



DSI
UNDERGROUND
A SANDVIK COMPANY

FASLOC® *Resin Bolting*



Resin Bolting



Introduction

Resin anchor bolting provides effective long term strata support in underground coal, hardrock, mining and tunnelling.

The resin anchored bolts can be fully encapsulated for corrosion resistance and point anchored and tensioned to plate and mesh for confinement of the coal or rock face.

DSI FASLOC® resin anchors are manufactured from a sophisticated blend of reinforced polyester resins and inert fillers. In addition to the typical two-part mastic/catalyst arrangement, DSI manufacture two speed anchors containing two distinct resin gel times in the same package where separate point

anchor and tension times are required for bolting. DSI also provides a two capsule arrangement where 2 resin capsules are joined and folded in half for packaging, and are available in either single-speed or two-speed configurations.



FASLOC® cartridges (Single Speed)



FASLOC® Duo Speed cartridges



FASLOC® SK Duo Speed cartridges

Description

FASLOC® resin capsules comprise an outer clear plastic heat sealed sheath clipped at both ends. Within this are two separate internal compartments consisting of:

1. Colour coded reinforced thixotropic polyester resin mastic of a specific setting speed and
2. Catalyst/hardener to activate the resin.

In addition to the typical two-part mastic/catalyst arrangement, Duo Speed cartridges contain two distinct resin gel times – Fast and Slow – in the same convenient package.

On rotation of the bolt through the capsule in the bolt hole, the two capsule compartments are ruptured and the components are mixed together initiating a rapid polymerisation process and cure to form a rock solid anchor.

Assisting this process are the unique size graded fillers to aid shredding of the film, mixing the resin, and by interlocking with each other and the interface of the hole further reduce strata movement.

The results are fast installation and rapid achievement of full strength.

With FASLOC® resin capsules load transfer results from short encapsulation pull tests have been found to be superior to other similar products.

FASLOC® resin capsules are available in both water based (FASLOC® S Single Speed and FASLOC® S Duo Speed) and oil based (FASLOC® HS Single Speed and FASLOC® HS Duo Speed) formulations of the catalyst component.

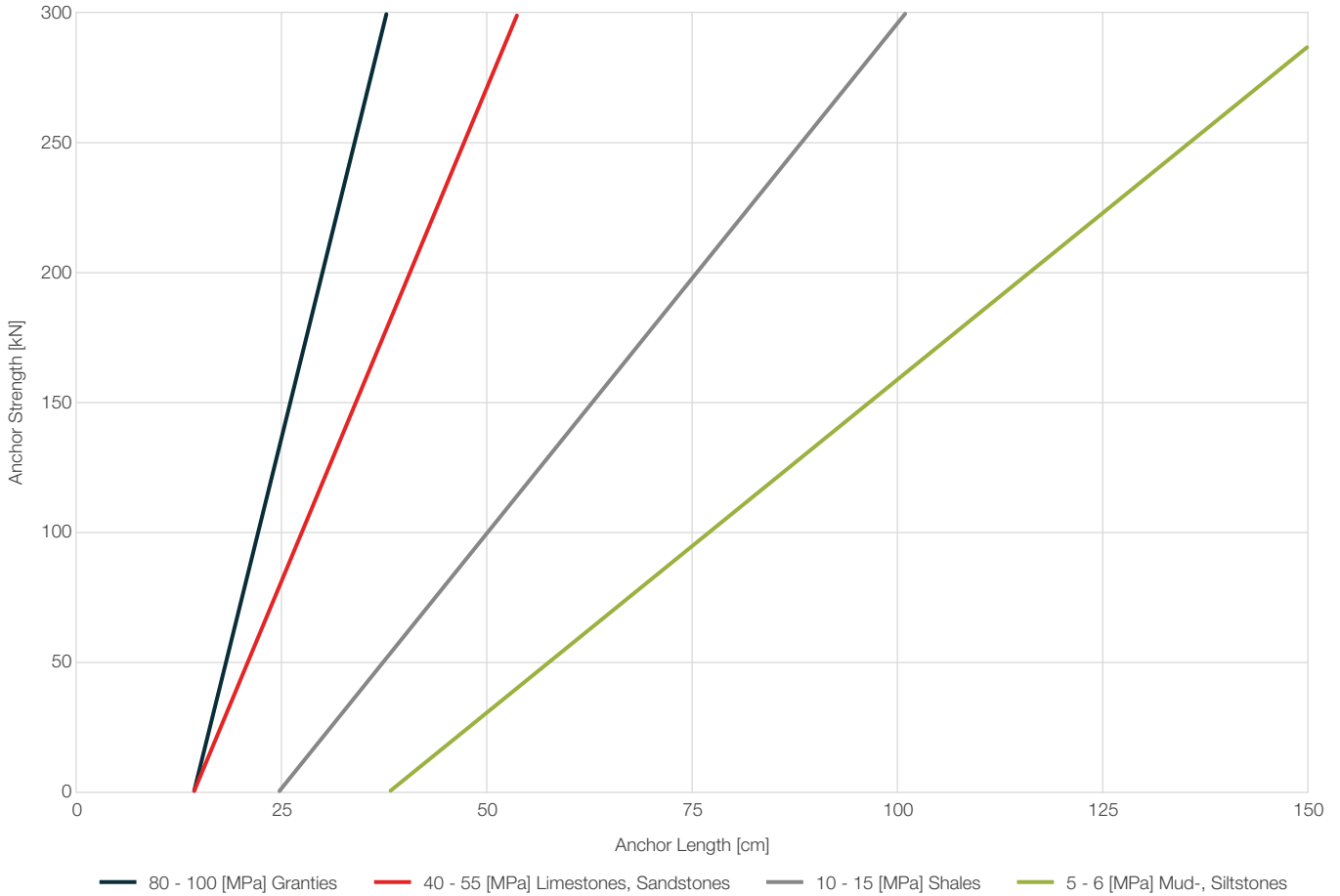
Oil based FASLOC® HS (high strength) are stronger, UCS and other mechanical parameters reach higher values and comply to standards such as BS 7861-1:2007.

