



Standard Practice for Sealing Sewer Manholes Using Chemical Grouting¹

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1. Scope

1.1 This practice covers proposed selection of materials, installation techniques, and inspection required for sealing manholes using chemical grout. Manholes or sections of manholes with active leaks shall be repaired. Manholes to be grouted are of brick, block, cast-in-place concrete, precast concrete, or fiberglass construction. Manholes or sections of manholes with active leaks will be designated by the engineer, owner's representative, or authorized inspector, for manhole grouting.

1.2 The contractor shall be responsible for furnishing all labor, supervision, materials, equipment, and inspection follow-up required for the completion of chemical grouting of manhole defects in accordance with the contract documents.

1.3 Materials, additives, mixture ratios, and procedures utilized for the grouting process shall be in accordance with manufacturer's recommendations and shall be appropriate for the application.

1.4 The values stated in inch-pound units are to be regarded as standard. The values given in parentheses are mathematical conversions to SI units that are provided for information only and are not considered standard.

1.5 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*

2. Terminology

2.1 Definitions of Terms Specific to This Standard:

2.1.1 *acrylamide*—organic solid of white, odorless, acrylic resinous material available in flake-like crystals and in liquid form. The greatest use of acrylamide is as a coagulant aid in drinking water treatment. Other major uses of acrylamide are in soil stabilization, in grout for repairing sewers and in acrylamide gels used in biotechnology laboratories.

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2.1.2 *acrylate*—a general term applied to various water-soluble acrylic resinous materials.

2.1.3 *authorized inspector*—the person(s) contracted or approved by the owner or owner's representative to do inspections.

2.1.4 *catalyst*—substance which markedly speeds up the cure of an adhesive when added in small quantities as compared to the amounts of primary reactants.

2.1.5 *chemical grout*—injection repair media other than cementitious grout that may be multi-component, with or without additives, and based on either polyurethane resin or acrylic resin.

2.1.6 *control agent*—substance added which controls the viscosity or flow properties of the material it is added to.

2.1.7 *engineer*—an engineer registered in the state where the work is to be done who has been contracted by or is acting on behalf of the owner or the owner's representative.

2.1.8 *exfiltration*—leaking or weeping to the external areas outside the barrier from a source inside the barrier.

2.1.9 *expanded gasket procedure (EGP)*—the sealing of joints, cracks, or holes by soaking dry, oil-free oakum with chemical grout and forcing the oakum/resin plug into the opening until it sets.

2.1.10 *hydrophilic grout*—hydrophilic grout will absorb and react with the water it comes into contact with.

2.1.11 *hydrophobic grout*—hydrophobic grout will repel water and push it away.

2.1.12 *manhole*—vertical shafts that intersect with sewers to allow transitions in alignment and grade and to allow entry for cleaning, inspection, and maintenance.

2.1.13 *oakum*—loose hemp or jute fiber, sometimes treated with resin or grout, used chiefly for caulking seams in structures and boats as well as packing pipe joints.

2.1.14 *owner's representative*—the individual who has been contracted to act on behalf of the owner for project planning and supervision.

2.1.15 *polyurethane resin*—any of various polymer resins containing the urethane radical; a wide variety of synthetic forms are made and used as adhesives, plastics, foams, paints, or rubber-like materials.

2.1.16 *RCP*—reinforced concrete pipe.

2.1.17 *rehabilitated manhole*—a manhole restored to its intended capacity or use per the specifications.

2.1.18 *repaired or sealed manhole*—a manhole that has been sealed from detected infiltration or exfiltrations, but not necessarily restored to its original designed capacity.

2.1.19 *sewer*—waste water sewer or storm drain sewer.

3. Significance and Use

3.1 This practice is used as a guide for the installation of chemical grout in the practice of sealing sewer manholes from leaks, cracks, and around penetrations. It is intended to assist sewer owners and engineer, owner's representative, or authorized inspectors for installation method specification and for contractors to refer to during installations of chemical grout for manhole sealing.

