ORLANDO UTILITIES COMMISSION

WATER BUSINESS UNIT

CONSTRUCTION STANDARDS

(A REFERENCE)

GENERAL STANDARDS

General Policy And Procedures

Table of Contents

General Policy And Procedures 1
Design Consideration 4
Coordination Efforts 5
Safe Work Practices and Accident Prevention 6
Material Delivery, Quality, Handling and Storage 8
Waste Material Disposal and Dust Control 9
Sanitary Regulations 10
Siltation and Bank Erosion Control 10
Traffic Control 10
Noise Abatement 10
Inspection, Testing, and Quality Assurance 11
As-Built Drawing 12
Public Involvement 14
Property Protection 17
Developer/ Contractor Procedures 18
Developer's Agreement 19
Drawing Standards 20
Cooperation with other Contractors 20
Site Preparation 21
Preparation Around Trees and Shrubs 22
Subsurface Investigation/Line Location 23
Dewatering 24
Trenching, Sloping, Shoring, and Spoils 25
Private Property / Public Access 27
Temporary Fences and Barriers 27
Temporary Services 27
Pipe Installation 28
General Pipe Specifications 29
Pipe Identification 32
Material Handling 32
Placement, Bedding, Backfilling, and Compaction 33
Joint Deflection 37
Casing Installation 39
Trenchless Pipe Installation 42
Flowable Fill Procedures 45

Table of Contents

Installation of Fittings 47
General Pipe Fittings Specifications 48
Offset Fabrication 50
Installation and Restraint 52
Valve Installation 54
General Valve Specifications 55
Installation and Restraint 57
Fire Hydrant Installation 59
General Fire Hydrant Specifications 60
Fire Hydrant Location and Spacing 60
Installation and Restraint 61
Site Restoration 62
Cleaning and Grading 63
Lawns, Shrubbery, and Trees 64
Pavement Repair and Resurfacing 65
Service Installation 67
Service Material Specification 68
Service Line and Meter Sizing 70
Service Line Location 71
Main Tapping 73
Meter Services 74
Renewal and Replacement Service Transfer 75
Testing And Chlorination 76
Hydrostatic Testing 77
Water Main Chlorination (AKA Disinfections) 78
Cross Connection Control 83
Program Overview 84
Backflow Prevention Requirements 86
Backflow Preventer Installation 88
Approved Backflow Prevention Devices 90
APPROVED DEVICES 91
APPROVED DEVICES 92

Design Consideration

1. General

In addition to the information provided herein for the General Policy and Procedures for the Orlando Utilities Commission (OUC) Water Business Unit, Water Engineering and Technical Services (WETS) and the Water Distribution (WDIS) sections refer to the OUC Administrative Policy Manual Section B Water Service Policies.

Refer to Policy Manual, Design Guideline Section

Pipe Diameter and Class

1. New Growth

- OUC plans for growth and all water mains are designed to meet the most current estimate of future water demands. The system shall be designed to satisfy domestic and fire protection requirements. Water distribution mains installed to accommodate new growth shall be constructed of piping material as follows:
- 2" water mains shall be Class 200 Polyvinyl Chloride (PVC) pipe, generally used at dead-ends of cul-de-sacs.
- 4" water mains shall be either Pressure Class 350 Ductile Iron (DI) or C900 (DR 18) PVC pipe, as conditions warrant. DI pipe only shall be used where protection from tree roots, chemical permeation, or traffic loads, etc. is necessary. Use of PVC must be approved by OUC.
- 6" through 24" water mains shall be Pressure Class 350 DI pipe.
- 30” and larger water mains shall be Pressure Class 250 DI pipe.

2. Renewals and Replacement

- Water distribution mains installed as renewal and replacement projects shall be reconstructed of the following piping material:
- 2" replacement water mains shall generally be Class 200 PVC pipe, OUC may require specialty restrained joint piping under roads or as conditions require.
- 4" replacement water mains shall generally be C900 PVC pipe. DI pipe shall be used where protection from tree roots, chemical permeation, or traffic loads, etc. is necessary
- 6" through 24" replacement water mains shall be Pressure Class 350 DI pipe.
- 30" and larger replacement water mains shall be Pressure Class 250 DI pipe.

Coordination Efforts

1. General

Complete coordination of the construction effort, including the customers' safe access to their property, work and equipment of other contractors or subcontractors on any projects in the area, the efforts of independent testing agencies, the road crossing conduits, underground and overhead utilities, and equipment of all utility companies including OUC Electric and Water, and the interests of the various regulatory agencies shall be the responsibility of the organization doing the work.

A. Customers

Efforts shall be made to provide OUC water customers with safe ingress to and egress from their property during the construction process. Disruption of their normal usage of utilities shall be kept at a minimum. Damage to existing facilities and landscaped or agricultural areas shall be minimized.

B. Contractors/Sub-contractors

OUC projects shall be scheduled and coordinated with the contractors and sub-contractors of any other projects in the vicinity to ensure that there are no conflicts where construction activities cross or connect.

C. Utilities

The coordination responsibility includes participation, if necessary, in a pre-construction meeting with all other utility companies involved, including OUC Electric before starting construction.

The job site shall be reviewed for any actual or potential conflicts with the proposed work in advance of construction. All water mains, storm drains, sewer and gas lines, telephone and electric power cables and conduits, any other obstructions, and all related appurtenances and service connections shall be located in the field. Such facilities shall be supported in a manner acceptable to the respective owner where those facilities are adjacent to or crossing the new utility line excavation.

All existing utilities shall be preserved and maintained in operation except when the utility owner has given express written consent to the contrary. Any and all damage to existing utilities as a result of the construction shall be repaired to the satisfaction of the utility owner.

Where connections are made to existing water mains or other shutdowns are necessary, interruptions to service shall be held to a minimum duration and accomplished at times acceptable to all parties involved. Any water meter temporarily removed shall be returned and installed at the original service address from which it was removed.

D. Regulatory Agencies

Traffic control shall be accomplished with the Manual of Uniform Traffic Control Devices and the Florida Department of Transportation (FDOT) Safety Manual in cooperation with FDOT and local authorities (the City of Orlando and Orange County).

Permitting, inspection, and placard posting requirements shall be coordinated with all permitting authorities and regulatory agencies.

Safe Work Practices and Accident Prevention

1. Safe Work Practices

It is the desire of Orlando Utilities Commission to conduct all operations with the greatest regard for employee safety, the safety of all persons working on OUC projects, the safety of the customers, and the safety of the public.

OUC employees and all others working on OUC projects shall observe and enforce all OSHA applicable and appropriate regulations, safety rules and practices. They shall comply with all facets of the Florida "Trench Safety Act". They shall have thorough knowledge of their jobs and the hazards surrounding the performance of those jobs. There shall be a "Competent Person", as defined by Florida law, on any OUC project at all times while work is being done. All persons involved shall exercise proper job planning, communication, and good judgment.

2. Accident Prevention

In addition to safe work practices, accident prevention demands that specific equipment be utilized.

OUC personnel and all others working on OUC projects shall properly use the necessary personal protective equipment such as toe guards, safety shoes, face shields, aprons, goggles, safety glasses, hard hats, etc. while on those projects. Such usage shall be dictated by the OUC "Safe Work Practices Manual" and the applicable OSHA Regulations.

3. Regulatory Information

A. Trench Safety Act

The Florida "Trench Safety Act" was passed to address the tragedies resulting from incidents of excavation cave-ins from the lack of compliance with the excavation standard. This legislation incorporates the Occupational Safety and Health Administration's (OSHA) revised Excavation Standard, 29 CFR 1926 Subpart P and any subsequent changes, updates, or revisions, as long as they are not inconsistent with Florida law. This will allow the Excavation Standard to be applied to both public and private construction projects.

B. Competent Person

The definition of a "Competent Person" under subpart P is the same definition found in Subpart C - General Safety and Health Provisions, §1926.32(f)-Definitions. It means one who is capable of identifying existing and predictable hazards in the surroundings, or work conditions which are unsanitary, hazardous, or dangerous to employees, and who has authorization to take prompt correct measures to eliminate them.

This is not a new definition incorporated into the Excavation Standard, but has always been a part of the Standard, under §1926.32(f). The term "Competent Person" is mentioned 38 times in 29 CFR 1926. When applied to the Excavation Standard, the "Competent Person" must have specific training in, and be knowledgeable about, soil analysis, the use of protective systems, and the requirements of this Standard. In addition, the "Competent Person" must have the authority to take immediate action, if a hazard exists.

Only the employer can designate an employee to be a “Competent Person”. Giving the employee the authority to take immediate action to correct a hazardous situation, up to, and including stopping work and removing employees from the hazardous situation, until the hazard has been abated can only substantiate this designation

Material Delivery, Quality, Handling and Storage

1. Material Delivery

All materials shall be transported or delivered in strict accordance with the instructions of the applicable manufacturer. The materials shall be delivered in ample quantities to insure the speedy and uninterrupted progress of the work so as to allow the work to be completed in the allotted time. Deliveries shall be coordinated in order to avoid delay in, or impediments of, the progress of the work of OUC personnel or others doing work on an OUC project.

2. Material Quality

All materials shall comply with the Orlando Utilities Commission's "Water Material Specifications Manual." All materials shall be of the manufacturer and of the manufacturer's catalog or part number listed in the OUC "Water Material Specifications Manual." The materials shall be new, unused, and correctly designed and free of defects. They shall be of standard first grade quality, and intended for the use for which they are offered.

3. Material Handling

All materials shall be handled, installed, connected, and used in accordance with the instructions of the applicable manufacturer. Materials shall be loaded and unloaded by methods affording adequate protection against damage. Under no circumstance shall any material be dropped, bumped, dragged, or subjected to undue stress.

4. Material Storage

Generally, material shall not be stored at the work site. Under no circumstances shall materials be stored on private property at the work site. Materials shall be transported to and used at the work site as needed. All other materials shall be stored and secured in an acceptable manner and at an appropriate location to insure the preservation of their quality and fitness for the work. Necessary precautions shall be taken at all times to prevent injury or damage by water, freezing, or inclement weather to such material. The materials shall be protected from weather staining, corrosion, and vandalism.

Stored materials shall be readily and easily accessible to facilitate inspection. All pipe will be stacked on 4" x 4" from the ground up.

Waste Material Disposal and Dust Control

1. Use of Chemicals

All chemicals used during project construction or furnished for project operations, whether herbicide, pesticide, disinfectant, polymer, reactant, or of other classification, must be approved by either EPA or USDA and NSF when in contact with potable water. Use of such chemicals shall be in strict conformance with their respective Material Safety Data Sheets.

2. Disposal of Chemicals

Disposal of all chemicals and chemical residues shall be in strict conformance with their respective Material Safety Data Sheets.

3. Waste Material Disposal

All debris and excess spoil resulting from clearing, demolition, or excavation operations, or any other phase of the construction process, shall be removed from the site and lawfully and safely disposed of at a site approved and permitted for said purpose, in accordance with all local laws, codes, and ordinances. Renewal and replacement sites will be cleaned daily.

Waterways of bodies of water, natural or otherwise, shall not be used for disposal of debris or spoil. Burning of brush or debris shall not be permitted.

4. Dust Control

Streets must be watered to prevent excessive dust from the construction and/or traffic.

Water cooled diamond tipped concrete saw blades shall be used to cut concrete sidewalks and driveways. Normal abrasive blades shall not be used.

Sanitary Regulations

Sanitary nuisances shall not be permitted on the work site or on adjoining property. Ample washroom and toilet facilities and a drinking water supply shall be furnished for all OUC personnel or others engaged in OUC projects. Such facilities shall be maintained in strict conformity with appropriate laws, rules, and regulations.

Siltation and Bank Erosion Control

Operations shall be arranged to minimize siltation and bank erosion on construction sites and on existing or proposed watercourses and drainage ditches. All pumping and flushing activities shall be accomplished so as not to cause excessive flooding conditions or damage to property.

Traffic Control

Traffic control shall be provided as stated previously.

Noise Abatement

Construction noise shall be eliminated or maintained at minimum levels to meet or exceed state, city, or county standards.

Inspection, Testing, and Quality Assurance

1. Inspection

All materials furnished to and work performed on an OUC project shall be inspected for compliance with OUC plans and specifications. Normal working hours for Inspectors shall be between the hours of 7 am and 3:30 pm. Normal working days shall follow the approved OUC calendar.

2. Testing

After pipe has been laid and backfilled between joints, all newly laid pipe and any valve section thereof shall be subjected to a hydrostatic pressure test of 150 pounds per square inch (gauge) for 2 hours with an OUC Inspector present. All testing shall be in accordance with AWWA Standard C600.

All visible leaks shall be repaired by approved methods. Leakage is defined as the quantity of water to be supplied into the newly laid pipe, or any valved section thereof, necessary to maintain the specified leakage test pressure after the pipe has been filled with water and the air expelled.

No pipe installation shall be considered as acceptable until it meets OUC Standards as per current detail sheet. Where any section of a water main is provided with concrete thrust or reaction blocking, the hydrostatic pressure test shall not be made until at least 24 hours have elapsed after the concrete blocking was installed.

Any cracked or defective pipes, fittings, valves, or fire hydrants discovered as a consequence of this pressure test shall be removed and replaced with sound, approved material, and the test shall be repeated until satisfactory.

3. Quality Assurance

All construction work performed on an OUC project shall begin only after the appropriate, applicable permits are obtained. All construction work performed and completed on an OUC project shall be accomplished in the manner best calculated to promote rapid construction consistent with safety of life and property and in strict accordance with OUC plans and specifications. All construction work performed on an OUC project shall be accomplished while maintaining the level of service to the customer that existed prior to the construction. All property and structures, including other utilities, damaged or disturbed during the performance of the work, shall be properly restored or repaired prior to completion of the project. The construction site shall be maintained as clean and neat as practicable during construction, and put in better condition than prior to construction, when the work is completed. All work accomplished by parties other than OUC personnel, including repair or replacement of new water mains and services, shall be guaranteed for a period of one year after the job completion.

As-Built Drawing

All drawings submitted to Orlando Utilities Commission's (OUC) Water Engineering and Technical Support Division for review and approval shall bear the seal and signature of the Florida Registered Professional Engineer responsible for the project.

The drawing size for all water main construction plan and profiles shall be either 22x34 or 24x36. The horizontal scale shall be not greater than one inch equal to fifty feet (1"=50'); the vertical scale shall be not greater than one inch equal to five feet (1"=5'). The plan view shall show all existing land base details with an emphasis on survey accurate locations of existing and proposed utilities. Land base information includes, but is not limited to above grade, existing features such as; property lines, street names, sidewalks, concrete aprons, edge of pavement, valve meter boxes, right-of ways and buildings. The profile view shall include all utilities crossing the proposed water main and all parallel utilities located within 10 feet of the proposed water main. Water main depth shall be shown as a projected elevation.

1. CADD File Format

The Contractor/Owner/Engineer shall provide all pertinent CADD files associated with the projects submitted to the OUC's Water Engineering and Technical Support Division for review. The format of CADD file(s) will be AutoCAD version 2004 or earlier written on a Compact Disk and scanned for viruses. All files, including fonts and x-refs, should be included in the submittal. Files converted from Micro station to AutoCAD will be accepted if final product meets the above-mentioned format. Converted files will require a level to layer name reference sheet.

2. Drawing File Setup

A. Drawing Units

The AutoCAD drawing units Length Type will be set to decimal and the precision of accuracy will be displayed at a minimum of two (2) decimal places and the drawing units will be feet. The Angle Type will be set to decimal degrees and the precision of accuracy will be at least two (2) decimal places. The Base Angle for 0.00 will be East. Any variation from this must be documented with the project submittal.

B. Drawing File Origins

State Planes Coordinates, East Florida, NAD 1983-90 is the preferred coordinate system. If a project coordinate system is used, all drawings will be based on this system and existing features i.e. edge of pavement, road intersections, buildings must be referenced to aid in the locating of project infrastructure in OUC's Geographic Information System. If no existing features are shown at least 2 State Plane Coordinate points must be surveyed and bench marked.

C. Layer Naming Conventions

OUC does not have a standard layering convention that must be used with submitted projects. Any developer/consultant's naming convention may be used as long as it is consistent and easy to understand. Anything out of the ordinary and/or extensive layering conventions must be documented and submitted with the project. Purge all unused layers, line types, shapes, text styles and blocks.

D. Plotting (Color to Pen No. Association)

Like layering conventions OUC will not designate specific plot settings or pen color assignments. The only standard is the consistency of plot settings throughout all project CADD files submitted. Anything out of the ordinary must be documented and submitted with the project.

E. Borders

The standard border sizes are 22x34 and 24x36. If an x-ref border is used, this file must also be submitted with the project files.

F. Record Drawing Information

All information revised and/or updated for the purpose of generating Record Drawings of As-Built Information on hardcopy drawings must be included in CADD files. This revised data must be visible as new information; line weights must be a heavier than standard pen size and text will be in a hand-lettered font with the font height set larger than the standard font size.

