

MasterEmaco T545

Rapid setting, high early strength repair mortar based on magnesia-phosphate cement for temperatures from -20°C to >30°C

DESCRIPTION

MasterEmaco T545 is a specially formulated repair mortar, based on magnesia-phosphate cement pre-mixed with selected aggregates, which gives controlled, extremely high early strengths in temperatures ranging from -20°C (or lower) up to over 30°C.

MasterEmaco T545 provides a repair material for concrete slabs which reaches an adequate strength for trafficking, or other use, at a very early age. It is also suitable for use as a repair medium at low ambient temperatures.

When MasterEmaco T545 is added to the gauging water and mixed, an exothermic chemical reaction commences and a chemical setting process takes place within approximately 15 minutes (at 20°C). The material hardens to give sufficiently high early strength to receive heavy traffic within a period of less than one hour at 15 - 20°C.

FIELD OF APPLICATION

For use in concrete repair situation where the minimum delay and work disruption is of the utmost importance.

- Cold store floor areas
- Concrete roads and nosings
- Bridge decks
- Quays/crane rails
- Industrial floor areas
- Loading bays and warehouses
- Around fixing bolts
- Raising and levelling manhole covers, gratings, hydrants etc


APPLICATION DEPTH

- 20mm to 75mm unfilled
- >75mm to 150mm filled with 10mm aggregate.

FEATURES AND BENEFITS

- High strength at a very early age (45 minutes).
- Minimum delay to traffic and production. When used to repair concrete pavings, it permits early re-opening to traffic - within 45 minutes at 20°C.
- Ready for use. Only requires the addition of water (see Mixing)
- Excellent bond to concrete and steel reinforcement. No secondary bonding agents required
- Inhibits corrosion in steel even in the presence of chlorides

- Highly durable. Excellent resistance to de-icing salts
- High freeze/thaw resistance
- No curing required
- Can be placed in sub-zero temperatures
- 'Non-shrink'
- Modulus and Thermal properties similar to concrete
- Lower permeability than cementitious mortars
- Chemically resistant to fuel, engine oils and urine.

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<p>Master Builders Solutions UK Ltd</p> <p>11</p> <p>0086 – CPD - 30612540</p>	
<p>EN 1504-3</p> <p>Fast setting, traffic repair mortar</p> <p>EN 1504-3 Principles 3.1/3.2/4.4/7.1/7.2</p>	
Class	R4
Compressive strength	≥ 45 MPa
Chloride ion content	≤ 0.05%
Adhesive bond	≥ 2.0 MPa
Restrained shrinkage/expansion	≥ 2.0 MPa
Elastic modulus	≥ 20 GPa
Thermal compatibility Freeze-thaw	≥ 2.0 MPa
Skid Resistance	Class I > 40 units wet tested
Capillary absorption	≤ 0.5 kg/m ² x h ^{0.5}
Reaction to fire	class A1
Dangerous substances	complies with 5.4

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APPLICATION METHOD

Surface Preparation

It is essential the surface of the concrete substrate to which the MasterEmaco T545 is to be applied, should be thoroughly sound and uncontaminated by dirt, oil or grease. The minimum thickness of repair should not be less than 20mm. The boundaries of the repair must be square cut. Under no circumstances should “feather edging” be used. It is also essential that the minimum thickness be measured from the peaks and not the troughs of any scabbled concrete. Scabbling should be to an even depth.

Where reinforcement is exposed, all scale should be removed and the bar thoroughly cleaned by wire brush, or sand blasting. Do not use bonding agents on the steel.

PRIMING

Although secondary bonding agents are not required, the area to be repaired must be thoroughly pre-wetted with clean water. Care should be taken, however, to ensure that all standing water is removed.

MIXING

The following sequence must be followed at all times when mixing MasterEmaco T545:

1. A suitable mixer (ie. tilting drum) should be located as near as possible to the area of work.
2. The amount to be mixed should never exceed that which can be transported, placed, compacted and finished within ten minutes
3. Wet down the mixer and drain off the free water
4. Pour the correcting measured amount of clean water into the mixer first. Do not add the water to MasterEmaco T545
5. When adding coarse aggregates* (*refer to ‘Thickness’ overleaf). these must be added to the water before the addition of MasterEmaco T545 into the mixer
6. Empty the full contents of the MasterEmaco T545 bag into the mixer
7. Minimum mixing time is 1 minute

WORKABILITY

Although stiff at the outset, workability will improve as mixing continues, to give the desired flow characteristics. On no account must further water be added. It is also essential that no admixtures are included.

