SUGGESTED MANHOLE FRAME SEALING SPECIFICATION
(Rehabilitation)

PART 1 GENERAL

1.01 SCOPE
This specification includes the materials and procedures required for the internal sealing of the frame-chimney joint area of brick and block manholes and the entire chimney area of precast, fiberglass and plastic manholes, as shown on the attached drawings.

1.02 WORK REQUIRED
A. An internal manhole frame seal, as specified herein shall be installed in all manholes within the areas included in this project. If excavation is required to repair, rebuild, or replace a manhole; or if manhole linings or coatings are required, the seal shall be installed after that work has been completed.

B. Brick or Block Manholes - When frame sealing is required on brick or block manholes, an internal flexible rubber manhole frame seal, meeting the requirements of this specification, shall be used to seal the frame-chimney joint area of the manhole.

C. Precast, Fiberglass or Plastic Manholes - When frame sealing is required on precast, fiberglass or plastic manholes, an internal flexible rubber manhole frame seal and where necessary, an interlocking extension or extensions, meeting the requirements of this specification, shall be used to seal the entire chimney of the manhole. The seal and extension or extensions shall extend from the frame down to the top of the cone.

1.03 DEFINITIONS
A. Chimney - The cylindrical variable height portion of the manhole structure used to support and adjust the finished grade of the manhole frame. The chimney extends from the top of the corbel or cone to the base of the manhole frame.

B. Cone or Corbel - That portion of the manhole structure which slopes upward and inward from the barrel of the manhole to the required chimney or frame diameter. "Corbel" refers to a section built of brick or block, while "cone" refers to a precast, fiberglass or plastic section.

C. Pre-Approved Equal - A product that meets the applicable material, performance and design life requirements of this specification and has been approved by the ENGINEER for use on this project a minimum of 7 days prior to bid opening.

1.04 SYSTEM DESCRIPTION
A. Design Requirements - The manhole frame seal shall be designed to prevent leakage of water through the above described portions of the manhole throughout a 50 year design life. The seal shall also be designed so that it can be installed in manholes where the diameter of the frame and chimney or cone differ by up to 20% and on manhole cones or frame castings with sloping surfaces.

B. Performance Requirements - The frame seal shall be capable of repeated vertical movement of the frame of not less than 2 inches and/or repeated horizontal movement of not less than 1/2 inch after installation and throughout its design life.

1.05 SUBMITTALS
A. Test Report - A test report from an approved third party testing agency, showing that the seal meets the performance requirements of Section 1.04 B, shall be provided by each frame seal manufacturer or supplier. The report shall include the results of the following
test performed on a test unit on which the frame seal is attached. The test unit shall consist of a watertight base unit, at least 1 unsealed grade ring or brick course and a differentially moveable, unsealed, manhole frame. The ENGINEER reserves the right to observe the testing.

1. The manhole frame shall be raised 2 inches and moved laterally 1/2 inch. The frame shall be held in this position for a minimum of 100 hours, after which it shall be returned to its normal position.

2. The same test unit is then placed in a water tank filled to just below the top of the frame. The frame shall then be raised 2 inches and lowered back down through a minimum of 30 cycles. The frame is then raised 2 inches and held in that position while the frame is moved laterally 1/2 inch. The frame is then returned to its normal position to complete the test.

The seal shall remain in place and watertight throughout the duration of the test. Any displacement, dislodgement or leakage of the seal shall be cause for failure. Any seal that fails the test may be reworked and retested.

B. Certification (Affidavit of Compliance) - The manufacturers of all manhole frame seals shall submit a notarized certification to the Engineer stating that their product meets the design life requirements of Section I.04 A and the applicable material requirements of Section 2.01 A&B.

PART 2 PRODUCTS

2.01 FRAME SEAL

Frame seals shall consist of a flexible internal rubber sleeve, extensions and stainless steel expansion bands, all conforming to the following requirements:

A. Rubber Sleeve and Extension - The flexible rubber sleeve and extensions shall be extruded or molded from a high grade rubber compound conforming to the applicable material requirements of ASTM C-923, with a minimum 1500 psi tensile strength, maximum 18% compression set and hardness (durometer) of 48±5.

