

CHAPTER 400 - WATER DISTRIBUTION SYSTEM CONSTRUCTION STANDARDS

SECTION 400.01 GENERAL

The standards and specifications found in this chapter are for materials and construction of water mains within the Village of Lombard, Illinois. Specific references made herein for manufactured materials such as pipe, hydrants, valves and fittings refer to designations for American Water Works Association (AWWA) or to the American National Standard Institute (ANSI). Nothing herein shall constitute or imply an endorsement by the Village of Lombard of any one material over another.

These specifications cover pipe fittings and items normally used for water distribution systems. Special considerations will be covered in the plans and special provisions. Water distribution systems shall be constructed in accordance with Standard Specifications for Water and Sewer Main Construction in Illinois, current edition.

A) SPECIFICATIONS

All water supply system improvements are subject to the requirements of the Illinois Environmental Protection Agency (IEPA). No construction shall commence prior to IEPA permit approval.

B) EASEMENTS

All Village owned and/or maintained water mains which are not constructed within right-of-way shall be centered in a thirty (30) foot wide easement.

SECTION 400.02 PIPE MATERIAL

A) DUCTILE IRON PIPE

C-151. Class 52TJ, thickness designation, casting, marking, testing, etc. shall be provided in accordance with applicable ANSI or AWWA standards.

B) LINING

Cement lining shall be included in accordance with ANSI A21-4 (AWWA - 104).

C) PIPE FITTINGS

All cast iron fittings shall conform to the latest ANSI Specifications A21.10 for short body, cast iron fittings twelve (12) inches and less, and AWWA C-110 for fittings fourteen (14) inches and larger. Lining, or other special items shall be specified in special provisions.

SECTION 400.03 PROTECTION OF WATER MAINS

A) GENERAL

Water mains and water service lines shall be protected from sanitary sewers, storm sewers, house sewer service connections and drains as per subsections B and C below. (See Standard Detail WATER 8). Water mains shall have a minimum of five (5) foot clearance around the pipe from other utilities such as street light/cable, gas, electric, cable TV, etc.

B) HORIZONTAL SEPARATION - WATER MAINS AND SEWERS

1. Water mains shall be located at least ten (10) feet horizontally from any existing or proposed drain, storm sewer, sanitary sewer, or sewer service connection.
2. Water mains may be located closer than ten (10) feet to a sewer line when:
 - a. Local conditions prevent separation of ten feet; and
 - b. The water main invert is at least 18 inches above the crown of the sewer; and
 - c. The water main is either in a separate trench or in the same trench on an undisturbed earth shelf where the invert of the water main is eighteen (18) inches above the crown of the sewer and located to one side of the sewer.
3. When it is impossible to meet the above conditions, the sewer shall be constructed of water main quality pipe, or upon approval from the Private Engineering Services Division, sleeved with steel pipe or PVC SDR 26, Class 160 PSI-ASTM D-2241(watertight at both ends) for the entire distance of the conflict plus ten (10) feet on either end. This is to be done in lieu of "spot" lowering or raising the water main when possible. If the pipe is 18 inches or larger, concrete pressure pipe may be used when permitted by the Private Engineering Services Division or a designated representative.

C) VERTICAL SEPARATION - WATER MAINS AND SEWERS

1. A water main shall be separated from a sewer so that its invert is a minimum of 18 inches above the crown of the drain or sewer whenever water mains cross storm sewers, sanitary sewers or sewer service connections. The vertical separation shall be maintained for that portion of the water main located within ten feet horizontally of any sewer or drain crossed. A length of water main pipe shall be centered over the sewer to be crossed with joints equidistant from the sewer or drain.
2. When it is impossible to obtain the proper vertical separation as described in (1) above; or the water main passes under a sewer or drain then:

Both the water main and sewer shall be constructed of water main quality pipe, or upon approval by the Private Engineering Services Division, sleeved with steel pipe, or PVC SDR 26, (water tight at both ends) for a minimum distance of ten (10) feet on each side of the water main. This is to be done in lieu of "spot" lowering or raising the water main when possible. (Spot lowering of water mains shall only be permitted in cases of direct conflict when sleeving and spot raising are not possible).
3. A vertical separation of eighteen (18) inches between the invert of the sewer or drain and the crown of the water main shall be maintained where a water main crosses under a sewer. Granular bedding shall support the sewer or drain lines to prevent settling and breaking the water main. Concrete cradles shall support any sewer greater than twenty-four (24) inches in diameter. Details shall be shown on the plans and approved by the Private Engineering Services Division.

SECTION 400.04

PIPE INSTALLATION FOR WATER MAINS

A) GENERAL INSTALLATION NOTES

Pipe shall be installed in accordance with manufacturer's specifications and instructions for installing the type of pipe used.

1. **Valves:** All valves shall be installed in pre-cast 60" internal diameter vaults. Valves shall be aligned in center of frame section with operating nut located in center of frame. Valve trim bolts shall be stainless steel. **Valves shall be Mueller A-2360 resilient wedge valve with stainless steel trip, or Waterous 2500 resilient wedge gate valve with stainless steel trim bolts. All accessory bolts, studs and nuts shall be "Cor-Ten". Valve bodies, bonnets and gates shall be epoxy impregnated in conformance with AWWA C550.**

2. **B-boxes:** All b-boxes shall be to grade and keyable after sod is laid. B-box walk-through will not be conducted until after sod is laid. Extension rods shall not be cut to shorten. B-box locations shall be noted on as-built drawings. B-box locations shall be imprinted in the curb where applicable.
3. **Water Service Lines:** Service lines shall have a minimum of five (5) foot bury and a maximum of eight (8) foot bury. Service lines shall be a minimum of one (1) inch diameter. Service lines shall comply with required horizontal vertical separation from sanitary and storm sewers. Couplings shall not be installed under pavement. When installing a back loop over or under a water main, the loop shall have a maximum of four (4) foot radius and all looped service lines shall be looped in the same direction. All lead service lines encountered in the public right of way shall be abandoned from the corporation stop to the curb stop (including corporation and curb stop) and upgraded to one (1) inch copper.

