



Product Systems for Tunnel Construction

EXPERTISE
TUNNELLING





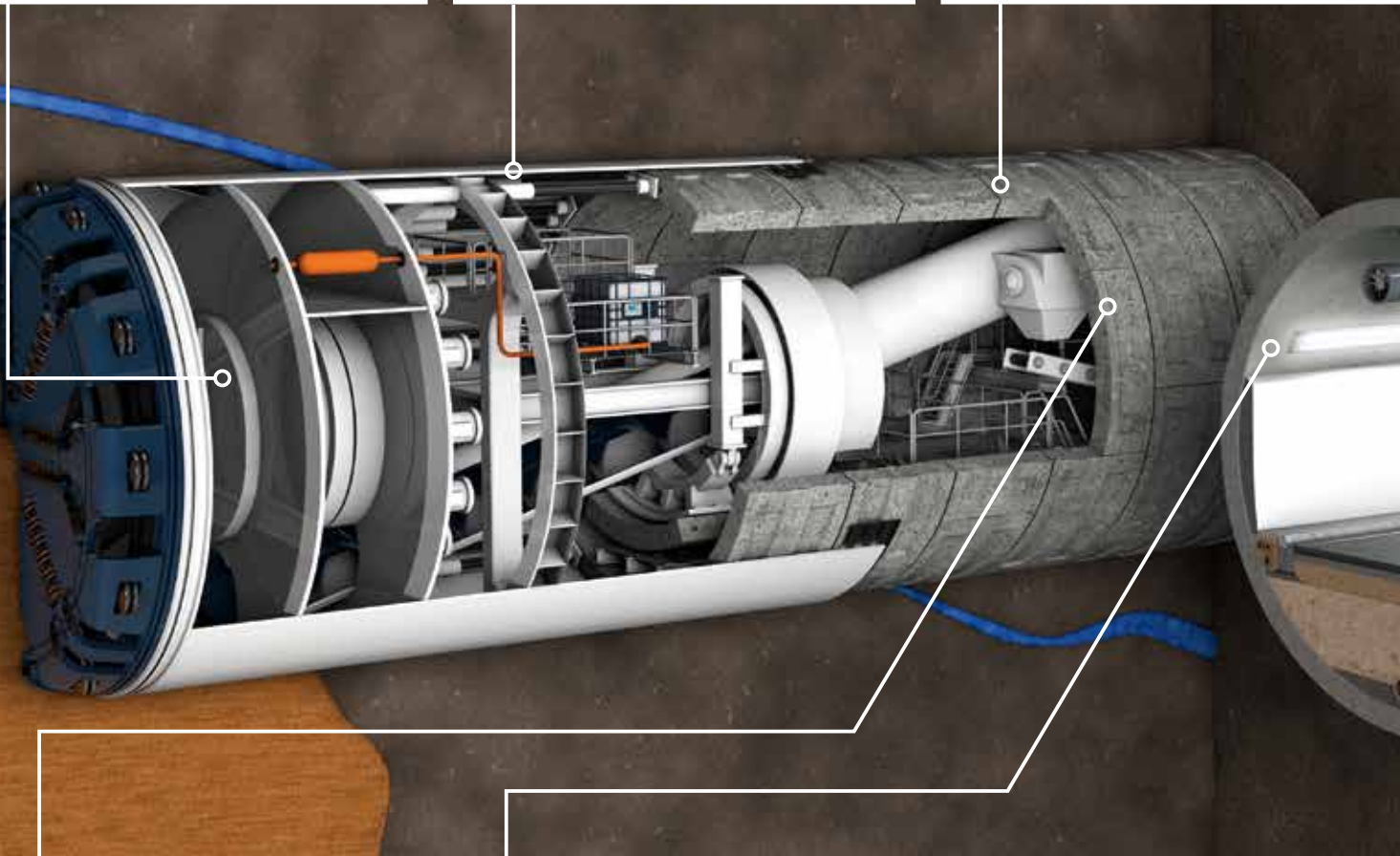
Soil conditioning with foams and polymers



Tail sealants and main bearing greases, backfill grouting systems



Product systems for segment production



Injection systems for waterproofing and sealing of cracks and cavities



Shotcrete, waterproofing membranes and tunnel lining solutions



Concrete replacement and surface protection



System solutions for mechanised and conventional tunnel construction

As your project partner, MC offers a full range of products and services for your tunnel construction activities – from excavation to repair. With decades of experience in major international projects, we are able to supply effectively optimised, application-specific solutions geared to securing your full satisfaction and peace of mind.