Public Involvement

Prior to work beginning on any OUC project, all affected water customers shall be notified in writing. Notification shall include the work description, expected duration, work hours, and emergency customer service information (see sample letter). At least 24 hours prior to the time a customer's water service is to be interrupted, each individual customer shall be made aware of the interruption or blockage orally and in writing with a door hanger similar to the sample door hanger. Every effort shall be made to keep service and access interruption to a minimum and to work with the customer in the event of any inconvenience.

Permission shall be requested from the customer prior to interrupting service, blocking the driveway or garage, or doing any work on that customer's private property. Special efforts shall be employed to notify the customer and to accommodate the customer's needs when water service lines are to be rerouted from back property water mains to the new mains.

Progress reports and surveys shall be distributed to affected customers and neighbors as the need arises.

Orlando Utilities Commission
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P.O. Box 3193
Orlando Florida 32802
Phone: 407.423.9100
Administrative Fax: 407.236.9616
Purchasing Fax: 407.384.4141
Website: www.ouc.com

OUC
The Reliable One®

January 1, 2001

OUC Customer
1111 Anywhere Drive
Orlando, FL 32800

Subject: New Water Main Installation

Dear Customer:

To improve overall water service to you, the Orlando Utilities Commission (OUC) construction crews will be installing a new water main starting in the next few weeks. All homes will be connected to the new main. Any water meter presently located in your back yard will be moved to the front of the property and reconnected to the house line. In order to do this, OUC personnel will need access to your property. We will notify you the day before work on you property is to begin. All work will be done between the hours of 8:00 a.m. and 5:00 p.m.

Our goal is to minimize the impact the construction will have on you and your activities. If you have any concerns or comments before construction begins, contact Ms. Engineer at 432-9100, ext. xxx, between 7:00 a.m. - 4:00 p.m. After construction begins for updates or concerns, contact Mr. Director at 244-xxxx, between 7:00 a.m. - 3:30 p.m. To report any emergency or service problem, call 823-9150.

The project is expected to take approximately four weeks.

Sincerely,

Providing innovative, friendly, dependable service

WATER SERVICE INTERRUPTION
NOTICE

Date_____

Dear Customer,

Due to construction on an OUC project, your water service will be temporarily interrupted during the hours listed below:

_____

_____

_____

During this time, improvements will be made to the public water system. It is suggested that you draw a supply of water to use during this outage.

When your water service is restored, you may experience discolored water or air in the lines. This should be easily cleared by opening several faucets in your house, for a few minutes.

If the problem persists, or if you have any questions, please call:

FIELD OPERATIONS
(407) 823-9150
24 HOURS/DAY

We apologize for any inconvenience and appreciate your cooperation and understanding.

ORLANDO UTILITIES COMMISSION

Property Protection

1. Private Property

All private property and structures of any kind adjacent to an OUC project shall be adequately protected against damage caused by equipment, material, or debris.

If water service must be transferred from a back property water line to a new street side water main, special care shall be taken to accomplish the work with a minimum of damage to the lawn, shrubbery, and trees.

2. Public Utility Installations and Structures

Public utility installations and structures shall be understood to include all pipes, poles, wires, conduits, house service connections, boxes, vaults, manholes, tracks and all other appurtenances and facilities pertaining thereto, whether owned or controlled by Orlando Utilities Commission, other governmental bodies or privately owned by individuals, firms, or corporations, used to serve the public with water, electricity, sewerage, telephone, gas, traffic control, transportation, drainage, or other public or private property which may be affected by the work.

All public utility installations and structures shall be protected from damage during any work on an OUC project. Only approved methods shall be employed during the performance of the work, and reasonable care and skill exercised so as to avoid unnecessary delay, injury, damage, or destruction of public utility installations or structures.

Access across any buried public utility installation or structure shall be accomplished in a manner so as to avoid any damage to these facilities. Neither the materials excavated nor the materials or equipment used in the construction of the project shall be so placed as to prevent free access to all fire hydrants, valves, or meter boxes. Unnecessary interference with, or interruption of, public utility services shall be avoided.

3. Trees and Shrubbery

All trees and shrubs shall be adequately protected in accordance with ordinances governing the protection of trees. Generally, pipelines shall go around or under trees and large shrubs. Backfill shall be from excavated materials and the trees and shrubs shall be supported and protected from damage. No excavated materials shall be placed so as to injure such trees or shrubs. Any trees or shrubs destroyed shall be replaced with new stock of similar size and age, at the proper season.

Developer/ Contractor Procedures

Developer's Agreement

It is hereby agreed that the Developer shall adhere to Orlando Utilities Commission policy and the following terms for any water facilities designed and constructed by the Developer for the purpose of having Orlando Utilities Commission own and maintain these facilities. In addition to the information provided herein for design considerations also refer to the *Guidelines for Design of Potable Water Distribution Facilities in New Developments* prepared by the OUC Water Business Unit Water Engineering and Technical Services Division located at www.ouc.com.

1. **Design**

   The Developer shall be responsible for the design of all on-site water facilities, including water mains, domestic services, and fire protection. Actual design should be coordinated through the appropriate fire protection authority prior to submitting final design for Orlando Utilities Commission's approval. All material shall comply with Orlando Utilities Commission's Material Specifications Manual. The final design of such water facilities will be submitted in quadruplicate, (three copies will be retained by OUC and one copy of the final submittal will be returned stamped approved) to Orlando Utilities Commission Water Engineering and Technical Support Division.

2. **Permits**

   It shall be the responsibility of the Developer to obtain and comply with necessary permits as required by the appropriate regulatory agencies. It should be noted that before any service is placed into service, or given final approval by Orlando Utilities Commission, the Developer should obtain proper certification through the Florida Department of Environmental Protection.

3. **Construction**

   The Developer shall furnish and install all water mains, valves, fittings, fire hydrants and services as shown on the approved construction plans on file in Water Engineering and Technical Support Division. Orlando Utilities Commission shall assign an inspector to inspect the materials furnished and the work performed for compliance with the plans and specifications. The water mains and appurtenances will be installed in accordance with AWWA standards and the latest revisions thereto, as well as Orlando Utilities Commission's Construction Standards Manual. Disinfections shall comply as specified in the Orlando Utilities Commission's Construction Standards Manual and AWWA C651 and the latest revisions thereto. The Developer shall keep an accurate record of the nature, location, and dimension of all work.

4. **Service**

   Prior to the setting of any meter by Orlando Utilities Commission, all irregularities from the approved plans and/or specifications must be corrected. Also the Developer shall furnish a copy of the FDEP Certification of Construction Completion, an "As-built" drawing or drawings, a detailed list showing all material quantities and the cost breakdown for the project.

Go to WWW.OUC.COM for most recent forms.

Drawing Standards

Refer to General Policies and Procedures Section of this manual for As Built Drawings information.

Cooperation with other Contractors

During construction progress, it may be necessary for other contractors and persons to work in or about the OUC project work site. OUC reserves the right to put such other contractors to work and to afford such access to the construction site and at such times that OUC deems proper. The Contractor shall not impede or interfere with the work of such other contractors and shall so arrange and conduct the operations that such other contractors may complete their work at the earliest date possible.

Site Preparation

Preparation Around Trees and Shrubs

Generally, pipelines shall go around trees and large shrubs, no pipe or fittings will be located under trees or large shrubs. All trees and shrubs shall be adequately protected in accordance with ordinances governing the protection of trees or as required by the agency having jurisdiction.

The customer shall be notified before any shrubbery, trees, or plants are removed. Necessary permits shall be obtained prior to such removal. Where it is necessary to remove plantings in order to accomplish the work, such shrubbery shall be replaced to the original condition of the customers' property. Prior to any construction, photographs or a construction video must be taken showing original conditions.

All trenching performed adjacent to tree trunks shall be accomplished in such a manner as to maintain a minimum clearance as required by the agency having jurisdiction. When trenching is to be performed closer than the above minimum, root pruning or other protective measures may be required. Interfering branches shall be removed without injury to trunks. A competent tree specialist who carries proper insurance and is licensed to work in the area specified shall perform protective measures.

No excavated materials shall be placed so as to injure trees or shrubs. Backfill shall be from excavated materials and the trees and shrubs shall be supported and protected from damage. Topsoil shall be stockpiled at an appropriate location for future use. Unsuitable materials shall be removed from the site properly disposed.

Subsurface Investigation/Line Location

1. Subsurface Investigation

The nature and location of the work, the ground confirmation, the character and quality of the substrata, the types and quantity of materials to be encountered, the nature of the groundwater conditions, the character of equipment and facilities needed preliminary to and during the prosecution of the work, the general and local conditions, and all other matters which could in any way affect the work, shall be determined and verified prior to beginning the work.

2. Line Location

Contractor shall have full responsibility for locating all public/private utility appurtenances and facilities used to serve the public with water, electricity, sewage, telephone, gas, traffic control, transportation, drainage, etc. shall be located, identified and properly marked prior to beginning any work. The contractor shall verify all depths and alignments prior to beginning any construction. Care shall be taken to protect such utilities from damage or interruption during the course of the work. Record of such location shall be maintained.

Dewatering

Any trench or structural excavation shall be adequately dewatered if subsurface water is encountered during the project. Subsurface water shall be kept 2 feet or more below the working area until pipe installation is complete and the trench is backfilled sufficiently to prevent movement or flotation of the pipe or structure.

Permits for the discharge of water shall be obtained from the appropriate regulatory agency. All water collected and pumped shall be disposed of in a manner which will cause no safety or health hazard, flooding, or nuisance to the surrounding area, and in a manner so as not to degrade the water quality of surrounding water or violate any environmental ordinances or requirements. Water containing debris, sand, or heavy sediment shall not be discharged in the storm-water system.

If dewatering is required, the contractor shall be responsible for all dewatering operations including but not limited to permits and discharging of dewatering.

Trenching, Sloping, Shoring, and Spoils

1. Trenching

All trench excavation shall be performed in compliance and strict adherence with the Occupational Safety and Health Administration's (OSHA) trench excavation safety standards, particularly those contained in 29 C.F.R., Subpart P, and the latest revisions thereto, as adopted by the Department of Labor and Employment Security. All available geotechnical information shall be considered in the design of the trench excavation safety system.

Trench-digging machinery may be utilized except in places where its operation will cause damage to other utilities, trees, buildings, or existing structures above and below ground, in which case hand methods shall be employed.

Trench excavation shall be in accordance with the most current edition of AWWA C600 and the latest revisions thereto. The trench bottom shall be excavated to the required depth so as to provide a uniform and continuous bearing and support for the pipe on solid and undisturbed ground at every point between the bell holes. Bell holes shall be provided at each joint to permit the jointing to be made properly. Excess excavation shall be avoided whenever possible. Any part of the trench bottom excavated below the specified grade should be corrected with suitable material and thoroughly compacted.

All excavated material shall be piled in a manner that will not endanger the work and that will avoid obstructing sidewalks and driveways. Gutters shall be kept clear of other satisfactory provisions shall be made for street drainage.

2. Sloping

Generally, excavations on OUC projects have soil conditions that allow sloping of the sides or walls of the trenches. The contractor shall perform any necessary investigations to determine the slopes allowable for the conditions he will encounter in the work.

3. Shoring

Shoring is sometimes necessary for personal or property protection against trench cave-ins. Such necessity depends upon factors such as the depth and width of the trench, type of soil and soil conditions, activities such as traffic capable of causing vibration in the vicinity of the excavation, the potential for rain that could cause flooding, and the length of time that the excavation is expected to remain open.

All shoring shall be installed in compliance and strict adherence with the Occupational Safety and Health Administration's (OSHA) trench excavation safety standards and the laws and codes dictated by other regulatory agencies having jurisdiction. All shoring shall be designated by a professional engineer.

A. Minimum Shoring Requirements

1. Shoring systems in trenches shall consist of uprights held rigidly opposite each other against the trench walls by jacks or horizontal cross members or cross braces, and longitudinal members or stringers as required.

2. Uprights shall not exceed 15 degrees from the vertical. Uprights in trenches more than 10 feet deep shall be no less than 3-inch by 8-inch material. Material at least 2-inch by 8-inch shall be used in trenches less than 10 feet deep.

Uprights shall extend from above the top of the trench to as near the bottom as permitted by the material being installed, but no more than two feet from the bottom.

3. Cross braces shall consist of steel screw-type trench jacks with a foot or base plate on each end of pipe or timbers placed horizontally and bearing firmly against the uprights or stringers.

4. The minimum number of horizontal cross braces, either screw jacks or timbers, require for each pair of uprights shall be determined by the number of 4-foot zones or segments into which the depth of trench may be divided. One horizontal cross brace shall be required for each of these zones, but in no case shall there be less than two cross braces or jacks. Trenches, the depths of which cannot be divided equally into these standard 4-foot zones of segments, shall have an extra horizontal cross brace supplied for the short remaining zone, if such zone is greater than two feet. In no case, however, shall the vertical spacing of horizontal cross braces be spaced greater than 5 feet center to center. Minor temporary shifting of horizontal cross bracing will be permitted, when necessary, for the lowering of materials into place. Allow no personnel in the trench while the cross braces are temporarily shifted or moved.

4. Excavated Material

The excavated material shall be placed two (2) feet or more back from the edge of the trench when digging trenches less than five (5) feet in depth. Trenches deeper than five (5) feet shall maintain four (4) feet of clearance between the edge of the trench and the spoils. In all cases, the area between the spoils and the trench shall remain clear of loose material.

Private Property / Public Access

1. Private Property

All work shall be conducted so that no equipment, material, or debris will be placed or allowed to fall upon private property in the vicinity of the work unless first having obtained written permission from the owner of such private property. Construction sites shall be cleaned daily, including but not limited to removal of dirt piles and /or trash debris from Roadway.

In the event that work is done on private property, special care shall be taken to assure minimum damage to the lawn, shrubbery, and trees. All necessary restoration shall be accomplished in a timely fashion directly following construction and/or as determined by an OUC Representative.

Property owners shall be given 48 hours notice prior to temporarily restricting access to their driveways and garages. Such interruptions shall be kept to a minimum.

2. Public Access

When construction blocks the normal ingress/egress to any house, building, or place of business, temporary structures or bridges shall be provided to maintain public access to those facilities at all times. Suitable temporary roadways, bridges, or steel plates shall be used when necessary to maintain vehicular and pedestrian traffic over public road, street intersections, and sidewalks. Such structures shall be removed promptly after they are no longer required. Care shall be taken to prohibit accidental entrance of the public within the workplace.

At least one lane shall be maintained for vehicular traffic in streets where construction is in progress. The appropriate street closure permits shall be obtained as required.

Temporary Fences and Barriers

If, during the course of a project, it is necessary to remove or disturb any fence or part thereof, a suitable temporary fence shall be provided and maintained until the permanent fence is replaced. Such fencing shall be removed promptly after it is no longer required.

Appropriate barriers shall be placed around the work area. Pedestrians and children must remain in a safe area, protected from any of the dangers of a construction site.

Temporary Services

In the event that a project will necessitate water service outage in excess of eight hours, temporary water lines from existing water mains shall be laid to maintain service to the affected customer or facility for as long as necessary. All such services shall be terminated and removed promptly after they are no longer required.

Pipe Installation

General Pipe Specifications

1. General

All piping materials installed, as a part of the Orlando Utilities Commission water distribution system shall be in accordance with the OUC Water Materials Specifications Manual and the latest revisions thereto. Such materials shall, in no event, be less than that necessary to conform to the requirements of any applicable law, ordinances, or codes.

All piping materials shall be new, unused, and designed for the use intended. The materials shall be of standard first grade quality, produced by expert workers, and intended for the use for which they are offered. Materials, which are inferior or are lower in grade than indicated, specified, or required shall not be accepted. Orlando Utilities Commission reserves the right to make such judgments.

All pipe diameter of 12" and less shall have a minimum burial depth of 36" and not to exceed 48" deep unless approved by OUC.

All pipe with a diameter of 12" or greater shall have a minimum burial depth of 48" and not to exceed 60" depth unless approved by OUC.

2. Pipe Usage

The established standard distribution system pipe sizes and materials currently in use are as stated previously in the section titled General Policy and Procedures.

A. Test Projects

From time to time, test projects shall be conducted for the purpose of evaluating different pipe products and installation procedures such as high density polyethylene pipe (HDPE) and horizontal directional drilling (HDD). All test projects shall be monitored as to total installation and material costs, safety issues, impact on water quality, maintenance costs, problems, etc. Such test projects shall be utilized as the need arises and as approved.

3. Ductile Iron Pipe

All 4” through 24” ductile iron pipe used in the OUC water distribution system shall be Pressure Class 350 compression/slip joint pipe conforming to ANSI/AWWA C150/A21.91 and ANSI/AWWA C151/A21.91 and the latest revisions thereto unless otherwise specified. All ductile iron pipes shall be lined with cement mortar in conformance with ANSI/AWWA C104/A21.90 and the latest revisions thereto. Self-restraining gaskets installed with ductile iron pipe shall be proprietary gaskets made by the same manufacturer as that of the pipe. Typically, joints between pipe and fitting shall be mechanical joint.

Acceptable manufacturers of ductile iron pipe are currently shown in the OUC Water Material Specification Manual at www.ouc.com.

