METHOD STATEMENT
SikaGrout®-9400

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BUILDING TRUST
CONSTRUIRE LA CONFIANCE

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1 SCOPE

This method statement is guidance only for applying SikaGrout®-9400 as a transition between tower and foundations in onshore steel wind towers. It is not project specific and shall be adapted according to the project requirements. Preparation works of bolts, shims, levelling plates requirements are indicated as recommendations but must follow all the specifiers indications. Tower sequencing is not within this scope.

2 PRODUCT DESCRIPTION

The SikaGrout®-9400 is a shrinkage-compensated, cement-based grout which, when mixed with water, produces a homogeneous, flowable and pumpable grout with exceptionally high early and final strength and modulus. The product exhibits increased fatigue. The latest best binder packing models and applied nanotechnology produce a grout with superior technical performance, exceptional rheological properties, and uniquely, extended open times.

Uses

MasterFlow 9400 has been especially formulated for:

- Grouting of wind turbine installations that are installed using prestressing techniques, for example base plate grouting of onshore wind turbines
- Installations where excellent fatigue resistance is required
- Onshore turbines where ultra-high final strengths are required
- Grouting in a wide temperature range
- Anchoring anchor bolts of wind turbine towers
- All void filling from 25 mm to 600 mm (1 à 24 po) (under tower flange) where high strength, high modulus, high ductility is important

Characteristics/ advantages

- Ultra-high compressive strength: above highest class of EN206, i.e. > C100/115
- Ultra-high modulus for exceptional stiffening properties
- Excellent fatigue resistance
- Quick return to service and removal of temporary support due to high early strength build-up ≥ 70 MPa (10 150 lb/in^2) at 24hrs at 20 °C (68 °F)
- No segregation or bleeding to ensure consistent final physical performance and to prevent pump blockages
- Extended pot life of ≥ 2 hours
- Can be pumped into complex areas or areas inaccessible to conventional grouting methods
- Dust reduced for ease of handling
- Cement based
- Low chromate

2.1 Limitations

- SikaGrout®-9400 must only be mixed with clean water.
- Do not add Portland cement or additional aggregates.
- Do not add water over the recommended dosage.
- Apply only to sound, prepared substrate.
- Products shall only be applied in accordance with their intended use.
- All work shall be carried out as directed by a Supervising Officer or a Qualified Engineer.
- The most recent and relevant local Product Data Sheets (PDS) and Material Safety Data Sheets (MSDS) shall apply.
- For specific construction / build information refer to the OEM, Engineer's or Specialist's details, drawings, specifications and risk assessments
- This method statement is only a guide and shall be adapted to suit the grout, standards, legislation or other local requirements

3 PRODUCT STORAGE

SikaGrout®-9400	is a shrinkage-compensated, cement-based grout which, when mixed with water, produces a homogeneous, flowable and pumpable grout with exceptionally high early and final strength and modulus. The product exhibits increased fatigue. The latest best binder packing models and applied nanotechnology produce a grout with superior technical performance, exceptional rheological properties, and uniquely, extended open times.

3.1 Material storage

Product must be stored in cool and dry conditions. Shelf life under these conditions is 12 months in unopened original bags.

4 EQUIPMENT

4.1 Materials

Sufficient quantities of Sika® materials	Refer to section 12
Sufficient clean water	For mixing 1-component, pre-wetting substrate & cleaning
Sufficient lubricating agent for the pump	For facilitating the pumping avoiding blockages and reducing equipment wear (slurry with cement + water)
Protective sealant for threaded bars	For de-bonding the grout from the threaded bars (Sikaflex®) when using the grout in an anchor foundation.
Mould release agent	For facilitating the demoulding of the formwork without damaging the grouted area (example: Sika® Separol®)
Expanding foam for sealing of the formwork	For avoiding grout leaks during the pumping stage (e.g. Sika Boom®)
Chemical anchoring	To anchor the formwork to the concrete to avoid movements during the pumping of the grout (example: Sika® AnchorFix)

4.2 Essential equipment

Hand tools	Trowel, spatula, tools for maintaining mechanical equipment and fixing formwork
Concrete substrate preparation	Suitable mechanical equipment for removing concrete laitance and achieve right roughness
Weather thermometer	Record ambient conditions
Material thermometer	Record substrate, water, powder & fresh grout temperature
Sponge, pressurized air (oil free) or vacuum	Wipe/blow or suck excess water on substrate surface
Mixing and pumping equipment	Refer to section 4.5
Bowser or IBC container	To hold a sufficient quantity of clean water
Accurate measuring scales (calibrated)	For precise measurement of mixing water

