

## City of East Dubuque, Illinois

Water Distribution System Requirements


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# WATER DISTRIBUTION SYSTEM REQUIREMENTS 

FOR
CITY OF EAST DUBUQUE, ILLINOIS

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PROJECT NO: 22175

|  | hereby certify that this engineering document was prepared by <br> me or under my direct personal supervision and that I am a duly <br> licensed Professional Engineer under the laws of the State of <br> Illinois. |
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# CITY OF EAST DUBUQUE, ILLINOIS WATER DISTRIBUTION SYSTEM REQUIREMENTS 

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# CITY OF EAST DUBUQUE, ILLINOIS <br> WATER DISTRIBUTION SYSTEM REQUIREMENTS 

PART I<br>WATER MAIN DESIGN PROVISIONS

## 1. GENERAL

A. The water system of the City of East Dubuque is owned and operated by the City of East Dubuque.
B. Water main design shall be in accordance with these provisions and specifications, and the current requirements of the Illinois Environmental Protection Agency (IEPA).
C. The person(s) or entity proposing the installation of water mains shall be responsible for obtaining the required construction permit(s) from the IEPA and all other permits required by the state or federal agencies and paying all costs associated with obtaining permits and/or approvals.
D. City to approval of water main design is required before the start of construction.
2. SCOPE
A. These provisions are intended to govern the design of water mains for installation within the City.
B. Drawings and project details for water mains to be installed by others shall be submitted to the City for review and approval. City approval of water main projects shall not transfer liability to the City.

## 3. DEFINITIONS

A. City - The City of East Dubuque, Illinois.
B. Engineer or City Engineer - The designated Engineer for City of East Dubuque, or the authorized representative of the Engineer.
C. Design Engineer - The Engineer or engineering firm responsible for the design of the water main project.
D. Inspector - A representative of City or its Engineer, at the site of the work.

## 4. BASIS OF DESIGN

A. Pressure:

1) The system must be designed to maintain a minimum pressure of 20 psi at ground level at all points in the distribution system under all conditions of flow.
2) Water mains must have a normal working pressure of at least 35 psi .
3) When static pressures exceed 100 psi, pressure reducing devices must be provided on water mains or on individual service lines.
4) All water mains, including those not designed to provide fire protection, must be sized after a hydraulic analysis based on flow demands and pressure requirements.
B. Fire Protection:
5) Water mains shall be designed to provide a safe and adequate supply of water including fire protection. Per AWWA Manual M31, the design fire flow shall be 750 gpm if houses are 31 to 100 feet apart and $1,000 \mathrm{gpm}$ if houses are 11 to 30 feet apart. Minimum fire flow design in industrial and commercial areas shall be $1,500 \mathrm{gpm}$. Residual pressure shall be 20 psi or greater.
C. Maximum design velocity should not exceed seven feet per second.

## 5. DETAILS OF DESIGN

A. Water mains shall be located within street rights-of-way whenever possible. If a water main is located on private property, it shall be centered within a 20 foot wide permanent water main easement or as otherwise approved.
B. The minimum size of water main that provides for fire protection and serving fire hydrants must be of 6 -inch diameter. Larger size mains will be required if necessary to allow the withdrawal of the required fire flow while maintaining the minimum residual pressure specified in Subsection 4.
C. The minimum size water main shall be 6 inch if looped (actual or anticipated). Eight (8) inch water mains are required for planned dead end mains. Larger water mains shall be installed when required by the City.
D. Water mains of 6 -inch through 12 -inch size may be either DIP or PVC.
E. Hydrant leads shall be DIP only.
F. Only new materials complying with these water distribution system requirements shall be installed.
G. Dead end mains shall be minimized by looping whenever possible. When looping is not initially possible, water mains shall be installed in such a manner to permit future looping such as extending mains beyond the end or edge of pavements. Dead ends shall terminate with an approved fire hydrant for flushing.
H. Water mains shall have a minimum 5.5 foot bury depth measured from top of pavement or ground to the crown of the pipe. The future use of the water main routes must be considered in establishing the depth of installation to prevent future problems with freezing. If the required depth of cover cannot be maintained, suitable and sufficient insulation around the water main shall be provided.
I. A sufficient number of valves shall be provided on water mains to minimize inconvenience, sanitary hazards, and safety hazards during maintenance, repair, and construction. Except for tees leading to hydrants, two valves shall be installed at each tee. Three valves shall be installed at each cross. The pipe connecting to each hydrant shall have a valve. Each line leading to a dead end shall have a valve at the point of connection. Valves shall be placed at street intersections and at intervals not greater than 500 foot intervals in commercial districts and not more than one block or 800 foot intervals in other districts. Each valve shall have an adjustable valve box with centering device.
J. Fire hydrants should be provided at each street intersection and at intermediate points between intersections when minimum hydrant spacing cannot be met. Fire hydrants shall be installed to serve an area with a radius no greater than 300 feet in residential areas ( 600 foot spacing) and 200 feet in all other areas except agricultural ( 400 foot spacing). Hydrant spacing in agricultural areas shall be based on future land use plans as approved by the City. Hydrants shall be connected to the distribution system with a 6 inch DIP. The connection shall be independently valved.
K. The Design Engineer is responsible for specific project thrust restraint design. Thrust restraint shall be shown in the drawings. Thrust restraint shall be by installation of joint restraint to the maximum possible. Concrete thrust restraint may be used only with the specific approval of the Engineer.
L. The City Water Distribution System includes multiple pressure zones. Design Engineer shall contact City for pressures in during design phase of proposed project.

## 6. SERVICE REQUIREMENTS

A. Individual service lines are required for each building connected to the water system, unless otherwise approved by the City.
B. Individual meters are required for each service connection and for each dwelling unit of a multiple unit facility (apartments, condominiums) unless otherwise approved by the City.
C. There shall be no connection between the water distribution system and any pipes, pumps, hydrants, or tanks, whereby unsafe water or other contaminating materials may be discharged or drawn into the system.

Backflow prevention devices and installation shall comply with the State of Illinois Plumbing Code and AWWA Manual M4 recommendations. Appropriate backflow prevention devices are required for connections to irrigation systems, fire suppression sprinkler systems, connections to industrial processes, heating systems, painting systems, facilities or houses with private wells, facilities with pressurizing pumps, cooling towers, etc. Backflow prevention assemblies shall be field-tested at least annually by a certified tester. A report of successful testing shall be filed with the City.
D. Pressure boosting systems shall not be installed unless specifically approved by the City.
E. City approval must be obtained for temporary services utilizing connections to a fire hydrant. Temporary fire hydrant connections must include a meter and backflow prevention device. Any connections and hydrant operations must be done under the supervision of a City representative.
F. Any existing lead or steel services tapped into a water main to be reconstructed shall be replaced.

## 7. SEPARATION DISTANCES FOR WATER MAINS AND SERVICE LINES

A. Horizontal Separation:

1) Water mains must be laid at least 10 feet horizontally from any existing or proposed drain, storm sewer, sanitary sewer, combined sewer or sewer service connection. The distance must be measured edge to edge
2) Water mains may be laid closer than 10 feet to a sewer line when:
a) Local conditions prevent a lateral separation of 10 feet;
b) The water main invert is at least 18 inches above the crown of the sewer; and the water main is either in a separate trench or in the same trench on an undisturbed earth shelf located to one side of the sewer.
3) When it is impossible to meet Subsection $(\mathrm{A})(1)$ or $(\mathrm{A})(2)$ above, the following requirements must be met:
a) Required Materials
i. Both the water main and drain or sewer must be constructed of water main materials specified in Part III of the Water Distribution System Requirements.
b) The drain or sewer must be pressure tested to the maximum expected surcharge head before backfilling.
4) Water mains must be laid at least 25 feet horizontally from any existing or proposed sanitary lift station, unless otherwise approved by IEPA.
5) Water mains must be separated from sewage disposal systems, disposal fields and seepage beds by a minimum of 25 feet.
6) No water pipe shall pass through or come in contact with any part of a sewer manhole or storm sewer inlet. The water main should be located at least 10 feet from sanitary sewer manholes. A minimum horizontal separation of three feet shall be maintained.
B. Vertical Separation:
7) When possible, the water main must be placed above the sewer.
a) A water main must be laid so that its invert is 18 inches above the crown of the drain or sewer whenever water mains cross storm sewers, sanitary sewers, or sewer service connections.
b) The vertical separation must be maintained for that portion of the water main located within 10 feet horizontally of the outer edge of any sewer or drain crossed.
c) A length of water main pipe must be centered over the sewer to be crossed with joints equidistant from the sewer or drain.
8) When it is impossible to maintain the 18 -inch separation specified in Subsection (1) above or the water main passes under a sewer or drain, the IEPA may approve an alternate construction method that reduces the risk of sanitary contamination including:
a) Both the water main and sewer are constructed of water main materials specified in Part III of the Water Distribution System Requirements, extending on each side of the crossing until at least 10 feet separates the two pipes; or
b) The water main or the sewer is encased in a carrier pipe equivalent to water main materials specified in Part III of the Water Distribution System Requirements, extending on each side of the crossing until at least 10 feet separate the two pipes; or
c) When the water main crosses a storm sewer, the storm sewer is constructed with reinforced concrete pipe conforming to ASTM C76 with ASTM C443 flat gasket joints or ASTM C361 "O-ring" joints within 10 feet of the water main.
9) When it is impossible to place the water main above the storm sewers, sanitary sewers or sewer service connections, the water main may be placed below the sewer if:
a) The water main is laid so that it is at least 18 inches below the invert of the drain or sewer wherever water mains cross storm sewers, sanitary sewers or sewer service connections.
b) Construction:
i. Both the water main and sewer are constructed of water main materials specified in Part III of the Water Distribution System Requirements, extending on each side of the crossing until at least 10 feet separates the two pipes;
ii. The water main or the sewer is encased in a carrier pipe equivalent to water main materials specified in Part III of the Water Distribution System Requirements,
extending on each side of the crossing until at least 10 feet separate the two pipes; or
iii. when the water main crosses a storm sewer, the storm sewer is constructed with reinforced concrete pipe conforming to ASTM C76 with ASTM C443 flat gasket joints or ASTM C361 "O-ring" joints within 10 feet of the water main.
c) The sewer or drain lines must be supported to prevent settling and breaking the water main.
10) Sanitary sewer force main must have at least the following minimum separation:
a) When the sanitary sewer force main and the water main are parallel, a 10-foot horizontal separation from water mains; and
b) When the sanitary sewer force main and the water main cross, an 18-inch vertical separation, with the water main invert above the sanitary sewer force main crown.

