BASF
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Application Guide for

MasterFlow® cementitious Precision grouts

MasterFlow® 810
MasterFlow® 815
MasterFlow® 870
MasterFlow® 4500
MasterFlow® 4510
MasterFlow® 4600

MASTER® BUILDERS SOLUTIONS

Introduction:

When mixing and placing cementitious grouts, it important is to mix and place the product in as short a time as possible, while maintaining the “as mixed” temperature between 10 – 30^0C. Ideally the time from bag opening to product placement should be 10 minutes at the desired “as mixed” temperature of 21^0 C. Proper organisation of equipment and crew is key to ensuring this. The purpose of this application guide is to offer advice and assistance in the grouting process.

1. FOUNDATION PREPARATION

The foundation surface must be free of all laitance and unsound material and thoroughly cleaned and cured. Keeping the surface covered it will make the later job of cleaning the surface prior to grouting much easier and less costly.

The grout foundation should be roughened as specified. As a guide CSP 3 profile 2-5mm (minimum) or CSP 5 profile (3-10mm) (maximum) is recommended. 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. Large paving breakers fitted 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 boltholes, 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. Continue cleaning until water runs clear.

Foundation surface and bolt holes must be saturated for a minimum time of 4 hours, preferably overnight or 24 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. Air relief holes must be provided where necessary. Eliminate sources of vibration (which can cause settlement and bleeding) until grout hardens.

2. FORMING

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 backboard (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.

For many applications, such as turbines and generators, or other base plates of lengthy dimensions, it is not prudent to build high, pouring “head” forms for these base plate lengths. In lieu of this, low forms, sufficiently high to contain the grout and at least 25mm above the bottom elevation of the plate to be grouted may be used. 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 MasterFinish 222), a good wax based curing compound (such as MasterKure 100) or plastic coating. 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.

After caulking the foundation, the area within the forms to be grouted should be cleaned and flooded with water to see if there are any leaks in the formwork or between the form and foundation.

3. STORAGE

Grout components shall be stored between 10˚C and 30˚C. Note the restrictions on hot and cold weather grouting below

4. MIXING GROUT

Mixing position

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 secondary containers, consider elevating these mixers 300 – 600mm so that they may more easily be discharged into these secondary containers.

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 reached a consistency that is not placable should be discarded

Controlling the temperature of the as mixed grout will result in consistent Grout flows and working times. 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. Please see the section “onsite QA” for details on this.

BASIC PRINCIPLES

- 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.
- The best retarder for BASF MasterFlow grouts is to lower the “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. Do not add ice directly to the mix.
- Aim for an ”as mixed” temperature of 15 - 21^0 C.
- Aim for work time of less than 10 minutes from “bag opening” to placement.
- 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).
- Do not use grout from damaged bags.
- Mix with potable water only.
- Do not mix by hand.

Single bag mixing:

- Small volumes of grout can be most efficiently mixed using hand held Festo style mixers. These mixers have variable speed settings. For fluid grouts a speed of around 300 rpm is ideal.
- 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 rpm ensuring the mixing blade is kept below the surface of the grout to prevent air entrapment.

Faster Speeds and long mixing time may introduce excess air without increasing the mixing efficiency.

For areas that require more than one bag one method would be to have a number of mixing buckets available and to mix two to three bags so as to have a supply of grout to enable semi continuous pours.

The sequence would be mix bag and allow it to sit, mix bag two, and allow it to sit mix bag three and allow it to sit. Mix bucket one for 20 seconds, mix bucket 2 for 20 seconds mix bucket 3 for 20 seconds and begin mixing bag 4 and begin applying the grout under the baseplate. This should allow for a semi continuous operation and ensure that the grout does not lose energy during the pouring operation.

Multi bag mixing:

Pan mixers (eg a SOROTO) or ribbon paddle-type mixers are most often used for mixing grout and are the best choice for larger volumes. Add approximately 80% of the required mixing water, then add 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. A flow check is the best way to ensure that the mixing time is correct. Please see the section “onsite QA” for details on this.

