

**KC Water  
Standards and Specifications  
For Water Main Extensions and Relocations**



**May 2018**

# **FOREWARD**

## ***Purpose:***

The purpose of this document is to provide minimum guidelines for the furnishing of all materials, labor, equipment, tools, superintendence, records, and other services necessary to construct, complete with appurtenances, water main extensions and relocations, as approved by KC Water.

## ***Scope:***

This Document is general in scope and will refer to conditions that may not be encountered on each water main extension and relocation project. Any provision that pertains to a nonexistent condition is not applicable to the work to be performed.

## ***Revisions:***

This document supersedes all previous versions of the Standards and Specifications for Water Main Extensions and Relocations. This document is a standard and must be adhered to unless deviations are approved by KC Water or Contract Documents or Drawings modify the standard. KC Water will revise this document on an as-needed basis and will issue a new document dated on the cover.

## **DEFINITIONS/ABBREVIATIONS**

The following is a list of definitions and/or abbreviation used throughout the document.

**ACI:** American Concrete Institute.

**ANSI:** American National Standards Institute.

**API:** American Petroleum Institute.

**Applicant:** An individual, firm, partnership, joint venture, corporation, company or association who desires a water main extension or relocation and who agrees to pay all bills for engineering, labor, and materials used for the design, construction, and installation of said water main extension or relocation.

**APWA:** American Public Works Association.

**ASPA:** American Sod Producers Association.

**ASTM:** American Society for Testing and Materials.

**AWWA:** American Water Works Association.

**City:** City of Kansas City, Missouri

**Contractor:** The individual, firm, partnership, joint venture, corporation, company or association contracting with the applicant to perform the construction and installation of said water main extension or relocation.

**CRSI:** Concrete Reinforcing Steel Institute.

**Director:** The Director of KC Water or his authorized representative.

**Drawings:** The construction plans, construction details, and supplemental drawings or reproductions thereof, approved by KC Water that show the location, character, dimensions, and details of the work.

**Engineer:** Unless otherwise specified, the term “Engineer” when used in these Standards and Specifications shall mean the individual, firm, partnership, joint venture, corporation, company or association contracting with the Applicant to perform the design of said water main extension or relocation.

**FS:** Federal Specifications.

**IMIAC:** Internal Masonry Industry All-Weather Council.

**ISO:** International Standards Organization.

**KC Water:** City of Kansas City, Missouri Water Services Department

**MDNR:** Missouri Department of Natural Resources

**MoDOT:** Missouri Department of Transportation

**NSF:** National Science Foundation

**Permits, Licenses, and Certificates:** An official document issued by the City, County, State or other governing body, authorizing construction in an area of their jurisdiction.

**Product:** Material, machinery, components, equipment, fixtures, and systems incorporated in the Work Product. Does not include machinery and equipment used for preparation, fabrication, conveying and erection of the Work.

**Sewers:** Any conduit or structure (manholes, inlets, etc.) for conveying wastewater or stormwater.

**Shop Drawings:** All drawings, diagrams, illustrations, brochures, schedules, and other data which are prepared by the Contractor, a sub-contractor, manufacturer, supplier, or distributor which illustrate the equipment, material, machinery, or some portion of the work is submitted to the Engineer for review prior to incorporation into the work product.

**Specifications:** Unless otherwise specified the term “Specifications” refers to the most current edition of “Standards and Specifications for Water Main Extensions and Relocations” as distributed by KC Water.

**Work:** All work to be completed and the equipment, supplies, labor, materials, and records to be furnished by the Contractor for each Water Main Extension and Relocation.

**Working Day:** Monday, Tuesday, Wednesday, Thursday and Friday, except all legal Holidays observed by the City. Legal Holidays, Saturday and Sunday are not working days.

**STANDARDS AND SPECIFICATIONS  
FOR  
WATER MAIN EXTENSIONS AND RELOCATIONS**

**TABLE OF CONTENTS**

<b>Section</b>	<b>Title</b>	<b><u>No. Pages</u></b>
<b>DIVISION 1 - GENERAL REQUIREMENTS</b>		
01000	General Requirements .....	9
01016	Water Mains Near Sewers .....	2
01300	Submittals .....	3
01600	Material and Equipment .....	2
01700	Traffic Regulations .....	5
01900	Project Closeout .....	2
<b>DIVISION 2 - SITEWORK</b>		
02200	Excavation and Backfill .....	12
02273	Riprap .....	4
02320	Utility Casings .....	5
02575	Surface Restoration .....	3
02608	Concrete Vaults .....	4
02618	Ductile Iron Pipe Water Main .....	9
02619	Pre-stressed Concrete Cylinder Pipe .....	8
02641	Valves .....	10
02645	Hydrants, Blow-off and Flushing Assemblies .....	2
02669	Thrust Restraints .....	3
02675	Water Main Testing, Disinfection, and De- chlorination .....	5
02930	Seeding .....	9
02931	Sodding .....	5
<b>DIVISION 3 - CONCRETE</b>		
03001	Concrete .....	10
03100	Concrete Formwork .....	3
03200	Concrete Reinforcement .....	3

**STANDARDS AND SPECIFICATIONS  
FOR  
WATER MAIN EXTENSIONS AND RELOCATIONS**

**TABLE OF CONTENTS (Continued)**

STANDARD DETAILS

01000-1	Pipeline Marker
01016-1	Sewer Crossing Detail
01016-2	Existing 2" Water Main Relocation at New Sewer
01016-3	Existing 4" or Larger Water Main Vertical Relocation at New Sewer
01016-4	Existing 4" or Larger Water Main Horizontal Relocation at New Sewer
01016-5	Existing 4" or Larger Pit Cast Pipe Water Main Relocation at New Sewer
02200-1	Embedment and Backfill for Water Mains
02200-2	Typical Stream Crossing, 12" Mains and Smaller
02320-1	Typical Encasement Under Roadways and Railroads
02320-2	Gas Main / Water Main Crossing
02608-1	Typical Pre-Cast Concrete Vault
02618-1	Polyethylene Encasement for Ductile Iron Pipe
02641-1	Typical Air Release (12" Mains or Smaller)
02641-2	Typical Air Release (16" Mains or Larger)
02641-2A	Typical Air Release 3" or Larger (16" Mains or Larger)
02641-3	Typical Butterfly Valve Installation
02641-4	Actuator Nut Extension
02645-1	Typical Hydrant Installation with 90° Bend (Type "A" Setting)
02645-2	Typical Hydrant Installation - Straight Set (Type "B" Setting)
02645-3	Typical Hydrant Set in Back-slope
02645-4	Typical Blow-off Assembly for 4"-12" Pipe
02645-5	Typical Blow-off Assembly for 16"-24" Pipe
02645-6	Typical Flushing Assembly
02669-1	Typical Backing Blocks for Tees and Plugs
02669-2	Typical Backing Blocks for Horizontal Bends
02669-3	Typical Straddle Block for 6-inch and 8-inch Pipe
02669-4	Typical Straddle Block for 12-inch and 16-inch Pipe
02669-5	Typical Straddle Block for 20-inch, 24-inch and 30-inch Pipe
02669-6	Alternate Backing Blocks for Tees and Plugs
02669-7	Alternate Backing Blocks for Horizontal Bends
02669-8	Alternate Straddle Blocks for 6-inch and 8-inch Pipe
02669-9	Alternate Straddle Blocks for 12-inch and 16-inch Pipe
02669-10	Alternate Straddle Blocks for 20-inch, 24-inch, and 30-inch Pipe
02669-11	Alternate Backing Blocks for Tees and Plugs
02669-12	Alternate Backing Blocks for Horizontal Bends
02669-13	Alternate Straddle Blocks for 6-inch and 8-inch Pipe
02669-14	Alternate Straddle Blocks for 12-inch and 16-inch Pipe
02669-15	Alternate Straddle Blocks for 20-inch, 24-inch, and 30-inch Pipe
18015-1	Operating Nut (Stem Nut) - Attachment A
18015-2	Operating Nut (Stem Nut) - Attachment B

## SECTION 01000

### GENERAL REQUIREMENTS

#### PART 1 GENERAL

##### 1.1 Section Description

- A. This section provides for the general administrative and construction requirements.

##### 1.2 Section Includes

- A. Curb Requirements
- B. Construction Notification
- C. Licenses, Permits and Certificates
- D. Easements and Rights-of-Way
- E. Protection of Property
- F. Fencing
- G. Removal and Restoration of Surfaced Areas
- H. Notices to Property Owners and Authorities
- I. Mail Boxes
- J. Line and Grade
- K. Unfavorable Construction Conditions
- L. Cutting and Patching
- M. Erosion and Sediment Control
- N. Reference Standards
- O. Compaction and Gradation Testing
- P. Pollution Control

- Q. Connections to Existing Facilities
- R. Project Records Documents
- S. Abandoned Water Mains
- T. Pipeline Markers

**1.3 Curb Requirements**

- A. All curbs are to be in place prior to construction of any water main extension or relocation. If curbs cannot be in place, a written explanation may be submitted to KC Water requesting an exception to this requirement. Rare exceptions may be granted at the sole discretion of KC Water, only if the Applicant agrees that they will be responsible for any adjustments to water mains and/or appurtenances that are required by KC Water to bring the water main in compliance with the Specifications, after the curbs are in place. KC Water will require additional survey information be provided to verify proper installation.

**1.4 Construction Notification**

- A. Prior to any work activity at the project site the Contractor shall contact the appropriate KC Water Construction Area Supervisor to arrange for a pre-construction conference. A pre-construction conference must be held a minimum of 2 working days prior to any work activity on the project site. Saturdays, Sunday or any Legal Holiday observed by KC Water shall not be included in the 2 working day period.

If the project site is located north of the Missouri River, the Contractor should contact the North Area Inspection Supervisor at 3805 N Oak, Suite Q. The phone number is 784-6401

If the project site is located south of the Missouri River the Contractor should contact the South Area Inspection Supervisor at 4700 E 63<sup>rd</sup> St. The phone number is 513-0249.

The following minimum information shall be addressed at the pre-construction meeting:

1. Proposed Starting Date
2. Project or Work Order Number and Location
3. Contractor Foreman's Name, Phone Number, and Emergency Numbers
4. Contractor's' Name, Phone Number, and Emergency Numbers
5. Pre-construction Photographs



6. Proposed sequence and schedule of Work
  7. Coordination of water main shuts for connections.
  8. Maintenance of Record Documents
  9. Survey cut sheet
- B. The Contractor shall notify KC Water Construction Area Supervisor when work will be suspended, not occur, or be resumed once the pre-construction meeting has been held or the Notice to Proceed has been given.
- C. When the Contractor has completed testing, chlorination and other work required to prepare for connecting new water mains to existing mains, the Contractor shall contact the appropriate KC Water Inspection Supervisor to arrange for a meeting to coordinate the required main shut and connections.

#### **1.5 Licenses, Permits, and Certificates**

- A. All licenses, permits, and certificates, etc. required for, and in connection with, the Work shall be secured by the Contractor at their sole cost and expense. The Contractor will be required to pay any permit fees for water service permits or water service taps.
- B. Contractor shall comply with all requirements and recommendations of the authority or authorities issuing the license, permit, or certificate.

#### **1.6 Easements and Rights-Of-Way**

- A. General:
1. Contractor will confine construction operations to the areas approved by KC Water and use due care in placing construction tools, equipment, excavated materials, and pipe materials and supplies so as to cause the least possible damage to property and least interference with public traffic.
- B. Private Property:
1. Contractor shall set stakes to mark the boundaries of easements across private property. The stakes shall be protected and maintained until completion of construction. After cleanup has been completed the Contractor shall remove all construction stakes.

2. Should it become necessary for the Contractor to access property outside the City's right-of-way, the Contractor shall obtain written consent from the owner and tenant prior to accessing property. The Contractor shall notify each owner and tenant a minimum of two (2) working days prior to entering property.
  3. Whenever an easement is occupied by crops that might be damaged by work operations, Contractor shall notify the property owner so that the crops may be removed before work is started. Contractor shall be responsible for all damage to crops outside the easement and shall make satisfactory settlement for the damage with the property owner.
  4. Contractor shall restore irrigated fields and replace all terraces to their original condition and to the satisfaction of the property owner where the work crosses fields or lawns that are leveled for irrigation or terraced.
- C. Crossing State Highways:
1. The Applicant or Contractor shall secure the necessary permit and post bond as required for work within the limits of the MoDOT right-of-way.
  2. All work within the right-of-way shall be in conformance with MoDOT requirements.
  3. The permit must be secured before any work is started within the MoDOT right-of-way.
- D. Crossing Railroads:
1. All work within railroad right-of-way shall be in conformance with the corresponding railroad company's requirements.
  2. Contractor will notify KC Water Inspection Office as to what the railroad company's requirements are in regards to railroad permits, flagmen, inspectors, etc.

## **1.7 Protection of Property**

- A. The Contractor shall protect from damage or injury all property including survey monuments, property markers, benchmarks, etc. Items damaged shall be replaced or repaired at the Contractor's expense.
- B. Contractor shall be responsible for location of all existing underground installations in advance of excavating or trenching by contacting 1-800-DIGRITE. Contractor shall protect, shore, brace, support, and maintain all underground pipes, conduits, drains, and other underground construction uncovered or otherwise affected by his construction operations.

- C. All existing utilities, adsorption fields, and utility services shall be located in advance of excavation and shall be protected against damage. Changes in grade and alignment may be made to the work to avoid conflicts with existing structures if approved by KC Water.
- D. Contractor shall not remove existing pipes, conduits, cables, trees, shrubs, curbs, or pavement to facilitate construction unless permission is granted by KC Water. All costs incurred, including restitution, shall be at the Contractor's expense.
- E. Contractor shall make provision for the uninterrupted flow of sewers, drains, and watercourses during construction. Structures disturbed during construction shall be restored as soon as possible.
- F. Trees, fences, poles, guy wires and anchors, shrubs, flowerbeds, sod, and all other property shall be protected unless their removal is authorized. Any property damaged shall be restored at the Contractor's expense to the satisfaction of the property owner or tenant. No trees shall be removed outside of the permanent easement, except where authorized by KC Water, or by written permission from property owners.
- G. To protect persons from injury and to avoid property damage, barricades, construction signs, and guardrails shall be placed and maintained during the progress of the Work. Rules and regulations of local authorities respecting safety provisions shall be observed.
- H. All work shall be conducted in a manner to minimize interruption to traffic. The Contractor shall provide suitable plating where traffic must cross open trenches.
- I. All pavement, surfacing, driveways, curbs, walks, buildings, utility poles, guy wires, fences, and other surface structures affected by construction operations, together with all sod and shrubs in yards, parkways, and medians, shall be restored to their original condition or better, whether within or outside the easement. All replacements shall be made with new materials.
- J. Contractor shall protect all existing structures and property from damage and shall provide bracing, shoring, or other work necessary for such protection.
- K. Contractor will be held responsible for any damage to existing structures, Work, materials, or equipment because of their operations and shall repair or replace any damaged structures, Work, materials, or equipment to the satisfaction of the Owner of the damaged item.
- L. Contractor shall be responsible for all damage to streets, roads, curbs, sidewalks, highways, shoulders, ditches, embankments, culverts, bridges, or other public or private property, which may be caused by transporting equipment, materials, or workers to or from the Work. Contractor shall make satisfactory and acceptable

arrangements with the agency having jurisdiction over the damaged property concerning its repair or replacement.

### **1.8 Fencing**

- A. Contractor shall maintain all existing fences affected by the Work until completion.
- B. Fences that interfere with construction operations shall not be relocated or dismantled until written permission is obtained from the owner of the fence, and the time period that the fence may be left relocated or dismantled has been agreed upon. Where fences must be maintained across the construction easement, adequate gates shall be installed.
- C. Gates shall be kept closed and locked at all times when not in use.
- D. On completion of the Work across any tract of land, Contractor shall restore all fences to their original or better condition, and to their original location.

### **1.9 Removal and Restoration of Surfaced Areas**

- A. Wherever street surfacing is cut or disturbed, the Applicant shall obtain the necessary permits and the Contractor shall remove and restore all street or roadway pavement, furnishing all necessary labor and materials.
- B. It shall be the responsibility of the Contractor to determine the nature and thickness of all pavements and surfacing to be cut and replaced together with any base courses required in connection therewith.
- C. Temporary surfacing, material to be approved by KC Water, shall be provided during construction so that all streets are kept in passable condition.
- D. Concrete pavement, asphaltic surface courses, macadam pavements, and any other type of pavement or surface course that is cut or damaged shall be restored in accordance with Section 02575.
- E. Streets, highways, and roads that, in the opinion of KC Water must be opened to traffic at the earliest possible time, shall be backfilled and the pavement restored immediately after the pipe and fittings are installed.

### **1.10 Notices to Property Owners and Authorities**

- A. Contractor shall notify owners of adjacent property and utilities when the Work may affect them.
- B. When it is necessary to temporarily deny access to property, or when any utility service connection must be interrupted, Contractor shall give two (2) working days' notice to the affected persons. Notices shall conform to any local

ordinances, will be delivered in writing, and will include appropriate information concerning the interruption and instructions on how to limit inconvenience.

- C. Utilities and other concerned agencies shall be notified at least two (2) working days prior to cutting or closing streets or other traffic areas or excavating near underground utilities or poles.

#### **1.11 Mail Boxes**

- A. U.S. Postal Service regulations prohibit the delivery of mail to addresses where there are no mailboxes or where the mailboxes are not readily accessible. In areas where it is necessary to remove mail boxes to facilitate the Work, it shall be the obligation of the Contractor to install any mail boxes so removed to their original positions and elevations and have the area stabilized and restored to the original or better condition. Where it is not possible to restore mail service within twenty-four (24) hours, temporary mail service shall be provided at the contractor's expense.
- B. Contractor shall not position materials and equipment that will impede the delivery of mail.
- C. Excavated material shall be removed as soon as possible from the vicinity of all mailboxes to minimize inconvenience.

#### **1.12 Line and Grade**

- A. A Registered Land Surveyor must set control points for the work. Horizontal and vertical control points shall be established using State Plane Coordinates, "Missouri Coordinate System of 1983, West Zone" and NAVD 88 Datum, with the date of adjustment. The Applicant is responsible for hiring a Registered Land Surveyor for this work. All additional survey, layout, and measurement work shall be the responsibility of the Applicant and the Contractor.
- B. Applicant and Contractor shall provide qualified and experienced staff, equipment and materials required to complete the survey, layout, and measurement work. Applicant and Contractor shall also furnish necessary labor, equipment, and materials to establish or designate control points when required, establish construction easement boundaries, and check survey, layout, and measurement work. Offset stakes shall be provided at a minimum of 100 feet along the water line and at all appurtenances and fittings. Offset stakes will be at 50' intervals if curbs are not in place.
- C. Contractor shall coordinate survey work and shall inform Engineer and KC Water in advance of the location and schedule of all survey work.
- D. Contractor shall provide to KC Water complete survey cut sheets containing Water Main Stationing, State Plane Coordinates in U.S. Survey Feet (expressed in feet and

decimals of a foot). These coordinates must conform to the “Missouri Coordinate System of 1983, West Zone”. Cut notes must also include, Top of Pipe Elevations, Off-Set Hub distances with elevations of hub, Finish Grade at Hydrant Sets, Benchmark Elevations, Height of Instrument, and all main shots, in NAVD 88 datum. Stationing, coordinates, and elevations must match drawings “approved for construction” by KC Water, and shall be indicated for every fitting and every station at maximum distances of 50 feet along the water line. Water mains to be installed with deflections shall have coordinate points established at the beginning point of deflection and at the ending point of deflection.

- E. The cut sheets shall be sealed by a Registered Land Surveyor and must be submitted to KC Water for approval a minimum of 2 working days prior to commencement of any Work included on the cut sheets. Saturdays, Sundays, or any Legal Holiday observed by KC Water are not to be included in the 2 working days period. Work shall not proceed if survey cut sheets are not approved by KC Water.
- F. The Contractor shall maintain one set of approved cut sheets at the project site and shall keep them continually updated for record purposes.

#### **1.13 Unfavorable Construction Conditions**

- A. During unfavorable weather, when ground is wet or frozen, or other unsuitable construction conditions, Contractor shall confine their operations to Work that will not be affected adversely by such conditions. No portion of the Work shall be constructed under conditions that would adversely affect the quality or efficiency of Work, unless special means or precautions are taken by Contractor to perform the Work in a manner acceptable to KC Water.

#### **1.14 Cutting and Patching**

- A. Contractor shall perform all cutting and patching required for the Work and as may be necessary in connection with uncovering Work for inspection or for the correction of defective Work.
- B. Contractor shall perform all cutting and patching required for and in connection with the Work, including but not limited to the following:
  - 1. Removal of improperly timed Work.
  - 2. Removal of samples of installed materials for testing.
  - 3. Alteration of existing facilities.
  - 4. Installation of new Work in existing facilities.

- C. Contractor shall provide all shoring, bracing, supports, and protective devices necessary to safeguard all Work and existing facilities during cutting and patching operations. Contractor shall not undertake any cutting or demolition that may affect the structural stability of the Work or existing facilities.
- D. Materials shall be cut and removed as required to complete the Work. Materials shall be removed in a careful manner, with no damage to adjacent facilities or materials. Materials that are not salvageable shall be removed from the site at the contractor's expense.
- E. All Work and existing facilities affected by cutting operations shall be with new materials, or with salvaged materials acceptable to KC Water, to obtain a finished installation with strength, appearance, and functional capacity required to match the existing area. If necessary, entire surfaces shall be patched and refinished.
- F. Any curbs removed or damaged shall be replaced at the Contractor's expense.

#### **1.15 Erosion and Sediment Control**

- A. All work shall conform to the latest revision of the Kansas City, Missouri Erosion and Sediment Control Specifications, which are made a part hereof by reference.
- B. Installation of all erosion control facilities, as required by contract documents or as shown on the construction plans must be complete prior to commencement of any other work. [Can be completed in phases for multiple phase projects.]

#### **1.16 Reference Standards**

- A. Reference to standards, specifications, manuals or codes of any technical society, organization, or association, or to the Laws or Regulations of any governmental authority, whether such reference be specific or by implication, shall mean the latest edition of the appropriate standard, specification, manual, code, or Law or Regulation in effect on the date of the first advertisement for the Work, unless specifically stated otherwise in the contract documents.
- B. The Contractor shall request clarification from KC Water before proceeding, should there be a conflict in Reference Standards.

#### **1.17 Compaction and Gradation Testing**

- A. When requested by KC Water, the Contractor shall accommodate compaction and gradation testing by the City or by an independent testing laboratory.
  - 1. Two initial gradation tests shall be made for each type of embedment, fill, or backfill material, and one additional gradation test shall be made for each additional 500 tons of each material.

2. Moisture-density (Proctor) tests and relative density tests on the materials, and in-place field density tests, shall be made at intervals selected by KC Water, necessary to verify proper compaction.
3. Compaction testing shall be performed in accordance with the procedures and standards specified in Section 02200.

#### **1.18 Pollution Control**

##### **A. Noise:**

1. Contractor shall take measures to prevent unnecessary noise and maintain the normal ambient sound levels in the area during work. All construction machinery and vehicles shall be equipped with practical sound-muffling devices, and operated in a manner to cause the least noise consistent with efficient performance of the Work.
2. During construction activities on or adjacent to occupied buildings, and when appropriate, contractor shall erect screens or barriers effective in reducing noise in the building and shall conduct his operations to prevent unnecessary noise which might interfere with the activities of building occupants.
3. Any Work, including excavation, demolition, alteration, or repair of any facility in or adjacent to a residential area other than between the hour of 7:00 a.m. and 6:00 p.m. on weekdays, except in the case of urgent necessity in the interest of public safety, shall require a letter of permission from KC Water.

##### **B. Dust:**

1. Contractor shall prevent unnecessary dust. Earth surfaces subject to dusting shall be kept moist with water or by approved application of an approved chemical suppressant. When practicable, dusty materials in piles or in transit shall be covered to prevent blowing.
2. Contractor shall make provisions so that buildings or operating facilities that may be affected adversely by dust shall be adequately protected from dust. Existing or new machinery, motors, instrument panels, or similar equipment shall be protected by suitable dust screens. Proper ventilation shall be included with dust screens.
3. Contractor shall maintain and keep clean streets throughout work period.



- C. Others:
  - 1. Contractor shall prevent the pollution of drains and watercourses by sanitary wastes, sediment, debris, and other substances resulting from the construction activities.
  - 2. No sanitary wastes will be permitted to enter any drain or watercourse other than sanitary sewers.
  - 3. No sediment, debris, or other substance will be permitted to enter sanitary sewers, and will be prevented from entering any drain or watercourse.

### **1.19 Connections to Existing Facilities**

- A. Unless otherwise specified or indicated, Contractor shall make all necessary connections to existing facilities, including structures, drain lines, and utilities such as water, sewer, gas, telephone and electric. In each case, Contractor shall receive permission from KC Water, or the owning utility prior to undertaking connections. Contractor shall protect facilities against deleterious substances and damage.
- B. Connections to existing facilities that are in service shall be planned in advance, and all required equipment, materials, and labor shall be available and be on the jobsite before the time of scheduling the connections. The Contractor shall verify the location and the outside diameter of existing water mains prior to scheduling connection. The Contractor shall provide all equipment, material, and labor required to adjust existing facilities so that all of the work is in compliance with current KC Water Standards. Work shall proceed continuously (around the clock) if necessary to complete connections in the minimum time. Operation of valves or other appurtenances on existing utilities, when required, shall be by or under the direct supervision of KC Water or owning utility.
- C. Service interruption or temporary service is to be provided by the Contractor at their expense. The Contractor shall furnish any bends or fittings necessary to make proper horizontal or vertical alignment for connections to existing mains. The Contractor shall notify, 24 hours in advance, all KC Water customers affected by the work of making connections as to the time of day and the span of time required to make said connections. When the closing of a valve to make the connections affects a customer who cannot be without service, the Contractor shall arrange to supply temporary service and schedule the time that is most convenient to the customer for making the connection to the existing mains.
- D. Operation of Existing Valves:
  - 1. Valves on Transmission Mains  
The operation of all valves on the City's existing transmission system shall be performed or supervised by the City. The Contractor shall not operate any valves on KC Water's transmission mains (any main larger than 12")

without supervision of the City. If the Contractor desires the operation of any valves, he shall make a request to KC Water for such operations. For transmission main shuts, Contractor shall give Owner at least one week's notice so a temporary test shut can be scheduled and conducted to ensure a tight shut. Contractor shall assist with filling out and distributing shut notices and operation of valves under direct supervision of the City. The hydrant branch valves may be operated in the presence of a representative of KC Water with no official advance notification.

2. Distribution Mains

The Contractor will perform test shuts and main shuts on the KC Water's distribution mains (any main 12" or smaller) without direct supervision at no extra cost to KC Water. All test shuts and main shuts require KC Water's approval. The request form for test shuts and main shuts shall be sent to the Project Manager and Area Supervisor at least one week prior to needing the shut. The Contractor will be responsible for notifying all residents who will be affected by construction activities which includes, but is not limited to, filling out and distributing shut notices,. The Contractor must still coordinate with both the resident inspector and the project manager. The contractor must follow the City's standard procedures when filling and flushing distribution mains including but not limited to, notifying City's Dispatch Office.

**1.20 Project Records Documents**

- A. Contractor shall maintain in a safe place at the project site one continually updated record copy of all Drawings, Standards and Specifications, Addenda, Shop Drawings, Written Amendments, Change Orders, Work Change Directives, written interpretations or clarifications of the contract documents, survey information (including approved cut sheets), and all other documents relevant to the Work. All such documents shall be kept in good condition and order, and shall be continuously updated to indicate all changes made during construction. No work shall be allowed in the absence of these record documents.
  
- B. Upon completion of the work at the project site, the Contractor shall submit to KC Water all Record Documents. The Contractor shall work with the Design Professional of Record to prepare the Record Drawings for the project. The Design Professional of Record shall revise the Drawings to document the Contractor's changes to the work. Record drawing submittals, that are a part of the Record Documents, shall include one paper copy, one reproducible copy (on Mylar or vellum), and one electronic copy on computer disc of the updated drawings in the latest version of Microstation® or AutoCAD® and PDF. The disc shall include an excel spread sheet or text file that contain the coordinates of every KC Water asset, and all other information necessary to edit and plot the drawings, and shall be labeled with the Project Name, KC Water Project Number, KC Water Work Order Number, KC Water Drawing Number, and date of publication. All measurements on the Record Drawings must be updated to

indicate the true location of the work as it was actually constructed in the field. The Record Drawings for water mains must include references for all beginning and ending points, bends, hydrants, valves, tees, fittings, and beginning and ending points of deflection of water mains indicated in State Plane Coordinates in U.S. feet (expressed in feet and decimals of a foot). The coordinates must conform to the "Missouri Coordinate System of 1983, West Zone". State wide Missouri Geographical Reference System monuments, Kansas City Metro Control Project monuments, Certified Land corners used as references to determine State Plane coordinates, and all control monuments used in the survey work must be listed with reference ties shown on the Record Drawings. The Record Drawings must indicate the elevations of the finished grade or improvements and the top of the water main at every fitting and Station at maximum spacing of 50' along the water main. All elevations shall be indicated in NAVD 88 Datum (in feet and decimals of a foot). Every sheet of the Record Drawings must be reviewed and **sealed by a Registered Land Surveyor, licensed in the state of Missouri** and must include the following statement on the title block inside the box marked "for KC Water use" and in close proximity to the Registered Land Surveyor's seal:

"Each sheet of these Record Drawings and attached Survey Cut Sheets for the Work have been reviewed and approved by the Registered Land Surveyor whose seal is affixed to this Record. The horizontal control, coordinates, and elevations shown on these Records are accurate and are based on the Missouri Coordinate System of 1983, West Zone and NAVD88 datum, with the date of adjustment. These Records have been revised, as required in Section 01000, 1.20 of the Standards and Specifications for Water Main Extensions and Relocations, under my personal supervision to show the true and accurate measurements of the work as it was actually constructed."

The Contractor must also sign each sheet of the documents with the following certification:

"I hereby certify that this Record correctly depicts the Work constructed as to size, horizontal and vertical location, and grade as shown on the approved construction drawings or their revision. The Work was done in accordance with these Records and the current version of the Standards and Specifications for Water Main Extensions and Relocations."

Contractor: \_\_\_\_\_ Date: \_\_\_\_\_  
Name (print): \_\_\_\_\_ Title: \_\_\_\_\_  
Signature: \_\_\_\_\_

- C. KC Water will review the submitted Record Documents and determine their adequacy prior to final acceptance of the Work. Record Documents determined to be inadequate will be returned to the Contractor for required revisions or additions. The Contractor will correct all inadequacies and make all additions required to make the Record Documents acceptable to KC Water. The Record

documents shall be an integral part of the work guaranteed by the Contractor's Performance and Maintenance Bond. If during the three year maintenance period KC Water determines that further revisions or corrections are necessary to make the Record Documents accurate, the Contractor, at no cost to KC Water will make or cause the revisions or corrections to be made.

### **1.21 Abandoned Water Mains and Fire Hydrants**

- A. Water service lines connected to mains being abandoned shall be reconnected to new mains in accordance with the "Regulations of KC Water," unless shown otherwise. The end of all abandoned water mains shall be plugged with sufficient concrete to prevent backfill material from entering the pipe.
- B. Covers, lids, and standpipes on all abandoned valves shall be removed to at least two feet (2') below grade and the area shall be properly backfilled and restored in accordance with the specifications.
- C. Fire hydrant assemblies that are to be abandoned and that have lead joints shall have the fire hydrant, valve, branch piping and tee removed from the existing water main. The lead joint tee shall be cut out and replaced with a new section of ductile iron pipe, two solid sleeves and encased in polywrap.
- D. Existing fire hydrants that are removed shall be returned to the KC Water store yard at 2409 E. 18<sup>th</sup> Street.

### **1.22 Pipeline Markers**

- A. Pipeline Markers as shown in Construction Detail Drawing No. 01000-1 shall be installed at locations noted on the Drawings.
- B. Contractor shall field verify Stations and locations for pipeline markers to comply with actual construction, and shall coordinate labeling with Engineer prior to fabricating and installing pipeline markers.

### **1.23 Route/Pre-Construction Photographs**

- A. The contractor shall have suitable digital color photographs taken along the entire construction area showing the condition of the terrain previous to any alteration by the Contractor and before construction is started. Photographic images shall be captured in digital format, with a minimum of 10-megapixel resolution, using minimal JPG compression. The photographs shall be taken at intervals necessary to record possible field conflicts. Each photo should be time stamped with the date and time the picture was taken.
- B. The principle reason for obtaining good photographs is so existing items such as cracked curbs, shrubs and sodded areas, broken pavement areas, or plugged

culverts in driveways, etc., lying along the construction route may be more clearly shown and recorded. This will to some degree prevent the possibility of post construction litigation with property owners adjacent to the Work.

- C. Two non-rewriteable CD-ROMs, DVD-ROMs or other approved electronic storage device shall be submitted to the Owner without charge as soon as is practicable after the photographs are taken. The Contractor should keep a copy of the pictures. Each photograph shall show the title of the project, name of the Contractor, date of photograph, location of the view, house addresses, etc. Polaroid photographs will not be acceptable.

END OF SECTION

## SECTION 01016

### WATER MAINS NEAR SEWERS

#### PART 1 GENERAL

##### 1.1 Section Description

- A. This section provides for the required procedures where the Work is in close proximity to existing sewers.

##### 1.2 Section Includes

- A. Horizontal Separation
- B. Vertical Separation

##### 1.3 Related Sections

- A. Section 01000 - General Requirements
- B. Section 02200 - Excavation and Trenching

##### 1.4 Horizontal Separation

- A. Water mains shall be laid at least 10 feet, horizontally, from any sewer. When local conditions prevent a horizontal separation of 10 feet, a water main may be laid closer than 10 feet to a sewer, provided that the water main is laid in a separate trench, or on an undisturbed earth shelf located on one side of the sewer, at such an elevation that the bottom of the water main is at least 18 inches above the top of the sewer. Water mains shall be laid such that there is a minimum of 18" clearance between the pipe wall and the exterior of any manhole and/or inlet on the sewer line. When it is impossible to obtain proper horizontal separation as stipulated above, the sewer must be reconstructed of ductile iron pipe meeting the requirements of Section 02618, pre-stressed concrete cylinder pipe meeting the requirements of Section 02619, or PVC pressure pipe and shall be pressure-tested to assure water-tightness before backfilling. PVC pipe will conform to AWWA C-900 or C-905.
- B. The required length of sewer to be replaced or constructed of pressure pipe will be the length necessary to achieve 10 feet horizontal separation.

##### 1.5 Vertical Separation:

- A. Whenever water mains must cross above sewers, the water main shall be laid at such an elevation that the bottom of the water main is at least 18" above the top

of the sewer. A full length of pipe shall be centered over the sewer to be crossed so that the joints will be equally distant from the sewer and as far away as possible. This vertical separation shall be maintained for that portion of the water main located within 10 feet, horizontally, of any sewer it crosses.

When it is impossible to obtain minimum vertical separation set forth above the sewer must be reconstructed of ductile iron, pre-stressed concrete cylinder, or PVC pipe, and shall be pressure tested to assure water tightness, before backfilling. PVC pipe will conform to AWWA C-900 or C-905.

- B. Whenever a water main must cross under a sewer, a vertical separation of 18 inches between the bottom of the sewer and the top of the water main shall be achieved. A full length of pipe shall be centered under the sewer to be crossed so that the joints will be equally distant from the sewer and as far away as possible. This vertical separation shall be maintained for that portion of the water main located within 10 feet, horizontally, of any sewer it crosses. The sewer shall be reconstructed of ductile iron pipe, pre-stressed concrete cylinder pipe, or PVC pressure pipe for a distance of 10 feet on either side of the crossing, and shall be pressure tested to assure water tightness before backfilling. PVC pipe will conform to AWWA C-900 or C-905. Where these conditions cannot be met, KC Water shall be consulted as to the precautions to be taken for protection of the public water supply.
- C. When PVC pipe is used for sewer reconstruction, the following guide shall apply:

<u>Depth of cover over sewer</u>	<u>Use</u>
Up to 22'	SDR-26
22' up to 30'	SDR-21

**PART 2 PRODUCTS**

- 1. Not Used

**PART 3 EXECUTION**

- 1. Reconstruction of sewer lines included in this Work shall be done in accordance with Construction Detail Drawing No. 01016-1.

END OF SECTION



## **SECTION 01300**

### **SUBMITTALS**

#### **PART 1 GENERAL**

##### **1.1 Section Description**

- A. This section provides for the required procedures for submission, content, format, and review of shop drawing and engineering data and construction records.

##### **1.2 Section Includes**

- A. Shop Drawings and Engineering Data
- B. Construction Records

##### **1.3 Related Sections**

- A. Section 01000 - General Requirements
- B. Section 01900 - Contract Closeout

##### **1.4 Shop Drawings and Engineering Data**

- C. General:
  - 1. Shop drawings and engineering data covering all equipment and materials that will become a permanent part of the Work shall be submitted to KC Water for review, when required by KC Water. The data shall include drawings, descriptive information, and sufficient detail to show the kind, size, arrangement, and operation of component materials and devices needed for installation and coordination with other materials and equipment.
  - 2. All submittals, regardless of origin, shall be stamped with the approval of Contractor and identified with the name of the Project, Contractor's name, and references to applicable specification sections and Drawings. Each submittal shall indicate the intended use of the item in the Work. When catalog pages are submitted, applicable items shall be clearly



identified and inapplicable data crossed out. The current revision, issue number, and date shall be indicated on all drawings and other descriptive data.

3. Contractor's stamp of approval is a representation to KC Water that Contractor accepts full responsibility for determining and verifying all quantities, dimensions, field construction criteria, materials, catalog numbers, and similar data, and that Contractor reviewed and coordinated each submittal with the requirements of the Work.
4. Contractor shall accept full responsibility for the completeness of each submission. When an item consists of components from several sources, Contractor shall submit a complete initial submittal including all components.
5. All deviations from the Specifications and Drawings shall be identified on each submittal and shall be tabulated in Contractor's letter of transmittal. Such submittals shall indicate details of all proposed changes, (including modifications to other facilities that may be a result of the deviation), and all required piping and wiring diagrams.
6. Three (3) copies of each drawing and necessary data shall be submitted to KC Water. KC Water will return two marked copies to Contractor. Facsimile (fax) copies will not be acceptable. KC Water will not accept submittals from anyone but the Contractor. Submittals shall be consecutively numbered in direct sequence of submittal and without division by subcontracts or trades.

B. Review of Shop Drawings and Data:

1. KC Water's review of shop drawings and data will cover only general conformity to the Drawings and Specifications, external connections, and dimensions that affect the layout. KC Water's review does not indicate a thorough review of all dimensions, quantities, and details of the material, equipment, device, or item shown.
2. KC Water's review shall not relieve Contractor of Contractor's responsibility for errors, omissions, or deviations in the drawings and data, nor of sole responsibility for compliance with the Work.
3. KC Water's submittal review period shall be a maximum of twenty-one (21) calendar days from the date of submittal or resubmittal.
4. When the shop drawings and data are returned marked "NOT ACCEPTABLE" or "RETURNED FOR CORRECTION", the corrections shall be made as noted thereon and as instructed by KC Water and three (3)

corrected copies resubmitted. Facsimile (fax) copies will not be acceptable.

5. When the shop drawings and data are returned marked "EXCEPTIONS NOTED", "APPROVED", or "RECORD COPY", no additional copies need be submitted unless requested by KC Water at time of review.

C. Substitutes and "Or-Equal" Items:

1. Whenever a material or article is specified or described by using the name of a proprietary product or the name of a particular manufacturer or vendor, the specified item mentioned shall be understood as establishing the type, function, and quality desired.
2. Whenever the names of proprietary products or the names of particular manufacturers or vendors are used, it shall be understood that the words "or equal" following the enumeration, if not specifically stated, are implied.

D. Resubmittal of Shop Drawings And Data:

1. Contractor shall accept full responsibility for the completeness of each resubmittal.
2. Contractor shall verify that all corrected data and additional information previously requested by KC Water are provided on the resubmittal.
3. When corrected copies are resubmitted, Contractor shall indicate in writing all revisions made.
4. Requirements specified for initial submittals shall also apply to resubmittals. Resubmittals shall bear the number of the first submittal followed by a letter (A, B, etc.) to indicate the sequence of the resubmittal.
5. Resubmittals shall be made within thirty (30) days of the date of the letter returning the material to be modified or corrected. Time extension may be granted if, within fourteen (14) days, Contractor submits an acceptable request, listing the reasons the resubmittal cannot be completed within the required time.

## 1.5 Construction Records

A. Survey Data:

1. All field books, notes, videotapes, and other data developed by Contractor in performing surveys required as part of the Work shall be

available to KC Water for examination throughout the construction period.

2. All such data shall be submitted to KC Water with the other documentation required for final acceptance of the Work.

B. Field marked drawings and corrected schematics and schedules shall be submitted by Contractor to KC Water. Refer to Section 01000 - General Requirements and Section 01900 - Contract Closeout.

## **PART 2 PRODUCTS**

1. Not Used

## **PART 3 EXECUTION**

1. Not used

END OF SECTION

## SECTION 01600 MATERIAL AND EQUIPMENT

### PART 1 GENERAL

#### 1.1 Section Description

- A. This section provides for the required procedures for selecting, acquiring, shipping, and storing products for the Work.

#### 1.2 Section Includes

- A. Selection and Acquisition
- B. Shipment
- C. Storage

#### 1.3 Selection & Acquisition

- A. Do not use materials and equipment removed from existing premises, except as specifically permitted by the Specifications. All products shall be new, never used before, unless otherwise specified.
- B. Provide interchangeable components of the same manufacturer, for similar removable components, such as T-bolts, glands, and gaskets.

#### 1.4 Shipment

- A. All materials and equipment incorporated into the work shall be suitably packaged to facilitate handling and protect against damage during transit and storage.
- B. Painted surfaces shall be protected against impact, abrasion, discoloration, and other damage. All painted surfaces that are damaged prior to acceptance of materials and equipment shall be repainted to the satisfaction of KC Water.
- C. Each item, package, bundle of material, or piece of equipment shall be tagged or marked as identified in the delivery schedule or on the Shop Drawings. Complete packing lists and bills of material shall be included with each shipment.
- D. Pipe and fitting linings shall be protected against damage.

## **1.5 Storage**

### **A. Offsite Storage**

1. Offsite storage of materials and equipment shall conform to manufacturer's recommendations.
2. Offsite storage arrangements shall be approved by KC Water. Such offsite storage arrangements shall be presented in writing and shall afford adequate and satisfactory security and protection. Offsite storage facilities shall be bonded and accessible to KC Water.

### **B. Onsite Storage**

1. Onsite storage of materials and equipment shall conform to manufacturer's recommendations.
2. Onsite storage shall not interfere with public access and/or safety.

### **C. Other Requirements**

1. Bedding material shall be stored so that it is protected from significant change in moisture content and so that large frozen masses will not form in freezing weather.
2. All components shall be protected from weather. Gaskets shall be protected from exposure to sunlight.

## **PART 2 PRODUCTS**

1. Not Used

## **PART 3 EXECUTION**

1. Not Used

END OF SECTION

## SECTION 01700

### TRAFFIC REGULATIONS

#### PART 1 GENERAL

##### 1.1 Section Description

- A. This section provides for the control and maintenance of traffic areas throughout the Work.

##### 1.2 Section Includes

- A. Notification
- B. Maintenance of Traffic
- C. Traffic Control
- D. Signs
- E. Vehicle Parking
- F. Flagmen
- G. Lights
- H. Haul Routes
- I. Street Closure

##### 1.3 Related Sections

- A. Section 01000 – General Requirements
- B. Section 01300 – Submittals

##### 1.4 Notification

- A. Advance written notice of construction activity shall be made to all adjacent residents no less than forty-eight (48) hours, or more than seventy-two (72) hours, before construction begins.
- B. The notice shall describe the activity anticipated in that area, the duration, and the effects upon the residents (such as restricted parking).

- C. The Contractor's on-site contact person, address, and direct telephone number shall be included, in addition to a contact person from KC Water.

### **1.5 Maintenance of Traffic**

- A. Traffic shall be maintained through construction, in accordance with the City of Kansas City, Public Works Department Standard Details.
- B. The Contractor is responsible for maintaining traffic.
- C. The Contractor shall conduct his work so as to minimize interference with traffic, vehicular or pedestrian.
- D. A permit is required from the KCMO Public Works Department, Street and Traffic Division for areas where traffic will be obstructed
- E. When necessary to cross or interfere with traffic the Contractor shall provide and maintain suitable and safe bridges, detours, or other temporary expedients for the accommodation of public and private travel. Contractor shall give at least eighteen (18) hours' notice to owners of private drives before interfering with them.

### **1.6 Traffic Control**

- A. General
  - 1. All streets, roads, highways, and other public thoroughfares that are to be temporarily closed or restricted to traffic shall be protected by effective barricades on which shall be placed acceptable warning signs. Barricades shall be located at the nearest intersecting public highway or street on each side of the blocked section.
  - 2. All open trenches and other excavations shall be covered with steel plates and have suitable barricades, signs, and lights to provide adequate protection to the public. Obstructions such as material piles and equipment shall be provided with similar warning signs and lights.
  - 3. All barricades and obstructions shall be illuminated with warning lights from sunset to sunrise. Material storage and performance of the Work on or alongside public streets and highways shall minimize obstruction and inconvenience to the public.
  - 4. All barricades, signs, lights, and other protective devices shall be installed and maintained in conformity with applicable statutory requirements and, where within railroad and highway rights-of-way, as required by the authority having jurisdiction.

B. Devices:

1. Contractor shall provide all barricades, cones, construction warning signs, flagmen, and incidental devices to protect personnel and equipment on the Work site.
2. Contractor shall display the required signs. Traffic control devices not in use shall be covered, removed, or turned away from view of oncoming traffic. Whenever the work area changes, all construction warning signs and traffic channelization devices shall be made current in both legend and function.
3. Traffic control devices shall conform to the "Manual on Uniform Traffic Control Devices for Streets and Highways". Substitutions for the required devices and methods will only be allowed with the written approval of the KCMO Public Works Department, Street and Traffic Division.

C. Non-work hours:

1. During non-work hours all roadways shall be opened to normal traffic.
2. Construction equipment or materials shall not interfere with traffic during non-work hours. Barricades (barrels, type I) equipped with appropriate warning lights shall be placed adjacent to the work area. Construction signs, except "ROAD CONSTRUCTION AHEAD" signs, shall be covered or turned from view of oncoming traffic.

## 1.7 Signs

A. No Parking:

1. "Emergency No Parking" signs may be installed at locations approved by KCMO Public Works Department.
2. Signs shall be in accordance with the KCMO Public Works "Standard Signs for Traffic Maintenance During Construction". Signs shall be on aluminum or plywood panels. Paper or cardboard signs will not be allowed. Signs must be installed a minimum of eighteen (18) hours prior to beginning Work. The Contractor must contact the Public Works Dispatcher (816-513-9300) as soon as the signs are installed so that the KCMO Police Department can be notified. The signs cannot be enforced without this notification to KC Water and KCMO Public Works Department.
3. Signs shall be installed on either steel driven posts or existing utility poles at a height of five (5) feet from the bottom of the sign. The signs are to be installed at 150-foot intervals. The Contractor shall immediately remove all signs and covers as soon as work has been



completed. If work will cease for more than seventy-two (72) hours, the signs and covers shall be removed and reinstalled subject to the minimum eighteen (18) hours' notice.