Water service lines shall be Type K copper manufactured in accordance with ASTM B88 and B251. For 1" service lines, corporation stops shall be either Mueller H-15008N or Ford F600NL. For 1 1/2" and 2" service lines, corporation stops shall be either Mueller B-25008N or Ford FB600NL. Components in contact with potable water shall comply with the latest requirements of the Federal Safe Drinking Water Act. Service lines greater than 1" in diameter shall have a stainless steel banded ductile iron saddle (Smith Blair 238 Tapped Full Circle Repair Clamp).

Service taps into polywrapped pipe will be done according to the procedure outlined in the DIPRA handout "Polyethylene Encasement Installation Guide". The publication is available online at <http://www.dipra.org>. Service lines shall be placed through the curb stop to the property line. Existing service lines may be a different size or material (e.g. lead or galvanized steel). The Contractor shall provide acceptable couplings or fittings between the new service line and the existing line. Couplings will only be permitted if the service line exceeds 100 feet for a 1" line or 60 feet for a 1 1/2" or 2" line. No couplings shall be permitted under any paved surface, including sidewalks, driveways, driveway aprons, and roadways.

4. **Water Main Installation:** All changes in direction shall be restrained and thrust blocked.
5. **Fire Hydrants:** As noted in the hydrant setting detail, all hydrants are to be Waterous Pacer WB-67. As noted in the hydrant setting detail, all hydrants are to have the auxiliary valve attached via flat flange type

connection. As noted in the hydrant setting detail, all trim nuts and bolts on hydrants shall be stainless steel. Hydrants shall be installed with bury mark at grade level and no lower than eighteen (18) inches nor higher than twenty-four (24) inches from center of steamer port to final grade. The grade around the hydrant shall be level for a fifteen (15) foot radius from the hydrant to prevent retention of water. Hydrants are to be installed plumb and level. When extending a hydrant, the “break” flange shall be relocated to grade level. Auxiliary valves shall be installed in a six (6) inch valve box, be keyable and to grade. All hydrants shall have a minimum of ¼ cubic yard of washed stone around the base for drainage. Abandoned hydrants shall be removed at a minimum of three (3) feet below grade and remaining hydrant barrel filled with concrete.

6. **Water main:** Water main shall be installed at a minimum depth of five and one-half (5.5) feet below finished grade and no deeper than eight (8) feet from finished grade without prior written approval of the Utilities Superintendent. Changes in direction of water main shall be installed with approved retainer fittings and thrust blocking. Water main shall not be sleeved or encased without the prior written approval of the Utilities Superintendent. The water main shall be re-wrapped water tight after it has been removed to install service taps, lateral connections etc. All field changes shall be noted in detail on the “as-built drawings”. Pressure testing of water main shall include hydrants by testing against the internal valve of the hydrant. When abandoning old water main, all live tee connections shall be removed on lead joint pipe and tee plugged on mechanical joint pipe. Capping of live water mains is not permissible unless approved in writing by the Utilities Superintendent. All dead connections shall be plugged water tight with brick and hydraulic concrete or cast iron cap.
7. **Valve Vaults:** All water valve vaults are to be pre-cast sixty (60) inch internal diameter, and lids must be marked “WATER”. Frame and covers not in paved areas shall be service weight. Vault opening “dog houses” shall be sealed with brick and mortar (not concrete). Tar mastic shall be used between all sections including rings and frames to top section. Mortar shall not be used to dress up adjusting rings. Vaults are to be water tight.
8. **Valve Boxes:** Valve boxes shall not be installed on any valve except auxiliary hydrant valves without written approval by the Utilities Superintendent.

B) EXCAVATION AND BACKFILL

Excavation and backfill for water mains shall conform to the provisions of Section 20, 21 and 22 and as required in other Sections of the Standard Specifications for Water and Sewer Main Construction in Illinois, current edition. No recycled concrete will be allowed. (See Standard Detail WATER 7).

C) DEPTH OF PIPE COVER

Unless otherwise shown on the plans or indicated in the Special Provisions, all pipe shall be installed with a minimum of five and one-half (5 ½) feet of ground cover, measured from the proposed grade to the top of the pipe. The maximum depth of cover shall be eight (8) feet unless written approval is obtained from the Private Engineering Services Division.

D) PIPE FOUNDATION

The trench, unless otherwise specified, shall have a flat bottom conforming to the grade to which the pipe is laid. The pipe shall be laid on sound aggregate bedding, CA-7 gradation, no less than six (6) inches in depth, true to grade, and shall have a firm bearing for the full length of pipe. Any part of the trench over excavated shall be corrected with trench backfill material and thoroughly compacted. (See Standard Detail WATER 7).

E) DEWATERING THE TRENCH

Where water is encountered in the trench, the water shall be removed during pipe laying and jointing operations. Provisions shall be made to prevent floating of the pipe. Trench water shall not be allowed to enter the pipe at any time.

SECTION 400.05 HANDLING OF PIPE

All types of pipe shall be handled in such a manner as to prevent damage to the pipe or coating. Damaged pipe, specials, and other accessories shall be rejected and replaced to the satisfaction of the Village. The methods of handling shall be corrected to prevent further damage when called to the attention of the Contractor.

The pipe and fittings shall be inspected by the Contractor for defects while suspended above grade.

Dirt or other foreign material shall be prevented from entering the pipe or pipe joint during handling or laying operations. Any pipe or fitting that has been installed with dirt or foreign material in it shall be thoroughly cleaned. At times when pipe laying is not in progress, and at the end of each working day, the open ends of the pipe shall be closed by a water tight plug to ensure absolute cleanliness inside the pipe.

