

Application Guide for MasterEmaco[®] Repair Products

MasterEmaco[®] P 5000AP

MasterEmaco[®] N 5100

MasterEmaco[®] N 102

MasterEmaco[®] N 5200CI

MasterEmaco[®] S 5300CI

MasterEmaco[®] S 5400CI

MasterEmaco[®] S 5440CI

MasterEmaco[®] S 820CI

MasterEmaco[®] S 822

MasterEmaco[®] T 920CI

MasterEmaco[®] T 288

MasterEmaco[®] T 545

MasterEmaco[®] S 680

MasterEmaco[®] S 620

MasterEmaco[®] S 902

MasterEmaco repair products

These products are used for a variety of concrete repair applications and share some common attributes and often some installation techniques.

PACKAGING

Product	Description	Packaging
MasterEmaco P 5000AP	Specialty steel primer for use with repair mortars	5kg
MasterEmaco N 102	Lightweight low strength repair mortar	20Kg
MasterEmaco N 5100	Thin layer fairing mortar	20Kg
MasterEmaco N 5200CI	Lightweight fast setting repair mortar	20Kg
MasterEmaco S 5300CI	High build repair mortar	20Kg
MasterEmaco S 5400CI	High strength repair mortar	20Kg
MasterEmaco S 5440CI	High strength flowable repair mortar	20Kg
MasterEmaco S 820CI	General purpose shotcrete with corrosion inhibitor	20Kg
MasterEmaco S 822	Shotcrete for cathodic protection	20Kg
MasterEmaco T 920CI	Rapid setting micro concrete	20Kg
MasterEmaco T 288	Fast setting trafficable repair mortar	20Kg
MasterEmaco T 545	Fastest setting trafficable repair mortar	20Kg
MasterEmaco S 680	CAC shotcrete for aggressive environments	20Kg
MasterEmaco S 620	Hand applied acid resistant mortar	20Kg
MasterEmaco S 902	Rapid setting underwater repair mortar	20Kg

For detailed explanations of the mechanisms of concrete deterioration, inspection and interpretation of inspections and repair technologies, a number of documents should be referred to. Some of these include:

- Standards Australia HB 84 - 2006 "Guide to Concrete Repair and Protection" prepared by the CSIRO and ACRA
- European Standard EN 1504:2004 "Products and systems for the protection and repair of concrete structure"
- ICRI (International Concrete Repair Institute) Concrete Surface Profile Chips (CSP 1-10)

SURFACE PREPARATION

Preparation of the concrete substrate for concrete repairs generally involves a couple of steps. Preparation will involve removal of the contaminated, cracked and affected concrete to create a suitable profile as well as the cleaning of the reinforcing steel.

For the best results, a CSP profile of 5 or greater is required and to achieve this, you need an aggressive surface preparation technique. The choice of technique will be determined by the size and depth of the patch. Suitable techniques include:

- Hammer and cold chisel
- Kango style impact hammer
- Machine mounted impact hammer
- Hydro demolition

All loose material should be removed and the reinforcing steel exposed to the point where there is no visible rust and a grey surface colour is observed. This indicates that the steel at this point is still passivated and thus you are out of the current corrosion zone. The reinforcing steel should be exposed on all sides so that you are able to fit a gloved hand behind the bar. In the event that the reinforcing steel has lost a significant amount of its cross-sectional area (approximately 20% is classified as significant) it may need to be replaced or additional steel installed. The replacement should be determined by the engineer, especially in structural applications.

The steel should be cleaned to an SA Class 2.5 and all rust removed. For small patches this can be done by wire brush. On larger jobs a needle gun or captive grit blasting will be effective. The action of the hydro demolition will clean the steel well and no further preparation would be necessary.

The edges of the patch should be square cut to a depth of 10-20mm or the minimum as specified on the TDS, to prevent any of the repair mortar from being feather edged. Patches should be regular in shape and it may be necessary to join a number of small irregular patches to make a single regular patch. This will reduce the risk of cracking in the patch and the premature failure.

PRIMING

Steel

- Once the steel has been cleaned it will generally be necessary to prime the steel using **MasterEmaco P 5000AP**.
- Priming stops the flash rusting resulting from the contact with the moisture in the air.
- The **MasterEmaco P 5000AP** is an acrylic modified cementitious coating with active corrosion inhibition. You just mix with water and coat the cleaned reinforcing steel.
- It is an orange colour to make a simple visual evaluation of the steel that has been coated.
- This should be allowed to dry for a few hours before application of repair mortars or shotcrete.
- If application of **MasterEmaco** shotcrete was to proceed directly after the hydro demolition, the need for the **MasterEmaco P 5000AP** is reduced and could be eliminated without creating any issues with the longevity of the repair.
- Note: Although Mater Builders Solutions does not sell a zinc rich steel primer the use of one is entirely compatible with any of the **MasterEmaco** repair products. Care must be taken if using a zinc rich primer to ensure none is left on the parent concrete as this will interfere with the bond of the repair mortar.