## 8. INSPECTION

A. Representatives of the City, including the Engineer, will make periodic visits to observe water main and service line installation. City representatives will work with contractors and developers to provide for construction records. However, construction record drawings and details shall be provided to the City by the developer or the contractor. Water main pressure and leakage testing must be observed by City representatives. The results of bacterial testing shall be submitted to the City.
B. Upon completion of the installation the developer, shall notify the City and the IEPA that the work has been completed.

## 9. CITY PARTICIPATION

A. When the City requires water mains larger than indicated in these requirements, the City will reimburse the developer for the difference in the material costs associated with larger mains.

## 10. EASEMENTS

A. Permanent easements for water mains shall be a minimum 20 feet wide, 10 feet on each side of the water main. If a water main is to be located on street right-of-way but within 10 feet of a lot line, the balance of the 10 foot distance shall be obtained or dedicated as a permanent easement.
B. Temporary construction easements shall be obtained or dedicated. The width shall be as approved by the Engineer.

# CITY OF EAST DUBUQUE, ILLINOIS <br> WATER DISTRIBUTION SYSTEM REQUIREMENTS 

PART II<br>CONSTRUCTION SPECIFICATIONS FOR SITE PREPARATION, EXCAVATION AND BACKFILL

## 1. GENERAL

A. The project site shall be kept free from ponding water due to construction operations at all times during the progress of the work. The contractor shall make arrangements for disposal of all water received at the site.
B. The contractor shall strip topsoils and separately store them to provide topsoil replacement. All obstructions such as culvert pipe, signs and fences shall be removed and stored for replacement upon completion of construction. The contractor shall provide temporary fencing, if necessary, to control livestock or to prevent accidents until permanent fencing is restored.
C. Site preparation, excavation, and backfill for water main construction shall be in accordance with these specifications and with the current requirements as established by the Illinois Environmental Protection Agency (IEPA).

## 2. SCOPE

A. Provide the labor, material, facilities and administration as required to complete all work covered by this section.

## 3. EXISTING UTILITIES AND CONDITIONS

A. Location - The contractor shall be fully responsible for liasion with owners of existing facilities encountered during the construction of water distribution system improvements or extensions. The contractor shall verify the location of all utilities.
B. Protection - All existing utilities shall be protected by the contractor during the progress of the work. Such protection shall allow the utilities to remain in continuous operation. Any utility damaged by the contractor during the course of the work shall be repaired at the contractor's expense.
C. Streets - The contractor shall conduct the work in a manner which will cause a minimum interuption to traffic. The contractor shall post suitable signs indicating that a street is closed and necessary detour signs for the proper maintenance of traffic. Traffic control signs shall conform to the current Illinois Manual on Uniform Traffic Control Devices (MUTCD) and IDOT Standards. Prior to the closing of any street, the contractor shall notify responsible city authorities, including police and fire departments, and schools.

## 4. ALIGNMENT AND ELEVATION

A. The trench shall be excavated to the line alignment and grade elevation as required by the shown drawings prepared by the Design Engineer and approved by the Engineer.
B. Alignment and Grade Stakes - The Design Engineer shall provide alignment and elevation reference when required. The contractor shall be responsible for protecting the original elevation reference stakes set by the Design Engineer.
C. Obstruction to Alignment- Whenever obstructions are encountered during the progress of the work and interfere to such an extent that an alteration in the plans is required, the Design Engineer, with approval from the Engineer, shall change the plans and provide for a deviation from the vertical and/or horizontal alignment or arrange for the removal, relocation, or reconstruction of the obstructions with the approval of the Engineer.

## 5. EXCAVATION

A. General - The ground shall be excavated by the open trench method to the depth required except where boring is required or desired. Excavated material suitable for use as backfill material shall be piled in an orderly manner at a sufficient distance back from the edge of the trench to avoid rollback, slides, or cave-ins. When specified by or approved by the City, trenchless installation methods may be used.
B. Width of Trench - The width of the trench shall be sufficient to allow the pipe to be installed and joined and to allow the embedment material to be placed and properly compacted. At least 6inches of clear space is required on each side of the pipe to permit compaction of embedment material. The width of the trench at ground surface shall not exceed that required to be consistent with safety requirements.
C. Extent of Open Trench - Trench excavation shall not precede completed water main installation by more than 200 feet.
D. Trench Bottom - Rock, boulders, and large stones shall be removed from the trench to provide a clearance of at least 6 inches below and around all parts of the pipe and pipe appurtenances.
E. Excess Depth Excavation- Should the excavation continue beyond or below the elevations required, backfill all such excavated space with select granular material meeting the approval of the Engineer at no cost to the City.
F. Excavation in Poor Soil - If the trench bottom is found to be unstable or to be composed of material which includes ashes, cinders, refuse, vegetable, or other organic matter or large pieces or fragments of inorganic material or any material that, in the judgment of the Engineer should be removed, such unsuitable material shall be excavated and removed to the width and depth required by the Engineer. The area from which the unsuitable material was removed shall be filled with compacted foundation stone approved by the Engineer.
G. Rock Excavation - Rock excavation shall consist of the excavation from the trench of boulders or concrete pieces $1 / 2 \mathrm{cu}$ yd in volume or greater and all rock in ledges, bedded deposits and conglomerate deposits exhibiting the physical characteristics and difficulty of rock removal.

Rock shall be removed from the trench to provide the required 6 inch minimum clearance between any portion of the pipe or appurtenance and the rock. The resulting space shall be backfilled with compacted select granular material approved by the Engineer. The surface of the rock excavation shall be free from projecting points, ribs, crevices or undrained pockets. The method of rock removal shall be the option of the Contractor. However, excessive blasting or overshooting will not be permitted. The contractor shall comply with all applicable local, state, and federal safety codes and requirements. The contractor shall be responsible for securing all permits required by law for blasting operations and any additional hazard insurance required. All
rock excavation operations shall precede laying of the pipe by at least 100 feet. No blasting shall be undertaken by the contractor until the contractor has notified the Engineer and City.

## 6. BORING

A. Bored Sections - Steel casing pipe less than 36 inches in diameter shall be bored. Proper alignment and elevations shall be maintained at all times. Excavation shall not precede the boring operation by a distance more than is deemed necessary. DIP carrier pipe and PVC carrier pipe shall be supported on all stainless steel casing spacers. The ends of the casing pipe shall be sealed with a double wrap of woven geotextile secured to the casing and carrier pipe with insulated copper wire, or with end seals as otherwise approved.

## 7. SHEETING, SHORING AND BRACING

A. General - Sheeting, shoring, trench box, and/or bracing shall be provided as required by governing federal or state laws and regulations, and as may be necessary to protect life, property, or the work. Trench wall stabilization shall remain in place until backfilling of the trench progresses to the point at which no damage or accident will result from its movement or removal. Trench sheeting shall be carefully removed to avoid water main movement.
8. DEWATERING
A. General - Trenches and excavations shall be kept free from water which, in the opinion of the Engineer, would in any way impair the quality of the work being performed or contaminate the water main. Methods and materials shall be provided for handling such water encountered during the progress of the work. The method of disposal of such water shall comply with state environmental regulations. In no case shall the water main be used for the disposal of such water.