“Ribbon Paddle” type or mortar mixers have horizontal shafts equipped with blades (or paddles), which revolve within a stationary drum. These mixers are capable of mixing grout to most any consistency. Add approximately 70% of the required mixing water, then add 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. A flow check is the best way to ensure that the mixing time is correct. Please see the section “onsite QA” for details on this.

Thick Section pours

For thick pour sections ie Where Gap Width is greater than 100mm use **MasterFlow 4510** or **MasterFlow 815**

> It is possible to bulk out **MasterFlow 810**, **MasterFlow 870** and **MasterFlow 4500** with clean, dry, silt free 10mm pea gravel when sections to be grouted are in excess of 100mm. However these mixtures are no longer suitable as a “Precision Grouting” application.

4. PLACING GROUT

Grout should be placed as quickly as possible after it has been properly mixed and discharged. Ideally less than 10 minutes from bag opening to placement. Grouts may be poured at a fluid or flowable consistency. The may also be pumped. The method of placement will depend on the size of the object grouted, its shape, available access to accomplish the grouting, clearances, obstacle around which the grout must be placed and environmental temperatures.

Placement of grout should be across the shortest dimension of the equipment or base plate involved whenever possible. With Large Baseplates or complex and congested areas to be grouted it may be necessary to divide the areas to be grouted into a number of sections. A size ratio of 1:1 or 1:2 has been found to work well (for example 2m wide and 2m deep or 2 m wide and 4 meters deep. Temporary formwork to divide the sections will be necessary and ensure that they will not be stuck to the grout. Fabric hoses filled with water have been found to be effective as has timber formwork that can be removed. 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 810, MasterFlow 870**, **MasterFlow 4500 and MasterFlow 4600** is 25-100mm, with a minimum of 10mm. Flow distance of more than 3 metres can be expected using flow troughs, at normal thickness. Where grout thickness exceeds 100mm, consider using MasterFlow 4510 or MasterFlow 815, 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. These are minimum requirements to which additions should be made allowing for anticipated difficulty of placement. Recommended grout thickness for **MasterFlow 815 and 4510** is 50-500mm.

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 are 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 structural or machinery plates that do not have a flat underside, or that are too large to pour, call for a variety of special placing and forming techniques too numerous to cover all applications.. For instance, inverted “cake pan” plates or those with stiffeners may have to be poured from the top through holes and the corners in each section drilled with small holes to permit displaced air to escape, permitting the grout to rise and make contact with the bottom of a plate during placing. This is occasionally done in 2 or 3 separate placements with delays of from 15 minutes to several days between placements.

Extremely large plates, or equipment under which the grout must travel more than 3 – 4 metres horizontally, may have to be poured through grout holes in the top of the plates to shorten the travel distance, or pumped,(eg a suitable pump is a Putzmeister SP 11) using special forming and pipe entry holes in order to fill the space completely. In these cases, one should trace the movement of the grout and move the pumping hose to prevent buckling due to hydraulic pressure.

Large plates or cavities requiring a cubic metre or more must be placed quickly and continuously. These large volumes are best pumped (eg a Putzmeister SP 11). Grout mixes develop considerable heat quickly in a large batch. Usually chilled (0°C) water is used in these applications, to maintain lower as-mixed temperatures during placing. See section on Hot Weather Grouting.

Shoulders

BASF discourages wide shoulders of grout and recommend that these shoulders have minimal horizontal dimension. BASF recommend chamfering shoulders to 45Deg, from bottom of the base plate to the substrate.

5. HOT WEATHER GROUTING (above 30°C)

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 only method of extending the working time that may be used with BASF grouts is through the use of cold materials and cool foundation and base plates.

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.

   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.

5. If the mixer is warm, cool it by charging the mixer with chilled 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 eg no more than 5 bags.

2. Provide increased mixing capacity so the grout can be poured faster and continuously or pumped.

Controlling the temperature of the environment and grout as mixed and placed, provides more working time and results in higher compressive strengths.

6. COLD WEATHER GROUTING (below 10°C)

Cool and cold temperatures affect the properties of grout in the same manner as concrete and mortars. Cold temperatures are more critical in grouts because high strength and precision bearing support are required from a relatively small section of grout when compared to the concrete beneath and the steel above the grout.

