

# TECHNICAL 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.
- 3 Execution:** Manholes requiring rehabilitation are listed or tabulated in the contract documents. The list will identify and locate the manholes to be rehabilitated, the type of rehabilitation required and the vertical footage for each manhole.

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

### 3.2.1 PARSON QUICK PLUG

Compressive Strength		ASTM C-109
15 Minutes	750 psi	
1 Hour	1,500 psi	
1 Day	3,700 psi	
7 Days	4,900 psi	
28 Days	5,500 psi	
Set time	60 seconds	ASTM C-191
Sulfate Resistance, Passed	25 Cycles Min	ASTM C-88
Freeze-Thaw Resistance, Passed	100 Cycles, no damage	ASTM C-666
Expansion	0.10%	ASTM C-827
Pull Out Strength, lbs.	14,500 lbs.	ASTM C-234
Bond Strength	1 Hour >400 psi	ASTM C-321
	24 Hours >1,000 psi	
Shrinkage	0% @ 90% RH	ASTM C-596
Density	105-110 pcf	

### 3.2.2 PARSON HYDRO GROUT (Hydrophobic)

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

### 3.2.3 PARSON PERMA SEAL (Hydrophilic)

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

### 3.2.4 PARSON SEAL-TITE (Hydrophobic)

Viscosity	A-200 cps @77°F B-800 cps @77°F	Brookfield Method
Density (Free Rise)	4 lbs/cu. ft.	ASTM D-1622
(Confined)	20 lbs/cu. ft.	
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	3 - 5 seconds	
Expansion Time	30 seconds	

### 3.3 Hydraulic Cement Patching.

Patching of manhole walls is recommended in areas where large voids exist, such as mortar missing between bricks, around steps and frames pipe penetrations. All loose, cracked and corroded material shall be removed from the area to be patched, exposing a sound substrate. PARSON RPM or approved equal, is recommended. The product shall be allowed to sufficiently harden prior to application of coating or lining product.

<b>PARSON RPM</b>		
Compressive Strength		ASTM C-109
1 day	>6700 psi	
7 days	>8000 psi	
28 days	>9000 psi	
Tensile Strength		ASTM C-190
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	0.0%	ASTM C-596
Freeze/Thaw	100 cycles, no damage	ASTM C-666

### 3.4 Rehabilitation in Low to Moderate Corrosive Environments

If substrate shows low to moderate signs of corrosion or requires structural enhancement, PARSON MH LINER or approved equal, is recommended. 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.

<b>PARSON MH LINER</b>		
Compressive Strength		ASTM C-109
1 Day	>4,000 psi	
28 Days	>9,000 psi	
Flexural Strength		ASTM C-293
28 Days	>1,600 psi	
Tensile Strength		ASTM C-496
28 Days	>800 psi	
Shrinkage		ASTM C-596
28 Days @ 90% RH	0.0%	
Bond		ASTM C-882
28 Days	>2,000 psi	
Freeze/Thaw	300 cycles, No damage	ASTM C-666
Permeability	< 300 coulombs	AASHTO T-277
Applied Density	125 pcf	
Sulfide Resistance	No wt. Loss after 90 Days in 20,000 ppm aqueous sulfuric acid solution	ASTM C-267

### 3.5 Rehabilitation in Moderate to High Corrosive Environments

If the substrate shows signs of moderate to high corrosion or degradation, PARSON CA LINER 100, a 100% Calcium Aluminate Cement with select aggregates, or approved equal is recommended. 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.

<b>PARSON CA LINER 100</b>		
Compressive Strength		ASTM C-109
1 Day	>5,500 psi	
28 Days	>9,000 psi	
Flexural Strength		ASTM C-293
28 Days	>1,600 psi	
Tensile Strength		ASTM C-496
28 Days	>800 psi	
Shrinkage		ASTM C-596
28 Days at 90% RH	0.0%	

Bond		ASTM C-882
28 Days	>2,000 psi	
Applied Density	130 pcf	
Freeze/Thaw	300 cycles, No damage	ASTM C-666
Permeability AASHTO T-277	< 300 coulombs (very low)	
Sulfide Resistance	No wt loss after 90 days in 20,000 ppm aqueous sulfuric acid solution	ASTM C-267

### 3.6 Rehabilitation in High Corrosive Environments

If the substrate shows signs of high corrosion or degradation, PARSON CA LINER 100+, a 100% pure fused Calcium Aluminate Cement and Calcium Aluminate aggregate mortar, or PARSON GEOLINER, a Geopolymer product, or approved equal is recommended. Either product 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.

#### 3.6.1 PARSON CA LINER 100+

Compressive Strength		ASTM C-109
1 Day	>6,000 psi	
28 Days	>9,000 psi	
Flexural Strength		ASTM C-78
24 hours	>1,400 psi	
28 Days	>1,700 psi	
Tensile Strength		ASTM C-496
28 Days	>900 psi	
Shrinkage		ASTM C-596
28 Days at 90% RH	0.0%	
Bond		ASTM C-882
28 Days	>2,400 psi	
Density	135 pcf	
Freeze/Thaw	300 cycles, No damage	ASTM C-666
Permeability	< 300 coulombs (very low)	AASHTO T-277
Sulfide Resistance	No wt. loss after 90 days in 20,000 ppm aqueous sulfuric acid solution	ASTM C-267