Buckets or containers	For mixing water, for mixing or pouring
Timer	To control correct mixing of grout
Quality control devices	Refer to Quality Control section
Curing membranes	To protect fresh exposed grout
Rope, chords, weights	For securing curing membranes
Cleaning	Brush, low-pressure water jet
Waste disposal	For packaging and excess grout

4.3 Additional equipment

Formwork	To hold grout (non-water-absorbent formworks shall be used. Wood and aluminum formworks shall not be used).
Insulation/protection blankets	To protect exposed grout surfaces from hot weather
Heated curing blankets	To protect exposed grout surfaces from cold weather
Pressure head system	For maintaining pressure on grout / better flow
Crushed ice or water chiller	Reduce temperature of water in high temperatures
Mesh	Sieving ice from mixing water
Heating element	Warm temperature of water in cold temperatures
Shelter/tent	Protect equipment from direct sun, cold temperatures or rain
Air heater	Defrost substrates / warm inside of the tower
Lighting	For night works when required
Generator	To support all the machinery and lighting

4.4 Substrate preparation equipment

In general, the suitable concrete preparation method is scarifying (mechanical means or high-pressure water jet). In case that the substrate cannot be properly prepared with this method, a more abrasive system may be used. All the dust and friable particles generated from the preparation must be removed before starting the pumping of the grout (example: with water or air).

All the threaded bars must be protected with a de-bonding tape before pouring the grout (e.g Armaflex or duct tape) and sealed at the end with Sikaflex® sealant. After the substrate preparation, an inspection of the bolt sleeves must be done. Any damaged or broken bolt sleeves shall be removed and repair before starting with the grouting works.

4.5 Mixing equipment and pumping equipment

Use professional equipment for mixing SikaGrout®-9400. Since high output is required, high-capacity forced action mixer (ex: high-capacity pan mixer (>300 L) and minimum power of 9 kw, ex: DZ 300V 9kw, 400 v, 50 Hz from the producer Inhersa) and piston/ worm pump (ex: Putzmeister P715 TD/ Putzmeister S5 EV) are recommended to be used.

Forced Action Pan Mixers:

~300 L useable capacity

~500 kg

~500 L useable capacity

~880 kg

Worm and Piston Pumps:

S5 EV: worm pump 2L6*

Output: 7—40 L/min

Pressure: 25 bar

Weight: 190 kg

2.29 L x 0.68 W x 0.65 H

P715 TD: diesel hydraulic drive piston pump

Output: 4–17.4 m^3/h

Pressure: 68 bar

Weight: 1850 kg

4.2 L x 1.5 W x 1.6 H

* In case of using worm pumps, the special measures for warm temperatures shall be taken into account to avoid excessive heat in the mix. Refer to Section 12.2.

IMPORTANT - Do not use continuous mixing equipment or conventional concrete mixer with SikaGrout®-9400. Consult your local Sika technical department for advice.

5 HEALTH AND SAFETY

5.1 Risk assessment

The risk to health and safety from construction site-related issues shall be evaluated and adequately communicated. Refer to local regulations, laws and legislation.

5.2 Personal protection

Work Safely!

Handling or processing cement products may generate dust which can cause mechanical irritation to the eyes, skin, nose and throat.

Appropriate eye protection shall be worn at all times while handling and mixing products.

Approved dust masks shall be worn to protect the nose and throat from dust.

Safety shoes, gloves and other appropriate skin protection shall be worn at all times.

Always wash hands with suitable soap after handling products and before food consumption.

FOR DETAILED INFORMATION REFER TO THE MATERIAL SAFETY DATA SHEET

5.3 First aid

Seek immediate medical attention in the event of excessive inhalation, ingestion or eye contact causing irritation. Do not induce vomiting unless directed by medical personnel.

Flush eyes with plenty of clean water occasionally lifting upper and lower eyelids. Remove contact lenses immediately. Continue to rinse eyes for 10 minutes and then seek medical attention.

Rinse contaminated skin with plenty of water. Remove contaminated clothing and continue to rinse for 10 minutes and seek medical attention.

