ROCBOLT™
TECHNOLOGIES

Delivering The Support You Need

Contents

Company Profile

Leading in Product Development and Production Technology

ROCBOLT™ Technologies strives to be the foremost manufacturer and supplier of specialized products and systems to the South African underground mining and geotechnical industries.

Offering a complete package of ground control products, engineered solutions, and new product developments, our 14,000sq.m steel and 5,500sq.m resin cartridge manufacturing facilities, strategically situated in Johannesburg, enable us to provide unparalleled support to our underground mining customers. We are committed to maintaining the highest safety, health, and environmental standards and are certified to the ISO 9001: 2015 management system.

For years, we have been exporting our high-quality products from South Africa throughout southern up to central Africa. With the unique ability to draw upon expertise from diverse mining locations, we deliver safe, sophisticated, and cost-effective solutions to our clients. Our experienced staff of skilled personnel provides a comprehensive range of high-quality ground support products, systems, and engineered solutions.

Our quest for better solutions and technology is a critical part of ROCBOLT™ Technologies' strategy of ongoing research and development in the underground mining and geotechnical industries.

In 2021 ROCBOLT was acquired by DSI Underground and has since been part of the Sandvik family.

About Sandvik

Sandvik is a high-tech and global engineering group offering products and services that enhance customer productivity, profitability, and safety.

Sandvik holds world-leading positions in selected areas – tools and tooling systems for metal cutting; equipment and tools, service and technical solutions for the mining industry and rock excavation within the construction industry; products in advanced stainless steels and special alloys as well as products for industrial heating.

On july 2021, Sandvik completed the acquisition of DSI Underground, the global leader in ground support and reinforcement products, systems, and solutions for the underground mining and tunneling industries.

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Mining

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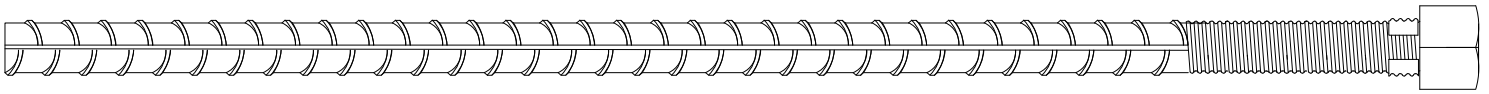
ROCBOLT™ TECHNOLOGIES

Forged Head Replacement Bolts



Features

- Roof and rock bolts are manufactured from a special hot rolled deformed bar featuring a rib pattern that actively assists with mixing the chemical anchors during installation
- Bolt rib pattern design has modified physical characteristics to maximize load transfer from the rock to the bolt, with higher transverse ribs together with lower profile longitudinal ribs
- Corrosion protection can be provided by hot dip galvanizing or alternative coatings. Details on request
- Rolled thread strength nominally equals the strength of the bar
- All anchor bolts are designed to be used with resins

Standard Lengths and Packaging

- Standard bolt lengths start from 600 [mm]
- Non – standard requirements are available on request
- Bolts are packaged in bundles
- Can be supplied assembled with bearing plates

Technical Data			
Bar Diameter [mm]	16	18	20
Min. yield load [kN]	100	127	157
Min. yield strength [MPa]	500	500	500
Min. ultimate load [kN]	120	158	200
Min. ultimate tensile strength [MPa]	640	640	640
Calculated shear load [kN] [1)]	98	124	132
Typical elongation [%] [2)]	20	20	20
Density [kg/m]	1.630	2.059	2.539
Cross sectional area [mm^2]	201	254	314

1) Calculated at 60 [%] of ultimate tensile load.
2) $5.65\sqrt{A}$

Notes

- Minimum order quantities may apply to this product
- Only ROCBOLT™ Technologies South Africa components should be used to enable the full performance of the bolt system to be obtained

ROCBOLT Technologies (Pty) Ltd.
30 North Reef Road
Germiston, 1429
South Africa

Phone +27 11 8786800
E-mail sales@rocbolt.com
www.rocbolt.com

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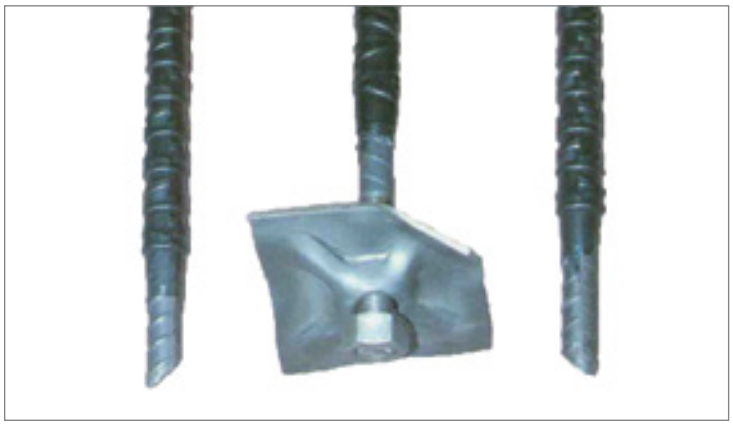
INSTaL+ Resin Bolting Solution

The INSTaL+ bolting system has been developed as an annulus correcting resin bolt. For use in resin bolting applications where normal bolting parameters are outside the limits to achieve acceptable load transfer results.

The system allows for full column resin bolting to be done with a smaller core diameter steel bolt in a hole up to 40 [mm] diameter with acceptable performance in terms of mixing and pull-out loads.



Advantages

- Reduces effective annulus
- Reduces risk of finger-gloving
- Simple installation in large holes
- No exotic equipment required
- More possible resin bolting applications
- No special training required
- Easy to install
- Corrosion resistant
- Less mass than equivalent steel bar

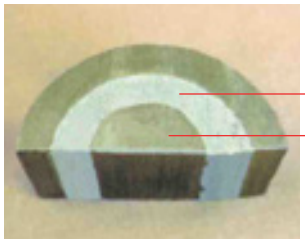
Hazard Information

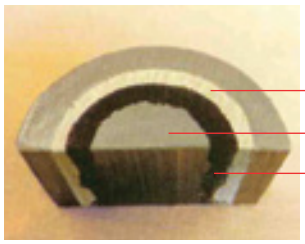
- All tests done by FIRELAB
- Flammability – the material does not spread fire and does not sustain burning
- Toxicity – the material has a toxicity index of 0.875 (an index of 5 is acceptable)

Technical Data			
Bar Diameter [mm]	16	18	20
Min. yield strength [MPa]	500	500	500
Typical ultimate load [kN]	140	178	220
25 [mm] coating			
Major diameter [mm] 1)	27	27	–
Effective diameter [mm] 1)	25	25	–
27 [mm] coating			
Major diameter [mm] 1)	29	29	29
Effective diameter [mm] 1)	27	27	27

1) After coating.

– PET compound coating – injection moulding
– Nut/bearing plate/load indicator as required





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South Africa

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E-mail sales@rocbolt.com
www.rocbolt.com

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Paddle Bolts

Features

- Paddle bolts are manufactured from deformed bars with “paddles” pressed on the up hole end which allows a smaller diameter bolt to mix chemical anchors in large diameter holes
- Standard thread roll formed at one end
- Designed to be used with resin capsules, but can be effectively used with cementitious grouts
- Effective in coal rib stabilisation and mesh retention on rock embankments
- Corrosion protection can be provided by hot dip galvanizing or alternative coatings. Details on request

Technical Data			
Bar Diameter [mm]	18	20	25
Min. yield load [kN]	127	157	245
Min. yield strength [MPa]	500	500	500
Typ. ultimate load [kN]	178	220	343
Typ. ultimate tensile strength [MPa]	700	700	700
Calculated shear load [kN] 1)	124.00	131.88	205.80
Typical elongation [%] 2)	20	20	20
Density [kg/m]	2.059	2.580	3.750
Major bar diameter [mm]	22.5	24.0	29.0
Cross sectional area [mm^2]	254	314	490

1) Calculated at 60 [%] of ultimate tensile load.
2) $5.65\sqrt{A}$

Notes

- Minimum order quantities may apply to this product
- Only ROCBOLT™ Technologies South Africa components should be used to enable the full performance of the bolt system to be obtained

ROCBOLT Technologies (Pty) Ltd.
30 North Reef Road
Germiston, 1429
South Africa

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E-mail sales@rocbolt.com
www.rocbolt.com

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Resin Roof Bolts

Features

- Roof and rock bolts are manufactured from a special hot rolled deformed bar featuring a rib pattern that actively assists with mixing the chemical anchors during installation
- Bolt rib pattern design has modified physical characteristics to maximize load transfer from the rock to the bolt, with higher transverse ribs together with lower profile longitudinal ribs
- Rolled thread strength nominally equals the strength of the bar
- The resin roof bolt is available in either spin-to-stall (shear pin nut) or reverse spin (nibbed) configurations
- All anchor bolts are designed to be used with resins
- Couplers available to create longer lengths
- Forged head replacement bolts available. Details on request
- Corrosion protection can be provided by hot dip galvanizing or alternative coatings. Details on request

Standard Lengths and Packaging

- Standard bolt lengths start from 600 [mm]
- Non – standard requirements are available on request
- Bolts are packaged in bundles
- Can be supplied assembled with bearing plates

Technical Data				
Bar Diameter [mm]	16	18	20	25
Yield load [kN]	100	127	157	245
Typical yield strength [MPa]	500	500	500	500
Ultimate load [kN]	140	178	220	343
Typical ultimate tensile strength [MPa]	700	700	700	700
Calculated shear load [kN] [1]	84	106	132	206
Typical elongation [%] [2]	20	20	20	20
Density [kg/m]	1.630	2.059	2.539	3.750
Cross sectional area [mm^2]	201	254	314	490

1) Calculated at 60 [%] of ultimate tensile load.
2) $5.65\sqrt{A}$

Notes

- Minimum order quantities may apply to this product
- Only ROCBOLT™ Technologies South Africa components should be used to enable the full performance of the bolt system to be obtained

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www.rocbolt.com

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FASLOC® Resin Cartridges

FASLOC® resin cartridges consist of a two compartment heat sealed tube of polyester film clipped at both ends. One compartment contains a dark grey or yellow resin mastic, the other an offwhite or coloured catalyst.

The FASLOC® resin compound is thixotropic and fast setting. This reduces viscosity during insertion and permits relatively low force and torque. The uniquely sized graded fillers assist with shredding the film, mixing the resin and, by interlocking with each other and the sidewalls of the hole, further reduce strata movement. The results are fast installation, rapid achievement of full strength, and minimum tendency for ungelled resin to drop from the holes during installation.

Product Range

- Standard products available in sizes from 23 [mm] to 35 [mm] diameter, and in lengths to suit the application
- Set times from 15 seconds to 10 minutes (at 20 [°C])
- High strength products available for specific applications
- Dual set time cartridges
- Spin-to-stall cartridges
- Non-standard products are available on specific request (subject to pre-testing prior to supply)

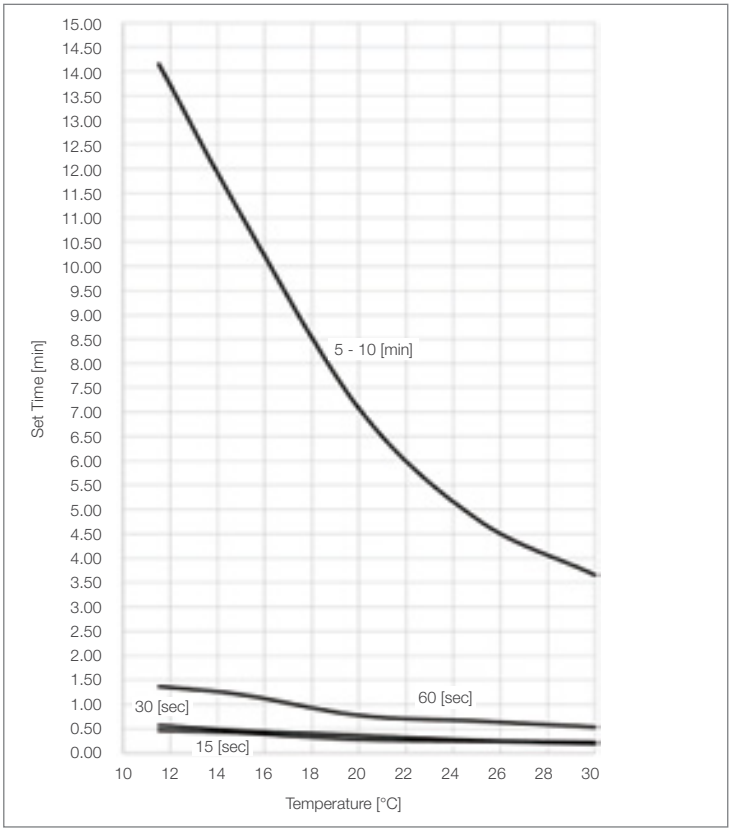
Set Times

A wide range of set times is offered for varied conditions. Cartridges are colour coded.

Colour	Set Time at 20 [°C]	Mixing Time
Purple	15 [sec]	8 [sec]
Red	30 [sec]	10 [sec]
Green	60 [sec]	15 [sec]
Blue	120 [sec]	20 [sec]
Yellow	5 - 10 [min]	20 [sec]

Please note that mix times as indicated above are for mechanised installations. These may vary with jackhammer and other installations.

Set times will vary with the temperature of FASLOC® resin cartridges as indicated in the graph.



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ROCBOLT TECHNOLOGIES

FASLOC® Resin Cartridges

Strengths

The performance of resin in the field depends on the design strength of the resin "mix". Shear strength specifications are minimum 19 [MPa] for standard FASLOC® and 23 [MPa] for FASLOC® A.

Note that the effectiveness of a resin bolt system depends on many factors such as:

- Type of tendon used
- Ratio of hole diameter to tendon diameter
- Capsule diameter and length
- Length of hole and encapsulation length
- Over-drill in hole length

Storage

- For maximum shelf life FASLOC® cartridges should be stored away from direct sunlight in a reasonably cool, well ventilated, dry area
- Storage life is four to six months at 20 [°C]
- Under adverse storage conditions, shelf life is reduced
- To ensure proper storage, the product should not be subject to temperatures in excess of 30 [°C] for prolonged periods
- Storage is recommended under cover with adequate ventilation. Conversely, while cold storage does not adversely affect the shelf life of FASLOC®, it should be warmed to a range of 10 [°C] - 15 [°C] before using to assure set times within the specified range
- It is essential that stocks be rotated so that the oldest stock is first out. Shelf life is 4 - 6 months

Quality Control

The superior quality of the FASLOC® bolt support system is assured through a three-part quality control program.

- Ingredient testing
- In-process control tests
- Finished product acceptance tests

Handling Precautions

Do not open or puncture cartridge. Physical contact with liquid contained in cartridge may cause mild irritation. Safety glasses or eye shield should always be used when roof bolting is done. In case of contact with eyes, immediately flush with plenty of water for at least 15 minutes. Call a doctor.

In case of skin contact, flush skin with water. Prolonged contact with skin may cause mild irritation. Irritation should subside when material is removed.

Cartridges are filled with inert fillers, water, polyester resin and catalyst (active ingredients include low levels of styrene and modified benzoyl peroxide). FASLOC® resin cartridges are for industrial use only and are intended for use in conjunction with bolts.

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30 North Reef Road
Germiston, 1429
South Africa

Phone +27 11 8786800
E-mail sales@rocbolt.com
www.rocbolt.com

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ROCBOLT Anchor Resin

ROCBOLT Anchor Resin is a pourable solution consisting of two components packaged in a plastic bucket. The first component, in a tin, containing resin and the second component, in a bag, being the filler/grout.

The filler is poured into the bucket provided and then the resin is decanted and mixed.

The resin mixture is fast setting, 15 [min] - 35 [min] at 25 [ºC].

Product Performance

- Set time (standard)
- Working time
- Packaged weight
- Typical volume (mixed)
- 15 [min] - 35 [min] at 25 [ºC]
- 8 [min]
- 10 [kg]
- 4.6 [l] (0.0046 [m^3])

Quality Control

The superior quality of ROCBOLT Anchor Resin is assured through a three-part quality control program.

- Ingredient testing
- In-process control tests
- Finished product acceptance tests

Storage

- For maximum shelf life, ROCBOLT Anchor Resin should be stored away from direct sunlight in a reasonably cool, well ventilated, dry area
- Storage life is four months at 20 [ºC]
- Under adverse storage conditions, above 25 [ºC], shelf life is reduced, conversely, while cold storage does not adversely affect the shelf life of ROCBOLT Anchor Resin, colder temperatures may cause slower setting times
- It is essential that stocks be rotated so that the oldest stock is first out due to the four month shelf life

Handling Precautions

Physical contact with resin contained in tins may cause mild irritation. Safety glasses or eye shield should always be used when installation is done. In case of contact with eyes, immediately flush with plenty of water for at least 15 minutes and consult a physician. Use of gloves is recommended.

In case of skin contact, flush skin with water. Prolonged contact with skin will cause skin irritation. Irritation should subside when material is removed from skin.

Buckets are filled with inert fillers and resin (active ingredients include low levels of styrene and benzoyl peroxide).

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Germiston, 1429
South Africa

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ROCBOLT™ TECHNOLOGIES

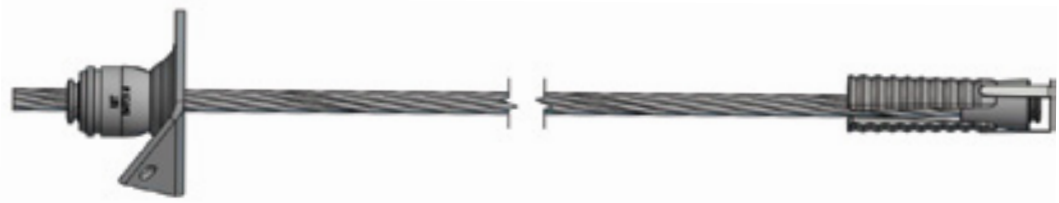
CableLok Barrel

Overview

The CableLok Barrel is designed to be used as a hydraulically pre-tensioned anchor bolt. By making use of seven strand cable the bolt is flexible and has high tensile strength. The bolt can be used for intersections or as normal mining bolt.

A specially fabricated barrel makes the installation and tensioning efficient. A purposefully designed ring engages the barrel and the pre-tension tonnage will be achieved accurately, the ring enables the barrel to shear at the specified load and thus locking the cable into place at the predetermined tonnage.

The CableLok Barrel mechanical bolt can be easily and efficiently installed with the correct sized expansion shell. It can then be post grouted if necessary, using pumpable resin or grout. Grouting pipes and breather tubes can be supplied with the CableLok Bolt mechanical anchor. The lengths of the CableLok Barrel ranges from 1.5 [m] to 15 [m] according to customer specifications.



CableLok Barrel Mechanical Anchor

Technical Data				
Cable Diameter	UTS System	UTS Cable	Expansion Shell Size	Pre-Tension
[mm]	[% of UTS Cable]	[kN]	[–]	[tons]
15.24	96	250	32, 35, 38 & 43	5, 10, 15
18	94	350	35, 38, 43 & 65	5, 10, 15, 20
18 Compact	98	380	35, 38, 43 & 65	5, 10, 15, 20

Expansion Shell	Min. Hole Size	Max. Hole Size
[–]	[mm]	[mm]
32	32.5	38
35	35.5	41
38	38.5	44
43	43.5	49
48	48.5	54
65	65.5	71

CableLok Barrel with Chemical Anchor

ROCBOLT Technologies (Pty) Ltd.
30 North Reef Road
Germiston, 1429
South Africa

Phone +27 11 8786800
E-mail sales@rocbolt.com
www.rocbolt.com

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CableLok Bolt

Overview

The CableLok Bolt is specifically designed to be used as a rotationally tensioned anchor. By making use of seven strand cables the bolt is flexible and has high tensile strength. The CableLok Bolt can be installed, using T-spanners or mechanical bolters.

Two types of CableLok Bolts are available, both as resin anchors and mechanical anchors. The CableLok mechanical anchor can be post grouted if required. Grouting pipes and breather tubes are supplied with the mechanically anchored CableLok Bolt. The length of the CableLok Bolts are supplied accordingly to customer specifications. Suitable spinning adaptors are available.

Expansion Shell	Min. Hole Size	Max. Hole Size
[–]	[mm]	[mm]
32	32.5	38
35	35.5	41
38	38.5	44
43	43.5	49

CableLok Bolt Mechanical Anchor

Cable Diameter	UTS System	UTS Cable	Expansion Shell Size	Spinning Adaptor
[mm]	[% of UTS Cable]	[kN]	[–]	[–]
12.70	94	160	32, 35, 38, 43	36F22FHEX
15.24	96	250	32, 35, 38, 43	46F22FHEX
18 standard	98	350	35, 38, 43, 65	55F22FHEX
18 compact	98	380	35, 38, 43, 65	55F22FHEX

CableLok Bolt Spin Anchor

Cable Diameter	UTS System	UTS Cable	Hole Size	Spinning Adaptor
[mm]	[% of UTS Cable]	[kN]	[mm]	[–]
12.70	94	160	20 - 25	36F22FHEX
15.24	96	250	25 - 32	46F22FHEX
18 standard	98	350	32 - 36	55F22FHEX
18 compact	98	380	32 - 36	55F22FHEX

ROCBOLT Technologies (Pty) Ltd.
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Germiston, 1429
South Africa

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ROCBOLT™ TECHNOLOGIES

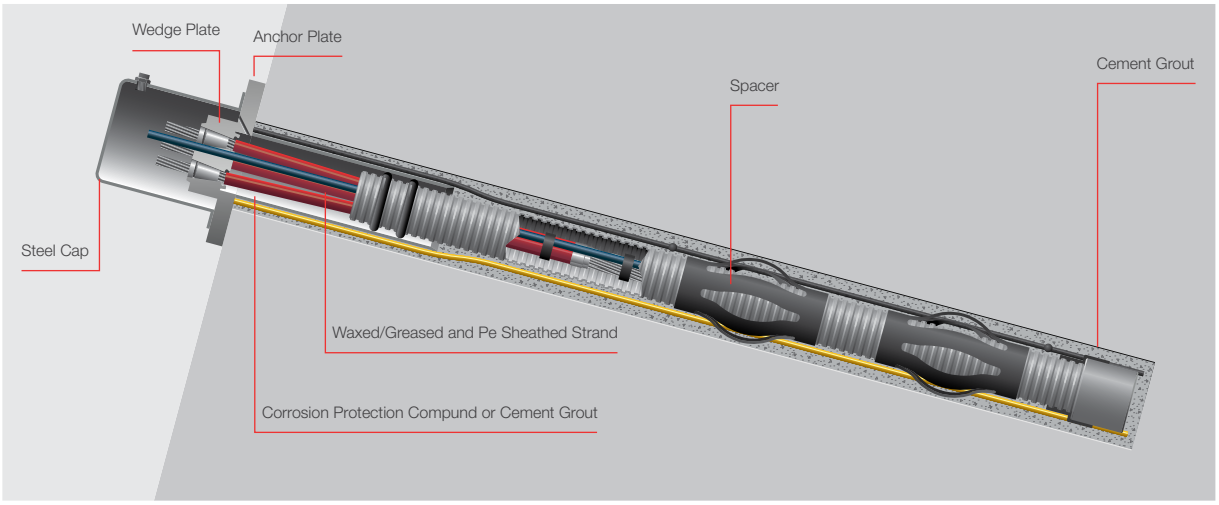
Multi-Strand Anchor Systems

Multi-strand anchors are an actively tensioned ground anchor system. Tensioning minimizes or eliminates anticipated deformations of the system and deformations at the civil engineering measure. This applies both to temporary structures (e.g. pit support systems) and permanent tie backs.