### **1.8 Vehicle Parking**

- A. Parking of construction vehicles and personal vehicles of contractor's personal shall not interfere with public traffic and parking, access by emergency vehicles, and KC Water operations.

### **1.9 Flagmen**

- A. Contractor shall provide trained and equipped flagmen to regulate traffic when construction operations or traffic encroach on public traffic lanes.

### **1.10 Lights**

- A. Contractor shall use lights during hours of low visibility to delineate traffic lanes and to guide traffic.

### **1.11 Haul Routes**

- A. Contractor shall consult with KC Water and KCMO Public Works Department to establish public thoroughfares to be used for haul routes and site access.

### **1.12 Street Closure**

- A. Contractor shall obtain a Street Closure Permit in advance of a proposed closure date.

## **PART 2 PRODUCTS**

- 1. Not Used

## **PART 3 EXECUTION**

### **3.1 Coordination**

- A. Damages:
  - 1. Damage to existing roads and utilities during the Work that requires immediate repair may be considered an "emergency". Therefore, Contractor shall immediately contact the utility and the KCMO Public Works Department, Street and Traffic Division whenever there is damage that may require immediate repair. Such repair work once declared an "emergency" will be pursued on a continuous (around the clock) basis until complete or

advanced to such a point that use of the roadway can be returned to normal operation and any subsequent repairs completed during normal working hours.

B. Adjustments:

1. The KCMO Public Works Department, Street and Traffic Division reserves the right to make adjustments or revisions in traffic handling requirements that may become necessary after the Work has started. These changes will be determined on the basis of periodic inspections throughout the duration of the Work.
2. Notice of such change will be transmitted to the Contractor and it will be his responsibility to make the necessary changes as soon as practicable after receipt of the notification.

**3.2 Inspections and Maintenance**

A. Inspections:

1. KC Water and Contractor shall make periodic inspections of the traffic control devices installed as part of Work and shall maintain record of any maintenance required. These records will be maintained throughout the Work and be incorporated as part of the final records.
2. The Contractor shall make daily inspections of the traffic control devices installed.

B. Maintenance:

1. Contractor shall be required to designate a specific employee to be responsible for the maintenance of the traffic control devices and establish a method of contacting this person. This information shall be provided to KC Water and the KCMO Public Works Department, Street and Traffic Division, in writing prior to the start of work.
2. Contractor may, at his option, establish a maintenance agreement with a qualified firm, approved by KC Water, to supply, install and maintain the required traffic control devices throughout the duration of the Work.
3. Whenever the work area changes, all construction warning signs and traffic channelization devices shall be made current in both legend and function.
4. The roadway shall be kept clean and free of construction related debris at all times.

END OF SECTION

## SECTION 01900

### PROJECT CLOSEOUT

#### PART 1 GENERAL

##### 1.1 Section Description

- A. This section provides for the procedures and submittals required by KC Water prior to acceptance of the Work.

##### 1.2 Section Includes

- A. Final Acceptance
- B. Final Clean-Up
- C. Project Record Documents

##### 1.3 Related Sections

- A. Section 01300 – Submittals

##### 1.4 Final Acceptance

- D. General Procedure:
  - 1. After the completion of the Work, the Contractor shall notify KC Water that the Work is ready for final inspection.
  - 2. A final inspection will be setup at a mutually agreed time between the Contractor and KC Water.
  - 3. KC Water will provide the Contractor with the results of the final inspection and will not provide acceptance until all work is done to the satisfaction of KC Water. Acceptance by KC Water will not relieve the Contractor of his responsibility under other terms of the Contract Documents.

##### 1.5 Final Clean-Up

- A. Contractor shall replace all surface material and restore paving, curbing, sidewalks, gutters, shrubbery, fences, sod, and other surfaces disturbed to a condition of equal or better than original condition.
- B. All excavated material shall be removed and disposed of properly.
- C. Contractor shall provide material for filling depressions caused by settlement.

- D. Contractor shall remove surplus pipe materials, tools, temporary structures, and rubbish. Restore construction site to its original condition or better.

**1.6 Project Record Documents**

- A. Contractor shall submit all Record Documents in accordance with Section 01000 – General Requirements

**PART 2 PRODUCTS**

- 1. NOT USED.

**PART 3 EXECUTION**

- 1. NOT USED.

END OF SECTION

## SECTION 02200

### EXCAVATION AND BACKFILL

#### PART 1 GENERAL

##### 1.1 Section Description

- A. This section describes the procedures and soil material to be used with excavation, trenching, embedment, and backfill for water main construction.

##### 1.2 Section Includes

- A. Granular Fills
- B. Embedment
- C. Backfill
- D. Filter Fabric
- E. Groundwater Barrier Material
- F. Topsoil
- G. Fills and Embankment Material

##### 1.3 Related Sections

- A. Section 01000 – General Requirements
- B. Section 01016 – Water Mains Near Sewers
- C. Section 01300 – Submittals
- D. Section 01600 – Materials and Equipment
- E. Section 02575 – Surface Restoration
- F. Section 02273 – Riprap
- G. Section 02930 – Seeding
- H. Section 02931 - Sodding

#### **1.4 References**

- A. ASTM C33 - Standard Specifications for Concrete Aggregates
- B. ASTM D698 - Test Method for Laboratory Compaction Characteristics of Soil Using – Standard Effort (12,400 ft-lb./ft)
- C. ASTM D1557 - Test Methods for Laboratory Compaction Characteristics of Soil Using - Modified Effort (56,000 ft-lb./ft)
- D. ASTM D3776 - Standard Test Methods for Mass Per Unit Area (Weight) of Fabric
- E. ASTM D4253 - Standard Test Methods for Maximum Index Density and Unit Weight of Soils Using a Vibratory Table
- F. ASTM D4254 - Standard Test Method for Minimum Index Density and Unit Weight of Soils and Calculation of Relative Density
- G. ASTM D4632 - Standard Test Method for Grab Breaking Load and Elongation of Geotextiles

#### **1.5 Submittals**

- A. Follow the procedures for submittals provided in Section 01300 - Submittals.
- B. Submit gradation test reports and quarry quality control reports for the following materials:
  - 1. Granular Fill
  - 2. Granular Embedment
  - 3. Graded Gravel Backfill
- C. Submit a Filter Fabric Manufacturer’s Data listing the average values of the properties specified herein.

#### **1.6 Quality Assurance**

- A. In accordance with OSHA “Safety and Health Regulations for Construction”, Chapter XVII of Title 29, CFR, Part 1926, and the Contractor shall employ a competent person and, when necessary, a registered professional engineer, to act upon all pertinent matters of the work of this section.
- B. Backfilling and construction of fills and embankments during freezing weather shall not be done except by permission of KC Water. No backfill, fill, or embankment

materials shall be installed on frozen surfaces, nor shall frozen materials, snow, or ice be placed in any backfill, fill, or embankment.

**1.7 Delivery, Storage, and Handling**

- A. Follow the procedures for the delivery, storage, protection and handling products to and at site provided in Section 01600 - Material and Equipment.
- B. Store and secure materials in neat stockpiles in locations that do not inconvenience public and KC Water operations.
- C. Comply with manufacturers recommendations for storage.

**PART 2 PRODUCTS**

**2.1 Materials**

- A. Granular Fills:
  - A. Granular Fill material shall be clean crushed rock or gravel; free from dust, clay, and trash; and graded 1-1/2 inch to No. 4 as defined in ASTM C33.
  - B. **Type 5 Aggregate:** Type 5 aggregate shall consist of crushed stone or sand and gravel. The aggregate shall not contain more than 15 percent deleterious rock and shale. If crushed stone is used, sand may be added only for the purpose of reducing the plasticity index of the fraction passing the no. 40 sieve in the finished product. The fraction passing the No. 40 sieve shall have a plasticity index not to exceed six. Any sand, silt and clay and any deleterious rock and shale shall be uniformly distributed throughout the material. When sand and gravel aggregate is used, the fraction passing the No. 200 sieve shall be less than ½ that of the fraction passing the No. 30 sieve.

Type 5 Aggregate shall conform to the following gradation requirements and in addition shall be so graded that the aggregate will readily compact to the specified density and withstand construction traffic without distortion and displacement.

Sieve Size	Percent Passing by Weight
1 inch	100
½ inch	60 – 90
No. 4	40 – 60
No. 30	15 – 35
No. 200	0 – 15

- C. Embedment:



1. Granular Embedment: Granular embedment shall be clean crushed rock with not less than 95% passing a 1/2" screen and not more than 5% passing a #4 screen.
2. Embedment material shall not contain cinders, clay lumps, or other materials that may cause pipe corrosion.

C. Backfill:

1. Compacted Backfill (under non-paved areas): Compacted backfill may be suitable job excavated material or graded gravel, as described below:
  - a. Job Excavated Material: Job excavated material may be used for compacted backfill when the job excavated material is finely divided and free from debris, organic material, cinders, any corrosive material, and stones larger than 3 inches in greatest dimension. Masses of moist, stiff clay shall not be used.
  - b. Graded Gravel Backfill: Gravel for compacted backfill shall be clean and conform to the following gradation. The gravel mixture shall contain no clay lumps or organic matter. The fraction passing the No. 4 sieve shall have a liquid limit not greater than 25 and a plasticity index not greater than 5.

Sieve Size	Percent Passing by Weight
1 inch	100
3/4 inch	85 – 100
3/8 inch	50 – 80
No. 4	35 – 60
No. 40	15 – 30
No. 200	5 – 10

D. Filter Fabric:

1. Nonwoven fabric consisting of only continuous chains of polymeric filaments or yarns of polyester formed into a stable network by needle punching. The fabric shall be inert to commonly encountered chemicals; shall be resistant to mildew, rot, ultraviolet light, insects, and rodents; and shall have the following properties:



Property	Test Method	Unit	Minimum Average Roll Value (weakest principal direction)
Fabric Weight	ASTM D3776	Oz/yd <sup>2</sup>	4.5
Grab Strength	ASTM D4632	lb.	120
Grab Elongation	ASTM D4632	Percent	60
Mullen Burst Strength	ASTM D3776	Psi	190
Apparent Opening Size	CW-02215	U.S. Standard Sieve Size	70

2. Filter fabric shall be provided in rolls wrapped with protective covering to protect the fabric from mud, dirt, dust, and debris.

E. Groundwater Barrier Material:

1. Finely divided material free from stones, organic matter and debris meeting soil classification GC, SC, CL or ML-CL. Job excavated material may be used if suitable.

F. Topsoil:

1. Topsoil: Naturally occurring gray or black fertile soil material containing humus, high in nutrients, free of large roots, rocks larger than 1/2 inch, subsoil, debris, large weeds and foreign matter.

G. Fills and Embankment Material:

1. All material placed in fills and embankments shall be free from rocks or stones larger than 6 inches in their greatest dimension, brush, stumps, logs, roots, debris, and other organic or deleterious materials. No rocks or stones shall be placed in the upper 18 inches of any fill or embankment. Rocks or stones within the allowable size limit may be incorporated in the remainder of fills and embankments, provided they are distributed so that they do not interfere with proper compaction. Job excavated material meeting their requirements may be used.

### PART 3 EXECUTION

#### 3.1 General Guidelines

- A. Excavations shall be restored to the level of the adjacent surfaces as soon as practicable. Unsupervised open excavations on public properties, including

easements are not permitted. Any person involved with open excavation on public properties shall provide effective protection to the public.

- B. Excavations in roadways shall be protected and secured in accordance with existing federal, state and local codes and standards, including, but not limited to, the most current edition of the Manual of Uniform Traffic Control Devices.
- C. Unsupervised excavations not within roadways shall be protected and secured. A protective cover over an excavation shall be installed so that it can sustain the weight of any persons and/or objects placed upon it. The cover shall be fixed to the ground so it cannot be moved. Protective covers shall have no opening(s) or protuberance(s) of sufficient size to cause a fall and/or injury. Advance warning devices shall be installed as necessary.
- D. Any excavation that is not covered shall be fenced in so that it surrounds the entire excavation area and prevents entry. The fencing shall be a minimum of 42" in height. The fence shall be secured and upright at all times.
- E. Protective excavation coverings and fences shall be inspected by the Contractor at least daily to assure integrity. Protective excavation coverings and fences in heavy traffic areas shall be inspected more often as necessary.
- F. Permits shall be secured prior to any work on public properties. In all instances the Contractor agrees to perform all work in accordance with the permit and to indemnify and hold harmless the City from all liability, judgments, costs, expenses and claims growing out of damages or alleged damages, of any nature to any person or property arising out of performance or non-performance of said work or the existence of facilities and/or appurtenances thereof.
- G. After opening an excavation, work shall continue at that excavation until all repairs, including final pavement restoration are complete. Any excavation left more than five (5) days without activity may be filled and patched by City forces and the cost billed to the Applicant/Contractor. Any new excavation of a restored excavation shall require a new excavation permit
- H. All excavations shall be backfilled and temporarily patched or plated while work is stopped. If circumstances do not allow backfilling or plating, than the excavation shall be thoroughly protected with barricades and fencing to prevent entry to excavation.
- I. Any excavation left overnight on any street on the Major Street Plan shall be completely covered with a steel plates. The plate shall be securely anchored, and all edges of the plate shall be beveled or ramped with hot mix concrete.

### **3.2 Surface Preparation**

#### **A. Clearing:**

1. Tag or identify existing trees, shrubs, and landscape materials to be removed, and obtain KC Water approval prior to removal.
2. Protect existing trees, plant life, and features that are to remain from damage by construction operations.
3. Open burning of brush or debris will not be permitted unless the Contractor obtains a permit for open burning of trade wastes from the KCMO Environmental Health Division, Air Quality Program Manager.
4. Dispose of all cleared and grubbed materials.

#### **B. Cutting Portland Cement Concrete Curbs and Pavement:**

1. Cuts in curbs and pavements shall provide the minimum working space for proper installation of pipe and appurtenances. Utilize a concrete saw to cut a clean groove to a minimum depth of 3 inches.
2. Curbs and concrete pavement excavated for pipelines shall be removed so that a shoulder not less than 12 inches in width at any point is left between the cut edge of the pavement and the top edge of the trench. Trench width at the bottom shall not be greater than at the top and no undercutting will be permitted.
3. Where the trench parallels the length of curbs or sidewalks, and the trench location is all or partially under the curb or walk, the entire structure shall be removed and replaced. Where the trench crosses surface construction (walks, curbs, etc.) the structures shall be removed and subsequently replaced between existing joints or between saw cuts. Pipeline crossings at existing concrete driveways shall not be open cut unless approved by KC Water.

### **3.3 Trench Excavation**

#### **A. General:**

1. Classification of excavated materials is not permitted. Excavation and trenching work shall include the removal and handling of all materials necessary to place the pipeline and appurtenances at the line and grade on the drawings, regardless of the type, character, composition, or condition of the material.

2. No more trenches shall be opened than is necessary to expedite the Work. Except where tunneling is required, all trench excavation shall be open cut from the surface.

B. Depth of Excavation:

1. Trenches shall be excavated to a depth sufficient to provide a minimum depth of 42" backfill cover over the top of the pipe as indicated below. Sixteen inch and larger diameter water lines shall be provided a minimum of 60" backfill cover. Greater pipe cover depths may be necessary on vertical curves or to provide necessary clearance beneath existing pipes, conduits, drains, drainage structures, or other obstructions.
2. Pipe cover depth shall be measured vertically from the outside top of pipe to finished ground or pavement surface elevation.

C. Trench Bottoms in Rock:

1. Rock excavations shall be carried to a minimum of six (6) inches below the bottom of the pipe. Granular embedment material as specified in this section and as shown in the Construction Detail Drawings shall be used to restore the trench bottom to the desired elevation and grade and to provide a uniform bearing and continuous support for the pipe along its entire length.
2. Prevent any portion of the pipe from coming to bear on solid rocks or boulders.

D. Blasting:

1. Blasting or other use of explosives for excavation will not be permitted without obtaining a blasting permit from the KCMO Public Works Department and KCMO Fire Department.
2. Contractor shall provide a plan for pre-blast surveys, monitoring during blasting, and post blast surveys to KC Water prior to use of explosives.
3. All existing safety regulations, laws, and ordinances on the storage, transportation, and use of explosives shall be observed.
4. Blasting will be permitted only when proper precautions are taken for the protection of persons, the work, private property, public utilities, and the public from damage or injury. Any damage done by blasting will be repaired.

E. Limiting Trench Widths:

1. Trenches shall be excavated to a width that will provide adequate working space and sidewall clearances for proper pipe installation, jointing, and embedment. Trench widths shall be as follows:

**TRENCH WIDTHS**  
**Ductile Iron Pipe**

<b>Pipe Size</b>	<b>Min. Trench Width in Earth</b>	<b>Max. Trench Width in Earth</b>	<b>Max. Trench Width in Rock</b>
4"	18"	24"	24"
6"	24"	30"	24"
8"	26"	32"	24"
12"	28"	34"	28"
16"	34"	40"	32"
20"	38"	44"	36"
24"	42"	48"	44"

**Pre-stressed Concrete Cylinder Pipe and Reinforced Concrete Pipe**

<b>Pipe Size</b>	<b>Min. Trench Width in Earth</b>	<b>Max. Trench Width in Earth</b>	<b>Max. Trench Width in Rock</b>
16"	36"	44"	36"
20"	40"	50"	40"
24"	44"	56"	48"

F. Dewatering:

1. Obtain all necessary permits for the disposal of water from the excavation.
2. Provide and maintain all dewatering equipment to remove and dispose of all surface water and groundwater entering excavations, trenches, or other parts of the Work. Excavation shall be kept dry throughout the Work to ensure that no damage from hydrostatic pressure, flotation, or other cause will result.
3. All excavations for concrete structures or trenches that are within 12 inches of groundwater or extend below groundwater shall be dewatered 12 inches or more below the bottom of the excavation.
4. Prevent surface water from entering excavations or trenches and causing damage to adjacent property.
5. The Contractor shall be responsible for the condition of pipe or conduit including storm sewers, used for drainage.

G. Sheeting and Shoring:

1. Except where banks are cut back on a stable slope, excavations for structures and trenches shall be supported to prevent caving or sliding.
2. Trench sheeting may be removed only if the pipe strength is sufficient to carry trench loads based on trench width to the back of sheeting. Unless approved by KC Water, trench sheeting shall not be pulled after backfilling.
3. Where trench sheeting is left in place, sheeting shall not be braced against the pipe, but shall be supported in a manner that will preclude concentrated loads or horizontal thrusts on the pipe. Cross braces installed above the pipe to support sheeting may be removed after pipe embedment has been completed.

H. Subgrade Stabilization:

1. Subgrades for trench bottoms shall be firm, dense, and thoroughly compacted and consolidated; free from mud and muck; and shall remain firm and intact under the feet of the workers.
2. Subgrades for trench bottoms that are solid, but become mucky on top due to construction operations, shall be reinforced with clean crushed rock or gravel. The stabilizing material shall be spread and compacted to a depth of not more than 12 inches; the material shall be furnished and installed as specified for Granular Fills. The finished elevation of stabilized subgrades shall not be above subgrade elevations.
3. Soft areas of subgrade not capable of proper compaction shall be excavated and backfilled with granular fill material compacted to 95% modified Proctor per ASTM D4253 and D4254.

I. Mechanical Excavation:

1. The use of mechanical equipment will not be permitted in locations where its operation would cause damage to trees, buildings, culverts, or other existing property, utilities, or structures above or below ground. In all such locations, hand excavating methods shall be used.
2. Mechanical equipment used for trench excavation shall provide a smooth excavation bottom and alignment with the pipe centered in the middle of the trench with adequate sidewall clearance. Undercutting the trench sidewall to obtain sidewall clearance will not be permitted.

J. Excavation Below Pipe:

1. Trenches shall be excavated to a sufficient depth to provide for the installation of Embedment as indicated on Construction Detail Drawings No. 02200-1.

K. Bell Holes:

1. Bell holes shall provide adequate clearance for tools and methods used in installing pipe. No part of any bell or coupling shall be in contact with the trench bottom, trench walls, or granular embedment when the pipe is jointed.

L. Drainage Maintenance:

1. Trenches across areas adjacent to drainage ditches or watercourses shall not be backfilled prior to completion of backfilling the trench on the upstream side of the area, to prevent impounding water after the pipe has been laid. Bridges and other temporary structures required to maintain traffic across unfilled trenches shall be constructed and maintained by the Contractor. Backfilling shall be done so that water will not accumulate in unfilled or partially filled trenches. Remove material deposited in roadway ditches or other watercourses crossed by the line of trench after backfilling is completed. Restore the original section, grades, and contours of ditches or watercourses. Surface drainage shall not be obstructed longer than necessary.

M. Stream Crossings:

1. Stream crossings shall be constructed in accordance with Construction Detail Drawing No. 02200-2.
2. Pipe encasement, where required by the Drawings shall be in accordance with specification Section 02320 and Construction Detail Drawings.
3. The construction of riprap for erosion prevention of ditch slopes shall be as shown on the Construction Detail Drawings and indicated in Section 02273.
4. The Contractor shall furnish all labor, equipment, and materials, and perform all Work as required for shoring, forming, dewatering, trenching, backfilling, riprap, concrete or steel, or any other items necessary in constructing stream crossings.

### **3.4 Fills and Embankment**

A. General:

1. Embankments or fill materials shall be placed where indicated on the Drawings.

2. Fill and embankment materials shall be placed in horizontal layers a maximum of eight (8) inches in thickness before being compacted. Material deposited in piles or windrows by excavating and hauling equipment shall be spread and leveled before compaction.
3. Each layer of material shall have the best practicable moisture content for satisfactory compaction. The material in each layer shall be wetted or dried as required and thoroughly mixed to ensure uniform moisture content and adequate compaction. Each layer shall be thoroughly compacted to 95 percent of maximum density at optimum moisture content as determined by ASTM D698.
4. Wherever a pipeline is to pass through a fill or embankment, the fill or embankment material shall be placed and compacted to an elevation not less than thirty-six (36) inches above the top of pipe elevation, and a trench shall be excavated in the embankment to permit placement of the pipe.
5. Granular Fills shall be provided where indicated on the Drawings. Granular Fills shall be placed on suitably prepared subgrades and compacted by vibration. Granular Fills shall be compacted to not less than 95 percent relative density as determined by ASTM D1557.
6. Where pipes are installed in embankments containing ground water, granular embedment material shall normally be omitted and the trench bottom shall be graded to provide uniform and continuous support for the pipe. The pipe shall be embedded in embankment material containing no rocks or stones. The embedment material shall be compacted as specified for the embankment.

### **3.5 Embedment and Backfill**

#### **A. Pipe Embedment:**

1. Embedment materials both below and above the bottom of the pipe, Classes of embedment to be used, and placement and compaction of embedment material shall conform to the requirements indicated on Figure 02200-1 and to the following supplementary requirements.
2. Embedment material shall contain no cinders, clay lumps, or other Material which may cause pipe corrosion.
3. All Embedment shall be Class A.
4. Placement and Compaction: Granular embedment material shall be spread and the surface graded to provide a uniform and continuous support beneath the pipe at all points between bell holes or pipe joints.



5. After each pipe has been aligned, placed in final position on the embedment material, and shoved home, sufficient pipe embedment material shall be deposited and compacted under and around each side of the pipe and back of the bell to hold the pipe in proper position and alignment during subsequent pipe jointing and embedment operations. Embedment material shall be deposited and compacted uniformly and simultaneously on each side of the pipe to prevent lateral displacement.
6. Granular Embedment shall be placed in maximum 6" layers and vibrated with a mechanical probe type vibrator during placement to ensure that all spaces beneath the pipe are filled. Each lift of embedment material shall be compacted with a platform type vibrating compactor to at least 70 percent relative density as determined by ASTM D4253 and D4254.
7. Where soil is migrating into embedment, place filter fabric on the trench surfaces so that it completely surrounds the embedment material. Joints shall be lapped 12 inches.
8. Groundwater Barrier: Interrupt continuity of embedment material by placing low permeability Groundwater Barrier Material to impede passage of groundwater through the embedment. Groundwater Barrier Material shall be placed around vault structures with cast-in-place bases and compacted to 95% of maximum density and along trenches at intervals approved by KC Water not to exceed 250 feet.
  - a. Groundwater Barriers (specified under pipe embedment) shall extend to the top of the graded gravel backfill.

B. Trench Backfill:

- a. Compacted Backfill: Compacted Soil Backfill may be used above the granular embedment in non-paved areas.
1. Job Excavated Materials (in non-paved areas): Place in uniform layers not exceeding eight (8) inches in thickness before being compacted. Each layer of material shall maintain optimum moisture content for compaction. The material in each layer shall be wetted or dried as required and mixed to ensure uniform moisture content and compaction. Increased layer thickness not to exceed 12 inches in thickness before being compacted may be permitted for non-cohesive material if the Contractor demonstrates to KC Water satisfaction that the specified compacted density will be obtained. The method of compaction and the equipment used shall be appropriate for the material to be compacted and shall not transmit damaging shocks to the pipe. Job excavated material shall be compacted to 95 percent of maximum density at

optimum moisture content, as determined by ASTM D698, or to 70 percent relative density, as determined by ASTM D4253 and D4254 when appropriate.

2. Type 5 Aggregate Backfill: Place in uniform layers not exceeding twelve (12) inches in thickness before being compacted. The backfill shall be compacted with a vibratory roller or platform vibrator to at least 70 percent relative density as determined by ASTM D4253 and D4254.

### **3.6 Final Grading and Placement of Topsoil**

- A. After completing backfilling, grade areas to the required elevations, slopes, and contours. All cuts, fills, embankments, and other areas that have been disturbed or damaged by construction operations shall be surfaced with topsoil to a depth of at least 4 inches.
- B. Use of graders or other power equipment will be permitted for final grading and dressing slopes. Grade surfaces to provide effective drainage. Unless otherwise indicated, provide a slope of at least 1- percent.
- C. Final grades and surfaces shall be smooth, even, and free from clods and stones, weeds, brush, and other debris.

### **3.7 Disposal of Excess Materials**

- A. Excess excavated materials that are not utilized in trench backfill shall be disposed of at an approved site or landfill.
- B. Excess earth from excavations may be distributed directly over the pipe trench and within the pipeline right-of-way to a maximum depth of 6 inches above the original ground surface elevation along the trench centerline and sloping each way. Wasted material shall be carefully finished with a drag, blade machine, or other suitable tool to a smooth, uniform surface without obstructing drainage. Wasting of excess excavated material as described will not be permitted where the line of trench crosses or is within a railroad, public road, highway right-of-way or established lawn or other landscaped area. The disposal of waste and excess excavated materials, including hauling, handling, grading, and surfacing, shall be an obligation of the Contractor.

### **3.8 Maintenance**

- A. The Contractor shall be responsible for all settlement of backfill, fills, and embankments that may occur.
- B. The Contractor shall make, or cause to be made, all repairs or replacements made necessary by settlement within 30 days after notice from KC Water.

END OF SECTION

## SECTION 02273

### RIPRAP

#### PART 1 GENERAL

##### 1.1 Section Description

- A. This section provides for the required placement of materials over the pipeline to minimize erosion of backfill and displacement of the pipe.

##### 1.2 Section Includes

- A. Riprap
- B. Grout
- C. Filter Fabric
- D. Riprap Bedding

##### 1.3 Related Sections

- A. Section 01300 – Submittals
- B. Section 01600 – Material and Equipment
- C. Section 02200 - Excavation and Trenching
- D. Section 03001 - Concrete

##### 1.4 Submittals

- A. Follow the procedures for submittals provided in Section 01300 – Submittals.
- B. Submit the following:
  - 1. One inch square sample of the fabric.
  - 2. Fabric manufacturer’s descriptive product data and installation instructions.
  - 3. Quarry data on gradation and stone physical properties for riprap and riprap bedding.

**1.5 Delivery, Storage, and Handling**

- A. Follow the provisions for the delivery, storage, protection and handling products to and at site provided in Section 01600 - Material and Equipment.
- B. Material stored on site shall be in neat stockpiles in locations that do not inconvenience public and KC Water operations.

**PART 2 PRODUCTS**

**2.1 Materials**

- A. Riprap:
  - 1. Stone: Sound, hard, and durable, free from cracks, seams, shale partings, and overburden spoil. Stone shall be approximately rectangular in cross section, free from thin, slab-like pieces having an elongation ratio greater than 4. The quantity of stone having an elongation ratio greater than 3 shall not exceed 20 percent by weight.
  - 2. Deleterious Substances: Deleterious substances such as shale and clay balls (in material retained on the 1/2 inch sieve) shall not exceed 7 percent by weight.
  - 3. Gradation: Stone for riprap shall be reasonably uniformly graded within the following limits:

Weight in Pounds	Percent of Total Weight Lighter Than
300	Maximum Allowable Size
200	85-95
50	30-50
10	0-15

- B. Grout:
  - 1. Grout for riprap shall be one (1) part Portland cement and three (3) parts fine aggregate with sufficient water to form plastic mix.
- C. Filter Fabric:
  - 1. A fibrous filter fabric shall be installed below the bedding material to increase soil stabilization. Filter fabric shall be in accordance with Section 02200.

D. Riprap Bedding:

1. Sound, durable limestone, free from cracks, seams, shale partings, and soil, or shall be natural gravel composed of hard, tough, and durable particles free from adherent coatings. Riprap bedding larger than one-inch standard sieve size shall be reasonably free from flat elongated particles. Riprap bedding material shall be reasonably well graded within the following limits:

**Riprap Embedment Gradation**

Sieve Size	Percent Passing by Weight
3 inch	Maximum Allowable Size
1-1/2 inch	75-95
1/2 inch	40-60
No. 4	5-25

**2.2 Quality Assurance**

- A. Quarry Source: Riprap shall be obtained from a quarry and ledge previously approved by the Missouri Department of Transportation or the Kansas City District of the U. S. Army Corps of Engineers. The source and the materials proposed for use shall be acceptable to KC Water.
- B. All riprap work shall be performed by a contractor having demonstrated experience in riprap placement on projects of similar size.
- C. The work shall be performed by experienced personnel who are familiar with the required work and who are under the supervision of a qualified foreman at all times when the work is in progress.

**PART 3 EXECUTION**

**3.1 Placing Filter Fabric**

- A. Filter fabric shall not be placed over frozen or spongy subgrade surfaces.
- B. Joints between the fabric shall be lapped at least 3 feet. A minimum 2 percent slack shall be provided in both directions. Fabric shall be installed in conformity with all other manufacturer's requirements.

**3.2 Placing Bedding and Riprap**

- A. Riprap Bedding: Riprap Bedding shall be spread uniformly to a depth of 6 inches over the required areas and covered with riprap placed by methods that will minimize segregation. Any damage to the underlying surface during placement of the bedding shall be repaired before proceeding with work. Compaction of the

bedding layer will not be required; however, the bedding surface shall be reasonably smooth.

- B. Riprap shall be placed to full layer thickness (at least 15 inches) so as to minimize segregation. Stone for riprap shall be placed in a manner that will produce a well-keyed and stable mass of rock.
- C. Distribution shall be obtained by selective loading at the quarry and controlled dumping at the site, or by other acceptable methods.
- D. Hauling over riprap after placement will not be permitted. Stone shall be placed by direct dumping in place by means of truck, skip box, clam, rock bucket, or orange peel.
- E. The larger stones shall be well distributed and the finished stone protection shall be free from pockets of small stones and clusters of large stones.
- F. Final finishing shall be done as material is being placed. Dumping of stone at the top of slopes and rolling it into place will not be permitted.
- G. Moving stone by drifting and manipulating stone by means of bulldozers or other blade equipment will not be permitted.
- H. A tolerance of plus or minus 0.5 foot from the required thickness will be allowed in the finished surface of the riprap.

### **3.3 Grouting**

- A. Fill spaces between the stones with grout in locations shown on the drawings or specified herein.
- B. Grout shall be placed into the voids until they are completely filled.
- C. Grout shall be cured as required for flatwork as referenced in Section 03001.

### **3.4 Maintenance**

- A. The Contractor shall maintain the riprap until final inspection. Any material displaced shall be repaired to the required lines and grades.

END OF SECTION

## SECTION 02320

### UTILITY CASINGS

#### PART 1 GENERAL

##### 1.1 Section Description

- A. This section provides for installation of casing pipe at locations shown on the Drawings to protect the water main from surface loadings.

##### 1.2 Section Includes

- A. Steel Casing Pipe
- B. Reinforced Concrete Pipe (RCP) Casing Pipe
- C. FRP Casing Pipe
- D. Accessories
- E. PVC Casing Pipe near gas mains

##### 1.3 Related Sections

- A. Section 01300 – Submittals
- B. Section 01600 – Materials and Equipment
- C. Section 02200 – Excavation and Trenching
- D. Section 02618 – Ductile Iron Pipe Water Main
- E. Section 02669 – Thrust Restraints

##### 1.4 References

- A. API RP1102 - Recommended Practice for Liquid Petroleum Pipelines Crossing Railroads and Highways.
- B. API 1104 - Standard for Welding Pipelines and Related Facilities.
- C. ASTM A36 - Structural Steel.
- D. ASTM A570 - Hot-Rolled Carbon Steel Sheet and Strip, Structural Quality.
- E. ASTM C33 - Standard Specifications for Concrete Aggregates.

- F. ASTM C76 - Standard Specifications for Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe.
- G. ASTM C361 - Standard Specifications for Reinforced Concrete Low-Head Pressure Pipe.
- H. AWWA C200 - Steel Water Pipe 6 Inches and Larger.
- I. AWWA C206 - Field Welding of Steel Water Pipe.
- J. SSPC SP3 - Power Tool Cleaning.
- K. AWWA C900 and C-905 – Polyvinylchloride Pipe

### **1.5 Submittals**

- A. Follow the procedures for submittals provided in Section 01300 – Submittals.
- B. Submit descriptive and engineering data for:
  - 1. Casing pipe material, coatings and linings.
  - 2. Pipe alignment skids.
  - 3. Guide spacer bands.
  - 4. Restrained casing spacers.
  - 5. End seals.

### **1.6 Delivery, Storage, and Handling**

- A. Follow the provisions for the delivery, storage, protection and handling projects to and at site provided in Section 01600 - Material and Equipment.
- B. Accept piping on site. Inspect for damage and inventory.

## **PART 2 PRODUCTS**

### **2.1 Materials**

- A. Steel Casing Pipe:
  - 1. New, smooth wall, welded steel pipe fabricated from ASTM A36 plate or ASTM A570 sheet with a minimum yield point of 248 MPa (36,000 psi), conforming to AWWA C200.



2. Casing Thickness: The following table provides a listing of minimum casing diameters and thickness:

**Minimum Casing Diameters**

Encased Pipe Diameter (inches)	Minimum Casing Diameter (inches) <sup>(1)</sup>	Wall Thickness (inches)	
		Under Highways	Under Railroads
6	18	0.250	0.312
8	18	0.250	0.312
12	24	0.281	0.375
16	30	0.312	0.438
20	36	0.344	0.563
24	42	0.375	0.625
30	44	0.375	0.625

(1) Minimum casing inside diameter shall exceed outside diameter of carrier pipe joints or couplings by 4 inches.

3. Joints: All joints in steel pipe casings shall be field welded to conform to API 1104 or AWWA C206.
- a. Clean to SSPC-SP3 and apply iron oxide field coating to all exterior joints after field welding.
  - b. Clean to SSPC-SP3 and apply iron oxide field coating to all interior joints on 24 inch diameter casings and larger after field welding.
4. Factory Coatings and Linings: Coat exterior and line interior of all casing pipe with iron oxide primer applied at 33 microns (1.5 mils) minimum thickness. Hold coatings and linings back from end joints to be welded at least 2 inches each side of joint.

**B. Reinforced Concrete Pipe (RCP) Casing Pipe:**

1. Pipe: ASTM C76 circular pipe of the strength class required by the drawings, or the highway, railroad, or utility having jurisdiction.
2. Joints: Steel end joints with a groove in the spigot end for an O-ring gasket.
3. Gasket: Synthetic Rubber, ASTM C361.

**C. Fiberglass Reinforced Pipes:**

1. Pipe to be manufactured by the centrifugal casting process to result in a dense, nonporous, corrosion-resistant, consistent composite structure conforming to ASTM D3262, ASTM D 4161, and ASTM D2412.
2. Joints: Unless otherwise specified, the pipe shall be field connected with fiberglass sleeve couplings that utilize elastomeric sealing gaskets made of EPDM rubber compound as the sole means to maintain joint water tightness. The joints must meet the performance requirements of ASTM D4161.
3. The actual outside diameter and the minimum wall thickness of the pipes shall be in accordance with ASTM D3262. Pipe shall be supplied in nominal lengths of 20 feet. Minimum Pipe stiffness when tested in accordance with ASTM D2412 shall normally be 36 psi.

D. Accessories

1. Casing spacers: shall be used to install the carrier pipe inside the casing pipe. Casing spacers shall fasten tightly onto the carrier pipe so that when the carrier pipe is being installed the spacers will not move along the pipeline. Casing spacers shall be doubled on each end of the casing pipe.

Each casing spacer shall be capable of providing support for the carrier pipe in service at a maximum spacing of 10'. Calculations shall be provided to the ENGINEER by the casing spacer manufacturer showing that the casing spacer will support the service load at the recommended spacing, including a factor of safety of two (2). Casing spacers used under this specification shall meet or exceed the specifications described herein as projection-type that has a minimum of projections around the circumference totaling the number of diameter inches.

Projection-type casing spacers panels, risers and fasteners shall be constructed of Stainless Steel type 304. Casing spacer skids shall be constructed of UHMV Polyethylene. Projection-type casing spacers shall be Power Seal Model 4810 or approved equal.

E. End Seals: Power Seal Model 4810ES or approved equal.

F. Sand: Clean, natural sand in accordance with ASTM C33.

G. PVC Casing Pipe near gas mains

1. When a water main will cross under or over, or is in close proximity to a gas main with an impressed current cathodic protection system the water main shall be placed inside a PVC casing pipe conforming to AWWA C-900 or AWWA C-905 for a distance of at least 10' each side of the gas main being crossed.

The water main shall also be protected by two layers of polyethylene encasement for a minimum distance of 25' each side of the gas main being crossed or for the full length of any water main paralleling within 10' of the gas main, or as indicated on the Drawings. Install in accordance with Construction Detail Drawing 02320-2.

## **2.2 Quality Assurance**

- A. Contractor: Company specializing in the installation of the Products specified in this Section with minimum three years documented experience.

## **PART 3 EXECUTION**

### **3.1 Installation**

- A. All work shall meet the minimum requirements of API RP1102, and the highway, railroad, or utility having jurisdiction. Installation shall be subject to their inspection and approval.
- B. Install Casing Pipes:
  - 1. Boring: Continuous flight auger, pneumatic or hydraulic jacking, or method approved by KC Water. Reinforce leading end of casing with jacking band.
  - 2. Install to line and grade indicated on the Drawings.
  - 3. Excavate working pits of adequate size to provide safe working conditions and in such a manner as not to disrupt traffic or damage the roadway grade or surface.
  - 4. Casings rejected due to misalignment or other failures shall be abandoned in place and filled with grout. Casing pipe shall not be recovered for reuse.

### **3.2 Casing Spacers**

- A. Shall be used for all casing pipe.
- B. Furnish casing spacers for pipe alignment guides as indicated on the Construction Detail Drawing No. 02320-1 for all carrier pipe to be installed in casing.
  - 1. Outside diameter of spacer to be sized slightly smaller than casing pipe inside diameter to limit carrier pipe movement.
  - 2. Install in accordance with spacer manufacturer's recommendations.

### **3.3 End Seals**

- A. Shall be used for all casing pipe.
- B. Install end seals as indicated on the Construction Detail Drawing No. 02320-1 and as follows:
  - 1. After inside of casing has been thoroughly cleaned.
  - 2. After carrier pipe has been permanently placed inside casing.

END OF SECTION

## SECTION 02575

### SURFACE RESTORATION

#### PART 1 GENERAL

##### 1.1 Section Description

- A. This section provides replacement of sidewalks, curbs, and pavement removed for water main construction operations.

##### 1.2 Section Includes

- A. Embedment and Backfill
- B. Roadway Surfacing
- C. Brick or other Paver Material
- D. Sidewalk

##### 1.3 Related Sections

- A. Section 01300 – Submittals
- B. Section 01600 – Material and Equipment
- C. Section 02200 – Excavation and Trenching
- D. Section 03001 – Concrete

##### 1.4 References

- A. American Public Works Association (APWA) - Standard Specifications.
- B. KCMO Public Works - Standard Specifications.

##### 1.5 Submittals

- A. Follow the procedures for Submittals provided in Section 01300 - Submittals.

##### 1.6 Quality Assurance

- A. All work shall conform to the latest APWA Standard Specifications and KCMO Department of Public Works Standard Specifications and Detail Drawing.

- B. Street cuts under Permit Work shall comply with KCMO Public Works Rules and Regulations for Excavation Permits. Excavations shall be protected at all times in accordance with Section 02200.
- C. The manufacturer shall be a company specializing in manufacturing of the Products specified in this Section with minimum three years documented experience.

### **1.7 Delivery, Storage, and Handling**

- A. Follow the provisions for the delivery, storage, protection and handling products to and at site provided in Section 01600 - Material and Equipment:
- B. Do not place asphalt when base surface temperature is less than 40° F (4° C), or surface is wet or frozen.

## **PART 2 PRODUCTS**

### **2.1 Materials**

- A. Embedment and Backfill: Refer to Section 02200
- B. Roadway Surfacing: In accordance with KCMO Public Works Standard Specifications and details.
- C. Brick or other Paver Material: Match existing.

## **PART 3 EXECUTION**

### **3.1 General Requirements**

- A. All excavation within City right-of-way requires a permit from the KCMO Public Works Department.
- B. All street or roadway pavement, driveway pavement, surfaced parking areas, sidewalks, curb and gutters, or other similar features encountered during water main construction shall be carefully demolished in accordance with the requirements herein, to allow for proper reconstruction of the feature.
- C. Existing pavements shall be cut parallel or perpendicular to the direction of traffic. Cuts shall be made with a concrete saw or similar tool designed for cutting pavement with a minimum of damage to the area to remain. The edges of cuts shall be smooth and straight. If, after trench excavation, cuts are less than one foot from the top of the trench in any location, the pavement shall be cut again, and additional pavement shall be removed to allow for proper pavement repair.
- D. All features subject to traffic (vehicular or foot) are to be reopened either permanently or temporarily, at the earliest possible time, to minimize inconvenience

to the users of the feature. Trenches are to be backfilled or plated whenever no work is being conducted in the traffic location.

- E. Any surface feature damaged by construction activities, whether in the location of a trench or not, shall be removed and restored in accordance with these requirements.

### **3.2 Examination**

- A. During demolition, existing pavement wearing course, base, and sub-base conditions shall be carefully observed, and measured as necessary for proper duplication during restoration.
- B. During restoration, examine sub-base and base to verify proper moisture content and ability to support construction activities and imposed loads.
- C. Verify grades and elevations are correct.

### **3.3 Curbs, Sidewalks, and Portland Cement Concrete Features**

- A. Portland Cement Concrete features are to be removed to the nearest joint in the existing material, provided that it is at least one foot from the top of the trench after excavation.
- B. Reconstruct curbs to match adjoining materials and dimensions.
- C. Reconstruct sidewalks and driveways to the current City standard or to match the existing materials and dimensions, whichever is the higher standard.
- D. Stone curbs, brick pavers and similar materials shall be carefully removed by hand, preserved for reuse, and replaced to match the existing feature. A concrete cap extending one foot beyond the top of trench shall be placed over the trench beneath the pavers. This supporting trench cap shall be 10 inches thick in areas subject to vehicular traffic, and 6 inches thick in areas subjected to foot traffic only. A sand bed shall be provided where required to properly level and install pavers.

### **3.4 Asphaltic Concrete Surfaces**

- A. If the location of a proposed cut is within 18 inches of an existing joint cut, pavement removal shall be extended to that joint or cut.
- B. Restoration of street cuts shall conform to the City "Street Cut Restoration Standards" and the requirements of the street cut permit.
- C. Restoration of parking lot, driveway, and similar surfaces shall match the existing surface or conform to current standard for the feature whichever
- D. Standard is higher.

### **3.5 Gravel and other Surfaces**

- A. Oiled crushed rock (chip and seal) surfaces shall be replaced with a minimum of 6 inches untreated compacted aggregate and 4 inches of Type 3 asphaltic concrete.
- B. Earth or crushed rock roads shall be restored with a minimum of 12 inches of untreated compacted aggregate over a trench cap as described above. The aggregate material shall closely resemble the original or surrounding material.
- C. All other surfaces shall be restored to match the surrounding surface, as directed by KC Water.

END OF SECTION



## **SECTION 02608**

### **CONCRETE VAULTS**

#### **PART 1 GENERAL**

##### **1.1 Section Description**

- A. This section provides for the installation of vaults to house water main appurtenances in locations shown on the drawings.

##### **1.2 Section Includes**

- A. Concrete Vaults
- B. Lids and Frames
- C. Vault Configuration

##### **1.3 Related Sections**

- A. Section 01300 – Submittals
- B. Section 01600 – Material & Equipment
- C. Section 02200 - Excavation and Trenching
- D. Section 02575 – Surface Restoration
- E. Section 02618 – Ductile Iron Pipe Water Main
- F. Section 02619 – Pre-stressed Concrete Cylinder Pipe Water Main
- G. Section 02641 – Valves

##### **1.4 References**

- A. ASTM A48 - Gray Iron Castings.
- B. ASTM C33 - Standard Specification for Concrete Aggregates.
- C. ASTM C150 - Standard Specification for Portland Cement.
- D. ASTM C207 - Standard Specification for Hydrated Lime for Masonry Purposes.
- E. ASTM C478 - Precast Reinforced Concrete Manhole Sections.

- F. ASTM C923 - Resilient Connectors Between Reinforced Concrete Manhole Structures, Pipes, and Laterals.
- G. International Masonry Industry All-Weather Council (IMIAC): Recommended Practices and Guide Specification for Cold Weather Masonry Construction.

### **1.5 Submittals**

- A. Follow the procedures for submittals provided in Section 01300 – Submittals.
- B. Provide information on materials and construction of vaults, vault lids and frames, component construction, features, configuration, and dimensions.

### **1.6 Quality Assurance**

- A. To ensure conformance to tensile strength requirements, the following procedure will be followed for each lot of castings used.
  - 1. All castings shall be Julian Heat dated.
  - 2. Two test bar specimens shall be poured when producing castings. Test bar specimens shall be Julian Heat dated. One test bar shall be sent to an independent laboratory for tensile strength testing. The other test bar shall be held at the foundry for a period of not less than one year.
  - 3. A test report from an independent laboratory verifying tensile strength shall accompany each shipment of castings. The heat date(s) on castings shall correspond to the tensile strength report(s).
- B. The manufacturer shall be a company specializing in manufacturing Products specified in this Section with minimum three years documented experience.
- C. Cold Weather Requirements: IMIAC - Recommended Practices and Guide Specifications for Cold Weather Masonry Construction.

