Grouting Concrete and Grouting Mortar

Application Manual

EXPERTISE
GROUTS

MC
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Emcekrete: Grouting concrete and grouting mortar

Grouting concrete and grouting mortar have to perform as a force-locked grouting or undergrouting, e. g., underneath machine plates on a concrete foundation. This utilization is standard practice. Grouting serves to level off unevenness in the concrete substrate and ensure reliable force and load transmission. Ideally, the grouting concrete or grouting mortar needs to exhibit high flowability and hardening free of voids and cavities.

Grouting concrete and grouting mortars from MC can be applied both manually and with machines. In the case of application with machines, using the correct equipment is essential (see page 26).

The purpose of this manual is to provide you with advice and guidance on how to perform grouting concrete and grouting mortar works to optimum effect.

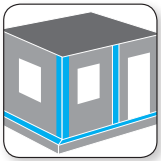
MC offers an extensive product portfolio characterised by their wide range and easy application. Additionally, MC products' maintain high quality standards.

For precise application instructions, please consult and comply with the leaflet entitled "General Application Advice for hydraulically curing grouting concrete and grouting mortars" and also the relevant Technical Data Sheets. Compliance is also required with correspondent Safety Data Sheets.

If you have any further questions regarding our product systems, or in relation to specific application issues, please contact us.

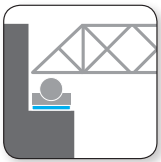
Grouting concrete and grouting mortars consist of a dry mix of cement, mineral aggregate and, when required, concrete additives and/or concrete admixtures. They are factory-made, stored dry and protected from weather conditions.

The production of grouting concrete and grouting mortars takes place at the construction site, after adding the prescribed amount of water (see Technical Data Sheet). The application has to be made immediately after mixing and using the high-flowable material. Follow general and specific instructions provided by MC.



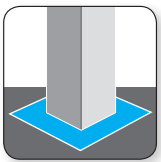
Cavities/joints in prefabricated concrete elements

Products used:
Vertical: Emcekrete 60 A, F, EF;
Emcekrete MFT
Horizontal: Emcekrete MFT, UFM



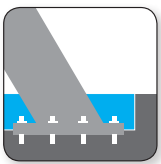
Structural bearings
e. g. bridge bearings

Products used:
Emcekrete 60 A, F, EF, 70 F;
Emcekrete UFM



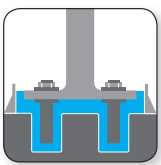
Sleeve foundations

Products used:
Emcekrete 60 A, F, EF, 70 F;
Emcekrete DBS 5-F



Fastening/anchor bolts, embedded steel elements

Products used:
Emcekrete 60 A, F, EF, 70 F



Chocking/grouting of machines with dynamic stressing, e. g. turbines, power trains, engines…

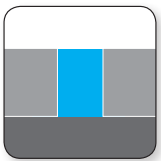
Products used:
Emcekrete 60 A, F, EF, 70 F

Rails
e. g. crane tracks/runway rails

Products used:
Emcekrete 60 A, F, EF, 70 F

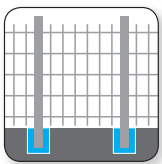
Wind turbines

Products used:
Emcekrete 60 A, F, EF, 70 F



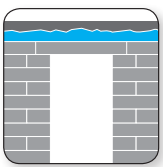
Grouting of floor joints

Products used:
Emcekrete 60 A, F, EF, 70 F



Particularly fast-setting, also as mast grout

Products used:
Emcekrete DBS 5-F



In semi-dry consistency as filling mortar

Products used:
Emcekrete UFM

Substrate requirements

Cleanliness

The substrate must be free of adhesion-reducing impurities such as grease, oil, dust, cement slurry etc. in order to ensure a good and strong cohesion.

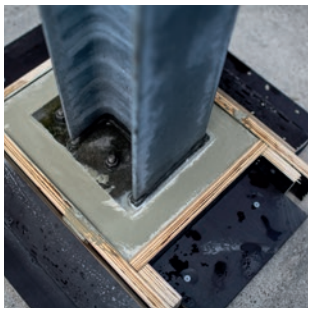
Load-bearing capacity

Grouting concrete and grouting mortars cannot effectively transmit loads and forces if the substrate itself does not exhibit the necessary load-bearing capacity. Consequently damaged areas and loose particles must be removed until load-bearing concrete is available as a substrate. In addition, the substrate must exhibit pull-off strength values of at least 1.5 N/mm^2.

