PART 1 - GENERAL

1.1 SUMMARY

A. Section includes epoxy, non-metallic, non-shrink, and ordinary Portland cement grouts for:
   1. Equipment bases.
   2. Handrails and railings.
   3. Construction joints.
   4. Intrusion grouting.

1.2 REFERENCES

A. American Society for Testing and Materials (ASTM)

B. United States Army Corps of Engineers
   1. CRD-C-619, Specification for Grout Fluidifier.
   2. CRD-C-621, Specification for Non-Shrink Grout.

1.3 SYSTEM DESCRIPTION

A. Classes of Ordinary Cement Type Grout:
   1. Provide Class A ordinary cement type grout having a compression strength of 4,000 psi and include the following:
      a. Foundation grout.
      b. Construction joint grout.

1.4 SUBMITTALS

A. Shop Drawings:
   1. Manufacturer's specifications and installation instructions for all proprietary materials.
   2. For ordinary cement grout, copies of grout design mix and laboratory strength test reports.

B. Reports and Certificates:
   1. For proprietary materials, submit copies of reports on quality control tests.
   2. Submit certification that materials meet specification requirements for nonproprietary materials.

1.5 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Delivery of Materials: Deliver grout materials from manufacturers in unopened containers and bearing intact manufacturer's labels.
B. Storage of Materials: Store grout materials in a dry shelter and protected from moisture.

**PART 2 - PRODUCTS**

### 2.1 MATERIALS

**A. Nonmetallic, 100% solids, high strength epoxy grout.**
1. Use prepackaged, solvent-free, moisture insensitive, high strength epoxy grout.
2. **Product and Manufacturer:** Provide one of the following:
   a. Euco High Strength Grout, as manufactured by The Euclid Chemical Company.
   b. Sikadur 42 Grout Pak, as manufactured by Sika Corporation.
   c. Five Star Epoxy Grout by Five Star Products, Incorporated.
   d. Or approved equal.

**B. Nonshrink, Nonmetallic Grout:**
1. Prepackaged non-staining cementious grout which shall meet the minimum requirements of CRD C-621 and requiring only the addition of water at the jobsite.
2. **Product and Manufacturer:** Provide one of the following:
   a. Euco N-S, as manufactured by The Euclid Chemical Company.
   b. Masterflow 928, as manufactured by Master Builders, Incorporated.
   c. Sika Grout 212, as manufactured by Sika Corporation.
   d. Or approved equal.

**C. Ordinary Cement-Sand Grout:** Prepare design mixes of ordinary cement grout.
1. **Cement:** Portland cement, ASTM C150, Type II; or blended hydraulic cement, ASTM C595, Type 1P.
2. **Aggregates:** ASTM C33 and as herein specified.
   a. Do not use aggregates containing soluble salts or other substances such as iron sulfides, pyrite, marcasite, ochre, or other materials that can cause stains on exposed concrete surfaces.
   b. **Fine Aggregate:** Clean, sharp, natural sand, free from loam, clay, lumps or other deleterious substances.
      1) Dune sand, bank run sand and manufactured sand are not acceptable.
   c. **Coarse Aggregate:** Clean, uncoated, processed aggregate containing no clay, mud, loam, or foreign matter, as follows:
      1) Crushed stone, processed from natural rock or stone.
      2) Washed gravel, either natural or crushed. Use of slag and pit or bank run gravel is not permitted.
      3) **Coarse Aggregate Size:** Size to be ASTM C33, No. 7 for Class B grout. Coarse aggregate not permitted in Class A grout.
3. **Admixtures:** Provide admixtures produced by established reputable manufacturers and use in compliance with the manufacturer's printed instruction. Do not use admixtures that have not been incorporated and tested in the accepted mixes, unless otherwise authorized in writing by ENGINEER. Refer to Section 03300, Cast-In-Place Concrete, for additional admixture requirements.
4. **Proportioning and Design of Mixes:** Prepare design mixes for each class of grout. Mixes are subject to the following limitations:
   a. **Class A Grout:**
      1) Specified 28-day Compressive Strength: 4,000 psi.
      2) Minimum amount of water necessary for the mixture to flow under its own weight.
      3) Fine Aggregate meeting ASTM C33.
4) Air Content Percentage: 6%.
5) Minimum Cement Content in Pounds per Cubic Yard: 658.
6) Slump at point of placement: 5"±1".