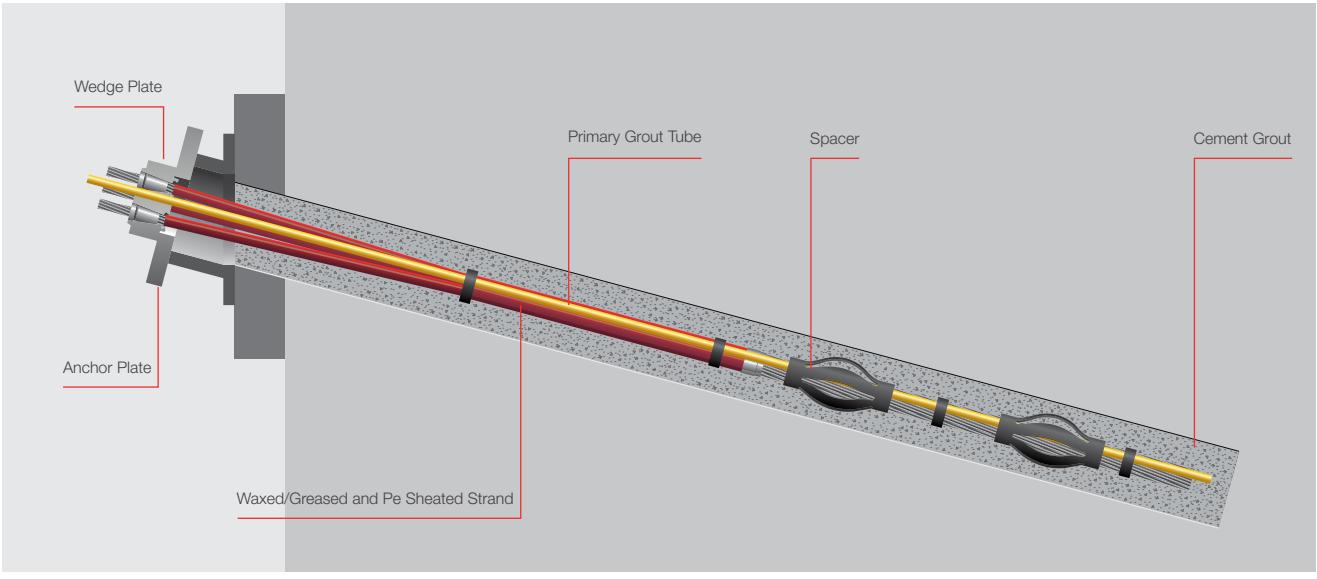
The strand anchors are produced with double corrosion protection (DCP), each individual strand is covered by corrosion protection compound and inserted into an individual duct in the factory. As long as the grout used for anchoring is load-bearing, the anchor force is unlimited because the number of strands that can be combined in the anchorage is variable at will.

Permanent (DCP) Anchor

acc. to DIN 4125



Temporary Anchor



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Germiston, 1429
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ROCBOLT™ TECHNOLOGIES

Multi-Strand Anchor Systems

By definition, an anchor consists of the following three main components:

- Bonded length:
  anchor is fixed in the borehole using grout (cement grout) and can transfer the forces to the loadbearing soil via bond and skin friction
- Unbonded length:
  each strand is uncoupled from the borehole using individual sleeves so that it can freely extend in the unbonded length. This way, tension can be applied to the anchor system
- Anchor head:
  anchor head transfers the anchor force to the substructure and thus to the structure that needs to be anchored

If required, anchors can be supplied retensionable.

Applications

- Excavations (deformation resistant)
- Tiebacks
- Uplift control
- Positional stability
- Rock stabilization

Features

- Large degree of flexibility: force, length, transport, installation
- Practically no restrictions in terms of length: 150 [m]
- Small pack size for transportation
- Minimal space required during installation
- Retensionable due to exterior thread at wedge plates
- Permanent strand anchor can be supplied in many variations (standard, EI-Iso, TWIN-Corr)

No.	Cross Sectional Area	Weight	Y1860 High Grade	
			Yield Load	Ultimate Load
[–]	[mm²]	[kg/m]	[kN]	[kN]
1	140	1.09	230	260
2	280	2.19	459	521
3	420	3.28	689	781
4	560	4.37	918	1,042
5	700	5.47	1,148	1,302
6	840	6.56	1,378	1,562
7	980	7.65	1,607	1,823
8	1,120	8.74	1,837	2,083
9	1,260	9.84	2,066	2,344
10	1,400	10.93	2,296	2,604
11	1,540	12.02	2,526	2,864
12	1,680	13.12	2,755	3,125
13	1,820	14.21	2,985	3,385
14	1,960	15.30	3,214	3,646
15	2,100	16.40	3,444	3,906
16	2,240	17.49	3,674	4,166
17	2,380	18.58	3,903	4,427
18	2,520	19.67	4,133	4,687
19	2,660	20.77	4,362	4,948
20	2,800	21.86	4,592	5,208
21	2,940	22.95	4,822	5,468
22	3,080	24.05	5,051	5,729

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Tensioning Equipment

Tensioning equipment is primarily used in conjunction with the CableLok Anchors. A stressing jack fits directly onto the anchor allowing an immediate and accurate preload force.The equipment is robust and comes with safety slings for easy handling.

The hydraulic system is equipped with the relevant gauges to determine the acquired tonnage. The stressing jack together with the jack jaws and shear rings can be configured to the various desired sizes and can be replaced with different sizes depending on the requirement.

Hydraulic Hand Pump Air or Manually Operated

Air Hydraulic Pump

Strand Tensioners Rear Gripping

Strand Tensioners Front Gripping

Croppers

- Tensioners from 100 - 250 [kN] capacity
- Tensioner stroke from 75 - 125 [mm]
- Tensioner allowable pressure from 40 - 60 [MPa]
- Mass of tensioning jack from 13 - 18 [kg]
- Minimum length of strand for tensioners 450 [mm]
- Ports ¼" NPT
- Cable cropper max cutting force = 290 [kN]; max pressure = 60 [MPa]
- Mass of cable cropper excluding hoses = 12 [kg]

Please enquire on specific tensioning equipment and various model options.

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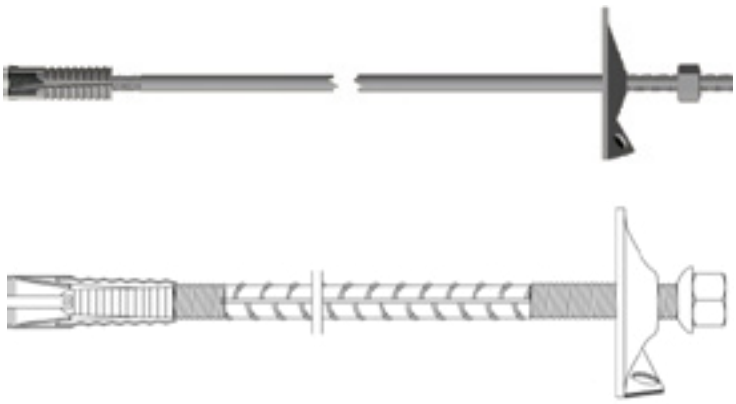
ROCBOLT™ TECHNOLOGIES

Mechanical Anchor Bolt

Mechanical Anchor Bolt

The mechanical anchor bolt is typically used when there is an additional support needed on the rock face. The anchor is commonly used in conjunction with wired mesh and other support sheeting to secure into place. No grout or resin is needed for installation.

Standard equipment can be used in making the anchor installation user friendly. Grouting is possible with the addition of grout feed and breath pipes.



Features

- Standard hex nuts for installation
- Washer as required
- Expansion unit for appropriate drill size
- Standard bar sizes are 14.5 [mm] and 16 [mm] but are available for larger diameter bars upon request

With the use of the expansion shell, the mechanical anchor is easy to install. The expansion unit, once installed, locks into place assuring no movement occurs on the anchor.

- 3-leaf shell
- 32, 35 expansion shells available, dependant on the bar diameter

Mechanical Anchor

Flat plates for general use

Technical Data			
Bar Diameter [mm]	Smooth 14.5	D16	D18
Min. yield strength [MPa]	450	500	500
Min. ultimate tensile strength [MPa]	590	700	700
Min. ultimate tensile load [kN]	97.3	140	178
Calculated shear strength [kN] [1)]	58	84	124
Cross sectional area [mm²]	165	200	254
Thread	DIN405 Rd16	DIN405 Rd18	DIN405 Rd20
Elongation [%]	19	20	20

1) Shear values calculated at 60 [%] of U.T.S

Expansion Shell	Min. Hole Size	Max. Hole Size
[–]	[mm]	[mm]
32	32.5	38
35	35.5	41
38	38.5	44
43	43.5	49

ROCBOLT Technologies (Pty) Ltd.
30 North Reef Road
Germiston, 1429
South Africa

Phone +27 11 8786800
E-mail sales@rocbolt.com
www.rocbolt.com

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Friction Bolts

Features

- The friction bolt is manufactured from high strength steel tube which has a slot along its entire length. A ring, or collar, is welded on the outer end to hold a domed plate to the rock surface
- The 33 [mm] and 39 [mm] friction bolt is suitable for installation with hand held rock drills (stoppers or drifters)
  The 46 [mm] friction bolt is NOT suitable for installation with hand held rock drills
- Friction bolts can be load tested by fitting a special ring to the bolt prior to its installation. Pull tests can then be conducted with a hollow ram hydraulic jack
- Further corrosion protection can be provided by hot dip galvanising or fero zink diffusion

Notes

- Minimum order quantities may apply to this product
- Only ROCBOLT South Africa components should be used to enable the full performance of the bolt system to be obtained

Installation Guidelines

- The hole length should be longer than the bolt, nominally 150 [mm], to allow for any rock fretting during installation
- The friction bolt is inserted into the hole. The driving dolly is fitted into the rock drill's chuck and then the bolt (with accessories) is placed onto the dolly
- Using full percussion and thrust the bolt is fully driven into the hole until the domed plate is firmly against the rock surface. Care should be taken to ensure the rock drill's feed/thrust is in the same orientation as the hole or the bolt may be bent during installation

Technical Data			
Bar Diameter [mm]	33	39	46
Min. yield strength [MPa]	420	420	420
Min. ultimate material tensile strength [MPa]	490	490	490
Min. ultimate tensile load [tons]	8	10	15
Shear strength [kN] [1)]	56	70	105
Hole diameter range [mm]	29 - 32	35 - 38	42 - 45
density [kg/m]	1.64	1.84	2.84

1) Calculated shear strength.

All dimensions, weights, quantities and specifications are those applicable at the time of publication and may be amended from time to time.

ROCBOLT Technologies (Pty) Ltd.
30 North Reef Road
Germiston, 1429
South Africa

Phone +27 11 8786800
E-mail sales@rocbolt.com
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ROCBOLT™ TECHNOLOGIES

Double Corrosion Protection (DCP) Bolts

Double Corrosion Protection (DCP) bolts provide support in the most aggressive geological environments. This anchor type rock bolt technology is ideal for complex engineering structures and unstable ground conditions where groundwater is predominant.

The tapered DCP bolt is enclosed by a polyethylene sheath that allows for easy installation, instant ground support and safe advancement by construction teams with a quick and stress-free patented grouting system.

Features

- DCP bolt is an expansion shell bolt with HDPE sheathing providing corrosion protection over the bolt length
- Pre-tensioned with expansion shell
- Provides immediate roof support
- Efficient anchorage with grout bell and spherical nut combination
- Grout adaptor provides efficient post grouting
- Durable HDPE sheathing allows for inner and outer annuluses to be grouted in single pass
- Grout bell available in black steel or HDG steel for ultimate corrosion protection
- Pull tested with standard equipment
- Available in 20, 25, and 32 [mm] diameter bars

Applications

- Systematic permanent reinforcement of underground excavations
- Ground support for areas with limited or no access during operational lifetime
- Mining: permanent roadways and excavations

DCP Rock Bolt Sample and Cutaway

ROCBOLT Technologies (Pty) Ltd.
30 North Reef Road
Germiston, 1429
South Africa

Phone +27 11 8786800
E-mail sales@rocbolt.com
www.rocbolt.com

Published Date 09.2022

Double Corrosion Protection (DCP) Bolts

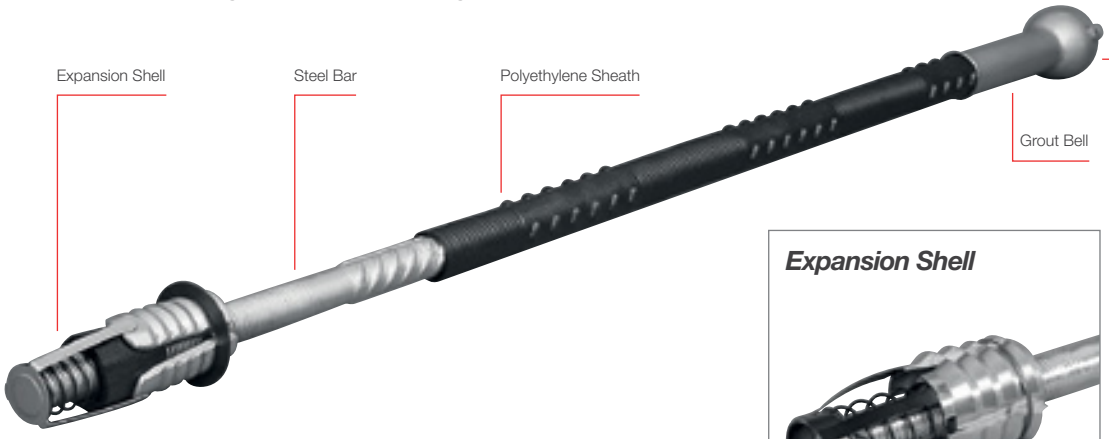
Technical Data			
Bolt Size [mm]	20	25	32
Tensile load [kN]	219	343	498.3
Yield strength [MPa]	500	500	450
Elongation [%]	22	22	14
Ultimate tensile strength [MPa]	700	700	620 (typical)
Calculated shear strength [kN] 1)	131.88	206	299
Hole size [mm]	48 - 55	48 - 55	64 - 72
Density [kg/m]	2.52	3.86	6.32
Cross sectional area of bar [mm]	314	490	804
Thread (left or right hand)	DIN 405	DIN 405/M27	M32

1) Calculated at 60 [%] of ultimate tensile load.

Notes

- Minimum order quantities may apply to this product
- Only ROCBOLT™ Technologies South Africa components should be used to enable the full performance of the bolt system to be obtained

DCP Rock Bolt Diagram – Sample Length of the DCP Rock Bolt



Expansion Shell

Grout Bell

ROCBOLT Technologies (Pty) Ltd.
30 North Reef Road
Germiston, 1429
South Africa

Phone +27 11 8786800
E-mail sales@rocbolt.com
www.rocbolt.com

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ROCBOLT TECHNOLOGIES

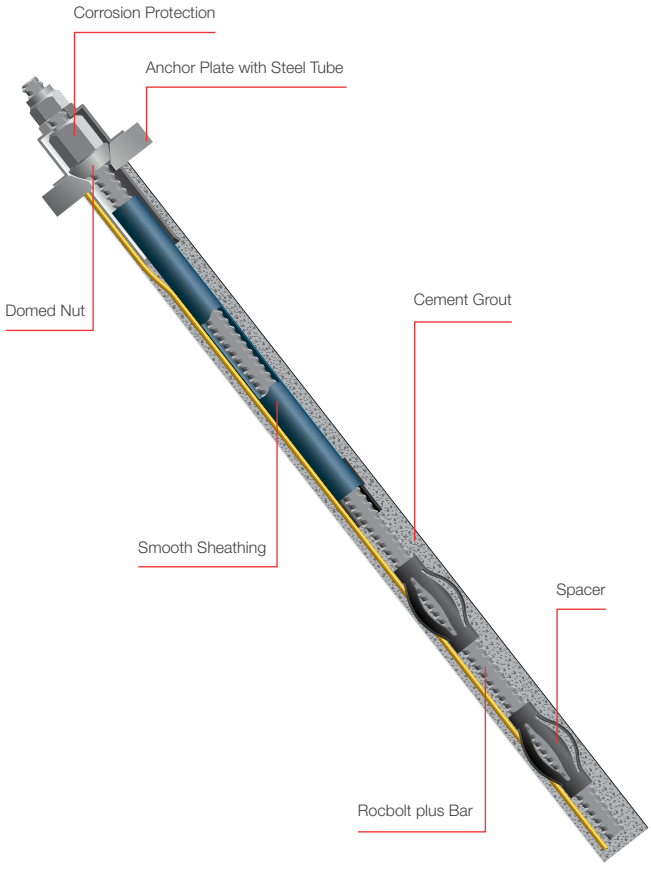
ROCBOLT Threadbar System

ROCBOLT Ground Anchors

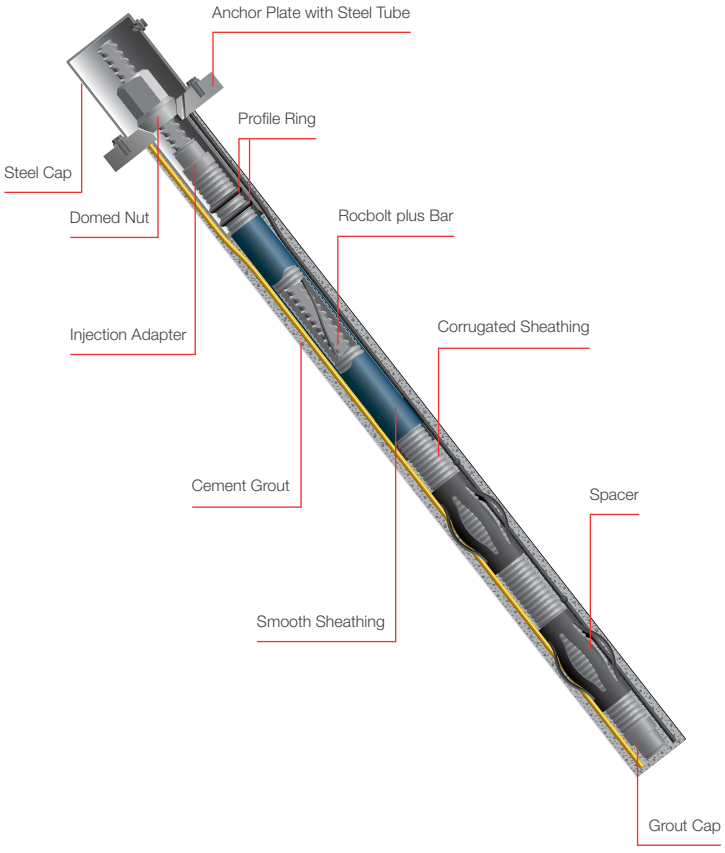
Advantages and Characteristics

- Easy system handling
- Simple restressing and destressing through anchorage with nut
- Permanent corrosion protection possible
- Easy removal of temporary anchors through threaded sleeves
- Flexibility in transport lengths by using couplers
- High bond strength between ROCBOLT Ground Anchor and cement grout
- Angle compensation using wedge washers
- Quality assurance through internal and external supervision of production

Permanent ROCBOLT Ground Anchor



Temporary ROCBOLT Ground Anchor



ROCBOLT Technologies (Pty) Ltd.
30 North Reef Road
Germiston, 1429
South Africa

Phone +27 11 8786800
E-mail sales@rocbolt.com
www.rocbolt.com

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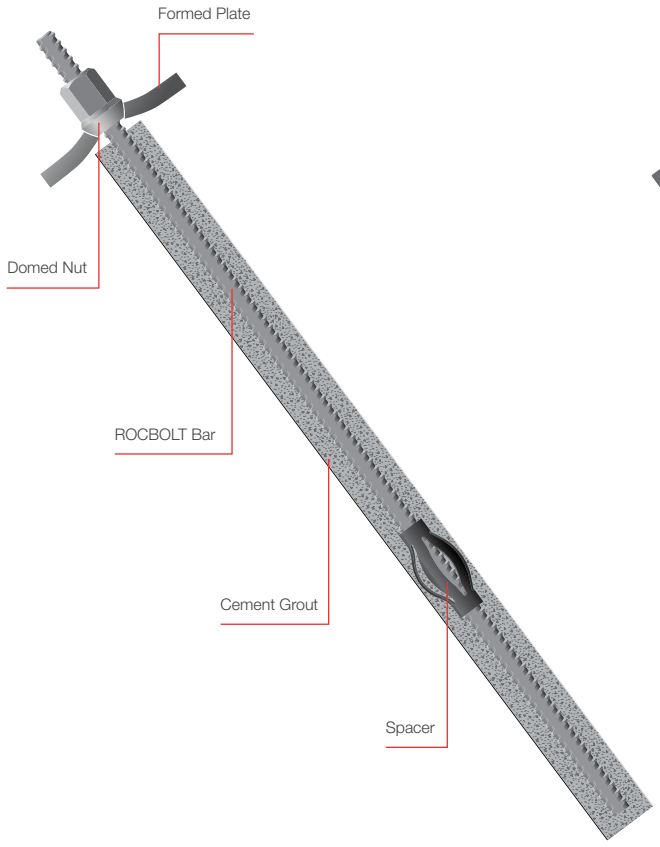
ROCBOLT Soil Nails

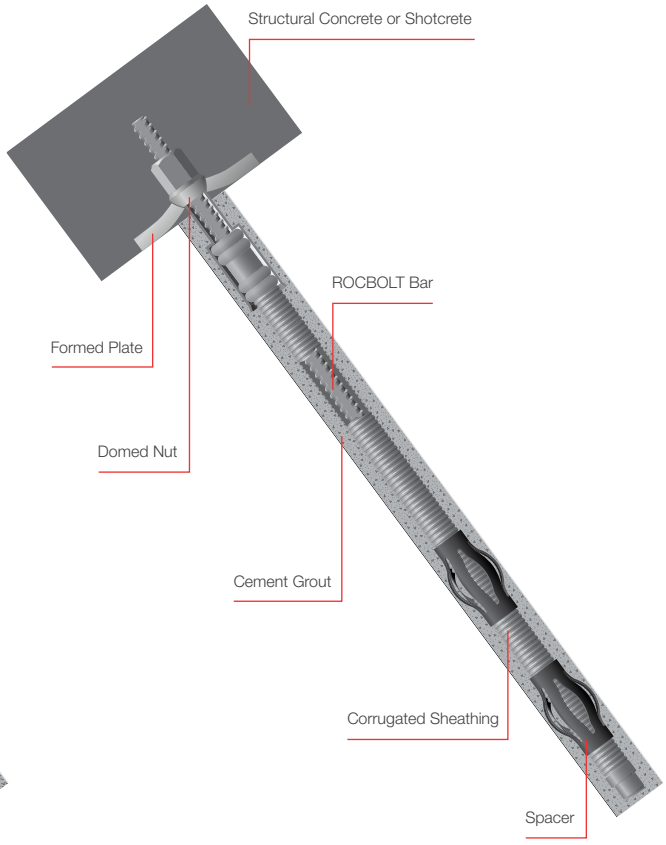
Advantages and Characteristics

- High durability through double corrosion protection possible
- Low susceptibility to corrosion
- Angle compensation up to 20 [°C] through formed plate
- Flexibility in length by using couplers
- Extension bars may be attached by using couplers
- Spacers ensure proper grout cover
- High standard of quality control from production stage to installation of the soil nails ensures consistent quality

ROCBOLT Soil Nail



ROCBOLT Soil Nail – Double Corrosion Protection



ROCBOLT Technologies (Pty) Ltd.
30 North Reef Road
Germiston, 1429
South Africa

Phone +27 11 8786800
E-mail sales@rocbolt.com
www.rocbolt.com

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ROCBOLT Threadbar Piles

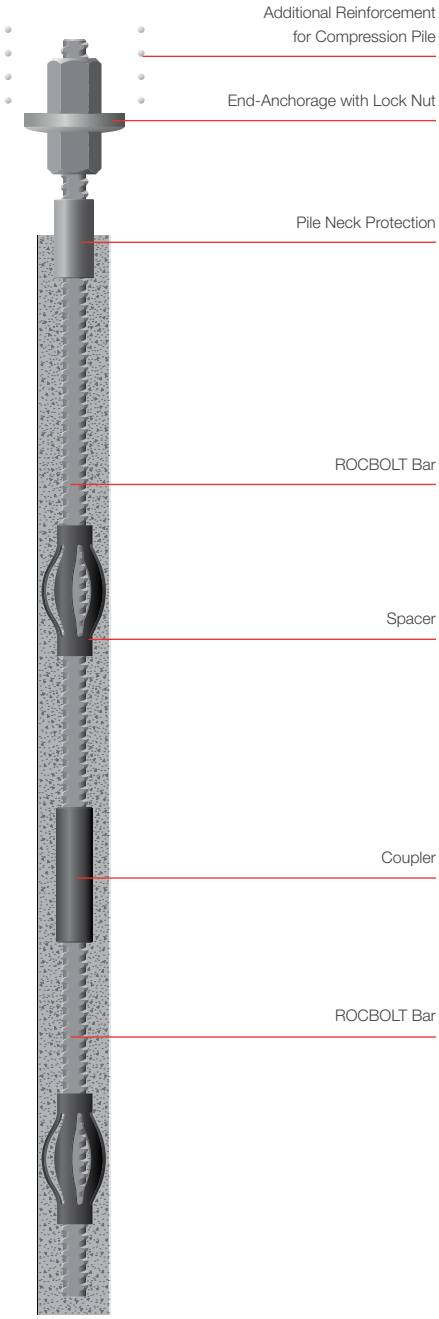
Advantages and Characteristics

The ROCBOLT threadbar pile is a drilled micropile with a central steel element based on the ROCBOLT anchor with hot-rolled, continuous thread deformations on both sides.