4. Polyvinyl Chloride Pipe

A. C900 PVC Pipe

Where approved, all 4” PVC pipe used in the OUC water distribution system shall be SDR 18 compression joint PVC pipe conforming to AWWA C900 and the latest revisions thereto. The outside dimension (OD) shall be 4” cast iron O.D. with wall thickness DR Series 18. The color shall be Water Blue, or the pipe shall have continuous blue markings to conform to the AWWA adopted color code. Compression joint PVC shall have an elastometric-gasket bell on one end and connections shall be made using an gasket-gasket conforming to ASTM D3139. Coupling end pipe shall not be used. Fittings used with C900 PVC pipe shall be class 350 ductile iron Compact fittings conforming to ANSI/AWWA C153/A2l/53 and the latest revision thereto.

B. Class 200 PVC Pipe

All 2” PVC pipe used in the OUC water distribution system shall be Class 200 compression joint pipe. The outside dimension (OD) shall be the same as 2” galvanized Schedule 40 pipe. The color shall be blue, or the pipe shall have continuous blue markings to conform to the AWWA adopted color code. Compression joint PVC shall have an gasket-gasket bell on one end and connections shall be made using and elastomeric-gasket conforming to ASTM D3139. Coupling end pipe shall not be used.

C. Restrained Joint Pipe (PVC)

All approved sizes of C900/RJ must be Class 150 (DR18) rated.

5. Pipe O.D. Guide

Nom. Pipe	Steel (Galv)	Polyvinyl Chloride (PVC) Sch 40	C900	Ductile Iron (DI)	Cast Iron (CI)	Asbestos-Concrete (A-C) Class 150	Asbestos-Concrete (A-C) Class 150/200
2”	2.38”	2.38”	-	-	-	-	
3”	3.50”	3.50”	-	3.96”	-	3.74”	3.84”
4”	4.50”	4.50”	4.80”	4.80”	4.85”±	4.64”	4.81”
6”	6.63”	6.63”	6.90”	6.90”	6.98”±	6.91”	6.91”
8”	8.63”	8.63”	9.05”	9.05”	9.09”±	9.11”	9.11”
10”	10.75”	10.75”	11.10”	11.10”	11.15”±	11.24”	11.66”
12”	12.75”	12.75”	13.20”	13.20”	13.45”±	13.44”	13.92”
16”	16.00”	-	-	17.40”	17.88”±	17.15	18.46”
20”	20.00”	-	-	21.60”	21.94”±	-	
24”	24.00”	-	-	25.80”	-	-	
30”	30.00”	-	-	32.00”	-	-	

Pipe Installation

All water transmission and distribution mains shall be designed in accordance with OUC's design standards. General highlights of those standards are listed in this section. Inasmuch as growth and expansion of the water system is in a constant state of flux, design standards and plans are subject to change. Consequently, these highlights are not all encompassing, but simply representative of the desired flows and pressures under normal conditions. Additional design standards may be applicable.

1. Average Day Conditions

► All water mains shall be sized to maintain pressure at 55 psi or greater.

2. Peak Hour Conditions

►All water mains shall be sized to maintain pressure at 35 psi or greater

► System velocities shall not exceed 7 feet per second (fps).

3. Fire Flow Conditions

► All fire flows will be provided by the developer

► System main evaluations shall be performed using maximum daily flows and have a minimum residual pressure of 20 psi.

Pipe Identification

Ductile iron potable water mains require special identification. See OUC standard detail sheet.

PVC water mains shall either be solid blue on color or white with blue lettering. Lettering shall appear on three (3) sides of the pipe and shall run the entire length of the pipe. The lettering shall be a permanent part of the pipe.

Three (3) solid blue lines permanently manufactured into the piping material shall identify polyethylene water mains. The lines shall appear on three (3) sides of the pipe, run the entire length of the pipe, and be no less than 3/16” wide.

All nonmetallic water mains shall be installed with a continuous, blue, insulated, 10 gauge or larger copper wire installed directly on top of the pipe for future location purposes. The wire shall be installed in such a fashion so as to sustain continuity. The contractor must perform a successful continuity test with an OUC representative present. Location markers, if used, shall be installed at no less than 40 foot intervals and at the manufacturer recommended depth.

Material Handling

All pipe, fittings, and appurtenances shall be handled in such a manner during transport, loading, unloading, and installation so as to protect the materials from any damage. Particular care shall be taken not to injure pipe coating, both interior and exterior. Broken, cracked, misshapen, imperfectly coated, or otherwise damaged or unsatisfactory material shall not be installed.

When not being handled, the pipe shall be supported on timber cradles to provide uniform support along the full length of the pipe. The pipe shall be supported in a manner, which will not permit distortion or damage to the lining or coating when being transported.

Gaskets shall be stored in a clean, dark, dry location until immediately before use.

Dirt or other foreign material shall be prevented from entering the pipe or pipe joint during handling or laying operations. When pipe laying is not in progress, the open ends of the pipe shall be closed by a watertight plug or some other acceptable means to ensure absolute cleanliness inside the pipe.

Placement, Bedding, Backfilling, and Compaction

1. Placement and Bedding – Ductile Iron Pipe

Ductile Iron pipe shall be installed in accordance with the manufacturer's specifications and instructions for the type of pipe use and the applicable manuals and AWWA Standards (the DIPRA *Handbook of Ductile Iron Pipe* and AWWA C600 for ductile iron pipe), unless otherwise stated in these standards.

Proper tools, implements, equipment, and facilities shall be used for the safe installation of all materials. Pipe, fittings, valves, and other appurtenances shall be carefully lowered into the trench piece by piece. Under no circumstances shall piping materials be dropped, dumped, or slid into the trench.

Lumps, blisters, and excess coating shall be removed from the bell and spigot ends of each pipe. The outside of the spigot and the inside of the bell shall be wire brushed and wiped clean, dry and free from oil and grease before the pipe is laid. Pipe joints shall be made up in accordance with the manufacturer's recommendations. Every effort shall be employed to ensure that sand or other debris does not enter the pipe.

The interior of the pipe shall be thoroughly cleaned of all debris, tools, clothing, and other foreign matter, before being gently lowered into the trench and shall be kept clean during laying operations by means of plugs or other approved methods. Any residue considered difficult to remove by scouring flush shall be removed by appropriate means and swabbed or sprayed with a liquid sodium hypochlorite solution (NaOCl), hereafter called 10% liquid chlorine.

When new main extensions are connected to existing mains, the new valve and/or fitting to be connected to the existing main shall be cleaned and shall receive a generous coating of 10% liquid chlorine. Any lateral dead end stubs (for future fire hydrants or water main extensions) shall be swabbed or sprayed with 10% liquid chlorine if they are not equipped with valves for adequate flushing and disinfect ion. The inside of tapping tees and the outside of the main to be sleeved shall be cleaned and swabbed or sprayed with 10% liquid chlorine to kill any trapped bacteria.

Bell sections and spigot ends are to be cleaned of all foreign matter with a firm bristle brush. The lubricant used on the sealing gaskets shall be suitable for use in potable water and shall not support any bacteria growth. The lubricant shall be in closed container and kept clean at all times.

Before laying any pipe, an adequate survey shall be accomplished to show horizontal and vertical alignment, and to prevent conflicts with other utilities.

When laying pipe, the trench water shall be pumped out and kept at a minimum. During suspension of work for any reason for any time, including the end of the workday, a watertight plug shall be placed in the end of the pipe last laid to prevent mud or other foreign material from entering the pipe.

Pipe shall be laid with bell ends facing in the direction of laying (upstream). The work shall at all times progress with caution so as to prevent damages to underground obstruction, both known and unknown. Every effort shall be made to lay the pipe in a straight line, using only the fittings designated on the plans.

The cutting of pipe for inserting valves, fittings, or closure pieces shall be done in a neat and workmanlike manner without damage to the pipe or cement lining and so as to leave a smooth end at right angles to the axis of the pipe.

Push-on joint pipe shall generally be used in the distribution system. All compact fittings shall be mechanical joint. The joints of all pipelines and fittings shall be made absolutely tight. The gasket material for the joint shall be properly positioned before the pipe is lowered into the trench. The joining of all pipe and fittings shall proceed in accordance with the manufacturer's instructions and requirements. Once the joint has been seated and tightened, all bolts and nuts will be checked and retightened one more time.

The push-on joint shall be made up by exerting sufficient force on the entering pipe so that its plain end is moved past the gasket until it seats completely as per the manufacturer's recommendations. Backhoe buckets or excavation equipment are not to be applied directly to the pipe.

Plugs shall be inserted in the bells of all dead ends of the pipe, tees, and crosses, and plain ends shall be capped.

2. Backfilling and Compaction – Ductile Iron Pipe

After the pipe and fittings have been laid, inspected, and found to be satisfactory, the trench shall be backfilled in accordance with DIPRA Laying Condition 2.

Backfill material shall be free from cinders, ashes, refuse, organic matter, boulders, rocks, stones, or other material that is unsuitable. The spoils of the trench may be used if it is suitable. All trenches shall be backfilled by hand, from the bottom of the trench to the centerline of the pipe in layers of 6 inches. Backfill material shall be deposited in the trench for the full width on each side of the pipe.

Compaction shall be performed by tamping. The pipe shall be backfilled by hand or by approved mechanical methods from the centerline of the pipe to the specified grade. Compaction shall be done in accordance with the requirements of the agency having jurisdiction.

In the absence of specific standards, all compaction shall conform to the following: The space between the pipe and the trench sides shall be packed full by hand shoveled earth, free from lumps, carefully deposited in layers, not exceeding 6 inches in depth. Such material shall be placed equally on each side of the pipe, and at the same time suitably tamped until enough fill has been so placed and compacted to provide a minimum cover of twelve (12) inches above the pipe. All backfill placed to this elevation shall be compacted to a minimum density of 98% of the modified proctor density. From this point, the backfill shall be compacted in uniform layers not exceeding twelve (12) inches in depth to a minimum of 98% of the modified proctor density where it is to support paving, sidewalks, etc. All other backfill shall be compacted to 90% of the modified proctor density.

3. Placement and Bedding – Polyvinyl Chloride Pipe

Polyvinyl Chloride pipe shall be installed in accordance with the manufacturer's specifications and instructions for the type of pipe use and the applicable manuals and AWWA Standards, the Unibell Handbook of PVC Pipe Design and Construction, and AWWA M23 PVC Pipe Design and Installation for PVC pipe unless otherwise stated in these standards.

Although recommended installation procedures for PVC pipe do not vary substantially from procedures used with other pipe products, there are differences that are significantly more important.

Trench width at the ground surface may vary depending on depth, type of soil, and position of surface structures. The minimum clear width of the trench, sheeted or unsheeted, measured at the springline of the pipe should be one foot greater than the outside diameter of the pipe. The maximum recommended clear width of the trench at the top or the pipe is equal to the pipe outside diameter plus two feet.

When laying PVC pipe, the trench water shall be pumped out and kept at a minimum until the pipe has been installed and backfill has been placed to a sufficient height to prevent flotation of the pipe. The trench bottom shall be constructed to provide a firm, stable, and uniform support for the full length of the pipe. Bell holes shall be provided at each joint to permit proper assembly and pipe support. When an unsuitable subgrade condition is encountered that could provide inadequate pipe support, additional trench depth shall be excavated and refilled with suitable foundation material. Rock, boulders, and large stones shall be removed to provide a four (4) inch soil cushion on all sides of the pipe and accessories.

As with ductile iron pipe, PVC pipe shall be laid with bell ends facing the direction of laying (upstream). The work shall at all times progress with caution so as to prevent damage to underground obstruction, both known and unknown. Every effort shall be made to lay the pipe in a straight line, using only the fittings designated on the plans.

To prevent damage, proper implements, tools, and equipment shall be used for the placement of pipe in the trench. Under no circumstances shall the pipe or accessories be dropped in to the trench.

All foreign matter or dirt shall be removed from the pipe interior. Pipe joints shall be assembled with care, in accordance with the manufacturer's recommendations. The outside of the spigot, the interior of the bell, and the gasket shall be cleaned using a rag, brush, or paper towel to remove any dirt or foreign material before the assembling. The gasket, pipe spigot bevel, gasket groove, and sealing surfaces shall be inspected for damage or deformation. Any residue considered difficult to remove by scouring flush shall be removed by appropriate means and swabbed or sprayed with a liquid sodium hypochlorite solution (NaOCl), hereafter called 10% liquid chlorine. Only lubricant as specified by the pipe manufacturer shall be applied to the joint and gasket. The lubricant shall be suitable for use in potable water and it shall not support any bacteria growth.

Push-on joint PVC pipe with factory-installed gaskets shall generally be used in the distribution system. All fittings shall be mechanical joint. The joints of all pipelines and fittings shall be made absolutely tight. The joining of all pipe and fittings shall proceed in accordance with the manufacturer's instructions and requirements. Once the joint has been seated and tightened, all bolts and nuts will be checked and retightened one more time.

After the spigot is correctly aligned to the bell of the pipe, the spigot shall be inserted in the bell until it contacts the gasket uniformly. The pipe shall then be pushed in the bell either by hand or with the use of a bar and block to the manufacturer's reference mark that indicated the correct depth of spigot penetration into the pipe's gasket joint. If undue resistance to insertion of the pipe end is encountered, or if the reference mark does not position properly, the joint shall be disassembled and the gasket position and other joint components shall be checked. The assembly steps shall be repeated.

A square cut is essential for proper assembly of field-cut pipe. The pipe shall be marked around its entire circumference to assure such a cut. The factory-finished beveled end shall be used as a guide for field beveling, either with a pipe beveling tool or a wood rasp that will cut the correct taper. Sharp edges on the leading edge of the bevel shall be rounded off with a pocketknife or a file.

The weight of fire hydrants, valves, or Ductile Iron fittings will not be carried by PVC pipe. When pipe laying is not in progress, open ends of installed pipe shall be closed to prevent entrance of trench water, dirt, foreign matter, or small animals into the line. 6" and larger pipe shall be carried by Ductile Iron pipe only.

4. Backfilling and Compaction – Polyvinyl Chloride Pipe

After the pipe and fittings have been laid, inspected, and found to be satisfactory, the trench shall be backfilled in accordance with the applicable manuals and AWWA Standards, the Unibell Handbook of PVC Pipe Design and Construction, and AWWA M23 PVC Pipe and Design and Installation for PVC pipe.

PVC pipe shall be installed with proper bedding providing uniform longitudinal support under the pipe. Backfill material shall be worked under the sides of the pipe to provide satisfactory support. Initial backfill material shall be placed to a minimum depth of six. (6) inches over the top of the pipe. All pipe embedment material shall be selected and placed carefully, avoiding stones greater than 1 ½" in diameter and debris. Sharp stones and crushed rock larger than ¾" which could cause significant scratching or abrasion of the pipe, and shall be excluded from the embedment material. Proper compaction procedures shall be exercised to provide soil densities as required.

After placement and compaction of pipe embedment materials, the balance of the backfill materials may be machine placed. All backfill material shall be free from cinders, ashes, refuse, organic matter, boulders, rocks, stones, or other material that is unstable. Proper compaction procedures shall be exercised to provide required densities to meet the same density requirements stated for ductile iron pipe.

Joint Deflection

1. Ductile Iron Pipe

Whenever it is necessary to deflect ductile iron pipe from a straight line, either in a vertical or horizontal plane without the use of fittings, the amount of deflection allowed shall not exceed that allowed under AWWA C600 and in accordance with the manufacturer's recommendations. No deflection shall be sought until the pipe has been properly homed or seated.

For restrained joint ductile iron pipe the deflection will not exceed 80 percent of the manufacturer recommended deflection. The maximum allowable deflection for unrestrained ductile iron pipe per 18 foot joint shall not exceed that shown in the table below:

Ductile Iron Pipe Deflection – 18 Foot Joint						
	Mechanical Joint			Push On Type Joint		
Nominal Pipe Size (inches)	Deflection (inches)	Radius of Curve (feet)	Deflection Angle (degrees)	Deflection (inches)	Radius Curve (feet)	Deflection Angle (degrees)
6	27.0	145	7	19.0	205	5
8	20.0	195	5	19.0	205	5
10	20.0	195	5	19.0	205	5
12	20.0	195	5	19.0	205	5
16	13.5	285	3	11.0	340	3*
20	11.0	340	3	11.0	340	3*
24	9.0	450	2	11.0	340	3*
30	**	**	**	11.0	340	3*
36	**	**	**	11.0	340	3*

** No data published by AWWA. Consult manufacturer
* Maximum deflection angle may be larger than shown. Consult manufacturer

Ductile Iron Pipe Deflection – 20 Foot Joint						
	Mechanical Joint			Push On Type Joint		
Nominal Pipe Size (inches)	Deflection (inches)	Radius of Curve (feet)	Deflection Angle (degrees)	Deflection (inches)	Radius Curve (feet)	Deflection Angle (degrees)
6	30.0	160	7	21.0	230	5
8	22.0	220	5	21.0	230	5
10	22.0	220	5	21.0	230	5
12	22.0	220	5	21.0	230	5
16	15.0	320	3	12.0	380	3*
20	12.0	380	3	12.0	380	3*
24	10.0	500	2	12.0	380	3*
30	**	**	**	12.0	380	3*
36	**	**	**	12.0	380	3*

** No data published by AWWA. Consult manufacturer

* Maximum deflection angle may be larger than shown. Consult manufacturer

2. PVC Pipe

Deflection and longitudinal bending of PVC pipe shall be strictly in accordance with AWWA M23 PVC *Pipe-Design and Installation* and the Unibell *Handbook of PVC Pipe Design and Construction*.

