

ENGINEERING SPECIFICATIONS

Manhole Rehabilitation Specifications / Chemical Grouting Specifications

TECHNICAL AND PROPERTY SPECIFICATIONS FOR MANHOLE REHABILITATION

- 1 Intent and Method of Manhole Rehabilitation.** Each indicated concrete or brick structure shall be rehabilitated to eliminate infiltration and exfiltration, restore structural integrity and protect the structure from future deterioration. All products to be used in the rehabilitation system shall be supplied by a single manufacturer to insure material compatibility. Contractors bidding on the rehabilitation project(s) must demonstrate that they are qualified by experience and must be trained and approved by the manufacturer to apply the specified products.
- 2 Materials:** The materials used shall be designed, manufactured, and intended for manhole and sewer structure rehabilitation and the specific application in which they are used. The materials shall be delivered to the job site in original unopened packages and clearly labeled with the manufacturer's identification and printed instructions. All material shall be stored and handled in accordance with recommendation of the manufacturer and the American Concrete Institute.
- 3 Execution:** Manholes requiring rehabilitation are listed or tabulated in the contract documents. The list will identify and locate the manholes to be rehabilitated and the type of rehabilitation required for each manhole.

3.1 Surface Preparation shall consist of water blasting (minimum 3500 psi) the interior of the manhole or structure in order to accomplish the removal of loose mortar, paints, protective coatings, efflorescence, all contaminants, laitance and curing components, leaving a clean, structurally sound substrate. Wire brushing or sand blasting may be required.

3.2 Hydrostatic Leak Correction. Leaks may be stopped using one of the following products, depending upon the type and severity of the leaks. Please contact the manufacturer for product recommendations.

PARSON QUICK PLUG

Compressive Strength		ASTM C-109
15 Minutes	750 psi	
1 Day	3700 psi	
28 Days	5500 psi	
Set time	60 seconds	ASTM C-191
Sulfate Resistance, Passed	25 Cycles Min.	ASTM C-88
Freeze-Thaw Resistance, Passed	62 Cycles	
Shrinkage/Expansion	+ 0.02	ASTM C-157
Pull Out Strength, lbs. (4# bar imbedded 6 inches in a cement pocket of 1.5 inch diameter)	12,000 lbs.	ASTM C-234

Viscosity	100 cps @77°F	ASTM D-1638
Density	4 lbs/cu. ft.	ASTM D-1622
Elongation	50%	ASTM D-638
Tensile Strength	27 psi	ASTM D-638
Shear Strength	20 psi	ASTM D-732
Water Absorption	< 1 % by volume	ASTM D-2842

PARSON MULTI GROUT

Viscosity	600 cps @77°F	ASTM D-1638
Density	65 lbs/cu. ft.	ASTM D-1622
Elongation	400%	ASTM D-638
Tensile Strength	2200 psi	ASTM D-638
Tear Strength	400 psi	ASTM D-624

PARSON PERMA SEAL

Viscosity	500 cps @77°F	ASTM D-1638
Density	5 lbs/cu. ft.	ASTM D-1622
Elongation	400%	ASTM D-638
Tensile Strength	370 psi	ASTM D-638
Shear Strength	170 psi	ASTM D-732

PARSON SEAL-TITE

Viscosity	A-200 cps @77°F B-800 cps @77°F	Brookfield Method
Density (Free Rise) (Confined)	4 lbs/cu. ft. 20 lbs/cu. ft.	ASTM D-1622
Shrinkage	0% after 90 days	
Compressive Strength	100 psi	ASTM D-1621
Tensile Strength	105 psi	ASTM D-638
Shear Strength	75 psi	ASTM C-273
Water Absorption	<1% by volume	ASTM D-2172
Elongation	5%	ASTM D-1623
Reaction Time	1 -3 seconds	
Expansion Time	30 seconds	

3.3 Hydraulic Cement Patching. Patching of manhole walls or sewer structures if necessary, shall be required in areas where large voids exist, such as mortar missing between bricks, around step frames, pipes and spalled concrete. All loose, cracked and corroded material shall be removed from the area to be patched, exposing a sound substrate. PARSON RPM or approved equal shall be applied to dampened surfaces. This product shall be allowed to cure before applying waterproof coating.

