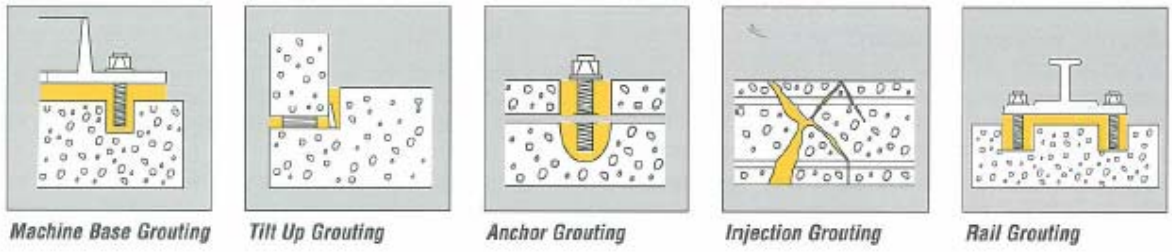
Construction

Sika Grouting Systems

Machinery and equipment which have precise tolerances for alignment, or require uniform support, cannot be placed directly onto finished concrete surfaces. Both the concrete surface and the machine base have irregularities which result in alignment difficulties and bearing load concentrations. Cementitious and epoxy grouts are used to fill the void between machine bases and the foundation. These structural grouts take on the role of transferring load between the machine and the foundation.

Sika Grouts can be used to fill the voids between a given substrate (usually concrete) and machinery baseplates, equipment baseplates, anchor bolt holes, bearing plates, prefabricated columns, rails, and tilt-up panels. Grout can also be injected into surface cracks, or used for waterproofing or repair work.



Properties of Grout

The performance of a grout under a machine or equipment base depends on the properties of the grout in both the plastic and hardened states. The properties of primary importance are volume change, strength, placement ability, stiffness, and durability.

Cementitious Grouts: Most cementitious grouts have properties in both the plastic and hardened states which make them acceptable for most applications. They are suitable for transfer of large static compressive loads and for transfer of many dynamic and impact loads.

Epoxy Grouts: Generally, epoxy grouts are used where special requirements such as chemical resistance, high early strength, or impact resistance are needed. When epoxy grouts are subjected to high temperatures their properties may be significantly altered.

Polyurethane Grouts: Polyurethane based grouts generally exhibit elastomeric qualities making them applicable for high impact and dynamic loads. The important properties of these grouts include noise reduction, reduced impact from vibration, insulation and optimum load deflection.

Grouting Considerations

The success of a grouting project is dependant on the design of the foundation and the baseplate, the clearances provided for the grout, and the provisions made to completely fill the void.

Machine and equipment bases: Machine bases should be designed so that grout can be placed beneath the plate without trapping water or air in unvented corners. If grout cannot be placed from one edge and flowed to the opposite edge, air vent holes must be provided through the plate to prevent air entrapment. Also, grout holes should be located so that grout does not have to travel more than about 1.2 metres. Grout holes should be spaced so that grouting can start at one hole and continued at other holes to ensure that the grout flows under all areas of the plate.

Concrete foundation: The concrete foundation should be designed to have sufficient strength and stiffness. If severed temperature changes are expected, wide shoulders or log pours should have expansion joints and/or steel reinforcement to minimise cracking.

Anchorage Design: The design of anchor bolts may have an effect on the grout performance. For vibrating machinery or impact loading, it is important for the grout to be maintained in compression. This can be achieved by uniformly torquing the anchor bolts after the grout has developed a significant amount of it's ultimate strength.

Clearances: Clearances provided for grout between the machinery base and the foundation is often determined by comparing the minimum thickness of grout possible with the maximum clearance under the baseplate possible for easy application.

Preparation for Grouting

Surface Preparation

Concrete Surfaces: The concrete surface should be relatively flat without deep pockets or grooves that my hold saturation water, or hinder the flow of grout. The surface should be roughened to provide a key for bonding. Any concrete laitance or unsound material must be removed. The roughened and cleaned surface should then be protected from subsequent contamination.