For restrained joint ductile iron pipe the deflection will not exceed 80 percent of the manufacturer recommended deflection.

Casing Installation

Casing installation shall be performed by jacking and boring under highways and railroads as required. All necessary materials, equipment, and traffic protection devices shall be on the job site before starting work.

Boring and jacking work shall strictly adhere to the Florida Department of Transportation Utility Accommodation Guide, CSX Transportation, Inc./Seaboard Railroad Standard Specifications for Pipelines, AASHTO Standards, and the requirements of any other agency, whether public or private, having jurisdiction over the highway or railroad concerned. All boring and jacking operations shall be performed within the right-of-way and/or easements as designated. No construction shall be started until the necessary permits have been obtained, and a copy of the permit is at the job site.

Jacking operations shall be continuous and precautions shall be taken to avoid interruptions which might cause the casing to “freeze” in place. Correct line and grade shall be carefully maintained.

Casing pipe shall be welded steel pipe having minimum outside diameter and wall thickness. In no event shall the wall thickness be insufficient to resist crushing by earth or live loads. Casing pipe inside diameter (I.D.) shall be at least 4” larger than the outside diameter of the ductile iron pipe bells, which are usually slip joint. Restrained joint pipe generally requires larger casing pipes.

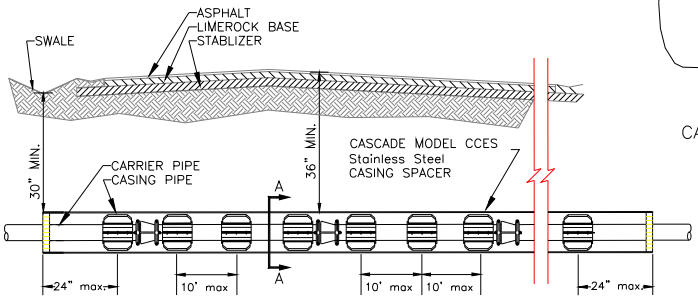
Nominal Pipe Size (O.D.)	D.I. Pipe (O.D.)	Slip Joint Pipe Bell O.D. (U.S. Pipe-AFC)	Casing Pipe Size	Standard Min. Wall (Thickness)	Railroad Min. Wall (Thickness)
4”	4.80”	6.52”-6.71”	12”	.250”	.250”
6”	6.90”	8.66”-8.90”	16”	.250”	.312”
8”	9.05”	10.82”-11.16”	16”	.250”	.312”
10”	11.10”	12.91”-13.25”	20”	312”	.375”
12”	13.20”	15.05”-15.37”	24”	.375”	.500”
16”	17.40”	19.74”-19.86”	30”	.375”	.500”
20”	21.60”	23.98”-24.28”	30”	.375”	.500”
24”	25.80”	28.16”-28.50”	36”	.375”	.625”
30”	32.00”	34.95”-35.40”	48”	.500”	.625”
36”	38.30”	41.37”-41.84”	54”	.500”	.625

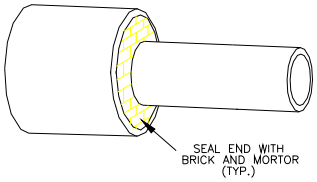
Casing pipe shall be furnished in 20’ foot sections only. The steel must meet the requirements of ASTM-853, Grade B. Only new pipe shall be used and all surfaces shall be smooth and uniform without bulges, dents, or warping. Finished lengths of pipe shall have beveled cut ends to facilitate proper welding of transverse joints. Field and shop welds of the casing pipes shall conform to the applicable portions of AWWA C206 and the American Welding Society (AWS) standard specifications AWSD7.0. Field welds shall be complete penetration, single-bevel groove type joints. Welds shall be airtight and continuous over the entire circumference of the pipe and shall not increase the outside pipe diameter by more than ¾”. The agency having jurisdiction over the jacking and boring site may require the casing to have bituminous coating.

All excess material shall be removed from the interior of the casing pipe prior to insertion of the carrier pipe. The carrier pipes shall be supported within the casing pipes so that the bells do not rest directly on the casing. Casing spacers shall be used to install carrier pipe within casing pipe to speed the installation and afford long term corrosion protection. Wooden skids are not acceptable. There shall be not metallic contact between the casing and the carrier pipe. The design and positioning of casing spacers shall ensure that the weight of the carrier pipe (see table below) and the weight of the water contained within it is adequately supported over the entire length of the carrier pipe. Casing spacers shall, at the very least, be installed within one (1) foot on each side of the bell and one in the center of a joint of pipe, a span not to exceed ten (10) feet. The end casing spacers shall be within six (6) inches of the end of the casing. All casing spacers shall be installed in accordance with the manufacturers instructions to ensure that no damage occurs during the tightening of the spacers or the carrier pipe insertion. Casing spacers must be within ¾" of the casing I.D.

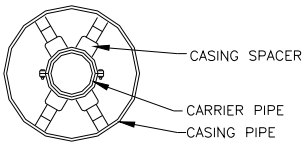
The annular opening between the casing and the carrier pipe shall be tightly sealed at each end of the casing with an end seal designed and manufactured for the purpose of preventing water from entering the casing. Brick and mortar is the only acceptable installation process.

		18 foot laying length		20 foot laying length	
Nominal Pipe Size	**Pressure Class**	**AWWA Weight per Joint**	**Average Weight per Foot**	**AWWA Weight per Joint**	**Average Weight per Foot**
4"	350	205 lbs.	11.4 lbs.	225 lbs.	11.3 lbs.
6"	350	300 lbs.	16.6 lbs.	330 lbs.	16.5 lbs.
8"	350	395 lbs.	22.0 lbs	440 lbs.	22.0 lbs.
10"	350	510 lbs.	28.4 lbs.	565 lbs.	28.3 lbs.
12"	350	655 lbs.	36.4 lbs.	725 lbs.	36.3 lbs.
16"	350	1060 lbs.	58.8 lbs.	1170 lbs.	58.5 lbs.
20"	350	1470 lbs.	81.6 lbs.	1625 lbs.	81.2 lbs.
24"	350	1985 lbs.	110.2 lbs.	2195 lbs.	109.7 lbs.
30"	250	2435 lbs.	135.2 lbs.	2690 lbs.	134.5 lbs.
36"	250	3260 lbs.	181.1 lbs.	3600 lbs.	180.1 lbs.





CASING END SEAL



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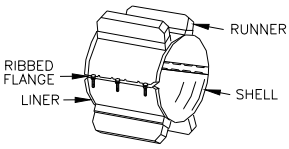


SPACER

CARRIER PIPE (IN.)	CASING OD (IN.)	WALL THICKNESS (OUC Std.)	HEAVY DUTY WALL THICKNESS (R.R. Projects)
4	12	0.250"	0.250"
6&8	16	0.250"	0.312"
10	20	0.312"	0.375"
12	24	0.375"	0.500"
16&20	30	0.375"	0.500"
24	36	0.375"	0.625"
30	48	0.500"	0.625"
36	54	0.500"	0.625"

STAINLESS STEEL SPACERS

CASING SPACERS SHALL BE:

1.) BE MADE FROM T–304 STAINLESS STEEL OF A MINIMUM 14 GAUGE THICKNESS.

2.) HAVE A SYNTHETIC RUBBER OR PVC LINER TO INSULATE THE PIPELINE FROM THE SPACER.

3.) HAVE A 1.5" WIDE GLASS REINFORCED PLASTIC OR UHMW POLYMER RUNNERS TO INSULATE THE SPACER FROM THE CASING.

4.) MANUFACTURED BY CASCADE WATERWORKS MFG. CO. (OR OTHER OUC APPROVED VENDOR).

PLACEMENT OF SPACERS ON CARRIER PIPE

GENERAL – ONE SPACER SHALL BE PLACED NOT MORE THAN TWO FEET FROM EACH END OF CASING. SUBSEQUENT SPACERS SHALL BE PLACED AT A MAXIMUM OF 10' APART WITHIN THE CASING, WITH AT LEAST THREE SPACERS PER JOINT OF PIPE.

CARRIER PIPE

CARRIER PIPE SHALL BE CENTERED WITHIN CASING BY USE OF MODEL CCES STAINLESS STEEL CASING SPACERS AS MANUFACTURED BY CASCADE WATER WORKS MFG. COMPANY OR OUC APPROVED EQUAL.

CASING PIPE

CASING PIPE SHALL EXTEND A MINIMUM OF 5' PAST EDGE OF PAVEMENT UNLESS OTHERWISE DIRECTED BY ENGINEER.

ORLANDO UTILITIES COMMISSION Water Business Unit 3800 Gardenia Ave. Orlando, FL 32839

	DWG: G. TAYLOR	JACK AND BORE DETAIL FOR PAVEMENT CROSSING WITH DUCTILE IRON PIPE	DWG D–99
	DATE: 2/23/04		
	REVISED: PRIEMER		

Trenchless Pipe Installation

When applicable and appropriate, trenchless technology, such as horizontal directional drilling (HDD) or some other method of directional boring, shall be utilized to keep restoration costs at a minimum. The purpose of this section is to expand and standardize the requirements pertaining to installations made by directional boring equipment, and to establish a standard of quality that takes into consideration the inherent problems associated with directional boring. The requirements contained herein are intended solely to prevent unnecessary failures. All directional boring methods and equipment shall be approved by an OUC Engineer before any work is permitted.

The requirements set forth in these standards are to regulate and control all aspects of directional boring. They specify a wide range of procedural precautions necessary to insure that the very basic, essential aspects of a proper directional boring installation are adequately controlled. Strict adherence shall be required under conditions outlined in these standards.

1. Horizontal Directional Drilling

Horizontal Directional Drilling is a method whereby stable, long distance, small-diameter tunnels are bored through a wide variety of soils using a method approved by the appropriate regulatory agency. The soil is cut by a small diameter rotating head. As the head bores through the soil, Bentonite clay is used to lubricate the head and to stabilize the soil surrounding the drilling path. The clay lining also makes the tunnel wall smooth and slippery, reducing frictional drag on the facility during installation. When the directional drilling head is pulled back out of the path, Bentonite clay is injected into the hole filling all voids.

A. Crossing Operations

All crossing operations shall be accomplished during daylight hours and shall not begin after the hour pre-established as the latest starting time that will allow completion during daylight hours. Planned nighttime work is expressly prohibited and will generally not be allowed unless stipulated in the special conditions of the utility permit/contract. In emergency situations, or where delay would increase the likelihood of a failure, nighttime work may be allowed to complete a delayed crossing.

B. Excavation and Pipe Installation

The nature and location of the work, the ground confirmation, the character and quality of the substrata, the types and quantity of materials to be encountered, the nature of the groundwater conditions, the character of equipment and facilities needed preliminary to and during the prosecution of the work, the general and local determined and verified prior to beginning the work.

C. Personnel Requirements

Currently, all horizontal directional drilling operations shall be conducted by an approved HDD Contractor. A responsible representative of the HDD Contractor and Orlando Utilities Commission must be present at all times during a directional drilling operation.

The Contractor shall have a sufficient number of competent workers on the job at all times to ensure the directional bore is made in a timely and satisfactory manner. Adequate personnel for carrying out all phases of the actual drilling operation must be on the job site at the beginning of the work.

A competent and experienced supervisor representing the Contractor that is thoroughly familiar with the equipment and type work to be performed, must be in direct charge and control of their operation at all times. In all cases the supervisor must be continually present at the job site during the actual directional drilling.

D. Equipment

All equipment used in the directional bore shall have the built-in capacity, stability and necessary safety features required to fully comply with the specifications and requirements of this section without showing evidence of undue stress or failure, and shall otherwise be in sound operating condition.

Backup equipment may be required where job site conditions indicate that severe damage to the roadway or a hazardous condition may result in the event of an equipment breakdown and where the condition of the equipment to be used indicates that routine component replacement or repair will likely be necessary during the drilling operation.

If equipment breakdowns or other unforeseen stoppages occur and forward motion of the directional cutting head is halted at any time other than for reasons planned in advance (addition of drill stems, etc.), the boring path shall be filled with a proper Bentonite solution immediately, or as directed by the appropriate regulatory agency.

When an obstruction is encountered that cannot be passed or an existing utility is damaged, pavement cutting for inspection may be approved by an OUC representative after consideration of all pertinent facts indicates that such action would offer the most practical solution to the problem for all parties concerned.

Any such authorized pavement opening shall be repaired according to appropriate regulatory agency's specifications and requirements. No cutting of the pavement will be allowed on interstate or other limited access facilities unless approved by FDOT.

The boring tool shall have a steering capability and have an electronic tool detection system. The position of the tool during operation shall be capable of being determined accurately both horizontally and vertically. The boring tool shall have a nominal steering radius of 30 ft.

E. Materials

All materials used in Horizontal Directional Drilling must be approved by Orlando Utilities Commission and shall conform to the applicable AWWA Standards. The piping material shall generally be HDPE PE3408 high density, very high molecular weight polyethylene pipe conforming to AWWA C906 with a minimum SDR of 11 and the latest revisions thereto. Sections of HDPE shall be joined into continuous lengths on the job site above ground and butt fused in strict accordance with pipe manufacturer's recommendations. The finished pipe assembly shall be pressure tested prior to insertion underground.

F. Pipe Materials

4” and less may be TR Flex, Flex Ring, Snap Ring Pipe, HDPE

6” and greater may be TR Flex, Flex Ring, Snap Ring Pipe.

- All piping must be approved by OUC prior to starting work.

Flowable Fill Procedures

- Coordination with the appropriate regulatory agency will be needed to determine if flowable fill or compaction will be used. Consideration should be given if hole is to large to plate and traffic needs dictate reopening before six hours. Delivery time should be taken into consideration during scheduling.

- Lead or supervisor will fax the approved O.U.C. Mix design form (fast setting and excavatable) to concrete vendor.

- Lead will retrieve acknowledgment receipt from the concrete vendor acknowledging they have received the request for flowable fill.

- OUC. mix design is a high early mix. (fast setting and excavatable)

- There will be no variations from this mix design.

- The concrete vendor drivers will supply a mix design ticket at the time of delivery.

- It will be the lead's responsibility to verify the mix design ticket supplied by the driver meets OUC's mix design request.

- The lead will also retrieve a sample from each load of flowable fill using a OUC water sample bag and label it with delivery ticket number.

- These samples will be stored for a two-week period, to ensure proper hardening.

- These samples will be stored in an area designated by the manager.

- All documentation relating to flowable fill will be turned in with the package to the coordinator and filed with the package.

O.U.C. MIX DESIGN FORM

Flowable Non-Shrink Fill
(Excavatable)

The following information will provide specifications for flowable non-shrink fill that is excavatable after 28 days.

Class of concrete: Flowable Fill (1 egg per yard) High Early; Mix No. 1

Materials		Quantities (SSD Basis)		Volume (CU. FT.)
Cement Type I		100		.51
Silica Sand		2253		13.73
Water		375		6.01
Air entraining agent (Darafill, oz.)		3.0		6.75
Chemical Admixture (Daraccell, oz.)		256		- - - -

Material Standard:

Cement		Type I		ASTM C 150
Fine Aggregate		Silica Sand		ASTM C 33
Ai –Entraining		Darafill		NA
Chemical Admixture		Daraccel		ASTM C 494

DELIVERY REQUEST LOCATION:

DATE NEEDED: TIME NEEDED

ACKNOWLEDGEMENT OF THIS FORM MUST FAXED BACK TO O.U.C. AT #407- 649 – 4463 BY A REPRESENTATIVE OF THE CONCRETE VENDOR.

SIGNATURE : DATE & TIME

Installation of Fittings

General Pipe Fittings Specifications

1. General

All pipe fittings and accessories installed, as a part of the Orlando Utilities Commission water distribution system shall be in accordance with the OUC Water Material Specifications Manual and the latest revisions thereof. Such materials shall in no event, be less than that necessary to conform to the requirements of any applicable law, ordinances, or codes.

All pipe fittings and accessories shall be new, unused, and correctly designed for the use intended. The materials shall be of standard first grade quality, received from the manufacturer. Materials, which are inferior or are lower in grade than indicated, specified, or required shall not be accepted. Orlando Utilities Commission reserves the right to make such judgments.

2. Pipe Fittings

Ductile iron pipe fittings, including bends, tees, crosses, reducers, sleeves, caps, plugs, and offsets, shall all be mechanical joint in conformance with ANSI/AWWA C111.A21.11 and the latest revision thereto. Ductile iron pipe fittings shall have standard bituminous pipe coating outside, and cement lining and seal coat inside in conformance with ANSI/AWWA C104/A21.40 or protective fusion bonded epoxy coating for interior and exterior conforming to C116/A21.16.98 and the latest revisions thereto.