FASLOC® cartridges enable convenient applications for short or long rock bolts where a fast cycle time is needed.

FASLOC® Duo Speed cartridges enable a convenient one capsule application where rebar pre-tension and a fast cycle time are needed.

Any anchorage system performance varies with the surrounding strata strength. FASLOC® provides approximately 25 to 40 [t] per grouted 0.5 [m] pull out resistance in hard rock, and 4 to 10 [t] per grouted 0.5 [m] in soft rock. Estimated performance can be viewed in the graph below.

Rock Bolt Anchor Strength related to UCS of Rock and Anchor Length



Technical Data / Physical Properties

Technical Data / Physical Properties			
FASLOC® Formulation Type	Gel Time at 20 [°C] [s]	UCS at 24 h – Minimum [MPa]	Punched Shear Strength at 24 h – Minimum [MPa]
FASLOC® S 30s (Fast)	25 - 35	30	20
FASLOC® S 180s (Slow)	170 - 220	60	20
FASLOC® HS 30s (Fast)	25 - 35	80	25
FASLOC® HS 180s (Slow)	170 - 220	80	25

FASLOC® Type	Diameter	Length		Gel Time	
	[mm]	[mm]		[s]	
FASLOC® (S, HS, SK)*	18 ÷ 42	200 ÷ 2500		10 ÷ 600	
FASLOC® (S, HS, SK)* DUO SPEED	23 ÷ 30	Fast	Slow	Fast	Slow
		200 ÷ 1200	200 ÷ 1200	15 ÷ 60**	60 ÷ 600**

*SK symbol means a two capsule arrangement where 2 cartridges are joined and folded in half for packing.

**Unless otherwise stated, the standard gel time for Fast part is 30 seconds and for Slow part is 180 seconds.

Application Instructions

When using FASLOC® (Single Speed) cartridges one or more cartridges are inserted into the borehole depending on the application specifications determined by the client.

When using FASLOC® Duo Speed capsule it is the only one cartridge placed in a borehole and the FAST (red colour) end must be inserted up the hole first followed by the SLOW (natural beige colour) end.

The required number, diameter and length of FASLOC® cartridges for civil, tunneling and mining applications is calculated by estimating the volume of the annulus between the bolt and the

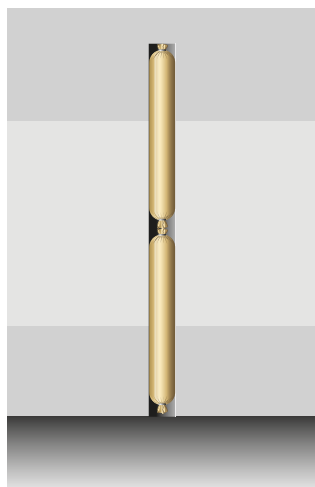
borehole. To ensure full encapsulation of the bolt it is recommended to add 10 -15% excess for borehole irregularities. The annular gap between the bolt diameter and the actual hole diameter should not be more than 10 [mm].