Frost

The substrate must be frost-free. If the grouting concrete or grouting mortar is applied to a substrate that is too cold or frozen, the concrete or mortar will set without forming force-locked adhesion.

Formwork requirements



- The formwork must be watertight and non-absorbent.
- The height of the formwork must exceed the grouting layer thickness.
- The formwork must be placed so that the grouting width is kept under 50 mm (otherwise danger of cracking!).

Pre-wetting

The concrete surface to be grouted must be thoroughly and sufficiently pre-wetted. Remove all excess water.

NOTE

Excess water changes the w/c ratio and consequently the properties of the concrete or mortar. It further prevents cohesion between the cement lime and the substrate.

Mixing

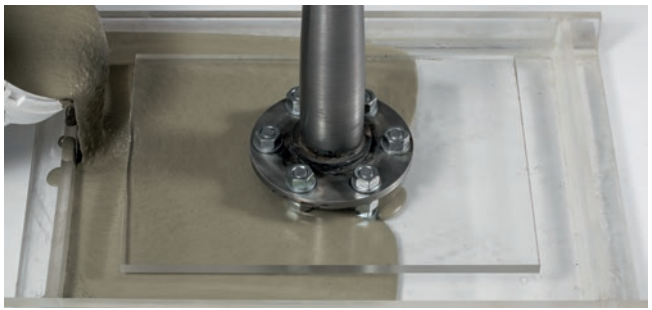
Grouting concrete and grouting mortars are mixed with a planetary mixer or a slow-rotating agitator (double-whirl type, max. 400 rpm).

The **mixing time** must be at least **3 minutes**. The dry grouting concrete or grouting mortar is poured into clean water and then mixed to a homogeneous and lump-free consistency.

NOTE

To ensure a homogeneous distribution of aggregates' grain size, always mix a complete bag.

Pouring

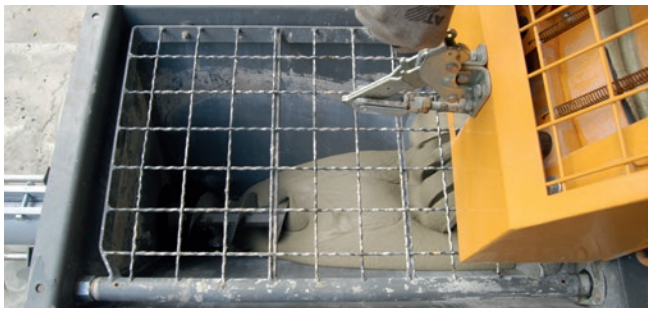


Apply the grouting concrete or grouting mortar immediately after it has been mixed. Continuously pour only from one side in order to prevent entrapped air formation. Pouring operations should be carried out from the longer side. The flow process can be supported with a wire loop.

NOTE

During pouring and within the first hours after application, avoid vibrations and shock impact in the proximity of the newly laid material.

Grouting with machines



Grouting concrete and grouting mortar can also be applied using machinery. For this, please ensure compliance with our equipment planner (on page 26).

NOTE

In order to determine technical suitability in each individual case, carry out preliminary tests under the existing application conditions.

Curing

The setting and curing process of grouting concrete and grouting mortars varies depending upon the material's layer thickness, and is accompanied by considerable heat development. If the material is allowed to dry out too quickly (danger of cracking!), appropriate measures must be adopted in order to prevent this from happening. Emcoril S curing agent should be sprayed onto the drying but still damp surface.

The formwork can usually be removed from the grout 24 hours after pouring (at +20 °C). Strength development after this period is sufficiently advanced to allow any embedded anchors or fixing bolts to be tightened. Where strong sunlight and draughts are present, it is recommendable to protect de-moulded grout flanks with Emcoril S.

Working at low temperatures

Substrate

- The substrate must be frost-free.
- The substrate and ambient temperature should be at least +5 °C.

Dry mixture

- The dry mortar must not be stored at temperatures below +15 °C.

Mixing

- Mix with warm water at approx. +30 °C.
- The fresh mortar temperature should be approx. +20 °C.

Pouring

- Once the material has been placed, protect the area from excessively fast cooling with appropriate measures such as covering with plastic sheeting. Leave this in place until an early strength of 5 N/mm^2 has been reached.

Working at high temperatures

Substrate

- The substrate must be pre-wetted.

Dry mixture

- The dry mixture must be stored in a cool place and protected from direct sunlight.

