

Lokset[®] Resin Capsule Long Tendon Support Resin



Reinforced polyester resin anchor

Uses

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

- Intersections
- Cut throughs
- Long life roadways eg 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
- Flex - bolts

Advantages

- Contains specially formulated resin mastic to aid insertion and push through where long tendon support is required eg up to 8 m.
- 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 Slow or Extra Extra Slow set capsule speeds
- A unique design of capsule configuration enabling extremely effective mixing of resin mastic and catalyst compartments.

Other advantages include:

- Rapid insertion, easy and quick to use
- Eliminates the need for costly and time consuming post grouting by completing full bolt encapsulation in 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
- No expansion stresses, can be used in weak strata

Description

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.

Technical support

Minova Australia together with your local distributor offers a complete technical and field support service.

Properties

Set time

Typical insertion properties at 25°C are as follows:

| Speed | Approx. Spin Time (secs) | Min. Hold Time (secs) | Capsule Colour | Label Colour |
|---------------------|--------------------------|-----------------------|----------------|--------------|
| FR | | | Light | Green |
| Slow | 30 | >120* | Green | |
| FR | | | Light | Purple |
| Extra Slow | 60 | >300 | Purple | |
| FR Extra Extra Slow | 60 | >1200 | Light Pink | Pink |

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.

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*** Where high tension loads are applied to the system then the hold time may be several minutes.** 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.

For further information on capsule types, size and speed, consult Minova Australia or your local distributor.

Compressive strength

Tested on 40 mm cubes with FR slow set resin in accordance with BS 7861:Part 1:1996 (Strata reinforcement support system components used in coal mines: Part 1, specification for rockbolting). 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.

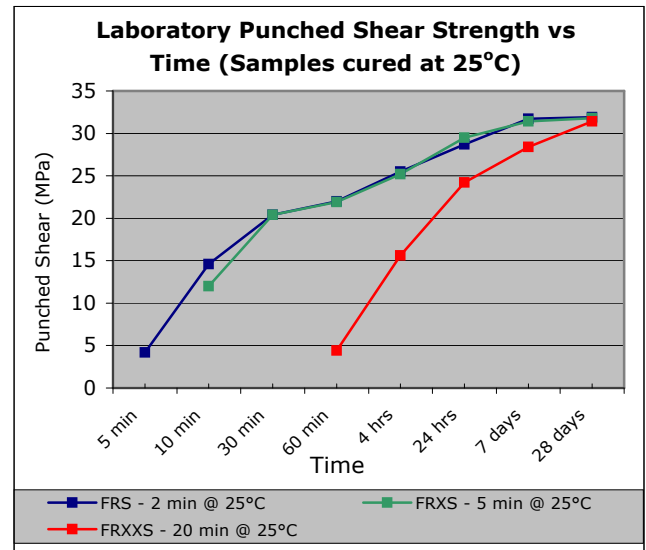
Typical results:

| Age (hours) | Push out force (kN) |
|-------------|---------------------|
| 24 | > 70 |

Punched Shear Strength

Measured according to BS 2782 (part 3). The appropriate quantities of resin mastic and catalyst are mixed together for six (6) seconds. The resultant mixture squashed between two uniform flat steel plates and allowed to gel. The plates are taken apart and the cured slice of resin is placed between two steel templates. The device is placed in a tensiometer and a plunger is forced into a hole in the plates at a predetermined rate thus pushing a flat circular disc out of the resin slice (ie shearing the resin). The force applied to shear the resin is recorded electronically by the tensiometer and converted to shear stress in MPa using the thickness of the disc in mm.

This test 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).



Application instructions

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, dependant 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. Where FR Slow and FR Extra/Extra Extra Slow capsules are used together, when pretensioning, it is essential the slow set (light green capsule) is inserted first followed by Extra Slow (light purple) and then Extra Extra Slow (light pink) set 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 is reached a further 5 - 10 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 then the hold time will be extended significantly.** As a rough guide in laboratory tests approximately half the ultimate strength of the **FRS** speed resin is reached after 15 minutes. Refer table: Punched Shear vs Time. Consult Minova for further information.

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

- Compressed air supply should be clean and dry
- 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

Consult Minova Australia or your distributor for further information.

Equipment

The ideal insertion rigs for use when full encapsulation is required are:

- Coalroc 'through the chuck drill system'
- Cram Flexibolt Installation System (FIS)
- Series 4000 Hydramatic Roofbolter fitted with Hollow Spindle drill head.

Note: The manufacturer's standard operating procedures for the operation of these machines must be followed at all times.