The rubber sleeve shall be double, triple or quadruple pleated with a minimum unexpanded vertical height of 8 inches, 10 inches or 13 inches respectively and a minimum thickness of 3/16 inches. The top and bottom section of the sleeve that compresses against the manhole frame casting and the chimney/cone shall have an integrally formed expansion band recess and a series of sealing fins to facilitate a watertight seal. These sealing fins shall have teardrop holes or air pockets to allow the sealing area to conform to minor surface irregularities that may be encountered.

The top section of the extension shall have a minimum thickness of 3/32 inches and shall be shaped to fit into the bottom band recess of the sleeve under the bottom chimney seal band and the remainder of the extension shall have a minimum thickness of 3/16 inches. The bottom section of the extension shall contain an integrally formed expansion band recess and multiple sealing fins matching that of the rubber sleeve.

Any splice used to fabricate the sleeve and extension shall be hot vulcanized and have a strength such that the sleeve shall withstand a 180 degree bend with no visible separation.

B. Expansion Bands - The expansion bands used to compress the sleeve against the manhole shall be integrally formed from 16 gauge stainless steel conforming to the
applicable material requirements of ASTM C-923, Type 304, with no welded attachments and shall have a minimum width of 1-3/4 inches.

The bands shall have a minimum adjustment range of 2-1/2 diameter inches and the mechanism used to expand the band shall have the capacity to develop the pressures necessary to make a watertight seal. The band shall be permanently held in place with a positive locking mechanism which secures the band in its expanded position after tightening.

C. Acceptable Manufacturers
   1. Cretex Specialty Products

2.02 EQUIPMENT
The CONTRACTOR shall have a manufacturer's recommended expansion tool and all other equipment/tools necessary to prepare the surfaces of the manhole and install the frame seals.

2.03 REPAIR MORTAR
Repair mortar shall be a one component, quick set, high strength, non shrink; polymer modified cementitious patching mortar, which has been formulated for vertical or overhead use meeting the requirements of ASTM C-109 for Compressive Strength, C-348 and C-78 for Flexural Strength and C-882 for Slant Shear Bond Strength. Repair mortar shall not contain any chlorides, gyspums, plasters, iron particles, aluminum powder or gas-forming agents nor shall it promote the corrosion of any steel that it may come in contact with.

2.04 CEMENTITIOUS GROUT
Cementitious grout shall be a premixed, non metallic, high strength, non-shrink grout which meets the requirements of ASTM C-191 and C-827 as well as CRD-C-588 and C-621. When mixed to a mortar or "plastic" consistency, it shall have minimum one day and 28 day compressive strength of 6,000 and 9,000 psi, respectively.

PART 3 EXECUTION

3.01 GENERAL
   A. Maintain manhole service throughout the duration of the project
   B. Provide 48 hour notice to the OWNER prior to start of work for the INSPECTOR to review and document the materials and equipment to be used for quality assurance and testing requirements.

3.02 QUALIFICATIONS
   A. The CONTRACTOR shall have completed the installation of internal manhole chimney seals on a minimum of 30 manholes. The CONTRACTOR may provide a minimum 8 hours on-site training by an approved representative of the manufacturer in lieu of the experience requirement for installation. The training must take place in the presence of the ENGINEER or designated representative.
   B. All installations of the internal manhole chimney seals must be supervised by a foreman responsible for installation of a minimum of 10 internal manhole chimney seals. The CONTRACTOR may provide a minimum 4 hours on-site training by an approved representative of the manufacturer in lieu of the experience requirement for installation. The training must take place in the presence of the ENGINEER or designated representative.

3.03 FIELD MEASUREMENTS
The CONTRACTOR shall field measure the manholes to determine the information required on the manufacturer's "Sizing and Ordering" procedure. This information is needed to obtain the
proper size of bands, the size, shape and width of the rubber sleeve and the need for and size of any extensions.