Concrete

- The concrete substrate should be a saturated surface dry (SSD) substrate, to accept the repair mortars, as a dry substrate will lead to surface cracking and poor bond to the substrate.
- The only exception to this is the **MasterEmaco T 545** which chemically bonds with the concrete and does not need a wetted substrate (Note: a damp substrate will not interfere with the bonding of the **MasterEmaco T 545**).
- Shotcrete materials like the **MasterEmaco S 820CI**, **MasterEmaco S 680** and **MasterEmaco S 822** only require the substrate to be wetted just prior to the beginning of spraying. This is accomplished by spraying just water or a very thin, wet mix, as a slurry coat onto the prepared surface and then continuing with the normal shotcrete.
- **MasterEmaco P 5000AP** as well as being used as a steel primer can be used as a bonding agent for the repair mortar to the concrete. The repair mortar should be applied whilst the **MasterEmaco P 5000AP** is still wet and if it dries out reapplication will be required.
- **MasterEmaco P 157** is an SBR bonding agent, which can be used when wetting is impractical and should be diluted 1:1 with water and applied generously by brush to the concrete. Apply the repair mortar whilst the **MasterEmaco P 157** is still tacky.
- Slurry coat of the repair mortar – normally a mixture of 2 parts water and 1 part dry powder of the repair product being used is used to create a slurry coat and apply this to a wetted substrate with a brush and apply the repair mortar whilst still wet. The benefit of this is that the materials are all on site and more can be simply made up as required.
- Note: epoxy bonding agents are not recommended for vertical and overhead repairs however some specifications may call for this and **MasterBrace 1444** is compatible with all the repair

mortars. Epoxy bonding can also be considered for the **MasterEmaco T 920CI** or **T 288** for heavy duty pavement repairs and on horizontal surfaces, **MasterEmaco 2525** would be the appropriate bonding agent. Ensure that the epoxy bonding agent is still tacky before applying any repair mortar. Depending upon the delay, either reapply the bonding agent if cross linking is still possible or sand and solvent wipe prior to reapplication. In extreme cases, removal of the cured bonding agent may be required before starting again.

MIXING

MasterEmaco N 102, N 5100, N 5200CI, S 5300CI, S 5400CI, S 5440CI, T 920CI, T 288, S 620

- Only mix full bags. Damaged or opened bags should not be used.
- Add mixing water (clean, potable water only) to a clean mixing container.
- Accurately measure the mixing water and hold back approximately 10% so that the consistency can be adjusted to the required slump.
- Mix mortars with a helical paddle attached to a slow speed (300-600 rpm) mixer or in a forced action pan mixer for 3 minutes until a lump free, plastic consistency is achieved. **MasterEmaco S 5440CI** is best mixed with a bird cage style mixer to give a fluid consistency.
- Stop mixing during this time to scrap down the sides and continue mixing.
- Add the remaining water until the required consistency is achieved.
- Mixing water needed will vary depending on consistency required.
- See table below for water addition ranges and verify amount by checking the latest copies of the individual technical data sheets.
- Allow the mortar to rest for 2 - 3 minutes and then remix briefly, adjusting the consistency as required. In very hot weather the water demand will be at the high end of the range.

WATER DEMAND

Product	Description	Packaging	Water demand
MasterEmaco P 5000AP	Specialty steel primer for use with repair mortars	5Kg	220-260mls per Kg of powder
MasterEmaco N 102	Lightweight low strength repair mortar	20Kg	3.8-4.0L
MasterEmaco N 5100	Thin layer fairing mortar	20Kg	3.0-3.5L
MasterEmaco N 5200CI	Lightweight fast setting repair mortar	20Kg	3.5-4.0L
MasterEmaco S 5300CI	High build repair mortar	20Kg	3.8-4.2L
MasterEmaco S 5400CI	High strength repair mortar	20Kg	3.0-3.4L
MasterEmaco S 5440CI	High strength flowable repair mortar	20Kg	2.2-2.5L
MasterEmaco S 820CI	General purpose shotcrete with corrosion inhibitor	20Kg	1.8-2.5L
MasterEmaco S 822	Shotcrete for cathodic protection	20Kg	1.8-2.5L
MasterEmaco T 920CI	Rapid setting micro concrete	20Kg	1.7-1.9L
MasterEmaco T 288	Fast setting trafficable repair mortar	20Kg	2.6-3.0L
MasterEmaco T 545	Fastest setting trafficable repair mortar	20Kg	1.4L
MasterEmaco S 680	CAC shotcrete for aggressive environments	20Kg	1.8-2.5L
MasterEmaco S 620	Hand applied acid resistant mortar	20Kg	2.8-3.2L
MasterEmaco S 902	Rapid setting underwater repair mortar	20Kg	3 L of powder with 1 L of water.