## 9. BACKFILL

A. General - The trench shall not be backfilled until the pipe elevations, gradient, alignment, and joints have been checked. The pipe bedding, haunching, and initial backfill to 12 inches above the top of the pipe shall be as required to provide pipe support and load carrying capacity. The space between the utility pipe and the bottom and the sides of the trench shall be backfilled with required/approved materials available from the trench excavation or bedding materials as may be required in other parts of these specifications. These materials shall be thoroughly compacted by hand for the full width of the trench to a depth of one (1) foot above the top of the pipe. The backfill material shall contain no rocks larger than $3 / 4$ inch or boulders and shall be free from cinders, ashes, roots, refuse, or organic material. Sand is permitted.

Consistent with pipe protection requirements, the remainder of the backfilling operation shall proceed by mechanical means in layers not to exceed 12 inches (loose). This backfill material shall contain no rock or stones greater than 3 inches in their greatest dimension. Rock or rock excavation debris shall be removed and approved imported material used for backfill. Trench excavation backfill material shall be compacted to $88 \%$ of maximum standard Proctor density.

All backfill material shall be carefully placed in the trench to avoid movement or damage to the utility pipe. The contractor shall be fully responsible for correcting any backfill settlement which occurs. Jetting and flooding of backfill materials shall be used only when approved by the Engineer.

Backfill material shall conform to Part III - 3J of these specifications.
B. Select Granular Backfill - Where water main and service line is constructed under or within 5 feet of pavement, sidewalk, driveways, and other utilities and structures, select granular backfill shall be placed and compacted to $95 \%$ of maximum standard Proctor density at minus $1 \%$ to plus $3 \%$ of optimum moisture in those locations designated on the plans. The select granular backfill material shall conform to Part III - 3J of these specifications.

The select granular backfill must have approval of the Engineer prior to its use. At the time of use, select granular backfill material shall be free from frozen lumps and foreign materials that may become mixed with it during handling.

## 10. TREE REMOVAL

A. General - Approval of the Engineer shall be obtained prior to removing any trees. The contractor shall be responsible for removal and disposal of such approved trees from the work area and grubbing of stumps and roots.

## 11. PAVEMENT REMOVAL

A. General - Pavement shall be removed to a minimum of one foot from the edge of the trench. No under cutting of pavement will be permitted. Pavement removal shall be cut and removed along straight lines approximately parallel to the centerline of the trench.
B. Concrete Pavement and Driveways - Concrete pavement and driveways shall be cut with a concrete saw utilizing a minimum vertical cut of 6 inches. The remainder of the concrete slab, if any, shall be broken out utilizing a method approved by the Engineer.
C. Asphalt Pavement - Asphalt pavement shall be removed by sawing with neat square edges.
D. Sidewalk - Sidewalk shall be removed to the nearest joint beyond the minimum distances of one foot from the edge of the trench.
E. Other Surfaces - Other types of surfaces may be removed by the machine used for excavating the trench.
F. Disposal - The contractor shall be responsible for proper disposal of removed pavement and surplus excavated material.

## 12. PAVEMENT REPLACEMENT

A. General - No permanent pavement may be restored unless the condition of the backfill will properly support the pavement without settlement. Approval to replace pavement will not relieve the contractor of responsibility for settlement.
B. Replacement - The contractor shall restore/replace all pavement, sidewalks, curbing, and gutters (as well as other site features) removed or disturbed as a part of the work, to a condition equal to that before the work began (or better), unless approved otherwise in writing by the Engineer.
C. Standards - If specifications for pavement restoration and/or replacement are not set forth by the City, the materials and installation shall conform to current edition of the Illinois Department of Transportation Standard Specifications for Road and Bridge Construction, unless otherwise approved by the Engineer.

## 13. ACCESS DURING CONSTRUCTION

A. General - A suitable means of access to property that abuts easements, streets, and roads involved in the construction of the project shall be maintained. Suitable access shall mean a roadway of sufficient width, free from ruts, potholes, and mud holes, and capable of carrying a passenger car without damage to the car. The contractor shall notify all adjoining property owners at least 24 hours in advance of a street closure. Whenever access must be denied due to construction operations, a suitable access shall be provided within 24 hours after that portion of the construction responsible for the access denial is completed. Whenever construction is halted due to inclement weather, weekends, holidays, or any other reason, a suitable access shall be provided for all adjoining property owners.

## 14. DISPOSAL OF DEBRIS AND REFUSE

A. General - All surplus excavated material shall be disposed of by the contractor. Such excess excavated material shall be hauled to a site provided by the contractor. All rubbish, debris, and refuse shall be disposed of at a proper disposal site.

## 15. SAFETY

A. Neither the City nor the Engineer nor any of their employees will be responsible for the contractor's compliance with safety and health requirements and regulations.

# CITY OF EAST DUBUQUE, ILLINOIS <br> WATER DISTRIBUTION SYSTEM REQUIREMENTS 

PART III<br>CONSTRUCTION SPECIFICATIONS FOR WATER MAINS AND APPURTENANCES

## 1. GENERAL

A. Reference to materials or systems herein by name, make, or catalog number is intended to establish a standard of quality and not to limit competition. The words "or approved equal" are implied following each brand name.
B. Water mains shall be constructed in accordance with these specifications and the current requirements of the Illinois Environmental Protection Agency (IEPA).
C. This specification shall apply to water mains from 6 inches to 12 inches in size and to 3 inch and 4 inch service lines.
2. SCOPE
A. Provide all labor, material, facilities, and administration necessary to complete all work covered by this specification in accordance with the best present day installation and construction techniques.
3. MATERIAL
A. Water Main

1) Ductile Iron Pipe (DIP) - Ductile iron pipe shall conform to AWWA C151. DIP shall be cement mortar lined in accordance with AWWA C104 with seal. The DIP shall be coated with an asphaltic material in accordance with AWWA C151. The minimum ductile pipe class shall be special thickness Class 52 for 6 inch through 12 inch.
2) Polyvinyl Chloride (PVC) Pipe - Polyvinyl chloride plastic pipe shall conform to AWWA C900 and have a minimum wall thickness of DR18. PVC plastic pipe may be used for 6 inch through 12 inch water mains and 4 inch service lines. Three inch PVC service lines shall be as specified in Part IV of these specifications.
3) Fire hydrant leads shall be 6 inch diameter DIP with minimum thickness Class 52.
4) DIP is required when installed in areas contaminated by organic compounds per IEPA requirements.
5) Water main pipe shall be made in the USA.
B. Water Main Pipe Joints
6) DIP joints shall be push-on joint or mechanical joint with rubber gaskets and shall conform to AWWA C111.
7) PVC pipe joints shall be gasketed, push-on joint conforming to AWWA C900.
8) Nitrile gaskets are required when DIP is installed in areas contaminated by organic compounds per IEPA requirements.
9) All nuts and bolts used for mechanical joint assembly shall be Cor-Blue per AWWA C111.
10) Sufficient joint lubricant shall be furnished by the pipe manufacturer and used in accordance with the manufacturer's recommendations.

## C. Fittings

1) Fittings for DIP shall be compact ductile iron per AWWA C153, with mechanical joints in accordance with AWWA C111, unless otherwise approved by the Engineer. Fittings shall be cement mortar lined in accordance with AWWA C104 and coated per C153. Fittings shall be made in the USA.
2) Fittings for PVC pipe shall be as required for DIP.
3) All nuts and bolts used for mechanical joint assembly shall be Cor-Blue per AWWA C111.
4) Cast couplings or mechanical joint sleeves may be used for connecting a plain end pipe to another plain end pipe. Cast couplings do not provide thrust restraint. Sleeves shall comply with AWWA C153 and have mechanical joints per AWWA C111. Cast couplings shall be Romac Macro, Romac 501 with epoxy coating and 304 stainless steel bolt, Smith Blair 441 with epoxy coating and 304 stainless steel bolts, Cascade Omega Series with stainless steel bolts, or approved equal.
D. Valves
5) Resilient Seated (RS) Gate Valves - Resilient seated gate valves shall conform to the requirements of AWWA C509 or AWWA C515 and NSF 61. Valve shall have nonrising stems (NRS). Valves shall have double O-ring stem seals and shall open CCW. Valve interior and exterior shall be epoxy coated per AWWA C550. Buried valves shall have mechanical joints in accordance with AWWA C111 and shall have a 2 inch nut actuator. Valve cover/bonnet, stuffing box, and operating nut bolts shall be stainless steel. Valves shall be Kennedy or Clow or approved equal.
6) All nuts and bolts used for valve mechanical joint assembly shall be Cor-Blue per AWWA C111.
7) Valve Boxes - Valve boxes shall be installed on all underground valves. The valve boxes shall be two-piece cast iron design. In paved areas, use a slide type. In all other areas, use a screw extension type. The cover shall be standard drop lid marked "WATER". Extensions may be required. Valve box shall have asphalt coating. Valve boxes shall be made in the USA by Tyler, or approved equal.
8) If water main is deeper than 6 feet, valve stem extensions shall be installed to bring nut within 3 feet of finished grade.
9) Valve Box Centering - All valve boxes shall be installed upon the valve with the use of a rubber Valve Box Adaptor II as manufactured by Adaptor, Inc. to support, center, and seal the box and protect the valve.