5. Proportion mixes by either laboratory trial batch or field experience methods, using materials to be employed on the Project for grout required. Comply with ACI 211.1 and provide a complete report, from an independent testing laboratory, to ENGINEER, at least 30 days prior to start of Work. Do not begin grout production until ENGINEER has approved mixes.

6. Laboratory Trial Batches: When laboratory trial batches are used to select grout proportions, prepare test specimens and conduct strength tests as specified in ACI 301, Chapter 3 - Proportioning.

7. Field Experience Method: When field experience methods are used to select grout proportions, establish proportions as specified in ACI 301, Chapter 4.

## PART 3 - EXECUTION

### 3.1 INSPECTION

A. Examine the substrate and conditions under which grout is to be placed with installer and notify ENGINEER, in writing, of unsatisfactory conditions. Do not proceed with the Work until unsatisfactory conditions have been corrected in a manner acceptable to ENGINEER.

### 3.2 INSTALLATION

A. General:
   1. Place grout as shown and in accordance with manufacturer's instructions. If manufacturer's instructions conflict with the Specifications, do not proceed until ENGINEER provides clarification.
   2. Manufacturers of proprietary products shall make available upon 72 hours notification the services of a qualified, full time employee to aid in assuring proper use of the product under job conditions. The cost of this service, if any, shall be borne by CONTRACTOR.
   3. When placing grout conform to temperature and weather limitations in Section 03300, Cast-In-Place Concrete.

B. Equipment Bases:
   1. After shimming equipment indicated to be epoxy grouted on the plans to proper grade, securely tighten anchor bolts. Properly form around the base plates, allowing sufficient room around the edges for placing the grout. Adequate depth between the bottom of the base plate and the top of concrete base must be provided to assure that the void is completely filled with the epoxy grout.
   2. After shimming equipment indicated to be nonshrink grouted on the plans to proper grade, securely tighten anchor bolts. Properly form around the base plates allowing sufficient room around the edges for placing the grout. Adequate depth between the bottom of the base plate and the top of concrete base must be provided to assure that the void is completely filled with the non-shrink, non-metallic grout.

C. Handrails and Railings: After posts have been properly inserted into the holes or sleeves, fill the annular space between posts and sleeve with the non-shrink, non-metallic grout. Bevel grout at juncture with post so that moisture flows away from posts.

++ END OF SECTION ++
GROUTING PROCEDURE

The purpose of this procedure is to provide assistance for those contractors whom have not had the experience in grouting tank floors for Clarifier and Thickener units. It is in no way the only way that this task can be performed and should only be considered as one possible alternative.

1. Concrete floor preparation:
   
   a. It is preferred that the concrete be left in a very rough condition at the time of concrete finishing. The best surface would be one that was roughened by use of a concrete rake rather than a finished surface thus increasing surface area for grout adherence.
   
   b. If the concrete surface has been finished rough, power wash the concrete surface prior to grouting and clean any loose debris from the grouting surface.
   
   c. If the concrete surface is not rough, the surface can be roughened by use of a power/mechanical concrete bushing tool. After bushing the surface of the concrete, remove all debris and power wash.
   
   d. If weather conditions are above freezing, saturate the concrete surface by means of submersion, sprinklers or hand application.
   
   e. The surface should be free of any standing water prior to the grouting process.

2. Grout screed board setup:

   a. The only method by which the grout should be applied is by using the mechanism rake. This will create a surface that will match the contour to which the mechanism rakes have been set. IMPORTANT NOTE: The rake arms are only to be used as a guide to the final grout contour. The grout should not be pushed around in the tank bottom using the rake arm.

   b. IMPORTANT NOTE: Before attaching or adding any additional weight to the rakes, mark a spot on the concrete floor at any point below one rake. Measure the distance between the rake and the reference spot on the concrete floor. This will be your reference dimension when balancing the rakes at the end of installing the screed board.
c. Choose one rake to attach a screed board to. This screed board will be fixed securely to the rake and will not function as a normal screed board (see figure 1). The screed board will run parallel with the length of the rake and should extend from the inner most radius to the outer most radius or as close as practical. Note that after the screed board is attached, rotate mechanism one complete revolution to insure that there is no contact between tank wall or center cone forms with end of screed.

d. The screed board will be attached to a 2x4 that is attached to each rake blade (see figure 1). The screed board should be set 1 1/2” to 2” below the rake blades at each end of the screed board then attach a string line from one end to the other on the screed board and set screed board straight.

e. Once the screed board is attached securely and straight, use the reference dimension established in 3.b and add weight to the opposite rake until reference dimension is established.