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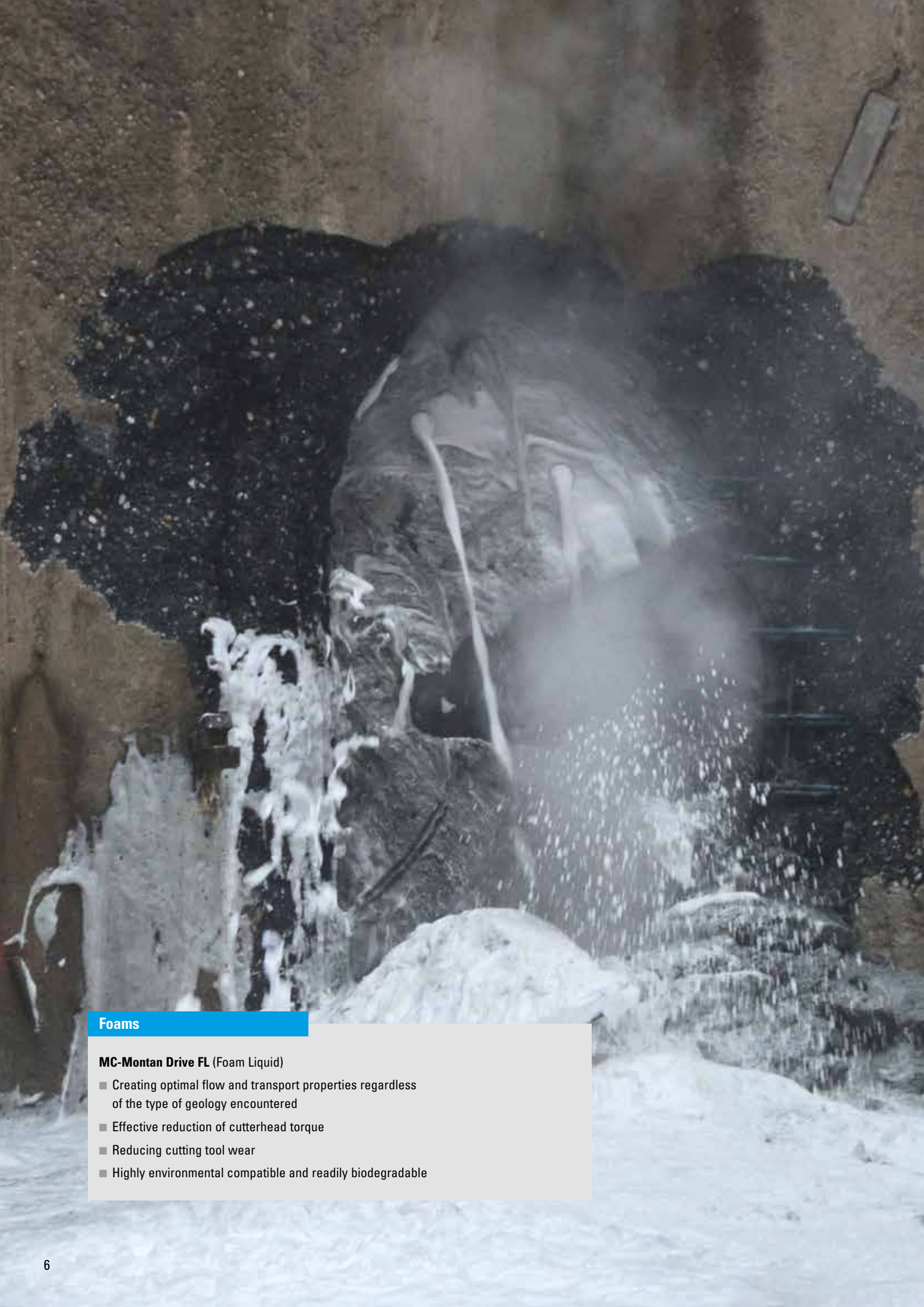
Mechanised Tunnelling

As a worldwide leading technology, mechanised tunnelling with tunnel boring machines (TBM) is particularly suitable in difficult ground conditions and in inner-city projects. Aside from the gripper and slurry methods, the EPB technology (earth pressure balance) is the most commonly used drilling technology.

Its success depends not only on careful planning and execution, but also – and critically – on ensuring optimal interaction between the machine technology employed and the speciality chemistry applied.

MC is able to support the full range of tunnelling variants with optimally adapted system solutions from the areas of soil conditioning, pipe jacking lubrication, tail sealing, main bearing lubrication and sealing, backfill grouting and state-of-the-art concrete technology.





Foams

MC-Montan Drive FL (Foam Liquid)

- Creating optimal flow and transport properties regardless of the type of geology encountered
- Effective reduction of cutterhead torque
- Reducing cutting tool wear
- Highly environmental compatible and readily biodegradable

Soil conditioning for earth pressure balance shields

Earth pressure balance machines (EPB TBM) use the excavated soil to create the necessary working pressure. To meet the special requirements for the supporting medium, the soil is conditioned with foams and polymers. The aim of soil conditioning is to ensure a suitable flow behaviour of the spoil through the cutterhead, into the excavation chamber and through the screw conveyor – as well as to ensure the support pressure transmission, reduce water permeability and decrease internal friction of the soil.

In addition to the cost-efficiency of EPB Tunneling and their high advance rates, the re-use of the excavated soil comes more and more into focus. MC takes this pro-actively into account with readily biodegradable products based on renewable raw materials when ever possible. MC offers also the lowest possible aquatic toxicity in order to preserve ground and tunnel water.

MC offers conditioning agents adapted to the geological conditions of a project, mixed-face conditions in particular. We also provide first-class on-site technical support – always a key factor when it comes to ensuring the truly effective use of such conditioning agents.

Polymers

MC-Montan Drive LB (Liquid Binder)

- Optimised conditioning of soils with a high water content
- Protection against water penetration through highly permeable soils
- Exceptional water-binding capacity

Defoamers

MC-Montan Drive DF (Defoamer)

- Fast reduction of foam formation
- Cleaning of foam-forming surfaces
- Highly environmental compatibility

Anti-Clay Additives

MC-Montan Drive CA (Clay Additive)

- Reduction of clay adhesion and cohesion effects at the cutterhead, in the excavation chamber and in the screw conveyor
- Reduced energy consumption through reduced cutterhead torque
- Environmentally compatible and readily biodegradable



Additives and flocculants for slurry shields

With fluid-supported shields, a bentonite suspension is normally used to create and maintain the necessary support pressure at the tunnel face. High proportions of clay minerals in the spoil can lead to clogging. This can also drastically reduce the efficiency of the separation plant. In response, MC has developed a range of suitable additives to optimise driving operations for fluid shields.