## E. Fire Hydrants

1) Fire hydrants shall be Kennedy Guardian.
2) Fire hydrants shall be dry barrel type conforming to AWWA C502. Hydrant bury depth shall be 6.0 feet to provide for 5.5 feet of cover above the top of the connecting 6 inch DIP lead.
3) All hydrants shall be independently valved and have a safety breakaway at 2 inches above ground surface. Below surface machine bolts shall be stainless steel. Hydrants shall be painted red to match existing.
4) Fire hydrant connections and operation shall conform to the requirements of the City Fire Department. Each hydrant shall have two 2-1/2 inch hose nozzles and one $4-1 / 2$ inch pumper nozzle. The size of the connections, type/configuration of threads, and direction of operation of the nozzle caps and the main valve shall match those currently in service.
5) Fire hydrants shall have compression type shutoff, closing with the pressure. The main valve shall not be less than 5 inch diameter. Hydrant inlet shall be a 6 -inch mechanical joint connection conforming to AWWA C111 with bolts as required for fittings. The hydrant design shall permit 360 degree rotation of the top section of the hydrant. All operating parts, including the valve seat, shall be removable through the barrel without digging. Stem seals shall be O-ring type. A weather cap or seal shall prevent water from entering the bonnet section. All hydrants must have bronze seat ring, one piece bronze operating nut with weathershield and mechanically attached nozzles. Nozzle caps shall be equipped with gaskets and securely chained to the barrel with metal chain. An automatic positive drainage system shall be provided at the base of the hydrant that is open when the main valve is closed and that closes when the main valve is opened. Drain valves shall be brass or bronze. Surfaces below grade and the interior of the hydrants shall be coated in accordance with AWWA C502. Hydrant design shall permit barrel extension.

## F. Tracer Wire and Access Boxes

1) Tracer Wire - Tracer wire shall be 12 gauge solid single copper conductor. The insulation material shall be suitable for direct burial applications. Insulation thickness shall be 30 mil (minimum). Insulation color shall be blue for water main. Tracer wire is required for both DIP and PVC pipe installation.
2) Access Boxes - Tracer wire access boxes shall be Copperhead Industries SnakePit ${ }^{8}$ Lite Duty with Two-terminal Switchable Lid (LD14*2T-SW), or approved equal, installed adjacent to each fire hydrant or as otherwise required or approved. Access boxes shall have a 2 -inch PVC extension riser from the top of the water main.

## G. Casing Pipe

1) Unless other specifications govern (railroad, IDOT, other utilities), casing pipe installed in an open cut or by boring shall be steel, conforming to AWWA C200. The diameter of the casing shall be as necessary to accommodate water main bells and spacers. Casing wall thickness shall be as necessary to accommodate loads during and after installation. The casing joints shall be fully welded. The contractor shall install stainless steel spacers for DIP and PVC carrier pipe in the casing. Casing end seals shall be a double wrap of woven geotextile secured with insulated copper wire or stainless steel bands, or end seals as otherwise approved by the Engineer.

## H. Polyethylene Wrap for DIP

1) All DIP (including valves, fittings, and hydrant leads) shall be wrapped with polyethylene encasement conforming to AWWA C105. Provide tubes or sheets with 8 mil minimum thickness.
I. Thrust Restraint Materials
2) All joint restraints (mechanical or push-on) shall be American made and shall meet or exceed the pressure rating of the pipe it is being installed on.
3) Mechanical joint restraints for DIP and PVC pipe shall be manufactured by EBAA, Tyler, or approved equal.
4) Push-on joint restraints for DIP and PVC pipe shall be of the split ring design, and shall be manufactured by EBBA, Tyler, or approved equal.
5) All nuts, bolts, and restraining rods used for joint assembly shall be Cor-Blue per AWWA C111.
6) Concrete thrust blocks shall not be used unless approved by City or City Engineer.
J. Backfill Materials
7) Trench Excavation - Trench excavation material finely divided with nothing larger than $3 / 4$ inch may be used for final backfill in areas that select granular material is not required. If trench excavation material is unsuitable, select granular material shall be used.
8) Select Granular Material - Select granular material shall be in accordance with IDOT's "Standard Specifications for Road and Bridge Construction" for gradations: CA-6, CA-7, CA-9, CA-10, CA-18 or engineer approved equivalent. The select granular material under or within 5 feet of existing or proposed pavement shall be compacted to $95 \%$ of maximum standard Proctor density at minus $1 \%$ to plus $3 \%$ of optimum moisture content, unless otherwise noted.
9) Sand - Sand used for select granular material shall be fine aggregate for portland cement concrete and mortar per Section 1003.02 of IDOT's "Standard Specifications for Road and Bridge Construction" or an alternate natural sand approved by the Engineer.
10) Foundation Stone - Foundation Stone shall be in accordance with IDOT's "Standard Specifications for Road and Bridge Construction" for gradations CA-2, CA-4, or engineer approved equivalent. The maximum size of stone allowed is 3-inch.

## K. Air Release Materials

1) Air Release Required - Air release is required at water main high points. Air release may be through a properly installed fire hydrant, or a yard hydrant.
2) Fire Hydrant - Fire hydrant installation on larger mains may require that the branch of the tee fitting be rotated up to eliminate air in the water main and installation of a vertical mechanical joint fitting in the hydrant lead.
3) Air Release Tap - The yard hydrant shall be Woodford Model Y2 in unfinished areas and Woodford Model Y95 in finished areas. Water service lines shall be 1 inch or $3 / 4$ inch Type K copper per Part IV, installed with NPT by flare or compression adapters (McDonald 74753 flare or 74753Q compression). A curb stop and box (see Part IV) shall be installed in the service line. The top of the water main shall be tapped using a 1 inch or $3 / 4$ inch NPT outlet saddle (Smith Blair 317 for DIP and PVC, Smith Blair 372 for PVCO, with NPT outlet) and a $1 / 4$ bend elbow with NPT inlet and flare or compression outlet (McDonald 74779M flare or 74779MQ compression).

## 4. CONSTRUCTION REFERENCES

A. Water distribution system improvements including water mains, valves, fittings, hydrants, and appurtenances shall be installed in accordance with applicable portions of the following references:

1) AWWA Standard C600 - Installation of Ductile Iron Water Mains and their appurtenances
2) AWWA Standard C605 - Underground Installation of Polyvinyl Chloride (PVC) Pressure Pipe and Fittings for Water
3) AWWA Standard C651 - Disinfecting Water Mains
4) AWWA Manual M17 - Installation, Operation and Maintenance of Fire Hydrants
5) Manufacturer's Recommendations
B. Copies of the references may be obtained from the American Water Works Association, and/or material suppliers/manufacturers.
5. CONTROL OF MATERIAL
A. Responsibility for Materials - The contractor shall be responsible for all materials furnished by them and shall replace, at their expense, any material found defective or damaged. The contractor's responsibility for material furnished by the City shall begin at the point of its delivery to the contractor. The contractor shall be responsible for the safe storage of materials furnished by them or to them, and accepted by them.
B. Handling and Storage of Materials
1) DIP, fittings, valves, hydrants, and accessories shall be loaded and unloaded by lifting with hoists or lifts to avoid shock or damage. Under no circumstances shall such material be dropped. DIP pipe shall be handled so that the coating and lining will not be damaged. If, however, any part of the coating or lining is damaged, the repair shall be made by the contractor at their expense in a manner satisfactory to the Engineer or the material replaced if required.
2) PVC pipe shall be unloaded in units or individually. If the PVC pipe is unloaded in units, unloading should be done according to manufacturer's suggestions and cautions, with recommended equipment. When unloading PVC pipe individually, care shall be taken to insure that pipe is not dropped or damaged. As the temperature falls, the flexibility and impact resistance of PVC pipe decreases. Extra care shall be taken in handling during cold weather. PVC pipe shall be stockpiled on a flat base and bending and point loads avoided. If PVC pipe is to be stored for periods longer than 180 days, the pipe shall be covered to protect it from prolonged exposure to the sun. The PVC pipe shall be covered with canvas or other
opaque material. Clear plastic sheets may not be used. The contractor shall provide for air circulation under the pipe covering material.
3) Stored materials shall be kept safe from damage. The interior and all sealing surfaces of all pipe, fittings, and other accessories shall be kept free from dirt and foreign matter at all times. Valves and hydrants shall be drained and stored in a manner that will protect them from damage by freezing.
4) Pipe shall not be stacked higher than recommended by the manufacturer or as established by applicable standards. Stacking shall be in such a manner to prevent pipe damage, point loading, or contamination.
5) Store all separate DIP rubber rings and gaskets at a central location. Keep them clean, away from oil, grease, excessive heat, and electric motors which produce ozone. If rubber rings and gaskets are not to be used immediately, store them in their cartons or containers, as shipped, in a cool, dark place (out of the direct rays of the sun). Do not remove gaskets installed by the PVC pipe manufacturer.

