PART 416 – COMPLETE MANHOLE REPLACEMENT

416.1 SCOPE

416.1.1 Work covered in this section consists of complete manhole replacement. Testing, cleanup, and materials requirements are also included.

416.1.2 The Contractor shall be responsible for the furnishing of all labor, supervision, materials, and equipment required to complete all rehabilitation and replacement work and testing in accordance with the Contract Documents. This includes any follow-up rehabilitation work required of the CONTRACTOR by the ENGINEER.

416.2 MATERIALS

416.2.1 The Contractor shall be thoroughly trained and familiar with handling, mixing, and placing all material. All materials shall be used in strict accordance with manufacturer's recommendations and with the provisions of all OSHA and other safety regulations. Field conditions must be appropriate for and compatible with component mixing for the linings and sealants. All materials shall conform to and be installed according to manufacturer's recommendations and specifications and shall conform to City Standard Specifications unless herein modified. Contractor shall supply all necessary materials, including storage and transportation to the satisfaction of Engineer. Materials damaged by Contractor shall be replaced at no additional cost to the City. Existing manhole frames and covers being replaced shall become the property of City. Contractor shall dispose of existing castings at a site indicated by Sewer Operations and Maintenance.

416.2.2 Precast concrete manholes will be allowed for complete manhole replacements.

416.2.3 Frames and covers shall be as specified in Part 418 – Replacement of Manhole Frame and Cover, Frame Seal, Chimney, and Grade Adjustment.

416.2.4 Exterior surfaces of manhole sections shall be coated only when specified. Coating shall be two mop coats of coal tar epoxy paint, Koppers "Bitumastic Super Service Black", Tnemec "46-450 Heavy Tnemecol", or approved equal. Dry film thickness shall be a minimum of 14.0 mils per coat. Recoating shall be done in accordance with manufacturer's recommendations. Interior coatings shall be required in accordance with Part 211.1.8.

416.2.5 Grout shall be non-shrink in the plastic state and show no expansion after set as tested in accordance with ASTM C827 and shall develop compressive strength not less than 3,000 psi with a trowelable mix within 24 hours per ASTM C109. The placement time shall be not less than 45 minutes based on initial set per ASTM C191. Test results shall be furnished by the manufacturer and submitted to the ENGINEER.

416.2.6 Opening for each connecting pipe shall be circular with a compression type flexible rubber gasket cast integrally into the manhole wall. Flexible gaskets shall be manufactured in accordance with rubber joint specification ASTM C443 and shall meet...
the performance and test requirements of ASTM C425 for compression joints. Pipe 
seals to the new manhole structure shall be A-Lok, Presswedge, or approved equal.

416.3 REPLACE COMPLETE MANHOLE

416.3.1 Complete manhole replacement shall be done in accordance with the Drawings and as shown in the Standard Specifications. Any structurally unsound manholes observed by Contractor shall be replaced as directed by ENGINEER.

416.3.2 The existing manhole structure designated for complete replacement shall be completely removed before installation of the new precast manhole structure. Contractor shall dispose of all debris and prevent any debris from entering the existing sewer lines.

416.3.3 Manhole diameters shall be 4' I.D. for 8" to 12" pipe; 5' I.D. for 15" to 21" pipe; and 6' I.D. for 24" to 36" pipe. For pipes larger than 36" diameter, a special manhole is required.

416.3.4 All new manholes shall have 30" frame and covers in accordance with the Standard Details

416.3.5 Install frames and covers in accordance with Part 418 – Replacement of Manhole Frame and Cover, Frame Seal, Chimney, and Grade Adjustment. Precast manhole sections shall be sealed and wrapped in accordance with construction details.

416.3.6 Any damage done to existing sanitary pipe during excavation or replacement shall be replaced by Contractor at no additional cost.

416.3.7 Contractor shall maintain wastewater flow at all times. Contractor shall submit a plan for maintaining wastewater flow to the ENGINEER prior to beginning work.

416.3.8 Form inverts with mortar material and steel-trowel to produce a dense, smooth finish and shape to form a channel that approximates the lower half of the inside diameter of the pipe. The channel shall extend to 3/4 the diameter of the pipe. Bench shall be shaped to drop approximately 2" from wall to invert.

416.3.9 Any incoming pipes which are 2' or more above the outgoing invert elevation shall be equipped with outside drop connections.

416.3.10 Complete manhole replacement shall also include replacement of frame and cover, bench and invert, frame seal, grade adjustment and five linear feet of pipe at each connection to the manhole. Pipe shall be like kind unless otherwise ordered by the ENGINEER. Additional footage of pipe, if required, will be paid for at a per foot price as shown in the bidding documents.

416.3.11 Service lines encountered shall be connected to the main sewer outside the manhole using an integral tee connection.
416.3.12 A concrete collar shall be constructed on each manhole constructed or repaired in pavement in accordance with the Drawings. Concrete collars shall not be constructed in unpaved areas. Concrete collars constructed in asphalt streets shall be constructed to finish grade with concrete. No additional payment will be made for concrete collars as the concrete collar is considered subsidiary to other items of work.

416.3.13 The exterior surface of all chimneys, frame adjustments and pre-cast manhole sections joints shall be thoroughly cleaned with a wire brush and then waterproofed with a minimum 3/8" coat of trowelable bitumastic joint sealant (Easystik, Tnemec Series 265 Elasto-Shield TG, or approved equal) up to and including the bottom flange of the frame. The entire frame and grade adjustment shall then be wrapped with six mil plastic to protect against damage from backfill.

416.3.14 Complete manhole replacement includes performing and completing the work and for furnishing all labor and materials necessary including excavation and removal of existing structure, trench safety system, replacement of frame and cover, installing new adjustment rings, manhole walls, manhole steps, corbel and/or flattops, bench/invert and base for complete manholes, pipe replacement required at each pipe entering the manhole, backfilling, surface restoration, and all testing.

416.4 MEASUREMENT AND PAYMENT

416.4.1 Complete manhole replacement shall be paid for at the Contract Unit Prices as follows:

A) A unit price to cover the construction of one standard manhole of the diameter and type indicated; 0' to 6' in depth.

B) A unit price which shall cover the entire cost of each additional foot of vertical manhole depth in excess of 6', measured to the nearest 0.1'.

416.4.2 The prices shall be payment in full for performing and completing the work and for furnishing all labor and materials necessary including excavation and removal of existing structure, trench safety system, replacement of frame and cover, installing new adjustment rings, manhole walls, corbel and/or flattops, bench/invert and base for complete manholes, five linear feet of pipe replacement at each pipe entering the manhole including rigid connection, backfilling, surface restoration all interior and exterior coatings, and all testing.

416.4.3 Additional pipe required for Manhole Replacement may be required when the 5’ length of pipe included in the Manhole replacement is inadequate to reach to sound pipe. If additional pipe is required, restoration bid items will be paid for, including Sodding, Pavement Replacement, Sidewalk and Driveway Replacement and Curb and Gutter Replacement at the unit price per bid item.
PART 417 – REPLACEMENT OF CLEANOUT / LAMPHOLE AND/OR CLEANOUT / LAMPHOLE FRAME AND COVER

417.1 GENERAL

407.1.1 Description: This section describes replacement of existing lamphole frame/cover, the sealing of cleanout frames and the complete cleanout/lamphole replacement. At the Engineer’s direction, cleanouts/lampholes where location permits, and the work area is not restricted may be replaced and paid for with a manhole in accordance with Part 416 – COMPLETE MANHOLE REPLACEMENT.

417.2 MATERIALS

417.2.1 The replacement cover shall form a water-resistant seal between the frame and lamphole cover surface. The cover shall have a concealed pick bar, and a machined bearing surface between cover and frame.

417.2.2 A typical standard lamphole frame/cover design shall conform to the City of Tulsa Standard Detail 360.

417.2.3 Covers shall set flush with the rim of the frame and shall have no larger than a 1/8” gap between the frame and lid.

417.2.4 Bearing surfaces shall be machine finished.

417.2.5 Portland Cement Concrete shall be specified in Part 402 – RESTORATION.

417.2.6 The joint between frame ring and chimney and between the frame ring and PVC shall be sealed with trowelable bitumastic joint sealer material. The bitumastic joint sealer shall meet or exceed Federal Specifications SS-S-210A. The trowelable sealer shall be as manufactured by Easystik, or approved equal, and applied in strict accordance with the manufacturer’s specifications and recommendations. The material shall be able to withstand hydrogen sulfide and other corrosive gases found in sewers.

417.2.7 Cleanout/lamphole riser section shall be constructed using DIP or PVC pipe as directed by the Engineer.

417.2.8 Backfill shall be in accordance with Part 403 – BACKFILL.

417.3 EXECUTION

417.3.1 The Contractor shall be responsible for supplying the required material for the replacement of the frame and/or covers, and sealing of frame including the unloading, temporary storage, and transporting of the materials.

417.3.2 To replace frame and cover only, the work consists of removal of existing lamphole frame and base, and replacement with a new frame, cover, and concrete base, in
accordance with the detail and specification. Excavation will be required for replacement or extension of pipe.

417.3.3 Frames shall be sealed to the base with bitumastic joint sealer. Base and frames shall be free of dirt, stones, debris, and voids to ensure a watertight seal. Wire brush frame and exposed base to remove dirt and loose debris. Coat exposed base surface with an approved bonding agent, Weld-Crete as manufactured by Larsen Products Company or approved equal, followed with an application of a quick-setting hydraulic cement to provide a smooth working surface as thin as possible. Place the flexible bitumastic joint material, minimum 1/2" thick, in two concentric rings along the inside and outside edge of the joint.

417.3.4 Lamphole rims in parkways, lawns, and other improved lands shall be at an elevation not more than 1” nor less than 1/2” above the surrounding ground. Backfill shall provide a uniform slope from the top of casting for not less than 3’ each direction to existing finish grade of the ground. The grade of all surfaces shall be checked for proper slope and grade by string lining the entire area regraded near the manhole.