4. Materials

4.1 *Grouting Materials*—Chemical grout sealing material:

4.1.1 Acrylamide base gel,

4.1.2 Acrylic base gel,

4.1.3 Hydrophilic polyurethane foam or gel,

4.1.4 Hydrophobic polyurethane foam or gel, and

4.1.5 Oil-free, oakum-soaked polyurethane resin.

4.2 *Grouting Materials Characteristics*—Specific characteristics that pertain to the application requirements are to be defined and approved by the owner's representative or project engineer of record. The following general characteristics or properties shall be exhibited by the chemical grout:

4.2.1 The chemical grout shall have documented service of satisfactory performance in similar usage and should have a manufacturer's written guarantee of performance for the application of sewer manhole sealing under intended conditions and when installed per the manufacturer's instructions.

4.2.2 The chemical grout shall have controllable reaction times and minimal shrinkage, as specified by the owner, owner's representative, or engineer, through the use of chemicals supplied by the same manufacturer. The minimum set time shall be established so that adequate grout travel is achieved.

4.2.3 The chemical grout shall have resistance to chemicals, most organic solvents, mild acids, and alkali. The manufacturer of the chemical grout shall be able to certify that the cured chemical grout is resistant to chemicals, most organic solvents, mild acids, and alkali and provide such certification to the contractor when requested.

4.2.4 The chemical grout shall be essentially non-toxic in a cured form. The manufacturer of the chemical grout shall be able to certify that the cured chemical grout is non-toxic and provide such certification to the contractor when requested.

4.2.5 Sealing material shall not be rigid or brittle when subjected to dry atmosphere. Use consideration when selecting materials for freeze/thaw and moving load conditions. The engineer is to specify which chemical grout type can or cannot be exposed to dry atmosphere and which types must be installed into soils or wet conditions only, based on the chemical grout properties and recommended applications.

4.2.6 The sealing material shall be non-corrosive.

4.2.7 Careful consideration of current or potential wet-dry cycles, ground pressures, and thermal conditions and application requirements must be thoroughly reviewed by the contractor or engineer when choosing or approving the appropriate type of chemical grout.

4.2.8 Careful consideration of water type (storm water versus waste water) is to be considered when choosing or approving the appropriate type of materials.

4.3 *Additives*—The chemical grout must be applied so as to have the grout material flow freely into the defects. To avoid any wasting of the material flowing through the defects gel control agent may be added. Grout additions may also be used for catalyzing the reaction, inhibiting the reaction, buffering the solution, lowering the freezing temperature of the solution, acting as filler, providing strength, or inhibition of root growth.

4.3.1 Additives must not alter other intended final properties and characteristics of the original material other than the properties targeted for improvement.

4.4 *Material Identification*—The contractor shall completely identify the types of grout, sealant, root control chemicals, or any combination thereof, used and provide case histories of successful use or defend the choice of grouting materials based on chemical and tested physical properties, ease of application, and expected performance to the satisfaction of the engineer, owner's representative, or authorized inspector. The grout materials' Technical Data Sheets, Material Safety Data Sheets, and the manufacturer's application instructions are to be submitted for approval by the engineer, owner's representative, or authorized inspector.

4.5 *Mixing and Handling*:

4.5.1 *Hazards*—Mixing and handling of chemical grout, which may be toxic under certain conditions, shall be in accordance with the recommendations of the manufacturer and in such a manner as to minimize hazard to personnel. It is the responsibility of the contractor to provide appropriate protective measures to ensure that the chemicals are handled by authorized personnel and in the proper manner.

4.5.2 All equipment shall be subject to the approval of the engineer, owner's representative, or authorized inspector. Only personnel thoroughly familiar with the handling of the grout material and additives shall perform the grouting operations.

5. Procedure

5.1 Manhole grouting shall not be performed until the repair or stabilization (bracing) of the manhole frame and grade rings or any other structural manhole repairs are complete.

5.2 *Preliminary Repairs*:

5.2.1 The contractor shall cut and trim all stems and roots within the manhole.

5.2.2 The contractor shall seal all unsealed lifting holes, unsealed step holes, and voids larger than approximately 1/2 in. (1 cm) in thickness. All cracked or deteriorated material shall be removed from the area to be patched and replaced with a waterproof quick-setting mortar in accordance with manufacturer's specifications. The EGP method is also acceptable for plugging lift holes and similar patching.