FOR DETAILED INFORMATION REFER TO THE MATERIAL SAFETY DATA SHEET

6 ENVIRONMENT

6.1 Cleaning tools / equipment

Clean all tools and application equipment with water immediately after use. Hardened material may only be removed mechanically.

6.2 Waste disposal

Dispose unwanted material responsibly through licensed waste disposal contractor in accordance with local legislation and/or regional authority requirements.

FOR DETAILED INFORMATION REFER TO THE MATERIAL SAFETY DATA SHEET

7 PLANNING

It is essential to plan the works in advance to minimize the contingencies during the grouting operations. Therefore, before starting the grout application, a meeting must be done to coordinate the tasks of each of the members of the team and verify that all the materials and equipment are available on site.

8 RECOMMENDED STEPS FOR GROUTING

The steps are the following:

1. Calculate the quantity of grout needed. Place order of material
2. Check weather forecast to plan necessary measures for the applications
3. Timing and breaks planning
4. Contingency plans
5. Power and water supplies
6. Pre-inspection of the substrate. Repairing methods
7. Previous works. Preparation of the equipment
8. Grouting
9. Quality control
10. Curing methods
11. Cleaning tools
12. Waste disposal
13. Final inspection

8.1 Quantity of grout

The yield of a product can be determined from the following equation (assuming no wastage).

Equation: $$\text{yield (litres)} = \frac{\text{(weight of powder (kg) + weight of water (kg))}}{\text{density of mixture (kg/l)}}$$

Given: weight of water 1 litre = ~1 kg

Example:

Calculate consumption of a bag weighing 25 kg mixed with 1.95 litres of water when the density of the fresh material is 2.4 g/cm^3.

1 bag of 25 kg yields: $$\frac{(25 + 1.95)}{2.4} = \textbf{~ 11.22 litres of mortar}$$

Therefore, the number of bags required for 1 m^3 of mortar will be:

N^o of bags required per 1m^3 = (1/yield) x 1000

(1/11.22) x 1000 = **~ 90 bags = 2250 kg**

An extra 10 % amount must be taken into account for the quantity of grout calculation.

8.2 Check weather forecast

Temperatures and weather conditions have a major role on application of cement-based materials, such as

- Start and finish times
- Substrate preparation
- Water dosage (pot life, workability time)
- Setting time and strength development (slower development at colder temperatures)
- Special precautions (ex: conditioning water in case of cold or warm conditions, heated curing blankets, etc). Refer to sections of hot weather and cold weather conditions.
- Protecting application area and equipment
- Curing technique

During the application, the substrate and ambient temperatures must be recorded and controlled. Ambient humidity and wind speed will also need to be recorded and taken into consideration for the water ratio and the curing methods.

8.3 Breaks

Breaks shall be planned so that there is no interruption in mixing; maintain a continuous pouring process per foundation and no stop and go during the application.

8.4 Contingency plans

Some contingencies may be planned in case of mechanical failure, grout underestimation, formwork leaks, etc. For some equipment it may not be possible to have two on every project, however, knowing where the next available equipment and whom to contact in emergency is useful.

It is recommended to have the following material available to minimize contingencies and delays:

- Additional amount of grout (~+10 %—20 %) **(IMPORTANT)**
- Spare mixer
- Sealant / foam
- Spare generators (when possible)
- Spare hoses (in case of blockages). It is recommended to have at least double the pumping distance of hoses available.

Blockages are time consuming and can break equipment.

Listed below are some common causes of contingencies and some suggestions are given for minimizing this risk.

Item	Possible Cause of Blockage	Minimizing Risk Action
Mixing Machine	▪ Maintenance ▪ Rust and corrosion ▪ Hardened material ▪ Incorrect assembly	▪ Service regularly (refer manufacturer's instructions) ▪ Inspect all parts for wear or damage ▪ Remove all hardened material ▪ Assemble in accordance with instructions ▪ Spare machine to minimize breakdowns
Pump Machine	▪ Maintenance ▪ Rust and corrosion ▪ Contaminated ▪ Incorrect assembly	▪ Service regularly (refer manufacturer's instructions) ▪ Inspect all parts for wear or damage ▪ Remove all hardened material ▪ Assemble in accordance with instructions
Power supply	▪ Assurance of power	▪ Second source of power (generator)

