

## MINING EDITION

PIONEERING SOLUTIONS IN GROUND SUPPORT  
FOR YOUR SUSTAINABLE FUTURE





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# AFRICA

## TRUSTED TO REINFORCE PROGRESS IN ALL KEY MINING TERRITORIES

As mines become deeper, more remote and technically challenging, the ability to source solutions from one reliable and cost-effective supplier is more important than ever. Working alongside you, we help drive your operations forward, efficiently and cost-effectively.

## ABOUT US

As DSI Underground, a Sandvik company we are a global business with a local presence in all key mining territories across APAC, EMEA, North America and LATAM – so, our people are always on hand to reinforce your mines, your operations, and your teams. Our customers include national and international companies and contractors who rely on our global strength and supply chain to deliver on time, at the most competitive cost.

## ABOUT SANDVIK

Sandvik is a global, high-tech engineering group providing solutions that enhance productivity, profitability and sustainability for the manufacturing, mining and infrastructure industries.

In 2022, the group had approximately 40,000 employees, sales in about 150 countries and revenues of about SEK 112 billion within continuing operations.

Our offering covers the entire customer value chain and are based on extensive investments in research and development, customer insights and deep knowledge of industrial processes and digital solutions.

### MISSION

To provide safety to underground operations and deliver expertise and sustainability for mining and tunneling globally.

### VISION

To be the global leader in providing ground support solutions, supported by our team of strata reinforcement specialists and developing advanced technologies.

### VALUES

#### • Customer Focus

We are agile, decentralized and make decisions close to customers.

#### • Innovation

We are technology leaders, through innovation.

#### • Fair Play

We are ethical and compliant, dedicated to health, safety and sustainability.

#### • Passion to Win

We establish market leadership through empowered people, strong performance management and continuous improvements.

# WE ARE WHERE YOU NEED US!



# PUTTING YOUR SAFETY FIRST

The mining industry continues to demand even higher levels of safety and productivity. In order to meet these requirements, we work continuously to develop safer products, and to produce comprehensive manuals on the safe and effective use of our products.

## IT'S ALL ABOUT EVERYONE'S HEALTH

Helping you to ensure a safer workplace and healthier workforce is of the utmost importance to us.

The wellbeing of any person coming into contact with our equipment is paramount. Therefore, we strive to identify and assess potential risk factors that could threaten the health of you and your employees.

All products in this catalogue are designed to meet safety requirements.

## BE AWARE OF ALL SAFETY PROCEDURES

We ask that you start by obeying all instructions given. Never work under an unsupported roof or close to potential pinch point locations. Beware of the potential hazards of a loose roof and ribs. Beware of possible coal burst. The use of temporary roof support is recommended. Scale down roof and ribs prior to bolting. It is important to bolt early in the mining process – as soon as it is safely and practically possible.

Safe work procedures should incorporate inspection – before the machine operates, and also through regular monitoring based upon mining conditions, safety and hazard management systems. Workers should be provided with safety information, instruction and training on transportation, installation, operational care and disposal of drilling tools.

## DRESS RIGHT FROM HEAD TO TOE

You must wear appropriate personal protective equipment (PPE) at all times. This is what we strongly recommend to help avoid injury:

- Safety helmet
- Hearing protection
- Safety glasses
- Protective, high visibility clothing
- Respiratory protection
- Safety boots
- Any site-specific PPE as required

## MAKE A RISK ANALYSIS BEFORE YOU START

Pay attention to safety when planning all of your work. Before you start, always take the time to go through all operations. Identify any potential risks and take appropriate measures to avoid them. If necessary, seek expert advice on how to help minimize risks. Finally, make sure that you have the right resources to perform all tasks in the safest manner possible.

## "TAKE FIVE" TO IDENTIFY HAZARDS

A great safety tool to use before you start working is our app "Sandvik Mining Take Five". The app consists of a simple, step-by-step checklist with five questions that you should ask yourself to identify potential hazards. The app is free to download for smartphones and tablets, both on the App Store and Google Play.





# 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 Ferro zink diffusion.

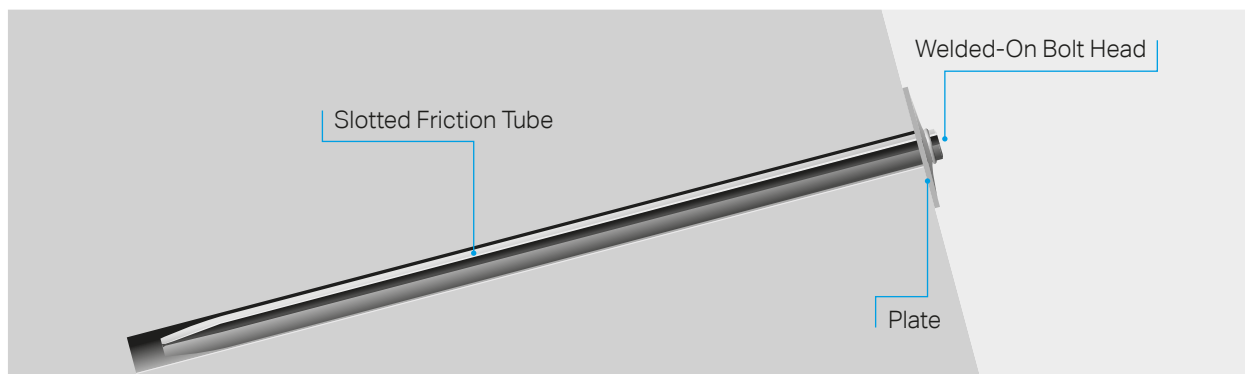
## INSTALLATION GUIDELINES

- 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.



Notes: minimum order quantities may apply to this product

## SYSTEM COMPONENTS







### SPECIFICATIONS

Characteristic Value / Type <sup>1)</sup>	Symbol	Unit	FS33	FS39	FS46
External Diameter <sup>2)</sup>	D <sub>e</sub>	mm	33	39	46
Nominal Weight <sup>2)</sup>	m	kg/m	1.5	1.8	2.9
Ultimate Load <sup>2)</sup>	F <sub>m</sub>	kN	105	110	150
Yield Strength <sup>3)</sup>	R <sub>e</sub>	N/mm <sup>2</sup>	410	410	410
Ultimate Strength <sup>3)</sup>	R <sub>m</sub>	N/mm <sup>2</sup>	520	520	520
Elongation <sup>3)</sup>	A	%	10	10	10
Recommended Drill Bit Diameter	B	mm	30-32	36-38	41-44
Delivery Lengths <sup>4)</sup>	L	mm	600-4000	600-4000	600-4000




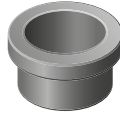
1) Note: all values are subject to change. Other dimensions, steel grades, and compliant bolt plates are available upon request.

2) Nominal value.

3) According to primary material supplier information; the modulus of elasticity: 210000 N/mm<sup>2</sup> (30450 ksi).

4) Off-size lengths are available upon request.

### PRODUCT ACCESSORIES EXAMPLES

Product Group	Products			
	Butterfly Plate	Dome Plate	Dome Plate	Pull Ring
Product Imagery				
Product Code Prefix	BUTT	FRP	TDD	PRING

# MD BOLT

## INTRODUCTION

The D47 Mechanical Dynamic (MD) Bolt is a 47 mm Friction Bolt reinforced with a 20 mm bar and a wedge arrangement at the bolt top end. Once the bolt is fully driven into the hole (like the Friction Bolt), the nut at the bottom is rotated to actuate a set of wedges that firmly anchor the bolt top end in the rock.

The D47 MD Bolt was the first in the emerging hybrid bolt technologies developed to produce a high capacity single pass bolt.

Mining methods, and ground conditions continuously vary while the ultimate safety of personnel and profitability must continue.

The D47 MD Bolt is the ideal product to achieve these goals.

## D47 MD BOLT FEATURES

- Good all purpose bolt useful for all conditions (including normal rock conditions)
- A productivity improving bolt with high static capacity
- Very simple bolt installation (similar to a standard Friction Bolt)
- No resins or grouts required, making it far easier to install, able to hammer straight in through wet and broken ground with no complications
- High friction anchorage capacity at the bolt top end
- Applicable to moving ground conditions
- High tensile and shear strength
- Rock plate secured to allow transfer of load to Friction Bolt and 20 mm bar
- The stopper safety device eliminates possible bar ejection
- The bottom of the tube is sealed to prevent atmospheric corrosion
- Low profile bolt head (no bar protrusion below the nut)
- Accessories can be screwed directly onto the installed bolts
- Fully galvanized for corrosion protection
- Bolt installation quality apparent to operator
- With the common size being 2.4 m these bolts are available in a range of sizes from 1.8 m, 2.1 m, 2.4 m and 3.0 m



**COMPONENT PROPERTIES**

<b>Characteristic</b>	<b>Value</b>
Bar Diameter	Ø20 mm
Bar Elongation (5D)	22 %
Bar Rolled Thread	M22x2.5 LH
Bar Ultimate Tensile Strength	225 kN
Bar Yield Strength	180 kN
Tube Thickness	3.0 mm
Tube Ultimate Tensile Strength	165 kN Typical
Tube Yield Strength	140 kN Typical
Drill Bit Size	Ø43-45 mm

**BOLT TECHNICAL SPECIFICATIONS**

<b>Property</b>	<b>Minimum</b>	<b>Typical</b>
Ultimate Tensile Strength	280 kN	300 kN
Shear Strength (Calculated)	246 kN	270 kN

<b>Property</b>	<b>Maximum</b>	<b>Typical</b>
Wedge Expansion	52 mm	

<b>Part Number</b>	<b>Description</b>	<b>Weight</b>
BMG2018S	1.8 m Long MD Bolt Galvanized	10.2 kg
BMG2018S	1.8 m Long MD Bolt Black	9.8 kg
BMG2021S	2.1 m Long MD Bolt Galvanized	12.0 kg
BMB2021S	2.1 m Long MD Bolt Black	11.7 kg
BMG2024S	2.4 m Long MD Bolt Galvanized	13.2 kg
BMB2024S	2.4 m Long MD Bolt Black	12.9 kg
BMG2030S	3.0 m Long MD Bolt Galvanized	16.5 kg
BMB2030S	3.0 m Long MD Bolt Black	16.2 kg

# MDX BOLT



## INTRODUCTION

Designed and developed in Australia for underground hard rock mines. The D47 Mechanical Dynamic Extra (MDX Bolt) has unparalleled "extra expansion" for extremely effective anchorage using the unique wedge design that is able to expand up to 60 mm. The D47 MDX Bolt is particularly suitable for seismic rock conditions and is the new benchmark in seismic ground support stability.

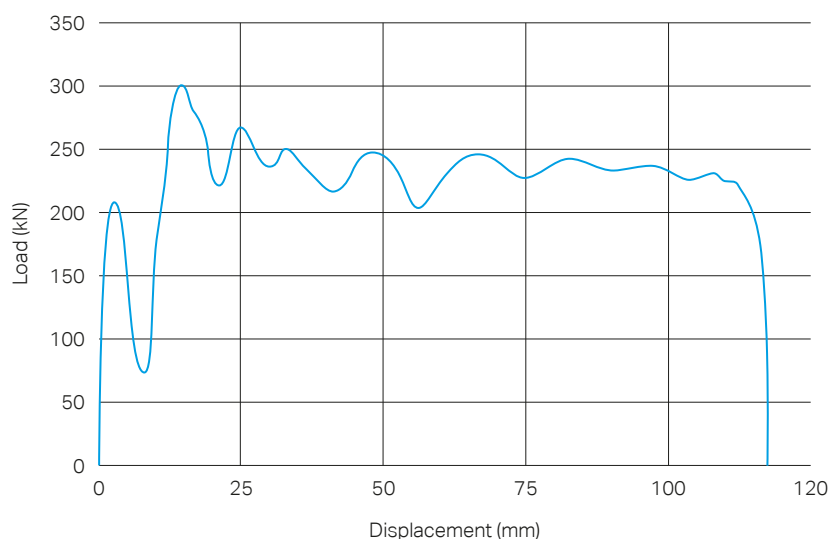
The Sandvik D47 MDX Bolt has been developed to provide strata support in a wide variety of rock conditions (weak and competent), and in particular seismic rock conditions. This development is a progression on the successful MD Bolt being used in Australian mines since 2010.