Cold temperatures retard setting times. This increases the possibility of frozen material, retarded strength gain in production to the severity of the cold and required reductions in mixing water requirements to prevent excessive flow, bleeding and settlement of aggregate particles. Cold base plates and foundation concrete quickly draw heat from the smaller volume of grout between them and these masses control the temperature of grout.

Storing the dry grout in a warm area and/or using warm water will raise as-mixed temperature and should be considered. However, the actual temperature of the foundation, equipment and machinery should be the guiding factor as to whether grouting should take place or not with the specific grout involved. Before grouting, if there is any question, the conducting of in-place bleeding tests at low temperatures, and at the consistency required, will determine safe in-place minimum temperatures for the grout. Decisions should be made as to whether or not the temperature of the equipment or structural need be raised prior to grouting. Always favour a decision on the side of safety, as grout removal and replacement is extremely difficult and can be expensive.

Raising the temperature of equipment requires a uniform and gradual increase in heat so as not to disturb base plate alignment. After the desired temperature is achieved, the alignment should be re-checked and adjusted if necessary.

For MasterFlow grouts, 7°C is the minimum temperature of the grouts after they are mixed. Below 7°C, the grout is likely to remain in a flowable state long enough to settle and bleed water to the surface. The consistency of the grout must also be such that it does not bleed at either as mixed or in place temperatures.

There are three important factors, which must be considered for successful cold weather grouting.

A. Mixed Grout Temperature and Consistency: the temperature of the unmixed grout in the package, the temperature of the mixing water, the size of the batch being mixed and the temperature in the mixing and working area effect the temperature of the mixed grout.

   i. Optimum storage temperatures for precision grouting in cold weather are over 7°C.

   ii. Warm the mixing water as necessary to provide mixed grout at the desired temperature, but do not mix grout warmer than necessary. Warmer mixed grout will require more mixing water for a given consistency and reduce the handling time in proportion to its temperature. Do not use mixing water hotter than 27°C.

   iii. Less mixing water = higher strength. Early age strengths at cool temperatures are low, but cold, placed and cured grouts will be approximately as strong as normally placed grouts at 28 days and stronger at ultimate strength.

   iv. Cool and cold grouts stay fluid and flowable longer than normal temperature grouts. Hence, the working time of less fluid, cool grout will be approximately the same as more fluid, warm grout.

B. 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.)

C. 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. PUMPING MasterFlow® GROUTS

BASF grouts can be pumped with the same equipment that will pump cement-sand or pea gravel mixes. Pumps should have a hopper capable of mild agitation and be fitted with a return line to allow grout to recirculate during temporary hold ups. A 50mm internal diameter (ID) pump hose is preferred.

Whenever a large volume of grout is to be pumped, or pumping distances are over 16 metres, a 50mm or more ID grout line should be used.

Keep the line from the pump to the discharge outlet as short as possible. Protect the grout pipe from heating by the sun by covering with wet burlap or cloth. Pack the grout line in ice and use iced mixing water when temperatures are extreme to retard stiffening from heat build-up and minimise line plug-ups. All connections between lengths of pipe should not reduce the internal diameter of the pipe and avoid where possible lips and ledges in the pipes.

All valves should be of the quick opening gate, plug or similar types to allow unrestricted passage of the grout. Do not use globe valves or similar types that severely restrict flow of the grout even when fully open.

Minimum Grout Line Sizes for Power Driven Pumps – Inside Diameter: 50mm

When pumping grout the need for adequate mixing equipment to keep the mixer and grout lines filled throughout the complete placement cannot be overemphasised. A slug of air entering the pump and lines usually ends up as a void in the placed grout. Mix grouts and mortars in paddle-type mixers rather than drum-type mixers. Keep mixed grout as cool as possible within product limitations using chilled water. If delays occur agitate and recirculate mixed material in the pump hopper when not actually pumping through to the work. Hand agitation should be used to prevent material from stiffening against the pump hopper walls. Keep the grout pump line alive by giving it a shot every 3 to 5 minutes and wasting some material if necessary. Do not mix more grout than can be pumped into the work in 10 minutes or less.