## 6. INSTALLATION, GENERAL

A. General - The project site shall be prepared and all excavation and backfill, as well as site restoration, shall be in accordance with Part II of these Water Distribution System Requirements and applicable references. Minimum cover for water mains shall be 5.5 feet.
B. Work Included - The contractor shall furnish all material (unless otherwise indicated in these specifications on the project drawing or the proposal/bid form), all equipment, tools, and labor necessary to perform the work required herein, and on the drawings including unloading, hauling, distributing, laying, and testing of the water main pipe, fittings, valves, hydrants, and accessories.
C. Water Used - The City will supply water necessary for disinfection, flushing, testing, etc.
D. Alignment and Elevations - Water mains shall be laid to and maintained at the alignment and elevations established on the drawings unless adjustment is necessary to avoid other underground utilities or structures, to provide required clearances, or to make connections. Fittings, valves, taps, hydrants, etc. shall be installed at required locations. Valves shall be installed with operating stems vertical and centered in the valve box. Hydrants shall be installed plumb, so that the cover backfill above the connecting water main will not be less than that of the adjacent main, so that the bury mark of the hydrant barrel is at finished ground level and the safety breakaway section is approximately 2 inches above the finished ground surface.
E. Trench Construction - The trench shall be excavated to the required alignment and depth and to the appropriate width in conformance with all federal and state regulations for the protection of the workers. Discharge from trench dewatering shall be transported to an acceptable location. Excavated material shall be placed in a manner that will not obstruct the work nor endanger the workers, obstruct sidewalks, driveways, or other structures. Removal of pavement and road surface shall be part of trench excavation. Dimensions of pavement removal shall not exceed those required for safe installation of pipe, valves, fittings, hydrants, etc. Pavement removal shall include sawing to ensure breakage along straight lines.

Rock (or similar rigid material) shall be removed to provide a clearance of at least 6 inches below and on each side of all pipe, valves, and fittings. The trench bottom shall be uniform and free from large stones, large dirt clods, and any frozen material. Appropriate backfill shall be placed, leveled, and compacted between any rock and the pipe. Where the water main trench passes over
another utility or previous excavation, the trench bottom shall be sufficiently compacted to provide equal and uniform support. All property and surface structures that are to remain including trees, shrubs, and fences shall be properly protected from damage. Cutting tree roots or branches shall be done only as approved. Temporary support is to be provided for all underground and surface structures, drains, and sewers encountered. Unsuitable material shall be removed to a minimum of at least 6 inches, unless otherwise required, and replaced with stable backfill.
F. Protection of Water Supplies - Water mains and appurtenances shall be separated from gravity sewers, wastewater pressure mains and manholes in accordance with Part I provisions.

## 7. PIPE INSTALLATION

A. General - Proper implements, tools and facilities satisfactory to the Engineer shall be provided and used for the safe and convenient performance of the work. All pipe, fittings, valves, and hydrants shall be lowered carefully into the trench in a manner that will prevent damage (do not use end hooks). Under no circumstances shall the pipe or accessories be dropped or dumped into the trench. All pipe and accessories shall be inspected for defects prior to placement. Any defective, damaged, or unsound material shall be repaired or replaced. All foreign matter or dirt shall be removed from the interior of the pipe. No debris, tools, clothing, or any foreign materials shall be placed in the pipe at any time. Lumps, blisters, and excess coating shall be removed from the DIP. As each length of pipe is placed in the trench, the joint shall be assembled and the pipe brought to correct alignment and elevation. Pipe shall be secured in place with approved backfill material. At all times when pipe laying is not in progress, the open end of the pipe shall be closed by a watertight plug.
B. Trench Bedding and Backfill Zones

1) Foundation - The natural or improved bottom of the trench which supports the pipe and its bedding.
2) Bedding - The four (4) inch layer of material placed on top of the foundation and on which the pipe lies.
3) Haunching - The material placed on each side of the installed pipe, from the top of bedding to the centerline (springline) of the pipe.
4) Initial Backfill - The backfill from the centerline (springline) of the pipe to twelve (12) inches above the top of pipe.
5) Final Backfill - The backfill from twelve (12) inches over the top of the pipe to natural or finished surface elevation.
C. Pipe Bedding and Backfill
6) Pipe Bedding - Select granular backfill shall be placed, consolidated and compacted in the bottom of the trench to $95 \%$ of Standard Proctor Density for DIP and PVC pipe. Bedding material shall be placed for the entire width of the trench and length of the pipe to be installed.
7) Haunching - Haunching material shall be placed longitudinally along the pipe in maximum six (6) inch layers, loose measure. The elevation of the haunching material on each side of the pipe shall be the same. Special care shall be taken to completely fill the space under the pipe
haunches. Compaction of the haunching shall be to $95 \%$ of Standard Proctor Density. Haunching material for PVC and DI pipe shall always be select granular material.
8) Initial Backfill - Initial Backfill shall be carefully deposited in uniform layers not exceeding six (6) inches thick, loose measure. The filling of the trench shall be carried on simultaneously on both side of the pipe in such a manner that damage to the pipe or injurious side pressures do not occur. Care shall be taken to avoid contact between the pipe and compaction equipment. Compaction equipment shall not be used directly over the pipe until sufficient backfill has been placed to insure that such equipment will not damage or disturb the pipe. Initial backfill material for PVC and DI pipe shall always be select granular material compacted to $95 \%$ of Standard Proctor Density.
9) Final Backfill - Upon completion of the initial backfill, the remainder of the trench shall be backfilled to the natural line or finished surface as rapidly as the conditions will permit. The backfill material shall consist of the suitable excavated material or select granular backfill. For areas under or within 5 feet of pavement, select granular backfill shall be used and compacted to $95 \%$ of Standard Proctor Density. Suitable excavated material can be used in all other areas and compacted to $80 \%$ of Standard Proctor Density.
D. Unsuitable Backfill Material
10) Where there is a deficiency of suitable backfill material due to a rejection of part or all of the excavated material as unsuitable for backfill purposes, the contractor shall furnish suitable backfill from other sources.
E. Direction of Pipe Laying - Pipe shall be laid with bell ends facing in the direction of laying unless otherwise directed or allowed by the Engineer. On slopes $10 \%$ or greater, the laying shall commence at the bottom and proceed upward.
F. Pipe Cutting - Cutting pipe for inserting valves, fittings, or closure pieces shall be done in a safe neat manner without creating damage to the pipe or lining. Cut ends shall be smooth and at a right angle with the pipe axis. Flame cutting of DIP is not permitted. Cut ends of both DIP and PVC pipe shall be deburred and ground or shaped to provide a slight outer bevel to prevent gasket damage. Cut pipe ends for push-on joints shall be shaped to match factory bevels.

## 8. JOINTS

A. DIP Push-On Joint Assembly - Push-on DIP joints shall be assembled in accordance with the manufacturer's recommendations. The groove in the bell shall be cleaned and the gasket properly installed. The beveled plain end shall be cleaned. Sufficient clean lubricant shall be applied to the joint and the plain end pushed into the bell to the required depth keeping the joint straight during assembly. Make deflections as applicable after joint assembly. Proper care shall be taken when pushing the pipe home to avoid damage to the pipe and gasket.
B. PVC Push-On Joint Assembly - Push-on PVC pipe joints shall be assembled in accordance with the manufacturer's recommendations. The sealing surface of the pipe spigot end, the bell, and the elastomeric gaskets shall be cleaned immediately before assembly. Factory installed gaskets shall not be removed. Joint lubricant approved by the pipe manufacturer shall be applied to the spigot and gasket. Insert the spigot end into a bell end only to the insertion line marked on the pipe. After assembly, the insertion line shall remain visible and remain flush with the lip of the adjoining PVC pipe bell. Do not insert the spigot beyond the insertion line in order to allow for thermal movement. Solvent cemented joints in PVC pipe will not be allowed.
C. Mechanical Joint Assembly - The socket and plain end shall be cleaned. The gland and gasket shall be placed on the plain end pipe, lubricated and the plain end inserted into the socket. The gasket shall be pressed firmly and evenly into the gasket recess. The joint shall be straight during assembly. Deflections, if any, shall be made after joint assembly but prior to tightening bolts. Manually install bolts through the bell into the gland. Tighten bolts alternately to the recommended torque.
D. Joint Deflection - Maximum deflection for DIP push-on joints shall be as indicated in AWWA C600. Maximum mechanical joint deflection for DIP and PVC pipe shall be as indicated in AWWA C600. The maximum joint deflection is as follows:

| Pipe Size | DIP Push-On |  |  | DIP/PVC Pipe M.J. |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | Deflection Angle | Offset In |  | Deflection Angle | Offset In |  |
|  |  | 18 ft . | 20 ft . |  | 18 ft . | 20 ft . |
| 3" | $5^{\circ}$ | 19" | 21" | $8.3{ }^{\circ}$ | 31" | 35" |
| $4 "$ | $5^{\circ}$ | 19" | 21" | $8.3{ }^{\circ}$ | 31 " | 35" |
| 6 " | $5^{\circ}$ | 19" | 21" | $7.1^{\circ}$ | 27 " | 30" |
| 8 " | $5^{\circ}$ | 19" | 21" | $5.3{ }^{\circ}$ | 20" | 22" |
| $10^{\prime \prime}$ | $5^{\circ}$ | 19" | $21 "$ | $5.3{ }^{\circ}$ | 20" | 22" |
| 12" | $5^{\circ}$ | 19" | 21" | $5.3{ }^{\circ}$ | 20" | $22^{\prime \prime}$ |

E. PVC Pipe Straight Alignment - PVC pipe shall not be in curved alignment unless specifically approved by the Engineer. PVC pipe shall, in general, be installed straight between fittings. If pipe bending is allowed, the radius shall be twice the manufacturer's recommended minimum (offset shall be half of manufacturer's recommended maximum).
F. DIP/PVC Pipe Transitions - Transitions between DIP and PVC pipe shall be made at fittings, cast couplings, or mechanical joints. Do not insert PVC pipe into a DIP push-on joint or DIP into a PVC pipe push-on joint.