### **1.7 Delivery, Storage and Handling**

- A. Follow the provisions for the delivery, storage and handling of products to and at site provided in Section 01600 - Material and Equipment.

## **PART 2 PRODUCTS**

### **2.1 Materials**

- A. Concrete Vaults:
  - 1. Vault Sections: Reinforced precast concrete in accordance with ASTM

C478 with gaskets in accordance with ASTM C923.

2. Mortar: Proportions by volume shall be one part Portland cement, ASTM C150 Type I; two parts sand, ASTM C33; and 10 percent by volume of lime ASTM C207, Type S.

B. Lids And Frames:

1. Castings shall conform to the requirements of ASTM Designation A48, Class 35B.
2. The word "WATER" shall be cast in the cover in 3" letters. The words Kansas City Missouri shall be cast in the cover in 1 ¼ " letters.
3. **UNPAVED/EASEMENTS/GREENWAY Locations:** Covers shall have "WATER" in the center.
  - a. The frame and cover shall be Deeter Foundry, Inc. #1320A or approved equal.
4. **PAVED City/Public Street Right-of-way Locations:** Castings installed in Paved areas will be adjustable/self-leveling. Covers shall have "WATER" in the center.
  - a. 24" East Jordon Iron Works 3024 Self-Level Manhole Frame and Cover with 1040AGS "T" Gasket Cover or approved equal.

OR

- b. 25" CertainTeed PAM VIATOP ductile iron casting reference #CDVT60QG or approved equal. ISO9000 certified foundry of all Ductile Iron components. Castings shall be third party certified 65-45-12 ductile iron and all related standards. Covers shall be hinged with drain and incorporate 90 degree blocking systems to prevent accidental closure. Casting shall have lifetime warranty for all components. Reference: AASHTO H20 and ISO 1083 or approved equal.

C. Vault Configuration

1. Shaft Construction: Concentric with lipped male/female joints; sleeve to receive pipe.
2. Shape: Cylindrical.
3. Clear Inside Dimensions:

- a. 60" diameter
- 4. Clear Lid Opening: 26 inches diameter, minimum.
- 5. Pipe Entry: Provide openings as required.
- 6. Steps: See detail drawing No. 02608-1.

### **PART 3 EXECUTION**

#### **3.1 Examination**

- A. Verify items provided by other sections of Work are properly sized and located.
- B. Verify that built-in items are in proper location, and ready for roughing into Work.
- C. Verify excavation for vaults is correct.
- D. Verify that subgrade will support vault.

#### **3.2 Preparation**

- A. Coordinate placement of inlet and outlet pipe or sleeves required by other sections.

#### **3.3 Placing Vault Sections**

- A. Place concrete blocks.
- B. Place vault sections plumb and level, at correct elevations.
- C. Set cover frames and covers level without tipping, to correct elevations.

#### **3.4 Corrosion Protection**

- A. Provide corrosion protection for the concrete and concrete reinforcement, when and as specified.
- B. Corrosion protection for concrete shall be required when the soil conditions indicate the need for sulfate resistant concrete and it is not available from the precast concrete member manufacturer.

END OF SECTION

## SECTION 02618

### DUCTILE IRON PIPE WATER MAIN

#### PART 1 GENERAL

##### 1.1 Section Description

- A. This section provides for pipe, fittings, and appurtenances associated with the installation of ductile iron pipe water main. This section applies to all water main 16" diameter and smaller and to other sizes when ductile iron pipe is selected.

##### 1.2 Section Includes

- A. Pipe
- B. Fittings
- C. Appurtenances
- D. Shop Coating and Lining
- E. Bolts and Nuts
- F. Protective Coatings

##### 1.3 Related Sections

- A. Section 01000 – General Requirements
- B. Section 01016 – Water Mains Near Sewers
- C. Section 01300 – Submittals
- D. Section 01600 – Material and Equipment
- E. Section 02200 – Excavation and Trenching
- F. Section 02575 – Surface Restoration
- G. Section 02608 – Concrete Vaults
- H. Section 02641 – Valves

- I. Section 02645 – Hydrants, Blow-offs and Flushing Assemblies
- J. Section 02669 – Thrust Restraints
- K. Section 02675 – Water Main Testing, Disinfection and De-chlorination

#### **1.4 References**

- A. ANSI/NSF61 - Drinking Water Treatment Chemicals.
- B. ASTM A53 - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc Coated, Welded and Seamless.
- C. ASTM A307 - Standard Specification for Carbon Steel Bolts and Studs, 60,000 psi Tensile.
- D. ASTM D4976 - Standard Specification for Polyethylene Tubing.
- E. AWWA C104/ANSI A21.4 - Cement-Mortar Lining for Cast-Iron Pipe and Fittings.
- F. AWWA C105/ANSI A21.5 - Polyethylene Encasement For Ductile Iron Piping.
- G. AWWA C110/ANSI A21.10 - Gray-Iron and Ductile Iron Fittings.
- H. AWWA C111/ANSI A21.11 - Rubber-Gasket Joints for Cast Iron and Ductile Iron Pressure Pipe and Fittings.
- I. AWWA C115/ANSI A21.15 - Flanged Ductile-Iron Pipe with Ductile Iron or Gray Iron Thread.
- J. AWWA C150/ANSI A21.50 - Standard for the Thickness Design of Ductile Iron Pipe.
- K. AWWA C151/ANSI A21.51 - Ductile Iron Pipe Centrifugally Cast for Water.
- L. AWWA C153/ANSI A21.53 - Ductile-Iron Compact Fittings, 3 in. through 24 in.
- M. AWWA C203 - Standards for Steel Pipe.
- N. AWWA C550 - Protective Epoxy Interior Coatings for Valves and Hydrants.
- O. AWWA C600 - Installation of Ductile Iron Water Mains and their Appurtenances.

#### **1.5 Submittals**

- A. Follow the procedures for submittals provided in Section 01300 - Submittals

- B. Submit shop drawings and project data (laying schedule) for piping work showing pipe and fitting sizes, valve locations, joint details; and hydrant locations.

## **1.6 Quality Assurance**

- A. Follow provisions of AWWA C600.
- B. The manufacturer shall be a company specializing in manufacturing the Products specified in this section with minimum three years documented experience.
- C. Mark rejected or defective materials and remove them from the work site.

## **1.7 Delivery, Storage, and Handling**

- A. Follow the provisions for the delivery, storage, protection and handling products to and at site provided in Section 01600 - Material and Equipment.
- B. Accept piping on site. Inspect for damage and inventory.

## **PART 2 PRODUCTS**

### **2.1 Water Main Pipe Materials**

- A. Pipe
  - 1. Unless indicated otherwise, all 4" diameter through 12" diameter shall be thickness class 52. Pipe 16-inch diameter and larger shall be thickness Class 54 minimum. The pipe shall be designed in accordance with AWWA C150-ANSI A21.50 and manufactured per AWWA C151-ANSI A21.51 complete with all accessories.
  - 2. The exterior of ductile iron pipe (not including fittings) shall be coated with a layer of arc-sprayed zinc per ISO 8179. The mass of the zinc applied shall be 200 g/m<sup>2</sup> of pipe surface area. A finishing layer topcoat shall be applied to the zinc. The mean dry film thickness of the finishing layer shall not be less than 3 mils with a local minimum not less than 2 mils. The coating system shall conform in every respect to ISO 8179-1 "Ductile iron pipes – External zinc-based coating - Part 1: Metallic zinc with finishing layer. Second Edition 2004-06-01."
  - 3. All ductile iron pipe, and all fittings, valves, and other buried appurtenances, shall be encased in polyethylene.
  - 4. Joints: The joints shall be of the push-on type unless otherwise specified conforming to ANSI/AWWA C111/A21.11, except gaskets shall be neoprene or synthetic rubber. Gaskets shall be certified as suitable for chlorinated potable water in accordance with ANSI/NSF61. Natural rubber will not be

acceptable.

5. Restrained Joints: See Section 02669.

B. Fittings

1. All fittings shall be made of Ductile Iron and manufactured according to AWWA C110/ANSI A21.10 or AWWA C153/ANSI A21.53.
2. Fitting joints shall be Mechanical Joint (MJ), Flange Joint (FLG), or Push-On Joint, per AWWA C111/ANSI A21.11. All MJ glands shall be ductile iron. Fittings shall have distinctly cast upon them, the pressure rating and the letters "DI" or "Ductile". FLG Fittings shall be used only for aboveground installations.
3. Flanged Joints: Shall be provided with full-face gaskets and shall meet the requirements of AWWA C115/ANSI A21.15.

C. Appurtenances

1. Welded - On Outlets: May not be used in lieu of tees.
2. Tie Rods: ASTM A276, Type 304 or Type 316 Stainless Steel.
3. Couplings: Dresser "Style 38" or Smith-Blair "441 or 411 Flexible Coupling"; without pipe stop. Bolted compression type couplings shall be manufactured of steel or ductile iron specifically for use with ductile iron pipe.

D. Shop Coating and Lining

1. All pipe and fittings shall be cement mortar lined in accordance with AWWA C104/ANSI A21.4. Pipe cement-mortar lining shall be without an asphaltic interior seal coating. All buried pipe and fittings shall be exterior coated with a black asphaltic coating minimum 1 mil in thickness per AWWA C151/ANSI A21.51. Any pipe or fittings above ground shall be prime coated with 6 mils DFT of Tnemec 140-1211 Epoxy Primer.
2. As an alternative to cement mortar lining on fittings, the manufacturer may use a Fusion Bonded Epoxy on both the interior and exterior that complies with AWWA C550 and is NSF 61 approved for potable water.
3. Ductile Iron Pipe used for sewers shall have an interior protective coating of Tnemec 431 coating.

E. Bolts and Nuts



1. Bolts: ASTM A307, chamfered or rounded ends projecting 1/4 to 1/2 inch from surface.

2. Nuts: ASTM A307, hexagonal, ANSI B18.2.2.

F. Marking:

2. Markings shall be legibly indented in the pipe or painted thereon with waterproof paint.

**2.2 Protective Coatings**

A. Polyethylene Encasement:

1. Polyethylene encasement materials shall be in accordance with ASTM D4976 and AWWA C105/ A21.5; LLD-12 mil or HDCL-4 mil. LLD-12 mil polywrap shall be blue.

<u>Item</u>	<u>LLD-12 mil</u>	<u>HDCL-4 mil</u>
Tensile Strength, psi	4,400	6,300
Elongation, percent	1,000	100
Dielectric Strength, v/mil	1,900	800
Tear Resistance, gf	4,400	250
Impact Resistance, g	1,100	800

2. The minimum tube size for each pipe diameter shall be in accordance with AWWA C105 as follows:

**Polyethylene Flat Tube Width (inches)**

<b>Nominal Pipe Diameter (inches)</b>	<b>Push-on Bell &amp; Spigot Joints</b>	<b>Mechanical Joints</b>
4	14	16
6	17	20
8	21	24
10	25	27
12	29	30
14	33	34
16	37	37
18	41	41
20	45	45
24	53	53

3. Adhesive tape shall be a general purpose adhesive tape 1-inch wide and approximately 8 mils thick, such as Scotch Tape No. 50, Polyken No. 900, Tapecoat CT or approved equal (Duct Tape will not be allowed).
- B. Exterior Surfaces Underground (Excluding Pipe & Fittings): All metal surfaces, including each mechanical coupling, shall be thoroughly cleaned and then coated with Tnemec coal-tar epoxy "High-Build Tnemec-Tar". All material and the application thereof shall conform to AWWA C203.
- C. Above ground pipe and fittings shall be field coated with Tnemec Coal Tar Epoxy "High-Build Tnemec-Tar."

### **PART 3 EXECUTION**

#### **3.1 Handling**

- A. Pipe, fittings, and accessories shall be handled in a manner that will ensure installation in a sound, undamaged condition. Equipment, tools, and methods used in unloading, reloading, hauling, and laying pipe and fittings shall be such that the pipe, pipe coating, and fittings are not damaged. Hooks shall not be used. Under no circumstances shall pipe or accessories be dropped or dumped. Pipe and fittings shall not be moved by inserting anything into pipe ends.
- B. Pipe and fittings on which the cement lining has been broken or loosened shall be replaced. Where the damaged areas are small and readily accessible, the lining may be permitted to be repaired in accordance with AWWA C104.

#### **3.2 Inspection**

- A. Pipe and fittings shall be carefully examined for cracks and other defects immediately before installation. Spigot ends shall be examined with particular care since they are vulnerable to damage from handling. All defective, damaged, or unsound pipe and fittings shall be rejected and marked as such and removed from the site of the work.

#### **3.3 Preparation**

##### **A. Cutting Pipe:**

1. Ductile iron pipe shall be cut with a saw or an abrasive wheel. Existing cast iron pipe shall be cut with a saw or abrasive wheel.
2. The cutting of pipe with a torch will not be permitted.
3. Cutting shall be done in a neat manner without damage to the pipe or the cement lining. Cuts shall be smooth, straight, and at right angles to the pipe axis. After cutting, the end of the pipe shall be dressed with a file to remove all roughness and sharp corners.

B. Cleaning:

1. The interior of all pipe and fittings shall be thoroughly cleaned of foreign matter before being installed and shall be kept clean until the work has been accepted.
2. Surfaces shall be wire brushed, if necessary, wiped clean, and kept clean until jointing is completed.

### 3.4 Installation

A. General

1. Alignment: Runs intended to be straight shall be laid straight. Deflections from a straight line or grade shall not exceed the quantities stipulated in Table 4 or Table 5 of AWWA C600. Shorter pipe sections or special bends shall be installed where the alignment or grade requires them.
2. Laying Pipe: Pipe shall be protected from lateral displacement by pipe embedment material installed as specified in Section 02200. Under no circumstances shall the pipe be laid in water; and no pipe shall be laid in unsuitable trench conditions.
  1. Pipe shall be laid with the bell ends facing the direction of laying except when reverse laying is specifically authorized by KC Water.
  2. Whenever pipe laying is stopped, the open end of the line shall be sealed with a watertight plug that will prevent water and objects from entering the pipe.
3. No pipe length less than 18" shall be used.

B. Mechanical Joints:

1. The gasket and gland shall, after proper joint cleaning, be in position on the spigot before shoving the pipe to its final position. Center the entering spigot so that the gland or follower ring is parallel to the face of the connecting bell. Joint shall be shoved "home" and the gland properly positioned with respect to the connecting bell with the connecting pipes in as nearly perfect alignment as practicable. The bolts shall be slightly and uniformly tightened. Deflection may be made after the bolts are tightened.
2. Coat the gasket with a lubricant (suitable for potable water) supplied by the pipe manufacturer and all surfaces of the bell, spigot, and gland that will come in contact with the gasket at any time during assembly.

3. Gasket shall be carefully pushed into position and evenly seated in the bell. The gland shall be shoved into place against the gasket, the bolts inserted, and the nuts tightened with the fingers until snug. Final tightening of the bolts shall be done with a ratchet torque wrench.
4. Partially tighten the bottom bolt, then the top bolts, alternately either side, and finally the remaining bolts, alternately tightening bolts 180 degrees apart. This cycle is then to be repeated until all bolts are tightened to the torque specified by the manufacturer:

5/8" bolts --- 40 to 60 foot pounds

3/4" bolts --- 60 to 90 foot pounds

5. If sealing is not maintained at the torque specified, the joint shall be disassembled, thoroughly cleaned, and reassembled. Overstressing of bolts to compensate for poor installation practice will not be permitted.

C. Push-On Joints:

1. Wipe the gasket seat clean with a cloth and position in place. Coat the gasket with a lubricant supplied by the pipe manufacturer. Apply to all of the inner surface of the gasket that will come into contact with the entering pipe.
2. Clean the plain end of the pipe and apply a thin film of lubricant (suitable for potable water) to the outside of the plain end of the pipe and its beveled edge. Align the plain end of the pipe with the bell of the pipe to which it is to be joined. The joint deflection angle should not exceed the recommended maximum of the manufacturer.
3. Bring the plain end of the pipe in contact with the gasket and exert sufficient force on the entering pipe so that its plain end compresses the gasket and makes contact with the base of the socket of the bell. This force can be applied by means of a jack type tool, backhoe, or other methods approved by KC Water.

D. Flanged Joints:

1. When bolting, care shall be taken to provide uniform gasket compression and prevent unnecessary stress on the flanges. Flange shall be free to move in any direction while the flange bolts are being tightened. Bolts shall be tightened gradually and at a uniform rate to provide uniform gasket compression.
2. Use full-face gaskets only.

E. Restrained Joints:

1. Restrained joints shall be installed in accordance with the pipe manufacturer's recommendations.
2. All joints within utility casings shall be restrained joints.

F. Encasement:

1. Polyethylene encasement shall be installed on all ductile iron pipe and fittings. The polyethylene shall prevent contact between the pipe, fittings, and the surrounding embedment.
2. The polyethylene encasement shall be installed as specified in "Method A" below and as shown on the Construction Detail Drawing No. 02618-1.
  - a. Method A: Polyethylene tubing shall be approximately two (2) feet longer than the length of the pipe section to provide a one (1) foot overlap on each adjacent pipe section. Tube ends need not be taped in place unless directed by KC Water. Repair rips, punctures, or other damages to the polyethylene with adhesive tape or with a short length of polyethylene tube cut open, wrapped around the pipe, and secured with adhesive tape as directed by KC Water (duct tape is not allowed).
3. Pipe-Shaped Appurtenances: Bends, reducers, offsets, and other pipe-shaped appurtenances shall be covered with polyethylene in the same manner as the pipe.
4. Odd-Shaped Appurtenances: Valves, tees, crosses, and other odd-shaped pieces that cannot practically be wrapped in a tube shall be wrapped with a flat sheet or split length of polyethylene tube. The sheet shall be passed under the appurtenance and brought up around the body. Seams shall be made by bringing the edges together, folding over twice, and taping down. Tape polyethylene securely in place at overlaps, valve tops and all other penetrations.
5. Lifting devices shall not be placed over polyethylene.
6. Polyethylene shall be protected from exposure to weather or damage at all times.
7. Openings in Encasement: Openings for branches, blow-offs, air valves, and similar appurtenances shall be made by making an x-shaped cut in the polyethylene and temporarily folding the film back. After the appurtenance is installed, tape the slack securely to the appurtenance and repair the cut as well as any other damaged areas in the polyethylene with tape. The new appurtenance shall be wrapped.

8. Junctions between Wrapped and Unwrapped Pipe: Where polyethylene wrapped pipe joins an existing pipe which is not wrapped, extend the polyethylene tube to cover the unwrapped pipe a distance of at least three feet. Secure the end with circumferential turns of tape.
9. Taps: Wrap 3 layers of adhesive tape over the polyethylene, covering the area where the tapping machine will be mounted. Mount the machine over the tape. Make the tap and install the corporation stop through the tape and polyethylene. After making the service connection, inspect the polyethylene, and repair damaged areas with tape.

### **3.5 Water Main and Sewer Separation**

- A. Refer to Section 01016

### **3.6 Appurtenances**

- A. Concrete Vaults: Refer to Section 02608
- B. Valves: Refer to Section 02641
- C. Hydrants, Blow-off, and Flushing Assemblies: Refer to Section 02645
- D. Thrust Restraints: Refer to Section 02669

END OF SECTION

## SECTION 02619

### PRE-STRESSED CONCRETE CYLINDER PIPE

#### PART 1 GENERAL

##### 1.1 Section Description

- A. This Section provides for pre-stressed concrete cylinder pipe, fittings, specials, bolts, gaskets, and appurtenances.

##### 1.2 Section Includes

- A. Materials
- B. Design of Pipe
- C. Joints
- D. Closure Assemblies
- E. Test Plugs
- F. Fittings and Specials
- G. Pipe Marking
- H. Exposed Metal Surfaces
- I. Testing

##### 1.3 Related Sections

- A. Section 01000 – General Requirements
- B. Section 01300 – Submittals
- C. Section 01600 – Material and Equipment
- D. Section 02200 – Excavation and Trenching
- E. Section 02575 – Surface Restoration
- F. Section 02608 – Concrete Vaults
- G. Section 02641 – Valves
- H. Section 02645 – Hydrants, Blow-off and Flushing Assemblies

- I. Section 02669 – Thrust Restraints
- J. Section 02675 – Water Man Testing, Disinfection and De-chlorination

#### **1.4 References**

- A. AWWA C105 - Polyethylene Encasement for Ductile-Iron Pipe Systems.
- B. AWWA C207 - Steel Pipe Flanges for Waterworks Service, Sizes 4 Inch Through 144 Inch.
- C. AWWA C300 - Reinforced Concrete Pressure Pipe, Steel Cylinder Type, for Water and Other Liquids.
- D. AWWA C301 – Pre-stressed Concrete Pressure Pipe, Steel Cylinder Type, for Water and Other Liquids.
- E. AWWA C303 - Concrete Pressure Pipe, Bar-Wrapped Steel Cylinder Type.
- F. AWWA C304 - Design of Pre-stressed Concrete Cylinder Pipe.
- G. AWWA M9 - Concrete Pressure Pipe.
- H. ANSI B16.1 - Cast-Iron Pipe Flanges and Flanged Fittings, Class 25, 125, 250 and 800.
- I. ANSI B16.21 - Nonmetallic Flat Gaskets for Pipe Flanges.
- J. ASTM A307 - Carbon Steel Bolts and Studs, 60,000 psi Tensile Strength.
- K. ASTM A648 - Specification for Steel Wire, Hard Drawn for Pre-stressing Concrete Pipe.
- L. ASTM C33 - Specification for Concrete Aggregates.
- M. ASTM C150 - Specification for Portland Cement.
- N. ASTM C454 - Practice for Disintegration of Carbon Refractories for Alkali.
- O. ASTM D1248 - Polyethylene Plastics Molding and Extrusion Materials.
- P. SSPC SP5 - White Metal Blast Cleaning.

#### **1.5 Submittals**

- A. Follow the procedures for submittals provided in Section 01300 – Submittals



- B. Submit the following for acceptance prior to fabrication:
1. Pipe and joint details.
  2. Special, fitting, and coupling details.
  3. Laying and installation schedule with a pipe elevation for each pipe joint.
  4. Specifications, data sheets, and affidavits of compliance for protective shop coatings and linings.
  5. Pipe manufacturer's design calculations for the pipe and fittings shall be signed and sealed by a Registered Professional Engineer licensed in the State of Missouri. The manufacturer's engineer shall be a current employee of the pipe manufacturer and shall have had at least 5 years of experience with the pipe manufacturer. The calculations shall confirm the pipe wall thickness, amount of pre-stressing wire required, concrete compressive strength, steel cylinder thickness, and other parameters used in the design.
  6. Provide one copy of the pipe manufacturer's video illustrating the process utilized in the manufacture of the pipe.
  7. Provide one copy of the pipe manufacturer's video illustrating the installation of the pipe.
- C. Certificates and Affidavits: Submit the following for acceptance prior to shipment:
1. Affidavit of compliance with applicable standard
  2. Certificate of origin for all steel flanges.
  3. Test certificates.
  4. Certification from gasket manufacturer that the gasket materials are compatible with the joints specified herein and are recommended for the specified field test pressure and for potable water service. Gaskets shall be certified as suitable for potable water that has been treated with chlorine or chloramines. Natural rubber will not be accepted.
  5. Certification of joint lubricant suitable for use in potable water piping.

## 1.6 Quality Assurance

- A. Manufacturer shall have at least 5 years of experience in the design and manufacture of pipe, fittings, specials, and appurtenances.
- B. Pipe shall be manufactured only in a facility having a current certificate under the compliance audit program of the American Concrete Pressure Pipe Association (ACPPA).
- C. In addition to the requirements of AWWA and ASTM, the pipe manufacturer must have an established quality assurance program. The program must document the various raw material components that go into manufacturing each piece of pipe for this project. Each individual pipe section must be identified and every production sequence documented, with all pertinent information recorded and stored. The information must be retrievable by

material, project, and shipping dates. As a minimum the following data shall be input into a KC Water approved computer program and submitted:

1. Pipe serial number.
2. Joint ring steel manufacturer and Certification of AWWA Standards.
3. Cylinder manufacturing date.
4. Cylinder steel manufacturer and Certification of AWWA Standards.
5. Core placement date, cement type, and concrete mix design.
6. Core kiln number.
7. Pre-stressing wire manufacturer, heat, and core number.
8. Pre-stressing date.
9. Coating date, cement type.
10. Coating kiln number.
11. Shipping date.

## **PART 2 PRODUCTS**

### **2.1 Pipe Requirements**

- A. Furnish pipe of materials, joint types, and sizes as indicated on the drawings or as specified except as noted herein.
- B. Pipe shall be designed to withstand all stresses resulting from external loads and internal pressures listed in the table under the Basis of Design paragraph (2.2, B, 3).
- C. Pipe Marking: All pipe and fittings shall be marked in conformance with the standard specification under which the pipe is manufactured and as otherwise specified.
- D. Pipe shall be designed for a bedding angle of 45°.

### **2.2 Concrete Cylinder Pipe**

- A. Materials
  1. All pipe shall be manufactured and designed according to the requirements of the latest editions of AWWA C301, "Pre-stressed Concrete Pressure Pipe, Steel-Cylinder Type, for Water and Other Liquids", AWWA C304, "Design of Pre-stressed Concrete Cylinder Pipe", and AWWA M9 "Concrete Pressure Pipe", except as modified herein. Pre-stressed concrete cylinder pipe shall be embedded cylinder type for all sizes.
  2. Cement shall be ASTM C150, Type II. The 28-day test cylinder concrete compressive strength used for the design of the pipe shall not exceed 7,000 psi. If a test cylinder compressive strength between 6,500 psi and 7,000 psi is used for design, a concrete mix design shall be submitted.

3. Fine aggregate shall be clean natural or manufactured sand as required by ASTM C33. No “rebound” shall be allowed in the cement mortar used for pipe.
4. Rubber gaskets shall be synthetic rubber.

B. Design of Pipe: Design shall conform to AWWA M9 and C304 and as specified:

1. Pipe Cylinder:
  - a. The cylinder hoop stress at 1.5 times working pressure shall not exceed the yield strength of the steel. A minimum cylinder thickness of 10 gauge shall be furnished.
  - b. Cold-rolled sheets will not be acceptable.
  - c. The length of pipe with restrained joints shall be as indicated on the drawings or as specified. Restrained joints and pipe cylinders shall be designed to withstand the calculated stresses at all points along the pipe with restrained joints. The maximum longitudinal stress in pipe cylinders shall not exceed 13,500 psi at the specified working pressure; or 17,000 psi at the specified working pressure plus surge pressure, or the field test pressure, whichever is the greatest.
2. Mortar Coating:
  - a. Mortar coating thickness shall be a minimum of one-inch (1") over the pre-stressing wire.
3. Basis of Design:
  - a. Pipe shall be designed and fabricated in accordance with AWWA C304 and C301, respectively. Pipe and fittings shall be designed to withstand the simultaneous application of the following external loadings and internal pressures under the specified conditions.
    - Fluid Unit Weight: 62.4 lb/ft<sup>3</sup>.
    - Outdoor Environment: 365 days.
    - Relative Humidity: 60 percent.
    - Time Before Filling: 365 days.
    - Minimum Cover Depth: 15 feet
    - Live Load: H-20 at 3 feet
    - Minimum Working Pressure: 200 psi
    - Minimum Surge Pressure: 100 psi
    - Minimum Test Pressure: 300 psi

C. Joints:

1. Bell-and-Spigot:
    - a. Provide bell-and-spigot-type joints for all buried pipe unless otherwise specified or indicated on the drawings.
    - b. Provide joints with steel joint rings and O-ring rubber gaskets conforming to AWWA C301.
    - c. Protect interior surface of the completed joint by grouting with Portland cement mortar.
    - d. The exterior surface of the completed joint shall be covered with a wide joint diaper (harness clamp restrained joint diaper with full width closed cell polyethylene foam lining) filled with grout.
    - e. All bells and spigots shall be the deep joint type (minimum 4-1/8 inches in joint depth).
  
  2. Flanged:
    - a. Provide flanged joints for all interior and exposed exterior pipe except where otherwise specified or indicated on the drawings.
    - b. Flanges shall have a pressure rating not less than that required for pipe.
    - c. Flanges, bolts, and gaskets shall conform to AWWA C207, Class D and shall be drilled ANSI B16.1 Class 125.
  
  3. Coupled:
    - a. Furnish couplings where indicated on the drawings.
    - b. Furnish pipe ends suitable for receiving the style of coupling indicated on the drawings or as specified.
    - c. Furnish anchored couplings where restraint is required to withstand specified operating or hydrostatic test pressure and where indicated on the drawings.
  
  4. Special:
    - a. Furnish pipe with joints suitable for attaching to valves and accessories and for indicated transitions.
    - b. Joints shall be plain end, flanged, mechanical, or as otherwise indicated on the drawings or as specified.
    - c. Adapters may be furnished in lieu of pipe with special joints.
  
  5. Restrained: Provide either clamp-type or snap-ring type rubber and steel joints acceptable to Engineer where restraint is required for joint to withstand specified operating and hydrostatic test pressure and where indicated on the drawings.
- D. Closure Assemblies:
1. Provide closure assemblies acceptable to Engineer where indicated on the drawings and as required by the sequence of construction.
- E. Test Plugs:
1. Provide pressure test plugs where required to test the installation.

2. Design test plugs to withstand hydraulic test pressure and external loading.
3. Join test plugs to pipe with selected joint and restrain as required to maintain internal pressures with external loading applied.
4. Provide outlets of proper size to facilitate flushing and disinfection.

F. Fittings and Specials:

1. Fabricate conforming to AWWA C301 and M9.
2. Design to withstand internal pressure and external loading not less than that of adjoining pipe.
3. Furnish fittings with bell-and-spigot ends where such fittings connect with concrete pipe.
4. Furnish wall fittings with approved anchor ring where indicated on the drawings. Such fittings shall be of ductile iron or fabricated steel.
5. Furnish all adapters, outlets, and other specials as specified or where indicated on the drawings.
6. Furnish openings for air valve, drain, sampling, sensing, testing, and other connections with threaded bosses or flanged outlets sized and located where indicated on the drawings. Steel connections shall be lined and coated with mortar or other protective coating material if mortaring is not feasible.
7. Provide tangent blow-off and drain assemblies where indicated on the drawings. Outlet shall be a minimum 6-inch anchored mechanical joint spigot.
8. Short Bevel Fittings: Furnish and maintain two nominal full bevels and four nominal half bevel bends on site during pipe installation for minor alignment adjustments. Replenish as used until pipe is installed. Return unused bevels to pipe manufacturer.

G. Pipe Marking:

In addition to the marking specified in paragraph "Pipe Marking", the following information shall be marked on each pipe, fitting, and special:

1. Design pressure.
2. Laying schedule number on all fittings and specials.
3. Date of casting.
4. Length of any short pipe.

#### H. Exposed Metal Surfaces:

1. All exposed interior and exterior metal surfaces, including joint rings, outlets, adapters, closure pieces, and miscellaneous steel, shall be coated with an epoxy meeting NSF requirements for contact with potable water.
2. Clean exposed metal joint surfaces to SSPC-SP5 quality and 0.04-0.06 mm (1.5-2.5 mils) profile depth. Apply two coats of epoxy in different colors at a minimum of 0.3-mm (12 mils) dry film total thickness.

#### I. Testing:

1. The pipe manufacturer shall hydrostatically test each cylinder after the joint rings have been attached. The hydrostatic test pressure shall be a minimum of 75 percent of the cylinder design and shall be applied for a minimum of 1 minute.
2. Proof of design tests for each pipe size and joint configuration shall be performed by the manufacturer, witnessed and sealed by the Independent Testing Service selected by the owner, and the results of the tests submitted to the owner for review and approval prior to the start of manufacture. The purpose of the tests are to prove the adequacy of the design and quality for each size and class of pipe and joint manufactured per the specification requirements. One standard length from each size and class of pipe shall be selected. The manufacturer shall conduct a combined load test to verify the design of the pipe. Strain gauges shall be placed strategically on the outside of the core and outside of the mortar coating to verify a zero allowable tensile stress with the following loads applied. An external load, equivalent to the maximum fill height in any one class, shall be applied simultaneously to the internal pressure, equivalent to the working pressure plus surge. The testing apparatus shall be designed to allow the entire pipe to deflect uniformly under the application of external load while maintaining a watertight seal. Bell and spigot configured bulkheads, which add stiffness to the pipe ends, will not be permitted.

Each joint shall be tested at a pressure not less than 1.5 times the test pressure. In addition to being tested in the un-deflected condition, at least one joint of each size and type shall be tested at the maximum angle of deflection recommended by the manufacturer.

When testing restrained joints, the piping shall not be blocked to prevent separation and the joint shall not leak or show evidence of failure.

When angular deflection is required at restrained bell-and spigot joints, special bevels shall be provided for the exact angle or the deflection shall be obtained by opening joints on one side. Deflections by opening joints on one side shall

not exceed the values recommended by the manufacturer and shall be proven by joint testing.

3. The manufacturer shall hydrostatically test completed pipe prior to shipment to job site. Pipe of each size and class shall be selected at random by KC Water; however, no more than 10% of the pipe will be tested unless there are lengths that fail the test. The hydrostatic test pressure shall be a minimum of 1.5 times the test pressure and shall be for a minimum of five minutes, during which time the coating shall be checked for exterior cracks. Any pipe with visible cracks, at the specified test pressure, shall be rejected

### **PART 3 Execution**

#### **3.1 General**

##### **A. Delivery, Storage and Handling**

1. Handle in a manner to ensure installation in sound and undamaged condition.
2. Do not drop or bump.
3. Use slings, lifting lugs, hooks, and other devices designed to protect pipe, joint elements, linings, and coatings.
4. Ship, move, and store with provisions to prevent movement or shock contact with adjacent units.
5. Handle with equipment capable of work with adequate factor of safety against overturning or other unsafe procedures.

#### **3.2 Installation**

##### **A. Use equipment, methods, and materials ensuring installation to lines and grades indicated.**

1. Maintain within tolerances specified or acceptable laying schedule.
  - a. Alignment:  $\pm 25$  mm (+1 inch) per 30 m (100 feet) in open cut or tunnel.
  - b. Grade:  $\pm 25$  mm (+1 inch) per 30 m (100 feet).
2. Accomplish horizontal and vertical curve alignments with bends, bevels, and joint deflections.
  - a. Limit interior joint opening in concrete pipe except for open side on deflected joints to:
  - b. 10 mm (3/8-inch) in laying schedule.
  - c. 13 mm (1/2-inch) in actual installation.
  - d. Use short specials in curve as indicated.

3. Obtain acceptance of method proposed for transfer of line and grade from control to the Work.
4. Install pipe of size, materials, strength class, and joint type with embedment indicated for plan location.
5. Install pipe with bell ends in direction of laying. Obtain Engineer approval for deviations there from.
6. Clean interior of all pipe, fittings, and joints prior to installation. Exclude entrance of foreign matter during installation and at discontinuance of installation.
  - a. Close open ends of pipe with snug-fitting closures.
  - b. Do not let water fill trench. Include provisions to prevent flotation should water control measures prove inadequate.
  - c. Remove water, sand, mud, and other undesirable materials from trench before removal of end cap.
7. Brace or anchor as required to prevent displacement after establishing final position.
8. Perform only when weather and trench conditions are suitable. Do not lay in water.
9. Observe extra precaution when hazardous atmospheres might be encountered.

### **3.3 Jointing**

#### **A. General Requirements**

1. Locate joint to provide for differential movement at changes in type of pipe embedment, impervious trench checks, and structures.
  - a. Not more than 200 mm (8 inches) from structure wall, or
  - b. Support pipe from wall to first joint with concrete cradle structurally continuous with base slab or footing or
  - c. As indicated.
2. Perform conforming to manufacturer's recommendations.
3. Clean and lubricate all joint and gasket surfaces with lubricant recommended.
4. Use methods and equipment capable of fully seating or making up joints without damage.
5. Check joint opening and deflection for specification limits.

#### **B. Special Provision for Jointing Concrete Pipe:**

1. With rubber gaskets to steel joint rings:



- a. Check gasket position and condition with feeler gauge prior to installation of next section.
  - b. Grout and/or point or seal joint spaces as follows:
    1. With stiff mortar of one part Portland cement as specified for pipe and one part sand. For pipe 600 mm (24-inch) and greater, trowel into entire circumference of joint to provide smooth, flush surface across joint. For pipes less than 600 mm (24 inches) in diameter, butter interior joint space of the bell with cement mortar prior to joining. Excess mortar squeezed out of the joint space by the joining action is to be smoothed by drawing an inflated swab through the pipe.
    2. With grout of pouring consistency made of one part Portland cement and two parts sand, retained by a wide cloth diaper strapped or wired to the pipe. Use diaper designed for the joint. Rod grout with stiff wire formed to pipe curvature during pouring. Use diapered grout seal on restrained clamp-type and snap-ring type joints.
    3. Lay pipe sufficiently in advance of pointing and grouting to preclude damage to mortar.
2. With rubber gaskets to concrete joint: Check gasket position with feeler gauge prior to installation of next section.
  3. Pressure pipe installation shall conform to AWWA M9.

### **3.4 Closure Pieces**

- A. Connect two segments of pipeline or a pipeline segment and existing structure with short sections of pipe fabricated for the purpose.
- B. Observe Specifications regarding location of joints, type of joints, and pipe materials and strength classifications.
- C. Field-fabricated closures (except ductile iron pipe and fittings), where required, shall be concrete encased between adjacent flexible joints.
- D. May be accomplished with sleeve coupling:
  1. Of length such that gaskets are not less than 75 mm (3 inches) from pipe ends.
  2. Wrap exterior of buried steel couplings with polyethylene encasement conforming to AWWA C105

### **3.5 Temporary Plugs**

- A. Furnish and install temporary plugs at each end of Work for removal by others when completed ahead of adjacent contract.

- B. Remove from pipe laid under adjacent contract in order to complete pipe connection when work by other contractor is finished prior to work at connection point under this Contract.
- C. Plugs:
  - 1. Test plugs as manufactured by pipe supplier.
  - 2. Fabricated by Contractor of substantial construction.
  - 3. Secured in place in a manner to facilitate removal when required to connect pipe.

### **3.6 Polyethylene Encasement**

- A. Encase all pressure pipe, fittings, valves, and other appurtenances with polyethylene film as indicated or specified.
- B. Polyethylene encasement materials shall be in accordance with ASTM D4976 and AWWA C105/A21.5; LLD-12 mil or HDCL-4 mil. LLD-12 mil polywrap shall be blue (See Section 02618, Section 2.2 Protective Coatings, A. Polyethylene Encasement).

### **3.7 Field Testing**

- A. Acceptance Tests for Pressure Pipelines:
  - 1. Perform hydrostatic pressure and leakage tests.
    - a. Conform to AWWA C600 procedures.
      - 1. As modified herein.
      - 2. Shall apply to all pipe materials specified.
    - b. Perform after backfilling.
  - 2. Test separately in segments between sectionalizing valves, between a sectionalizing valve and a test plug, or between test plugs.
    - a. Select test segments such that adjustable seated valves are isolated for individual checking.
    - b. Contractor shall furnish and install test plugs.
      - Including all anchors, braces, and other devices to withstand hydrostatic pressure on plugs.
      - Be responsible for any damage to public or private property caused by failure of plugs.
  - 3. Limit fill rate of line to available venting capacity. Fill rate shall be regulated to limit velocity in lines when flowing full to not more than 0.15 to 0.30 m/s (0.05 to 1 fps).
  - 4. KC Water shall make water for testing available to Contractor at nearest source.
  - 5. Contractor to provide equipment and labor to accurately measure and control flow rates.
  - 6. Pressure and Leakage Test:
    - a. Conduct at pressure determined by following formula:

Test gradient El. (as specified by KC Water) - El. gauge x (.4335) = test pressure on gauge. Minimum test pressure shall be 160 psi for 12" and smaller water mains, and 225 psi for 16" and larger water mains.

$P_{pt}$  = test pressure in psi at gauge elevation

- b. Be at least 2-hour duration. Maintain pressure throughout test  $\pm$ 34.5 kPa (+5 psi) of test pressure.
- c. Leakage test shall be conducted concurrently with the pressure test.
- d. Acceptable when leakage does not exceed that determined by the following formula:

1. In metric units:

$L_m = 0.0000014 SD(P)^{1/2} / 2$ , in which

$L_m$  = allowable leakage, in liters per two hours

$S$  = length of pipe tested in meters

$D$  = nominal diameter of the pipe, in millimeters

$P$  = average actual leakage test pressure in kPa

2. In English units:

$L = 0.0000075 SD(P)^{1/2} / 2$ , in which

$L$  = allowable leakage, in gallons per two hours

$S$  = length of pipe tested, in feet

$D$  = nominal diameter of the pipe, in inches

$P$  = average actual leakage test pressure in psig

- e. These formulas are based on an allowable leakage of 1.08 L/day/km/mm (11.65 gpd/mile/in) of nominal diameter at a pressure of 1034 kPa (150 psi).
- f. When testing against closed metal-seated valves, an additional leakage per closed valve of 1.2 mL/h/mm (0.0078 gal/hr/in) of nominal valve size shall be allowed.
- g. When hydrants are in the test section, the test shall be made against the main valve in the hydrant.
- h. Repeat test as necessary.
  - 1. After location of leaks and repair or replacement of defective joints, pipe, fittings, valves or hydrants. All visible leaks are to be repaired regardless of the amount of leakage.
  - 2. Until satisfactory performance of test
- i. KC Water will witness pressure and leakage test.

### 3.8 Disinfection

#### A. Disinfection of Pipelines for Conveying Potable Water:

- 1. Contractor shall provide all equipment and materials and perform conforming to AWWA C651.
  - a. As modified herein.
  - b. Include preliminary flushing, chlorination, and final flushing and piping for flushing.
- 2. Obtain approval of materials and acceptance of methods proposed for use.
- 3. May be conducted in conjunction with acceptance tests.

4. Contractor will provide sampling and laboratory testing.
5. Minimum preliminary flushing rates to produce 0.76 m/s (2.5 fps) velocity in main shall be as follows:

Pipe Size	Flow Rate	
16"	1200 gpm	12" discharge
30"	5500 gpm	12" discharge
42"	11,000 gpm	12" discharge

- a. Provide equipment and labor to accurately measure and control flow rates
- b. Dispose of flushing water without damage to public or private property.
6. A minimum initial dosage of 60 mg/L (ppm) in all portions.
  - a. Allow to stand for 24 hours.
  - b. Minimum 24-hour chlorine residual shall be at least 45 mg/L (ppm).
  - c. De-chlorinate to 0 mg/L (ppm) chlorine.
  - d. Flush pipeline before use for potable water supply purposes. Dispose of final flushing water without damage to public or private property.
7. Repeat disinfection procedure should initial treatment fail to yield a passing Bac-T or minimum residual.
  - a. At no additional cost to Owner.
  - b. KC Water will provide water under terms stipulated for acceptance tests.

### 3.9 Experience and Field Pipe Manufacturer's Services:

- A. All pre-stressed concrete cylinder pipe, fittings, and specials shall be fabricated, lined, and coated by the pipe manufacturer. Minimum required qualifications and experience shall include manufacture of a pipeline at least 5 miles in length, of equal or larger diameter than the pipe to be provided, with joints, lining, and coating suitable for the same or greater pressure rating, which has performed satisfactorily for the past 5 years.
- B. Pipe manufacturer shall provide a qualified field service representative to be on-site for the minimum time stipulated. The field service representative must have a minimum of 5 years' experience as a representative of the pipe manufacturer in the area providing such services. The individual may be a registered professional engineer possessing a minimum of 2 years of experience in the area of manufacture of pipe and service representation in lieu of the 5 years of experience as stated above. The Owner shall have the right of final acceptance of the field service representative based on a resume of the individual indicating the minimum experience required above.
- C. All pipe shall be installed in accordance with the pipe manufacturer's recommendations. An experienced, competent, and authorized field service representative of the pipe manufacturer shall visit the site and inspect, check, instruct, guide, direct the pipe installation contractor's procedures for pipe handling,

laying, and jointing at the start of pipe installation for each crew, at each connection with existing piping and be on site full time when all restrained joint pipe, all fittings, and all bevels are being installed, and revisit the site as often as necessary, to perform an installation check, by means of physical verification of the gasket position in the pipe joint (feeler gauge). Each pipe joint shall also be checked by the pipe installation contractor as instructed by the pipe manufacturer's field service representative to determine that the joint and the means of restraint are installed properly. The pipe manufacturer's field service representative shall also attend the pipe installation contract pre-construction conference and all progress meetings, and final acceptance testing and start-up. The pipe manufacturer's field service representative shall coordinate his services with the pipe installation contractor.

- D. The pipe manufacturer's field service representative shall furnish to the Owner, through Engineer, a written report certifying that the pipe installation contractor's installation personnel have been properly instructed and have demonstrated the proper pipe handling and installation procedures. The pipe manufacturer's field service representative shall also furnish to the Owner, through Engineer, a written report of each site visit.
- E. All costs for these services shall be included in the unit prices in the Invitation for Bid.

End of Section.

## **SECTION 02641**

### **VALVES**

#### **PART 1 GENERAL**

##### **1.1 Section Description**

- A. This section provides for the installation of required valves.

##### **1.2 Section Includes**

- A. Gate Valves
- B. Butterfly Valves
- C. Air Release Valves
- D. Tapping Valves
- E. Valve Boxes, Bases, Lids and Covers, Torque Limiting Devices
- F. Valve Seals and Coatings
- G. Check Valves

##### **1.3 Related Sections**

- A. Section 01300 – Submittals
- B. Section 01600 – Material and Equipment
- C. Section 02608 – Concrete Vaults
- D. Section 02618 – Ductile Iron Pipe Water Main
- E. Section 02669 – Thrust Restraints

##### **1.4 References**

- A. ANSI B16.1 - Pipe Flanges and Flanged Fittings, Cast-Iron
- B. ANSI/AWWA C110/A21.10 - Ductile-Iron and Gray-Iron Fittings.

- C. ANSI/AWWA C111/A21.11 - Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
- D. AWWA C504 - Rubber-Seated Butterfly Valves.
- E. AWWA C509-94 - Standard Specification for Resilient Seated Gate Valves for Water Supply Service.
- F. AWWA C512-99 - Air Release, Air/Vacuum, and Combination Air Valves for Water Works Service.
- G. ASTM A48 - Standard Specifications for Gray-Iron Castings.
- H. ASTM A126 - Standard Specifications for Gray-Iron Castings for Valves, Flanges, and Pipe Fittings.
- I. ASTM A276 - Standard Specification for Stainless Steel Bars and Shapes.
- J. ASTM A536 - Standard Specification for Ductile Iron Castings.
- K. ASTM A564 - Standard Specification for Hot-Rolled and Cold-Finished Stainless Steel Bars and Shapes.
- L. ASTM D471 - Standard Test Method for Rubber Property-Effect of Liquids.
- M. ASTM D1149 - Standard Test Method for Rubber Deterioration-Surface Ozone Cracking in a Chamber.
- N. C508: Swing-Check Valves for Waterworks Service, 2 in. through 24 in.

