



**TOWN OF BRECKENRIDGE**  
**PUBLIC WORKS**

## **TOWN OF BRECKENRIDGE**

# Water Construction Standards

May 1986

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April 19, 1988

ADDENDUM TO THE TOWN OF BRECKENRIDGE WATER REGULATIONS, MAY 1986

**Section II – Water Transmission and Distribution Lines**

II.2.2 Ductile Iron Pipe and Fittings

**B. Fittings**

1. Type - The “Megalug” thrust restraint retainer glands are acceptable and preferable in addition to typical thrust blocks as a replacement alternative to rodding where specified. (Manufacturer’s reference: EBAA Iron, Series 1100, “Megalug”)

The above also applies to the following:

**Section IV – Fire Protection Facilities**

IV.2.1 Additional Requirements

**Detail 6 – Fire Hydrant Assembly**

**Detail 10 – River Crossing Detail**

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## **I. SUBMITTAL INFORMATION**

### **I.1 GENERAL**

**I.1.1 Scope** – This section shall cover the required submittal material necessary for the Town of Breckenridge to review a water project to ensure that it conforms to these regulations. Included in this section are the requirements on preliminary, final and as-built drawings, specifications, soils reports, and other supporting documents. Finally, this section will cover the submission and review procedure to be followed for the Town of Breckenridge.

### **I.2 PRELIMINARY DRAWING REQUIREMENTS**

**I.2.1 General** – This section shall include the requirements necessary for preliminary drawing submittal, specifications, calculations and soils reports.

**I.2.2 Title Sheet** – The first sheet of the drawings shall be the title sheet and shall have the following shown thereon.

- A. Location map, North arrow, numerical and graphical scale.
- B. Index to sheet of the drawings.
- C. General notes.
- D. Title block. The title block should not include the words “title sheet”, but should contain the project name and a description of the information shown thereon.

**I.2.3 Plan** – The following items shall be included on all plan drawings.

- A. Scale: One inch = 50 feet. Show scale numerically and graphically.
- B. North arrow.
- C. Show outline of water main and service lines. Show centerline of water line with appropriate ties to centerline of street or survey control lines, curbs, property lines or right-of-way lines.
- D. Show right-of-way and easement lines, street centerline and name, property lines, curbs, gutters, cross gutters, sidewalks, driveways, paving and other improvements, existing and proposed.
- E. On each sheet of the plan, show a sufficient number of typical sections to give the relative location of surface and underground improvements with respect to proposed water main. Size, type and other appurtenant data for all improvements. If a transmission line is being proposed, then both a plan and profile view shall be provided.
- F. Drawings shall be on standard 24”X36” sheets.
- G. Utilities, sewers and storm drains.
  - 1) Indicate the type, size and ownership of all existing utilities in streets or rights-of-way in which the water line is to be installed. Tie utilities, sewers, building connections and storm drains to street rights-of-way centerline or to street property line.
  - 2) Indicate portions of existing utilities that are to be abandoned because of water construction.

- H. Details – At intersection where tees, crosses, valves, and concrete reaction blocks are to be provided, or at any other sections of the lines where a large number of fittings will be involved, show a large scale view of the appurtenances with dimensions to each separate fitting.

**I.2.4** Calculations – Two sets of calculations supporting the design criteria used shall be furnished with the preliminary drawings. Each sheet of calculations shall be dated and have the name or initials of individual making the calculations. All calculations shall be by a professional engineer registered in the State of Colorado.

**I.2.5** Soils Report – A soils investigation report shall be provided with the preliminary drawings only upon special request by the Town. If such a report is requested, sufficient subsurface exploration borings and analyses shall be made to permit the Town to make an adequate assessment of any soil problems which may be encountered. The soil investigation report shall contain the findings and supporting data for the following:

- A. The relative density type and extent of material to be encountered.
- B. Excavation problems.
- C. Location and extent of excavation.
- D. The suitability of excavated materials for use as backfill or bedding.
- E. The compaction characteristics of the soils.
- F. The groundwater level and conditions.
- G. The earth resistivity, moisture content, Ph, degree of variation, presence of sulfates, and the likelihood of stray, direct currents.
- H. Test Holes – The depth of test holes shall be at least two feet below the proposed pipeline elevation. The spacing of test holes shall be a minimum of 600 ft or where unusual conditions exist. The spacing shall be such to adequately define soil.

**I.2.6** Surveys – All of the existing conditions including rights-of-way easements and horizontal and vertical control information shall be prepared by a registered land surveyor in the State of Colorado.

### **I.3 SUBMISSION AND REVIEW PROCEDURE**

**I.3.1** Procedures – This section shall cover the procedures and time frame necessary to submit water drawings to the Town of Breckenridge.