417.3.5 Lamphole riser stacks which may be damaged during removal of the existing lamphole, shall be replaced at the Contractor’s expense by using a like material and jointing to existing undamaged pipe using a rubber coupling with stainless steel bands.

417.3.6 Cleanout/lamphole diameters shall be 8”.

417.3.7 Backfill shall be in accordance with Part 403 – BACKFILL.

417.3.8 Restoration shall be in accordance with Part 402 – RESTORATION.

417.3.9 Replacement shall include replacement of riser pipe, replacement of frame and cover, backfill and concrete, restoration and all other appurtenances related to the replacement.

417.3.10 Trench Safety shall be in accordance with applicable OSHA, State, and local regulations.

417.4 MEASUREMENT AND PAYMENT

417.4.1 To replace cleanout/lamphole cover and frame only, payment shall be based on the Contract Unit Price per each cleanout/lamphole frame and cover replacement. Payment will provide complete compensation for locating lamphole; excavation; removal and replacement of lamphole casting; concrete embedment (base); placing and compaction of backfill and restoration of surface features.

417.4.2 Cleanout/lamphole replacement shall be paid at the Contract Unit Price to cover the construction of one standard cleanout/lamphole for all depth. Unit price shall include all items necessary for complete replacement of cleanout/lamphole to include, but not be limited to, frame and cover replacement, concrete, riser pipe, concrete embedment
(base), placing and compaction of backfill and restoration of surface features, and all labor and materials required for complete replacement.
PART 418 – REPLACEMENT OF MANHOLE FRAME AND COVER, FRAME SEAL, CHIMNEY, AND GRADE ADJUSTMENT

418.1 SCOPE

418.1.1 Work covered in this section consists of replacement of manhole frame, cover, frame seal, chimney, and grade adjustment in accordance with this Section and with City of Tulsa Standard Detail 402. Testing, cleanup, and materials requirements are also included.

418.1.2 The Contractor shall be responsible for the furnishing of all labor, supervision, materials, and equipment required to complete all rehabilitation and replacement work and testing in accordance with the Contract Documents. This includes any follow-up rehabilitation work required of the Contractor by the ENGINEER.

418.2 MATERIALS

418.2.1 The Contractor shall be thoroughly trained and familiar with handling, mixing, and placing all material. All materials shall be used in strict accordance with manufacturer's recommendations and with the provisions of all OSHA and other safety regulations. Field conditions must be appropriate for and compatible with component mixing for the linings and sealants. All materials shall conform to and be installed according to manufacturer's recommendations and specifications. Contractor shall supply all necessary materials, including storage and transportation to the satisfaction of Engineer. Materials damaged by Contractor shall be replaced at no additional cost to the City. Existing manhole frames and covers being replaced shall become the property of City. Contractor shall dispose of existing castings at a site indicated by the Sewer Operations and Maintenance.

418.2.2 Frame Sealing Materials

A) The joint between frame ring and chimney and between the frame ring and top row of brick shall be sealed with trowelable bitumastic elastic material. The bitumastic joint sealer shall meet or exceed Federal Specifications SS-S-210A. The trowelable sealer shall be as manufactured by EasyStik, or approved equal, and applied in strict accordance with the manufacturer's specifications and recommendations. The material shall be able to withstand hydrogen sulfide and other corrosive gases found in sewers.

B) Alternatively, for frame to manhole or riser ring to manhole, two rings of bitumastic rope of M1 adhesive may be used in lieu of trowelable bitumastic as approved by the Engineer.

C) Applied sealing material may not be permitted in certain applications where field conditions restrict its use as directed by the ENGINEER.

418.3 FRAME
418.3.1 Frame material shall be cast iron conforming to ASTM A48, Class 35B, or better. The frame shall exhibit a tensile strength of not less than 35,000 psi.

418.3.2 Frames for existing 4’ I.D. Sanitary manholes, new 4’ I.D. and larger Sanitary Manholes, or lampholes shall conform to Standard Details 352, 353, 354 or 360, as applicable, and Part 209 – Castings.

418.3.3 Bearing surfaces between the ring and cover shall be machine finished or ground to assure non-rocking fit in any position, and interchangeability.

418.3.4 Frames shall be certified by the manufacturer to meet AASHTO M 306-89 requirements.

418.4 COVER

418.4.1 The replacement cover shall form a water-resistant seal between the frame and manhole cover surface. The cover shall have pick bars or pick slots and a machined bearing surface on the bottom and side of the casting. The cover material shall be cast iron conforming to ASTM A48, Class 35B or better, for Gray Iron. The cover shall exhibit a tensile strength of not less than 35,000 psi.

418.4.2 A typical manhole cover design shall conform to Standard Details 353 and 354.

418.4.3 Covers shall set flush with the rim of the frame and shall have no larger than a 1/8” gap between the frame and cover.

418.4.4 Covers shall be certified by the manufacturer to meet AASHTO M 306-89 requirements.

418.5 CHIMNEY RISER RINGS

418.5 Precast concrete chimney riser rings shall be a minimum of 4” thick, shall conform to ASTM C478, and shall be one piece. For sloping surface grades tapered chimney rings may be used to permit the manhole frame and cover to conform to the sloping surface. No chimney ring will be allowed if the ring has a crack of more than 0.01” as measured by an appropriate gauge or measuring device. Concrete chimney riser rings shall not be used unless approved by the ENGINEER.

418.5.2 Plastic riser rings shall be manufactured by Cretex or approved equal.

418.6 WATERPROOFING MEMBRANE

418.6.1 A cold-applied seamless, elastomeric membrane shall be used for all partial and complete manhole rehabilitation. HLM 5000, as manufactured by Sonnenborn Building Products, shall be applied to the exterior of the exposed structure.
418.6.2 The membrane shall be a single component moisture curing bitumen modified polyurethane that is formulated for hand application by trowel to vertical surface. It shall comply with ASTM C836-84.

418.7 MATERIALS TESTING

418.7.1 Testing shall be the responsibility of the Contractor. Tests for compliance with this Specification shall be made as specified herein and in accordance with the applicable Specification. A Certificate of Compliance with this Specification along with a report of each test, shall be furnished by the Contractor for all material furnished under this specification. The Contractor shall inform the Engineer as to when, where, and by whom, testing will be conducted, at least one week prior to testing. The Engineer may, at its own expense, witness testing of the materials.

418.8 EXECUTION

418.8.1 Replacement of Cover/Frame/Frame Seal

418.8.2 Excavation and Pavement Replacement in Paved Areas:

A) The removal of the manhole frame and cover shall be accomplished by making a circular cut in the pavement as shown in the Drawings.

B) Material in the exposed area shall be excavated toward the casting to a depth of approximately 6" below the bottom of the frame. Excavated material shall be disposed of by Contractor.

C) Specified sub-base materials shall be tamped in place to the minimum specified density as shown on the Drawings to form the sub-base for the pavement.

D) Contractor shall, at no additional cost to the City, replace any portion of the existing manhole that is damaged during replacement of covers and frames.

E) A concrete collar shall be constructed on each manhole constructed or repaired in pavement in accordance with the Drawings. Concrete collars shall not be constructed in unpaved areas. Concrete collars constructed in asphalt streets shall be constructed to finish grade with concrete. No additional payment will be made for concrete collars as the concrete collar is considered subsidiary to other items of work.

F) At the City's option, all castings removed from the work and not reused shall remain the property of the City. Contractor shall stockpile castings at a location designated by the City. If the City elects not to retain ownership of the unused castings, the Contractor shall be responsible for their proper disposal. Disposal of other removed materials is also the Contractor's responsibility.

G) The surfacing used to cover the exposed area shall conform to the existing pavement as specified in the Standard Specifications.
H) Pavement replacement not performed to the satisfaction of the ENGINEER shall be replaced by Contractor at no additional cost to City.

418.8.3 Excavation for Replacement in Unpaved Areas:

A) No unnecessary excavation of materials from around the manhole shall be done.

B) Backfill shall be replaced and compacted to prevent subsequent settlement and to restore the site to a condition equal to or better than that found. Backfill shall not cover the manhole.

C) If surface obstructions are present that prevent access to the manhole, the obstructions shall be removed and reinstalled after completion of the work. Cost for this additional work is considered subsidiary to other items of work and will not be paid for directly.

418.8.4 Removal, Replacement, and Sealing of Manhole Frames:

A) Replacement of chimney adjustment rings, and/or brick and mortar broken during excavation shall be at Contractor’s expense. Damaged adjustments shall be replaced with plastic adjustment rings.

B) The manhole frame shall be removed from the manhole and the condition of the grade adjustment rings shall be observed. Any damages shall be brought to the ENGINEER’S attention.

C) All surfaces between the frame, chimney and corbel shall be free of dirt and debris. Joint sealing material shall be troweled concentrically on the grade to frame joint. If deterioration of the grade adjustments or chimney is observed, Contractor shall notify ENGINEER prior to replacement of the manhole frame, and partial chimney replacement may be required.

D) Contractor shall, at no additional cost to the City, replace any portion of the existing manhole that is damaged during replacement of covers and frames.

E) In paved areas frames shall be installed to the slope and finish elevation of the paved surface. The top of the frame shall be even with or 1/8” below the finished elevation. Allowances for the compression of the joint sealer material shall be made to assure a proper final grade elevation.

F) Manhole frames in non-paved areas shall be installed at not more than 2” nor less than 1” above the surrounding surface. Site restoration shall provide a uniform slope away from the top of the manhole frame for a distance of not less than 3’ in any direction.

G) Manholes in drainage courses shall be at the elevation which existed prior to rehabilitation or as directed by ENGINEER.
H) A concrete collar shall be constructed on each manhole constructed or repaired in pavement in accordance with the Drawings. Concrete collars shall not be constructed in unpaved areas. Concrete collars constructed in asphalt streets shall be constructed to finish grade with concrete. No additional payment will be made for concrete collars as the concrete collar is considered subsidiary to other items of work.