While the MDX Bolt maintains the key features of the MD Bolt, regarding the ease of installation (single pass with no grout), its performance in both the seismic and very weak rock conditions has been significantly improved.

## MDX BOLT FEATURES

- A universal bolt suitable for broken, very weak, strong and seismic rock conditions
- A very quick and simple "one-pass" installation-same as the MD Bolt
- No resins or grouts required, making it far easier to install, able to hammer straight in through wet and broken ground with no complications
- Easily installed with standard jumbo tools
- Unique wedge design
- Unique yield design capable of absorbing very high dynamic loads
- High tensile and shear strength
- Fully galvanized for corrosion protection
- The stopper safety device arrests bar ejection
- The bottom of the tube is sealed to prevent atmospheric corrosion
- Low profile head, no protrusion below the nut
- Accessories can be screwed directly onto the installed bolts
- Bolt installation quality apparent to operator
- These bolts are available in a range of sizes from 1.8 m, 2.1 m, 2.4 m, 3.0 m, 3.8 m and 4.0 m

### TYPICAL MDX BOLT RESPONSE TO DYNAMIC LOADING



#### COMPONENT PROPERTIES

Characteristic	Value
Bar Diameter	Ø20 mm
Bar Elongation (5D)	22%
Bar Rolled Thread	M22x2.5 LH
Tube Thickness	2.5 mm
Drill Bit Size	Ø43-45 mm

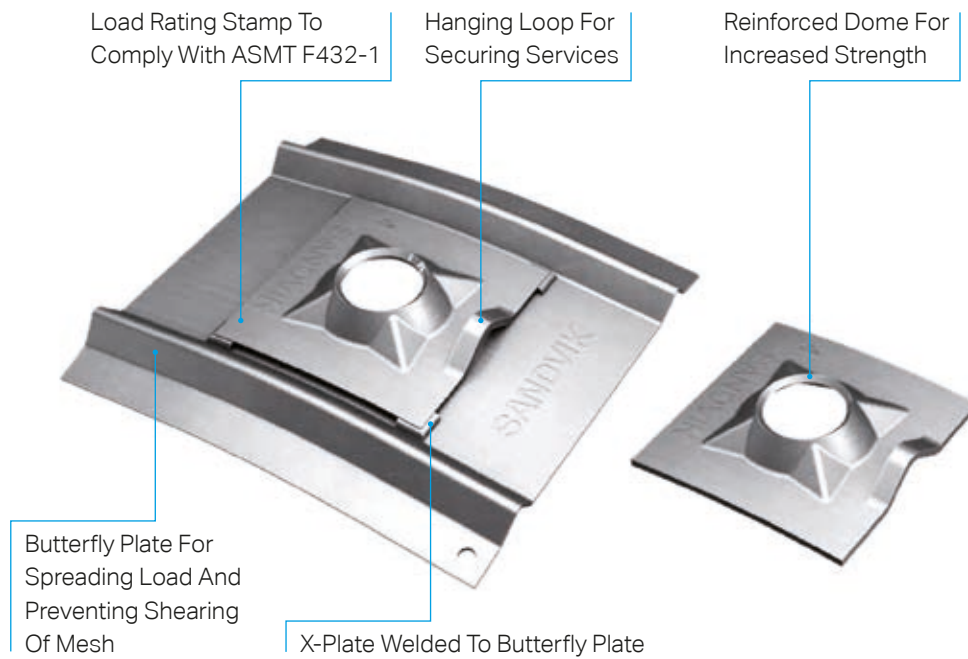
#### BOLT TECHNICAL SPECIFICATIONS

Property	Minimum	Typical
Ultimate Tensile Strength	205 kN	225 kN
Yield Strength	155 kN	181 kN
Shear Strength (Calculated)	255 kN	246 kN
Dynamic Capacity	28 kJ	30 kJ
Dynamic Displacement	129 mm	142 mm

Property	Maximum	Typical
Wedge Expansion	60 mm	

Part Number	Description	Weight
BXG4718	1.8 m Long MDX Bolt Galvanized (47 mm)	9.5 kg
BXG4721	2.1 m Long MDX Bolt Galvanized (47 mm)	10.9 kg
BXG4724	2.4 m Long MDX Bolt Galvanized (47 mm)	12.3 kg
BXG4730	3.0 m Long MDX Bolt Galvanized (47 mm)	15.4 kg
BXG4738	3.8 m Long MDX Bolt Galvanized (47 mm)	19.4 kg
BXG4740	4.0 m Long MDX Bolt Galvanized (47 mm)	20.5 kg

# SANDVIK X-PLATE



## INTRODUCTION

The new X-Plate from Sandvik is specifically developed to offer cutting-edge ground support in seismic ground conditions, and to complement the MDX bolts.

The Sandvik X-Plate can absorb more energy thanks to its stronger plate and improved design, compared to current versions of the rock plates and combination plates, while at the same time being a thinner material.

Test results, conducted in both static and dynamic test rigs, show that the X-Plate can absorb 22% more load than a standard product in static loading conditions, and 54% more energy in dynamic loading conditions.

## BENEFITS

- State-of-the art rock plate, designed to improve performance in seismic conditions
- Increased product strength during a seismic event providing more energy absorption
- When tested in accordance with ASMT F432-19, the X-plate meets grade rating '4'

## SUSTAINABLE SOLUTION

The new X-Plate is a more sustainable solution than a standard rock plate. The X-Plate requires 14% less steel in manufacturing, which represents great CO<sub>2</sub> savings in both manufacturing and shipping.

Test results and calculations are to be considered as results reached under certain and controlled conditions. These test results and calculations should not be treated as specifications and Sandvik does not guarantee, warrant or represent the outcome of test results or calculations in any or all circumstances.

# POSIMIX RESIN BOLT SYSTEM

## PRODUCT CODE GUIDE

Bolt Type	Diameter	Length	Drive Nut And Accessories	Coating	Packaging
TB	2	240	DFPHHPDB1	G	

## PHYSICAL PROPERTIES

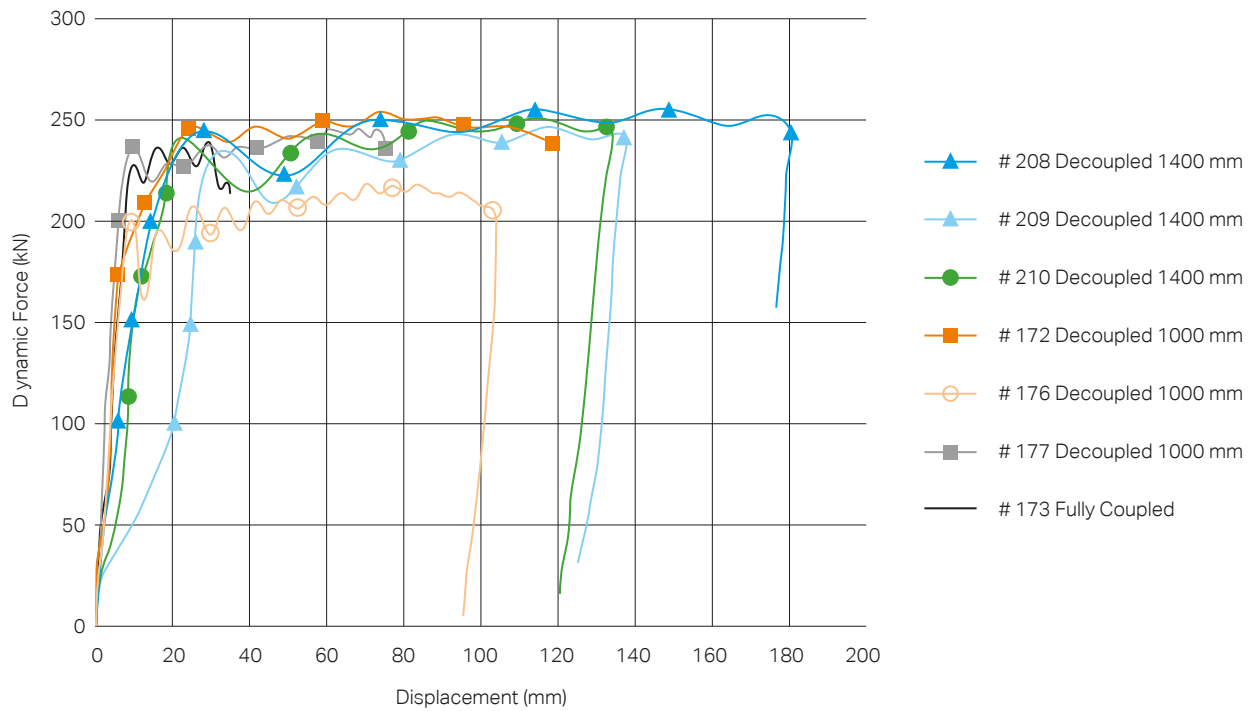
Characteristic	Minimum		Typical	
Yield Strength	540 MPa	160 kN	615 MPa	185 kN
Tensile Strength	600 MPa	195 kN	725 MPa	215 kN
Calculated Shear Strength	120 kN	120 kN	130 kN	130 kN
Standard Elongation	16%	16%	19%	19%
Uniform Elongation	12%	12%	12%	12%
Mass Per Metre	2.47 kg	2.47 kg	2.47 kg	2.47 kg
Bar Diameter	20.0 mm	20.0 mm	20.0 mm	20.0 mm
Cross Sectional Area Of Bar	300 mm <sup>2</sup>	300 mm <sup>2</sup>	300 mm <sup>2</sup>	300 mm <sup>2</sup>
Major Bar Diameter	22.1 mm Maximum	22.1 mm Maximum	22.1 mm Maximum	22.1 mm Maximum



## KEY FEATURES

- The 20 mm debonded Posimix bolt system is designed to allow for a specified amount of ground deformation according to the rock mass demand requirements.
- The system is fully resin encapsulated with various debonded lengths available on the bolt for particular mining situations.
- The debonded region of the bolt means the majority of the energy is dissipated by deformation of the bolt within this region.
- The debonded Posimix section is provided in lengths of 1.0 m-1.4 m for most practical mining applications.
- Extensive dynamic testing has been completed by the WA School of Mines.
- The Posimix bolting system was designed to assist in the installation of rock bolts with chemical anchors in larger diameter holes 35-38 mm by providing:
  - Substantially enhanced mixing of the chemical anchors
  - Increased load transfer capabilities
  - Ability to be installed with a face jumbo as well as hand held machines
- The Posimix device centralizes the bolt in the hole allowing an even distribution of the chemical anchor around the bolt. It also acts as an Archimedes screw pump forcing the chemical towards the back of the hole, assisting in mixing whilst consolidating the anchor for improved load transfer properties.
- Recommended hole size is 35-38 mm in diameter.
- Corrosion protection alternatives to hot dip galvanizing may be provided.

## DYNAMIC LOAD-DISPLACEMENT RESPONSE ON VARIOUS DECOUPLED POSIMIX CONFIGURATIONS



### ENERGY DISSIPATION – POSIMIX BOLTS

Sample Number	Bolt Length (mm)	Debonded Length (mm)	Deformation At Discontinuity (mm)	Energy Dissipated (kJ)	Test Result	Demand Category Application
173	2400	0	35	7	Rupture	Low
172	2400	1000	115	26	Rupture	Medium
176	2400	1000	96	21	Stable	Medium
177	2400	1000	77	27	Rupture	Medium
208	2400	1400	171	42	Stable	High
209	2400	1400	113	29	Stable	High
210	2400	1400	128	33	Stable	High

### INSTALLATION GUIDELINES

- The rock bolt hole is drilled as per mine support designs.
- Hole depth is critical. Hole depth should be shorter than the bolt to allow for the height of the washer and nut.
- After insertion of the resin anchors the bolt is rotated through the anchors while being pushed to the back of the hole. In the case of full encapsulation, anchors of different setting times are often used and the higher speed anchor is to be inserted first followed by the slower speed anchors.
- It is important to follow the resin anchor recommended mixing and hold times as printed on the resin anchor cartons. Do not over mix.