#### **I.3.2 Preliminary Drawing Review**

- A. Two sets of blueprints and specifications of the proposed water system accompanied by two sets of supporting data shall be submitted to the Town two weeks prior to final approval by the Town of Breckenridge Planning Commission. The water manager and Town Engineer shall review the preliminary drawings and specifications of the proposed water system.
- B. Should the staff approve the preliminary plans, written notice of said approval shall be transmitted to the Applicant along with any modifications required by staff. Such approval of preliminary plans shall permit the Applicant to prepare

final construction drawings in accordance with the standards established by the Town and incorporate any modifications required by the staff.

### **I.3.3 Final Drawing Review**

- A. Final drawings and specifications shall be prepared in the form prescribed for preliminary drawing requirements. In addition, the title sheet shall provide a space for certification of approval by the staff of the Town of Breckenridge.
- B. Final drawings consisting of two sets of blue-line prints shall be submitted to the Town staff for final review two weeks before the building permit is issued.
- C. If the final drawings are found to be in compliance with the Town's standards and these regulations and any modifications requested by the staff, the Town staff shall approve the plans.
- D. Approval of water plans is necessary before issuance of a building permit for the project.
- E. The applicant should be cautioned against receiving construction bids or beginning construction until certification or approval of final plans and specifications has been received from Town of Breckenridge staff.
- F. Inspection of water mains will be required per Town of Breckenridge standards. Construction inspection shall be provided under the direction of a Colorado licensed registered engineer. The inspector shall be approved by the Town of Breckenridge before commencement of work.

### **I.3.4 As-Built Drawing – One set of as-built drawings shall be submitted to the Town within 30 days of completion of construction. Said drawings shall be prepared according to the following general requirements:**

- A. A certified survey shall be provided to the Town, which shall show the location of the water line to permanent physical objects located in the field. All valves, trees, hydrants, storage tanks, pump stations and other major appurtenances shall be given two swing ties to a physical permanent object in the field. In all cases, the distance from water line and appurtenance items shall be dimensioned to right-of-way easements and property lines.
- B. Spot elevations on the main water line relative to finished grade shall be provided at each 100-ft interval. In addition, all valves, fittings, and other major appurtenant items shall be shown with the proper elevation. All benchmarks used on the project to determine water line depth shall be shown on the drawings and shall be based upon U.S.G.S. datum or approved equal.
- C. Manufacturer's literature and product data, including catalog sheets and descriptive literature for all materials and equipment used, shall be provided with as-built drawings.
- D. As-built drawings shall be drawn under the direction of a Colorado registered engineer to assure compliance with original design drawings. Certification shall be presented along with the as-built drawings stating such compliance.
- E. As-built drawings shall be provided to the Town in AutoCad dwg files. These files shall be submitted to the Town GIS department.

## **II. WATER TRANSMISSION AND DISTRIBUTION LINES**

### **II.1 GENERAL**

**II.1.1 Scope** – This section shall include all materials, labor, equipment and miscellaneous items necessary to install all raw water, potable water transmission and distribution pipe lines and appurtenances as specified herein for the Town of Breckenridge.

**II.1.2 Protection of Work** – All pipe, fittings, valves, and equipment shall be carefully handled, stored and protected to prevent damage to materials, protective coatings and linings. At no time shall such materials be dropped or dumped into the trench.

Precautions shall be taken to prevent foreign matter from entering the pipe, fittings and valves prior to and during installation. No debris, tools, clothing, or any other material shall be placed in the pipe during installation. Whenever pipe installation is suspended, either temporarily or overnight, the open end of the pipe shall be sealed with a water-tight plug to prevent the entrance of trench water, debris or foreign matter into the pipeline system.

Under no circumstances shall trench water be allowed to enter the pipeline. When water is present in the trench, the plug shall remain in place until the trench is pumped dry. Whenever trench water becomes evident, measure shall be taken to prevent pipe flotation.

If, in the opinion of the Engineer, the Contractor is incapable of keeping the pipe free of foreign matter during installation, the Engineer shall require the Contractor to cover the pipe ends with close woven bags until the start of the joining operation.

### **II.2 MATERIALS**

**II.2.1 General** – This item covers the types of materials that will be required for the construction and installation of water lines. All materials used shall be new; of the best quality available, and conform to applicable standards as indicated herein. Cast iron pipe, plastic pipe and AC pipe will not be permitted.

#### **II.2.2 Ductile Iron Pipe and Fittings**

##### **A. Ductile Iron Pipe**

- 1) Reference Standard – ANSI, 21.51/AWWA C151
- 2) Thickness Class – Minimum Class 52 unless design conditions warrant higher-class pipe.
- 3) Pipe joints shall be push-on joints except where specifically shown or detailed otherwise.

##### **B. Fittings**

- 1) Type – All fittings shall be mechanical joint except where specifically shown or detailed otherwise.
- 2) Reference Standard – ANSI/AWWA C153 for flanged mechanical joint and push-on joints.