PLACING AND FINISHING

Pre-wet the area to be treated and remove surplus water. The freshly mixed MasterEmaco T545 should be placed into the pre-wetted area without delay.

In view of the flow characteristics of MasterEmaco T545, the use of vibrating pokers or vibrating screed board is not normally required. However, full compaction must be achieved. Compact by hand in small areas and level the surface by ruling with a firm, straight-edged tamping bar.

The minimum of finishing with wooden floats leaves a better skid-resistant surface. However, particular care should be taken to achieve good compaction and bond at the edges and corners. On large areas, alternate narrow bay construction is desirable.

Do not re-tamper or over trowel, once the material has begun to stiffen.

BATCHING

Batching should always be carried out in 25kg units, (ie. one bag) of MasterEmaco T545 or multiples thereof.

SPECIAL CIRCUMSTANCES

Extremes of temperature affect the setting time of MasterEmaco T545. However, providing pre-conditioning of the substrate and gauging water is carried out, normal properties can easily be achieved. Once the chemical reaction is started it cannot be stopped.

COLD WEATHER WORKING

Below 5°C down to cold store temperature of -20°C or lower, pre-warm the mixer and equipment with warm water before batching. At temperatures below 0°C, or when ice is present, warm the substrate by infra-red or other suitable heating. The mixing water should be warmed to a temperature of 25°C to 30°C. The repaired area should be covered by insulating materials, such as loft insulation.

The area should be covered for not less than three hours, depending on the severity of the temperature. It is advisable to insulate in temperatures below 7°C.

For freezer floor repairs, refer to specific MasterEmaco T545 Specification Sheet.

HOT WEATHER WORKING

Where the temperature is above 30°C, the use of chilled water in the mix will allow the open time to be extended, thereby allowing normal procedure to be carried out in areas such as those found in steel works, etc. The mixer drum, barrows and equipment must be kept cool by shading, use of cold water etc.

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WET WEATHER WORKING

In wet conditions, care should be taken to ensure that both mixing and placing are carried out in protected environments, e.g. tenting.

MasterEmaco T545 must be protected from the effects of inclement weather for a period of not less than 30 minutes after placing and finishing.

THICKNESS

The minimum thickness of MasterEmaco T545 shall be 20mm at all times.

MasterEmaco T545 can be applied from 20mm up to 75mm in thickness. For depths between 75mm to 150mm in thickness, MasterEmaco T545 can be bulked out with 10kg of a nominal 10mm graded, dust free, aggregate per 25 kg bag of product.

The workability of the bulked out material will depend upon the shape and absorption of the aggregate used. It is advisable to perform a trial to determine the correct aggregate loading to achieve the desired workability and physical properties.

Under no circumstances should either fine aggregates or cement be added.

ADDITIONAL INFORMATION

In conjunction with this leaflet, refer to the specific MasterEmaco T545 Specification Sheet.

Specification Sheet F1-02a:

Repair of concrete roads, motorways, airfields, pavement, industrial floors and slabs.

Specification Sheet F1-04:

Freezer floor repairs

Specification Sheet F1-05:

Repairs to manhole cover surrounds and raising of manhole covers.

FINISHING AND CLEANING

Wash all tools and equipment with water immediately after use. Hardened MasterEmaco T545 must be removed mechanically.

PACKAGING

MasterEmaco T545 is supplied in 25kg sacks.

COVERAGE

25kg of MasterEmaco T545 combined with the correct amount of water (see Guide to Application, Mixing) will yield approximately 11.6ltrs. Where coarse aggregates are added at the rate of 10kg per 25kg MasterEmaco T545, an approximate increase in yield of 30% will be achieved.

STORAGE

Store in cool, dry conditions.

SHELF LIFE

12 months minimum when stored in accordance with the manufacturer's instructions.

SPECIFICATION CLAUSE

Pavement Repairs

All rapid repair of concrete slabs and pavements and raising road furniture etc. shall be carried out by using MasterEmaco T545, as manufactured by Master Builders Solutions UK Ltd or equal approved, to the following specification.

Mixing and use of the product and all related work shall be carried out strictly in accordance with the manufacturer's recommendations.

