Emaco T545 Data Sheet

Specification notes

Product: Emaco T545

Supplier:
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... for more information on our flooring and construction products
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)

<table>
<thead>
<tr>
<th>Class</th>
<th>Compressive strength</th>
<th>Chloride ion content</th>
<th>Adhesive bond</th>
<th>Restrained shrinkage/expansion</th>
<th>Elastic modulus</th>
<th>Thermal compatibility</th>
<th>Freeze-thaw</th>
<th>Skid Resistance</th>
<th>Capillary absorption</th>
<th>Reaction to fire</th>
<th>Dangerous substances</th>
</tr>
</thead>
<tbody>
<tr>
<td>R4</td>
<td>≥ 45 MPa</td>
<td>≤ 0.05%</td>
<td>≥ 2.0 MPa</td>
<td>≥ 2.0 MPa</td>
<td>≥ 20 GPa</td>
<td>≥ 2.0 MPa</td>
<td>Class 1</td>
<td>≥ 40 units wet tested</td>
<td>≤ 0.5 kg/m² x h⁰.⁵</td>
<td>class A1</td>
<td>complies with 5.4</td>
</tr>
</tbody>
</table>

- Excellent bond to concrete and steel reinforcement. No secondary bonding agents required
- Highly durable. Excellent resistance to de-icing salts
- High freeze/thaw resistance
- No curing required
- Can be placed in sub-zero temperatures
- ‘Non-shrink’

0086 – CPD - 30612540

EN 1504-3 Principles 3.1/3.2/4.4/7.1/7.2

BASF Plc Construction Chemicals
Earl Road, Cheadle Hulme, Cheadle, England, SK8 6QG

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Date of Issue: August 2015
Version No. 3
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- Modulus and Thermal properties similar to concrete
- Lower permeability than cementitious mortars
- Chemically resistant to fuel, engine oils and urine.
- Inhibits corrosion in steel even in the presence of chlorides
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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 BASF plc, Construction Chemicals 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 BASF plc, Construction Chemicals, 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 BASF plc, Construction Chemicals, 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
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**Product Data**

<table>
<thead>
<tr>
<th>Property</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Appearance</td>
<td>Grey Granular Powder</td>
</tr>
<tr>
<td>Plastic Density</td>
<td>kg/m³</td>
</tr>
<tr>
<td>Setting Time (materials at ambient temperature)</td>
<td>15 minutes at 20°C 35 minutes at 8°C</td>
</tr>
<tr>
<td>Non-Shrink</td>
<td></td>
</tr>
</tbody>
</table>

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.

<table>
<thead>
<tr>
<th>Mortar mix (standard)</th>
<th>MasterEmaco T545 25 kg</th>
</tr>
</thead>
<tbody>
<tr>
<td>(20mm up to 75mm)</td>
<td>Water 1.5 litre</td>
</tr>
<tr>
<td>Concrete mix (large areas &gt;75mm to 150mm deep)</td>
<td>Coarse Aggregate 10 kg 10mm (max)</td>
</tr>
<tr>
<td>Small Batches</td>
<td>60ml Water per 1kg</td>
</tr>
</tbody>
</table>

NB. See Guide to Application, Thickness.

**The effect of Ambient Temperature on Compressive Strength of MasterEmaco T545**

<table>
<thead>
<tr>
<th>Curing Temperature</th>
<th>Average Compressive Strength in N/mm²</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1 hour</td>
</tr>
<tr>
<td>10°C</td>
<td>3</td>
</tr>
<tr>
<td>20°C</td>
<td>18</td>
</tr>
<tr>
<td>30°C</td>
<td>30</td>
</tr>
</tbody>
</table>

*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

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

<table>
<thead>
<tr>
<th>Materials Bonded</th>
<th>Compressive Strength N/mm²</th>
<th>Substrate Surface Preparation</th>
<th>Shear Bond Strength (N/mm²)</th>
<th>Mode of Failure</th>
</tr>
</thead>
<tbody>
<tr>
<td>OPC Concrete/ MasterEmaco T545 Mortar</td>
<td>56 47</td>
<td>Saw cut dry Surface</td>
<td>26.3</td>
<td>Bond interface</td>
</tr>
<tr>
<td>OPC Concrete/ MasterEmaco T545 Mortar</td>
<td>65 53</td>
<td>Roughened (*) and Dampered</td>
<td>44.8</td>
<td>Bond interface</td>
</tr>
<tr>
<td>OPC Concrete/ Mortar</td>
<td>49 50</td>
<td>Saw cut wet Surface</td>
<td>38.2</td>
<td>Bond interface</td>
</tr>
<tr>
<td>OPC Concrete/ MasterEmaco T545 Mortar</td>
<td>51 53</td>
<td>Roughened and Water Saturated (S.S.D.)</td>
<td>38.2</td>
<td>Monolithic</td>
</tr>
<tr>
<td>OPC Mortar/ Epoxy Mortar</td>
<td>65 77</td>
<td>Smooth and dry</td>
<td>42</td>
<td>Concrete substrate</td>
</tr>
</tbody>
</table>