418.9 REPLACEMENT OF CHIMNEY / GRADE ADJUSTMENT / FRAME SEALING

418.9.1 Excavation shall be to a minimum depth of 6" below the repair depth.

418.9.2 Chimneys being replaced shall use plastic riser rings as described in Section 418.5.2.

418.9.3 Contractor shall replace that portion of the defective manhole chimney up to a maximum depth of 24" below the bottom of the frame. If the chimney is deeper than 24", Contractor shall notify the Engineer prior to performing any work on the manhole. In those instances, the Contractor may be required to perform a Partial Manhole Replacement to include removal and replacement of the existing corbel or manhole barrel and either:

A) Replacement with a new manhole wall section and precast flattop section, or
B) Replacement with a new manhole wall section, corbel, frame, and cover.

418.9.4 A bonding agent, Weld-Crete as manufactured by Larsen Products Company or approved equal, shall be applied to the top surface of the existing manhole after the defective portion of the manhole has been removed. Hydraulic cement mortar shall be used to bring the surface to grade and provide a smooth surface for the joint sealing material and additional chimney riser rings. Thickness of hydraulic cement shall not exceed 3". Hydraulic cement shall be allowed to set a minimum of one hour prior to placement of joint sealing material and adjustment rings. Set time may be adjusted in accordance with the manufacturer’s recommendations. The bonding agent and the cement mortar shall not be applied when the temperature is below manufacturer’s recommendations.

418.9.5 All surfaces between the frame, chimney, and corbel shall be free of dirt and debris. Joint sealing material shall be placed at the edge of each chimney to frame joint, and top of corbel section.

418.9.6 Contractor shall, at no additional cost to City, replace any portion of the existing manhole that is damaged during chimney and frame sealing.

418.9.7 Grade adjustments exceeding 12", but less than 24", must be braced during backfilling operations. When the required grade adjustment exceeds 24", ENGINEER shall be notified prior to placement of new adjustment rings to determine if additional work is necessary.
418.9.8 The exterior surface of all chimneys and frame adjustments shall be thoroughly cleaned with a wire brush and then waterproofed with a minimum 1/2" coat of trowelable bitumastic joint sealant up to and including the bottom flange of the frame. The entire frame and grade adjustment shall then be wrapped with six mil plastic to protect against damage from backfill.

418.10 PARTIAL MANHOLE REPLACEMENT (TYPE F)

418.10.1 Overview: Partial manhole replacement shall be performed when required by the plans or as directed by the Engineer. Partial manhole replacement will be utilized when frame and cover replacements, chimney replacements, or grade adjustments cannot be performed within the allowable requirements of the City of Tulsa Specifications with regard to maximum height of the chimney section. Partial manhole replacement shall normally be required when a proposed grade adjustment would result in a chimney height of greater than 24". (See condition “A” in Standard No. 401.) Unless required by the plans, Partial Manhole Replacement shall not be performed unless directed by the Engineer.

418.10.2 Determination of need: Contractor shall bring to the Engineer’s attention any manhole which, if adjusted to grade, would have a chimney height greater than 24". The Contractor and Engineer shall jointly inspect the manhole and reach agreement as to the work to be performed on the manhole. Should the Engineer require it, a partial manhole replacement shall be performed.

418.10.3 Execution: Partial manhole replacement shall consist of the removal of the existing manhole components necessary to expose the top barrel section of the manhole wall, to include the frame and cover, adjusting rings, and corbel; and replacement with additional manhole wall sections, corbel, adjusting rings, frame and cover as are necessary to achieve the proper manhole top elevation with a chimney height of less than 24”.

418.10.4 The Contractor shall excavate the exterior of the manhole to an elevation 1’ below the corbel/wall joint and shall remove the frame and cover, adjusting rings, corbel, and any portions of the wall which must be removed for the performance of the work. The exterior and top of the existing manhole wall shall be thoroughly cleaned of any dirt and debris; and any voids, joints, or irregularities shall be grouted.

418.10.5 The Contractor shall measure the diameter of the old manhole wall. In those instances where the old wall section is a precast section designed to utilize an O-ring gasket, and the new precast wall section or corbel will mate and seal over the old section, the installation will be completed in a manner consistent with the requirements for new construction (See Standard No. 358 and Section 314.7 of the Standard Specifications).

418.10.6 In those instances where the new and old wall sections have incompatible diameters, the Contractor shall complete the installation of the new wall/corbel section in accordance with Standard No. 401A. The Contractor shall utilize a new wall section or corbel with a diameter larger than the existing wall section. The Contractor shall saw cut the bottom edge of the new wall section or corbel to produce a flat, smooth surface.
Around the existing wall section, the Contractor shall pour a concrete collar upon which to set the new wall section or corbel. The top surface of the concrete collar and the bottom surface of the new wall section or corbel shall be prepared with hydrophilic paste and waterstop and the new wall section or corbel shall be placed upon the concrete collar. The exterior gap between the collar and new wall section or corbel shall be sealed with a non-shrink grout.

418.10.7 Prior to pouring of the concrete collar, a strip of hydrophilic paste shall be placed on the existing manhole wall to seal all joints, depressions, cavities, and irregularities in the surface. This shall be followed by placing a hydrophilic waterstop on the paste. The Cast-In-Place concrete collar shall be allowed to cure for 48 hours prior to installation of the new wall section or corbel. One strip of hydrophilic waterstop shall be placed on the new wall section or corbel prior to its installation on the concrete collar. Hydrophilic paste shall be ADEKA P101, or equal. Hydrophilic waterstop shall be ADEKA KBA-1510FP, or equal.

418.10.8 All new or old surfaces shall be primed with Weldcrete as manufactured by Larsen Products Company, or equal, prior to placement of concrete.

418.10.9 The exterior surfaces of all exposed existing wall sections, concrete collar, and new wall section, corbels, and adjusting rings shall be thoroughly cleaned with a wire brush and then waterproofed with a minimum ½" coat of troweable bitumastic joint sealant up to and including the bottom flange of the frame and then wrapped with a six mil sheet of plastic to protect against damage from backfill.

418.11 MEASUREMENT AND PAYMENT

418.11.1 Each item listed under this specification shall be measured and paid for at the unit price bid per manhole, regardless of size, for each manhole replaced or rehabilitated.

418.11.2 Measurement of Repair Types:

A) Replacement of manhole cover and frame and frame seal in accordance with Part 418.9.1 (Type A Repair) shall be paid for at the Contract Unit Price.

B) Replacement of manhole frame seal in accordance with Part 418.9.4 (Type B Repair) shall be paid for at the Contract Unit Price.

C) Replacement of manhole cover, frame, frame seal and chimney in accordance with Part 418.9.1 and 418.10 (Type C Repair) shall be paid for at the Contract Unit Price.

D) Replacement of manhole frame seal and chimney in accordance with Part 418.10 (Type D Repair) shall be paid for at the Contract Unit Price.

E) Payment for manhole grade adjustment shall be included in bid items for Repair Types A, B, C, D, or F in accordance with Part 418 of the Construction specification. No separate payment shall be made for manhole grade adjustment.
F) Partial Manhole Replacement in accordance with Part 418.11 (Type F) shall be paid for at the unit price bid for each of the following items:

1) Type Ff: Precast Flattop Section: The unit price bid for each precast flattop section shall be payment in full for performing and completing all work and furnishing labor, supervision, materials, equipment necessary to remove and dispose of the existing ring and cover, and install a new precast flattop section, complete with frame and cover upon an existing or new manhole wall section. No additional payment will be made for materials or installation of the new frame and cover. Additional payment will be made for a concrete collar (Type Ff) and also for the vertical footage or precast wall section (Type Fw) needed to achieve the proper finished to elevation.

2) Type Fc: Precast Corbel Section: The unit price bid for each precast corbel shall be payment in full for performing and completing all the work, and furnishing labor, supervision, materials, equipment necessary to remove the existing frame and cover, corbel, or manhole wall section and replace it with a precast corbel of the required height; install adjusting rings, frame and cover; and all additional materials, equipment and labor needed for a complete restoration of the manhole. No additional payment shall be made for modifying portions of the existing manhole or the end section of the precast corbel to affect a watertight seal between the old and new manhole components or for adjusting rings, frame, and cover. Additional payment will be made for a concrete collar (Type Fc). Additional payment will also be made for a precast wall section (Type Fw), if needed.

3) Type Fw: Precast Manhole Wall Section: The unit price bid for each vertical foot of precast manhole wall shall be payment in full for performing and completing all the work and furnishing labor, supervision, materials, equipment necessary to remove the existing corbel or section of manhole wall, and install each foot of new precast wall section up to the height required for the proposed installation. Payment for Precast Manhole Wall Section will be in addition to payment for a Precast Corbel Section if a new corbel is needed, or a new Precast Flattop Section if a new precast flattop section is needed. Additional payment will be made for a concrete Collar (Type Fc).

4) Type Ff: Cast-In-Place Concrete Collar: The unit price bid for each Cast-In-Place Concrete Collar shall be payment in full for performing and completing all the work, furnishing labor, supervision, materials, and equipment necessary to form and pour the concrete collar and install hydrophilic paste and waterstop, in preparation for installation of a Precast Corbel or Precast Wall Section. Cast-In-Place Concrete Collar shall only be paid for once for each manhole in which a Cast-In-Place Concrete Collar is installed.

418.11.3 The prices shall be payment in full for performing and completing the work and for furnishing all labor and materials necessary including excavation and removal of existing structure, replacement of frame and cover, chimney, frame sealing, grade adjustment, backfilling, surface restoration, and all testing. No payment shall be made
until the manhole and its adjacent area have been restored and the manhole and its appurtenances have satisfactorily passed testing.
PART 419 – PATCHING, REPAIRS, AND PLUGGING LIFT HOLES

419.1 SCOPe

419.1.1 Work covered in this section consists of rehabilitation of bench and invert, patching holes in the manhole, and plugging precast lift holes. Testing, cleanup, and materials requirements are also included. Steps shall not be removed from manholes requiring rehabilitation unless the steps are deemed unsound by the ENGINEER.

419.1.2 The Contractor shall be responsible for the furnishing of all labor, supervision, materials, and equipment required to complete all rehabilitation and replacement work and testing in accordance with the Contract Documents. This includes any follow-up rehabilitation work required of the Contractor by the ENGINEER.