SECTION 400.06 LAYING OF PIPE

A) LAYING OF PIPE ON CURVES

Long radius curves, either horizontal or vertical, may be laid with standard pipe by deflections at the joints. If the pipe is shown curved on the plans and no special fittings are shown, the Contractor can assume that curves can be made by deflection of the joints with standard lengths of pipe. If shorter lengths are required, the plan will indicate maximum lengths that can be used.

Where field conditions require deflection of curves not anticipated by the plans, the methods to be used shall be submitted for approval by the Private Engineering Services Division.

Maximum deflections at pipe joints and laying radius for various pipe lengths are as found in the following standards:

Ductile Iron Pipe Push-On Joints AWWA C 600

At no time shall the deflection of the pipe joints exceed the manufacturer's maximum recommended deflection.

When rubber gasketed pipe is laid on a curve, the pipe shall be deflected at the joints. Deflections shall not exceed manufacturers recommendations. Trenches shall be made wider on curves for this purpose.

B) JOINTS FOR DUCTILE IRON PIPE

Joints for ductile iron pipe shall consist of Push-On Rubber Gasket Joints unless otherwise approved by the Private Engineering Services Division.

C) JOINTING RUBBER GASKET JOINT PIPE (AWWA C 111)

- A. The inside of the bell shall be thoroughly cleaned to remove all foreign matter from the joint. The circular rubber gasket shall be inserted in the gasket seat provided.
- B. A thin film of gasket lubricant shall be applied to the inside surface of the gasket. Gasket lubricant shall be a solution of vegetable soap or other solution supplied by the pipe manufacturer and approved by the Private Engineering Services Division.
- C. The spigot end of the pipe shall be cleaned and entered into the rubber gasket in the bell, using care to keep the joint from contacting the ground. The joint shall then be completed by forcing the plain end to the seat of the bell. Care must be taken not

to damage exterior coating or interior linings while forcing the joint.

- D. Pipe lengths shall not be beveled in the field.
- E. All pipe shall be furnished with a depth mark to assure that the spigot end is inserted to the full depth of the joint.

D) THRUST BLOCKING AND TIE RODS

Blocking to prevent movement of lines under pressure at bends, tees, caps, valves and hydrants shall be Portland Cement Concrete, a minimum of 12" thick, placed between solid ground and the fittings, and shall be anchored in such a manner that pipe and fitting joints will be accessible for repairs. The Portland Cement Concrete shall meet or exceed a compressive strength of 3500 psi after 28 days.

All bends of eleven and one-quarter ($11 \frac{1}{4}$) degrees or greater, and all tees and plugs shall be thrust protected to prevent movement of the lines under pressure. Details shall be shown on the plans. (See Standard Detail WATER 6).

Where unstable soil and/or backfill conditions exist, it may be necessary to install thrust blocking at deflected sections as well as at fittings. If required by the Private Engineering Services Division, blocking for deflections shall be installed at a point approximately one-fifth ($1/5$) of the pipe length on each side of the coupling. Couplings shall not be blocked.

Where conditions prevent the use of concrete thrust blocks, tied joints or restrained joints such as Mega-Lug, or Field-Lok type approved by the Private Engineering Services Division shall be used.

E) CONNECTIONS TO EXISTING MAINS

Connection to existing water mains shall be accomplished under full water service pressure. Pressure tapping saddles/valves are to be provided at the point of connection to the existing system, unless written approval for a water shut-off is granted by the Private Engineering Services Division. If written approval is granted, the contractor shall notify the affected property owners twenty-four (24) hours prior to the interruption of service.

SECTION 400.07 PRESSURE TESTING AND FLUSHING OF WATER MAINS

A) HYDROSTATIC TEST

The newly laid water mains or any valved sections of it shall be subject to a hydrostatic pressure test of no less than one-hundred and fifty (150) pounds per square inch (PSI) or fifty (50) pounds per square inch (PSI) above normal working pressure when working pressure exceeds one-hundred and fifty (150) pounds per square inch (PSI). Duration of each pressure test shall be for a period of not less than four (4) hours. **The Village may exercise the right to continue the test to the maximum of 6 hour duration. Test pressure shall not vary by more than +/- 5 psi for the duration of the test.** A Village representative shall be present to witness the testing.

B) PROCEDURE FOR TEST

Each valved section of pipe shall be slowly filled with water and the specified test pressure shall be applied by means of a pump connected to the pipe in a satisfactory manner. The pump pipe connection and all necessary apparatus, including gauges and meters, shall be furnished by the Contractor. **The Village may also exercise the right to supply to the Contractor a Village-owned pressure gauge which shall be used for any pre-tests and/or during the actual pressure test.** Pressure testing of water main shall include hydrants by pressure testing against the internal valve of hydrant. Before applying the specified test pressure, all air shall be expelled from the pipe. To accomplish this, taps shall be made, if necessary, at points of highest elevation and afterwards tightly plugged. All exposed pipes, fittings, valves, hydrants, and joints shall be carefully examined during the open trench test. All joints showing visible leaks shall be repaired until tight. Any cracked or defective pipes, fittings, valves, or hydrants discovered in consequence of this pressure test shall be removed and replaced by the Contractor with sound material and the test shall be repeated until satisfactory to the Private Engineering Services. At no instance shall "Bell Joint Clamps" be permitted to repair leaks at push-on joints.

C) PERMISSIBLE LEAKAGE

Leakage is defined as the quantity of water to be supplied in the newly laid pipe and any valved section of it, necessary to maintain the specified leakage test pressure after the pipe has been filled with water and the air expelled.