Place 9mm hardware screen over the pump hopper to remove lumps of grout, or other debris that may jam the pump or plug the grout line. Keep the pump hopper at least half full of grout at all times so as not to draw air into the line. (If this should be done by accident, the line must be bled). If it is not possible to draw the discharge outlet of the line back to be recirculated through the pump hopper until the air is bled, it may be necessary to bleed the line to waste to prevent the inclusion of an air void in the work. Place grout by pumping into farthest corner and gradually withdrawing hose as space fills. Take care to ensure air is not entrapped under plate.

Have the following immediately available at all times: Hose connected to a water line with good pressure and the other end connected to a pipe smaller in diameter than the grout pipe diameter and more than half the length of the grout pipe. The purpose is to quickly insert the water line into the grout pipes to quickly clean them out in the event of a breakdown. MasterFlow grouts stiffen more rapidly than plain mortars or slurries. (Some grout pumping contractors prefer to “butter” the mixer, pump and grout lines with cement slurry prior to placement of grouts or mortars. This “butter” mixture is wasted until the grout has filled the line. After completion of the placement, a plain sand-cement mortar is again run through the equipment to waste as an aid to cleaning out the grout.)

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

Cracks: If exposed grout shoulders extend beyond the bedplate or are over several metres in length there is a probability of some superficial, hairline cracks appearing in the exposed grout. The hairline cracks will be perpendicular to the plate or member grouted and are of no structural significance and do not compromise the integrity of the application
Curing temperatures are critical if early loading of a base plate or machine is anticipated. For the early loading of grouts, as needed in repairs or fast installation and utilisation of rail systems or machinery, higher temperature curing is very useful.

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 levelling screws until grout has attained sufficient bearing strength, which will depend on site temperatures.

On-site QA/QC

It is good practice to do some regular checks to ensure that the grout consistency is maintained throughout the application. Here are typical QA/QC requirements requested of grouting crews records…

- Batch numbers of the grout used for each location or placement.
- Ambient temperature
- Relative Humidity at regular intervals (every two hours is recommended).
- As mixed temperature of the grout. The intervals will depend on size of the mix etc but as a guide at least every second mix should be measured.
- Flow Trough measurement.
- Water addition.

Flow Tests:
There are many flow test apparatus's, such as ring tests and flow troughs, but for on-site work, the simplest method is the use of a flow trough device. The expected flow trough measurement for each BASF grout is given in the individual Technical Data Sheets.

Ring tests are meant to be comparative tests only, ie. to test one batch against another and not meant to replicate any laboratory or standard tests. Maintaining the flow within a range will ensure that application is as uniform as it can be.

Cube tests

Collection of material for compressive strength checks:
Please refer to AS/NZS 1478 for the method of filling storing and testing 50mm cubes. However please note that AS/NZS 1478 is a testing standard for testing material in a laboratory with all the relevant temperature and environmental controls. It is expected that samples collected in the field may vary with testing done in a laboratory for many reasons and results should be viewed with that in mind.