419.2 MATERIALS

419.2.1 The Contractor shall be thoroughly trained and familiar with handling, mixing, and placing all material. All materials shall be used in strict accordance with manufacturer’s recommendations and with the provisions of all OSHA and other safety regulations. Field conditions must be appropriate for and compatible with component mixing for the linings and sealants. All materials shall conform to and be installed according to manufacturer’s recommendations and specifications. Contractor shall supply all necessary materials, including storage and transportation to the satisfaction of Engineer. Materials damaged by Contractor shall be replaced at no additional cost to the City. Existing manhole frames and covers being replaced shall become the property of City.

419.3 HYDRAULIC CEMENT

419.3.1 Hydraulic cement shall be used for repairing, filling, patching, and plugging various holes in manhole chimney, corbel, walls, bench, and invert. Hydraulic cement shall be durable, quick setting, high early strength hydraulic cement such as Pennygrout or Octocrete supplied by IPA or approved equal. Wall coating material may also be applied to the bench.

419.4 BENCH AND INVERT REHABILITATION (TYPE Gh)

419.4.1 Existing deteriorated bench and invert areas shall be removed to sound material. Care shall be taken to avoid damaging other parts of the manhole. Loose and broken brick and mortar shall be removed from the manhole to eliminate the possibility of pieces entering the sewer lines.

419.4.2 After removal of the existing deteriorated bench and invert areas, new bench and invert shall be formed in accordance with the Drawings. Bonding agent, Weld-Crete as manufactured by Larsen Products Company or approved equal, shall be applied to existing surfaces in accordance with manufacturer’s recommendations. Octocrete or approved equal shall be placed in such a manner that it is consolidated, fills existing voids, and creates a smooth, dense, steel troweled surface in accordance with the
Drawings. Wastewater flow shall be maintained by methods which prevent contact with new bench and invert for 6-8 hours after concrete placement. If 6-8 hours set time is not possible, a fast setting, high early strength concrete shall be used with provisions for flow control until concrete has initially set. The bench and invert shall be finished in such a manner as to have a smooth surface and form a continuous monolithic conduit with the sewer pipe entering and leaving the manhole. The bench and invert shall form a watertight seal with the manhole walls, base and pipe seal and shall be cleaned of all debris or foreign matter.

419.4.3 Contractor shall, at no additional cost to City, replace any portion of the existing manhole which is damaged during bench and invert rehabilitation.

419.5 PLUG LIFT HOLES/PATCH HOLES (TYPE Go/TYPe Gr)

419.5.1 The lift hole or hole to be patched shall be cleaned and all loose debris removed. Holes shall have all unsolid material removed with hammer and chisel. Holes and voids shall be filled, and the patch consolidated to leave the repair location leak resistant. The surface shall be troweled to a smooth finish even with surrounding surfaces.

419.6 MEASUREMENT AND PAYMENT

419.6.1 Plug Lift Hole (Type Go): Lift Hole Plugging shall be paid at the unit price bid per manhole, regardless of the size of the manhole.

419.6.2 Patch Hole (Type Gr): Hole Patching shall be paid for at the unit price bid per manhole, regardless of the size or number of holes to be patched.

419.6.3 Bench and Invert Rehabilitation (Type Gh): Bench and Invert Rehabilitation shall be paid for at the unit price bid per manhole, regardless of the size, diameter, or material of the manhole or connected line segments.
PART 420 – MANHOLE STEP REMOVAL AND REPLACEMENT

420.1 SCOPE

420.1.1 Work covered in this section consists of removing steps in the manhole, patching holes, and replacing steps when specified. Testing, cleanup, and materials requirements are also included.

420.1.2 The Contractor shall be responsible for the furnishing of all labor, supervision, materials, and equipment required to complete all rehabilitation and replacement work and testing in accordance with the Contract Documents. This includes any follow-up rehabilitation work required of the Contractor by the ENGINEER.

420.2 MATERIALS

420.2.1 The Contractor shall be thoroughly trained and familiar with handling, mixing, and placing all material. All materials shall be used in strict accordance with manufacturer’s recommendations and with the provisions of all OSHA and other safety regulations. Field conditions must be appropriate for and compatible with component mixing for the linings and sealants. All materials shall conform to and be installed according to manufacturer’s recommendations and specifications. Contractor shall supply all necessary materials, including storage and transportation to the satisfaction of Engineer. Materials damaged by Contractor shall be replaced at no additional cost to the City.

420.3 HYDRAULIC CEMENT

420.3.1 Hydraulic cement shall be used for repairing, filling, patching, and plugging various holes in manhole chimney, corbel, walls, bench, and invert. Hydraulic cement shall be durable, quick setting, high early strength hydraulic cement such as Pennygrout or Octocrete supplied by IPA or approved equal.

420.4 MANHOLE STEP REMOVAL AND STEP INSTALLATION

420.4.1 Existing deteriorated steps shall be removed and surrounding loose or deteriorated structure removed to sound material. Care shall be taken to avoid damaging other parts of the manhole. Loose and broken brick and mortar shall be removed from the manhole to eliminate the possibility of pieces entering the sewer lines.

420.4.2 After removal of the existing deteriorated steps and surrounding areas, holes shall be patched in accordance with the Drawings and Part 418 – Patching, Repairs, and Plugging Lift Holes.

420.4.3 Contractor shall, at no additional cost to City, replace any portion of the existing manhole, which is damaged during step removal, patching, or step installation.

420.4.4 When specified in the Drawings and Contract Documents, install replacement steps in accordance with manufacturer’s recommendations.
420.5 MEASUREMENT AND PAYMENT

420.5.1 Step removal and, when specified, replacement, shall be paid for at the Contract Unit prices bid for Step Removal and Replacement (Type I Repair) per each step removed, regardless of size of manhole.

420.5.2 The prices shall be payment in full for performing and completing the work and for furnishing all labor and materials necessary including equipment, flow diversion, excavation, backfilling, pipe restoration or utility restorations, manhole cleaning, debris removal, step removal, hole preparation, patching and hole plugging, step installation (when specified), manhole surface restoration, and all testing per manhole for all steps removed.

420.5.3 The replacement of Manhole Steps bid item is only for manholes being rehabilitated. In manholes being rehabilitated, step condition shall be reviewed by the Engineer and Contractor and steps replaced if deemed necessary. Payment will be by the number of steps installed.
PART 421 – INTERIOR MANHOLE REHABILITATION – CORBEL (CONICAL) AND WALL REHABILITATION, BENCH AND INVERT, AND PIPE SEAL REHABILITATION

421.1 SCOPE

421.1.1 Work covered in this section consists of rehabilitation of manhole corbel or cone and walls, bench and invert, and pressure grouting and coating pipe seals including the lower 18" of the manhole, and pressure grouting precast joints. This Bid Item includes all interior manhole repairs below the chimney. Testing, cleanup, and materials requirements are also included.

421.1.2 The Contractor shall be responsible for the furnishing of all labor, supervision, materials, and equipment, including manhole cleaning, patching, repairs required to stop active leaks, corbel, wall, bench and invert, and pipe seal coating and grouting, and surface restoration, required to complete all rehabilitation and replacement work, and testing in accordance with the Contract Documents. This includes any follow-up rehabilitation work required of the Contractor by the ENGINEER.

421.2 MATERIALS

421.2.1 The Contractor shall be thoroughly trained and familiar with handling, mixing, and placing all material. All materials shall be used in strict accordance with manufacturer's recommendations and with the provisions of all OSHA and other safety regulations. Field conditions must be appropriate for and compatible with component mixing for the linings and sealants. All materials shall conform to and be installed according to manufacturer's recommendations and specifications. Contractor shall supply all necessary materials, including storage and transportation to the satisfaction of Engineer. Materials damaged by Contractor shall be replaced at no additional cost to the City. Existing manhole frames and covers being replaced shall become the property of City. Contractor shall dispose of existing castings at a site indicated by the Sewer Operations and Maintenance.

4) INTERIOR COATING: This Specification will describe minimum requirements for a one-component, rheoelastic, fiber or polypropylene-reinforced, shrinkage compensated mortar lining system for manhole wall and corbel (cone) rehabilitation. Coating materials for use in manhole rehabilitation shall conform to Strong Systems, Inc. MS-2A; Master Builders, Inc. Emaco S88C; Standard Cement Materials, Reliner MSP; Permacast MS 10,000; or Quadex QM-1s Restore; wall coating material may also be used for the bench and invert rehabilitation repair.

B) Design Mix. Design mix shall be a preblended mixture of cements, chemically active aggregates, glass fibers and other additives specifically selected for special properties. No material (other than water) shall be used with or added to the approved design mix without prior approval or recommendation from the ENGINEER.

C) Water Supply. All water used in the mixture shall be clean and potable.
D) Certification. The Contractor must furnish certification to the ENGINEER that the coating system materials proposed for the project meet or exceed all of the minimum requirements as specified herein.

E) Density. Density of the material at placement of the coating system shall not be less than 95 lbs./cubic feet.

F) Working Time. Approximate working time of the material after initial application shall be 30 minutes.

G) Compressive Strength. Compressive strength shall conform to ASTM C495 and C109 and shall meet or exceed a minimum 28-day break of 4,000 psi.

H) Flexural Strength. Flexural strength shall conform to ASTM C348 and shall meet or exceed a minimum 28-day break of 1,200 psi.

I) Slant Shear Bond Strength. Slant shear bond strength shall conform to ASTM 882 modified and shall meet or exceed a minimum 28-day break of 2,400 psi.

J) Freeze-Thaw. Freezethaw testing shall conform to ASTM C666 and shall show no visible damage after 100 cycles.

K) Permeability. Permeability of the formulation shall conform to ASTM T277 and shall be less than or equal to 450 Coulombs.