Hose	▪ Damaged hoses ▪ Kinks and bends ▪ Blocked hose ▪ Extreme temperatures ▪ Suction ▪ Grains stuck in pump ▪ Worm too small for maximum grain size	▪ Keep double length of hoses (spare hoses) ▪ Lay to straight or gentle curves ▪ Use a short length hose (where possible) ▪ Thoroughly clean hose after every use ▪ Use hose with uniform diameter, do not reduce diameter in the couplings ▪ Protect from extreme conditions to avoid a premature setting of the material ▪ Thoroughly pre-wet hose ▪ Over dosage water ▪ Sedimentation in slurry
Pre-Mixed Mortar	▪ Mortar too dry ▪ Lumpy mortar ▪ Sedimentation ▪ Different characteristics	▪ Check water measurement ▪ Mix until homogeneous ▪ Check water measurement ▪ Check mixing time and used bags
Climatic Conditions	▪ Extreme temperatures ▪ Hardening fast, low flow ▪ Mortar too fluid	▪ Shelter equipment, work at night ▪ Use max. water, condition water, protect from sun ▪ Check mixing speed ▪ Adjust water dosage at low temperatures
Packaging	▪ Contamination ▪ Hard lumps	▪ Take care when opening bags ▪ Prevent packaging entering mixing ▪ Do not damage bags: wet, unprotected or broken
Pauses and Breaks	▪ Hardening of mortar in machine and hose	▪ Plan breaks before starting ▪ Never leave mixed mortar unattended ▪ Keep grout agitated ▪ Keep a continuous flow of material ▪ No stop and go during grouting works
Contamination of the mix	▪ Foreign particles ▪ Changing products ▪ Different mortar characteristics	▪ Protect equipment ▪ Clean thoroughly ▪ Do not oil parts in contact with mortar

8.5 Power and water

Power for equipment shall be approved for use on the job site. Always conform to local laws and restrictions when using diesel powered equipment. When using an electric motor check the voltage requirement is available on the job site. Check there is an adequate supply of clean water on the job site to fill bowser or IBC containers.

8.6 Previous works

- Setup of mixing and pumping equipment. Place it as close as possible to the base of the tower
- Check of the correct functioning of the equipment, including power and water supply, before starting the grouting operations
- Verify that the right amount of grout and potable water are available. Calculate the required volume of grout for the application by using the equation in section 8.1: calculate the yield of the product. Make sure there is enough material on the job site to carry out the work. Take into account at least 10 % of extra material.
- Check the quality control (QC) devices are ready, including the number of moulds for QC specimens
- Verify the hose lengths, arrangement, couplings. If possible, use only one single hose length. It is mandatory to not have any reduction of the diameter at the couplings. Do not use hydraulic hoses.

- Prepare grout lines: Lubricate them with cementitious slurry made of cement and water. The recommended hose length to avoid moving the pumping equipment is at least twice the diameter of the pedestal (check project specifications). The minimum recommended inner diameter of the hoses is 50 mm (2 in). Larger hose diameters or shorter hose lengths may be chosen to ease the installation of the grout.
- Verify that the substrate is properly prepared and pre-wet before starting the pumping procedure.

9 SUBSTRATE PREPARATION

9.1 Pre-inspection

The concrete substrate in the area to be grouted shall be inspected in advance to check for cracks and other defects. Any damaged surfaces detected must be notified to the Supervisor.

The clearance distance between foundation and baseplate shall be checked at regular intervals from inside and outside and reported to the Supervisor for rechecking the grout consumption. The application thickness shall be within the values 25 mm and 600 mm (1 in and 24 in). Do not exceed the maximum layer thickness; contact your local Sika for advice.

Check at least 12 opposite points (or as instructed by the supervisor or the manufacturer) to ensure that the distance between the framework and the section of the flange (inner and outer tower edge) is at least the minimum specified in the project layouts.

9.2 Concrete

The concrete substrate shall be thoroughly clean, in a good sound condition and free from dust, loose material, surface contamination and materials which reduce bond. Delaminated, weak, damaged and deteriorated concrete shall be removed by suitable means (ex: soft scarifying and high-water jet pressure >200 bar [2900 lb/po^2]).

Do not vibrate the grout since this could cause segregation and bleeding. Eliminate any source of vibration before starting the grouting operations.

It is mandatory to pre-wet the concrete substrate before the application of the grout. Refer to section 9.6.

