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# **BASF CONSTRUCTION CHEMICALS AUSTRALIA PTY LTD**

## **APPLICATION GUIDE for MASTERFLOW® GENERAL PURPOSE GROUTS**

Masterflow® 95

Masterflow® 835

Masterflow® 929

Masterflow® Construction Grout

### **IMPORTANT: READ THIS FIRST**

BASF Construction Chemicals does not warrant the performance of this product unless the instructions of this document and other related BASF Construction Chemicals documents are adhered to in all respects.



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## 1. SURFACE PREPARATION

The foundation surface must be free of all laitance and unsound material and thoroughly cleaned and cured. The grout foundation should be roughened as specified. The concrete surface may be uniformly roughened before it has set by the use of a nail rake in one direction only. Use of a bull float, darby, broom, or wood float finish, or scratching at random with a garden rake or trowel is NOT recommended.

After the concrete hardens, hand held, pistol grip pneumatic hammers with chisel point heads are recommended for roughening to remove laitance and loose material to ensure a good bond. Use of large paving breakers, equipped with bush hammers, spade or chisel bits, are NOT recommended. Where grout will extend horizontally out beyond the edge of the plate or object grouted, the foundation must also be prepared below these areas to help assure bond.

Before setting structural elements or machinery, all of the areas of the foundation, which will be in contact with the grout, including anchor bolt holes, must be thoroughly cleaned. Remove any oil, grease, and curing membrane. One method of cleaning a concrete surface is the use of compressed air and water.

Foundation surface and bolt holes must be saturated for a minimum time of 4 hours. This should be concluded immediately prior to grouting.

Just before mixing and placing is started, all free "standing" water must be removed from any anchor bolt holes and foundation surfaces over which grout is to be placed. This most often is accomplished with compressed air and/or blotting with dry absorbent rags. Any rust, oil or grease on the bedplate being grouted must be removed but if the base plate is already coated with a high quality coating such as polyurethane this does not have to be removed.

## 2. FORMWORK

Forms should be watertight and strong enough to withstand the hydraulic pressure of plastic, flowable or fluid grout, without leaking. When flowing the grout into place, all forms should extend vertically at least 25mm above the underside of the bedplate surface to help ensure complete filling of the space to be grouted and prevent overflowing.

The side forms should not be tight against the plate, but should be erected 25 to 50mm horizontally away from the plate so that air being displaced is not trapped below the plate. The vertical form on the exit side (opposite the placing side) should be extended 50 to 100mm away from the plate so that straps or other placing aids can be inserted to assist movement of the grout should that become necessary.

HEADER BOX - The form on the placing side should be extended 50 to 100mm horizontally from the plate at the foundation and be slanted upward at an approximate 45 degree angle so that grout can be poured on it with a minimum of turbulence (and entrapment of air

bubbles) while directing it smoothly on its way under the plate. A blackboard (splash board) form should be built on top of the plate and at the plate edge, opposite the slanted headboard, to prevent spillage of grout and provide containment of the “head” of grout as it is being placed. However, as a sloped pouring form is desirable, a portable “head box” which can be moved along the length of the plate as the grouting proceeds may be used. This portable “head box” serves well in helping to place the grout and saves a lot on forming costs. The box with a sloped pouring surface should rest in part on the form, floor and/or base plate and this method serves just as well, and often better than a long sloped form, as the thrust of the grout flow is better controlled.

Forms should be caulked to prevent leakage. Forming materials, such as wood, which absorb water, should be coated with water resistant oil (form oil), a form release agent (such as Rheofinish FR222). These coatings prevent loss of water from the grout and act as bond breakers so that smooth grout surfaces result after form removal and the forms are protected for reuse. The points to caulk are the interfaces between the form and rough foundation surface where grout might leak out during its placement or before setting.

Material used for caulking between the form and concrete surface may be a stiff consistency of sand-cement mixture or stiff consistency of the grout to be used. Vertical joints in the forms should be caulked if large cracks are evident. The use of duct tape applied on the inside of the form, at corners, is useful for this.

### **3. MIXING GROUT**

Mortar mixers and paddle-type mixers are most often used for mixing grout. Small volumes of grout can be most efficiently mixed using hand held Festo style mixers.