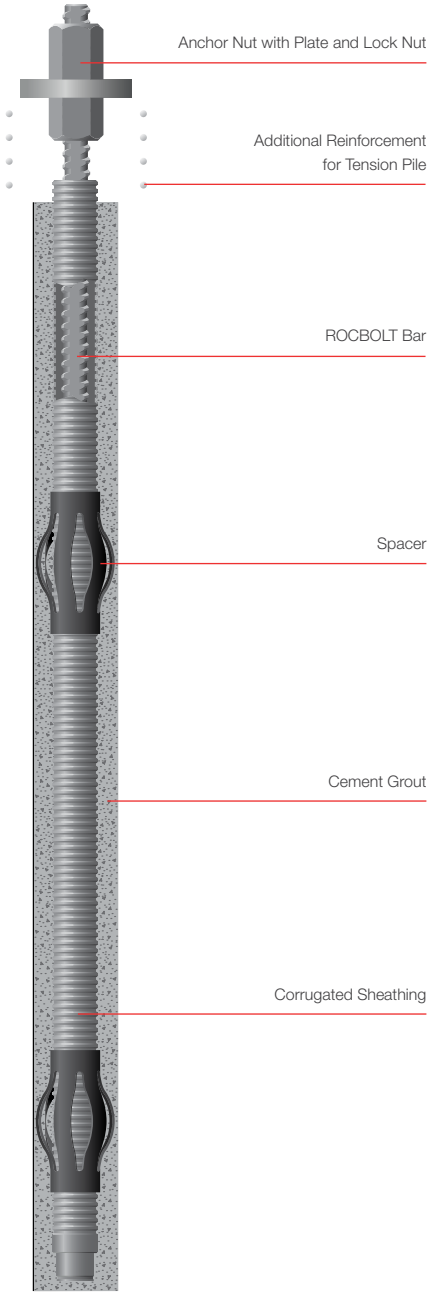
The ROCBOLT anchor is encapsulated in cement grout which acts both as corrosion protection and as load transfer into the soil or rock.

- Excellent load transfer into concrete structures by means of anchoring elements
- Tensile, compressive and alternating loads can be efficiently transferred to the structure
- The coarse ROCBOLT thread guarantees maximum bond between steel and cement grout
- The stress-strain curve of the ROCBOLT bar shows high ductility
- Settlement can be prevented by using preloaded ROCBOLT threadbar piles
- Load transfer into soil is optimised by post-grouting
- Double corrosion protected piles can be used for high corrosion impact as in aggressive media such as seawater or contaminated ground
- Can be cut off or coupled at any given point
- A small drill hole diameter permits economic drilling equipment
- Robust, coarse thread remains threadable even when dirty or damaged

ROCBOLT Threadbar Pile



ROCBOLT Threadbar Pile – Double Corrosion Protection



ROCBOLT Technologies (Pty) Ltd.
30 North Reef Road
Germiston, 1429
South Africa

Phone +27 11 8786800
E-mail sales@rocbolt.com
www.rocbolt.com

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ROCBOLT Threadbar System

ROCBOLT Anchor System Applications

- Tie rods
- Marine ties
- Mining roof support
- Heavy lifting
- Reinforcing
- Tunnelling
- Formwork and scaffolding anchors
- High strength reinforcing

500B Threadbar

Technical Data								
Nominal Diameter [mm]	16	20	25	28	32	40	50	64
Min. yield strength [MPa]	500	500	500	500	500	500	500	555
Min. tensile strength [MPa]	550	550	550	550	550	550	550	700
Min. yield load [kN]	101	157	245	308	402	628	982	1,758
Min. ultimate load [kN]	111	173	270	339	442	691	1,080	2,217
Cross sectional area [mm^2]	201	314	491	616	804	1,257	1,963	3,167
Weight [kg/m]	1.58	2.47	3.85	4.83	6.31	9.86	15.41	24.86

670 Threadbar

Technical Data										
Nominal Diameter [mm]	18	22	25	28	30	35	43	57.5	63.5	75
Min. yield strength [MPa]	670	670	670	670	670	670	670	670	670	670
Min. tensile strength [MPa]	800	800	800	800	800	800	800	800	800	800
Min. yield load [kN]	170	250	330	410	475	640	980	1,740	2,120	2,960
Min. ultimate load [kN]	200	300	390	490	565	770	1,170	2,080	2,540	3,535
Cross sectional area [mm^2]	250	375	491	616	707	962	1,466	2,597	3,167	4,418
Weight [kg/m]	1.96	2.94	3.85	4.83	5.55	7.55	11.51	20.38	24.86	34.68

ROCBOLT Technologies (Pty) Ltd.
30 North Reef Road
Germiston, 1429
South Africa

Phone +27 11 8786800
E-mail sales@rocbolt.com
www.rocbolt.com

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950 Threadbar

Technical Data						
Nominal Diameter [mm]	18	26.5	32	36	40	47
Min. yield strength [MPa]	950	950	950	950	950	950
Min. tensile strength [MPa]	1,050	1,050	1,050	1,050	1,050	1,050
Min. yield load [kN]	230	525	760	960	1,190	1,650
Min. ultimate load [kN]	255	580	845	1,070	1,320	1,820
Cross sectional area [mm^2]	241	551	804	1,020	1,257	1,735
Weight [kg/m]	1.96	4.48	6.53	8.27	10.21	14.10

Notes

- Minimum order quantities may apply to this product
- Extended lead times may apply to certain items. Please enquire
- Only ROCBOLT™ Technologies South Africa components should be used to enable the full performance of the bolt system to be obtained

ROCBOLT Technologies (Pty) Ltd.
30 North Reef Road
Germiston, 1429
South Africa

Phone +27 11 8786800
E-mail sales@rocbolt.com
www.rocbolt.com

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Pigtail Eye Bolt

The pigtail eye bolt is threaded at one end to allow the use of an expansion shell, and is hot formed into an eye on the other end. The typical applications of the pigtail eye bolt is for suspension of cabling, ventilation, electrical, water piping and tooling. The two sizes of expansion units allow for a wider range of hole sizes to be used.

Features

- 3 leaf expansion shell
- Various size expansion shells may be used, see table below
- Large diameter of the “eye” for ease of use
- Easy installation
- Long thread allowing maximum tension with the expansion shell on inner hole wall
- M16 thread
- No special tools needed for installation

Technical Data	
Thread Type	M16
Bar diameter [mm]	14.5
Min. ultimate load [kN]	78.5
Calculated shear strength [kN] 1)	44.6
Eye diameter [mm]	60
Lengths [mm]	380,45

1) Shear values calculated at 60 [%] of U.T.S

Expansion Shell	Min. Hole Size	Max. Hole Size
[–]	[mm]	[mm]
32	32.5	38
35	35.5	41
38	38.5	44
43	43.5	49

Notes

- Minimum order quantities may apply to this product
- Only ROCBOLT™ Technologies South Africa components should be used to enable the full performance of the bolt system to be obtained

ROCBOLT Technologies (Pty) Ltd.
30 North Reef Road
Germiston, 1429
South Africa

Phone +27 11 8786800
E-mail sales@rocbolt.com
www.rocbolt.com

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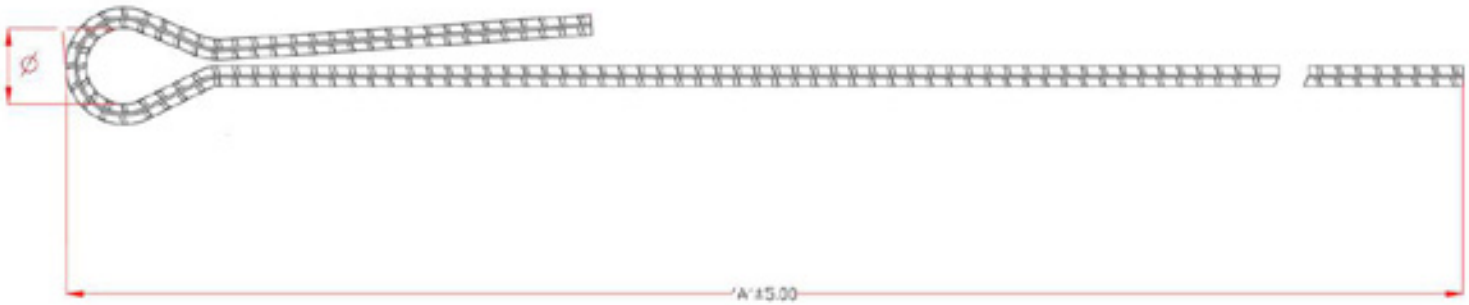
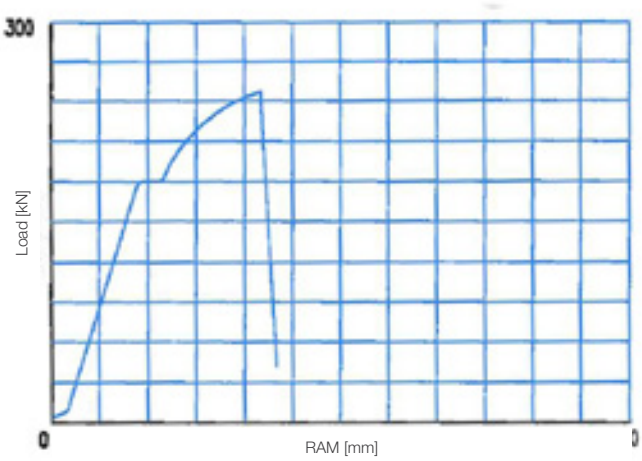
Grout Rod

The typical applications of the grout bar are for suspension of cabling, ventilation, electrical, water piping and tooling. The bar can be shaped to meet customers requirements.



Diameter [mm]	Length [m]
16 (smooth)	1.2 - 3.4
16	1.2 - 3.4



Features

- Various sizes can be made to customer requirements
- Easy Installation

Notes

- Minimum order quantities may apply to this product
- Only ROCBOLT™ Technologies South Africa components should be used to enable the full performance of the bolt system to be obtained

ROCBOLT Technologies (Pty) Ltd.
30 North Reef Road
Germiston, 1429
South Africa

Phone +27 11 8786800
E-mail sales@rocbolt.com
www.rocbolt.com

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ROCBOLT™ TECHNOLOGIES

Mineral Bond LV
High Strength Silicate Resin

Application

Mineral Bond LV is a 2-component, fast reacting and high strength silicate resin. It is suitable for grout stabilization (for heavily cracked rock mass), gas sealing and water stopping.

Material Characteristic

Components			
[–]	Unit	Mineral Bond LV A	Mineral Bond LV B
Appearance	–	Pale brown liquid	Dark brown liquid
Density at 20 [°C]	[g/cm³]	1.45 +- 0.05	1.21 +- 0.05
Viscosity at 25 [°C]	[mPa·s]	250 +- 90	200 +- 90

Material Properties		
[–]	Unit	Mineral Bond LV
Foam factor	–	1.0
Reaction start time	[s]	30 - 90
Reaction end time	[s]	120 - 360
Max. reaction temp.	[°C]	< 110
Compressive strength	[MPa]	> 40
Flexural strength	[MPa]	> 20
Bonding strength	[MPa]	3.9

The components Mineral Bond LV A and Mineral Bond LV B shall be pumped using a two component pump as commonly used in the mining and tunneling industry with a volumetric ratio of 1:1.

It is recommended to use two static mixers of the type: M-10x360 (part no. M-10x360) or equivalent.

Components Mixing Ratios		
[–]	Mineral Bond LV A	Mineral Bond LV B
By volume v/v	100	100
By weight m/m	100	87

If the components A and B are mixed at a different mixing ratio, the reaction time and mechanical properties may deviate from above specifications.

Both adhesive components are supplied in jerry can containers (other packaging is possible on the request). Recommended storage in dry and airy rooms at temperature range of 10 to 30 [°C].
The guaranteed shelf life from the date of manufacture is 12 months for Mineral Bond LV A and Mineral Bond LV B in original unopened packs (if stored according to the instructions).

Data presented in this document were obtained under laboratory conditions. Actual results under differ ent conditions may slightly deviate from published data. A proper material safety data sheet for this product is available upon request.

Before an application, please contact with the supplier to confirm product usefulness at given application conditions.

ROCBOLT Technologies (Pty) Ltd.
30 North Reef Road
Germiston, 1429
South Africa

Phone +27 11 8786800
E-mail sales@rocbolt.com
www.rocbolt.com

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ROCBOLT Self-Drilling Hollow Bar Anchor System

Features

- Fast drilling and placing due to drilling, anchor installation and grouting in a single operation
- Neither separate anchor installation nor removal of casing and drill rods
- Similar installation methods for all ground conditions
- Choice of drill bits for different ground conditions
- Hollow core not only serves for flushing with air or water during drilling, but also for grouting the anchor tendon
- Flexibility in length by using couplers
- Ability to work with small drill rigs without casing in restricted headroom conditions
- Accommodation of needs for enhanced protection against corrosion upon request
- High standard of quality control from production stage to the installation of the ROCBOLT self-drilling hollow bar anchor ensures consistent quality
- Advantageous in all applications where normally cased drilling is required
- Allows for anchoring in both cohesive and non-cohesive ground, even under limited space conditions

Drill Rope Thread RH

Drill "T" Thread RH

ROCBOLT Self-Drilling Hollow Bar Anchor System

Technical Data								
Outer diameter [mm]	R25N	R32S	R38N	R51N	T40	T40	T52	T76S
Inner diameter [mm]	12	17	22	33	16	20	26	45
Cross sectional area [mm²]	292	440	611	968	910	713	1,250	2,400
Yield load [kN] 1)	150	280	400	630	525	430	730	1,500
Ultimate load [kN] 1)	200	360	500	800	660	540	929	1,900
Weight [kg/m]	2.3	3.45	5.5	7.8	7.15	5.8	9.9	19

1) Ultimate and yield load capacity are measured values.

ROCBOLT Technologies (Pty) Ltd.
30 North Reef Road
Germiston, 1429
South Africa

Phone +27 11 8786800
E-mail sales@rocbolt.com
www.rocbolt.com

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ROCBOLT Self-Drilling Hollow Bar Anchor System

Anchor Coupler

Technical Data		
[–]	Length [mm]	Outside Diameter [mm]
R25N/12	150	36
R32S/17	190	42
R38N/22	220	52
R51N/33	200	63
T40/16	140	57
T52/26	160	70
T76S/45	220	95

Anchor Nut

Technical Data		
[–]	Length [mm]	Across Flat [mm]
R25N/12	41	41
R32S/17	65	46
R38N/22	60	50
R51N/33	70	75
T40/16	50	65
T52/26	70	80
T76S/45	80	100

Anchor Plate

Technical Data			
[–]	Size [mm]	Hole Diameter [mm]	Thickness [mm]
R25N/12	150x150	30	8
R32S/17	200x200	35	12
R38N/22	200x200	41	12
R51N/33	250x250	60	30
T40/16	200x200	54	16
T52/26	220x220	65	35
T76S/45	250x250	80	60

Anchor Centralizer

Technical Data		
[–]	OD [mm]	Length [mm]
R32S/17	72	30
R38N/22	72	41
R51N/33	92	54
T40/16	88	43
T52/26	112	55

Notes

- Minimum order quantities may apply to this product
- Only ROCBOLT™ Technologies South Africa components should be used to enable the full performance of the bolt system to be obtained

ROCBOLT Technologies (Pty) Ltd.
30 North Reef Road
Germiston, 1429
South Africa

Phone +27 11 8786800
E-mail sales@rocbolt.com
www.rocbolt.com

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DSI Pump Set – Multi Pump

Intended Use

The DSI Multi Pump is a pneumatic pump designed to inject, by means of compressed air, resins and void fill foams. These are used for strengthening weak rock and coal, and filling voids in mines and other excavations. Resin and foam information available upon request.

Accessories available:

- Injection gun
- Lances
- Hoses
- Seals
- Flushing oil
- Connection fittings
- Available on request

Conditions of Use and Storage

- Temperature:
  permissible ambient temperature during operation: +5 to +40 [°C]
- Relative humidity:
  air humidity: 30 [%] to 95 [%]

Transport Conditions

The DSI pump set can be transported using light means of transport or moved on the ground for short distances. When handling or transporting the set, the fastening belts must be secured to the outer frame and must not be attached to the compression cylinders or the pump.

Pump Set Parameters

Technical Data				
Mixing Ratio (Resin/Catalyst)	1/1	2/1	3/2	4/1
Performance	9.0 [l/min] 40 [rpm]	7.5 [l/min] 40 [rpm]	8.0 [l/min] 40 [rpm]	9.5 [l/min] 40 [rpm]
Pressure ratio	34/1	34/1	34/1	27/1
Pumping distance depending on hose diameter: 12 [mm] for resin and 10 [mm] for catalyst 20 [mm] for resin and 12 [mm] for catalyst	 100 [m] 600 [m]	 100 [m] 600 [m]	 100 [m] 600 [m]	 100 [m] 600 [m]
Feed pressure	2 - 7 [bar]	2 - 7 [bar]	2 - 7 [bar]	2 - 7 [bar]
Consumption (air)	2 [m^3/min]	2 [m^3/min]	2 [m^3/min]	2 [m^3/min]
Dimensions	1.22 x 0.48 x 0.48 [m]	1.22 x 0.48 x 0.48 [m]	1.22 x 0.48 x 0.48 [m]	1.22 x 0.48 x 0.48 [m]
Weight	105 [kg]	110 [kg]	110 [kg]	105 [kg]
Application temperature	15 - 33 [°C]	15 - 33 [°C]	15 - 33 [°C]	15 - 33 [°C]

ROCBOLT Technologies (Pty) Ltd.
30 North Reef Road
Germiston, 1429
South Africa

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E-mail sales@rocbolt.com
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YIELD-LOK® Bolt

Overview

The YIELD-LOK® Bolt provides a two in one solution in areas with high seismic activity. It is primarily used to absorb energy through yielding a pre-determined length. At a specific point, the bolt then provides additional support by halting the yield and holds a load until failure. The design of the YIELD-LOK® Bolt utilises every aspect and strength of the bolt to ensure for maximum performance for both loads that occur. With the unique head design and profile of the polymer coating on the bolt, the resin capsules are mixed entirely and thoroughly providing the best results.

Extensive testing ensures that the performance is at its highest for the bolt. The YIELD-LOK® Bolt goes through vigorous quality checks before and after packaging.

Features

- The YIELD-LOK® Bolt is manufactured from high strength steel round bar. The round bar strength is crucial to the performance of the bolt
- The round bar is covered with the InstaL+ Polymer Coating material giving the YIELD-LOK® Bolt its unique performance. The polymer coating allows the bolt to yield within, keeping the entire bar intact
- The design allows for absorption of energy that is released from multiple seismic activities
- Standard hex nut is fitted to the threaded end of the bar for easy installation purposes

Advantages

- The design makes installation the same as any resin roof bolt
- No special equipment needed
- High initial impact load
- Additional load point after yield
- Better resin mixing due to unique head and polymer coating design
- Larger yield length across bolt
- The polymer coating protects the bolt against the elements
- No extra accessories are needed to install the bolt

Technical Data	
Bar diameter [mm]	18
Min. ultimate tensile load [kN]	200
Calculated shear strength [kN] 3)	120
Major diameter [mm]	29.4
Cross sectional area major [mm²]	678.9
Typical yield point static [kN]	140
Typical yield point dynamic [kN]	150
Yield displacement [mm] 1)	650
Absorbed energy over 140 [mm], [kJ] 2)	38.49

1) Theoretical based on coating length – point loaded.
2) Dynamic tests Canmet Canada.
3) Shear values calculated at 60 [%] of U.T.S

ROCBOLT Technologies (Pty) Ltd.
30 North Reef Road
Germiston, 1429
South Africa

Phone +27 11 8786800
E-mail sales@rocbolt.com
www.rocbolt.com

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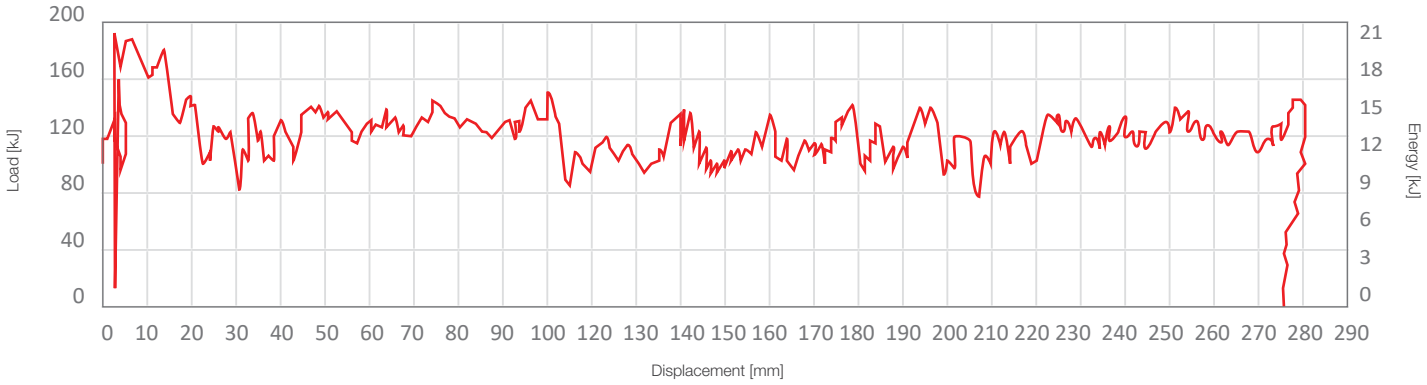
Typical Test Results

External Dynamic Test Results (Canmet)

SA YIELD-LOK® Bolt performance
projected energy absorption on an impact load of
± 3.3 [tons] = 47.19 [kJ]

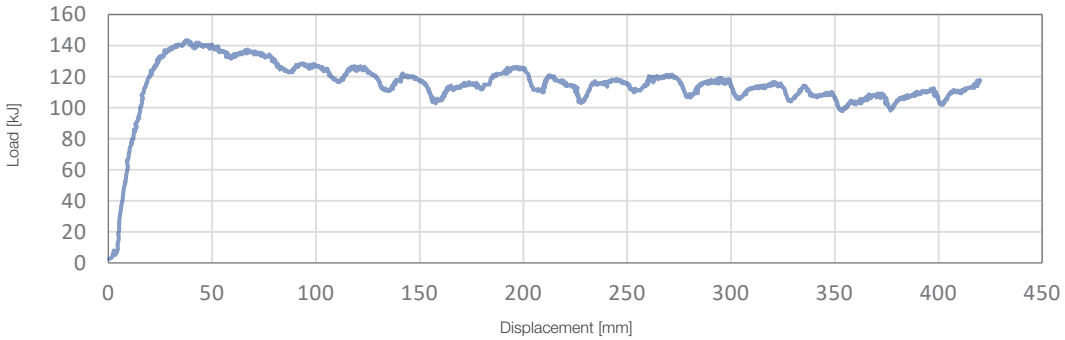
Notes

- Extrapolated energy/load vs displacement based on Canmet tests set up as follows
- Impact energy = 16.4 [kJ]; mass = 1,115 [kg]; height = 1.5 [m]; velocity = 5.42 [m/s]



In House Static Test Results

Consolidated results
velocity = 0.00245 [m/s]



Note:
test stopped at 430 [mm] – no failure

Notes

- Minimum order quantities may apply to this product
- Only ROCBOLT™ Technologies South Africa components should be used to enable the full performance of the bolt system to be obtained

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30 North Reef Road
Germiston, 1429
South Africa

Phone +27 11 8786800
E-mail sales@rocbolt.com
www.rocbolt.com

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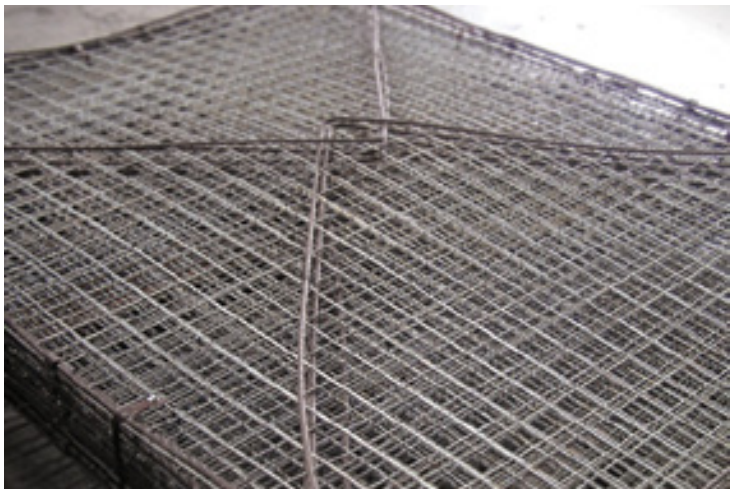
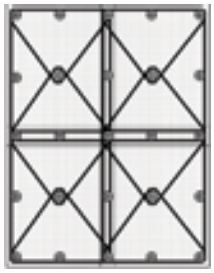
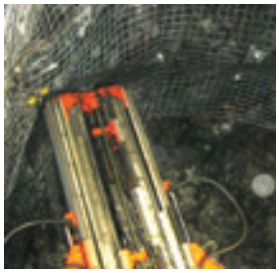
High Energy Absorption Mesh (HEA)

Where ground conditions are rock-burst prone and challenging, HEA mesh by ROCBOLT Technologies provides improved surface containment with the addition of pre-laced wire strand. In dynamic conditions where an excavation surface deforms, the strata loading is effectively transferred to all bolts and tendons, with a strong connection between the bolts and mesh offered by the HEA mesh installation.