Mixing

- Mixing should be carried out with cold or chilled water.
- The fresh mortar temperature should be around +20 °C, and must not exceed +30 °C.

Pouring

- Exposed surfaces must be protected against direct sunlight, heat, draughts and wind immediately after pouring.

Grain size

Grouting concrete*

Grouting concrete is defined by an grain size > 4 mm.

Grouting mortar*

Grouting mortar is defined by an grain size ≤ 4 mm.

*According to DAfStb [German Committee for Reinforced Concrete] Code of Practice: "Manufacture and Application of Cement-Bound Grouting Concrete and Grouting Mortar"

Grouting layer thickness

Grouting concrete and grouting mortar

The maximum layer thickness of the grouting concrete or grouting mortar should not exceed **25 times** the maximum grain size employed*.

*According to DAfStb [German Committee for Reinforced Concrete] Code of Practice: "Manufacture and Application of Cement-Bound Grouting Concrete and Grouting Mortar"

Slump and flow classes

Slump measurement

Slump class for grouting concrete*

The consistency classes are defined according to Table 1. Measurement is performed with the smallest amount of water specified for each temperature range.

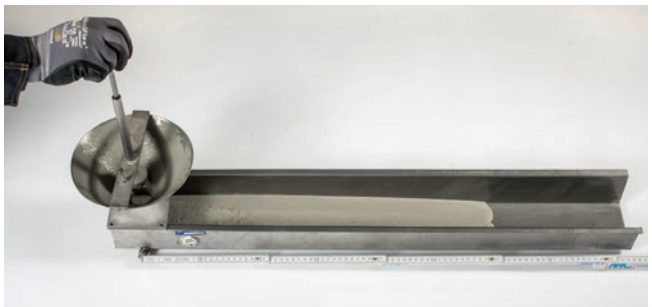
Table 1 – Slump classes for grouting concrete

Class	Slump value (diameter) in mm
a1	500 to 590
a2	600 to 690
a3	≥ 700

*According to DAfStb [German Committee for Reinforced Concrete] Code of Practice: "Manufacture and Application of Cement-Bound Grouting Concrete and Grouting Mortar"

Basic technical guidelines

Slump-flow measurement



Flow class for grouting mortar*

The consistency classes are defined as indicated in Table 2. Measurement is performed with the smallest amount of water specified for each temperature range.

Table 2 – Flow classes for grouting mortar

Class	Slump-flow in mm
f1	550 to 640
f2	650 to 740
f3	≥ 750

*According to DAfStb [German Committee for Reinforced Concrete] Code of Practice: "Manufacture and Application of Cement-Bound Grouting Concrete and Grouting Mortar"

Early strength classes

Grouting concrete*

Each individual compressive strength measurement $f_{c,cube}$ performed after 24 hours must correspond to the minimum following values:

- Early strength class A: 40 N/mm²,
- Early strength class B: 25 N/mm²,
- Early strength class C: 10 N/mm².

Grouting mortar*

Each individual compressive strength measurement $f_{c,cube}$ performed after 24 hours must correspond to the minimum following values:

- Early strength class A: 40 N/mm²,
- Early strength class B: 25 N/mm²,
- Early strength class C: 10 N/mm².

*According to DAfStb [German Committee for Reinforced Concrete] Code of Practice: "Manufacture and Application of Cement-Bound Grouting Concrete and Grouting Mortar"

Shrinkage classes for grouting concrete

The shrinkage values at an age of 91 days, a temperature of +20 °C and a relative humidity value of 65%, determined on the basis of the mean value of three specimens ($\varepsilon_{s,m,91}$) and individual values ($\varepsilon_{s,i,91}$), must meet the following requirements:

Grouting concrete, shrinkage class SKVB 0*:

$\varepsilon_{s,m,91}$ ≤ 0.6 ‰ and

$\varepsilon_{s,i,91}$ ≤ 0.8 ‰

Grouting concrete, shrinkage class SKVB I*:

$\varepsilon_{s,m,91}$ ≤ 0.8 ‰ and

$\varepsilon_{s,i,91}$ ≤ 1.0 ‰

Grouting concrete, shrinkage class SKVB II*:

$\varepsilon_{s,m,91}$ ≤ 1.5 ‰ and

$\varepsilon_{s,i,91}$ ≤ 2.0 ‰

*According to DAfStb [German Committee for Reinforced Concrete] Code of Practice: "Manufacture and Application of Cement-Bound Grouting Concrete and Grouting Mortar"