Mortar mixers will generally not produce lump-free grout and generally the larger the mixer the less efficient will be the mixing. A few lumps, however, will not harm the grout in place nor the overall placing result, but these may be removed to prevent blocking, or obstructing the grout placement by the use of screens placed in the head form if lumps must be removed. These screens may be made from expanded metal or iron grating with suitable size openings.

Mixers should be located as close as possible to the object being grouted to minimise transporting time, equipment, and labour. If mortar or paddle-type mixers are to be emptied into wheelbarrow, consider elevating these mixers 300 – 600mm so that they may more easily be discharged into the wheelbarrows.

An adequate potable water supply should be located adjacent to the mixer. The size of the batches mixed should be compatible with the volume of the space being filled, and the speed with which the grout can be mixed, discharged, transported and placed.

Do not mix more grout at one time than can be placed in ten minutes. However, lower mixed grout temperatures will extend the working time. Also, during short job delays, the grout may be agitated in the mixer to keep it workable. Do not add additional water to maintain the desired consistency. Grout that has been mixed for a long time and has lost workability and



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reached a consistency that is not placable should be discarded rather than retempered and used. Grout flow and working time can be effectively controlled by the use of temperature controls. See the Hot Weather and Cold Weather Grouting sections of this Application Guide for more details. Consistency of the grout should be checked initially and periodically thereafter to see that it meets specifications.

### **BASIC PRINCIPLES**

- A. Wet out the mixing container with water. Place the mixing water in the mixer first, then add the dry grout rapidly in a steady stream. Do not let large clumps drop in at one time.
- B. The best retarder for non-catalysed grouts is a lower “as mixed” grout temperature. This is usually accomplished through the use of cold or iced mixing water or cool storage of the dry grout material.
- C. BASF grouts are supplied in a ready to use form requiring only the addition of water. Do not add any other dry materials (sand, cement etc).
- D. Do not use grout from damaged bags.
- E. Mix with potable water only.
- F. Do not mix by hand.

### **SMALL SIZE BATCHES**

Small batches are those in which one or two bags are mixed at one time with a drill-mixer (eg Festo) and grout stirrer in a 20 to 25-litre pail. Add all the required water to the mixing pail. Slowly and uniformly add the grout into the water over 30 seconds while mixing. Do not “dump” the grout into the mixer. This may cause lumping, which will be hard to break down. Mix for 1-2 minutes at 300-400rpm ensuring the mixing blade is kept below the surface of the grout to prevent air entrapment. Excessive mixing will entrap air, reducing flow and strength.

### **MEDIUM-SIZE BATCHES**

A medium-size batch is one prepared in a power driven mixer, using from 1 to 20 bags per batch. The most widely used equipment is the common horizontal-shaft, paddle-type mortar mixer. Other useable mixers are revolving drum concrete mixers and vertical-shaft, paddle mixers.

Mortar Mixers: add approximately 70% of the required mixing water, then cut into the bags using care to flow each bag slowly into the mix (rather than dump the entire bag contents as a mass) with the mixer running. Mix for 3 minutes to break up any lumps. Slowly add the remaining water. Mix until grout appears homogeneous, about 4-5 minutes in total.

Lumps in the grout as poured are not desirable, but a few small ones, if wet through, can be tolerated. A better procedure is to pour the grout through a 10mm or 13mm screen and waste the lumps.

#### 4. PLACING GROUT

Grout should be placed as quickly as possible after it has been properly mixed and discharged. Grouts may be poured at a fluid or flowable consistency. Placement of grout should be across the shortest dimension of the equipment or base plate involved whenever possible. Make sure that all free water from the surface of the foundation and anchor boltholes has been removed just prior to grouting them. All anchor bolthole grouting should be completed prior to placing the major grouting above, although the foundation may be grouted immediately following the bolthole grouting.

Recommended grout thickness for Masterflow 95, Masterflow 835, Masterflow 929 and Masterflow construction grout is 25-100mm, with a minimum of 10mm. Flow distance of more than 1.5 metres can be expected using flow troughs, at normal thickness. Where grout thickness exceeds 50mm, special procedures may be necessary to restrict temperature rise. However, general practice for placing fluid grout is to have a 50mm vertical clearance between base plate and foundation form flat plates, having few obstructions beneath, with up to 1.2 metre of horizontal placing dimension. Roughly chipped foundations will require additional clearance, and for placements of grout with more than 1.2m horizontal flow, an additional 25mm clearance should be added for each 1.2m travel.

