



MICHELS PIPE SERVICES

P.O. Box 128 • 817 West Main St. • Brownsville, WI 53006-0128
920.583.3132 • Fax: 920.583.3429
www.michels.us

SEWER LINE JOINT TESTING

After cleaning and TV inspection is completed, joint testing shall be performed on sewer line joints in order to determine if leakage exists. For the purposes of this section and the next, "Sewer Line Joint Sealing," small holes, cracks and other defects which can be successfully tested and/or sealed shall be considered in a like manner to a sewer line joint.

Joint testing shall be performed by inducing a specified air pressure into the void area which has been created for the purpose of isolating the joint being tested. Joint testing with liquid will not be allowed. Continuous monitoring of the void area pressure shall be maintained at all times and recorded on a pressure metering device which accurately displays the pressure to within $\pm 1/10$ th of one psi and responds to and records all changes of the pressure in the void area. Systems which have questionable accuracy will not be approved.

Testing procedures shall consist of applying a precise pressure of no less than 6 psi in excess of ground water pressure into the void area which has been formed to isolate the joint. When the pressure has been recorded on the ground level meter for a sufficient time to stabilize the system, the application of pressure shall cease. The pressure recording meter shall be observed for a period of 15 seconds. Should the pressure in the void area drop 2 psi in the 15 second period, the joint or joints in the void area will have been deemed to fail the test. Any joint failing the test will be sealed as detailed in these specifications.

Because joint grouting operations, as outlined in the next section, and/or contact with foreign material can foul or cause the air testing equipment to become inaccurate, prior to each air test, and before the testing device is inflated to isolate the joint, the entire system shall be purged to demonstrate a free and unobstructed flow of air. This test shall prove all hoses, valves, and orifices which are part of the air test system to be operating properly and also demonstrate that all gauges or pressure metering devices return to a zero datum before subsequent joint testing is performed.

The contractor may be required by the engineer at any time before or during the project to satisfactorily demonstrate the effectiveness and accuracy of his testing equipment. This may require system purging, gage calibration and "zeroing," system "proof" tests on pipe barrel sections and open sewer laterals to show that the system is operating properly, and other demonstrations required by the engineer to ascertain the continued effectiveness of the testing equipment.

SEWER LINE JOINT SEALING

Sewer line joints that will not pass the outlined joint testing procedure will be sealed with the chemical grouting materials specified.



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Chemical grouting of sewer joints shall be accomplished by forcing sealing materials into and through the joints of the sewer pipe from within the sewer pipe in order to completely eliminate infiltration. The chemical grouting equipment and material will have the ability to successfully seal pipe line joints which are offset up to 1" or gapped up to 1" as viewed from the interior of the pipe. An offset joint is a joint where there is longitudinal displacement of adjacent pipe sections. Offset and/or separated joints beyond the limits specified shall be sealed only with the approval of the engineer and the concurrence of the contractor's supervising technician.

The sealing equipment shall contain two separate pumping systems capable of supplying an uninterrupted continuous flow of the sealing material at rates of between one-quarter and ten gallons per minute at a minimum pressure of 60 psig, for a continuous period of up to ten minutes. Each pumping system shall include a tank for mixing polymerizing materials and additive solids and liquids which will form the final grout mixture. Each of these tanks shall be equipped with mixing and/or recirculation systems to allow continuous or frequent agitation of suspended solid additives such as Celite 2091, an additive used for added viscosity and strength. Suspended solids shall be agitated continuously throughout the grouting operations. The sealing material shall pass from the individual mixing tanks through two separate pumps which function as a positive pressuring, metering, and proportioning system. No system of pumps or pressure devices which does not continuously maintain the exact proportioning of the fluids contained in the mixing tanks will be allowed.

The grouting materials will be pumped through a dual hose system which terminates at the mixing chamber of the sealing device.

The sealing device is referred to hereafter as a packer and shall be a cylindrical case of a size less than pipe size with cables at either end used to pull it through the sewer lines.

The packer device shall be constructed in such a manner as to allow a restricted amount of sewerage flow at all times. Air-impervious sleeves, constructed so that they can be pneumatically expanded, shall be mounted over the cylinder. When the packer is inflated, two widely spaced annular bladders shall be formed, producing an annular void between the cylinder on which they are mounted and the inside wall of the pipe to be sealed. No sealing device which is expanded hydraulically or mechanically will be allowed in order to prevent damage to the pipe.

The packer shall be positioned over the area of infiltration by means of a metering device at the surface and the closed circuit television in the line. The packer sleeve so positioned shall be expanded using precisely controlled pressures not to exceed 25 psig. The packer sleeve inflation system shall be constructed so that pressure in the elements can be increased or decreased at any time during a joint sealing operation. The pressure shall, however, not exceed 25 psig without consent of the engineer.