Allowable leakage shall not be greater than that computed by the following table. (Table 1)

**TABLE 1
ALLOWABLE LEAKAGE FOR PIPELINE 1,000 Ft. - GPH**

Average Test Pressure	Pipe Size in Inches								
	2	3	4	6	8	10	12	14	
PSI									

200	0.21	0.32	0.43	0.64	0.85	1.06	1.28	1.48
175	0.20	0.30	0.40	0.59	0.80	0.99	1.19	1.39
150	0.19	0.28	0.37	0.55	0.74	0.92	1.10	1.29
125	0.17	0.25	0.34	0.50	0.67	0.84	1.01	1.18
100	0.15	0.23	0.30	0.45	0.60	0.75	0.90	1.05
80	0.14	0.20	0.27	0.41	0.54	0.68	0.81	0.95
60	0.12	0.18	0.23	0.35	0.47	0.59	0.70	0.82

Average Test Pressure	Pipe Size in Inches							
	16	18	20	24	30	36	42	48
PSI								
200	1.70	1.91	2.12	2.55	3.19	3.82	4.46	5.09
175	1.59	1.79	1.98	2.38	2.98	3.58	4.17	4.77
150	1.47	1.66	1.84	2.21	2.76	3.31	3.86	4.41
125	1.34	1.51	1.68	2.01	2.52	3.02	3.53	4.03
100	1.20	1.35	1.50	1.80	2.25	2.70	3.15	3.60
80	1.08	1.22	1.35	1.62	2.03	2.44	2.84	3.25
60	0.94	1.06	1.17	1.42	1.76	2.11	2.46	2.82

Suitable means shall be provided by the Contractor for determining the quantity of water lost by leakage. The leakage test shall be conducted after satisfactory completion of the pressure test, before being acceptable.

Flanged pipe shall be watertight.

**SECTION 400.08
FLUSHING OF WATER MAINS**

Sections of pipe to be disinfected shall first be flushed to remove any solids or contaminated material that may have become lodged in the pipe. A hydrant shall be installed near the end of the main. A two and one-half (2 1/2) inch hydrant opening will, under normal pressure, provide the necessary velocity in pipe sizes up to and including twelve (12) inches.

All taps required by the Contractor for temporary or permanent release of air space and/or chlorination or flushing purposes, shall be provided by the contractor as part of the construction of water mains. When completed, the contractor shall remove the copper tubing and the corporation stop shall be placed at the "off" position.

SECTION 400.09 REQUIREMENT OF CHLORINE

Before being placed into service, all new mains, repaired portions or extensions to existing mains shall be chlorinated so that a chlorine residual of not less than one-half (1/2) the original concentration but not less than twenty-five (25) parts per million remains in the water after standing twenty-four (24) hours in the pipe.

A) FORM OF APPLIED CHLORINE

Chlorine shall be applied by one of the following methods subject to approval by the Private Engineering Services Division.

- A. Liquid Chlorine - A chlorine gas-water mixture shall be applied by means of a solution-feed chlorinating device, or the dry gas may be fed directly through proper devices for regulating the rate of flow and providing effective diffusion of the gas into the water within the pipe being treated. Chlorinating devices for feeding solutions of chlorine gas, or the gas itself, must provide means for preventing the back flow of water into the chlorine.
- B. Chlorine-Bearing Compounds in Water - In certain instances, when the usage of chlorine gas is not practical, such as in congested or confined areas, upon approval of the Private Engineering Services Division, a chlorine-bearing compound of known chlorine content, prepared in solution form, may be substituted for chlorine gas.

B) POINT OF APPLICATION

The preferred point of application of the chlorinating agent is at the beginning of the pipeline extension or any valved section of it, and through a corporation stop inserted in the pipe. The water injector for delivering the chlorine-bearing water into the pipe should be supplied from a tap made on the pressure side of the gate

valve controlling the flow into the pipe line extension. Alternative points of application may be used when approved or directed by the Private Engineering Services Division.

C) RATE OF APPLICATION

Water from the existing distribution system, or other approved source of supply, shall be controlled to flow very slowly into the newly laid pipeline during the application of the chlorine. The rate of chlorine mixture flow shall be in such proportion to the rate of water entering the newly laid pipe that the dosage applied to the water will be at least fifty (50) parts per million unless otherwise directed by the Private Engineering Services Division.

D) RETENTION PERIOD

Treated water shall be retained in the pipe at least twenty-four (24) hours. After this period, the chlorine residual at pipe extremities and at other representative points shall be at least one-half (1/2) the original concentration but not less than twenty-five (25) parts per million.

E) CHLORINATING VALVES AND HYDRANTS

In the process of chlorinating newly laid pipe, all valves or other appurtenances (including fire hydrants) shall be operated while the pipeline is filled with the chlorinating agent and under normal operating pressure.

F) PREVENTING REVERSE FLOW

Valves shall be manipulated so that the strong chlorine solution in the line being treated will not flow back into the line supplying the water. Check valves may be used on chlorine equipment piping if desired.

SECTION 400.10 FINAL FLUSHING AND TESTING

Following chlorination, all treated water shall be thoroughly flushed from the newly laid pipe at its extremity until the replacement water throughout its length shows, upon test, the absence of chlorine, or a residual not in excess of that carried in the system.

After flushing, water samples collected on two (2) successive days from the treated piping system, as directed by the Private Engineering Services Division or his designated representative, shall show satisfactory bacteriological results. Bacteriological analysis must be performed by a laboratory approved by the Director of the Illinois Department of Public Health and the Private Engineering Services Division and are the responsibility of the contractor.

Should the initial treatment result in an unsatisfactory bacteria test, the original chlorination procedure shall be repeated by the Contractor until satisfactory results are obtained. If it passes, a second sample will be taken twenty-four (24) hours later.

The Underground Utilities Division of the Department of Public Works shall be notified at least forty-eight (48) hours prior to flushing.

SECTION 400.11 VALVES FOR WATER MAINS

A) DESCRIPTION

The valves shall be suitable for ordinary waterworks service, intended to be installed in a normal position on buried pipe lines for water distribution systems.

All valves shall at a minimum conform to the standards of the latest AWWA C 509, and C-504 in design, material and workmanship. All materials used in the manufacture of waterworks valves shall conform to the AWWA standards designed for each material listed.