WATCH POINTS

Joints

All joints (and non-static cracks) in the substrate must be duplicated in the MasterEmaco T545 repair. As soon as the repair is hard, any joints that could be not pre-formed must be saw cut through the full depth of the repair and to at least the same width as the joints in the substrate. Clear out all debris from the formed joint and seal with a suitable sealant such as MasterSeal NP 474.

Overcoating

Particular attention needs to be paid to preparation if MasterEmaco T545 is to be overcoated. For instructions contact Master Builders Solutions UK Ltd, Technical Services Department.

Proper Use

MasterEmaco T545 is an advanced product and the above instructions should be meticulously followed, if in any doubt as to use, seek advice from Master Builders Solutions UK Ltd, Technical Services Department.

Odour

When using MasterEmaco T545 in large volumes or high temperatures, a slight smell of ammonia may be observed

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HANDLING AND TRANSPORT

Usual preventive measures for the handling of chemical products should be observed when using this product, for example do not eat, smoke or drink while working and wash hands when taking a break or when the job is completed.

Specific safety information referring the handling and transport of this product can be found in the Material Safety Data Sheet. For full information on Health and Safety matters regarding this product the relevant Health and Safety Data Sheet should be consulted.

Disposal of product and its container should be carried out according to the local legislation in force. Responsibility for this lies with the final owner of the product.

CONTACT DETAILS

Master Builders Solutions UK Ltd,
19 Broad Ground Road

Lakeside

Redditch

Worcestershire

B98 9LJ

Tel: +44 (0) 1527 512255

Fax +44 (0) 1527 503576

www.master-builders-solutions.com/en-gb

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Product Data		
Property	Unit	
Appearance		Grey Granular Powder
Plastic Density	kg/m ²	2200
Setting Time (materials at ambient temperature)		15 minutes at 20°C 35 minutes at 8°C
Non-Shrink		Unlike most fast-setting materials. MasterEmaco T545 can be considered as 'non-shrink' with average linear expansion of 0.02% ± 0.02%. (MasterEmaco T545 concrete averages 0.01% ± 0.01%). This expansion is usually completed in 3-7 hours.

Mix Proportions		
The following table gives the exact proportions to be used		
Mortar mix (standard) (20mm up to 75mm)	MasterEmaco T545	25 kg
	Water	1.5 litre
Concrete mix (large areas >75mm to 150mm deep)	MasterEmaco T545	25 kg
	Coarse Aggregate	10 kg 10mm (max)
	Water	1.5 litre
Small Batches	60ml Water per 1kg	

NB. See Guide to Application, Thickness.

The effect of Ambient Temperature on Compressive Strength of MasterEmaco T545

Curing Temperature	Average Compressive Strength in N/mm ²			
	1 hour	3 hours	24 hours	7 days
10°C	3	30	40	50
20°C	18	35	45	52
30°C	30	45	50	65

*All materials and equipment were conditioned to the curing temperature before mixing and casting. 70mm cubes were used.

Strength development of MasterEmaco T545 mortar and concrete

Strengths in N/mm² at 20°C and using 100mm cubes

Properties	MasterEmaco T545	1 Hour	3 hours	24 hours	28 days
Compressive Strength BS.1881	Mortar	22	33	44	53
	Concrete	21	32	43	48
Flexural Strength BS.6319 Pt. 3. BS.1881	Mortar	5	7	9	10
	Concrete	2	5	6	8
Tensile Strength BS.6319 : Pt7	Mortar	3	2.5	3	3.5

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Comparison of Slant Shear Bond between concrete and two different types of repair materials

The figures clearly illustrate the superior bond of MasterEmaco T545 to prepared and dampened concrete

Materials Bonded	Compressive Strength N/mm ²	Substrate Surface Preparation	Shear Bond Strength (N/mm ²)	Mode of Failure
OPC Concrete/ MasterEmaco T545 Mortar	56 47	Saw cut dry Surface	26.3	Bond interface
OPC Concrete/ MasterEmaco T545 Mortar	65 53	Roughened (*) and Dampened	44.8	Bond interface
OPC Concrete/ Mortar	49 50	Saw cut wet Surface	38.2	Bond interface
OPC Concrete/ MasterEmaco T545 Mortar	51 53	Roughened and Water Saturated (S.S.D.)	38.2	Monolithic
OPC Mortar/ Epoxy Mortar	65 77	Smooth and dry	42	Concrete substrate

*Surface roughened by acid etching. Test Method BS.6319 Part 4.