All four (4) inch through twelve (12) inch ductile iron fittings, except offsets, shall be Class 350 “compact” fittings conforming to ANSI/AWWA C153/A21.53 and the latest revisions thereto.

All 16” through 24” ductile iron pipe fittings and six (6) inch through twelve (12) inch offsets shall be Class 350 “compact“ fittings conforming to ANSI/AWWA C153/A21.53 and the latest revisions thereto. Thirty (30) inch ductile iron pipe fittings shall be Class 250 “Compact” fittings conforming to ANSI/AWWA C153/A21.53 and the latest revisions thereto.

Acceptable manufacturers are listed on the OUC website ()

3. Special Considerations

Certain construction requirements necessitate the use of, or adaptation to, pipe, fittings, or joints not usually installed in the Orlando Utilities Commission water distribution system. All special pipe, fittings, or joints shall be designed for the use intended and whenever possible, meet the appropriate AWWA standard.

A. Flanged Fittings

All flanged fittings shall be gray iron or ductile iron conforming to ANSI/AWWA C153/A21.53, C110/A21.10 and the latest revisions thereto, and shall be flange by flange, Class 250, pressure rating 250 psi. All flanges shall be faced and drilled in accordance with ANSI B16.1 Class 125.

B. Sleeves

In addition to meeting specifications for mechanical joint pipe fittings, sleeves shall generally be the short pattern.

C. Reducers

All reducers will be MJ x MJ.

D. Caps and Plugs

All ductile iron caps and plugs shall conform to the pipe fitting specifications and they shall be tapped two (2) inch FIPT with a two (2) inch brass plug inserted.

E. Couplings

Couplings (transition) designed to join pipe of differing materials and diameters shall be bolted, sleeve-type couplings for plain end pipe conforming to ANSI/AWWA C219 and the latest revisions thereto. All transition couplings shall be used only for the type and diameter of pipe for which they were designed.

Offset Fabrication

From time to time, it becomes necessary to horizontally or vertically offset the water main more quickly than normal deflection will allow, and the proper sized offset fitting is not available. Such an offset is accomplished by making offset joints with 45° and 22 ½° bends. The following tables give the minimum plain end stub length (dimension "L" on illustration D-29A) necessary to fabricate offset joints in various sizes, with compact (C110 fittings) at the given amount of offset or offset distances.

1. 45° Compact Offset Joints (estimated pipe stub lengths)

Pipe Stub Length (dim. "L")

Offset	4"	6"	8"	10"	12"	16"
2' 0"	2' 6"	2' 4"	2' 3"	2' 1"	1' 11"	1' 11"
2" 6"	3' 2"	3' 0"	2' 11"	2' 9"	2' 7"	2' 7"
3' 0"	3' 11"	3' 9"	3' 8"	3' 6"	3' 4"	3' 4"
3' 6"	4' 7"	4' 5"	4' 4"	4' 2"	4' 0"	4' 0"
4' 0"	5' 4"	5' 2"	5' 1"	4' 11"	4' 9"	4' 9"
4' 6"	6' 0"	5' 10"	5' 9"	5' 7"	5' 5"	5' 5"
5' 0"	6' 9"	6' 7"	6' 6"	6' 4"	6' 2"	6' 2"
5' 6"	7' 5"	7' 3"	7' 2"	7' 0"	6' 10"	6' 10"
6' 0"	8' 2"	8' 0"	7' 11"	7' 9"	7' 7"	7' 7"
6' 6"	8' 10"	8' 8"	8' 7"	8' 5"	8' 3"	8' 3"
7' 0"	9' 7"	9' 5"	9' 4"	9' 2"	9' 0"	9' 0"
7' 6"	10' 3"	10' 1"	10' 0"	9' 10"	9' 8"	9' 8"
8' 0"	11' 0"	10' 10"	10' 9"	10' 7"	10' 5"	10' 5"
8' 6"	11' 8"	11' 6"	11' 5"	11' 3"	11' 1"	11' 1"
9' 0"	12' 5"	12' 3"	12' 2"	12' 0"	11' 10"	11' 10"
9' 6"	13' 1"	12' 11"	12' 10"	12' 8"	12' 6"	12' 6"
10' 0"	13' 10	13' 8"	13' 7"	13' 5"	13' 3"	13' 3"

2. 22 ½” Compact Offset Joints (Estimated pipe stub lengths)

Pipe Stub Length (dim. “L”)

Pipe Size	4”	6”	8”	10”	12”	16”
2’ 0”	5’ 0”	4’ 11”	4’ 10”	4’ 9”	4’ 8”	4’ 7”
2” 6”	6’ 3”	6’ 2”	6’ 1”	6’ 0”	5’ 11”	5’ 11”
3’ 0”	7’ 7”	7’ 6”	7’ 5”	7’ 4”	7’ 3”	7’ 3”
3’ 6”	8’ 11”	8’ 10”	8’ 9”	8’ 8”	8’ 7”	8’ 6”
4’ 0”	10’ 2”	10’ 1”	10’ 0”	9’ 11”	9’ 10”	9’ 10”
4’ 6”	11’ 6”	11’ 5”	11’ 4”	11’ 3”	11’ 2”	11’ 2”
5’ 0”	12’ 10”	12’ 9”	12’ 8”	12’ 7”	12’ 6”	12’ 6”
5’ 6”	14’ 1”	14’ 0”	13’ 11”	13’ 10”	13’ 9”	13’ 9”
6’ 0”	15’ 5”	15’ 4”	15’ 3”	15’ 2’	15’ 1”	15’ 1”
6’ 6”	16’ 9”	16’ 8”	16’ 7”	16’ 6”	16’ 5”	16’ 5”
7’ 0”	18’ 0”	17’ 11”	17’ 10”	17’ 9”	17’ 8”	17’ 8”
7’ 6”	19’ 4”	19’ 3”	19’ 2”	19’ 1”	19’ 0”	19’ 0”
8’ 0”	20’ 8”	20’ 7”	20’ 6”	20’ 5”	20’ 4”	20’ 3
8’ 6”	22’ 0”	21’ 11”	21’ 10”	21’ 9”	21’ 8”	21’ 7”
9’ 0”	23’ 3”	23’ 2”	23’ 1”	23’ 0”	22’ 11”	22’ 11”
9’ 6”	24’ 7”	24’ 6”	24’ 5”	24’ 4”	24’ 3”	24’ 2”
10’ 0”	25’11”	25’ 10”	25’ 9”	25’ 8”	25’ 7”	25’ 6”

Note: See Illustration D-7

Installation and Restraint

1. Fitting Installation

All fittings and related materials shall be handled in such a manner during transport, loading, unloading, and installation so as to protect the materials from any damage. Particular care shall be taken not to injure fitting coatings, both interior and exterior. Broken, cracked, misshapen, imperfectly coated, or otherwise damaged or unsatisfactory material shall not be installed.

Gaskets shall be stored in a clean, dark, dry location until immediately before use. Dirt or other foreign material shall be prevented from entering the fitting during handling or laying operations.

Proper tools, implements, equipment, and facilities shall be used for the safe installation of all materials. Fittings and other appurtenances shall be carefully lowered into the trench piece by piece. Under no circumstances shall materials be dropped, dumped, or slid into the trench.

Lumps, blisters, and excess coating shall be removed from the bells of each pipe. The inside of the bell shall be wire brushed and wiped clean, dry and free from oil and grease before the fitting is installed. Joints shall be made up in accordance with the manufacturer's recommendations.

Every effort shall be employed to ensure that sand or other debris does not enter the fitting. Any residue considered difficult to remove by scouring flush shall be removed by appropriate means and swabbed or sprayed with a liquid sodium hypochlorite solution (NaOCl), hereafter called 10% liquid chlorine.

The lubricant used on the sealing gaskets shall be suitable for use in potable water and shall not support any bacterial growth. The lubricant shall be in closed containers and kept clean at all times.

All fittings shall be mechanical joint. The joints of all pipelines and fittings shall be made absolutely tight. The joining of all pipe and fittings shall proceed in accordance with the manufacturer's instructions and requirements. The mechanical joints shall be centered in the bells and shall be assembled in accordance with the most current edition of AWWA standards.

The joints shall be tightened on opposite sides of the fittings in such a manner that the gland shall be brought up evenly to the joint. If effective sealing is not obtained, the joint shall be disassembled and reassembled after thorough cleaning. The bolts shall be tightened to the torque recommended by the manufacturer. If the joint is defective, the fitting shall be removed and replaced.

The following table indicates the typical number and sizes of bolts and nuts necessary for each facing or bell of the various sizes of compact (C153) ductile iron fittings.

Compact Ductile Iron Fittings

Size	Number of Nuts & Bolts	Bolt Diameter		Bolt Length
4”	4	¾”	X	3 ½”
6”	6	¾”	X	3 ½”
8”	6	¾”	X	3 ½”
10”	8	¾”	X	3 ½”
12”	8	¾”	X	3 ½”
16”	12	¾”	X	4”
20”	14	¾”	X	4”
24”	16	¾”	X	4 ½”
30”	20	1”	X	6”
36”	24	1”	X	6”

Plugs shall be inserted into the bells of all tees and crosses, and plain ends shall be capped.

2. Joint Restraint

Adequate precautions shall be taken to prevent the separation of all joints, especially at bends, tees, crosses, valves, and plugged ends. All bends, tees, plugs, caps, and other fittings on pressure pipelines shall have appropriate mechanical thrust restraint (wedge-action or full circumference articulating wedge, equal to the 1100 Series Megalug or Sur-Grip) installed in accordance with AWWA C600 and DIPRA Thrust Restraint Design for Ductile Iron Pipe. All components of restraining mechanisms for push-on or mechanical joints shall be of corrosion resistant material or suitably protected against corrosion. Concrete thrust blocking shall only be used when applicable and specified with prior approval from OUC. The pipe lengths immediately on either side of a fitting shall be adequately tied together using restrained joint gaskets such as Field Lok® or Fast-Grip® gaskets. These are rubber gaskets with metal teeth that bite into the pipe upon insertion and prevent longitudinal movement. The slip joint gasket is removed to accommodate restrained joint gaskets. The length of restrained pipe required to adequately restrain a joint depends on the pipe size, water pressure, depth of cover, and soil conditions where two or more fittings are together, use the fitting that yields the greatest length restrained pipe. All road crossings shall be restrained at each joint. The following tables specify those distances based on the following criteria:

a. The test pressure is 150 psi.

b. The laying condition it Type 2 as defined in the DIPRA Handbook of Ductile Iron Pipe (Sixth Edition).

c. Poor soil conditions are assumed.

d. All bends are installed horizontally.

e. The pipe is ductile iron pipe.

f. Depth of cover is assumed to be 3 feet for 12” and smaller water mains; depth of cover is assumed to be 4 feet for 16” and larger water mains.

g. None of the pipe is poly wrapped.

Refer to current water detail sheet installation instructions.

Valve Installation

General Valve Specifications

1. General

All valves and accessories installed as a part of the Orlando Utilities Commission water distribution system shall be in accordance with the OUC Water Material Specifications Manual and the latest revisions thereof. Such materials shall, in no event, be less than that necessary to conform to the requirements of any applicable law, ordinances, or codes.

All valves and accessories shall be new, unused, and correctly designed for the use intended. The materials shall be of standard first grade quality, produced by expert workers, and intended for the use for which they are offered. Inferior materials or are lower in grade than indicated, specified, or required shall not be accepted. Orlando Utilities Commission reserves the right to make such judgments. All interior coatings and equipment in contact with potable water shall be approved per NSF 61.

2. Gate Valves

Distribution system gate valves, four (4) inch through twelve (12) inch, shall be resilient seat or wedge gate valves conforming to AWWA C116/A21.16 and the latest revisions thereto. The valves shall have mechanical joint ends with a working pressure of 200 psi, operate in the vertical position, open left or counter clockwise with a non-rising stem and a two (2) inch square operating nut. The interior of the cast iron or ductile iron valve shall be lined with a thermosetting epoxy protective coating. All internal ferrous surfaces shall have a 4 mil factory applied thermosetting epoxy coating.

Acceptable manufacturers are listed on the OUC website (www.ouc.com)

3. Butterfly Valves

Distribution system butterfly valves, twelve (12) inch through 24”, shall be Class 150B for buried installation with mechanical joint connections and they shall conform to ANSI/AWWA C116/A21.16 and the latest revisions thereto. The operator shall open left or counter clockwise with a two (2) inch square-operating nut. All internal ferrous surfaces shall have a 4 mil factory applied thermosetting epoxy coating.

Acceptable manufacturers are listed on the OUC website (www.ouc.com)

4. Tapping Valves

Four (4) inch through twelve (12) inch tapping valves shall be Class 250 resilient seat or wedge valves conforming to AWWA C116/A21.16 and the latest revisions thereto. The valves shall have a mechanical joint end and a tapping valve end. They must operate in the vertical position, open left or counter clockwise with a non-rising stem and a two (2) inch square-operating nut. The exterior and interior of the cast iron valve shall be lined with a thermosetting epoxy protective coating. All internal ferrous surfaces shall have a 4-mil factory applied thermosetting epoxy coating.

Acceptable manufacturers are listed on the OUC website (www.ouc.com)

Valve Type, Location, and Spacing

Generally, OUC distribution system valving shall be accomplished with resilient seated gate valves on 4” through 10” water mains. Butterfly valves shall usually be utilized on 12’ and larger water mains. All valves shall be installed within the roadway right-of–way with no less than twelve (12) inches of cover over the valve operating nut. The valves generally shall be installed where they can be easily referenced from measurable landmarks for future location. Valves shall be installed at all directions at a tee and cross. A valve shall be located on each side of a jack and bore or horizontally directional drilled crossing. All valves shall be located as close as possible to the connected water main. There shall be a sufficient number of valves so that single lines in the network may be isolated from the remainder of the system. All water mains, that branch from a larger main and cross under an arterial highway or street, shall be valved close to the larger main and before the crossing. Valves will be located at dead ends for future extensions or connections of a main.

1. Transmission Valves

Main line valves on transmission mains are normally butterfly valves. The normal location of main line valves on transmission mains shall be where they can be referenced to obvious permanent landmarks or monuments. Transmission main valves shall generally be installed at intervals of approximately 2000 feet.

2. Residential Distribution Valves

Distribution system valves in residential neighborhoods shall generally be installed at intersections, at intervals of no greater than 1000 feet.

3. Commercial Distribution Valves

Valves in commercial and industrial areas shall be spaced so that they may isolate sections of the main no longer than two (2) sides of a block, not to exceed approximately 1000 feet.

Installation and Restraint

1. Handling

All valves shall be handled in such a manner during transport, loading, unloading, and installation so as to protect them from any damage. Under no circumstances shall valves be dropped, skidded, rolled, or placed against pipe or other fittings in such a manner that damage could result. Slings, tongs, or hooks used for lifting shall be properly padded in such a manner as to prevent damage. Particular care shall be taken not to injure valve coatings, both interior and exterior. Broken, cracked, imperfectly coated, or otherwise damaged or unsatisfactory valves shall not be installed. If any part of the valve's coating and lining is damaged, the valve replacement shall be made before installation.

Valves shall be stored at all times in a safe manner to prevent damage and kept free of dirt, mud, or other foreign matter. All valve gaskets shall be stored and placed in a cool location out of direct sunlight and out of contact with petroleum products. All valve gaskets shall be used on a first-in. first-out basis. Dirt or other foreign material shall be prevented from entering the valve during handling or laying operation.

2. Installation

Proper tools, implements, equipment, and facilities shall be used for the safe installation of all valves. Valves shall be carefully lowered into the trench piece by piece. Under no circumstances shall valves be dropped, dumped, or slid into the trench.

Lumps, blisters, and excess coating shall be removed from the bells of each valve. The inside of the bell shall be wire brushed and wiped clean, dry and free from oil and grease before it is installed. Joints shall be made up in accordance with the manufacturer's recommendations.

Every effort shall be employed to ensure that sand or other debris does not enter the valve. Any residue considered difficult to remove by scouring flush shall be removed by appropriate means and swabbed or strayed with a 10% liquid sodium hypochlorite solution (NaOCl), hereafter called 10% liquid chlorine.

The lubricant used on the sealing gaskets shall be suitable for use in potable water and shall not support any bacterial growth. The lubricant shall be in closed containers and kept clean at all times.

The joints of all pipelines and valves shall be made absolutely tight. The joining of all pipe and valves shall proceed in accordance with the manufacturer's instructions and requirements. The mechanical joints shall be centered in the bells and shall be assembled in accordance with the most current AWWA standards.

If effective sealing is not obtained, the joint shall be disassembled and reassembled after thorough cleaning. The bolts shall be tightened to the specified torques with a torque wrench.

If the joint is defective, the fitting shall be removed and replaced. Valves shall be installed so that the operating nut is plumb.

Cast iron valve boxes, with cast iron tops and bottoms, shall be installed over the valve, firmly supported and maintained centered over the valve and plumb over the operating nut of the valve with the box cover flush with the surface of the finished pavement or at such other levels as may be directed. The valve and valve box shall be installed so as to allow a valve key to move easily through the valve box and completely open and close the valve.