3. Setting up the drive for grouting:

a. The drive is to be used to rotate the mechanism during the grout application.

b. Even if permanent power has been run to the drive motor, it will be required to run the drive forwards and backwards during the grout application. Therefore an external drive system must be incorporated as shown in figure 2.
c. Once the external drive system has been attached, an operator can apply a tensioning force to the belt that will turn the rakes. The grinder can be turned upside down or right side up to reverse the direction of the drive.

4. Grout Setting:

   a. It is imperative that the concrete floor be free of any dirt or debris.
   
   b. Some type of a bonding agent should be used to help the grout bond to the concrete floor. If a premixed bonding agent is preferred, consult your local concrete specialty company. A simple and very effective bonding agent is a slurry mixture of water and Portland cement. This can be mixed in a five gallon bucket and broom applied to the floor just in front of the grout pour. If using the cement slurry bonding agent, make sure to apply only enough slurry that can be covered by the grout before the slurry begins to dry. If the slurry dries before the grout is placed over it, the grout will not bond to the concrete in that area.

   c. The grout mixture should be a sand and cement mixture with no aggregate. If aggregate is used for excessive thickness purposes, it should be no larger than “Pea Gravel”. Any type of aggregate included in the grout mix may cause surface imperfections due to the screed dragging the aggregate as it rotates. If a vibrator can be added to the rake, such as the VIBCO’s SCR-100 w/ clamp on blocks, it may help in reducing the aggregate dragging situation. It is important to note that if a vibrator is used it should have the capability of being turned on and off remotely so that the grout does not become too fluid and slump down the slope of the floor.

   d. The grout should be pumped into the tank and distributed in a radial line just in front of the screed board. Make sure that grout is only slightly higher than the bottom of
the screed board. If too much grout is set in front of the rake, the rake will float up on top of the grout thus establishing an incorrect grout surface. There should be a number of laborers using concrete rakes to level the grout by eye. The rake can then be rotated to create the correct grout surface. Once the rake has rotated over the grouted area, possible low areas can be determined. The rake can then be rotated backwards by first having someone stand on or push the rake down on the opposite side (the rake without a screed). Turn the grinder upside down and rotate the rake backwards until it is in an area that has no low spots. The person standing on or pushing the opposite rake down should slowly step off or release pressure so not to allow the screed rake to leave an indentation in the grout surface. This process will be repeated a number of times until the grouting operation has reached the beginning point.

e. There will be an area that the screed will not reach at the perimeter and center of the tank. In these areas a mag. float should be used to cut the excess grout from the surface and contour as needed by hand. This operation should be performed as the rake progresses. Any foot print holes caused when hand finishing these two areas can be repaired as described above.

f. Once the rake has nearly reached the starting point, equipment and the majority of the personnel should evacuate the tank. The beginning of the grout area may be hard enough at this point to allow personnel to use knee boards and stand so as to allow for final closure of the grout pour. If the grout is not hard enough for the use of knee boards at this point then more than enough grout must be applied in front of the rake to allow the rake to screed the final area in while the personnel leave the tank. The rake may have to run backwards and forwards a few times to finish out the level. This will cause some damage to the grout surface which will have to be repaired by hand once the grout has set up enough for use of knee boards.

g. Repair damaged areas as required.

5. Curing the Grout:

a. After the grout surface has been repaired and or finished, the tank can be filled with water to complete the hydro test and aid in curing the grout. The tank can be filled by connecting to the underflow line or adding a hose at the center of the tank. If filling by hose, the hose should be run to the bottom discharge cone or sludge trough.

b. If flooding the tank is not an option, then the use of an absorbent cloth such as burlap can be placed over the grout and wetted for a few days to allow the grout to Hydrate at a slow rate.
6. Disclaimer:

This procedure has been produced from our experience with grouting Clarifier or Thickener floors and is only a suggestion. If the contractor has experience with performing this task, their experience and expertise should take precedence over the above procedure. As such, ClearStream Environmental accepts no liability for the installation of the grout in the tank bottoms.

If any further information is needed or additional suggestion are required, please feel free to contact us at 801-676-1890.