet. The cartridge is also available in a variety of speeds including: Super Slow (1530), X-Slow (0510), Slow (-90), Medium (-45), Fast (-35), X-Fast (-20) and Super-Fast (-10). A slow cartridge gels in one minute at 90 degrees F (32.2 degrees C), medium gels in one minute at 45 degrees F (7.2 degrees C), etc. For more information, please refer to the Lokset® Resin Cartridge product line brochure and Resin Usage Chart.

USES

Millions of Lokset® Resin Cartridges are used every year for permanent rock reinforcement in mines, tunnels and foundations.



ADVANTAGES

- Proven – After introducing resin anchors to the United States (1971), Lokset® Resin Cartridges have a proven track record of success
- Speed – The fast-gelling Lokset® Resin Cartridges enable rapid installation to be carried out, with application of load in minutes
- Viscosity – The E series Lokset® Resin Cartridge is available in High, Medium, Low and Very Low Insertion Force (VLIF) viscosities. The VLIF formulation is unique in the industry and provides optimum performance with cable and mechanical assisted resin point anchor rock bolts.

APPLICATION METHOD

Contact your local Minova representative if the E Series cartridge is to be used in other applications.

1. Before use, read the installation and safety information provided to include the product Safety Data Sheet (SDS).
2. To obtain a consistent set time, make sure the Lokset® Resin Cartridge and bolt are at mine temperature before use.
3. Drill the borehole to the correct diameter at a depth equal to the length of the bolt plus 1-inch. Mark the drill steel to use as a guide.
4. Insert the appropriate Minova resin cartridge slowly rotating the bolt as you push through resin column.
5. Push the bolt into the hole. Slow rotation of the bolt as it passes through the cartridge is suggested but not required. Ensure each cartridge is completely punctured. For tension rebar applications, rotation is not suggested during bolt insertion.
6. Just below the roof, stop and spin the bolt a minimum of 35 revolutions to mix the cartridge. This should take 3 to 8 seconds.
7. Stop rotation and push the bolt upward with full thrust until the resin sets.

SAFETY INSTRUCTIONS AND LIMITATIONS

Do not over-spin the bolt. If bolt rotation continues through the gel time, damage to the anchor may occur.

Never re-rotate the bolt. Bolt rotation after the final spin may damage the partially set resin.

Observe the usual precautionary measures for handling chemicals, see Lokset® & Eclipse® Resin Cartridge SDS.

PACKAGING AND TRANSPORTATION

Product packaging is dependent upon cartridge length. Please contact a Minova Customer Service Representative for packaging information.

STORAGE AND SHELF LIFE

Lokset® Resin Cartridges can be stored for 12 months in a cool dry, ventilated place. Store away from direct sunlight or other heat sources which can reduce products usability and shelf life. Stock rotation is strongly recommended.

DISPOSAL

If this product as supplied becomes a waste, it does not meet the criteria of a hazardous waste as defined under the Resource Conservation and Recovery Act (RCRA) 40 CFR 261. Dispose of material in accordance with all applicable federal, state/provincial and local laws and regulations. Regulations may vary in different locations. Waste characterizations and compliance with applicable laws are the responsibility solely of the waste generator.

APPROVALS AND CERTIFICATES



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ADDITIONAL DOCUMENTATION

Started more than 135 years ago, Minova is a global manufacturer and supplier of chemical and mechanical earth control products and support equipment. With manufacturing plants on five continents and operations in more than 25 countries, Minova is an industry-leading provider of ground support solutions for the underground mining, construction and energy industries.

If further information is required consult Minova Americas website: www.minovaglobal.com.

- Lokset® Resin Cartridge Safety Data Sheet (SDS)
- The Minova Guide to Resin-Grouted Rockbolts
- Lokset® Resin Cartridge Anchors for Rock and Concrete Reinforcement Brochure
- Lokset® Resin Cartridges Brochure
- Minova Lokset® Product Specification

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RESIN USAGE CHART

Hole Diameters	25mm (1")	32mm (1-1/4")	35mm (1-3/8")	38mm (1-1/2")	41mm (1-5/8")	38mm (1-1/2")	41mm (1-5/8")	45mm (1-3/4")	48mm (1-7/8")	51mm (2")	57mm (2-1/4")	51mm (2")	57mm (2-1/4")
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#8 (1" Ø)			18.2	13.0		15.5	11.8	Not recommended					
#9 (1 1/8" Ø)	Not recommended			16.5	11.8	19.7	14.1	14.1	11.2	Not recommended			
#10 (1 1/4" Ø)	Not recommended				15.0		18.0	16.9	13.0	10.4		13.1	
#11 (1 3/8" Ø)	Not recommended							23.0	16.0	12.0		15.2	
#14 (1 5/8" Ø)	Not recommended										12.7		16.1

Chart indicates inches of bolt encapsulation based on standard 12" length Lokset® Resin Cartridges for anchoring and grouting rock bolts. This chart is prepared as a guide based on average drilling conditions in concrete or rock. Field trials should be conducted to determine actual resin requirements. (Inches grouted data includes a calculated 15% loss, which is typical.) *Example: When a 1 1/2" hole is drilled using a 1" diameter deformed (rebar type) bolt, one 3512 (1 3/8: Ø x 12" long) cartridge will grout 15.5 linear inches of bolt. Conduct field trials to ensure correct resin requirements for both anchor and grout "zones" for individual bolt lengths and diameters.

Note: Blank spaces are non-recommended bolt and hole combinations.

MINING / CONSTRUCTION

LOKSET® TOOSPEEDIE® RESIN CAPSULES

TWO SPEED POLYESTER RESIN ANCHORING SYSTEM

DESCRIPTION

A development that remains to be the most ground-breaking evolution in resin bolting, the LokSet® TOOSPEEDIE® eliminates the need to use multiple resin capsules to achieve pre-tensioning of fully encapsulated resin grouted rock bolts.

The LokSet® TOOSPEEDIE® resin capsules are available in multiple set time ratios, as designated by our product code breakdown. Combinations of set times are possible using any of Minova's resin mastic formulations.

The LokSet® TOOSPEEDIE® resin capsules consist of fast and slow speed polyester resin mastic in one sausage-shaped, enclosed capsule. One capsule compartmentalizes a resin mastic, and the other compartment a catalyst hardener.

LokSet® products are used in conjunction with steel bolts and cable (rebar). Rotation of the bolt during installation ruptures the cartridge, shreds the film, and mixes the two components, thus causing a chemical reaction which transforms the resin mastic to a rock-solid anchor.

LokSet® TOOSPEEDIE® Resin Capsules are available for A, and B Series applications as well as High, Medium, Low and Very Low Insertion Force viscosities.

USES

Millions of LokSet® Resin Capsules are used every year for permanent rock reinforcement in mines, tunnels and foundations.



ADVANTAGES

- Proven – After introducing resin anchors to the United States (1971), LokSet® Resin Capsules have a proven track record of success
- Speed – The fast-gelling LokSet® TOOSPEEDIE® Resin Capsules enable rapid installation to be carried out, with application of load in minutes
- Immediate tensioning – Allows roof bolt to be tensioned immediately after installation

APPLICATION METHOD

Contact your local Minova representative if the LokSet® TOOSPEEDIE® resin capsule is to be used in other applications.

1. Before use, read the installation and safety information provided to include the product Safety Data Sheet (SDS).
2. To obtain a consistent set time, make sure the LokSet® TOOSPEEDIE® resin capsule and Eclipse bolt are at a minimum 50°F temperature before use.
3. Drill the borehole to the correct diameter at a depth equal to the length of the bolt plus 1-inch. Mark the drill steel to use as a guide.
4. Insert the appropriate Minova resin capsule slowly rotating the bolt as you push through the resin column.
5. Push the bolt into the hole. Slow rotation of the bolt as it passes through the capsule is suggested but not required. Ensure each capsule is completely punctured. For tension rebar applications, rotation is not suggested during bolt insertion.
6. Just below the roof, stop and spin the bolt a minimum of 35 revolutions to mix the capsule. This should take 3 to 8 seconds.
7. Stop rotation and push the bolt upward with full thrust until the resin sets.

SAFETY INSTRUCTIONS AND LIMITATIONS

Do not over-spin the bolt. If bolt rotation continues through the gel time, damage to the setting resin may occur.

Never re-rotate the bolt. Bolt rotation after the final spin may damage the partially set resin.

Observe the usual precautionary measures for handling chemicals, see Lokset® Resin Cartridge SDS.

PACKAGING AND TRANSPORTATION

Product packaging is dependent upon cartridge length. Please contact a Minova Customer Service Representative for packaging information.

STORAGE AND SHELF LIFE

LokSet® TOOSPEEDIE® resin capsules can be stored for 12 months in a cool dry, ventilated place. Store away from direct sunlight or other heat sources which can reduce products usability and shelf life.

DISPOSAL

If this product as supplied becomes a waste, it does not meet the criteria of a hazardous waste as defined under the Resource Conservation and Recovery Act (RCRA) 40 CFR 261. Dispose of material in accordance with all applicable federal, state/provincial and local laws and regulations. Regulations may vary in different locations. Waste characterizations and compliance with applicable laws are the responsibility solely of the waste generator.

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If further information is required consult Minova Americas website: www.minovaglobal.com.

- LokSet® Resin Cartridge Safety Data Sheet (SDS)
- The Minova Guide to Resin-Grouted Rockbolts
- LokSet® Resin Cartridge Anchors for Rock and Concrete Reinforcement Brochure
- LokSet® Resin Cartridges Brochure
- Minova LokSet® Product Specification

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MINING / CONSTRUCTION

TEKGROUT®

FAST-SETTING, PUMPABLE CEMENTITIOUS INJECTION GROUT

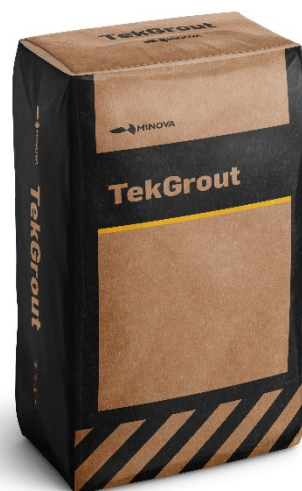
DESCRIPTION

TekGrout® injection grout is a single-component, variable strength cementitious grout designed as an alternative to polyurethane systems. A wide flexibility with strengths and viscosities enables excellent strata penetration and gel times as low as 40 seconds. The material’s adhesive and interlocking characteristics collectively assure a solid bond.

Consult your local Minova representative for additional application information.

USES

TekGrout® injection grout is ideal for the consolidation of fractured strata or loose rock and gravel. TekGrout® can also be used to control some water flows.



ADVANTAGES

- Flexibility – formulation allows project-specific mix; strengths up to 2,500 psi; variable viscosity enables maximum strata penetration, with minimal product waste
- Adjustable Set Times – set time can be varied from under a minute to several hours, depending on project requirements
- Non-Flammable – No unusual storage or ventilation requirements, equipment clean-up procedures or waste disposal

APPLICATION METHOD

Unlike polyurethane systems, fresh air respirators or self-contained breathing apparatus are not required, and no unusual ventilation requirements are needed while pumping.

Drill packer holes and install packer tubes before preparing to pump the material. Locate the placer unit as close to the injection site as is practical, then supply power and water. Before pumping and grout material or connecting the discharge line to a packer, flush all lines with water to assure there are no blockages.

Pump the grout material through the lines and set the output to the desired water-to-solids ratio.

Discontinue pumping only long enough to connect the discharge line to the first packer tube, then begin pumping. Continue to pump until full grouting has been achieved. Assure the desired water-to-solids ratio by monitoring accordingly (only experienced technicians should be used, and are available

through Minova USA, Inc.). Proceed to the next hole. Repeat the procedure until all locations have been grouted

TECHNICAL DATA

The data below is laboratory data only. It may vary in practice due to thermal exchange between cement and rock, temperature and other factors.

CURE TIME STRENGTH (PSI)

Water/ solids ratio	Viscosity (cps)	2 hrs	24 hrs	7 days	28 days	Quantity/yd ³ (lbs)	Bags/yd ³
5 : 1	25	n.d.	12	100	230	315	6.3
4 : 1	32	n.d.	20	160	290	390	7.8
2.5 : 1	40	20	70	420	800	600	12.0
2 : 1	42	25	80	600	1100	725	14.5
1.5 : 1	75	40	120	950	1800	900	18.0
1.25 : 1	150	110	300	1200	2200	1020	20.4
1 : 1	250	200	450	2000	2900	1220	24.4

SAFETY INSTRUCTIONS AND LIMITATIONS

Observe the usual precautionary measures for handling cements, see TekGrout® SDS.

When pumping is completed for the shift, thoroughly clean the pumping unit and all discharge lines with water as recommended by pump manufacturer.

PACKAGING AND TRANSPORTATION

TekGrout® injection grout is packaged in 50 lb, 3-ply bags with 1 polyethylene layer, 48 bags per stretch-wrapped pallet.

STORAGE AND SHELF LIFE

At least 4 months if stored in cool dry conditions.

DISPOSAL

If this product as supplied becomes a waste, it does not meet the criteria of a hazardous waste as defined under the Resource Conservation and Recovery Act (RCRA) 40 CFR 261. Dispose of material in accordance with all applicable federal, state/provincial and local laws and regulations. Regulations may vary in different locations. Waste characterizations and compliance with applicable laws are the responsibility solely of the waste generator.

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If further information is required consult Minova Americas website: www.minovaglobal.com.

- TekGrout® Safety Data Sheet (SDS)
- Minova Pumps for Mining Brochure
- Minova Pumpable Cement Grouts Brochure

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MINING / CONSTRUCTION

CELROC P

THIXOTROPIC NON-SHRINK GROUT

DESCRIPTION

Celroc P is a non-shrink, non-metallic grout consisting of rapid hardening hydraulic cements and a super plasticizer, designed to produce a pumpable grout at low water/cement ratios. Minimal dilution in moving water is a unique feature. Celroc P sets without water bleed, and controlled expansion ensures a perfect bond to all surfaces, including concrete, rock and steel.

Celroc P is designed for anchoring and void filling applications. The product is also ideal for anchoring and grouting rock and soil anchorages in deep holes in open foundations, dams and underground rock structures.

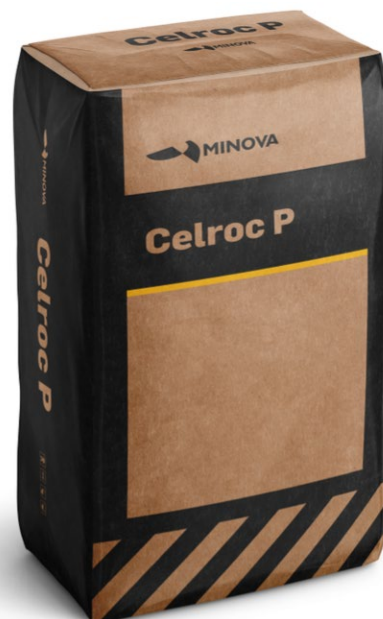
Celroc P is highly sulfate resistant and tolerates aggressive ground water conditions. Unit yield is 0.5 cubic feet when mixed at the standard water/powder ratio of 0.30. Celroc P ideal for stand-pipe installation and grouting steel in casings where speed and performance are essential. It may be tremied when underwater placement is required.