- 3) Material – ductile, epoxy coated.
  - 4) Pressure Rating – 350 psi.
- C. Joints
- 1) Mechanical, Reference Standard – ANSI A 21.11/AWWA C111-72.
  - 2) Push-on, Reference Standard – ANSI A 21.11/AWWA C111-72.
  - 3) Flanged, Reference Standard – ANSI B 16.1, Class 125.
  - 4) Every joint shall be provided with conductivity straps to provide electrical continuity at all joints. Type of conductivity strap and proposed method of installation will be approved by the water manager.
- D. Gaskets
- 1) Type – Rubber-ring gaskets shall be suitable for the specified pipe sizes and pressure.
  - 2) Reference Standard – AWWA C111.
  - 3) Lubricant – A non-toxic vegetable soap lubricant shall be supplied with the pipe.
- E. Protective Lining
- 1) Type – Cement Mortar.
  - 2) Reference Standard – ANSI A 21.4/AWWA C104-64.
  - 3) Thickness – Standard.
- F. Couplings
- 1) Style – Mechanical compression sleeve or solid sleeve is acceptable.

## II.3 INSTALLATION

**II.3.1 General** – All transmission and distribution lines, to be dedicated to the Town of Breckenridge, shall be located a minimum of ten feet inside a public easement. The location of water lines within side lot line easements or rear lot easements is discouraged.

When site conditions allow, the water line should be located outside paved areas. Wherever possible, mains shall be placed in areas where snow cover will not be removed in winter. At all times water lines shall be located so that Town maintenance personnel can easily maintain and operate those lines.

Easement or rights-of-way used during the installation of water mains shall be a minimum width of 25 ft, 12 ½ ft on either side of centerline. In dredge areas and other special conditions, a wider easement may be required.

On dead end lines, install a fire hydrant or Denver blow-off.

**II.3.2 Pipeline Depth** – The minimum depth of cover of water mains and service lines shall be as follows: (Depth of cover equals depth from finished grade to top of pipe).

- A. Mains shall be buried a minimum depth of cover of nine feet (below existing or proposed grade) in all locations.

- B. When water mains are to be located underneath storm drains, culverts, or any other submerged air space, the required depth of cover may be greater than ten feet. This is necessary to ensure that the water line is beyond the frost depth associated with the storm drain culvert, etc. In some cases, the Town water system supervisor may allow insulation in place of increased depth where water lines cross under one of the above.
- C. 11 Ft Cover – Dredge rock areas.

**II.3.3 Cleaning and Inspection** – Clean all pipe, fittings, valves, and related materials thoroughly of all foreign material; inspect for cracks, flaws, or other defects prior to installation. Mark all defective, damaged or unsound materials with bright marking crayons or paint and remove from job site. Of particular concern should be the gasket groove in the pipe bell. All spurs, excess paint, and any other defects within the gasket groove shall be either removed or repaired or the pipe shall be deemed unacceptable. Check tightness of bonnet and packing bolts on all valves.

The Contractor shall take all necessary precautions to prevent any construction debris from entering the water lines during construction of water lines and appurtenances. If debris shall enter the distribution system, the Contractor shall furnish all labor and materials necessary to clean the system. Under no circumstances will the Contractor flush the debris into an existing distribution system.

**II.3.4 Installation** – Pipe shall be laid in straight sections with bell ends facing the direction of laying unless otherwise directed by the Town water manager. Where pipe is laid on grade of 1% or greater, the installation shall proceed uphill with the bell ends facing upgrade. The pipeline shall be installed so that a continuous positive or negative grade is maintained between high and low points to avoid air pockets. At no time will a high point in the line be acceptable unless an air and vacuum valve is installed to relieve air pockets. Jointing of the pipe shall be made in accordance with the directions of the manufacturer of the pipe and the manufacturer of the couplings. The allowable pipe deflection per joint shall not exceed the maximum deflection tolerances specified by the manufacturer. Pipe bedding before backfill shall be uniform throughout, paying particular attention at the bell end.

Pipe shall be lowered into the trench with ropes, slings, or machinery. Under no circumstances will the pipe be pushed off the bank and allowed to fall into the trench.

In joining the pipe, the exterior four inches of the pipe (at the spigot) end and the inside of the adjoining bell shall be thoroughly cleaned to remove oil, grit, tar, and other foreign material. The gasket shall be placed in the bell with the large round side of the gasket pointing inside the pipe so it will spring into its proper position inside the pipe bell. A thick film of the non-toxic joint lubricant shall be applied over the entire surface of the gasket. The spigot end of the pipe shall then be wiped clean and inserted into the bell to contact the gasket. The pipe shall be pushed all the way into the bell by crowbar or by jack and choker slings or backhoe. Extreme care shall be exercised when joining the pipe to avoid damaging the bell or rolling the gasket. The bell end of the pipe shall be protected by a piece of wood when pushing the pipe. Generally, every pipe has a depth of insertion stripe on the spigot end. The pipe shall be inserted to the full depth of the stripe.

The cutting of pipe for fittings or closure pieces shall be done in a neat and workmanlike manner to prevent damage to the pipe or lining. All cuts should leave a smooth end at right angles to the axis of the pipe. Flame cutting on pipe, by means of an oxyacetylene torch, will not be allowed. Once a pipe is cut, the cut end shall be beveled free of spurs, which may damage rubber gaskets.