To watch a video demonstration of the Posimix Bolt product, scan the above code with a QR Code Scanning App available on your smartphone.





#### PRODUCT ACCESSORIES EXAMPLES

Product Group	Products			
	Star Plate	Dome Plate	Butterfly Plate	OSRO® Strap
Product Imagery				
Product Code Prefix	STP	D	BUTT	OS

- DSI Underground, a Sandvik company manufactures a comprehensive range of plates specifically designed for this range of bolts.

#### STANDARD LENGTH AND PACKAGING

- Standard bolt lengths range from 1500 to 3000 mm in 300 mm increments.
- Non-standard lengths are available by negotiation.
- Bolts are packaged in bundles with threads protected by heavy duty polyethylene bags.
- Bolt fittings, such as nuts, anti-friction washers and dome balls, are supplied fitted to rock bolts in the configuration requested.

#### NOTES

- Only DSI ground support rock bolt components should be used to enable the optimum performance of the bolt system to be obtained.
- Assistance should be sought from our DSI ground support technical services engineers in selection of the correct bolt for the application together with its product code.
- DSI Underground, a Sandvik company is Quality Assured to ISO 9001:2015.

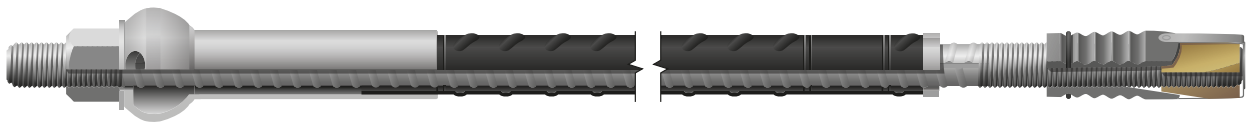
# CT CORROSION PROTECTED MECHANICAL BOLT

## PRODUCT CODE GUIDE

Bolt Type	Bell Type	Length	Thread Length	Thread Type
CT	SS	400	15065	LH

## PHYSICAL PROPERTIES

Characteristic	Minimum		Typical	
Yield Strength	600 MPa	220 kN	650 MPa	240 kN
Tensile Strength	840 MPa	310 kN	920 MPa	340 kN
Calculated Shear Strength	205 kN	205 kN	225 kN	225 kN
Elongation (After Fracture)	13%	13%	15%	15%
Mass Per Metre	2.92 kg	2.92 kg	2.92 kg	2.92 kg
Bar Core Diameter	21.7 mm	21.7 mm	21.7 mm	21.7 mm
Major Bar Diameter	23.2 mm	23.2 mm	23.2 mm	23.2 mm
Cross Sectional Area	370 mm <sup>2</sup>	370 mm <sup>2</sup>	370 mm <sup>2</sup>	370 mm <sup>2</sup>
Rolled Thread	M24 x 3.0 mm Pitch	M24 x 3.0 mm Pitch	M24 x 3.0 mm Pitch	M24 x 3.0 mm Pitch



## KEY FEATURES

- The CT Bolt is designed to be used with cementitious grout or resin.
- The bolt is provided with an expansion shell for preloading, thus allowing for tunnel or mine heading to advance without immediate grouting.
- Grout Bell allows for grouting after preloading.
- Anti-corrosion tube over full length of bolt for long life term protection.
- Available in differing material forms to suit design requirements.

## INSTALLATION GUIDELINES

- Drill 43-45 mm hole diameters. The drill hole length must be longer than the bolt by approximately 50 mm.
- Domed washer plate is fitted to the bolt.
- The bolt is inserted into the hole.
- After placing the bolt in the hole to its full length, the bolt is then rotated to set the expansion shell to the required tension. DSI ground support recommend no more than 55 kN.
- Attach grouting adaptor to grout bell.
- Mix 0.33 to 0.35 W/C grout. Pump grout. Grout is pumped through the inner annulus to the bolt end and returns along the outer annulus.
- Terminate grouting with visible grout return.
- Detach adaptor and proceed to the next bolt.

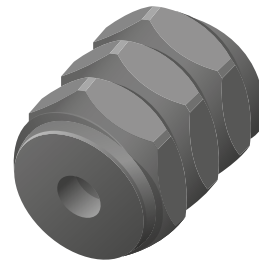
### STANDARD LENGTH AND PACKAGING

- Standard bolt lengths range from 1200 to 9000 mm in increments of 300 mm.
- Non-standard lengths are available upon request.
- Bolts are packaged in bundles with threads protected by heavy duty polyethylene bags.

- All bolts are supplied fitted with accessories with the exclusion of washer plates which are supplied loose.
- Detach adaptor and proceed to next bolt.

### OPTIONAL BLIND NUT END

- No thread protruding below nut
- Reduce bolt tail protruding below roofline
- Existing bolts can be pull tested without need for special pull rings – the pull test coupler threads straight onto the exterior nut thread
- Standard hex nut size – standard bolt dolly's
- Exterior thread exceeds 300 kN



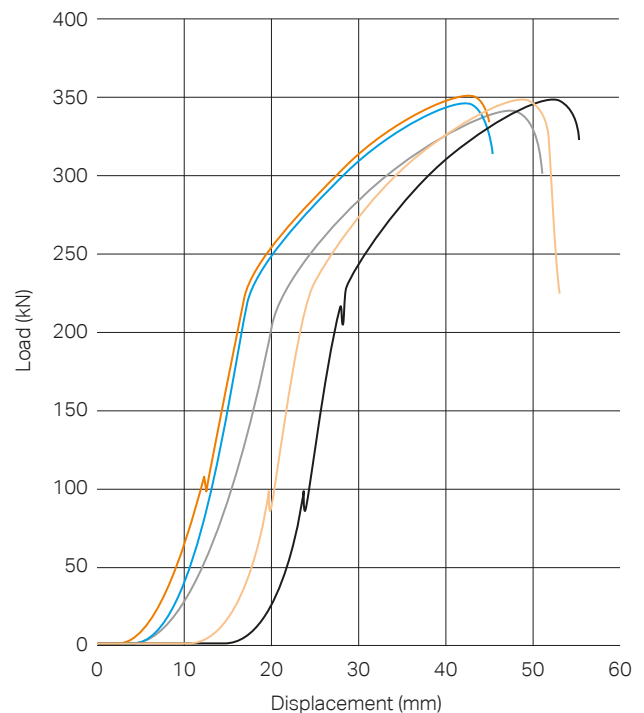
### VALIDATION

- The five tests indicated that the external thread and coupling can transfer a typical tensile load of the bar, being 340 kN. Note: the variation in the displacement is due to the take up of the coupling and the gripping of the grips on the bar.

### NOTES

- Only DSI Underground, a Sandvik company rock bolt components should be used to enable the optimum performance of the bolt system to be obtained.
- DSI Underground, a Sandvik company is Quality Assured to ISO 9001:2015

### PULL TEST RESULT



— Test 20171058    — Test 20171207    — Test 20171208  
 — Test 20171209    — Test 20171210

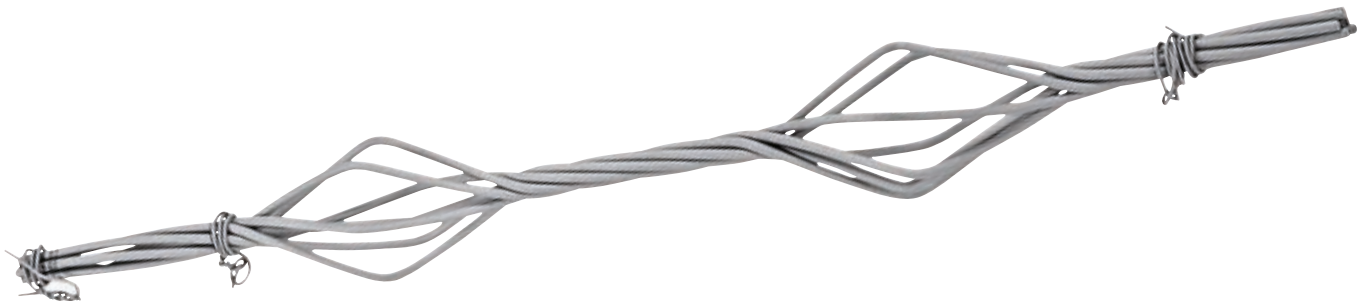
# CABLE BOLT BULBED CUT TO LENGTH

## PRODUCT CODE GUIDE

Bolt Type	Strands	Bulbs / Meter	Length	Tails Type	Packaging	Tail Length
CB	D/S	1B	060	D	C	05

## PHYSICAL PROPERTIES

Characteristic	Minimum	Typical
Yield Load At 0.2% Elongation – Single / Twin Strand	212 kN / 424 kN	250 kN / 500 kN
Tensile Strength – Single / Twin	250 kN / 500 kN	265 kN / 530 kN
Elongation On 600 mm Gauge Length	3.5%	6.5%
Barrel And Wedge Tensile Load (Linear)		245 kN
Mass Per Metre	1.13 kg	1.13 kg
Nominal Cross Sectional Area	143 mm <sup>2</sup>	143 mm <sup>2</sup>
Nominal Strand Diameter	15.2 mm	15.2 mm



## KEY FEATURES

- Manufactured from stress relieved, low relaxation, high strength 15.2 mm diameter 7 wire steel strand the cable bolt is formed by bulbing the strand into small cages, typically 26-28 mm diameter, and at 1 bulb per metre.
- It is a highly flexible product that can be tailored to suit site requirements. It can be manufactured with or without bulbs, bulb frequency can be modified, and de-bonding tube can be added to change the installed cable stiffness performance.
- The bulbed cable bolt is supplied in either single, double or in combination forms. Single bulbed plus single plain cable. They are supplied in nominated lengths for grouting into holes from 35 mm to 105 mm diameter.
- Can be used with cementitious grouts as well as resin anchors when early support is required.
- For up hole applications involving cementitious grout, cable bolts are fitted with a spring wire "fish hook" to hold the cable bolt at the top of the drill hole. Cementitious grout can then be emplaced either top-down or bottomup.
- Surface confinement is usually provided by flat or domed plates and barrel and wedge anchors. For accessories refer to appropriate pages for slotted or multiple hole plates, barrel and wedge anchors, cable bolt spacers, grout and breather tubes.


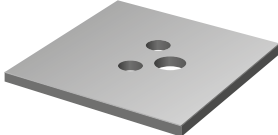

**STANDARD LENGTH AND PACKAGING**

- Standard bolt lengths range from 3000-30000 mm in 300 mm increments.
- Specialised requirements are available by negotiation.
- Bulbed cable bolts are normally supplied in straight lengths up to 6 metres and bundled. Cables over this length are usually coiled.

**INSTALLATION GUIDELINES**

- In coal mining applications the preferred hole diameters are 35/36 mm for single bulbed cable bolts and 50 mm for double bulbed cable bolts.
- Holes are drilled approximately 200 mm shorter than the bolt length. If the bolts are to be tensioned a tail of between 200 to 500 mm is required dependent on the type of tensioning unit to be used.
- For cementitious grouting, the bulbed cable bolt is prepared by attaching a breather tube to the full length of the bolt. Allow for greater than 2 metres of breather tube to protrude into the roadway from the bottom of the drill hole. Similarly, attach an adequate length of grout emplacement tube to the bottom of the cable for connection to the pump.
- The bulbed cable bolt is inserted into the drill hole and the drill hole collar is sealed to eliminate the loss of grout when pumping. Optimal grout migration and cable encapsulation requires a good drill hole seal at the collar.
- Connect the grout tube to the pump. The air bleed (breather) tube is placed into a container of water and pumping commenced. Air bubbles will exhaust from the breather tube while pumping and be visible in the water container.
- When the hole is full of grout these air bubbles will cease to flow.
- After the grout has cured the bolt can be tensioned to approximately 10 tonnes to provide surface confinement. Resin pointanchored single cables can be tensioned to 20 tonnes.

**TYPICALLY USED PRODUCTS WITH THESE ITEMS ARE**

Product Group	Products		
	Tensioner	Plate	Barrel And Wedge
Product Imagery			
Product Code Prefix	TEN	FCB	BLW

**NOTES**

- Only DSI Underground, a Sandvik company rock bolt components should be used to enable the optimum performance of the bolt system to be obtained.
- DSI Underground, a Sandvik company is Quality Assured to ISO 9001:2015.