HEA Mesh has the ability to allow large deformations whilst maintaining a high load capacity. The ability of HEA mesh to absorb energy in dynamic and repeated loadings can complement yielding reinforcement as an element in a complete dynamic system.







Key Benefits

- Superior containment of rock mass
- Jumbo specific for rapid installation
- Reduced shotcrete requirement
- Deformation plus strength for superior performance

Indicative Performance [1)]

- Deformation (typical maximum value at sheet centre): 900 [mm]
- Point loading (typical maximum value at sheet centre): 17.5 [tons]

1) Based on University of Western Australia laboratory test results – underground loading conditions may differ.

Product Properties	Typical
Sheet size (typical) [mm]	2,400 x 3,000
Aperture [mm]	100 x 100
HEA mesh wire diameter [mm]	5.6
Mass per sheet [kg]	45.5
Cable (strand) diameter [mm]	12.7
Cable tensile strength [kN]	1,870

Other sizes available per customer requirements.

Installation Overview

The pre-laced modular concept of HEA mesh is designed to meet the development intensive requirements of Jumbo based one pass mesh and bolt installations. This is achieved by the mesh behaving as standard mesh during handling and bolting.

The bolting pattern provides interconnection of the cable lacing system between successive HEA mesh modules. Correct overlay of HEA mesh sheets and bolt placement is critical to ensure cable lacing performs as a complete system. HEA mesh effectively removes the “weak link” of support systems.

HEA mesh provides a cost effective solution to the high energy demands of rock burst containment.

ROCBOLT Technologies (Pty) Ltd.
30 North Reef Road
Germiston, 1429
South Africa

Phone +27 11 8786800
E-mail sales@rocbolt.com
www.rocbolt.com

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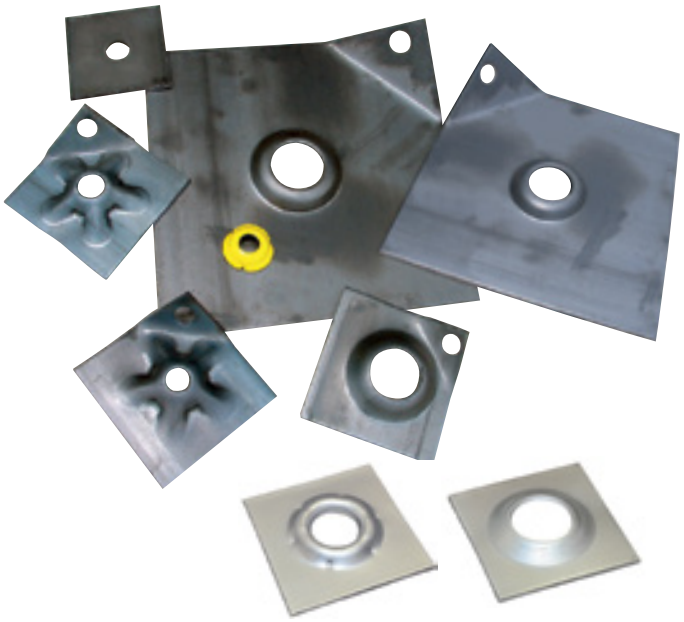
Washers

Domed Washer

Physical Properties

Technical Data	4.5	5.0
Length [mm]	125	125
Width [mm]	125	125
Thickness [mm]	4.5	5.0

Hole size: 36, 38, 42, 44 and 48 [mm]



Features

- Bolts are compatible with domed washers fitted with matching seats
- Domed washers are complimentary to the seat and overcome the problems of surface angularity. This allows the development of a good torque tension ratio
- The domed washer and seat assembly provides up to 18° angle of tilt

Packaging

- Domed washers are bundled with bars or palletised

Ribbed Dome Washer

- Rib washer 18.5 - 19 [mm] and 22.5 - 27.5 [mm] centre holes
- Yielding washer – dog ear

300 x 300 [mm] Washer with Central Dome and Dog Ear

- Flat dome washer with 36, 38, 44 and 48 [mm] centre hole

ROCBOLT Technologies (Pty) Ltd.
30 North Reef Road
Germiston, 1429
South Africa

Phone +27 11 8786800
E-mail sales@rocbolt.com
www.rocbolt.com

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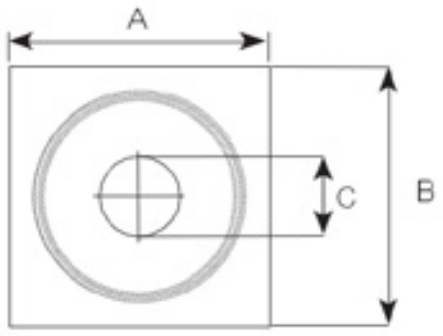
Washers

Flat Washer

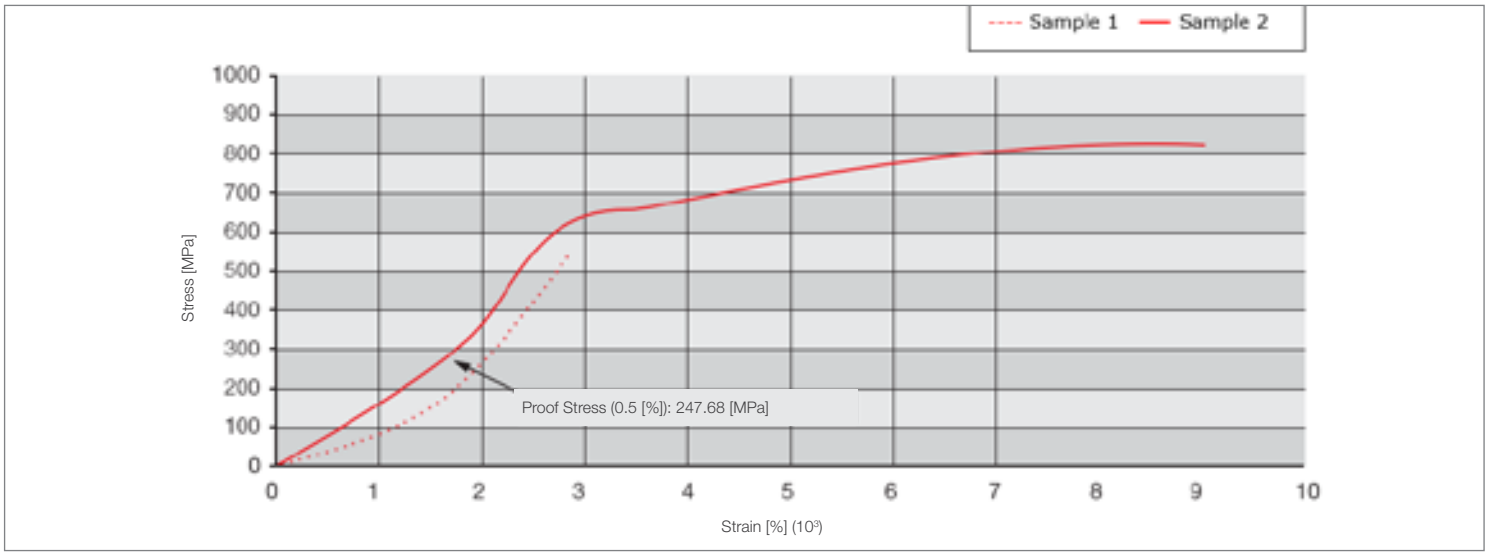
Flat Plates for General Use

Technical Data	
A x B [mm]	100 x 100
Thickness [mm]	4.5, 5.0
C [mm]	18.5 - 19



Extensive Testing of High Quality Washers

Typical Test Results for the Rib Washer



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30 North Reef Road
Germiston, 1429
South Africa

Phone +27 11 8786800
E-mail sales@rocbolt.com
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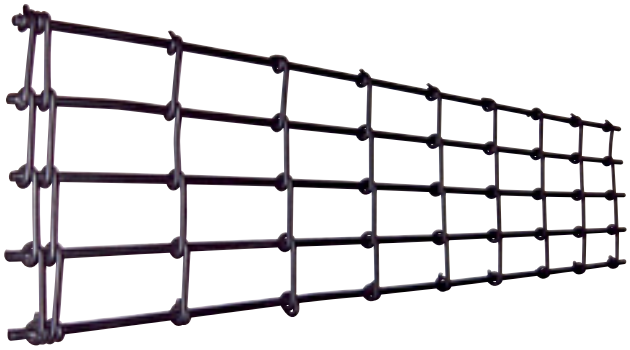
Straps

Osro Straps

Bar Type: Round Steel

Diameter [mm]	Length [m]	Width [m]
Horizontal bars 6 - 10	1 - 6	0.25 - 1
Strapping bars 5.5	1 - 6	0.25 - 1



W Straps

Steel [mm]	Length [m]	Width [mm]	Multi-Hole
1.6	1.2 - 4.0	250 - 500	500 [mm] apart

Couplers

For 20 [mm] and 25 [mm] Bar

Technical Data	20 [mm]	25 [mm]
Outer diameter [mm]	28	32
Length [mm]	61	70

Spherical Seats

Technical Data	Type
Outer diameter [mm]	50
Height [mm]	12.4

ROCBOLT Technologies (Pty) Ltd.
30 North Reef Road
Germiston, 1429
South Africa

Phone +27 11 8786800
E-mail sales@rocbolt.com
www.rocbolt.com

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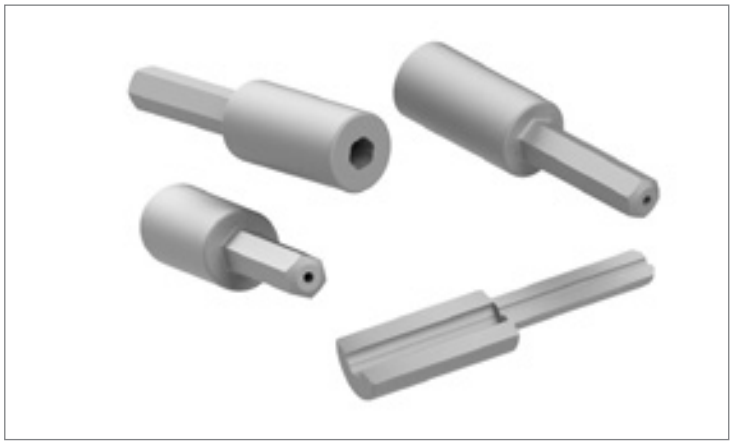
Accessories for Rock and Roof Bolts

Nuts

- 18 DIN 405 drive nut
- 20 DIN 405 drive nut
- 22 DIN 405 drive nut
- 25 DIN 405 drive nut
- Nuts can be delivered on request

Spanners

- SA-27F/22 [m] or 27M/22F
- SA-32F/22 [m] or 32M/22F
- SA-35F/22 [m] or 35M/22F
- Spanners can be delivered on request

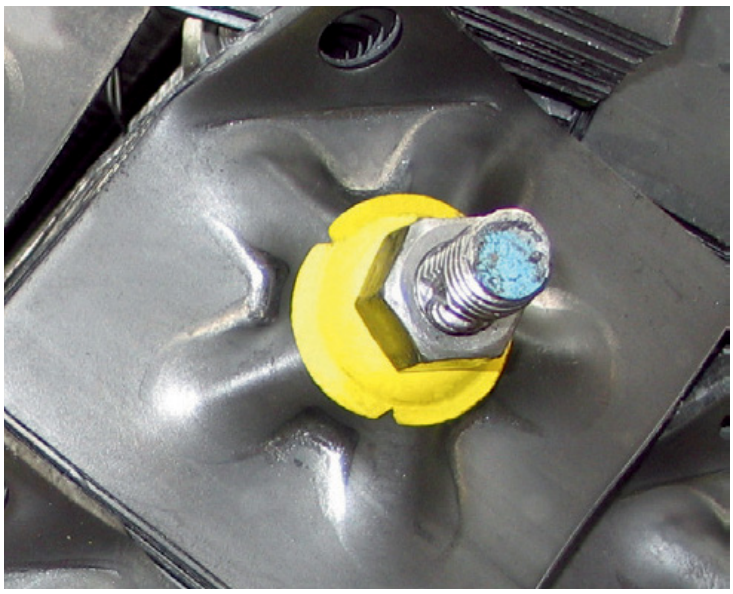


Torque Indicators

- Torque indicators can be used on 16, 18, 20 and 25 [mm] anchor bolts
- Torque indicators are installed between the nut and the washer. The collapsed torque indicator is an indication of a correctly installed anchor bolt

Standard Torque Indicator

Flower Torque Indicator



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Germiston, 1429
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E-mail sales@rocbolt.com
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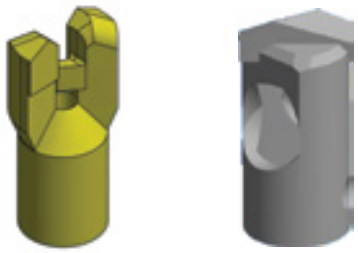
Drill Bits

Two types of drill bits are available, namely, wet drill bits and vacuum drill bits for dry drilling.

Sizes supplied:

- 25.60 [mm] – wet and vacuum bits
- 23.50 [mm] – wet bits only

A female thread, DIN 405x16 allows the drill bit to be coupled to the drill rod.



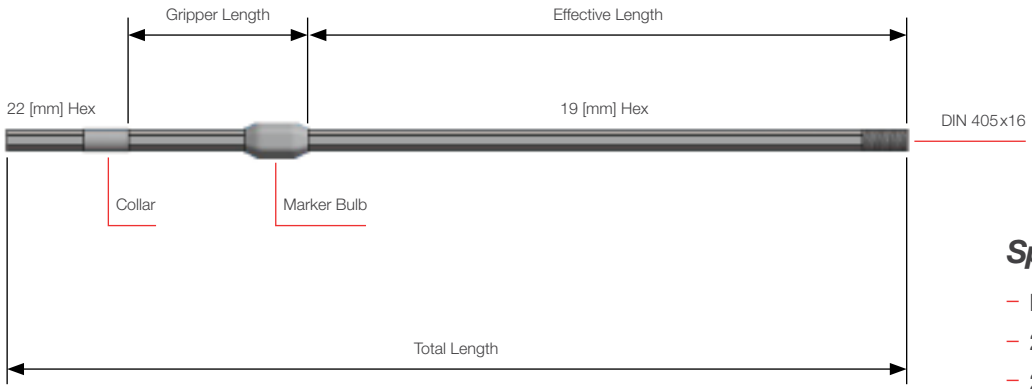
Drill Rods

Two types of drill rods are available, namely, 22 [mm] vacuum rods for dry drilling and 22/19 [mm] John-ex rods for wet drilling.

Sizes supplied:

- 25.60 [mm] – wet and vacuum bits
- 23.50 [mm] – wet bits only

A female thread, DIN 405x16 allows the drill bit to be coupled to the drill rod.



Specifications

- Length to customer specification
- 22 [mm] vacuum rods
- 22/19 [mm] John-ex
- DIN 405x16 John-ex
- The rods can be supplied with colour bulb indicators

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30 North Reef Road
Germiston, 1429
South Africa

Phone +27 11 8786800
E-mail sales@rocbolt.com
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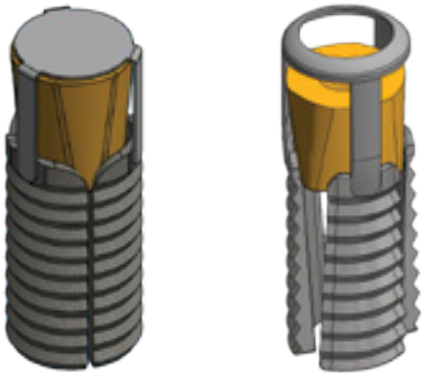
Mechanical Expansion Shells

The primary use of the expansion shells is to mechanically point anchor roof bolts and cable bolts. Expansion shells are excellent for immediate support where grout and resin installations are difficult. Post grouting after installation is possible.

The expansion shell has a leaf locking system to allow pre-tensioning on the chosen support. The expansion shell comes in various diameters. Spring loaded systems are also available.

Various internal thread sizes and types are available upon request.



Mechanical Anchor Cable Bolt

Mechanical Anchor Roof Bolt

Expansion Shell Type	Min. Hole Size	Max. Hole Size	Max. Thread Size
[–]	[mm]	[mm]	[mm]
ESB32	32.5	38	Rd 20
ESB35	35.5	41	Rd 22
ESB38	38.5	44	Rd 24
ESB43	43.5	49	Rd 26

Notes

- Minimum order quantities may apply to this product
- Only ROCBOLT™ Technologies South Africa components should be used to enable the full performance of the bolt system to be obtained

ROCBOLT Technologies (Pty) Ltd.
30 North Reef Road
Germiston, 1429
South Africa

Phone +27 11 8786800
E-mail sales@rocbolt.com
www.rocbolt.com

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Tunneling

Contents

Double Corrosion Protection (DCP) Bolts

Double Corrosion Protection (DCP) bolts provide support in the most aggressive geological environments. This anchor type rock bolt technology is ideal for complex engineering structures and unstable ground conditions where groundwater is predominant.

The tapered DCP bolt is enclosed by a polyethylene sheath that allows for easy installation, instant ground support and safe advancement by construction teams with a quick and stress-free patented grouting system.

Features

- DCP bolt is an expansion shell bolt with HDPE sheathing providing corrosion protection over the bolt length
- Pre-tensioned with expansion shell
- Provides immediate roof support
- Efficient anchorage with grout bell and spherical nut combination
- Grout adaptor provides efficient post grouting
- Durable HDPE sheathing allows for inner and outer annuluses to be grouted in single pass
- Grout bell available in black steel or HDG steel for ultimate corrosion protection
- Pull tested with standard equipment
- Available in 20, 25, and 32 [mm] diameter bars

Applications

- Systematic permanent reinforcement of underground excavations
- Ground support for areas with limited or no access during operational lifetime
- Mining: permanent roadways and excavations

DCP Rock Bolt Sample and Cutaway

ROCBOLT Technologies (Pty) Ltd.
30 North Reef Road
Germiston, 1429
South Africa

Phone +27 11 8786800
E-mail sales@rocbolt.com
www.rocbolt.com

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Double Corrosion Protection (DCP) Bolts

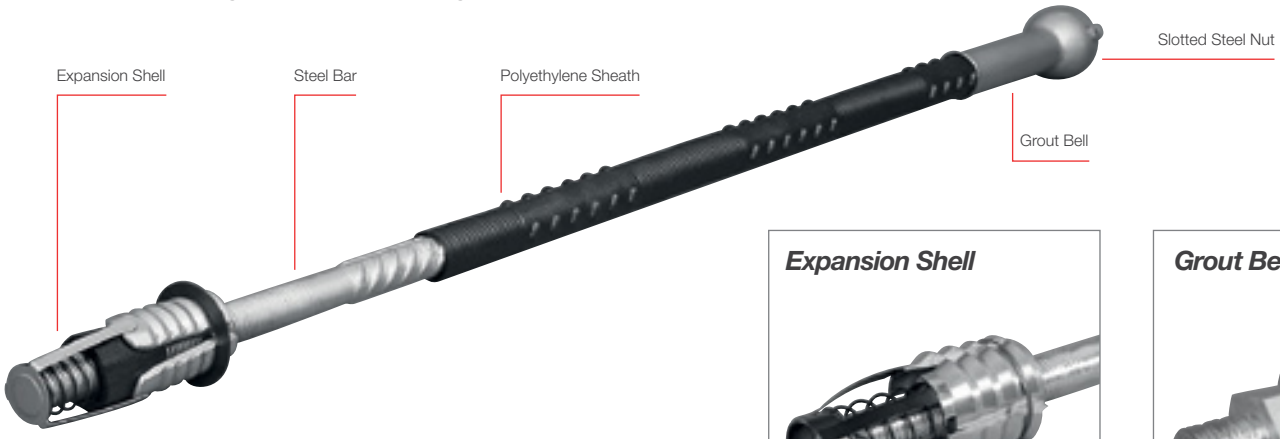
Technical Data			
Bolt Size [mm]	20	25	32
Tensile load [kN]	219	343	498.3
Yield strength [MPa]	500	500	450
Elongation [%]	22	22	14
Ultimate tensile strength [MPa]	700	700	620 (typical)
Calculated shear strength [kN] 1)	131.88	206	299
Hole size [mm]	48 - 55	48 - 55	64 - 72
Density [kg/m]	2.52	3.86	6.32
Cross sectional area of bar [mm]	314	490	804
Thread (left or right hand)	DIN 405	DIN 405/M27	M32

1) Calculated at 60 [%] of ultimate tensile load.

Notes

- Minimum order quantities may apply to this product
- Only ROCBOLT™ Technologies South Africa components should be used to enable the full performance of the bolt system to be obtained

DCP Rock Bolt Diagram – Sample Length of the DCP Rock Bolt



Expansion Shell

Grout Bell

ROCBOLT Technologies (Pty) Ltd.
30 North Reef Road
Germiston, 1429
South Africa

Phone +27 11 8786800
E-mail sales@rocbolt.com
www.rocbolt.com

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ROCBOLT Anchor Resin

ROCBOLT Anchor Resin is a pourable solution consisting of two components packaged in a plastic bucket. The first component, in a tin, containing resin and the second component, in a bag, being the filler/grout.

The filler is poured into the bucket provided and then the resin is decanted and mixed.

The resin mixture is fast setting, 15 [min] - 35 [min] at 25 [ºC].

Product Performance

- Set time (standard)
- Working time
- Packaged weight
- Typical volume (mixed)
- 15 [min] - 35 [min] at 25 [ºC]
- 8 [min]
- 10 [kg]
- 4.6 [l] (0.0046 [m^3])

Quality Control

The superior quality of ROCBOLT Anchor Resin is assured through a three-part quality control program.

- Ingredient testing
- In-process control tests
- Finished product acceptance tests

Storage

- For maximum shelf life, ROCBOLT Anchor Resin should be stored away from direct sunlight in a reasonably cool, well ventilated, dry area
- Storage life is four months at 20 [ºC]
- Under adverse storage conditions, above 25 [ºC], shelf life is reduced, conversely, while cold storage does not adversely affect the shelf life of ROCBOLT Anchor Resin, colder temperatures may cause slower setting times
- It is essential that stocks be rotated so that the oldest stock is first out due to the four month shelf life

Handling Precautions

Physical contact with resin contained in tins may cause mild irritation. Safety glasses or eye shield should always be used when installation is done. In case of contact with eyes, immediately flush with plenty of water for at least 15 minutes and consult a physician. Use of gloves is recommended.

In case of skin contact, flush skin with water. Prolonged contact with skin will cause skin irritation. Irritation should subside when material is removed from skin.

Buckets are filled with inert fillers and resin (active ingredients include low levels of styrene and benzoyl peroxide).

