

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 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
	62 Cycles	
Freeze-Thaw Resistance, Passed	+ 0.02	ASTM C-157
Shrinkage/Expansion	12,000 lbs.	ASTM C-234
Pull Out Strength, lbs.		
(4# bar imbedded 6 inches in a cement pocket of 1.5 inch diameter)		

PARSON HYDRO GROUT

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 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. 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		ASTM C-109
28 Days	>9,000 psi	
Flexural Strength		ASTM C-78
28 Days	>1,600 psi	
Tensile Strength		ASTM C-190
28 Days	>800 psi	
Shrinkage		ASTM C-157
28 Days	0.0%	
Shear Bond		ASTM C-882
28 Days	>2,000 psi	

Freeze/Thaw	300 cycles, No damage	ASTM C-666
Chloride Permeability	< 500 coulombs	AASHTO T-277
Density	130 pcf	

3.5 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. 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	>1,600 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
Density	140 pcf	
Freeze/Thaw	300 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

3.6 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. 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 24 hours	6,000 psi	ASTM C-109
28 Days	>9,000 psi	
Flexural Strength 24 hours	1,400 psi	ASTM C-293
28 Days	>1,700 psi	
Tensile Strength 28 Days	>900 psi	ASTM C-190
Shrinkage 28 Days at 90% RH	0.0%	ASTM C-157
Shear Bond 28 Days	>2,400 psi	ASTM C-882
Density	150 pcf	
Freeze/Thaw	300 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 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-80 epoxy corrosion barrier coating, or approved equal applied at a thicknesses up to 80 mils. shall be accomplished using equipment approved by the coatings manufacturer. If additional coats are required to achieve desired thickness, apply when tack-free and up to 12 hours. If maximum recoat time of 12 hours has been exceeded, the coating surface must be sandblasted or grinded to create a profile. Pressure wash to remove residue and dry with towels or forced air. Application temperature range is 40°F and 110°F.

PARSONPOXY SEL-80

Set Time at 70°F	4 – 8 hours	
Cure Time at 70°F	24 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
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
Impact, IZOD	0.315 ft lb/in of notch	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	

3.8 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 PARSONPOXY SEL-80HB epoxy corrosion barrier coating or approved equal, applied at thicknesses up to 125 mils. shall be accomplished, using equipment approved by the coatings manufacturer. If additional coats are required to achieve desired thickness, apply after tack-free and up to 12 hours. If maximum recoat time of 12 hours has been exceeded, the coating surface must be sandblasted or grinded to create a profile. Pressure wash to remove residue and dry with towels or forced air.

PARSONPOXY SEL-80HB

Set Time at 70°F	4 – 6 hours	
Cure Time at 70°F	12 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/in of notch	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	

3.9 Mortar / Epoxy Composite System

3.9.1 Cementitious Mortar Underlayment

Apply minimum ½" and up to 3" of PARSON MH LINER or 2" PARSON CA LINER 100 Cementitious Mortar to walls and bench using low to medium viscosity wetmix shotcrete equipment, or by trowel. Substrate should be water saturated, surface moist using clean, potable water. Finishing may be done by trowel, float, and/or brush, depending on desired finish. Refer to product sheet for mixing and applications instructions.

	PARSON MH LINER	PARSON CA LINER 100
Compressive Strength 28 Days ASTM C-109	>9,000 psi	>9,000 psi
Flexural Strength 28 Days ASTM C-78	>1,400 psi	>1,600 psi
Tensile Strength 28 Days ASTM C-109	>800 psi	>800 psi
Shrinkage ASTM C-157 28 Days at 90% RH	0.0%	0.0%
Shear Bond 28 Days ASTM C-882	>2,000 psi	>2,000 psi
Freeze/Thaw ASTM C-666	100 cycles, No damage	300 cycles, No damage
Chloride Permeability AASHTO T-277	<500 coulombs	<300 coulombs

3.9.2 Epoxy Corrosion Barrier Topcoat

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-80 and PARSONPOXY SEL-80HB as a corrosion barrier topcoat over MH LINER or CA LINER 100 shall be accomplished using manufacturer approved equipment. Recommended application time is within 24 hours after placement of PARSON MH LINER or CA LINER 100. Applicators must be trained and approved by the manufacturer. If the recommended time frame is exceeded, one of the following procedures must be performed prior to application of PARSONPOXY SEL-80 or SEL-80HB. (1) Reclean the structure in accordance with section 3.1 and dry using forced air. (2) Reclean the structure in accordance with section 3.1 and apply ½" of PARSON MH LINER or CA LINER 100 in accordance with section 3.3. (3) Apply denatured alcohol using concrete brush and dry using forced air.

	PARSONPOXY SEL-80	PARSONPOXY SEL-80HB
Set Time at 70°F	4-8 hours	4-6 hours
Cure Time at 70°F	24 hours	12 hours
Compressive Strength ASTM D-695	19,500 psi	19,500 psi
Tensile Strength ASTM D-638	8,000 psi	8,000 psi
Flexural Strength ASTM D-790	13,000 psi	13,000 psi
Elongation ASTM D-638	4.3% min.	4.3% min.
Flexural Modulus ASTM D-790 (initial)	750,000 psi	750,000 psi
Flexural Modulus ASTM D-790 (long term)	375,000 psi	375,000 psi
Impact, IZOD ASTM D-256	0.315 ft lb/in of notch	
Adhesion ASTM D-4541, Concrete	Substrate failure	Substrate failure
Steel (SSPC-10)	>1500 psi	>1500 psi
Hardness, Shore D ASTM D-2240	88	88
Water Vapor Transmission ASTM-1653, Method B	3.6 gms/sq.m per 24 hrs	3.6 gms/sq.m per 24 hrs
Taber Abrasion, CS17 Wheel ASTM D-4060, 1000 g load / 1000 cycles	<110 mg loss	<110 mg loss
Temperature Resistance Steel, unprimed and concrete	>220°F	>220°F
Chemical Resistance		Excellent
Thickness	up to 80 mils	up to 125 mils

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 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.

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

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

STAINLESS STEEL (Grade 304)

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

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.

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. Manufacture 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
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.