USES

Celroc P is used to grout and rapidly consolidate highly fractured rock strata which would otherwise prevent the drilling of anchor bolt holes, or where water infiltration threatens foundation stability. The product can also be pumped overhead without grout loss by adjusting the water/cement ratio.

ADVANTAGES

- Non-shrink – controlled expansion
- Rapid setting – sets in 75 minutes
- High strength - thixotropic



APPLICATION METHOD

Place 1-1/2 gallons (5.67 litres) of water in mixer. Start agitator and add 50 pounds (22.5 Kg) of Celroc P from the bag, stirring throughout. Dispersion is fast, and no lumping should occur. Pour or pump the grout immediately after preparation.

Thoroughly flush all lines with water upon completion of grouting. Adjusting water/cement ratios from .27 to .35 provides for a cement from a gel to pourable (batter-like) consistency.

Purge all equipment lines, pumps and tanks of Portland cement mixes with clean water prior to batching and placing Celroc P.

TECHNICAL DATA

The data below is laboratory data only. It may vary in practice due to thermal exchange between cement and substrate, temperature and other factors.

**COMPRESSIVE STRENGTH
ASTM C-109**

Temperature at 73°F (24°C) Water / Celroc P Ratio = 0.30	
75 minutes	Initial Set
4 1/2 hours	1,500 psi (10.3 MPa)
24 hours	5,000 psi (34.5 MPa)
48 hours	7,000 psi (48.3 MPa)

**SAFETY INSTRUCTIONS AND
LIMITATIONS**

Observe the usual precautionary measures for handling chemicals, see Celroc P SDS.

Use water to clean material from skin and clothing.

PACKAGING AND TRANSPORTATION

Celroc P is available in 50 lb, (22.5 Kg) bags.

STORAGE AND SHELF LIFE

Unused quantities may be resealed and stored in a cool, dry place for up to six months. Never add material to this product unless instructed by Minova USA, Inc.

DISPOSAL

If this product as supplied becomes a waste, it does not meet the criteria of a hazardous waste as defined under the Resource Conservation and Recovery Act (RCRA) 40 CFR 261. Dispose of material in accordance with all applicable federal, state/provincial and local laws and regulations. Regulations may vary in different locations. Waste characterizations and compliance with applicable laws are the responsibility solely of the waste generator.

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If further information is required consult Minova Americas website: www.minovaglobal.com.

- Celroc P Safety Data Sheet (SDS)
- Minova Chemicals, Polymers & Steel Application Guide
- Minova – Pumps for Civil Engineering, Tunneling and Restoration
- Strata Injection and Cavity Fill Chemicals – Minova Master Product Catalogue
- Minova Celroc P Product Specification

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CONSTRUCTION

TEKROK

PUMPABLE CONSTRUCTION CEMENT

DESCRIPTION

TekRok cement was developed in response to customer demand for a high-strength pumpable cement for underground construction projects. It was specifically designed for pumping through our placer unit. The Tekplacer meters and mixes the proper amounts of water and powder as it pumps the TekRok material. Fifty- four 50-pound bags of TekRok powder are used per cubic yard.

The cured TekRok cement is non-shrinking and dries to a durable, off-white finish. The material has a pumping life of up to 30 minutes and sets in 5 to 8 hours. TekRok cement is especially suited for small to medium sized construction projects, or for projects where the convenience of a pumpable cement is required.

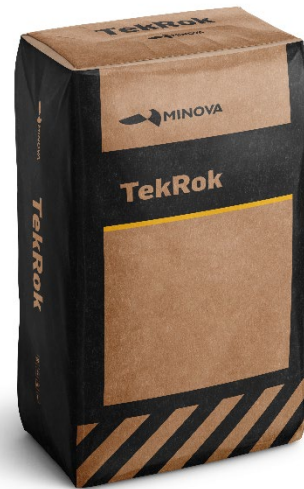
USES

TekRok pumpable construction cement is ideal for small- to medium-sized construction projects. Examples for uses of TekRok cement include belt drives, heads, take- ups, crusher stations, belt tensioners, track switches, shop floors, sump holes, topping-off overcasts, etc.

Consult your local Minova representative for additional application information.

ADVANTAGES

- Fast – pumping rate of over 4 yd³ per hour can be achieved
- Convenient – Can be pumped over 150 feet through standard 2-inch mine spray hose, can be pumped directly into standing water
- Simple – Powder and water are automatically metered as they are mixed in the Tekplacer unit



APPLICATION METHOD

To calibrate the placer unit and to make adjustments to the water supply, it is highly recommended that a consultant from Minova, or an authorized contractor, be on site to advise personnel, especially during the pumping process.

1. Build forms around the site. Level and fill the site as necessary.
2. Run a 2" hose from the placer to the job site.
3. Hook up fresh water at the rate of 10 gpm at a minimum of 50 psi, and AC power, to the Tekplacer.
4. Adjust water and powder feed so that 3 gallons of water are used for every 2 bags (3.3 gal/100 lbs) of TekRok cement.
5. Pump the material into the forms, leveling as needed.

TekPlacer

Made in the USA by Minova; Multi-use placer unit is used to transfer several of Minova’s cementitious products: TekSeal®, TekFoam, Tekcrib, TekRok

Motor: 15 hp AC; Full load amps - 21 @ 460V, 18 @ 575V.; Cable Size: normally #6 (permissible unit available).

Develops 200+ psi, and typically pumps TekRok cement 150’ through a 2” hose. Requires 10 gpm @ 50 psi Dimensions: 3’6” x 2’3” x 11’9”; Weight: 1,700 lbs; Unit capacity with Tekrok: over 4 yds³/hour.

SAFETY INSTRUCTIONS AND LIMITATIONS

Observe the usual precautionary measures for safe handling, see TekRok SDS.

Good housekeeping is needed during storage, transfer, handling, and use of this material to avoid excessive dust accumulation. Never add material to this product unless instructed by Minova.

Use of product in extremely high or low temperatures will affect set times.

PACKAGING AND TRANSPORTATION

TekRok pumpable cement is packaged in 50 lb, 3-ply bags with 1 polyethylene layer, 56 bags per stretch-wrapped pallet.

STORAGE AND SHELF LIFE

TekRok has a shelf life of twelve months in dry conditions.

DISPOSAL

If this product as supplied becomes a waste, it does not meet the criteria of a hazardous waste as defined under the Resource Conservation and Recovery Act (RCRA) 40 CFR 261. Dispose of material in accordance with all applicable federal, state/provincial and local laws and regulations. Regulations may vary in different locations. Waste characterizations and compliance with applicable laws are the responsibility solely of the waste generator.

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ADDITIONAL DOCUMENTATION

Started more than 135 years ago, Minova is a global manufacturer and supplier of chemical and mechanical earth control products and support equipment. With manufacturing plants on five continents and operations in more than 25 countries, Minova is an industry-leading provider of ground support solutions for the underground mining, construction and energy industries.

If further information is required consult Minova Americas website: www.minovaglobal.com.

- TekRok Safety Data Sheet (SDS)
- Minova Pumps for Mining Brochure
- Minova Pumps for Civil Engineering, Tunneling and Restoration
- Minova Pumpable Cement Grouts Brochure

MANUFACTURER

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MINING

TEKSEAL®

MSHA-APPROVED PUMPABLE, PERMANENT, BLAST-PROOF VENTILATION SEAL SYSTEM

DESCRIPTION

Tekseal® is a cement-based non-flammable chemical grout product that forms a low-density foam when mixed with water via the Minova Tekplacer mixer. Material is then pumped into a pre-constructed form. TekSeal® mix is typically pumped 500-1000 feet through a 1 1/4-inch diameter hose. The product begins to gel in minutes forming a non-toxic, non-combustible product. Tekseal® can be used for installing permanent underground ventilation seals, general void filling and backfilling. It may also be used for general void filling and back filling. (See the TekSeal® TDS for cavity filling).

Supplied as a powder, Tekseal forms a low-density foam (0.6 to 0.8 specific gravity) when combined with a controlled amount of air and water. The 400 psi compressive strength mixture begins to gel in minutes, forming a non-toxic, non-combustible product weighing approximately 1200 lbs/yd.

USES

TekSeal® cement is a foamed mix which is primarily used to create pumpable seals. For applications other than explosion-proof seals, the strength can be adjusted to suit the application.

Consult your local Minova USA, Inc. representative for additional application information.



ADVANTAGES

- TekSeal® is MSHA approved for Main Line and GOB Seal applications at both 50 psi and 120 psi overpressures. (Go to www.msha.gov for details).
- Acid mine water resistant – determined as a result of months of MSHA testing in pH 3 water
- Yieldable – Yields with ground pressure to 60% of original height before brittle failure – a substantial improvement over conventional seals, TekSeal® mimics the stiffness of the adjacent ribs. This helps maintain even stresses, resulting in reduced fracturing of the ribs and minimizes air leakage through the surrounding strata.

APPLICATION METHOD

Pumpable Seals

To calibrate the placer unit and to make adjustments to the water supply, trained and certified supervisors are required and are available through Minova or authorized contractors. They must be on site to advise mine personnel, especially during the pumping process.

1. Remove all loose material from roof, ribs and floor at the seal site (no need to re-bolt, hitch or grade).
2. Run at least 600’ of 1 1/4-inch slick line or hose from the placer to the seal site.
3. Hook up fresh water at a rate of 25 gpm at 50 psi, and AC power, to the placer. 15 gal of water per 100 lbs of Tekseal® powder are required.
4. Pump the mix into the formwork.

Placer

Made in the USA by Minova; Multi-use placer (Tekplacer) unit is used to transfer several of Minova’s cementitious products: Tekfoam, Tekcrib, Tekrok, Tekrok SCR

Motor: 20 hp AC; Full load amps - 21 @ 460V, 18 @ 575V; Cable Size: normally #6. Develops 200+ psi, and typically pumps Tekseal® cement 1,000 feet through a 1 1/4-inch hose. For greater pumping distances, please contact your local Minova representative. Requires water supply @ 50 psi without the optional water heater, 100 psi with heater. Dimensions: 3’6” x 2’3” x 11’9”; Wgt: 1,700 lbs;

Unit capacity: 17.5 yds³/hour.

Water heater

Required in some applications to bring the water temperature above 60°F. Full load amps - 90 @ 460V, 110 @ 575V; Cable Size: normally #2; Dimensions: 3’2” x 3’4” x 3’10”; Wgt: 1,700 lbs when full.

SAFETY INSTRUCTIONS AND LIMITATIONS

Good housekeeping is needed during storage, transfer, handling, and use of this material to avoid dust accumulation.

PACKAGING and TRANSPORTATION

TekSeal® is available in 45 lb. (20.41 kg) 3-ply bags with one polyethylene layer, 48 bags per stretch-wrapped pallet. Alternately TekSeal® is available in 1500 or 2000 lb. “super-sacks”, reducing handling, manpower and waste packaging issues.

STORAGE AND SHELF LIFE

Three months in dry conditions.

DISPOSAL

If this product as supplied becomes a waste, it does not meet the criteria of a hazardous waste as defined under the Resource Conservation and Recovery Act (RCRA) 40 CFR 261. Dispose of material in accordance with all applicable federal, state/provincial and local laws and regulations. Regulations may vary in different locations. Waste characterizations and compliance with applicable laws are the responsibility solely of the waste generator.

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If further information is required consult Minova Americas website: www.minovaglobal.com.

- TekSeal®, TekSeal® Lite Safety Data Sheet (SDS)
- MSHA Approval Number 50M-02.1 – 50 psi Minova Main Line TekSeal® Installation Guide
- Minova Approval Number 120M-02.2 – 120 psi Minova Main Line TekSeal Installation Guide
- Minova Pumps for Mining Brochure
- Minova Pumpable Cement Grouts Brochure
- Minova TekSeal® Product Specification

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MINING

TEKPAK® P

THE ADVANCED PUMPABLE CRIB SYSTEM

DESCRIPTION

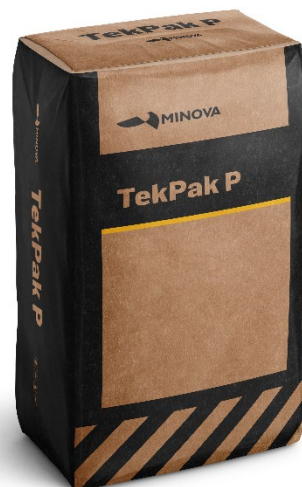
TekPak® P is a patented pumpable crib material having substantial benefits in terms of roof control, speed and ease of installation.

TekPak® P has a high early strength allowing the crib to resist bed separation and convergence. The fully cured strength is substantial with over 150 tons of load bearing capacity

TekPak® P is a two-part system consisting of Tekcem P and Tekbent P which when mixed together rapidly react to produce a load bearing crib.

Tekcem P is a non-combustible brown powder which forms an easy to pump slurry with water.

Tekbent P is a non-combustible low viscosity non-setting liquid and has an indefinite pumping life and Tekcem P is pumpable for at least 12 hours.



USES

For developing load-bearing pumpable cribs in mines and shafts.

ADVANTAGES

- High yield – a crib, comprising a substantial proportion of water, reducing the material requirement.
- Long distance pumping – from over 15,000 feet out through low cost small diameter pipe, such as ‘slickline’, thus easing transport and enabling more than one site to be serviced from a single pumping station.
- Consistent performance – compared to wood cribs.

APPLICATION METHOD

The slurries of Tekcem P and Tekbent P can be prepared in any standard batch or continuous mixer* Approximately 3 minutes mixing under medium shear (i.e. paddle type mixer) is adequate for either product.

The slurries are then pumped separately to the crib where they are mixed just prior to entering the crib bag.

Equal volumes of Tekcem P and Tekbent P slurries are employed. Do not allow Tekcem P and Tekbent P to mix until just before entering the crib bag; the combined mix sets in a few seconds.

SAFETY INSTRUCTIONS AND LIMITATIONS

Observe the usual precautionary measures for safe handling, see Tekcem P and Tekbent P SDS's.

PACKAGING AND TRANSPORTATION

Tekcem P, 50 lbs, 3 ply bags with one polyethylene layer, 48 bags per stretch wrapped pallet. Also available in 500 lb bags, 4 bags per stretch-wrapped pallet and bulk tankers.

Tekbent P, bulk tankers, totes or 5 gallon pails.

** Consult with manufacturer for specific recommendations regarding mix proportions and crib installation.*

STORAGE AND SHELF LIFE

Twelve months if you keep liquid above 40°F and powder cool and dry

DISPOSAL

If this product as supplied becomes a waste, it does not meet the criteria of a hazardous waste as defined under the Resource Conservation and Recovery Act (RCRA) 40 CFR 261. Dispose of material in accordance with all applicable federal, state/provincial and local laws and regulations. Regulations may vary in different locations. Waste characterizations and compliance with applicable laws are the responsibility solely of the waste generator.