## **1.5 Submittals**

- A. Follow the procedures for submittals provided in Section 01300 - Submittals
- B. Shop Drawings: Detailed drawings, data and descriptive literature on all valves and appurtenances, including:
  - 1. Manufacturer
  - 2. Dimensions
  - 3. Size
  - 4. Materials of construction
  - 5. Weight

6. Protective coating
  7. Actuator weight and turns to operate where applicable
  8. Calculations for actuator torque where applicable
  9. Proof of design tests in accordance with Sec. 5.2.4. AWWA C504
  10. Cross section drawings detailing all components
- C. The Contractor shall submit descriptive literature describing the proposed valves and accessories. Contractor shall also furnish a copy of the manufacturer's warranty that applies to the valves and actuators.

### **1.6 Quality Assurance**

- A. Valves shall be manufactured by a company specializing in the regular production of the Products specified herein and proven reliable in similar service for at least five (5) years.
- B. Insofar as possible, all valves of the same specific type shall be the product of one (1) manufacturer.

### **1.7 Delivery, Storage and Handling**

- A. Follow the provisions for the delivery, storage, protection and handling Products to and at site provided in Section 01600 - Material and Equipment.

## **PART 2 PRODUCTS**

### **2.1 General**

- A. Marking and identification of valves shall conform to AWWA C504 or AWWA C509.

### **2.2 Gate Valves**

- A. Gate Valves: Except as modified or provided herein, all gate valves shall be 200 psi, ductile iron body, resilient-seated, tight closure gate valves with non-rising stems conforming to the requirements of AWWA C509. Thin wall valves are prohibited.
- B. Valve Ends:
  1. Mechanical Joint or Push On Joint: Conforming to ANSI/AWWA C111/A21.11 except where flange ends are required. All glands shall be ductile iron.



2. Flanged: Conforming to the dimensions and drilling of ANSI B16.1 for cast iron flanges and flange fittings, Class 125. The laying lengths of the flange valves shall conform to the dimensions of ANSI B16.1.
- C. Valve Gate: Wedge type gate with a minimum 3/8 inch thick resilient rubber, urethane rubber, Buna "N" or SBR rubber bonded to or mechanically attached to one side or both sides of the gate. No sliding or shear is permitted on the resilient seat, when compressed to a drop-tight shut-off.
  - D. Fasteners: All exterior bolts and nuts shall be ASTM A276 Type 304 or Type 316 stainless steel.
  - E. Operating Nut: The valve shall be equipped with a two-inch square AWWA **stainless steel** nut having a flanged base upon which shall be cast the word OPEN and an arrow indicating the direction to open. The nut shall be securely pinned to the actuator shaft using a stainless steel fastener
  - F. Valve Stems: The gate valve stems shall be produced from a material that is corrosion resistant to potable water and has a minimum yield strength of 40 KSI.
  - G. Seals: Gate Valves shall be provided with stem seals of the "O" ring type. Two "O" rings shall be used with at least one "O" ring inserted above the thrust collar. The packing plate shall be attached to the valve bonnet by not less than two (2) bolts if bolts are required and one "O" ring below the thrust collar.
  - H. Coatings: All exterior surfaces of each valve shall be cleaned and painted in the shop with two (2) coats of asphalt varnish conforming to Federal Specifications TT-V-51-E. The interior surface shall have a protective coating of fusion-bonded, non-toxic epoxy that is safe for potable water. Non-toxic epoxy may also be used for exterior coating
  - I. Tapping Valves: The valves shall be 200 psi, ductile iron body, resilient-seated, tight closure gate valves with non-rising stems in conformance with ANSI/AWWA C509, except that the outlet end shall be a standard mechanical joint end conforming to ANSI/AWWA C111/A21.11 and the inlet end shall have an inlet flange conforming to ANSI B16.1 for cast iron flanges, Class 125. Gland shall be ductile iron. Approved mechanical joint valves shall be used with Power Seal Model 3490MJ tapping sleeves.

### 2.3 Butterfly Valves

- A. General: These specifications provide for the purchase and installation of ductile iron, vault installation or direct bury, rubber-seated, tight closure in both directions, 16 fps butterfly valves and actuators in sizes from 16-inch through 90-inch diameter. All valves shall be Short-Body Flanged-end valves for use in vaults or Mechanical-Joint-end valves for direct bury. The valves and actuators shall be of the latest model

with all standard accessories ordinarily furnished to the industry except as otherwise specified herein. All valves of one size shall be built by one manufacturer with actuators built by one manufacturer. The latest revision of AWWA C504, Standard for Rubber Seated Butterfly Valves, shall govern unless noted otherwise herein. The intent of all provisions of AWWA C504 shall apply equally to valves larger than 48" diameter and to 250 psi valves unless noted otherwise herein. Each valve shall have a unique serial number, which shall be part of the information on the tag specified in paragraph 10.

- B. Owner’s Data: The quantity, pressure rating, valve material type, and sizes shall be as indicated on the drawings. Each valve shall be fastened to and delivered on an individual pallet on 4" x 4", or heavier, wood skids, high enough to protect the valve and actuator. All other requirements of AWWA C504 Section 6.2 "Shipping" shall apply. Delivery shall be to the jobsite.
- C. Descriptive Literature: The Bidder shall include literature describing the valves and actuators to be furnished.
- D. Warranty: The Supplier shall furnish three copies of the warranty that applies to the valves and actuators they propose to furnish. The warranty period shall be for a minimum of three years after substantial completion of the contract under which the valve is installed or twenty years from the date of shipment, whichever comes first.
- E. Shop Drawings: The approved Supplier, ONLY, before manufacturing the valves and actuators, shall submit eight (3) sets of certified shop drawings, parts lists, exploded assembly drawings, and material specifications, for approval, to KC Water. In addition to the above, the supplier shall furnish certified copies of proof-of-design tests performed in accordance with Section 5.2.4 of AWWA C504.
- F. Design: All valve parts shall be designed for a minimum safety factor of 3, based on yield strength, or 5, based on tensile strength.
- G. Flow Coefficient “K”: The flow coefficient in terms of velocity head (K), in the full open position, shall not be greater than the following:

	<u>75 psi</u>	<u>150 psi</u>	<u>250 psi</u>
16 inch thru 24 inch	K=0.40	K=0.45	K=0.55
30 inch thru 48 inch	K=0.40	K=0.40	K=0.50
54 inch thru 72 inch	K=0.40	K=0.40	-----
78 inch thru 90 inch	K=0.40	-----	-----

Pressure measurements shall be made at two pipe diameters upstream of the valve and eight pipe diameters downstream of the valve in accordance with recommended procedures of ASME Report on Fluid Meters, Latest Edition.

- H. Minimum Port Diameter: The minimum port diameter through the valve shall not be less than as listed below:

<u>Nominal Size</u>	<u>Allowable Difference in Diameter</u>
16-inch - 42 inch	1 inch
48-inch - 54-inch	1 1/4-inch
60-inch - 72-inch	1 1/2-inch
78-inch - 90-inch	3 inch

- I. Fasteners: All bolts and nuts inside and outside the valve, except Mechanical Joint bolts and nuts, shall be ASTM A276 Type 304 or Type 316 stainless steel or ASTM A564 Grade 630 stainless steel.

- J. Valve Body: The valve body shall be ductile iron poured to full gray iron thickness.

The position of the valve seat in the valve body shall be marked on the outside of the valve body, within 12 inches of the actuator nut of upper valve trunion, tagged or cast, in 1/4" high print, "SEAT THIS SIDE." Tags shall be ASTM A276 Type 304 or Type 316 stainless steel.

- K. End Plate: No bolt or end thrust adjusting screw shall extend through the End Plate.

- L. End Connections: The dimensions and drillings of end flanges shall conform to ANSI B16.1 for 75 psi valves, ANSI B16.1 Table 5 for 150 psi valve and 250 psi valves, both with 150 psi drillings. If specified in the invitation to bid, 250 psi dimensions and drillings of end flanges shall conform to ANSI B16.1 Table 8, to include but not be limited to, flange outside diameter, flange thickness, bolt circle diameter, bolt diameter, and bolt quantity. The Mechanical Joint valves are to include the following accessories: gaskets, ductile iron gland rings, mechanical joint bolts, and nuts.

- M. Shafts: All valve shafts shall be in accordance with AWWA C504 Table 3 unless otherwise addended herein. All valve shafts, dowels, and taper pins shall be ASTM A276 Type 304 or Type 316 stainless steel or ASTM A564 Grade 630 condition H1100 stainless steel. The valve shaft shall have a means of clearly indicating the position of the disc on the actuator end of the shaft. This mark shall be machine grooved and shall be visible when the cover and lubrication are removed and shall be offset to the same side as the disc. The valve shaft shall be completely enclosed between the valve body and the actuator body.

- N. Valve Disc: The valve disc shall be ductile iron and shall seat perpendicular to the centerline axis of the valve body.



- O. Valve Seats: The resilient seat shall be EPDM synthetic rubber applied either to the valve disc or valve body. The resilient seat shall be mechanically secured to either the valve disc or valve body with ASTM A276 Type 304 or Type 316 stainless steel fasteners or non-bonding epoxy. Resilient seats shall be field adjustable and replaceable without special tools or instruction.

Mating surfaces for the valve seats shall be ASTM A276 Type 304 or Type 316 stainless steel.

All seats shall be designed to provide tight shut-off with flow in both directions.

- P. Shaft Seals: Seal shall be provided by the use of standard V-type packing or standard "O" ring seals; pull-down packing is not acceptable. The valve shall be designed so that the actuator may be removed and replaced while the valve is in service without losing water.

- Q. Actuator: The actuator shall be Limatorque Model HBC series or Auma Model GS series (additional spur gear reduction gear boxes may be necessary to achieve minimum "number of turns" requirement) or those that have received written approval after May 1, 2002 from KC Water. The actuator shall be a link lever traveling nut type, worm gear type, or yoke and nut type and shall be capable of withstanding submersion in water to a pressure of 10 psi. All exposed bolts, nuts, and shafts shall be of ASTM A276 Type 304 or Type 316 stainless steel or ASTM A564 Grade 630 condition 1100 stainless steel. All actuators must have outside mechanical adjustments capable of adjusting valve travel without removing the valve from the pipeline or removing the actuator cover.

Buried service valves shall open right (clockwise). The actuator shall be equipped with a two-inch square AWWA ductile iron nut having a flanged base upon which shall be cast the word OPEN and an arrow indicating the direction to open. The nut shall be securely pinned to the actuator shaft using a stainless steel fastener.

Vault service valves shall open left (counter-clockwise). The actuator shall be supplied with a handwheel. The handwheel shall be no smaller in diameter than 30 inches and no larger in diameter than 36 inches. Manual actuators shall be suitable for future adaptation to motor operation. Vault service actuators shall have an indicator on the exterior of the actuator indicating the valve disc position. This indicator shall be stainless steel.

All gearing and actuator stops shall be enclosed in a suitable housing with a removable cover to permit inspection, repair, and adjustment of the mechanism. Adjustable stop limiting devices shall be provided inside the actuator housing to stop the input shaft at full open and full closed positions. The use of stop nuts or shaft collars which rely on clamping forces or set screws to prevent rotation of the nut or collar on the screw shaft will not be acceptable.

The actuator shall rotate the disc from full open to full closed and vice-versa using not less than, nor more than, the number of turns indicated below:

Valve Size (Inches)	Minimum Turns	Maximum Turns
16	30	60
20	40	80
24	40	80
30	40	200
36	80	200
42	80	220
48	90	300
54	90	700
60	200	700
72	200	700
90	200	700

The number of turns shall be included in the information on the tag specified in paragraph 10.

- R. Painting Interior of Valves: The interior of valves sizes 16-inch through 48-inch shall be coated with a white, NSF 61 certified, fusion-bonded or powder coated epoxy. The interior of valve sizes 54-inch through 90-inch shall be coated with a white epoxy paint, Tnemec N141 NSF 61 or approved equal. Surface preparation and application shall be in accordance with SSPC PA-1. The dry film thickness of the coating shall be a minimum of 10 mils. A painting Affidavit of Compliance shall be submitted in accordance with paragraph 21 and AWWA C550 NSF 61 and shall be free of holidays.
- S. Painting Exterior of Valves: The exterior of valve sizes 16-inch through 48-inch shall be coated with an NSF 61 certified, fusion-bonded or powder coated epoxy. The exterior of valve sizes 54-inch through 90-inch shall be coated with an epoxy paint, Tnemec N141 NSF 61 or approved equal. Surface preparation and application shall be in accordance with SSPC PA-1. The dry film thickness of the coating shall be a minimum of 10 mils. A painting Affidavit of Compliance shall be submitted in accordance with paragraph 21 and AWWA C550 NSF 61 and shall be free of holidays.
- T. Factory Inspection: KC Water’s inspector will witness leakage and hydrostatic tests at the Manufacturer's facility and will inspect all valves for conformance to the specifications. The Manufacturer shall include in the bid all expenses for transportation, lodging, and meals required by KC Water's inspector to complete the inspection. Absolutely no expenses are to be paid by the inspector at any time.

After the valves are delivered, KC Water may again test the valves and actuators for compliance with the specifications. The valves that do not meet specification will be shipped back to the manufacturer for modifications, at the Manufacturer's expense. The manufacturer shall also be responsible for all testing expenses incurred by KC Water if the valve fails to perform as specified herein.

- U. Tests: All test data per AWWA C504 shall be submitted in triplicate to KC Water.
- V. Affidavit of Compliance: The manufacturer shall send an affidavit of compliance, in triplicate, to KC Water.
- W. Torque Limiting Devices: Contractor shall provide a Torque Limiting Device for each direct-bury butterfly valve as specified herein.
  1. The torque limiting device shall make over-torque, in either direction, impossible. The unit shall be preset and designed to release when the torque level exceeds 210 foot pounds on the operating nut, in either direction, OPENING or CLOSING the valve. The torque unit shall reset automatically when the torque level drops below 200 foot pounds on the operating nut in either direction.
  2. The torque level of the unit shall be adjustable so it may be field set to release at a desired torque limit.
  3. The device shall be model D86 Overtorque Protector, manufactured by Aunspach Controls Co, Inc. or approved equal.
  4. The unit shall be less than 5-1/4 inches in diameter and made to mount on the valve inside of the 6-inch diameter stem riser tube of the valve box or in the valve box.
  5. The unit shall be provided with a two-inch AWWA operating nut, securely attached to the device. The nut shall have an arrow on the base indicating the valve opens to the "RIGHT" (clockwise) and the word "OPEN". The unit shall be provided with a two-inch square tapered AWWA socket securely attached to the device. The socket shall fit a 2-inch AWWA nut.
  6. The unit shall be designed to withstand submersion in water to a pressure of 10 psi; to endure long periods (years) of active or inactive use buried underground and submerged in water. The unit shall be sealed to prevent water and dirt from entering the mechanism. The unit shall be packed with a suitable grease.
  7. All housing parts, including nut and socket, shall be coated inside and outside with catalyzed (2-part) epoxy. A top coat of catalyzed (2-part) polyurethane enamel shall be applied over the epoxy for additional hardness and extra corrosion protection.

8. Contractor shall mount the torque limiting device's integral socket on each butterfly valve's 2-inch AWWA operating nut inside of the stem riser tube before backfilling around the valve. No fasteners or screws shall be used.

## **2.4 Air Release Valves**

### **A. Air Release Valves and Vaults:**

1. Air release assemblies shall be manufactured in accordance with AWWA C512.
2. Air release valve vaults and castings: Refer to Section 02608.
3. All piping shall be brass pipe except the air outlet from the air release valve that shall be brass or copper tubing. Brass piping shall be ASTM B43, Extra Strong with ASME 816.1 Class 250 fittings.

### **B. Air Release Valves for mains 12-inches in diameter or smaller (3/4-inch Diameter):**

1. Isolation valves shall be 3/4-inch bronze ball valves, 150 psi working pressure.
2. The 3/4-inch air release assembly shall be as manufactured by ARI Flow Control Accessories, Model S-050 or an approved equal.
3. Air release valves shall be installed in accordance with Drawing No. 02641-1.
4. Provide vault cover with minimum one 1-inch dia. hole for air flow.

### **C. Air Releases for mains larger than 12-inches in diameter:**

1. Each assembly shall have a two-inch inlet connection.
2. Isolation valves shall be 2 inch bronze ball valves with screwed, non-rising stems, 175 psi working pressure..
3. The 2" air release valve shall be an ARI Flow Control Accessories Combination Air Release Valve, Model D-040 or approved equal.
4. Air release valves shall be installed in accordance with Drawing Nos. 02641-2 and 02641-2B.
5. Provide vault cover with a minimum four 1-inch dia. holes for air flow.

## **2.5 Valve Boxes, Bases, Lids and Covers**

### **A. One-piece Valve Boxes and Bases:**

1. One-piece valve boxes and bases shall be injection molded plastic conforming to ANSI/ASTM 2853, Class 1212 as manufactured by Ametek or approved equal.
- B. Two-piece Valve Box and Base:
  1. Valve Boxes: Boxes shall be 6" Class 52 DIP; or 6" Class 160 PVC pipe. Bases are required on all valves.
  2. Valve Bases: Valve bases shall be Clay & Bailey No. 2260-4 or an approved equal.
- C. Lids and Covers: Valve lids and covers shall be Clay & Bailey No. 2193, 2193NS or an approved equal. Valve lids shall have "Water" cast in the lid.

## **2.6 Check Valves**

- A. All check valves shall be Ken-Flex Resilient Hinge check valves as manufactured by Kennedy Valve Company or approved equal.
- B. Check valves shall be ductile iron body with reinforced Buna-N rubber flapper.
- C. Check Valves shall be rated for 250 psi working pressure, 500 psi hydrostatic test for structural soundness.
- D. Check Valves shall have ANSI 16.1 – Class 125 flanged end connections.
- E. The check valve body shall have full flow equal to nominal pipe diameter at all points in the valve. The valve body shall be of ductile iron construction to ASTM-A-536 – 65-45-12. Castings will be clean and sound without defects that will impair their service. No plugging or welding of such defects will be allowed. The seating surface will be at a 45 degree angle to minimize water hammer.
- F. Rubber Clapper & Hinge shall be constructed of ductile iron to ASTM-A 536-65-45-12. Both Clapper and hinge shall have permanently bonded Buna-N rubber with a metal reinforcement connecting the hinge to the clapper.
- G. The top cover plate will be of ductile iron to ASTM-A536-65-45-12 & must be of full size to allow removal of the disc without removing the valve from line. All exterior nuts and bolts shall be 304 or 316 stainless steel.
- H. All iron parts inside and out will be fusion bonded epoxy coated. All coatings must be NFS-61 approved for use in drinking water systems.
- I. Vault service check valves shall have an external mechanical position indicator.



## **PART 3 EXECUTION**

### **3.1 Inspection**

- A. Each valve shall be inspected before installation to insure that all foreign substances have been removed from within the valve body, and shall be opened and closed to see that all parts are in required working condition.

### **3.2 Setting Valves**

- A. All valves and fittings shall be set and jointed in the manner specified herein. The valves shall be set vertical in the horizontal pipeline. All valves shall be anchored directly to adjacent tees or crosses.
- B. One-piece valve box and base or a two-piece valve box and valve base shall be installed on all valves. An approved valve box alignment device shall also be installed in all valve boxes.
- C. Valve covers, bases, and lids shall be supported and maintained, centered and plumb over the actuator nut. Cover shall be flush with the roadway or ground surface or at such other as directed by KC Water.

### **3.3 Appurtenances**

- A. Hydrants; Blow-off, and Flushing Assemblies: Refer to Section 02645
- B. Concrete Vaults and Covers: Refer to Section 02608
- C. Thrust Restraints: Refer to Section 02669
- D. General
  - 1. Certification: The manufacturer shall provide an affidavit in triplicate certifying that the valves and actuators comply with the provisions of these Specifications.
- E. Leak Tests: (for Butterfly Valves)
  - 1. Each valve shall be shop tested in both directions for leaks in the closed position. The test shall be conducted with the body in a horizontal plane.
  - 2. Air pressure shall be applied to the lower face of the disc for 5 minutes.
  - 3. Both 150-psi and 250-psi rated valves shall be leak tested to 250-psi pressure.
  - 4. The upper surface of the valve disc shall be visible and covered with a pool of water at "O" psi pressure. There shall be no leakage past the valve disc. Bubbles will appear in the water on the disc if it is leaking.

5. The valve body shall be tested with an internal hydrostatic pressure equivalent to two times the specified shutoff pressure. There shall be no leakage, during the test, through the metal, the end joints, or the shaft seals; nor shall any part be permanently deformed.
  6. The hydrostatic test period for 4-inch valve bodies through 20-inch bodies shall be at least 3 minutes. Valve bodies 24-inch and larger shall be tested for at least 10 minutes.
- F. Performance Tests:
1. Each valve shall be shop operated three times from full closed to full open position, and reverse, under no flow condition to demonstrate that the complete assembly is workable.
  2. Each valve should also be tested in the same manner following installation.

END OF SECTION

## SECTION 02645

### HYDRANTS, BLOW-OFF AND FLUSHING ASSEMBLIES

#### PART 1 GENERAL

##### 1.1 Section Description

- A. This section provides for the installation of hydrants, and blow-off and flushing assemblies.

##### 1.2 Section Includes

- A. Hydrants
- B. Blow-off and Flushing Assemblies

##### 1.3 Related Sections

- A. Section 01000 – General Requirements
- B. Section 01016 – Water Mains Near Sewers
- C. Section 01300 – Submittals
- D. Section 01600 – Material and Equipment
- E. Section 02575 – Surface Restoration
- F. Section 02200 – Excavation and Trenching
- G. Section 02618 – Ductile Iron Pipe Water Main
- H. Section 02619 – Pre-stressed Concrete Cylinder Pipe Water Main
- I. Section 02641 – Valves
- J. Section 02669 – Thrust Restraints
- K. Section 03001 – Concrete

##### 1.4 Submittals

- A. Follow the procedures for submittals provided in Section 01300 – Submittals.
- B. Product Data: Submit catalog cuts and dimension data.

## 1.5 Quality Assurance

- A. The manufacturer shall be a company specializing in manufacturing the Products specified in this Section with minimum three years documented experience.

## 1.6 Delivery, Storage, and Handling

- A. Follow the provisions for delivery, storage, protection, and handling Products to and at site provided in Section 01600 - Material and Equipment.
- B. Accept units on site. Inspect for damage and inventory.

## PART 2 PRODUCTS

### 2.1 Hydrants

- A. **General.** Hydrants shall be current Kansas City, MO. pattern hydrants manufactured especially for KC Water. All hydrants shall be designed and manufactured in strict compliance with AWWA C-502 entitled "A.W.W.A. Standard for Dry-Barrel Fire Hydrants" unless otherwise specified.
- B. **Approved hydrants.** Only the following hydrants are approved.
  - Clow Medallion
  - M&H Regent 129i
  - Mueller Super Centurion 200
  - AVK QPL245 Nostalgic Style Fire Hydrant – Model 2760
  - 1. No changes or modifications to the approved hydrant shall be made without prior written notice and written approval.
- C. **Specifications.** Hydrant bury will be measured from the bottom of the hydrant base to the bury line (finished grade line) and shall be five foot (5') bury unless otherwise specified.
  - 1. All hydrants shall be the traffic model type. Hydrants shall have one (1) pumper nozzle located in the horizontal plane. The upper barrel and lower barrel shall be sealed by a EPDM rubber gasket or O-ring.
  - 2. Hydrant base shall be provided with a mechanical joint inlet to accommodate 6-inch diameter ductile iron pipe, in accordance with A.N.S.I. A21.11 (AWWA Standard C-111, Rubber Gasket Joints for Cast Iron and Ductile Iron Pressure Pipe and Fittings"). The hydrant

shall be supplied with necessary accessories for the mechanical joint.

3. Main valve of the hydrant shall be 5-1/4 inch diameter compression type, which closes with water pressure.
4. The operating nut shall be a truncated pentagon, 1-1/2 inches on the bottom, 1-7/16 inches on the top, with a finished height of 1-1/8 inches (**see attachment A**). The bonnet shall be so constructed that the opening nut shall not travel during opening and closing the hydrant. The bonnet shall house a Viton gasket or O-ring seal between the opening nut and the bonnet to prevent moisture and foreign material from entering the lubricant reservoir. The bonnet shall also house Viton gasket or O-ring seal between the bonnet and the upper stem to retain the lubricant in the reservoir.
5. The hydrant shall be supplied with a tamper resistant shield for the operating nut. The shield shall be in accordance with the attached drawing, **Attachment B**.
6. The hydrant shall open by turning the operating nut to the right (in a clockwise direction when viewing the hydrant from above).
7. The pumper nozzle threads shall be in accordance with the Federal Screw Thread Standard H28, Section 10, American National Hose Coupling and Fire Hose Coupling Threads. The pumper nozzle shall have right-hand threads and have a 4-inch nominal diameter with 4 (four) threads per inch. The nozzle threads shall be lightly greased from factory with a suitable food grade lubricant.
8. Nozzle cap shall be cast iron and shall be furnished with a synthetic rubber installed in a retaining groove in the inside of the cap. The dimensions and shape of the nozzle cap nut shall be the same as the operating nut as described in Section 4 above, except with a finished height of 1-inch.
9. The exterior of the hydrant above the bury line, nozzle caps, and the bonnet shall be powder coated with epoxy or Triglycidyl Isocyanurate (TGIC) polyester. If epoxy powder is used, it shall be top-coated with a UV resistant, high-gloss acrylic polyurethane paint. **The barrel section of the hydrant shall be gloss International Orange. The bonnet section and nozzle caps shall be gloss Black.** The exterior of the hydrant below the bury line shall be coated with an asphalt varnish with a film thickness of at least 10 mils.
10. All non-thread, non-machines interior surfaces of the hydrant base shall be coated with a wet-applied NSF 61 certified white potable epoxy (such as Tnemec 20-AA90) or powder coated with an NSF 61

certified white epoxy. The exterior of the hydrant base shall also be epoxy coated.

11. Hydrant extensions (spool pieces), if requested and approved by KC Water, shall be a complete assembly allowing for the hydrant's height to be adjusted in six (6) inch increments. The assembly shall be furnished with instructions and all required accessories necessary to adjust the hydrant's height and maintain the hydrant's traffic feature. Hydrant extensions shall be International Orange in color and shall be coated in accordance with Section 9.
  12. All external hardware shall be 304 or 316 stainless steel.
  13. The lower hydrant stem from the break-away coupling to the main valve and any attaching hardware securing the main valve assembly to the lower stem shall be 304 or 316 stainless steel. Any cross pins securing any part of the main valve assembly or break away stem coupler shall be 420 stainless steel. The lower stem nut may be integral to the lower valve plate or main valve assembly.
  14. Main valve assemblies shall be of either three-piece (upper valve plate, main valve seat, lower valve plate) or one-piece EPDM encapsulated ductile iron design. The lower valve plate of three-piece design main valve assemblies shall be powder coated with an NSF 61 certified epoxy.
  15. The upper surface of the seat ring shall have raised lugs allowing for positive engagement of a hydrant disassembly tool. The raised lugs shall be of sufficient design to allow for the removal of the seat ring.
- D. **Shop Drawing.** Prior to manufacturing the hydrants, the manufacture shall submit three (3) sets of detailed shop drawings for written approval.
- E. **Packaging.** All hydrants shall be bundled in a group no larger than three (3) hydrants wide by three (3) hydrants high. All hydrants shall be shipped with the hydrant base inlet pointing down. All hydrants shall be separated wood framing adequate to prevent the hydrants from touching the ground or each other. Binding the hydrants together shall be a band or wrap adequate to per handling of the hydrant bundles with a crane truck or a forklift. All hydrants shall be delivered with the hydrant nozzle cap installed.
- F. **Delivery.** The Yard Store shall receive a notice of shipping at least 2 days prior to shipping the hydrants. All hydrants shall be delivered to the Yard Store, 2409 E. 18<sup>th</sup> Street, Kansas City, Missouri, 64127. Before payment is made for any deliveries, Systems Engineering Division shall be notified and the shipment will be inspected by Systems Engineering Division or its designee for compliance with these specification.

## **2.2 Blow-off and Flushing Assemblies**

- A. Mechanical joint plug: Drilled and tapped for 2-inch standard pipe threads.
- B. Elbows and outlet pipe: standard weight galvanized pipe and fittings.
- C. All discharge piping shall have a 2" PVC cap on top.

## **PART 3 EXECUTION**

### **3.1 Preparation**

- A. The areas around each hydrant valve shall be thoroughly compacted to prevent settlement of these areas.
- B. The weep holes of the hydrant shall be kept clear and free to drain with 1-½ C.Y. of coarse stone (¾" clean minimum).

### **3.2 Installation**

- A. Hydrant shall stand plumb and when placed behind curbs, the centerline of the hydrant shall be at least twenty-four (24) inches from the back of the curb or 4' from the edge of pavement when there is no curb. Hydrant shall not be set in a drainage ditch.
- B. Hydrant shall be rotated so as to have the nozzle facing the street or rotated to face any direction as required by KC Water.
- C. Hydrants are to be installed with mechanical joint anchoring fittings or approved restraint devices. Refer to Section 02669.
- D. Hydrants are to be installed in accordance with Details 02645-1, 02645-2, and 02645-3.
- E. After installation and before hydrants are placed in service, Contractor shall field apply two separate coats of all surface spray enamel paint, in accordance with paint manufacturers recommendations, to completely cover each hydrant dome in accordance with the following:

Hydrants connected to 12" or larger mains  
Krylon 5816 Green (or approved equal)

Hydrants connected to mains smaller than 6"  
Krylon 5814 Red (or approved equal)

Hydrants connected to 6" or larger mains, but smaller than 12" mains.

Krylon 5812 Black (or approved equal)

This color-coding is intended to provide firefighters and other emergency workers a permanent, quick visual reference to indicate the size of water main connected to each hydrant.

- F. Blow off and flushing assemblies are to be installed in accordance with Details 02645-4, 02645-5, and 02645-6.

END OF SECTION



**SECTION 02669**  
**THRUST RESTRAINTS**

**PART 1 GENERAL**

**1.1 Section Description**

- A. This section provides for the required restraining devices to limit movement of pipe and fittings.

**1.2 Section Includes**

- A. Restrained Joints
- B. Concrete Blocking

**1.3 Related Sections**

- A. Section 01000 – General Requirements
- B. Section 01300 – Submittals
- C. Section 01600 – Material and Equipment
- D. Section 02200 – Excavation and Trenching
- E. Section 02618 – Ductile Iron Pipe Water Main
- F. Section 02619 – Pre-stressed Concrete Cylinder Pipe Water Main
- G. Section 02645 – Hydrants and Blow-off and Flushing Assemblies
- H. Section 03001 – Concrete
- I. Section 03200 – Concrete Reinforcement

**1.4 Submittals**

- A. Follow the procedures for submittals provided in Section 01300 - Submittals.
- B. Submit shop drawings and descriptive details showing the size, length, and location of each fitting and adjacent pipe, and the details of all anchorage and harnessing proposed.

**1.5 Quality Assurance**

- A. The manufacturer shall be a company specializing in manufacturing the Products specified in this section with minimum three (3) years documented experience.

## **1.6 Delivery, Storage and Handling**

- A. Follow the provisions for the delivery, storage, protection and handling products to and at site provided in Section 01600 - Material and Equipment.

## **PART 2 PRODUCTS**

### **2.1 Restrained Joints**

- A. Restrained Push-on joints for ductile iron pipe and fittings: American "Flex- Ring", "Fast-Grip", Clow "Super-Lock"; U.S. Pipe "TR Flex" or "Field Lok", or Griffin "Snap-Lok".
- B. Restrained Mechanical Joints: EBAA Iron "Mega-Lug" or Ford Uni-flange. "Mega-Lug" shall not be used on plain end fittings.
- C. Restrained joint fittings: One Bolt
- D. Restrained joints for PCCP shall be as specified in Section 02619.

### **2.2 Concrete Blocking**

- A. Concrete shall be as per Section 03001.

## **PART 3 EXECUTION**

### **3.1 Reaction Anchorage and Blocking**

- A. Piping and fittings with push-on or mechanical joints, or similar joints subject to internal pressure shall be blocked, anchored, or harnessed to preclude separation of joints. All push-on and mechanical joint bends deflecting 11-1/4 degrees or more shall be provided with suitable blocking, anchors, joint harness, or other acceptable means for preventing movement of the pipe caused by internal pressure.
- B. Concrete blocking shall extend from the fitting to solid undisturbed earth and shall be installed so that all joints and bolts are accessible for repair.
- C. The dimensions of concrete blocking shall be as indicated on Construction Detail Drawings numbered 02669-1, 02669-2, 02669-3, 02669-4 and 02669-5. Alternate details 02669-6, 02669-7, 02669-8, 02669-9, 02669-10, 02669-11, 02669-12, 02669-13, 02669-14, 02669-15 may be used only if specified by the design professional on the approved for construction drawings. If support against

undisturbed earth cannot be obtained, restrain joints as specified in 3.2, Restrained Length (length shall be approved by KC Water).

- D. A maximum of eight (8) inches of backfill material may be placed over concrete arch encasement or concrete blocking after the initial set, to aid in curing. No additional backfill shall be placed over arch encasement or blocking until the concrete has been in place for at least one (1) day.
- E. Reaction blocking, anchorages, or other supports for fittings installed in fills or other unstable ground, above grade, or exposed within structures, shall be provided as required by the Construction Detail Drawings and as directed by KC Water.
- F. All clamps, rods, bolts, and other metal accessories used in reaction anchorages, or joint harness subject to submergence or contact with earth or other fill material and not encased in concrete shall be protected from corrosion by two coats of approved coal tar applied in the field to clean, dry metal surfaces. The first coat shall be dry and hard before the second coat is applied. Metal surfaces exposed above grade or within structures shall be painted with one prime coat and two finish coats of a paint acceptable to KC Water.

END OF SECTION

## **SECTION 02675 WATER MAIN TESTING**

### **DISINFECTION AND DECHLORINATION**

#### **PART 1 GENERAL**

##### **1.1 Section Description**

- A. This section provides for the required procedure for the water main testing, disinfection, and de-chlorination prior to placing in service.

##### **1.2 Section Includes**

- A. Corporation Cocks
- B. Hydrostatic Testing
- C. Disinfection of Water Mains

##### **1.3 Related Sections**

- A. Section 01000 – General Requirements
- B. Section 01300 – Submittals
- C. Section 01600 – Material and Equipment
- D. Section 02618 – Ductile Iron Pipe
- E. Section 02619 – Pre-stressed Concrete Cylinder Pipe
- F. Section 02641 – Valves
- G. Section 02645 – Hydrants, Blow-off and Flushing Assemblies

##### **1.4 References**

- A. AWWA C651 - Standards for Disinfecting Water Mains.

##### **1.5 Submittals**

- A. Follow the procedures for submittals provided in Section 01300 – Submittals.
- B. Certificate: The Contractor shall certify in writing that cleanliness of water distribution system meets or exceeds specified requirements.
- C. At the completion of the disinfection procedures, Contractor shall prepare a Disinfection Report; including:

1. Type and form of disinfectant used.
  2. Date and time of disinfectant injection start and time of completion.
  3. Test locations.
  4. Initial and 24 hour disinfectant residuals (quantity in treated water) in parts per million for each outlet tested.
  5. Date and time of post disinfectant flushing start and completion.
  6. Disinfectant residual after flushing in parts per million for each outlet tested.
- C. Contractor shall provide, at their expense, water sample collection and testing by a MDNR approved laboratory which shall prepare a Bacteriological Report; including:
1. Date issued, project name, and testing laboratory name, address, and telephone number.
  2. Time and date of water sample collection, and testing.
  3. Name of person collecting samples.
  4. Test locations.
  5. Initial and 24 hour disinfectant residuals in parts per million for each outlet tested.
  6. Coliform bacteria test results for each outlet tested.
  7. Certification that water conforms, or fails to conform, to bacterial standards of the Missouri Department of Natural Resources.
  8. Bacteriologist's signature and authority.

## **1.6 Quality Assurance**

- A. Work shall be performed in accordance with AWWA C651.

## **PART 2 PRODUCTS**

### **2.1 Corporation Cocks**

- A. The Contractor will furnish and install a three-fourth inch (3/4") Corporation cock to be used in the testing and disinfection of each new main. The location of these corporation cocks shall be as directed by KC Water.

- B. After the line has been tested and prior to placing the main in service, the Contractor shall remove the corporation cock and replace it with a tapered brass plug.

### **PART 3 EXECUTION**

#### **3.1 Hydrostatic Testing**

##### **A. General**

1. The entire main shall be tested (pressure test and allowable leakage test) immediately after construction as directed and witnessed by KC Water.
2. With approval of KC Water, the pressure test and leakage test may be conducted simultaneously. However, should the Contractor be granted permission to make both tests simultaneously, the required test pressure shall be equal to or greater than that for pressure tests as specified below.

##### **B. Pressure Test**

1. After the trench has been backfilled, the test connections made and the main filled with water, a minimum pressure of not less than the normal operating pressure (for the lowest point on the line) plus 50% for surge but in no case less than 160 psi for 12" and smaller mains and 225 psi for 16" and larger mains, unless otherwise stated, shall be maintained on the new water main for at least two (2) hours.
2. The Contractor shall furnish all pumps, piping, gauges, labor and other material and services necessary to bring the main up to the specified test pressure.
3. All exposed pipe, fittings, valves, hydrants and joints shall be inspected by KC Water and all evidence of moisture appearing on the surface of the ground during the test shall be investigated by the Contractor by excavation where the pipe has been covered with backfill.
4. All defective pipe, fittings, valves or hydrants discovered during the pressure test shall be removed and replaced by the Contractor and the pressure test shall be repeated until satisfactory to KC Water.
5. The Contractor shall furnish and install all temporary blow-off assemblies, fittings, thrust blocks, and restraining devices required for temporary connections for flushing, pressure testing, chlorination, and de-chlorination of water mains.

##### **C. Leakage Test**

1. An allowable leakage test shall be conducted after the pressure test has been satisfactorily completed. The Contractor shall maintain a minimum pressure in the new water main of 150 psi (or a minimum of 10 psi greater than the normal

operating pressure of the system, if the normal operating pressure is lower than 140 psi ) for the lowest point on the line for at least two (2) hours.

2. Leakage shall be defined as the quantity of water that must be supplied into the newly laid pipe to maintain the specified leakage test pressure after the air has been expelled and the pipe has been filled with water.
3. No water main, or section thereof will be accepted if and while it has a leakage rate in excess of that determined by the following formula:

$$L = .0000075 SD(P)^{1/2} / 2$$

Where:

L = Maximum permissible leakage in gallons for two hours.

S = Length of pipe tested, in feet.

D = Nominal internal diameter of the water main being tested in inches.

P = Average test pressure in psi in the water main being tested.

4. Should the actual leakage exceed the allowable leakage, the test pressure shall be maintained for an additional period of time as directed by KC Water so that the leakage location may be detected.

### **3.2 Disinfection of Water Mains**

#### **A. General**

1. After completion of hydrostatic testing the Contractor shall flush and disinfect the entire main under the direction of KC Water.
2. The Contractor shall prepare the main for disinfection by exposing the pipe at all entry points where the chlorine will be introduced into the pipe and installing temporary blow-offs at all discharge ends.
3. Continuous feed method of chlorination is required. The slug method of chlorination may be used only when directed by KC Water.

#### **B. Continuous Feed-Method**

1. Water supplied from an approved source of supply shall be made to flow at a constant, measured rate into the new water main.
2. At a point not more than 10 ft downstream from the beginning of the new main, water entering the new main shall receive a dose of chlorine fed at a

constant rate such that the water will have not less than 60 mg/L free chlorine. To ensure that this concentration is achieved, the chlorine concentration should be measured at regular intervals.

3. As an optional procedure, water used to fill the new water main during the application of chlorine shall be supplied through a temporary connection. This temporary connection shall be installed with an appropriate cross-connection control device for backflow protection of the active distribution system. Chlorine application shall not cease until the entire main is filled with heavily chlorinated water. The chlorinated water shall be retained in the main for at least 24 hours, during which time all valves and hydrants shall be operated to ensure disinfection of the appurtenances. At the end of this 24-hour period, the treated water in all portions of the main shall have a residual of at least 45 mg/L free chlorine.
4. The preferred equipment for applying liquid chlorine is a solution-feed, vacuum-operated chlorinator and a booster pump. The vacuum-operated chlorinator mixes the chlorine gas in solution water; the booster pump injects the chlorine-gas solution into the main to be disinfected. All connections shall be checked for tightness before the solution is applied to the main.
5. After the required retention period (24 hours), the 24 hour residual chlorine sample shall be pulled, the heavily chlorinated water shall then be de-chlorinated to 0 mg/L chlorine. A reducing agent shall be applied to the water before discharging, to neutralize thoroughly the chlorine residual remaining in the water. Two sets of Bac-T samples shall be taken, one immediately after the final flush, the second taken 24 hours later.
6. Contractor shall coordinate disinfectant testing and bacteriological testing to demonstrate that the above requirements have been met.

#### C. Slug Method

1. Water supplied from an approved source of supply shall be made to flow at a constant, measured rate into the new water main.
2. At a point not more than 10 ft downstream from the beginning of the new main, water entering the new main shall receive a dose of chlorine fed at a constant rate such that the water will have not less than 100 mg/L free chlorine. To ensure that this concentration is achieved, the chlorine concentration should be measured at regular intervals.
3. The chlorine shall be applied continuously and for a sufficient period to develop a solid column, or "slug" of chlorinated water that will, as it moves through the main, expose all interior surfaces to a concentration of approximately 100 mg/L for at least 3 hours



4. If at any time chlorine residual drops below 50 mg/L, the flow shall be stopped. Then the chlorination equipment shall be relocated at the head of the slug, and, as flow is resumed, chlorine shall be applied to restore the free chlorine in the slug to not less than 100 mg/L.
5. After the required retention period (at least 3 hours), the 3 hour residual chlorine sample shall be pulled, the heavily chlorinated water shall then be de-chlorinated to 0 mg/L chlorine. A reducing agent shall be applied to the water before discharging, to neutralize thoroughly the chlorine residual remaining in the water. Two sets of Bac-T samples shall be taken, one immediately after the final flush, the second taken 24 hours later.
6. Contractor shall co-ordinate disinfectant testing and bacteriological testing to demonstrate that the above requirements have been met.

END OF SECTION

## SECTION 02930

### SEEDING

#### PART 1 GENERAL

##### 1.1 Section Description

- A. This section provides for areas to be restored with seeding materials.

##### 1.2 Section Includes

- A. Soil for Repairs
- B. Mulch
- C. Fertilizer and Herbicide
- D. Seed

##### 1.3 Related Sections

- A. Section 01000 – General Requirements
- B. Section 01300 – Submittals
- C. Section 01600 – Material and Equipment
- D. Section 01900 – Project Closeout
- E. Section 02200 - Excavation and Trenching
- F. Section 02931 - Sodding

##### 1.4 References

- A. FS O-F-241 - Fertilizers, Mixed, Commercial.

##### 1.5 Definitions

- A. Seeding areas: All areas disturbed by construction operations including areas of cut and fill, trenching, temporary roads, and temporary staging or storage areas shall be seeded unless otherwise specified.
- B. Sequence of Work: Sequence shall be clearing, grading, fertilizing, tilling, seeding, covering and firming, and application of mulch. All seeded areas shall be mulched with grain straw or wood cellulose fiber, or covered with erosion control fabric.

- C. Weeds: Include Dandelion, Jimsonweed, Quackgrass, Horsetail, Morning Glory, Rush Grass, Mustard, Lambsquarter, Chickweed, Cress, Crabgrass, Canadian Thistle, Nutgrass, Poison Oak, Blackberry, Tansy Ragwort, Bermuda Grass, Johnson Grass, Poison Ivy, Nut Sedge, Nimble Will, Bindweed, Bent Grass, Wild Garlic, Perennial Sorrel, and Brome Grass.

## **1.6 Submittals**

- A. Follow the procedures for submittals provided in Section 01300 - Submittals.
- B. Invoices and Analysis Labels: A copy of the supplier's invoices for all seed, mulch, and fertilizer which shows the quantity by weight purchased and a representative label bearing the manufacturer's or vendor's guaranteed statement of analysis shall be submitted to KC Water for review and approval to assure compliance with specified requirements for quality and application rates.

## **1.7 Quality Assurance**

- A. Comply with regulatory agencies for fertilizer and herbicide composition.
- B. Seed and Fertilizer shall be labeled in accordance with U.S. Department of Agriculture Rules and Regulations under the Federal Seed Act and State seed laws. Seed shall be furnished in sealed standard containers of the vendor. Each seed container shall bear the name, trade name, or trade mark, and a warranty of the producer and a certificate of the percentage of the purity and germination of each kind of seed specified. Seed which has become wet, moldy, or otherwise damaged in transit or in storage will not be acceptable
- C. All seeding work shall be performed by a contractor having demonstrated experience in seeding on projects of similar size. The work shall be prepared by experienced personnel who are familiar with the required work and who are under the supervision of a qualified foreman at all times when the work is in progress.
- D. The Contractor shall have access to equipment such as a fertilizer spreader, farm tractor with tilling equipment, grass seed drill or cultipacker type seeder, mulch blower, or hydro-mulcher for application of mulch, and straight serrated disk for crimping mulch into the soil.

## **1.8 Delivery, Storage, and Handling**

- A. Follow the provisions for the delivery, storage, protection and handling Product to and at site provided in Section 01600 - Material and Equipment.
- B. Deliver grass seed mixture in sealed containers. Seed in damaged packaging is not acceptable.

- C. Deliver fertilizer in waterproof bags showing weight, chemical analysis, and name of manufacturer.

## **PART 2 PRODUCTS**

### **2.1 Soil for Repairs**

- A. The soil used in any repair work shall be of a quality at least equal to that in areas adjacent to the area to be repaired. Soil shall be free from tree roots, clay balls, stones, and other materials that hinder grading, planting, and maintenance operations and that is free from noxious and other objectionable weed seeds and toxic substances.

### **2.2 Mulch**

- A. Vegetative Type Mulch:
  - 1. Vegetative Type Mulch shall be baled, dry, un-weathered, no discoloration or mold damage.
  - 2. A minimum of 50 percent of weight of the herbage making up the material shall be a minimum of 10 inches in length. Mulch material containing an excessive amount of weed and crop seeds will not be acceptable.
- B. Wood Cellulose Fiber Mulch:
  - 1. Prepared from virgin wood fibers containing no substance that might inhibit germination or growth of grass seed. Mulch shall be dyed an appropriate color to allow visual maintenance of its application and shall contain a tacking agent. The wood cellulose fibers shall be evenly dispersed and suspended when agitated in water. When sprayed uniformly on the surface of the soil, the fiber shall form a blotter-like ground cover that readily absorbs water and allows infiltration to the underlying soil. Weight specifications from suppliers, and for all applications, shall refer only to air dry weight of the fiber, at a standard equivalent of 10 percent nominal moisture content.
  - 2. The mulch material shall be supplied in packages having a gross weight not in excess of 100 pounds and shall be marked by the manufacturer to show the air-dry weight. Suppliers shall certify that laboratory and field testing of their product has been conducted. Certificates shall be submitted in accordance with Section 01300 and that it meets all of the foregoing requirements pertaining to wood cellulose fiber mulch.

