

**SEWER MANHOLE INSITU REPLACEMENT, PERMAFORM® FORMED-IN-
PLACE CONCRETE WITH EMBEDDED PLASTIC LINER
BY AP/M PERMAFORM®**

This process is installed only by applicators licensed by AP/M PERMAFORM® under rights granted under US Patents 4995584, 4997602, 50173313, and 5032197.

- 1 Intent:** It is the intent of this specification to provide for the non-disruptive structural replacement of sewer manholes by the installation of a formed-in-place, thick-wall, seamless concrete manhole within the existing manhole extending from the bench to the frame.

- 2 General:** This method, PERMAFORM® utilizes an internal forming system for forming a new and structurally independent wall within the existing manhole conforming generally to the existing inside dimensions and shape. The new interior wall shall have a cross-sectional dimension of sufficient thickness to be structurally independent and allow for the maximum new inside diameter. It shall be constructed of high strength ready mixed concrete designed to impart certain desirable properties for municipal and industrial sewer collection systems. This procedure does not require interruption of sewer flows at the base or at elevated points of entry.

- 3 Reference specifications:**
 - 3.1 ASTM C-39 Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens
 - 3.2 ASTM C-94 Standard Test Method for Ready-Mix Concrete
 - 3.3 ASTM C-143 Standard Test Method for Slump of Hydraulic Cement Concrete
 - 3.4 ASTM D-149 Standard Test Method for Dielectric Breakdown Voltage and Dielectric Strength of Solid Electrical Insulating Materials at Commercial Power Frequencies
 - 3.5 NACE RP0274 High Voltage Electrical Inspection of Pipeline Coating Prior to Installation

- 4 Materials:**
 - 4.1 **Concrete:** The concrete shall be Type I/II Portland cement concrete with 5/8 inch minus coarse aggregate with fiber reinforcement and plasticizers producing an average compressive strength of 4,000 psi at full cure. (Other formulations and filler materials may be selected to meet specific needs.)
 - 4.2 **Plastic liner:** When corrosive elements are present, a ribbed or studded plastic liner shall be anchored into the new interior wall during the procedure to create an impermeable barrier. The plastic liner shall be PVC, PE or other as best suited for the corrosion condition and compatibility with the pipe liner.

- 5 Manhole Acceptance:** The new interior shall be inspected by the Contractor in the presence of the Owner's Representative to ensure its integrity. NACE RP0274 spark testing standard shall be used as prescribed for the material and thickness to detect cracks and thin spots in the entire interior. Any defects shall be promptly repaired and reinspected.

6 Submittals:

6.1 All submittals shall conform completely to the requirements of the Contract document.

6.2 The following items may be required of the *installer* to be submitted to the *engineer*. This Contract shall not be considered complete until receipt and acceptance of the following:

- A Reference submittals
 - a Contractor certification
 - b Material certification

- B Product data
 - a Design mix
 - b Plastic liner

7 Product handling: Special handling is not required.

8 Product installation:

8.1 **Preparation:** The Contractor shall employ adequate cleaning to remove loose material and debris from the manhole. Existing steps which might interfere with the erection of the forms shall be removed. Precautions shall be taken to prevent foreign material from entering the active lines. Infiltration which may adversely affect placement of the concrete shall be eliminated or reduced to an acceptable level.

8.2 **Equipment:** Segmented, stackable steel forms shall be bolted together in cylindrical and conical sections with either eccentric or concentric cones or flat top ceilings and conform generally to the interior shape of the existing manhole.

8.3 **Installation procedure:**

- A Pipe extensions shall be placed through the new concrete wall at the base and at higher points of entry, such as drop inlets, to maintain flows during the procedure.

- B The form shall be sized and erected to conform to the existing interior dimensions and shape. The space between the forms and the existing wall shall be of a sufficient thickness, usually 3 inches and no less than 1½ inches. The finished opening shall have a minimum diameter of 20 inches.

- C The form shall be positioned, sealed and finished at the manhole base to ensure concrete does not enter the sewer.

- D The concrete shall be carefully placed from the bottom up in such a manner as to prevent segregation of the cement and aggregate. The concrete shall be consolidated to fill all pockets, seams and cracks within the existing wall.

- E When the concrete has sufficiently cured to preclude slump or damage, the form shall be disassembled and removed.
- F If the plastic liner is employed, it shall be fitted securely to the exterior of the steel forms during their erection within the manhole. When the forms are removed, any joints in the liner shall be welded and tested.
- G The bench shall receive an overlay of concrete or MS-10,000 as directed by the engineer at a thickness of three inches at the wall tapering to 1/2" at the edge of the invert channel. When corrosion resistance is needed, the bench shall receive a coating of COR+GARD® 100% solids epoxy.

Prior to the overlay, a hydrophylic sealing strip shall be placed around the circumference of the bench where it meets the vertical wall and around all pipe penetrations to form a water stop.

- H At the frame and cover, the plastic lining may be folded under the frame and reset with butyl mastic.

- OR -

The plastic liner may extend 1/4" above the finished concrete at which time COR+GARD® epoxy is poured into such space against the plastic liner to seal any exposed concrete.

- OR -

A flexible chimney seal may be attached or applied to the upper 3" portion of the plastic liner and the lower 3" portion of the prepared frame.