Check the temperatures of the following elements:

- Pedestal concrete temperature between formwork (2 °C <T≤ 40 °C [36 °F <T≤ 104 °F])
- Temperature of steel section 1 flange (2 °C <T≤ 40 °C [36 °F <T≤ 104 °F])
- Pedestal concrete temperature outside formwork (2 °C <T≤40 °C [36 °F <T≤ 104 °F])
- Temperature of steel formwork (2 °C <T≤ 40 °C [36 °F <T≤ 104 °F])
- Water ~ 18 °C—22°C (65 °F—72 °F) (in cold weather conditions) and ~5 °C—10 °C (41 °F—50 °F) (in warm weather conditions)
- Bags / Powder ~ 17 °C—25 °C (63 °F—77 °F)
- Ambient temperature /relative humidity (2 <T≤ 40°C [36 °F <T≤ 104 °F] / R.H. <90 %)
- Grout mix temperature measured in the pump hopper < 35 °C (95 °F)

The optimum substrate temperature is **21 °C ±5 °C (70 °F±41 °F)**. Do not apply grout on frozen substrate or temperatures **<+2 °C (+36 °F) or surfaces > +40 °C (+104 °F)** during and after application.




Refer to sections “grouting under warm conditions” and “grouting under cold conditions” for further information.

9.3 Threaded bars or anchor bolts

In order to prevent cracks when post-tensioning the anchors during the erection of the tower, verify that the upper part of the threaded bars have been properly covered with a de-bonding tape (~6 mm [1/4 in] thick) before starting the grouting operations. For this, prefabricated sleeves or duct tape may be used. When using prefabricated sleeves, they must be slightly shorter than the minimum scheduled grout thickness (~1.0 cm–0.5 cm [13/64 in—25/64 in]) to let air escape that could get trapped during the grouting operations. This last section of 0.5 cm—1.0 cm (13/64 in—25/64 in) must be covered with duct tape. Seal the ends with the appropriate Sikaflex®.

9.4 Shims and levelling plates

The specifier's and manufacturer's recommendations shall always be followed over any statement indicated in this document.

Use round shims, when possible, to minimize the entrained air and cracking risks.

Use the shims to warranty the grout thickness, defined by the difference of level between the pedestal and the top face of the shims. Check the horizontality of all support points with a transit level.

It is recommended to mark where the levelling shims are places to pay special attention during the grouting operations to minimized empty spots.

9.5 Formwork

Formwork shall be higher than the underside of the baseplate to prevent overspill, allow water curing and if possible, create a pressure head typically >20 mm–30 mm (25/32 in—3/16 in), as directed by the specifier. The formwork shall not absorb water or moisture. Do not use aluminum or wood formworks. It is recommended to use metallic stiffeners to ensure the curve and position of the formwork throughout the grouting process.

Release agents shall be applied to the formwork before placing into position so as to not contaminate the substrate. Formwork shall be watertight and designed with means to remove excess water after pre-wetting.

Use expansive foam Sika Boom® to seal the gap between the formwork and foundation.

The exposed substrate shall be protected to prevent ingress of debris or contamination until ready for grouting.

The formwork shall be inspected 24 hours before grouting for integrity, placement and water tightness. Any corrective measures shall be completed in good time before the grouting operation. It is recommended to grout at least 10 mm (25/64 in) over the bottom level of the flange unless something different is defined in the project.

An isolation tape can be adhered around the perimeter of the baseplate to allow some thermal expansion of the tower against the grout - as directed by the Specifier. Take care in cold and high humidity conditions the isolation tape adheres to the surface sufficiently. Position the isolation tape above the bottom level of the flange (in the external and in the internal side of the flange) so as to not trap air. Use the isolation tape as an indication of the maximum filling level. Remove the isolation tape after grouting, clean thoroughly and fill the gap with a SikaFlex® sealant to prevent water ingress.

9.6 Pre-wetting substrate

Concrete surfaces shall be saturated with clean water 24 hours before the application of SikaGrout®-9400 until a saturated surface dry (SSD) is obtained.

Just before application, remove excess water, for example, using a clean sponge for small areas or air pressure for large areas. Ensure there is no standing water on the surface. The surface shall achieve a dark mat appearance without glistening and surface pores and pits shall not contain water (SSD). Use pressurized air (oil free) to blow away excess water in difficult to reach areas. The surface shall not be allowed to dry before application.