# CABLE BOLT 15.2 MM

DELIVERED IN REELS – PLAIN WITH BULBS

Manufactured from stress-relieved, low relaxation, high strength 15.2 mm diameter 7 wire steel strand, the cable bolt is formed by bulging the strand into small cages, typically 26 to 28 mm diameter. They are available in varied lengths and configurations: cable bolts can be plain or equipped with bulbs to increase the bonding strength between steel and surrounding grout. Bulbs are normally

equally spaced along the cable, following the customer's requirement.

DSI Underground, a Sandvik company has developed a complete system complete with cone-and-barrels, face plates, and tensioning devices.

## TECHNICAL SPECIFICATIONS CABLE BOLT Ø15.2 MM

Physical Properties	Values	
	Minimum	Typical
Nominal Strand Diameter	15.2 mm	15.3 mm
Nominal Cross-Sectional Area	139 mm <sup>2</sup>	140 mm <sup>2</sup>
Nominal Mass Per Meter	1.10 kg/m	1.10 kg/m
Standard	prEN10138-3 1860 MPa	prEN10138-3 1860 MPa
Ultimate Load Cable Bolt <sup>1)</sup>	260 kN	298 kN
Ultimate Load Cable Bolt System <sup>2)</sup>	230 kN	255 kN
Characteristic Value Of 0.1 % Proof Force	223 kN	223 kN
Elongation A <sub>gt</sub>	≥ 3,5 %	≥ 3,5 %
Total Length L = L1	1500 ÷ 8000 mm	1500 ÷ 8000 mm
Bulb Diameter <sup>3)</sup>	Ø26 mm	Ø26 ÷ Ø34 mm
Spacing Between Bulbs L3	500 mm	1000 ÷ 2000 mm
Length From Beginning L2	200 mm	1000 mm

1) Nominal value ultimate load: cable bolt.

2) Nominal value ultimate system load: cable bolt, face plate, wedge, and barrel.

3) Other dimensions available on request.

## KEY FEATURES

- System fit for fully mechanized cable bolting rigs, thanks to customized reel dimensions.
- Manufactured from stress relieved, low relaxation, high strength 15.2 mm diameter 7 wire steel strand the cable bolt is formed by bulging the strand into small cages, typically 26-28 mm diameter, and at 1 bulb per meter.
- The cable bolt bulbs can be modified, in frequency and diameter, so that geotechnical engineers are able to design specific reinforcement products to suit the ground conditions being encountered.
- Grouting hose with contact nipple STECKO DN10 (PN-G-32000).
- Surface confinement is usually provided by flat or domed plates and barrel, wedge anchors.
- Full system, complete with appropriate cones-and-barrel system and heavy-duty face plate.

## WEDGE AND BARREL GRIP SYSTEM

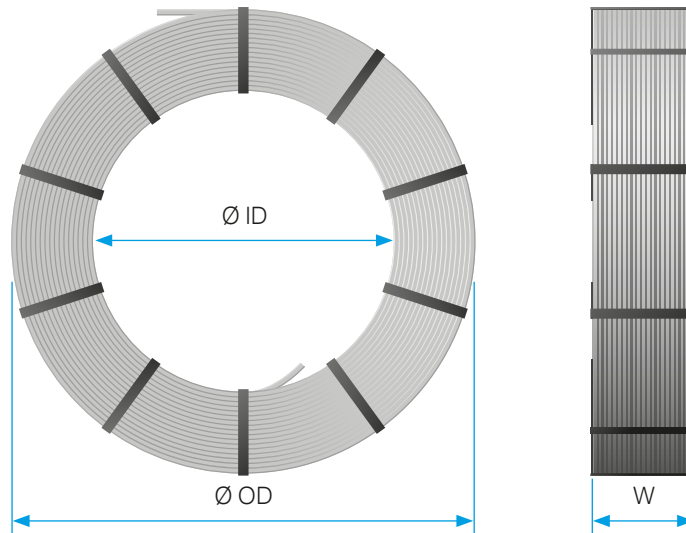
- 3-wedge system for maximized grip
- Minimal ultimate cable bolt system ≥ 230 kN
- Barrel dimensions Ø42 x 46 mm

### FACE PLATE

- Standard face plates:
  - Flat plate 150x150x08-021 with central hole Ø21.5 mm S235
  - Domed plate 150x150x08-030 with central hole Ø30 mm S235 & hemispherical washer
- Face plates can be provided with corrosion protection using zinc coating (HDG ISO 1461).

### DELIVERIES AND PACKAGING

- DSI Underground, a Sandvik company is committed to deliver coils to all available mechanized cable-bolting rigs. Different reel configurations are available upon request with bulbs or plain.
- Minimum / maximum inner diameter 780/900 mm\*\*
- Minimum / maximum outer diameter 1000/1400 mm\*\*
- Reels available in the left-hand wind



### 7 WIRE HD CABLE BOLT 15.2 MM – REELS\*\*

Type	Ø OD (mm)	Ø ID (mm)	Height (mm)	Length (m)	Weight (kg)
#1	1400	840	360	~1350	1500
#2	1300	840	300	~1200	1300

\*\* All dimensions, weights, quantities, and specifications are those applicable at the time of publication and may be amended at any time.

# HEAVY DUTY CABLE BOLT 18 MM

DELIVERED IN REELS – PLAIN OR WITH BULBS

Cable Bolts Ø18 mm are a valid alternative whenever the performance of the most common 15.2 mm cable is considered insufficient. This is particularly true when cables are installed by fully mechanized drilling and bolting rigs. In this case, the cable is delivered in special reels, fit for such equipment (such as Sandvik DS421 or Epiroc Cabletec). Cable bolts can be plain or equipped with bulbs to increase

the bonding strength between steel and surrounding grout. Bulbs are normally equally spaced along the cable, following the customer's requirement.

Only DSI Underground, a Sandvik company has developed a complete system with cone-and-barrels, face plates, and tensioning devices.

## TECHNICAL SPECIFICATIONS 7 WIRE HEAVY DUTY CABLE BOLT Ø18 MM

Physical Properties	Values	
	Minimum	Typical
Nominal Strand Diameter	17.8 mm	18 mm
Nominal Cross-Sectional Area	190 mm <sup>2</sup>	200 mm <sup>2</sup>
Nominal Mass Per Meter	1.56 kg/m	1.6 kg/m
Standard	prEN10138-3 1770 MPa	ASTM A 416M 1860 MPa
Ultimate Load Cable Bolt <sup>1)</sup>	354 kN	Max. 407 kN
Ultimate Load Cable Bolt System <sup>2)</sup>	320 kN	348 kN
The Characteristic Value Of 0.1 % Proof Force <sup>4)</sup>	~304 kN	~304 kN
Elongation A <sub>gt</sub>	≥ 3.5 %	≥ 3.5 %
Total Length L = L1	1500 ÷ 8000 mm	1500 ÷ 8000 mm
Bulb Diameter d1 <sup>3)</sup>	Ø26 mm	Ø26 ÷ Ø30 mm
Spacing Between Bulbs L3	500 mm	1000 ÷ 2000 mm

1) Nominal value ultimate load: cable bolt (prEN10138-3 1770 MPa).

2) Nominal value ultimate system load: cable bolt, face plate, wedge, and barrel.

3) Other dimensions available on request.

4) Refers to prEN10138-3 1770 MPa.

### MAIN ADVANTAGES

- High loading capacity (ca. 40% more than a regular 15.2 mm cable) at the low weight per meter
- Ideal for deep mines or difficult ground conditions
- Ideal to use as a single cable, facilitating tensioning operations (efficient alternative to twin 15.2 mm cables)
- System fit for fully mechanized cable bolting rigs, thanks to customized reel dimensions
- Full system, complete with appropriate cones-and-barrel system and heavy-duty face plate

### WEDGE AND BARREL GRIP SYSTEM

- 3-wedge system for maximized grip
- Steel grade 41Cr4 y 20MnCr5 in line with UNE EN ISO 683 2 or equivalent
- Nominal load capacity of the grip system = 320 kN
- Domed barrel available upon request
- Barrel dimensions Ø42 x 46 mm





### FACE PLATE

- Standard face plates:
  - Flat plate 150x150x10-021 with central hole Ø21.5 mm S235
  - Domed plate 150x150x10-030 with central hole Ø30 mm S235 & hemispherical washer
- Face plates can be provided with corrosion protection using zinc coating (HDG ISO 1461).

### DELIVERIES AND PACKAGING

- DSI Underground, a Sandvik company is committed to deliver coils to all available mechanized cable-bolting rigs. Different reel configurations are available upon request with bulbs or plain.
- Minimum / maximum inner diameter 800/900 mm\*\*
- Minimum / maximum outer diameter 990/1400 mm\*\*
- Reels available in the left-hand wind



### 7 WIRE HD CABLE BOLT 18 MM – REELS\*\*

Type	Ø OD (mm)	Ø ID (mm)	Height (mm)	Length (m)	Weight (kg)
#1	1300	800	300	~520	830
#2	1400	900	350	~915	1450
#3	990	800	760	~690	1095

\*\* All dimensions, weights, quantities, and specifications are those applicable at the time of publication and may be amended at any time.

# PADDLE BOLT THREAD BAR 25 MM

## PRODUCT CODE GUIDE

Bolt Type	Diameter	Length	Drive Nut And Accessories	Paddles	Coating	Packaging
PTB	5	240	DFPH	P5	G	050

## PHYSICAL PROPERTIES

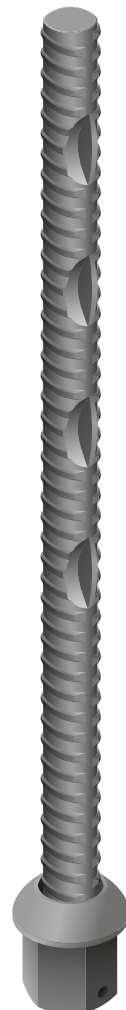
Characteristic	Minimum		Typical	
	Yield Strength	500 MPa	245 kN	550 MPa
Tensile Strength	630 MPa	309 kN	700 MPa	340 kN
Elongation (After Fracture)	15%	15%	18%	18%
Mass Per Metre	4.10 kg	4.10 kg	4.10 kg	4.10 kg
Bar Core Diameter	Ø25 mm	Ø25 mm	Ø25 mm	Ø25 mm
Major Bar Diameter	Ø28.5 mm	Ø28.5 mm	Ø28.5 mm	Ø28.5 mm
Cross Sectional Area	490.9 mm <sup>2</sup>	490.9 mm <sup>2</sup>	490.9 mm <sup>2</sup>	490.9 mm <sup>2</sup>
Rolled Thread	Continuous Coarse	Continuous Coarse	Continuous Coarse	Continuous Coarse

## KEY FEATURES

- The 25 mm thread bar bolt is manufactured from hot rolled reinforcing bar having a left hand continuous helix thread form.
- The bolt has paddle indents at one end to aid cartridge shreading and resin mixing. The bolt can be supplied without paddles – refer to TB5 data sheet.
- The paddle bolt is usually fully encapsulated with resin anchors but can be effectively used with cementitious grouts.
- Corrosion protection may be provided by galvanizing or various Obduro coatings.
- Various length debonding tube can be fitted for dynamic strata situations.
- Recommended hole size is 35-38 mm in diameter.

## INSTALLATION GUIDELINES


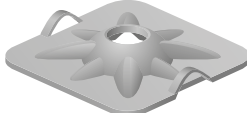
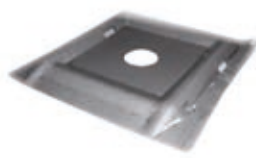

- Nominal 35 mm rock bolt hole is drilled or per mine support designs.
- Hole depth is critical. Hole depth should be shorter than the bolt to allow for the height of the washer and nut.
- After insertion of the resin anchors the bolt is rotated through the anchors while being pushed to the back of the hole. In the case of full encapsulation, anchors of different setting times are often used, and the higher speed anchor is to be inserted first followed by the slower speed anchors.
- It is important to follow the resin anchor recommended mixing and hold times as printed on the resin anchor cartons. Do not over mix.