Shrinkage classes for grouting mortar

The shrinkage values at an age of 91 days, a temperature of +20 °C and a relative humidity value of 65%, determined on the basis of the mean value of three specimens ($\varepsilon_{s,m,91}$) and individual values ($\varepsilon_{s,i,91}$), must meet the following requirements:

Grouting mortars, shrinkage class SKVM 0*:

$\varepsilon_{s,m,91}$ ≤ 0.6 ‰ and

$\varepsilon_{s,i,91}$ ≤ 0.8 ‰

Grouting mortars, shrinkage class SKVM I*:

$\varepsilon_{s,m,91}$ ≤ 0.8 ‰ and

$\varepsilon_{s,i,91}$ ≤ 1.0 ‰

Grouting mortars, shrinkage class SKVM II*:

$\varepsilon_{s,m,91}$ ≤ 1.2 ‰ and

$\varepsilon_{s,i,91}$ ≤ 1.4 ‰

Grouting mortars, shrinkage class SKVM III*:

$\varepsilon_{s,m,91}$ ≤ 1.5 ‰ and

$\varepsilon_{s,i,91}$ ≤ 2.0 ‰

*According to DAfStb [German Committee for Reinforced Concrete] Code of Practice: "Manufacture and Application of Cement-Bound Grouting Concrete and Grouting Mortar"

Swelling

Grouting concrete*

Grouting concrete must, under all application conditions, exhibit a swelling value of at least 0.1%.

Grouting mortar*

Grouting mortar must, under all application conditions, exhibit a swelling value of at least 0.1%.

*According to DAfStb [German Committee for Reinforced Concrete] Code of Practice: "Manufacture and Application of Cement-Bound Grouting Concrete and Grouting Mortar"

Compressive strength

Tested grouting concrete and grouting mortars must exhibit a high early strength (see page 20) and a compressive class strength of at least C 50/60*.

The DAfStb code of practice does not apply to the following:

- Grouting concrete and grouting mortar with light, heavy or recycled aggregates
- Grouting concrete and grouting mortar with artificially introduced porosities
- Grouting concrete and grouting mortar specified as standard concrete

*According to DAfStb [German Committee for Reinforced Concrete] Code of Practice: "Manufacture and Application of Cement-Bound Grouting Concrete and Grouting Mortar"

Basic technical guidelines

Manufacturer Putzmeister

Machine Spiral pump S 5 EVTM

Products	Emcekrete 60 EF	Emcekrete 60 F, 70 F	Emcekrete 60 A	Emcekrete VB 25
Mixer	yes			
Spiral	2L54			
				
Flowrate*	7–40 l/min			
Pump pressure	25 bar			
Pumping distance**	up to 60 m			
Pumping height**	up to 40 m			
Motor	5.5 KW			
Mixer drive	2.2 KW			
Mixer volume	80 l			
Funnel volume	100 l			
Dimension in mm	2,505 x 680 x 1,150			
Weight in kg	400			
Mortar tube***	DN 35 (Ø 48 OD)		DN 50 (Ø 67 OD)	

Results

Products	Emcekrete 60 EF	Emcekrete 60 F, 70 F	Emcekrete 60 A	Emcekrete VB 25
Water	3.1 l per 25 kg sack	3.15 l per 25 kg sack	2.8 l per 25 kg sack	2.8 l per 25 kg sack
Material quantity per mix	5 sacks (each 25 kg)	5 sacks (each 25 kg)	5 sacks (each 25 kg)	5 sacks (each 25 kg)
Flow spread	approx. 21 cm	approx. 27 cm	approx. 19 cm	approx. 27 cm
Mixing time	3 min	3 min	3 min	3 min
Prisms: Flexural and compressive strength in N/mm²	1d: 5.6 / 45.0 7d: 9.3 / 54.7 28d: 9.5 / 62.5	1d: 6.9 / 61.9 7d: 8.9 / 65.0 28d: 9.7 / 62.2	—	—
Cube: Flexural and compressive strength in N/mm²	—	—	1d: – / 6.4 7d: 6.2 / 72.5 28d: 7.5 / 81.6	1d: – / 5.0 7d: – / 20.0 28d: – / 35.0

* Depending on the pump, the pumping flow rate may change.