- II.3.5** Connection to Existing Water Facilities – All main line connections between existing and proposed piping shall be made during business hours or at a time, which is acceptable to and coordinated with the Town of Breckenridge. All shut-offs shall be planned 24 hours in advance and all persons affected by the shut-off shall be given a 24-hour notice. Take all precautions to prevent contamination when making connections to existing potable water lines. No trench water, mud, or other contaminating substances shall be permitted to enter the pipeline.
- II.3.6** Future Connections – At intersections of new lines to old lines where the possibility may exist for a future connection, two tees and two valves should be provided. On dead-end runs of new lines, one valve should be provided at least forty ft back from the thrust end. This procedure allows a future connection to be made while keeping the existing main line in service at all times (See Detail Drawings).
- II.3.7** Protection of Water Supplies – Water lines shall be located a minimum of ten feet horizontally from existing or proposed sewer mains. Wherever the sewer line main or service cross above or within eighteen inches beneath the water lines, the sewer line shall be made impervious by the method listed below:
- A. Twenty feet SDR 26 or C900 PVC sewer pipe shall be used for sewer pipe and centered over the water main. Solid PVC gasket couplings or bell ends shall be used joining the replacement sewer pipe to the standard SDR 35 PVC sewer pipe, which is equal outside diameter. Extra care shall be taken during backfill operations in order to ensure the integrity of this installation.
- In all cases, select granular backfill compacted to 95% standard proctor shall be used to prevent any settling of the higher pipe. Any work performed on other utilities, such as sewer lines owned by the Breckenridge Sanitation District, shall conform to that particular district's standards.
- All work should be in strict conformance with the Colorado Department of Health's "Design Criteria for Potable Water Systems" and the Breckenridge Sanitation District Standards; final inspection of sewer installation by Breckenridge Sanitation District is required before backfilling on top of sewer line.
- II.3.8** Reaction Anchor and Blocking – Concrete thrust blocks shall be provided as shown in the Detail Drawings for tees, elbows, bends, plugs, reducers, valves, fire hydrants, and crosses if one or more sides of the cross are plugged. The bearing area of the block shall be at least equal to that stated on the attachment. The bearing surface shall be against undisturbed earth. The block shall be placed normal to the thrust as shown on

the drawings. Concrete for thrust blocks shall have 3,000 psi compressive strength. (NOTE: No materials other than concrete may be used in thrust blocks).

If the concrete has not had sufficient time to cure (e.g., resting water service), the Contractor shall be required to use temporary bracing for added strength. Use of additional wood or steel bracing will help prevent fitting and valves from leaking or “blowing off” when water pressure is restored to the main line.

Whenever a concrete thrust block is placed, wood or plastic sheets shall be used to prevent concrete from adhering to nuts and bolts. Any concrete splattered onto a nut or bolt will be removed before the line is backfilled.

## **II.4 SIZING OF MAINS**

**II.4.1 General** – All main water lines shall be sized for peak hour flow plus fire flows as required by the Red, White and Blue Fire Department at a 20 psi residual flow. Minimum size shall be 8” in diameter.

Special situations approved by the Town Engineer or the water manager may be acceptable with lines smaller than 8” in diameter, such as a short dead-end domestic service feeder with no hydrants.

**II.4.2 Fire Flow** – Typical fire flows required within the Town of Breckenridge Master Plan boundaries are as follows:

- A. 3500 gpm at 20 psi for three hours – high density commercial.
- B. 1500 gpm at 20 psi for three hours – residential.
- C. Absolute minimum fire flow is 1500 gpm for any project.

It is required that the fire department provides a fire flow requirement calculation for the project before the water system is designed. Fire flow is determined by the fire department using the I.S.O. (Insurance Service Office) guidelines. The available fire flow must equal the required fire flow. No fire flow greater than 3500 gpm at 20 psi is required. No fire flow less than 1000 gpm at 20 psi will be accepted. Generally high density commercial will require 3500 gpm and the average residential, 1500 gpm.

## **III. WATER SERVICE LINES AND APPURTENANCES**

**III.1 GENERAL** - (Note: Domestic service branches off fire line in mechanical room. Fire lines are dual service for fire & domestic in TOB water system.)

**III.1.1 Scope** – This section shall include furnishing all materials, labor, equipment, and miscellaneous items necessary to install all water service lines and appurtenances as specified herein for the Town of Breckenridge. Note: The Town of Breckenridge will own and maintain that portion of the service line from the main line up to and including the curb valve. The curb valve shall be placed on the property line; however, at all times it will fall on the town side of the property line. All work and materials from the curb valve to the building shall be in conformance to the most recently adopted Uniform Plumbing Code of the Town of Breckenridge.