3.04 SURFACE PREPARATION
   A. Manhole Without Cementitious Coating
      1. All loose and protruding mortar and brick that would interfere with the seal's performance shall be removed and the appropriate areas of the manhole frame, chimney and or cone/corbel cleaned by wire brushing. All sealing surfaces shall be reasonably smooth and circular, clean and free of any loose material or excessive voids. If an adequate sealing surface does not exist on the masonry, a repair mortar conforming to the requirements of Section 2.03 shall be used to prepare a uniformly vertical three (3) to four (4) inch wide surface for the seal and/or extensions to seal against.
      2. All surface preparation shall be in accordance with the frame-chimney seal manufacturer's recommended instructions.

   B. Manhole With Cementitious Coating
      1. All loose and protruding mortar and/or brick that would interfere with the seal's performance shall be removed from the cone/corbel area of the manhole by the CONTRACTOR.
      2. The CONTRACTOR shall be responsible to ensure all sealing surfaces be reasonably smooth, circular, vertical and free of any defects or excessive voids that would prevent the seal from achieving watertightness.
      3. If an adequate vertical surface does not exist, a repair mortar, conforming to the specifications contained herein, shall be used to prepare a uniformly vertical three (3) to four (4) inch wide surface for the seal and/or extension to compress against.
      4. If the surfaces in the manhole cone/corbel provide the necessary three (3) to four (4) inch high vertical surface, the CONTRACTOR shall apply the cementitious liner material and trowel or brush the surface to achieve a uniform vertical and circular surface.
      5. Care shall be taken to prevent the buildup of any cementitious material on the frame casting. The CONTRACTOR shall take steps to either protect the inside surface of the frame casting or remove any excess cementitious material prior to it taking the initial set.
      6. The CONTRACTOR shall ensure that any diameter differential between the inside of the frame casting and the inside of the lined manhole chimney section does not exceed twenty (20) percent.
      7. All surface preparation shall be in accordance with the frame-chimney seal manufacturer’s recommended instructions.

3.05 REALIGN MANHOLE FRAME
All manhole frames that are misaligned from the chimney or cone/corbel by 3 inches or more shall be excavated and realigned. All existing frames shall be thoroughly cleaned before reinstallation. The frames shall be set in a bed of cementitious grout conforming to the requirements of Section 2.04, mixed to a mortar or “plastic” consistency. The frames shall be set so that the tops of the covers are flush with the adjoining pavement or ground surface.

3.06 INSTALLATION OF FRAME SEAL
The internal frame seals and extensions shall be installed in accordance with the manufacturers instructions.
3.07 QUALITY ASSURANCE
A. All seal installations may be subject to visual inspection by the OWNER or its representative prior to project closeout and final payment. The CONTRACTOR shall correct any deficiencies identified during the visual inspection at no additional cost.
B. The CONTRACTOR shall provide all materials and personnel required to conduct acceptance testing of the installed chimney seals and/or extensions.
C. Acceptance testing shall be conducted in the presence of the ENGINEER, OWNER or its representative.
D. Manholes failing the acceptance test must have the chimney seal and/or extension removed, reinstalled and retested.
E. The ENGINEER or its representative shall select a minimum 5% and up to a maximum of 10% of the sealed manholes for leakage testing. These manholes shall be representative of the majority of the manholes sealed. If the failure rate is 5% or less, the work shall be deemed acceptable. If the failure rate id greater than 5%, an additional test area of the same size as the original test area will be selected for additional testing. If the failure rate of the combined test areas is 5% or less, than the work shall be deemed acceptable. The testing process shall be repeated until a failure rate of 5% or less is achieved. Testing beyond the initial test area shall be conducted by the CONTRACTOR at no additional expense to the OWNER or ENGINEER.
F. Leakage Test Procedures
1. Install the chimney seal and fully tighten only the lower expansion band per the manufacturer's recommended installation instructions. Do not install the upper expansion band at this time.
2. Pulling the top of the seal away from the manhole frame, pour one-half (1/2) gallon of water behind the seal.
3. Observe the lower sealing area for a minimum of one (1) minute for any leakage.
4. If no leakage is detected, drain the water by folding the top of the chimney seal down releasing the water from behind the seal.
5. If the chimney seal passes the test, install the upper expansion band per the manufacturer's recommended installation instructions.
G. Determination of Chimney Seal Acceptance
1. If the lower band sealing area holds water without leaking during the test time, the chimney seal will have passed the test.
2. Leakage shall be defined as a visible continuous dripping or stream of water. The appearance of moisture or damp spots shall not be construed as leakage or be grounds for failure.
H. Determination of Chimney Seal Failure
1. If the lower band sealing area has any leakage as defined in Section 3.02, G.2. during the test time, the chimney seal will have failed the test.