Whether separation is performed through classic sedimentation techniques or using centrifuges, the application of flocculants needs to be well managed. Aligned to the composition of the slurry, the correct selection or combination of flocculation agents is essential to the achievement of an efficient and effective separation result.

Anti-Clay

MC-Montan Drive BA (Bentonite Additive)

- Reduction of clay adhesion and cohesion
- Reduced wear of cutting tools
- Environmentally compatible and readily biodegradable

Flocculants

MC-Montan Support FA – Anionic/Cationic (Flocculation Agent)

- High rates of sedimentation
- Effective pH range: 1 – 14
- Anionic or cationic polyelectrolyte
- Wide application versatility





Tail sealants

The annular gap between the segments and the TBM tail shield needs to be sealed against water, soil and grout penetration into the TBM invert. This is realised by a multi-row brush system installed on the TBM together with the injection of tail sealants into the corresponding chambers.

Tail sealant

MC-Montan Seal ST (Shield Tail)

- Reliable tail sealant for the tunnel drive and for the first fill of the brushes
- Excellent adhesion on all surfaces
- Based on plant oil or bentonite
- Outstanding pumpability (optimised for use in combination with HDT-Montan Device HD)
- Sustainably sound environmental compatibility
- Free of microplastics

Particularly under very high water pressures, leaks in this system can jeopardise the safety of the entire project. Additional protection against the penetration of water during repair work is provided by a travelling annular space and rock injection system using soft-elastic sealant materials.

Temporary shield tail waterproofing

MC-Montan Injekt TR-X

- Soft-elastic, swellable Injection compound for temporary waterproofing and repair works
- Short, controllable reaction times for optimal sealing results
- Suitable for use in contact with mortar systems thanks to exceptional alkali resistance
- Sustainably sound environmental compatibility – harmless in contact with soil and groundwater



MC-Montan Seal ST



First fill of brush seals

Main bearing sealing and EP greases

The main bearing of a tunnel boring machine is one of its most valuable and sensitive parts. It therefore needs to be properly and securely protected against the penetration of water and soil particles.

A system of main bearing labyrinth seals provides this effective protection, supported by EP greases and main bearing sealing grease. MC offers a selection of lubricating and sealing greases, which underwent an extensive test programme conducted by Freudenberg Sealing Technologies.

Main bearing sealing grease

MC-Montan Support MB S (Main Bearing Seal)

- Reliable main bearing sealing
- Use of raw materials complying with extremely high quality standards
- Exceptional adhesion and cohesion

EP2 grease

MC-Montan Support MB L (Main Bearing Lube)

- Effective main bearing lubrication
- Use of raw materials complying with extremely high quality standards
- Exceptional lubrication performance with good adhesion and cohesion



MC-Montan Support MB S



MC-Montan Support MB L

Individually designed backfill grouting systems

The annular gap which is created by the difference in diameter of the cutter head and the segmental lining has to be filled and stabilised with a backfill grouting mortar to minimise surface subsidence and to consolidate and stabilise loose rock. Injected into the annular space over the full area, the mortar is formulated for stiffness and strength values aligned to those of the surrounding rock material.

MC develops single-component and two-component backfill grout formulations aligned to the in-situ rock conditions specific to your tunnel construction project. Every tunnel project is consequently provided with the optimum bedding solution to ensure minimum surface settlement.

Activator

MC-Montan Grout 01

- Speciality activator for annular space backfill mortar
- Exceptionally high reactivity
- Gel phase initiated in line with project-specific requirements

Stabiliser

MC-Montan Grout 02 (pure / pro)

- Highly effective stabiliser for annular space mortar systems
- Optimised mortar conveying and pumping properties thanks to dispersive effect
- Controllable, extended working times
- Sustainably sound environmental compatibility

Viscosity modifier

MC-Montan Grout 05

- Viscosity modifier and injection aid for annular space backfill grout
- Rapid attainment of required bedding properties
- Accurately controllable slump
- Ideal for undrained rock conditions

Foamed grouting system

MC-Montan Grout FM (Foaming Mortar)

- Dimensionally stable cavity grouting
- Cost-effective material consumption rates







Special annulus grout systems

MC is able to offer tailored solutions for annular gap grouting applications. The basic composition of MC's special backfill grouts is founded on extensive experience with "earth-friendly concrete" (EFC), a composition that hardens and sets without the use of cement.

These special backfill grouts are two-component systems usually comprising a pre-batched base mix and an activator.

Depending on requirements, the base mix with a very long working time, can be used as a suspension or mortar with addition of the appropriate aggregates. MC then works to optimise the selected system and to coordinate the admixtures according to the requirements and operational aspects of the application.