L) Manholes scheduled for Interior Manhole Coating shall have a minimum 1” coating thickness for depths up to 12’ measured from the lowest flowline elevation to the rim. For depths greater than 12’, an additional 1/2” thickness shall be added to the manhole below the 12’ depth. For example, a 15’ deep manhole scheduled for Interior Manhole Coating would have the bottom 3’ coated with a minimum coating thickness of 1-1/2” and the top 12’ would have a minimum coating thickness of 1”. The additional material thickness shall be considered subsidiary to the bid item Interior Manhole Coating and will not be paid for directly.

421.3 CHEMICAL GROUTING SYSTEMS

421.3.1 Where the pressurized injection of chemical grout behind the manhole walls and joints is required, the material supplied shall be a urethane gel with properties as follows:

A) While being injected, the chemical sealant must be able to react/perform in the presence of infiltrating water.

B) The cured sealant must be capable of withstanding submergence in water without degradation.

C) The cured sealant must prevent the passage of water through the manhole defect.

D) The cured sealant must be flexible as opposed to brittle or rigid.
E) In place, the cured sealant shall be able to withstand freeze/thaw and wet/dry cycles without adversely affecting the seal.

F) The cured sealant must not be biodegradable. Additives may be used to meet this requirement, without affecting long-term strength.

G) The cured sealant shall be chemically stable and resistant to concentrations of acids, alkalis, and organics found in normal sewage.

H) Packaging of component materials must be compatible with field storage and handling requirements. Packaging must provide for worker safety and minimize spillage during handling.

I) In the event that the chemical sealant may be harmful by passing through the unbroken skin, by inhalation of dust, vapor or mist, or by swallowing, the handling and mixing shall be performed with proper equipment and by personnel thoroughly familiar with the chemicals involved and shall be in strict accordance with the manufacturer's recommendations and with the provisions of all safety regulations.

J) Mixing of component materials must be compatible with field conditions.

K) Residual sealing materials must be easily removable from the bench of manhole to prevent reduction or blockage of the sewer flow.

L) Urethane gel grout shall be utilized for the entire manhole.

M) No grouting operations shall be performed at temperatures below 40° F or where the temperature of the groundwater is below 40° F.

421.4 URETHANE GEL: URETHANE GEL SHALL HAVE THE FOLLOWING PROPERTIES AND CHARACTERISTICS:

421.4.1 One-part urethane prepolymer thoroughly mixed with between five and ten parts water by weight. The recommended mix ratio is one-part urethane prepolymer to eight parts of water (11% prepolymer).

421.4.2 A liquid prepolymer having a solids content by weight of 77% to 83%, specific gravity of 1.04 (8.65 pounds per gallon), and flash point of 200° F.

421.4.3 A liquid prepolymer having a viscosity of 600 to 1,200 centipoise at 70° F, that can be pumped through 500' of 1/2" hose with a 1,000-psi head at a one-ounce per second flow rate.

421.4.4 The water used to react the prepolymer should be in the pH range of 6.5 to 8.0.
421.4.5 A cure time of 80 seconds at 40° F, 55 seconds at 60° F, and 30 seconds at 80° F, when one-part prepolymer is reacted with eight parts of water only. Higher water ratios give longer cure times.

421.4.6 A cure time that can be reduced to ten seconds for water temperatures of 40° F to 80° F when one-part prepolymer is reacted with eight parts water containing gel control agent.

421.4.7 A relative rapid viscosity increase of the prepolymer/water mix. Viscosity increases from about 10 to 60 centipoise in the first minute for 1:8 prepolymer/water ratio at 50° F.

421.4.8 A reaction (curing) which produces a chemically stable, non-biodegradable, tough, flexible gel.

421.4.9 The ability to increase mix viscosity, density, gel strength, and resistance to shrinkage by using additives in the water component of the grout.

421.4.10 The ability to accept suspended additives such as 2,6-dichlorobenzonitrile root control.

421.4.11 Contain a minimum of 15% shrink control agent supplied by the same manufacturer.

421.5 MATERIALS DELIVERY AND STORAGE

421.5.1 The Contractor shall provide adequate facilities for storage of raw materials and for preparation of the materials for installation. They shall conform to the manufacturer's recommendations and all applicable codes, regulations, and safety requirements. These facilities shall be approved by the ENGINEER prior to initiation of manhole rehabilitation or replacement and shall be provided by the Contractor at no additional cost. Materials stored will not be paid for.

421.6 MATERIALS TESTING

421.6.1 Testing shall be the responsibility of the Contractor. Tests for compliance with this Specification shall be made as specified herein and in accordance with the applicable Specification. A Certificate of Compliance with this Specification along with a report of each test, shall be furnished by the Contractor for all material furnished under this Specification. The Contractor shall inform the ENGINEER as to when, where and by whom, testing will be conducted, at least one week prior to testing. The ENGINEER may, at its own expense, witness testing of the materials.

421.7 WALL REHABILITATION (TYPE Gg)

421.7.1 General. Corbel and wall rehabilitation shall be performed by the installation of approved coatings. The type of rehabilitation system to be utilized for each manhole shall be identified in the Drawings.
421.7.2 Manholes that are scheduled to interior manhole coating, and that are above grade with manhole components exposed shall have the exposed exterior corbel and wall of the manhole coated using approved coating materials and in accordance with manufacturer's recommendations and specifications for exterior application.

Prior to performing the work, the Contractor and Engineer will jointly inspect the manhole exterior and agree upon the scope and extent of exterior coating required. Exterior coating shall be performed on:

A) Manholes with exposed brick or block.

B) Brick or block manholes with a cracked or otherwise damaged exterior mortar coating.

C) Other manholes, as required by the Engineer. Exterior coating of precast or Cast-In-Place concrete manholes in good condition shall not normally be required. Based on the condition of the manhole exterior, the Engineer may require that only portions of the manhole exterior be coated.

Materials utilized for coating the exteriors of manholes shall conform to the requirements of Part 421.2.1.

421.7.3 Installation of a coating system shall entail the preparation of the manhole interior, application of the liner, and testing.

421.7.4 Interior Coatings. It is the intent of this section to govern all aspects of internal rehabilitation of manhole corbels, walls, bench and invert, and pipe seals using a high-strength, waterproofing, coating system. Manhole defects shall be repaired where shown or specified, or as directed by ENGINEER. Repair of manhole defects shall be accomplished by the methods specified herein. All manufacturer's recommendations shall be strictly followed for the entire rehabilitation procedure, including cleaning and possible surface preparation of the interior of the manhole, storing, and preparing the products and sealing the manholes. The work consists of spray and/or trowel applying an interior coating mix to the corbel, walls, benches and inverts, and pipe seals of manholes, resulting in a monolithic liner of a minimum 1" thickness for depths up 12'. For depths greater than 12', an additional 1/2" thickness shall be added to the manhole below the 12' depth. The applicator, approved and trained by the coating manufacturer, shall furnish all labor, equipment, and materials for applying the system over brick, tile, precast concrete, or concrete block manholes.

A) Preparation:

1) Place bench covers over invert before prepping manhole. Contractor shall prevent all construction materials from entering sewer pipelines.

2) All foreign materials shall be removed from the manhole walls and bench using high pressure water spray (minimum 3,500 psi). Loose and protruding brick, mortar and concrete shall be removed using a mason’s hammer and chisel.
and/or scrapers. Voids shall be filled with Octocrete as manufactured by IPA, Strong-Seal QSR as manufactured by Strong Systems, Inc., or approved equal, at least one hour prior to spray application of the coating system.

3) Active leaks shall be stopped using products specifically for that purpose. Ipanex-R as manufactured by IPA, or approved equal, mixed in accordance with manufacturers recommendations. If necessary, water shall be channeled to the bottom of the manhole structure through one or more weep holes and allowed to weep during the coating process. Once the walls of the manhole have been rehabilitated, weep holes shall be plugged with Ipanex-R or approved equal.

4) After all preparation has been completed, Contractor shall remove all loose material.

B) Mixing: Contractor shall follow published recommendations of the manufacturer for mixing of all products.

C) Spraying:

1) Prior to spraying, the surface shall be damp without noticeable free water droplets or running water. If required by the manufacturer, bond-coat slurry will be applied to the surface prior to application of the formulation. Material shall be spray applied to a minimum 1" uniform thickness to ensure that all voids and crevices are filled, and a smooth surface remains after troweling. The troweling shall compact material into voids and crevices and "set" the bond on the manhole surface (brick, tile, block, or concrete). Wall/Corbel coating shall not go above top of corbel.

2) After the coating application to all vertical surfaces has been completed, the temporary bench covers shall be removed and the bench reconstructed with the coating mix from walls to the invert in such a manner so as to produce a bench having a gradual slope from the walls to the invert with the wall/bench joint interface built up and rounded to a uniform radius the entire circumference of the manhole. The thickness of the bench shall be no less than 3/4" at the invert and shall increase in the direction of the wall so as to provide the required minimum slope as shown on the Drawings.

3) No application shall be made when ambient temperatures are less than manufacturer's recommendations and when freezing is expected within 24 hours unless specific recommendations are made by the manufacturer. If ambient temperatures are in excess of 90° F, precautions shall be taken to keep mixing water below 85° F, using ice if necessary.

4) The final application shall have a minimum of four hours cure time before being subjected to active flow.

A) A minimum of two test cylinders shall be taken from each day's work with the date, location and job recorded on each. The cylinders shall be sent to a certified
concrete testing laboratory, where a 28-day compression test will be made and recorded. Cost of testing shall be the responsibility of the Contractor.

B) Packaging of component materials must be compatible with field storage and handling requirements. Packaging must provide for worker safety and minimize spillage during handling.

C) Residual filler and formulations must be easily removable from the sanitary sewer line and manhole trough to prevent blockage of flow and minimize the amount of solids that enter the waste stream.

421.8 MANHOLE GROUTING

421.8.1 PRESSURE GROUTING: All manholes listed for interior rehabilitation shall have pipe seals pressure grouted and coated. Pressure grouting shall be done in accordance with the Drawings. Any structurally unsound manholes observed by Contractor shall be replaced as directed by ENGINEER.

421.8.2 The existing manhole structure designated for pressure grouting for pipe seals or for precast joints shall be thoroughly cleaned prior to grouting. Contractor shall dispose of all debris and prevent any debris from entering the existing sewer lines.