Application diagrams

Figure 1: Mixing the grout with a birdcage paddle on the mixer

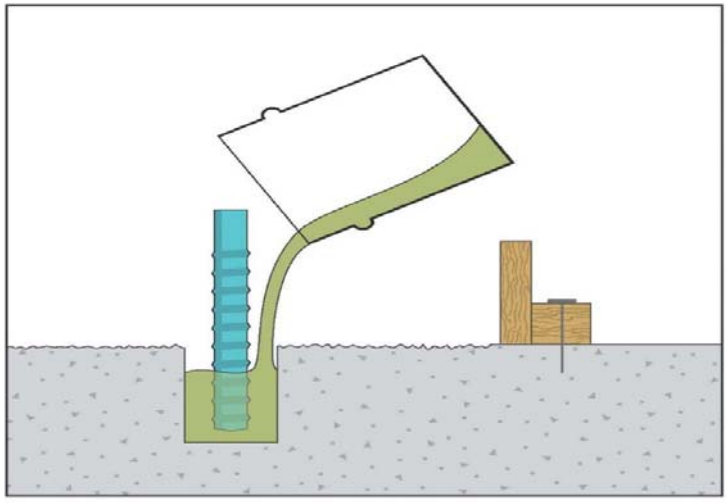

Figure 2: Fill bolt holes first

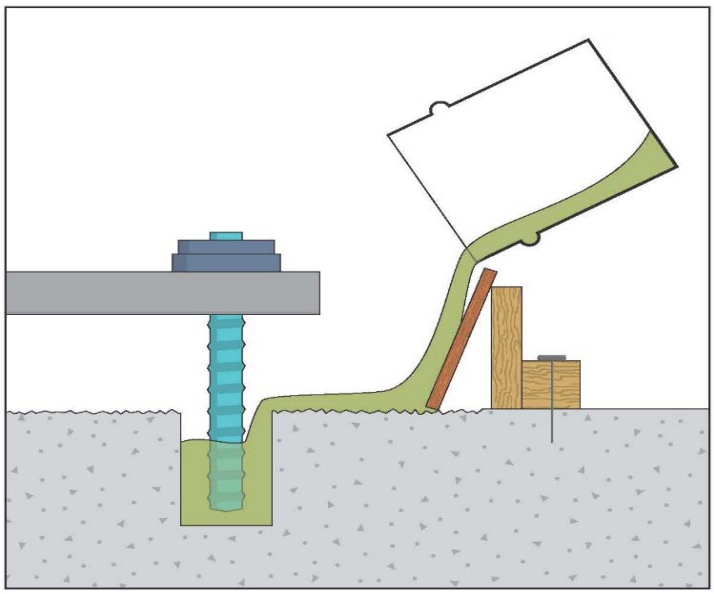

Figure 3: Use sloping board to direct grout to bolt holes if plate is in place

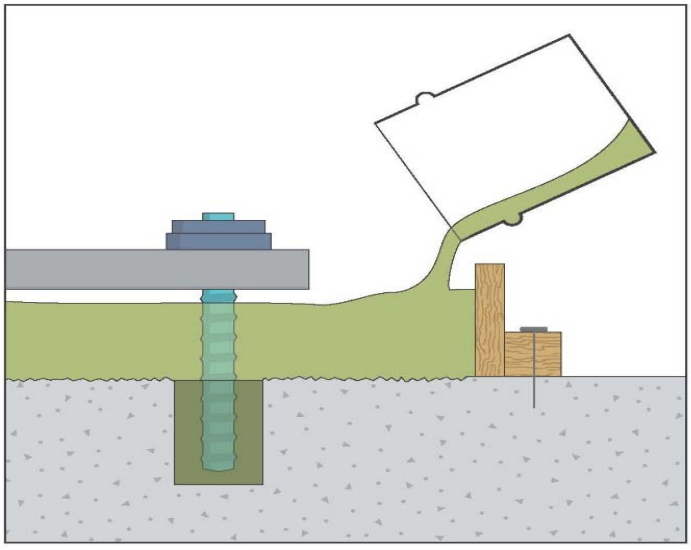

Figure 4: Once bolt holes are hardened begin grouting the rest of the plate

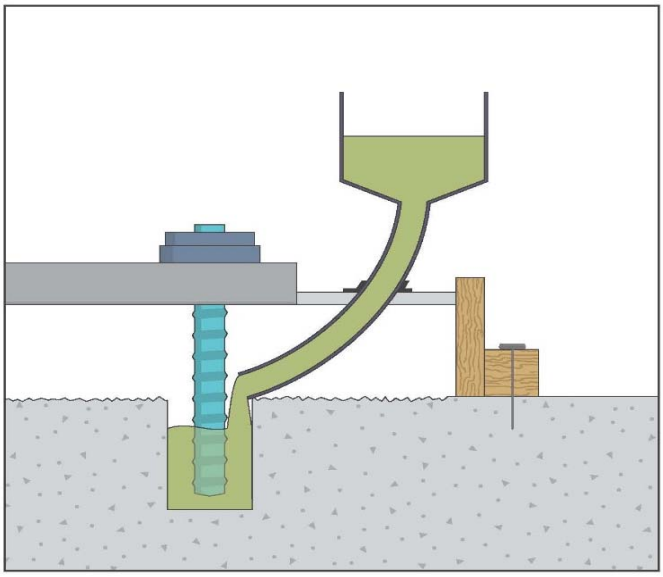

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Figure 5: Bolt holes can also be filled using a tremie to direct the grout if the underside of the plate is congested

