Method Statement

MasterRoc TSL 865
Thin Spray-on Liner
General

This document has been produced by BASF Underground Construction for the application of MasterRoc TSL865 thin spray-on liners. MasterRoc TSL865 can be sprayed onto rock, soil substrates or coal strata above and underground as weathering protection and surface support.

This Method Statement is generic and may be adapted to local site conditions where appropriate.

It is strongly recommended that a specific Method Statement relevant to the actual project is produced for each application. A professional geotechnical engineer must take part in establishing this Method Statement to ensure that MasterRoc TSL865 is used as part of a system where optimization and use of other support elements has been properly evaluated. When MasterRoc TSL865 is used in a combination it is even more important that the geotechnical engineer considers the most adequate installation sequence of the support elements.

Field of application

MasterRoc TSL865 can be used for

- Air-slacking and rock weathering reduction
- Vent stopping
- Ventilation improvement through surface friction reduction
- Corrosion protection of standing steel support
- Abutment for low pressure injection
- Rock and coal strata stabilization

In individual cases the product can be considered for

- Rock surface reinforcement in areas with difficult accessibility
- Ground support in areas with difficult accessibility
- An alternative to mesh/screen protection
- Preliminary per-round support allowing later sprayed concrete application on a larger area giving improved efficiency
- Preliminary slope protection binding the surface before the area is ready for sprayed concrete
• Against hard rock strain bursting
• Pillar/rib support
• Rehabilitation of collapsed areas
• Immediately after TBM cutter head in tunneling operations

Surface Requirements

Surface cleaning and substrate temperature
Any contamination of the surface must be removed, such as dust, oil, soot and loose particles etc. The substrate and ambient temperature during application should be between +5°C and +45°C.

Rock substrates must be properly scaled by suitable mechanical scaling methods, to remove larger loose blocks. Cleaning with compressed air in combination with water will then take place to effectively remove all dust.

If the substrate quality is so poor that active scaling and cleaning will only “excavate” the rock, then these activities must be limited to what can be considered beneficial and reasonable. This decision should be made by a qualified geotechnical engineer. Under such conditions, it is obvious that the bond strength will be limited by the character of the substrate and this makes it especially important to consider carefully the need for supplementary support elements, like rock bolts.

Active water
When MasterRoc TSL865 is used as a sealant e.g against water, air or other gases it may be necessary to achieve full coverage. In this instance the following procedure should be considered.

As with all spray applied products, it is not possible to seal against active water ingress through the substrate. However, damp sections of substrate without visible active water ingress may be sprayed over with MasterRoc TSL865. Spots and local areas with active water should be either pre-sealed, or managed by suitable drainage. It is also acceptable to allow water to penetrate the membrane in local spots, as long as the water is simply penetrating and then channeled down to the tunnel floor (and not run down the wall washing out a totally destroyed membrane strip of several meters in length). Active water leakage may be diverted by:

• Collecting the water in hoses fixed into pre-drilled boreholes
• Pre-excavation grouting
• Post grouting

In all cases, a practical solution must be adapted to each individual case, and should be strictly implemented on site.

Spraying Equipment

Spraying equipment might require special local approval, which has to be evaluated by the operator, e.g. Atex certificate in Europe for areas with risk of explosion.

In the following a Reed pump is recommended as spraying equipment. It is seen as the best choice to achieve a properly applied MasterRoc TSL865 but cannot be used in all underground conditions and has no approval for coal mines.

MasterRoc TSL865 shall be applied with an air or electric driven Reed pump (or similar tested and verified suitable equipment), with the following specific equipment lay-out:

• Rotor shall have 18 pocket feed bowl (approx. 1m³/hr)
• Water separator on the air supply
• Air supply (5m³ electric driven, 12m³ for air driven equipment)
• Rotor dust collector
• Spraying nozzle “Double Bubble” with 18 hole water ring
• Spraying hose DIA 32 mm
• It is required to use two valves on the water line on the nozzle. The first valve is a needle valve for fine control of water dosage, the second being a ball valve for on – off control. Please refer to Figure below
• A water pump is advised to guaranteed to ensure delivery of the correct water pressure and volume throughout the spraying process (6 bar pressure)
The Reed pump (SOVE – Electric or SOVA – Air driven) or chosen spray equipment must be fitted with a dust collection filter, or similar dust collection system.

Spraying equipment (REED Sov) and double bubble nozzle

The following air and water properties are required:

- Air volume for air driven equipment: > 13m³/minute
- Air volume for electrical equipment: > 6m³/minute
- Air pressure: 7 bar
- Water pressure: > 6 bar (constant)

The supplied compressed air must pass a de-watering system, otherwise a water separator device should be supplied with the spraying equipment.

Care should be taken to minimize excessive dust when filling the hopper of the Reed pump or other suitable equipment such as a Allentown, Blastcrete Gun. The floor areas near the gun should be soaked with water during the application process to bind any settling dust.

The following procedure should be implemented for all applications:

- Start water
- Start air
- Start material feed and adjust the air and water
- Apply product to substrate
- Shut-off material feed
- Finally, turn-off air
• When clear, shut-off water (keep nozzle facing downwards to prevent water running back into delivery line)

**NOTE: Do not spray - under no circumstances - MasterRoc TSL865 without addition of water at the nozzle.**

Water addition should be between 40 and 50 % by product weight. Preliminary site tests must be undertaken with the equipment that will be used on the project, with the powder to water output settings established to achieve the recommended water addition.