421.8.3 Grade adjustments, frame and cover replacements, chimney repairs, frame seals and other repairs shall be performed prior to pressure grouting. Pressure grouting shall be done prior to interior coating. All roots exposed in the manhole shall be removed.

421.8.4 Grouting of the manhole may include precast wall joints, pipe seals, and/or bench and invert. Areas and specific manholes requiring grouting shall be specified in the Schedule in the Drawings.

421.9 PIPE SEAL COATING AND PRESSURE GROUTING (TYPE Gk)

421.9.1 Injection holes shall be drilled in accordance with the Drawings. After removal of the grouting probe, activated oakum rope shall be used to fill the injection hole. Pipe seal pressure grouting will include the entire lower 18" of the manhole. Injection hole shall be patched with waterproof, quick setting mortar and covered with a moisture resistant two-part epoxy adhesive coating. Any pipe damaged by Contractor while drilling the injection hole shall be replaced at no expense to City.

421.9.2 Contractor shall, at no additional cost to City, replace any portion of the existing manhole or pipe, which is damaged during pipe sealing.

421.9.3 The deteriorated area of the pipe seal shall be removed to sound material. Care shall be taken to avoid damaging other parts of the manhole structure. Loose and broken brick, mortar, concrete, and pipe shall be removed from the manhole.
421.9.4 Bonding agent, Weld-Crete as manufactured by Larsen Products Company or approved equal, shall be applied to existing surfaces in accordance with manufacturer's recommendation.

421.9.5 Contractor shall place Octocrete, as manufactured by IPA, or approved equal to the area. Octocrete shall be placed in such a manner that it is consolidated, fills existing voids, and creates a smooth, dense surface in accordance with the Drawings.

421.9.6 Wastewater flow shall be maintained by methods which prevent contact with new pipe seal for 6-8 hours after Octocrete placement.

421.9.7 The pipe seal shall form a water-tight seal with the manhole wall, bench, trough, and pipe. The manhole and pipes shall be cleaned of all debris and foreign matter.

421.9.8 All manholes scheduled for Corbel and Wall Rehabilitation, interior coating, shall have pipe seals and the lower 18" of the manhole drilled and grouted. The lower 18" is measured from the lowest flowline elevation up 18". Drilling and grouting the lower 18" shall include at least two rows of drill and grout holes. Grouting the pipe seals and the lower 18" is subsidiary to Interior Manhole Coating and will not be paid for directly.

421.9.9 Additional grouting above the bottom 18" is not expected to be needed. Contractor is responsible to stop all active inflow and infiltration leaks in the manhole prior to placing the interior coating. Work and materials required to stop leaks in the manhole are considered subsidiary to Interior Manhole Coating and will not be paid for directly.

421.9.10 Drop manholes scheduled for Interior Manhole Coating shall have the pipe seals of all grade lines and drop lines grouted in addition to the bottom 18" of the manhole. All incoming and outgoing pipe seals shall be grouted, regardless of the height above the flowline of the manhole.

421.10 SEAL PRECAST JOINTS – PRESSURE GROUTING (TYPE Gp)

421.10.1 General: Prior to pressure grouting of manholes specified in the Drawings, all unsealed step holes, missing pipe seals and unsealed lift holes shall be repaired. A quick-setting cement and bricks, when necessary, shall be used to fill these defects. After the setting of the hydraulic cement, the repair shall be covered with a moisture resistant two-part epoxy adhesive coating such as Aquatapoxy as manufactured by American Chemical Corp. or approved equal.

421.10.2 Grout Material Utilization

A) Corbel and Frame, Wall, Pipe Seal, Bench and Invert: Urethane grout or other approved chemical pressure grout shall be utilized for the entire manhole.

B) No grouting operations shall be performed at temperatures below manufacturer's recommendations or where the temperature of the groundwater is below manufacturer's recommendations.
421.10.3 Corbel and Wall Grouting

A) Surface Preparation: Prior to pressure grouting of manhole corbel, entire surface area shall be coated with a layer of dry polymer mortar in accordance with the manufacturer’s recommendations. Dry polymer mortar shall not be applied to the wall portion of the manhole unless grout migration back into the manhole is observed during the grouting operation. No drilling or pressure grouting shall be done until the dry polymer mortar has been allowed to dry for a period of 24 hours. The dry polymer mortar shall extend to a point 12” below the corbel to wall joint. The dry polymer mortar shall be Octocrete as manufactured by IPA Systems, Inc., or approved equal.

B) Corbel Drilling: A minimum of four injection holes shall be drilled at 90° angles from each other at the same plane of elevation. Additional rows shall be separated by a distance of 18”, and the holes shall be staggered with the holes in the rows above and below in accordance with the Drawings. After removal of the grouting probe, activated oakum rope shall be used to fill the injection holes. Injection holes shall be patched with a waterproof quick setting mortar.

C) Wall Drilling: A minimum of four injection holes shall be drilled at 90° angles from each other at the same plane of elevation. Additional rows shall be separated by a distance of 24”, and the holes shall be staggered with the holes in the rows above and below in accordance with the Drawings. After removal of the grouting probe, activated oakum rope shall be used to fill the injection holes. Injection holes shall be patched with a waterproof quick-setting mortar.

421.11 PRECAST JOINT SEALING

421.11.1 Pressure Grout: A minimum of four injection holes shall be drilled at 90° angles from each other at the same plane of elevation approximately 6” above the precast section joint. An additional row of holes shall be drilled 6” below the joint staggered by 45° as shown in the plans. After removal of the grouting probe, activated oakum rope shall be used to fill the injection holes. Injection holes shall be patched with a waterproof, quick-setting hydraulic cement.

421.12 MEASUREMENT AND PAYMENT

421.12.1 Wall Rehabilitation (Type Gg):

A) Wall Rehabilitation shall be paid for at the unit price bid per square foot of manhole corbel or wall area rehabilitated. Corbel or wall area rehabilitated shall be measured as the interior and/or exterior surface area actually coated, measured to the nearest 0.1 square foot.

B) In manholes where Wall Rehabilitation is performed, Bench and Invert Rehabilitation, Pipe Seal Coating and Pressure Grouting, Lift Hole Plugging, Precast Joint Sealing, and Hole Patching shall be paid for separately at the unit price bid for each individual item.
421.12.2 Bench and Invert Rehabilitation (Type Gh): Bench and Invert Rehabilitation shall be paid for at the unit price bid per manhole, regardless of the size of the manhole or the number, diameter, or material, of the line segments connecting the manholes.

421.12.3 Pipe Seal Coating and Pressure Grouting (Type Gk): Pipe Seal Coating and Pressure Grouting shall be paid for at the unit price bid per manhole, regardless of the size of the manhole or the number, diameter, or material of the line segments entering the manholes.

421.12.4 Lift Hole Plugging (Type Go): Lift Hole Plugging shall be paid for at the unit price bid per manhole, regardless of the size of the manhole or the number of lift holes to be plugged.

421.12.5 Pre-cast Joint Sealing (Type Gp): Pre-cast Joint Sealing shall be paid for at the unit price bid per manhole, regardless of the size of the manhole of the number of joints sealed.

421.12.6 Hole Patching (Type Gr): Hole Patching shall be paid for at the unit price bid per manhole, regardless of the size or number of the holes to be patched.

421.12.7 Epoxy Coating (TypeGs):

A) Epoxy coating shall be paid for at a unit price bid per square foot of manhole corbel or wall area rehabilitated. Wall area rehabilitated shall be measured as the interior surface area actually coated, measured to the nearest 0.1 square foot.

B) In manholes where Epoxy coating is performed, Bench and Invert Rehabilitation, Pipe Seal Coating and Pressure Grouting, Lift Hole Plugging, Pre-cast Joint Sealing, and Hole Patching shall be paid for separately at the unit price bid for each individual item.
PART 422 – MANHOLE TESTING OF NEW AND REHABILITATED MANHOLES

422.1 GENERAL

422.1.1 Scope

A) This section describes manhole testing to effectively confirm the water-tight integrity of new manholes and existing manholes following infiltration related repairs and inflow related repairs.

422.1.2 Description

A) Infiltration may be observed in manhole defects at manhole walls, pipe seals or bench/trough areas. Infiltration related repairs are intended to eliminate leakage of groundwater into manholes.

B) Inflow may be observed in manhole defects at manhole frames, covers, frame seals, grade adjustments, grade adjustment seals, corbels, or walls. Inflow related repairs are intended to eliminate sources of surface water entry that become active during rainfall events.

422.1.3 Testing, Observations, and Guarantee Periods

A) The testing required shall be performed by the Contractor at locations designated by the Engineer and documented to the satisfaction of the Engineer.

B) Any new or rehabilitated manholes that are observed to be leaking by the Engineer during periods of high groundwater or during inflow conditions shall be subject to additional repairs. The Contractor shall be responsible for all additional repairs required on unsatisfactory manholes during the guarantee period.

422.2 MATERIALS

422.2.1 Not specified.

422.3 EXECUTION

422.3.1 Infiltration Testing

A) All of rehabilitated manholes and all of new manholes shall be observed (tested) by the Contractor in the presence of the Engineer for sources of infiltration. Observations will be made during high groundwater conditions, wherever possible.

B) Manholes shall be tested after installation with all connections (existing and/or proposed) in place. Drop-connections and gas sealing connections shall be installed prior to testing. The lines entering the manhole shall be temporally plugged with the plugs braced to prevent them from being drawn into the manhole. The plugs shall be installed in the lines beyond drop-connections, gas sealing
connections, etc. The test head shall be placed inside the frame at the top of the manhole (so that the manhole frame seal is tested) and inflated in accordance with the manufacturer's recommendations. A vacuum of 10" of mercury shall be drawn, and the vacuum pump will be turned off. With the valve closed, the level of vacuum shall be read after the required test time. If the drop in the level is less than 1" of mercury (final vacuum greater than 9" of mercury), the manhole will have passed the vacuum test. After a successful test, the temporary plugs will be removed. The required test time is determined from Table I.