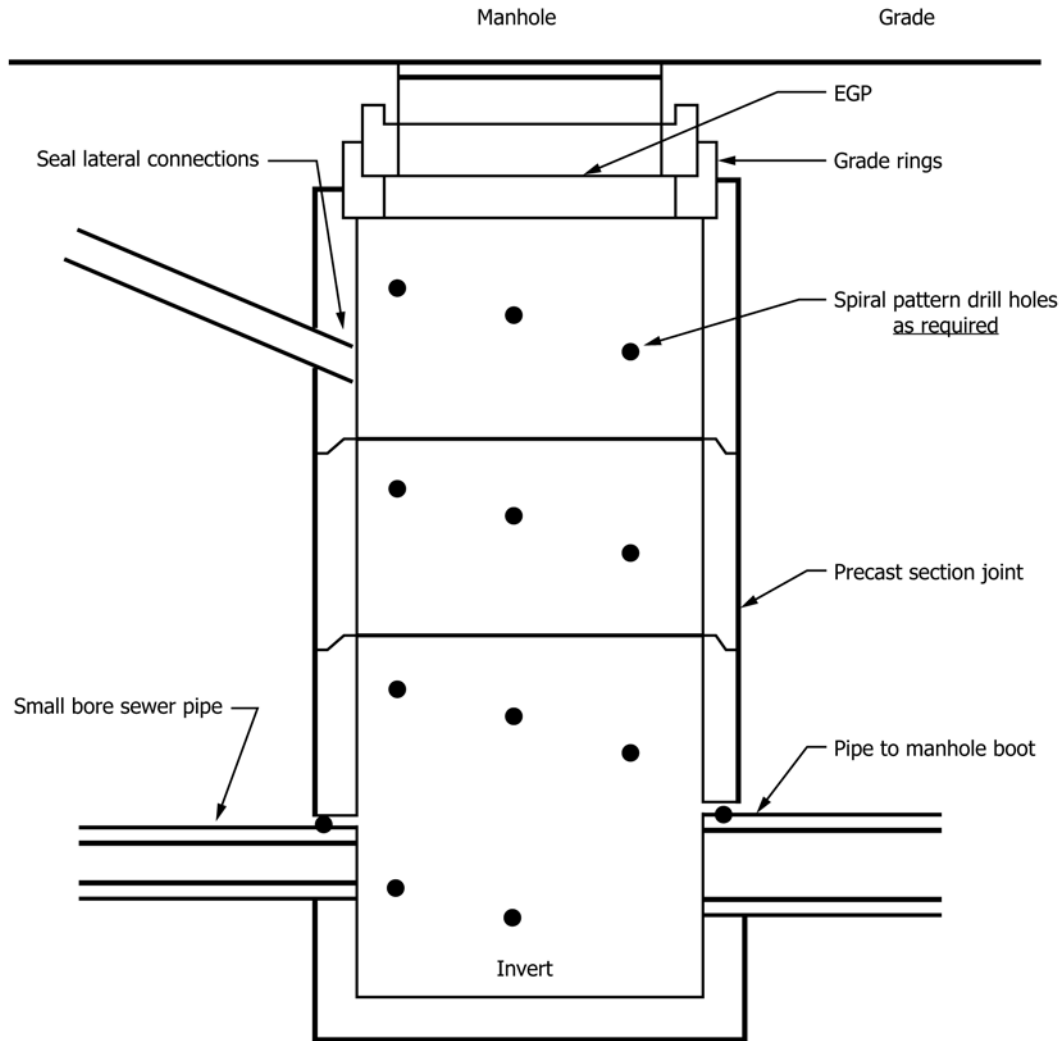


FIG. 1 Manhole with Spiral Pattern Drill Holes

5.2.3 As required to complete sealing of the manhole, the contractor may be required to perform the EGP in addition to, or as well as, the injection of chemical grout into voids or soil surrounding the manhole to control inflowing water in larger cracks, joints, or pipe to manhole boots. EGP is the sealing of joints, cracks, or holes by soaking dry, oil-free oakum with chemical grout and forcing the oakum/resin plug into the opening until it sets.

5.2.4 The contractor may also be required to perform the EGP to seal intruding drop or lateral connections, slip line terminal seals, and open joints in RCP manholes.

5.2.5 The contractor may also be required to perform the EGP to seal between the corbel and grade rings and between the manhole frame and grade rings.