**STANDARD LENGTH AND PACKAGING**

- Standard bolt lengths range from 600 mm to 3000 mm in 300 mm increments.
- Non-standard requirements are available by negotiation.
- Bolts are packaged in bundles of 50 with sub bundles available on request.
- Bolt fittings such as nuts, anti-friction washers and domed balls, are supplied fitted to rock bolts in the configuration requested.

**TYPICALLY USED ACCESSORIES**

Product Group	Products			
	Star Plate	Octo Plate	Butterfly Plate	Resin
Product Imagery				
Product Code Prefix	STP	OCT	BUTT	RC

**NOTES**

- Only DSI ground support rock bolt components should be used to enable the optimum performance of the bolt system to be obtained.
- Assistance should be sought from our DSI ground support technical services engineers in selection of the correct Posimix bolt for the application together with its product code.
- DSI Underground, a Sandvik company is Quality Assured to ISO 9001:2015.

# SOLID DEFORMED PADDLE BOLT 25 MM

## PRODUCT CODE GUIDE

Bolt Type	Diameter	Length	Fittings	Pin	Thread	Paddles	Coating	Packaging
PCS	5	240	DFP3	HH	LH	P5	G	050

## PHYSICAL PROPERTIES

Characteristic	Minimum		Typical	
	Yield Strength	540 MPa	244 kN	640 MPa
Tensile Strength	625 MPa	282 kN	700 MPa	323 kN
Calculated Shear Strength	169 kN	169 kN	193 kN	193 kN
Elongation (After Fracture)	6 %	6 %	20 %	20 %
Tensile Strength Of Threaded End	245 kN	245 kN	245 kN	245 kN
Mass Per Metre	3.55 kg	3.55 kg	3.55 kg	3.55 kg
Major Bar Diameter	27.0 mm	27.0 mm	27.0 mm	27.0 mm
Bar Core Diameter	23.0 mm	23.0 mm	23.0 mm	23.0 mm
Cross Sectional Area	452 mm	452 mm	452 mm	452 mm
Thread	1" [UNC]	1" [UNC]	1" [UNC]	1" [UNC]

## KEY FEATURES

- The solid deformed bolt is manufactured from hot rolled reinforcing bar having rib deformations generally in a "herringbone" form.
- The Bolt has a 1" UNC rolled thread at one end and four (4) paddle indents at the other end.
- The solid deformed bolt is usually fully encapsulated with resin anchors, but can be effectively used with cementitious grouts.
- Corrosion protection may be provided by thermal diffusing or thermal metal spray coating or in conjunction with X60 Thermoplastic coating.

## INSTALLATION GUIDELINES



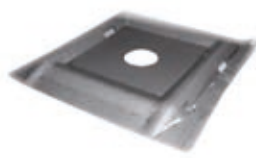

- 33-35 mm hole diameters are preferred when incorporated with the DSI ground support paddle
- Hole depth is critical. Hole depth should be shorter than the bolt to allow for the height of the washer and nut.
- It is important to follow the resin anchor recommended mixing and hold times as printed on the resin anchor cartons. Do not over mix.



**STANDARD LENGTH AND PACKAGING**

- Standard bolt lengths range from 600 to 3000 mm in 300 mm increments.
- Non-standard lengths are available on application.
- Bolts are packaged in bundles with threads protected by heavy duty polyethylene bags.
- Bolt fittings, such as nuts, antifriction washers and domed balls, are supplied fitted to rock bolts in the configuration requested.

**TYPICALLY USED ACCESSORIES**

Product Group	Products			
	Star Plate	Dome Plate	Butterfly Plate	W-Strap
Product Imagery				
Product Code Prefix	STP	D	BUTT	MW

**PRODUCT ACCESSORIES EXAMPLES**

- DSI Underground, a Sandvik company manufactures a comprehensive range of plates specifically designed for this range of bolts.

**NOTES**

- Only DSI Underground, a Sandvik company rock bolt components should be used to enable the optimum performance of the bolt system to be obtained.
- DSI Underground, a Sandvik company mining products division is Quality Assured to ISO 9001:2015.

# EXPANSION SHELL

## PRODUCT CODE

Designator	Size	Type
ASES	20	STD

## PHYSICAL PROPERTIES





Bolt Diameter (mm)	Thread Size	Nominal Hole Diameter (mm)	Shell Length (mm)	Wedge Length (mm)	Net Weight (kg)
16	M16	26	45	41	0.12
16	M16	30	54	50	0.15
20	M20	35	83	54	0.24
24	M24	45	83	57	0.60
22.7	U227	45	83	57	0.60



## KEY FEATURES

- DSI Underground, a Sandvik company expansion shells hold in any rock strata which is sufficiently competent to provide an adequate anchorage. They are designed to anchor in soft ground or hard rock. In good strata the anchorage exceeds the ultimate strength of the steel bolt. All expansion shells require a competent strata in the anchor zone. The suitability of the anchorage and the specific expansion shell to be used is best determined by physical load testing.
- The expansion shells feature parallel contact with the hole wall with sharp serrations on the outside leaves ensure positive holding power.
- The expansion shell assembly is securely held by a strong protective sleeve, to save installation time and prevent loss of parts while handling. The sleeve must be removed prior to installation.
- Corrosion protection may be provided by hot dip galvanizing (AS/NZ4680) or zinc plated to AS1789.

**TYPICALLY USED ACCESSORIES**

Product Group	Products			
	Star Plate	Double Ended Bolt	Butterfly Plate	W-Strap
Product Imagery				
Product Code Prefix	STP	DS2	BUTT	MW

**PRODUCT ACCESSORIES EXAMPLES**

- DSI Underground, a Sandvik company manufactures a comprehensive range of plates specifically designed for this range of Bolts.

**PACKAGING**

- All 16 mm expansion shells are contained in cardboard boxes then packed on pallets.

**NOTES**

- Only DSI Underground, a Sandvik company rock bolt components should be used to enable the optimum performance of the bolt system to be obtained.
- DSI Underground, a Sandvik company is Quality Assured to ISO 9001:2015, ISO 14001:2015 and AS-NZS 4801:2001.



# FASLOC® S RESIN BOLTING

## KEY FEATURES

The FASLOC® S resin cartridges are manufactured from a sophisticated blend of reinforced polyester resins. Standard, single-speed resin cartridges utilize a two-part mastic / catalyst arrangement. FASLOC® S cartridges enable convenient applications for short or long rock bolts where a fast cycle time is needed. During installation, the bolt rotation ruptures and shreds the foil packaging of the cartridge, enabling the key components to mix, starting a chemical reaction that transforms the resin into a solid, strong anchor.



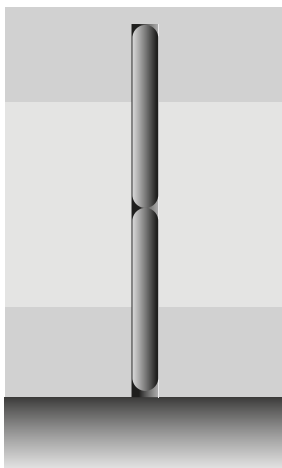
## SELECTION OF CARTRIDGE TYPE, METHOD OF USE

Insert the cartridge / cartridges to the top of the previously drilled and cleaned borehole. Selection of diameter and total length of the cartridge should be based on bolt length, diameter, and planned anchoring length.

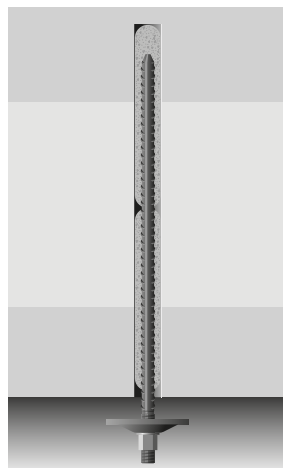
For indications see table 1 on the next page or ask your DSI ground support representative. Then insert the bolt attached to the bolting machine and mix the resin and catalyst components, rotating and moving the bolt up to the bottom of the borehole. After the mixing, hold the bolt until the resin is set, then turn the nut (see pictures 1-5).

Table 2 on the next page shows estimated mixing and hold times, depending on the cartridge type and rotational speed of bolting equipment, at a temperature of about 20 °C.

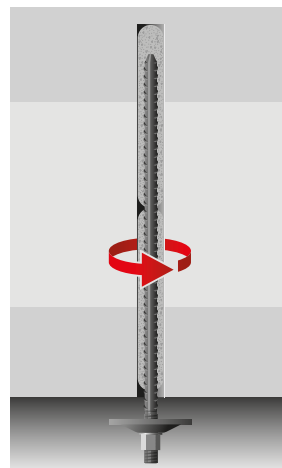
These instructions are general guidelines. Various factors affect installation, so on-place tests should be conducted to determine actual mix and hold times. Generally, for adequate mixing, it is recommended to follow the rule of a minimum of 30 turns of the anchor.



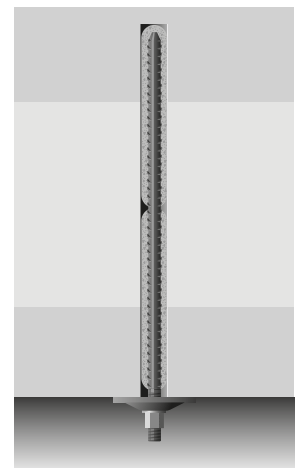
1. Insertion of required resin cartridges into a pre-drilled and cleaned borehole. Diameter, length, and quantity of cartridges depend on bolt length, bolt diameter, and bond length.



2. Insertion of the bolt into the hole to a point just below the excavation line. Slow rotation of the bolt during insertion is optional.



3. Bolt rotation.  
Note: follow rotation speed and spin time recommendations.  
30 spins at minimum.



4. Push the bolt upward with the maximum thrust available from the machine and hold until the resin cartridges set. Do not rotate after step 3 – damage to partially gelled resin may result.



**TABLE 1: SELECTION OF CARTRIDGE DIMENSIONS**

Bolt Diameter (mm)	Hole Diameter In (mm) / Cartridge Diameter In (mm) / Hole Length In (mm) per 300 (mm) Of Resin Capsule							
	25 / 23	27 / 23	27 / 24	28 / 24	28 / 25	30 / 25	30 / 25	32 / 28
16	350	-	-	-	-	-	-	-
19	490	350	380	380	330	360	-	-
22	-	-	-	470	510	370	460	350
25	-	-	-	-	-	-	-	480

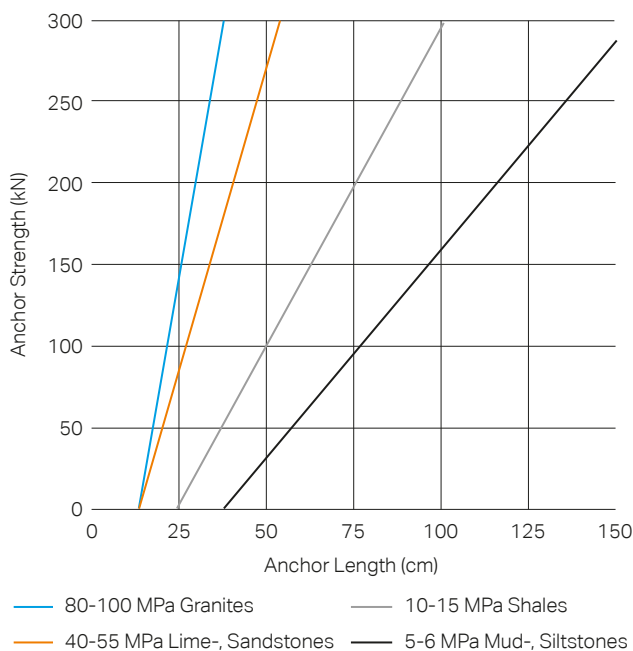
**TABLE 2: MIX AND HOLD TIMES**

Revolutions (rpm)	Mixing Time / Hold Time In Seconds							
	100	100	300	300	600	600	800	800
Gel Time Type	Mix	Hold	Mix	Hold	Mix	Hold	Mix	Hold
15	NR*	NR*	9-12	5-15	7-10	5-10	7-10	5-10
30	NR*	NR*	20-25	10-20	10-20	10-20	10-15	10-20
60	30-40	10-40	20-30	10-30	20-30	10-30	20-30	10-30
90	30-40	20-90	20-30	10-60	20-30	10-60	20-30	10-60
180	40-90	120-180	30-90	120-180	30-60	90-120	20-60	90-120
Ultra-Slow	40-240	180-600	40-240	180-600	40-240	180-600	40-240	180-600