10 MIXING

The mixing of the SikaGrout®-9400 must be done only with clean potable water, without any other additional product. The mixing ratio of the SikaGrout®-9400 is between 6.8 % and 8.6 %, this means 1.70 L and 2.2 L (0,44 US gal and 0.58 US gal) of water per 25 kg (55,1 lb) of powder. The water amount needed for mixing of SikaGrout®-9400 depends on the ambient temperature. The water amounts for different temperatures are defined below. Do not use water beyond these stated maximum and minimum limits. Use precise techniques to measure the water amount.

Unit	2 °C—15 °C (35,6 °F–59 °F)	16 °C—25 °C (60,8 °F–77 °F)	26 °C—30 °C (78,8 °F–86 °F)	31 °C—35 °C (87,8 °F–95 °F)	36 °C—40 °C (96,8 °F–104 °F)
Metric (L)	1.70	1.75 ± 0.05	1.85 ± 0.05	1.95 ± 0.05	2.15 ± 0.05
Imperial (US gal)	0.44	0.46 ± 0.01	0.48 ± 0.01	0.51 ± 0.01	0.56 ± 0.01

Mixing shall always be carried out in accordance with the recommendations contained in the latest product data sheet (PDS).

For suitable mixing equipment refer to section 4.5 of this method statement.

11 QUALITY CONTROL

The following recommendations for quality control must be made the grouting process (before, during and after). All results must be recorded.

[A] Substrate Quality Control - Before and After Preparation

Characteristic	References	Frequency	Parameters
Cleanliness of Concrete	Visual	After preparation & immediately before application	No contamination, loose particles or defects
Defects	Visual	After preparation	No damaged concrete or cracks
Roughness	Visual	After preparation	Minimum roughness 2 mm; not over roughened as it will affect the flow
Formwork	Visual	After preparation	Strong, non-water absorbent, watertight no release agent on substrate
Wetted surface	Visual	After preparation	No excess or ponding water (SSD)

[B] Climatic Conditions – Before and During Application

Characteristic	References	Frequency	Parameters
Temperature (ambient & substrate)	Record	During application	Within PDS limits
Ambient Humidity	Record	During application	Within PDS limits
Precipitation	Record	During application	Keep records and provide protection

[C] Grout Quality Control – During Mixing and Application

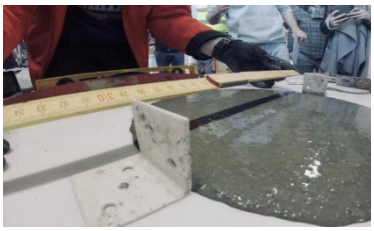
Characteristic	References	Frequency	Parameters
Packaging	Visual	Every bag	No damage
Batch Number	Visual	All bags	Keep records
Dry product aspect	Visual	Every bag	Loose, no lumps and not compacted
Mixed material	Visual	During mixing	Homogeneous, no lumps no unmixed dry powder
Bleeding Sedimentation	Visual	After mixing	No bleeding or segregation
Compressive Strength	ASTM C109/ EN 196	Number of specimens per test according to manufacturer's requirements	Test intervals and specimen sizes according to specifier's requirements ex: 1d, 3d, 7d, 28 days
Flow characteristic: spread flow method	ASTM C230 EN 13395-1	Every mix	300 mm diameter (11.8 in)– Measure on 5th minute after getting the material from the hose

The grout quality control shall be conducted adjacent to the tower application. A stable level surface shall be provided to check the flow characteristics. The area shall be covered and protected from wind, rain and direct sunlight.

The prism, cube moulds shall be prepared adjacent to the tower of application with provisions for protecting the specimens until they are removed at least 24 hours to an accredited testing laboratory, ex: in container, fully insulated box, etc. Specimens shall not be transported while grout is fresh. The accredited testing institute shall send to the Supervisor, during the planning stage, a method statement detailing how the specimens are to be prepared, store and removed from the job site to the laboratory.