### **2.3 Fertilizer and Herbicide**

A. Starter Fertilizer:

1. Fertilizer shall be pelleted or granulated and shall be an approved brand composed of a "Slow Release Nitrogen" fertilizer in the 1-2-1 range, such as 13-25-12 grade. Fertilizer shall be uniform in composition, free flowing and suitable for application with approved equipment.

B. Herbicide:

1. Pre-emergent herbicide shall be siduron (Tupersan). In areas where herbicide runoff may compromise water quality, herbicide should be Glyphosate, N-(phosphonomethyl) glycine in a form approved for aquatic applications.

**2.4 Seed**

A. Pure Live Seed:

1. The following formula shall be used to determine the amount of commercial seed required to provide each kind of seed for the specified quantities of pure live seeds:

$$\text{Pounds of Commercial Seed Required} = \frac{10,000 \times \text{Pure Live Seeds (lbs. Per acre)}}{\text{Purity (percent)} \times \text{Germination (percent)}}$$

1. Type "A" Seed: This seeding mixture will normally be used when seeding is required in areas of non-residential established lawns, shoulders and slopes in street right-of-way, and any other areas where a high-type seeding is deemed necessary. The seed mixture will be 100 percent Turf-Type Tall Fescue composed of an equal mix of three of four compatible species. The mixture shall not include any varieties of the slower growing Turf-Type Tall Fescue. The species shall be one of the following or equal as approved by KC Water:

Apache	Arid	Austin
Bonanza	Carefree	Chieftan
Cimmaron	Cochise	Falcon
Guardian	Hounddog	Jaguar II
Maverick II	Mustang	Olympic
Phoenix	Rebel II	Rebel 3D
Safari	Shenandoah	Thoroughbred
Titan	Tribute	Vegas

The seed mixture shall also include 100 percent Annual Rye grass to provide a temporary grass stand. The seed mixture shall be sowed at a rate of 10 lbs. per

1000 square feet (436 lbs. per acre) of the Turf-Type Tall Fescue and 2 lbs. per 1000 square feet (87 lbs. per acre) of the Annual Rye.

3. Type "B" Seed: This seeding mixture will normally be used to seed areas off street right of ways that are not maintained.

Kind of Seed	Minimum Pure Live Seed	Rate of Pure Live Seed (Lbs. per Acre)
Alta Fescue or Kentucky 31 Fescue (Festuca Elatior Var. Arundinces)	75	90
Rye grass (Lolium Perenne or L. Multiflorum)	80	50
<b>TOTAL</b>		<b>140</b>

4. Type "C" Seed: This seeding mixture will normally be used in public parks, wildlife refuges, and any other areas where this seeding mixture is deemed necessary. The types of seeding mixtures for different habitats will be as follows:

Planting Habitat	Scientific Name	Common Name	Initial or Permanent Cover	Coverage
Wet Woodland	Elymus virginicus L.	Virginia Wild Rye	P	3 lbs./ac pls.
	Cinna arundinacea L.	Wood Reed	P	100 plants/ac
	Sporobolus heterolepis A. Gray	Prairie Dropseed	I,P	3 lbs./ac pls.
	Elymus canadensis L.	Canada Wild Rye	P	3 lbs./ac pls.
	Festuca octoflora	Six-weeks Fescue	I	0.5 lbs./ac pls.
	Triticum aestivum L.	Winter Wheat	I	60 lbs./ac pls.

Planting Habitat	Scientific Name	Common Name	Initial or Permanent Cover	Coverage
Dry Woodland	Elymus canadensis L.	Canada Wild Rye	P	3 lbs./ac pls.
	Elymus virginicus L.	Virginia Wild Rye	P	3 lbs./ ac pls.
	Sporobolus heterolepis A. Gray	Prairie Dropseed	I,P	3 lbs./ac pls.
	Triticum aestivum L.	Winter Wheat	I	60 lbs./ac pls.

Planting Habitat	Scientific Name	Common Name	Initial or Permanent Cover	Coverage
Wet Open	Elymus canadensis L.	Virginia Wild Rye	P	3 lbs./ac pls.
	Echinochloa muricata Fern.	Rough Barnyard grass	I,P	2 lbs./ac pls.
	Spartina pectinata	Prairie Cordgrass	P	200 rhiz./ac
	Leersia oryzoides	Redtop Bentgrass	P	200 rhiz./ac
	Triticum aestivum L.	Winter Wheat	I	60 lbs./ac pls.

5. Adding Switchgrass (*Panicum virgatum* – 3 lbs./acre) to the wet open mix would be a good idea. Of the native grasses listed, it provides the greatest soil erosion control because of its extensive root system. It is also drought tolerant and a warm season grass while the others are primarily cool season.

### PART 3 EXECUTION

#### 3.1 Preparation of Subsoil

##### A. General:

1. The work shall not be started until substantially all earthwork has been completed in the area to be seeded. The topsoil spread and finish grading shall be completed immediately before the seeding work is started.

##### B. Clearing:

1. Prior to grading and tilling, vegetation that may interfere with operations shall be mowed, grubbed, and raked. The collected material shall be removed from the site. The surface shall be cleared of stumps, stones,

cable, wire, and other materials that might hinder the work or subsequent maintenance.

C. Grading:

1. Establish and maintain grades, in a true and even condition. Eroded areas and areas having inadequate drainage, as indicated by ponding of water, shall be filled. Ruts, deep tracks, dead furrows, and ridges shall be eliminated.

D. Cleanup:

1. Within reasonable time after completion of the construction operations, the entire area shall be cleared of excess soil and waste material, including, but not limited to, stones, stumps, roots, brush, wire, grade stakes, and all objects that might be a hindrance to maintenance operations or affect the visual appearance of the site. All roads over which hauling operations have been conducted, regardless of the type of surfacing, shall be kept clean, and soil clods and debris left on the surface shall be removed. The wheels of vehicles shall be cleaned to avoid leaving soil upon the surface of roads, walks, and other surfaced areas.

### 3.2 Fertilizing

- A. Application of Fertilizer: Fertilizer as specified shall be applied within 24 hours prior to the tilling operation. The fertilizer shall be distributed over the entire area to be seeded at the rate of 200 pounds per acre, and incorporated into the soil to a depth of at least 4 inches by disking or harrowing methods. Fertilizing rate is equivalent to 2.3 pounds per 500 square feet.

### 3.3 Seeding

A. Preparation of Seed Bed:

1. After fertilizer has been applied, the areas to be seeded shall be tilled to a depth of at least 4 inches by disking, plowing, harrowing, or other accepted methods until the soil is well pulverized and smoothed with a weighted spike-tooth harrow, railroad chains, or bridge timber float drag. When a chisel plow is used, the chisels shall be set not more than 10 inches apart and the areas shall be cross or double-tilled. All areas shall be left smooth for ease of mowing. All operations shall be done in a direction parallel to the contour lines on the slope and not uphill or downhill. Areas tilled shall be maintained until seeding and mulching is complete to insure a smooth area with no gullies or depressions.



B. Application of Seed:

1. Seeding equipment calibration tests shall be made in the presence of KC Water to determine the equipment setting required to apply the seed at the specified rates. Markers shall be used to ensure that no skips occur between successive passes of the seeder. If unplanted skips and areas are noted after germination and the growth of the grass, the unplanted areas shall be prepared again, fertilized, seeded, compacted, protected with herbicide (Section 3.4.A) and mulched (Section 3.4.B) as if none of those steps had previously taken place. The seed box shall be kept at least half full during seeding operations to ensure even distribution of seed over all the areas seeded. The types of acceptable seeding depending upon the area are as follows:
2. All seeding work shall be done between the dates of February 1 and April 15 for spring planting or August 15 and October 15 for fall planting. Sowing shall be accomplished by use of an approved mechanical seeder or drill (hand spreader can be used in small areas), making sure that successive seed strips overlap to provide uniform coverage. The mixtures shall be applied in a crossing pattern of two passes, each applying half of the seed required. Seed should be drilled to a depth of 1/2 inch. The sprigs (rhizomes) shall be broadcast evenly and uniformly on the soil surface.

C. Compaction:

1. Immediately following the completion of seeding operations, the entire area shall be compacted by means of a roller weighing at least 60 but not more than 90 pounds per linear foot of roller or any other method approved by KC Water.

### 3.4 Seed Protection

A. Application of Herbicide:

1. Following completion of seeding operations, pre-emergent herbicide as specified shall be applied to all seeded areas at the rate suggested by the manufacturer.

B. Mulching:

1. Mulching shall be done within 24 hours following the seeding operation except in the case of wood cellulose type mulch.
2. Vegetative Type Mulch: Straw mulch shall be spread uniformly in a continuous blanket at a depth of not less than 1-1/2 inches and not more than 2 inches loose measurement (approximately 1-1/2 to 2 tons per acre). Mulch shall be spread by hand or by a blower type mulch spreader. Blower

type mulch spreaders shall be adjusted and operated in such a manner as to prevent excessive breakage of the mulch material. If this cannot be accomplished, the mulch shall be spread by hand. Care shall be exercised to ensure that all wire from baled hay is collected as it is removed from the bale. Mulching shall be started at the windward side of relatively flat areas, or at the upper part of a steep slope, and continued uniformly until the area is covered. The mulch shall not be bunched.

- a. No mulch shall be spread unless it can be anchored on the same day.
3. Anchoring Straw Mulch: The straw mulch shall be anchored in the soil to a depth of 2 to 3 inches by a notched disk set straight or a mulch crimping machine. The machine shall be weighted and operated in such a manner to secure the mulch firmly in the ground to form a soil binding mulch and prevent loss or bunching of straw by wind. Two or more passes may be required to anchor the mulch to the satisfaction of KC Water.
4. Application of Wood Cellulose Fiber: Wood cellulose fiber mulch shall be applied with a hydro-mulcher at not less than 1000 pounds per acre. Precautionary measures shall be taken in preventing overspray on structures, paving, and plantings.

### **3.5 Maintenance**

#### **A. Watering:**

1. Promptly after seeding and mulching, wet the seedbed thoroughly. Watering shall continue so as to keep all areas moist throughout the germination period.

#### **B. Water Usage:**

1. Water used in this work shall be furnished by the Contractor and shall be suitable for irrigation and free from ingredients harmful to plant life. All watering equipment required for the work shall be furnished by the Contractor. Water shall be taken from adjacent fire hydrants or public water lines only through hydrant connections permitted and issued by KC Water. Written approval from the property owner shall be obtained prior to the use of suitable water from ponds or creeks. Water from private owners shall also be metered.

#### **C. Maintenance of Area:**

1. The Contractor shall be responsible for maintaining all seeded areas until acceptance by KC Water. If at any time before acceptance of the completed contract, any portion of the seeded surface becomes gullied or otherwise damaged, or the seeding has been damaged or destroyed, the affected

portion shall be cleared of stones, etc. and repaired to re-establish the specified condition prior to the acceptance of the work.

2. In established yards, shoulders and slopes in street right-of-way, and any other areas where a Type "A" seeding is necessary, all newly seeded grassed areas shall be kept in a healthy growing condition by watering, weeding, mowing, trimming, edging, etc., until completion and acceptance by KC Water. The seeded areas shall be mowed with approved mowing equipment to a height of 3 inches whenever the average height of vegetation becomes 6 inches.
3. Turf grass of one-square foot or more that does not show definite growth and establishment shall be re-seeded in accordance with all requirements of this section including soil preparation and mulching. The Contractor shall continue the care and maintenance of all seeded areas as specified above until all work of this project has been satisfactorily completed and all deficiencies have been corrected at which time final inspection shall be made.
4. Areas Off of Street Right-of-Way (Type "B" Seed): All seeded areas shall be maintained until acceptance by the Engineer. Maintenance shall include repair of erosion damage, re-seeding, including all preparation requirements maintenance of mulch, and watering.

END OF SECTION

## SECTION 02931

### SODDING

#### PART 1 GENERAL

##### 1.1 Section Description

- A. This section provides for areas to be restored with sodding materials.

##### 1.2 Section Includes

- A. Sod
- B. Fertilizer

##### 1.3 Related Sections

- A. Section 01000 – General Requirements
- B. Section 01300 – Submittals
- C. Section 01600 – Material and Equipment
- D. Section 01900 – Project Closeout
- E. Section 02200 - Excavation and Trenching
- F. Section 02930 - Seeding

##### 1.4 References

- A. ASPA (American Sod Producers Association) - Guideline Specifications to Sodding.
- B. FS O-F-241 - Fertilizers, Mixed, Commercial.

##### 1.5 Definitions

- A. Sodding areas: All established lawn areas that have been disturbed by construction operations including areas of cut and fill, trenching, temporary roads, and temporary staging or storage areas shall be sodded unless otherwise specified.
- B. Sequence of Work: Sequence shall be clearing, grading, fertilizing, tilling, and sodding.
- C. Weeds: Includes Dandelion, Jimsonweed, Quackgrass, Horsetail, Morning Glory, Rush Grass, Mustard, Lambsquarter, Chickweed, Cress, Crabgrass, Canadian Thistle,

Nutgrass, Poison Oak, Blackberry, Tansy Ragwort, Bermuda Grass, Johnson Grass, Poison Ivy, Nut Sedge, Nimble Will, Bindweed, Bent Grass, Wild Garlic, Perennial Sorrel, and Brome Grass.

## **1.6 Submittals**

- A. Follow the procedures for submittals provided in Section 01300 - Submittals.

## **1.7 Quality Assurance**

- A. Comply with regulatory agencies for fertilizer and herbicide composition.
- B. All sodding work shall be performed by a contractor having demonstrated experience in sodding on projects of similar size. The work shall be prepared by experienced personnel who are familiar with the required work and who are under the supervision of a qualified foreman at all times when the work is in progress.
- C. Sod: Shall be a minimum age of 18 months, with root development that will support its own weight without tearing, when suspended vertically by holding the upper two corners.
- D. Submit sod certification for grass species and the location of sod source.
- E. Sod Producer: Shall be a company specializing in sod production and harvesting with minimum three years documented experience.

## **1.8 Delivery, Storage, and Handling**

- A. Follow the provisions for the delivery, storage, protection and handling Products to and at site provided in Section 01600 - Material and Equipment.
- B. Deliver sod in rolls. Protect exposed roots from dehydration.
- C. Do not deliver more sod than can be laid within 24 hours. Sod harvested more than 48 hours prior to placement will be rejected and shall be removed immediately from the site.

## **PART 2 PRODUCTS**

### **2.1 Sod**

- A. General:
  - 1. The sod to be used as source material shall be a thick stand of Kentucky Blue Grass, Turf Type Tall Fescue, Bermuda Grass, Zoysia Grass or other grasses as required. The sod shall contain a growth of not more than 1

percent of other grasses and clovers, shall be free from all prohibited and noxious weeds.

2. Broken pads and torn or uneven ends will not be acceptable. Standard size sections shall be strong enough to support their own weight and should retain their size and shape when suspended vertically from a firm grasp on the upper 10 percent of the section. Sod shall not be harvested or transplanted with moisture content (excessively dry or wet) that will adversely affect its survival.
3. Sod shall be relatively free of thatch, up to 1/2 inch allowable (uncompressed). Sod shall be reasonably free of diseases, nematodes, and soil-borne insects. State nursery and/or plant materials laws require that all sod entering inter-state commerce be inspected and approved for sale. The same applies to sod being shipped intra-state. The inspections and approval must be made by the state agricultural department, office of the state entomologist.
4. Sod for golf courses and other areas as deemed necessary shall be of the Kentucky Blue Grass and Turf Type Tall Fescue Grass as specified above. Bermuda Grass and Zoysia Grass sod will not be acceptable for these areas.

B. Turf Type Tall Fescue Sod:

1. Composed of an equal mix of three or four compatible species of 100 percent Turf Type Tall Fescue. The mixture shall not include any varieties of the slower growing Turf Type Tall Fescue "Dwarf". The species shall be one of the following:

Apache	Arid	Austin
Bonanza	Carefree	Chieftan
Cimmaron	Cochise	Falcon
Guardian	Hounddog	Jaguar II
Maverick II	Mustang	Olympic
Phoenix	Rebel II	Rebel 3D
Safari	Shenandoah	Thoroughbred
Titan	Tribute	Vegas

C. Kentucky Blue Grass and Turf Type Tall Fescue Sod:

1. Cut in strips of uniform thickness, the range of acceptable thickness shall be 1 1/2 to 2 inches; each strip containing at least one square yard. Sod shall be cut in strips not less than 12 inches wide.

D. Bermuda Grass or Zoysia Grass Sod:

1. Cut into strips of uniform thickness, the range of acceptable thickness shall be 1 1/2 to 2 inches; each strip being not less than 12 inches wide and 24 inches long. Strips that crumble will not be acceptable.

## **2.2 Fertilizer**

- A. Fertilizer shall be inorganic 12.12.12 or 13.13.13 grade, uniform in composition, free flowing and suitable for application with approved equipment, delivered to the site in convenient containers, each fully labeled, conforming to applicable state fertilizer laws, bearing the name, trade name, or trade mark and warranty of the producer.

## **PART 3 EXECUTION**

### **3.1 Preparation of Subsoil**

- A. General:
  1. The work shall not be started until all earthwork has been completed. Backfills and fills shall be properly compacted, the topsoil shall be spread and finish grading shall be completed immediately before the sodding work is started.
- B. Preparation of Area:
  1. Preparation of areas to be sodded shall include filling, reshaping eroded areas, cleaning ditches and refinishing slopes to the established grade section.
- C. Cleanup:
  1. Within reasonable time after completion of the construction operations, the entire area shall be cleared of excess soil and waste material, including, but not limited to, stones, stumps, roots, brush, wire, grade stakes, and all objects that might be a hindrance to maintenance operations or affect the visual appearance of the site. All roads over which hauling operations have been conducted, regardless of the type of surfacing, shall be kept clean, and soil clods and debris left on the surface shall be removed. The wheels of vehicles shall be cleaned to avoid leaving soil upon the surface of roads, walks, and other surfaced areas.
- D. Preparation of Sod Bed:
  1. After fertilizer has been applied, the areas to be sodded shall be tilled to a depth of at least 2 inches by disking, plowing, harrowing, or other accepted methods until the soil is well pulverized and smoothed with a weighted spike-tooth harrow, railroad chains, or bridge timber float

drag. When a chisel plow is used, the chisels shall be set not more than 10 inches apart and the areas shall be cross or double-tilled. All areas shall be left smooth for ease of mowing. All operations shall be done in a direction parallel to the contour lines on the slope and not uphill or downhill.

### **3.2 Fertilizing**

- A. Before tilling operations, fertilizer shall be spread uniformly at the rate of 300 pounds per acre. Fertilizing rate is equivalent to 3.5 pounds per 500 square feet.

### **3.3 Laying Sod**

#### **A. Application of Sod:**

1. Kentucky Blue Grass and Turf Type Fescue sod shall not be placed during a drought, or during the period from June 1 to September 1, unless authorized by KC Water, and shall not be placed on frozen ground. Bermuda and Zoysia sods shall only be placed during the period from May 1 to October 15. KC Water reserves the right to delay the sodding of all types of sod or to vary the permissible sodding seasons, due to weather, soil conditions, or for other causes.
2. Sod shall be moist when it is placed. Sod strips shall be laid along contour lines, commencing at the lowest point of the area and working upward. The transverse joints of sod strips shall be staggered and the sod carefully placed to produce tight joints. If necessary to walk excessively on newly laid sod, walking boards should be laid for this purpose. The sod shall be firm and watered immediately after it is placed. The "firming" shall be accomplished by application of a roller weighing not less than 60 nor more than 90 pounds per linear foot of roller or other approved method.

#### **B. Anchoring Sod:**

1. On 2:1 slopes, or steeper, the sod shall be anchored with 1/2 inch square by 8 inch long wooden pegs. The wooden pegs shall be driven into the ground 3 pegs to the square yard or other approved methods. Pegging shall be done immediately after sod is firmed.

### **3.4 Maintenance**

#### **A. Water Usage:**

1. Water used in this work shall be furnished by the Contractor and will be suitable for irrigation and free from ingredients harmful to plant life. All watering equipment required for the work shall be furnished by the Contractor. Water shall be taken from adjacent fire hydrants or public water lines only through hydrant connections permitted and issued by KC



Water. Written approval from the property owner shall be obtained prior to the use of suitable water from ponds or creeks. Water from private owners shall also be metered.

B. Maintenance:

1. The Contractor shall be responsible for maintaining the installed grass sod until all areas are complete and accepted by KC Water. Grass areas in excess of one square foot that are dead or in poor condition regarding color and quality shall be replaced including all sodded preparation steps, and fertilized at the Contractor's expense prior to final acceptance.
2. The Contractor shall maintain the grass area for a minimum period of approximately 30 days or until the grass reaches a mowing height of 4 inches. The Contractor shall notify the City that the installed grass is ready to be mowed, and upon approval, the Contractor shall cut and "bag" grass clippings to a height of 2 1/2 inches. Completion of the mowing and replanting of all dead or dying grass by the Contractor shall be required prior to final acceptance.

END OF SECTION

## **SECTION 03001**

### **CONCRETE**

#### **PART 1 GENERAL**

##### **1.1 Section Description**

- A. This section provides for the materials and procedures utilized in cast-in-place concrete for thrust restraints restoration and repair of surface structures.

##### **1.2 Section Includes**

- A. Concrete Mixture
- B. Curing
- C. Form Work
- D. Reinforcement

##### **1.3 Related Sections**

- A. Section 01000 – General Requirements
- B. Section 01300 – Submittals
- C. Section 01600 – Material and Equipment
- D. Section 02200 - Excavation and Trenching
- E. Section 02608 - Concrete Vaults and Covers
- F. Section 02669 - Thrust Restraints

##### **1.4 References**

- A. ACI 301 - Specifications for Structural Concrete Buildings
- B. ASTM C33 - Standard Specification for Concrete Aggregates.
- C. ASTM C94 - Standard Specification for Ready-Mixed Concrete.
- D. ASTM C150 - Standard Specification for Portland Cement.
- E. ASTM C171 - Standard Specification for Waterproof Paper for Curing Concrete.

- F. ASTM C260 - Standard Specification for Air-Entraining Admixtures for Concrete.
- G. ASTM C309 - Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete.
- H. ASTM C494 - Standard Specification for Chemical Admixtures for Concrete.
- I. ASTM C881 - Standard Specification for Epoxy-Resin-Base Bonding Systems for Concrete.
- J. ASTM C1315 - Standard Specification for Liquid Membrane-Forming Compounds Having Special Properties for Curing and Sealing Concrete.
- K. MCIB – Specifications for Concrete Work.

### **1.5 Submittals for Review**

- A. Follow the procedures for submittals provided in Section 01300 - Submittals
- B. Submit proposed mix design of each class of concrete to KC Water for review prior to commencement of work.

### **1.6 Quality Assurance**

- A. Perform work in accordance with ACI 301.
- B. Tests: Testing firm will take cylinders and perform slump and air entrainment tests in accordance with ACI 301 and ASTM standards.

## **PART 2 PRODUCTS**

### **2.1 Concrete Mixture**

- A. Concrete Mixture:
  - 1. The concrete shall be MCIB WA530-1-4 as designated by the Mid-West Concrete Industry Board, Inc., Kansas City, Missouri.
- B. Cement:
  - 1. The cement shall be Portland Cement Type I unless high early strength is required in which instance Type III shall be used.
  - 2. All cement shall conform to the "Standard Specification for Portland Cement," ASTM C150.
- C. Aggregate:

1. All aggregates shall conform to the appropriate bulletins and specifications of the Mid-West Concrete Industry Board, Inc.

D. Admixtures:

1. Air-entraining admixtures shall comply with ASTM C260 (AASHTO M154), current edition.
2. Chemical admixtures shall comply with ASTM C494 (AASHTO M194), current edition.
3. All Concrete shall include a water-reducing admixture and an air-entraining admixture.

E. Water:

1. Water for mixing and curing concrete shall be clean and free from injurious amounts of sewage, oil, acid, alkali, salt, or organic matter. (Only potable water will be acceptable without testing.)

F. Ready-Mix Concrete:

1. Ready-mixed concrete shall be used unless otherwise permitted by KC Water.
2. Ready-mixed concrete shall be mixed and delivered in accordance with the requirements set forth in the "Standard Specifications for Ready-Mixed Concrete," ASTM C94.

## 2.2 Curing

- A. Cotton Mats: American Association of State Highway Officials (AASHTO) - "Standard Specifications for Cotton Mats for Curing Concrete Pavements," Designation M-73, current edition.
- B. Burlap: AASHTO - "Standard Specifications for Burlap Cloth Made from Jute or Kenaf," M-182, Class 2, 3, or 4, current edition.
- C. Waterproof Paper: ASTM – "Standard Specification for Waterproof Paper for Curing Concrete", Designation C-171, Current Edition.
- D. Liquid Membrane: ASTM – "Standard Specifications for Liquid Membrane Forming Compounds for Curing Concrete", Designation C-309, current edition.
- E. Membrane Curing Compounds: ASTM C1315 - "Standard Specifications for Liquid Membrane-Forming Compounds Having Special Properties for Curing and Sealing Concrete", current edition.

- F. Concrete Bonding Agent; ASTM C881 - Standard Specifications for Epoxy-Resin-Base Bonding Systems for Concrete”, Type I and V, moisture insensitive, current edition.
- G. Polyethylene Sheeting: AASHTO – “Standard Specifications for White Polyethylene Sheeting (Film) for Curing Concrete”, Designation M-171, current edition.

### **2.3 Form Work**

- A. Refer to Section 03100 - Concrete Formwork

### **2.4 Reinforcement**

- A. Refer to Section 03200 - Concrete Reinforcement

## **PART 3 EXECUTION**

### **3.1 Surface Preparation**

- A. General:
  - 1. Concrete shall not be placed on muddy or frozen ground.
  - 2. Dry sub-grade shall be wetted in advance of concrete placement.
  - 3. All mud, freestanding water, loose dirt, and debris shall be removed prior to placement of concrete.
- B. Surface Preparation of Existing Concrete:
  - 1. Where new concrete is placed against existing concrete, the surface of the existing concrete shall be chipped to remove the existing surface to a depth that exposes a clean concrete surface. No oil, grease, or dirt stains shall be evident when the new concrete is poured.
  - 2. Latency or soft layers of mortar shall be removed from the top or face of previously hardened concrete prior to placing additional concrete in contact with the existing surfaces.
  - 3. If, in the opinion of KC Water, a structural bond is required between the old and new concrete, a concrete bonding agent shall be used.
- C. Under-Water Conditions:
  - 1. Prior to placing concrete, any water flow into excavation or forms shall be controlled or stabilized.

2. Tremies shall be used in all cases unless other methods are specified.
3. Tremies shall be equipped with watertight valves or caps at the lower end that shall be kept submerged in freshly placed concrete when placing concrete.

### **3.2 Formwork**

- A. Refer to Section 03100 – Concrete Formwork

### **3.3 Reinforcement**

- A. Refer to Section 03200 – Concrete Reinforcement

### **3.4 Placing Concrete**

- A. General:
  1. Only those methods and arrangements of equipment shall be used which will reduce to a minimum any segregation of coarse aggregate from the concrete.
  2. Every consideration shall be given to the proper placement of all concrete and the proper care of all concrete after placement.
  3. Sufficient capacity of manpower and placing equipment shall be provided so that the work may be kept free from cold joints and other defects in the finished product.
  4. Concrete shall be deposited into the forms or on the grade as nearly as practicable in its final position and in such manner that the concrete will completely fill the forms.
  5. Vibration shall not be used to move concrete in a horizontal direction after initial placement.
  6. Placement of concrete on a slope shall begin at the lower end of the slope and progress upward.
  7. Concrete that has partially hardened or has been contaminated by foreign material shall not be deposited in the work but shall be discarded.
  8. When inclined chutes beyond the mixer are permitted by KC Water, a baffle shall be provided at the bottom end so that concrete will drop vertically without segregation.
  9. No water shall be added to the concrete for any reason at the job site that will result in exceeding the specified water-cement ratio.

10. Care shall be taken to fill the forms and to finish the concrete so that top surface is true to line and grade.
11. Care shall be taken to assure proper concrete coverage of reinforcing steel and mesh as designed.
12. Care shall be taken to maintain the proper location of all joint material, dowels, embedded items, etc., during concrete placement.
13. No mud or other foreign materials shall be tracked into the concrete during placement operations, and all contaminated concrete shall be removed.

B. Footings:

1. Footings shall have sound and stable earth sides or assembled forms.
2. Placement operations shall be performed in such a manner as to prevent loose earth falling into footing area during placement of concrete.

C. Walls And Thrust Restraints:

1. Collection hoppers shall be used wherever depth of wall or thrust restraints exceeds four (4) feet.
2. Concrete that might contact forms or reinforcing steel during placement shall be placed by the use of trunks or pipes whenever the drop exceeds six (6) feet for unexposed work, or three (3) feet for exposed work.
3. When trunks or pipe are used, they shall be located at horizontal spacing of not to exceed ten (10) feet.
4. Concrete for walls and thrust restraints shall be placed in horizontal layers not exceeding two (2) feet in depth.
5. Where concrete is to be placed for slabs monolithically with walls, beams, or columns which have a depth of four (4) feet or more, the placing of concrete for slab shall be delayed one (1) to three (3) hours after placing of concrete in lower portions to allow for subsidence.
6. Placing of concrete in slabs and thrust restraints shall be done in such manner as to prevent "cold joints," both horizontally and vertically.

D. Slabs:

1. Strike-off screens shall be set to proper grades for all concrete slab construction, and the tolerance for screens for smooth finish slabs shall not exceed one-eighth (1/8) inch, plus or minus, in a distance of seven (7) feet.

2. Strike-off shall be accomplished by use of a straight edge of adequate weight and length.
3. Vibrating screens or other approved strike-off methods shall be used when concrete slump is less than three (3) inches and slab thickness is more than four (4) inches.
4. Jitterbugs shall not be used.

E. Vibrating:

1. Mechanical internal vibrators shall be used whenever possible in all formed concrete work.
2. Vibrators shall be inserted at uniform spacing of twelve (12) inches to twenty (20) inches to assure thorough consolidation of all concrete.
3. Vibrators shall be inserted and withdrawn vertically to a depth, which will assure penetration into the previous lift with vibration periods of from five (5) to fifteen (15) seconds.
4. Form vibration and hand spading will be required at points inaccessible for thorough internal vibration.
5. During placement of concrete, stand-by vibrators shall be immediately available in the event of mechanical failure in the vibrators being used.

### 3.5 Concrete Curing

A. General:

1. Curing and protection shall consist of providing adequate measures to prevent the loss of moisture so hydration of the cement can continue. Special care shall be taken to provide proper curing for all concrete, including edges.
2. All regular concrete shall be cured for a period of not less than five (5) days, and concrete made with high early strength cement shall be cured not less than three (3) days unless otherwise directed or specified by KC Water.
3. Whenever placing of concrete is interrupted, the concrete already placed shall be kept continuously moist with damp mats or burlap until placing is resumed. Concrete shall not be directly sprayed with water prior to obtaining initial set.

B. Concrete In Forms:



1. Concrete adjacent to wood forms shall be cured either by keeping the forms continuously wet, beginning not later than eighteen (18) hours after placing has been completed, or by loosening the forms as directed or approved by the Engineer and applying water to the top portion and allowing the water to run down between the forms and the concrete.
2. When metal forms are used for vertical surfaces, the forms shall either be kept in contact with the concrete for the entire curing period, or the forms may be removed completely and one of the other acceptable curing methods used.
3. Concrete slabs shall be cured by either wet covering, steel materials, or membrane curing compounds.
4. Supporting forms under flat slabs will not be required to be kept moist.

C. Curing Methods:

1. One of the following methods of curing shall be used as soon as possible after the final finishing operations and when the concrete has set sufficiently so that it will not be damaged in the process.
2. Wet covering shall consist of either burlap, cotton mats, damp earth or sand, or ponded water. Coverings shall be kept moist for the duration of the curing period. Water shall be applied in a manner, which will not damage the concrete, and shall be free from impurities, which may damage or discolor the concrete.
3. The covering shall completely cover the concrete surfaces with sufficient material remaining at the sides for proper anchorage. Adjoining sheets shall be lapped six (6) inches or be sealed. All tears and holes shall be patched promptly with adhesive tape or other approved means. The covering shall be anchored continuously around the edges and at laps, and shall be weighted on the surface as required to prevent billowing by the wind. The covering material may be reused provided all holes and tears are properly repaired.
4. During hot weather, the membrane curing compound shall be a white pigmented compound when used on concrete exposed to sunlight and on all other concrete unless KC Water specifies a clear type with fugitive dye. Membrane curing compounds shall not be used where concrete is to be bonded to concrete. Where concrete is to be painted or covered with floor covering, or where concrete is to be bonded to other construction material, membrane curing compound shall be applied by spraying in such a manner as to provide a uniform, continuous, and water-impermeable film using not less than the amount recommended by the manufacturer. Compounds shall be stirred prior to and during use. If an even covering cannot be obtained by one coat, the compound shall be applied in two (2) coats with the direction of application of the second coat at right angles to that of the first coat. The

membrane shall be protected from damage during the curing period, and any damage shall be repaired promptly.

5. Vertical faces of slabs on grade shall be cured by backfilling with moist earth or by use of one of the methods described herein.
6. If approved by KC Water, a combination of various curing methods may be used providing the intermediate time of exposure to drying is less than one (1) hour. For example, concrete work may be initially cured for one (1) day with a wet covering followed by four (4) days curing with a sheet material or membrane curing compound.

### **3.6 Concrete Protection**

#### **A. General:**

1. The provisions of this Section shall apply to all concrete work, which is done when the air temperature is below forty degrees Fahrenheit (40° F) or forecast to drop below that temperature within twenty-four (24) hours of the time concrete is to be placed.
2. Concrete Production: Adequate equipment for heating the concrete materials shall be provided. No ingredient that is frozen or contains ice shall be placed in the mixer.
  - a. When air temperature is below 40° F, or forecast to fall below 40° F in the next 24 hours, concrete ingredients shall be heated.
  - b. Temperature of concrete at time of delivery shall be not less than 60° F nor greater than 80° F and 70° F is preferred.
  - c. Heating shall be accomplished by heating either the aggregates or the mixing water or both. When the water temperature is above 165° F, the aggregate shall be premixed with the water for one (1) minute before cement and admixtures are added. Cement shall not be mixed with water or aggregates having temperature above 165° F.
  - d. The addition of calcium chloride WILL NOT be permitted.
3. Placing and Finishing: Concrete shall not be placed on or come in contact with frozen subgrade or forms and equipment containing ice or snow.
  - a. Concrete, when placed, shall have a slump not to exceed four (4) inches for flat work or five (5) inches for walls and columns.
  - b. During placing and finishing, concrete shall be maintained at a temperature of 50° F or above but not more than 80° F.

- c. Heating of enclosures for flat slab finishing shall be done by vented heating methods, and open-flame heating methods will not be permitted.
  - d. Troweling shall be delayed in order to avoid bringing an excess of fines to the surface.
  - e. During placing and finishing, the slabs shall be protected from wind to prevent loss of heat and rapid drying.
4. Protection: When freezing temperatures are forecast, suitable and adequate facilities shall be provided prior to beginning concrete placement for maintaining the ambient air temperature at the surface of the concrete or forms for the times and temperatures specified herein.
- a. Type I (normal) cement concrete - not less than 50°F for five (5) days or 70°F for three (3) days.
  - b. Type II (low heat of hydration/moderate sulfate resistant) cement concrete - not less than 50°F for fourteen (14) days.
  - c. Type III (high early strength) cement concrete - not less than 50°F for three (3) days or 70°F for two (2) days.
  - d. Protective measures shall be maintained for at least four (4) days beyond the period specified above.
  - e. Sudden cooling (in excess of 20°F in any 24-hour period) of ambient air temperature at the surface of the concrete or forms shall not be permitted. During this period concrete shall not be allowed to drop to a temperature below 40°F.
  - f. Newly finished flat work shall be covered and protected during cold weather for at least 14 days against exposure to rain, sleet, and ice.
  - g. All methods for protecting concrete shall be subject to approval of the Director.
  - h. Insulated forms may be used when approved by KC Water. Care shall be taken to keep the internal concrete temperature below 130°F and avoid sudden cooling at end of protection period.
  - i. During the entire protection period adequate means shall be provided to prevent loss of moisture from the concrete surface.

B. Hot Weather Protection:

1. General: The provisions of this Section shall apply to all concrete work that is done when the air temperature is above 80°F or forecast to rise above that temperature within 24 hours of the time concrete is to be placed.
2. Concrete Production: Stockpiled aggregates shall be saturated and the surface kept moist by intermittent sprinkling or continuous fog spray.
  - a. Mixing water shall be kept cool by adequate protection of storage tanks and piping. Supply lines shall be shaded, insulated, or buried.
  - b. When necessary to produce and maintain concrete at an acceptable temperature, chopped or crushed ice shall be added directly to the mixer to the limit of 50% by weight of the total water required. Ice shall be added at a rate and in a manner that it will be completely melted during the mixing period. Chilled mixed water will also be acceptable.
  - c. The cement factor required by the design mix shall be increased as necessary to maintain the specified water-cement ratio whenever additional water is added to compensate for loss of slump during transportation, handling, and placing.
3. Placing and Finishing: Temperature of concrete when placed shall not exceed 85°F.
  - a. Forms, reinforcing, and subgrade surfaces shall be wet down immediately before concrete is placed. Wetting down of areas around the work to cool the air and increase humidity is recommended.
  - b. Placing and finishing shall be done as quickly as possible. Adequate manpower and equipment shall be available to handle and place the concrete immediately after its mixing and delivery to the site.
  - c. Concrete shall be placed in layers in such manner as to insure bond and union with adjacent layers, thus avoiding cold joints.
4. Protection: In extremely hot weather or in very dry and/or windy weather, sunshades, wind breakers, fog nozzles, or a combination of such items will be required during flat slab finishing operations.
  - a. If in the opinion of KC Water proper protection is not being provided, KC Water may order concrete operations to be suspended until adequate protective measures are provided.
  - b. Concrete shall be kept cool and moist during the specified curing period.

- c. Top surface of slabs shall be cured as specified in Paragraph 6-" Curing and Protection." Initial curing media shall be applied within 20 minutes after the final finishing has been completed in each area.
- d. When air temperature exceeds 90°F and as soon as practicable without damage to the surface finish, all exposed concrete shall be kept continuously moist by means of fog sprays, wet burlap, cotton mats, and other effective means. This water cooling shall be in addition to the initial sealing by the membrane curing compound.

END OF SECTION

## SECTION 03100

### CONCRETE FORMWORK

#### PART 1 GENERAL

##### 1.1 Section Description

- A. This section provides for the materials and installation for cast-in-place concrete formwork.

##### 1.2 Section Includes

- A. Forms
- B. Form work accessories

##### 1.3 Related Sections

- A. Section 01000 – General Requirements
- B. Section 01300 – Submittals
- C. Section 01600 – Material and Equipment
- D. Section 03001 - Concrete
- E. Section 03200 - Concrete Reinforcement

##### 1.4 References

- A. ACI 347 - Recommended Practice For Concrete Formwork.

##### 1.5 Submittals

- A. Follow the procedures for submittals provided in Section 01300 - Submittals.
- B. Shop Drawings: Indicate pertinent dimensions, materials, bracing, and arrangement of joints and ties.

##### 1.6 Quality Assurance

- A. Perform Work in accordance with ACI 347.

##### 1.7 Delivery, Storage, and Handling

- A. Follow the provisions for the delivery, storage, protection and handling products to and at site provided in Section 01600 - Material and Equipment.
- B. Store off ground in ventilated and protected manner to prevent deterioration from moisture.

## **PART 2 PRODUCTS**

### **2.1 FORMS**

- A. Suitable and substantial forms shall be provided for all structural concrete and, where required, for plain concrete. All forms shall be constructed and maintained plumb and true to line, securely braced, tied, clamped and shored, and tight enough to prevent leakage of mortar.
- B. The deflection of the forms due to the weight of plastic concrete, placing equipment, and workmen shall be accurately figured and taken into account in the design of the forms so that finished concrete members will have surfaces, lines, planes, and elevations required within tolerances in accordance with ACI 117.
- C. Forms shall be constructed so that they can be removed without damage to the concrete.
- D. Forms for walls and thrust restraints shall be designed structurally for the rate of placement of concrete.

### **2.2 Formwork Accessories**

- A. Forms shall be securely braced and tied with approved form ties that do not leave any parts within 3/4 inch of the surface of the concrete. Wire ties and wood spreaders will not be permitted.

## **PART 3 EXECUTION**

### **3.1 Preparation**

- A. Verify lines, levels and centers before proceeding with formwork.
- B. A coat of non-staining oil, lacquer, or other approved material shall be applied to protect form surface and to facilitate stripping. Coating shall be applied in strict accordance with the current directions of the manufacturer.
- C. Screens shall be constructed and located so as to produce continuous plane surfaces and shall be sturdy and designed so as to leave no undesirable parts permanently embedded in the concrete.

- D. Screens shall be set sufficiently in advance of placement of concrete to avoid interruption in the placing of concrete.
- E. All exterior surfaces of the forms shall be thoroughly cleaned with water or compressed air immediately prior to placing of concrete.
- F. All surfaces of forms that are to be reused shall be thoroughly cleaned and repaired prior to reuse.

### **3.2 Erection - Formwork**

- A. Openings and chases of proper size shall be provided in the forms for piping, ductwork, etc., at the locations indicated or as otherwise approved.
- B. All approved embedded items shall be accurately located and securely fastened in place prior to placing of concrete.
- C. Control, contraction, expansion, and construction joints shall be provided at the locations indicated or specified.

### **3.3 Form Removal**

- A. Forms shall be removed in such manner as to assure the complete safety of the structure. In no case shall supporting forms or shoring be removed until the concrete members have acquired sufficient strength to support their weight safely.

END OF SECTION



**SECTION 03200**  
**CONCRETE REINFORCEMENT**

**PART 1 GENERAL**

**1.1 Section Description**

- A. This section provides for the materials and installation for cast-in-place concrete reinforcement.

**1.2 Section Includes**

- A. Reinforcing steel bars, wire fabric and accessories for cast-in-place concrete.

**1.3 Related Sections**

- A. Section 01000 – General Requirements
- B. Section 01300 – Submittals
- C. Section 01600 – Material and Equipment
- D. Section 03001 – Concrete
- E. Section 03100 – Concrete Formwork

**1.4 References**

- A. ASTM A615/A615M - Standard Specification for Deformed and Plain Billet Steel Bars for Concrete Reinforcement.
- B. ASTM A616/A616M - Standard Specification for Rail Steel Deformed and Plain Bars for Concrete Reinforcement.
- C. CRSI 63 - Recommended Practice For Placing Reinforcing Bars.
- D. CRSI 65 - Recommended Practice For Placing Bar Supports, Specifications and Nomenclature.

**1.5 Submittals for Review**

- A. Follow the procedures for submittals provided in Section 01300 - Submittals.

- B. Shop Drawings: Indicate reinforcement bar sizes, spacing, locations, and quantities of reinforcing steel and wire fabric; bending and cutting schedules; splicing and supporting and spacing devices.

**1.6 Quality Assurance**

- A. Perform work in accordance with CRSI 63, CRSI 65, and CRSI Manual of Standard Practice.

**PART 2 PRODUCTS**

**2.1 Reinforcement**

- A. Reinforcing steel bars shall conform to the requirements of the following Standards and Grades:

<u>ASTM STANDARD</u>	<u>Grade</u>
A 615 - Billet Steel	40 or 60
A 616 - Rail Steel	50 or 60
A 617 - Axle Steel	40 or 60

- B. Welded steel wire fabric shall conform to the requirement of ASTM A185.

**PART 3 EXECUTION**

**3.1 Preparation**

- B. Before being installed in the final position, all metal reinforcements shall be free of mud, clay, ice, grease, oil, loose rust and scale, and other coatings that would reduce or destroy the bond.

**3.2 Placement**

- A. Metal reinforcements shall be accurately formed and positioned to the required dimensions.
- B. Steel reinforcements shall be accurately positioned as required and shall be secured against displacement by using annealed wire ties or suitable clips at all intersections.
- C. The steel reinforcements shall be supported by metal supports, spacers, or hangers.
- D. The legs on the metal chair supports shall be plastic coated.
- E. The minimum center to center distance between parallel bars shall be not less than two and five-tenths (2.5) times the diameter of the bars so installed; but in no case



shall the clear spacing between bars be less than one and five-tenths (1.5) times the maximum size of the course aggregate.

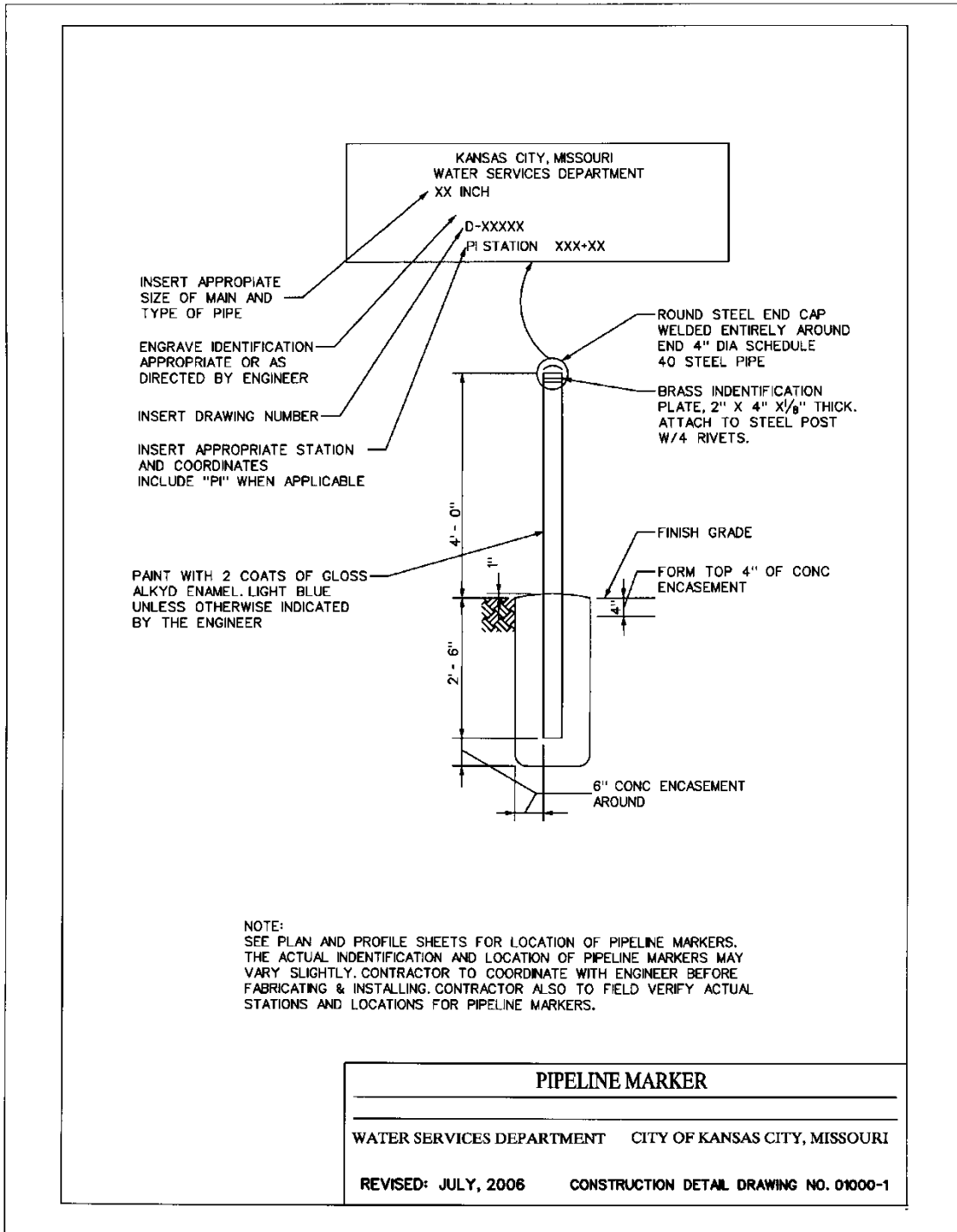
### 3.3 Protection

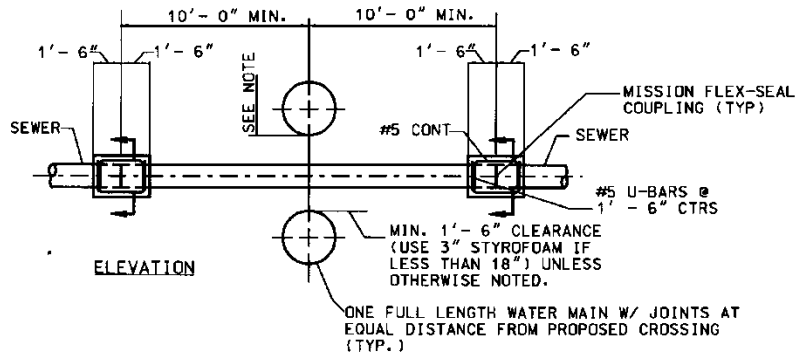
- A. Metal reinforcements (bars or mesh) shall be protected with concrete as stipulated in the following table. The concrete cover shall be measured from the edge of the bar or mesh to the face of the concrete.