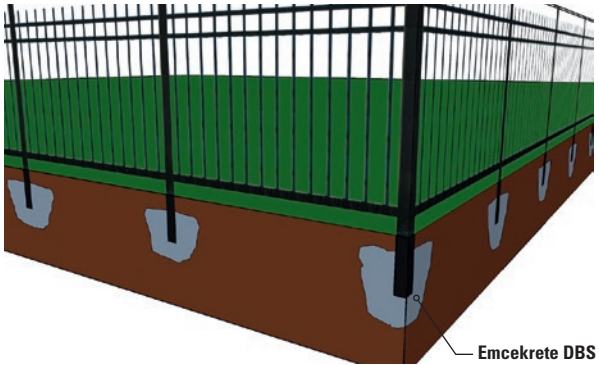
** Data on empirical values and dependent on material.

*** Mortar hoses must be lubricated with a cement lime slurry of honey-like consistency.

These machines and accessories have been tested with the MC products indicated. Machinery and equipment from other manufacturers may also be suitable.

However, corresponding trials will need to be carried out by the applicator. In such cases, please ask for our technical Support.

Emcekrete DBS 5-F is used for grouting work requiring fast setting for early loadability; particularly suitable for garden fences and power line masts.



Substrate preparation

See page 8.

Mixing

Emcekrete DBS 5-F should be mixed using a slow-rotating agitator (ideally a double-whirl type, see page 10). The substrate should be lightly pre-wetted (see page 9).

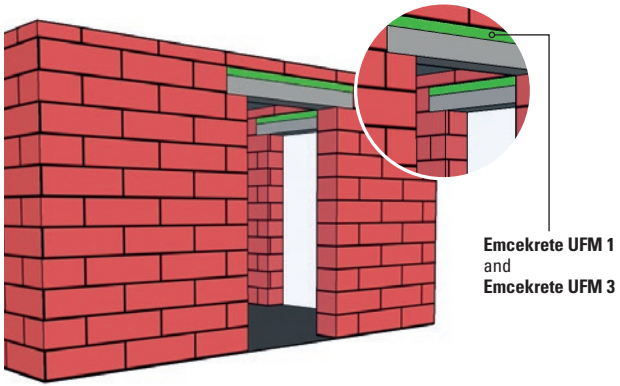
Application

The mortar is then poured. The flow process can be supported with a wire loop. Emcekrete DBS 5-F sets exceptionally quickly.

NOTE

All preparations need to be taken in advance.
The application time is just 3–5 minutes (at +20 °C).

Emcekrete UFM is used for filling up of ceiling and wall stop ends, as well as for closing fixed joints in precast concrete elements.



Substrate preparation

See page 8.

Mixing

To mix Emcekrete UFM, use a slow-rotating agitator (ideally a double-whirl unit, see page 10). The dry filling mortar is poured into the prepared, clean water and then mixed to a homogeneous and lump-free consistency. Each mixture must be made up from a complete sack.

Application

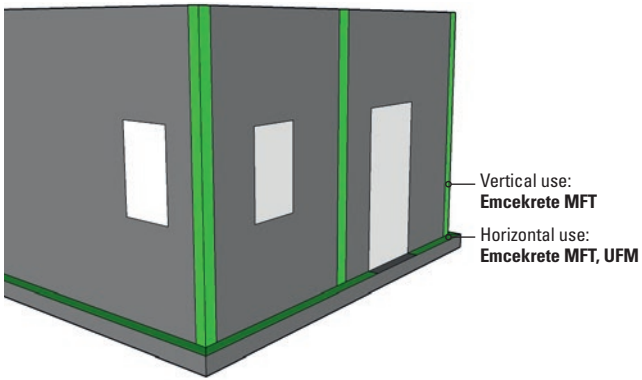
Lightly pre-wet the substrate (see page 9).

Apply Emcekrete UFM filling mortar to the pre-wetted and still damp surface.

Apply using a trowel, smoothing trowel or jointing iron.

To create a fine and smooth surface after application, smooth with a smoothing trowel.

Emcekrete MFT has been especially formulated for filling of segmental joints in precast concrete constructions.



Substrate preparation

See page 8.

Mixing

Emcekrete MFT should be mixed using a slow-rotating agitator (ideally a double-whirl type, see page 10).
The substrate should be lightly pre-wetted (see page 9).

Application

Emcekrete MFT should be applied on the pre-wetted, still matt damp, substrate in horizontal and vertical open segmental joints (e. g. in precast industry). Due to the mortar's consistency, it does not need a formwork and is used to underfill precast elements.

NOTE

In order to achieve a good surface finish, protect Emcekrete MFT in its fresh condition from drying out too quickly!