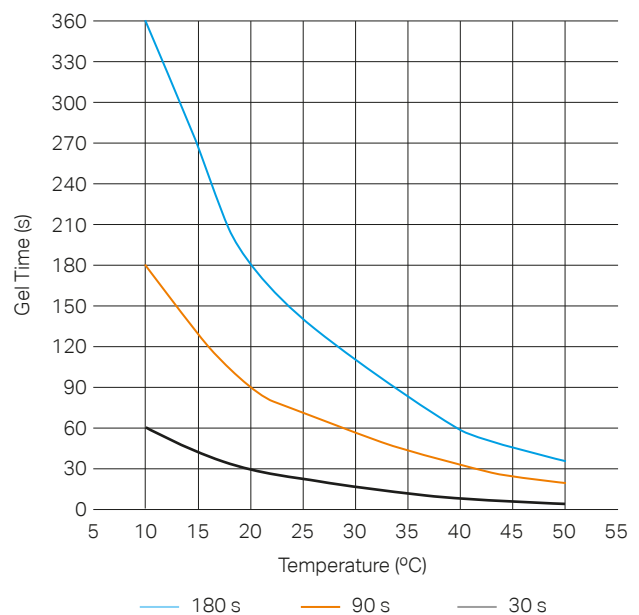
\* Not recommended

**BASIC TECHNICAL DATA**

**ROCK BOLT ANCHOR STRENGTH RELATED TO UCS OF ROCK AND ANCHOR LENGTH**



**GEL TIME RELATED TO TEMPERATURE**



# FASLOC® DUO SPEED RESIN BOLTING

## PRODUCT CODE GUIDE

Designator	Length	Diameter	Speed	Speed
RO	1000	24	F	S

## KEY FEATURES

The FASLOC® Duo Speed resin anchor is a two-part mastic and oil-based catalyst at a ratio of 11:1, pre-packaged into a single cartridge with two distinct resin gel times. This provides a separate point anchor and tension time

for rock bolting. Bolt rotation during installation ruptures and shreds the resin cartridge enabling the two key components to mix and create a chemical reaction transforming the resin into a solid anchor.

## PERFORMANCE TESTING

### PULL-OUT TEST

Age (hrs)	Load (kN)
24	210

Measured using slow set resin, 300 mm encapsulation in 60 MPa grout using 21.7 mm core diameter high tensile grade bolts in a 28 mm diameter hole.

### TYPICAL RESULTS PUNCH SHEAR TEST

Age (hrs)	Shear Strength (MPa)
24	> 22

Measured according to BS2782 (Part 3), with slow set resin.

## RESIN INSTALLATION TIMES

Resin Speed	Spin Time* (sec)	Hold Times* (sec)
Extra Fast / Slow	12	12-60
Fast / Slow	14	12-60
Medium / Slow	16	19 -60

\* Target times given for 25c, variations can occur with temperature differences, drill speeds, strata conditions, bolt profile, hole diameter, annulus and other effects.



**SHELF LIFE**

Suggested shelf life is 6 months when stored below 25c. Storage at lower temperature is recommended along with careful stock rotation based on use-by date.

**STANDARD LENGTHS AND PACKAGING**

- Standard cartridge diameters include 24 mm, 30 mm and 36 mm.
- Typical cartridge lengths range from 600-3000 mm.
- Resin cartridge parachute style retainers are available as in box accessories.

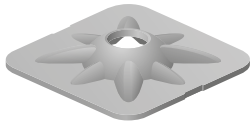


**PRODUCT ACCESSORIES EXAMPLES**

- DSI Underground, a Sandvik company manufactures a comprehensive range of products specifically designed for this range of resin.

**NOTES**

- DSI Underground, a Sandvik company is Quality Assured to ISO 9001:2015.

**TYPICALLY USED ACCESSORIES**

Product Group	Products		
	Octo Plate	Star Plate	Bolt
Product Imagery			
Product Code Prefix	OCT	STP	AKH

# HIGH ANCHORING SYSTEM

## KEY FEATURES

High Anchoring System (HAS) is designed to improve safety and simplify the process of inserting resin capsules into drilled holes, especially if they are located at a considerable height, which makes it difficult to place

the resin capsule in the borehole using standard methods. HAS is mainly intended for the mechanized anchoring process, but it can also be successfully used in a manual application.

## THE SYSTEM

**HAS** consists of the following components:

- Threaded adapter R32 (or other if needed) to be mounted on the anchoring machine
- Transparent tube
- FASLOC® SK resin capsules with a special retainer

**FASLOC® SK** consists of two resin capsules of the same size, connected by the ends. They are available in two versions:

- Single Speed: both capsules have the same gel time (depending on the customer's needs)
- Duo Speed: one of the capsules is a fast part (15-60 seconds, depending on the needs), and the other is a slow part (more than 60 seconds)

FASLOC® SK resin capsules are equipped with a special, high-strength retainer, which is delivered separately to the client or is permanently attached to the ends of the capsules in our factory. The retainer ensures that a heavy capsule (over 2 kg) is blocked in the anchor hole.

ADAPTER ATTACHED TO TRANSPARENT TUBE



FASLOC® SK DUO SPEED



FASLOC® SK SINGLE SPEED CAPSULES WITH HIGH STRENGTH RETAINER ATTACHED



FASLOC® SK DUO SPEED CAPSULES IN A BOX AND RETAINERS DELIVERED SEPARATELY



## COMPLETE HIGH ANCHORING SYSTEM



### HIGH ANCHORING SYSTEM (HAS) OFFERS THE PERFECT BALANCE OF SAFETY AND EFFICIENCY:

- Enhanced safety: HAS enables remote insertion of resin capsules, minimizing the need for workers to operate close to the anchoring site. This significant safety feature ensures your team can work confidently and securely.
- Time and effort savings: HAS eliminates the need for manual resin insertion, using lift-up basket, scaffolding or ladder, leading to significant time and resource savings. This streamlined process empowers your team to allocate efforts toward critical tasks, optimizing overall productivity.
- Reusability for optimal performance: each tube and adapter is designed for multiple uses, ensuring cost-effectiveness and top-notch performance throughout your projects.
- Versatility: HAS is compatible with most drilling rigs, making it a versatile and adaptable solution for various anchoring applications.
- Reliable resin delivery: our system guarantees the reliable delivery of undamaged resin capsules to the back of the borehole, providing a secure and durable anchoring solution.
- Quality assurance: when used with FASLOC® SK capsules, the system ensures complete and precise resin placement in one continuous operation, delivering consistent and reliable results.

### APPLICATION METHODS

#### HAS offers two convenient alternative application methods:

- Machine application: after drilling a borehole, the tube with the suspended resin capsule is attached to the anchoring machine using the adapter. Subsequent operations are carried out by skillfully controlling the anchoring machine's arm.
- Manual application: the miner stands at an appropriate elevation and inserts the tube with the suspended resin capsules into the pre-drilled hole. After insertion, the tube is removed, leaving the resin securely anchored in place with the retainer.

#### Advantages:

- Suitable for high and long anchorages, simplifying the anchoring process
- Complete anchoring in a long borehole achieved in a single operation
- Convenient and compact packaging of the resin capsules for easy transportation, supplied in a box in folded form

# WELDED WIRE MESH SHEET

## PRODUCT CODE GUIDE

Code	Coating	Wire Diameter	Aperture	Aperture	Length	Width
W	B	4/5	4	4	XX	XX
W	G	4/5	4	6	XX	XX

## PHYSICAL PROPERTIES

		Minimum Ultimate Tensile			
		WH HEAVILY GALVANISED 380 MPa Coating Weight 320 g/m <sup>2</sup> Minimum		WG GALVANISED 380 MPa Coating Weight 80 g/m <sup>2</sup> Minimum	
Line Wire (mm)	Cross Wire (mm)	Min. Wire Tensile (kN)	Weld Shear (kN)	Min. Wire Tensile (kN)	Weld Shear (kN)
4.00	4.00	4.8	3.6	4.8	3.6
5.00	5.00	7.5	7.0	7.5	7.0
5.60	5.60	9.4	8.0	9.4	8.0
8.00	8.00	19.1	15.1	19.1	15.1

		Minimum Ultimate Tensile			
		WB BRIGHT (BRT) 500 MPa Coal		WBD BRIGHT (BRT) 380 MPa Ductile Hard Rock	
Line Wire (mm)	Cross Wire (mm)	Min. Wire Tensile (kN)	Weld Shear (kN)	Min. Wire Tensile (kN)	Weld Shear (kN)
4.00	4.00	6.3	4.7	4.8	4.7
5.00	5.00	9.8	7.4	7.5	7.4
5.60	5.60	12.3	9.2	9.4	9.2

## TYPICAL SIZE OPTIONS

Length (mm)	Width (mm)	Aperture (mm)
1000-6000	1200-2500	Line Wire 100-150 And Cross Wire 50 mm And Greater

Custom sizes available on request, subject to manufacturing location.



#### KEY FEATURES

The DSI Underground, a Sandvik company welded wire mesh sheet has been designed to provide a safe working environment by providing surface support underground.

The welded wire mesh sheet is manufactured from individual wire strands electrically resistant welded together to form a mesh sheet.

The welded wire mesh can be supplied in a variety of configurations using different wire gauges and wire spacing. The objectives of the welded wire mesh sheet have been incorporated into the design by a number of features:

- Designed to suit customers specific mine drive dimensions and ground conditions
- Suitable for shotcrete applications
- Provides of consistency of rock bolt patterns
- Typically flush all round
- Easy to handle

#### NOTES

- DSI Underground, a Sandvik company is Quality Assured to ISO 9001:2015.



# DSI HOLLOW BAR ROCK BOLT/SDA R18N-120 KN AND R28N-190 KN

R18N and R28N rock bolt systems belong to the large family of DSI Underground, a Sandvik company Self-Drilling Anchors. R18N and R28N offer a competitive solution when rock stability is based on a high number of reinforcing elements installed in a sufficiently dense pattern. This is the case of several underground structures, both in mining and tunneling, where rock bolts featuring a load capacity in the range of 150-200 kN are largely used.

R18N and R28N can then replace conventional solid rebar, grouted rock bolts, offering the benefits in a self-drilling anchor or simply a superior installation quality, thanks grouting after bolt installation through the internal channel (so called "top-down" sequence or "post grouting").



## MAIN BENEFITS

- Fast and safe drilling installation with trouble-free application in unstable boreholes
- Drilling, installation, and optional grouting in a single operational step
- Proven installation process in difficult ground conditions
- Sound and efficient alternative compared to traditional pre-grouted, solid rebar bolts (such as S/N anchors)





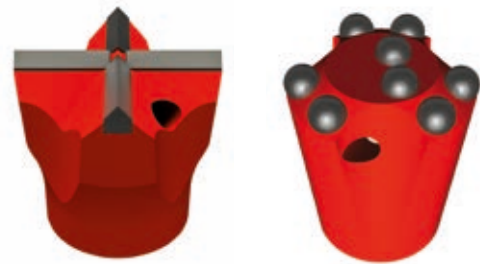
## TECHNICAL SPECIFICATIONS

Small Diameter Hollow Bar	Unit	R18N	R28N
Nominal Outer Diameter	mm	18	–
Nominal Inner Diameter	mm	8	–
Cross Section	mm <sup>2</sup>	180	–
Ultimate Strength	N/mm <sup>2</sup>	830	–
Ultimate Load	kN	>150	>220
Yield Strength	N/mm <sup>2</sup>	660	–
Yield Load	kN	120	190
Elongation (A5)	%	>6	>6
Nominal Weight	kg/m	1.4	2.3
Thread Type	–	“Rope” Left	“Rope” Left
Steel Grade	–	ASTM A519-035140/EN 10083-141Cr4	ASTM A519-035140/EN 10083-141Cr4
Hardness	HB	230-300	230-300
Delivery Length	–	1-2-3-4 m: Other Lengths On Request	1-2-3-4 m: Other Lengths On Request

## ACCESSORIES

DSI Underground, a Sandvik company has developed a large variety of drill bits, fit for any rock condition. R18N and R28N can be associated with drill featuring hard steel or TC (Tungsten Carbide), with cross inserts or buttons, with different design and optimized performance. The goal is to obtain a fast and reliable drilling at lowest possible cost per unit.