For cementitious grouts the concrete surface must be continuously saturated with water for at least 24 hours before grouting. The saturation of the surface is to prevent water from being rapidly absorbed from the grout. Rapid water loss will result in shrinkage.

Epoxy grouts require the surface to be dry unless otherwise specified.

Metal surfaces: Before placing cementitious grout, metal surfaces should be cleaned of all paint, oil, grease, loose rust, or other contaminants. For epoxy grouts, the metal surface should be sandblasted to bright metal unless otherwise specified. If grouting is to be delayed, the clean metal surface can be primed using an epoxy resin to prevent corrosion.

Anchor bolt preparation

If anchor bolts are to be grouted, anchor bolt sleeves, holes, and similar items should be cleaned of all debris, dirt, and water using an oil-free air compressor or vacuum. Concrete in the holes should be saturated with water for 24 hours and the water removed just prior to grouting when using cementitious grout. For epoxy grout, all surfaces must be dry unless otherwise specified.

Any anchor bolt sleeve or hole should be grouted before pouring grout under the plate. This is necessary to ensure that the grout maintains contact with the plate. If total placement is attempted in one pour, air and unremoved water may rise to the grout surface. This will result in grout settlement and reduce the contact areas of the plate.

Formwork

Formwork design must take into account the type of grout, the consistency of the grout, the method of placement, and the distance the grout must travel. Forms should be built so that the grout can be placed as continuously and expeditiously as possible.

Formwork must always be rigid, sufficiently tight fitting, and sealed to prevent leakage. It should extend to at least 25mm above the highest grout elevation under the machine base. Forms should be coated with compatible form oil or wax to facilitate form removal. Care should be taken to prevent contamination of the concrete surface or the underside of the machine base with form release agent.

Formwork for flowing grout: For placement where the grout will be place from one side of the baseplate and flowed to the other side, the forms must be constructed to provide a method of developing a head on the placement side. Forms should also have sufficient clearance to permit rodding and tamping if required.

Formwork on the placement side should extend above the bottom of the plate to form a headbox. The headbox should begin 50 to 100mm away from the plate and slope away at about 45°. The slope allows the grout to be poured under the plate with a minimum of turbulence and air entrapment. The form on the opposite side should be 50 to 100mm from the plate and should extend to at least 25mm above the bottom of the plate. The height of the headbox depends on the distance the grout must flow. In general, the height of the headbox above the bottom of the plate should be about 1/5 of the travel distance of the grout.

On the side of the plate, parallel to the direction of the grout flow, the forms should be no more than 25mm away from the plate.

For grout that is pumped under the plate through grout holes, the forms should be at least 100mm away from the plate on all sides, and at least 25mm above the bottom of the plate.

Formwork for stiff-pack grout: For placement of stiff pack grout, forms do not have to be as tight fitting as for flowing grouts, but they must be more rigid. The constant compaction of the dry-pack will loosen forms unless they are well braced. If movement of forms occurs during compaction, it may result in insufficient compaction.

Grouting Procedures

Consistency

The consistency needed for grout placement depends on the clearance provided between the machine base and the foundation, the type of machine base, and the method of placement.

Water content, or grout consistency, should not exceed the recommended maximum or minimum values determined by Sika. The water content should be the minimum required that will reliably fill the void to be grouted. The consistency for epoxy grout should be that resulting from Sika's recommendations. Placement should not be attempted with any grout if the resulting consistency is not suitable for the existing clearances and flow lengths using the method proposed.

Temperature

The ambient temperature, the grout temperature at placing, and the temperature of the substrate and baseplate, all affect workability, setting time, strength, bleeding, and volumetric characteristics of a grout. Temperatures must be adjusted to be within the ranges recommended by Sika. For temperatures above or below those ranges, trials should be conducted, or recommendations gained from Sika's technical department. The temperature of the substrate and the baseplate may be reduced to within permissible placing range by cooling with ice or cold water. Under cold conditions, ambient, plate and substrate temperatures can be increased by using heating fans. The mixing temperatures of cementitious grouts can be reduced by using cold water, ice, or dry material stored in cool conditions. Under cold conditions, the initial mixing temperature can be increased by using warm water in cementitious grouts, or by storing the cementitious or epoxy grout material in warm conditions.