## III.2 MATERIALS

### III.2.1 Polyethylene (PE) Service Pipe

- A. Reference Std. AWWA C901-88 Type PE 3408 SDR-9 PC 200.
- B. Size – 1", 1 ½" & 2" only.
- C. Tracing wire – Bare or scrape insulation every few feet. Clamp bare wire to corporation and curbstop. Run tracing wire into house.
- D. Full bedding Spec., Detail Drawings.
- E. Copper O.D. size
- F. Uses stainless steel insert inside PE pipe.

### III.2.2 Copper Service Pipe

- A. Reference Standard – AWWA 75-CR, Type K.
- B. Size – ¾"
- C. Repairs on existing K copper use K copper not P.E.

### III.2.3 Corporation Stops

- A. Materials – Brass or bronze.
- B. Size – ¾", 2"
- C. Reference Standard – AWWA C800-55, Ball Corp. only.
- D. Inlet – Threaded cc type only.
- E. Outlet – Copper OD size service thread for compression (or pack joint) connection, no flaring or soldering will be allowed.

### III.2.4 Service Saddles

- A. Materials – Ductile iron service saddles, "O" ring gasket, double strap, cc thread, ¾" – 2" corporations; 4" and larger – fabricated up to ½ diameter.
- B. The Town of Breckenridge will allow saddles or direct taps to be installed provided that the proper direct tapping equipment is used. The Town of Breckenridge will schedule and inspect the tapping operation.

### III.2.5 Curb Stop

- A. Materials – Cast bronze body, resilient "O" ring seals, standard tee head operator, ball valve type only
- B. Inlet – Copper OD size service thread for compression fitting, no flaring or soldering will be allowed.
- C. Outlet – Copper OD size service thread for compression connections.

### III.2.6 Curb Box

- A. Material – Cast iron box, complete with lid and red brass screw.
- B. Type – McDonald 5600 or equal Arch base, key rod pinned to valve, cap – "WATER".
- C. Size – McDonald – 1" pipe size. McDonald 5607L lid or equal.
- D. Enlarged adaptor base for 1", 1 ½", and 2" curbstops. (Tyler #6500 or equal)

### **III.2.7 Couplings**

- A. Materials – Brass: compression fittings. No flaring or soldering allowed. Sizing tool required for 3/4" copper and repairs to existing 1", 1 1/2", and 2" K copper. No galvanized pipe or fittings. PE couplings: compression or electrofusion (male tail piece available with MIPT). (electrofusion performed by trained company).

### **III.3 INSTALLATION – See separate connection requirements detail.**

- III.3.1 Service Line Installation** – All trenching, backfilling, and compaction shall conform to Section IX of these regulations. All service lines shall be disinfected and pressure tested as per Sections VI and VII of these regulations. The Town must inspect all service lines before being backfilled.
- III.3.2 Service Line Depth** – A depth of cover for all service lines shall be a minimum of nine feet from tap to mechanical room. All service lines in dredge rock areas must use full wrap insulation at least 2 inches thick contacting around the outside of the pipe, including the taps, valves, one foot up the valve box, fittings, couplings, bell joints, etc. Manufacture equals are Urecon pre-insulated pipe, Urecon or Foam Glass half shells, and spray on urethane foam. These service lines would be at a depth of 7', from just after the tap to the mechanical room or crawl space.
- III.3.3 Tapping Pressurized Mains** – All taps on pressurized mains shall be inspected by the Town of Breckenridge. All taps shall be performed by others with acceptable tapping equipment approved by the Town of Breckenridge. No pressurized main with service connections will be shut down for connections except for special conditions approved by the water manager or Town Engineer. Taps 4" and larger must have a thrust block behind the tapping tee and under the tapping valve. Taps less than, or equal to, one-half the pipe diameter of the main can be done with the fabricated steel tapping sleeves. Taps greater than one-half of the pipe diameter shall be done with ductile iron tapping tees. These requirements for tapping sleeves versus tapping tees apply to mains equal to or less than 12 inches in size. Mains equal to or greater than 14 inches in size, all use fabricated steel tapping sleeves for taps less than, or equal to, one-half the pipe diameter. Taps greater than one-half the diameter on mains 14 inches and larger will require special consideration and approval by the water manager or Town Engineer.
- III.3.4 Tapping Unpressurized Mains** – All taps on unpressurized mains (new subdivision mains) shall be performed by the Contractor with approved tapping equipment.
- III.3.5 Permits** – An encroachment permit for excavation in Town streets, alleys, easements, and county roads must be completed prior to tap. A two working day notice is required by the water department prior to making taps and locating lines.
- III.3.6 Service Line Sizing** – Service lines to be sized by Owner. The Owner is encouraged to have an engineer, plumber, mechanical contractor, or architect size the service line. The Town will not provide this service. The Town Building Inspector requires that service lines on private property and within building structures be properly engineered

before acceptance of the plumbing plan. Fire sprinkler lines will serve as the domestic service line for dual purpose with a T tapped off of it inside the building and a meter installed for the domestic line as per the meter specifications.