Geopolymer / EFC

MC-Montan Grout BG 02 (Backfill Geopolymer)

- Cement-free binding agent
- High sulphate and chloride resistance
- Inactive pre-batched base mix
- Low heat generation

Alkali-activated

MC-Montan Grout AA 03 (Alkali Activated)

- Alkali-activated binder compound
- Prevents anhydrite swelling
- High sulphate and chloride resistance
- Inactive pre-batched base mix
- Low heat generation

Drainable

MC-Montan Grout DO 04 (Drain Out)

- Drainable backfill grout
- High sulphate and chloride resistance
- Inactive pre-batched base mix

Compressible

MC-Montan Grout CB 05 (Compressible Backfill)

- Permanently compressible backfill grout
- High sulphate and chloride resistance
- Inactive pre-batched base mix

Machine parts for optimised application of MC products

In order to increase the efficiency of the used speciality chemicals, MC offers also dedicated machine technology. The application of MC-Montan Device CT (Cell Tube) foam generator results in exceptional foam qualities and outstanding conditioning results, especially under difficult geological conditions. The machine components are easy to fit, with project support from MC assured.

Foam core

MC-Montan Device CT

- Simple to use, reliable and low in maintenance
- High foaming power in combination with MC-Montan Drive additives
- Production of solid cellular foams possible

Essential for an efficient TBM drive is not only the well performing tail sealant but also reliable and almost maintenance free press plate pumps. The HDT-Montan Device HD high-pressure pump in combination with the appropriate sealing compounds offers a huge potential for operational optimisation.

Press plate pumping system

HDT-Montan Device HD

- Special high-pressure pump for the delivery of highly viscous media
- Particularly low maintenance requirement thanks to high chemical and mechanical resistance
- Small footprint and low-height profile
- Easy drum replacement with quick-change system





Tunnel segment technology

In TBM operations, tunnel segments serve to both seal and support the excavated tunnel. These precast concrete segments are therefore required to meet the highest quality standards.



Meeting the highest demands on concrete quality and durability

Tunnel segments are subjected to the highest demands on quality and durability. They have to be able to withstand not only the forces imposed upon them by the in-situ rock but also the pressures generated during the tunnel heading operation. Properly reinforced designs based on high-performance concrete are therefore essential.

MC is able to offer you an integrated solution individually aligned to your project. Leveraging our extensive product portfolio and the knowledge of our concrete technology experts, we can put together a tailor-made system solution for your project that meets the highest demands on both quality and durability.

High-performance superplasticiser

MC-PowerFlow

- High-performance superplasticiser for maximum quality demands on the concrete and the final finish
- Exceptionally high water-saving potential
- Fast strength development for high early strength values and early formwork stripping
- Free from corrosion-promoting components

Hardening accelerator

MC-FastKick

- Special hardening accelerator for controllable, reduced curing times
- Very high early strength combined with minimal decrease in final strength values
- Reduced cycle times even at low temperatures
- Free from chlorides and corrosion-promoting components

Polypropylene fibres

MC-Montan Support PP-Fibre (Polypropylene)

- Fire protection through enhanced gas permeability in the composite
- Reduced water requirement during application
- Improved usage of the required concrete cover
- Corrosion-resistant



Concrete admixture

Centrilit NC

- Concrete admixture for maximum homogeneity and chemical resistance
- Reduced chloride migration and improved abrasion resistance thanks to increased concrete density
- Versatile applicability, also suitable for high-performance concretes
- Sustainably sound environmental compatibility

Stabiliser

Centrament Stabi

- Special stabiliser for highly fluid concretes
- Minimisation of the internal frictional forces of the concrete mix
- Optimised protection against segregation and blooming
- Exceptional concrete homogeneity

Air-entraining agent

Centrament Air

- Air-entraining agent for homogeneous concrete mixtures and segregation avoidance
- Efficient introduction of microporosity in the concrete structure
- Outstanding application and compaction properties
- Free from corrosion-promoting components

Setting retarder

Centrament Retard

- Setting retarder of the latest generation
- Long-lasting, good flowability for high concrete quality
- Optimum concreting conditions thanks to extended working times
- Free from chlorides and corrosion-promoting components

Release agent

Ortolan Basic/Classic/Extra

- Concrete release technology with integrated corrosion protection for outstanding surface finishes
- Exceptional separation effect with minimum concrete residues on the formwork
- Universally applicable for all absorbent and non-absorbent formwork
- Environmentally compatible and readily biodegradable



Centrilit NC —
pozzolanic aluminosilicate







Concrete repair and cosmetic systems for exceptional surface quality

Tunnel segments are often exposed to huge loads. Any incorrect segment erection or segment displacement due to external forces can result in concrete cracking and spalling. MC's wide range of products for concrete reprofiling offers you efficient products that enable you to react flexibly and quickly to unforeseen events.

Concrete replacement

Nafufill KM 250

- Single-component concrete replacement system for manual and spray application
- Resistant to de-icing salts and chloride-proof
- Fire resistance rating F 120 to DIN 4102-2
- Fire resistant according to the tunnel fire curves of Germany's ZTV-ING code of practice, the EBA code of practice for railway tunnels, and the TNO Report issued by the Rijkswaterstaat (RWS) of the Netherlands
- Certified to EN 1504-3, Class R4 – structurally relevant

Coarse filler

Emcefix-Spachtel G extra

- Polymer-modified coarse filler for concrete cosmetic purposes
- Bond coat integrated
- Resistant to freeze-thaw cycling and extreme temperatures
- Certified to EN 1504-3, Class R2 – structurally irrelevant

Fine filler

Emcefix-Spachtel F

- Polymer-modified fine filler for concrete cosmetic purposes
- Available in 7 colours
- For layer thicknesses up to 6 mm
- Certified to EN 1504-3, Class R1 – structurally irrelevant

Thermal filler

Nafuquick HT (High Temperature)

- Polymer-modified thermal filler for concrete cosmetic purposes
- Exceptional water retention capacity eliminates need for additional curing agents
- Thixotropic, highly stable and suitable for overhead work
- Suitable for substrate temperatures up to +70 °C
- Certified to EN 1504-3, Class R1 – structurally irrelevant





Conventional Tunnel Construction

Conventional tunnelling using mining excavation techniques is still encountered in infrastructure projects around the world. Mining excavation has always represented a significant engineering challenge, demanding a high degree of technical expertise, care and attention from all participants. This concerns tunneling methods ranging from loose ground to hard rock.