Valves should not normally be spaced more than 750 feet apart. Valves are to be spaced to isolate no more than 30 homes. In multi-family spacing, valves should not isolate more than 50 residences, excluding apartment buildings, etc.

B) MANUFACTURER AND MARKING

The valves shall be standard pattern and shall have the name or mark of the manufacturer, size, and working pressure plainly cast in raised letters on the valve body. Valves from one of the following manufacturers are acceptable: American Flow Control or Mueller.

C) TYPE AND MOUNTING

The valve bodies shall be cast iron, mounted with approved non-corrosive metals. All wearing surfaces shall be of approved non-corrosive material, Mueller 2360, American Flow Control 2500 or approved equal. Valve shall have 300 series, stainless steel trim.

All valves twelve (12) inches or less shall be resilient wedge valves with non-rising stems with upper and lower thrust collars. Waterways shall be smooth and have no groove or depression where foreign material can lodge and prevent sealing. The stem shall be bronze or other approved non-corrosive metal. All valves shall open by turning counterclockwise. Wedge valves shall meet the standards of AWWA C509 with stainless steel trim bolts.

All valves fourteen (14) inches and larger shall be butterfly valves meeting AWWA C-504 standards.

End connections of all valves shall consist of one of the following types:

1. Mechanical Joints
2. Push-on (Rubber Gasket) Joints

D) VALVE STEM SEALS

Unless otherwise designated in the special provisions, all valves up to and including twelve (12) inches in size, shall be furnished with O-Ring Stem Seals. Number, size, and design shall conform to the AWWA Standard for R/W valve O-Ring Stem Seals.

E) WRENCH NUTS

Wrench nuts shall be made of cast iron and shall be one and fifteen-sixteenths (1-15/16) inches square at the top, two (2) inches square at the base, and one and three fourths (1 3/4) inches high, unless otherwise designated in the Special Provisions. Nuts shall have a flanged base upon which shall be cast an arrow at least two (2) inches long showing the direction of the opening. The word "open" in one-half (1/2) inch or larger letters shall be cast on the nut to clearly indicate the direction of opening the valve.

F) R/W TAPPING VALVES

Tapping valves shall be furnished with flanged inlet and connections having a machined projection on the flanges to mate with a machined recess on the outlet flanges of the tapping sleeves and crosses. Tapping sleeve shall be made of stainless steel with stainless steel bolts.

G) HYDROSTATIC PRESSURE TEST AT FACTORY

Each valve shall be tested at the factory for performance and operation prior to painting and shall be subjected to the following hydrostatic pressure tests:

1. Each three (3) inch to twelve (12) inch valve, inclusive, shall be subjected to hydrostatic pressure test under pressures of both three hundred (300) psi and one hundred seventy-five (175) psi.
2. Each fourteen (14) inch to forty-eight (48) inch butterfly valve shall be subjected to test pressures per AWWA C 504.

3. Each sixteen (16) inch to forty-eight (48) inch valve, inclusive, shall be subjected to test pressures of three hundred (300) psi and one hundred fifty (150) psi.

These tests shall be conducted in accordance with provisions of AWWA standards. Tests for special valves shall be made as provided for in the Special Provisions.

H) PAINTING AT FACTORY

After the factory test and inspection, all ferrous parts of the valves except finished or bearing surfaces shall be epoxy impregnated.

I) INSTALLATION OF VALVES

All valves shall be inspected upon delivery in the field to ensure proper working order before installation. They shall be set and jointed to the pipe in the manner as set forth in the AWWA Standards for the type of connection ends furnished.

All valves shall be provided with a standard valve chamber so arranged that no shock will be transmitted to the valve and the box or vault opening shall be centered over the operation nut, and the cast iron cover be set flush with the road bed or finished surface. Valves shall be wrapped with polyethylene casing.

After installation all valves shall be subjected to the field test for piping as outlined in Section 400.07 of these specifications. Should any defects in materials or workmanship appear during these tests, the Contractor shall correct, at his expense, such defects with the least possible delay and to the satisfaction of the Private Engineering Services Division.

SECTION 400.12

VALVE VAULTS AND BOXES FOR WATER MAINS AND WATER SERVICE

This section shall apply to the construction of standard or special valve vaults, cast iron valve boxes and curb boxes, all in accordance with the Lombard Standards. All existing valves shall be operated by Village of Lombard personnel only. Fire hydrants shall be opened with permission from the Village of Lombard.

A) GENERAL

All water valve vaults are to be pre-cast concrete, sixty (60) inch internal diameter, and lids must be marked "WATER". Frame and covers in non-paved areas shall be service weight. Vault openings "dog houses" shall be sealed with brick and mortar (not concrete) both inside and outside of the structure. Resilient, flexible, non-hardening preformed, butyl mastic material (Rub R Nek, EZ Stick or an equal approved by the Private Engineering Services Division) shall be used

between all sections including rings and frame to top section. All outer joints shall be wrapped with EZ Wrap mortar shall not be used to dress up adjusting rings. The vaults shall be water tight when completed. All valves two and one half (2 1/2") inches in diameter or larger shall be placed within a vault with the exception of fire hydrants which may utilize auxiliary boxes.

Valve boxes/vaults shall be free of debris, centered over operating nut and easily keyable.

Auxiliary valve boxes and extensions shall be cast iron only (no plastic).

B) RING AND COVER AND VALVE BOX CASTINGS

Castings with cast iron ring and cover and cast iron parts of valve boxes shall conform to the requirements of Standard Specifications for Gray Iron Castings, ASTM Designation A-48.