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- Tekcem P Safety Data Sheet (SDS)
- Tekbent P Safety Data Sheet (SDS)
- Minova Pumpable Cement Grouts Technical Data Sheet (TDS)

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MINING / CONSTRUCTION

TEKFOAM

PUMPABLE FOAMED CEMENT FOR CAVITY FILLING

DESCRIPTION

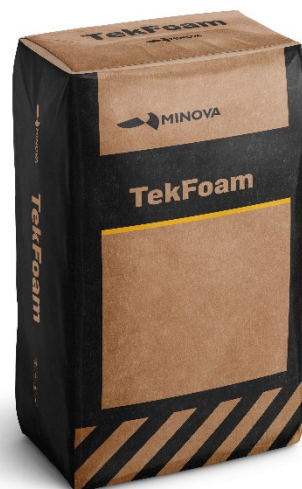
TekFoam is a pumpable foamed cement. Supplied as a cement powder, forms a low-density foam when combined with the proper amount of air and water. TekFoam is specially designed for use in the Minova placer unit. TekFoam cement is a non-combustible, void-filling, structural cementitious foam approximately (0.32 sg) when combined with the proper amount of air and water in the specially designed Tekplacer unit. Normally, four 45 lb bags/yd³ (5.23 bags/m³) are used TekFoam mix is typically pumped 400 feet (121.9 m) through a 1-inch (25.4 mm) diameter hose and farther through a larger diameter hose. The 20 psi (0.1379 MPa) product begins to gel in minutes, forming a non-toxic, non-combustible product weighing approximately 540 lbs/yd³ (320.4 kg/m³), and because of its rapid strength gain, is firm enough to walk on in minutes. Consult your local Minova representative or see our product brochure (Pumpable Cement Grouts) for additional information.

USES

TekFoam is specially designed for the filling of cavities on longwall sections, for back filling over arches to provide contact against a roof, filling a cavity to prevent methane build-up, and cushioning against falling debris over a false roof.

ADVANTAGES

- Fast – Pumping rate of over 100 yds³ (76.46 m³) per shift is possible; convenient one bag blend
- High yield – Less material to handle; four 45 lb (20.41 kg) bags will yield 1 yd³ (0.76 m³) - less costly than typical foamed cements
- Simple – Tekplacer unit meters in proper amounts of air and water while pumping foam to the site.



APPLICATION METHOD

To calibrate the placer unit and to make adjustments to the water supply, it is highly recommended that a consultant from Minova, or an authorized contractor, be on site to advise mine personnel, especially during the pumping process.

Build a form to hold the foam in the desired location. Formwork can be of light-weight construction unless the foam is also to provide roof support. TekFoam cement can bridge gaps over 1" (25.4 mm) wide.

Run at least 200 ft (60.7 m) of 1" (25.4 mm) hose from the pump to the cavity area.

In the case of a cavity that needs to be filled remotely, install two 3" (76.2 mm) diameter or greater stand pipes into the cavity. One pipe needs to go into the highest point of the cavity, while the other pipe can be lower.

Run the 1" (25.4 mm) discharge line up the lower stand pipe.

Continued>

TECHNICAL DATA SHEET



Hook up fresh water at a rate of 15 gpm (56.8 L/m) at 50 psi (0.3447 MPa), and AC power, to the placer. Twenty-four gallons (90.8 L) of water per 100 lbs (45.4 kg) of Tekfoam powder are required. Pump the TekFoam mix into the cavity until it emerges from the higher stand pipe.

TekPlacer

Made in the USA by Minova, Multi-use Tekplacer unit is used to transfer several of Minova's cementitious products: TekSeal, Tekcrib, and TekRok SCR. Placer – Made in the USA by Minova; Multi-use placer (Tekplacer) unit is used to transfer several of Minova's cementitious products: TekFoam, Tekcrib, Tekrok, Tekrok SCR.

Motor: 20 hp AC; Full load amps - 21 @ 460V, 18 @ 575V; Cable Size: normally #6. Develops 200+ psi, and typically pumps Tekseal® cement 1,000 feet through a 1 1/4-inch hose. For greater pumping distances, please contact your local Minova representative. Requires water supply @ 50 psi without the optional water heater, 100 psi with heater. Dimensions: 3'6" x 2'3" x 11'9"; Wgt: 1,700 lbs; Unit capacity: 17.5 yds³/hour.

Water heater

Required in some applications to bring the water temperature above 60°F. Full load amps - 90 @ 460V, 110 @ 575V; Cable Size: normally #2; Dimensions: 3'2" x 3'4" x 3'10"; Wgt: 1,700 lbs when full.

SAFETY INSTRUCTIONS AND LIMITATIONS

Observe the usual precautionary measures for handling cements, see TekFoam SDS.

PACKAGING and TRANSPORTATION

TekFoam is available in 45 lb (20.41 kg), 3-ply bags with 1 polyethylene layer, 48 bags per stretch-wrapped pallet.

STORAGE AND SHELF LIFE

Shelf life is at least 12 months in a dry, cool place.

DISPOSAL

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- TekFoam Safety Data Sheet (SDS)
- Strata Injection and Cavity Fill Chemicals – Minova Master Product Catalogue
- Injection Accessories – Minova Master Product Catalogue
- Minova Pumpable Cement Grouts Brochure

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MINING / CONSTRUCTION

TERRACOL® SYSTEM

NANOSILICA-BASED CHEMICAL GROUT SYSTEM

DESCRIPTION

Terracol® grout is dual component, low-viscosity, chemical grout system used for ground consolidation and stabilization of foundations and footings located on fine to medium sands.

The Terracol® System is a complete process consisting of two components; Terracol Component A (colloidal silica suspension in the form of nano-particles), and Terracol® Component B (hardener).

Both Components are completely water soluble. The amount of Terracol® Component B hardener needed ranges from about 10:1 to 5:1 by weight depending on the desired gel time. As an example, a 6.6:1 ratio results in an approximate 30 minute gel time at 70°F (21.1°C).



USES

Other important uses include control of water inflow into shafts and tunnels during excavation, pre-grouting of TBM/EPBM tunnel headings, formation of impervious grout curtains to contain pollution by hazardous waste, and cut-off walls into alluvial deposits at dam sites.

ADVANTAGES

- Adaptable – gel time adjustable by varying proportions of hardener to allow project-specific formulation; low viscosity enables maximum strata penetration and minimal product waste
- Safety – environmentally friendly material
- Low viscosity – 5 to 10 cps enables maximum permeation into fine sands and fine cracks.

APPLICATION METHOD

Mixing (batch method)

The mixing tank can be steel or plastic and should be fitted with a good agitator. Tank capacity should be related to the pumping rate and selected gel time to ensure the entire batch of Terracol® grout is dispensed within the established gel time.

With the mixing blades rotating, Component B hardener is added to Terracol® Part A. Mix until the Terracol® Component B Hardener is completely dispersed after a few minutes.

Terracol® grout is now ready for injection. It may be pumped with progressing cavity pump (e.g. Moyno) or higher-pressure piston pumps

TECHNICAL DATA

The data below are laboratory data only. They may vary in practice due to thermal exchange between grout and strata, surface properties of the rock, humidity, pressure and other factors.

MATERIAL DATA

Parameter	Terracol® Component A	Terracol® Component B
Material	Colloidal silica suspension	Hardener
Viscosity	≈ 10cps	≈ 1cps
Color	Clear liquid	Clear
pH value	9.5 – 10.5	7
Specific gravity	1.2	1.07

PACKAGING AND TRANSPORTATION

CONTAINER TYPE	TERRACOL® COMPONENT A	TERRACOL® COMPONENT B
Pail		5 gal (40 lbs)
Steel Drum	55 gal (550 lbs)	55 gal (475 lbs)

Other packing units available on request.

SAFETY INSTRUCTIONS AND LIMITATIONS

Good housekeeping is needed during storage, transfer and handling in the use of this material to avoid leaks and spills. Never add material to this product unless instructed by Minova USA, Inc.

STORAGE AND SHELF LIFE

Terracol® Component A should be kept at a temperature of 40°F - 95°F (4.5°C - 30°C). Do not allow it to freeze or it will be damaged irreversibly. Both components have a shelf life of one year if stored correctly.

DISPOSAL

If this product as supplied becomes a waste, it does not meet the criteria of a hazardous waste as defined under the Resource Conservation and Recovery Act (RCRA) 40 CFR 261. Dispose of material in accordance with all applicable federal, state/provincial and local laws and regulations. Regulations may vary in different locations. Waste characterizations and compliance with applicable laws are the responsibility solely of the waste generator.

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- Terracol® Component A Safety Data Sheet (SDS)
- Terracol® Component B Safety Data Sheet (SDS)
- Minova Technical Handbook for the Safe Use of injection Resins within the Mining Sector
- Minova Field Manual – Handling Injection Resins in Tunneling and Civil Engineering
- Minova – Pumps for Civil Engineering, Tunneling and Restoration
- Minova Terracol® Product Specification

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MINING / CONSTRUCTION

TERRASET[®] SYSTEM

SILICATE-BASED CHEMICAL GROUT SYSTEM

DESCRIPTION

Terraset[®] grout is a low-viscosity, chemical grout system used for ground consolidation and stabilization of foundations and footings located on fine to medium sands. The Terraset[®] System comprises Terraset[®] Component A Sodium Silicate Grout and Terraset[®] Component B Hardener.

Both components are completely water soluble. On a volume basis, the amount of Terraset[®] Component B Hardener needed ranges from 10% to 15% based on the silicate concentration. The higher hardener concentration creates the most durable gels. Gel time of the mixed grout solution is approximately 12 minutes at 70°F (21.1°C). Terraset[®] Component B hardener obtains predictable gel times over a wide range of temperatures when mixed with Terraset[®] Component A silicate. The resulting gels are homogenous, dense, and well structured.

USES

Other important uses include control of water inflow into shafts and tunnels during excavation, pre-grouting of TBM/EPBM tunnel headings, formation of impervious grout curtains to contain pollution by hazardous waste, and cut-off walls into alluvial deposits at dam sites.

ADVANTAGES

- Adaptable – Mix concentrations allow project-specific formulation; low viscosity enables maximum strata penetration, minimal product waste
- Chemical resistivity – Unaffected by acids, alkalis, salts and hydrocarbons, resistant to fungi, and bacteria
- Low viscosity – 2 to 5 cps enables maximum permeation into fine sands and cracks.



APPLICATION METHOD

Mixing (batch method)

Batch mixing permits only one predetermined gel time to be used for each batch. The mixing tank can be steel or plastic and should be fitted with a good agitator. Tank capacity should be related to the pumping rate and selected gel time to ensure the entire batch of Terraset[®] grout is dispensed within the established gel time.

1. Add the required volume of water to the mixing tank. (See Table 1 Batch System).
2. Start the agitator, then add the appropriate volume of Terraset[®] Component B Hardener and continue stirring for a few minutes.
3. Add the correct amount of Terraset[®] Component A Silicate to Terraset[®] Component B Hardener. Normal grout concentration used is 50% by volume. In order to achieve practical working strengths, silicate concentrations of less than 30% are not recommended.
4. Terraset[®] grout is now ready for injection. Continue stirring the grout mixture throughout the grouting operation.

TECHNICAL DATA

The data below are laboratory data only. They may vary in practice due to thermal exchange between resin and strata, surface properties of the stone, humidity, pressure and other factors.

BATCH SYSTEM

Tank Volume	Percent Terraset® Grout	Gallons Terraset® Comp A	Gallons Terraset® Comp B	Gallons Water
10 Gallons	30	3	0.3	6.7
	40	4	0.4	5.6
	50	5	0.5	4.5
	60	6	0.6	3.4
	70	7	0.7	2.3
20 Gallons	30	6	0.6	13.4
	40	8	0.8	11.2
	50	10	1.0	9.0
	60	12	1.2	6.8
	70	14	1.4	4.6
30 Gallons	30	9	0.9	20.1
	40	12	1.2	16.8
	50	15	1.5	13.5
	60	18	1.8	10.2
	70	21	2.1	6.9
40 Gallons	30	12	1.2	26.8
	40	16	1.6	22.4
	50	20	2.0	18.0
	60	24	2.4	13.6
	70	28	2.8	9.2
50 Gallons	30	15	1.5	33.5
	40	20	2.0	28.0
	50	25	2.5	22.5
	60	30	3.0	17.0
	70	35	3.5	11.5

COMPRESSIVE STRENGTH

Compressive Strength ASTM C39	
1 day	115 psi (0.80 MPa)

PACKAGING AND TRANSPORTATION

CONTAINER TYPE	TERRASET COMPONENT A	TERRASET COMPONENT B
5 Gal (Can)	-	22.6 kg 50 lbs
Steel Drum	240 .4 kg 530 lbs	-

Other packing units available on request.

Metering System

The metering method typically allows a more convenient way of mixing and pumping Terraset® than with the batch method.

1. In one tank, blend water with Terraset® Component B Hardener.
2. In another tank, blend water with Terraset® Component A Silicate to lower the viscosity.
3. Using a positive displacement pump, bring the two liquids together at the end of the discharge line, sending the combination through a static mixer at the injection point. (See Figure 1. Field Equipment)
4. Terraset® grout is now ready for injection.

The convenience of the metering system over the batch method is illustrated below.

Figure 1. (Field Equipment) Illustrates a layout using two variable speed positive displacement pumps feeding into a mixing chamber, located just before the point of injection. Terraset® Component A Silicate is blended with water in Tank (TA-1). This effectively cuts the viscosity of the base grout and ensures efficient mixing with the Terraset® Component B Hardener in the mixing chamber. Terraset® Component B Hardener is blended with water in Tank (TA2).

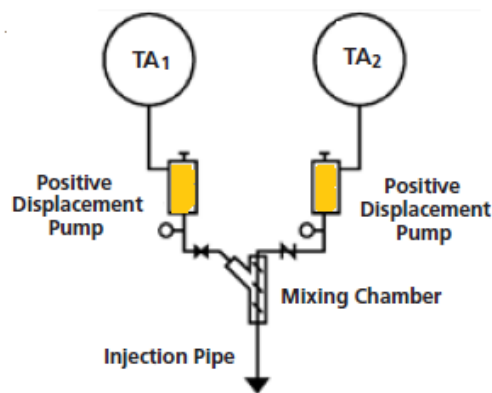


Figure 1. Field Equipment

SAFETY INSTRUCTIONS AND LIMITATIONS

Terraset® Component A silicate must be protected from freezing and should be monitored regularly for thickening that may occur.

STORAGE AND SHELF LIFE

One year in a cool dry place but do not allow material to freeze. Store away from direct sunlight or other heat sources which can reduce products usability and shelf-life.

DISPOSAL

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APPROVALS AND CERTIFICATES



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ADDITIONAL DOCUMENTATION

Started more than 135 years ago, Minova is a global manufacturer and supplier of chemical and mechanical earth control products and support equipment. With manufacturing plants on five continents and operations in more than 25 countries, Minova is an industry-leading provider of ground support solutions for the underground mining, construction and energy industries.

If further information is required consult Minova Americas website: www.minovaglobal.com.