#### 3.6.2 PARSON GEOLINER

Compressive Strength		ASTM C-109
1 day	> 3,000 psi	
Bond		ASTM C-882
28 days	> 2,000 psi > 8,000 psi	
Flexural Strength		ASTM C-293
28 days	> 800 psi	
Shrinkage		ASTM C-596
28 days	0.0% (at 90% RH)	
Tensile Strength		ASTM C-496
28 days	> 800 psi	
Freeze/Thaw	300 cycles, No damage	ASTM C-666
Applied Density	135 pcf	
Sulfide Resistance	No weight loss after 90 days in 20,000 ppm aqueous sulfuric acid solution	ASTM C-267

### 3.7 Rehabilitation in Extremely High Corrosive Environments

Surface preparation and repairs 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-80 or PARSONPOXY SEL-80HB epoxy corrosion barrier coatings, or approved equal shall be accomplished using equipment approved by the coatings manufacturer.

#### 3.7.1 PARSONPOXY SEL-80

Recommended thickness	80-100 mils	
Set Time @ 70°F	6-8 hours	
Recoat time	tack free up to 12 hours	
Cure Time @ 70°F	18-20 hours	
Compressive Strength	19,500 psi	ASTM D-695
Tensile Strength	8,000 psi	ASTM D-638
Flexural Strength	13,000 psi	ASTM C-790
Elongation	4.3% min.	ASTM D-638
Flexural Modulus (initial)	750,000 psi	ASTM D-790
Flexural Modulus (long term)	375,000 psi	ASTM D-790
Modulus of Elasticity	554,000 psi	ASTM D-638
Impact, IZOD	0.315 ft lb	ASTM D-256
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	

#### 3.7.2 PARSONPOXY SEL-80HB

Recommended thickness	125-150 mils	
Set Time @ 70°F	3-5 hours	
Recoat time	tack free up to 8 hours	
Cure Time @ 70°F	12-14 hours	
Compressive Strength	19,500 psi	ASTM D-695
Tensile Strength	8,000 psi	ASTM D-638
Flexural Strength	13,000 psi	ASTM D-790
Flexural Modulus (initial)	750,000 psi	ASTM D-790
Flexural Modulus (long term)	375,000 psi	ASTM D-790
Modulus of Elasticity	554,000 psi	ASTM D-638
Elongation	4.3% min.	ASTM D-638
Impact, IZOD	0.315 ft lb	ASTM D-256
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	

#### 3.7.3 COMPOSITE LINER SYSTEM

Compressive Strength	19,500 psi	ASTM D-695
Flexural Strength	13,000 psi	ASTM D-790
Flexural Modulus	1,500,000 psi	ASTM D-790
Tensile Strength	8,000 psi	ASTM D-638
Modulus Of Elasticity	550,000 psi	ASTM D-638
Elongation	4.3%	ASTM D-638
Adhesion to Concrete	substrate failure	ASTM D-4541 (in-house)

#### 3.7.4 CONBLOCK MIC

Color: Clear	pH: 3.8
Odor: None	Actives Content: 3.6%
Density: 8.3 lbs./gal.	Volatile Content: < 1.0%

### 3.8 Internal or External Frame & Cone and Joint Inflow / Infiltration Correction.

3.8.1 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

3.8.2 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/lb/in	ASTM D-624, method B

### 3.9 Invert/Channel Repair

3.9.1 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.

(Refer to Section 3.3 for Physical Properties)

3.9.2 For repairs requiring an epoxy material use Parsonpoxy FS1. Install a pipe plug, with bypass if available, into upstream pipe to completely stop flow into the invert/channel of the manhole. The surface must be as clean and dry as possible. Apply product to a thickness of 100 mils. Allow a minimum of 45 minutes before removing pipe plug. Be careful not to damage coating.

#### PARSONPOXY FS1

Slant Shear Strength ASTM C-882	100% concrete failure
Compressive Strength ASTM D-695	19,500 psi
Tensile Strength ASTM D-638	8,000 psi
Shore D Hardness ASTM D-2240	88

### 3.10 Manhole Cover Inflow Correction

When prevention of groundwater inflow through the manhole cover is required, a PARSON MANHOLE INSERT or approved equal is recommended. The insert shall be manufactured of Ultra High Density, high molecular weight Polyethylene Copolymer or Stainless Steel material and be trimmed to exact measurements as provided by the customer. The manhole insert shall vent the manhole by means of two ventilation holes or valve(s) 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 1" heavy weight polypropylene strap shall also be included and installed by the manufacturer.

#### 3.10.1 Ultra High Density, high molecular weight Polyethylene

Impact brittleness	-180 deg. F	ASTM D-1248, Class A, Cat. 5 Type III
Softening Temperature	254 deg. F	ASTM D-746-70
Tensile Strength	3800 psi	ASTM D-1525-70
Elongation	800%	ASTM D-638-71A
Thickness Uniform	1/8 in.	

#### 3.10.2 STAINLESS STEEL (Grade 304)

Corrosion Resistance	Excellent	
Tensile Strength	600 MPa	ASTM A-240M
Density	8,000 kg/m <sup>3</sup>	
Thickness	18 gauge	

# 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 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 cased by thermal cycle changes and or settling of the structure.

**Grouting Materials:** BY Parson Environmental Products, Inc.

#### **Polyurethane Chemical Grout**

HYDRO GROUT

PERMA-SEAL

#### **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.