Product range

	Product name	Field of application	Aggregate size [mm]	Grouting layer thickness [mm]	Water addition [l]	Compressive strength [N/mm²]	Application time [min]	Slump/ slump-flow class	Early strength class	Pumpable
Universal grout	**Emcekrete 60 A** CE	For the grouting of: • Precision machinery • Machine foundations • Bridge bearings • Crane rails • Turbines • Motors • Steel constructions • Fixing bolts and anchors • Steel elements embedded in concrete • Rigid joints between precast elements or between precast elements and in-situ concrete	0–8	24–200	2.3–2.4	C 70/ 85	30	a3	A	yes
	Emcekrete 60 F CE		0–3	10–75	3.0–3.25	C 50/ 60	30	f1	A	yes
	Emcekrete 60 EF CE		0–1.2	< 10	3.0–3.25	C 50/ 60	30	f1	A	yes
High performance grout	**Emcekrete 70 F** CE	Grouting of: • Precision machines • Power stations • Machine foundations • Fixing and base plates • Steel and concrete columns • Bridge bearings and crane rails • Steel constructions • Joints between precast elements • Wind turbines	0–3	10–75	3.25	2h: 14.0 4h: 21.0 1d: 47.0 7d: 65.0 28d: 93.0	30	f3	A	yes

Product range

	Product name	Field of application	Aggregate size [mm]	Grouting layer thickness [mm]	Water addition [l]	Compressive strength [N/mm²]	Application time [min]	Slump/ slump-flow class	Early strength class	Pumpable
Special grout	**Emcekrete VB 25**	For the grouting of: • Large-scale elements • Pumps • Machines of all kinds • Steel constructions • Crane rails • Anchors • Fixing bolts and steel elements embedded in concrete For the filling of joints between precast elements and in-situ concrete For the filling of openings and recesses	0–8	24–300	2.5–3.0	1d: 5.0 7d: 20.0 28d: 35.0	30	Not defined	C	yes
Fast-hardening grout	**Emcekrete FH 10**	For the filling of: • Steel elements embedded in concrete • Openings and recesses in concrete For the filling/underfilling of: • Manhole frames in order to raise them up to the level of the road surface • Precision machinery • Machine foundations • Bridge bearings • Crane rails • Turbines, engines • Steel constructions	0–1.2	5–40	3.5–4.0	4 h: 2.5 24 h: 30.0 7 d: 38.0 28 d: 52.0	15	Not defined	B	no

Product range

	Product name	Field of application	Aggregate size [mm]	Grouting layer thickness [mm]	Water addition [l]	Compressive strength [N/mm²]	Application time [min]	Slump/ slump-flow class	Early strength class	Pumpable
Fast-hardening grout	**Emcekrete FH 10 Super 0-5**	For the filling/underfilling of: • Manhole covers • Rainwater inlets • Various shaft constructions	0–1	5–40	3.25–3.5	2 h: 8.0 24 h: 14.0 28 d: 48.0	10	Not defined	C	no
Instant grout	**Emcekrete DBS 5-F** CE	For the grouting of: • Garden fences • Power line masts on railways General applications requiring high early loading	0–4	12	approx. 3.25	1 h: 10.0 24 h: 16.0 28 d: 51.0	3–5	Not defined	C	no
Filling mortar	**Emcekrete UFM 1** CE	For the filling of ceiling and wall stop ends	0–1.2	< 10	3.0–3.25	24 h: 54.0 28 d: 72.6 56 d: 76.0	30	Not defined	A	no
	Emcekrete UFM 3 CE	For the sealing of rigid joints between precast elements	0–3	10–60	3.0–3.4	24 h: 51.0 28 d: 80.0 56 d: 81.0	30	Not defined	A	no
Assembly mortar	**Emcekrete MFT** CE	As a masonry and set mortar Filling of segmental joints in precast elements	0–4	10–50	approx. 5.76	1 d: 10.0 7 d: 39.0 28 d: 54.0	60–90	Not defined	C	yes

Grouting concrete and grouting mortar

The hydraulically curing grouting concrete and grouting mortars in the Emcekrete range offer the ideal solution for your requirements – whether for the grouting of steel elements embedded in concrete, rigid joints between precast elements, machine foundations, bridge bearings, crane rails or masts, or for the filing and underfilling of ceiling and wall stop ends.

- Universal grouting
- High performance grouting
- Special grouting
- Fast-setting grouting
- Instant grouting
- Filling mortars
- Assembly mortars

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