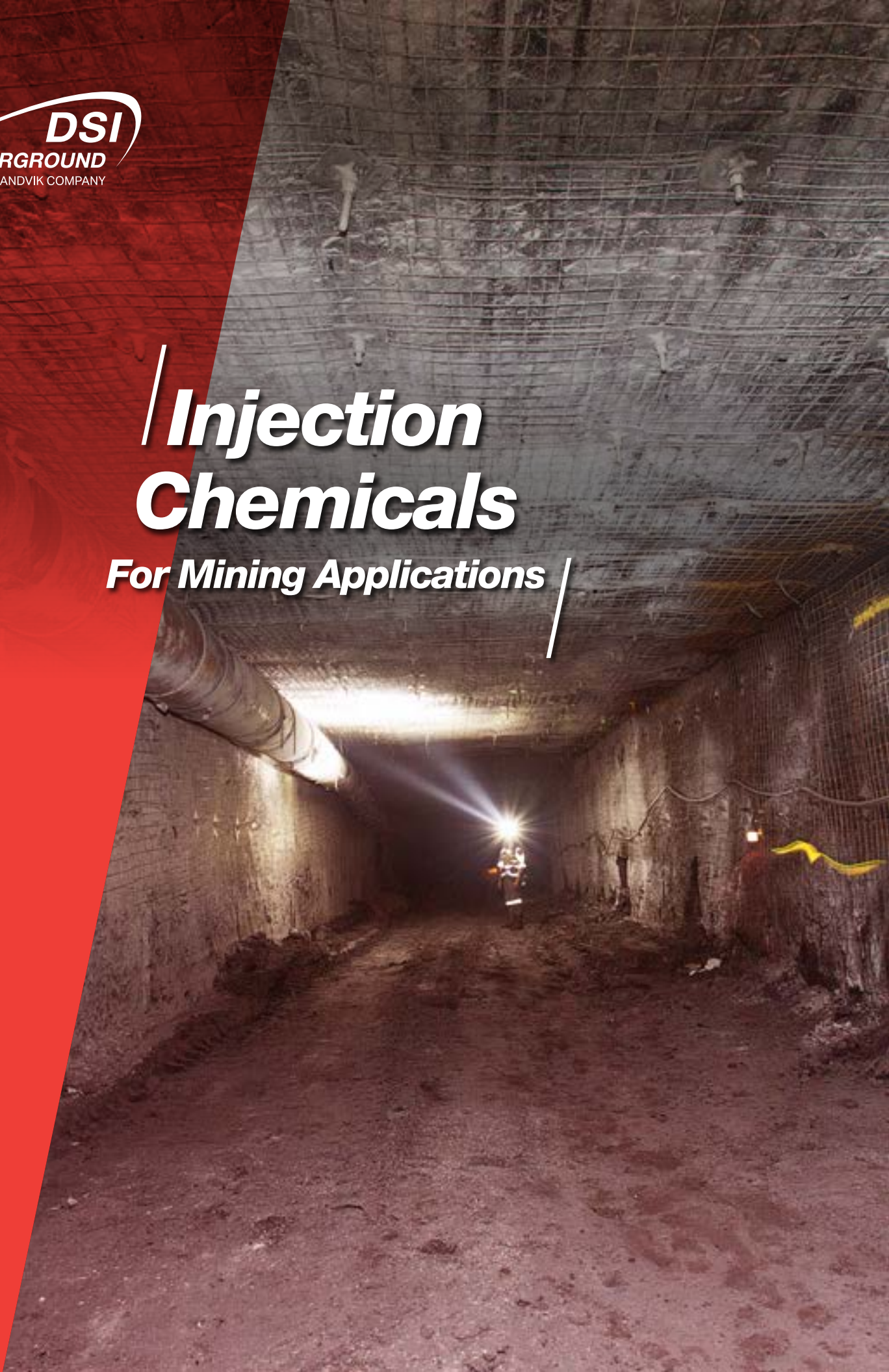




Injection Chemicals

For Mining Applications



/ **Organo-Mineral Resin for Bolting** /



Resin Injection type bolting is an excellent new technology that can significantly increase safety and speed up development. In many instances, it can greatly improve rock support in all sorts of ground conditions. The most interesting such system is DSI's silicate resin that we call "Mineral Bolt" resin.