MIXING

MasterEmaco P 5000AP

- In a suitable container, mix **MasterEmaco P 5000AP** with a paddle mounted on a slow-speed drill or by hand, until a smooth, thick consistency is achieved.
- Mixing water needed: 0.22 to 0.26 litres per kg of powder, depending upon consistency required.
- Leave to stand for approx. 5 minutes and re-mix briefly before use.
- Adjust the consistency with water when required but without exceeding the maximum water demand.

MIXING

MasterEmaco S 902

- Water requirements vary depending on temperature, humidity and the consistency desired.
- Mixing three volumes of **MasterEmaco S 902** with approximately one volume of water will give a stiff plastic consistency.
- Place **MasterEmaco S 902** into container and add half the water, mix quickly with a short handled trowel, add extra water as required until no white streaks are present to get the desired plastic consistency.
- Mix only small batches at one time, as MasterEmaco S 902 must be placed within 5 minutes of mixing.
- The **MasterEmaco S 902** should be shaped quickly into spheres of about cricket ball size and applied as soon as possible.
- Do not re-temper material which has begun to stiffen - discard material which has lost its plasticity.

MIXING

MasterEmaco S 820CI, S 822, S 680

- These materials are applied via a dry shotcrete machine and the water is added at the nozzle and controlled by the shotcrete operator.
- Increasing the water will reduce the rebound and dust creation.

MIXING

MasterEmaco T 545

- WATER CONTENT IS CRITICAL. A 20kg bag of **MasterEmaco T 545** mixed with a maximum 1.4 litres of water
 - Add all the water to a clean bucket and add the **MasterEmaco T 545** and mix for approximately 1 to 1½ minutes and place.
 - Use neat material for patches less than 25mm in depth. Do not use MasterEmaco T 545 for patches less than 13mm deep.
 - For deeper patches, **MasterEmaco T 545** must be extended by adding up to 12kg of properly graded, dust-free, hard, rounded aggregate.
 - Note: Do not use calcareous aggregate made from soft limestone. Test aggregate for fizzing with 10% HCl. If fizzing occurs, aggregate is unsuitable for use with **MasterEmaco T 545**.
 - Do not add sand, fine aggregate or Portland cement to **MasterEmaco T 545**.
 - **MasterEmaco T 545** gives off ammonia fumes when mixed with water and care should be taken to provide adequate ventilation.
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- **MasterEmaco T 545** is slightly acidic once mixed with water and will mark aluminium, galvanized metals and glass so care should be taken to avoid contact. The material becomes alkaline once it hardens.

- **MasterEmaco T 545** will not freeze at temperatures above -7°C.
- To obtain permanent repairs the edge of the patch should be square cut to a depth of not less than 10mm.

APPLICATION THICKNESS

Product	Description	Packaging	Min-max thickness
MasterEmaco P 5000AP	Specialty steel primer for use with repair mortars	5kg	1-2mm
MasterEmaco N 102	Lightweight low strength repair mortar	20Kg	5-100mm
MasterEmaco N 5100	Thin layer fairing mortar	20Kg	0-3mm
MasterEmaco N 5200CI	Lightweight fast setting repair mortar	20Kg	3-100mm
MasterEmaco S 5300CI	High build repair mortar	20Kg	10-75mm
MasterEmaco S 5400CI	High strength repair mortar	20Kg	5-50mm
MasterEmaco S 5440CI	High strength flowable repair mortar	20Kg	20-500mm
MasterEmaco S 820CI	General purpose shotcrete with corrosion inhibitor	20Kg	10-150mm
MasterEmaco S 822	Shotcrete for cathodic protection	20Kg	10-150mm
MasterEmaco T 920CI	Rapid setting micro concrete	20Kg	25-200mm
MasterEmaco T 288	Fast setting trafficable repair mortar	20Kg	10-300mm
MasterEmaco T 545	Fastest setting trafficable repair mortar	20Kg	13-25mm (Neat) 25-150mm (filled)
MasterEmaco S 680	CAC shotcrete for aggressive environments	20Kg	10-150mm
MasterEmaco S 620	Hand applied acid resistant mortar	20Kg	10-50mm
MasterEmaco S 902	Rapid setting underwater repair mortar	20Kg	20-50mm

APPLICATION

Primer – MasterEmaco P 5000AP

- Once mixed the **MasterEmaco P 5000AP** can be applied by stiff bristled brush when used as a primer on prepared concrete and paint brush for coating the reinforcing steel.