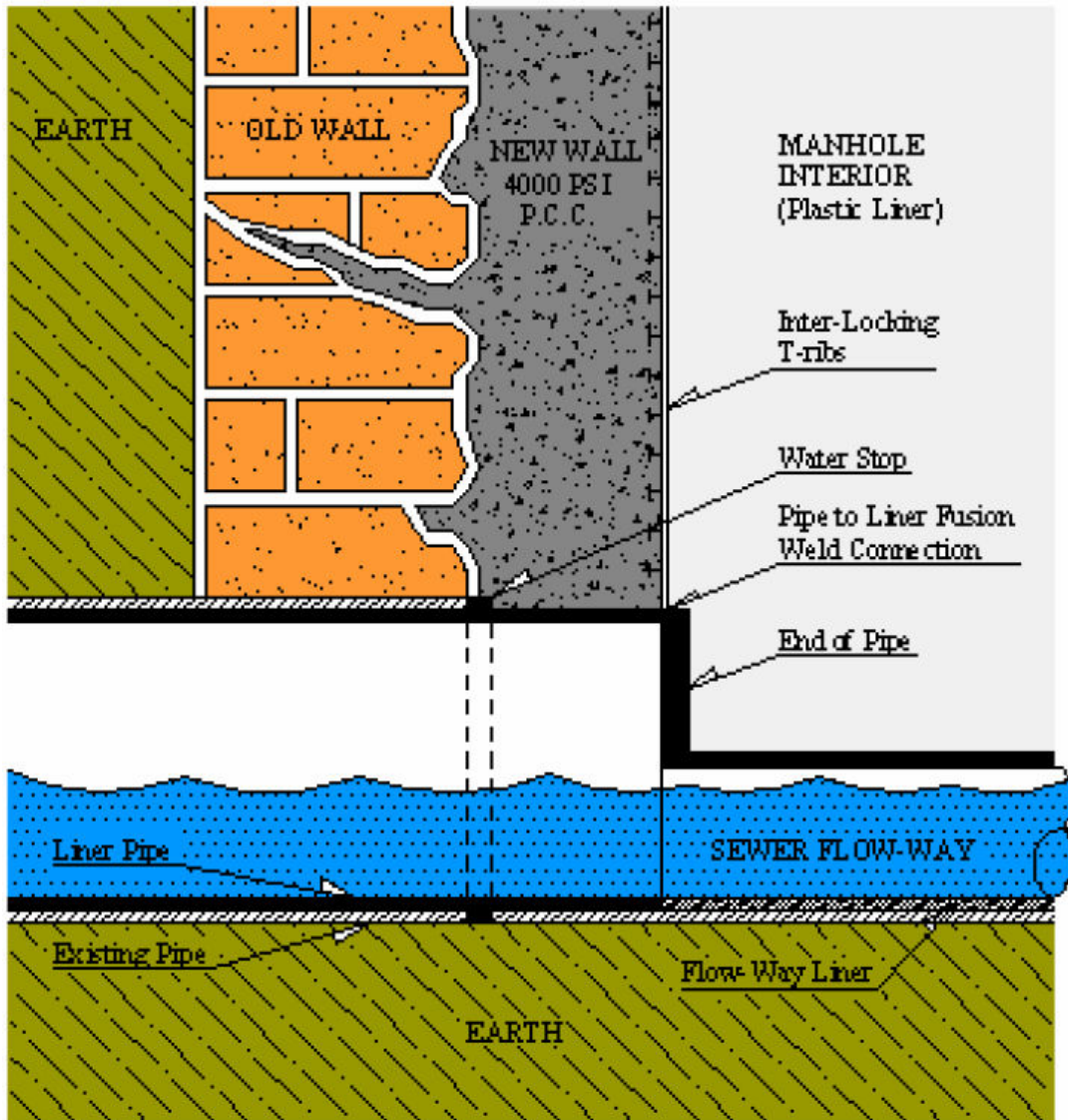
- I Sealing at all pipe penetration shall be accomplished using one of the following procedures:
 - a If the penetrating pipe is PVC and the liner is PVC or if the penetrating pipe is PE and the liner is PE, a fusion or extrude weld shall be made at their jointure with the new plastic lined wall.
 - b If the penetrating pipe is clay (VCP), cast iron, ductile iron or other material, a flat square section of the plastic liner approximately 1.5 times the pipe diameter shall be fitted over the penetrating pipe and fastened with a stainless steel hose clamp. Then it shall be folded back over the hose clamp and flush with the plastic liner embedded into the wall. A weld strip or an extrude bead shall be welded along each edge of this flashing.

8.4 **Finish:** The resultant concrete interior wall shall be smooth and free of honeycomb and areas of segregated aggregate.

8.5 **Cleanup:** Upon completion, the Contractor shall clean up the work site and properly dispose of any excess material or debris.

8.6 **Safety:** The assembled internal manhole forms shall be bolted together to prevent shifting and shall have sufficient stiffness and strength to prevent collapse. All work shall be performed in strict accordance with the city and OSHA safety standards for confined space entry procedures.

- 9 **Measurement for Payment:** 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.



Typical cross section of PERMAFORM® manhole with plastic liner and pipe seal