ROCBOLT Technologies (Pty) Ltd.
30 North Reef Road
Germiston, 1429
South Africa

Phone +27 11 8786800
E-mail sales@rocbolt.com
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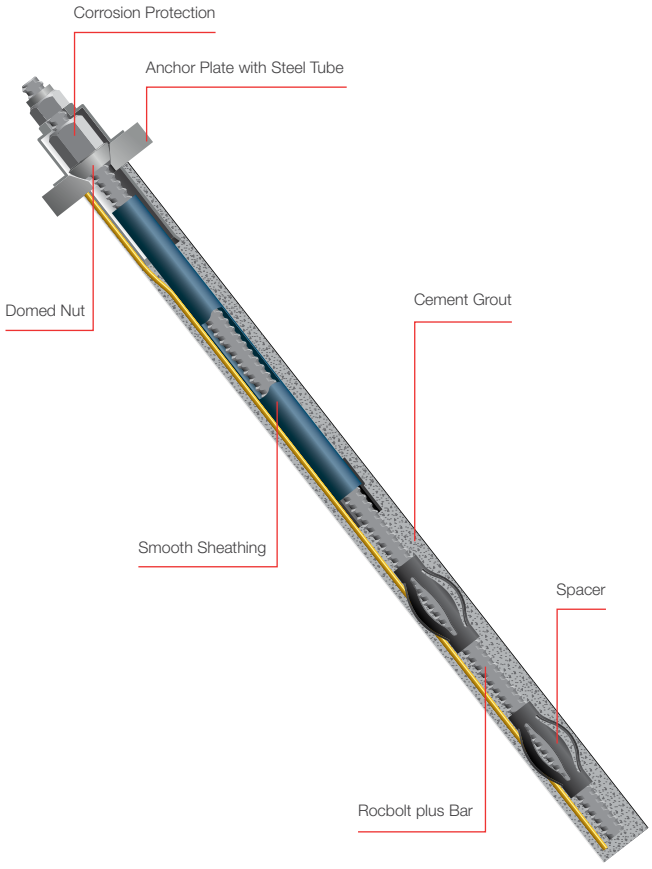
ROCBOLT Ground Anchors

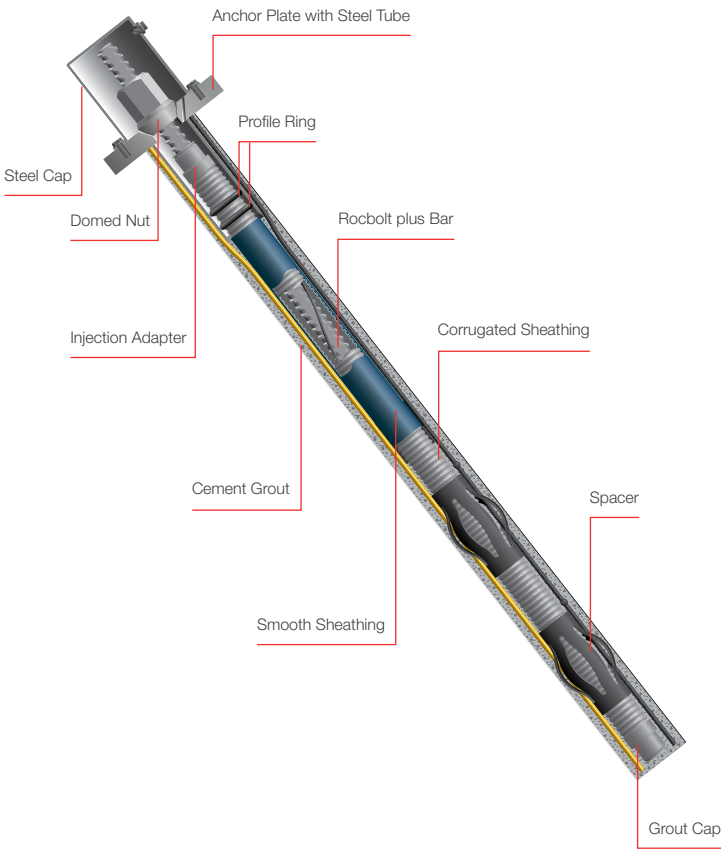
Advantages and Characteristics

- Easy system handling
- Simple restressing and destressing through anchorage with nut
- Permanent corrosion protection possible
- Easy removal of temporary anchors through threaded sleeves
- Flexibility in transport lengths by using couplers
- High bond strength between ROCBOLT Ground Anchor and cement grout
- Angle compensation using wedge washers
- Quality assurance through internal and external supervision of production

Temporary ROCBOLT Ground Anchor



Permanent ROCBOLT Ground Anchor



ROCBOLT Technologies (Pty) Ltd.
30 North Reef Road
Germiston, 1429
South Africa

Phone +27 11 8786800
E-mail sales@rocbolt.com
www.rocbolt.com

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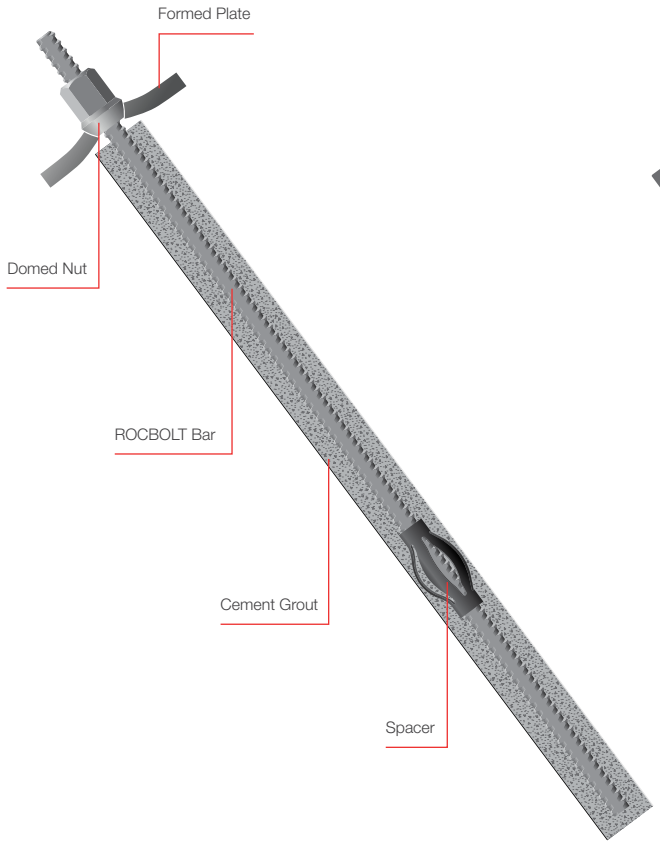
ROCBOLT Soil Nails

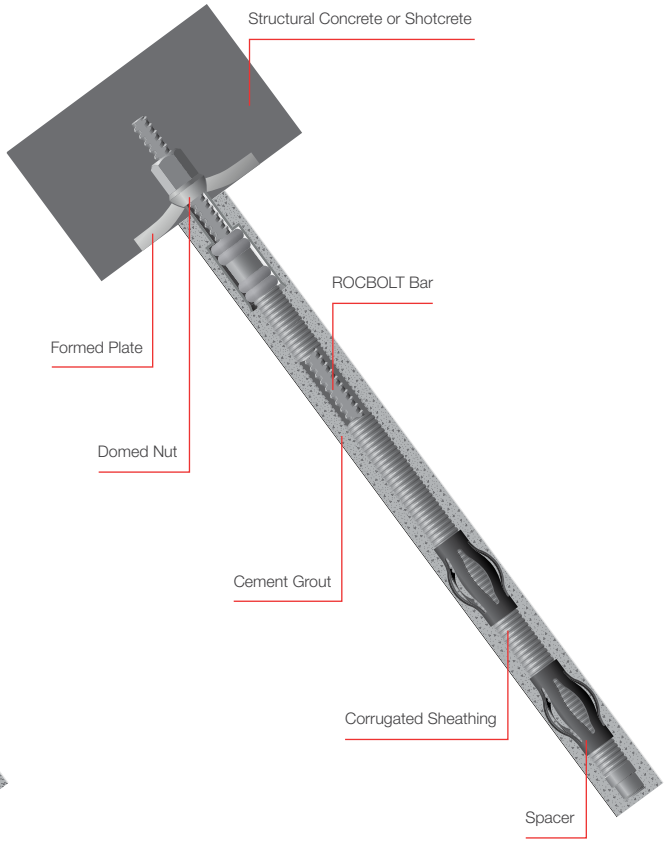
Advantages and Characteristics

- High durability through double corrosion protection possible
- Low susceptibility to corrosion
- Angle compensation up to 20 [°C] through formed plate
- Flexibility in length by using couplers
- Extension bars may be attached by using couplers
- Spacers ensure proper grout cover
- High standard of quality control from production stage to installation of the soil nails ensures consistent quality

ROCBOLT Soil Nail



ROCBOLT Soil Nail – Double Corrosion Protection



ROCBOLT Technologies (Pty) Ltd.
30 North Reef Road
Germiston, 1429
South Africa

Phone +27 11 8786800
E-mail sales@rocbolt.com
www.rocbolt.com

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ROCBOLT Threadbar Piles

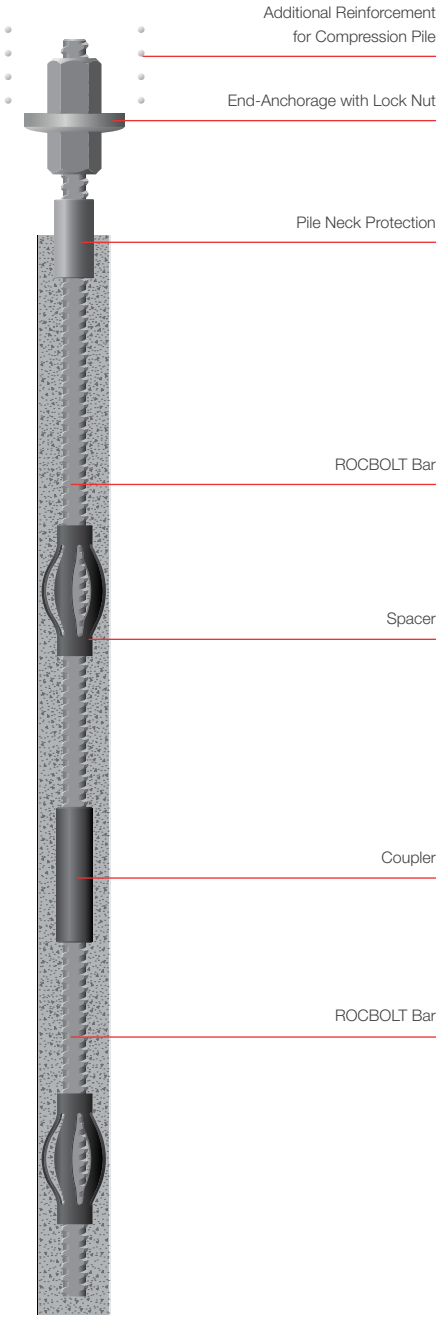
Advantages and Characteristics

The ROCBOLT threadbar pile is a drilled micropile with a central steel element based on the ROCBOLT anchor with hot-rolled, continuous thread deformations on both sides.

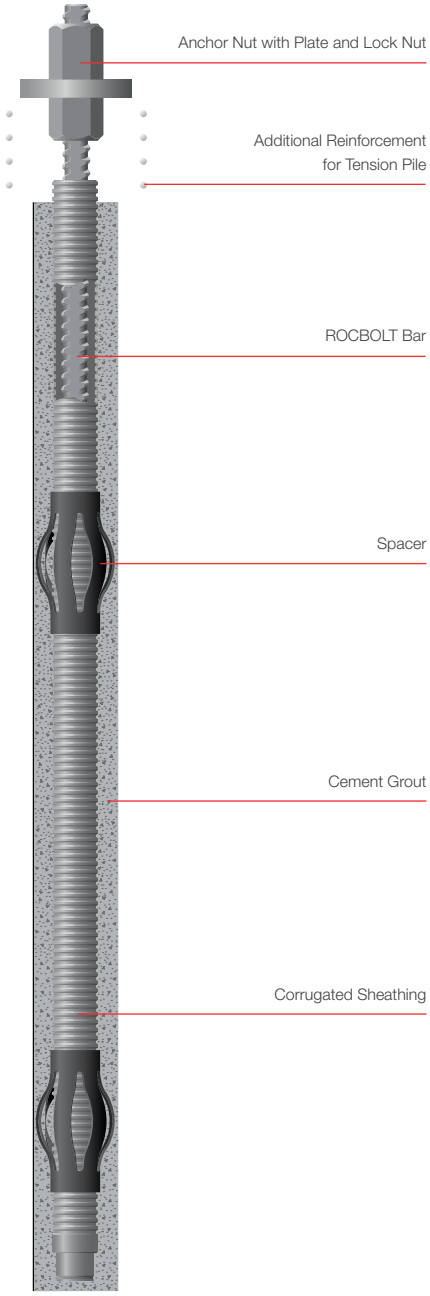
The ROCBOLT anchor is encapsulated in cement grout which acts both as corrosion protection and as load transfer into the soil or rock.

- Excellent load transfer into concrete structures by means of anchoring elements
- Tensile, compressive and alternating loads can be efficiently transferred to the structure
- The coarse ROCBOLT thread guarantees maximum bond between steel and cement grout
- The stress-strain curve of the ROCBOLT bar shows high ductility
- Settlement can be prevented by using preloaded ROCBOLT threadbar piles
- Load transfer into soil is optimised by post-grouting
- Double corrosion protected piles can be used for high corrosion impact as in aggressive media such as seawater or contaminated ground
- Can be cut off or coupled at any given point
- A small drill hole diameter permits economic drilling equipment
- Robust, coarse thread remains threadable even when dirty or damaged

ROCBOLT Threadbar Pile



ROCBOLT Threadbar Pile – Double Corrosion Protection



ROCBOLT Technologies (Pty) Ltd.
30 North Reef Road
Germiston, 1429
South Africa

Phone +27 11 8786800
E-mail sales@rocbolt.com
www.rocbolt.com

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ROCBOLT TECHNOLOGIES

ROCBOLT Threadbar System

ROCBOLT Anchor System Applications

- Tie rods
- Marine ties
- Mining roof support
- Heavy lifting
- Reinforcing
- Tunnelling
- Formwork and scaffolding anchors
- High strength reinforcing

500B Threadbar

Technical Data								
Nominal Diameter [mm]	16	20	25	28	32	40	50	64
Min. yield strength [MPa]	500	500	500	500	500	500	500	555
Min. tensile strength [MPa]	550	550	550	550	550	550	550	700
Min. yield load [kN]	101	157	245	308	402	628	982	1,758
Min. ultimate load [kN]	111	173	270	339	442	691	1,080	2,217
Cross sectional area [mm^2]	201	314	491	616	804	1,257	1,963	3,167
Weight [kg/m]	1.58	2.47	3.85	4.83	6.31	9.86	15.41	24.86

670 Threadbar

Technical Data										
Nominal Diameter [mm]	18	22	25	28	30	35	43	57.5	63.5	75
Min. yield strength [MPa]	670	670	670	670	670	670	670	670	670	670
Min. tensile strength [MPa]	800	800	800	800	800	800	800	800	800	800
Min. yield load [kN]	170	250	330	410	475	640	980	1,740	2,120	2,960
Min. ultimate load [kN]	200	300	390	490	565	770	1,170	2,080	2,540	3,535
Cross sectional area [mm^2]	250	375	491	616	707	962	1,466	2,597	3,167	4,418
Weight [kg/m]	1.96	2.94	3.85	4.83	5.55	7.55	11.51	20.38	24.86	34.68

ROCBOLT Technologies (Pty) Ltd.
30 North Reef Road
Germiston, 1429
South Africa

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E-mail sales@rocbolt.com
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950 Threadbar

Technical Data						
Nominal Diameter [mm]	18	26.5	32	36	40	47
Min. yield strength [MPa]	950	950	950	950	950	950
Min. tensile strength [MPa]	1,050	1,050	1,050	1,050	1,050	1,050
Min. yield load [kN]	230	525	760	960	1,190	1,650
Min. ultimate load [kN]	255	580	845	1,070	1,320	1,820
Cross sectional area [mm^2]	241	551	804	1,020	1,257	1,735
Weight [kg/m]	1.96	4.48	6.53	8.27	10.21	14.10

Notes

- Minimum order quantities may apply to this product
- Extended lead times may apply to certain items. Please enquire
- Only ROCBOLT™ Technologies South Africa components should be used to enable the full performance of the bolt system to be obtained

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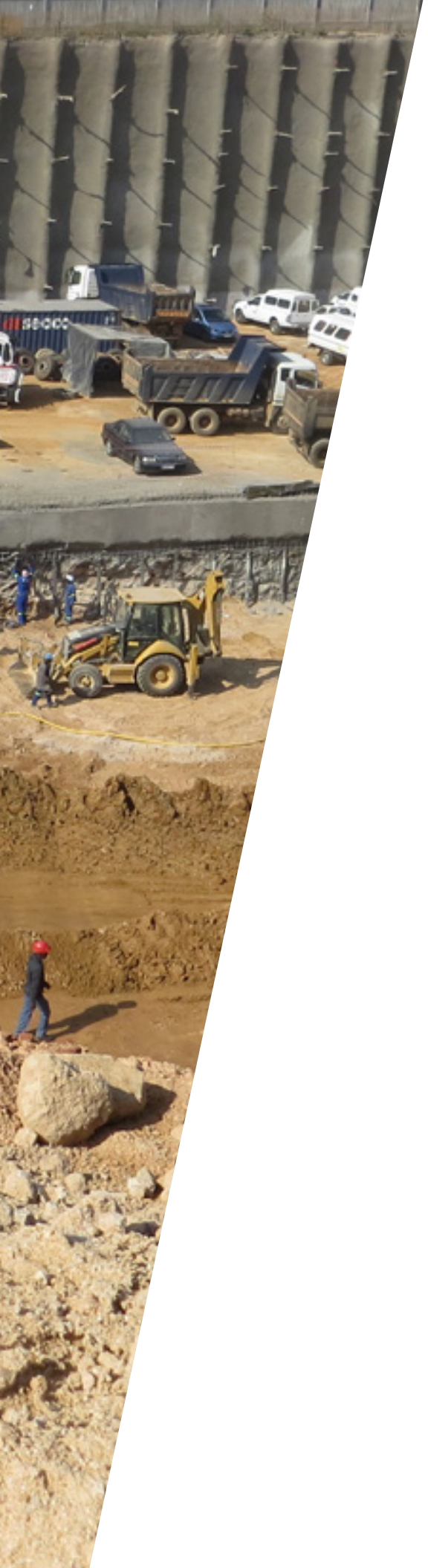
Geotechnical



Contents

Double Corrosion Protection (DCP) Bolts

Double Corrosion Protection (DCP) bolts provide support in the most aggressive geological environments. This anchor type rock bolt technology is ideal for complex engineering structures and unstable ground conditions where groundwater is predominant.

The tapered DCP bolt is enclosed by a polyethylene sheath that allows for easy installation, instant ground support and safe advancement by construction teams with a quick and stress-free patented grouting system.

Features

- DCP bolt is an expansion shell bolt with HDPE sheathing providing corrosion protection over the bolt length
- Pre-tensioned with expansion shell
- Provides immediate roof support
- Efficient anchorage with grout bell and spherical nut combination
- Grout adaptor provides efficient post grouting
- Durable HDPE sheathing allows for inner and outer annuluses to be grouted in single pass
- Grout bell available in black steel or HDG steel for ultimate corrosion protection
- Pull tested with standard equipment
- Available in 20, 25, and 32 [mm] diameter bars

Applications

- Systematic permanent reinforcement of underground excavations
- Ground support for areas with limited or no access during operational lifetime
- Mining: permanent roadways and excavations

DCP Rock Bolt Sample and Cutaway

ROCBOLT Technologies (Pty) Ltd.
30 North Reef Road
Germiston, 1429
South Africa

Phone +27 11 8786800
E-mail sales@rocbolt.com
www.rocbolt.com

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Double Corrosion Protection (DCP) Bolts

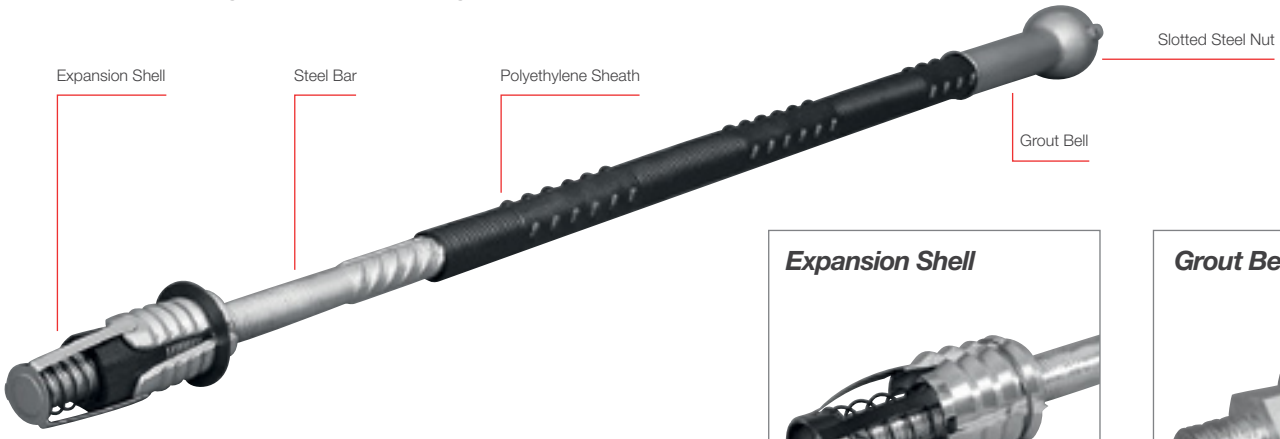
Technical Data			
Bolt Size [mm]	20	25	32
Tensile load [kN]	219	343	498.3
Yield strength [MPa]	500	500	450
Elongation [%]	22	22	14
Ultimate tensile strength [MPa]	700	700	620 (typical)
Calculated shear strength [kN] 1)	131.88	206	299
Hole size [mm]	48 - 55	48 - 55	64 - 72
Density [kg/m]	2.52	3.86	6.32
Cross sectional area of bar [mm]	314	490	804
Thread (left or right hand)	DIN 405	DIN 405/M27	M32

1) Calculated at 60 [%] of ultimate tensile load.

Notes

- Minimum order quantities may apply to this product
- Only ROCBOLT™ Technologies South Africa components should be used to enable the full performance of the bolt system to be obtained

DCP Rock Bolt Diagram – Sample Length of the DCP Rock Bolt



Expansion Shell

Grout Bell

ROCBOLT Technologies (Pty) Ltd.
30 North Reef Road
Germiston, 1429
South Africa

Phone +27 11 8786800
E-mail sales@rocbolt.com
www.rocbolt.com

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ROCBOLT™ TECHNOLOGIES

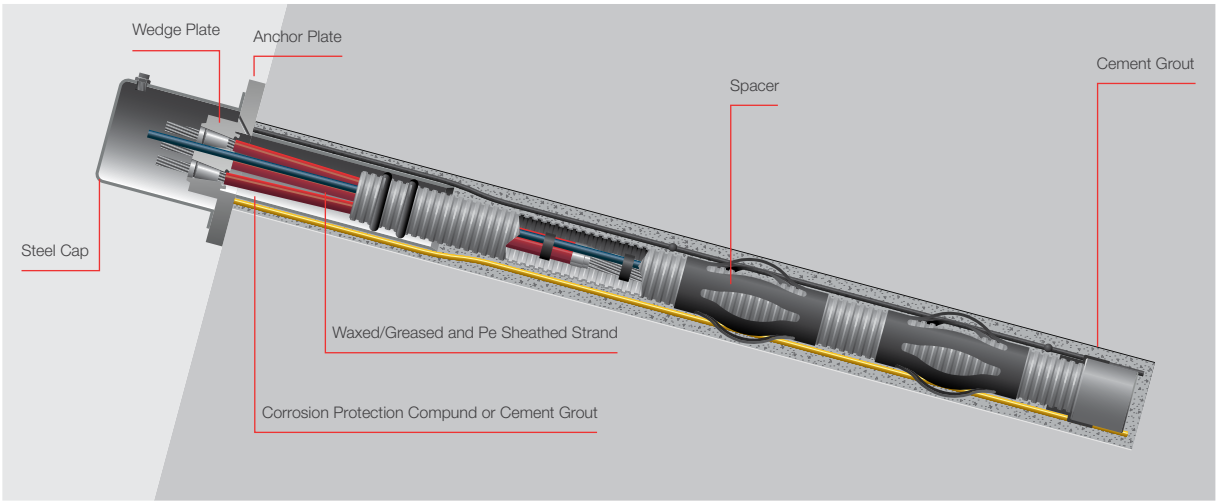
Multi-Strand Anchor Systems

Multi-strand anchors are an actively tensioned ground anchor system. Tensioning minimizes or eliminates anticipated deformations of the system and deformations at the civil engineering measure. This applies both to temporary structures (e.g. pit support systems) and permanent tie backs.