**III.3.7 Flushing** – all service lines shall be thoroughly flushed at a velocity of at least two ft/sec. This needs to be witnessed by the water division staff or documented.

**III.4 METERS** – See separate meter specifications detail.

**III.4.1 Type** – Magnetic drive, sealed register. Compound meters with strainers for 3” and larger.

**III.4.2 Manufacturer’s Reference** – Badger, RTR Register, Itron ERT with cast iron frost plate bottoms.

**III.4.3 Installation** – Install all meters inside the building in a horizontal position with a suitable holding device to support piping, meter and provide electrical bond when meter is taken out for testing. Pre-manufactured holding devices or yolks are available to install meter. Install in the building where meter and pressure reducing valve will not freeze.

Turbo meters should be installed five pipe diameters downstream of bends, valves, check valves or any other fitting that causes turbulence. However, PRV’s are required 5 diameters upstream. See meter specifications for detail.

See Detail Drawings for meter and appurtenances installation.

**III.4.4 Fire Hose Fitting** – For services 1 ½” and larger, a 1 ½” NST male connection for fire hose flushing of parking lots shall be installed as shown in Detail Drawings.

**III.4.5 Meter Inspection** – A water department representative must inspect the water meter after it is installed and before the Certificate of Occupancy is issued.

**III.5 PRESSURE REDUCING VALVE (PRV)** (For all domestic service lines.)

**III.5.1 Manufacturer’s Reference** – Watts U-5, Clay-Val 90-01 Series or equal.

**III.5.2 Installation** – Install upstream of all meters. Allow for easy access to strainer and cleanout plug. See Detail Drawings for installation.

**III.5.3 Pressure Testing** – Downstream pressure to be set at 40 to 75 psi.

**III.6 CHECK VALVE**

**III.6.1 Type** – Rubber or Teflon seat and spring assist.

**III.6.2 Manufacturer’s Reference** – Watts series 600 and Ford H series or equal.

**III.6.3 Installation** – Install check valve in location as shown in Detail Drawings.

**III.6.4** Approved backflow valves required for certain uses as determined by the Water Division. See meter specifications detail.

## **IV. FIRE PROTECTION FACILITIES**

### **IV.1 GENERAL**

**IV.1.1** Scope – This section shall include furnishing all materials, labor, equipment and miscellaneous items necessary to install fire hydrants as specified herein for the Town of Breckenridge.

### **IV.2 MATERIALS**

#### **IV.2.1 Fire Hydrants**

- A. Type – Dry barrel, compression, traffic model with a breakaway flange assembly and coupling.
- B. Reference Standard – AWWA C502-85.
- C. Outlet Size – One 4 ½” N.S.T., two 2 ½” N.S.T.
- D. Hydrant Size – 5 ¼” V.O. or greater, bronze to bronze seating.
- E. Inlet Size – Six inch.
- F. Operation – One and one-half inch pentagonal national standard operating nut, open counter clockwise, lubricating reservoir.
- G. Special Features – Outlet hydrants shall open when turned to the left (counter clockwise).
- H. Depth of Bury – Nine and one-half feet unless otherwise shown on Drawings. 11.5 feet in dredge rock areas. (Depth of bury is from the grade line marked on the hydrant to the bottom of the hydrant.) Only 1 extension allowed for 11.5’ bury hydrants. Bottom stem needs to be one piece.
- I. Additional Requirements – Furnish hydrant complete with pipe and tee, six inch restrained mechanical joint gate valve and thrust blocks. Hydrant shall be restrained to the hydrant tee by ¾” threaded rods protected from corrosion by the use of an approved bituminous coating, or with mega lug mechanical joint. Furnish hydrant with bronze to bronze seating and lubrication reservoir and weather cap on operating nut.
- J. Manufacturer’s Reference –  
“American Darling” No B84B  
Mountain Specification  
  
“Kennedy” No. K81A  
Mountain Specification  
  
“Mueller” Centurian A423  
Mountain Specification  
  
“Watrous” WB100  
Mountain Specification

(The four hydrants specified above are the only hydrants accepted.)



- K. Color – Hydrant to be safety red above the ground line. (Sherwin Williams, Chem 400.)
- L. Rating – Standard Class 250.
- M. Hydrant Markers – Install a hydrant marker with flag on all new hydrants. Marker to be installed on the highest barrel flange bolt on the hydrant (not on bonnet unless lots of snow).