*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

<table>
<thead>
<tr>
<th>Age when tested</th>
<th>Diameter (mm)</th>
<th>Reinforcement Type of Steel Bar</th>
<th>Grout Core Hole Size (mm)</th>
<th>Pull (in KN) at curing temperature of</th>
</tr>
</thead>
<tbody>
<tr>
<td>3 hours</td>
<td>2.7</td>
<td>Deformed</td>
<td>Diameter 50, Depth 225</td>
<td>2°C: 52, 22°C: 88</td>
</tr>
<tr>
<td>6 hours</td>
<td>12.7</td>
<td>Deformed</td>
<td>Diameter 50, Depth 225</td>
<td>2°C: 73, 22°C: 102 CF, 108 CF</td>
</tr>
<tr>
<td>24 hours 7 days</td>
<td>12.7</td>
<td>Deformed</td>
<td>Diameter 50, Depth 225</td>
<td>2°C: 69, 22°C: 89 CF, 94 CR</td>
</tr>
<tr>
<td>24 hours 7 days</td>
<td>19</td>
<td>Threaded</td>
<td>Diameter 50, Depth 150</td>
<td>2°C: 80, 22°C: 90 CF, 94 CR</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Material</th>
<th>Nominal Strength N/mm²</th>
<th>E-Value GPa</th>
</tr>
</thead>
<tbody>
<tr>
<td>MasterEmaco T545 : Mortar</td>
<td>65 60</td>
<td>41 43</td>
</tr>
<tr>
<td>OPC Concrete</td>
<td>40 50 60</td>
<td>31 34 36</td>
</tr>
</tbody>
</table>

Comparison of Thermal Coefficient of Expansion of different repair materials

<table>
<thead>
<tr>
<th>Type of Materials</th>
<th>Coefficient of Thermal Expansion (10⁻⁶ per °C)</th>
</tr>
</thead>
<tbody>
<tr>
<td>MasterEmaco T545Mortar</td>
<td>11.75</td>
</tr>
<tr>
<td>OPC Concrete</td>
<td>6 - 12</td>
</tr>
<tr>
<td>OPC Mortars</td>
<td>10.5 - 11.85</td>
</tr>
<tr>
<td>Epoxy Mortars</td>
<td>20 - 30</td>
</tr>
</tbody>
</table>
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Freeze/Thaw Resistance Test on MasterEmaco T545 (in accordance with ASTM C666, Pro. A)

<table>
<thead>
<tr>
<th>Number of Cycles</th>
<th>Relative Dynamic Modulus %</th>
</tr>
</thead>
<tbody>
<tr>
<td>144</td>
<td>92.0</td>
</tr>
<tr>
<td>300</td>
<td>79.8</td>
</tr>
</tbody>
</table>

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)

<table>
<thead>
<tr>
<th>Number of Cycles</th>
<th>Rating</th>
<th>Surface Condition</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>0</td>
<td>No scaling</td>
</tr>
<tr>
<td>25</td>
<td>0</td>
<td>No scaling</td>
</tr>
<tr>
<td>50</td>
<td>1.5</td>
<td>Slight scaling</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Type of Material</th>
<th>CaCl₂ add in (%)</th>
<th>14 days</th>
<th>30 days</th>
<th>90 days</th>
</tr>
</thead>
<tbody>
<tr>
<td>OPC</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Concrete</td>
<td>0.5</td>
<td>1</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>(W/C = 0.4)</td>
<td>5.0</td>
<td>2</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>OPC</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Concrete</td>
<td>0.5</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>(W/C = 0.6)</td>
<td>5.0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>MasterEmaco T545</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Mortar</td>
<td>5.0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>MasterEmaco T545</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Concrete</td>
<td>0.5</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

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 form 0 = no corrosion 9 = total corrosion
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. Re-seal 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.

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