Conventional tunnel construction imposes highest demands on the temporary and permanent consolidation and shoring methods, the lining system and the sealant technologies selected. With extensive experience in the fields of concrete technology, injection systems and waterproofing, MC will always be able to offer you individually optimised system solutions for your specific tunnel project.

Maximum quality for the highest shotcreting standards

Inherently versatile, shotcreting can be readily adapted to changing conditions. Shotcrete is mainly used for temporary consolidation, for sealing cavities and fissures and for edge reinforcement in the rock strata. The New Austrian Tunnelling Method (NATM), also known as the Sequential Excavation Method (SEM) or Sprayed Concrete Lining method (SCL), utilises the natural strength of the geological vault effect augmented by the optimised strength development of shotcrete to minimise pressure on the inner shell.

Shotcrete can be applied by either dry or wet spraying. Both the pre-batched base mix used in the wet spraying process and the hardening accelerator have to meet high application and scheduling requirements. MC can draw on extensive experience in the composition of shotcrete as well as in the use of hardening accelerators in order to find the optimum system solution for your tunnel project – every time.

Hardening accelerator

MC-Montan Shotcrete HA (High Acceleration)

- High-performance shotcrete accelerator for optimal control of strength development
- Very high early strength combined with minimal decrease in final strength values
- Also able to accelerate concretes of thicker consistency
- Free from chlorides and corrosion-promoting components





High-performance superplasticiser

MC-Montan Shotcrete SP (Superplasticiser)

- Superplasticiser based on MCP technology for pre-batched shotcrete mixes
- Exceptionally long-lasting liquefaction and optimised stabilisation in the case of thicker consistencies
- Simple and fast intermixing for optimal concrete homogeneity
- Cost-efficient dosages and high water-saving potential

Setting retarder

Centrament Retard VZ

- Special setting retarder for shotcrete
- Optimum working times thanks to long-lasting, accurately controllable setting retardation
- Simple and fast intermixing for optimised concrete homogeneity and maximum efficacy
- Free from corrosion-promoting components
- Suitable for concretes according to Germany's DAfStb and ZTV-ING codes of practice

Concrete admixture

Centrilit NC

- Concrete admixture for maximum homogeneity and chemical resistance
- Reduced chloride migration and improved abrasion resistance thanks to increased concrete density
- Versatile applicability, also suitable for high-performance concretes
- Sustainably sound environmental compatibility

Hardening accelerator

MC-FastKick

- Special hardening accelerator for controllable, reduced curing times
- Very high early strength combined with minimal decrease in final strength values
- Reduced cycle times even at low temperatures
- Free from chlorides and corrosion-promoting components



Tunnel waterproofing – permanently impermeable, highly resilient

Whether for cross passages, galleries, access adits or entire tunnel sections, MC provides you with exactly the right waterproofing solution for your project. In conventional Tunneling, the barrier seal is provided by plastic sheet membrane or sprayable waterproofing membrane. Both systems have a common purpose – to ensure that the tunnel remains dry over its planned service lifetime. This objective places particularly high requirements on the barrier systems used. They are expected to protect the support structure and technical installations while at the same time ensuring disruption-free operation. Hence they need to be able to both withstand chemical attack and resist mechanical stress phenomena.

Particularly in the area of cross passages, access tunnels, galleries or station construction – where complex geometries occur – high-performance and flexible sealing and waterproofing systems are essential.

Sprayable waterproofing membranes

MC-Montan Shot Seal

- Highly flexible, dry-spray waterproofing membrane
- Outstanding resistance to alkalis, UV and weathering
- Sandwiching possible between two shotcrete layers
- Very high adhesion to concrete, steel and plastic sheet membrane
- Permanently impermeable to pressurised water and diffusion

Sheet membranes

MC-Montan Plan (320/330)

- Available in signal yellow and in layer thicknesses of 2 and 3 mm
- Highly flexible material of intrinsic robustness
- Modifiable for open construction, subsequent sealing in segmental construction or for cross-cuts
- Accessories such as geotextiles, fixing rings and drainage piping all available
- Modified injection entry points possible as further optional accessories



Achieving the best application properties and durable concrete quality

The final support measure in conventional tunnel construction frequently takes the form of an inner shell or lining created using in-situ concrete. However, the project-specific requirements may vary considerably. MC therefore offers you individualised concrete formulations specifically adapted to your needs.

Lining concrete has to meet both specific application requirements and exacting durability demands. The prevailing exposure classes and conditions under which construction takes place will affect the concrete formulation selected, with quality critical to the success of your project.