5.2.6 *Grout Curtain Sealing*—If a chemical grout curtain is required around a brick or block manhole, the procedure may involve the use of chemical grout in combination with a coating.

5.2.7 The manhole surface shall be cleaned, patched, and all active leaks plugged and confirmed by the engineer, owner’s representative, or authorized inspector, before coatings may be applied.

5.3 *Temperature*—Normal grouting operations shall be performed in accordance with manufacturer’s recommendations.

5.4 *Chemical Grouting Material Usage*—Chemical grouting of the manhole may include corbel, wall, pipe seals, manhole joints, wall to flattop joint, bench/trough, or any combination thereof. Chemical grouting may also include probe grouting around the exterior of the manhole and into the surrounding soil in order to seal off or keep water away from the manhole, or to stabilize loose soils around the manhole. The engineer, owner’s representative, or authorized inspector, will direct areas of the manhole designated to be grouted. If the entire manhole is scheduled for grouting, grouting shall include the entire manhole including corbel, wall, pipe seals, and bench/trough. Pipe seal grouting shall include all pipe seals in the specified manhole and grouting of the specified manhole including the bench/trough to the maximum height of 18 in. (46 cm) from the crown of the pipes (see Fig. 1).

5.5 *Drilling and Injection:*

5.5.1 Injection holes shall be drilled through the manhole wall at locations as recommended by the manufacturer. Injection holes are always to be drilled staggered within rows (see

Fig. 1). Additional injection holes shall be drilled near observed defects and at pipe seals.

5.5.2 Grout shall be injected through the holes under pressure with a suitable probe. Injection pressure shall not cause damage to the manhole structure or surrounding surface features. Grout shall be injected through the lowest holes first. The procedure shall be repeated until the manhole is externally sealed with grout.

5.5.3 External grouting from the ground surface may be required to seal leaks due to cavities and voids around the manhole.

5.5.4 Grout travel shall be verified by observation of grout extruding from defects or adjacent injection holes. Additional injection holes shall be drilled, if necessary, to ensure observation of grout travel to all required regions.

5.5.5 Injection holes shall be cleaned and patched with a waterproof quick-setting mortar for appropriate use on the type of substrate material the manhole is composed of.

6. Testing of Sealed Manholes

6.1 For exfiltration or vacuum testing usually 10 % of the sealed manholes are tested, as chosen or required by the inspector. Manholes that fail are reworked and retested by the contractor. If more than 5 % of the manholes tested fail the initial test, an additional 10 % of the sealed manholes are tested. This process continues until the testing is satisfactory or until all manholes have been tested.

6.2 Limitations of testing include recognizing that exfiltration and vacuum testing may be non-applicable or cost-prohibitive for all manholes; therefore, the use of either method is subject to the following considerations.

6.2.1 *Complete Sealing*—These test methods are applicable only when the entire manhole has been sealed or rehabilitated. The sealing or rehabilitation of only some portions of the manhole may cause these tests to fail. Therefore spot repairs

and partial sealing or rehabilitation can only be tested by observation for infiltration and visual inspection.

6.2.2 *Inlet and Outlet Sewers*—Manholes built over large diameter sewers may be impractical and uneconomical to test using either of these methods because of bypassing requirements, availability of plugs, and high forces that are generated on the plugs. Consideration must be given to these factors when determining the method of acceptance testing to be used.

6.2.3 *Structural Condition*—The structural condition of some manholes may be such that testing with these methods is impractical or destructive. The owner's representative and contractor shall therefore deem those manholes that have not been structurally lined as structurally sound, before testing using these methods.

7. Field Testing or Inspection, or both, for Final Acceptance

7.1 Twelve months after completion of all chemical grouting work, and at the discretion of the owner or owner's representative, inspections of specific sections that were repaired should be conducted by the owner, owner's representative or engineer.

7.1.1 The owner is to notify the grouter within one week of any leak detected or filed inspection during the first twelve months after completion of the chemical grouting work.

7.1.2 Previously grouted defects, which leak or fail inspection within the first twelve months after the sealing work was completed, shall be resealed at no additional cost to owner.

7.1.3 Inspection of previously grouted defects can consist of observation for leaks as well as any specified tests as required by the Inspector (see Section 6).

8. Keywords

8.1 chemical grouting; manholes; sewers

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