The thixotropic silicate resin can be used with a wide variety of the bolts, such as DSI's bolts, standard and FRP rebar, both solid and hollow core, dynamic hollow core, cable bolts, VersaBolts™, etc. The resin chemistry is one of the most advanced in the market, and bond strength testing has been done with

a wide range of bolts and installation parameters. We can assist mines in choosing the optimum combination of bolt and hole diameters, as well as the fastest set times to maximise productivity.

Product Range

Product Designation	Product	Product Description
Organo-Mineral Silicate Thixotropic Resin for Bolting	Mineral Bolt MI	<ul style="list-style-type: none"> - Super fast - ultra short setting time - Can be used in lower temperature - Excellent for mechanised automatic application
	Mineral Bolt FAST	<ul style="list-style-type: none"> - Fast - short setting time - Can be used in lower temperatures - Excellent for application when immediate support is required
	Mineral Bolt SLOW	<ul style="list-style-type: none"> - Slow - extended setting time - Suitable for re-bars and hollow bars anchoring
	Mineral Bolt ULTRA SLOW	<ul style="list-style-type: none"> - Ultra Slow -long setting time - Specifically designed for cable grouting

The use of Mineral Bolt injection resin is becoming increasingly used due to several advantages:

- set times can be configured to the individual applications
- the fast curing process speeds up rock support and therefore development
- both component A and B are both low viscosity, making it easy pumped, including long distances
- the resin is thixotropic, and once pumping stops, viscosity increases and will stay in place
- it is easily mixed,
- can be used in difficult works in the presence of water and all types of ground conditions. It is especially useful in loose and fractured rock, but also when drill holes become oversized and conventional bolting proves difficult.
- systems logistics, from small drums to higher volume containers,
- no dust issue that is associated with mixing cement
- reduced physical handling in comparison with cement
- consistent quality control is assured with every bolt install, when pumped in the proper ratio of 1:1
- can be used with automated bolters or with manual installations

Installation Options Mineral Bolt

Bolt type	Rock Bolt Material	Injection Method	Resin Setting Time
[–]	[mPas]	[s]	[–]
Hollow bar	Steel or GRP	via bar	FAST to ULTRA SLOW (depends on length)
Hollow cable	Steel	via cable	
Solid bar	Steel or GRP	via grouting tube	SLOW TO ULTRA SLOW
Cable	Steel	Borehole grouting + bar insertion	
		top to bottom via grouting tube attached to the cable	
		bottom to top borehole grouting with venting tube attached to the pre-inserted cable	
		top to bottom borehole pre-grouting + cable insertion	



Specifications

Product	Consistency after Mixing	Reaction Start Time [s]	Tack Free Time [s]	Foam Factor
Mineral Bolt MI	very high viscous liquid	30	60	1.0
Mineral Bolt FAST	high viscous liquid	45	90	1.0
Mineral Bolt MEDIUM	viscous liquid	105	210	1.0
Mineral Bolt SLOW	viscous liquid	180	375	1.0
Mineral Bolt ULTRA SLOW	viscous liquid	285	500	1.0

Recommended Hollow Bar types for the installation with Mineral Bolt

Hollow Bar Range				
Bar Type	Ultimate Load [kN]	Yield Load [kN]	Elongation %	Suggested borehole diameter
R22-180	>180	145	> 6	33 - 40
R25-200	> 200	150	> 8	35 - 45
R28	> 220	150	> 15	35 - 45
R32-280	> 280	220	> 5	40 - 51