C) VAULT APPURTENANCES

The following items shall apply to all vault structures:

- A. Vaults shall be furnished with a self-sealing frame and solid cover (Neenah Foundry R-1772-C, East Jordan Iron Works 1022 or approved equal) with the word "Water" imprinted on the cover in raised letters. (See Standard Detail WATER 5).
- B. Both the vault frame and cover shall have machined horizontal and vertical bearing surfaces.
- C. Pick holes shall not create openings through the vault cover.
- D. Vault frames shall be adjusted to proper grade utilizing rubberized adjusting rings or reinforced precast concrete rings; brick, metal shims or concrete blocks shall not be allowed.
- E. Adjusting rings shall be securely sealed to the cone section or top barrel section of the vault using resilient, flexible, non-hardening, non-preformed, butyl mastic material (Rub R Nek, EZ Stick or an equal approved by the Private Engineering Services Division). This mastic shall be applied in such a manner that no surface water or ground water can enter the vault through gaps between the top barrel section or cone section and the first adjusting ring, between adjusting rings, or between the last adjusting ring and the vault frame. Up to twelve (12) inches of adjusting rings may be installed on a given vault; however no more than three (3) rings in total shall be used. Concrete rings must be at least 3" thick.

Non-shrink hydraulic cement shall be used on all vault interior joints (dress up) except from the top of the cone to the frame.

- G. Seal tight valve vaults maybe either pre-cast concrete, or cast in place; with a minimum diameter of sixty (60) inches. On vaults with butterfly valves, eccentric cones shall be installed so that the opening of the cone is placed as close to the center line of the operation as possible (See Standard Detail WATER-4).

D) CAST VALVE BOXES FOR GATE VALVES

Adjustable cast iron valve boxes shall be set to position during backfilling operations so they will be in a vertical alignment to the valve operating stem. The lower casting of the unit shall be installed first in such a manner as to be cushioned and to not rest directly upon the body of the R/W valve or upon the water main. The upper casting of the unit shall then be placed in proper alignment and to such an elevation that its top will be at final grade. Backfilling around both units shall be placed and compacted to the satisfaction of the Private Engineering Services Division. (See Standard Detail WATER 3)

E) CURB BOXES

Curb boxes shall be Mueller H10302, 1.5”dia. Minneapolis pattern with a pentagon nut style lid or approved equal. Inside diameter shall be one and one-quarter (1 ¼) inch for a one (1) inch curb box. Inside diameter shall be one and one-half (1 ½) inch for a one and one-quarter (1 ¼) inch curb box. Curb box for a one and one-quarter (1 ¼) inch curb stop or larger with no rod shall be of such construction that it shall be capable of extensions and installed to finished grade; conforming to the depth of bury of the service line as provided in the Lombard Standard Detail WATER-1. "Pigtails" on customer side of curb stop are not allowed.

When planting trees, the outside of the root ball shall be at least five (5) feet from the service box.

Curb stops are to be Mueller B-25155 or Ford B22-444M.

SECTION 400.13 FIRE HYDRANTS

These specifications are to be used in conjunction with the AWWA Standard C-502 for fire hydrants for ordinary water works service.

A) LOCATION REQUIREMENTS

The location and spacing of fire hydrants is regulated by the Subdivision and Development Ordinance. In addition to the Subdivision and Development Ordinance, the Division of Fire Prevention requires the following:

1. Fire hydrants shall be located between twenty (25) feet and seventy-five (75) feet of all fire department connections used for sprinkler or standpipe operations. The fire department connection will be required to be located on the front, or street side, of all buildings.
2. Fire hydrants shall not be located closer than fifty (50) feet from transformers, other hazardous electrical equipment or other hazards created by use of the fire hydrant or water.
3. Fire service water mains which serve a fire sprinkler system or an automatic fire standpipe system, and also serves a fire hydrant on the same water main in a dead-end- type design, shall be designed as follows. The fire service main shall be minimally designed to provide adequate flow for both the fire protection system and the expected outside hose stream requirements. If a domestic water service line is to be tapped off of a fire service line, the water main shall be sized large enough to satisfy the demand for fire and domestic water flows. The water main shall not be less than eight (8) inch diameter up to the point of the hydrant connection. There shall be a gate valve on the water main between the fire hydrant and the building, in addition to the auxiliary valve. The valve shall lie within an easement. The easement shall be a thirty (30) foot easement centered over the water main.
4. Fire hydrants serving commercial property shall be located at roadway intersections, with intermediate hydrants provided so that the space between hydrants shall not exceed one hundred and fifty (150) feet.
5. All fire hydrants shall be supplied by a looped water system, comprised of a minimum eight (8) inch diameter water main. An exception to this may be allowed, as in the case of a dead-end type situation, provided the length of water main feeding the hydrant is no longer than one hundred and fifty (150) feet, and the diameter of the water main is not less than eight (8) inches. If a dead-end hydrant is allowed, calculations shall be provided which indicate the available water flow from such hydrant.
6. Hydrants shall be located on all sides of new buildings, preferably near corners, with intermediate hydrants located in accordance with spacing and other hydrant location requirements. Where possible, hydrants shall be located a minimum of twenty-five (25) feet from any building, and between five (5) feet and ten (10) feet from the roadway.
7. All fire hydrant service water mains shall be tested and flushed in accordance with all other requirements of this specifications manual. In addition, private

fire service water mains feeding sprinkler systems, standpipe systems, and all other private fire protection systems shall be tested and flushed in accordance with the most recent edition of “N.F.P.A. 24-Standard for the installation of Private Fire Service Mains and Their Appurtenances”. Flushing of such mains shall be witnessed by the Bureau of Fire Prevention prior to any fire protection system being connected to the fire service main. A properly completed “Contractor’s Material and Test Certificate for Private Fire Service Mains” shall be provided to the Bureau of Fire Prevention at time of completion.

8. The private fire service water main feeding the sprinkler system, standpipe system, or other fire protection system, shall be designed to provide adequate flow for the intended fire protection system design. The design and size of the main shall also be adequate to handle any anticipated future building additions, changes in the hazard being protected which may require greater water demand, etc. The pipe size shall also be given consideration in regards to N.F.P.A. requirements for minimum fire service water supply piping where fire pumps will be installed.
9. Fire hydrants shall be located at the end of dead-end roadways being used for fire access, and at the end of cul-de-sacs.
10. A system of valves shall be included in the design of water mains to prevent the water supply surrounding the building from becoming completely impaired during maintenance or repairs to a portion of the system.

