

LOKSET® LONG TENDON

HARD ROCK MINING – WEST COAST LONG TENDON SUPPORT

DESCRIPTION

Lokset® long tendon capsules contain specially formulated resin mastic to aid insertion and push through, where long tendon support is required.

The Lokset long tendon support resin capsule consists of reinforced, specially formulated polyester resin mastic to aid insertion and push through in one compartment and an organic peroxide catalyst separated by a physical barrier in the other. The rotation of the bolt during installation ruptures the capsule, shreds the skin and mixes the two components causing a chemical reaction and transforming the resin mastic into a solid anchor.

APPLICATION AND USES

The Lokset long tendon resin capsule is used as an anchoring support in strata especially where long tendon support is required:

- ▶ Intersections
- ▶ Cut throughs
- ▶ Long life roadways e.g. belt roads
- ▶ Secondary support
- ▶ Additional primary support

The capsule can be used with a range of long tendon support cables:

- ▶ HI-TEN Strand cables
- ▶ SuperStrand cables
- ▶ Flexibolts
- ▶ Spinbolts
- ▶ Multicables
- ▶ Megabolts
- ▶ Megastrands
- ▶ Flexicables
- ▶ Cable bolts



Figure 1 – Lokset® Long Tendon Resin Capsules

ADVANTAGES

- ▶ Point anchor installation with slow set capsule
- ▶ Full encapsulation with pre-tensioning utilising combination of Slow and Extra Slow speeds.
- ▶ Full encapsulation without pre-tensioning using Extra Extra Slow set capsule speed.
- ▶ A unique design of capsule configuration enabling extremely effective mixing of resin mastic and catalyst compartments.
- ▶ Rapid insertion, easy and quick to use
- ▶ Eliminates the need for costly and time-consuming post grouting by completing full bolt encapsulation in a single operation
- ▶ Rapid strength build up, bolt will take load almost immediately
- ▶ High compressive strength, strong, rapid and consistent anchorage
- ▶ High modulus
- ▶ Protects bolt from corrosion, can be used in moderately wet conditions

TECHNICAL DATA

Typical insertion properties at 25°C are as follows:

Speed	Spin time ¹	Hold time ²	Capsule colour	Label colour
FR Slow	15-30 sec	>120 sec	Blue/ Green	Blue
FR Extra Slow	30 sec	>1200 sec	Blue/ Green	Blue

¹ Approximate spin time in seconds
² Minimum hold time in seconds

The hold time is the minimum time allowed after completion of the spin time before bolt tensioning is attempted. In many cases the hold time will be greater than that listed.

The times listed are an indication only, they may vary with temperature, mining conditions, equipment, hole: bolt annulus, age and storage conditions of resin capsules.

Each mine site should be evaluated to determine optimum installation parameters.

Compressive Strength

Tested in accordance with ¹BS 7861:Part 1:1996. Tested on 40 mm cubes with FR slow set resin.

¹Strata reinforcement support system components used in coal mines: Part 1, specification for rock bolting

Typical results:

Age (hours)	Uniaxial compressive Strength (MPa)
24	>60

Push Out Test

Measured on 22 mm bolt encapsulated to 50 mm depth in 28 mm I.D. threaded cylinder, with FR Extra Extra slow set resin.

Typical results:

Age (hours)	Push Out Force (kN)
24	>70

Punched Shear Strength

This test (according to BS 2782 Part 3) provides excellent correlation with mine pull out tests (without the variances) and is directly related to the strength of the resin. With fast setting resins the test can be performed in a very short time after the resin mixture has gelled (15 seconds).

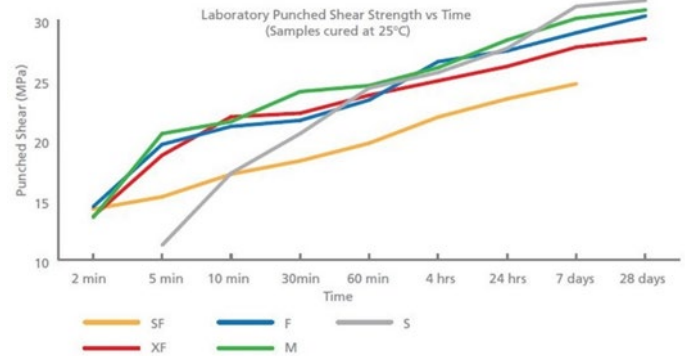


Figure 2 - Laboratory Punched Shear Strength vs Time

APPLICATION METHOD

It is essential that good bolting procedures are followed and the instructions on the box are observed. As a guide the following steps must be taken:

- 1) Drill hole to correct diameter ensuring water/air flush is used. The hole should be clean and free from dust and other loose particles. In Coal mining 27-28 mm hole diameters are normally preferred with 22 mm core diameter roof bolts or cables. Do not exceed the manufacturers recommended diameter.
- 2) Drill hole to correct length for bolt. The ideal hole length should be at least 100 mm shorter than the bolt, dependent on the bolt/cable being used. Do not deviate from the manufacturers recommended length of hole in relation to the bolt.
- 3) Select the correct resin capsule(s) that has been specified for the job
- 4) Check that the use by date on the box label has not expired.
- 5) The manufacturers operating instructions for the use of the drilling and insertion machine must be followed. Where pneumatically operated machines are used it is essential the minimum required air supply pressure is exceeded.

- 6) When pre-tensioning and when FR Slow and FR Extra Extra Slow capsules are used together follow the below steps:

Step 1 *Insert the slow set (light green) capsule first*

Step 2 *Next insert the Extra Extra Slow set (light pink) capsule.*

Cable ties may be used to lodge the capsules in the hole and conduit tubes to assist in insertion. **Ensure the capsule reaches the top of the hole.**

Usually the correct length, diameter and number of capsules are inserted to ensure full column encapsulation.

Should insertion problems occur then the problem must be investigated.

- 7) Connect the bolt to the spinning dolly/spanner.
- 8) The bolt is pushed **and** spun at maximum rpm at a constant feed rate through the entire length of the capsule(s). When the top of the hole has reached a further 2 - 4 seconds spinning will suffice to ensure complete mixing. Total spin time through the capsule and at the top of the hole should not exceed the "approximate spin time" on the box label. It is essential the bolt is pushed **and** spun to the top of the hole before mixing is completed.
- 9) **Do not over mix the resin.** If mixing continues beyond the recommended spin time and into the gel time, the solidifying chemical may be ground up and destroyed.
- 10) The bolt is then held stationary and after the hold time has elapsed the bolt may be tensioned as required. The hold time is the **minimum** time allowed after completion of the spin time before bolt tensioning can be attempted. In many cases the hold time will be greater than that listed. **Where high tension loads are applied to the system the hold time will be extended significantly.** As a rough guide, in laboratory tests, approximately half the ultimate strength of the resin is reached after 30 minutes.

The following items must also be checked where hand-held (air operated) equipment is utilised:

- ▶ Clean and dry supply of compressed air
- ▶ Air supply from roof bolter to miner should not be more than 100 metres of 2" hose
- ▶ Air pressure must be between 85 - 100 psi (586 - 690 KPa) when bolter(s) are operating

- ▶ Water pressure should be between 80-90 psi (550 - 620 KPa) and hoses flushed out prior to connection

SAFETY INSTRUCTIONS AND LIMITATIONS

The annular gap between bolt and hole diameter should be kept at a minimum. The recommended annular gap is between 4 - 6 mm e.g.

Bolt diameter:	22 mm
Hole diameter:	28 mm
Annular gap:	5 mm

Where larger annular gaps are encountered (e.g. in Hardrock mines) the bolt must possess larger deforms or a mixing device such as mixing wire or paddles. Follow the installation guidelines. Larger hole diameters/annular gaps may result in extended cure times, less efficient mixing, finger gloving of the bolt into the resin capsule, a reduction in load transfer (strength), a reduction in encapsulation length.

In all cases it is strongly recommended that short encapsulation pull tests be performed to verify that required load strengths are achieved.

Extended tensioning times may be due to:

- ▶ Low temperatures
- ▶ Broken ground
- ▶ Large hole diameters
- ▶ Insufficient spinning
- ▶ High nut break out loads
- ▶ High machine torque load levels
- ▶ Excessive thrust/feed on the installation rig
- ▶ Intermixing of slower setting resin into faster setting resin capsules.

The resin appearing to be "too quick" with the bolt not reaching the top of the hole may be due to:

- ▶ High temperatures
- ▶ Smaller diameter holes
- ▶ Hole closure
- ▶ Angled holes
- ▶ Misaligned holes/rigs
- ▶ Low feed pressure
- ▶ Premature nut break out
- ▶ Old/out of date resin

Bolting parameters will vary depending on several factors such as:

- ▶ Strata condition/type
- ▶ Temperature
- ▶ Hole: bolt annulus
- ▶ Age of resin capsule
- ▶ Equipment
- ▶ Installation method

Volume

It is essential the correct length of capsule is selected to fill the volume left in the hole after allowing for the volume of the bolt.