Pull out test results for Mineral Bolt MI and selected Hollow Bars

Resin Version	Bar Type	Embedment length [mm]	Maximum Load
Mineral Bolt MI	R22	500	Above the steel strength
	R25		
	R28 DYNAMIC		
	R32		



Mechanisation and automation of the Injection Bolting

Bolting using pumpable grouts is one of the most anticipated features of modern rock bolting technology. It has the potential to be adapted to virtually all bolts types and used in all ground conditions. Grout physical properties are maintain consistent under all conditions and offer many benefits such as:

- high stiffness for maximum reinforcing
- high load bearing capabilities
- high deformation at failure
- resistance to corrosion
- quick and ease of installation
- user friendly
- removes many of the human factors associated with other bolting systems

Resin injection products have developed to such a degree that they can now be adapted to the latest automated bolter designs and further equipment development is ongoing. DSI is developing many pumping platforms at the necessary pumping accessories to inject the resins.

Mineral Bolt resin is a perfect grout for hollow core bars and dynamic hollow core bars, especially automated installed bolts.

Mineral Bolt resin set times can be manufactured to minimise wait times for all bolt types and installation equipment and methods.

With the advent of Mineral Bolt resin, acceptance of resin injection bolting is increasing quickly for the following reasons:

- one hole, one bolt with immediate support can easily be done, reducing the risk of ground falls,
- operator safety is improved since the operator is always be under supported ground,
- immediate support reduces falls that can damage drilling equipment,
- the lengths of bolts and the large annular gap very often associated with many bolts systems are no longer a critical issue,
- high speed and one man bolting operation ensures lower costs.

The combination of a well-formulated Mineral Bolt resin with a modern automatic bolting machine is the prospect of technical and financial success in underground mining, increases safety of bolting operations.



Pumps and Accessories

Pumps

Selection of a suitable high-pressure pump depends on the type of application, available infrastructure, and ground conditions. Availability of existing

equipment may also influence equipment selection. DSI Underground offers a wide range of high-pressure pumps for underground applications.

Further details are described in separate technical data sheets.

2-Component High-Pressure Piston Pump

- Pneumatically driven piston pump
- 1:1 mixing ratio for processing DSI Inject PUR and SIL Systems
- Independent intake of both components
- Robust design and little susceptibility to damage
- Easy operation and handling
- Spare parts and starter set available
- Technical data sheet and operation manual available on request