B) MATERIALS

All materials used in the production of fire hydrants for ordinary service shall conform to the specifications designated for each material listed in AWWA Standard C-502.

The hydrant shall be Waterous Pacer WB-67-250 series with all stainless steel trim bolts, with a five and one-quarter ($5 \frac{1}{4}$) inch main valve opening, two (2) two and one-half ($2 \frac{1}{2}$) inch hose nozzles and one (1) four and one-half ($4 \frac{1}{2}$) inch pumper nozzle. The seat must be of bronze to bronze. The name or mark of the manufacturer and size of the valve opening shall be plainly cast in raised letters and so placed on the hydrant barrel as to be visible after the hydrant has been installed.

As a minimum requirement, all hydrants shall be designed for a working pressure of 150 pounds per square inch. Workmanship, design, and material shall conform to the AWWA Standard 502. The hydrant bodies shall be cast iron, fully mounted with approved non-corrodible metals. All wearing surfaces shall be either bronze or some other approved non-corrodible material and there shall be no moving bearing or contact surfaces of iron in contact with iron or steel. All contact

surfaces shall be finished or machined in the best workmanlike manner and all wearing surfaces shall be easily renewable.

The design of the hydrant shall be such that all working parts may be removed through the top of the hydrant and shall have the required AWWA specified number of turns of the stem to open the resilient wedge and are equal to the area of the valve opening. Any change in area of the water passage through the valve must have an easy curve, and all outlets must have round corners of good radius.

Lugs, if required for harnessing the hydrant to the connection pipe from the main in the street, shall be provided on the bell of the elbow or on the hydrant bottom casting. A drawing of the lug construction shall be submitted for approval, upon request of the Private Engineering Services Division.

Hydrants shall be provided with a sidewalk flange. Breaking devices shall be at the sidewalk flange which will allow the hydrant barrel to separate at this point with a minimum breakage of hydrant parts in case of damage. There shall also be provided at this point a safety stem coupling on the operating stem that will shear at the time of impact. Unless otherwise specified, all hydrants shall be equipped with O-Ring stem seals. The breakaway flange is to be just above the proposed ground level per manufacturer specifications.

Hydrant cap chains are not to be installed on the hydrants.

Type of Inlet Connection:	Flanged with mechanical joint auxiliary valve.
Size of Inlet Connection:	5-1/2"
Depth of trench:	66"
Direction of Opening:	Counter-clockwise
Operating Nut:	National Standard 1-1/2" pentagon
Nozzle thread:	National Standard
Color:	Yellow
Packing:	Rubber type o-ring.

C) FACTORY HYDROSTATIC PRESSURE TEST

Before the hydrant is painted at the factory, it shall be subjected to an internal hydrostatic pressure test of 300 pounds per square inch with the hydrant valve in a closed position and again with the hydrant valve in an open position.

D) PAINTING

All iron parts of the hydrant, both inside and outside, shall be thoroughly cleaned and thereafter painted with one coat of paint of a durable composition, and one additional coat of Tnemec-Gloss Yellow Safety Paint.

E) CONSTRUCTION DETAILS

Hydrants shall be plumb and shall be set so that the center of the hydrant port is eighteen (18") to twenty-four (24") inches above the surrounding finished grade ensuring the breakaway flange is at proper ground height. All hydrants shall be inspected in the field upon delivery to the job to ensure proper operation before installation. A minimum of one-quarter (1/4) cubic yard of washed coarse stone shall be placed at and around the base of the hydrant to ensure proper drainage of the hydrant after use. The blocking of the hydrant shall consist of a wedge of P.C.C. concrete of not less than one-quarter (1/4) cubic yard extending from the hydrant to undisturbed soil and shall be so placed to form a barrier adjacent to the hydrant base top to counteract the pressure of water exerted thereon. Care shall be taken to ensure that weep holes are not covered by concrete. The hydrant shall be set on a concrete block to ensure a firm bearing for the hydrant base. The resetting of existing hydrants and moving and reconnection of existing hydrants shall be handled in a manner similar to the new installation. The hydrant setting shall follow the Lombard Standard Detail WATER-2. The auxiliary valve shall be opened during pressure testing.

All hydrants, not in service, shall be completely covered with a secure, weather-resistant, black or brown bag or sack. The covering shall not be removed until the hydrant is operational and in service for fire department use.

SECTION 400.14 PROTECTION AGAINST CORROSION

This section covers material specifications and installation procedures for polyethylene encasement to the underground installations of ductile iron pipe and other related appurtenances or water main.

A) POLYETHYLENE WRAPPING

Polyethylene wrapping of all iron pipe shall be required.

The polyethylene encasement shall prevent contact between the pipe and the surrounding backfill and bedding material but is not intended to be a completely air and water tight enclosure. Overlaps shall be secured by the use of adhesive tape or other material capable of holding the polyethylene encasement in place until backfilling operations are completed.

B) MATERIALS

The material used for the job shall be in accordance with the Table 2 as shown:

TABLE 2

Raw Material Used to Manufacture Polyethylene Film

Type, Class, Grade, Other Characteristics.....in accordance with ASTM D-1248

Type.....1
 Class.....A Natural Color or C black
 Grade..... E-1
 Flow Rate (Formerly Melt Index).....0.4
 Maximum
 Dielectric Strength.....Volume Resistivity
 Polyethylene Film.....Minimum ohm-cm³=10-15
 Tensile Strength.....1200 PSI
 Minimum
 Elongation.....300 Percent
 Minimum
 Dielectric Strength.....800 Volts Per Mil Thickness
 Minimum

C) THICKNESS

Polyethylene film shall have a minimum thickness of 0.008 inch (8mils). The minus tolerance of thickness shall not exceed 10 percent (10%) of the nominal thickness.