<u>Condition of Service</u>	<u>Minimum Inches of Cover</u>
Placed against undisturbed earth	3 inches
Formed face exposed to earth or liquid	2 inches
Other formed surfaces	3/4 inches

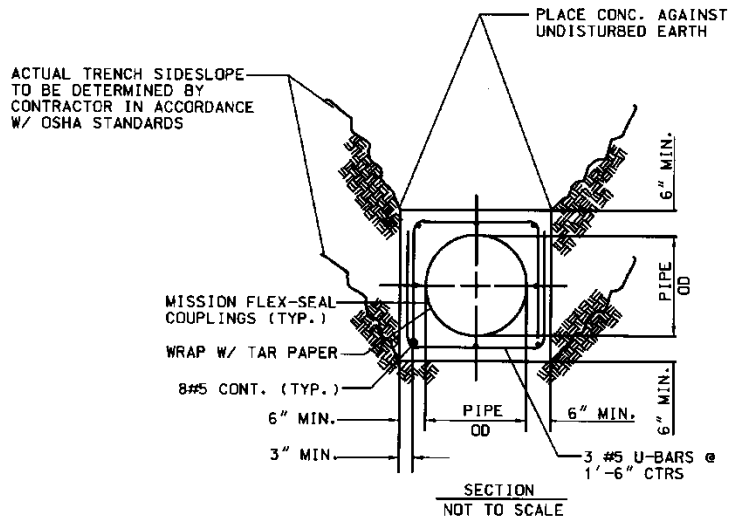
END OF SECTION

# STANDARD DETAILS





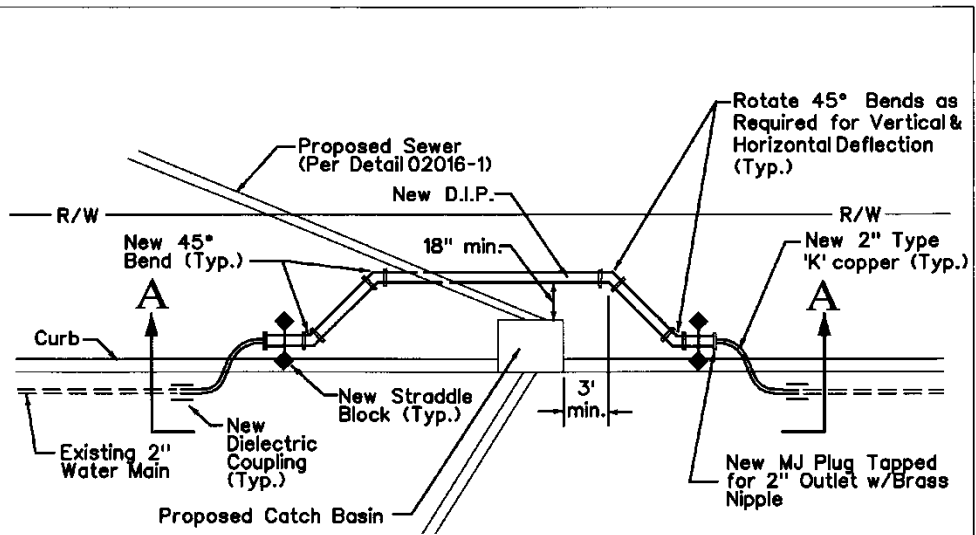
NOTE:  
 IF WATER MAIN CROSSES BELOW SEWER,  
 OR IF WATER MAIN CROSSES LESS THAN 18" ABOVE SEWER,  
 SEWER IS TO BE REPLACED W/ CL 52 DIP  
 OR PCCP OR PVC, AND JOINTS ENCASED AS  
 DETAILED ABOVE.  
 PVC PIPE SHALL CONFORM TO AWWA C-900 OR C-905



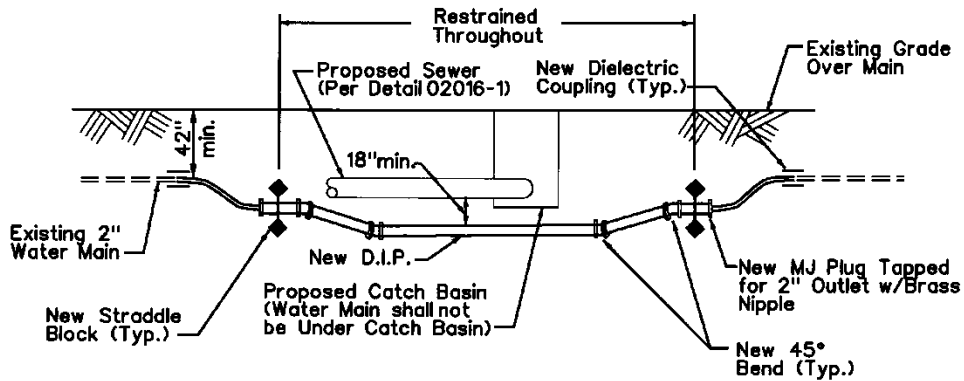
### SEWER CROSSING DETAIL

WATER SERVICES DEPARTMENT CITY OF KANSAS CITY, MISSOURI

REVISED: JULY, 2006 CONSTRUCTION DETAIL DRAWING NO. 01016-1

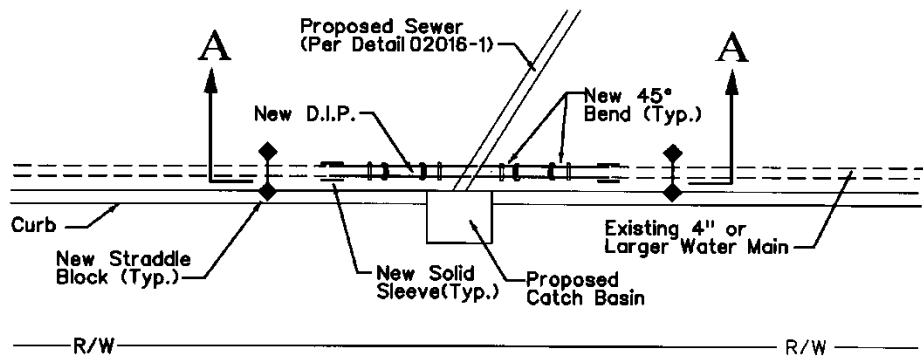


**PLAN**  
 NOT TO SCALE  
 Restrain All Joints

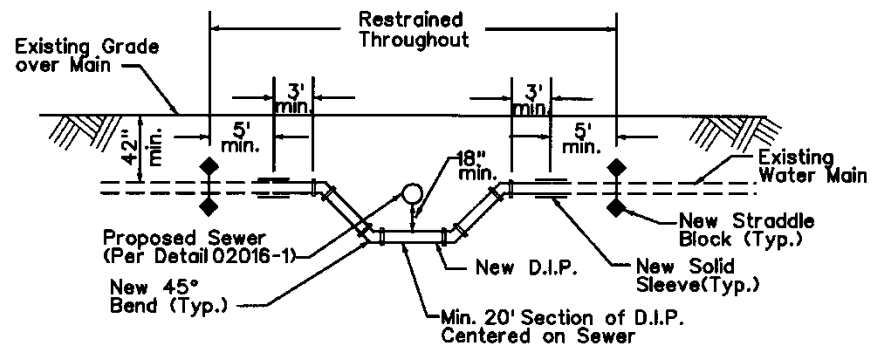


**SECTION A-A**

<b>EXISTING 2" WATER MAIN RELOCATION AT NEW SEWER</b>	
WATER SERVICES DEPARTMENT	CITY OF KANSAS CITY, MISSOURI
REVISED: JULY, 2006	CONSTRUCTION DETAIL DRAWING NO. 01016-2

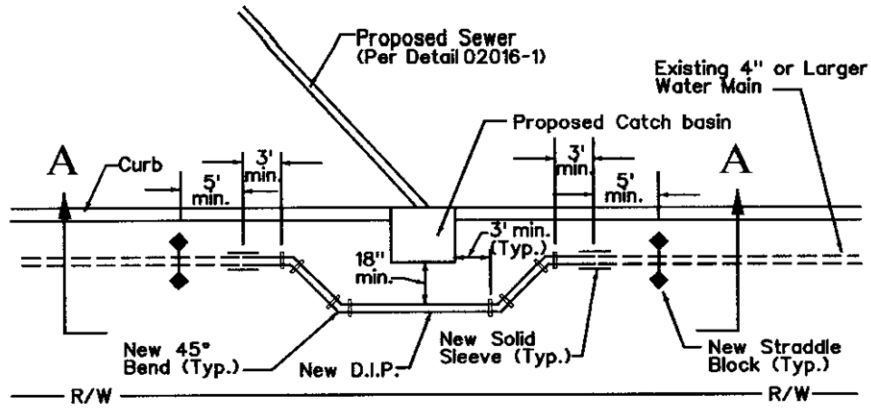


**PLAN**  
 NOT TO SCALE  
 Restrain All Joints

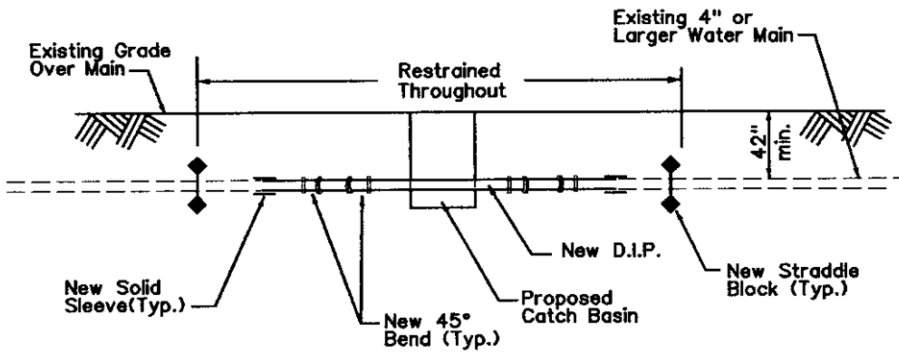


**SECTION A-A**

EXISTING 4" OR LARGER WATER MAIN
VERTICAL RELOCATION AT NEW SEWER
WATER SERVICES DEPARTMENT    CITY OF KANSAS CITY, MISSOURI
REVISED: JULY, 2006    CONSTRUCTION DETAIL DRAWING NO. 01016-3



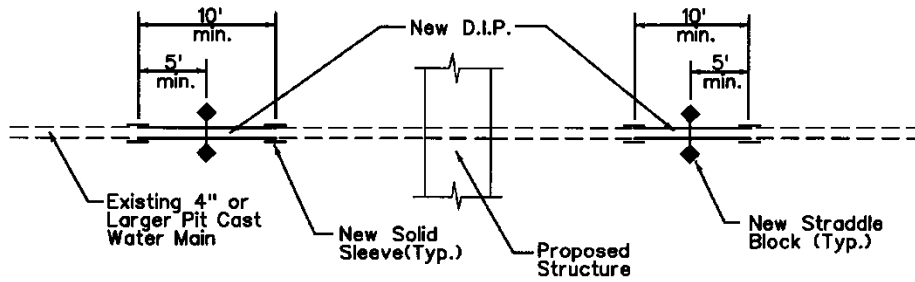
**PLAN**  
 NOT TO SCALE  
 Restrain All Joints



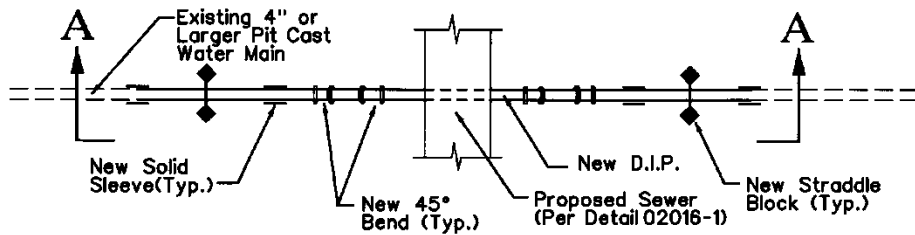
**SECTION A-A**

EXISTING 4" OR LARGER WATER MAIN	
HORIZONTAL RELOCATION AT NEW SEWER	
WATER SERVICES DEPARTMENT	CITY OF KANSAS CITY, MISSOURI
DRAWING NO. 19808	
REVISED: MARCH, 2011	CONSTRUCTION DETAIL NO. 01018-4

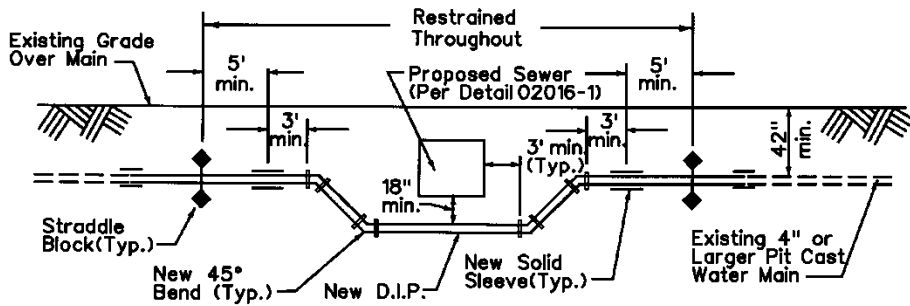




### TEMPORARY PLAN

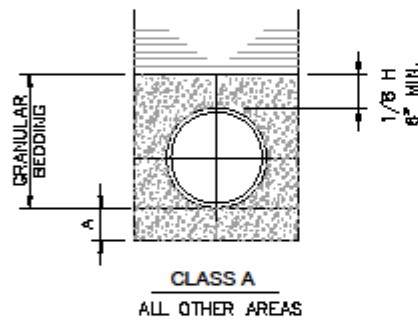
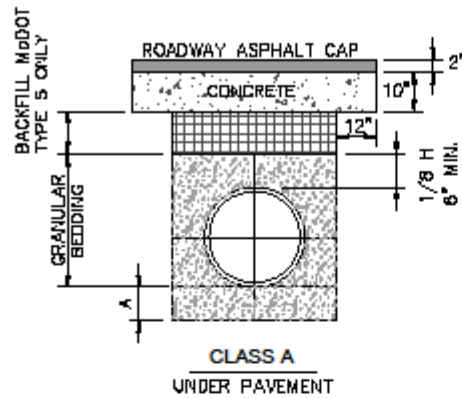


### PERMANENT PLAN



### SECTION A-A

EXISTING 4" OR LARGER PIT CAST PIPE	
WATER MAIN RELOCATION AT NEW SEWER	
WATER SERVICES DEPARTMENT CITY OF KANSAS CITY, MISSOURI	
NOT TO SCALE	REVISED: JULY, 2006 CONSTRUCTION DETAIL DRAWING NO. 01016-5



**NOTES**

FOR EMBEDMENT AND BACKFILL SPECIFICATIONS AND ASSOCIATED COMPACTION REQUIREMENTS SEE SECTION 02200.

**LEGEND**

- GRANULAR BEDDING
- BACKFILL
- MODOT TYPE 5 AGGREGATE FOR BASE

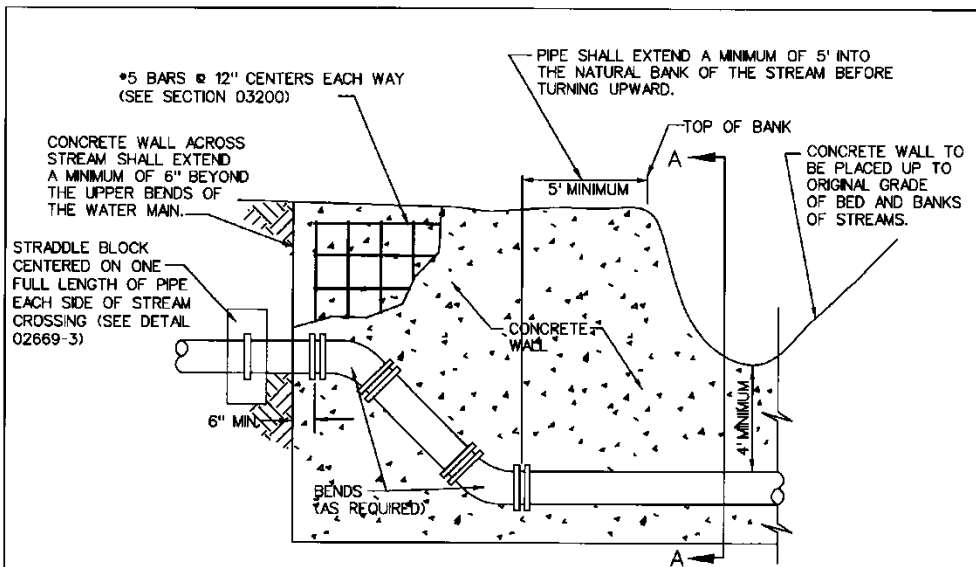
**ABBREVIATIONS**

- H COVER ABOVE TOP OF PIPE
- A DEPTH OF EMBEDMENT BELOW 20" AND SMALLER PIPE (MINIMUM IN SOIL SHALL BE 3"; MINIMUM IN ROCK SHALL BE 6")

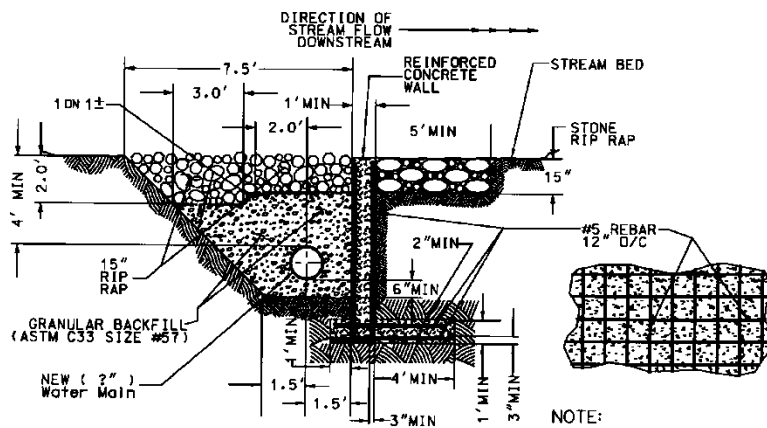
**EMBEDMENT AND BACKFILL FOR ALL PIPES  
REQUIRES CLASS A EMBEDMENT**

WATER SERVICES DEPARTMENT      CITY OF KANSAS CITY, MISSOURI

REVISED: AUGUST, 2016      CONSTRUCTION DETAIL DRAWING NO. 02200-1



PROFILE



NOTE:  
WHERE TRENCH IS LOCATED IN ROCK,  
CONCRETE WALL NEED NOT EXTEND  
BELOW ROCK SURFACE.

SECTION A-A

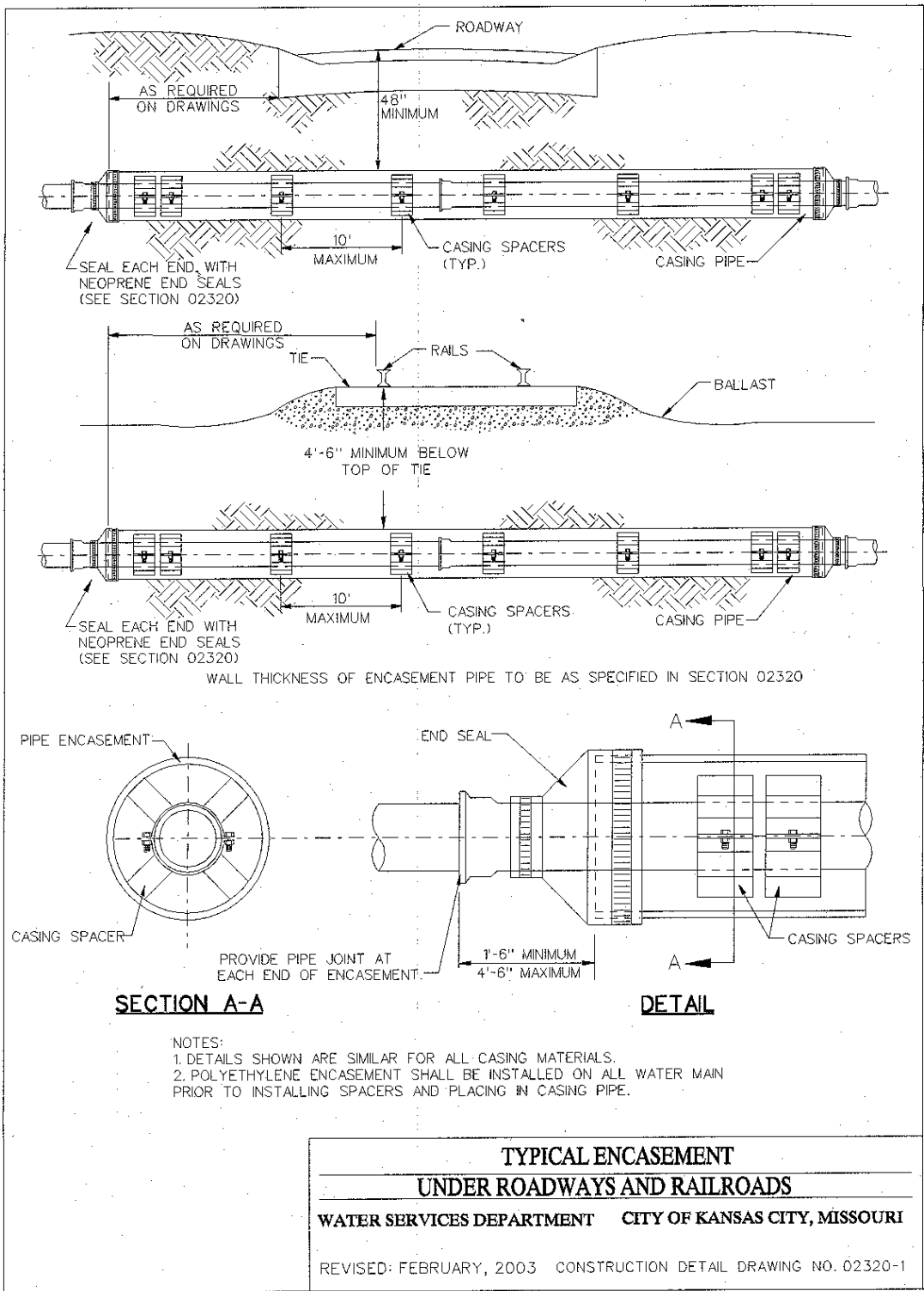
- NOTES:
1. JOINTS SHALL BE RESTRAINED THROUGHOUT.
  2. RIP-RAP ON UPSTREAM SIDE OF CONCRETE WALL SHALL EXTEND ACROSS STREAM BED AND BANKS TO THE END OF THE CONCRETE WALL.

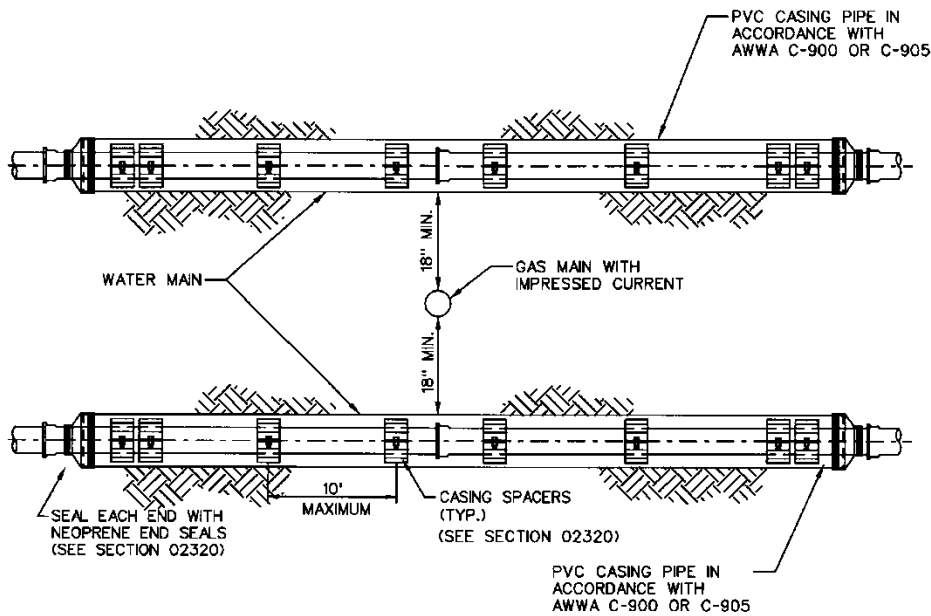
**TYPICAL STREAM CROSSING**

WATER SERVICES DEPARTMENT CITY OF KANSAS CITY, MISSOURI

REVISED: JULY, 2006

CONSTRUCTION DETAIL DRAWING NO. 02200-2





**NOTES:**

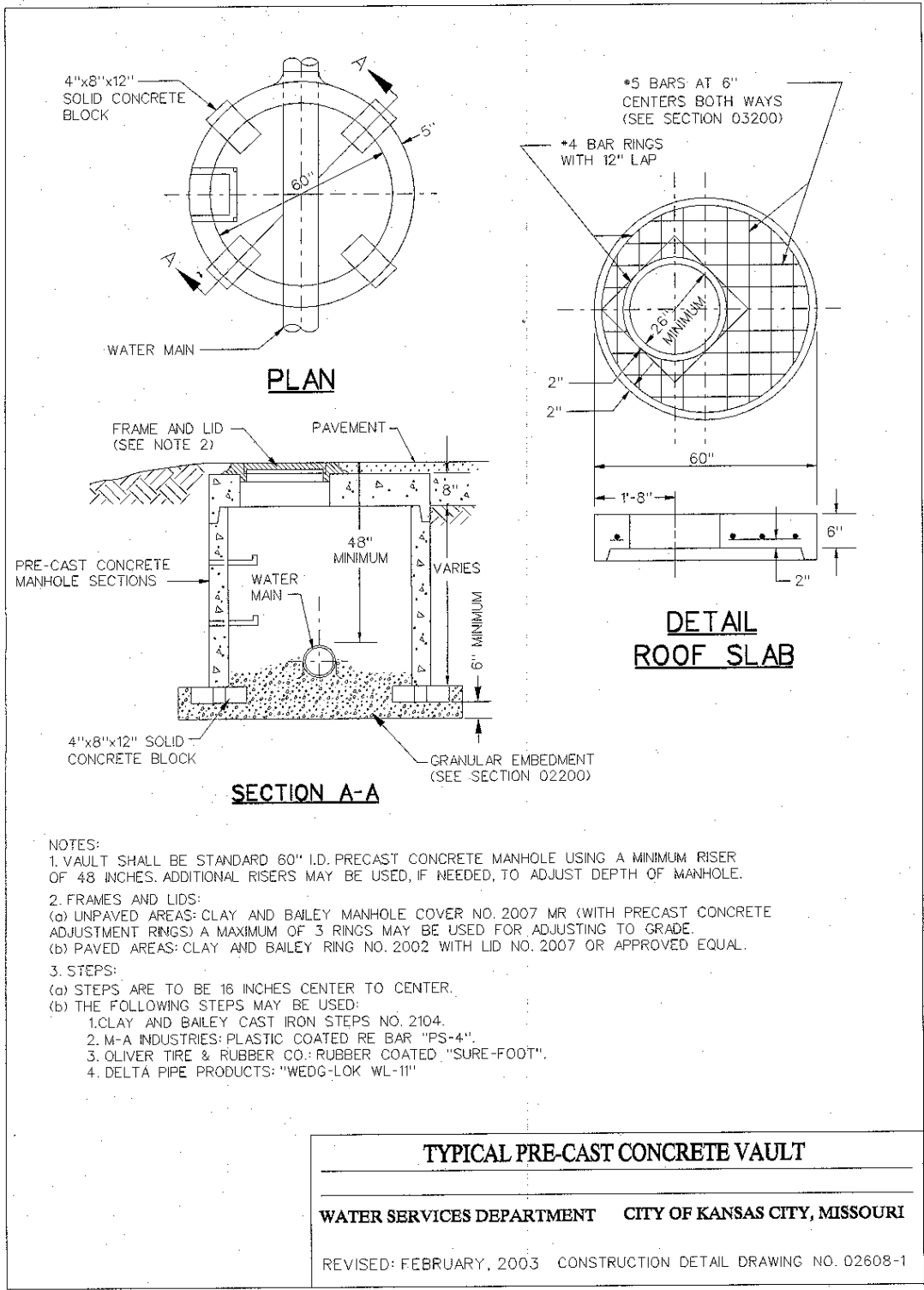
1. INSTALL DOUBLE THICKNESS OF POLYETHYLENE ENCASEMENT ON WATER MAIN MINIMUM 25' EACH SIDE.
2. INSTALL CASING PIPE LENGTH REQUIRED TO EXTEND 10' EACH SIDE OF GAS MAIN.
3. MINIMUM DIAMETER OF CASING PIPE AS SHOWN IN TABLE, SECTION 02320 PART 2.

**GAS MAIN / WATER MAIN CROSSINGS**

WATER SERVICES DEPARTMENT    CITY OF KANSAS CITY, MISSOURI

REVISED: JULY, 2008

CONSTRUCTION DETAIL DRAWING NO. 02320-2



- NOTES:**
1. VAULT SHALL BE STANDARD 60" I.D. PRECAST CONCRETE MANHOLE USING A MINIMUM RISER OF 48 INCHES. ADDITIONAL RISERS MAY BE USED, IF NEEDED, TO ADJUST DEPTH OF MANHOLE.
  2. FRAMES AND LIDS:
    - (a) UNPAVED AREAS: CLAY AND BAILEY MANHOLE COVER NO. 2007 MR (WITH PRECAST CONCRETE ADJUSTMENT RINGS) A MAXIMUM OF 3 RINGS MAY BE USED FOR ADJUSTING TO GRADE.
    - (b) PAVED AREAS: CLAY AND BAILEY RING NO. 2002 WITH LID NO. 2007 OR APPROVED EQUAL.
  3. STEPS:
    - (a) STEPS ARE TO BE 16 INCHES CENTER TO CENTER.
    - (b) THE FOLLOWING STEPS MAY BE USED:
      1. CLAY AND BAILEY CAST IRON STEPS NO. 2104.
      2. M-A INDUSTRIES: PLASTIC COATED RE BAR "PS-4".
      3. OLIVER TIRE & RUBBER CO.: RUBBER COATED "SURE-FOOT".
      4. DELTA PIPE PRODUCTS: "WEDG-LOK WL-11"

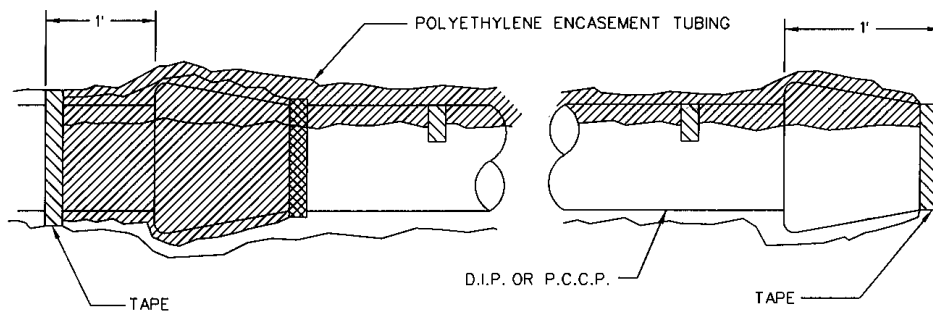
**TYPICAL PRE-CAST CONCRETE VAULT**

---

**WATER SERVICES DEPARTMENT    CITY OF KANSAS CITY, MISSOURI**

---

REVISED: FEBRUARY, 2003    CONSTRUCTION DETAIL DRAWING NO. 02608-1



METHOD A

NOTES

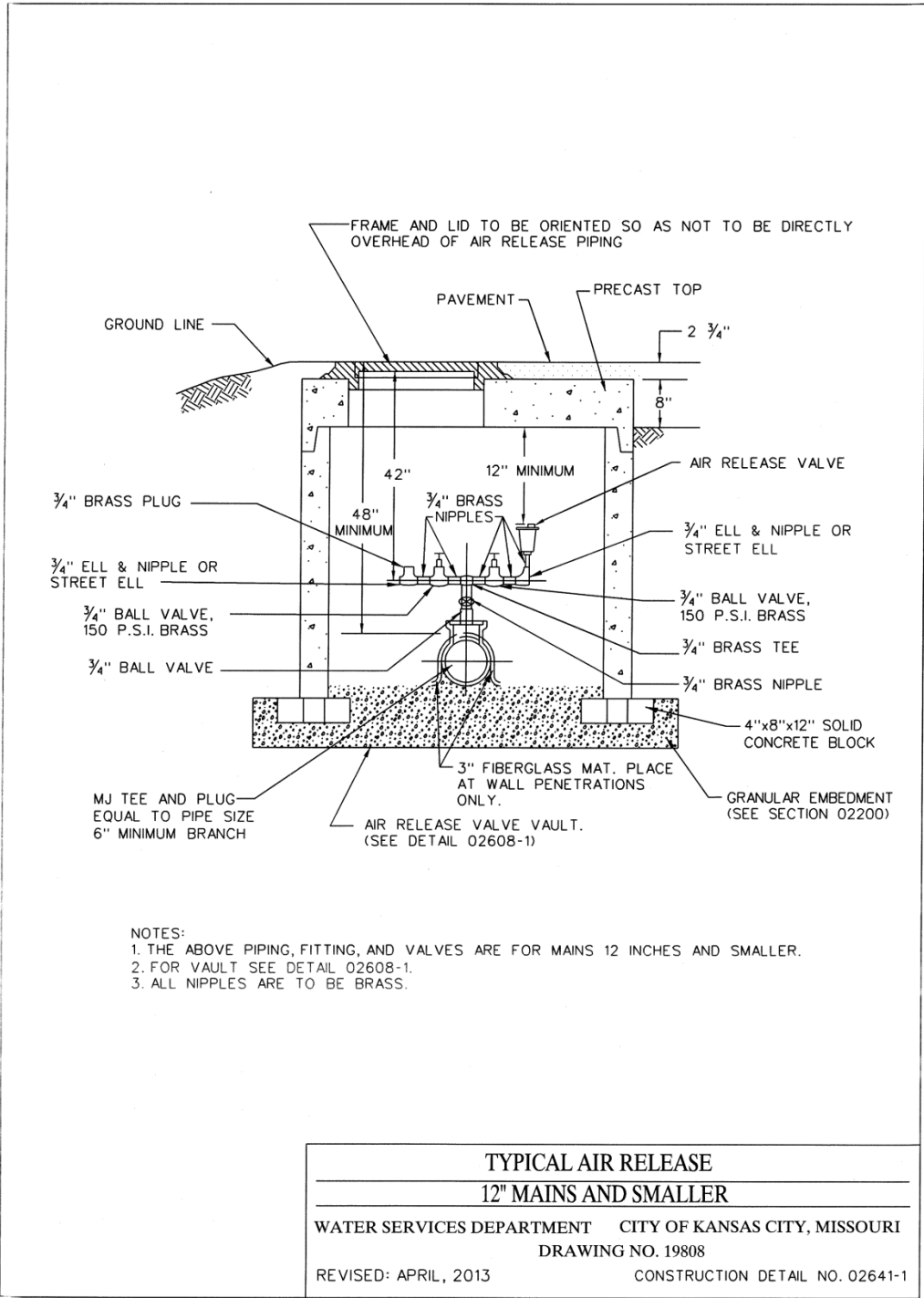
1. TAPE IN ACCORDANCE WITH AWWA C-105

POLYETHYLENE ENCASEMENT FOR BURIED PIPE

WATER SERVICES DEPARTMENT CITY OF KANSAS CITY, MISSOURI

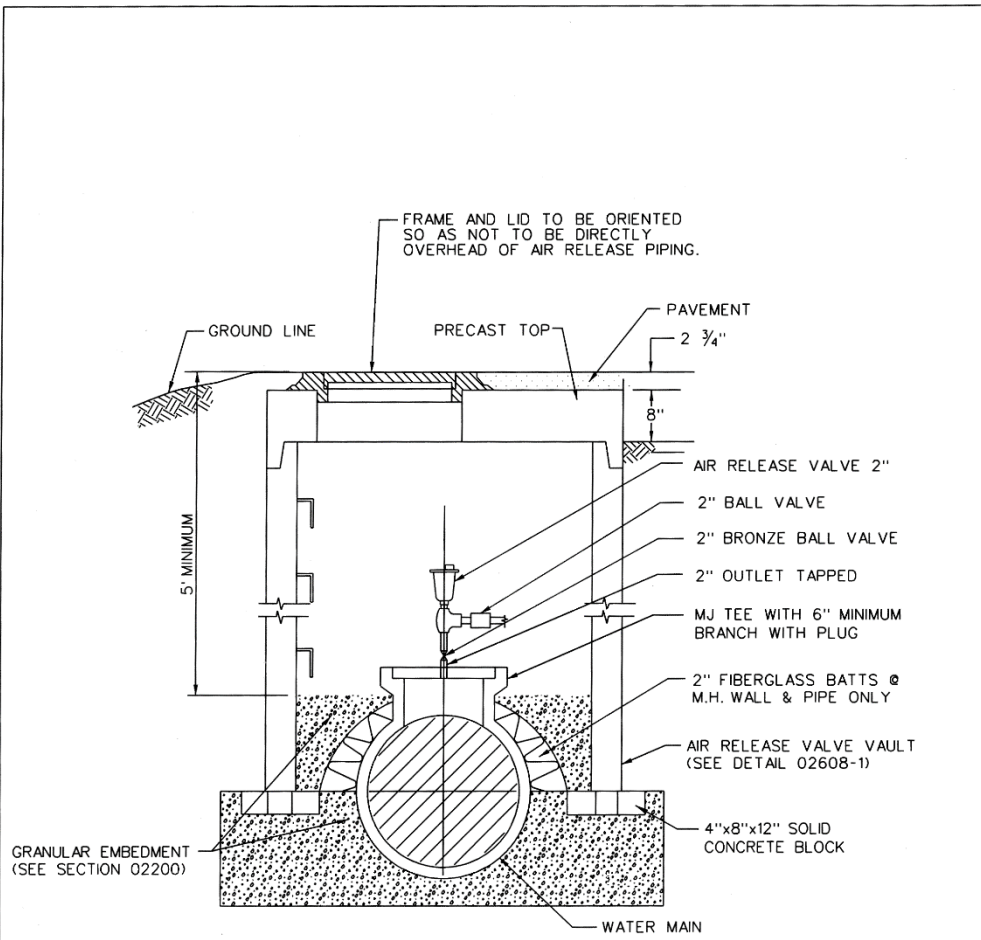
REVISED: APRIL 2014

CONSTRUCTION DETAIL DRAWING NO. 02618-1



WaterWMSStd-airrelease.dgn 5/7/2013 4:25:07 PM





- NOTES:
1. THE ABOVE PIPING, FITTINGS AND VALVES ARE FOR MAINS 16 INCHES AND LARGER.
  2. FOR VAULT SEE DETAIL 02608-1.
  3. ALL NIPPLES ARE TO BE BRASS.

**TYPICAL AIR RELEASE 2" OR SMALLER  
16" MAINS AND LARGER**

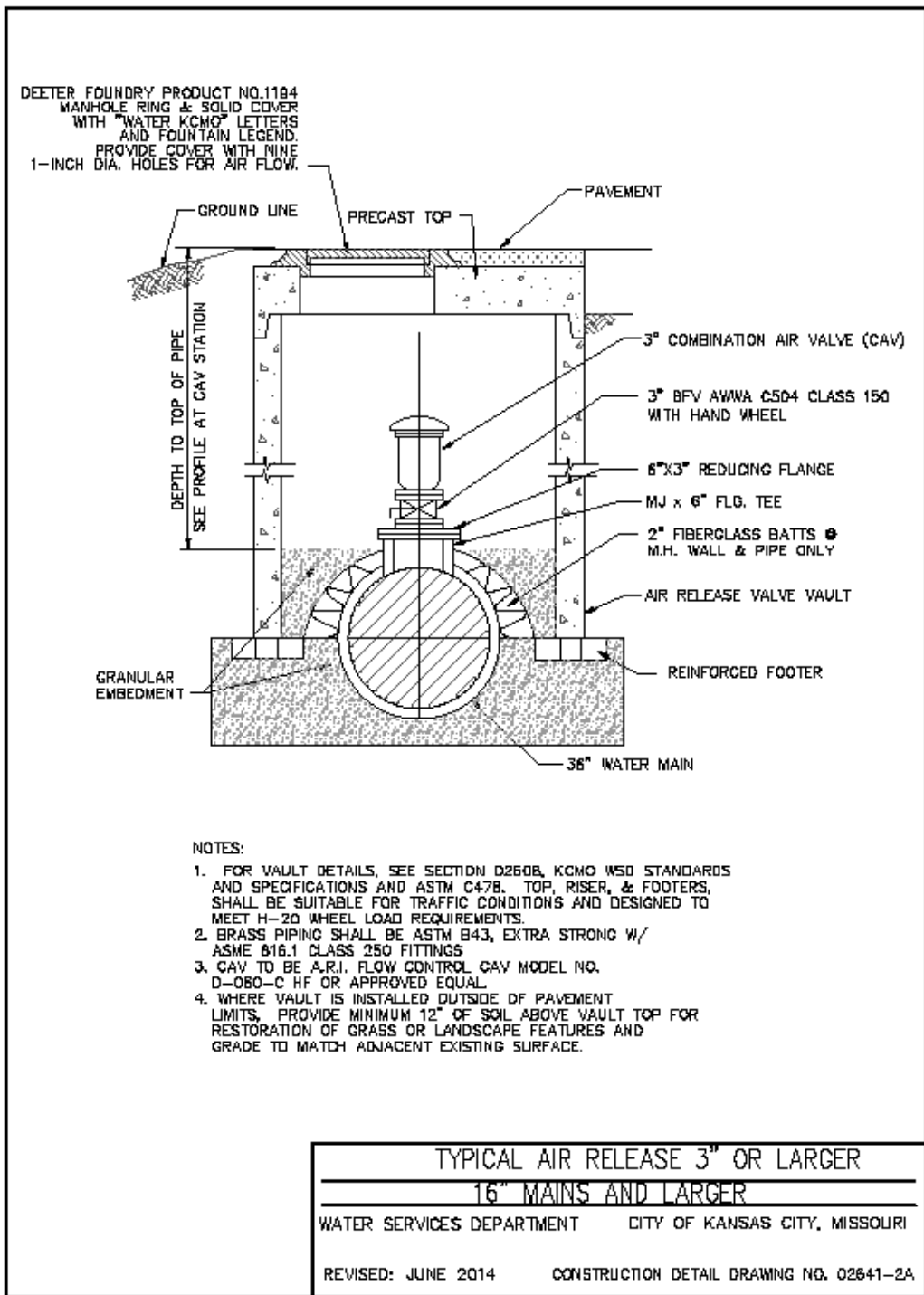
---

WATER SERVICES DEPARTMENT    CITY OF KANSAS CITY, MISSOURI

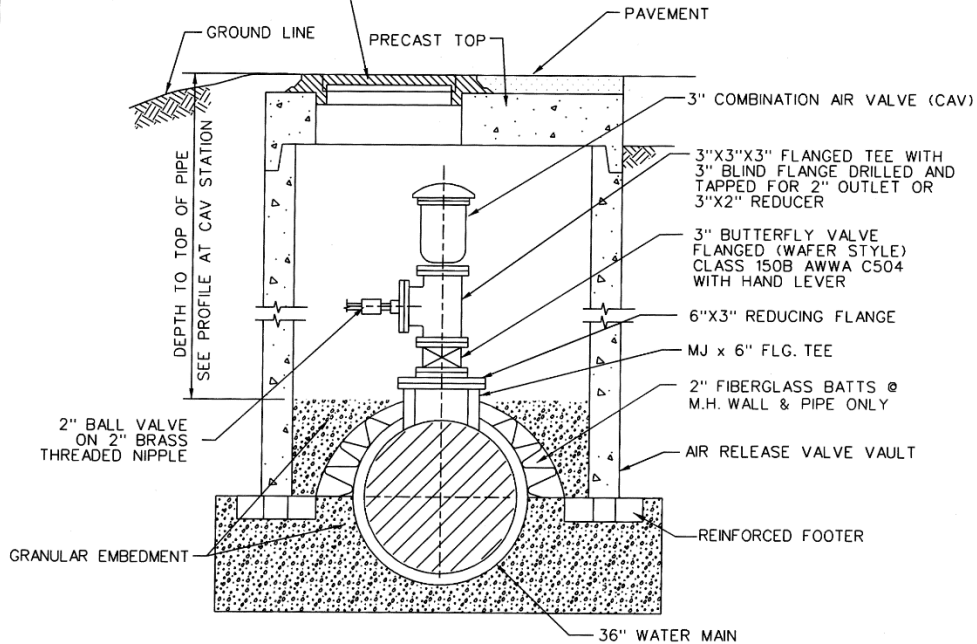
---

REVISED: APRIL, 2013                      CONSTRUCTION DETAIL DRAWING NO. 02641-2

...Air\_Release\_det43013..dgn 5/7/2013 4:27:34 PM



DEETER FOUNDRY PRODUCT NO.1194  
 MANHOLE RING & SOLID COVER  
 WITH "WATER KCMO" LETTERS  
 AND FOUNTAIN LEGEND.  
 PROVIDE COVER WITH NINE  
 1-INCH DIA. HOLES FOR AIR FLOW.