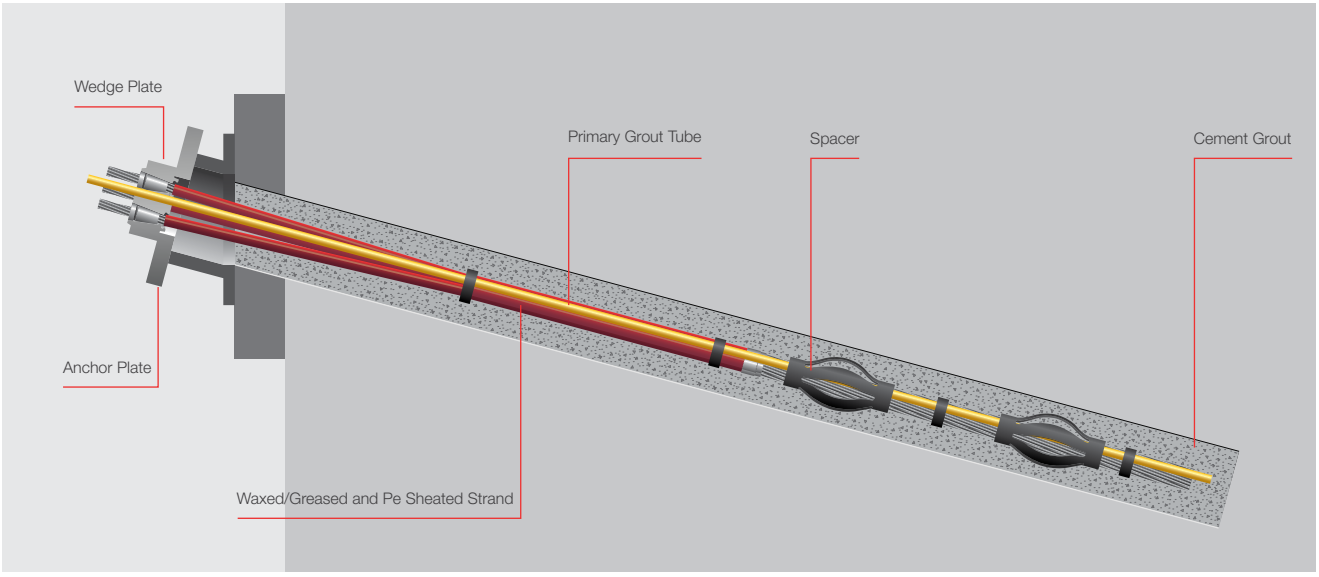
The strand anchors are produced with double corrosion protection (DCP), each individual strand is covered by corrosion protection compound and inserted into an individual duct in the factory. As long as the grout used for anchoring is load-bearing, the anchor force is unlimited because the number of strands that can be combined in the anchorage is variable at will.

Permanent (DCP) Anchor

acc. to DIN 4125



Temporary Anchor



ROCBOLT Technologies (Pty) Ltd.
30 North Reef Road
Germiston, 1429
South Africa

Phone +27 11 8786800
E-mail sales@rocbolt.com
www.rocbolt.com

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Multi-Strand Anchor Systems

By definition, an anchor consists of the following three main components:

- Bonded length:
  anchor is fixed in the borehole using grout (cement grout) and can transfer the forces to the loadbearing soil via bond and skin friction
- Unbonded length:
  each strand is uncoupled from the borehole using individual sleeves so that it can freely extend in the unbonded length. This way, tension can be applied to the anchor system
- Anchor head:
  anchor head transfers the anchor force to the substructure and thus to the structure that needs to be anchored

If required, anchors can be supplied retensionable.

No.	Cross Sectional Area	Weight	Y1860 High Grade	
			Yield Load	Ultimate Load
[–]	[mm²]	[kg/m]	[kN]	[kN]
1	140	1.09	230	260
2	280	2.19	459	521
3	420	3.28	689	781
4	560	4.37	918	1,042
5	700	5.47	1,148	1,302
6	840	6.56	1,378	1,562
7	980	7.65	1,607	1,823
8	1,120	8.74	1,837	2,083
9	1,260	9.84	2,066	2,344
10	1,400	10.93	2,296	2,604
11	1,540	12.02	2,526	2,864
12	1,680	13.12	2,755	3,125
13	1,820	14.21	2,985	3,385
14	1,960	15.30	3,214	3,646
15	2,100	16.40	3,444	3,906
16	2,240	17.49	3,674	4,166
17	2,380	18.58	3,903	4,427
18	2,520	19.67	4,133	4,687
19	2,660	20.77	4,362	4,948
20	2,800	21.86	4,592	5,208
21	2,940	22.95	4,822	5,468
22	3,080	24.05	5,051	5,729

Applications

- Excavations (deformation resistant)
- Tiebacks
- Uplift control
- Positional stability
- Rock stabilization

Features

- Large degree of flexibility: force, length, transport, installation
- Practically no restrictions in terms of length: 150 [m]
- Small pack size for transportation
- Minimal space required during installation
- Retensionable due to exterior thread at wedge plates
- Permanent strand anchor can be supplied in many variations (standard, EI-Iso, TWIN-Corr)

ROCBOLT Technologies (Pty) Ltd.
30 North Reef Road
Germiston, 1429
South Africa

Phone +27 11 8786800
E-mail sales@rocbolt.com
www.rocbolt.com

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ROCBOLT Self-Drilling Hollow Bar Anchor System

Features

- Fast drilling and placing due to drilling, anchor installation and grouting in a single operation
- Neither separate anchor installation nor removal of casing and drill rods
- Similar installation methods for all ground conditions
- Choice of drill bits for different ground conditions
- Hollow core not only serves for flushing with air or water during drilling, but also for grouting the anchor tendon
- Flexibility in length by using couplers
- Ability to work with small drill rigs without casing in restricted headroom conditions
- Accommodation of needs for enhanced protection against corrosion upon request
- High standard of quality control from production stage to the installation of the ROCBOLT self-drilling hollow bar anchor ensures consistent quality
- Advantageous in all applications where normally cased drilling is required
- Allows for anchoring in both cohesive and non-cohesive ground, even under limited space conditions

Drill Rope Thread RH

Drill "T" Thread RH

ROCBOLT Self-Drilling Hollow Bar Anchor System

Technical Data								
Outer diameter [mm]	R25N	R32S	R38N	R51N	T40	T40	T52	T76S
Inner diameter [mm]	12	17	22	33	16	20	26	45
Cross sectional area [mm²]	292	440	611	968	910	713	1,250	2,400
Yield load [kN] 1)	150	280	400	630	525	430	730	1,500
Ultimate load [kN] 1)	200	360	500	800	660	540	929	1,900
Weight [kg/m]	2.3	3.45	5.5	7.8	7.15	5.8	9.9	19

1) Ultimate and yield load capacity are measured values.

ROCBOLT Technologies (Pty) Ltd.
30 North Reef Road
Germiston, 1429
South Africa

Phone +27 11 8786800
E-mail sales@rocbolt.com
www.rocbolt.com

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ROCBOLT Self-Drilling Hollow Bar Anchor System

Anchor Coupler

Technical Data		
[–]	Length [mm]	Outside Diameter [mm]
R25N/12	150	36
R32S/17	190	42
R38N/22	220	52
R51N/33	200	63
T40/16	140	57
T52/26	160	70
T76S/45	220	95

Anchor Nut

Technical Data		
[–]	Length [mm]	Across Flat [mm]
R25N/12	41	41
R32S/17	65	46
R38N/22	60	50
R51N/33	70	75
T40/16	50	65
T52/26	70	80
T76S/45	80	100

Anchor Plate

Technical Data			
[–]	Size [mm]	Hole Diameter [mm]	Thickness [mm]
R25N/12	150x150	30	8
R32S/17	200x200	35	12
R38N/22	200x200	41	12
R51N/33	250x250	60	30
T40/16	200x200	54	16
T52/26	220x220	65	35
T76S/45	250x250	80	60

Anchor Centralizer

Technical Data		
[–]	OD [mm]	Length [mm]
R32S/17	72	30
R38N/22	72	41
R51N/33	92	54
T40/16	88	43
T52/26	112	55

Notes

- Minimum order quantities may apply to this product
- Only ROCBOLT™ Technologies South Africa components should be used to enable the full performance of the bolt system to be obtained

ROCBOLT Technologies (Pty) Ltd.
30 North Reef Road
Germiston, 1429
South Africa

Phone +27 11 8786800
E-mail sales@rocbolt.com
www.rocbolt.com

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ROCBOLT Anchor Resin

ROCBOLT Anchor Resin is a pourable solution consisting of two components packaged in a plastic bucket. The first component, in a tin, containing resin and the second component, in a bag, being the filler/grout.

The filler is poured into the bucket provided and then the resin is decanted and mixed.

The resin mixture is fast setting,
15 [min] - 35 [min] at 25 [ºC].

Product Performance

- Set time (standard) 15 [min] - 35 [min] at 25 [ºC]
- Working time 8 [min]
- Packaged weight 10 [kg]
- Typical volume (mixed) 4.6 [l] (0.0046 [m^3])

Quality Control

The superior quality of ROCBOLT Anchor Resin is assured through a three-part quality control program.

- Ingredient testing
- In-process control tests
- Finished product acceptance tests

Storage

- For maximum shelf life, ROCBOLT Anchor Resin should be stored away from direct sunlight in a reasonably cool, well ventilated, dry area
- Storage life is four months at 20 [ºC]
- Under adverse storage conditions, above 25 [ºC], shelf life is reduced, conversely, while cold storage does not adversely affect the shelf life of ROCBOLT Anchor Resin, colder temperatures may cause slower setting times
- It is essential that stocks be rotated so that the oldest stock is first out due to the four month shelf life

Handling Precautions

Physical contact with resin contained in tins may cause mild irritation. Safety glasses or eye shield should always be used when installation is done. In case of contact with eyes, immediately flush with plenty of water for at least 15 minutes and consult a physician. Use of gloves is recommended.

In case of skin contact, flush skin with water. Prolonged contact with skin will cause skin irritation. Irritation should subside when material is removed from skin.

Buckets are filled with inert fillers and resin (active ingredients include low levels of styrene and benzoyl peroxide).

ROCBOLT Technologies (Pty) Ltd.
30 North Reef Road
Germiston, 1429
South Africa

Phone +27 11 8786800
E-mail sales@rocbolt.com
www.rocbolt.com

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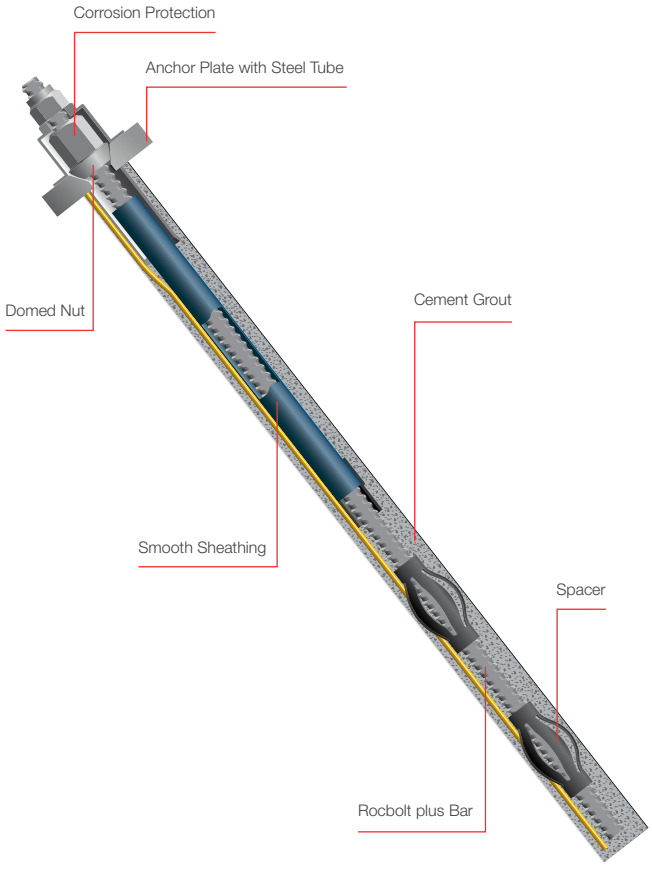
ROCBOLT Ground Anchors

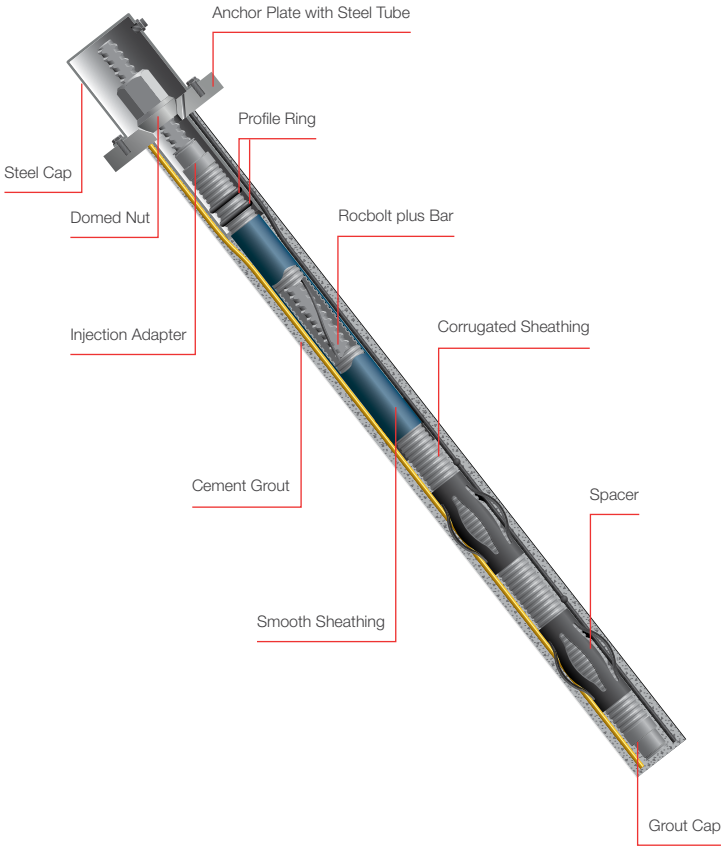
Advantages and Characteristics

- Easy system handling
- Simple restressing and destressing through anchorage with nut
- Permanent corrosion protection possible
- Easy removal of temporary anchors through threaded sleeves
- Flexibility in transport lengths by using couplers
- High bond strength between ROCBOLT Ground Anchor and cement grout
- Angle compensation using wedge washers
- Quality assurance through internal and external supervision of production

Permanent ROCBOLT Ground Anchor



Temporary ROCBOLT Ground Anchor



ROCBOLT Technologies (Pty) Ltd.
30 North Reef Road
Germiston, 1429
South Africa

Phone +27 11 8786800
E-mail sales@rocbolt.com
www.rocbolt.com

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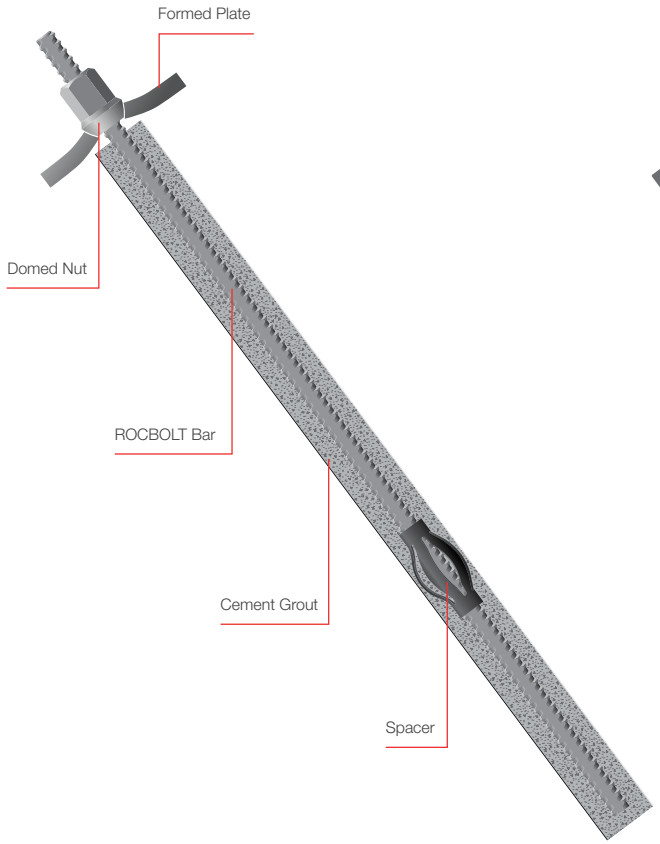
All dimensions, weights, quantities and specifications are those applicable at the time of this publication and may be amended from time to time. Please contact your local DSI Underground service representative for final confirmation of any key specifications.

ROCBOLT Soil Nails

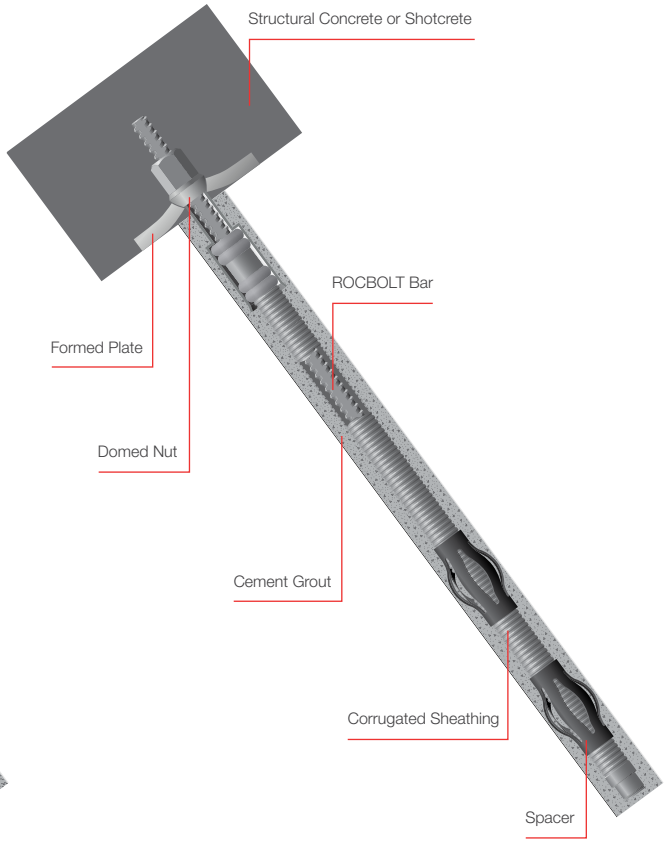
Advantages and Characteristics

- High durability through double corrosion protection possible
- Low susceptibility to corrosion
- Angle compensation up to 20 [°C] through formed plate
- Flexibility in length by using couplers
- Extension bars may be attached by using couplers
- Spacers ensure proper grout cover
- High standard of quality control from production stage to installation of the soil nails ensures consistent quality

ROCBOLT Soil Nail



ROCBOLT Soil Nail – Double Corrosion Protection



ROCBOLT Technologies (Pty) Ltd.
30 North Reef Road
Germiston, 1429
South Africa

Phone +27 11 8786800
E-mail sales@rocbolt.com
www.rocbolt.com

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ROCBOLT Threadbar Piles

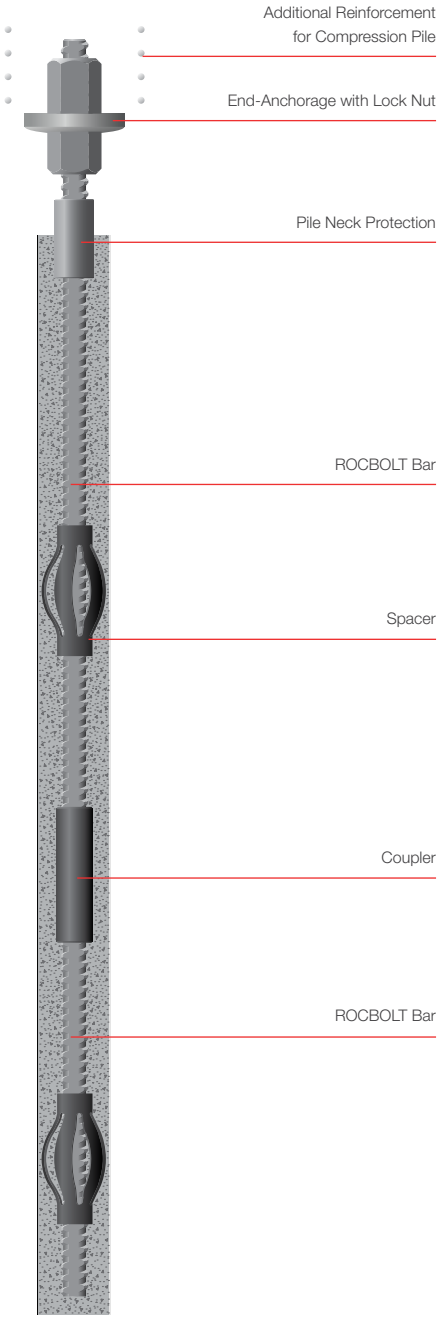
Advantages and Characteristics

The ROCBOLT threadbar pile is a drilled micropile with a central steel element based on the ROCBOLT anchor with hot-rolled, continuous thread deformations on both sides.

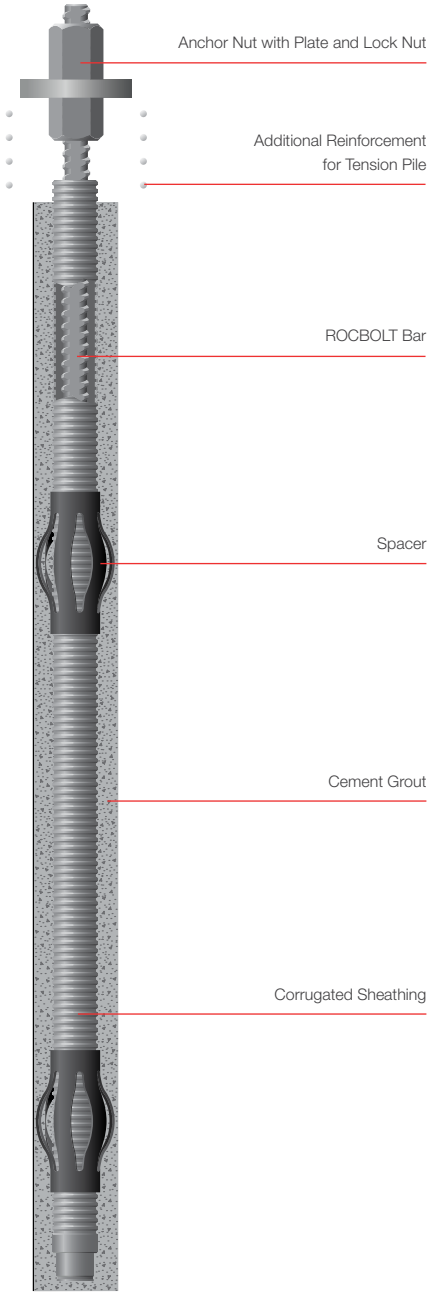
The ROCBOLT anchor is encapsulated in cement grout which acts both as corrosion protection and as load transfer into the soil or rock.