[D] Grout Quality Control – After Application

Characteristic	References	Frequency	Parameters
Defects	Visual	28 days after application	No defects
Filling under baseplate	Visual	After removal of curing	No gaps



12 PUMPING PROCEDURES

12.1 Application—placing the grout

- Grout should be placed as quickly as possible after it has been properly mixed and discharged. Use the grout ~5–15 minutes after mixing to take advantage of the optimum flow properties. The grout is placed in the machine's hopper and pumped through a hose to the point of placement. The placement of the grout must be finished within the pot life of the first mix (up to 180 minutes at +20 °C [+68 °F)).
- Place the grout through the hose from the bottom to the top to push out the air and maintain a momentum. The placement point can be moved slowly along the side of the plate and moved at the same rate as the face of grout moves along the length of the plate on the opposite side.
- Start the pumping process against the temporary formwork installed underneath the T-flange and radial in the trench for preventing the grout from flowing in two directions. With it we will control the joint between the fresh grout and the laid grout, making sure that is vertical. Once nearly all the required grout has been poured, this temporary formwork must be carefully removed so we can finish pouring the grout. The number of temporary formwork must be defined according to the project requirements and the job site conditions.
- Do not try to alter the direction of the grout as pumping from different positions can trap air. Always maintain sufficient pressure head while pumping.
- Ensure a process of continuous pumping to avoid air entrapment and prevent the grout flow from coming to a stop. Keep pumping until the grout level is above the underside base plate as indicated before in this method statement.
- Constantly check the inner and outer exposed shoulders of the grout to ensure filling properly.
- Do not use chains, as these might entrap air.
- Do not vibrate the formwork or the grout, as this could cause bleeding or segregation of the grout. Make sure any vibrating source is removed or stopped before placing the grout.
- Cover the area will be grouted by using burlap, geotextile, etc. from all sides during grouting to prevent early drying of the grout surface due to wind under the base plate.

Early drying of the surface due to wind

Protecting the area against wind and direct sunlight

- Stage pouring is applicable by dividing large volumes or long distances into manageable parts (maximum in 3 parts under critical circumstances). Under hot climate conditions, it is recommended to do it without temporary formwork, in one go, to minimize cold joints. In this case, the pumping hose will be moved behind the grout tongue keeping at least one metre of distance. The decision on how to divide the parts shall be determined in the planning period and agreed with the supervisor. When deciding number of stages consider:
  - Temperature conditions
  - Roughness of substrate
  - Clearance between baseplate and foundation
  - Obstacles
  - Fluidity of grout
  - Pressure head

12.2 Application under warm conditions 28 °C (82 °F)

The application temperature range of the SikaGrout®-9400 is from +2 °C to +40 °C (+36 °F and +104 °F), being +20 °C (+68 °F) the optimum. Avoid if possible, however, when the maximum day temperature is expected to be >+35°C cover the general application area two to three (2-3) days with white membranes and protect from direct sunlight. Some projects may not allow daytime grouting above +35 °C (+95 °F). Check requirements with the supervisor before starting work.
Pre-wet the surface with cold water (<20 °C [68 °F]) 24 hours before grouting, maintain saturated and covered. Substrate temperature at time of application shall be optimum <+21 – 27°C (<70 °F and 81 °F). Protect the working area from direct sunlight with temporary shelter or canopies. Do not mix or expose equipment, materials or application to direct sunlight.

Store SikaGrout®-9400, water and equipment in cooled container facilities (<15 °C if the ambient temperature is more than 35 °C [95 °F]). The grout temperature at application shall be optimum <+21 – 27°C (70 °F and 81 °F), colder if possible. Apply the grout when temperatures are falling. Place cold water (cooled down with a water chiller) water for mixing. If there is not a chiller available put ice into the mixing water and wait until the ice has melted before using it as mixing water. Any ice or dry ice should not be added directly into the grout. To decrease the water temperature fast, shaved ice can also be used. In this case, the water must be poured into the mixer through a sieve and filtered. The temperature of the water must be above 2 °C (37 °F).

If the mixer is warm, cool it by charging the mixer with cold or iced water. This will help to reduce the heating of the grout. Pumping with a warm pump line into a warm hose may cause plugging. To avoid it, the hose and the pumping equipment should be protected against direct sunlight. The pump can be cooled down by filling cold water or chilled cement slurry before application. The chilled lubrication material must be completely discharged and discarded before pumping the grout. Additionally, the hose can be painted with white colour or covered with a reflective insulation material. Place white membranes or similar over hoses to keep cool and reflect the sun and if possible do not use black hose as these will increase the temperature of the mix. If the temperature inside the tower is more than 30 °C (86 °F), the inside of the tower must be air-conditioned for at least 6 hours before and 24 hours after the application.