NOTES:

1. FOR VAULT DETAILS, SEE SECTION 02608, KCMO WSD STANDARDS AND SPECIFICATIONS AND ASTM C478. TOP, RISER, & FOOTERS, SHALL BE SUITABLE FOR TRAFFIC CONDITIONS AND DESIGNED TO MEET H-20 WHEEL LOAD REQUIREMENTS.
2. BRASS PIPING SHALL BE ASTM B43, EXTRA STRONG W/ ASME 816.1 CLASS 250 FITTINGS
3. CAV TO BE A.R.I. FLOW CONTROL CAV MODEL NO. D-060-C HF OR APPROVED EQUAL.
4. WHERE VAULT IS INSTALLED OUTSIDE OF PAVEMENT LIMITS, PROVIDE MINIMUM 12" OF SOIL ABOVE VAULT TOP FOR RESTORATION OF GRASS OR LANDSCAPE FEATURES AND GRADE TO MATCH ADJACENT EXISTING SURFACE.

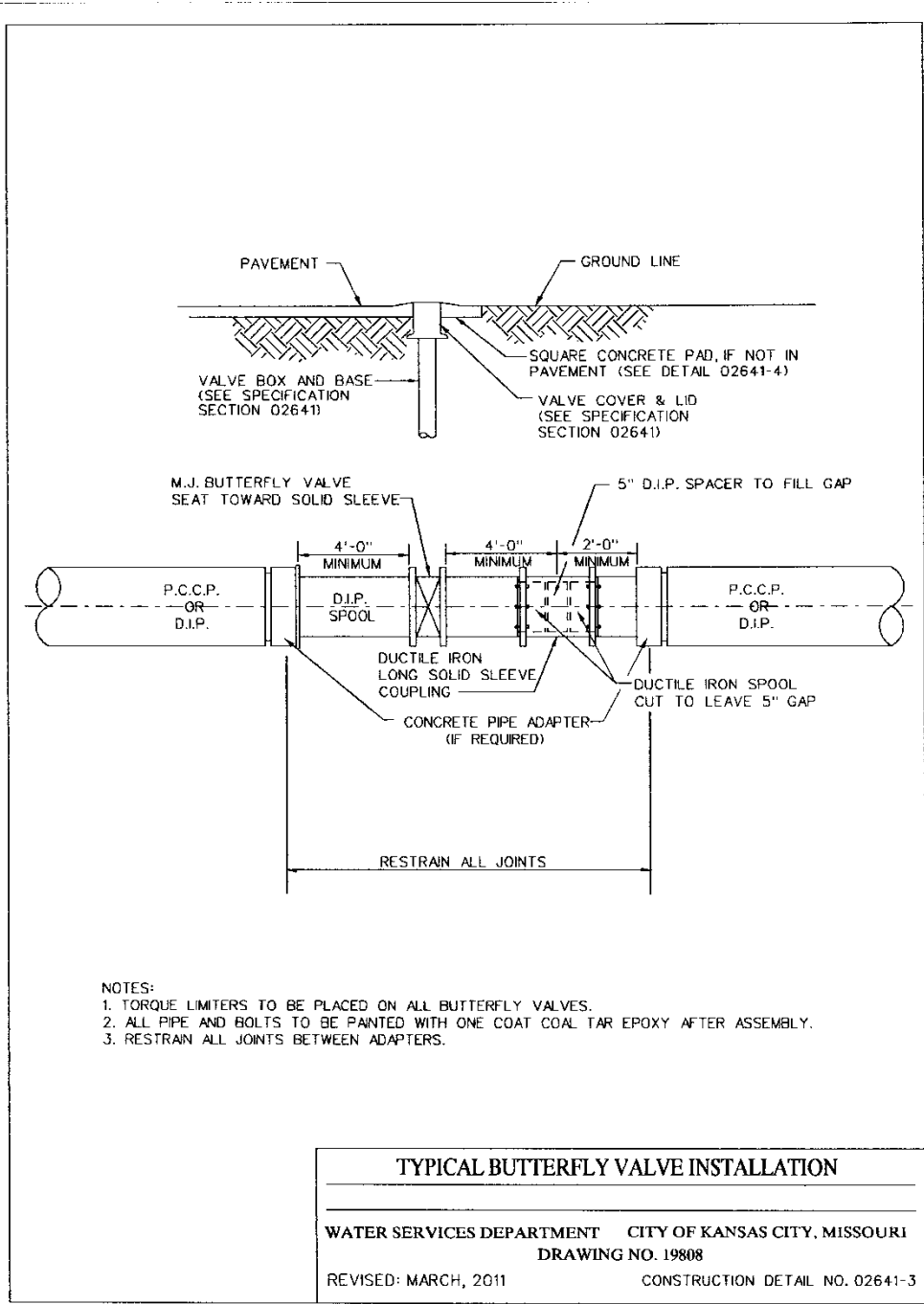
TYPICAL AIR RELEASE 3" OR LARGER  
 16" MAINS AND LARGER

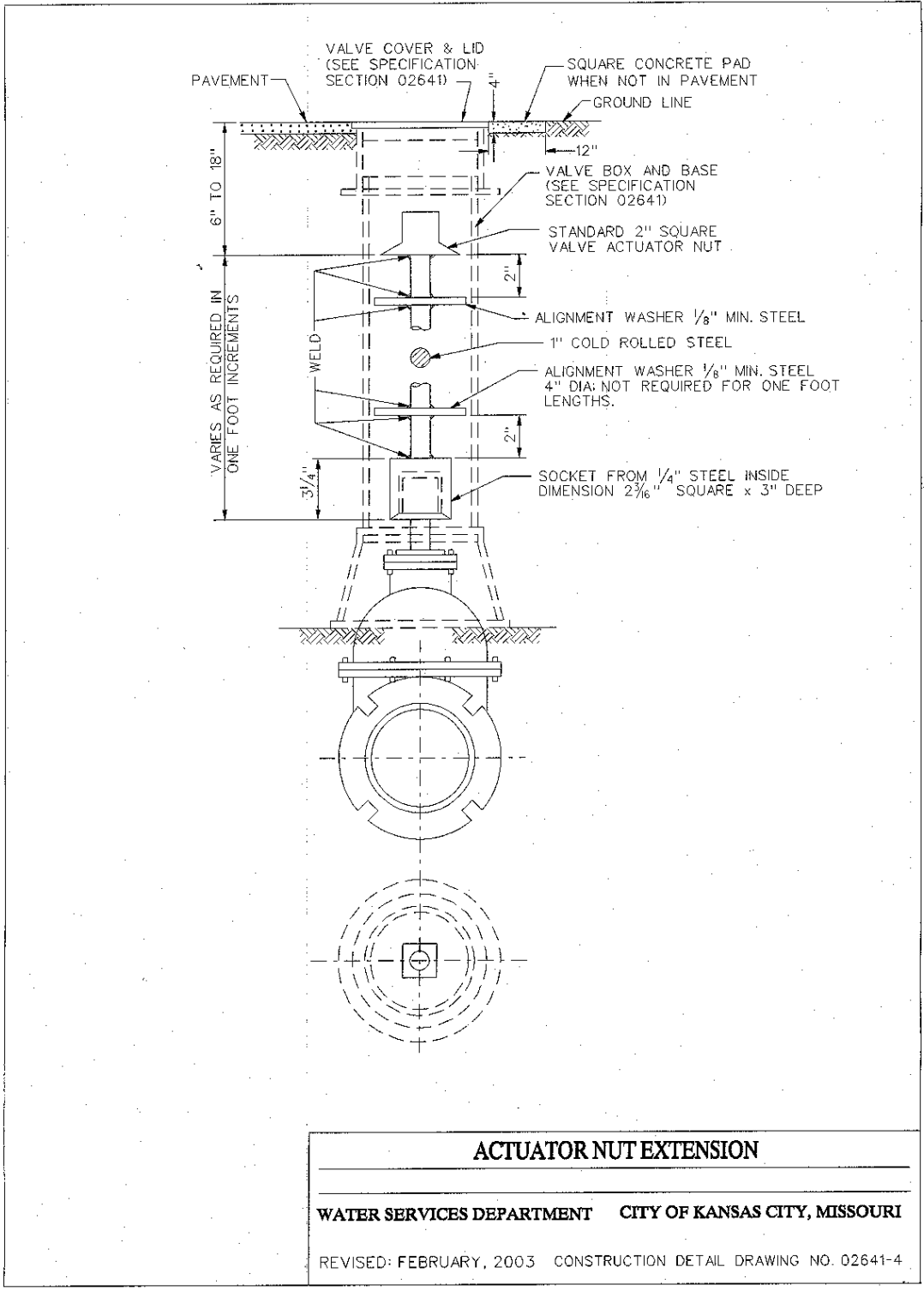
WATER SERVICES DEPARTMENT CITY OF KANSAS CITY, MISSOURI

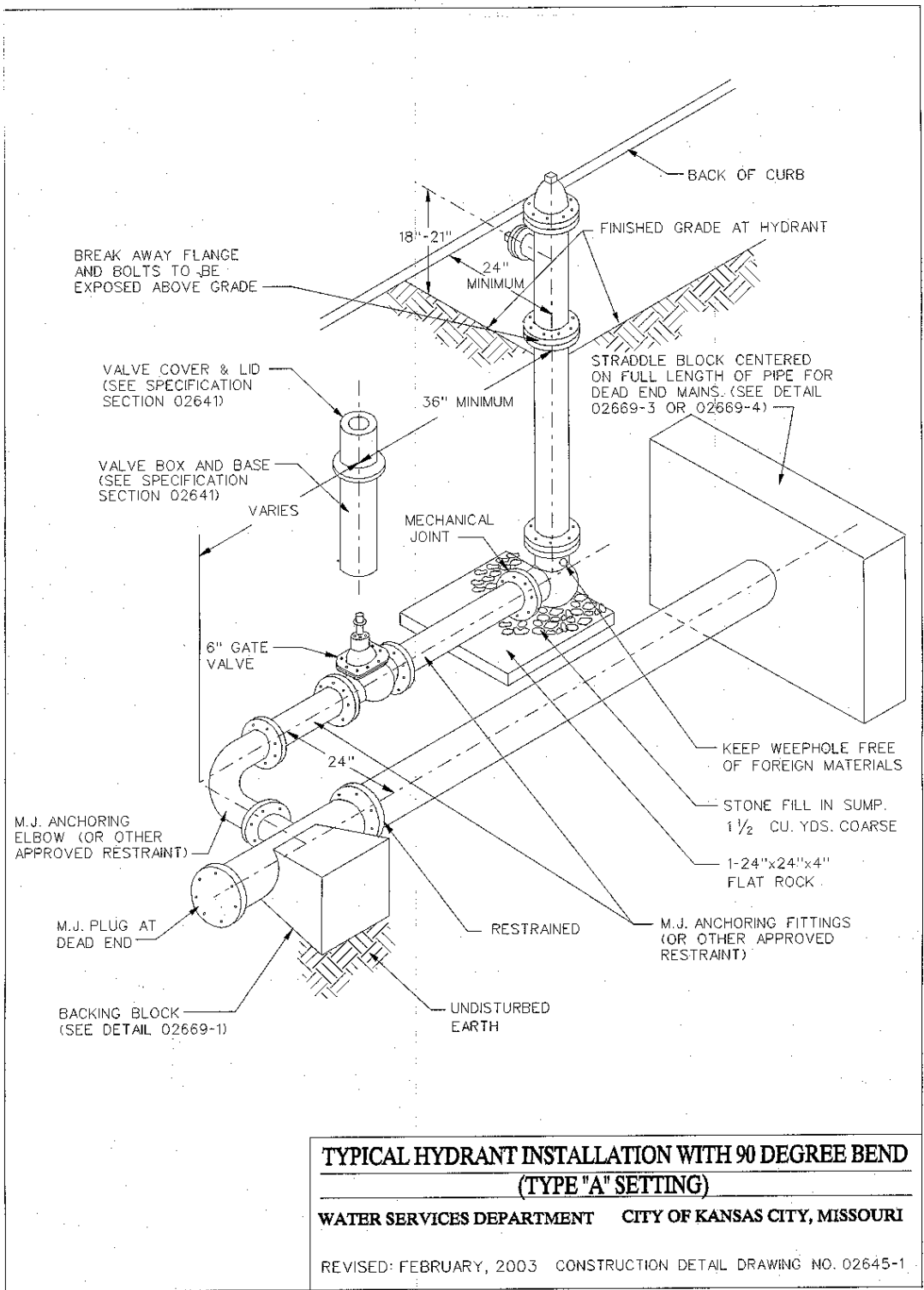
REVISED: APRIL 2013

CONSTRUCTION DETAIL DRAWING NO. 02641-2B

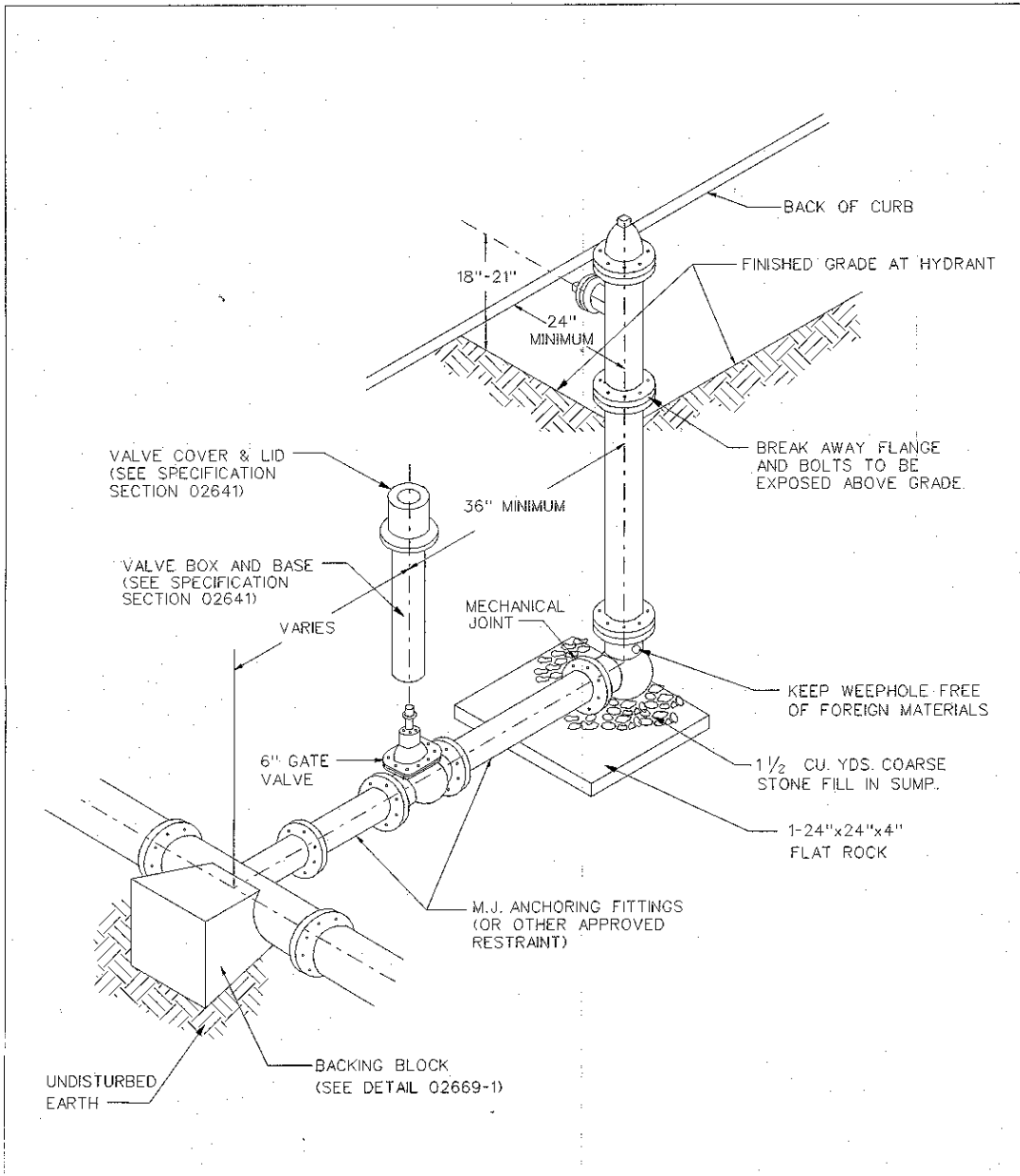
...13-INCH CAV DETAIL Rev42913 dgn 5/7/2013 4:09:27 PM







**TYPICAL HYDRANT INSTALLATION WITH 90 DEGREE BEND**  
**(TYPE "A" SETTING)**  
**WATER SERVICES DEPARTMENT    CITY OF KANSAS CITY, MISSOURI**  
 REVISED: FEBRUARY, 2003    CONSTRUCTION DETAIL DRAWING NO. 02645-1



NOTE:  
 1. VALVE BOX AND BASE CAN BE ONE PIECE, OR TWO PIECES AS SPECIFIED IN SECTION 02641.

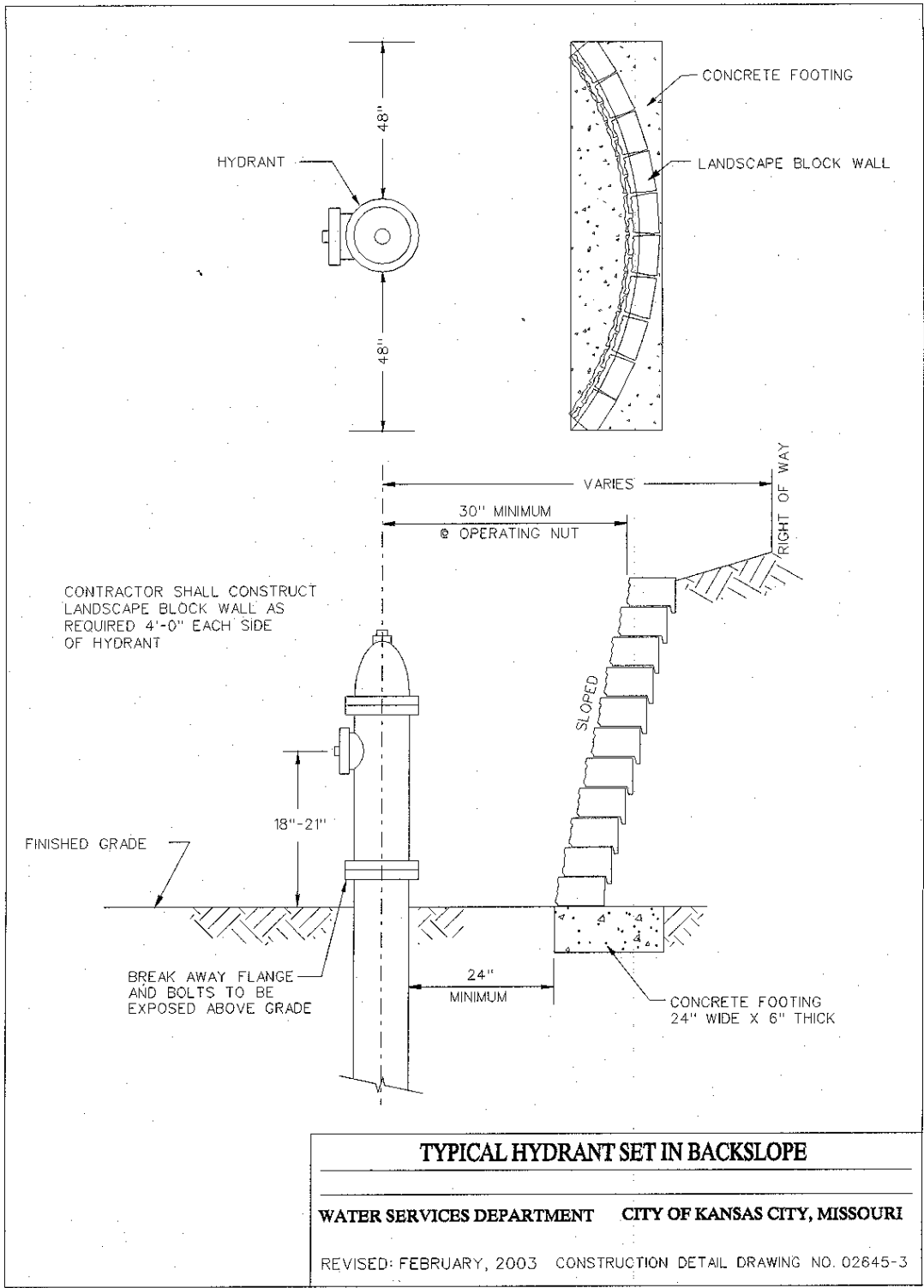
**STRAIGHT SET HYDRANT INSTALLATION**  
**(TYPE "B" SETTING)**

---

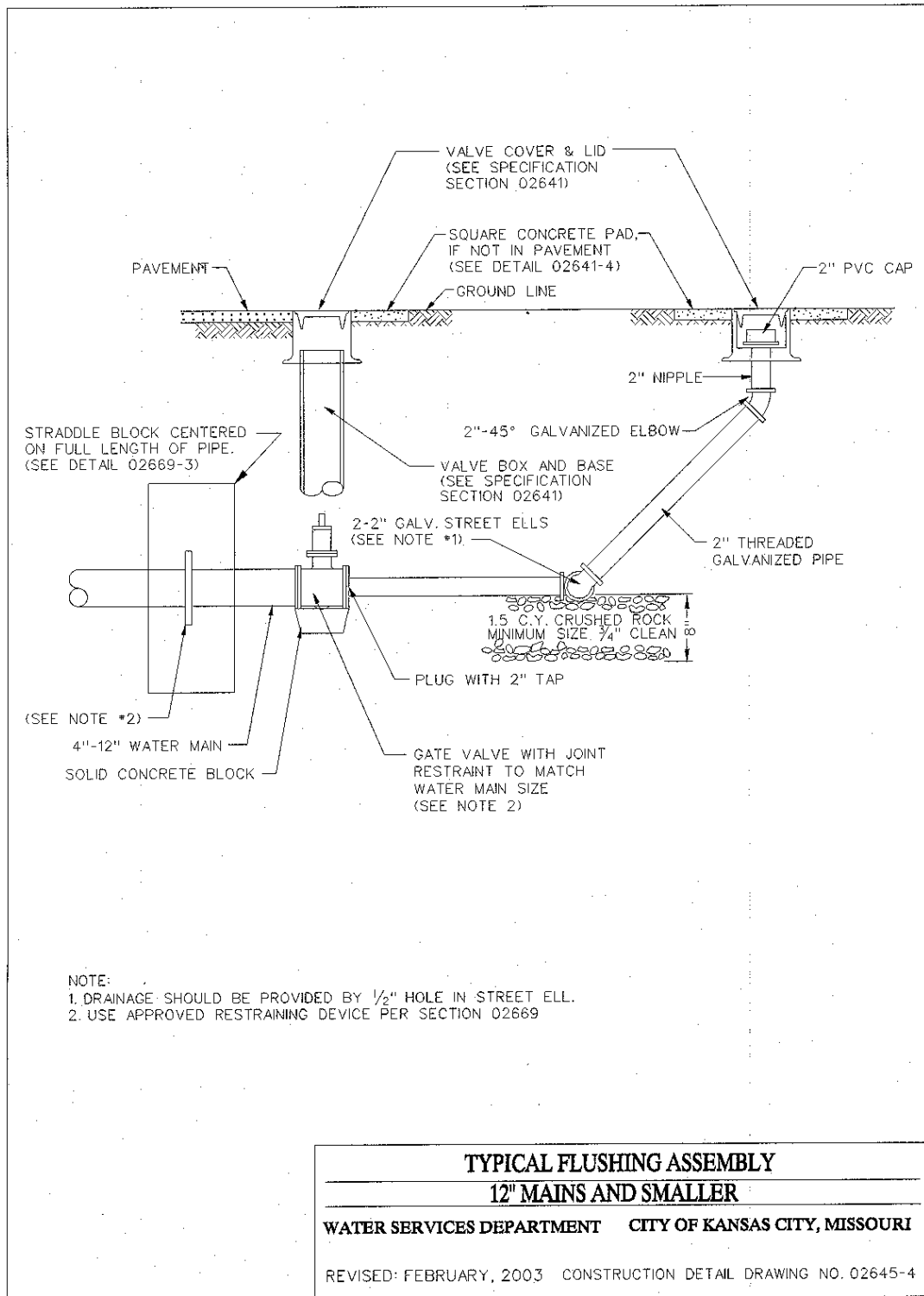
**WATER SERVICES DEPARTMENT    CITY OF KANSAS CITY, MISSOURI**

---

REVISED: FEBRUARY, 2003    CONSTRUCTION DETAIL DRAWING NO. 02645-2





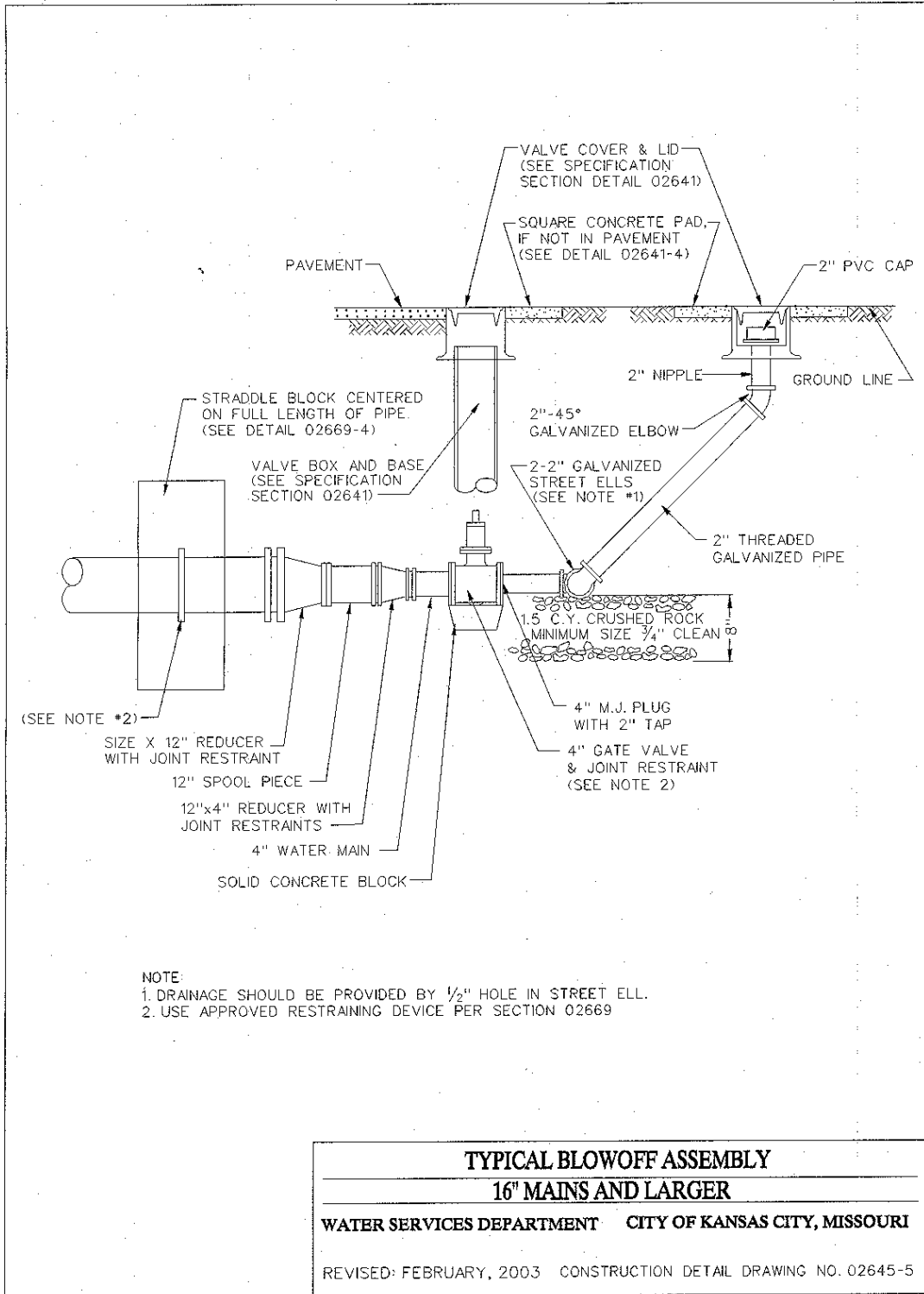


**TYPICAL FLUSHING ASSEMBLY**

**12" MAINS AND SMALLER**

**WATER SERVICES DEPARTMENT CITY OF KANSAS CITY, MISSOURI**

REVISED: FEBRUARY, 2003 CONSTRUCTION DETAIL DRAWING NO. 02645-4

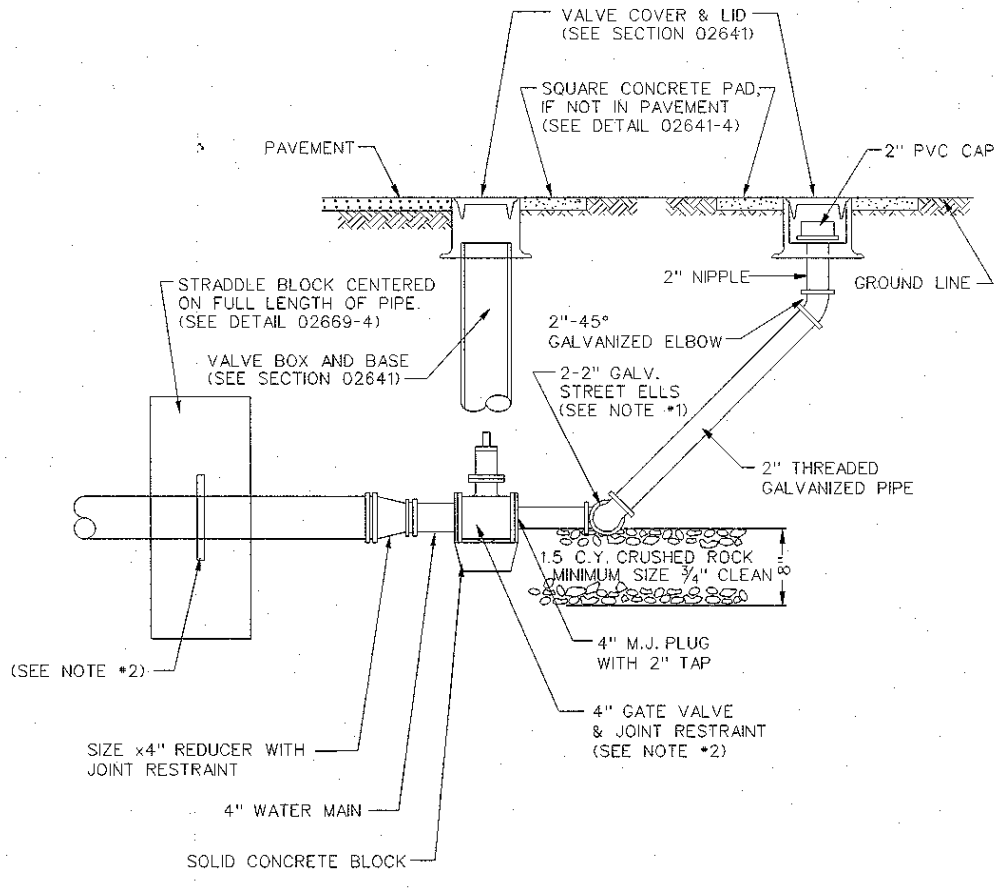


**TYPICAL BLOWOFF ASSEMBLY**

**16" MAINS AND LARGER**

**WATER SERVICES DEPARTMENT CITY OF KANSAS CITY, MISSOURI**

REVISED: FEBRUARY, 2003 CONSTRUCTION DETAIL DRAWING NO. 02645-5



- NOTE:
1. DRAINAGE SHOULD BE PROVIDED BY 1/2" HOLE IN STREET ELL.
  2. USE APPROVED RESTRAINING DEVICE PER SECTION 02669

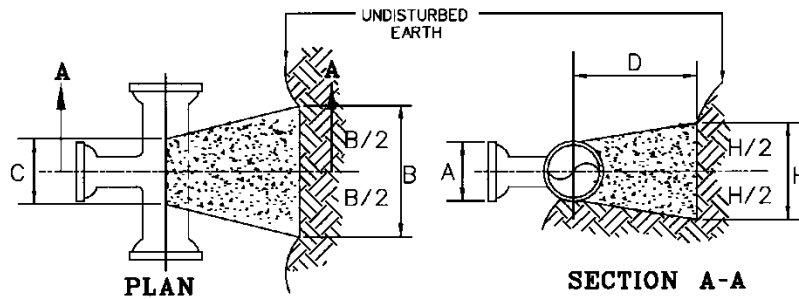
**TYPICAL BLOWOFF ASSEMBLY**  
**12" MAINS AND SMALLER**

---

**WATER SERVICES DEPARTMENT    CITY OF KANSAS CITY, MISSOURI**

---

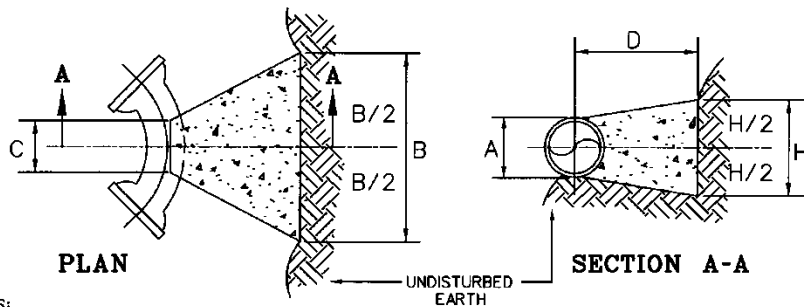
REVISED: FEBRUARY, 2003    CONSTRUCTION DETAIL DRAWING NO. 02645-6



- NOTES:
1. BACKING BLOCKS FOR PIPING SIZES UP THROUGH 12-INCH ARE BASED ON WORKING PRESSURE OF 175 P.S.I. PLUS 50% SURGE.
  2. BACKING BLOCKS FOR PIPING SIZES 16-INCH THROUGH 24-INCH ARE BASED ON A WORKING PRESSURE OF 150 P.S.I. PLUS 50% SURGE.
  3. THE PROJECT DESIGN PROFESSIONAL IS RESPONSIBLE FOR THE DESIGN OF THRUST BLOCKS. THE BLOCK SIZES SPECIFIED HEREIN ARE MINIMUM SIZES, BASED ON SOIL RESISTANCE OF 2,000 POUNDS PER SQUARE FOOT. WHERE SOFTER SOILS MAY BE ENCOUNTERED, THE PROJECT DESIGN PROFESSIONAL MUST PROVIDE A DESIGN FOR REVIEW BY THE DEPARTMENT.
  4. SEE SECTION 03001 FOR CONCRETE SPECIFICATIONS.
  5. CONSTRUCT FORMS IN ACCORDANCE WITH SECTION 03100.

BRANCH OR PLUG SIZE A	B (in.)	C (in.)	D (in.)	H (in.)	REQUIRED BEARING AREA (SQ.FT.)	ESTIMATED CONCRETE REQ. CYD.
6"	46	6	20	24	7.4	0.24
8"	60	8	26	32	13.2	0.55
12"	114	12	51	38	29.7	2.45
16"	126	16	55	52	45.2	4.00
20"	140	20	60	72	70.7	6.74
24"	184	24	80	80	101.8	13.00
30"	230	30	100	100	159.0	25.61

**TYPICAL BACKING BLOCKS FOR TEES AND PLUGS**  
**2,000 POUNDS PER SQUARE FOOT SOIL RESISTANCE**  
 WATER SERVICES DEPARTMENT    CITY OF KANSAS CITY, MISSOURI  
 REVISED: July, 2006                      CONSTRUCTION DETAIL DRAWING NO. 02669-1



**NOTES:**

1. BACKING BLOCKS FOR PIPING SIZES UP THROUGH 12-INCH ARE BASED ON WORKING PRESSURE OF 175 P.S.I. PLUS 50% SURGE.
2. BACKING BLOCKS FOR PIPING SIZES 16-INCH THROUGH 24-INCH ARE BASED ON A WORKING PRESSURE OF 150 P.S.I. PLUS 50% SURGE.
3. THE PROJECT DESIGN PROFESSIONAL IS RESPONSIBLE FOR THE DESIGN OF THRUST BLOCKS. THE BLOCK SIZES SPECIFIED HEREIN ARE MINIMUM SIZES, BASED ON SOIL RESISTANCE OF 2,000 POUNDS PER SQUARE FOOT. WHERE SOFTER SOILS MAY BE ENCOUNTERED, THE PROJECT DESIGN PROFESSIONAL MUST PROVIDE A DESIGN FOR REVIEW BY THE DEPARTMENT.
4. SEE SECTION 03001 FOR CONCRETE SPECIFICATIONS.
5. CONSTRUCT FORMS IN ACCORDANCE WITH SECTION 03100.

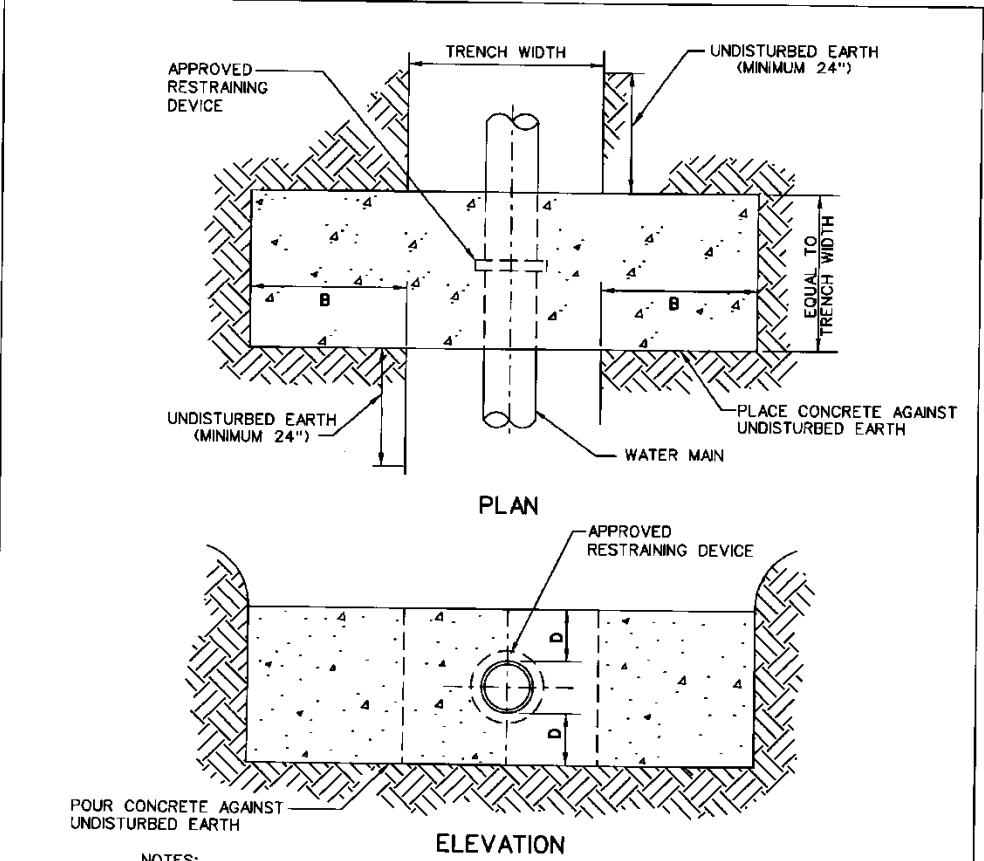
1 1/4 DEGREE BENDS							22 1/2 DEGREE BENDS						
PIPE SIZE A	B (in.)	C (in.)	D (in.)	H (in.)	REQUIRED BEARING AREA (SQ.FT.)	ESTIMATED CONCRETE REQ. CYD.	PIPE SIZE A	B (in.)	C (in.)	D (in.)	H (in.)	REQUIRED BEARING AREA (SQ.FT.)	ESTIMATED CONCRETE REQ. CYD.
6"	18	6	12	12	1.5	0.03	6"	28	6	12	16	2.9	0.06
8"	28	8	12	14	2.6	0.06	8"	34	8	13	22	5.1	0.11
12"	38	12	13	22	5.8	0.14	12"	56	12	22	30	11.6	0.43
16"	50	16	17	26	8.9	0.28	16"	72	16	28	36	17.7	0.85
20"	64	20	22	32	13.9	0.58	20"	86	20	33	46	27.6	1.54
24"	76	24	26	38	20.0	0.97	24"	106	24	41	54	39.7	2.77
30"	95	30	33	48	31.2	1.90	30"	136	30	53	66	62.1	5.60

45 DEGREE BENDS							90 DEGREE BENDS						
PIPE SIZE A	B (in.)	C (in.)	D (in.)	H (in.)	REQUIRED BEARING AREA (SQ.FT.)	ESTIMATED CONCRETE REQ. CYD.	PIPE SIZE A	B (in.)	C (in.)	D (in.)	H (in.)	REQUIRED BEARING AREA (SQ.FT.)	ESTIMATED CONCRETE REQ. CYD.
6"	38	6	16	22	5.7	0.15	6"	60	6	27	26	10.5	0.46
8"	54	8	23	28	10.1	0.39	8"	84	8	38	32	18.7	1.12
12"	82	12	35	40	22.7	1.28	12"	126	12	57	44	42.0	3.47
16"	100	16	42	50	34.6	2.37	16"	160	16	72	58	64.0	7.36
20"	130	20	55	60	54.1	4.83	20"	200	20	90	72	100.0	14.27
24"	152	24	64	74	77.9	8.10	24"	242	24	109	86	143.9	24.98
30"	196	30	83	90	121.7	16.49	30"	324	30	147	100	224.9	52.46

**TYPICAL BACKING BLOCKS FOR HORIZONTAL BENDS**  
**2,000 POUNDS PER SQUARE FOOT SOIL RESISTANCE**

WATER SERVICES DEPARTMENT    CITY OF KANSAS CITY, MISSOURI

REVISED: JULY, 2006                      CONSTRUCTION DETAIL DRAWING NO. 02669-2



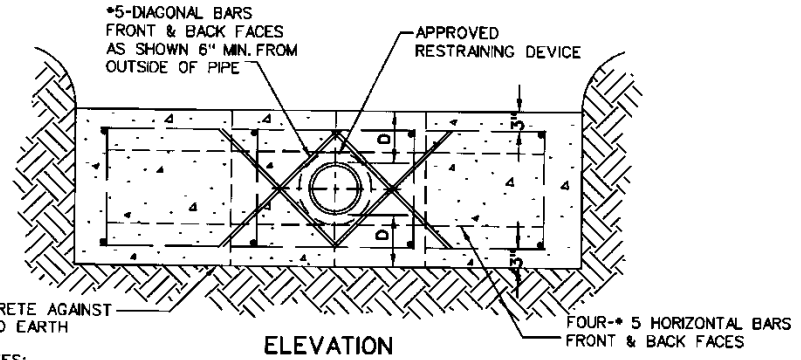
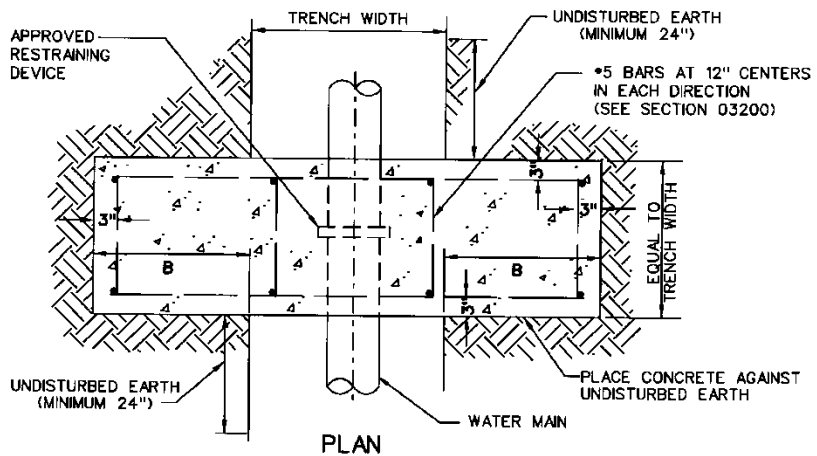
- NOTES:
1. STRADDLE BLOCKS ARE SIZED FOR 175 P.S.I. LINE PRESSURE 50% SURGE.
  2. THE PROJECT DESIGN PROFESSIONAL IS RESPONSIBLE FOR DESIGN OF STRADDLE BLOCKS. THE SIZES SPECIFIED HEREIN ARE MINIMUM SIZES BASED ON SOIL RESISTANCE OF 2,000 POUNDS PER SQUARE FOOT. WHERE SOFTER SOILS MAY BE ENCOUNTERED, THE PROJECT DESIGN PROFESSIONAL MUST PROVIDE A DESIGN FOR REVIEW BY THE DEPARTMENT.
  3. SEE SECTION 03001 FOR CONCRETE SPECIFICATIONS.
  4. CONSTRUCT FORMS IN ACCORDANCE WITH SECTION 03100.