Admixtures

Admixtures can be added to cementitious grouts to increase setting times, to reduce setting times, to achieve higher early strengths, to reduce formwork stripping times and to achieve a desired workability in hot or cold conditions.

The admixture is usually added to the grout with the mixing water in a dosage determined by Sika recommendation and site trials. Local ambient and substrate temperatures as well as site conditions, will influence the admixture dosage. Any admixture used must be selected, mixed and trialled according to Sika's recommendations.

Mixing

Cementitious grouts: These must be mixed using methods and equipment which will result in a grout with uniform consistency which is free of lumps. For plastic, flowable, and pourable grouts, horizontal shaft mixers with a stationary drum are preferred. In most instances, initially the dry powder should be added to approximately 70% of the total recommended water content while mixing takes place. The remaining 30% of water should be added to the grout at a continuous rate while mixing continues. Mixing should continue until a homogenous grout appears. This usually takes 3 to 5 minutes. Allow the mix to stand so that any entrapped air is freed before pouring. For mixing directions refer to manufactures Technical data Sheet.

Portable revolving drum concrete mixers are not recommended, as they do not always break up the lumps in a cementitious grout.

Mixing of small quantities of plastic, flowable, or fluid grout in a bucket using a propeller-type mixer and drill is acceptable, provided the drill speed is slow enough to prevent air entrapment. Hand mixing is not recommended, as it does not provide sufficient energy to disperse constituents and break up lumps.

Stiff pack grouts are best mixed using a horizontal shaft mortar mixer. However, hand mixing can be used. Mixing should be performed on a watertight platform, repeatedly turning the grout over with a shovel. Final mixing is accomplished by rolling and rubbing the material between gloved hands.

Epoxy grouts: Epoxy grouts must be batched and mixed according to Sika's recommendations. In general, the Grout is mixed only long enough to ensure that uniform consistency and complete aggregate wetting are achieved. The liquid components of epoxy grouts are mixed for 3 to 5 minutes using a slow speed drill. The aggregate is mixed into the pre-blended epoxy mixture, and mixed at slow speed.

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Grouting Placement

Pouring

When grout is to be placed from the perimeter of a machine base, the formwork must be constructed so that a pressure head can be developed in a headbox on one side of the plate. All placement should be made from one side of the plate. Placement should begin at one end of the plate and continue at that point until the grout rises above the bottom of the plate on the opposite side of the plate. The portable head box can then be moved along the side of the plate from one end to the other. Continuous movement of a single face of grout prevents air entrapment.

To facilitate grout compaction and flow, rodding, tamping or flexible strapping in short strokes while maintaining an adequate head of grout is recommended.

For thick placements, control of heat generation and shrinkage is critical. Sika's recommendations for thick placement must be followed for the particular grout.

Pumping

When grout is to be placed through holes in the machine base, formwork should be constructed as already discussed. Pumping should begin at the grout inlet nearest one end of the plate. Grout should be pumped into that inlet until it flows up into an adjacent inlet and flows from the entire plate perimeter adjacent to the inlet. The pumpline should be moved to successive inlets until grouting is complete. Grout should not be pumped into more than one inlet simultaneously because air will be trapped.

When a hose is used to pump grout under a plate, the hose should be inserted under the plate to the point farthest from the point of insertion. The hose should be withdrawn as grout is pumped under the plate.

Dry-packing

Dry-pack placement and compaction should take place against a solid backing. It should be applied in layers and compacted over the entire surface using tamping methods. Tamping direction should vary to ensure complete compaction, and the dry-pack should be visually inspected before further layers are applied. Just prior to the placement of the next layer, the compacted dry-pack layer should be rubbed with the end of the tamping rod to leave a key for bonding more grout.

Curing and Protection

Cementitious grouts

After placement of cementitious grouts, they must be protected from excessive moisture loss and from the extremes of temperature. Moisture is retained by the process of curing. Curing can be conducted by keeping exposed areas wet for a given time, or by application of a curing compound.