High-performance superplasticiser

MC-PowerFlow

- High-performance superplasticiser for meeting maximum quality demands on the concrete and the final finish
- Exceptionally high water-saving potential
- Fast strength development for high early strength values and early formwork stripping
- Free from corrosion-promoting components

Setting retarder

Centrament Retard

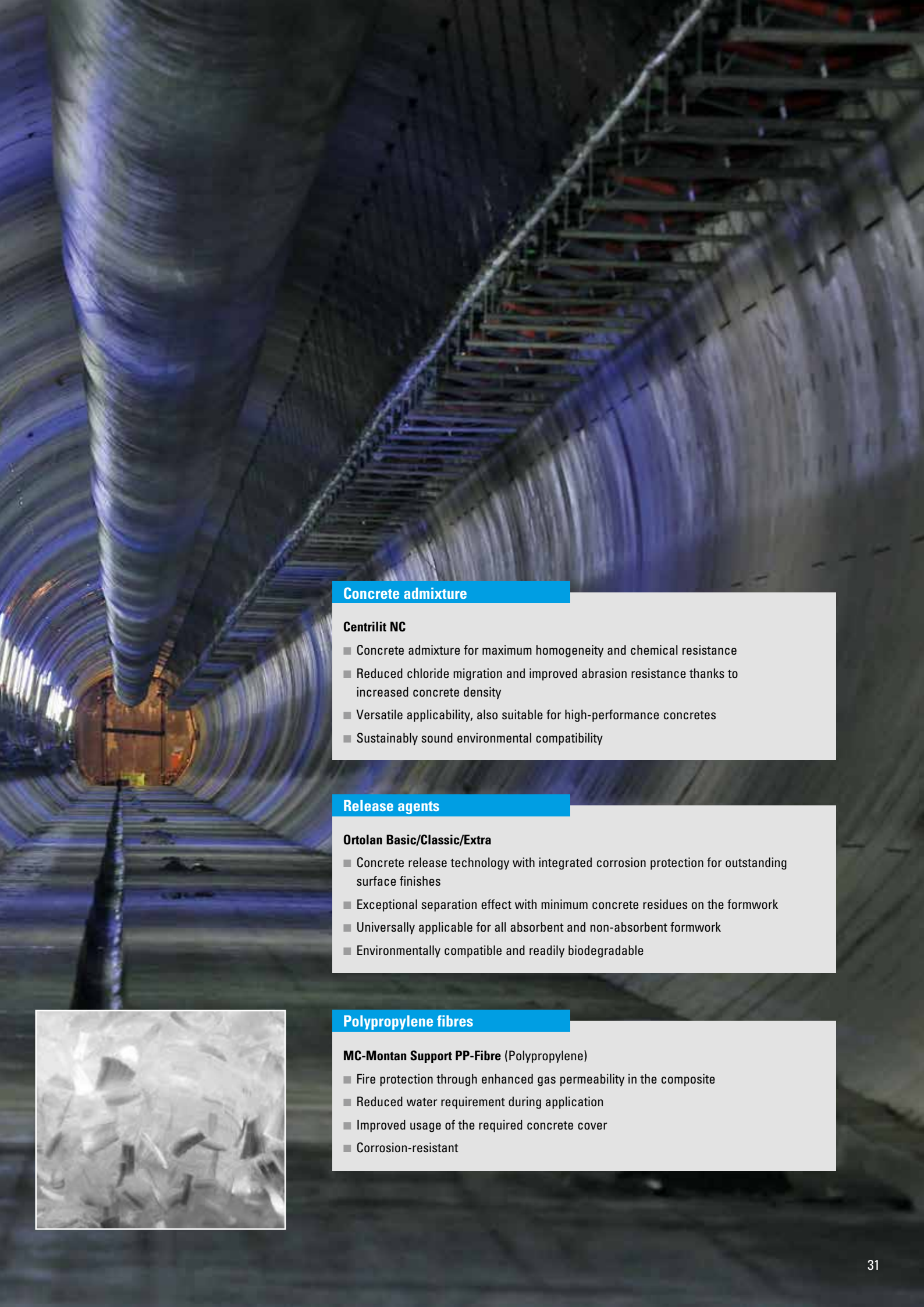
- Special setting retarder for shotcrete
- Optimum working times thanks to long-lasting, accurately controllable setting retardation
- Simple and fast intermixing for optimised concrete homogeneity and maximum efficacy
- Free from corrosion-promoting components
- Suitable for concretes according to Germany's DAfStb and ZTV-ING codes of practice

Hardening accelerator

MC-FastKick

- Special hardening accelerator for controllable, reduced curing times
- Very high early strength combined with minimal decrease in final strength values
- Reduced cycle times even at low temperatures
- Free from chlorides and corrosion-promoting components





Concrete admixture

Centrilit NC

- Concrete admixture for maximum homogeneity and chemical resistance
- Reduced chloride migration and improved abrasion resistance thanks to increased concrete density
- Versatile applicability, also suitable for high-performance concretes
- Sustainably sound environmental compatibility

Release agents

Ortolan Basic/Classic/Extra

- Concrete release technology with integrated corrosion protection for outstanding surface finishes
- Exceptional separation effect with minimum concrete residues on the formwork
- Universally applicable for all absorbent and non-absorbent formwork
- Environmentally compatible and readily biodegradable

Polypropylene fibres

MC-Montan Support PP-Fibre (Polypropylene)

- Fire protection through enhanced gas permeability in the composite
- Reduced water requirement during application
- Improved usage of the required concrete cover
- Corrosion-resistant



Rock Stabilisation, Waterproofing and Repair Technologies

Tunnel construction demands a high degree of technical expertise, care and attention from all participants in the excavation and build process. This applies right from the planning phase and even more so during execution of the work. Each tunnel construction project, whether carried out by conventional means or using mechanised tunnel boring equipment, represents a unique set of engineering challenges, with success dependent on a multitude of different factors. Despite the best possible planning, execution and high-performance technologies, problems can still arise at the excavation stage, depending on the rock strata encountered.