- Excellent load transfer into concrete structures by means of anchoring elements
- Tensile, compressive and alternating loads can be efficiently transferred to the structure
- The coarse ROCBOLT thread guarantees maximum bond between steel and cement grout
- The stress-strain curve of the ROCBOLT bar shows high ductility
- Settlement can be prevented by using preloaded ROCBOLT threadbar piles
- Load transfer into soil is optimised by post-grouting
- Double corrosion protected piles can be used for high corrosion impact as in aggressive media such as seawater or contaminated ground
- Can be cut off or coupled at any given point
- A small drill hole diameter permits economic drilling equipment
- Robust, coarse thread remains threadable even when dirty or damaged

ROCBOLT Threadbar Pile



ROCBOLT Threadbar Pile – Double Corrosion Protection



ROCBOLT Technologies (Pty) Ltd.
30 North Reef Road
Germiston, 1429
South Africa

Phone +27 11 8786800
E-mail sales@rocbolt.com
www.rocbolt.com

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ROCBOLT™ TECHNOLOGIES

ROCBOLT Threadbar System

ROCBOLT Anchor System Applications

- Tie rods
- Marine ties
- Mining roof support
- Heavy lifting
- Reinforcing
- Tunnelling
- Formwork and scaffolding anchors
- High strength reinforcing

500B Threadbar

Technical Data								
Nominal Diameter [mm]	16	20	25	28	32	40	50	64
Min. yield strength [MPa]	500	500	500	500	500	500	500	555
Min. tensile strength [MPa]	550	550	550	550	550	550	550	700
Min. yield load [kN]	101	157	245	308	402	628	982	1,758
Min. ultimate load [kN]	111	173	270	339	442	691	1,080	2,217
Cross sectional area [mm^2]	201	314	491	616	804	1,257	1,963	3,167
Weight [kg/m]	1.58	2.47	3.85	4.83	6.31	9.86	15.41	24.86

670 Threadbar

Technical Data										
Nominal Diameter [mm]	18	22	25	28	30	35	43	57.5	63.5	75
Min. yield strength [MPa]	670	670	670	670	670	670	670	670	670	670
Min. tensile strength [MPa]	800	800	800	800	800	800	800	800	800	800
Min. yield load [kN]	170	250	330	410	475	640	980	1,740	2,120	2,960
Min. ultimate load [kN]	200	300	390	490	565	770	1,170	2,080	2,540	3,535
Cross sectional area [mm^2]	250	375	491	616	707	962	1,466	2,597	3,167	4,418
Weight [kg/m]	1.96	2.94	3.85	4.83	5.55	7.55	11.51	20.38	24.86	34.68

ROCBOLT Technologies (Pty) Ltd.
30 North Reef Road
Germiston, 1429
South Africa

Phone +27 11 8786800
E-mail sales@rocbolt.com
www.rocbolt.com

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950 Threadbar

Technical Data						
Nominal Diameter [mm]	18	26.5	32	36	40	47
Min. yield strength [MPa]	950	950	950	950	950	950
Min. tensile strength [MPa]	1,050	1,050	1,050	1,050	1,050	1,050
Min. yield load [kN]	230	525	760	960	1,190	1,650
Min. ultimate load [kN]	255	580	845	1,070	1,320	1,820
Cross sectional area [mm^2]	241	551	804	1,020	1,257	1,735
Weight [kg/m]	1.96	4.48	6.53	8.27	10.21	14.10

Notes

- Minimum order quantities may apply to this product
- Extended lead times may apply to certain items. Please enquire
- Only ROCBOLT™ Technologies South Africa components should be used to enable the full performance of the bolt system to be obtained

ROCBOLT Technologies (Pty) Ltd.
30 North Reef Road
Germiston, 1429
South Africa

Phone +27 11 8786800
E-mail sales@rocbolt.com
www.rocbolt.com

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Material Safety Data Sheets

Contents

Section 1: Identification of the Substance/Mixture and of the Company

1.1 Product Identifier

- Substance name: Mineral Bond LV, component A
- Index number: not applicable (mixture)
- Synonyms: not applicable
- CAS number: not applicable (mixture)
- EC number: not applicable (mixture)
- Registration number: excluded from registration (polymer)

1.2 Relevant Identified Uses of the Substance or Mixture and Uses Advised Against

Relevant Identified Uses

Component A of 2-component, high strength silicate resin.
It is suitable for grout stabilization, for heavily cracked rock mass, gas sealing and water stopping.

Uses Advised Against

Any other uses than those listed should be consulted with the supplier.

1.3 Details of the Supplier of the Safety Data Sheet

- Company: ROCBOLT Technologies (Pty) Ltd
- Address: 30 North Reef Rd., Germiston,1429
- Telephone: +27 (0)11 9701643
- Fax: +27 (0)11 9703596
- Website: www.rocbolt.com

1.4 Emergency Telephone Numbers

- Telephone: +27 (0)11 9701643
- Fax: +27 (0)11 9703596

Section 2: Hazards Identification

2.1 Classification of the Substance or Mixture

Classification according to Regulation (EC) No 1272/2008 (CLP)

- Skin irritation: category 2; H315
- Eye irritation: category 2; H319

Additional information: for full text of hazard- and EU hazard-statements: see section 16

2.2 Label Elements

Labelling according to Regulation (EC) No 1272/2008 (CLP)

- Signal word: WARNING
- Hazard pictograms

Hazard Statements

- H315: Causes skin irritation
- H319: Causes serious eye irritation

Prevention Statements

- P262: Do not get in eyes, on skin, or on clothing.
- P280: Wear protective gloves/protective clothing/eye protection/face protection.

Response Statements

- P303 + P361 + P353: IF ON SKIN (or hair): remove/take off immediately all contaminated clothing. Rinse skin with water/shower.
- P305 + P351 + P338: IF IN EYES: rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.

ROCBOLT Technologies (Pty) Ltd.
30 North Reef Road
Germiston, 1429
South Africa

Phone +27 11 8786800
E-mail sales@rocbolt.com
www.rocbolt.com

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Section 3: Composition/Information on Ingredients

3.1 Substances

Not applicable

3.2 Mixtures

Registration Number	Weight [%]	CAS No	EC No	Classification According to Regulation (EC) No 1278/2008 (CLP)
Silicic acid, sodium salt 01-2119448725-31-XXXX	80 - 100	1344-09-8	215-687-4	Skin irritation 2; H315 Eye irritation 2; H319

Additional information: for full text of H-statements: see section 16

Section 4: First Aid Measures

4.1 Description of First Aid Measures

- General information: in the event of accident or ailments appearing caused by the product it is necessary to protect the injured against continued exposure and immediately provide medical attention to him
- Poisoning by inhalation: move to fresh air
- Skin contamination: rinse with running water and soap. Apply replenishing cream. Change all contaminated clothing
- Eye contamination: rinse immediately with plenty of running water (for 15 minutes), seek medical attention from a specialist
- Poisoning by swallowing: rinse the mouth. Drink 1 - 2 glasses of water

4.2 Most Important Symptoms and Effects, Both Acute and Delayed

Alkaline solution. Impact on the unprotected eyes can damage the eyes. Prolonged or repeated impact on the risk of unprotected skin may cause skin irritation.

4.3 Indication of any Immediate Medical Attention and Special Treatment Needed

Each time, if you use a doctor recommended to provide the assisting these SDS.

Section 5: Firefighting Measures

5.1 Extinguishing Media

- Suitable extinguishing media: non-combustible
- Unsuitable extinguishing media: non-combustible

5.2 Special Hazards Arising from the Substance or Mixture

- Hazardous combustion products: non-combustible

5.3 Advice for Firefighters

Avoid direct contact with skin and eyes. Apply general purpose measures for personal protection equipment. The substance is soluble in water. Avoid getting into drains/surface water/ground water.

Section 6: Accidental Release Measures

6.1 Personal Precautions, Protective Equipment and Emergency Procedures

In case of accidental spills contaminated site rampart, used sand or sorbent remains mechanically gather, be disposed of. Prevent from entering the municipal water system – sewage, water courses and the soil. Do not rinse with water. Prevent spraying and aerosol inhalation of the substance with air. Avoid contact with skin and eyes, avoid contact with substance, and provide adequate ventilation in enclosed spaces. Apply protective clothing and rubber gloves to protect against dirt, apply a mask or respirator with dust filter A/P2; use face protection-goggles. Remove contaminated clothing and wash before reuse.

6.2 Environmental Precautions

Do not empty into drains/surface water/ground water. Methods for cleaning and take-up: remove mechanically. In the case of environmental contamination with plenty of substance notify to local authority and emergency services.

6.3 Methods and Material for Containment and Cleaning Up

The whole material is released into the environment to collect mechanically. Provide material collected for recycling. Do not rinse with water. Do not neutralize.

6.4 Reference to other Sections

Use the control measures and personal protective equipment described in section 8 of this SDS. The released material to follow the rules described in section 13 of this SDS – waste disposal.

ROCBOLT Technologies (Pty) Ltd.
30 North Reef Road
Germiston, 1429
South Africa

Phone +27 11 8786800
E-mail sales@rocbolt.com
www.rocbolt.com

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Section 7: Handling and Storage

7.1 Precautions for Safe Handling

Store in original containers. Empty containers to the end. Store in a dry place. Avoid contact with skin and eyes. Follow the general principles of occupational health and safety of chemicals, good industrial practice and the manufacturer's recommendations. If there is a need to handling the substance, use personal protective gloves, eye protection, clothing according to the principles described in section 8 of this SDS.

7.2 Conditions for Safe Storage, Including any Incompatibilities

Store only in the original containers. Store in tightly sealed, closed containers. Do not store near acids. Do not store in containers made of or coated with zinc, aluminium.

7.3 Specific End Use(s)

No information on specific end-uses. See also subsection 1.2

Section 8: Exposure Controls/Personal Protection

8.1 Control Parameters

Silicic Acid, Sodium Salt

DNEL

Application Area	Exposure Routes	Health Effect	Value
Workers	Inhalation	Long-term systemic effects	5.61 [mg/m^3]
Workers	Skin contact	Long-term systemic effects	1.59 [mg/kg] BW/d
Consumers	Inhalation	Long-term systemic effects	1.38 [mg/m^3]
Consumers	Skin contact	Long-term systemic effects	0.8 [mg/kg] BW/d
Consumers	Oral	Long-term systemic effects	0.8 [mg/kg] BW/d

PNEC

Compartment	Value
Marine water	1 [mg/l]
Fresh water	7.5 [mg/l]
Marine sediment	no PNEC available
Fresh water sediment	no PNEC available
Sewage treatment plant	348 [mg/l]
Aquatic intermittent release	7.5 [mg/l]

8.1 Control Parameters

1,2-Ethanediol

DNEL

Application Area	Exposure Routes	Health Effect	Value
Workers	Inhalation	Long-term local effects	35 [mg/m³]
Workers	Skin contact	Long-term systemic effects	106 [mg/kg] BW/d
Consumers	Inhalation	Long-term local effects	7 [mg/m³]
Consumers	Skin contact	Long-term systemic effects	53 [mg/kg] BW/d

PNEC

Compartment	Value
Soil	1.53 [mg/kg]
Marine water	1 [mg/l]
Fresh water	10 [mg/l]
Marine sediment	3.7 [mg/kg]
Fresh water sediment	37 [mg/kg]
Sewage treatment plant	199.5 [mg/l]
Aquatic intermittent release	10 [mg/l]

8.2 Exposure Controls

Avoid contact with eyes, mucous membranes and inhalation of vapours. It is forbidden to smoking, drinking, eating while working. Observe the typical standards of hygiene at work.

- Respiratory protection: in conditions of insufficient ventilation, while spraying the product, it is recommended to wear a mask with the filter type A2-P2 or better
- Eye protection: wear approved chemical safety goggles with side shields where eye exposure is reasonably probable, meet the requirements of EN 166
- Hand protection: use suitable protective gloves, such as: polychloroprene ≥0,5 [mm] thick and breakthrough time ≥480 minutes; nitril ≥0,35 [mm] thick and breakthrough time ≥480 minutes; butyl rubber ≥0,5 [mm] thick and breakthrough time ≥480 minutes or fluoro-rubber ≥0,4 [mm] thick and breakthrough time ≥480 minutes

  For prolonged or repeated skin contact use suitable protective gloves meet the requirements of EN 374
- Skin protection: according to the exposure when handling the product wear suitable protective clothing, aprons, protective boots

General Recommendations

See also section 7.

Provide adequate ventilation. Remove contaminated clothing immediately. Wash hands before breaks and after work. Wash contaminated gloves before removing. At work do not eat, drink or smoke. Avoid contact with skin. Do not get in eyes. Do not breathe vapours.

ROCBOLT Technologies (Pty) Ltd.
30 North Reef Road
Germiston, 1429
South Africa

Phone +27 11 8786800
E-mail sales@rocbolt.com
www.rocbolt.com

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Section 9: Physical and Chemical Properties

9.1 Information on Basic Physical and Chemical Properties

– Appearance:	light brown clear liquid
– Odour:	characteristic
– Odour threshold:	unidentified
– pH:	11 - 13
– Melting point/freezing point:	not determined
– Initial boiling point and boiling range:	not determined
– Flash point:	not applicable. Liquid, incombustible
– Evaporation rate:	not determined
– Flammability (solid, gas):	liquid, incombustible
– Upper/lower flammability or explosive limits:	not applicable. Liquid, incombustible
– Vapor pressure:	not determined
– Vapor density:	not determined
– Relative density:	1.45 ± 0.05 [g/cm^3]
– Solubility(ies):	mixed in water in any ratio
– Partition coefficient (n-octanol/water):	not determined
– Auto-ignition temperature:	not applicable. Liquid, incombustible
– Decomposition temperature:	not determined
– Viscosity:	300 ± 50 [mPa·s]

9.2 Other Information

No other information.

ROCBOLT Technologies (Pty) Ltd.
30 North Reef Road
Germiston, 1429
South Africa

Phone +27 11 8786800
E-mail sales@rocbolt.com
www.rocbolt.com

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Section 10: Stability and Reactivity

10.1 Reactivity

Alkalinity, water soluble substance.

10.2 Chemical Stability

Stable under normal condition storage and handling.

10.3 Possibility of Hazardous Reactions

Reacts with acids: heat released.

10.4 Conditions to Avoid

Avoid heat sources.

10.5 Incompatible Materials

Acids; aluminium, zinc, tin, lead.

10.6 Hazardous Decomposition Products

Under normal conditions, the substance is not degradable.

ROCBOLT Technologies (Pty) Ltd.
30 North Reef Road
Germiston, 1429
South Africa

Phone +27 11 8786800
E-mail sales@rocbolt.com
www.rocbolt.com

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Section 11: Toxicological Information

11.1 Information on Toxicological Effects

Toxicological Effects	Silicic Acid, Sodium Salt	1,2-Ethanediol
Acute toxicity	– LD50 Oral – rat = 3,400 [mg/kg] bw – LC50 Inhalation – rat > 2.06 [g/m^3]: LD50 Dermal – rat > 5,000 [mg/kg] bw	– LD50 Oral – rat – 4.700 [mg/kg] – LD50 Dermal – rabbit – 10.626 [mg/kg]
Skin corrosion/irritation	– Skin irritation 2; H315	– Skin – rabbit – Result: no skin irritation
Serious eye damage/eye irritation	– In vitro study rabbit – Result: irritating	– Eyes – rabbit – Result: mild eye irritation – 24 [h]
Respiratory or skin sensitisation	– Based on the category approach, sodium silicate is not sensitising	– No data available
Germ cell mutagenicity	– In vitro: negative, in vivo: negative – Not classified	– No data available
Carcinogenicity	– No reliable data available – In addition, sodium silicate does not carry any structural alerts for carcinogenicity	– This product is or contains a component that is probably not carcinogenic based on its IARC, ACGIH, NTP, or EPA classification
Reproductive toxicity	– Not classified	– Laboratory experiments have shown teratogenic effects – Overexposure may cause reproductive disorder(s) based on tests with laboratory animals
Specific target organ toxicity – single exposure	– Not classified	– No data available
Specific target organ toxicity – repeated exposure	– Not classified	– Oral – may cause damage to organs through prolonged or repeated exposure – kidney
Aspiration hazard	– Not classified	– No data available

ROCBOLT Technologies (Pty) Ltd.
30 North Reef Road
Germiston, 1429
South Africa

Phone +27 11 8786800
E-mail sales@rocbolt.com
www.rocbolt.com

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Section 12: Ecological Information

12.1 Toxicity

Silicic Acid, Sodium Salt

– Acute toxicity to fish:	LC50 (96 [h]): 1,108 [mg/l] (brachydanio rerio) LC50 (96 [h]): 260 - 310 [mg/l] (onchorhynchus mykiss) NOEC (96 [h], mortality): 348 [mg/l] (brachydanio rerio)
– Long-term toxicity for fish:	no NOEC available
– Acute toxicity for invertebrates:	EC50 (48 [h]): 1,700 [mg/l] (daphnia magna)
– Long-term toxicity for algae:	EC50 (72 [h], biomass): 207 [mg/l] (scenedesmus subspicatus) EC50 (72 [h], growth rate): > 345.4 [mg/l] (scenedesmus subspicatus) Exposure for aquatic environment is not sufficient to classify the substance. Because of the physical properties – extremely low vapor pressure – release to the atmosphere during use of the substance is not possible

12.2 Persistence and Degradability

As inorganic substances and in view of their chemical structure, soluble silicates are not amenable to biodegradation. In water, the substance is hydrolyzed.

12.3 Bioaccumulative Potential

The substance has a low potential for bioaccumulation, which was confirmed toxicokinetic studies on vertebrates.

12.4 Mobility in Soil

Due to good solubility in water can penetrate into the surface waters of the release site and can be detected at points located far away from this place.

12.5 Results of PBT and vPvB Assessment

Not applicable.

12.6 Other Adverse Effects

No other effects.

ROCBOLT Technologies (Pty) Ltd.
30 North Reef Road
Germiston, 1429
South Africa

Phone +27 11 8786800
E-mail sales@rocbolt.com
www.rocbolt.com

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Section 13: Disposal Considerations

13.1 Waste Treatment Methods

Avoid or minimize waste material production. The material must be disposed in accordance with local or national rules (waste act). Unrefined material is not suitable for disposal. Do not let waste material, even in small quantities, down to wastewater, sewage system or watercourses. Emptied packaging must be passed to authorized waste receiver.

Section 14: Transport Information

14.1 UN Number

Not dangerous goods.

14.2 UN Proper Shipping Name

Not dangerous goods.

14.3 Transport Hazard Class(es)

Not a hazardous material under the provisions of RID and ADR.

14.4 Packing Group

Not dangerous goods.

14.5 Environmental Hazards

Not a hazardous material for environmental.

14.6 Special Precautions for User

Alkaline substance. The Accidental release (spill) to collect the mechanical application of personal protection measures described in section 8 of this SDS.

14.7 Transport Bulk According to Annex II of Marpol and the IBC Code

The substance is not transport in bulk.

Section 15: Regulatory Information

15.1 Safety, Health and Environmental Regulations/Legislations Specific for the Substance or Mixture

- 1. Regulation (EC) No. 1907/2006 of the European Parliament and of the Council of 18 December 2006 concerning the Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH) and establishing a European Chemicals Agency, amending Directive 1999/45/EC and repealing Council Regulation (EEC). No 793/93 and Commission Regulation (EC) No 1488/94 as well as Council Directive 76/769/EEC and Commission Directives 91/155/EEC, 93/67/EEC, 93/105/EC and 2000/21/EC as amended, (REACH) (OJ EU L of 2006 No. 396, item 1).
- 2. Regulation (EC) No 1272/2008 of the European Parliament and of the Council of 16 December 2008 on classification, labelling and packaging of substances and mixtures, amending and repealing Directives 67/548/EEC and 1999/45/EC, and amending Regulation (EC) No 1907/2006 (OJ EU L of 2008 No. 35, item 1).
- 3. Commission Regulation (EU) 2015/830 of 28 May 2015 amending Regulation (EC) No. 1907/2006 of the European Parliament and of the Council on the Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH) (OJ EU L of 2015 No. 132).
- 4. Commission Directive No. 2000/39/EC; 2006/15/EC and 2009/161/EC establishing first, second and third lists of indicative occupational exposure limit values (OJ EU L 2000, No. 142, item 47; OJ EU L 2006, No. 38, item 36; OJ EU L of 2009 No. 338, item 87).

15.2 Chemical Safety Assessment

A chemical safety assessment has not been carried out.

Section 16: Other Information

The Full Version of the Hazard Classes and Category Codes from Sections 2 and 3

– Skin irritation 2:	skin corrosion/irritation; category 2
– Eye irritation 2:	serious eye damage/eye irritation; category 2
– Acute toxicity 4:	acute toxicity (oral); category 4
– STOT RE 2:	specific target organ toxicity – repeated exposure; category 2

Full Text of H-Sentences (Hazard Statements) Referred to under Sections 2 and 3

– H302:	harmful if swallowed
– H315:	causes skin irritation
– H319:	causes serious eye irritation
– H373:	may cause damage to organs (kidney) through prolonged or repeated exposure if swallowed
– DNEL:	derived no effect level
– PNEC:	predicted no effect concentration

The current edition of the safety data sheet replaces the previous edition.
The information provided in this safety data sheet is correct to the best of our knowledge, information and belief at the date of its publication. The information given is designed only as guidance for safe handling, use, processing, storage, transportation, disposal and release and is not to be considered a warranty or quality specification. The information relates only to the specific material designated and may not be valid for such material used in combination with any other materials or in any process, unless specified in the text.

ROCBOLT Technologies (Pty) Ltd.
30 North Reef Road
Germiston, 1429
South Africa

Phone +27 11 8786800
E-mail sales@rocbolt.com
www.rocbolt.com

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Section 1: Identification of the Substance/Mixture and of the Company

1.1 Product Identifier

- Substance name: Mineral Bond LV, component B
- Index number: not applicable (mixture)
- Synonyms: not applicable
- CAS number: not applicable (mixture)
- EC number: not applicable (mixture)
- Registration number: excluded from registration (polymer)

1.2 Relevant Identified Uses of the Substance or Mixture and Uses Advised Against

Relevant Identified Uses

2-component, high strength silicate resin.
It is suitable for grout stabilization (for heavily cracked rock mass), gas sealing and water stopping.

Uses Advised Against

Any other uses than those listed should be consulted with the supplier.

1.3 Details of the Supplier of the Safety Data Sheet

- Company: ROCBOLT Technologies (Pty) Ltd
- Address: 30 North Reef Rd., Germiston,1429
- Telephone: +27 (0)11 9701643
- Fax: +27 (0)11 9703596
- Website: www.rocbolt.com

1.4 Emergency Telephone Numbers

- Telephone: +27 (0)11 9701643
- Fax: +27 (0)11 9703596

Section 2: Hazards Identification

2.1 Classification of the Substance or Mixture

Classification according to Regulation (EC) No 1272/2008 (CLP)

- Skin irritation 2: category 2; H315
- Skin irritation 2: category 2; H315
- Skin sens 1: category 1; H317
- Eye irritation 2: category 2; H319
- Acute toxicity 4: category 4; H332
- Resp. sens 1: category 1; H334
- STOT SE 3: category 3; H335
- Carc. 2: category 2; H351
- STOT RE 2: category 2; H373

Additional information: for full text of hazard- and EU hazard-statements: see section 16

2.2 Label Elements

Labelling according to Regulation (EC) No 1272/2008 (CLP)

- Signal word: DANGER
- Hazard pictograms

Hazard Statements

- H315 Causes skin irritation.
- H317 May cause an allergic skin reaction.
- H319 Causes serious eye irritation.
- H332 Harmful if inhaled.
- H334 May cause allergy or asthma symptoms or breathing difficulties if inhaled.
- H335 May cause respiratory irritation.
- H351 Suspected of causing cancer.
- H373 May cause damage to organs repeated exposure.

ROCBOLT Technologies (Pty) Ltd.
30 North Reef Road
Germiston, 1429
South Africa

Phone +27 11 8786800
E-mail sales@rocbolt.com
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Precautionary Statements

– P260	Do not breathe dust/fume/gas/mist/vapours/spray.
– P280	Wear protective gloves/protective clothing/eye protection/face protection.
– P284	In case of inadequate ventilation wear respiratory protection.
– P302 + P352	IF ON SKIN: wash with plenty of soap and water.
– P304 + P340	IF INHALED: remove victim to fresh air and keep at rest in a position comfortable for breathing.
– P305 + P353 + P338	IF IN EYES: rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.
– P308 + P313	IF EXPOSED OR CONCERNED: get medical advice/attention/international regulation.

Supplemental Hazard Information

– EUH204	Contains isocyanates. May produce an allergic reaction.

2.3 Other Hazards

The substance does not meet the criteria for persistent, bioaccumulation and toxicity (PBT), or the criteria for very persistent and very bioaccumulative (vPvB) in accordance with Annex XIII of 1907/2006/EC.

Additional information: people with allergic anamneses (e.g., asthma, chronic bronchitis) should not work with this product. Symptoms of adverse effects on the respiratory system may appear after a few hours. The main threat to the respiratory tract is dust, vapours and aerosols.