## 9. VALVE FITTING AND HYDRANT INSTALLATION

A. Valve and Fitting Installation - All valves shall be inspected prior to installation for direction of opening, number of turns to open, proper operation, tightness of pressure containing bolts and test plugs, cleanliness, damage and cracks. Defective valves shall be repaired or replaced. Valves shall be closed before being installed. Valves and fittings shall be installed in accordance with requirements for mechanical joint assembly. Valves shall be uniformly supported with the connected pipe. Valves and fittings shall be located where shown on the drawings and/or where required. A valve box with centralizer as specified shall be provided for every valve. The valve box shall be centered over the valve stem and shall be plumb. The box cover shall be flush with the finished surface. Backfill shall be select granular backfill around the valve and bottom of the valve box to prevent soil migration into the box, and shall be properly tamped around the valve box. All dead ends shall be closed with suitably restrained plugs or caps. If a valve precedes a cap or plug, it shall also be restrained as a dead end.
B. Hydrant Installation - Prior to installation, inspect all hydrants for direction of opening, nozzle threading, operating-nut, and operating-nut dimensions, tightness of pressure-containing bolting, cleanliness of inlet elbow, damage, and cracks. Defective hydrants shall be repaired or replaced. Hydrants shall be installed plumb with the nozzles oriented toward the street and/or location of probable fire department connection. All fire hydrants shall be placed on a concrete slab 4 inches
thick to prevent settling. The hydrant shall be properly restrained against thrust. Care shall be taken to adequately support connecting pipe to minimize shear forces. All hydrants shall be installed with a shut-off valve located in the 6 inch hydrant lead. Hydrants shall be located as shown on the drawings or as directed by the City Engineer. Care shall be taken when placing hydrants not to plug the drainage hole in the base of the hydrant. Hydrant shall be backfilled with an approved $1 / 8$ to $3 / 8$-inch gravel or clean crushed stone to a height of 3 feet above the bottom of the trench and for the width of the trench. The drainage rock shall be covered with an eight mil polyethylene sheeting and the backfill tamped around the hydrant. Hydrants shall be operated to assure all parts are in working condition and the drain functions.
C. Thrust Restraints - All bends, offsets, tees, crosses, wyes, plugs, caps, valves, and hydrants shall be restrained from movement due to thrust created by system pressures. Restraints shall be by restrained joints. Tie rods or concrete thrust blocks may be used if approved by the Engineer. Wood blocking is not acceptable. Cast-in-place concrete must achieve required strength prior to application of pressure to the water main.

Restrained joints and length of restrained pipe shall be established by the Design Engineer and be subject to the approval of the Engineer.

Proper thrust restraint design is the responsibility of the Design Engineer. Restrained joints shall be utilized for thrust restraint unless otherwise approved by the Engineer. Concrete thrust blocks may be used only if approved by the City Engineer.

## 10. CONNECTIONS TO EXISTING WATER MAINS

A. Connections to existing mains shall be made so that water is not shut off for more than four hours to anyone. The contractor shall provide at least two hours advance notice to all affected by service interruption. Connections shall be made using a tee, branch valve, and cast coupling or mechanical joint sleeve.

## 11. SPECIAL INSTALLATION REQUIREMENTS

A. Polyethylene Wrap - DIP, valves, and fittings shall be wrapped with polyethylene encasement per AWWA C105. Polyethylene tubes shall be furnished by the pipe manufacturer unless otherwise approved by the Engineer. Installation of polyethylene shall be in accordance with AWWA C105 and as follows:

1) The polyethylene tube shall be cut approximately 2 feet longer than the pipe length, slipped over the spigot end of the pipe, and bunched up in an accordion fashion.
2) The pipe shall be placed in the trench and the pipe joint made in a normal manner leaving a shallow bell hole.
3) Pull the bunched polyethylene from the preceding pipe over the end of the next length of pipe and secure in place with tape.

Slip the bunched polyethylene from the length over the bell of the preceding pipe and secure in place. Take up the slack width to make a snug, but not tight, fit along the barrel of the pipe, securing the fold at quarter points.
4) Repair any rips, punctures, or other damage to the polyethylene with tape or with a short length of polyethylene tube cut open, wrapped around the pipe and secured in place.
5) Proceed with installation of the next section of pipe in the same manner.
B. Casing - Lines under railroad tracks, highways, and other locations requiring casing pipes shall be noted on the drawings. Size, wall thickness, and classification shall be as shown on the drawings, or as required by the railroad or IDOT. Installation shall be by boring. Care shall be taken to maintain line and grade.

Casing spacers shall be used for all DIP and PVC pipe. If other specifications govern boring, the contractor shall comply with those requirements. The ends of a casing shall be sealed with a double wrap of woven geotextile, secured with insulated copper wire or stainless steel bands around the casing and the carrier pipe, or end seals as otherwise approved.

## 12. DISINFECTION

A. AWWA C651 - Water mains shall be disinfected in accordance with AWWA C651. The contractor shall, during construction of the water main, take precautions to protect the interior of the pipe, fittings, and valves against contamination. Pipe delivered for construction shall be positioned to minimize entrance of foreign materials. Plug all pipe openings when pipe laying is not in progress.

Plugs shall remain in place until the trench is dewatered. If dirt enters the pipe, and if in the opinion of the Engineer, the dirt will not be removed by the flushing operation, the interior of the pipe shall be cleaned by mechanical means and then swabbed with a one percent hypochlorite disinfecting solution. The cleaning and swabbing procedure shall minimize the amount of material forced into joint spaces.
B. Tablet Method - In general, the tablet method of chlorination shall be used initially. If the pipe and accessories are or become dirty or contaminated, flushing and rechlorination are required and the continuous feed or slug method shall be used. The tablet method shall obtain an average chlorine dosage of $25 \mathrm{mg} / \mathrm{l}$, the continuous feed method shall obtain a 24 hour chlorine residual of not less than $10 \mathrm{mg} / \mathrm{l}$, and the slug method shall provide a three hour exposure to not less than 100 $\mathrm{mg} / \mathrm{l}$ free chlorine.

The tablet method shall include the use of either five gram (g) tablets or granules that contain 65 percent available chlorine by weight. The calcium hypochlorite tablets or granules shall conform to AWWA B300. Do not use calcium hypochlorite intended for swimming pool disinfection. The tablet method of disinfection shall consist of placing granules or tablets in the water main as it is being installed and filling the main with fresh potable water when installation is completed. Pipe and appurtenances shall be kept clean and dry.

When granules are used they shall be placed at the upstream end of the first section of pipe, at the upstream end of each branch main, and at 500 foot intervals. The quantity of granules shall be as follows:

| Pipe Size |  | Hypochlorite Granules |
| :---: | :---: | :---: |
| $3 "$ |  | $1.0 \mathrm{oz} / 27 \mathrm{~g}$. |
| $4 "$ |  | $1.7 \mathrm{oz} / 48 \mathrm{~g}$. |
| $6 "$ |  | $3.8 \mathrm{oz} / 113 \mathrm{~g}$. |
| $8 "$ |  | $6.7 \mathrm{oz} / 190 \mathrm{~g}$. |
| $10 "$ |  | $10.5 \mathrm{oz} / 298 \mathrm{~g}$. |
| $12 "$ |  | $15.1 \mathrm{oz} / 428 \mathrm{~g}$. |

When tablets are used they shall be placed in each section of pipe and one tablet shall be placed in each hydrant, hydrant branch, and other appurtenance. The quantity of tablets for 18 or 20 foot pipe segments shall be as follows:

| Pipe Size |  | Hypochlorite Tablets |
| :---: | :---: | :---: |
| $3 "$ |  | 1 |
| $4 "$ | 1 |  |
| $6 "$ | 1 |  |
| $8 "$ | 2 |  |
| $10^{\prime \prime}$ | 3 |  |
| $12 "$ | 4 |  |

C. Filling - When pipe installation is completed, the main shall be filled with water at a rate such that water within the main will flow at a velocity no greater than 1 foot per second. All air pockets shall be eliminated. The chlorinated water shall remain in the pipe at least 24 hours ( 48 hours if water temperature is below 41 degree F). Heavily chlorinated water shall be prevented from flowing into water mains in active service.
D. Chlorine Testing - After the 24 hour retention period, the heavily chlorinated water shall be tested for free residual chlorine concentration. The presence of free chlorine must be found in all samples ( 2 samples minimum and 2 samples per 1200 feet of water main). Contractor shall provide chlorine testing equipment and perform tests.
E. Flushing - After the retention period, heavily chlorinated water shall be flushed from the main being disinfected and shall not remain in prolonged contact with the pipe and appurtenances. Flushing shall continue until the chlorine concentration is no greater than two milligrams per liter or the level prevailing in the existing distribution system. The heavily chlorinated water must be neutralized with an appropriate chemical such as ascorbic acid, sodium bisulfate, sodium, or calcium thiosulfate and/or procedures that eliminate all chlorine prior to discharge into surface drainageways.
F. Bacteriological Testing - After final flushing and before the new water main is placed into service, two consecutive sets of acceptable samples taken at least 24 hours apart shall be collected from the new main. One set of samples shall be collected from every 1200 feet of the new water main, plus one set from the end of the line, and at least one set from each branch. Samples shall be tested for bacteriological quality per "Standard Methods" and shall all show the absence of coliform organisms prior to placing the water main into service. Sample containers shall be treated with sodium thiosulfate. The use of fire hydrants as sampling locations may not provide optimum sampling conditions. Reflushing and/or redisinfection per AWWA C651 is required if all bacteriological test results do not indicate safe results.

