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Report on Grouting between Foundations and Bases for Support of Equipment and Machinery

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This report provides an overview of current practices of grouting for support of equipment and machinery. Materials and installation methods are described for epoxy and cementitious-based grouts used as the load-transfer material between equipment bases and their foundations.

Characteristics of placed material, test methods for forecasting long-term performance, qualification of grout materials, foundation design and detailing considerations, and installation procedures are described.

Keywords: bleeding; consistency tests; curing; durability; epoxy grout; cementitious-based grout; equipment grout; formwork (construction); foundations; grout; hydraulic cement grout; inspection; machinery grout; mixing; placing; sand-cement grout; stiffness; strength; tests; volume change.

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ACI 351.1R-12 supersedes ACI 351.1R-99 and was adopted and published March 2012.

CHAPTER 1—SCOPE

1.1—Scope

This report provides an overview of current practices for grouting to support equipment and machinery. Recommendations are provided for those portions of the grouting operation where a consensus could be developed among knowledgeable manufacturers and users. Various approaches are outlined for areas where opinions differ. Many statements and much of the information contained in this report are based on published manufacturers' data and observations and practical experience by technical representatives and users. There is little current published research available at this time, but the information in this report is the most current information available. This report describes materials and installation methods for grouts used as load-transfer material between machine or equipment bases and their foundations. Characteristics of the placed material, test methods for forecasting their long-term performance, and installation procedures are included. The information may also be appropriate for other types of applications where filling of the space between load-carrying members is required, such as under column baseplates or in joints between precast concrete elements.

Machinery and equipment that have precise tolerances for alignment or require uniform support cannot be placed directly on finished concrete surfaces. Both the concrete surface and the machine base have irregularities that result in alignment difficulties and bearing load concentrations. For this reason, machine bases or soleplates are aligned and leveled by shimming or other means, and the resulting space between the machine base and the foundation is filled with a load-transfer grout material. The load-transfer grout materials most frequently used are nonshrink cementitious grouts and nonshrink epoxy grouts.

CHAPTER 2—DEFINITIONS

ACI provides a comprehensive list of definitions through an online resource "ACI Concrete Terminology" (http://terminology.concrete.org). Definitions provided herein complement that resource.

2.1—Definitions

aggregate reduction—reducing the normal four bags of aggregate used with most commercial epoxy grout mixtures to two or three bags.

amine blush—cloudy finish to the surface of an epoxy grout that can inhibit bonding of subsequent applications.

chock—wedge or block for steadying a body and holding it motionless.

cure time—time after setting in which chemical and physical changes in the grout produces long-term durability strength and serviceability.

flowable grout—a cementitious grout consistency with a flow of 125 to 145 by the flow test in accordance with the applicable provisions of the ASTM C1437-07 test method; the flow expressed as a percentage of the original base diameter after five drops of the flow table in 3 seconds.

fluid grout—a cementitious grout consistency with a time of efflux of 10 to 30 seconds when tested by the flow cone procedure of the ASTM C939-10 test method.

grout shoulder—the portion of the grout that extends beyond the base plate toward the edge of the concrete foundation.

plastic grout—a cementitious grout consistency with a flow of 100 to 125 by the flow test in accordance with the applicable provisions of ASTM C1437-07 test method; the flow calculated after five drops of the flow table in 3 seconds.

working time—time in which the grout can be placed without having a detrimental effect on the strength and serviceability of the grout.

CHAPTER 3—GROUT

3.1—Requirements

After placement and hardening in the space between a machine or equipment base and the foundation, the grout is expected to perform one of the following functions:

- Permanently maintain the original level and alignment of the machinery or equipment and transfer all loads to the foundation when shims and other temporary positioning devices are removed.
- Act together with shims or other alignment devices in the transfer of loads to the foundation.
- Provide only stability support or corrosion protection for shims or other alignment devices that are designed to transfer all loads to the foundation.

The most important requirement for a grout intended to transfer loads to the foundation is the volume-change characteristics that result in complete and permanent filling of the space. Plain grouts consisting of cement, aggregate, and water do not have these characteristics. Other properties of the grout, such as consistency, strength, chemical resistance, temperature resistance, and compatibility with the operating environment are also important. These properties, however, are obtained more easily than the necessary volume-change characteristics.

For most applications, the space between the foundation and the machinery or equipment base can best be filled by placing a flowable grout into the space. To maintain