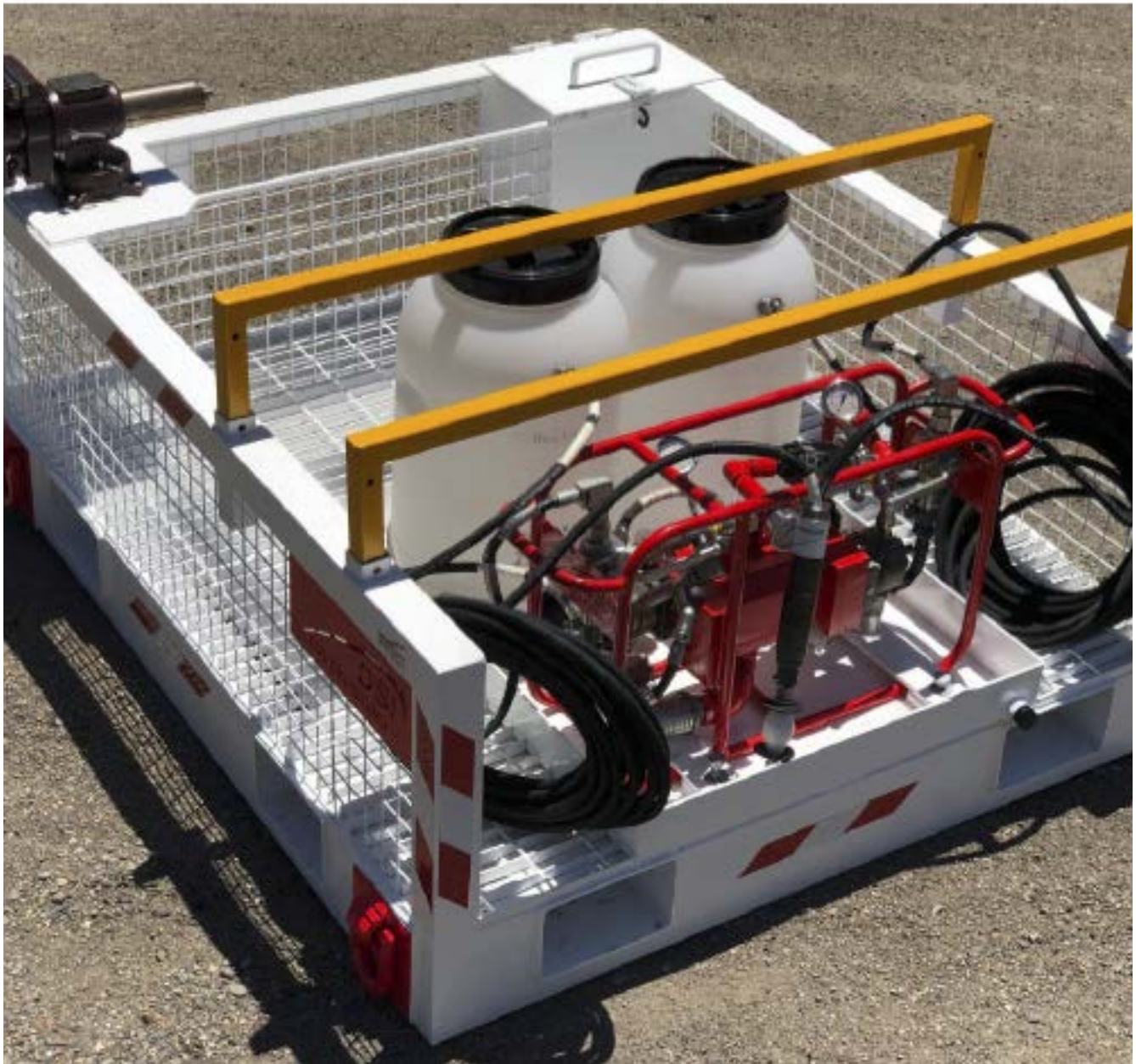


2-Component High-Pressure Hydraulic Pump

- Hydraulic driven
- Easy in the operation and handling
- Stepless flow of the resin
- Can be supplied using the hydraulic from the underground machines
- Perfect solution for the long run applications
- Heavy-duty pump