3. Joint Restraint

Adequate precautions shall be taken to prevent the separation of all joints. All valves on pressure pipelines shall have appropriate mechanical thrust restraint (wedge-action) installed in accordance with AWWA C600 and DIPRA *Thrust Restraint Design for Ductile Iron Pipe*. All components of restraining mechanisms for mechanical joints shall be of corrosion resistant material or suitably protected against corrosion. Concrete trust blocking shall only be used when applicable, specified, and approved by OUC.

The pipe immediately on either side of an inline valve generally does not require restraint if there are a sufficient number of joints. However, if restraint is required, the joins shall be adequately tied together using restrained joint gaskets such as Field Lok® or Fast-Grip® gaskets. The string of restrained pipe required to adequately restrain the joint depends on the pipe size, water pressure, depth of cover, and soil conditions. The table below specifies the minimum distances based on the following criteria:

A. The maximum test pressure is 150 psi.

B. The laying condition is Type 2 as defined in the DIPRA Handbook of Ductile Iron Pipe (Sixth Edition).

C. Poor soil conditions are assumed.

D. All valves are installed with a horizontal run.

E. The pipe is ductile iron pipe.

F. Depth of cover is assumed to be 3 feet for 12” and smaller water mains; depth of cover is assumed to be 4 feet for 16” and larger water mains.

G. None of the pipe is poly wrapped.

The figures represent the minimum restrained distance from the valve, in feet on both sides of the valve.

Valve Size →	4”	6”	8”	10”	12”	16”	20”	24”	30”	36”
Restrained Distance	47’	72’	97’	121’	144’	146’	180’	213’	259’	302

4. Blow-Off Valves

Blow-off valves shall be installed at the ends of all dead-end water mains when practical. The blow-off shall be installed in such a fashion so as to direct the discharge water where it can be disposed of safely and easily.

Fire hydrants installed at or near the dead-end of sixteen (16) inch or smaller diameter water mains may be used as blow-offs in some instances, though only if the discharge of water would not significantly impact traffic or present a safety problem and use of the hydrant is approved by OUC.

Temporary “disinfection/chlorination” and flushing blow-offs shall be installed size for size, or full bore, on newly installed water mains, or large enough to give a velocity of at least 5 feet per second in the water main being flushed, unless otherwise specified by OUC . At least one (1) temporary blow-off valve shall be installed at the low point in each valve section, where flushing water may be disposed of easily. Retention ponds, drainage ditches, and storm drains may be used for this purpose. The discharge pipe may not be connected into sewers, drains, etc., nor may the discharge pipe be installed below the overflow level of ponds or ditches being discharged into.

All blow-off valves shall be restrained in accordance with the table previously shown.

Fire Hydrant Installation

General Fire Hydrant Specifications

The location and spacing of fire hydrants shall comply with requirements of the fire department having jurisdiction. The design fire flow demands, sizing of fire services, the location and spacing of fire hydrants must be reviewed and approved by the fire department having jurisdiction prior to final approval of the potable water distribution facilities design by WETS. The number and spacing of fire hydrants shall be as required by the appropriate fire department (Agency).

If not specified by the fire department having jurisdiction, unless otherwise directed by the Fire Department representative.

Fire hydrants shall be located in a manner to provide complete accessibility and separated from any and all obstructions such as utility poles, posts, walls, etc., by a distance of at least three (3) feet measured from the centerline of the fire hydrant to the nearest face of the obstruction. All fire hydrants located within FDOT right-of-way shall conform to FDOT clear zone requirements.

Private fire hydrants are permitted, but Orlando Utilities Commission reserves the right to require appropriate backflow device at the customer's expense. OUC is to own and maintain the appurtenances pertaining to the fire service through the OUC fire service control valve (OUC's point of delivery).

Fire Hydrant Location and Spacing

If not specified by the fire department having jurisdiction, fire hydrants shall be located six (6) feet from the back of the curb or the edge of the pavement, or in some other location which will minimize the hazard of damage by traffic and injury to pedestrians. In order to minimize any inconvenience to property owners, fire hydrants shall be installed at or near side property lines. Fire hydrants shall be installed so that the 4 ½” pumper port faces the street, or driveway, unless otherwise directed by the Fire Department or an OUC representative.

Fire hydrants shall be located in a manner to provide complete accessibility and separated from any and all obstructions such as utility poles, posts, walls, etc., by a distance of at least three (3) feet measured from the centerline of the fire hydrant to the nearest face of the obstruction. All fire hydrants located within FDOT right-of-ways shall conform to FDOT clear zone requirements.

Installation and Restraint

Fire hydrants shall be handled in such a manner during transport, loading, unloading, and installation so as to protect them from any damage. Under no circumstances shall hydrants be dropped, skidded, rolled, or placed against pipe or other fittings in such a manner that damage could result. Slings, tongs, or hooks used for lifting shall be properly padded in such a manner as to prevent damage. Particular care shall be taken not to injure hydrant coatings, both interior and exterior. Broken, cracked, imperfectly coated, or otherwise damaged or unsatisfactory hydrants shall not be installed. If any part of the fire hydrant's coating and lining is damaged, replacement shall be made before installation. Fire hydrants shall be stored at all times in a safe manner to prevent damage and kept free of dirt, mud, or other foreign matter. Accessory gaskets shall be stored and placed in a cool location out of direct sunlight and out of contact with petroleum handling or laying operations.

Proper tools, implements, equipment, and facilities shall be used for the safe installation of all fire hydrants. Fire hydrants shall be handled so as to avoid any damage at all times. Hydrants shall be carefully lowered into the trench piece by piece. Under no circumstances shall hydrants be dropped, dumped, or slid into the trench.

All fire hydrants shall be thoroughly cleaned of dirt or foreign material before installation. The inside of the foot shall be wire brushed and wiped clean, dry and free from oil and grease before the hydrant is installed. Fire hydrants shall be connected to the water main with a six (6) inch branch controlled by an independent six (6) inch resilient seat gate valve as a hydrant shutoff valve.

The joints of all pipelines and fire hydrants shall be absolutely tight. The joining of all pipe and hydrants shall proceed in accordance with the manufacturer's instructions and requirements. The mechanical joints shall be centered in the bells and shall be assembled in accordance with AWWA standards. If effective sealing is not obtained, the joint shall be disassembled and reassembled after thorough cleaning. The bolts shall be tightened to the specified torques with a torque wrench. If the joint is defective, the fitting shall be removed and replaced.

Fire hydrants shall be installed so that they stand plumb with their pumper nozzle perpendicular to the curb (facing the street or a nearby driveway). To ensure that the breakaway feature functions properly, hydrant sets shall be installed with four foot by four foot (4'x 4'), eight (8) inch thick concrete thrust collar poured around the barrel of the hydrant, six (6) inches below the ground line. This concrete collar may be eliminated in areas where the hydrant is set in a sidewalk, if the sidewalk is installed prior to final acceptance of the hydrant. The top of flange elevation shall be finish grade plus four (4) inches. Standard depth of bury shall be 36" to 60", in six inch increments.

The fire hydrant shall be firmly supported under the foot or elbow with a support block. All backfill shall be thoroughly compacted under the support block, and under the thrust collar. The pipe attached to the hydrant shall be restrained by a megalug.

The upper barrels of all fire hydrants shall be painted with Flynt Paint Products, aluminum Silver paint. The bonnet and port caps shall be painted with C150 Safety Blue, Product Carbocrylic 3359 DTM, and Carboline Manufacturing.

Site Restoration

Cleaning and Grading

1. General Cleaning

During construction, the work site and the adjacent premises shall be maintained as free from material, debris, excess spoil, and rubbish as is practicable. Any debris or rubbish that constitutes a nuisance or is objectionable shall be removed from the site. The work site shall be cleaned at the end of each workday. All surplus materials and temporary structures shall be moved from the site when no longer required.

At the conclusion of the work, all tools, temporary structures and materials shall be promptly taken away, and all water, dirt, rubbish, or any other foreign substances shall be promptly removed from the work site and properly disposed. Natural waterways or bodies of water shall not be used for disposal of debris. All debris shall be disposed of at a site approved and permitted by the appropriate government agency. Burning of brush or debris shall not be permitted.

2. Grading

All areas within the limits of construction, including transition areas, shall be graded to restore the original contour and surface before the end of the work day, whenever possible. Ponding shall be prevented. After grading, the area shall be compacted to the specified depth and percentage of maximum density. No grading shall be done in areas where there are existing pipelines that may be uncovered or damaged, until such lines have been relocated.

Newly graded areas shall be protected from traffic, erosion, and the accumulation of trash and debris. The grade shall be repaired and reestablished in settled, eroded, and rutted areas. When completed compacted areas are disturbed by subsequent construction operations or adverse weather, the surface shall be scarified, reshaped, and compacted to the required density.

Lawns, Shrubbery, and Trees

1. Restoration of Lawns and Grassy Areas

Lawn areas shall be left in as good or better condition as before the starting of the work.

Where sod is to be removed, it shall be carefully removed and later replaced, or the area where sod has been removed shall be restored with new sod within two weeks of completion of the work in that location, to the satisfaction of the customer. Sod that does not take root within 90 days shall be replaced.

All grassed areas disturbed during construction shall be restored with new sod of the same type as the surrounding area, or St. Augustine or Bahia, whichever is better or as required by the regulation agency. The sod shall be live, fresh, and free of weeds, have well matted roots, and uninjured at the time of placing and meet the FDOT Standard Specifications.

All areas to be sodded shall first be fine graded to match the surrounding areas and sacrificed or loosened to a suitable depth. Sod shall be placed as soon as possible after being dug and shall be shaded and kept moist from the time it is dug until it is planted. Methods for sodding shall meet the applicable requirements of the FDOT Standard Specifications, or the governing permitting agency.

2. Shrubbery and Trees

Where necessary to remove plantings in order to accomplish the work, such shrubbery shall be replaced to the satisfaction of the customer or property owner. Trees will be transplanted when feasible and when a successful transplant is probable. The necessary shrubbery and trees shall be replaced on OUC projects done by others before such work is accepted by OUC. Newly planted shrubs and trees shall be kept well watered and alive, healthy, and vigorous for ninety (90) days after a project is completed. Trees shall be braced or tied to resist wind conditions until they have taken root.

Pavement Repair and Resurfacing

1. Streets, Driveways, Sidewalks, Curbs and Gutters

Where street paving, driveways, sidewalks or curb and gutter are disturbed, restoration shall be made to a condition at least equal to the original.

All road sub-base, soil cement, limerock base, asphaltic concrete surface, Portland cement concrete pavement and driveway, sidewalk and concrete curb restoration must be accomplished in accordance with the best commonly acceptable practices and the appropriate City, County, and/or State road construction requirements. All paving and related work shall be in accordance with the laws, ordinances, rules, regulations, standards, and specifications applicable to the City of Orlando, Orange County, the State of Florida, and the federal government. All methods, procedures, and equipment shall be safe and adequate for job completion.

All materials used for restoration shall conform to standard requirements of that particular agency responsible for roadway maintenance where the construction takes place. Base material shall be of the type removed or of equal or greater structural strength as determined by the governing agency. Existing base material from the excavation shall not be reused as a base material, but may be used as a stabilizer unless it is determined to be unsuitable.

Edges shall be mechanically sawed to provide a neat, straight edge to the necessary width prior to replacement. Base material shall be placed to the depths required by the permitting agency and thoroughly compacted to the density required by the governing permitting agency.

Careful attention shall be given to the proper reconstruction of the pavement adjacent to the gutters and at street intersections to obtain satisfactory drainage to inlets from the intersecting streets.

Until permanent pavement replacement is completed, additional base materials shall be provided for all trenches and disturbed areas as is necessary to maintain smooth transiting of the areas be vehicular traffic. Dust control shall be provided as necessary.

All traffic control functions, including signs, flagmen, and safety devices shall comply with the USDOT's *"Manual on Traffic Control and Safety"* and/or the laws, ordinances, ruled, and regulations of the appropriate governing body.

2. Soil Proctor and Density Tests

All excavation or work to be subsequently resurfaced or paved in some form shall be properly backfilled and compacted, in accordance with all laws, rules, regulations, standards, and specifications applicable to the City of Orlando, Orange County, the State of Florida, and federal government, and soil proctor and field density tests shall be conducted when required.

Soil proctor moisture-density tests and field density tests shall be accomplished by qualified operators, with the best commonly acceptable practices. All methods, procedures, and equipment shall be safe and adequate for job completion.

3. Pavement Marking and Street and Traffic Signs

All disturbed pavement marking shall be replaced with thermoplastic compound sealing primer and glass spheres that meet the requirements of FDOT Standard Specifications or the requirements of the governing permitting agency. All stop bars, crosswalks, skip lines, directional arrows, messages, reflective markers, etc, shall conform to the State of Florida DOT *"Roadway and Traffic Design Standards".* Pavement marking of repairs/replacements shall match the previously existing pavement where applicable.

Where markings are required other than the replacement of previously existing markings, the requirements of the U.S. Department of Transportation, Manual of Uniform Traffic Control Devices for Streets and Highways shall be followed.

Removal and relocation of all street or traffic signs shall be approved through the appropriate permitting agency.

Service Installation

Service Material Specification

All materials in contact with potable water will be NSF 61 certified.

1. Service Clamps

Acceptable manufacturers are listed in the OUC Material Specification Manual. Service clamps or service saddles designed for and used on ductile iron pipe shall be the double strapped type with 2" female iron pipe threading. The bodies shall be malleable or ductile iron with carbon steel, electro-galvanized with dichromate seal, or stainless steel straps. The straps shall be designed for the pipe O.D. that the clamps will be used on. The clamps shall have neoprene or equal gaskets cemented in place.

Service Clamps or service saddles designed for and used on PVC pipe shall be the single strapped type with the appropriate size CC threading. The bodies and straps shall be cast 85-5-5-5 bronze with silicon bronze or stainless steel bolts and nuts, and grade 60 "0" rings or equal, cemented in place.

2. Tapping Sleeves

Tapping sleeves shall be the split type made of fusion bonded epoxy coated carbon steel with stainless steel bolts and nuts. Stainless steel tapping sleeves are not acceptable. The flanged outlet shall be a Class D, 150 lb. Drilled and recessed for a tapping valve, and conform to ANSI/AWWA C207 and the latest revisions thereto.

3. Service Tubing

All small service tubing shall be soft annealed, type K, self-tempered, 250 psi test copper tubing conforming to federal specifications WW-T-99 (ASTM B88-47) in ¾" and 1" sizes. Two inch service tubing shall either be soft annealed, type K, self-tempered, 250 psi test copper tubing conforming to federal specifications WW-T-99 (ASTM B88-47), or Pressure Class 200 SDR 21 PVC pipe of the same outside diameter (O.D. 2.375"), as determined by the OUC Water Engineering and Technical Services Division.

4. Corporation Stops

Corporation stops for 1" service lines shall be brass bodied with CC (AWWA taper) by compression joint, conforming to ANSI/AWWA C800 and the latest revisions thereto. The service fitting must accommodate copper tubing. Both grip joint and pack joint are acceptable.

5. Curb Stops

Curb stops or curb cocks for both ¾" and 1" services shall be brass bodied conforming to ANSI/AWWA C800 and the latest revisions thereto. Curb stops shall be full port ball valve or equal with padlock wings so that the valve can be locked "OFF". The connections shall be compression joint inlet by female iron pipe thread outlet. Pack joint is the only acceptable fittings.

6. Ball Valves

Meter valves for 2" services shall be full port ball valves conforming to ANSI/AWWA C800 and the latest revisions thereto. The valve must have a tee valve head with a padlock wing, and a 90º or quarter turn check. The connections shall be 2" CTS (copper tubing size) compression coupling by 2" flange with elongated bolt holes to accommodate flanged water meters. Pack joint is the only acceptable fittings.

7. Water Meters

All 5/8” by ¾”, 1”, 1 ½”, and 2” cold-water displacement type water meters shall conform to AWWA C700 and the latest revisions thereto. The split case body materials shall be high grade bronze, basically devoid of any external plastic parts. The dial covers shall be of high strength heat treated glass or an equal glass product.

The 5/8” by ¾” and 1” meter connections shall be meter casing spuds with external straight pipe thread. The 1 ½”, and 2” meter connections shall be oval type companion flanges.

All turbine type cold-water meters shall be 2” through 10” Class II turbines conforming to AWWA C701 and the latest revisions thereto. The main case materials shall be high grade bronze or cast iron. The dial covers shall be of high strength heat treated glass or an equal glass product. The 2” meter connections shall be oval type companion flanges, and 3” through 10” meter connections shall be round type flanges conforming to ANSI B16.1 cast iron pipe flange, Class 125.

8. Meter Boxes

Generally, meter boxes and meter box covers shall be high density black polyethylene with ultraviolet inhibitors and antioxidants. The meter box cover shall be complete with cast iron reader lid hinged by solid galvanized rod. Nail hinges are not acceptable.

Meter boxes nominal sizes with cast iron reader lids are listed in the OUC Material Specifications Manual.

Special Irrigation meter services only use medium sized high density black polyethylene or polypropylene meter boxes with ultraviolet inhibitors and antioxidants. The general bottom inside dimensions shall not exceed 475 square inches. The meter box cover shall be complete with cast iron reader lid hinged with a solid galvanized rod. Nail hinges are not acceptable.