## 13. TESTING

A. General - Pressure and leakage testing shall be performed in accordance with AWWA C600 for DIP and AWWA C605 for PVC pipe.
B. Pressurization - After the pipe has been laid and backfilled, all newly laid pipe or any valved section thereof shall be subjected to a hydrostatic pressure of at least 150 percent of the working pressure at the lowest point of testing along the water main and a minimum of 125 percent of the working pressure at the highest point of testing along the water main. Test pressure shall not exceed pipe or thrust restraint design pressures, shall be for a two hour duration, shall not vary by
more than plus or minus five psi for the duration of the test, shall not exceed 200 percent of the rated pressure of any valves or hydrants, and shall not exceed the pressure rating of closed resilient seated gate valves.

Each valved section of pipe shall be filled with water slowly and the specified test pressure, based on the elevation of the lowest point of the line or section under test and corrected to the elevation of the test gauge, shall be applied by means of a pump connected to the pipe in a satisfactory manner. Valves shall not be operated during the test.
C. Air Removal - Before applying the specified test pressure, air shall be expelled completely from the pipe, valves, and hydrants. If permanent air vents are not located at all high points, the contractor shall install a permanent air release tap according to these specifications and remove all air.
D. Examination - Any exposed pipe, fittings, valves, hydrants, and joints and the route of the water main shall be examined carefully during the test. Any defective material, joints, or leaks discovered during the test shall be repaired or replaced and the line retested.
E. Schedule - Testing the water main may be done by any reasonable schedule preferred by the contractor in the presence of the Engineer or City representative, provided that the contractor shall give at least 48 hours notice ahead of the time the contractor contemplates making the test.
F. Leakage Defined - Leakage shall be defined as the quantity of water that must be supplied into newly laid pipe, to maintain pressure within 5 psi of the specified test pressure after the air in the pipeline has been expelled and the pipe has been filled with water.
G. Allowable Leakage - No pipe installation will be acceptable if the leakage is greater than the quantity determined by the formula in AWWA C600/C605. Leakage equals the product of the pipe length in feet being tested, the nominal diameter of the pipe in inches and the square root of the average test pressure in psi; all divided by 148,000 .

Hydrants shall be closed during testing, but hydrant isolation valves shall be open. If any test discloses leakage greater than that allowable, the contractor shall, at their own expense, locate and make repairs as necessary until leakage is within allowable limits. All visible leaks shall be repaired regardless of the amount of leakage.

## 14. BACKFILLING

A. Backfilling shall be in accordance with Part II, AWWA C600 or AWWA C605 and manufacturer's recommendations. Haunching and initial backfill (from the bottom of pipe to the top of pipe) shall be carefully placed and compacted to provide proper side support to the pipe. Areas requiring special backfill shall include restrained pipe length locations and pipe laid under pavements, sidewalks and other utilities. Unless otherwise necessary, excavated material, if suitable, may be used for trench backfill with proper compaction. Special backfill material such as sand or crushed stone must have approval of the Engineer. Trenches shall be backfilled as quickly as possible.

The contractor shall be responsible for trench settlement and shall take the necessary measures to assure no settlement occurs under other utilities or pavement.

## 15. REMOVAL RESTORATION AND MAINTENANCE

A. Restoration - The contractor shall restore the surface of the disturbed construction area to the condition prior to construction, or better. In areas of grass, topsoil shall be removed, stored, and
replaced. All property, structures, pavement, trees, shrubbery, fences, poles, or surface structures removed, damaged or disturbed by the contractor shall be replaced or repaired by the contractor as required.
B. Cleanup - All surplus water main materials furnished by the contractor and all tools and temporary structures shall be removed from the site by the contractor. All soil, rubbish, and excess earth from the excavation shall be hauled to a site furnished by the contractor, and the construction site left clean to the satisfaction of the City. Cleanup activities shall keep up with construction activities. If cleanup is unsatisfactory, the City shall notify the contractor who will perform cleanup. If cleanup is not done by the contractor, the City may perform it and bill the contractor. Return any unused materials furnished by the City to a designated location.
C. Maintenance of Site - During the course of construction, the contractor shall maintain all areas to permit use of the construction area after cleanup. Further, the contractor shall perform whatever maintenance is necessary, of items disturbed or placed or replaced by the contractor without delay. All maintenance shall be done at no cost to the City and to the satisfaction of the City.

# CITY OF EAST DUBUQUE, ILLINOIS <br> WATER DISTRIBUTION SYSTEM REQUIREMENTS 

## PART IV <br> CONSTRUCTION SPECIFICATIONS FOR SERVICE CONNECTIONS TO WATER MAINS

## 1. GENERAL

A. Reference to materials or systems herein by name, make, or catalog number is intended to establish a standard of quality, and not to limit competition; the words "or approved equal" are implied following each brand name.
B. Service connections shall conform to the requirements of this part, Part III as applicable, and the State of Illinois Plumbing Code.
C. Service Requirements

1) Size - The minimum size service required is $3 / 4$ inch nominal. However, 1 inch minimum services are recommended. Services of 2-1/2 inch, 3-1/2 inch and 5 inch sizes are not allowed.
2) Material - Services $3 / 4$ inch to 2 inch shall be copper or HDPE. Any 3 inch and 4 inch service may be PVC or DIP. All 3 inch and larger services shall conform to water main requirements in Part III, except that the 3 inch PVC pipe and fittings shall comply with Part IV.
3) Taps - Services ( $3 / 4$ inch to 2 inch) connections to existing mains shall be live taps, unless otherwise approved. Service connections to new mains should be installed on depressurized mains to allow pressure testing of mains and services.
4) Service Valves - Services lines $3 / 4$ inch through 2 inch shall include a corporation stop and saddle as required at the main and a curb stop at or near the property line or easement limit. Services 3 inch and larger shall include a valve at the tee or tapping sleeve.
2. SCOPE
A. Provide all labor, material, facilities, and administration necessary to complete all work required for proper leak-free installation of service connections to water mains all in accordance with the best present day installation and construction techniques. Installation shall conform to applicable codes, AWWA standards, and manufacturer's recommendations.
3. MATERIALS
A. Water Service Tubing and Pipe
1) Copper tubing and polyethylene pipe can be used for service lines $3 / 4$ inch through 2 inch.
2) Copper Tubing - Copper tubing for $3 / 4$ inch, 1 inch, $1-1 / 4$ inch, $1-1 / 2$ inch, and 2 inch service lines shall be Type K conforming to ASTM B88. Joints in copper shall be either flared or grip ring compression type. Underground soldered joints, pack joints, and insert joints (stubin) are not permitted.
3) Polyethylene Pipe - Polyethylene water service lines shall be SDR-9 CTS polyethylene pipe conforming to ASTM D2239 and AWWA C901. The pressure rated polyethylene pipe shall be rated for 250 psi. Polyethylene pipe is required to have tracer wire installed to the curb box.
4) PVC Pipe - PVC pipe for 3 inch service lines shall be SDR 17 conforming to ASTM D2241. Pipe joints shall be gasket type conforming to ASTM D3139 with gaskets conforming to ASTM F477. No solvent cemented joints will be allowed. PVC Pipe shall have tracer wire installed.
5) Larger Services - The requirements for water mains shall apply to 3 inch and larger services. See Part III.

## B. Water Service Fittings

1) Bronze Fittings - Bronze fittings for copper tube and polyethylene pipe service lines shall be no-lead per federal regulations and shall conform to AWWA C800. Connections shall be grip ring compression type for copper tube and polyethylene pipe. Stainless steel inserted stiffeners are required when using polyethylene pipe. Flared end compression type fittings are allowed for copper tubing. The use of "U" or "Y" branch multiple branch/tap fittings is prohibited.
2) Ductile Iron Fittings - Fittings for 3 inch and larger services shall be mechanical joint, compact ductile iron per Part III with transition gaskets.