Limitations

The annular gap between bolt and hole diameter should be at a minimum. It is recommended the annular gap be between 4 - 6 mm eg:

| | | |
|---------------|---|-------|
| Bolt diameter | : | 22 mm |
| Hole diameter | : | 28 mm |
| Annular gap | : | 6 mm |

Where annular gaps larger than this are encountered (eg in Hardrock mines) then the bolt must possess larger deforms or a mixing device such as Posimix wire or Paddles etc and the installation guidelines followed. 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

All bolting parameters will vary depending on a number of factors such as:

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

Consult Minova Australia or your distributor for further information.

Estimating

Packaging

Lokset Resin Capsules are available in standard diameters of 20 mm, nominal 25 mm (actual 23.6 mm), 26 mm, 30 mm, 36 mm and 38 mm. Lengths range from 150 mm to 1700 mm. They are packaged in cardboard cartons labelled with colour codes and supplied on wooden pallets.

Contact Minova Australia or your local distributor for further information.

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.

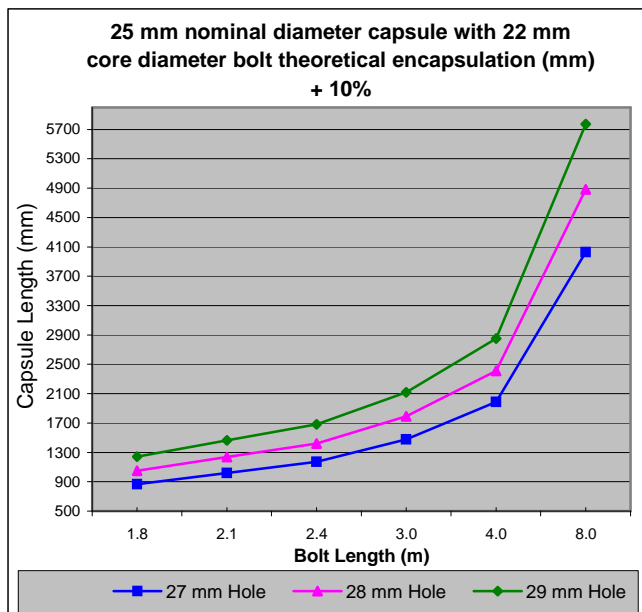
It is good practice to use a capsule size which exceeds this volume by around 10% to allow for variations in hole diameter and length, bolt size and strata conditions.

The following example is given as a guide:

Using a 22 mm bolt in a 28 mm hole requires an 1100 mm long, 25 mm nominal diameter capsule to fill 413cc or a 1750 mm length of hole.

Consult Minova Australia for further information on encapsulation.

The following is given as a guide:



| | | | | | | |
|-----------|------|------|------|------|------|------|
| 27mm Hole | 867 | 1020 | 1172 | 1478 | 1988 | 4027 |
| 28mm Hole | 1051 | 1237 | 1422 | 1793 | 2412 | 4885 |
| 29mm Hole | 1243 | 1462 | 1681 | 2120 | 2851 | 5775 |

Storage

Shelf Life

The Lokset resin capsule suggested shelf life is 6 months when stored between 20-25°C. Storage at lower temperatures such as in cool rooms is highly recommended and will extend the shelf life when stored at 0-5°C. 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.

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.

Precautions

Health and safety

Wear suitable protective clothing, gloves and eye/face protection.

- In case of contact with skin remove contaminated clothing and immediately wash with soap and water, seek medical attention if skin irritation persists.
- In case of contact with eyes, flush with copious amounts of water and seek medical assistance.
- If inhaled remove from exposure and seek medical advice if effects persist.
- If ingested wash out mouth with water and obtain medical attention.

For further information see the relevant material safety data sheet, copies of which are available on our website.

Additional information

Minova Australia offer a comprehensive range of strata control products, all of which have been developed after extensive research and testing on a global scale via our international network of operations. These products include:

- Resin anchor systems
- High yield grouts and foams
- High volume output grouts
- Monolithic chock systems
- High performance cable bolt grouts
- Polyurethane resin systems
- Binder systems and accelerators for backfilling
- Pre-packaged high build spray cements
- Sprayable coatings for ventilation control
- Water stop grouts
- Ventilation Formwork Systems including: Meshblock, Gunmesh, Tecmesh and Tecplastic
- Grout Mixers and Batchers both air and hydraulically operated
- Flexible high strength membrane for strata support
- Contract Installations
- Flexible membranes for strata support and waterproofing applications

If further information is required consult Minova Australia.

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