Meter boxes placed in sidewalks or driveways shall be cast iron with cast iron covers.

Service Line and Meter Sizing

It is the Orlando Utilities Commission Water Business Unit's intention to consistently and economically manage and deliver a sufficient quantity of maximum purity and quality to every customer as required. Success in this endeavor depends, to a great extend, on the proper design of not only the distribution system but of the proper sizing of individual service lines and water meters.

1. Standard Domestic Services

Standard domestic services shall consist of 1" service lines with 5/8" x ¾" water meters or 1" water meters, as requested by the customer. Standard domestic services may be residential, commercial, or industrial.

2. Irrigation Services

A. Standard Irrigation Services

A standard irrigation service shall also consist of a 1" service line with a 5/8" x ¾" water meter or 1" water meter, as requested by the customer. Orlando Utilities Commission requires that the irrigation system be adequately zoned to assure that meter flows do not exceed AWWA Standards.

B. Special Irrigation Service

Special irrigation services shall consist of 1" service lines with 5/8" x ¾" water meters or 1" water meters, but they may not be larger than existing water meter from which they will be served.

3. Non-Standard Services

Any service connection larger than 1" is considered to be a non-standard service. Non-Standard services may be any reasonable size requested by the customer, plumber, developer, etc., but the size of the water meter shall be determined by the Customer and must be approved by OUC when making such a determination, past experience, in-depth studies, present, future, and fixed demands, as well as variable, intermittent, and continuous demands shall be considered.

Service Line Location

1. Service Line Location

All water service lines, both metered and fire service, shall be installed in public streets, roads, alleys, or in suitable easements over private property. Where required, easements shall be secured from other local government entities before service lines can be installed on their properties. Approval from the appropriate railroad agency is required for any water service within any railroad right-of-way. Any service connections made to an existing or new water distribution main shall be located on the street of the home or facility. There shall be no rear lot line services permitted. Water services shall be in a solid one piece casing.

2. Service Line Depth

All 1” and 2” water service lines shall be installed with the normal minimum cover of eighteen (18) inches. Four (4) inch and larger water service lines shall normally be installed with a minimum cover of 30”. Depth of installation may be varied in the vicinity of existing utilities, under streets, and on unimproved streets in anticipation of future street improvement.

3. Separation

Separation shall meet DEP and other appropriate government agency regulations.

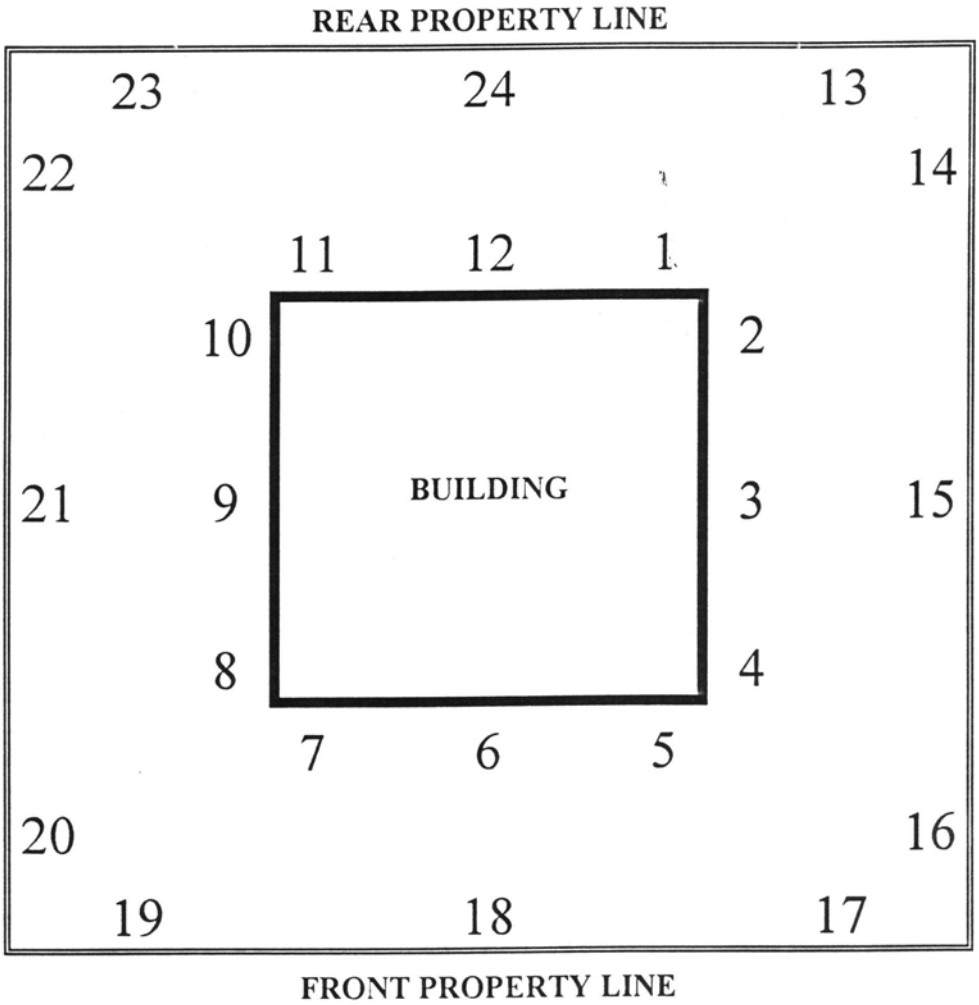
4. Meter Location

Small water meters of 5/8” to 2” are customarily located in an underground meter box at finish grade on the customer side of the sidewalk or right-of-way in grassed areas.

Three inch and larger water meters are generally located above ground at the property line perpendicular with the street. Under special circumstances, vaults may be considered for large installations.

5. Meter Location Codes

The perimeter of both water meters and electric meters are documented as time locations by imaging the outside of the building as the face of a standard 12 hour clock and the boundaries of the property as the face of a 24 hour “military time” clock, with the front property being the bottom of each clock face.



Main Tapping

Connections for a new water service or water main are generally made to an existing water main using a wet tapping process with the water main under pressure. Such procedures involve either a direct tap to the water main or the use of a tapping sleeve.

Prior to making a tap, the water main and the area around, under, and behind it shall be excavated to expose that area to be tapped. The tapping area of the water main shall be properly cleaned prior to making the tap. Support for the tapping equipment shall be provided.

1. Direct Taps

Direct taps involve insertion of a corporation stop directly into the water main using a tapping machine that drills and threads the wall of the pipe.

Care shall be taken to ensure that sufficient pipe wall thickness for the appropriate number of pipe threads is available to hold the corporation stop in place. Direct taps are limited to 1" service lines, and may be made only on 4" and larger ductile iron water mains. Direct taps shall not be made on PVC pipe.

The tap angle for a direct tap for services on the water main shall be horizontal middle of the pipe diameter only, preferable at the 22 ½ º point. The water main shall not be tapped on the top.

After the corporation stop is installed and the service line is connected, the installation shall be inspected and tested for leaks before being covered with backfill.

2. Standard Taps

All taps on PVC pipe up to 2" shall provide heavy threaded outlets for the attachment of appropriate appurtenances. 4" and larger taps shall be flanged or MJ connections.

After the tapping saddle or sleeve, and the valve have been installed, but before the tap is made, the sleeve or saddle shall be tested to ensure a watertight joint. The tap angle when using a tapping saddle or sleeve shall be the 22 ½ º point above the 90º point or horizontal middle of the pipe diameter. The main shall not be tapped on the top. Taps 2" and larger will be horizontal.

The entire installation shall be inspected and tested for leaks after the service line is connected and before it is covered with backfill.

Meter Services

A small short side meter service is any 1” through 2” service tapped to a water main on the same side of the street as the property being served. Short side meter services are considered such, only if the pavement does not have to be disturbed.

The services consist of a corporation stop (1”) or gate valve (2” & larger) tapped into the main or installed into a service clamp, copper tubing leading to a curb stop and water meter located in a meter box at the property line of the facility being served.

The customer or plumber is to make the connection to the discharge side of the water meter, run a water line to the facility, and install a house valve at the entrance to the facility.

If the service is equipped with a special irrigation meter, care shall be taken to make the domestic connection and the irrigation connection to the correct water meters. The water meter directly in line with the curb stop is always the domestic meter.

Renewal and Replacement Service Transfer

A transfer of service occurs whenever a new water main is installed to replace an existing water main. The existing service line shall be severed at the corporation stop, or gate valve, which will be plugged and abandoned. If the existing service line was connected to a valve located under the pavement, the hand wheel and valve box shall be removed, and the resulting hole in the pavement shall be backfilled and patched with asphalt.

The new main shall be tapped as per OUC standards with copper tubing connected to the existing service line if it is still serviceable. If the existing service line is polyethylene or galvanized, in poor condition, or if it cannot be used for any other reason, it shall be abandoned and a new water service line shall be extended from the new tap to the existing water meter as determined by OUC.

The service consists of a corporation stop or gate valve tapped into the main or installed into a service clamp, water service line leading from under the pavement to a curb stop and existing water meter located in an existing meter box at the property line of the facility being served.

If the service line is to be transferred from an existing water main located at the rear lot line to a new water main on the street side of the building, the service line shall be cut, plugged, and abandoned and the existing meter shall be removed. A new water meter shall be set at the front of the property with a new service line connected to the house line, as closely as possible to the point were the house line enters the building.

Testing And Chlorination

Hydrostatic Testing

Where newly laid pipe or valved section thereof has been laid and backfilled between the joints, it shall be subjected to a hydrostatic gauge pressure of 150 psi for a minimum of 2 hours. During the hydrostatic test, the water main shall also be checked for leakage, which, if detected, shall be stopped by an OUC approved method. After repair section will be selected. All testing shall be in accordance with AWWA Standard C600 and the latest revision thereto.

Each valved section of the pipe shall be slowly filled with water. The test pressure, based on the elevation of the lowest point of the water line or section under test, and corrected to the elevation of the test gauge, shall be applied by means of test pump connected to the pipe in a satisfactory manner.

Before applying the specified test pressure, all air shall be expelled from the pipe. If fire hydrants, sample points, taps, or blow-offs are not available at high elevations taps at points of high elevation shall be made before the test is made. Plugs shall be inserted in place of the tops after the test has been completed.

Any cracked or defective pipes, fittings, or fire hydrants discovered as a consequence of the pressure test shall be removed and replace with new material and the test shall be repeated until satisfactory results are received.

The leakage test shall be conducted at the above-mentioned pressure of 150 psi. Leakage is defined as the quantity of water, in gallons per 2-hour, to be supplied into the newly laid pipe or any valved section thereof, necessary to maintain the specified leakage test pressure after the pipe has been filled with water and the air expelled.

No pipe installation shall be accepted until the leakage is less than that shown on the OUC detail sheet. Any installation of 300 feet or less will not exceed zero water loss. If any section of the water main is provided with concrete thrust blocking, the hydrostatic pressure test shall not be made until at least 24 hours after the thrust blocking was poured.

Water Main Chlorination (AKA Disinfections)

1. General

The following outlined is in with the "Rules of the Department of Environmental Protection" Chapter 62-555 Public Water System. The procedure also meets and exceeds the requirements set forth in AWWA Standard C651 or current revision thereto. All materials in contact with potable water will be NSF 61 certified and all chemicals used in the disinfection will be NSF 60 certified.

The terms "disinfection" and "chlorination" are used synonymously in this section to describe the process of rendering water mains acceptable for the delivery of potable water. This section will also use the common terms "chlorinate" and "chlorinator".

The basic disinfection procedure, per ANSI/ AWWA C651, consists of:

1. Preventing contaminating materials from entering the water main during storage, construction, or repair,
2. Removing, by flushing or other means, those materials that may have entered the water main.
3. Chlorinating any residual contamination that may remain, and flushing the chlorinated water from the main.
4. Protecting the existing distribution system from contaminants due to hydrostatic pressure test and chlorination procedures.
5. Determining the bacteriological quality by laboratory test after chlorination.
6. Final connections of the approved new water main to the existing distribution system.

2. Preventative and Corrective Measures During Construction

It should be noted that any connection of a new water main to the existing distribution system prior to receipt of satisfactory bacteriological samples might constitute a cross-section. Therefore, the new main must be isolated until bacteriological tests described in Section 7 of AWWA Standard C651 are satisfactorily completed. Orlando Utilities Commission maintains a procedure to protect the existing distribution system from backflow contamination during testing of a new water main.

a. O.U.C. relies on the feed valve to be in a closed position to protect the existing distribution system during testing phase. The feed valve is to be operated only for flushing and chlorination procedures. To help ensure protection, any operation of this valve must be authorized by O.U.C.

b. O.U.C. does not allow a customer service connection to the new water main until final clearance is received from the DEP. However, to maintain pressure and insure water quality, the feed valve is put in the open position when bacteriological testing has been determined *to* be satisfactory by a state approved laboratory.

Precautions shall be taken *to* protect pipe, fittings, and valves against bacteria contamination. It is realized that pipe and appurtenances cannot always be kept clean when stored on a construction site prior *to* laying, or in a storage yard awaiting installation. Immediately prior *to* laying the pipe, sections are *to* be inspected for debris and all debris shall be removed.

When new main extensions are *to* be connected *to* existing mains, the new valve and/or fitting *to* be connected *to* the existing line is *to* be cleaned and shall receive a generous swabbing *of* 10% liquid chlorine. This process is done because the point *of* injection *of* the disinfection solution is generally downstream *from* these fittings.

Any lateral dead end stubs (for future fire hydrants and main extensions) must be swabbed or sprayed with 10% liquid chlorine if they are not equipped with valves for adequate flushing and chlorination operation. The inside *of* tapping tees and the outside *of* the main *to* be sleeved are *to* be cleaned and swabbed or sprayed with 10% liquid chlorine.

Blow-offs, referred *to* as "orifice size" or "flush opening *of* pipe lines", are *to* be installed *so* that flushing water will not cause erosion *of* soil or sod or pollution *to* existing streams or lakes. The blow-off valve shall be a throttling valve large enough to permit an adequate flush as described below. Blow-offs will be installed size for size on the newly installed main up *to* 12". All newly installed mains larger than 12" shall have at least 12" blow-offs. Larger blow-offs may be needed to achieve the required flushing velocity. Blow-offs shall be left in place until the new water main is placed into service.

3. Flushing

Proper flushing and scouring of the newly installed water mains removes air and debris. A clean system is essential to the pressure test and chlorination process. Flushing, however, is not a substitute for preventive measures taken before and during pipe laying.

The duration of flushing will vary with the length of line and to some extent, with pipe size. The objective of the flushing is to "change the water" in the new water line a minimum of six (6) times at a velocity of 5 feet/second minimum flushing velocity in order to scour out all loose debris. The duration of the flushing in seconds can be determined by multiplying 6 (change of water) times the length of pipe in feet divided by 5 (desired velocity of the water).

Before flushing begins, the new water line must be filled with no air pockets. When filling new water lines 16" and larger, they must be filled with a 3/4" tap and all sample points open to assure discharge of air. After filling, the flushing is to be controlled from the blow-off valve to prevent entrapping air. Sample points are to be flushed during the flushing process.

The flushing period shall be continuous once it is started. In other words, two separate five-minute flushes will not constitute a ten-minute flush. The minimum length of flushing time is six minutes for any size or any length of pipe.

4. Disinfecting and Sampling

The disinfecting agent (chlorine) shall be liquid sodium hypochlorite (NaOCl) referred to previously as 10% liquid chlorine.

The 10% liquid chlorine is introduced into the new line through a tapped inlet and a portable chlorinator to a measured residual of 25 mg/L (250 ppm) minimum. Care should be taken to prevent the backup of chlorine solution in the old water main by:

1. Closing the upstream valve, and disconnecting the chlorinator.
2. Simultaneously closing the blow-off valve and stopping the portable chlorinator.

Flow during chlorination is controlled from the downstream or blow-off end of the line.

Sampling spigots are to be opened and flushed with the chlorine solution prior to placement on the sampling point. After installation of the sampling spigots, they are to be capped, bagged, or foil wrapped to prevent contamination by wind blown debris and locked to prevent unauthorized handling. Warning tags in good condition are to be attached to each sample point.

The disinfecting or chlorinating procedure is generally a five (5) day process that normally starts on a Monday.

1. Monday: Chlorine is introduced into the main and left there overnight.
2. Tuesday: The chlorine is completely flushed, filled with system water, and secured for 24 hrs.
3. Wednesday: Samples are taken from each sample point and delivered to the OUC laboratory for analysis.
4. Thursday: Repeat Wednesday samples.
5. Friday: If both samples pass the lab test, the main may be placed into full service after FDEP clearance.

OUC uses the continuous feed method of chlorination. The continuous feed method consists of placing 10% liquid chlorine in the main during construction, completely filling the main to remove all air pockets, flushing the completed main to remove particulates, and filling the main with potable water. Chlorine gas may be used as an alternative only when accomplished by a certified contractor.

Procedure for chlorinating the main.