PARSON RPM

Compressive Strength		ASTM C-109
1 day	>6700 psi	
7 days	>8000 psi	
28 days	>9000 psi	
Tensile Strength		ASTM C-109
1 day	>590 psi	
7 days	>685 psi	
28 days	>800 psi	
Flexural Strength		ASTM C-348
1 day	>1025 psi	
7 days	>1250 psi	
28 days	>1400 psi	
Bond	160 psi	ASTM C-321
Shrinkage	0%	ASTM C-596
Freeze/Thaw	100 cycles, no damage	ASTM C-666

3.4 Waterproofing

A. Smooth or low profile surface showing no signs of corrosion.

Where waterproofing of the sanitary sewer manhole or structure is necessary due to ground water infiltration and the substrate is effectively smooth with a surface profile of less than 1/8", the use of PARSON SEALCRETE, a two component, acrylic modified cementitious coating, or approved equal is recommended. Apply PARSON SEALCRETE GREY, or approved equal to a clean damp surface with a nylon or fibre whitewash brush. After allowing approximately 4-6 hours for SEALCRETE GREY to be hard and dry to the touch, apply a coat of PARSON SEALCRETE WHITE, or approved equal. Dampen Grey coat prior to application of White coat.

PARSON SEALCRETE

Freeze/Thaw Resistance	50 cycles, No Scaling	ASTM C-672
Accelerated Weathering	5000 hrs, No loss of adhesion	ASTM G-26
Water Vapor Permeance	28 days, 9 perms	ASTM E-96
Tensile Strength, psi	1000	ASTM C-190
Flexural Strength, psi	1800	ASTM C-348
Water Vapor Transmission Rate (Perms)	9	ASTM E-96
Freeze Thaw Resistance cycles passed	50	
Bond Strength, psi	concrete failure	ASTM D-4541
Accelerated Weathering	No loss of adhesion	ASTM G-26
Hydrostatic Pressure Resistance	10 psi	

3.5 Rehabilitation in Low to Moderate Corrosive Environments (Ph range 3+)

If substrate is rough, shows moderate signs of corrosion or structural enhancement is required, PARSON MH LINER Microsilica Cement Mortar, or approved equal, is recommended. Surfaces should have a minimum profile of 1/8". Substrate should be water saturated, surface moist using clean, potable water. PARSON MH LINER can be applied by low to medium velocity wetmix shotcrete equipment or by trowel. Application thickness up to 3" in a single lift as required by each structure to return surface to original dimensions. Finish may be done by trowel, float, and/or brush, depending on desired finish.

PARSON MH LINER

Compressive Strength 28 Days	>9,000 psi	ASTM C-109
Flexural Strength 28 Days	>1,400 psi	ASTM C-78
Tensile Strength 28 Days	>800 psi	ASTM C-190
Shrinkage 28 Days at 90% RH	0.0%	ASTM C-157
Shear Bond 28 Days	>2,000 psi	ASTM C-882
Freeze/Thaw	100 cycles, No damage	ASTM C-666
Chloride Permeability	< 500 coulombs	AASHTO T-277

3.6 Rehabilitation in Moderate to High Corrosive Environments (Ph range 2+)

If the substrate shows signs of moderate to high corrosion or degradation due to hydrogen sulfide (H₂S) attack, PARSON CA LINER 100, a 100% Calcium Aluminate Cement with select aggregates, or approved equal is recommended. Surfaces should have a minimum profile of 1/8". Substrate should be water saturated, surface moist using clean, potable water. PARSON CA LINER 100 can be applied by low to medium velocity wet mix shotcrete equipment or by trowel. Application thickness up to 2" in a single lift as required by each structure to return surface to original dimensions. Finish may be done by trowel, float and/or brush depending on desired finish.

PARSON CA LINER 100

Compressive Strength 28 Days	>9,000 psi	ASTM C-109
Flexural Strength 28 Days	>1,200 psi	ASTM C-293
Tensile Strength 28 Days	>800 psi	ASTM C-190
Shrinkage 28 Days at 90% RH	0.0%	ASTM C-157
Shear Bond 28 Days	>2,000 psi	ASTM C-882
Freeze/Thaw	100 cycles, No damage	ASTM C-666
Chloride Permeability	< 300 coulombs (very low)	
Sulfide Resistance	No weight loss after 90 days in 20,000 ppm aqueous sulfuric acid solution	ASTM C-267

3.7 Rehabilitation in Moderate to High Corrosive Environments (Ph range 1+)

If the substrate shows signs of high corrosion or degradation due to hydrogen sulfide (H2S) attack, PARSON CA LINER 100+, a 100% pure fused Calcium Aluminate Cement and aggregate lining, or approved equal is recommended. Surfaces should have a minimum profile of 1/8". Substrate should be water saturated, surface moist using clean, potable water. PARSON CA LINER 100+ can be applied by low to medium velocity wet mix shotcrete equipment or by trowel. Application thickness up to 2" in a single lift as required by each structure to return surface to original dimensions. Finish may be done by trowel, float and/or brush depending on desired finish.