- Terraset® Component A Safety Data Sheet (SDS)
- Terraset® Component B Safety Data Sheet (SDS)
- Minova Technical Handbook for the Safe Use of injection Resins within the Mining Sector
- Minova Field Manual – Handling Injection Resins in Tunneling and Civil Engineering
- Minova Terraset® Product Specification

MANUFACTURER

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MINING / CONSTRUCTION**CARBOTHIX FAST****SILICATE RESIN ANCHORING GROUT****DESCRIPTION**

CarboThix Fast is an immediate partially stiffening and very fast curing dual component silicate resin for bonding injection drilling anchors, also for rock stabilization and water sealing. CarboThix Fast was developed to improve the productivity of ground support installation in underground mining and tunnelling applications. Using the pumpable resin enables load to be taken up in minutes rather than the typical 24 hours from cementitious grouted systems. During application, the two components are intimately mixed and achieve a grease-like viscosity (the so called thix effect), so that the grout stops flowing and cures to form a tough elastic and non-porous resin that will not mix with water or be diluted in wet holes. Together they form an interpenetrating network, as a tough elastic non-porous silicate resin. The resulting viscous emulsion will not take up any additional water (from the rock), will not mix with water and is resistant to dilute acids and alkalis as well as fats. As the system is under pump pressure, some grout is pushed into minor cracks and fissures around the anchor hole, ensuring full encapsulation of the anchor. As the two resin components are mixed at a set volume, consistent mixing of the grout is guaranteed, an advantage over cementitious grouts. This delivers a reliable quality of grout and anchoring performance. Operator safety and handling issues are also improved over cementitious grouting systems

USES

CarboThix Fast was developed to improve the productivity of ground support installation in underground mining and tunnelling applications. The thixotropic nature of the grout as well as its resistance against water provide a unique sealing against pressurized water inflow. Typical applications of CarboThix Fast include grouting of cable bolts, steel or GFRP bolts, and sealing of roof bolts.

**ADVANTAGES**

- Full encapsulation of anchors
- Immediate loading capacity of the bolt
- Long distance pumping (up to 1500 ft)

APPLICATION METHOD

After thoroughly mixing the two components, the resin instantly achieves a grease-like viscosity level so that the mix stops flowing, even in large fissures, and requires pump pressure for displacement. The components are to be pumped at the volumetric ratio of 1:1 by using a dual component pump with final mixing of the materials achieved at the wand via a static mixer prior to placement. CarboThix's high strength, provides a uniform transfer of local rock stresses over the whole length of the bolt.

For bonding of injection anchors (SDA's, and hollow bar), the mixed resin is injected into the drilled hole to the maximum depth to fill the annular space and adjacent joints. For detailed instructions on use (particularly before a change of injection resins), consult the Minova "Technical handbook for the safe use of injection resins within the mining sector".

TECHNICAL DATA

The data below is laboratory data. Results may vary in practice due to thermal exchange between resin and strata, surface properties of the rock, humidity, pressure, and other factors.

MATERIAL DATA

Parameter	Unit	Component A	Component B
Density at 77°F (25 °C)	kg/m ³	1430 ± 50	1160 ± 50
Color		light brown	dark brown
Flash point	°F	N/A	>212
Viscosity at 77°F (25 °C)	cps	300 - 420	150 - 230

REACTION DATA

Initial Temperature	77°F (25°C)
Solidification Time	1 min – 1 min 30 sec

SAFETY INSTRUCTIONS AND LIMITATIONS

This product is designed, manufactured and sold specifically and exclusively for use in drilled boreholes in underground mining and tunneling applications. Any use of this product in wet open air outside of a fully encircled borehole is at the user’s sole risk and responsibility and Minova USA, Inc. disclaims all liability.

PACKAGING AND TRANSPORTATION

CONTAINER TYPE	CARBOTHIX FAST COMPONENT A	CARBOTHIX FAST COMPONENT B
PC (Jug)	77 lbs (35 kg)	66 lbs (27 kg)
Steel Drum	614 lbs (278 kg)	529 lbs (240 kg)
IBC (Tote)	3,069 lbs (1392 kg)	2,435 lbs (1,104 kg)

Other packing units available on request.

STORAGE AND SHELF LIFE

At least 12 months from date of manufacture when stored in a dry place. If this time is exceeded, we recommend having the material checked by Minova USA, Inc. for compliance with specification. Instruction on storage conditions must be observed. Please see Safety Data Sheet (SDS) recommendations for product handling and storage.

DISPOSAL

If this product as supplied becomes a waste, it does not meet the criteria of a hazardous waste as defined under the Resource Conservation and Recovery Act (RCRA) 40 CFR 261. Dispose of material in accordance with all applicable federal, state/provincial and local laws and regulations. Regulations may vary in different locations. Waste characterizations and compliance with applicable laws are the responsibility solely of the waste generator.

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- CarboThix Fast Component B Safety Data Sheet (SDS)
- Minova Technical Handbook for the Safe Use of Injection Resins within the Mining Sector
- CarboThix Product Brochure
- Minova Field Manual – Handling Injection Resins in Tunneling and Civil Engineering
- Minova CarboThix Product Specification

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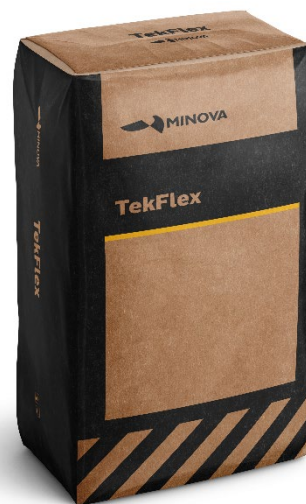
MINING / CONSTRUCTION

TEKFLEX®

FLEXIBLE, HIGH-STRENGTH MEMBRANE STRATA SUPPORT

DESCRIPTION

TekFlex® coating, developed in response to customer-demand for a premium strata support membrane with famous Minova USA, Inc. quality, is a cement-based spray material designed with superb flexibility, high tensile strength, and excellent adhesive qualities. The product enhances the structural integrity of the rock and forms an impervious barrier, which eliminates the degrading effects of weathering. Material coverage at a thickness of 1/6-inch varies from 1.2 to 2.7 sq. ft per liter, depending on the roughness of the rock surface.



ADVANTAGES

- Tough – Ability to stretch, excellent tensile characteristics, and fiber reinforcing assure coating integrity even after strata deformation
- Excellent adhesion – Special formulation enables superb adhesion
- No unusual storage or ventilation requirements during application, clean up or waste disposal
- Simple Mixing – Convenient packaging of two and one half parts liquid component to one part powder component minimizes mixing errors – no water or additional additives required

USES

TekFlex® coating is a patented high tensile strength sealant specially designed to permanently stabilize the integrity of rock structures accommodating the stresses associated with strata movement while providing a barrier to moisture degradation.

APPLICATION METHOD

No unusual ventilation requirements are needed during application. Workers should take general precautions including protective clothing, gloves, dust masks, and adequate eye protection.

1. Remove or protect any objects that are not to be covered with TekFlex® coating.
2. Remove as much dust and loose material as possible. Spraying onto a clean, dust-free substrate enables best results.
3. As TekFlex® sealant material may be mixed and sprayed using various types of equipment, follow the instructions for the particular equipment you are using.

Continued>

Notes:

- a) The best time to spray is right after excavation, when fresh, solid rock is first exposed.
 - b) Temperature should be 40°F (4.5°C) or higher. Ideal is roughly 60°F (15.5°C).
 - c) The practical thickness achievable will depend somewhat on the orientation of the rock. Suggested thickness is 1/6” (4mm).
4. Pot life is approximately one half hour. Water may be used for clean-up during this time.
 5. Thoroughly purge all TekFlex® material from the machine and lines with water when preparing for clean-up. Follow any machine manufacturer’s recommendations for clean-up.

Consult your local Minova USA, Inc. representative for additional application information.

SAFETY INSTRUCTIONS AND LIMITATIONS

Good housekeeping is needed during storage, transfer, handling, and use of this material to avoid spills and leaks. Never add material to this product unless instructed by Minova USA, Inc.

PACKAGING AND TRANSPORTATION

TekFlex® Liquid is available in 5 gallon pails, 36 pails per stretch-wrapped pallet. TekFlex® powder is available in 44 lb, 3-ply bags with 1 polyethylene layer, 43 bags per stretch-wrapped pallet. Three pallets of liquid are consumed with each pallet of powder.

STORAGE AND SHELF LIFE

Both components: Twelve months, in cool, dry conditions. Temperature of the TekFlex® Liquid component must be kept above the freezing point.

DISPOSAL

If this product as supplied becomes a waste, it does not meet the criteria of a hazardous waste as defined under the Resource Conservation and Recovery Act (RCRA) 40 CFR 261. Dispose of material in accordance with all applicable federal, state/provincial and local laws and regulations. Regulations may vary in different locations. Waste characterizations and compliance with applicable laws are the responsibility solely of the waste generator.

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If further information is required consult Minova Americas website: www.minovaglobal.com.

- TekFlex® Safety Data Sheet (SDS)
- Minova Sprayed Structural & Waterproofing Membranes Brochure
- Minova Sealants & Coatings Brochure
- Minova Pumps for Civil Engineering, Tunneling and Restoration
- Minova TekFlex® Product Specification

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MINING / CONSTRUCTION

TEKFLEX® PM

POLYMER MODIFIED SPRAYABLE CEMENT COATING

DESCRIPTION

TekFlex® PM was developed in response to customer demand for a more easily applied gunite with improved adhesion. TekFlex® PM can be pumped through Minova designed air-powered and hydraulic-powered equipment.

TekFlex® PM used in conjunction with TekFlex® PM Accelerator causes the product to set rapidly. This allows high build, bridging of gaps and allows TekFlex® PM to seal holes with pressure on them, such as on a leaky overcast. TekFlex® PM is a non-shrinking cement that dries to a durable off-white finish. TekFlex® PM has a pumping life of up to 30 minutes and sets in 5 to 8 hours. TekFlex® PM is especially suited for large remediation or preventative sealing.



USES

Uses include the prevention of spalling from moisture ingress and helping ensure the structural integrity of mine passages. It is an excellent alternative to gunite or shotcrete without the mess.

ADVANTAGES

- Good adhesion – Contains polymer latex for superior adhesion
- Convenient – TekFlex® PM can be pumped over 400 feet through standard mine spray hose
- Non-flammable – No unusual storage or ventilation requirements, equipment clean-up procedures or waste disposal

APPLICATION METHOD

It is recommended that a consultant from Minova or an authorized contractor be at the site during pumping to aid in training on the equipment, mixing and spraying.

1. Spray clean the roof and ribs with water or air.
2. Run a one- to two-inch hose from the pump to the job site.
3. Fill the pumps water tank.
4. Hook up either 460 / 575 Volt AC power, start compressor, start water pump and grout pump.
5. Add TekFlex® PM to hopper and adjust water flow until pressure gauge reads 20-40 bar (300 to 600 psi).
6. Spray roof and ribs to desired thickness

TECHNICAL DATA

The data below is laboratory data only. It may vary in practice due to thermal exchange between cement and substrate, temperature and other factors.

Compressive Strength	28 days / 4000 psi (27.5 MPa)
Yield	12 1/2 ft ² / bag at 1/2" thick

APEX

Made in the USA by Minova. Multi-use can handle several of Minova’s cementitious products, such as TekFlex® PM and TekFlex® All-Powder.

10 horsepower AC motor; full load 14 amps at 460V. Apex develops 870 psi pressure and is capable of pumping TekFlex® PM over 400 feet through a 1-1/2 inch-hose. Cable size normally used is #6.

Apex requires a clean source of water.

See diagram for dimensions. Weight is approximately 2,300 lbs. Apex has an Integral compressor.

SAFETY INSTRUCTIONS AND LIMITATIONS

Spraying TekFlex® PM onto flowing water is not recommended.

PACKAGING AND TRANSPORTATION

TekFlex® PM is available in 55 lb, 3-ply bags with 1 polyethylene layer, 48 bags per stretch-wrapped pallet.

STORAGE AND SHELF LIFE

TekFlex® PM has a shelf life of twelve months in cool, dry conditions. Product must be kept above the freezing point from 40 °F (4.4 °C) to 140 °F (60 °C) in a dry area away from water ingress. High temperature and humidity may reduce product shelf life.

DISPOSAL

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- TekFlex® PM Safety Data Sheet (SDS)
- TekFlex® PM Accelerator Safety Data Sheet (SDS)
- Minova Sprayed Structural & Waterproofing Membranes Brochure
- Minova Sealants & Coatings Brochure
- Minova TekFlex Product Specification

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MINING / CONSTRUCTION

TEKFLEX® DRY SPRAY

FLEXIBLE, HIGH-STRENGTH MEMBRANE STRATA SUPPORT

DESCRIPTION

TekFlex® Dry Spray coating was developed in response to customer demand for a premium strata support membrane with Minova quality. TekFlex® Dry Spray is a cement-based spray material designed with superb flexibility, high tensile strength and excellent adhesive qualities. The product enhances the structural integrity of the rock and forms an impervious barrier, which eliminates the degrading effects of weathering. It provides material coverage at a thickness of 1/6" (4 mm) is theoretically 50 ft². Actual coverage will be less due to surface roughness.

USES

TekFlex® Dry Spray coating is a patented high tensile strength sealant specially designed to permanently stabilize the integrity of rock structures accommodating the stresses associated with strata movement while providing a barrier to moisture degradation.

ADVANTAGES

- Excellent adhesion – Special formulation enables superb adhesion to the rock, assuring a long lasting coating
- Easy to apply – All powder formulation is applied using simple dry-process gunite equipment
- Easy to apply – All powder formulation is applied using simple dry-process gunite equipment
- Non-flammable – No unusual storage or ventilation requirements, equipment clean-up procedures or waste disposal



APPLICATION METHOD

No unusual ventilation requirements are needed during application. Workers should take general precautions, including protective clothing, gloves, dust masks and adequate eye protection.

Remove or protect any objects that are not to be covered with TeFlex® Dry Spray coating.

Remove as much dust and loose material as possible. Spraying onto a clean, dust-free substrate enables best results.

TekFlex® Dry Spray sealant material is mixed and sprayed with small dry process gunite equipment, e.g. Reed Sova, Allentown, Meyco Piccola, etc. Contact Minova for advice on configuring equipment.

Continued>

The following should be noted:

1. The best time to spray is right after excavation, when fresh, solid rock is first exposed.
2. Temperature should be 40° F (4.5° C) or higher. Ideal temperature is roughly 60° F (15.5° C).
3. The practical thickness achievable will depend somewhat on the orientation of the rock. Suggested thickness is 1/6” (4mm).
4. Always spray water first followed by powder feed. Adjust water content at the nozzle to minimize dust and prevent slump of material.
5. When job is complete, maintain air flow but cease powder feed, and purge spray nozzle with water. Turn off water and air supply, taking care to ensure water does not flow back up the hose.

SAFETY INSTRUCTIONS AND LIMITATIONS

Spraying TekFlex® Dry Spray onto flowing water is not recommended.

PACKAGING AND TRANSPORTATION

TekFlex® Dry Spray is available in 40 lb, 3-ply bags with 1 polyethylene layer, 56 bags per stretch-wrapped pallet.