1. At a point not more than 10ft (3m) 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 25mg/L (250ppm) free chlorine. To ensure that this concentration is provided, measure the chlorine concentration at regular intervals in accordance with the procedures described in the current edition of *Standard Methods for the Examination of Water and Wastewater* or AWWA Manual M12, or using appropriate chlorine test kits. The table, from AWWA C651, below gives the amount of chlorine required for each 100 ft (30.5m) of pipe of various diameters.

   Solutions of 10% liquid chlorine required may be prepared with sodium hypochlorite or calcium hypochlorite.

Pipe Diameter		10 percent Chlorine Solution	
In	(mm)	gal	(L)
4	(100)	0.016	(0.06)
6	(150)	0.036	(0.14)
8	(200)	0.065	(0.25)
10	(250)	0.102	(0.39)
12	(300)	0.144	(0.54)
16	(400)	0.260	(0.98)
20	(500)	0.400	(1.50)
24	(600)	0.580	(2.20)

2. The chlorinated water shall be retained in the main for at least 24 hours. At the end of this 24 hr period, the treated water in all portions of the main shall have a residual of not less than 10mg/L (100ppm) free chlorine.

3. Direct feed chlorinators, which operate solely from gas pressure in the chlorine cylinder, shall be used for the application of liquid chlorine. The danger of using direct feed chlorinators is that water pressure in the main can exceed gas pressure in the chlorine cylinder. This allows a backflow of water into the cylinder, resulting in severe cylinder corrosion and escape of chlorine gas. Hypochlorite solutions may be applied to the water main with a gasoline or electrically powered chemical feed pump designed for feeding chlorine solutions. Feed lines shall be of such material and strength as to safely withstand the corrosion caused by the concentrated chlorine solutions and the maximum pressures that may be created by the pumps. All connections shall be checked for tightness before the solution is applied to the main. The pump must have a screen filter through which the chlorine solution must pass before injection into the main.

5. Final Flushing

The final flushing consists of the following steps:

A. Clearing the main of heavily chlorinated water: After the applicable retention period, heavily chlorinated water should not remain in contact with pipe for longer than 24-hrs. In order to prevent damage to the pipe lining or corrosion damage to the pipe itself, the heavily chlorinated water shall be flushed from the main until chlorine measurements show that the concentration in the water leaving the main is no higher than that generally prevailing in the distribution system or is acceptable for domestic use.

B. Disposing of heavily chlorinated water must meet appropriate governing agency regulations and is the responsibility of the developer/contractor.

6. Bacteriological Tests

A. Standard Conditions. After final flushing and before the new water main is connected to the distribution system, two consecutive set of acceptable samples, taken at least 24 hr apart, will be collected from the new main. Sampling points should be spaced 500 feet (152m) apart on distribution mains with turns and bends. On straight run mains, the spacing can be increased to 1000 feet (305m) apart. In

addition, samples will be collected from each end of the line and from each branch. The sample points should be left no lower than three (3) feet above the finished parkway grade and no higher than five (5) feet All samples shall be tested for bacteriological quality in accordance with *Standard Methods for the Examination of Water and Wastewater,* and shall show the absence of coliform organisms.

B. Sampling Procedure. Samples for bacteriological analysis shall be collected in sterile bottles treated with sodium thiosulfate as required by *Standard Methods for the Examination of Water and Wastewater.* No hose or fire hydrant shall be used in the collection of samples. A corporation cock will be installed in the main with a copper tube gooseneck assembly. After samples have been collected, the gooseneck assembly may be removed and retained for future use.

7. Emergency or Maintenance Chlorination

In the event a water main should rupture and repairs need to be made all repairs will be made by an OUC approved method.

Cross Connection Control

Program Overview

Although Orlando Utilities Commission employs the latest technologies to produce and deliver high quality, safe drinking water, it is ever vigilant of the potential for contamination or pollution of the drinking water system and the potable water supply. Successful prevention of such contamination and pollution is dependent upon knowledge of the origins of cross-connections and backflow, and the cooperation of the governing health agencies, the local plumbing officials, the water purveyor, and the water user or consumer. OUC takes an aggressive role in that success with an active, ongoing cross-connection control program.

1. Origins

OUC's cross-connection control program was based upon the guidelines of early editions of the following publications.

- *Manual of Cross-Connection Control*. Foundation of Cross-Connection Control and Hydraulic Research, University of California, Los Angeles (8th ed., 1988)
- *Accepted Procedure and Practice in Cross-Connection Control Manual.* AWWA Pacific Northwest Section (4th ed., 1985)
- Angele, G.J. *Cross-Connections and Backflow Prevention.*AWWA, Denver (2d ed., 1974)
- *Cross-Connection Control Manual* (EPA 430/9-73-002). Water Supply Div., USEPA, Washington, D.C. (1975)
- *Backflow Prevention and Cross-Connection Control, Newest Revision of* AWWA Manual M14. AWWA, Denver (1966; bibliography 1970)

The OUC cross-connection control program currently follows the guidelines established in *Recommended Practice for Backflow Prevention and Cross-Connection Control,* AWWA Manual M14, AWWA, Denver (2d ed., 1990).

2. Regulations

In the event of any conflicts the most stringent requirements will apply.

Several years ago, the State of Florida enacted the Florida Safe Drinking Water Act. The requirements of this act are advertised and enforced by the Department of Environmental Protection. Rules 62-550, 62-555, and 62-560 have particular impact on the OUC water system. OUC complies with these rules in its efforts to provide contaminant free potable water to its customers.

The State of Florida Division of Environmental Health (Orange County Health Department) has long embraced the basic principles of environmental sanitation and safety through properly designed, acceptably installed, and adequately maintained plumbing systems. These principles are promoted by the Rules of the Department of Health and Rehabilitative Services, Chapter 10D-9, Plumbing, which states that, all plumbing systems hereafter installed shall conform with the requirements of this chapter.

Both the City of Orlando and Orange County have adopted the Florida Building Code, to serve as the plumbing regulation enforced by the local plumbing officials.

All of the aforementioned documents mandate various degrees of contamination and pollution prevention and are enforced by the appropriate governmental agencies. A major emphasis of these laws, rules, regulations, and policies, is backflow prevention and cross-connection control.

3. Program Responsibilities

OUC is primarily concerned with the prevention of contaminant or pollutant backflow into the water sources, distribution system, or service lines. To address these concerns, the cross-connection control program operates within two divisions of the Water Business Unit; Water Engineering and Technical Support (WETS) Division, and Water Distribution (WD) Division.

The cross-connection control program is structured to accomplish the goal of backflow prevention in several ways.

A. Water Distribution and Water Engineering

- Reviews plans for equipment or conditions known to be actual or potential cross-connections.
- Monitors and inspects new construction for conditions or equipment that may cause or encourage backflow.
- Inspects existing facilities for actual and potential cross-connections and code violations that could allow future cross-connections.
- Requires actual or potential hazards to be eliminated or requires appropriate backflow prevention devices to be properly installed.
- Responds to contamination or pollution situations to determine whether the cause was a cross-connection, and implements the appropriate protection against recurrence
- Tests all testable backflow preventers on an annual basis to ascertain if in proper functioning.
- Maintains backflow prevention device performance and test records.

Backflow Prevention Requirements

When requiring the installation of backflow prevention devices, OUC has established certain practices that are compatible with both its responsibility and authority to control cross-connection problems.

1. Hazard Classification

When assessing an actual or potential cross-connection, the probability of plumbing alterations, new equipment installation, and customer negligence is first considered. This helps to determine what kind of hazard might occur, what the risk may be, and what type of backflow prevention device to install, and where to install it.

A. Health Hazard

An actual or potential cross-connection capable of introducing any substance into the potable water supply with the probability of causing death, illness, or spread disease, is considered a health hazard, a contaminant, or a high degree of hazard. Such hazards demand the installation of very dependable, usually more expensive backflow preventer.

B. Non-health Hazard

An actual or potential cross-connection involving any substance that could be a nuisance or aesthetically objectionable, but would not cause any illness, is considered a non-health hazard, a pollutant, or a low degree of hazard. Backflow prevention required for these types of cross-connections is generally a little less sophisticated and more economical.

2. Backflow Preventer Location

A. Containment

OUC generally follows the containment or premises isolation theory when requiring backflow prevention devices. This means that a backflow preventer capable of protecting the distribution system from any contaminant or pollutant within the facility, will be required at the point of service, or at the meter.

B. In-plant Isolation

Sometimes, the customer is allowed to participate in internal protection or in-plant isolation if the private system piping is sufficiently secured at each point of contamination, and, if OUC personnel are permitted free access at any time for inspection purposes. This practice gives the customer adequate protection against in-house cross-connections as well as protecting the public water system. The in-plant isolation method of cross-connection control does, however, require closer coordination and more regular inspection by OUC personnel than the containment practice.

3. Methods of Backflow Prevention

Although there have been several devices and methods of backflow prevention introduced over the years, the potable water industry and OUC recognize and approve only three of them at this time. All commercial sites shall have RP devices only, approved by an OUC representative. Each of the approved methods of backflow prevention is designed for a certain degree of hazard and type of installation, as well as to protect the water system against certain conditions, or causes of backflow.

Backflow is caused by one of three conditions; back siphonage of a nonpotable environment into a potable water system, back pressure from a nonpotable environment into a potable water system, or a combination of both. The cause of the actual or potential cross-connection is evaluated and determined while deciding the method of backflow prevention.

A. Air Gap

An approved air gap, which is not a device but is instead a plumbing condition, is the only absolute means to eliminate the possibility of any cause of backflow. An approved air gap is defined as an unobstructed vertical distance of at least twice the diameter of the water supply outlet, through free atmosphere between the lowest point of a water supply outlet and the flood level rim of the fixture or assembly into which the outlet discharges.

Although the air gap is the most effective means of preventing either a high degree of hazard or a non-health hazard type of cross-connection, and certainly the most economical, it is vulnerable to bypass arrangements, and is generally impractical because of total pressure reduction to the customer.

The air gap is approved only for a non-health type hazard in an in-plant isolation situation.

B. Reduced Pressure Principle Backflow Preventer

The only mechanical device approved as backflow protection from a health, contaminant, or high degree of hazard, is a reduced pressure principle backflow prevention device, also known as an RP, RPZ, RPA or even as a reduced pressure detector assembly (RPDA), also capable of detecting water flow. These devices are generally installed at the point of service, although sometimes they are additionally installed at the point of contamination within the facility. These devices are always installed above ground so that their test cocks and relief valves may not become submerged. The properly installed device is suitable protection against back siphonage, back pressure, and the combination of both.

Backflow Preventer Installation

All backflow prevention methods or devices shall be installed in accordance with the manufacturers installation and the following Orlando Utilities Commission requirements.

1. Air Gap

- The water supply outlet shall be installed a prescribed unobstructed distance through free atmosphere, vertically above the flood or overflow level rim of the vessel, fixture, or assembly into which it discharges.
- That prescribed distance shall be equal to no less than twice the diameter of the water supply outlet, but under no circumstances, less than one (1) inch.
- The air gap assembly shall be constructed in such a way that connecting a hose to the water supply outlet would be extremely difficult.
- No hose, rim, or apparatus of any kind shall be introduced to alter the relationship between the water supply outlet and the vessel, fixture, or assembly so that the effectiveness of the air gap would be nullified.

2. Reduced Pressure Principle Backflow Prevention Device

- Pipe lines shall be thoroughly flushed to remove foreign material and debris before installing the device.
- If not already provided with the assembly, shut off valves will be installed at each end of the device for testing and servicing purposes
- The device shall be placed in the horizontal position unless otherwise specified by the manufacturer's instructions.
- The device shall always be installed in an accessible location to facilitate testing and servicing.
- The centerline of the device shall always be installed a minimum of 12 inches plus the nominal size of the device above ground or the maximum flood level, whichever is highest, in order to prevent any part of the device from becoming submerged. The relief valve shall never be plugged or solidly piped into a drainage ditch, sewer, or pump. The relief valve discharge pipe shall be terminated a minimum of 12 inches above ground or maximum flood level and located so that it is clearly visible and accessible.
- The device shall be adequately supported to prevent the assembly from sagging.
- The device shall be approved by OUC or meet ANSI/AWWA C511 and the latest revisions thereto or ASSE Standard #1013 (rev. 1993 or newest revision) or USCCCC&HR or Florida Building Code.

3. Double Check Valve Assembly

- Pipelines shall be thoroughly flushed to remove foreign material and debris before installing the device.
- If not already provided with the assembly, shut off valves shall be installed at each end of the device for testing and servicing purposes.
- The device shall be placed in the horizontal position unless otherwise specified by the manufacturer's instructions.

- The device shall always be installed in an accessible location to facilitate testing and servicing.
- The device shall always be installed a minimum of 12 inches plus the nominal size of the device above ground or the maximum flood level, whichever is highest, in order to prevent any part of the device from becoming submerged.
- OUC recommends the device shall be adequately supported to prevent the assembly from sagging.
- The device shall be approved by or meet ANSI/AWWA C510 and latest revision thereto or ASSE Standard #1015 (rev. 1993) or USCCCC&HR or Florida Building Code.

Approved Backflow Prevention Devices

Approval of backflow prevention devices is best left in the hands of organizations with the time and resources to thoroughly evaluate the devices and determine their capability to perform as design. OUC allows its customers to properly install any appropriate backflow preventer that has been tested and approved by the University of Southern California, Foundation for Cross-Connection Control and Hydraulic Research (USC), or certified as meeting the standards of either the American Water Works Association (AWWA) or the American Society of Sanitary Engineers (ASSE). City and County regulations come from the Florida Building Code, which also supports approval by these organizations.

- **Standards**

  The standards and publications to which approved backflow prevention devices shall comply are listed below:

  - AWWA Standard for Reduced Pressure Principle Backflow Prevention Assembly. AWWA Standard 511.
  - ASSE Standard #1013, Reduced Pressure Principle Backflow Preventer – Revised 1993
  - ASSE Standard #1047, Reduced Pressure Detector Assembly Backflow Preventer – ANSI/ASSE 1995
  - ASSE Standard #1015, Backflow Prevention Assembly – Revised 1993
  - ASSE Standard #1011, Hose Connection Vacuum Breakers – 1993 – ANSI/ASSE 1995
  - USC *Manual of Cross-Connection Control.* Foundation of Cross-Connection Control and Hydraulic Research, Univ. of S. Calif., Los Angeles (8th ed., 1988)
  - Florida Building Code

The approved device tables that follow indicate most of the devices available that meet the standards, specifications, and requirements of the approving agencies recognized by the Orlando Utilities Commission. These tables are not meant to limit the distribution of backflow prevention devices to those listed, but to promulgate known acceptable devices. OUC is constantly alert to the introduction of additional approved backflow preventers available to our customers.

REDUCED PRESSURE PRINCIPLE

APPROVED DEVICES

MAKE	SIZES	REQUIREMENT MET
AMES	¾ thru 10”	ASSE
HERSEY	¾ thru 10”"	USE
CLAVAL	¾ thru 1¼” 2” thru 10”	USC
FEBCO	¾ thru 10”	USC
BUCKNER	¾ thru 2”	ASSE
CONBRACO	¾ thru 2”	ASSE
NEPTUNE	¾ thru 3”	USC
RAINBIRD	¾ thru 10”	USC
WATTS	¾ thru 10”	USC
WILKINS	¾ thru 10”	USC, ASSE

The listed backflow prevention devices are recognized by Orlando Utilities Commission as acceptable and in compliance with the standards set forth by one or more of the following approving agencies:

AWWA American Water Works Association

ASSE American Society of Sanitary Engineers #1001-70, #1011-70, #1013-71, #1015-72 & #1020-74

USC University of Southern California, Foundation for Cross Connection Control & Hydraulic Research

Florida Building Code

* Indicates most of the devices available that meet the standards, specifications and requirements of approving agencies recognized by OUC.

All new models must meet OUC Specification approvals. Contact 407-244-8786 for additional information.

DOUBLE CHECK VALVE ASSEMBLY

APPROVED DEVICES

MAKE	SIZES	REQUIREMENT MET
AMES	1”	ASSE
BUCKNER	1”	ASSE
CLAVAL	1”	USC
CONBRACO	1”	USC, ASSE
FEBCO	1”	USC
HERSEY	1”	USC
NEPTUNE	1”	USC
RAINBIRD	1”	USC
VIKING	1”	USC
WATTS	1”	USC
WILKINS	1”	USC

The listed backflow prevention devices are recognized by Orlando Utilities Commission as acceptable and in compliance with the standards set forth by one or more of the following approving agencies:

AWWA American Water Works Association

ASSE American Society of Sanitary Engineers #1001-70, #1011-70, #1013-71, #1015-72 & #1020-74

USC University of Southern California, Foundation for Cross Connection Control & Hydraulic Research

Florida Building Code

* Indicates most of the devices available that meet the standards, specifications and requirements of approving agencies recognized by OUC.

All new models must meet OUC Specification approvals. Contact 407-244-8786 for additional information.

Construction Drawings

Construction Drawings

All drawings may be found at the following web link;
http://www.ouc.com/business/engineering/water/docs/const_standards_man.pdf