Table I
MINIMUM TIME REQUIRED FOR A VACUUM DROP
OF 1" Hg (10" Hg – 9" Hg) (MIN:SEC)

<table>
<thead>
<tr>
<th>HEIGHT OF M.H. (DEPTH IN FT.)</th>
<th>48&quot; M.H.</th>
<th>60&quot; M.H.</th>
<th>72&quot; M.H.</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>10.0 sec.</td>
<td>13.0 sec.</td>
<td>16.0 sec.</td>
</tr>
<tr>
<td>8</td>
<td>20.0 sec.</td>
<td>26.0 sec.</td>
<td>32.0 sec.</td>
</tr>
<tr>
<td>12</td>
<td>30.0 sec.</td>
<td>39.0 sec.</td>
<td>48.0 sec.</td>
</tr>
<tr>
<td>16</td>
<td>40.0 sec.</td>
<td>52.0 sec.</td>
<td>64.0 sec.</td>
</tr>
<tr>
<td>20</td>
<td>50.0 sec.</td>
<td>65.0 sec.</td>
<td>80.0 sec.</td>
</tr>
<tr>
<td>24</td>
<td>60.0 sec.</td>
<td>78.0 sec.</td>
<td>96.0 sec.</td>
</tr>
<tr>
<td>**</td>
<td>T = 5.0 sec.</td>
<td>T = 6.5 sec.</td>
<td>T = 8.0 sec.</td>
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</tbody>
</table>

**For all Manholes over 24' in depth, add the "T" seconds as shown for each respective diameter for each 2' of additional depth of manhole to the time shown for that 24' depth. [Example: A 30' deep, 48" Manhole Total Test Time would be 75.0 seconds. 60.0 + 3(5.0) = 75.0 seconds] (Values listed above are extrapolated from ASTM C924-85).

C) Manhole vacuum levels observed to drop greater than 1" of mercury (Final vacuum less than 9" of mercury) will have failed the test and will require additional rehabilitation. The Contractor shall make the necessary repairs to the already completed rehabilitation work at no additional compensation. If the failure of the vacuum test is determined to be due to preexisting conditions not on the manhole rehabilitation schedule for that manhole, this additional work may be authorized by the Engineer. After completion of the additional rehabilitation the manhole shall then be retested as described above until a successful test is made.

D) If it is determined by the Engineer that additional rehabilitation work items need to be completed on a manhole that has failed the vacuum test, these may be authorized. After the additional work is completed, the manhole will be retested.

422.3.2 Inflow Testing

A) All of rehabilitated manholes and all of new manholes shall be dyed water tested unless the manhole has successfully passed the vacuum test. Manholes shall be dyed water tested in the presence of the Engineer. The dye test shall consist of applying a concentrated dye solution around the manhole frame. Dyed water shall be applied for at least ten minutes.
B) Manholes observed to be actively leaking greater than one drip per five seconds will have failed the test and will not be acceptable. Manholes failing the test will require additional rehabilitation by the Contractor at no additional compensation.

422.4 MEASUREMENT AND PAYMENT

422.4.1 The cost of manhole testing will not be paid for separately but shall be included in the Contract Unit Price of the rehabilitation or replacement being performed.
PART 423 – OBSTRUCTION REMOVAL

423.1 GENERAL

423.1.1 INTENT: Obstruction removals are excavations to clear obstructions such as solids, dropped joints, crushed or collapsed pipe, and reductions in the cross-sectional area of more than 20% that will prevent pre-construction television inspection and associated pipeline rehabilitation.

423.1.2 TELEVISION INSPECTION: Obstructions indicated on the Drawings are based on previously performed television inspections. The exact location of the obstruction removal will be determined by internal television inspection prior to excavation. The television video will have a digital footage display on the screen and shall be reviewed by ENGINEER prior to excavation to determine the extent of the repair as indicated on the Drawings.

423.1.3 NOTIFICATION: CONTRACTOR shall notify ENGINEER not less than 48 hours in advance of the time he plans to begin work at a particular location with the Project.

423.2 MATERIALS

423.2.1 BACKFILL: Backfill, including pipe bedding, shall be placed and compacted as specified in Part 403.

423.3 PROCEDURE

423.3.1 The Contractor shall identify all obstructions for the sewer section scheduled for rehabilitation.

423.3.2 If the Contractor identifies obstructions that cannot be removed by conventional sewer cleaning equipment, then, with the Engineer’s approval, an excavation shall be made to remove the obstruction. The repair shall be an adequate repair for insertion of required equipment or material. This shall be paid at the bid price for obstruction removal.

423.3.3 Surface Restoration: Service and lateral pits, and other work areas shall be restored to condition as good as that before construction occurred. Disturbed grasses shall be sodded in accordance with Part 402 – Restoration. Pavements removed or damaged shall be replaced. Concrete embankment shall be replaced or installed at locations indicated in the Drawings and in accordance with these specifications.

423.4 MEASUREMENT AND PAYMENT

423.4.1 Obstruction Removal shall be paid for at the Contract Unit Price for each obstruction removal actually performed.

423.4.2 Protruding Service connection removal and replacement shall be paid for at the Contract Unit Price for Service Connection.
423.4.3 The prices shall be payment in full for performing and completing the work and for furnishing all labor and materials necessary including excavation and removal of existing structure, trench safety system, pipe repair materials, connectors, pipe sealing materials, labor, backfilling, surface restoration, testing, and all incidental costs.
PART 424 – CURED-IN-PLACE SECTIONAL AND SPOT REPAIR

424.1 GENERAL

424.1.1 It is the intent of this specification to provide for the reconstruction of a particular section of sewer pipe without excavation. The reconstruction will be accomplished using a non-woven fabric tube of particular length and a thermoset resin with physical and chemical properties appropriate for the application. The tube is impregnated with the resin and then placed inside or over a protective launching device with a translucent bladder and then winched into the existing sewer. The inflation bladder, when expanded, will conform to the host conduit. When the launching device is properly positioned, the end is opened, and the resin-saturated tube is moved into place. Once the tube/resin composite is cured, the inflation bladder and the launching device are removed.

424.1.2 Reference Standards

A) Installation and material tests of Cured-In-Place sectional and spot repair must meet the minimum requirements demonstrated in the following standards:

<table>
<thead>
<tr>
<th>Standard</th>
<th>Description</th>
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</thead>
<tbody>
<tr>
<td>ASTM F1216</td>
<td>Standard Practice for the Installation of Cured-In-Place Pipe by Inversion Lining</td>
</tr>
<tr>
<td>ASTM F1743</td>
<td>Standard Practice for Rehabilitation of Existing Pipelines and Conduits by Pull-In-Place Installation of Cured-In-Place Thermosetting Resin Pipe (CIPP)</td>
</tr>
<tr>
<td>ASTM D790</td>
<td>Test Method of Flexural Properties of Plastics: Flexural Strength 4,500 psi (minimum) and Flexural Modulus 250,000 psi (minimum)</td>
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<tr>
<td>NASSCO</td>
<td>Specifications for Sewer Collection System Rehabilitation</td>
</tr>
</tbody>
</table>

424.2 MATERIALS

424.2.1 Tube

A) The tube shall consist of one or more layers of flexible needled felt or an equivalent nonwoven material capable of carrying resin, withstanding installation pressures and curing temperatures. The tube shall be compatible with the resin system used. The tube shall be capable of conforming to offset joints, bells, and disfigured pipe sections. The tube shall be fabricated to a size that, when installed, will tightly fit the internal circumference of the original conduit. Allowance shall be made for circumferential stretching during inversion.

424.2.2 Resin

A) A general purpose, unsaturated, styrene-based, thermoset resin and catalyst system or an epoxy resin and hardener that is compatible with the inversion process shall be used. The resin must be able to cure in the presence of water and the initiation temperature for cure shall be less than 180° F (82.2° C).
B) Resin – The resin used shall be high-grade corrosion resistant isophthalic polyester, vinyl ester, or epoxy, specifically designed for the Cured-In-Place sectional and pipe repair being installed.

C) The minimum length shall be that deemed necessary by the ENGINEER to effectively span the entire pipeline defect being corrected to sound pipe beyond either end of the defect, unless otherwise specified. The required minimum lengths shall be verified in the field before impregnation of the tube with resin.

424.3 EXECUTION

424.3.1 Pre-Installation Procedures

A) Safety

1) CONTRACTOR shall carry out his operations in strict accordance with all OSHA and manufacturer’s safety requirements. Particular attention is drawn to those safety requirements involving working with scaffolding and engineering confined spaces.

B) Cleaning and Inspection

1) CONTRACTOR shall clean and inspect each line immediately prior to reconstruction utilizing a pan and tilt camera capable of verifying active or inactive service connections and the overall structural condition of the pipeline. All roots, debris, and protruding service connections shall be removed prior to reconstruction. Inspection shall include the complete length of the line from manhole to manhole.

2) Prior to installing Cured-In-Place sectional and point repairs, the CONTRACTOR shall verify that service connections are active by introducing dye into the lines at cleanouts, vent stacks or other access points as approved by the Engineer. Dye testing shall be recorded by CCTV inspection at the location in the main line where the dye appears. All addresses will be noted on log sheets for future reference. The CCTV camera shall be equipped with a rotating head and shall be pivot ed to provide a view into each service line.

C) Line Obstructions and Point Repairs

1) The original pipeline shall be clear of obstructions such as solids, dropped joints, protruding service connections, crushed or collapsed pipe, and reductions in the cross-sectional area of more than 20%. Protruding service connections shall be removed to prevent dimpling of the finished liner. Maximum allowable protrusion shall be 1/2". If inspection reveals an obstruction that cannot be removed by conventional sewer cleaning equipment, then a point repair excavation shall be made per Part 411.
2) If, during pre-television inspection, the CONTRACTOR identifies dropped joints, line sags, or sections requiring repairs not scheduled, he shall notify the ENGINEER. The ENGINEER will determine whether such defects require correction by Cured-In-Place sectional and spot repair and/or by point repair excavation. The CONTRACTOR shall not perform such additional repairs without prior approval from the ENGINEER.