STORAGE AND SHELF LIFE

TekFlex® Dry Spray has a shelf life of twelve months in cool, dry conditions. Product must be kept above the freezing point in a dry area away from water ingress. High temperature and humidity may reduce product shelf life.

DISPOSAL

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- Minova Sealants & Coatings Brochure
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SURFACE SUPPORT

BEARING PLATE

DESIGNED FOR STRENGTH

Minova’s Bearing Plates are manufactured from high-strength steel. They are designed to help prevent loose material from falling between the roof bolt patterns and provide strength to your immediate roof.

The “donut-shaped” embossment around the center hole increases deflective strength. The donut distributes the load to the roof bolt and serves to center the bolt and provide protection to the bolt head.

Bearing Plates are also manufactured with a “dome” embossment. The dome is used in applications where the seam height is greater.

Bearing Plates are available in a variety of sizes and grades to fit your roof plan requirements.

If additional strength is required in the center for stronger bolting systems, the donut embossed Bearing Plates have been designed to accommodate a Donut Plate Insert (DPI) washer.

The DPI can be used between the roof bolt and Bearing Plate. The DPI strengthens the hole location where high loading and deformation occurs. This unique combination provides the required strength in critical areas, the center and the edges. The system effectively reduces bolt pull-through and plate bending in heavy ground conditions.

SPECIFICATIONS:

Size	Grade	Embossment
6”X 6”	2, 3, 4, 5, 6	Dome, Donut, Flat
8”X 8”	2, 3, 4, 5, 6	Dome, Donut, Flat
9”X 9”	2, 3	Donut
6”X 16”	2, 3	Dome, Low Profile

*Standard hole sizes are 13/16”, 1”, 1-1/8”
And 1-3/8”*



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- Steel Bolts, Plates, Other Steel Articles Safety Data Sheet (SDS)
- Minova Guide to Rock Bolting
- Minova Chemicals, Polymers & Steel Application Guide

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CABLE SYSTEMS

CABLE BOLT

VERSATILITY AND REMARKABLE PERFORMANCE

Natural movement in rock strata can threaten a safe work environment. Minova’s Cable Bolts are designed to perform despite lateral strata movement. Cable Bolts incorporate much higher strength than traditional bolts with incomparable flexibility to adjust to the movement of the earth’s strata.

Cable Bolts are applicable where standard ground support is marginal or inadequate. Common application areas include, tailgates, bleeders, recovery rooms, set-up rooms, headgates, intersections and other mine areas where additional support is indicated.

Minova leads the way with low profile cable bolt technology.

- Uses existing bolting equipment
- Reduces or eliminates the need for expensive cribbing or standing supports
- Available in long one-piece fixtures in any seam height
- Lowers costs by enhancing ventilation
- Strengthens and reinforces roof structures



SPECIFICATIONS:

Material	Strand	Borehole	Ultimate Load	Patent
0.6" Gr270K	Bright, Galvanized	1", 1-3/8"	Approximately 30 tons	5,230,589 and 5,259,703
0.7" Gr270K	Bright, Galvanized	1", 1-3/8"	Approximately 40 tons	

Required resin and Cable Bolt length are determined by testing.

SIGNIFICANT ADVANCEMENT IN ROOF SUPPORT TECHNOLOGY

- Available in two diameters
- Galvanized strand is available for applications where stand times are greater than one year
- Minova’s exclusive bulbing system provides improved resin mixing and anchorage

- Available in passive or post-tensioned systems

INSTALLATION PROCEDURES

1. Drill hole at proper diameter and depth.
2. Insert appropriate Minova resin cartridge. It is critical that resin cartridges are inserted all the way to the top of the borehole before cartridges are broken. This is accomplished by pushing the cartridge with the Cable Bolt by hand.
3. Rotate Cable Bolt to the top of the borehole. It may be necessary to push Cable Bolt by hand (or with the bolting machine) before bolt head can be inserted into spin-in wrench.
4. Once the Bearing Plate is within ¼" of the roof, spin bolt to ensure complete mixing of resin. Rotate the cable in the clockwise direction only.
5. Stop rotation.
6. Apply full thrust with bolting machine and hold constant until resin sets.

Consult your Minova Technical Sales Representative for specific mixing and hold requirements.

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TENSIONABLE SYSTEM

CONTINUOUS THREAD BOLT

Minova's Continuous Thread Bolts have been designed to take the worry out of complex bolting in both civil and mining applications. This versatile bolt can be used for roof/rib support, tunneling, and slope stabilization support projects.

Minova's Continuous Thread Bolts work much like Minova's Tension Rebar Bolts but have the added benefit of being able to be mix the resin and be torqued in the same rotation direction. Additionally, unlike the Tension Rebar Bolt, the Continuous Thread Bolt is threaded the entire length of the bar, which allows for more versatility if roof control plans change down the road.

The Continuous Thread Bolt is available as a one-piece bolt and as a two-piece bolt.

INSTALLATION PROCEDURES:

1. Drill hole at proper diameter and depth.
2. Make depth 1" longer than the bolt.
3. Insert appropriate Minova resin cartridge.
4. Insert Continuous Thread Bolt and Bearing Plate to within 1/16" to 1/8" of roofline.
5. Rotate bolt to ensure complete mixing of resin.
6. Stop rotation.
7. For specified resin set time, hold bolt in place.
8. Torque bolt to pre-determined torque in accordance with approved roof control plan.

Consult your Minova Technical Sales Representative for specific mixing and hold requirements.

Specifications (ASTM Grade 75)

Bar Diameter	Min Yield	Min Tensile	Borehole	Plate
#6 (19 mm) *	33,000 lbs	44,000 lbs	1"	Gr3, Gr4
#7 (22 mm) *	45,000 lbs	60,000 lbs	1-1/8", 1-3/8"	Gr3, Gr4
#8 (25 mm) *	59,250 lbs	79,000 lbs	1-3/8"	Gr4, Gr5



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POINT ANCHOR SYSTEM

DOUBLE LOK BOLT

Minova’s Double Lok Bolt is state-of-the-art for both anchorage and speed. It boasts a double benefit and provides greater control at a lower cost.

The Double Lok Bolt does not require any special tools or installation techniques. Instead, when used with the proper Minova resin, the expansion shell of the Double Lok Bolt sets the initial anchorage and allows the resin to cure while the rock is in a state of compression.

Additional anchorage for this system takes place along the interface of the bolt shaft, resin and bore-hole wall. The “combination anchorage” of the expansion shell and resin has proven very successful for adverse ground conditions

INSTALLATION PROCEDURES

1. Drill hole at proper diameter and depth.
2. Make depth 2” longer than the bolt.
3. Insert appropriate Minova resin cartridge.
4. Insert Double Lok Bolt and Bearing Plate to within 1/16” to 1/8” of roofline.
5. Rotate bolt using drill pre-set to proper torque. Bearing Plate should be tight against roof.

SPECIFICATIONS

Bar Diameter & Grade	Min Yield	Min Tensile	Borehole	Shell	Plate	ft-lbs
#5 (16 mm) Gr60	13,600 lbs	20,300 lbs	1”	Standard	Gr2	125 - 225
5/8” SRD Gr75	17,000 lbs	22,600 lbs	1”	Standard	Gr2	125 - 225
#6 (19 mm) Gr40	13,400 lbs	23,400 lbs	1-3/8”	Standard, Long	Gr3, Gr4	125 - 225
#6 (19 mm) Gr60	20,000 lbs	30,100 lbs	1-3/8”	Standard, Long	Gr3, Gr4	150 - 275
3/4” SRD Gr75	25,100 lbs	33,400 lbs	1-3/8”	Standard, Long	Gr3, Gr4	175 - 300
#7 (22 mm) Gr40	18,500 lbs	32,300 lbs	1-3/8”	Standard	Gr3, Gr4	175 - 300
#7 (22 mm) Gr60	27,700 lbs	41,600 lbs	1-3/8”	Standard	Gr3, Gr4	200 - 350
7/8” SRD Gr75	34,700 lbs	46,200 lbs	1-3/8”	Standard	Gr3, Gr4	250 - 375



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FULLY GROUTED SYSTEMS

ECLIPSE BOLT

Minova has developed this high-performance, cost-effective bolting system to enhance resin mixing and minimize the adverse effects of “glove fingering.” Glove fingering occurs when the plastic film packaging within the cured resin is forced against the borehole wall to potentially interfere with the mechanical interlock of the resin and the rock mass. The offset head forces the bolt around the outside of the borehole wall, shredding the cartridge and increasing the mixing action.

- 1/8” offset reduces gloving up to 70%
- Specially designed for Minova Lokset® resin
- Increases mixing efficiency
- Increases pullout strength
- Uniform resin anchorage
- Off-set effective to end of bolt
- Consistent quality mixing
- No cavitation

INSTALLATION PROCEDURES

1. Drill hole at proper diameter and depth.
2. Make depth 1” longer than the bolt.
3. Insert the appropriate Minova Lokset® Eclipse resin cartridge.
4. Insert Eclipse Bolt and Bearing Plate to within 1/16” to 1/8” of roofline.
5. Rotate bolt 3 - 5 seconds.
6. Hold bolt tight against roof for 3 - 7 seconds depending on resin speed

SPECIFICATIONS

Bar Diameter & Grade	Min Yield	Min Tensile	Borehole
#5 (16 mm) Gr60	18,600 lbs	27,900 lbs	1”



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MINING / CONSTRUCTION / TUNNELING / GEO-TECHNICAL

EXRB EXPANDABLE ROCK BOLTS

ROCK STABILIZATION

DESCRIPTION

The EXRB Expandable Rock Bolt is a full column anchored rock bolt that forms a mechanical interlock between the entire bolt and the borehole wall. When rock surrounding an underground excavation needs to be reinforced or stabilized, choose Minova’s EXRB to create the safe and stable working environment your site requires.

The EXRB offers fast and reliable rock reinforcement with assured quality and guaranteed mechanical properties.

Minova EXRB consists of a folded steel tube with upper bushing and inflation bushing welded at each end of the tube. A specially designed adjustable face plate is delivered as an option.

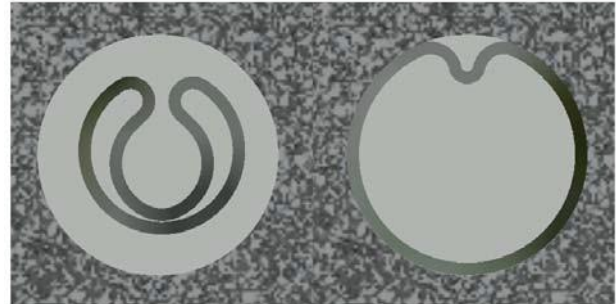
EXRB requires steel with extremely good elongation and formability properties. This produces a finished bolt that will be able to accommodate large rock movements and still maintain its high load bearing capacity. EXRB delivers a high level of safety and uninterrupted production in the customer’s operations.

USE

The EXRB is a cost-effective means of rock reinforcement in a variety of rock conditions from hard to soft rock. It is flexible and allows for variations in the borehole diameter. The EXRB is designed to accommodate large rock movements and while maintaining high load bearing capacity.

ADVANTAGES

- Provides immediate and full support action
- Accommodates large rock movements while maintaining high load bearing capacity.
- High deformation characteristics accommodates ground movements in tension as well as in shear



THE EXRB DIFFERENCE

- High quality raw materials
- Energy efficient steel production
- Seamless production control in our own facilities throughout the manufacturing process
- Production according to ISO 9001 & ISO 14001
- QA and certified engineered rock reinforcement product
- Full production chain customization on request
- Traceability throughout the manufacturing process
- Short delivery times
- All EXRB may be supplied with a protective coating
- Reliable logistics

SAFE AND EASY INSTALLATION

- Accommodates variations in borehole diameter
- Quality assured installation - when the pump stops the bolt is successfully installed
- No cement grout or other chemicals required to anchor the bolt

TECHNICAL DATA / DESIGN DATA

FEATURES

Minova’s EXRB ensures a minimum breaking load as well as corresponding elongation. EXRB are available in two types, EXRB (cold formed) and EXRB+ (cold formed and normalized). Each type is available in three different load bearing capacities.

EXRB 120 / 120+ 12 metric tons

EXRB 160 / 160+ 16 metric tons

EXRB 240 / 160+ 24 metric tons

Consult your local Minova USA, Inc. Customer Service Representative for more information.

The difference between the EXRB and EXRB+ is the elongation characteristics: the EXRB (cold formed type) has an elongation of approximately 15% and the EXRB+ (cold formed and normalized type) has an elongation of approximately 30%. The EXRB+ is made of unique steel which goes through a specially developed annealing process, giving the bolts their exceptional elongation characteristics while still maintaining their high load bearing capacity. This process gives the EXRB+ superior properties allowing it to accommodate large rock deformation even in highly deformable rock masses.

TECHNICAL PROPERTIES	EXRB 120	EXRB 120+	EXRB 160	EXRB 160+	EXRB 240	EXRB 240+
Bolt diameter	28 mm		38 mm		38 mm	
Profile diameter	27.5 mm		36 mm		36 mm	
Material thickness	2 mm		2 mm		3 mm	
Upper bushing diameter	28 mm		38 mm		38 mm	
Inflation bushing diameter	30/37 mm		41/48 mm		41/48 mm	
Hole diameter	32 - 39 mm		43 - 52 mm		43 - 52 mm	
Minimum breaking load	120 kN		160 kN		240 kN	230 kN
Minimum elongation	10 %	20 %	10 %	20 %	10 %	20 %
Typical elongation	15 %	30 %	15 %	30 %	15 %	30 %
Standard lengths*	1.5 – 4.0 m		2.4 – 6.0 m		2.4 – 6.0 m	



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SURFACE SUPPORT

HEADER PLATE

DESIGNED FOR ADDITIONAL COVERAGE OR BEARING SURFACE

Minova’s Header Plates are manufactured from high-strength steel and are designed to help prevent loose material from falling between the roof bolt pattern and provide strength to your immediate roof.

The Header Plate is applicable when additional bearing surface is needed. Header Plates are available with the following embossments:

- Low-profile with length-wise ribs
- Dome

SPECIFICATIONS

Size	Grade	Embossment
6” X 10”	2	Low-Profile
6” X 16”	2, 3	Low-Profile
6” X 16”	2, 3	Dome



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CONVENTIONAL SYSTEMS

MECHANICAL BOLT

The Mechanical Bolt provides support by the suspension method. The mine roof is effectively suspended by anchoring the different layers of strata together. Anchorage is accomplished with the assistance of an expansion shell. The Mechanical Bolt is tensioned during installation, which sets the expansion shell against the borehole wall. Mechanical Bolts are offered with a standard expansion shell or bail style expansion shell.

INSTALLATION PROCEDURES

1. Drill hole at proper diameter and depth.
2. Make depth 2" longer than the bolt.
3. Insert Mechanical Bolt and Bearing Plate to roofline.
4. Rotate bolt using drill pre-set to proper torque. Bearing Plate should be tight against roof.