- Most common threaded R28N drill bits span from 33 to 38 mm diameter
- R28N couplers for longer bolts upon request



## MINERAL BOLT FAST- UREA- SILICATE RESIN

Mineral Bolt Fast MI is a 2-component, fast reacting, high strength silicate resin for rock bolt grouting. This formulation has been developed to suit fully mechanized bolting with standard and dynamic version or hollow bars/SDA. With its initial low viscosity Mineral Bolt FAST MI can penetrate and consolidate fractures and cracks around the borehole but its subsequent adjustable thixotropy properties the quantity of resin injected can be reduced to the optimum and resin will remain in the hole, limiting spillage.

- A grouting system with guaranteed full encapsulation, thanks to bottom-up procedure and its automatic visual inspection.
- Excellent static and dynamic mechanical properties, even in difficult ground conditions. Good adhesion to the substrate in wet and dry borehole conditions.
- Ideal for use in broken rock and for rehabilitation works, since resin can provide rock consolidation, beyond the simple role as bonding agent for the rock bolt.

- It requires only simple dual pumps due to relatively low viscosity of components. Pumping requires only few seconds and this system can improve rock support operations.
- High consistency and repeatability: every single mix, every single rock bolt has the correct mix of the two components, thanks to fixed pumping ratio 1:1 in volume and use of high performance DSI Underground, a Sandvik company static mixer.
- Environmentally friendly since it is free from volatile solvents. It does not release any dust (as cement) and reduce manual handling to the minimum.
- Convenient logistics: DSI Underground, a Sandvik company can deliver Mineral Bolt Fast MI in customized packaging: from small drums to 1000 litre IBC and even high volume-containers, ideal for fix location and long-distance pumping.

# STEEL RIBS

Steel Ribs are efficient and safe ground control elements in Tunneling. Selection of section types and dimensions is accomplished in accordance with structural and project requirements. In addition to custom-bent Steel Ribs, straight beams, forepoling sheets, and steel lagging can also be fabricated.

Steel Ribs are high-capacity load-carrying elements, hence their efficiency depends on the quality of the blocking which influences load transmission from the Steel Ribs to the ground. Use of Steel Ribs in combination with BULLFLEX® roof support backfilling helps to overcome this shortcoming and increases the utilization rate of passive steel support. For support applications under large deformations, a yielding passive support system such as TH profiles may be required.

DSI Underground, a Sandvik company has manufactured cold-formed beams for underground support applications since 1922, applying sound techniques for shaping steel required in the Tunneling industry. Techniques learned about shaping steel for strength, performance, and value in the world's tunnels and shafts can be applied to the benefit for each project.

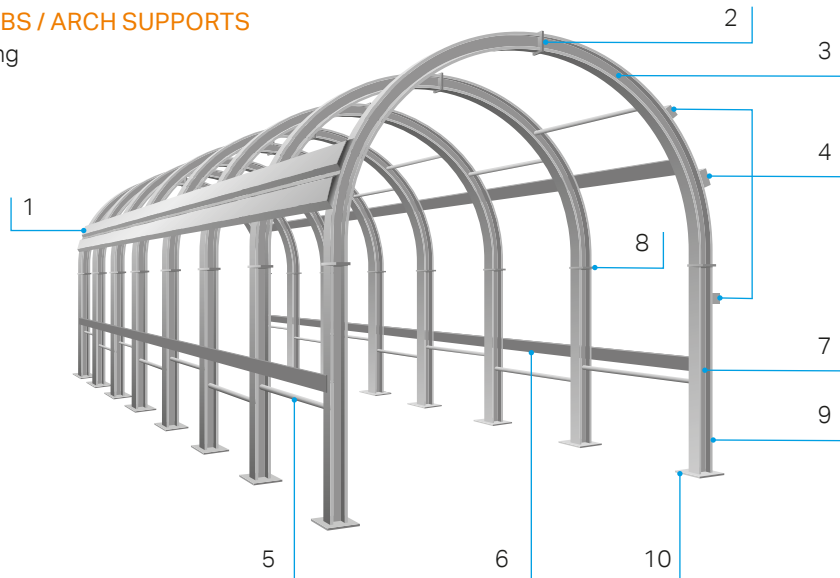
Typical applications for Steel Ribs are:

- Tunnel ribs
- Shaft rings and breakout structures
- Mine sets and overcasts



## COMPONENTS OF STEEL RIBS / ARCH SUPPORTS

1. "W" Strap Or Sheet Lagging
2. Crown Joint
3. Steel Rib
4. Blocking Piece
5. Tie Rod
6. Collar Brace
7. Steel Post
8. Butt Joint
9. Rib And Post Support
10. Foot Plate

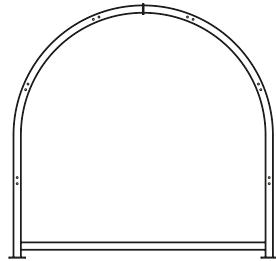


**MAIN ADVANTAGES**

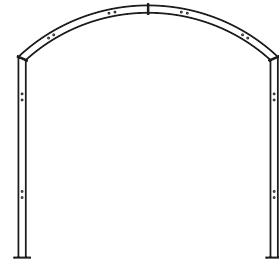
- Customized cold-formed beam constructions
- Various rib support types available upon request
- Flexible adaptation of the beam geometry to the respective excavated cross-section
- TH sections and other special support profiles available upon request
- Custom formed lagging resistant to machine jack thrusts and impact loads

**STEEL RIBS SUPPORT TYPES**

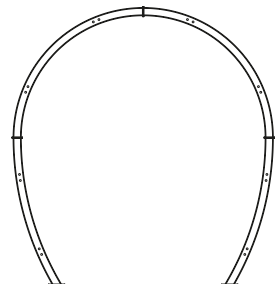
- Type 1:  
2 piece horseshoe with optional invert strut



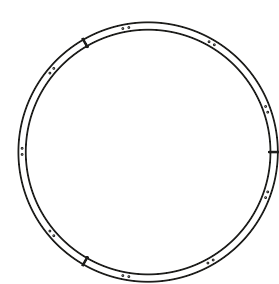
- Type 2:  
4 piece modified horseshoe



- Type 3:  
4 piece horseshoe



- Type 4:  
3 piece circular



**TUNNEL RIBS**



**SHAFT RINGS AND BREAKOUT STRUCTURES**



**MINE SETS AND OVERCASTS**



**STEEL LAGGING**

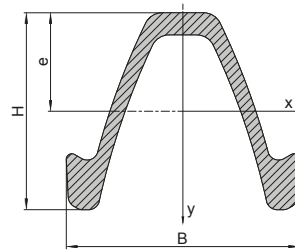


## STEEL RIBS (EMEA)

### TH PROFILE

- Mine support steel 31Mn4 according to DIN 21544
- Bent to the corresponding profile
- Single overlapping segments are usually connected by two locks
- Different types of TH locks are available upon request

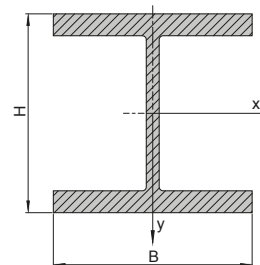
Characteristic Value / Type	Symbol	Unit	TH 21	TH 25	TH 29	TH 36
Nominal Weight	m	kg/m	21	25	29	36
Profile Height	H	mm	108	118	124	138
Profile Width	B	mm	124	135	151	171
Neutral Axis	e	mm	52	58	58	69
Section Modulus	$W_x$	cm <sup>3</sup>	61	80	94	136



### HEB PROFILE

- I profile – broad flange girder
- Primary material S235JRG2 or S355J2G3 according to EN 10025-2
- Bent to the corresponding profile
- Connection of the segments via head plates that are available in different designs
- Alternative connection of the abutting segments via laces
- Different lace types and lace screws are available upon request

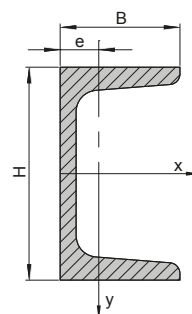
Characteristic Value / Type	Symbol	Unit	HEB 100	HEB 120	HEB 140
Nominal Weight	m	kg/m	20.9	27.4	34.5
Profile Height	H	mm	100.0	120.0	140.0
Profile Width	B	mm	100.0	120.0	140.0
Section Modulus	$W_x$	cm <sup>3</sup>	89.9	144.0	216.0
Section Modulus	$W_y$	cm <sup>3</sup>	33.5	52.9	78.5



### UNP PROFILE

- U profile – flanges with inclined inner surfaces
- Primary material S235JRG2 or S355J2G3 according to EN 10025-2
- Bent to the corresponding profile
- Connection of the segments via welded-on and screwed head plates or flange connections
- Different lace types and lace screws are available upon request

Characteristic Value / Type	Symbol	Unit	UNP 80	UNP 100	UNP 120	UNP 140	UNP 160	UNP 180
Nominal Weight	m	kg/m	8.60	10.6	13.4	16.4	18.8	22.0
Profile Height	H	mm	80.0	100	120	140	160	180
Profile Width	B	mm	45.0	50.0	55.0	60.0	65.0	70.0
Neutral Axis	e	cm	1.45	1.55	1.60	1.75	1.84	1.92
Section Modulus	$W_y$	cm <sup>3</sup>	6.40	8.50	11.1	14.8	18.3	22.4





# xCELL CYCLOPS™

**MODERN SAFETY MEASURES FOR MODERN MINES**

As underground mines are getting deeper and more complex, ground conditions are becoming more challenging to manage.

With Sandvik xCell Cyclops™ convergence sensors you get a real-time flow of convergence data delivered straight to your device.

It enables you to monitor and deal with risks before they become dangerous and costly.

With continuous monitoring, you make your mine a safer environment to work in while minimizing rehabilitation costs.

**xCELL CYCLOPS™ (FRONT)**



Robust For Mine Environment

Laser Sensing Technology

LED's Indictaor

Wi-Fi And BLE Connectivity

**xCELL CYCLOPS™ (BACK)**



Ball Pivot Mechanism And Locking

Retrofittable To MD/MDX And Bars

Battery Powered

**EASY INSTALLATION / INSTANT MONITORING**

xCell Cyclops™ convergence sensor is easily mounted to your MD, MDX or standard threaded bolt heads. The built-in ball pivot mechanism makes it easy to aim

the sensor. Once installed, the unit continuously measures the distance from one side of the tunnel to the other using precision laser technology.

### WI-FI AND BLUETOOTH CONNECTIVITY

With Wi-Fi connectivity, the data is instantly available in the web and iOS interface. If Wi-Fi is not available, xCell Professor™ Bluetooth Low Energy gateway is mounted on already existing vehicles for drive-by data collection.

When the vehicle passes a sensor, it automatically downloads the data stored in the memory of the sensor. Once the gateway connects to Wi-Fi, the latest information is directly uploaded to the cloud.

xCELL PROFESSOR™



Mounted On Vehicles

Automatic BLE Drive-By Collection

Web And IOS Interface



Automatic Visualisations



### SIMPLE INTERFACE / ADVANCED INSIGHTS

The cloud-based web and iOS interface enable admins and users to collect data, make configurations, and find visualizations of the sensor measurements. The interface automatically turns the data into graphs and charts showing location, distance, convergence and speed of

movement. These parameters can be configured to set off notifications and alarms. Remote access to this data, in contrast to current manual measuring methods, creates safer and more efficient work environments while improving your knowledge of the rock mass behavior in your mine.