1 Celite 209: A product of Johns-Manville Company



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The pneumatically expanded sleeves shall seal against the inside periphery of the pipe to form a void area at the point of infiltration, which is now completely isolated from the remainder of the pipeline. Into this isolated area, the thoroughly mixed sealant material shall be pumped. All sealant materials shall have been proportioned and thoroughly mixed prior to leaving the mixing chamber of the sealing device and prior to entering this void area formed by the pipe wall and the inflated packer.

To insure the complete mixing of the grouting materials, the sealing device shall contain a mixing chamber which accepts sealant materials, including initiator, activator and additives such as diatomaceous earth from the pumps and dual hose system, and combines them into a single catalyzed liquid which is then injected from a single orifice into the void area formed by the packer and the pipe wall.

The diameter of the orifice exiting from the mixing chamber shall be no greater than the largest hose of the dual hose system. The discharge orifice and dual hose system will be connected by a mixing chamber, which enables all components of the final grout to combine in a single mixing conduit.

The function of the mixing chamber is to combine the proportioned grouting materials from the pumps and dual hose system and to discharge them into the void area formed by the pipe wall and the packer as a completely catalyzed and homogeneous grout.

It is recognized that partial and, at times, complete catalyzation can take place without a mixing chamber, but to insure a predictable and reproducible product at all times, sealing systems which do not include a mixing chamber and/or inject the grouting fluids uncombined and/or unmixed from more than a single discharge orifice will not be allowed.

Sealant materials shall be pumped at pressures in excess of groundwater pressure into the void area between the pipe and the packer and through the leak into the soil surrounding the pipe. The pumps, meters and packer shall be integrated so that the proportions and quantities of materials and pressures for sealing can be regulated in accordance with the type and size of leak, percentage of voids being filled, type of soil surrounding the pipe, and the rate of flow of sealing solution in relation to the back pressure.

The sealing equipment shall be designed to monitor the injection of the grouting materials and determine when the leak has effectively been sealed to the pressures required. The effectiveness of the seal shall be verified at the request of the engineer or his representative by performance of an air test such as required before sealing and outlined in "Sewer Line Joint Testing." Air test systems which incorporate valves, transducers, gauges or other mechanical or electrical device that contact the grouting material or can otherwise be affected by the grouting operations shall perform the following sequence prior to the post sealing pressure test.

1. Reduce pressure in the air inflatable packer bladders to such a degree that complete 360° contact is no longer maintained with the pipe wall, thus enabling air from the test area to escape between the bladders and the pipe wall.



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2. Pressure the air test system and make certain that a free flow of air is allowed to pass through the system. (The grouting operation can cause the air port to become plugged during the sealing process.)
3. Move the packer forward and/or backward or employ other scraping methods to dislodge the gelled grouting material from the joint.
4. Reposition the packer on the previously sealed joint and test as required by the specifications. If a pressure sensing transducer or other device is used to monitor the testing operation it must be made certain that it has not been fouled, plugged or rendered inaccurate by contact with the sealing materials.

If any grouted joint shall fail this test, it shall again be grouted as previously specified in this section and re-tested until it satisfies the required air pressure test. All joints sealed shall be required to pass a minimum air pressure test, applied at the joint, equal to 0.43 psig per foot of depth of the sewer, or no less than 6 psig, whichever is greater.

The mixing, pumping and packing devices for chemical grout sealing of sewer line joints shall be capable of utilizing sealing material and additives, as hereafter specified in "Sealing Materials." Grouting materials shall not be allowed to remain on the pipe walls, adhere to roots or protrude from the joints which have been sealed. To insure that all grouting material has been removed from the interior of the pipe, all man-hole sections which have been grouted shall be cleaned with high-velocity sewer cleaning machines. At the request of the engineer, the cleanliness of the pipe will be verified by television inspection of the sealed manhole section.

All joint sealing shall be accomplished by forcing chemical sealing materials into the infiltration point through a system of tanks, pumps, a dual hose system, mixing chamber and the packer. Jetting or driving pipes from the surface that could damage or cause undermining of the pipelines shall not be allowed. Uncovering of the pipe by excavation of the pavement and/or soil which could disrupt traffic, undermine adjacent utilities and structures and cause further damage to the pipeline being repaired shall not be allowed.

After a manhole section has been grouted and for a period of time up to twelve months following completion of the project, the engineer may require the contractor to clean and test, in accordance with "Sewer Line Testing," up to 10 percent of the pipeline joints which have been previously sealed. This 10 percent will be selected at random and will include all the sizes of piping from this project. If it is found that any of the joints do not pass this test, they shall be resealed and tested in accordance with "Sewer Line Joint Sealing" at no additional cost to the owner. If, after testing 10 percent of the previously sealed joints, it is found that 4 percent or more of the joints tested do not pass the required air test, the engineer may require the contractor to test and, if necessary, reseal all the joints sealed in the original contract. All testing and resealing shall be performed per the original specifications and at no additional cost to the owner.



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