SPECIFICATIONS

Bar Diameter & Grade	Min Yield	Min Tensile	Borehole	Installation Torque
5/8" Gr75	17,000 lbs	22,600 lbs	1", 1-3/8"	125 - 250
3/4" Gr75	25,100 lbs	33,400 lbs	1-3/8"	175 - 300
7/8" Gr75	34,700 lbs	46,200 lbs	1-3/8"	250 - 375



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POINT ANCHOR SYSTEM REBAR BOLTS

HEADED AND BENDABLE

Minova Reinforcing Steel Bar (Rebar) is manufactured to critical tolerances and standards to meet the day-to-day needs of our mining customers. Our quality control program ensures that each Rebar Bolt order arrives at your site just as you have specified. And, because Minova is a world leader in manufacturing, you can be assured that we will be able to fill your orders quickly and efficiently, regardless of the order size or delivery requirement. Rebar bolts, or resin bolts as they are commonly referred to, are available in all standard diameters and grades as well as in special rolled dimensions (SRD) for your specific applications. Matched Bearing Plate systems and Minova Lokset resin capsules are available for all fully grouted Minova Rebar Bolts.

BENDABLE OPTIONS

- Hot Notched
- Mill Notched
- BORE Bendable Oval Rebar

INSTALLATION PROCEDURES

1. Drill hole at proper diameter and depth.
2. Make depth 1" longer than the bolt.
3. Insert appropriate Minova resin cartridge.
4. Insert Rebar Bolt and Bearing Plate to within 1/16" to 1/8" of roofline.
5. Rotate bolt to ensure complete mixing of resin.
6. Stop rotation while maintaining boom pressure, hold in place.
7. Relieve boom pressure.

Consult your Minova Technical Sales Representative for specific mixing and hold requirements, as well as potential customized product availability.

AREAS OF APPLICATION

- Deep excavation support
- Roof and wall support
- Rock bolting
- Slope stabilization
- Soil nailing



Bolt Diameter		Grade	Minimum Yield		Minimum Tensile		Borehole Diameter	
mm	(#)		kN	(lbs)	kN	(lbs)	mm	In ("")
16 mm	(#5)	60	83	(18,600)	124	(27,900)	25 mm	(1')
19 mm	(#6)	40	78	(17,600)	137	(30,800)	25mm	(1')
19 mm	(#6)	60	117	(26,400)	176	(39,600)	25mm	(1")
~19 mm	(3/4" SRD)	75	121	(27,200)	161	(36,300)	25 mm	(1")
22 mm	(#7)	40	107	(24,000)	187	(42,000)	28mm, 34mm	(1-1/8", 1-3/8")
22 mm	(#7)	60	160	(36,000)	240	(54,000)	28mm, 34mm	(1-1/8", 1-3/8")
~22 mm	(7/8" SRD)	75	166	(37,400)	222	(49,800)	25 mm, 28mm, 34mm	(1", 1-1/8", 1-3/8")
25 mm	(#8)	60	211	(47,400)	316	(71,100)	32mm, 34mm	(1-1/4", 1-3/8")

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TENSIONABLE SYSTEM

CONTINUOUS THREAD BOLT

Minova's Continuous Thread Bolts have been designed to take the worry out of complex bolting in both civil and mining applications. This versatile bolt can be used for roof/rib support, tunneling, and slope stabilization support projects.

Minova's Continuous Thread Bolts work much like Minova's Tension Rebar Bolts but have the added benefit of being able to be mix the resin and be torqued in the same rotation direction. Additionally, unlike the Tension Rebar Bolt, the Continuous Thread Bolt is threaded the entire length of the bar, which allows for more versatility if roof control plans change down the road.

The Continuous Thread Bolt is available as a one-piece bolt and as a two-piece bolt.

INSTALLATION PROCEDURES:

1. Drill hole at proper diameter and depth.
2. Make depth 1" longer than the bolt.
3. Insert appropriate Minova resin cartridge.
4. Insert Continuous Thread Bolt and Bearing Plate to within 1/16" to 1/8" of roofline.
5. Rotate bolt to ensure complete mixing of resin.
6. Stop rotation.
7. For specified resin set time, hold bolt in place.
8. Torque bolt to pre-determined torque in accordance with approved roof control plan.

Consult your Minova Technical Sales Representative for specific mixing and hold requirements.

Specifications (ASTM Grade 75)

Bar Diameter	Min Yield	Min Tensile	Borehole	Plate
#6 (19 mm) *	33,000 lbs	44,000 lbs	1"	Gr3, Gr4
#7 (22 mm) *	45,000 lbs	60,000 lbs	1-1/8", 1-3/8"	Gr3, Gr4
#8 (25 mm) *	59,250 lbs	79,000 lbs	1-3/8"	Gr4, Gr5



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POINT ANCHOR SYSTEM

TENSION REBAR BOLTS

Minova Tension Rebar Bolts offer precise tension and significant cost savings. Where better beam building is needed, the Tension Rebar Bolt System has strength characteristics to meet those needs.

This exceptional support is installed in a 1"-1³/₈" hole and allows for dramatic savings in resin. It is available in lengths ranging from 6'-8', in right- or left- hand thread spin and with a variety of tension nuts and washers available.

INSTALLATION PROCEDURES

1. Drill hole at proper diameter and depth.
2. Make depth 1" longer than the bolt.
3. Insert appropriate Minova resin cartridge.
4. Insert Tension Rebar bolt and Bearing Plate to within 1/16" to 1/8" of roofline.
5. Rotate bolt to ensure complete mixing of resin.
6. Stop rotation.
7. For specified resin set time, hold bolt in place.
8. Torque bolt to pre-determined torque in accordance with approved roof control plan.

Consult your Minova Technical Sales Representative for specific mixing and hold requirements.



**Nut and 2" Flat Washer standard, 3" DPI and/or other Washer options upon request*

SPECIFICATIONS *Minova Tension Rebar Bolts provide precise tension for roof support*

Bolt Diameter		Grade	Minimum Yield		Minimum Tensile		Borehole Diameter		Torque	
mm	(#)		kN	(lbs)	kN	(lbs)	mm	in (")	~Nm	(ft-lbs)
16 mm	(#5)	60	83	(18,600)	124	(27,900)	25 mm	(1')	170 - 270	(125 - 200)
19 mm	(#6)	40	78	(17,600)	137	(30,800)	25mm	(1')	170 - 270	(125 - 200)
19 mm	(#6)	60	117	(26,400)	176	(39,600)	25mm	(1")	200 - 340	(150 - 250)
-19 mm	(3/4" SRD)	75	121	(27,200)	161	(36,300)	25 mm	(1")	240 - 300	(175 - 225)
22 mm	(#7)	40	107	(24,000)	187	(42,000)	28mm, 34mm	(1-1/8", 1-3/8")	240 - 300	(175 - 225)
22 mm	(#7)	60	160	(36,000)	240	(54,000)	28mm, 34mm	(1-1/8", 1-3/8")	270 - 340	(200 - 250)
-22 mm	(7/8" SRD)	75	166	(37,400)	222	(49,800)	25 mm, 28mm, 34mm	(1", 1-1/8", 1-3/8")	339 - 458	(250 - 325)
25 mm	(#8)	60	211	(47,400)	316	(71,100)	32mm, 34mm	(1-1/4", 1-3/8")	270 - 400	(200 - 300)

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- Minova Guide to Resin-Grouted Rockbolts
- Minova Chemicals, Polymers & Steel Application Guide

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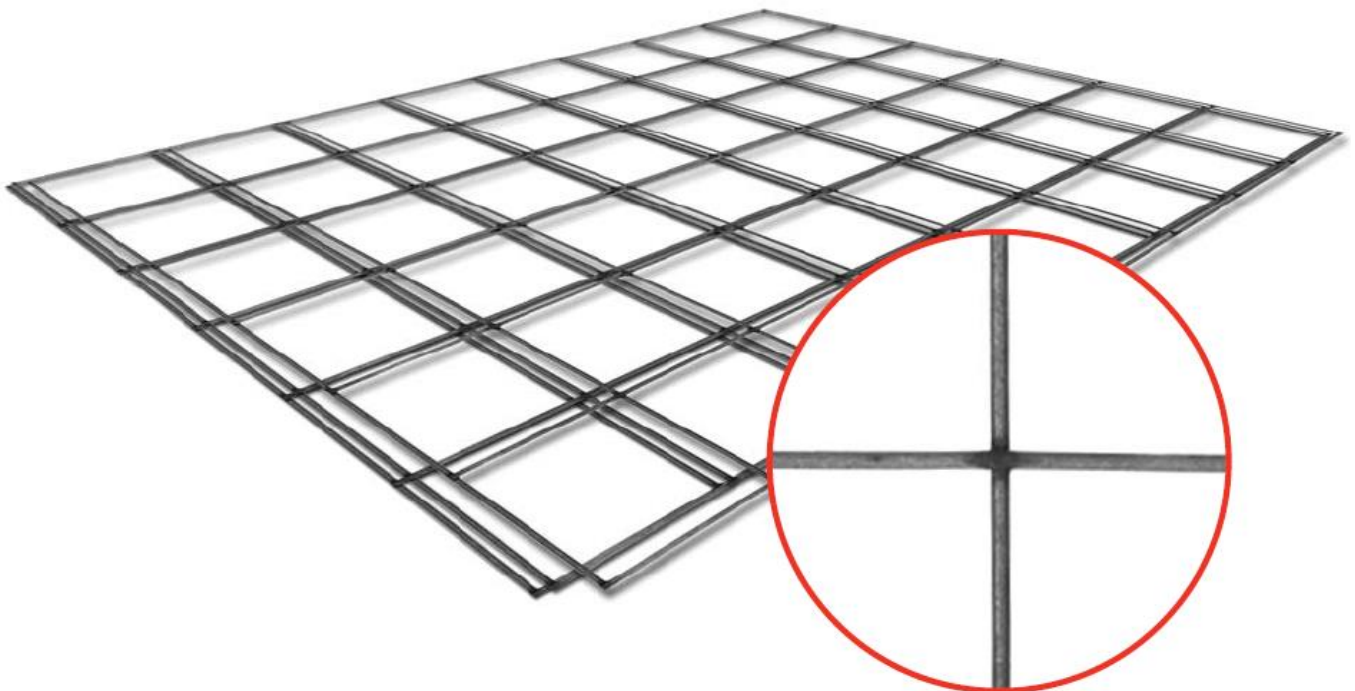
ACCESSORIES

WELDED WIRE MESH

Rock material falling between the bolting pattern causes most rock fall injuries. Welded Wire Mesh provides a protective “screen” that reduces the number of rock fall injuries in the protected area.

Welded Wire Mesh provides additional protection in areas that incur roof or wall deterioration. The mesh is comprised of wires running horizontally and vertically that are welded together at the intersections. The mesh is then bolted tight to the roof or walls.

- Reinforces mine structures
- Edges are trimmed and flush-cut for added safety
- Easy handling
- Cut-to-size
- Hole aperture size and gauge thickness per customer specification
- Can be produced with galvanized coating for corrosion resistance



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CONSTRUCTION

CABLE SLING

COST-EFFECTIVE, LONG-TERM CONTROL

DESCRIPTION

The Cable Sling System (CSS) is a highly cost-effective solution that provides long-term control.

Cable Sling Systems are available in 0.6" and 0.7" in a two- or three-piece system with the appropriate connector units, based upon each customer's requirements.

USES

The Cable Sling System (CSS) is used for long-term, permanent roof control and long wall applications.

ADVANTAGES

- Uncompromising Strength.
- Customized Options.
- The new cable connector system eliminates the waste created when separate barrel and wedge units are provided
- This unique design incorporates the wedges and helps keep them "clean" for maximum installation loads.
- The cable connector can be loaded to the cable tensile strength without shearing the strand.



TECHNICAL DATA

Minova's research indicates that the design capacity of the CSS should be limited to the ultimate strength of the cable being used, approximately 30 or 40 tons.

SPECIFICATIONS

Materials	Strand	Borehole	Plate
0.6" Gr270K	Bright, Galvanized	1", 1-3/8"	6" x 16" Gr2
0.7" Gr270K	Bright, Galvanized	1", 1-3/8"	6" x 16" Gr2

APPLICATION METHOD

1. Drill a 1" or 1-3/8" diameter hole, depending on application, at an angle of about 45 degrees, into the mine roof approximately 1' – 2' from pillar edge. The borehole should be about 1" longer than the length of cable to be inserted. The entry spacing of slings is dependent upon support requirements and mining conditions.
2. Insert predetermined Minova resin cartridge(s) into the borehole.
3. Push the angled cable until resistance is felt from resin cartridge(s). Bring wrench and bolter head up to cable and rotate slowly until you reach the

back of the hole. Spin the angled cable in the clockwise direction only for the recommended time and hold until resin has cured.

It is very important that cable ends are cleaned and free of any dirt or residue before you perform this step: Install a cable connector onto end of the angle cable by sliding the cable through the connector until the cable protrudes about 2 inches.

4. Repeat Steps 1 through 3 for angle cable end on opposite side of entry.
5. Insert one end of horizontal cable cross member through the cable connector to accommodate the required length of your cable jack (usually about 15 inches).
6. Insert other end of horizontal cable member through the cable connector on the opposite side. Pull horizontal cross member as tight as possible by hand.
7. Roughly position the 6" X 16" cable sling plates as closely to angle bolt holes as possible. These can be readjusted as sling is slowly tightened to conform to the roof geometry, cutter and loading conditions.

Your Minova technician can provide assistance with the latest strategies on bearing plate placement.

8. Slide the cable jacking system until tight against barrel and wedge assembly on the cable connector. Begin hydraulic jacking to tighten cable. Re-check position of the bearing plates and repeat tensioning cycle until desired cross member loads are achieved.

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MINING / CONSTRUCTION

DOME PLATE

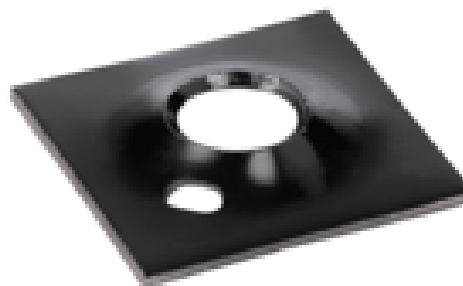
COST-EFFECTIVE, LONG-TERM CONTROL

DESCRIPTION

Minova Dome Plates provide high load bearing capacities and are available in sizes 150 mm and 200 mm square, typically used with Solid Bolts, Strata Bolts and Cable Bolts.

Minova plates are designed in-house to provide optimal surface support in a range of strata conditions.

Plate Type	Material	Galvanizing
Dome Plates	AS1594	AS4680



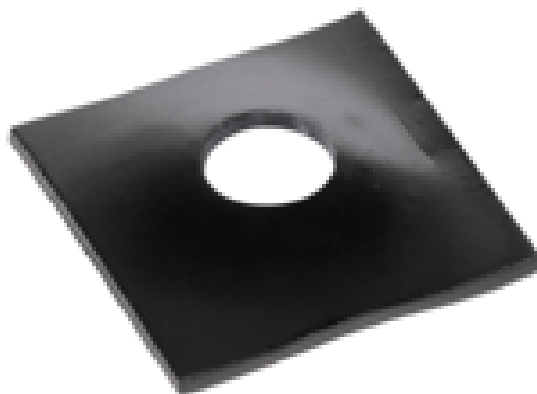
Domed Plate w/ grout tube hole

USES

The Dome Plate is used in conjunction with bolts to stabilize structures, earthen embankments, and to provide support over larger surface areas.