Continuous moist curing after placement results in higher compressive strength of the grout and better durability. Moist curing is generally achieved by continual hosing or sprinklers, or by applying wet hessian, or plastic sheeting over the exposed surface. The surfaces should be left wet for at least 7 days before the surface is permitted to dry. Curing compounds can be applied to the grout surface after placement, and may be more practical on surfaces that are difficult to cure using continual moisture techniques.

After placement of the grout, the foundation and the baseplate must be kept at a temperature within the range specified for placing the fresh grout. The temperature must be kept within this range until the final set. After the final set, the grout must be protected from excessive hot or cold conditions until the final strength has been achieved.

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Epoxy grouts

Epoxy grout curing is generally not affected by exposure to the air, so the main consideration after placement is protection from temperature extremes. Temperature of the foundation and the baseplates must also be considered. During hot weather, equipment and baseplates should be shaded to provide uniform curing conditions.

Sika Grout Range

For the complete technical information refer to the Sika Technical Data Sheet for each specific grout.

Cementitious Grouts

SikaGrout 212HP

- Shrinkage compensated high strength grout
- Plastic or flowable consistency
- Dual expansion
- Suitable for machine bedplates, anchor bolts, bridge bearing pads, tilt-up sections, cranerails.
- SAA MP20 type ‘A’ and ‘C’ grout
- Compressive strength of 90 MPa at 28 days

SikaGrout 100

- Shrinkage compensated high strength grout
- Plastic or flowable consistency
- Suitable for microconcreting, bearing plate bedding
- Anchor bolts, general aggregate concrete
- SAA MP20 type ‘C’ grout
- Safe for use in underground mines
- Compressive strength of 75 MPa at 28 days

SikaGrout GP

- Shrinkage compensated general purpose cementitious grout
- Suitable for general grouting applications
- SAA MP20 type ‘A’ grout
- Compressive strength of 54 MPa at 28 days
- Suitable for plastic, flowable or rammable consistency

SikaGrout-Backfill

- Aggregate free, easy to place grout
- Suitable for sensitive areas
- Ideal for backfilling or cable bolt grouting

SikaGrout-UW

- Shrinkage compensated grout for under water application
- Suitable for reinstating concrete elements under water
- No significant ‘wash out’ of cement
- Compressive strength of 75 MPa at 28 days

SikaGrout-HES

- High early strength grout
- Reaches 20MPa at 2 hours
- High alumina cement content

SikaGrout-Ultra

- Ultra high compressive strength grout
- Reaches 100MPa at 28 days
- Self placing capabilities
- Easy to use and place

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Epoxy Grouts

Sikadur-42

- Solvent free epoxy based grout
- Plastic consistency
- Insensitive to moisture
- Very high mechanical strengths
- Low creep under permanent load
- Excellent chemical resistance

Sikadur-52

- Low viscosity – plastic consistency
- Suitable for crack injection and for filling cracks
- Insensitive to moisture
- High mechanical strengths

Sikadur-53

- High density flowable grout displaces water
- Can be used in wet and underwater situations
- Applicable in low temperatures
- Very high mechanical strengths
- Excellent chemical resistance

Polyurethane Grouts

Icosit KC 340 Range

- Used for flexible rail fixing
- Excellent adhesion to steel and concrete
- Vibration and sound absorbing
- Prevent stray currents from leakage
- Flexible grout for fixing machinery

Additional Products

- Form Release Agents – Formol
- Curing Compounds – Antisol, Sikagard Coatings
- Admixtures – SikaGrout Power Packs
- Repair Mortars – Sika MonoTop, Sika Gunite

Important Notification

The information, and, in particular, the recommendations relating to the application and end-use of Sika's 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 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 proprietary rights of third parties must be observed. All orders are accepted subject of our terms and conditions of sale. Users should always refer to the most recent issue of the Technical Data Sheet for the product concerned, copies of which will be supplied on request.

PLEASE CONSULT OUR TECHNICAL DEPARTMENT FOR FURTHER INFORMATION.