In such cases, attendant measures such as rock stabilisation, waterproofing and temporary shield tail sealing need to be implemented. Such activities can help sustain the required rate of advance while also ensuring a maximum degree of safety. Damage and leakage in the tunnel lining or shell can be repaired immediately by attendant systems following the excavating machinery.

Promptly implemented, attendant measures following advancement – such as sealant injection, concrete repair and surface protection – minimise the risk of structures failing or degrading. This not only reduces repair and maintenance costs in the future but also has a positive effect on the durability of the entire tunnel system.



Secondary Measures

Depending on the in-situ geology and the tunnel cross section having to be cut, additional, attendant activities such as rock stabilisation, sealing and waterproofing may need to accompany the excavation operation in order to ensure achievement of the required advance rates.



Filling of cavities, rock strata consolidation

Knowledge of the geological conditions along the tunnel axis is essential for the planning and execution of tunnel construction projects. Ensuring progress will involve both planned and ad hoc activities aligned to rock stabilisation, with the focus on filling cavities and consolidating strata so as to achieve the required advance rate.

The objective is to stabilise the rock in critical areas. The properties of the consolidated strata have to ensure that high rates of advance can continue. In addition, any materials introduced into the existing strata will also need to offer full ground-water neutrality and environmental compatibility.

Duromer resin

MC-Montan Injekt FR/FN/FS

- Tough, flexible duromer (thermoset) compound for the sealing and consolidation of rock strata, even under high water pressure
- Optimum injectability thanks to very low viscosity and controllable reaction times
- Very high tensile and compressive strength
- Sustainably sound environmental compatibility – harmless in contact with soil and groundwater

Organo-mineral resin

MC-Montan Injekt CB

- Rock consolidation and water-proofing
- Optimum flow properties and short reaction times
- High tensile and compressive strength
- Hygienically harmless to groundwater
- Organo-mineral composition

Elastomer resin

MC-Montan Injekt DR/DS

- Flexible compound for sealing and consolidating rock strata
- Very low viscosity for very good injectability and penetration activity
- Water-displacing
- Sustainably sound environmental compatibility – harmless in contact with soil and groundwater

Duromer foam

MC-Montan Injekt LE

- Duromer (thermoset) foam for stabilising and permanently consolidating rock strata
- Strong expansion
- Very short expansion time and rapid strength development for immediate consolidation results
- Sustainably sound environmental compatibility – harmless in contact with soil and groundwater

Rapid and reliable water stop

Water is an ever-present constituent of rock formations and is an important design and planning consideration for both mechanised and conventional tunnelling operations. Flowing and pressurised groundwater can hinder excavation and endanger safety. Erosion of the annular space backfill grout, and water-filled cavities are among the phenomena encountered in the presence of pressurised water flows.

Strata injection technologies can effectively stem water ingress in such cases. MC offers a range of speciality injection resins in system solutions specifically tailored to your project requirements. The product systems applied have to be not only fast and reliable in their sealing capability but also groundwater-neutral and otherwise environmentally compatible.

Duromer resin

MC-Montan Injekt FR/FN/FS

- Tough, flexible duromer (thermoset) compound for the sealing and consolidation of rock strata, even under high water pressures up to 7 bar
- Optimum injectability thanks to very low viscosity and controllable reaction times
- Very high tensile and compressive strength
- Sustainably sound environmental compatibility – harmless in contact with soil and groundwater

Duromer foam

MC-Montan Injekt LE

- Duromer (thermoset) foam for stabilising and permanently consolidating rock strata
- Strong expansion
- Very short reaction time and rapid strength development
- Sustainably sound environmental compatibility – harmless in contact with soil and groundwater

Elastomer resin

MC-Montan Injekt DR/DS

- Flexible compound for sealing and consolidating rock strata (for water pressures up to 7 bar)
- Very low viscosity for very good injectability and penetration activity
- Water-displacing
- Sustainably sound environmental compatibility – harmless in contact with soil and groundwater





Tunnel and segmental lining sealing

During construction and lifetime of a tunnel, multiple damages of the segments or segment joints can occur. Important for all sorts of damage is the required rapid reaction based on technically proven and reliable measures – whether as injection, concrete patching and re-profiling or the application of surface protection coatings.



Effective segmental lining sealing with swellable acrylic resins

Injection systems are used for leaks occurring over a wide area, in joints or as a result of cracking. The application may involve the use of an external waterproofing membrane, rehabilitation of leaking joints, the sealing of water-bearing cracks, or provision of a rigid seal to close off cracks and cavities in the concrete.

Where wide-area damp penetration or leaking joints are the problem, soft-elastic/flexible product systems offering the additional security of in-situ swelling are invariably the best solution. With their outstanding penetration capability and exceptional bonding properties, MC's systems quickly result in successful rehabilitation, leaving the components dry, joints sealed and waterproofing membranes intact.