It is good practice to use a capsule size which exceeds this volume by around 10% to allow for variations in hole diameter and length, bolt size and strata conditions.

25 mm nominal diameter capsule with 22 mm core diameter bolt
Theoretical encapsulation + 10%

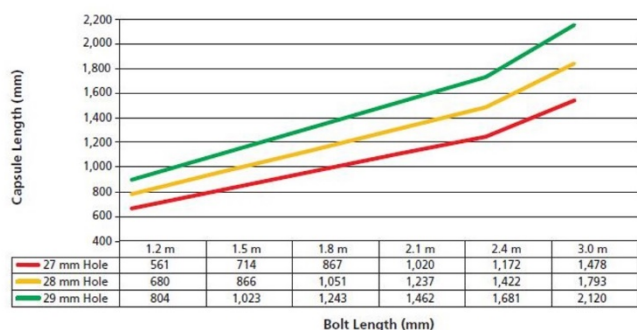


Figure 3 - 25mm Nominal Diameter Capsule with 22mm Core Diameter Bolt

PACKAGING AND TRANSPORTATION

Lokset Long Tendon resin capsules are available in standard diameters of nominal 25 mm (actual 23.6 mm). Lengths range from 300 mm to 1700 mm.

Resin capsules are packaged in water resistance cardboard cartons labelled with colour codes and supplied on wooden pallets. Capsules are packed according to their length and in quantities relative to the capsule size.

Long Tendon Product code

Typical Code	F130025FRXXS
F	Lokset Long Tendon F Series or J series
1300	Capsule length (1300mm)
25	Capsule diameter (25mm)
FRXXS	F Series Extra Extra Slow

Long Tendon Product Label

Label colour is dependent on resin speed and resin combination:

Resin Speed	Colour of Label
Super Fast	
Extra Fast	
Fast	
Medium	
Slow	

Example of capsule label: Lokset Long Tendon Slow

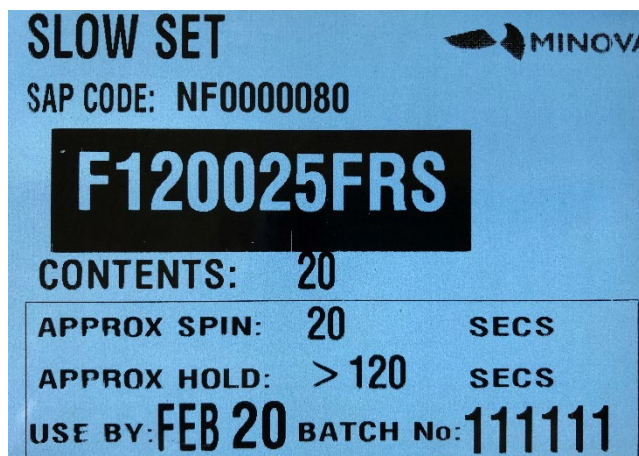


Figure 4 - Capsule Label

STORAGE AND SHELF LIFE

Suggested shelf life for Lokset Long Tendon resin capsule is 4 months when stored between 20-25°C. Extended shelf life can be expected when stored at lower temperatures of 0-5°C in cool rooms and is highly recommended. Stock rotation is strongly recommended. Storage at higher temperatures will severely reduce shelf life.

STORAGE CONDITIONS

Store in a cool, dry place away from direct sunlight. Do not double stack pallets. When using cool room storage, the resin capsules should be allowed time to attain ambient temperature before use otherwise SPIN and HOLD TIMES will be extended.

HEALTH AND SAFETY

For further information see the Lokset® Safety data sheet on www.minovaglobal.com/apac.

TECHNICAL SUPPORT

We provide technical advisory service by a team of specialists in the field. The service includes on site assistance and advice on evaluation trials and laboratory work.

QUALITY

The superior quality of the Lokset resin capsule is assured through a four-part quality control program:

- 1) Raw Material Testing
- 2) In-process quality control testing
- 3) Finished product acceptance testing
- 4) Quality system management to ISO 9001

Testing levels and specifications for each of the above programs have been established statistically, based on actual historical data to ensure the customer receives a uniform quality product which will perform dependably under field conditions.

MANUFACTURER

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An ISO 9001: 2015 Quality Management Certified Company



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