ADVANTAGES

- Prevents loose material from falling between bolt patterns
- Provides strength to immediate unstable areas
- Dome embossments provide additional strength to the plate



Domed plate

TECHNICAL DATA

Dome Plate Dimensions (mm)	Thickness (mm)	Dome Height (mm)	Hole Size (mm)	Test Hole Diameter (mm)	Typical Yield Strength (MPa)	Typical Tensile Strength (MPa)	Plate Load (kN)	Typical Bolt Used
125 x 125	4	18	36	50	210 – 310	330 – 370	79	Strata Bolt™ 34
125 x 125	4	19	49	50	210 – 310	330 – 370	140	Strata Bolt™ 47, Strata Tunnel Bolt
150 x 150	4	25	43	50	210 – 310	330 – 370	108	Strata Bolt™ 40
150 x 150	4	24	49	50	210 – 310	330 – 370	147	Strata Bolt™ 47, Strata Tunnel Bolt, Secura Bolt™
150 x 150	7	22.5	36	80	210 – 310	300 – 400	197	Secura Bolt,™ Cable Bolt
200 x 200	4	24	49	50	210 – 310	330 – 370	147	Strata Bolt™ 47, Strata Tunnel Bolt
150 x 150	6	21.5	36	100	210 – 310	300 – 400	100	M24 Rockbolts, Cable Bolts
150 x 150	8	23.5	36	100	210 – 310	300 – 400	169	M24 Rockbolts, Cable Bolts
150 x 150	10	25.5	36	100	210 – 310	300 – 400	265	Secura Bolt,™ M24 Rockbolts, Cable Bolts
150 x 150	10	25.5	36	100	300 – 360	430 – 480	300	Secura Bolt,™ M24 Rockbolts, Cable Bolts
200 x 200	12	31	42	100	300 – 360	430 – 480	460	Cable Bolts
250 x 250	12	31	42	100	300 – 360	430 – 480	460	Cable Bolts
300 x 300	12	31	42	100	300 – 360	430 – 480	460	Cable Bolts
200 x 200	16	35	42	100	300 – 360	430 – 480	640	Cable Bolts
250 x 250	16	35	42	100	300 – 360	430 – 480	640	Cable Bolts
300 x 300	16	35	42	100	300 – 360	430 – 480	640	Cable Bolts

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SURFACE SUPPORT

FLAT PLATE

COST-EFFECTIVE, LONG-TERM CONTROL

Minova Flat Plates provide exceptional surface support and are available in sizes ranging from 4"x4" to 12"x12" in varying strengths, thicknesses and hole diameters.

Minova plates are designed in-house to provide optimal surface support in a range of strata conditions.

The Flat Plate is used in conjunction with typical bolting materials to stabilize structures, earthen embankments, and to provide support over larger surface areas.

Our high strength steel plate helps prevent loose material from falling between bolt patterns. Also provides strength to immediate unstable areas.



Product Standards:

Plate Type	Material	Galvanizing
Flat Plates	AS1594	AS4680

TECHNICAL DATA

Flat Plate Dimensions (mm)	Thickness (mm)	Dome Height (mm)	Hole Size (mm)	Test Hole Diameter (mm)	Typical Yield Strength (MPa)	Typical Tensile Strength (MPa)	Plate Load (kN)	Typical Bolt Used
200 x 200	10.0	N/A	18.0	N/A	210 – 310	300 – 400	N/A	Cable Bolt
250 x 250	10.0	N/A	18.0	N/A	210 – 310	300 – 400	N/A	Cable Bolt
300 x 300	10.0	N/A	18.0	N/A	210 – 310	300 – 400	N/A	Cable Bolt
200 x 200	12.0	N/A	20.0	N/A	210 – 310	300 – 400	N/A	Cable Bolt
250 x 250	12.0	N/A	20.0	N/A	210 – 310	300 – 400	N/A	Cable Bolt
300 x 300	12.0	N/A	20.0	N/A	210 – 310	300 – 400	N/A	Cable Bolt

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MINING / TUNNELING / GEO STABILIZATION

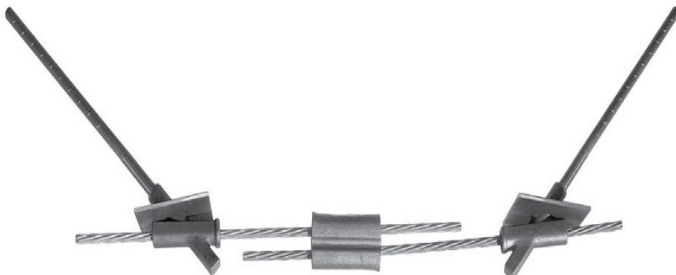
IN-ROOF™ CABLE TRUSS SYSTEM

DESCRIPTION

The IN-ROOF™ Cable Truss System is a flexible support system that can be installed in-cycle much faster and easier than existing truss supports. Applications include longwall gates, entries and crosscuts.

Simplicity - Only Three Basic Components

- IN-ROOF™ bracket/bolt assembly
- Cable tie rods
- Cable coupler
- Integrated cable wedges in the coupler
- Maximizes Safety
- Installed in-cycle within protective confines of bolter
- Maximum Clearance Final assembly extends a maximum of 2-1/2" from the roof line
- IN-ROOF™ Bracket
- Angle of bracket enables proper anchor bolt angle of installation



Uncompromising Strength

Minova’s research indicates that the design capacity of the IN-ROOF™ system should be limited to the ultimate strength of the cable being used (30 tons).

- Roof tensile zones are placed in compression
- Mine roof stability is increased
- Decreased roof falls
- Roof bolt and IN-ROOF™ bracket are combined and shipped as a single unit
- Roof bolt/bracket and bearing plate to be spun as a unit during resin mixing

Installation Procedures:

1. Drill hole at proper diameter and depth.
2. Insert appropriate Minova resin cartridge.
3. Insert bolt with bracket/bearing plate assembled.
4. Rotate the bolt/bracket/plate assembly for the specified time according to recommendations for the Minova resin being used. Align bracket across entry. When proper mixing and alignment are complete, thrust bolt/bracket/plate assembly tight against roof.
5. The horizontal cable tie rod may be easily installed in-cycle or at a later time, depending on support requirements and the roof control plan.
6. Cable tie rods are inserted through the roof bolt/bracket and center coupler.
7. Tensioning takes place in the opening center using a cast coupler unit and a hydraulic tensioner.

Specifications:

Roof Bolt	PC Strand	Strand	Borehole
#7 Gr60	.600", Gr270k	.600", Gr270k	1-1/8", 1-3/8"
.600", Gr270k	.600", Gr270k	.600", Gr270k	1", 1-1/8"

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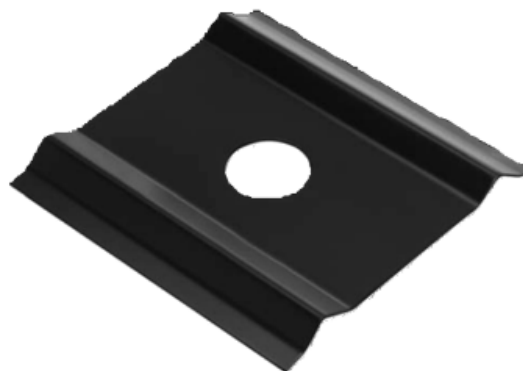
SURFACE SUPPORT

MINI MONSTER MAT

Minova’s Mini Monster Mats are used in conjunction with roof bolts and plates to help control large roof deformation and provide surface control to the immediate roof.

Specifications:

Size (w x l)	Gauge	Holes
12” x 12” or 24”	12	Per Customer Spec.



MONSTER MAT

Like the Mini Monster Mat, Minova’s Monster Mats are used in conjunction with roof bolts and plates to help control large roof deformation and provide surface control to the immediate roof. Monster Mats are applicable in extreme conditions that require greater coverage than that provided by the Mini Monster Mat.

Specifications:

Size (w x l)	Gauge	Holes
12” x up to 192”	12	Per Customer Spec.



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STRUCTURAL SUPPORT

POWERMESH FIREP® FRP MESH

FiReP® FRP Powermesh was developed to comply with standard grid applications while providing the added benefits of durability or cuttability.

The high load capacity at each joint, comparable to that of welded steel mesh, is unique and makes the design of FRP grid reinforced RC structures a viable option for engineers and architects.

Options:

- Available rod size 3 mm– 12 mm
- Other mesh sizes available on request
- Polyester / Epoxy / Vinyl ester resin
- Non-flammable
- Anti-static coating

Benefits of FiReP® Powermesh

- High corrosion resistance
- Cuttability
- High tensile strength
- Flexibility
- Low weight
- Anti-static coating (optional)
- Anti-magnetic
- High thermal isolation
- No electrical conductivity
- Wide range of various meshes and spacing sizes



Product Data:

Parameter	Standard 100 x 100 x 6 mm
Rod diameter (mm)	6
Spacing (mm)	100 x 100
Breaking load of 6 mm rod (kN)	> 28.3
Ultimate strength of 6 mm rod (N/mm ²)	> 1,000
Tensile E-Modulus (N/mm ²)	60,000
Load at knot (kN)	> 3 and > 5
Overall dimensions (mm)	2,000 x 800
Weight (g)	1,800

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MINING / TUNNELING / GEO STABILIZATION

POWERTHREAD FIREP® ROCKBOLT SYSTEM

DESCRIPTION

FiReP® Powerthread FRP is a comprehensive rock bolting system with various components (e.g. plastic nut, GRP nut, steel nut, plastic plate, GRP plate, couplings, adapter and injection connection) is available. Due to its continuous thread the bolt can be trimmed if needed. The bolt has a high ultimate load and due to its profile, offers a maximum bond strength with all grouting materials. The cuttability protects machinery and equipment and prevents damage to machinery while drifting and enlarging tunnels.

The FiReP® Powerthread FRP Rockbolt is available in solid and hollow bolts. The setting of the solid rods can be carried out with mortar or resin capsules, while the setting of the hollow rods can be carried out with injection.

The FiReP® Powerthread bolt has a high corrosion resistance and is well suited for permanent support. The high flexibility is well suited for application without couplings in confined locations. Due to its high tensile strength, the bolt has a high and immediate load bearing capacity if applied with fast setting resin capsules. The FiReP® Powerthread low weight facilitates handling.

USES

The FiReP® Powerthread FRP Rockbolt was developed for strata support in mining and tunnelling, as well as for slope and face stabilization.

ADVANTAGES

- High tensile strength
- High corrosion resistance
- Low weight



Specifications

Unit		Tubular Bolt		Solid Bolt						
		J64-25	J64-28	K60-20	K60-22	K60-25	K60-27	K60-30	K60-32	K60-38
Outer diameter (mm)		25/12	28/12	20	22	25	27	30	32	38
Tensile stress area (mm ²)		250	357	200	250	346	400	510	580	830
Ultimate load (kN)		250	350	200	250	350	400	490	560	750
Breaking load thread (kN)	Steel Nut	150	200	80	100	180	200	200	320	–
	FRP Nut	70	80	60	60	70	80	80	80	–
	Power Nut	150	180	80	100	180	180	–	–	–
Ultimate strength (N/mm ²)		1,000	1,000	1,000	1,000	1,000	1,000	960	960	900
Torsion resistance (Nm)		100	110	60	70	120	130	180	230	–
Shear resistance (N/mm ²)		400	400	460	460	460	460	430	430	400
Tensile E-Modulus (N/mm ²)		50,000	50,000	50,000	50,000	50,000	50,000	50,000	50,000	50,000
Strain at failure (%)		2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5
Weight (g/m)		630	880	560	690	900	1,040	1,330	1,500	2,100

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SURFACE SUPPORT

SAAB GRIPPER

A REVOLUTIONARY PUSH ON PLATE

DESCRIPTION

The Saab Gripper* is a push on plate designed to install mine screen to the back and sides of mine excavations. Typically used with mechanically anchored rockbolts (threaded at both ends) and/or threaded re-bar Gripper plates are available in three sizes to accommodate thread diameters of 5/8, 3/4, and 7/8 inches respectively. The unique design of the Gripper features four legs which allow for easy installation of the Gripper onto the threaded end of the bolt. As the plate is pushed onto a bolt or rebar, these legs engage the root of the threads, locking the plate onto the bolt. This design also allows for movement of the plate in one direction only, thus preventing the plate from slipping backwards off the bolt.

FEATURES

All facets of conventional screen installation are outperformed by the Saab Gripper, including vibration resistance. Heat treating to 45 Rockwell on the 'C' scale gives the Gripper its strength and allows deformation and not failure under load. The plate is also embossed to provide stiffness and extra strength. Where conventional plates become loose and may even fall off due to nearby blasting, the Gripper will not fail without warning. The plate will buckle, and the legs will slide down along each thread as opposed to breaking off. Tests have concluded that the Gripper will carry loads of 3 to 4 tons and still retain a residual load capacity of 1 ton after failure. This is beneficial under blasting and rock bursting conditions where sustained resistance is needed after an initial shock wave.

The Saab Gripper has proven to be stronger than the screen that it supports and is solution-dipped to ensure corrosion resistance in an environment which can quickly cause deterioration of mine screen.



ADVANTAGES

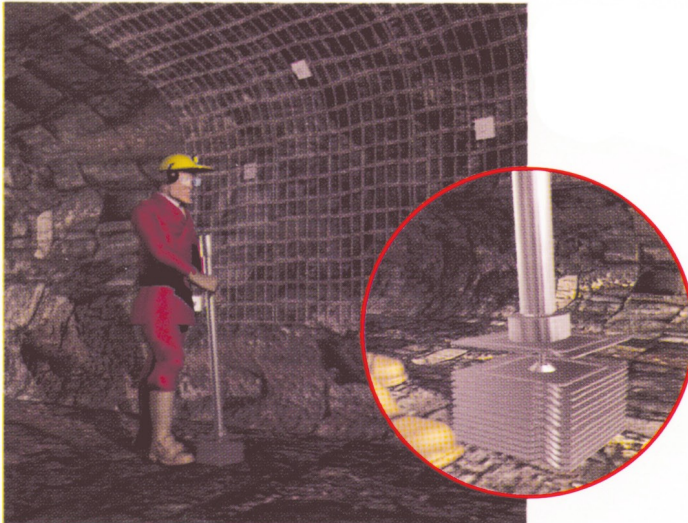
- Installation of the Gripper is fast, effective and safe.
- When a Gripper is used, no time is wasted fumbling with a second rockbolt plate and nut.
- The Gripper can even be installed on bent bolts or bolts with damaged threads— conditions which prevent the use of a rockbolt plate.
- The Gripper will not damage rockbolt threads and can be used to install all types of mine screen, including expanded mesh and chain link.
- The Gripper features two hanging tabs which can be used to hang vent tubing, service wires, blasting lines, and other devices requiring permanent or temporary installation.

Installation Tool



*US Patent: 6004077

HAND INSTALLATION TOOL



Miner picks up plate from carrying holder with magnetic end of installation tool.