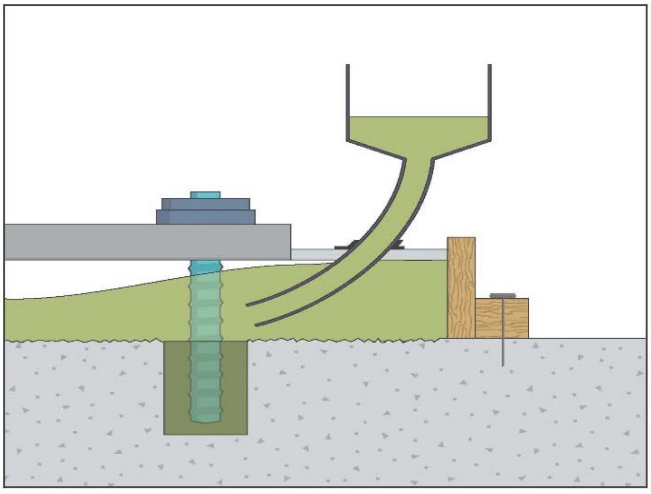

Figure 6: Use the tremie to direct the grout to difficult places to get to

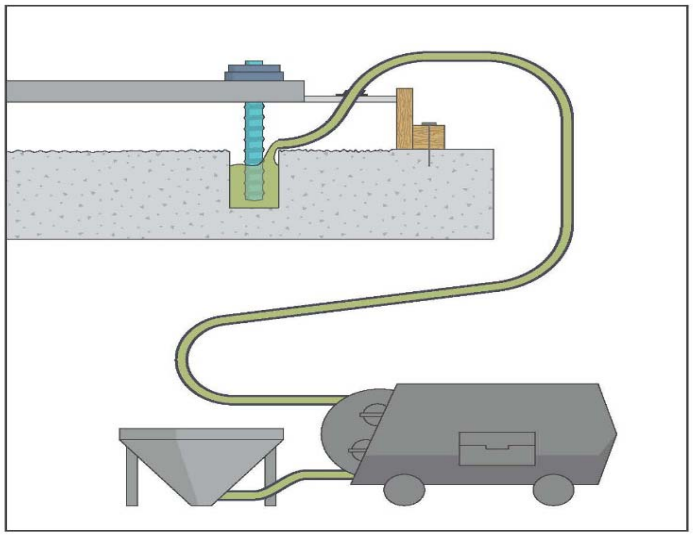

Figure 7: For large pours or long distances a pump can be used to fill bolt holes

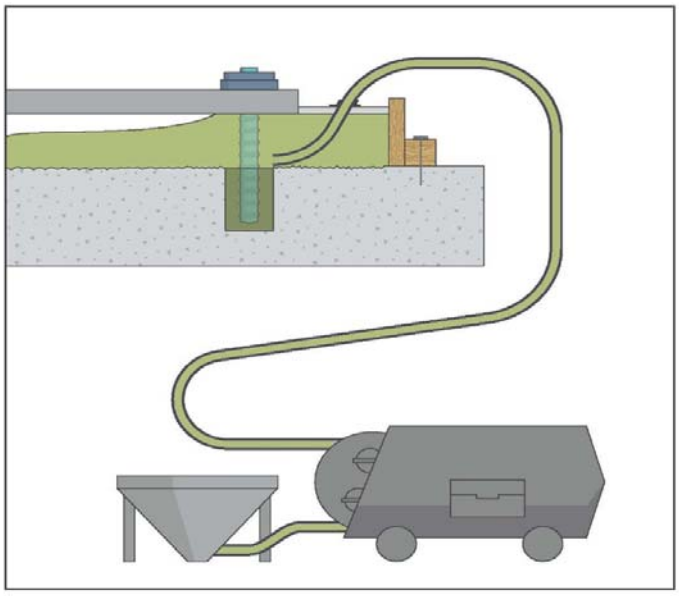

Figure 8: The pump can be used for very long pours to get the grout to the end of the plate if the distance to allow it to flow are to great