Once the grout is ready, cure it under water. Maintain curing method for at least three (3) days after application.

All measures are a guide and must be agreed with the Supervisor in the planning phase and written into the Method Statement.

12.3 Application under cold conditions +5 °C (41 °F)

Avoid if possible, however, when the minimum day temperature is 0 °C–+5 °C (32 °F—41 °F) cover the general application area two to three (2 to 3) days before grouting. Use thermal protection system and approved job site heaters to warm under the covers and inside the tower (where relevant) a minimum one to two (1 to 2) days before grouting.

Pre-wet the surface with warm +25 °C (77 °F) water 24 hours before grouting, maintain saturated and covered. Do not allow water to freeze. Remove excess water before grouting.

The substrate temperature at the time of application shall be >+2 °C (37 °F). If the concrete surface is rebated, it may be possible to fill with water and use an approved job site heating element to maintain the standing water warm.

Store SikaGrout®-9400, water and equipment in climate-controlled container facilities at ~21 °C (70 °F). The grout temperature at application is recommended as an optimum +15 °C–21 °C (15 °F—70 °F).

Pour grout when temperatures are rising and do not pour at night. After application use insulating blankets or heated curing blankets for two (2) days to protect the fresh grout from cold temperatures and frost.

Use heated tent system when grouting <0 °C (32 °F) and maintain tent temperature ~+21 °C (70 °F) for two (2) days before grouting and one (1) day after grouting.

All measures are a guide and must be agreed in the planning phase with the supervisor and written into the Method Statement.

12.4 Curing

Curing is essential to avoid premature drying that could lead to cracking and de-bonding problems. The curing procedure must be approved by the supervisor following the manufacture of the turbine instructions.

Protect fresh grout from premature drying right after placing the grout. Use the following curing technique to protect fresh grout:

- Using a proper curing compound, as Sikafloor® WB-18
- Cure the grout under water for at least three (3) days or as indicated in the project specifications.

Additional curing measures can be adopted such as:

- Wetted jute, burlap or similar
- Curing under water
- Geotextiles
- White plastic sheets (reflect sun)
- Black plastic sheets (cold temperatures)
- Other suitable membranes

The application shall be protected from wind, rain, frost and direct sunlight. The curing period is dependent on ambient conditions. In warm temperatures with low humidity, the application shall be kept moistened to avoid premature drying. Follow always the manufacturer's specifications.

Once the grout is ready, apply curing compound on grout surface based on the rules stated in the PDS of the curing compound. In case of curing under a layer of water; when the grout is ready, cure it under a layer of water. The curing method shall be kept at least for three (3) days. Follow the manufacturer procedure.

Additional methods shall be implemented to avoid the evaporation of the water or the change in the water temperature. These methods may be the following ones:

- Damp clean cloths, burlap or geotextiles
- Plastic (polyethylene) sheets or other suitable membranes
- Protection by means of extruded polystyrene plates.
- Insulation mats and / or thermal mats or special heated curing blankets or aluminum bubble sheets in case of cold weather to maintain the curing water at least at ~10 °C (50 °F) or at ~22 °C (72 °F) in case of warm weather
- Apply white plastic sheets (reflect sun in warm weather conditions) or black plastic sheets (cold temperatures)

Maintain this curing until the final set of the grout unless other is specified. Final set can be determined as that time at which one cannot penetrate the grout with a pointed trowel. Remove the when the compressive strength ≥ 40 MPa (5800 lb/in^2) or **else specified**.



13 LEGAL NOTE

The information, and, in particular, the recommendations relating to the application and end-use of Sika products, are given in good faith based on Sika's current knowledge and experience of the products when properly stored, handled and applied under normal conditions in accordance with Sika's recommendations. in practice, the differences in materials, substrates and actual site conditions are such that no warranty in respect of merchantability or of fitness for a particular purpose, nor any liability arising out of any legal relationship whatsoever, can be inferred either from this information, or from any written recommendations, or from any other advice offered. The user of the product must test the products suitability for the intended application and purpose. Sika reserves the right to change the properties of its products. The proprietary rights of third parties must be observed. All orders are accepted subject to our current terms of sale and delivery. Users must always refer to the most recent issue of the local Product Data Sheet for the product concerned, copies of which will be supplied on request or by visiting our website at www.sika.ca.

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