## C. Water Service Valves

1) Corporation Stops - Corporation stops shall be no-lead and shall conform to AWWA C800 and shall be ball type rated for 300 psi with rubber seats. Inlet threads on corporation stops shall be AWWA tube. The outlet shall be flare or grip ring compression for $3 / 4$ inch through 2 inch copper water services. The outlet shall be grip ring compression with stainless steel inserted stiffener for PE Pipe. Unless otherwise approved, corporation stops shall be:

| Manufacturer | Flare <br> (Copper Tubing) | Compression <br> (Copper Tubing) | Compression <br> (PE Pipe) |
| :---: | :---: | :---: | :---: |
| A.Y. McDonald | 74701B | 74701 BQ | 74701B-3Q |

2) Curb Stops - Curb stops shall be no-lead and shall conform to AWWA C800 and shall be ball type, Minneapolis pattern, with flare or grip ring compression connections for $3 / 4$ inch through 2 inch copper water services. The outlet shall be grip ring compression with stainless steel inserted stiffener for PE Pipe. Curb stops shall be as follows or equal:

| Manufacturer | Flare <br> (Copper Tubing) | Compression <br> (Copper Tubing) | Compression <br> (PE Pipe) |
| :---: | :---: | :---: | :---: |
| A.Y. McDonald | 76104 | 76104 Q | $76104-3 \mathrm{Q}$ |

3) Curb Boxes - Curb boxes shall be extension type Minneapolis pattern with cast iron base, and lid with pentagon plug or nut. Curb boxes shall be as follows:

| Manufacturer | $\underline{\text { Model }}$ |
| :--- | :--- |
| A.Y. McDonald | 5623 (w/bushing if necessary) |

4) Gate Valves - Valves in 3 inch and larger service lines shall be mechanical joint, resilient seated gate valves per Part III with transition gaskets for PVC. Gate valve assembly shall include a valve box and box centering guide.
D. Tapping Saddles and Sleeves
5) Tapping saddles are required for all $3 / 4$ inch through 2 inch taps of existing and new PVC water mains and for 1-1/4 inch and larger taps of existing Cast Iron Pipe (CIP) and DIP mains. Direct $3 / 4$ inch and 1 inch taps may be used on existing CIP and DIP water mains. Direct taps of existing CIP or DIP or new DIP water mains will be permitted if the wall thickness is sufficient for two AWWA threads, otherwise tapping saddles are required. If the wall thickness is unknown, tapping saddles are required. Two threads on 6 inch DIP requires Class 51 and on 8 inch through 12 inch, Class 350 is suitable.
6) Tapping saddles shall be designed for nearly full support of C900 PVC water main. Saddles for DIP and PVC shall have a ductile iron or bronze/brass body, two stainless steel straps with stainless steel studs, nuts and washers; and a NSF 61 gasket. The tapping saddle service outlet connection shall be AWWA taper threads. Tapping saddles shall be as follows:

| Manufacturer | Ductile Iron Body | Bronze Body | SST Body |
| :---: | :---: | :---: | :---: |
| Smith Blair | 317 | -------- | 372 |
| A.Y. McDonald |  | 3855 |  |
| Romac | 202NS | 202BS | 306 |
| Cascade | CNS2 | ------- | CSC2 |

3) Tapping sleeves for pressurized connections of 3 inch and larger shall be all stainless steel with a mechanical joint outlet. Tapping sleeves shall be Smith Blair 663--MJ, or approved equal. A 4 inch by 3 inch mechanical joint reducer may be required for a 3 inch service line.
E. Water Meters
4) City of East Dubuque shall determine size and type of water meter.
5) Water meters up to and including 1 inch shall be furnished by the City of East Dubuque. Owner's plumber shall install the meter.
6) Water meters larger than 1 inch shall be furnished by the City of East Dubuque. Owner's plumber shall install the meter. The City will bill the Owner for the cost of the meter.
7) Water meters shall be installed immediately upon completion of the service and prior to pressurizing new system.
8) For any new installation the meter shall be placed as close as possible to where service enters the structure. The owner's plumber shall install shut off valves on both sides of the meter.
9) The Owner shall furnish and install 18 gauge 3 -conductor wire from the water meter to an area near the electric meter. In the case of underground electric with a meter pedestal, the Owner shall run the wire in conduit to the meter pedestal.

## 4. INSTALLATION

A. General

1) Code Compliance - Water services shall be installed in accordance with the State of Illinois Plumbing Code.
2) Protection of Water Supplies - Separation distances required for sewers and water mains shall be applicable to water service connections and sanitary and storm sewers. See Part I of these specifications.
3) Installation Records - The installing contractor shall record the locations of taps, sleeves, tees, service lines, and curb stops/boxes. Copies of these records shall be submitted to the City. The contractor shall assist representatives of the City in making measurements for additional records.

## B. Excavation

1) Excavation shall conform to the applicable portion of Part II.
2) Alignment - Water service lines shall be installed in a straight alignment and perpendicular to the water main connection, to the extent possible, between tap and curb stop.
3) Trench Depth - Trench depth shall allow for water service installation with a minimum depth of cover of 5.5 feet from the final surface to the top of the pipe/tube. The depth shall provide for a uniform slope without intermediate high points.
4) Insulation - In-ground obstructions may prevent the water service line from being installed with 5.5 feet of cover or service lines may be relatively close above or below storm sewers or culverts. With approval of the City, the service line shall be insulated above and/or below the obstruction or pipe. The insulation shall be extruded polystyrene foam.
5) Trench Width - The trench width shall be as necessary for proper service line installation with a minimum width of 18 inches to allow for proper bedding, haunching, initial backfill, and final backfill.
C. Water Service Installation
6) Tapping of water mains shall be witnessed by City employee or Engineer. The Contractor shall coordinate with City to witness the tapping operation and shall provide a minimum of 24 hour notice to the City.
7) Taps - Taps shall be located no closer than 2 feet from the end of a water main pipe segment. A distance of 3 feet between taps is required. Taps shall be installed on the horizontal centerline of the water main (3 o'clock or 9 o'clock positions).

Tapping saddles are required for all taps on PVC mains and for 1-1/4 inch and larger taps on CIP and DIP mains. Direct $3 / 4$ inch and 1 inch taps may be made on existing CIP or DIP mains and future DIP mains with sufficient wall thickness for the required number of threads. Shell cutters shall be used for holes in PVC water mains at service taps. The use of twist drills or spade bits is not permitted for PVC. Twist drills may be used for CIP/DIP taps.

Water main tapping shall be performed by workers with experience in the procedure. The contractor is responsible for arranging for larger live taps and tapping sleeve connections by a qualified and experienced entity as approved by the City. Live taps will be required when shutting down system will result in hardship to critical areas.
3) Corporation Stops - Corporation stops shall be installed on all $3 / 4$ inch to 2 inch water service connections. The corporation stop must be left in the fully open position at the completion of the installation. Thread sealant tape may be used.
4) Curb Stops - Curb stops shall be installed near the property line or easement limit for all $3 / 4$ inch to 2 inch water service connections. The base of the curb stop shall be level. Plug or enclose a curb stop that is not connected to a building. Install the curb box plumb over the curb stop with the top at final surface elevation. Brace during backfilling.
5) Larger Valves - Valves for 3 inch and larger service lines shall be gate valves per Part III, installed at the tee in or tapping sleeve on the water main.
6) Copper Tubing and PE Pipe Installation - Copper tubing or PE pipe shall be installed to accommodate minor movement of the service line. Tubing or pipe shall be cut squarely and any burrs removed. The end of the copper tubing shall be properly flared with the correct tool after installation of the sleeve nut for flare connections. Copper tubing and PE pipe shall be fully inserted into compression joints. Flare and compression nuts shall be tightened per manufacturer's recommendations.
7) Larger Service Lines - Install 3 inch or larger service lines as required for water mains in Part III.
8) Tracer Wire - The installation of an insulated copper tracer wire from the tap or main connection into the building is recommended for future service line locating.
9) Bedding, Haunching, Backfill - Clean stone shall not be used for bedding, haunching, and initial backfill of copper service lines. Refer to Pipe Installation in Part III for installation requirements for service lines.
10) Testing - Service lines on new water mains shall be pressure and leakage tested as part of the water main testing. Service lines on existing water mains shall be thoroughly checked prior to backfilling for leaks when main pressure is applied. However, if service lines are connected to existing mains and installed into a building (or include a hydrant), the entire service shall be pressure tested. Pressure tests shall be at $150 \%$ of water main pressure. The pressure test must be observed by a City representative. Test procedures shall conform with AWWA C600 or C605.

When 2 inch and larger service lines are extended into buildings the service line shall be disinfected, flushed, and one water sample collected. The sample shall be tested for bacterial safety. Disinfection and water sampling shall comply with AWWA C651.
11) Curb/Valve Box Stake - Place a 2 inch by 2 inch by 4 foot treated wood stake adjacent to each curb box and valve box. The stakes shall remain until connections to the building are installed and the area is landscaped or restored (surfaced, paved, permanently seeded, etc.).