PARSON CA LINER 100+		
Compressive Strength		ASTM C-109
24 hours	6,000 psi	
28 Days	>9,000 psi	
Flexural Strength		ASTM C-293
24 hours	1,400 psi	
28 Days	>1,700 psi	
Tensile Strength		ASTM C-190
28 Days	>900 psi	
Shrinkage		ASTM C-157
28 Days at 90% RH	0.0%	
Shear Bond		ASTM C-882
28 Days	>2,400 psi	
Density	150 pcf	
Freeze/Thaw	100 cycles, No damage	ASTM C-666
Chloride Permeability	< 300 coulombs (very low)	
Sulfide Resistance	No weight loss after 90 days in 20,000 ppm aqueous sulfuric acid solution	ASTM C-267

3.8 Rehabilitation in High Corrosive Environments (Ph range .5+)

Rehabilitation and repair shall be accomplished in accordance with sections: (3.1); (3.2); (3.3) of this document. After completion and inspections of work accomplished under these sections, application of a monolithic lining of PARSON MH LINER, or CA LINER 100 with an integral corrosion barrier topcoat of PARSONPOXY SEL-80 (suggested 80 mils thickness) or approved equal shall be accomplished.

PARSONPOXY SEL-80		
Cure Time	24 hours	
Compressive Strength	19,500 psi	ASTM D-695
Tensile Strength	8,000 psi	ASTM D-638
Flexural Strength	12,700 psi	ASTM D-790
Elongation	4.3% min.	ASTM D-638
Adhesion	Substrate Failure	ASTM D-4541, Concrete
	>1,500 psi	Steel (SSPC-10)
Hardness, Shore D	88	ASTM D-2240
Water Vapor Transmission	3.6 gms/sq.m per 24 hrs	ASTM-1653, Method B
Taber Abrasion, CS17 Wheel	<110 mg loss	ASTM D-4060, 1000 g load / 1000 cycles
Temperature Resistance	>220°F	Steel, unprimed and concrete
Chemical Resistance	Excellent	

3.9 Rehabilitation in High Corrosive Environments (Ph range .5+)

Rehabilitation and repair shall be accomplished in accordance with sections: (3.1); (3.2); (3.3) of this document. After completion and inspections of work accomplished under these sections, application of PARSONPOXY SEL-80HB as a stand alone corrosion barrier coating, or as a corrosion barrier topcoat over PARSON MH LINER or CA LINER 100 (suggested 125 mils thickness) or approved equal shall be accomplished.

PARSONPOXY SEL-80HB

Cure Time	8 hours	
• Compressive Strength	19,500 psi	ASTM D-695
• Tensile Strength	8,000 psi	ASTM D-638
• Flexural Strength	12,700 psi	ASTM D-790
• Elongation	4.3% min.	ASTM D-638
• Adhesion	Substrate Failure	ASTM D-4541, Concrete
	>1,500 psi	Steel (SSPC-10)
• Hardness, Shore D	88	ASTM D-2240
• Water Vapor Transmission	3.6 gms/sq.m per 24 hrs	ASTM-1653, Method B
• Taber Abrasion, CS17 Wheel	<110 mg loss	ASTM D-4060, 1000 g load / 1000 cycles
• Temperature Resistance	>220°F	Steel, unprimed and concrete
• Chemical Resistance	Excellent	

3.10 Frame & Cone (Chimney) Inflow / Infiltration Correction.

- 3.10.1 Joints to receive a two component, flexible, modified epoxy/ urethane hybrid Joint Sealant shall utilize PARSONPOXY FP or approved equal. The joint and surrounding area shall be clean, structurally sound and free from oil, grease, loose mortar, paints and other contaminants.

PARSONPOXY FP

Elongation	600%	ASTM D-412
Tensile Strength	1600 psi	ASTM D-412
Impact Flexibility	120 inch pounds	ASTM D-256
Hardness, Shore A	80	ASTM D-2240
Adhesion	350 psi (substrate failure)	ASTM D-4541
Slant Shear Strength	2000 psi	ASTM D-638

3.10.2 FLEXRIB SEAL

Joints to receive a flexible seal manufactured from EPDM or Polyisoprene Rubber with internal Stainless Steel expansion bands shall utilize FLEXRIB SEAL or approved equal. Remove rust, dirt, seals and other debris from the inside of the frame casting and the manhole cone area where the seat will be installed.