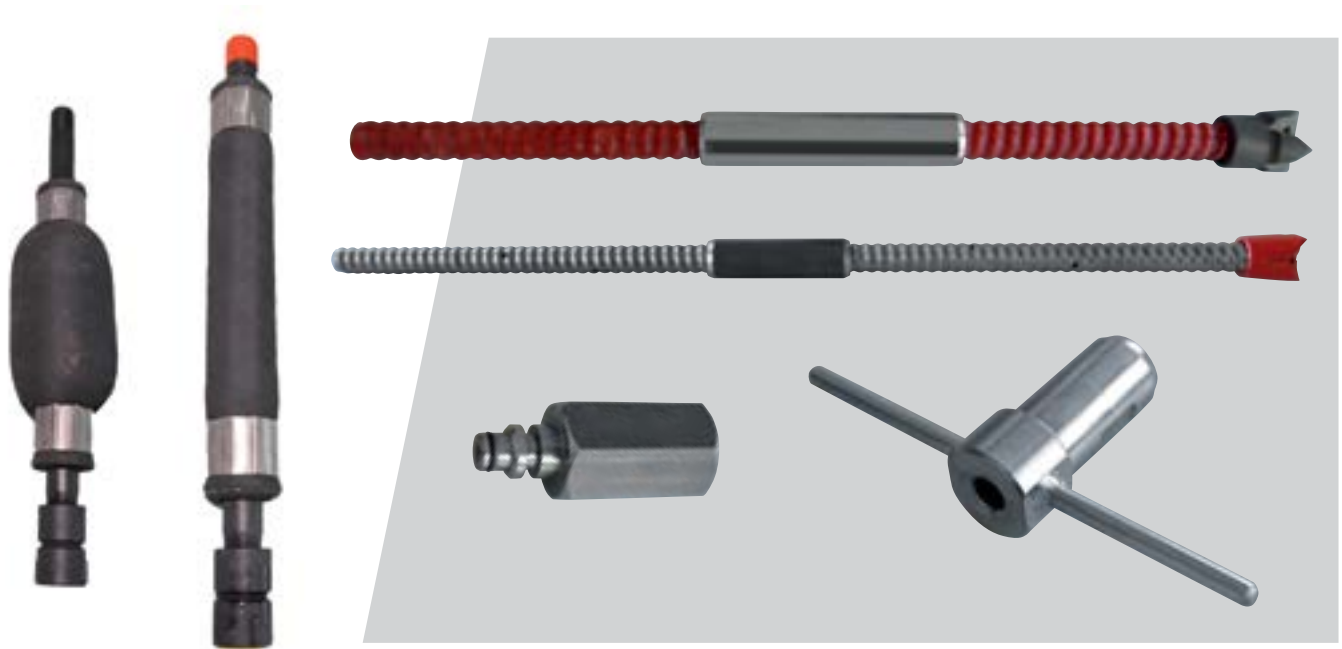


Pumping platforms

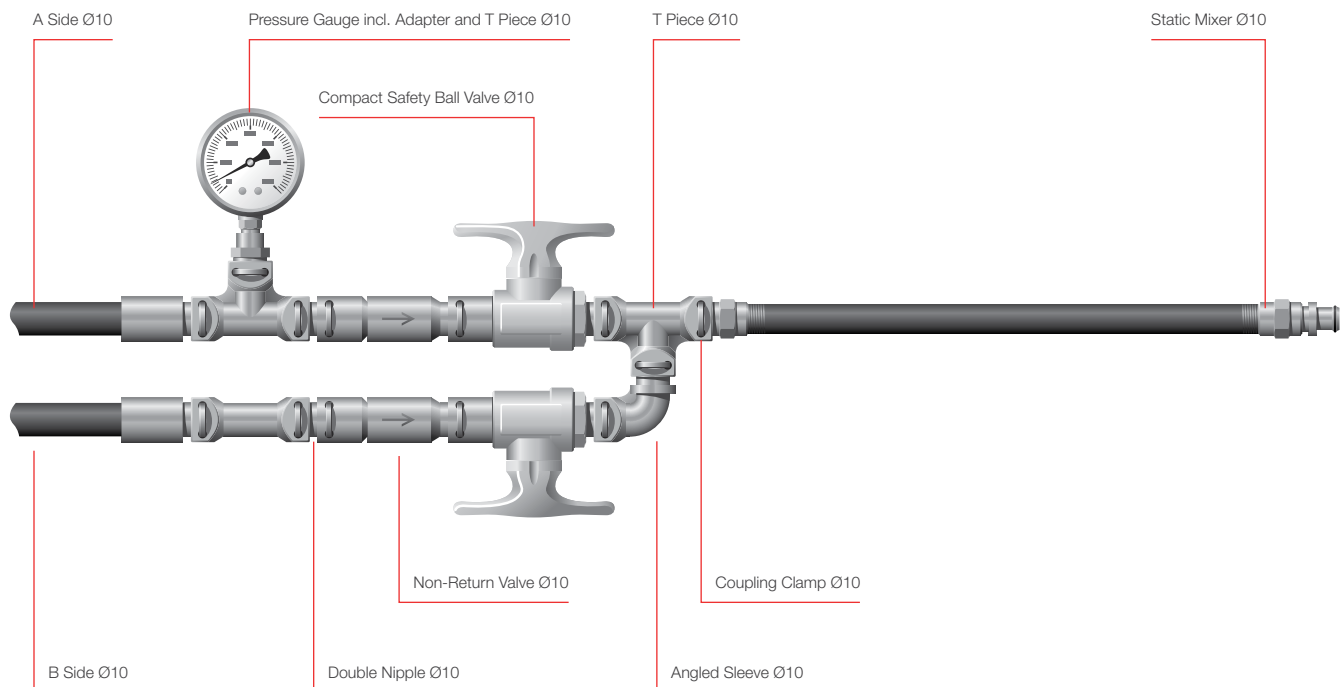


Accessories

- Mixing tubes and static mixers
- Injection lances
- High pressure hoses
- Feeding pipes
- Valve
- Gauge
- STECKO parts
- Safety valves
- Expandable Packers
 - steel
 - plastic
 - with or without static mixer
- Mechanical Packers



Mixing Assembly 1 to 1 (Example)



Approvals and Further References

Approvals

Test Procedures

- Mechanical properties
- Reaction temperature
- Escape filter tests
- Hygienic assessment
- Impact on the ground and drinking water
- Fire testing
- Long-term durability
- Impact on the ground and drinking water

Approvals

- Product-specific approvals are listed in DSI Underground technical data sheets



Cooperation Partners

- MFPA Leipzig GmbH, Germany
- DMT GmbH, Germany
- Central Mining Institute, Poland
- Hygienic Institute Gelsenkirchen, Germany



Packaging

- IBC tanks for large-scale applications
- Steel barrels (200 [liters])
- Metal or plastic, 20 or 25 [liters] drum