If using a grout of plastic consistency, these clearances should be increased slightly (by about 10%). It is better to have greater clearance than required than to have too little. When grouts are poured, placing should start at one end (on the slanted or head box) and continue there until the grout rises above the bottom of the bedplate on the exit side. The pouring point is then moved slowly along the slanted head form on the pouring side as soon as grout continues to come up on the opposite side, to ensure that air is being displaced rather than trapped.

Grout should not be placed indiscriminately at separate locations along one side as this prevents tracing the actual movement and progress of the grout and can result in large pockets or voids being trapped between such placing points, nor should grout be poured towards the centre from opposite sides, for the same reason.

Before starting the grout placement, steel packing straps 20 – 25mm wide can be introduced below the plates and worked slowly back and forth to encourage the flow of grout around obstacles and to exit side. DO NOT use chains for this purpose, as they tend to entrap air bubbles each time the links pass down into the grout. DO NOT vibrate as this may lead to segregation of the grout.

Grouting products generally do not make good floor toppings as they are too rich in cementitious material and are designed to expand if not restrained. For this reason BASF discourages wide shoulders of grout and recommend that these shoulders have minimal horizontal dimension. Where wide shoulders or topping of large areas of the foundation are anticipated, use a mortar designed for such applications (eg. Emaco Nanocrete R2).



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## 5. HOT WEATHER GROUTING (above 30 degrees Celsius)

High ambient temperatures accelerate stiffening and require grout mixing and placing procedures that can only be accomplished in the short period of time the grout remains workable.

The alternative is to extend the length of time the grout is workable and placable through the use of cold materials and cool foundation and base plates. This approach does not affect the non-shrink and strength development characteristics of the grout. This is the only method of extending the working time that may be used with BASF grouts.

### RECOMMENDATIONS:

1. Store the bags of grout in as cool a place as practicable, but at least in the shade.
2. Give extra attention to saturating the concrete base -- for 24 hours or more.
3. Cool the base plate while saturating the concrete base by covering both with wet burlap or cloth and keeping it wet. Shortly after the grout is poured, its temperature will change to that of the steel base plate and concrete foundation, between which the grout is poured. Keep the temperature of the grout "as mixed" under 21°C and preferably between 10°C - 13°C. The "as mixed" temperature is the temperature of the grout immediately after mixing.

Rule of Thumb: Try to have the "as mixed" temperature of the grout at least as much under 21°C as the base plate and foundation are above 21°C. For example: If the base plate and foundation are at 27°C, strive to cool the grouting material and mixing water sufficiently to obtain an "as mixed" temperature of 15°C and preferably lower.

4. Cool the Mixing Water: To lower the "as mixed" temperature of the grout, use cold water. If necessary, float ice in drums of water; employing enough drums so that when water is drawn off for mixing, the replacement water has time to cool. Insulating the drums or wrapping them with wet rags will help keep the water cold. Do not add ice directly to the grout mix, and do not use 'dry ice' as a cooling agent.

Where large batches of grout are to be mixed or where the packages of grout product are over 32°C, consider substituting shaved ice for some of the mixing water on a weight-for-weight basis. Generally, shaved ice can be used in place of 50 to 70% of the mixing water by weight of the mixing water. Do not use more ice than will be completely melted within the proper mixing time of the grout. Unmelted ice poured with the grout will float to the top of the grout and will melt, producing water pockets under the base plate with resulting loss of bearing. Always pour the mixed grout through a 10mm screen to remove unmelted ice, lumps and foreign material.

It is good practice to take the temperature of the initial batch to determine if more or less cooling is required. An "as mixed" temperature of less than 7°C can be damaging to the grout. Therefore, the ice must be carefully controlled in batching and mixing.



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5. If the mixer is warm, cool it by charging the mixer with cold or iced water will help reduce heating of the grout.

6. If the grout is being pumped, a warm pump line can heat the grout and cause plugging. Covering the line with cloth or burlap that is kept continually wet will help cool the pump line. Also, consider using reflective insulation around the line and erecting sunshades to shield the line from the hot sun. The pump line can be cooled by filling it with chilled water or chilled cement slurry before batching the grout. However, the chilled priming mix must be completely discharged and discarded before pumping the grout.