D) TUBE SIZE OR SHEET WIDTH

Tube or sheet size for each pipe diameter shall be listed in Table 3.

TABLE 3

Minimum Polyethylene Width Inch

<u>Nominal Pipe</u>	<u>Flat Tube Diameter Inch</u>	<u>Sheet</u>
3	14	28
4	16	32
6	20	40

8	24	48
10	27	54
12	30	60
14	34	68
16	37	74
18	41	82
20	45	90
24	54	108
30	67	134
36	81	162
42	95	190
48	108	216
54	121	242

E) PIPE WRAPPING

The standard includes three different methods for the installation of polyethylene encasement on pipe. Methods A and B are for use with polyethylene tubes and method C is for use with polyethylene sheets.

METHOD A

Cut polyethylene tube to a length approximately two (2) feet longer than that of the pipe section. Slip the tube around the pipe, centering it to provide a one (1) foot overlap on each adjacent pipe section, and bunching it accordion-fashion length-wise until it clears the pipe ends.

Lower the pipe into the trench and make up the pipe joint with the preceding section of pipe. A shallow bell hole must be made at joints to facilitate installation to the polyethylene tube.

After assembling the pipe joint, make the overlap of the polyethylene tube. Pull the bunched polyethylene from the preceding length of pipe, slip it over the end of the new length of pipe and secure in place. Then slip the end of the polyethylene from the new pipe section over the end of the first wrap until it overlaps the joint at the end of the preceding length of pipe.

Secure the overlap in place. Take up the slack width to make a snug, but not tight, fit along the barrel of the pipe, securing the fold at quarter points.

Repair any rips, punctures, or other damage, including openings around corporations, to the polyethylene with adhesive tape or with a short length of polyethylene tube cut open, wrapped around the pipe and secured in place. Proceed with installation of the next section of pipe in the same manner.

METHOD B

Cut polyethylene tube to length approximately one (1) foot shorter than that of the pipe section. Slip the tube around the pipe, centering it to provide six (6) inches of bare pipe at each end. Make polyethylene snug, but not tight; secure ends as described elsewhere.

Before making up a joint, slip a three (3) foot length of polyethylene tube over the end of the preceding pipe section, bunching it accordion fashion lengthwise. After completing the joint, pull the three (3) foot length of polyethylene over the joint, overlapping the polyethylene previously installed on each adjacent section of pipe by at least one (1) foot; make snug and secure each end as described elsewhere.

Repair any rips, punctures, or other damage, including openings around corporations to the polyethylene. Proceed with installation of the next section of pipe in the same manner.

METHOD C

Cut polyethylene sheet to a length approximately two (2) feet longer than that of the pipe section. Center the cut length to provide a one (1) foot overlap on each adjacent pipe section, bunching it until it clears the pipe ends. Wrap the polyethylene around the pipe so that it circumventially overlaps the top quadrant of the pipe. Secure the cut edge of polyethylene sheet at intervals of approximately three (3) feet.

Lower the wrapped pipe into the trench and make up the pipe joint with the preceding section of pipe. A shallow bell hole must be made at joints to facilitate installation of the polyethylene. After completing the joint, make the overlap as described above.

Repair any rips, punctures or other damage, including openings around corporations, to the polyethylene. Proceed with installation of the next section in the same manner.

F) WRAPPING PIPE-SHAPED APPURTENANCES

Cover bends, reducers, offsets, and other pipe-shaped appurtenances with polyethylene in the same manner as the pipe.

G) WRAPPING ODD-SHAPED APPURTENANCES

When valves, tees, cross taps, and other odd-shaped pieces cannot be wrapped practically in a tube, wrap with a flat sheet or split length of polyethylene tube by passing the sheet under the appurtenance and bringing it up around the body. Make seams by bringing the edges together, folding over twice, and taping down.

Handle width and overlaps at joints as described above. Tape polyethylene securely in place at valve stem and other penetrations.

H) PROTECTION AGAINST CORROSIVE SOILS

All Ductile Iron Pipe installed as part of the public system shall include polyethylene encasement.

SECTION 400.15 CONNECTION TO EXISTING WATER MAINS

Connections to all approved live Village water mains shall be pressure tap connections unless otherwise approved by the Private Engineering Services Division. (See also Section 400.06E)

A) NOTIFICATION

1. When connecting onto the end of an existing line, work must be coordinated with the Underground Utilities Division with a minimum of forty-eight (48) hour notice. Water main valves shall only be operated by underground Utilities Division Personnel. When water is needed to chlorinate new lines from an already accepted Village main, Underground Utilities personnel must operate existing Village valves.
2. When connecting into an existing line where no customers are involved, the contractor shall chlorinate and pressure test both new and existing lines in accordance with Village standards.
3. When connecting onto the end of an existing water main of which customers are already using the main, the following shall be done.
 - A. The Underground Utilities Division must have a forty-eight (48) hour notice prior to water main shut-down.
 - B. The Developer/Contractor is responsible for notifying all affected customers, a minimum of forty-eight (48) hours prior to water main shut down.
 - C. Water shall be returned to existing customers the same day or as soon as possible.

SECTION 400.16 UTILITY IDENTIFICATION

A wood 2" x 4" x 6' stake with not less than the top two (2) feet painted blue shall be installed next to each vault, buffalo box, and valve box for protection of that appurtenance. The stake (2" x 4" x 6') shall be maintained in an upright position.

When newly poured curbs are installed, the contractor shall use a Village approved stamp to indent the wet concrete with a "W" to identify the location of each water vault, buffalo box, and valve box. The letter "W" will be indented at the top of the curb, one and one-half (1 1/2") inch to two (2") inches in height and width and at a depth of three-eighths (3/8") inch.

If the developer and/or the contractor fail to indent the curbs as outlined above, the Village may require that identification medallions, or other symbols approved by the Private Engineering Services Division, be affixed to the curb.