### IV.3 INSTALLATION

- IV.3.1 Location** – Fire hydrants shall be located whenever possible at an intersection and in a public right-of-way or a utility easement. There shall be a minimum of one and one-half feet between outlet nozzle and back of curb or sidewalk. In all cases, hydrants shall be located out of the direct flow of pedestrian and vehicular traffic. Wherever possible, hydrants located consecutively along a street shall be placed on opposite sides of the street so that stringing fire hoses across a street during a fire can be kept to a minimum. Hydrants shall be placed at all intersections, at end of cul-de-sacs and at all dead end runs. Hydrant locations shall be approved by Red, White and Blue Fire Protection District. Locate near property line.
- IV.3.2 Hydrant Spacing** – The spacing of fire hydrants shall be determined by the Red, White and Blue Fire Department and the Town Engineer. Fire hydrants shall be located at 500 ft intervals, at all intersections and at the end of all cul-de-sacs over 500 ft in length. The Fire Department may adjust distances depending upon special circumstances. The International Fire Code requires a fire hydrant when any portion of a building is in excess of 150 feet from a water supply on a public street. All dead end lines shall have a hydrant or Denver blow-off installed at the end of the line.
- IV.3.3 Installation** – All hydrants must be extended so the top of hydrant is four feet above finished grade. The breakaway flange shall be located 3” above finished grade. If the previous mentioned conditions are not met after the hydrant is installed and the street is at final grade, the hydrant must be brought to proper grade by installing extensions or other modifications as required. Bag all hydrants that are not in service.
- IV.3.4 Hydrant Appurtenances** – All fire hydrants shall be connected to the main line by means of a mechanical joint tee with six inch Class 52 ductile iron pipe branch piping to the hydrants. Each fire hydrant shall have a six inch valve on the branch pipe conforming to standards as outline under Section VI of these standards. The 6” gate valve shall be restrained to the main tee. See Detail Drawings.
- IV.3.5 Hydrant Restraint** – The hydrant shall be restrained to the main line with all ¾” all-thread rod extending from the main line tee to the six inch valve and then from the six inch valve to the hydrant. The ¾” rods shall be tied to each joint with the use of eye bolts. A bitumastic coating to prevent corrosion shall be liberally applied to the all thread rod and eye bolts. Or the hydrant can be restrained with flange, mega lug, Foster Adaptor, or a swivel tee. In addition, the hydrant and main line tee shall be provided with concrete reaction blocks. See Detail Drawings.
- IV.3.6 Dry Barrel Type Drainage** – All hydrants shall be provided with a minimum of one-third cubic yard of ½” to 1” cleaned crushed rock and shall be placed under the weep hole

outlet to ensure proper drainage. High ground water below frost line might require plugging the drain holes or adding RV antifreeze.

**IV.3.7 Inspection** – Prior to backfilling around the hydrant, a visual test shall be conducted to ensure the proper operation of the weep holes. The hydrant shall be partially opened and then closed. Water trapped in the hydrant barrel section should begin to drain. If water is not draining, then the well holes should be cleared of any obstructions restricting the flow of water. Inspect the main valve bottom nut from proper tightness before backfilling.

## **V. VALVES**

### **V.1 GENERAL**

**V.1.1 Scope** – This section shall include furnishing all materials, labor, equipment, and miscellaneous items necessary to install gate valves, butterfly valves, air release and vacuum valves, and valve boxes as specified herein for the Town of Breckenridge. Inspect all valve packing bolts and bonnet bolts for proper tightness.

### **V.2 GATE VALVES**

#### **V.2.1 Materials**

##### **A. Resilient Seat Gate Valves**

- 1) Size – As shown on plans up to 12” (14” and larger shall be butterfly valves).
- 2) Reference Standard – AWWA C550.
- 3) Style – Iron body, bronze stem resiliency gate valves, lubrication free, unobstructed through port to minimize flow, entire body encapsulated inside and out with epoxy coating.
- 4) Pressure Rating – 350 psi. Where existing line pressure exceeds 200 psi, a Class 250 double disk gate valve shall be provided. Manufacturer’s reference: “American Darling” #45.
- 5) Wrench Nut – Two inch square, open by turning to the left (counter clockwise).
- 6) Stem – Non-rising.

**V.2.2 Location** – Whenever possible, water main valves shall be located at street intersections. Valves must be placed on all runs of a tee or cross. For instance, each cross shall have four valves located at the intersection while tees shall have three valves located at the intersection. Valves shall be located forty feet before the end of all dead-end intersections for future connections, without service connections in that forth foot interval.

**V.2.3 Valve Spacing** – Valves on cross connecting or looped mains shall be spaced such that no single break shall require more than 500 feet of line to be out of service at one time. All distribution mains connecting to transmission mains must be valved at the tie-in.

**V.2.4** Installation – All gate valves shall be installed with the two inch operating nut plumb and true with the vertical and centered within the valve box. Town personnel will inspect the valve and valve box after installation to ensure that a valve key can easily be set on the operating nut.

### **V.3** BUTTERFLY VALVES

#### **V.3.1**

- A. Reference Standard – AWWA C504
- B. Type – Rubber-seated tight closing type.
- C. Ends – Both ends shall be mechanical joint unless installed in valve vaults.
- D. Valve Body – Shall be high strength cast iron ASTM A 126 Class B with 18-8 type 304 stainless steel body seat.
- E. Operator – Valve operator shall be of the traveling nut type, sealed, gasketed and lubricated for underground service. Operating nut shall be two inch square and shall open to the left (counter clockwise).
- F. Rate Working Pressure – Class 150B; 200 psi. Above 200 psi working pressure, use “Mueller” Class 250B or equal.