Insert the cartridge / cartridges to the top of the previously drilled and cleaned borehole.

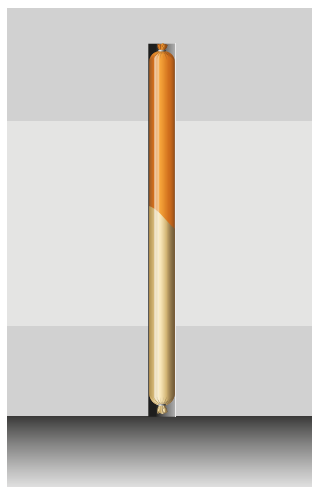
Then insert the bolt attached to the bolting machine and mix the resin and catalyst components, rotating and moving the bolt up to the bottom of the borehole. After the mixing, hold the bolt until the resin is set, then turn the nut.

See pictures 1a/1b – 3.

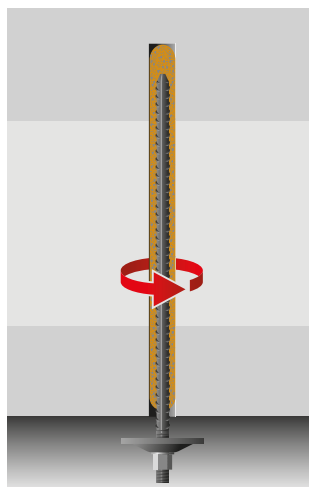
These instructions are general guidelines. Various factors affect installation, so on-place tests should be conducted to determine actual mix and hold times. Generally, for adequate mixing, it is recommended to follow the rule of a minimum of 30 turns of the anchor.



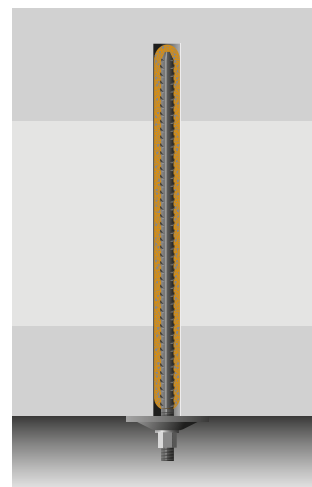
1a. Insert the FASLOC® (Single Speed) cartridge/cartridges to the top of the borehole.



1b. Insert the FASLOC® Duo Speed cartridge to the top of the borehole. The FAST (red) end must be inserted up the hole first followed by the SLOW (natural beige) end.



2. 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.



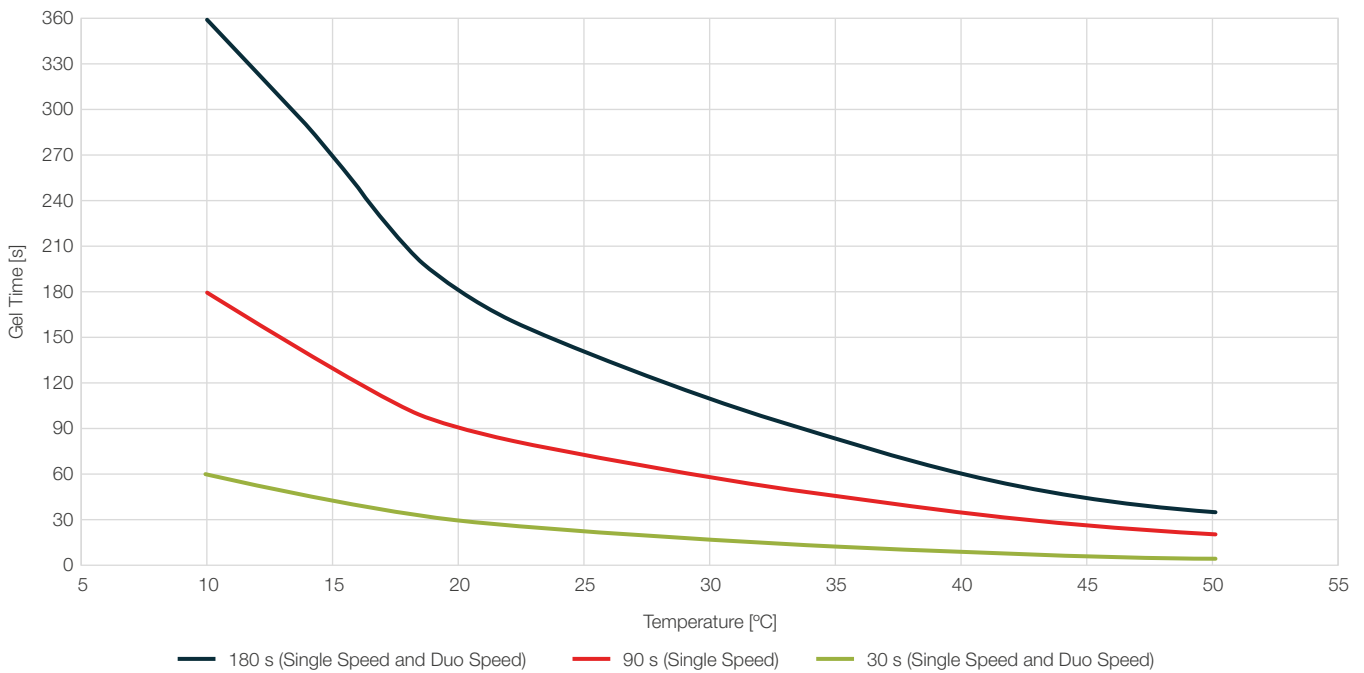
3. After the mixing, hold the bolt until the resin is set, then turn the nut.