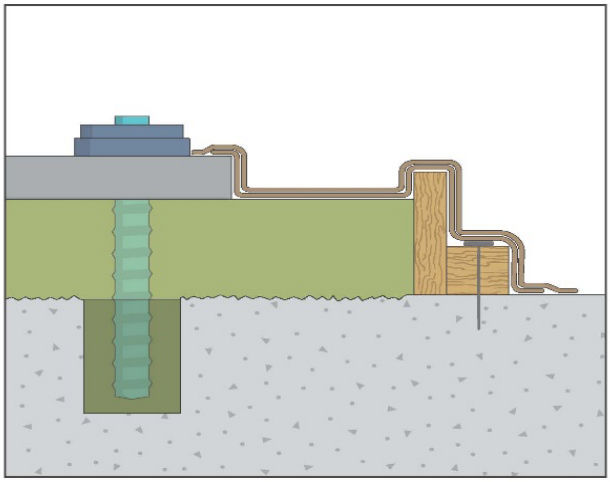

Figure 9: Once grouting is complete cure the grout with hessian and keep the hessian damp

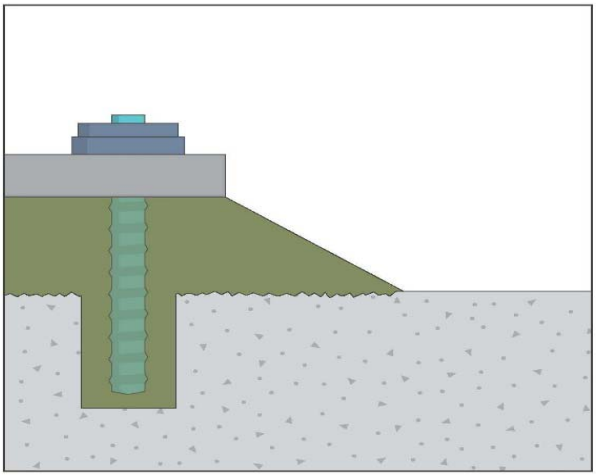

Figure 10: Chamfer the edges of the grout to distribute the load and reduce the risk of edge cracking