Section 3: Composition/Information on Ingredients

3.1 Substances

Not applicable

3.2 Mixtures

REACH Registration Number	Weight [%]	CAS No	EC No	Classification According to Regulation (EC) No. 1278/2008 (CLP)
Polymeric MDI excluded from registration (polymer)	80 - 100	9016-87-9	Not applicable	Skin irritation 2; H315 Skin sens 1; H317 Eye irritation 2; H319 Acute toxicity 4; H332 Resp. sens 1; H334 STOT SE 3; H335 Carc. 2; H351 STOT RE 2; H373

Additional information: for full text of H-statements: see section 16

Section 4: First Aid Measures

4.1 Description of First Aid Measures

- General information: move the exposed person to fresh air at once.
  Poisoning by inhalationIf any health problems occur, or in the event of any doubt or an accident, seek medical attention and provide the doctor with information from the safety data sheet. Always ensure the affected person peace of mind and ensure his/her warmth. If the affected person is unconscious, lay him/her down and transport him/her to a doctor in a stabilised position. If the affected person is not breathing, immediately commence artificial resuscitation. If the heart has stopped, indirect heart massage must be commenced immediately
- Skin contamination: wash thoroughly using copious warm water and soap or cleaning agent based on polyethylene and rinse thoroughly. Remove contaminated clothing and shoes immediately. Not use any solvents or thinners.
  In all cases of doubt, or when symptoms, e.g., irritation of skin persists, seek medical attention
- Eye contamination: rinse eyes for 15 minutes at least with plenty of water, holding eyelids wide open. Seek for medical attention. Avoid strong water stream because of risk of the cornea injury
- Poisoning by swallowing: the injured conscious: rinse mouths with water. Do not induce vomiting without medical supervision. Provide medical attention immediately.
  The injured unconscious: do not administer orally anything for unconscious injured. Provide medical attention immediately

4.2 Most Important Symptoms and Effects, Both Acute and Delayed

Headache, nausea, shortness of breath, sore throat, redness of the skin. Repeated or prolonged contact may cause skin sensitization. Repeated or prolonged contact may cause asthma.

4.3 Indication of any Immediate Medical Attention and Special Treatment Needed

Remove contaminated clothing and wash before reuse. If you feel unwell, seek medical advice immediately if possible, show the label.

Advise to doctor:
irritating to respiratory system and is a potential agent of causing allergic skin and respiratory tract. The first characteristics are irritation of respiratory tract and bronchi. Depending on the size of the exposure and the persistence of symptoms may require longer care. May cause skin and eye irritation as a result of reaction with water in the tissues.

Symptoms of exposure may appear late.

ROCBOLT Technologies (Pty) Ltd.
30 North Reef Road
Germiston, 1429
South Africa

Phone +27 11 8786800
E-mail sales@rocbolt.com
www.rocbolt.com

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Section 5: Firefighting Measures

5.1 Extinguishing Media

- Suitable extinguishing media: carbon dioxide (CO_2), dry powder or foam. Fight larger fires with water spray. Water jets. Use water jets only to cool the surfaces of the containers exposed to fire to prevent them from bursting (explosion)
- Unsuitable extinguishing media: high volume water jet

5.2 Special Hazards Arising from the Substance or Mixture

- Hazardous combustion products: during a fire, produce a dense smoke containing hazardous products – carbon monoxide (CO), carbon dioxide (CO_2), hydrogen cyanide (HCN) in trace amounts, nitrogen oxides (NO_x), isocyanate fumes. Do not inhale fumes and gases produce in the fire. See also section 10

5.3 Advice for Firefighters

According to the size of fire, it may be necessary to use protective suits against the heat, individual breathing equipment, gloves, protective goggles or facemasks and gloves.

Prevent fire extinguishing water and fire residues from contaminating surface water, the ground water system or into drains or sewers. See also section 10.

Section 6: Accidental Release Measures

6.1 Personal Precautions, Protective Equipment and Emergency Procedures

- For those not belonging to the staff assisting:
  forbid unauthorized access to the site contamination
- For those providing assistance:
  avoid contact with eyes and skin. Provide adequate ventilation. Wear appropriate protective equipment – see section 8

6.2 Environmental Precautions

Avoid discharge into surface water or sanitary sewer system. Do not allow material to contaminated ground water system. If the product contaminates rivers, lakes or drains inform respective authorities.

6.3 Methods and Material for Containment and Cleaning Up

Absorb in sawdust, dry sand or with absorbent based on hydrated calcium silicate and collect mechanically into labelled containers and deliver for disposal according to local regulations.

Damp waste left in an open container for a period of one hour to complete the reaction – the carbon dioxide is produced. Cured residues in accordance with the recommendations set forth in section 13.

The released product may be neutralized with one of the two decontaminants, the composition of which is given below:
- Sodium carbonate: 5 - 10 [%]; washing agent: 0.2 - 2 [%], with addition of water to 100 [%]
- Ammonia solution: 3 - 8 [%]; washing agent: 0.2 - 2 [%], with addition of water to 100 [%]

6.4 Reference to Other Sections

Protective equipment and clothing – see section 8.

Disposal of waste – see section 13 and 15.

Section 7: Handling and Storage

7.1 Precautions for Safe Handling

Ensure adequate ventilation, general and local, exhaust. Observe regular review of ventilation equipment. Avoid contact with eyes. Avoid contact with skin. Do not breathe vapours. Wear gloves and protective clothing. Do not eat, drink, smoke or store food in the working areas. Immediately remove contaminated clothing and wash before reuse.

7.2 Conditions for Safe Storage, Including any Incompatibilities

Store in tightly closed original container in a dry place. Protect from freezing. Store at temperatures from 10 to below 40 [°C]. The product can withstand short-term heating to 50 [°C]. See also section 10. Suitable materials for the container: Polyethylene HDPE or steel. Do not store with food, drink and animal feed.

7.3 Specific End Use(s)

No information on specific end-uses. See also subsection 1.2

Section 8: Exposure Controls/Personal Protection

8.1 Control Parameters

8.1.1 Occupational Exposure Limit Values

- Substance: 4,4'-methylenediphenyl diisocyanate
- CAS number: 101-68-8

Countries	Limit Value (8 Hours)		Limit Value (Short Term)	
[–]	[ppm]	[mg/m³]	[ppm]	[mg/m³]
Austria	0.005	0.05	0.01	0.1
Belgium	0.005	0.052	–	–
Denmark	0.005	0.05	0.01	0.1
European Union	–	–	–	–
France	0.01	0.1	0.02	0.2
Germany	–	0.05	–	0.05
Hungary	–	0.05	–	0.05
Poland	–	0.05	–	0.2
Spain	0.005	0.052	–	–
Sweden	0.002	0.03	0.005	0.05

Source: http://limitvalue.ifa.dguv.de/Webform_gw.aspx

8.1.2 DNEL/PNEC-Values

Workers:

- Acute/short-term exposure – systemic effects (dermal): DNEL = 50 [mg/kg] bw/day
- Acute/short-term exposure – systemic effects (inhalation): DNEL = 0.1 [mg/m³]
- Acute/short-term exposure – local effects (dermal): DNEL = 28.7 [mg/cm²]
- Acute/short-term exposure – local effects (inhalation): DNEL = 0.1 [mg/m³]
- Long-term exposure – systemic effects (inhalation): DNEL = 0.05 [mg/m³]
- Long-term exposure – systemic effects (dermal): not applicable
- Long-term exposure – local effects (inhalation): DNEL = 0.05 [mg/m³]
- Long-term exposure – local effects (dermal): not applicable

General Population:

– Acute/short-term exposure – systemic effects (dermal):	DNEL = 25 [mg/kg] bw/day
– Acute/short-term exposure – systemic effects (inhalation):	DNEL = 0.05 [mg/m^3]
– Acute/short-term exposure – systemic effects (oral):	DNEL = 20 [mg/kg] bw/day
– Acute/short-term exposure – local effects (dermal):	DNEL = 17.2 [mg/cm^2]
– Acute/short-term exposure – local effects (inhalation):	DNEL = 0.05 [mg/m^3]
– Long-term exposure – systemic effects (inhalation):	DNEL 0.025 [mg/m^3]
– Long-term exposure – systemic effects (dermal):	not applicable
– Long-term exposure – systemic effects (oral):	not applicable
– Long-term exposure – local effects (inhalation):	DNEL = 0.025 [mg/m^3]
– Long-term exposure – local effects (dermal):	not applicable
– Long-term exposure – local effects (oral):	not applicable
– PNEC aqua (freshwater):	1 [mg/l]
– PNEC aqua (marine water):	0.1 [mg/l]
– PNEC aqua (intermittent releases):	10 [mg/l]
– PNEC STP:	1 [mg/l]
– PNEC soil:	1 [mg/kg] soil dw (dry weight)

8.2 Exposure Controls

Avoid contact with eyes, mucous membranes and inhalation of vapours. It is forbidden to smoking, drinking, eating while working. Observe the typical standards of hygiene at work.

– Respiratory protection:	in conditions of insufficient ventilation, while spraying the product, it is recommended to wear a mask with the filter type A2-P2
– Eye protection:	wear approved chemical safety goggles with side shields where eye exposure is reasonably probable, meet the requirements of EN 166
– Hand protection:	use suitable protective gloves, such as: polychloroprene ≥0,5 [mm] thick and breakthrough time ≥480 minutes; nitril ≥0,35 [mm] thick and breakthrough time ≥480 minutes; butyl rubber ≥0,5 [mm] thick and breakthrough time ≥480 minutes or fluoro-rubber ≥0,4 [mm] thick and breakthrough time ≥480 minutes. For prolonged or repeated skin contact use suitable protective gloves meet the requirements of EN 374
– Skin protection:	according to the exposure when handling the product wear suitable protective clothing, aprons, protective boots

General Recommendations

See also section 7.

Provide adequate ventilation. Remove contaminated clothing immediately. Wash hands before breaks and after work. Wash contaminated gloves before removing. At work do not eat, drink or smoke. Avoid contact with skin. Do not get in eyes. Do not breathe vapours.

Section 9: Physical and Chemical Properties

9.1 Information on Basic Physical and Chemical Properties

– Melting point/freezing point:	<0 [°C] (DIN 51556)
– Initial boiling point and boiling range:	>300 [°C] (read-across based on MDI mixed isomers – 26447-40-5.)
– Flash point:	>200 [°C] (open cup)
– Flammability:	not flammable
– Upper/lower flammability or explosive limits:	not flammable
– Vapour pressure:	<10 - 5 [mbar] (at 20[°C])
– Vapour density (air=1):	no data
– Density:	1.20 +/- 0.03 [g/cm^3] (at 25 [°C])
– Water solubility:	reacts with water
– Partition coefficient n-octanol/water:	not applicable
– Auto-ignition temperature:	> 600 [°C] (1,013 [hPa]) (EU Method A.15)
– Decomposition temperature:	(read-across based on oligomeric MDI- CAS 32055-14-4)
– Viscosity:	no data
– Explosive properties:	200 ± 80 [mPa·s] (at 25 [°C], dynamic) (ASTM D4899)
– Oxidising properties:	not explosive

9.2 Other Information

These data are not always consistent with the specifications of a particular batch of product.
See product sheet for more detailed information.

ROCBOLT Technologies (Pty) Ltd.
30 North Reef Road
Germiston, 1429
South Africa

Phone +27 11 8786800
E-mail sales@rocbolt.com
www.rocbolt.com

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Section 10: Stability and Reactivity

10.1 Reactivity

Reacts with water, acids, alcohols, amines, bases and oxidants.

10.2 Chemical Stability

The main removal mechanism of MDIs in the environment is hydrolysis. MDI reacts quickly with water to form predominantly solid, insoluble polyurea. Under conditions typical of many types of environmental contact, i. e. with relatively poor dispersion of the denser isocyanate, the interfacial reaction leads to the formation of a solid crust encasing partially or unreacted material. This crust restricts ingress of water and egress of amine, and hence slows and modifies hydrolysis. Polymerise above 200 [°C], and produces carbon dioxide.

10.3 Possibility of Hazardous Reactions

Reaction is slow with cold or warm water (<50 [°C]), with hot water or steam the reaction is faster, producing carbondioxide causing pressure increase. Acids, alcohols, amines, bases and oxidants cause fire and explosion hazard.

10.4 Conditions to Avoid

High temperature, moisture, strong light.

10.5 Incompatible Materials

Water, acids, alcohols, amines, bases and oxidants.

10.6 Hazardous Decomposition Products

No hazardous decomposition products if stored and handled as prescribed/indicated.

ROCBOLT Technologies (Pty) Ltd.
30 North Reef Road
Germiston, 1429
South Africa

Phone +27 11 8786800
E-mail sales@rocbolt.com
www.rocbolt.com

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Section 11: Toxicological Information

11.1 Information on Toxicological Effects

– Acute toxicity (oral):	based on available data, the classification criteria are not met. Rats: LD50 > 2,000 [mg/kg] bw method: 84/449/EEC (read-across based on methylenediphenyl diisocyanate – CAS 26447-40-5.)
– Acute toxicity (aerosol inhalation):	rats: LC50 > 2.24 [mg/l] air (1 h) method: OECD Guideline 403 (read-across based on 4,4'-methylenediphenyl diisocyanate – CAS 101-68-8.)
– Acute toxicity (dermal):	based on available data, the classification criteria are not met. Rabbit: LD50 > 9,400 [mg/kg] bw (24 h) method: OECD Guideline 402
– Skin corrosion/irritation:	rabbits: irritating (4 h/14 days) method: OECD Guideline 404 (read-across based on methylenediphenyl diisocyanate – CAS 26447-40-5.)
– Serious eye damage/irritation:	rabbits: not irritating. (24 h/21 days) method: OECD Guideline 405 (read-across based on methylenediphenyl diisocyanate – CAS 26447-40-5.) Summarized the available animal data would not support classification of MDI as an eye irritant. But together with human occupational case reports in which symptoms of eye irritation were reported the legal classification as eye irritant should be applied
– Respiratory or skin sensitization:	animal data as well as studies in humans provide evidence of possible skin sensitization, and of respiratory sensitization due to MDI. Animal studies indicate that MDI is a strong allergen. Human case reports describe the occurrence of allergic contact dermatitis due to MDI exposure
– Skin sensitization:	mice: sensitizing method: OECD Guideline 429 (LLNA) (read-across based on 4,4'-methylenediphenyl diisocyanate – CAS 101-68-8.)
– Respiratory sensitization:	guinea pig: sensitizing method: not available (read-across based on 4,4'-methylenediphenyl diisocyanate – CAS 101-68-8.)
– Germ cell mutagenicity:	based on available data, the classification criteria are not met. Gene mutation, in vitro – salmonella typhimurium: negative method: EU Method B 13/14 (read-across based on 4,4'-methylenediphenyl diisocyanate – CAS 101-68-8.)
– Chromosome aberration, in vivo:	rats (inhalation): negative (3 weeks; 1/week, 1 h/day) method: OECD Guideline 474 (read-across based on 4,4'-methylenediphenyl diisocyanate – CAS 101-68-8.)

– Carcinogenicity:	rats (inhalation: aerosol) NOAEC = 0.2 [mg/m^3] air (toxicity) (2 years; 6 h/day, 5 days/week) NOAEC = 1 [mg/m^3] air (carcinogenicity) (2 years; 6 h/day, 5 days/week) LOAEC = 6 [mg/m^3] air (carcinogenicity) (2 years; 6 h/day, 5 days/week) method: OECD Guideline 453
– Reproductive toxicity:	based on available data, the classification criteria are not met. Effects on fertility: no fertility nor multigeneration studies are available for MDI. Rats (inhalation) NOAEL = 4 [mg/m^3] air (developmental toxicity) (10 days; 1/day, 6 h) NOAEL = 4 [mg/m^3] air (maternal toxicity) (10 days; 1/day, 6 h) method: OECD Guideline 414
– STOT-single exposure:	MDIs irritant the respiratory tract (read-across based on 4,4'-methylenediphenyl diisocyanate – CAS 101-68-8.)
– STOT-repeated exposure:	Rats (inhalation: aerosol) LOAEC = 1.0 [mg/m^3] air (2 years; 6 h/day, 5 days/week) target organs: respiratory – lung method: OECD Guideline 453
– Aspiration hazard:	not classified due to lack of data

Section 12: Ecological Information

12.1 Toxicity

– Short-term toxicity to fish:	freshwater fish (brachydanio rerio) LC50 > 1,000 [mg/l] (96 h) method: OECD Guideline 203
– Short-term toxicity to aquatic invertebrates:	freshwater invertebrates (daphnia magna) EC50 > 1,000 [mg/l] (24 h) method: OECD Guideline 202
– Long-term toxicity to aquatic invertebrates:	freshwater invertebrates (daphnia magna) NOEC >= 10 [mg/l] (21 days) method: OECD Guideline 211
– Toxicity to aquatic algae and cyanobacteria:	freshwater algae (desemodesmus subspicatus) EC50 > 1,640 [mg/l] (72 h) method: OECD Guideline 201
– Toxicity to microorganisms:	microorganisms (activated sludge) EC50 > 100 [mg/l] (3 h) method: OECD Guideline 209

ROCBOLT Technologies (Pty) Ltd.
30 North Reef Road
Germiston, 1429
South Africa

Phone +27 11 8786800
E-mail sales@rocbolt.com
www.rocbolt.com

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12.2 Persistence and Degradability

– Photo-transformation in air:	half-life (DT50): 1 day method: QSAR (read-across based on 4,4'-methylenediphenyl diisocyanate – CAS 101-68-8.)
– Hydrolysis:	MDI reacts with water to form predominantly inert polyurea. Half-life (DT50): 20 h (at 25 [°C]) (read-across based on oligomeric MDI – CAS 32055-14-4.)
– Photo-transformation in water and soil:	there are no photo-transformation data in water and soil for the test substance. Biodegradation in water: under test conditions no biodegradation observed (28 days) method: OECD Guideline 302 C. Biodegradation in water and sediment: data waiving. In accordance with Annex XI, simulation biodegradation tests are technically not feasible as the test substance reacts quickly with water. The corresponding PEC/PNEC ratios would be less than 1. Taking into account the scientific and exposure arguments, it appears appropriate to waiver the long-term fish/plant/soil and sediment toxicity studies

12.3 Bioaccumulative Potential

Bioaccumulation – aquatic/sediment: due to the high reactivity of the substances of the MDI category with water, bioaccumulation tests can in principle not be performed with these substances. However, one bioaccumulation test with 4,4'-MDI and a mesocosm study with PMDI with an indication of bioaccumulation potential have been performed. As no analytical measurements were done, it cannot be determined if the values are truly related to MDI. However, based on the available information and the reactivity of MDI substances of the category approach, no new bioaccumulation study is deemed necessary.

BCF (cyprinus carpio): 200 (28 days)
method: OECD Guideline 305 E
(read-across based on 4,4'-methylenediphenyl diisocyanate – CAS 101-68-8.

12.4 Mobility in Soil

There is no data available.

12.5 Results of PBT and vPvB Assessment

Not applicable.

12.6 Other Adverse Effects

According to information provided by the manufacturer, the product has weak effects to the aquatic environment – class 1 by the german classification (classification manufacturer). Do not allow undiluted product or large quantities of it to reach surface water, ground water or sewage system. The product is not mixed with water. In the reaction with water produces carbon dioxide, and inert non – biodegradable solid (polyurea). Product is not classified as dangerous for the environment.

ROCBOLT Technologies (Pty) Ltd.
30 North Reef Road
Germiston, 1429
South Africa

Phone +27 11 8786800
E-mail sales@rocbolt.com
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Section 13: Disposal Considerations

13.1 Waste Treatment Methods

Avoid or minimize waste material production. The material must be disposed in accordance with local or national rules (waste act). Unrefined material is not suitable for disposal. Do not let waste material, even in small quantities, down to wastewater, sewage system or watercourses. Emptied packaging must be passed to authorized waste receiver.

European Waste Catalogue code (EWC) 08 05 01: waste Isocyanates

Section 14: Transport Information

14.1 UN Number

Not dangerous goods.

14.2 UN Proper Shipping Name

Not dangerous goods.

14.3 Transport Hazard Class(es)

Not dangerous goods.

14.4 Packing Group

Not dangerous goods.

14.5 Environmental Hazards

No.

14.6 Special Precautions for User

Not dangerous goods.

14.7 Transport in Bulk According to Annex II of Marpol and the IBC Code

No regulation.

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30 North Reef Road
Germiston, 1429
South Africa

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E-mail sales@rocbolt.com
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Section 15: Regulatory Information

15.1 Safety, Health and Environmental Regulations/Legislation Specific for the Substance or Mixture

- 1. Regulation (EC) No. 1907/2006 of the European Parliament and of the Council of 18 December 2006 concerning the Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH) and establishing a European Chemicals Agency, amending Directive 1999/45/EC and repealing Council Regulation (EEC). No 793/93 and Commission Regulation (EC) No 1488/94 as well as Council Directive 76/769/EEC and Commission Directives 91/155/EEC, 93/67/EEC, 93/105/EC and 2000/21/EC as amended, (REACH) (Official Journal of the European Union L of 2006 No. 396, item 1).
- 2. Regulation (EC) No 1272/2008 of the European Parliament and of the Council of 16 December 2008 on classification, labelling and packaging of substances and mixtures, amending and repealing Directives 67/548/EEC and 1999/45/EC, and amending Regulation (EC) No 1907/2006 (OJ EU L of 2008 No. 35, item 1).
- 3. Commission Regulation (EU) 2015/830 of 28 May 2015 amending Regulation (EC) No. 1907/2006 of the European Parliament and of the Council on the Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH) (OJ EU L of 2015 No. 132).
- 3. Commission Regulation (EU) 2015/830 of 28 May 2015 amending Regulation (EC) No. 1907/2006 of the European Parliament and of the Council on the Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH) (OJ EU L of 2015 No. 132).
- 4. Commission Directive No. 2000/39/EC; 2006/15/EC and 2009/161/EC establishing first, second and third lists of indicative occupational exposure limit values (OJ EU L 2000, No. 142, item 47; OJ EU L 2006, No. 38, item 36; OJ EU L of 2009 No. 338, item 87).

15.2 Chemical Safety Assessment

A chemical safety assessment has not been carried out.

ROCBOLT Technologies (Pty) Ltd.
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Germiston, 1429
South Africa

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E-mail sales@rocbolt.com
www.rocbolt.com

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Section 16: Other Information

The full Version of the Hazard Classes and Category Codes

- Acute toxicity 4: acute toxicity (oral); category 4
- Carc. 2: carcinogenicity; category 2
- Eye irritation 2: serious eye damage/eye irritation; category 2
- Resp. sens. 1: respiratory sensitisation, category 1
- Skin irritation 2: skin corrosion/irritation, category 2
- Skin sens. 1B: skin sensitisation, category 1B
- STOT RE 2: specific target organ toxicity – repeated exposure; category 2
- STOT SE 3: specific target organ toxicity – single exposure; category 3

Full Text of H-Sentences (Hazard Statements) Referred to under Sections 2 and 3

- H315: causes skin irritation
- H317: may cause an allergic skin reaction
- H319: causes serious eye irritation
- H332: harmful if inhaled
- H334: may cause allergy or asthma symptoms or breathing difficulties if inhaled
- H335: may cause respiratory irritation
- H351: suspected of causing cancer
- H373: may cause damage to organs repeated exposure

According to information provided by the manufacturer, technical (polymers) MDI (pMDI) CAS 9016-87-9 (in the form of aerosol respirable fraction) is classified as category 3 carcinogens.

The current edition of the safety data sheet replaces the previous edition.
The information provided in this safety data sheet is correct to the best of our knowledge, information and belief at the date of its publication. The information given is designed only as a guidance for safe handling, use, processing, storage, transportation, disposal and release and is not to be considered a warranty or quality specification. The information relates only to the specific material designated and may not be valid for such material used in combination with any other materials or in any process, unless specified in the text.

ROCBOLT Technologies (Pty) Ltd.
30 North Reef Road
Germiston, 1429
South Africa

Phone +27 11 8786800
E-mail sales@rocbolt.com
www.rocbolt.com

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Contact Details

George Katergarakis

Managing Director

Mobile: +27 83 410 3535

David Odendaal

Sales Manager, Exports

Geotechnical & Construction

Mobile: +27 82 831 1344

Dennis van Heerden

Sales Manager, Mining

Mobile: +27 83 309 6997

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Steel & Resin Plant
30 North Reef Road
1429 Germiston
South Africa

Phone +27 11 878 6800
E-mail sales@rocbolt.com

www.rocbolt.com

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