Hydro-structure resins

MC-Montan Injekt TR-X

- Soft-elastic, swellable barrier sealant
- Short, controllable reaction times
- Unmatched chemical resistance even in contact with highly alkaline media
- Very good formability with the additional security of exceptional swelling capacity
- Sustainably sound environmental compatibility – harmless in contact with soil and groundwater

MC-Injekt GL-95 TX

- Soft-elastic, swellable barrier and joint sealant
- Short, controllable reaction times
- Sustainably sound environmental compatibility – harmless in contact with soil and groundwater

Structural segment crack injection

Cracks are a normal occurrence in concrete, which means that their presence cannot be excluded either in the course of the tunnelling operation or during operation of the finished construction. Cracks become problematic where they give rise to rebar corrosion due to the ingress of water and chlorides. Such phenomena jeopardise the durability of the structure and reduce service lifetime.

Crack injection repairs serve to seal and strengthen, with restoration of lost component properties to effectively combat damage recurrence. There are also product systems designed to fill and seal voids and cavities in concrete, returning the associated structures to full serviceability.

Injection resin

MC-Injekt 2133 flex

- Highly flexible crack sealant
- Ready-to-use single-component expansion resin
- Closed-cell structure, durably impermeable even in cracks of major width variation
- Hygienically harmless in water-bearing areas

MC-Injekt 2300 top/2300 rapid

- Highly flexible crack sealant
- Excellent injectability
- Water-impermeable
- Hygienically harmless in water-bearing areas

MC-Injekt 1264 compact

- Structural rehabilitation with effective deep-crack repair
- Very good injectability and high penetration activity
- Optimal moisture tolerance
- High tensile and compressive strength values with rapid strength development



This section through an injected component clearly shows the depth of penetration achieved with MC-Injekt 2133 flex through even the finest of hairline cracks.



0,1

0,2

0,3



Test specimen with Nafufill KM 250
after a fire simulation



Highly fire-resistant concrete replacement system

Spalling and other concrete defects that occur in tunnel sections as excavation advances need to be quickly repaired in order to protect the rebar from corrosion. Where corrosion has taken place in existing tunnels, the areas affected can also be permanently rehabilitated and protected.

In road and rail tunnels in particular, the systems employed have to offer high fire ratings. Given this imperative, particularly high-performance products – capable of keeping what they promise in an emergency – are essential for such repair work.

Concrete replacement

Nafufill KM 250

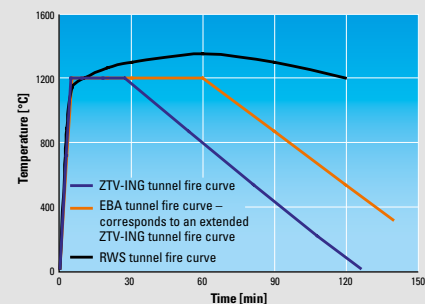
- Single-component concrete replacement system for manual trowelling and spray application
- Resistant to de-icing salts and chloride-proof
- Fire resistance rating F 120 to DIN 4102-2
- Fire resistant according to the Tunnel Fire Curves issued by Germany's ZTV-ING, the EBA Code of Practice for Railway Tunnels, and the TNO Report issued by the Rijkswaterstaat (RWS) of the Netherlands
- Certified to EN 1504-3, Class R4 – structurally relevant

Cooled test specimen with Nafufill KM 250 showing full fire rating compliance



Various fire loads have been specified in the form of tunnel fire curves in order to ensure and assess the fire resistance of tunnel constructions. The following temperature-time curves count among the most stringent:

- ZTV-ING, Part 5 Tunnel Construction, 25 minutes full fire phase at 1200 °C
- ZTV-ING, Part 5 Tunnel Construction, 55 minutes full fire phase at 1200 °C
- EBA (Fed. Railway Authority) Code, 55 minutes full fire phase at 1200 °C
- TNO Report, RWS, Netherlands, 120 minutes full fire phase at 1350 °C



Comprehensive concrete protection with long-lasting dirt-repelling effect

Surface protection systems in tunnel constructions are not only required to perform standard functions in protecting the concrete; the products used also have to meet certain safety criteria, such as creating a non-reflective yet bright surface so as to contribute to traffic safety and transit visibility.

Further criteria include a minimal tendency towards soiling, high abrasion resistance, good cleanability and low scratchability. Appropriately high-performance products used in such applications can greatly reduce the maintenance costs of a tunnel.

Surface Protection

MC-Color Flair vision

- Certified surface protection for traffic infrastructure
- Pigmented coating with integrated easy-to-clean technology
- Resistant to extreme temperatures, freeze-thaw cycling and de-icing salts
- Resistant to UV and weathering

Fine filler

Nafufill KM 103

- Fine filler for substrate preparation
- No post-curing required
- Very high water retention
- Class R1 and R2 to EN 1504 Part 3







On-site technical assistance and expert advice

Every tunnel is an individual project with specific challenges. MC proposes a close cooperation with the contractor in order to develop efficient tailor made systems. MC offers also extensive technical laboratory and on site support. You can build on the comprehensive support and consultancy services provided by our experts. And you can rely on our determination to secure your satisfaction and peace of mind.

Our experts will be on your site in order to provide you with individual advice, assistance and specialist knowledge that you may need.



Product Systems for Tunnel Construction

- Soil conditioning
- Sealants and lubricants for TBMs
- Backfill grouting solutions
- Concrete admixtures
- Release agents and formwork oils
- Rock stabilisation
- Injection systems
- Concrete repair
- Surface protection systems
- Waterproofing and sealing systems

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BE SURE. BUILD SURE.

Contact details