# PULL TESTING EQUIPMENT

## INTRODUCTION

Pull testing equipment is required for pull-out tests on anchors and rock bolts. Pull-out tests on anchors and rock bolts are performed for supervision of the rock bolting quality. Depending on the type and design of the rock bolt in use, different testing equipment is utilized. Depending on the operation purpose, modularly designed sets of different pull testing equipment can be adapted to the whole range of rock bolts provided by DSI Underground, a Sandvik company.



## FIELDS OF APPLICATION

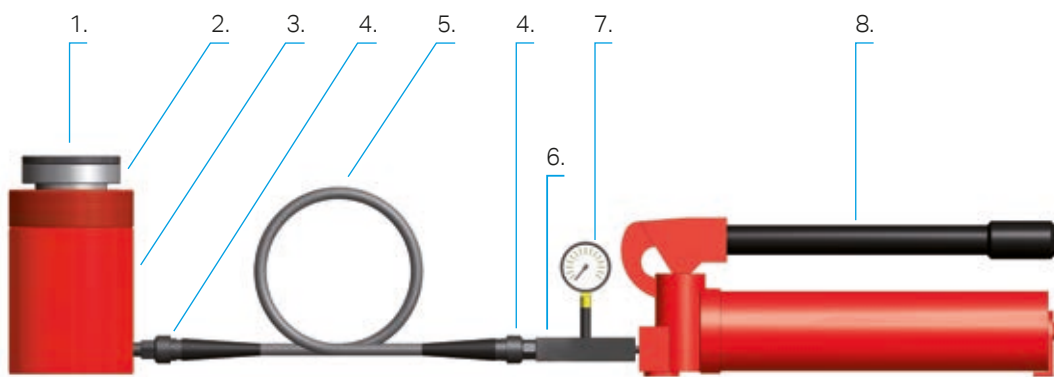
- Pull-out tests
- Supervision of quality criteria of installed rock bolts
- System components
  - The pull testing equipment consists of a series of mechanic and hydraulic components and is designed for an ultimate test force of up to approx. 60 t.
- Hydraulic components
  - Hollow bar cylinder
  - Hydraulic hose
  - Electric pump or hand pump, with gauge
  - Gauges are provided on demand with a calibration certificate
- Supporting frame
  - Depending on test requirements and test forces, the frame is available either as a tripod or a tubular frame in different sizes
- Mechanic components
  - Intermediate disks
  - Angle compensation plates
  - Balance rods and adapters for rock bolts that are to be tested





### SYSTEM COMPONENTS HAND PUMP / ELECTRIC PUMP

- |   |  |
|---|--|
| 1. Bearing Plate Hollow Plunger Cylinder / Nut          | 6. Manometer Piece                           |
| 2. Thrust Piece   | 7. Manometer (Incl. Calibration Certificate) |
| 3. Hydraulic Hollow Plunger Cylinder, Single Acting     | 8. Hand Pump / Electric Pump                 |
| 4. High-Flow Coupling                                   |  |
| 5. Hydraulic Hose Incl. 2 High-Flow Coupling Connectors |  |






### FURTHER REFERENCES

- DSI Underground, a Sandvik company leaflets on pull tests
- System sketch of test assemblies
- Data sheets and operating procedures

### NOTES

- Pull-out test must only be carried out in compliance with the present instructions by skilled personnel
- DSI Underground, a Sandvik company has experienced technical personnel for planning, operation, and analysis of pull tests

## TECHNICAL SPECIFICATIONS

Anchor Or Bolt Type	Hydraulics <sup>1)</sup>		Tripod Or Bearing Cylinder <sup>2)</sup>		Pull Adapter <sup>3)</sup>
	Max. 320 kN	Max. 640 kN			
Mining Anchors	X		X		Coupling, Rod And Nut
Mechanical Anchors Type ALWAG®	X		X		Pull Adapter, Washer And Nut <sup>4)</sup>
SN-Anchors	X	X	X		Pull Adapter, Washer And Nut <sup>4)</sup>
Resin Rock Bolts	X		X		Pull Adapter, Washer And Nut <sup>4)</sup>
Thread Bar Anchors	X		X		Coupling, Rod And Nut
GRP Solid Bars	X		X		Pull Adapter, Washer And Nut <sup>4)</sup>
GRP Hollow Bars And S-D Hollow Bars	X		X	X	DSI Coupling, Hollow Bar And Nut <sup>4)</sup>
OMEGA-BOLT® Expandable Friction Bolts	X		X		OMEGA-BOLT® Pull Head, Washer And Nut
POWER SET® Self-Drilling Friction Bolts	X			X	POWER SET® Pull Testing Equipment
Friction Stabilizers	X		X	X	POWER SET® Pull Testing Equipment
CT-Bolt™ Combination Rock Bolts	X		X		Pull Adapter, Washer And Nut <sup>4)</sup>
Cable Bolts, System Barrels And Wegdes	X	X	X	X	See Section Cable Tensioner (Page 21)
Tensionable Strand Anchors	X	X	X	X	See Section Cable Tensioner (Page 21)
DSI Hollow Bar System	X	X	X	X	DSI Coupling, Hollow Bar And Nut

1) Proof force 0-320 kN: hollow plunger cylinder type RCH-302, proof load: 0-640 kN hollow plunger cylinder type RCH-603.

2) Tripod or bearing cylinder according to hydraulics (320/640).

3) Schematic display. Coupling and pull head, pull rod, washer and nut are adapted to each anchor and rock bolt.

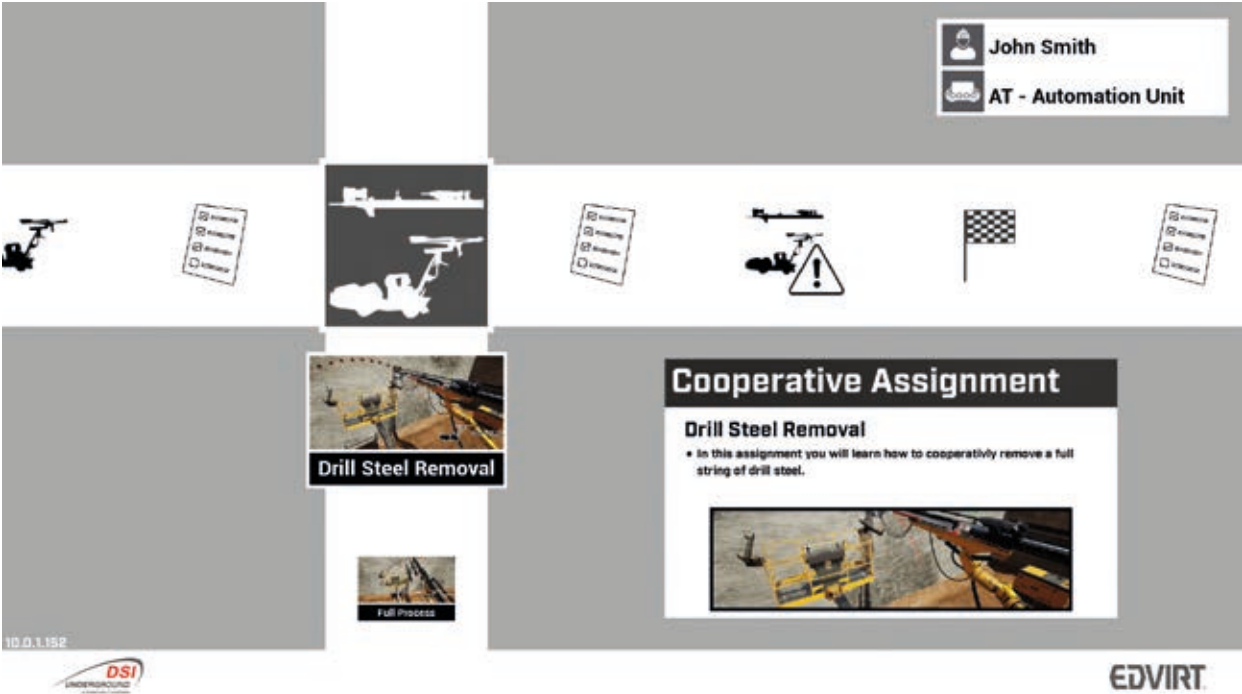
4) Recommendation: max. proof force ...  $F_{p,0.2}$  of the anchor or rock bolt.



# VR SIMULATOR

## INTRODUCTION

- The first virtual reality (VR) training simulator for pipe umbrella installation
- State-of-the-art training for both drill jumbo and basket operators
- Highly realistic and authentic simulation process
- Scenario-based simulator practice in VR combined with extensive theory modules
- Training of operators in a safe environment without risking accidents or machine damage
- Remote support during mounting, commissioning, maintenance, and operation



## Increased Safety

Industry-leading virtual training before commencement in construction

## Enhanced Quality

Virtual reality based simulators increase the performance of both novice and experienced operators, powered by

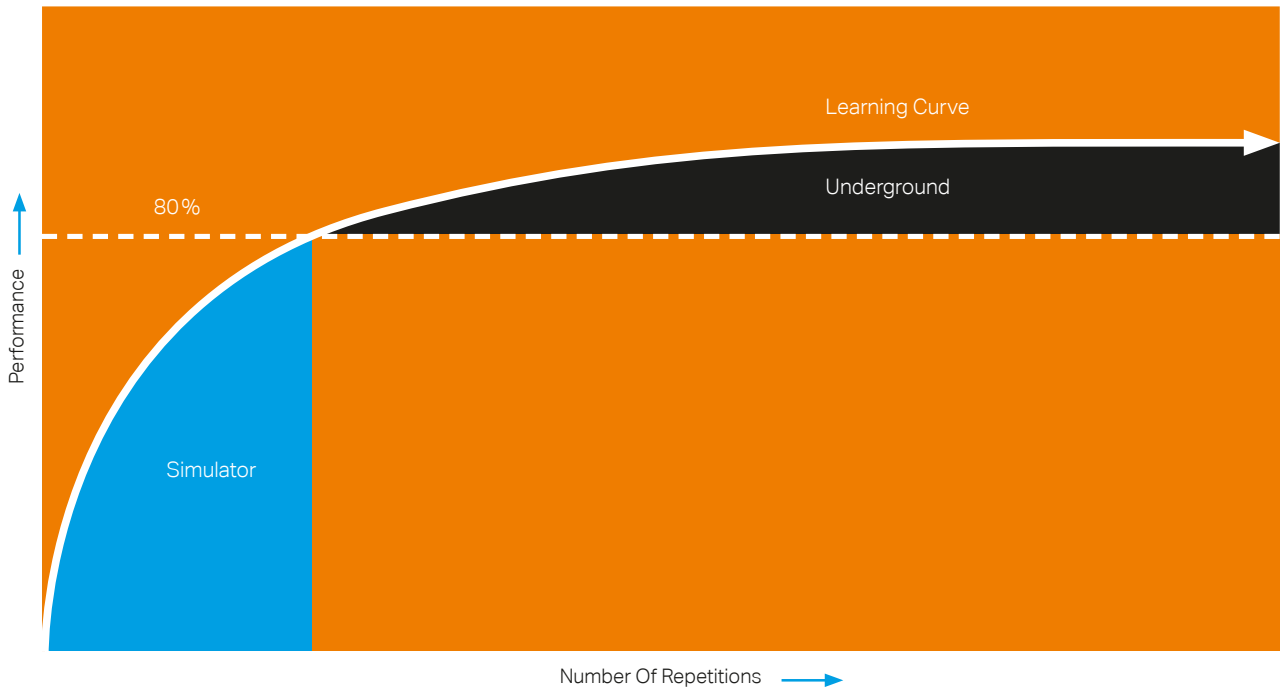
**EDVIRT**

## Leveraged Costs

Simulators and training courses are designed to reduce costs and improve machine utilization



## REINFORCING COMPETENCE



### TRAINING PROGRAM

- Modular training and assessments with user-based performance analysis
- Integrated video case studies illustrate best underground practices
- Bolstered by contributions from global industry experts
- Comprehensive personalized and certified training courses
- Multi-user simulator training where two operators and a trainer can jointly conduct scenario-based VR training
- Training can be delivered in person or remotely
- Customized project-based consulting





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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 ground support representative for final confirmation of any key specifications.