Effect of Temperature on Gel Time

FASLOC® resin gel times are determined at 20 [°C]).

Resin is temperature sensitive, so at lower temperatures, gel time will be slower than normal and at higher temperatures the

gel time will be faster than normal (see the figure below).



Packaging, Storage and Shelf Life

FASLOC® cartridges are packed into cardboard or beaverboard boxes depending on customer requirements. The number of cartridges per box and the number of boxes per pallet as well as the type of pallet depend on the dimensions of the cartridges and the customer's requirements.

To maximise shelf life FASLOC® resin should be stored away from direct sunlight in a reasonably cool, well ventilated dry area. Ideally storage in a cool room such as a large fridge storage room or an air conditioned insulated container is preferred.

Cold storage may extend the shelf life of the capsules. However to ensure correct set times the capsules should be allowed to attain ambient underground temperature before use.

The guarantee period of shelf life for properly stored cartridges – storage temperature ≤ 20 [°C] – is 9 months. Under adverse storage conditions shelf life will be reduced. The capsules should not be subject to temperatures ≥ 30 [°C] for prolonged periods.

It is essential stocks are rotated correctly to ensure that oldest stock is used first.

FASLOC® cartridges can optionally be supplied with plastic retainers, which are used to support the cartridge in a vertical hole in the roof of the excavation during application. Depending on the arrangement, the retainers can either be attached to the supplied cartridges or inserted into the box separately, in a pouch. DSI Underground Chemicals offers 2 types of retainers, the so-called "baskets" and the "parachutes" (photos below).



Parachute



Basket



Quality Control

FASLOC® has a 3 part quality control program:

1. Raw material certification, approval and testing
2. In-process control tests
3. Finished product acceptance tests

Capsule sample retains from each manufactured batch are kept following manufacture to aid traceability.

Handling Precautions

Do not open or puncture capsule, physical contact with the liquid within the capsule may cause mild skin irritation.

Safety glasses/goggles/gloves should always be used. In case of contact with eyes or skin immediately flush with copious quantities of water for at least 15 minutes. Seek medical attention. For further information see Safety Data Sheet.

Capsules are filled with inert fillers, polyester resin and catalyst. FASLOC® resin capsules are for industrial use only and are intended for use in conjunction with mine/tunnel bolts.

Notice of Disclaimer of Liability

Products supplied by DSI comply with DSI's specifications. DSI does not claim that its products will be fit for the user's intended use. The conditions under which DSI products are used have not been assessed by DSI and must be assessed and monitored by each user.

The effectiveness of DSI products will be affected by various factors, including mine conditions, mine temperature, product temperature, product storage and

transportation conditions, strata control design, and the skill and experience of the user. In the case of DSI bolt installations, bolt hole size, length and quality, bolt profile, bolt pre-load, bolt encapsulation; resin spin time, and resin hold time, are just some of the critical factors to proper installation and good performance.

This installation guide only contains general information relevant to installing DSI products.

The user assumes all responsibility and liability arising from the use of DSI products or reliance on this installation guide. DSI is committed to maintaining current and accurate information and this installation guide is subject to change without further notice. Please contact us for any further information regarding our products, their performance, quality, specification, testing and installation.



Please note:

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