D) By-Pass of Flow and Interruption of Service

1) The lines scheduled for Cured-In-Place sectional and spot repair shall have all flows bypassed around them when determined necessary by the Engineer to ensure adequate conveyance of flow during repair. The pumping system shall be sized for normal to peak flow conditions. The upstream manhole shall be monitored at all times and an emergency deflate system shall be incorporated so that plugs may be removed at any time without requiring confined space entry.

2) When preparing for making connection to the existing system or other work, which will interrupt service to the utility users, CONTRACTOR shall notify the affected user at least 48 hours in advance of service interruption, stating the approximate time and duration of interruption of service. Advance notification shall not extend beyond 72 hours.

3) Public advisory services will be required to notify all parties whose service laterals will be out of commission and to advise against water usage until the mainline is back in service.

424.3.2 Installation of Lines

A) The tube shall be inspected for tears or frayed sections. Tubes failing the inspection shall be immediately removed from the job site and replaced with suitable sections at no additional cost to City. Tubes passing the inspection shall be impregnated with the thermoset resin.

B) No uncontrolled pouring of resin will be allowed during tube saturation. All resin shall be contained. CONTRACTOR shall ensure that no public or private property is exposed to contamination by liquid resin components or compounds.

C) The saturated tube, with inflation bladder where required by the installation process, shall be pulled into the host pipe in accordance with the manufacturer's standard specifications. The pull shall be complete when the tube is properly aligned with the section of the host pipe being reconstructed. Any loss of resin required for development of proper wall thickness and curing of the repair or any loss of resin into the collection system creating an obstruction will not be permitted. Any resin lost during the insertion process shall be caught and removed from the system at the next downstream manhole. No contamination or dilution of the resin by exposure to dirt, debris, or water during the pull will be permitted.
D) When required, the tube shall be inverted out of the launching device by controlled air or water pressure. The tube shall be held tightly in place against the wall of the host pipe by the applied pressure until the cure is complete. The resin and tube shall be completely protected during the curing. No contamination or dilution of the tube/resin composite by exposure to dirt, debris, or water during curing will be permitted.

E) When the curing process is completed, the pressure shall be released and the inflation bladder and launching device shall be removed from the host pipe with the winch. No barriers, coatings, or any material other than the cured tube/resin composite shall be left in the host pipe. Any materials other than the cured tube/resin composite used in the installation shall be removed from the pipe by the CONTRACTOR.

424.3.3 Service Connections

A) After the tube/resin composite has been cured, CONTRACTOR shall reconnect the existing active service connections. Service connections shall be reinstated by one of two methods. In general, service connections shall be reinstated internally in accordance with Part 423.3.b. Where service connections are found to be protruding or otherwise defective (i.e., end of service connection is broken away or irregular such that the full circumference of the service line would not contact with the Cured-In-Place Pipe) reinstatement shall be an external service reconnection in accordance with Part 423.3.c.

B) Internal Reconnection: Without excavation, the service connection shall be reinstated by means of a television camera and a cutting device that re-establishes the connection to not less than 90% capacity. Service connections shall be cut in with neat and smooth circumferential lines to prevent snagging of debris and/or solids. CONTRACTOR shall provide a physical demonstration, in the presence of the Engineer, to show the assurance of a watertight seal of all service connections.

C) External Reconnection: Service connections shall be reinstated by excavation and reconnecting the service with an approved saddle. The CONTRACTOR shall remove the appropriate amount of carrier pipe to allow the saddle to be directly connected to the outside wall of the CIPP. An epoxy, meeting the manufacturer’s recommendations, shall be applied to the saddle to assure a water-tight seal between the saddle and CIPP. The saddle shall be secured with stainless steel bands. After the epoxy has set and prior to backfilling, the CONTRACTOR shall seal any open annular space between the existing sewer and new liner pipe with a non-shrink grout. The service connection riser shall be carried from the main to the existing elevation of the connection, utilizing bell and spigot cast iron soil pipe. At a location approved by the ENGINEER, a connection between the existing lateral service and the new service shall be made, utilizing a solid sleeve coupling, Rockwell Omni, OCUT sewer connector, or approved equal. The CONTRACTOR shall then completely encase the saddle and exposed pipe in concrete. Care shall be used not to damage the CIPP. If damage occurs as a result of the
CONTRACTOR’S operations, the CONTRACTOR shall assume all cost associated with the repair of the CIPP.

D) It is the intent for service connections to be re-opened by internal reconnection where a watertight seal can be made. Where service connections are identified by TV inspection as defective, they shall be re-opened by external reconnection.

E) Service interruptions to any home tributary to the sewer line being rehabilitated shall not exceed 24 hours.

F) If external service connections are identified, the Engineer shall determine if a point repair should be made by the remove and replace method.

424.3.4 Final Inspection

A) Upon completion of the installation, the rehabilitated sewer shall be CCTV inspected providing both a video recording and log identifying all service connections and openings, in accordance with Part 415 – Construction of Television Inspection of Sanitary Sewers.

B) Visual inspection of the sectional and spot repair shall be in accordance with ASTM F1216, Section 8.6.

C) Upon acceptance of the installation work and testing, the CONTRACTOR shall restore the project area affected by the operations to a condition at least equal to that existing prior to the work.

424.4 MEASUREMENT AND PAYMENT

424.4.1 Cured-In-Place Sectional and Spot Repair shall be paid for at the applicable Contract Unit Price as follows: The unit price shall cover the entire cost of Cured-In-Place sectional and spot repair for a 6’ length.

424.4.2 Additional length of Cured-In-Place sectional and spot repair in excess of 6’ shall be paid for at the applicable Contract Unit Price measured to the nearest 1’.

424.4.3 The prices shall be payment in full for performing and completing the work and for furnishing all labor and materials necessary including excavation and removal of existing structure, trench safety system, pipe repair materials, connectors, pipe sealing materials, labor, backfilling, surface restoration, testing and all incidental costs.

424.4.4 Service reconnections within the point repair area shall be included with the unit price bid for the point repair.

424.4.5 Pre-installation television inspection and cleaning shall be paid for by bid unit price per foot of sewer line inspected. All post-television inspection shall be included in price of repair in accordance with Part 415.
PART 425 – SEALED MANHOLE FRAME AND COVER

425.1 GENERAL

425.1.1 The Contractor shall install a sealed frame and cover when performing manhole repair Types A (manhole frame, cover and frame seal) and C (manhole frame, cover, frame seal, and chimney) within the City of Tulsa regulatory flood plain boundary, as shown on the plans, or when directed by the Engineer.

425.1.2 Manhole frame and cover repairs shall adhere to City of Tulsa Construction Specifications Part 418 – Replacement of Manhole Frame and Cover, Frame Seal, Chimney Seal, and Grade Adjustment; except where specified otherwise by this Part.

425.2 DEFINITIONS

425.2.1 Sealed frame and cover shall be defined as a frame and cover as described in City of Tulsa Standard Detail Nos. 352,353, or 354, as applicable, with the incorporation of a sealing gasket, bolts, and bolting pads.

425.2.2 Sealed Lamphole Frame and Cover shall be defined as a lamphole frame that among its attributes includes a minimum circular opening of 8.5" in diameter to conform to the City of Tulsa Standard Detail No. 360 (Standard Detail for Lampholes). In addition to the requirements of the referenced detail, the frame and cover shall incorporate a sealing gasket, bolts, and bolting pads.

425.3 MATERIALS

425.3.1 Sealed Frame and Cover shall be “Deeter 1265 – Bolted and Sealed” or “Deeter 1296 – Bolted and Sealed”, as applicable, with Tulsa emblem or equal.

425.3.2 Sealed Lamphole Frame and Cover shall be “Deeter 1828-B – Bolted and Sealed.”

425.3.3 Bolt threading for sealed manhole frame and cover shall be 5/8" at 11 threads per inch, unless specified otherwise by the Engineer. Bolts shall utilize the McGard locking system keyed to the City of Tulsa standard lock.

425.3.4 All other materials shall be in accordance with City of Tulsa Construction Specification Part 418 – Replacement of Manhole Frame and Cover, Frame Seal, Chimney Seal, and Grade Adjustment.

425.4 EXECUTION

425.4.1 Sealed Lamphole Frame and Cover

A) Installation of a Sealed Frame and Cover shall result in a watertight installation conforming to the requirements of Special Detail No. 2.
B) Contractor shall apply hydrophilic paste to ensure filling of any voids or pits on the pipe surface and to ensure adhesion of the hydrophilic waterstop to the pipe prior to placement of the concrete collar. Paste and waterstop shall be placed immediately prior to pouring of the concrete collar and kept from contact with water. Avoid premature wetting of the paste or waterstop in order to avoid premature swelling of the paste or waterstop. Paste or waterstop which begin to swell prior to placement of the concrete shall be removed and replaced prior to placement of the concrete collar. Follow all manufacturer's requirements for hydrophilic paste and hydrophilic waterstop.

C) Concrete collar shall be placed and finished to a smooth, level surface. Troweleable bitumastic shall be placed in a layer 3/16" over the collar prior to placement of the frame and cover.

425.5 MEASUREMENT AND PAYMENT

425.5.1 Payment for the installation of a Sealed Frame and Cover, and payment for a Sealed Lamphole Frame and Cover shall be in addition to the prices bid for Type A, Type C repair, Type F repair, Manhole Replacement, Lamphole Replacement, or Lamphole Frame and Cover, for each Sealed Frame and Cover, and for each Sealed Lamphole Frame and Cover installed.

425.5.2 The price bid for a sealed Frame and Cover shall be payment in full for performing and completing all additional work and for furnishing all additional labor and materials necessary above and beyond the cost of a Type A or Type C repair.

425.5.3 The price bid for a Sealed Lamphole Frame and Cover shall be payment in full for performing and completing all additional work and for furnishing all additional labor and materials necessary above and beyond the cost of a Lamphole Frame and Cover, or a Lamphole Replacement.

425.5.4 No payment shall be made until the manhole and its adjacent area have been restored and the manhole and its appurtenances have satisfactorily passed testing.

SECTION END