Bond of MasterEmaco T545 to Embedded Steel

Core holes were drilled in 35 N/mm² concrete and steel bars were grouted into the holes using MasterEmaco T545

Age when tested	Diameter (mm)	Reinforcement Type of Steel Bar	Grout Core Hole Size (mm)		Pull (in KN) at curing temperature of	
			Diameter	Depth	2°C	22°C
3 hours	2.7	Deformed	50	225	-	88
6 hours	12.7	Deformed	50	225	52	-
24 hours	12.7	Deformed	50	225	73	102 CF
7 days	12.7	Deformed	50	225	115 RB	108 CF
24 hours	19	Threaded	50	150	69	89 CF
7 days	19	Threaded	50	150	80	94 CR

Young's Modulus of Elasticity of MasterEmaco T545 and Pavement Quality OPC Concretes

Material	Nominal Strength N/mm ²	E-Value GPa
MasterEmaco T545 : Mortar	65	41
Concrete	60	43
OPC Concrete	40	31
	50	34
	60	36

Comparison of Thermal Coefficient of Expansion of different repair materials

Type of Materials	Coefficient of Thermal Expansion (10 ⁻⁶ per °C)
MasterEmaco T545Mortar	11.75
OPC Concrete	6 - 12
OPC Mortars	10.5 - 11.85
Epoxy Mortars	20 - 30

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Freeze/Thaw Resistance Test on MasterEmaco T545 (in accordance with ASTM C666, Pro. A)

Number of Cycles	Relative Dynamic Modulus %
144	92.0
300	79.8

The results of relative dynamic modulus are well above the limit of 60 normally required for frost resistant air-entrained pavement quality concrete

Scale Resistance of MasterEmaco T545 to de-icing chemicals (ASTM C672)

Number of Cycles	Rating	Surface Condition
5	0	No scaling
25	0	No scaling
50	1.5	Slight scaling

The above results are positively comparable with good quality air-entrained pavement concrete

Corrosion inhibition properties of MasterEmaco T545

Tests carried out on standard mild steel reinforcing bars

Type of Material	CaCl ₂ add in (%)	Corrosion Scale (*) of Steel Bar after		
		14 days	30 days	90 days
OPC Concrete (W/c =0.4)	0	1	2	1
	0.5	1	2	2
	5.0	2	2	4
OPC Concrete (W/C = 0.6)	0	1	2	1
	0.5	1	1	2
	5.0	3	1	4
MasterEmaco T545 Mortar	0	0	0	0
	5.0	0	0	0
MasterEmaco T545 Concrete	0	0	0	0
	0.5	0	0	0

Addition of CaCl₂ is by weight of cement for OPC Concrete and by weight of the pre-packed mortar for MasterEmaco T545.

* Corrosion scale is from 0 = no corrosion 9 = total corrosion

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Health and Safety

*For full information on Health and Safety matters regarding this product the relevant Health and Safety Data Sheet should be consulted.

The following general comments apply to all products.

As with all chemical products, care should be taken during use and storage to avoid contact with eyes, mouth, skin and foodstuffs, (which may also be tainted with vapour until the product is fully cured and dried). Treat splashes to eyes and skin immediately. If accidentally ingested, seek medical attention. Keep away from children and animals. Reseal containers after use.

Solvent Based Products

Use in well ventilated areas; avoid inhaling. Suitable respiratory equipment may be needed, eg when spraying. Can cause skin, eye irritation. Wear protective eye shields and gloves during use. Do not smoke or allow sparks or naked lights when stored or in use.

Resin Products

Can cause irritation, dermatitis or allergic reaction. Use protective equipment particularly for skin and eyes. Use only in well ventilated areas.

Spillage

Chemical products can cause damage; clean spillage immediately.

DISCLAIMER

"Master Builders Solutions UK Ltd" (the Company) endeavours to ensure that advice and information given in Product Data Sheets, Method Statements and Material Safety Data Sheets (all known as Product Literature) is accurate and correct. However, the Company has no control over the selection of its products for particular applications. It is important that any prospective customer, user or specifier, satisfies him/her-self that the product is suitable for the specific application. In this process, due regard should be taken of the nature and composition of the background/base and the ambient conditions both at the time of laying/applying/installing the material and when the completed work is to be brought into use.

Accordingly, no liability will be accepted by the Company for the selection, by others, of a product, which is inappropriate to a particular application.

Products are sold subject to the Company's standard conditions of sale and all customers, users and specifiers, should ensure that they examine the Company's latest Product Literature.