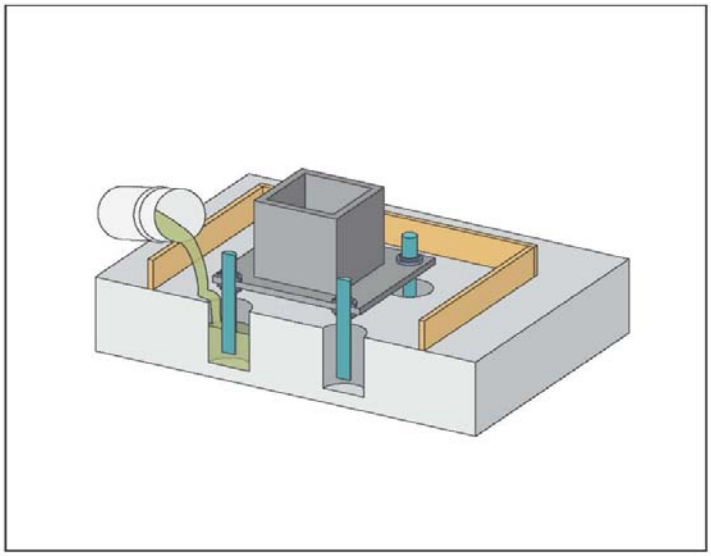

Figure 11: Grout bolt holes first

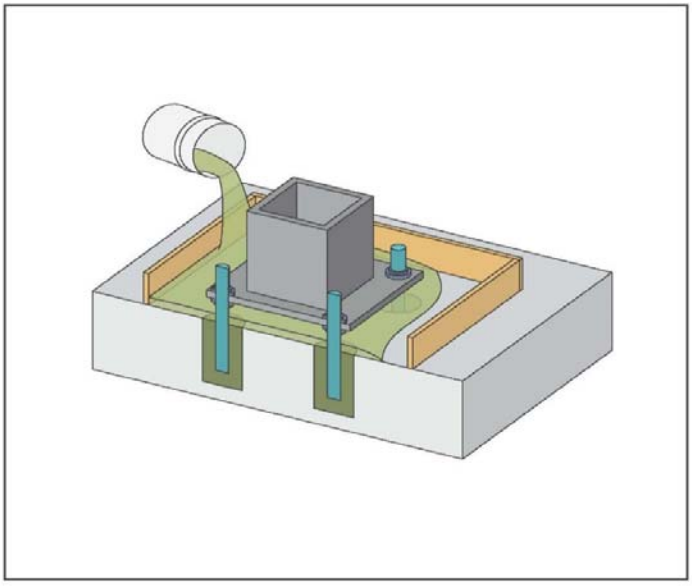

Figure 12: Grout the underside of the plate after the bolt holes have hardened

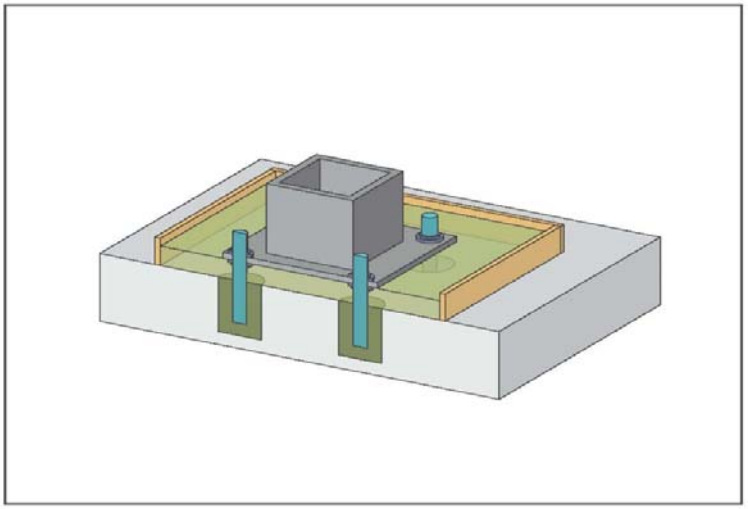

Figure 13: Continue adding grout until the grout is 10-15mm higher than the edge of the plate

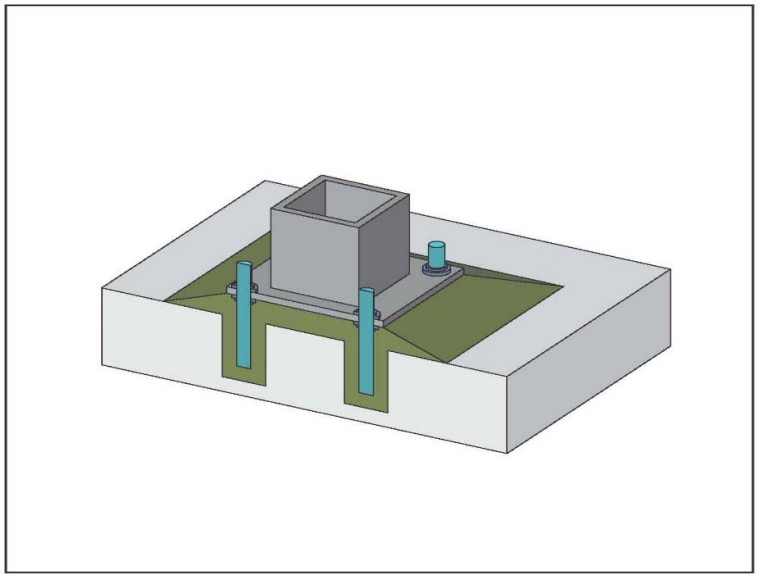

Figure 14: Whilst the grout is still soft, remove formwork and chamfer the edges. Apply wet hessian after this to cure the grout.

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