7. Use screens to shade the area being grouted.

8. Grout early in the morning or at night when temperatures are cooler.

**When cooling cannot be accomplished:**

Two approaches should be considered in order to cope with rapid setting in hot weather.

1. Form the area to be grouted into smaller sections so that each section can be grouted individually.

2. Provide increased mixing capacity so the grout can be poured faster and continuously. Controlling the temperature of the environment and grout as mixed and placed, minimises the need for extra water, provides more working time and results in higher compressive strengths.

**6. COLD WEATHER GROUTING (below 10 degrees Celsius)**

Masterflow 95, Masterflow 835, Masterflow 929 and Masterflow construction grout are not suitable for placement below 10 degrees Celsius. Cool and cold temperatures affect the properties of grout in the same manner as concrete and mortars.

**A. Foundation and Equipment Temperature:**

i. Accurately measure the temperature of the base plate and the concrete foundation by placing a thermometer on both surfaces. A contact thermometer performs best. If an air or immersion thermometer is used, covering it with a piece of dry insulation material or dry rags may be helpful in determining the contact surface temperature without the interference of air temperature.

ii. If the temperature of the base plate and/or foundation is below the minimum placing temperature, bring the bedplate and foundation up to the minimum. Apply heat uniformly. Cooler in place temperatures (above the minimum) are better, unless early strength is necessary. (Heating methods should comply with equipment manufacturers and erectors instructions.)



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### **B. Ambient (Curing) Temperature:**

i. Newly placed grout must be protected from freezing. After placement, the grout must be maintained at or above minimum placing temperature until the grout has attained final set. Thereafter, the temperature must be kept above freezing until the compressive strength exceeds 28 MPa.

ii. Cold and cool temperatures retard early strength gain. Early strengths may be accelerated by warm, moist curing. If early strength is required, use heated water and maintain placed grout temperature above 20°C for 24 hours. However, this must be carefully and uniformly applied to avoid thermal shock damage.

iii. Curing procedures to retain water for long-term strength gain and other properties are important, even in cool, moist conditions.

## **7. CURING**

All BASF cementitious products require thorough curing in order to achieve their full potential in strength and durability. Premature drying harms grouts not only the strength and durability suffer loss, but more importantly, the chemical action that reduces or eliminates drying shrinkage after hardening. Properly cured, however, these grouts provide continued bearing when normal drying does take place at later age.

Pre-saturation of concrete foundation prior to grouting is important to curing because the saturated condition prevents loss of water from the fresh grout.

**Curing is generally accomplished in two steps and these should commence immediately after the grout placement.**

### **1. Preventing Early Moisture Loss, Plastic State:**

Cover exposed, freshly placed grout with soaking wet clean rags as soon after placing as possible. Maintain this wet cover until final set and/or exposed grout is to be finished. Then follow No. 2 below. Final set can be determined as that time at which one cannot penetrate the grout with a pointed trowel.

### **2. For Long-Term Curing in the Hardened State:**

As soon as final set occurs, remove wet rags and trim shoulder or finish as desired. NEVER remove forms or cut back grout below underside of unit grouted BEFORE grout has hardened. Immediately thereafter, liberally apply Masterkure 402, Masterkure 404 or other BASF curing agent on all exposed grouts. Applying curing compound by brush is preferred to spraying so as to avoid waste and not spray the agent over the base plate and its supported equipment.



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Curing compounds are difficult to remove from intricate machinery parts and, if a sprayer is to be used, it may be advisable to recommend covering the top of the base plate and machinery with a temporary tarpaulin or plastic sheeting to protect the equipment.

In a few instances, regardless of the curing method, where exposed grout shoulders extend beyond the bedplate or connected member, or are over several metres in length as in large equipment, there is a probability of some superficial, hairline cracks appearing in the exposed grout perpendicular to the plate or member grouted. Fine hair cracks are of no structural significance and they do not detract from the quality and satisfactory results of the non-shrink, load-bearing grout, if our saturation and curing procedures listed previously are fully carried out.

During the long curing time required for grouts to reach strength in cold environments, it is vital that the grout does not dry out. Finally, do not remove shims or back off leveling screws until grout has attained sufficient bearing strength, which will depend on site temperatures

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