Example: Normal operating speed: 10kg/minute of MasterRoc TSL865 powder, with 4 – 5 liters/minute of water

When beginning the application, always spray with a higher amount of water. This will avoid excessive dust to be blown into the air prior to fine-tuning. Once air and powder has started to be fed, water can be gradually being reduced until the spraying jet starts emitting dust (this limit on water dosage is pretty sharp and can easily be observed). Then water dosage should be slightly increased again to go back to the close-to-no-dust situation. The nozzle is now ready to be directed onto the support area.

Alternatively, the water ring system mentioned above may be replaced by the membrane water injection system. This requires a minimum water pressure of 12 bars, or for a booster pump to be used on the water line to achieve this pressure. This water injection system is preferable, but is not an absolute requirement for good spraying.

Compressed air supply is often full of condensed water. Such water causes the build up of hardened material in the spaying nozzle and/or spraying hose. Such build up may be very difficult to remove and can cause unnecessary practical problems. A complete equipment set-up must always include a proper water separator with sufficient capacity to dry out all air used for spraying. Such a water separator can be part of the complete BASF equipment delivery.
Conditions for successful spraying

General

For the successful application of MasterRoc TSL865

- Air temperature (acceptable working range between 5°C and 45°C)
- Ventilation to remove any dust produced during spraying. In the US, please refer to applicable standards of 30 CFR - Part 75 Subpart D—Ventilation per MSHA and the mine’s approved Ventilation Plan.
- Adequate lighting and lifting platforms should be provided to ensure quality and safe MasterRoc TSL865 application.
- If ground conditions are poor and it is decided to use the MasterRoc TSL865 for initial support, the use of a hydraulic manipulator (robot) should be considered.

Spraying

If possible, surfaces onto which MasterRoc TSL865 is applied shall be thoroughly cleaned with high pressure air-water jetting (using dry gun nozzle system for example). No standing water should be visible on the substrate when applying the membrane.

Spraying distances should typically be between 1.5 and 2.5m. Manipulation of the nozzle should be such as to promote the full coverage of the substrate with an average minimum thickness of MasterRoc TSL865 of 3mm. When the substrate is very rough and blocky the spray-parameters must be adjusted to allow a nozzle distance of about 0.5 m. This distance is necessary for rapid adjustment of the spraying direction of up to 90°.

It is recommended that two operatives are used for the application of the membrane. One controls the nozzle, and the second will manage the delivery hoses for the nozzle man, control thickness, move lights and prevent possible mistakes during the application.

Lapping of adjacent sections of MasterRoc TSL865 is simply achieved by ensuring an overlap width of 20 to 30cm. The cured underlying membrane should be thoroughly cleaned with high pressure air-water
jetting to remove all loose material and dust prior to the application of MasterRoc TSL865 to adjacent section.

**Quality Control**

To ensure that the correct thickness is achieved, wet film thickness tests may be considered at random locations to ensure the required thickness has been achieved. Consumption rates for a given area can also be used to indicate that the overall thickness of MasterRoc TSL865 has been applied.

Site generated inspection check sheets are required to record each section of the tunnel where MasterRoc TSL865 is applied. Recording of the following information is required as a minimum:

- Section of substrate (chainage), bay number etc)
- Date
- Shift
- Operative
- Pre-spraying checks (surface condition, surface drainage system, cleanliness etc.)
- Thickness checks (indicated by locations) and by method chosen
- Post-spraying checks

All checks should be ticked and initialed by those responsible for quality procedures on site.

**Training**

All operatives involved with the application of MasterRoc TSL865 shall undergo specific on-site training by BASF UGC Representatives before application in the works.

The training program shall include classroom sessions to highlight specific details and critical operations, followed by practical application at a trial site until the operative and product performance is satisfactory.
Cleaning

The dry spraying machine and delivery lines should be cleaned with compressed air.

The nozzle and injector should be cleaned with water. The nozzle should be checked every time there is a break in the spray application.

Coarse dry sand (0-4mm) pumped through the entire equipment can remove material build up.

Be aware that the nozzle must be located in a place without water drips from the roof (or it must be shielded by a plastic tarp or similar). This will prevent water from entering into the nozzle and the resulting build up of material in the equipment. It is also extremely important to avoid water from the compressed air supply to enter into the material transport air. The product has been deliberately made highly reactive with water to build strength as soon as possible after application. It is therefore obvious why care must be taken to avoid water in the system between the gun and the nozzle.

Storage and Disposal

MasterRoc TSL865 has a shelf life of 6 months if stored in original, unopened bags between +5 °C and +40°C. The storage area must remain dry.

MasterRoc TSL 865, if spilled from an open bag, should be sprayed with water or removed with a shovel into a suitable container and removed from the mine.

Safety with MasterRoc TSL865

When working with MasterRoc TSL865, in addition to standard personal protective equipment required for underground work, operatives require eye protection, dust masks and gloves.

For the operation of working platforms, use of compressed air tools and pumping equipment refer to local or national rules for this equipment.

As with all mine/tunnel construction operations, it is the duty of the contractor/sub-contractor engaged with the application of MasterRoc TSL865 to produce and implement a risk assessment prior to commencing the work.