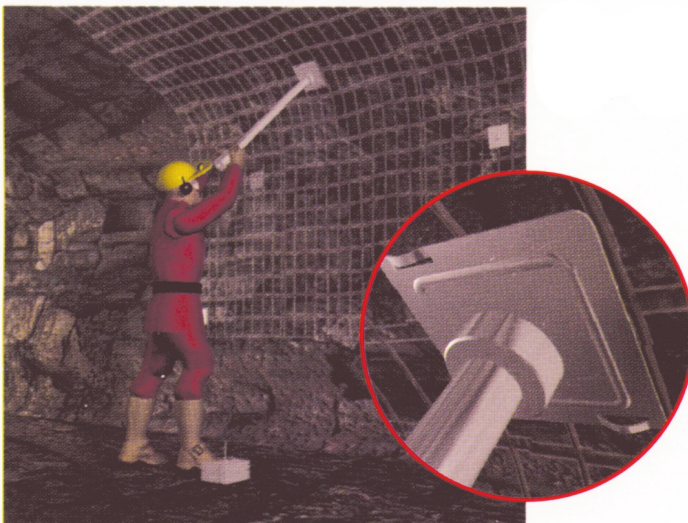
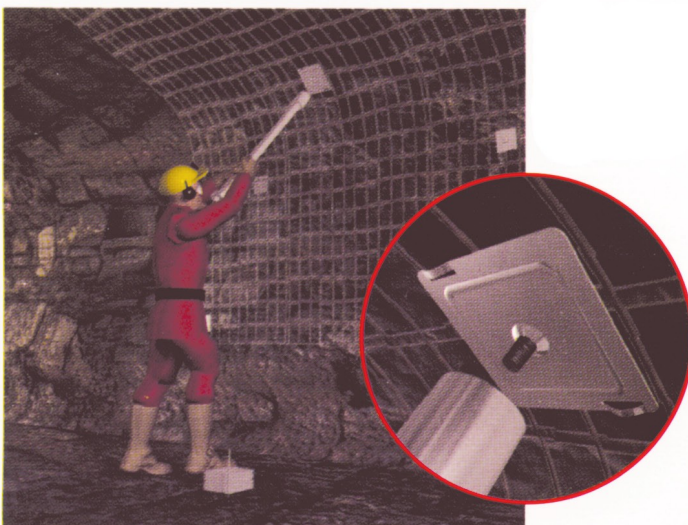
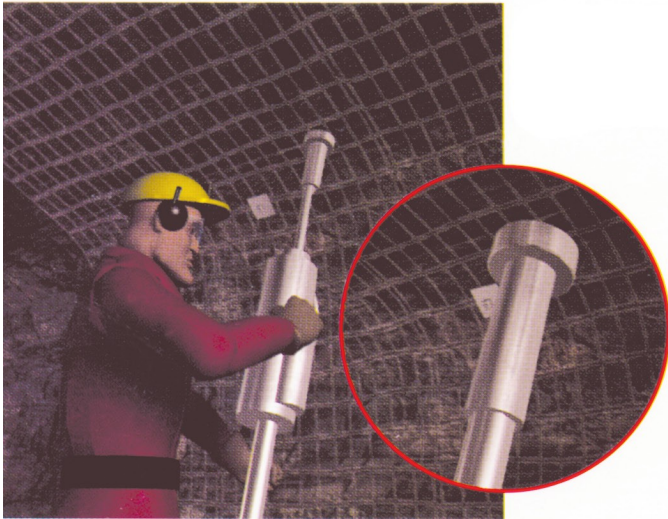


Plate is pressed on threaded rod so it will stay in place.

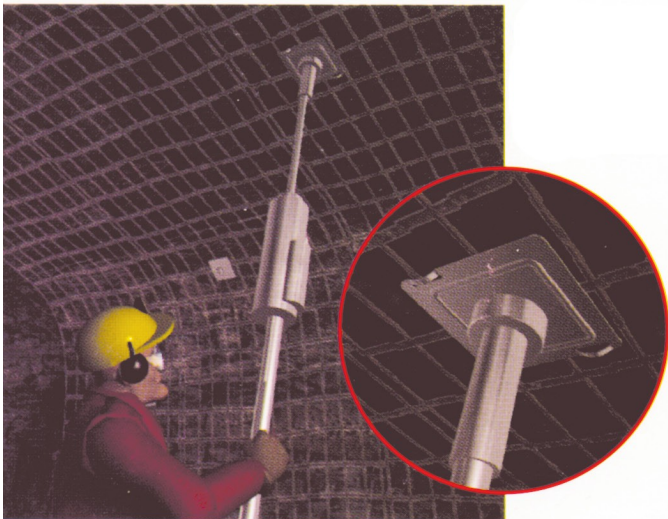


Installation tool is reversed, allowing miner To hammer plate tight with driving head.

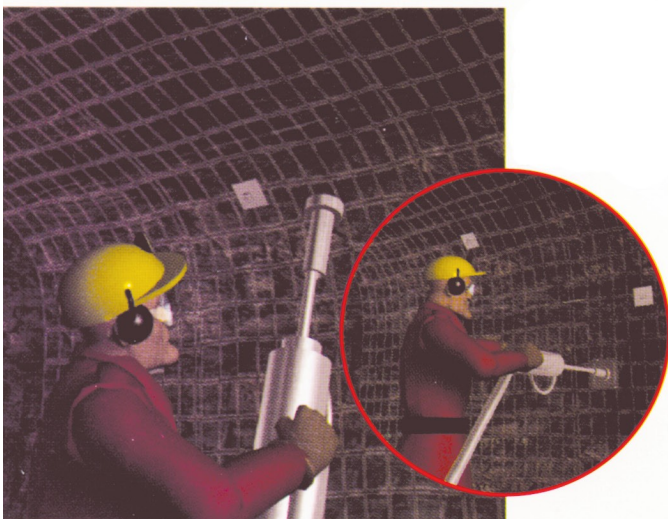
MACHINE INSTALLATION TOOL



Place magnetic Saab installation tool into the chuck of the drill.



Place Saab Gripper plate on magnet and press into place with force of the drill leg. Do not use rotation.



Lower drill and move to next installation. Tool works equally well on wall installations, holding plate, allowing for easy installation.

INSTALLATION

A magnetic installation tool is used to achieve fast, effective and safe installation of the Gripper plate on the threaded end of a bolt. Two variations of this tool can be supplied which allows hand installation or stoper (machine) installation.

The **hand installation tool** consists of a 4-foot length of 1 1/2-inch diameter pipe with a magnetic head welded at one end and a 5-inch length of 3-inch diameter pipe welded at the other end.

The **stopper installation tool** consists of a 6-inch-long dolly with a magnetic head which can be used with standard mine dolly steel.



Saab Gripper

Size:5 3/4 inches square
Thickness:0.06 inches
Hole Diameter: 5/8, 3/4, 7/8 inches



Installation Tool

Sizes:Steel – 2 foot, 4 foot
Sizes:Aluminum, 4 foot

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CABLE SYSTEMS

SQUARE HEAD CABLE BOLT

SPECIAL DEFORMED STRAND

Minova's patented* SDS Square Head Cable Bolts are designed to provide the same versatility as traditional cable bolts while providing a higher degree of anchorage capacity. Added benefits of this cable bolt with its innovative square head indented strand design are improved resin/strand mechanical inter- lock, eliminated or reduced bulbs, lower hydraulic pressure during insertion and better encapsulation.

SDS Square Head Cable Bolts can be used in every application where traditional cable bolts are used and where standard ground support is marginal or inadequate. Common application areas include gate roads, bleeder, recovery room, set-up room, intersections and other mine areas where additional support is indicated.

* Patent Pending

Installation Procedures:

1. Drill hole at proper diameter and depth.
2. Insert appropriate Minova resin cartridge. It is critical that resin cartridges are inserted all the way to the top of the borehole before cartridges are broken. This is accomplished by pushing the cartridge with the Cable Bolt by hand.
3. Rotate Cable Bolt to the top of the borehole. It may be necessary to push Cable Bolt by hand (or with the bolting machine) before bolt head can be inserted into the chuck.
4. Once the Bearing Plate reaches the roof, spin Cable bolt to ensure complete mixing of resin, counter-clockwise direction only.
5. Stop rotation and apply full thrust with bolting machine and hold constant until resin sets.
6. Apply torque with bolting machine in accordance with approved roof control plan.

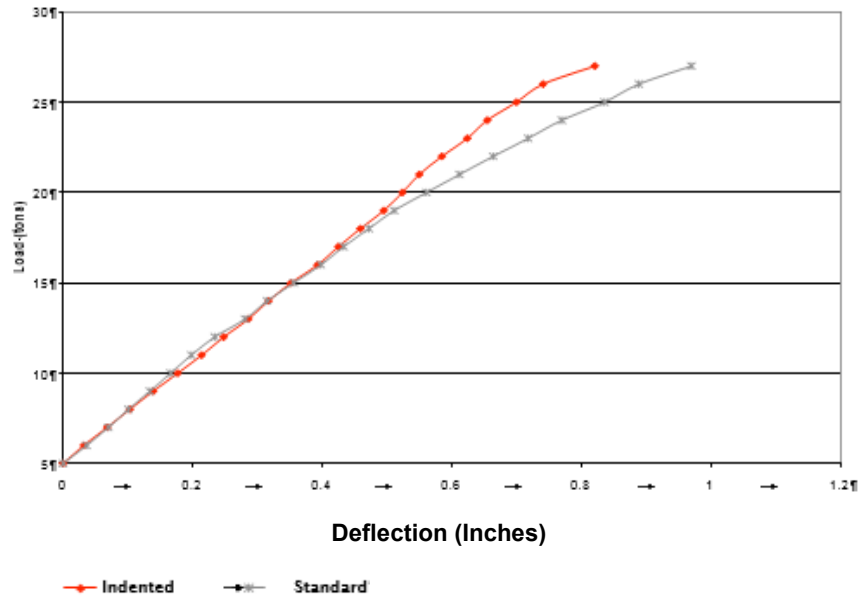
Consult your Minova Technical Sales Representative for specific mixing and hold requirements

Specifications:

Material	Strand	Borehole	Ultimate Load
0.6" Gr270K	Black, indented	1"	Nominal 30 tons



**10' Cable Pulls
Indented vs Standard Strand**



Enhanced Performance, Maintaining Versatility and Strength

- 1 1/8" square head allows use of existing bolting equipment — no additional wrench required
- Requires no additional training
- Improved low profile square head design
- Provides enhanced resin/strand mechanical interlock eliminating the need for bulbing
- Better resin encapsulation
- Strengthens and reinforces roof structures
- Reduces or eliminates the need for expensive cribbing or standing supports
- Available in long one-piece bolts for any seam height

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- Minova Square Head Cable Bolt Product Brochure

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CABLE SYSTEMS

TENSIONABLE CABLE BOLT SYSTEM

SUPERIOR ANCHORAGE SUPPORT

Minova’s patented* Tensionable Cable Bolt (TCB) System offers an advanced support system with all the installation versatility of traditional cable bolts while providing the ability to tension the cable during the normal roof bolting cycle. The TCB System provides compression into the roof and ensures “top-to-bottom” tensioning of the cable, which places the anchorage higher in the roof structure to eliminate “anchorage shock” during loading.

The TCB System can be used for primary support and as secondary support in applications where traditional cable bolts are used and enhanced beam building is needed. Common application areas include tail gates, bleeder, recovery room, set-up room, head gates, intersections and other mine areas where longevity and additional support is required.

* Patent US7625155B1

Installation Procedures:

1. Drill hole at proper diameter (1” or 1 3/8”) and depth.
 2. Insert appropriate Minova resin cartridge. It is critical that resin cartridges are inserted all the way to the top of the borehole before cartridges are broken. This is accomplished by pushing the cartridge with the Cable Bolt.
 3. Push the Cable Bolt to the top of the borehole. It may be necessary to push Cable Bolt by hand (or with the bolting machine) before bolt head can be inserted into the wrench.
 4. Once the Bearing Plate reaches within 1/16” to 1/8” of the roof, reverse spin bolt to ensure complete mixing of resin, counter-clockwise direction only.
- Note:** Do not overmix the resin.
5. Stop rotation.
 6. Hold Cable Bolt for the specified resin set time.
 7. Apply torque with bolting machine in accordance with approved roof control plan.

Specifications:

Material	Strand	Borehole	Ultimate Load
0.6” Gr270K	Galvanized, Black indented, or Bulbed	1” or 1-3/8	Nominal 30 tons



TCB System Components

Cable Components	Plates
Tensionable Cylinders	Dome plates
One hex nut	Flat plates
One hardened washer	Plates designed for site conditions
Cut to length 0.6" OC strand cable, indented	Resin
One 2-piece wedge set	1-3/8" hole - TCB cartridges, speed varies depending on site conditions
One stiffener	1" hole - TCB cartridges, speed varies depending on site conditions, also 1" hole will require reaming bottom 6" of the hole to an 1-3/8" hole

Convenience. Safety. Efficiency.

- Uses existing bolting equipment
- Enhanced beam building with tension up to 15,000 lbs.
- Can be used as primary support and installed right after mining
- Reduces the need for secondary support
- Reduces or eliminates the need for expensive cribbing or standing supports
- Available in long one-piece bolts for any seam height
- Lowers costs by allowing the installation during normal bolting operation
- Strengthens and reinforces roof structures

Minova leads the way with cable bolt technology that can be installed within development stages.

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MINING / TUNNELING / GEO STABILIZATION

U-BOLT HYBRID TRUSS SYSTEM

DESCRIPTION

Roof conditions in today’s underground mining operations are more challenging than ever before. Weak roof, deep cover and stress fields are but a few of the contributing factors that lead to the increased requirements for added ground control. Trusses, when properly installed, rely on the inherent strength of the strata above support pillars to provide anchorage and compressive forces.

Systems have evolved, and currently many systems incorporate high strength cables as a key component to add flexibility and capacity. One such system is Minova’s U-Bolt Hybrid Truss System.

Advantages

- A variety of truss anchors can be used
- Double Lok
- Tension Rebar
- Resin Bolt
- Continuous Thread Bar (CTB)

Two configurations of truss shoe assembly

- Cast shoe incorporates plate and U-bolt saddle
- 2-Vangle block that can be used with various flat plates

Specifications

- Truss bolts made from 7/8” Grade 75 material
- Cross-members made from 0.6” (270K) low relaxation, 7-strand cable
- Nominal strength of 30 tons
- Hole diameters – 1”, 1-3/8”

Installation Procedures:

1. Drill hole proper diameter and depth at ± 45 degree angle.
2. Insert proper Minova resin cartridge.
3. Insert truss anchor bolt assembly into hole per the recommendations according to the type of bolt.
4. Attach U-bolts to the shoe or 2-V angle block
5. Insert cable cross-member into cable connector.
6. Insert opposite ends of cable cross-member into U-bolt via the 3-hole block and attach barrels and wedges.
7. Tension the system with the hydraulic tensioning unit or a hand pump assembly.

Cable cross member for strength and flexibility.

Threaded U-bolts for re-tensioning without the need for hydraulic power.



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