PART 4 MEASUREMENT AND PAYMENT

4.01 MANHOLE FRAME SEAL
This item shall be paid at the unit price bid per manhole frame seal and shall include the cost of furnishing and installing an internal rubber seal along with the surface preparation work needed to facilitate its installation. Measurement shall be based on the actual number of seals installed.

4.02 MANHOLE FRAME SEAL EXTENSION
This item shall be paid at the unit price bid per manhole frame seal extension and shall include the cost of furnishing and installing an internal rubber extension along with the surface
preparation work needed to facilitate its’ installation. Measurement shall be based on the actual number of either 7 inch or 10 inch extensions installed.

4.03 REALIGN MANHOLE FRAME

A. Paved Areas - This item shall be paid at the unit price bid for frame realignment-paved, and shall include the cost of all saw cutting, pavement removal, disposal and replacement, excavation, backfill and the cleaning and reinstallation of the existing frame.

B. Unpaved Areas - This item shall be paid at the unit price bid for frame realignment-unpaved, and shall include the cost of excavation, cleaning and reinstallation of the existing frame, backfill and surface restoration.

Measurement of each item shall be based on the actual number of each type of frame realignment.

NOTE: A specifier is within his rights to issue a proprietary specification that names only one brand. If in the informed and professional judgment of the specifier, his client’s needs will be best served by naming a particular brand, then he has the responsibility to limit his specification to one source. This practice is even acceptable on publicly funded projects. This principle of proprietary specification has found legal support in the case of Whitten Corp v. Paddock Pool Builders, Inc., a Federal District Court case from Massachusetts (376 F. Supp125). Further support came in 1975 when the U.S. Supreme Court rejected further appeal and review.
PRECAST MANHOLE WITH INTERNAL SEAL

1. The rubber sleeve is available in heights of 6.5" (Standard) or 10" (Wide) & a 13" (Extra Wide). The same expansion bands are used on all sizes.

2. See the chimney height table below for seal and extension combinations needed to span from the frame to the top of the cone on manholes with various chimney heights. Frame offsets or diameter differences will reduce these span heights.

3. The top of the cone shall have a minimum of 3" high vertical sealing surface that is smooth and free of any form offsets or excessive honeycomb.

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<tr>
<th>COMBINATIONS OF SEALS AND EXTENSIONS</th>
<th>TO SPAN HEIGHTS OF:</th>
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<tbody>
<tr>
<td></td>
<td>W/ STANDARD SEAL</td>
</tr>
<tr>
<td>Seal Only</td>
<td>0&quot; to 4.5&quot;</td>
</tr>
<tr>
<td>Seal + 7&quot; Extension</td>
<td>Over 4.5&quot; – 10.5&quot;</td>
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<tr>
<td>Seal + 10&quot; Extension</td>
<td>Over 10.5&quot; – 13&quot;</td>
</tr>
<tr>
<td>Seal + Multi Extensions</td>
<td>Over 13&quot;</td>
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Add 6" of coverage for each additional 7" Extension.
Add 8.5" of coverage for each additional 10" Extension.

INTERNAL MANHOLE CHIMNEY SEAL W/ EXTENSIONS
PRECAST