FLEXRIB SEAL

Elongation	500%	ASTM D-412
Tensile Strength	1580 psi	ASTM D-412
Hardness, Shore A	48	ASTM D-2240
Tear Resistance	>210/bf/in	ASTM D-624, method B

3.11 Invert/Channel Repair

For repairs requiring a cementitious material use PARSON RPM, or approved equal. Install a pipe plug, with bypass if available, into upstream pipe to completely stop flow into the invert/channel of the manhole. The surface may be damp or saturated surface dry (SSD), but have no standing water or hydrostatic leaks present. Apply product to a nominal thickness of 1/2" thick and trowel smooth. Wait a minimum of 30 minutes before removing pipe plug and releasing flow.

3.12 Manhole Cover Inflow Correction

Should prevention of groundwater inflow through the manhole cover be required, a PARSON MANHOLE INSERT or approved equal shall be installed under the cover. The insert shall be manufactured to exact measurements and made of High Density Polyethylene Copolymer or Stainless Steel material. The manhole insert shall vent the sewer system by means of two ventilation holes or valve(s) (1 or 2) manufactured of an Ethylene Propylene compound. An adhesive backed, closed cell neoprene or cross linked polyethylene gasket may be applied as required on the underside of the rim of the insert by the manufacturer. A corrosion resistant nylon lifting strap shall also be included and installed by the manufacturer.

HDPE Plastic (ASTM D-1248, Class A, Cat. 5 Type III)

Impact brittleness	-105 deg. F	ASTM D-746-70
Softening Temperature	254 deg. F	ASTM D-1525-70
Tensile Strength	700 psi	ASTM D-638-71A
Thickness Uniform	1/8 in.	

STAINLESS STEEL

Corrosion Resistance	Excellent	
Tensile Strength	600 MPa	ASTM A-240M
Density	8,000 kg/m ³	
Endurance Limit	240 MPa	

The manhole frame rim shall be cleaned of all dirt and debris prior to measuring. The manhole insert shall be manufactured per exact measurements determined from charts available from PARSON ENVIRONMENTAL PRODUCTS. Measurements must be done in strict accordance with manufacturer's instructions.

4 Preconstruction Conference. Prior to the start of work, a preconstruction conference shall be scheduled and attended by the Owner's Representative, the Contractor's Project Manager, the Inspector(s) and any other persons deemed necessary by the Owner. All contract technical specifications and drawings shall be reviewed for completeness. Any errors, omissions, ambiguities or proposed changes in the work shall be discussed and agreed upon by all parties. Job safety requirements shall be fully reviewed and agreed to by all parties.

5 Safety. The contractor shall comply with all federal, state, and local laws and regulations governing safety in the workplace. The Contractor shall provide barricades, warning signs and traffic control at/around the structure as necessary to assure safety of both workers and the public. After opening the structure, the Contractor shall test the air in the structure to assure safe levels of oxygen, toxic gases and combustible gases. Before entry of personnel, the structure shall be suitably ventilated and lighted, using explosion proof equipment as necessary. Suitable personnel safety gear and equipment shall be provided to permit access to the surfaces of the structure where rehabilitation work is to be done. The contractor shall be confined space entry certified for all workers on crew.

6 Waste Control & Disposal. The contractor shall comply with all federal, state, and local laws and regulations governing handling, storage and disposal of waste materials. Suitable provisions shall be made by the Contractor to collect and remove all generated waste and debris from the structure and to insure that none of these generated materials enters the sewer system. If the structure must be removed from service during rehabilitation, the Contractor shall plug all inflow and outflow lines and pump as necessary as defined in separate sections of the bid documents.

7 Final Acceptance. After the various types and stages of rehabilitation work have been completed, the work shall be visually inspected and physically tested (if deemed necessary) for compliance with the specification's performance standards. The Contractor shall perform these tests in the presence of the Inspector/Engineer, as required. The Engineer reserves the right to inspect the rehabilitated manholes and structures during the warranty period. The contractor shall correct any leakage or defects on the work found by this inspection within an agreed-upon time at no additional cost to the Owner.

8 Measurements for Payments. Payment shall be made at the unit price per vertical foot of depth measuring from the invert to the frame or at lump sum per manhole. In the case of other structures, payment will be made on a per square foot basis or lump sum basis.