PIPE SIZE	TRENCH WIDTH (in.)	B (in.)	D (in.)	REQUIRED BEARING AREA (SQ. FT.)	ESTIMATED CONCRETE REQ. CYD.
6"	30	24	9	7.4	0.9
8"	32	30	12	13.2	1.5

**TYPICAL STRADDLE BLOCK FOR 6 AND 8 INCH PIPE**  
**2,000 POUNDS PER SQUARE FOOT SOIL RESISTANCE**

WATER SERVICES DEPARTMENT    CITY OF KANSAS CITY, MISSOURI

REVISED: JULY, 2006                      CONSTRUCTION DETAIL DRAWING NO. 02669-3



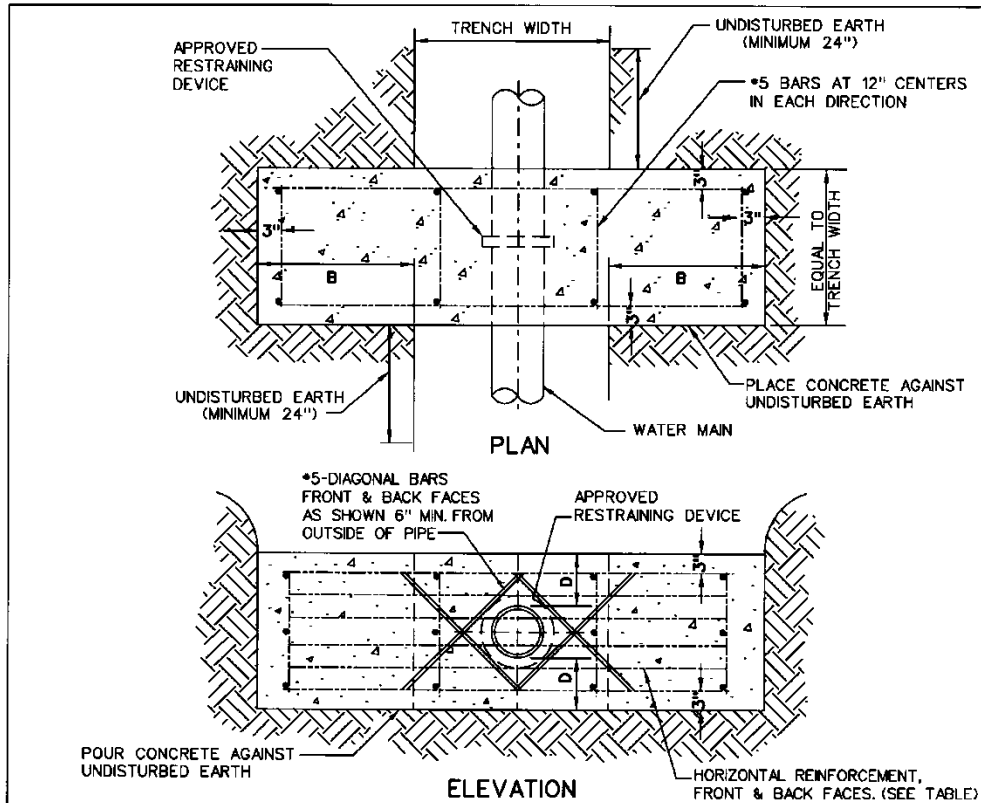
- NOTES:
1. STRADDLE BLOCKS 12" ARE SIZED FOR 175 P.S.I., AND 16" & LARGER ARE SIZED FOR 150 P.S.I. LINE PRESSURE 50% SURGE.
  2. THE PROJECT DESIGN PROFESSIONAL IS RESPONSIBLE FOR DESIGN OF STRADDLE BLOCKS. THE SIZES SPECIFIED HEREIN ARE MINIMUM SIZES BASED ON SOIL RESISTANCE OF 2,000 POUNDS PER SQUARE FOOT. WHERE SOFTER SOILS MAY BE ENCOUNTERED, THE PROJECT DESIGN PROFESSIONAL MUST PROVIDE A DESIGN FOR REVIEW BY THE DEPARTMENT.
  3. SEE SECTION 03001 FOR CONCRETE SPECIFICATIONS.
  4. CONSTRUCT FORMS IN ACCORDANCE WITH SECTION 03100.

PIPE SIZE	TRENCH WIDTH (in.)	B (in.)	D (in.)	REQUIRED BEARING AREA (SQ. FT.)	ESTIMATED CONCRETE REQ. CYD.
12"	34	51	15	29.7	4.1
16"	40	48	26	45.2	7.8

**TYPICAL STRADDLE BLOCK FOR 12 & 16 INCH PIPE**  
**2,000 POUNDS PER SQUARE FOOT SOIL RESISTANCE**

WATER SERVICES DEPARTMENT    CITY OF KANSAS CITY, MISSOURI

REVISED: JULY, 2006                      CONSTRUCTION DETAIL DRAWING NO. 02669-4



- NOTES:
1. STRADDLE BLOCKS ARE SIZED FOR 150 P.S.I. LINE PRESSURE 50% SURGE.
  2. THE PROJECT DESIGN PROFESSIONAL IS RESPONSIBLE FOR DESIGN OF STRADDLE BLOCKS. THE SIZES SPECIFIED HEREIN ARE MINIMUM SIZES BASED ON SOIL RESISTANCE OF 2,000 POUNDS PER SQUARE FOOT. WHERE SOFTER SOILS MAY BE ENCOUNTERED, THE PROJECT DESIGN PROFESSIONAL MUST PROVIDE A DESIGN FOR REVIEW BY THE DEPARTMENT.
  3. SEE SECTION 03001 FOR CONCRETE SPECIFICATIONS.
  4. CONSTRUCT FORMS IN ACCORDANCE WITH SECTION 03100.

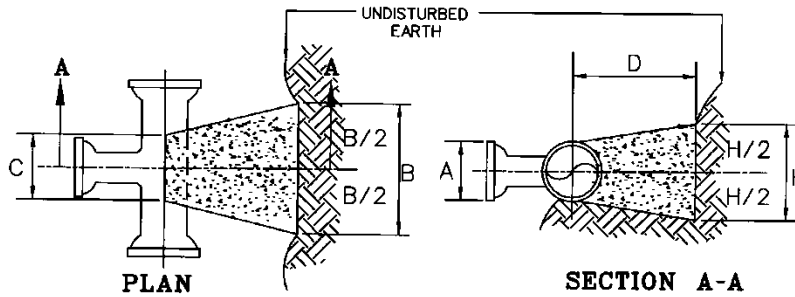
PIPE SIZE	BAR SIZE	NO. OF BARS (each face)	TRENCH WIDTH (in.)	B (in.)	D (in.)	REQUIRED BEARING AREA (SQ. FT.)	ESTIMATED CONCRETE REQ. CYD.
20"	*5	5	44	71	26	70.7	12.3
24"	*6	6	48	92	28	101.8	18.6
30"	*7	6	60	115	35	159.0	36.4

**TYPICAL STRADDLE BLOCK FOR 20, 24, & 30 INCH PIPE**  
**2,000 POUNDS PER SQUARE FOOT SOIL RESISTANCE**

WATER SERVICES DEPARTMENT    CITY OF KANSAS CITY, MISSOURI

REVISED: JULY, 2006                      CONSTRUCTION DETAIL DRAWING NO. 02669-5





- NOTES:
1. BACKING BLOCKS FOR PIPING SIZES UP THROUGH 12-INCH ARE BASED ON WORKING PRESSURE OF 175 P.S.I. PLUS 50% SURGE.
  2. BACKING BLOCKS FOR PIPING SIZES 16-INCH THROUGH 24-INCH ARE BASED ON A WORKING PRESSURE OF 150 P.S.I. PLUS 50% SURGE.
  3. THE PROJECT DESIGN PROFESSIONAL IS RESPONSIBLE FOR THE DESIGN OF THRUST BLOCKS. THE BLOCK SIZES SPECIFIED HEREIN ARE MINIMUM SIZES, BASED ON SOIL RESISTANCE OF 2,500 POUNDS PER SQUARE FOOT. WHERE SOFTER SOILS MAY BE ENCOUNTERED, THE PROJECT DESIGN PROFESSIONAL MUST PROVIDE A DESIGN FOR REVIEW BY THE DEPARTMENT.
  4. SEE SECTION 03001 FOR CONCRETE SPECIFICATIONS.
  5. CONSTRUCT FORMS IN ACCORDANCE WITH SECTION 03100.

BRANCH OR PLUG SIZE A	B (in.)	C (in.)	D (in.)	H (in.)	REQUIRED BEARING AREA (SQ.FT.)	ESTIMATED CONCRETE REQ. CYD.
6"	48	6	21	18	5.9	0.20
8"	60	8	26	26	10.6	0.45
12"	96	12	42	36	23.8	1.62
16"	110	16	47	48	36.2	2.79
20"	140	20	60	60	56.5	5.76
24"	180	24	78	66	81.4	10.41
30"	220	30	95	84	127.2	19.73

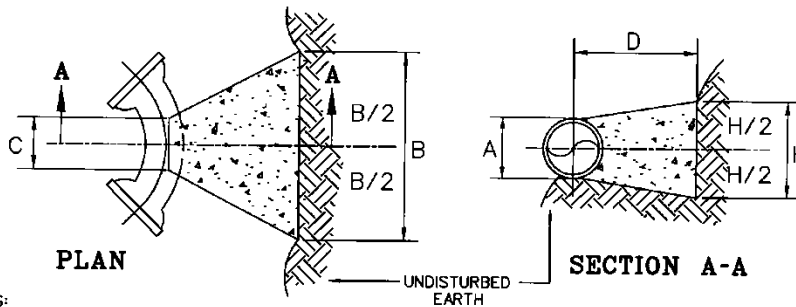
This detail to be used only if specified by project design professional on Approved for Construction drawings.

**ALTERNATE BACKING BLOCKS FOR TEES AND PLUGS**  
**2,500 POUNDS PER SQUARE FOOT SOIL RESISTANCE**

WATER SERVICES DEPARTMENT CITY OF KANSAS CITY, MISSOURI

REVISED: July, 2006

CONSTRUCTION DETAIL DRAWING NO. 02669-6



**NOTES:**

1. BACKING BLOCKS FOR PIPING SIZES UP THROUGH 12-INCH ARE BASED ON WORKING PRESSURE OF 175 P.S.I. PLUS 50% SURGE.
2. BACKING BLOCKS FOR PIPING SIZES 16-INCH THROUGH 24-INCH ARE BASED ON A WORKING PRESSURE OF 150 P.S.I. PLUS 50% SURGE.
3. THE PROJECT DESIGN PROFESSIONAL IS RESPONSIBLE FOR THE DESIGN OF THRUST BLOCKS. THE BLOCK SIZES SPECIFIED HEREIN ARE MINIMUM SIZES, BASED ON SOIL RESISTANCE OF 2,500 POUNDS PER SQUARE FOOT. WHERE SOFTER SOILS MAY BE ENCOUNTERED, THE PROJECT DESIGN PROFESSIONAL MUST PROVIDE A DESIGN FOR REVIEW BY THE DEPARTMENT.
4. SEE SECTION 03001 FOR CONCRETE SPECIFICATIONS.
5. CONSTRUCT FORMS IN ACCORDANCE WITH SECTION 03100.

11¼ DEGREE BENDS						
PIPE SIZE A	B (in.)	C (in.)	D (in.)	H (in.)	REQUIRED BEARING AREA (SQ.FT.)	ESTIMATED CONCRETE REQ. CYD.
6"	18	6	12	12	1.5	0.032
8"	28	8	12	14	2.6	0.059
12"	36	12	12	20	5.8	0.100
16"	40	16	12	26	8.9	0.167
20"	56	20	18	30	13.9	0.401
24"	64	24	20	36	20.0	0.617
30"	90	30	30	40	31.2	1.447

22½ DEGREE BENDS						
PIPE SIZE A	B (in.)	C (in.)	D (in.)	H (in.)	REQUIRED BEARING AREA (SQ.FT.)	ESTIMATED CONCRETE REQ. CYD.
6"	24	6	12	16	2.3	0.050
8"	28	8	12	20	4.1	0.091
12"	46	12	19	28	9.3	0.341
16"	78	16	24	32	14.1	0.593
20"	86	20	35	36	22.1	1.365
24"	96	24	36	48	31.8	2.000
30"	142	30	52	54	49.6	4.534

45 DEGREE BENDS						
PIPE SIZE A	B (in.)	C (in.)	D (in.)	H (in.)	REQUIRED BEARING AREA (SQ.FT.)	ESTIMATED CONCRETE REQ. CYD.
6"	34	6	14	20	4.5	0.11
8"	46	8	19	26	8.1	0.26
12"	80	12	34	34	18.2	1.00
16"	100	16	42	40	27.7	1.90
20"	116	20	48	54	43.3	3.40
24"	150	24	63	60	62.3	6.50
30"	168	30	69	84	97.4	11.10

90 DEGREE BENDS						
PIPE SIZE A	B (in.)	C (in.)	D (in.)	H (in.)	REQUIRED BEARING AREA (SQ.FT.)	ESTIMATED CONCRETE REQ. CYD.
6"	52	6	23	24	8.4	0.32
8"	78	8	35	28	14.9	0.84
12"	122	12	55	40	33.6	3.00
16"	144	16	64	52	51.2	5.30
20"	180	20	80	64	80.0	10.20
24"	208	24	92	80	115.2	17.00
30"	288	30	129	90	179.9	37.10

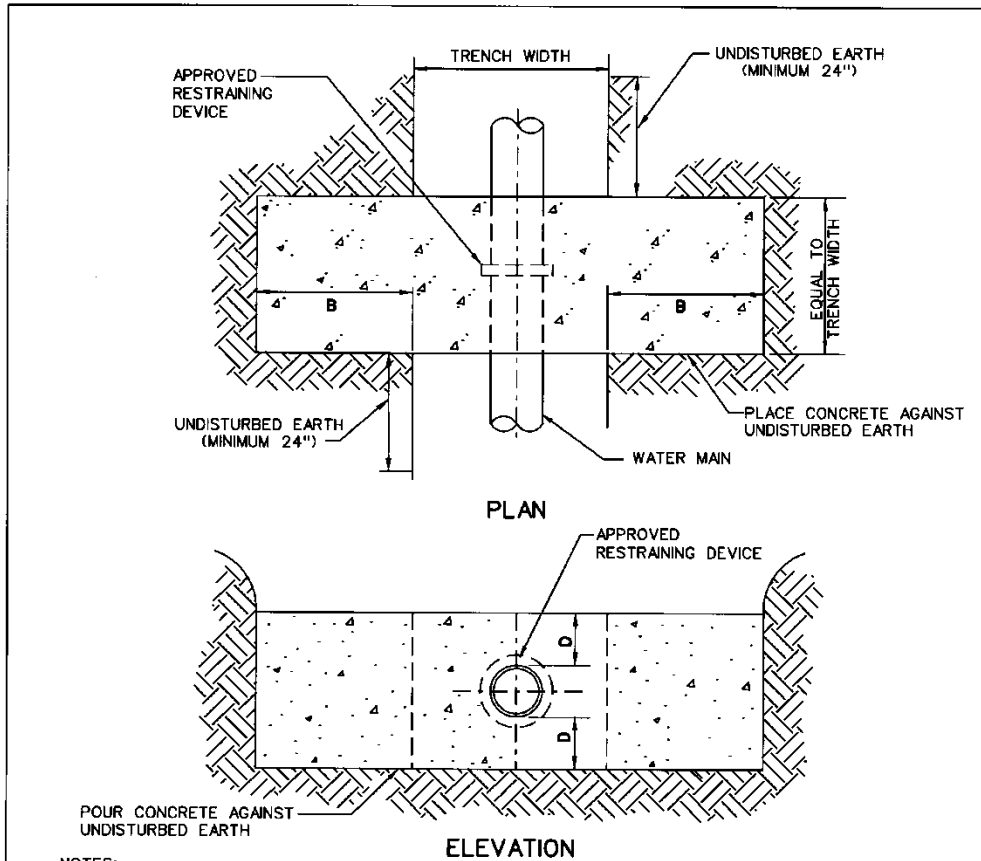
This detail to be used only if specified by project design professional on Approved for Construction drawings.

**ALTERNATE BACKING BLOCKS FOR HORIZONTAL BENDS**  
**2,500 POUNDS PER SQUARE FOOT SOIL RESISTANCE**

WATER SERVICES DEPARTMENT CITY OF KANSAS CITY, MISSOURI

REVISED: JULY, 2006

CONSTRUCTION DETAIL DRAWING NO. 02669-7



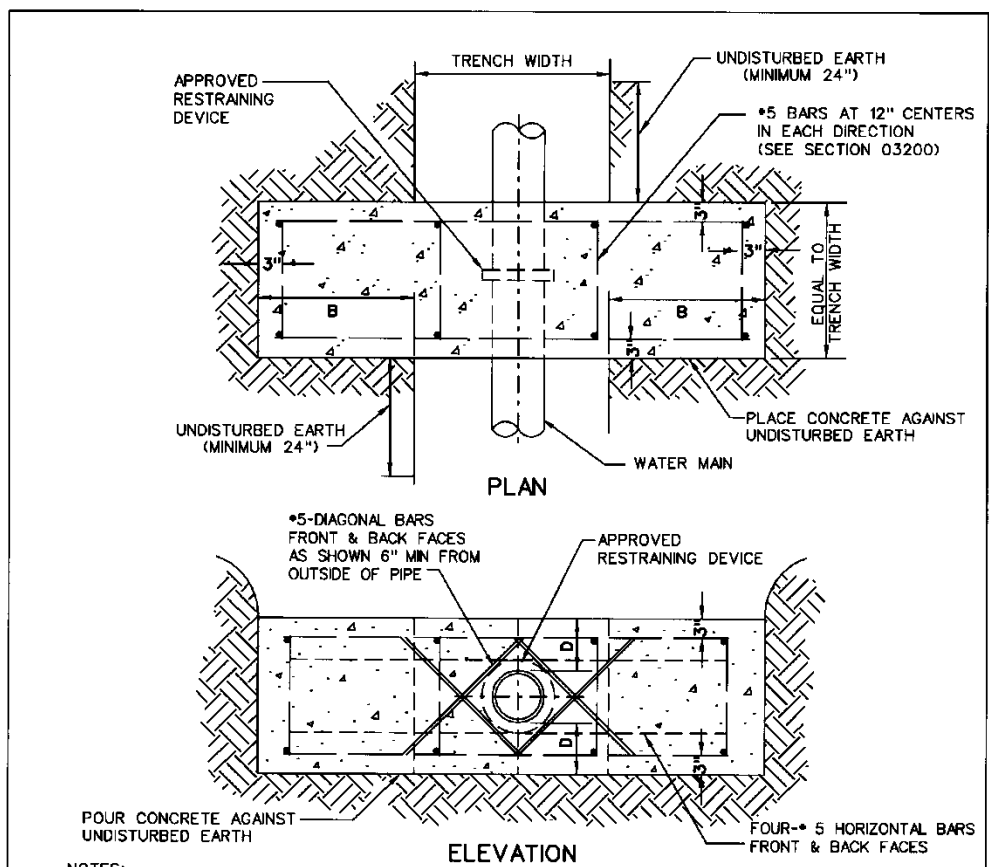
- NOTES:**
1. STRADDLE BLOCKS ARE SIZED FOR 175 P.S.I. LINE PRESSURE 50% SURGE.
  2. THE PROJECT DESIGN PROFESSIONAL IS RESPONSIBLE FOR DESIGN OF STRADDLE BLOCKS. THE SIZES SPECIFIED HEREIN ARE MINIMUM SIZES BASED ON SOIL RESISTANCE OF **2,500 POUNDS PER SQUARE FOOT**. WHERE SOFTER SOILS MAY BE ENCOUNTERED, THE PROJECT DESIGN PROFESSIONAL MUST PROVIDE A DESIGN FOR REVIEW BY THE DEPARTMENT.
  3. SEE SECTION 03001 FOR CONCRETE SPECIFICATIONS.
  4. CONSTRUCT FORMS IN ACCORDANCE WITH SECTION 03100.

PIPE SIZE	TRENCH WIDTH (in.)	B (in.)	D (in.)	REQUIRED BEARING AREA (SQ. FT.)	ESTIMATED CONCRETE REQ. CYD.
6"	30	24	6	5.9	0.71
8"	32	32	8	10.6	1.16

This detail to be used only if specified by project design professional on Approved for Construction drawings.

**ALTERNATE STRADDLE BLOCK FOR 6 AND 8 INCH PIPE**  
**2,500 POUNDS PER SQUARE FOOT SOIL RESISTANCE**

WATER SERVICES DEPARTMENT CITY OF KANSAS CITY, MISSOURI  
 REVISED: JULY, 2006 CONSTRUCTION DETAIL DRAWING NO. 02669-8

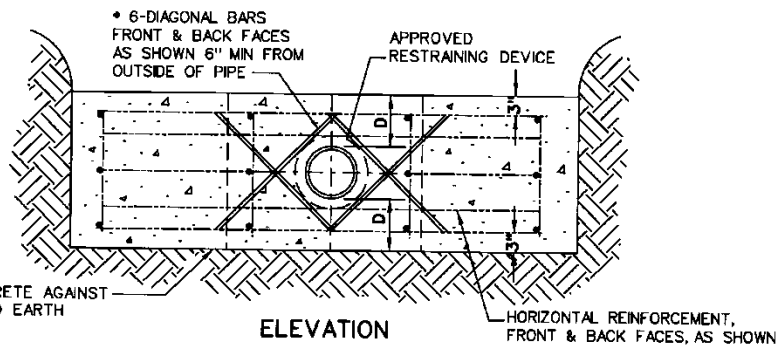
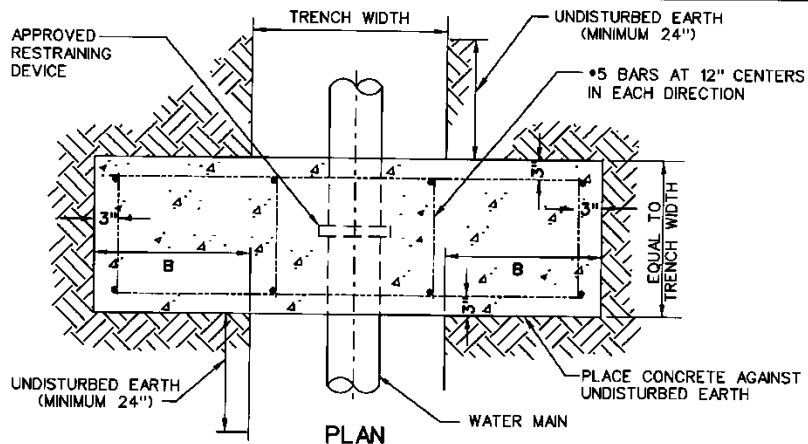


- NOTES:
1. STRADDLE BLOCKS 12" ARE SIZED FOR 175 P.S.I. , AND 16" & LARGER ARE SIZED FOR 150 P.S.I. LINE PRESSURE 50% SURGE.
  2. THE PROJECT DESIGN PROFESSIONAL IS RESPONSIBLE FOR DESIGN OF STRADDLE BLOCKS. THE SIZES SPECIFIED HEREIN ARE MINIMUM SIZES BASED ON SOIL RESISTANCE OF 2,500 POUNDS PER SQUARE FOOT. WHERE SOFTER SOILS MAY BE ENCOUNTERED, THE PROJECT DESIGN PROFESSIONAL MUST PROVIDE A DESIGN FOR REVIEW BY THE DEPARTMENT.
  3. SEE SECTION 03001 FOR CONCRETE SPECIFICATIONS.
  4. CONSTRUCT FORMS IN ACCORDANCE WITH SECTION 03100.

PIPE SIZE	TRENCH WIDTH (in.)	B (in.)	D (in.)	REQUIRED BEARING AREA (SQ. FT.)	ESTIMATED CONCRETE REQ. CYD.
12"	34	38	17	23.8	3.60
16"	40	45	22	36.2	6.51

This detail to be used only if specified by project design professional on Approved for Construction drawings.

**ALTERNATE STRADDLE BLOCK FOR 12 & 16 INCH PIPE**  
**2,500 POUNDS PER SQUARE FOOT SOIL RESISTANCE**  
 WATER SERVICES DEPARTMENT CITY OF KANSAS CITY, MISSOURI  
 REVISED: JULY, 2006 CONSTRUCTION DETAIL DRAWING NO. 02669-9



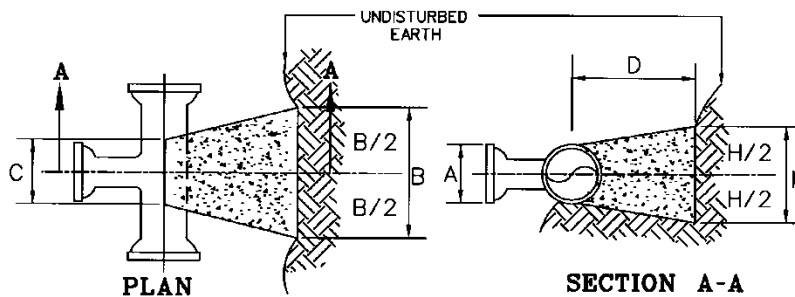
- NOTES:
1. STRADDLE BLOCKS ARE SIZED FOR 150 P.S.I. LINE PRESSURE 50% SURGE.
  2. THE PROJECT DESIGN PROFESSIONAL IS RESPONSIBLE FOR DESIGN OF STRADDLE BLOCKS. THE SIZES SPECIFIED HEREIN ARE MINIMUM SIZES BASED ON SOIL RESISTANCE OF 2,500 POUNDS PER SQUARE FOOT. WHERE SOFTER SOILS MAY BE ENCOUNTERED, THE PROJECT DESIGN PROFESSIONAL MUST PROVIDE A DESIGN FOR REVIEW BY THE DEPARTMENT.
  3. SEE SECTION 03001 FOR CONCRETE SPECIFICATIONS & 03300 FOR REINFORCEMENT SPECIFICATIONS.
  4. CONSTRUCT FORMS IN ACCORDANCE WITH SECTION 03100.

PIPE SIZE	BAR SIZE	NO. OF BARS	TRENCH WIDTH (in.)	B (in.)	D (in.)	REQUIRED BEARING AREA (SQ. FT.)	ESTIMATED CONCRETE REQ. CYD.
20"	•5	5	44	60	24	56.5	10.2
24"	•6	5	48	78	26	81.4	15.5
30"	•7	5	60	96	33	127.2	30.2

This detail to be used only if specified by project design professional on Approved for Construction drawings.

**ALTERNATE STRADDLE BLOCK FOR 20, 24, & 30 INCH PIPE  
2,500 POUNDS PER SQUARE FOOT SOIL RESISTANCE**

WATER SERVICES DEPARTMENT CITY OF KANSAS CITY, MISSOURI  
REVISED: JULY, 2006 CONSTRUCTION DETAIL DRAWING NO. 02669-10



**NOTES:**

1. BACKING BLOCKS FOR PIPING SIZES UP THROUGH 12-INCH ARE BASED ON WORKING PRESSURE OF 175 P.S.I. PLUS 50% SURGE.
2. BACKING BLOCKS FOR PIPING SIZES 16-INCH THROUGH 24-INCH ARE BASED ON A WORKING PRESSURE OF 150 P.S.I. PLUS 50% SURGE.
3. THE PROJECT DESIGN PROFESSIONAL IS RESPONSIBLE FOR THE DESIGN OF THRUST BLOCKS. THE BLOCK SIZES SPECIFIED HEREIN ARE MINIMUM SIZES, BASED ON SOIL RESISTANCE OF 3,000 POUNDS PER SQUARE FOOT. WHERE SOFTER SOILS MAY BE ENCOUNTERED, THE PROJECT DESIGN PROFESSIONAL MUST PROVIDE A DESIGN FOR REVIEW BY THE DEPARTMENT.
4. SEE SECTION 03001 FOR CONCRETE SPECIFICATIONS.
5. CONSTRUCT FORMS IN ACCORDANCE WITH SECTION 03100.

BRANCH OR PLUG SIZE A	B (in.)	C (in.)	D (in.)	H (in.)	REQUIRED BEARING AREA (SQ.FT.)	ESTIMATED CONCRETE REQ. CYD.
6"	40	6	17	18	4.9	0.14
8"	54	8	23	24	8.8	0.34
12"	72	12	30	40	19.8	0.97
16"	88	16	36	50	30.2	1.80
20"	114	20	47	60	47.1	3.65
24"	136	24	56	72	67.9	6.22
30"	154	30	62	100	106.0	10.83

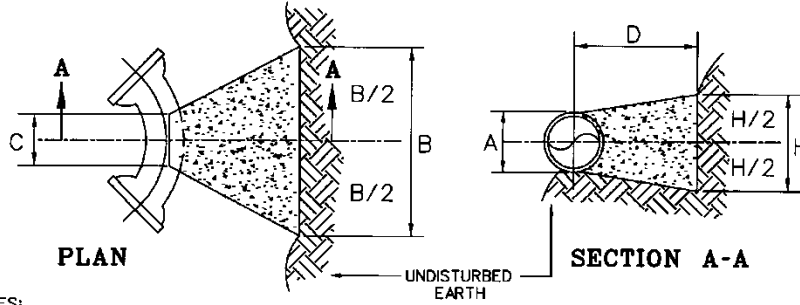
This detail to be used only if specified by project design professional on Approved for Construction drawings.

**ALTERNATE BACKING BLOCKS FOR TEES AND PLUGS**  
**3,000 POUNDS PER SQUARE FOOT SOIL RESISTANCE**

WATER SERVICES DEPARTMENT CITY OF KANSAS CITY, MISSOURI

REVISED: July, 2006

CONSTRUCTION DETAIL DRAWING NO. 02669-11



**NOTES:**

1. BACKING BLOCKS FOR PIPING SIZES UP THROUGH 12-INCH ARE BASED ON WORKING PRESSURE OF 175 P.S.I. PLUS 50% SURGE.
2. BACKING BLOCKS FOR PIPING SIZES 16-INCH THROUGH 24-INCH ARE BASED ON A WORKING PRESSURE OF 150 P.S.I. PLUS 50% SURGE.
3. THE PROJECT DESIGN PROFESSIONAL IS RESPONSIBLE FOR THE DESIGN OF THRUST BLOCKS. THE BLOCK SIZES SPECIFIED HEREIN ARE MINIMUM SIZES, BASED ON SOIL RESISTANCE OF 3,000 POUNDS PER SQUARE FOOT. WHERE SOFTER SOILS MAY BE ENCOUNTERED, THE PROJECT DESIGN PROFESSIONAL MUST PROVIDE A DESIGN FOR REVIEW BY THE DEPARTMENT.
4. SEE SECTION 03001 FOR CONCRETE SPECIFICATIONS.
5. CONSTRUCT FORMS IN ACCORDANCE WITH SECTION 03100.

11¼ DEGREE BENDS						
PIPE SIZE A	B (in.)	C (in.)	D (in.)	H (in.)	REQUIRED BEARING AREA (SQ.FT.)	ESTIMATED CONCRETE REQ. CYD.
6"	18	6	12	12	1.0	0.032
8"	20	8	12	14	1.7	0.044
12"	32	12	12	20	3.9	0.101
16"	36	16	12	24	5.9	0.144
20"	40	20	12	34	9.2	0.226
24"	52	24	14	38	13.3	0.380
30"	76	30	23	40	20.8	0.971

22½ DEGREE BENDS						
PIPE SIZE A	B (in.)	C (in.)	D (in.)	H (in.)	REQUIRED BEARING AREA (SQ.FT.)	ESTIMATED CONCRETE REQ. CYD.
6"	24	6	12	14	1.9	0.048
8"	28	8	12	18	3.4	0.073
12"	46	12	17	24	7.7	0.227
16"	62	16	23	28	11.8	0.491
20"	78	20	29	34	18.4	0.949
24"	96	24	36	40	26.5	1.704
30"	142	30	56	42	41.4	4.100

45 DEGREE BENDS						
PIPE SIZE A	B (in.)	C (in.)	D (in.)	H (in.)	REQUIRED BEARING AREA (SQ.FT.)	ESTIMATED CONCRETE REQ. CYD.
6"	30	6	12	18	3.8	0.074
8"	40	8	16	24	6.7	0.176
12"	74	12	31	30	15.1	0.785
16"	94	16	39	36	23.1	1.521
20"	120	20	50	44	36.1	3.044
24"	140	24	58	54	51.9	5.057
30"	164	30	67	72	81.2	9.125

90 DEGREE BENDS						
PIPE SIZE A	B (in.)	C (in.)	D (in.)	H (in.)	REQUIRED BEARING AREA (SQ.FT.)	ESTIMATED CONCRETE REQ. CYD.
6"	52	6	23	20	7.0	0.265
8"	72	8	32	26	12.4	0.664
12"	112	12	50	36	28.0	2.238
16"	128	16	56	48	42.7	3.841
20"	166	20	73	58	66.6	7.845
24"	188	24	82	74	96.0	12.732
30"	270	30	120	80	149.9	28.935

**ALTERNATE BACKING BLOCKS FOR HORIZONTAL BENDS**

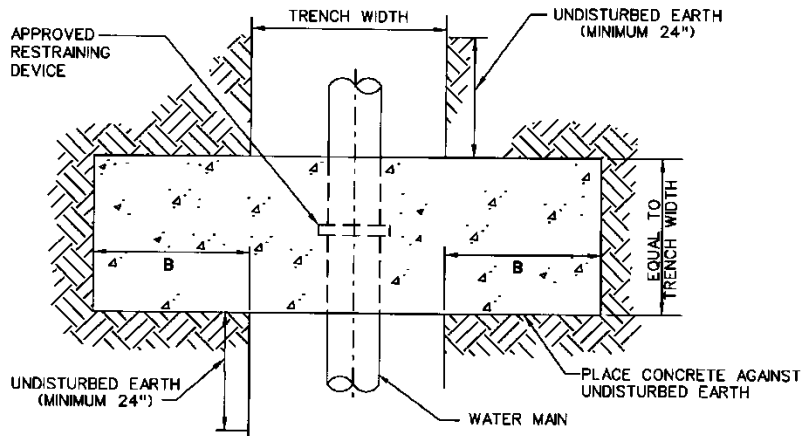
**3,000 POUNDS PER SQUARE FOOT SOIL RESISTANCE**

This detail to be used only if specified by project design professional on Approved for Construction drawings.

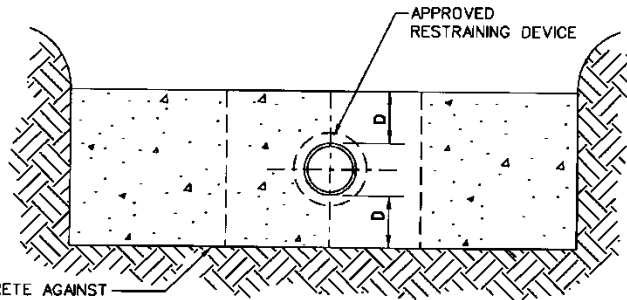
WATER SERVICES DEPARTMENT CITY OF KANSAS CITY, MISSOURI

REVISED: JULY, 2006

CONSTRUCTION DETAIL DRAWING NO. 02669-12



PLAN



ELEVATION

NOTES:

1. STRADDLE BLOCKS ARE SIZED FOR 175 P.S.I. LINE PRESSURE 50% SURGE.
2. THE PROJECT DESIGN PROFESSIONAL IS RESPONSIBLE FOR DESIGN OF STRADDLE BLOCKS. THE SIZES SPECIFIED HEREIN ARE MINIMUM SIZES BASED ON SOIL RESISTANCE OF 3,000 POUNDS PER SQUARE FOOT. WHERE SOFTER SOILS MAY BE ENCOUNTERED, THE PROJECT DESIGN PROFESSIONAL MUST PROVIDE A DESIGN FOR REVIEW BY THE DEPARTMENT.
3. SEE SECTION 03001 FOR CONCRETE SPECIFICATIONS.
4. CONSTRUCT FORMS IN ACCORDANCE WITH SECTION 03100.

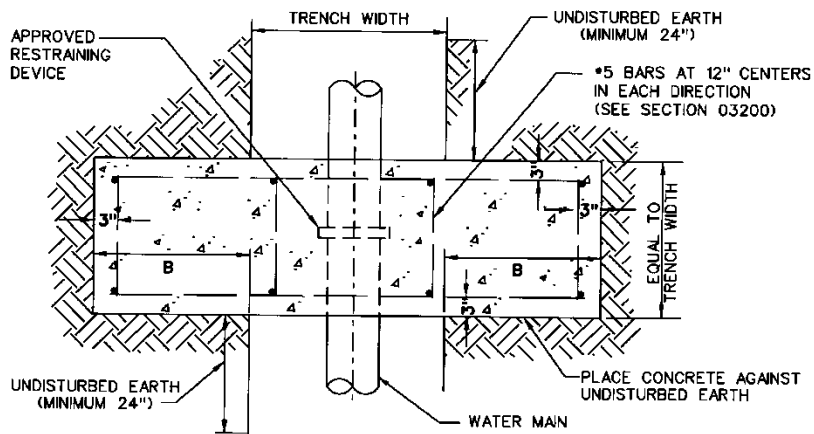
PIPE SIZE	TRENCH WIDTH (in.)	B (in.)	D (in.)	REQUIRED BEARING AREA (SQ. FT.)	ESTIMATED CONCRETE REQ. CYD.
6"	30	24	5	4.9	0.62
8"	32	29	7	8.8	1.00

This detail to be used only if specified by project design professional on Approved for Construction drawings.

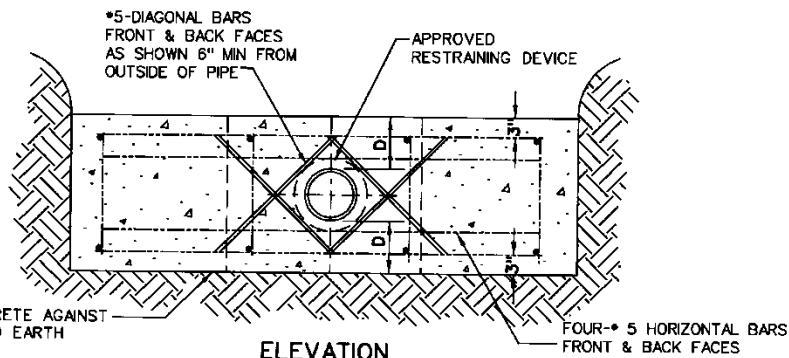
**ALTERNATE STRADDLE BLOCK FOR 6 AND 8 INCH PIPE**  
**3,000 POUNDS PER SQUARE FOOT SOIL RESISTANCE**

WATER SERVICES DEPARTMENT CITY OF KANSAS CITY, MISSOURI  
 REVISED: JULY, 2006 CONSTRUCTION DETAIL DRAWING NO. 02669-13





PLAN



ELEVATION

NOTES:

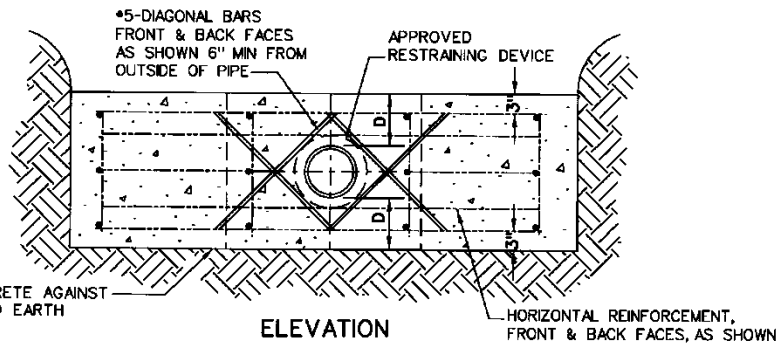
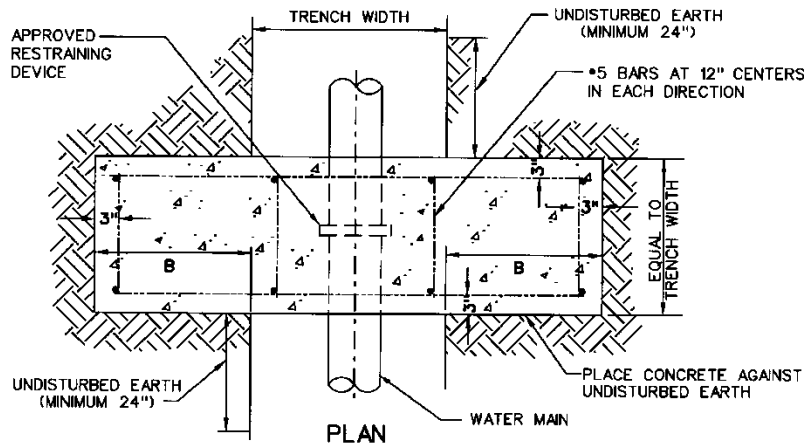
1. STRADDLE BLOCKS 12" ARE SIZED FOR 175 P.S.I., AND 16" & LARGER ARE SIZED FOR 150 P.S.I. LINE PRESSURE 50% SURGE.
2. THE PROJECT DESIGN PROFESSIONAL IS RESPONSIBLE FOR DESIGN OF STRADDLE BLOCKS. THE SIZES SPECIFIED HEREIN ARE MINIMUM SIZES BASED ON SOIL RESISTANCE OF 3,000 POUNDS PER SQUARE FOOT. WHERE SOFTER SOILS MAY BE ENCOUNTERED, THE PROJECT DESIGN PROFESSIONAL MUST PROVIDE A DESIGN FOR REVIEW BY THE DEPARTMENT.
3. SEE SECTION 03001 FOR CONCRETE SPECIFICATIONS.
4. CONSTRUCT FORMS IN ACCORDANCE WITH SECTION 03100.

PIPE SIZE	TRENCH WIDTH (in.)	B (in.)	D (in.)	REQUIRED BEARING AREA (SQ. FT.)	ESTIMATED CONCRETE REQ. CYD.
12"	34	34	15	19.8	3.0
16"	40	42	18	30.2	5.4

This detail to be used only if specified by project design professional on Approved for Construction drawings.

**ALTERNATE STRADDLE BLOCK FOR 12 & 16 INCH PIPE  
3,000 POUNDS PER SQUARE FOOT SOIL RESISTANCE**

WATER SERVICES DEPARTMENT CITY OF KANSAS CITY, MISSOURI  
REVISED: JULY, 2006 CONSTRUCTION DETAIL DRAWING NO. 02669-14



**NOTES:**

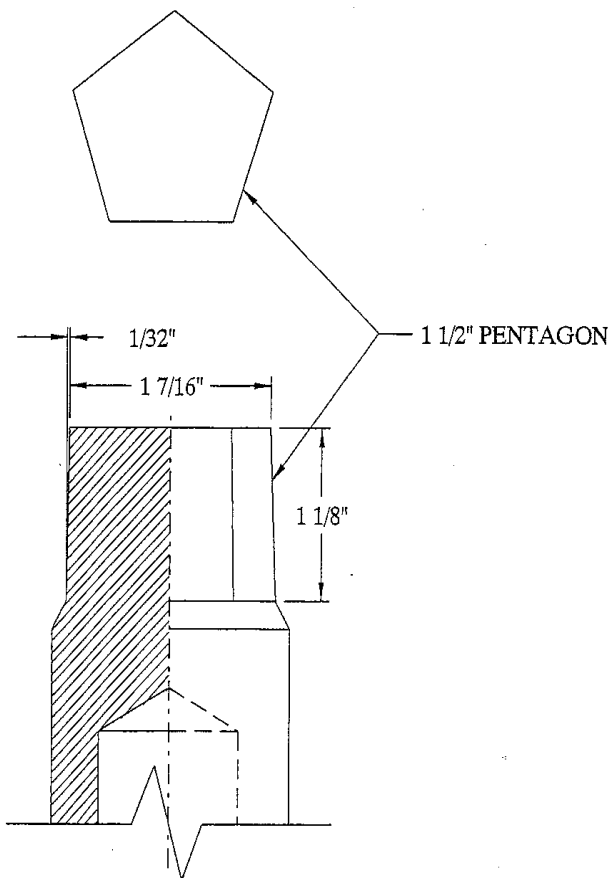
1. STRADDLE BLOCKS ARE SIZED FOR 150 P.S.I. LINE PRESSURE 50% SURGE.
2. THE PROJECT DESIGN PROFESSIONAL IS RESPONSIBLE FOR DESIGN OF STRADDLE BLOCKS. THE SIZES SPECIFIED HEREIN ARE MINIMUM SIZES BASED ON SOIL RESISTANCE OF **3,000 POUNDS PER SQUARE FOOT**. WHERE SOFTER SOILS MAY BE ENCOUNTERED, THE PROJECT DESIGN PROFESSIONAL MUST PROVIDE A DESIGN FOR REVIEW BY THE DEPARTMENT.
3. SEE SECTION 03001 FOR CONCRETE SPECIFICATIONS & 03300 FOR REINFORCEMENT SPECIFICATIONS.
4. CONSTRUCT FORMS IN ACCORDANCE WITH SECTION 03100.

PIPE SIZE	BAR SIZE	NO. OF BARS	TRENCH WIDTH (in.)	B (in.)	D (in.)	REQUIRED BEARING AREA (SQ. FT.)	ESTIMATED CONCRETE REQ. CYD.
20"	*5	5	44	57	20	47.1	8.6
24"	*6	5	48	68	24	68.0	13.2
30"	*7	5	60	85	30	106.3	25.7

This detail to be used only if specified by project design professional on Approved for Construction drawings.

**ALTERNATE STRADDLE BLOCK FOR 20, 24, & 30 INCH PIPE  
3,000 POUNDS PER SQUARE FOOT SOIL RESISTANCE**

WATER SERVICES DEPARTMENT CITY OF KANSAS CITY, MISSOURI  
REVISED: JULY, 2006 CONSTRUCTION DETAIL DRAWING NO. 02669-15



SCALE 1"=1"

**OPERATING NUT (STEM NUT)**  
**ATTACHMENT A**

WATER SERVICES DEPARTMENT  
 CITY OF KANSAS CITY, MISSOURI

ENGINEERING DIVISION

DRAWING NO. **18015**

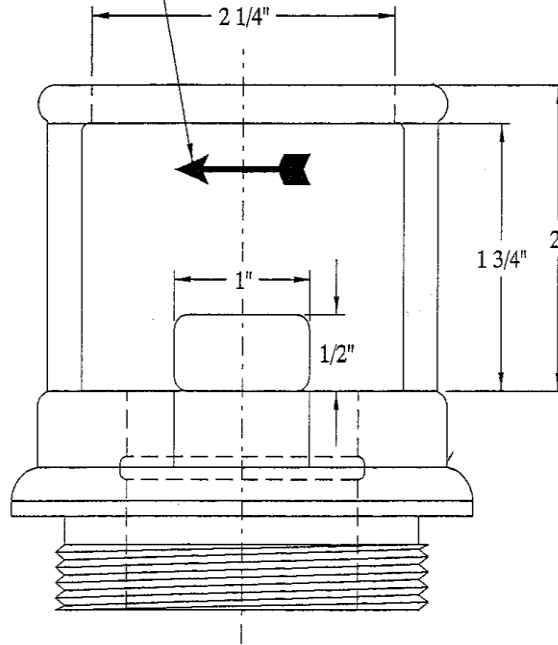
NO.	DATE	BY	NATURE
REVISIONS			

DESIGNED BY: B. SCHROEDER APPROVED BY: E. RYSER  
 DETAILED BY: M. DeMAY DATE: 25-MAR-1997

1 OF 2

RAISED DIRECTION ARROW  
(OPEN-CLOCKWISE)

NOTE:  
MANUFACTURERS NAME SHALL BE  
CAST IN RAISED LETTERS, 1/4" HIGH,  
ON FACE OPPOSITE ARROW



TOLERANCES:  
CAST CORNERS  
ROUNDS +/- 1/16"  
FILLETS +/- 1/16"

BREAK CORNERS  
APPROX. .005" R (TYP.)

MATERIAL:  
DUCTILE IRON A.S.T.M.  
536 GRADE 60-40-18  
OR A.S.T.M. A-445

SCALE 1"=1"

NO.	DATE	BY	NATURE
REVISIONS			

**SECURITY STYLE HOLD DOWN NUT**  
**ATTACHMENT B**

WATER SERVICES DEPARTMENT  
CITY OF KANSAS CITY, MISSOURI

ENGINEERING DIVISION

DRAWING NO. **18015**

DESIGNED BY: B. SCHROEDER APPROVED BY: E. RYSER

DETAILED BY: M. DeMAY DATE: 25-MAR-1997

2  
OF  
2