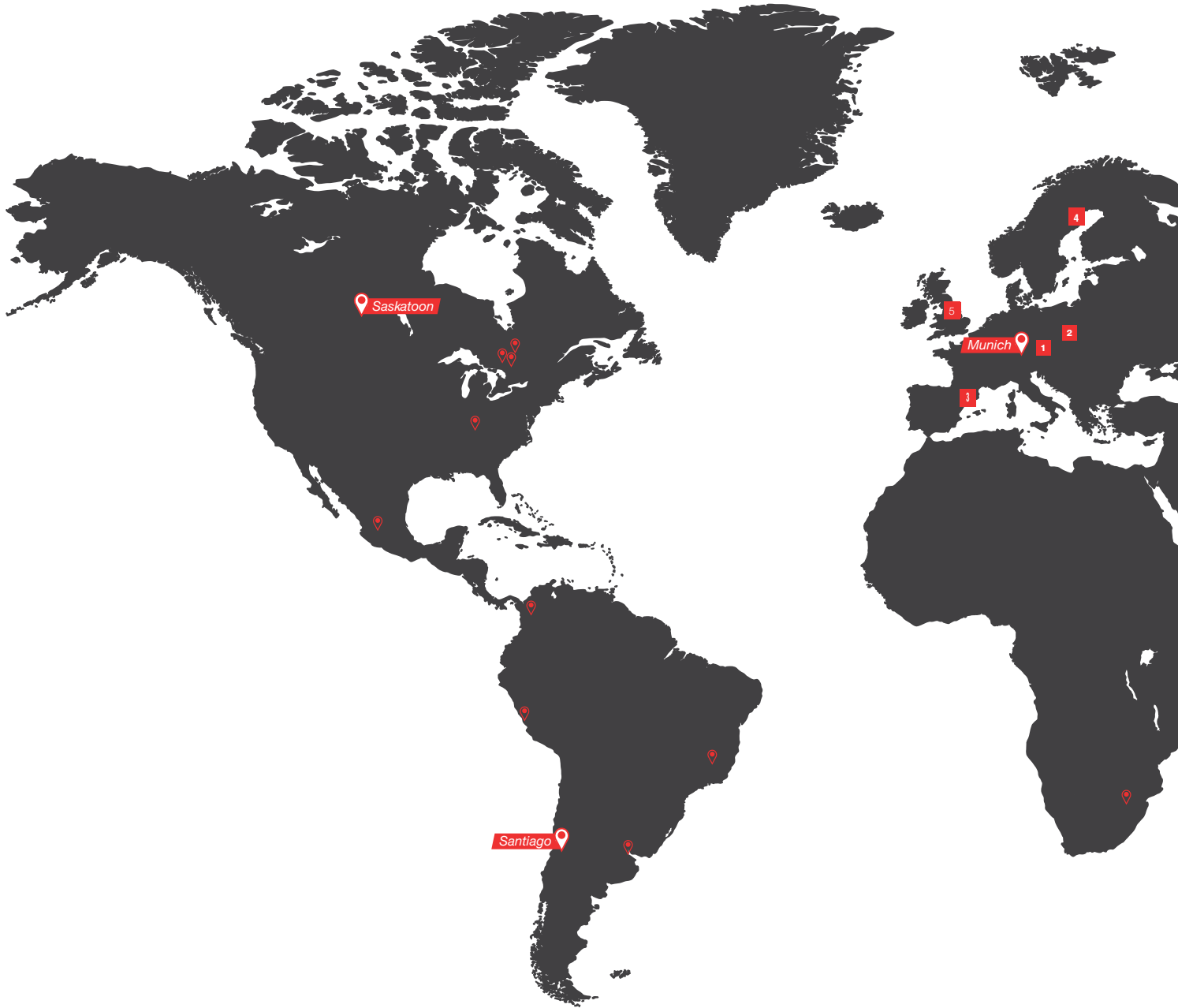


Further References

- Safety data sheets
- Technical data sheets
- Instructions for mixing and processing, cleaning and disposal, health and safety



Reinforcing Progress



Head Offices

Canada Underground

DSI Underground Canada Ltd.
3919 Millar Avenue
Saskatoon, SK S7P 0C1
Canada
www.dsiunderground.ca

Latin America Underground

DSI Underground Chile SpA.
Avda. Cordillera #482
Quilicura, Santiago - Chile
Chile
www.dsiunderground.cl

EMEA Underground

DSI Underground GmbH
Destouchesstrasse 68
80796 Munich
Germany
www.dsiunderground.com

APAC Underground

DSI Underground
25 Pacific Highway
Bennetts Green, NSW 2290
Australia
www.dsiunderground.com.au



Europe

1 Austria

DSI Underground Austria GmbH
Alfred-Wagner-Strasse 1
4061 Pasching/Linz
Austria
www.dsiunderground.at

2 Poland

DSI Schaum Chemie sp. z o.o.
Injection Resin Competence Center
ul. Podleska 76
43-190 Mikołów
Poland
www.dsi-schaumchemie.pl

3 Spain

DSI Underground Spain S.A.U.
Calle Nicaragua 137
Despacho 1
08029 Barcelona
Spain
www.dsiunderground.com

4 Sweden

DSI Underground Nordics AB
Hyvelgatan 15
931 36 Skellefteå
Sweden
www.dsiunderground.com

5 United Kingdom

DSI Underground U.K. Ltd.
Systems House
Ireland Close, Off Fan Road
Staveley, Chesterfield
Derbyshire, S43 3PT
United Kingdom
www.dsiunderground.com



Please note:

This brochure is only for basic information purposes only. The technical data and information provided here is to be considered non-binding and may be subject to change without notice. We cannot assume any liability for loss or damage due to the use of this technical data or any improper use of our products. Should you require further information on particular products, please do not hesitate to contact us.

Canada

Sudbury Office

73 Elm Street, unit 300

Sudbury, Ontario, P3C 1R6

Phone +1 866 3446244

E-mail eastorders@dsiunderground.com

Main Office

3919 Millar Avenue

Saskatoon, Saskatchewan, S7P 0C1

Phone +1 866 3446244

E-mail order.desk@dsiunderground.com