CHEMICAL GROUTING

Guide Specification

PART 1 - GENERAL

1.01 SCOPE OF WORK

This section governs all work, materials and testing required for the chemical grouting of concrete defects. Concrete structures with active leaks shall be repaired as indicated in the Plans and Specifications.

1.02 DESCRIPTION

The Contractor shall be responsible for furnishing all labor, materials, equipment, and testing required for the completion of chemical grouting of Concrete Structures defects in Accordance with the Contract Documents.

1.03 MANUFACTURER'S RECOMMENDATIONS

All Materials, additives, mix ratios, and procedures needed for the grouting process shall be in accordance with manufacturer's recommendations. Manufacturer must provide material data sheets and M.S.D.S sheets.

1.04 TANKS AND STRUCTURES

Structures to be grouted are concrete construction.

PART 2 - PRODUCTS

All products are to from the same Manufacturer

2.01 GROUTING MATERIALS

Chemical grout shall be a Polyurethane based material designed for use in a wet environment. Material must be capable of with standing movement caused by thermal cycle changes and or settling of the structure.

Grouting Materials: BY Parson Environmental Products, Inc.

Polyurethane Chemical Grout

HYDRO GROUT

MULTI GROUT

FLEXIFOAM

PERMA-SEAL

2.01 GROUTING MATERIALS (Continued)

Injection Accessories

OAKUM ROPE

INJECTION PORTS

PARSON QUICK PLUG

PARSON RPM

The following properties shall be exhibited by the grout.

1. Documented service of satisfactory performance in similar usage.
2. Controllable reaction times and shrinkage through the use additives supplied by the manufacturer. The minimum set time shall be established by so that adequate grout travel is achieved.
3. Resistance to chemicals; to most organic solvents, mild acids and alkali.
4. The chemical shall be essentially non-toxic in a cured form.
5. The material shall be able to withstand freeze/thaw and moving load conditions.

2.02 ADDITIVES

Additives may be utilized for catalyzing the reaction, lowering the freezing temperature of the chemical, and minimizing dehydration of the materials.

2.03 MATERIAL IDENTIFICATION

The Contractor shall completely identify the types of grout, mortar, and sealant used and provide case histories of successful use or provide proper documentation on the choice of grouting materials based on chemical and physical properties, ease of application, and expected performance, to the satisfaction of the Engineer.

2.04 MIXING AND HANDLING

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 to minimize hazard to personnel. It is the responsibility of the Contractor to provide appropriate protective measures to ensure that chemicals or gels are handled by authorized personnel in the proper manner. All equipment shall be subjected to the approval of the Engineer. Only personnel authorized by the Manufacturer and thoroughly familiar with the handling of the grout material and additives shall perform the grouting operations.

PART 3 - EXECUTION

3.01 GENERAL

Polyurethane grouting shall not be started until any structural repairs are complete if needed.

3.02 PRELIMINARY REPAIRS

A. The Contractor shall seal all voids and cracks larger than approximately one-half (1/2) inch in Width. All cracked or deteriorated material shall be removed from the area to be patched and replace with a waterproof quick setting mortar such as PARSON QUICK PLUG, in accordance with manufacturer's specifications.

B. The Contractor shall perform the necessary assessments prior to starting the job.

3.03 TEMPERATURE

Normal grouting operations shall be performed in accordance with manufacturers recommendations.

3.04 GROUTING MATERIAL USAGE

Grouting of concrete structure a manhole may include, wall, pipe seals, expansion joints, wall to flattop joint, and/or bench/trough. The Engineer will direct areas of the structure designated to be grouted. If entire structure is scheduled for grouting, it shall include wall, pipe seals, floors, and bench/trough. Pipe seal grouting shall include all pipe seals in the specified areas.

3.05 DRILLING AND INJECTION

A. Injection holes shall be drilled through the structure at locations as per industry standards

B. Grout shall be injected with the proper pump and pressures as with suitable ports and packers. Injection pressure shall not cause damage to the manhole structure or surrounding surface. Grout shall be injected through the lowest holes first until rejection or grout is visible at the next port or on the surface. This procedure shall be repeated until the Structure is sealed.

C. Grout travel shall be verified by observation of grout to defects or adjacent injection holes.

Provide additional injection holes, if necessary to ensure grout travel.

D. Injection holes shall be cleaned with a drill and patched with a waterproof quick setting mortar such as PARSON QUICK PLUG or PARSON RPM.