Mortars - MasterEmaco N 102, N 5100, N 5200CI, S 5300CI, S 5400CI, S 620, S 488CI

- The minimum temperatures must be maintained during application and for at least 12 hours thereafter for optimum curing of the product.
- These products can be placed using a gloved hand or trowelled onto the prepared surface.
- Apply mixed product directly to the prepared damp substrate, or wet on wet onto the primed surface.
- A thin scratch coat or contact layer (a slurry coat of the **MasterEmaco** material) before building up to the required thickness, wet on wet, will improve the wet adhesion and cohesion of the mortar.
- Apply to the desired layer thickness (see application thickness table).
- Smoothing with a trowel and finishing by float or sponge can be done as soon as the mortar has begun to stiffen, typically after approximately 45 - 60 minutes at 20°C. Note: At lower temperatures and/or higher humidity these times will be extended.

Form and pour - MasterEmaco, S 5440CI, T 920CI, T 288

- The minimum temperatures must be maintained during application and for at least 12 hours thereafter for optimum curing of the product.
- These products can be placed using a pump, poured from the mixing bucket and trowelled into place onto the prepared surface.
- The formwork should be water tight and sturdy and the forms should be treated with a form release agent like **MasterFinish RL 211** or **222** to ensure they can be easily removed.
- When possible pre-wet the substrate before pumping or pouring the mortar into the form.
- Ensure that excess water is drained prior to filling form with mortar.
- Saturated surface dry or bonding agent should be considered where practical.
- Keep forms on until the material has reached the desired strength and cure the material after removal of forms.
- **MasterEmaco T 288** and **T 920CI** are mostly used in horizontal excavations and the surrounding concrete becomes the form.
- Move the material to the desired places with a trowel and finish off the surface profile required.
- **MasterEmaco T 288** will set relatively quickly and finishing off should be done as quickly as possible.

MasterEmaco T 545

- **MasterEmaco T 545** when mixed is a high slump mortar and cannot be placed vertically unless behind a form.
- Surface carbonation inhibits chemical bond, so application must be done shortly after preparation of the substrate.
- Apply an indicator (phenolphthalein) to the prepared surface to determine if carbonation is present (carbonated concrete will show no colour and non-carbonated concrete will show up pink)
- Into a dry recently prepared excavation pour the **MasterEmaco T 545** into the void to be filled and move into place with a trowel.
- The substrate should not be wet nor bonding agents used as the **MasterEmaco T 545** chemically bonds with the concrete.
- **MasterEmaco T 545** has a short open time and will generate significant heat during the hardening process.
- **MasterEmaco T 545** does not require any curing.

MasterEmaco S 902

- When applying **MasterEmaco S 902** to eroded piles, the **MasterEmaco S 902** "ball" should be centred in the cavity firmly, and quickly smoothed out from the centre to the sides with both hands, using "forward and sideways" pressure, moulding to appropriate shape and thickness.
- When applying underwater, place freshly-mixed "balls" of **MasterEmaco S 902** into a wire basket and lower steadily to diver.
- Where there is wave action or turbulence in the water, it is advisable to press the **MasterEmaco S 902** firmly in place for a moment or so before smoothing it out to shape.

Shotcrete - MasterEmaco S 820CI, S 822, S 680

- **MasterEmaco S 820CI, S 822, S 680** are applied via a dry shotcrete machine and the water is added at the nozzle and controlled by the shotcrete operator.
- Adjusting the water will influence the rebound and dust creation.

CURING

- All cementitious materials will benefit from curing and if possible the use of a curing compound is advised, such as **MasterKure 404**.
- This is often impractical due to the requirement for the application of subsequent coatings and in this case, the use of wet hessian or plastic should be considered.
- Thinner applied mortars such as the **MasterEmaco N 102, N 5200CI** need protection to reduce the risk of surface crazing from premature drying.



Figure 1 - Cleaning out behind the reinforcing



Figure 2 - Square cutting the edges of the patch



Figure 3 - Shows grey colour of properly prepared steel



Figure 4 - Shows the MasterEmaco P 5000AP applied to prepared steel



Figure 5 Mixing the repair mortar



Figure 6 - Getting the required consistency



Figure 7 - Apply a slurry coat



Figure 8 - Build up repair in layers



Figure 9 - Screed off to give flat surface



Figure 10 - Use a sponge float to get good surface



Figure 11 - Finished patch ready for curing



Figure 12 - Dry shotcrete machine



Figure 13 - Spraying on a wall



Figure 14 - Spraying mortar onto overhead repair

Caution

For information on personnel protective equipment, first aid and emergency procedures, and water disposal methods, refer to the product bag or Safety Data Sheet

DISCLAIMER

Application Guide for MasterEmaco Repair V8 1220

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