### **V.4** AIR RELEASE AND VACUUM VALVES

**V.4.1** General – This specification covers all air release, vacuum valves or combination air release valves. The type of valve used shall be dependent upon the conditions under which it will operate.

#### **V.4.2** Materials

- A. Size – To be designed by Engineer for proper application.
- B. Body – Cast iron.
- C. Float – Stainless steel.
- D. Seat – Buna-N.
- E. Pressure Rating – 200 psi.

**V.4.3** Locations – Air release, vacuum valves or combination air release valves shall be installed to permit efficient filling or draining of long pipelines. In addition, they should provide protection against vacuum and shall continuously vent pockets of air accumulated in the pipeline. The type of valve shall depend upon the intended use of operation.

**V.4.4** Installation – Air release, vacuum valves or combination release valves shall always be installed at the extreme high point of the distribution or transmission line. Where the vault must, out of necessity, be in a road, driveway or other traveled surface, the perimeter of the manhole vault shall be insulated with 2 inch thick extruded polystyrene board (Manufacturer’s reference – Dow “blue board”) at a depth of two feet and a width of four feet with ½” – 1” granular bedding four feet with ½” – 1” granular bedding four inches thick under and on top of the insulation board. These valves shall be installed in a precast manhole vault with the fittings as shown in Detail Drawings.

## V.5 VALVE BOXES

### **V.5.1 Materials**

- A. Material – Cast iron.
- B. Type – Three piece, screw type.
- C. Size – 5 ¼” diameter.
- D. Cover – Deep socket type with the word “WATER” cast in the top.
- E. Base – No. 160 type with 20.5 inch bottom opening.
- F. Valve markers – For valves that fall outside of road pavement and shoulders, install a six foot long, green “carsonite” marker on all new valves. Marker to have valve decal at top.

**V.5.2 Installation** – Valve boxes shall be installed plumb and true, and centered over the two inch operating nut. Bricks shall be placed under the flange of the valve box bottom so that at no time loadings on the valve box will be transmitted to the valve. Valve box lid to be placed ½” – ¼” below grade when located in asphalt or concrete and 6” below grade in gravel roads.

## **VI. TRENCHING, BACKFILLING AND COMPACTION**

### VI.1 GENERAL

**VI.1.1 Scope** – This section shall include all labor, materials, equipment, and miscellaneous items necessary to perform all excavation, backfilling and compaction of underground water lines and appurtenances as specified herein for the Town of Breckenridge.

All work within the existing rights-of-way of the Town of Breckenridge shall be done in compliance with requirements issued by the Town of Breckenridge. It shall be the Contractor’s responsibility to secure all required excavation permits and pay all costs thereof.

### **VI.1.2 Protection of Work**

- A. All excavation shall be protected by barricades, lights, signs, etc., as required by governing federal, state and local safety codes and regulations. Under no circumstances will more than 20’ of trench be left open at night. Any trench left open at night will be protected by a temporary snow fence barricade and reflective tape.
- B. Sheeting, Shoring and Bracing – Where trench walls are not excavated at a stable slope, the Contractor shall provide and maintain sheeting sufficient to prevent caving, sliding or failure and property or bodily damage.

Under normal construction conditions, sheeting shall be removed as work progresses. Sheeting shall remain installed if directed by the Town or if pipe does not have sufficient strength to support backfill based on trench width as defined by the sheeting.

The Contractor shall be held solely responsible for any violations of applicable safety standards. Particular attention is called to minimum requirements of OSHA and State of Colorado Occupational Safety and Health laws.

- C. Site Drainage – Excavation to be protected from surface water at all times.

## VI.2 MATERIALS

**VI.2.1 Embedment Material** – Pipeline embedment materials shall comply with the appropriate class as listed below and as illustrated in Detail Drawings.

- A. Class A – Use for all distribution and transmission mains that are ductile iron. In addition, use for all copper water service lines.
  - 1) Characteristics – Densely compacted  $\frac{3}{4}$ " screened aggregate granular foundation, four inches below bottom of pipe with densely compacted  $\frac{3}{4}$ " screened aggregate to 12" above top of pipe.

## **VI.2.2 Backfill Material**

- A. Characteristics – Made of materials free from debris, organic matter and frozen material. Uniformly graded sufficient to allow proper compaction.
- B. No boulders greater than six inches in diameter in top twelve inches of backfill; bottom, six inches; or side, six inches.

Generally, no boulder greater than 12 inches in diameter in remainder of trench.

## VI.3 METHODS AND PROCEDURES

### **VI.3.1 Site Preparation**

- A. Clearing – Remove all vegetation, stumps, roots, organic matter, debris and other miscellaneous structures and materials from work site.
- B. Topsoil Removal – Strip existing topsoil from all area to be disturbed by construction. Topsoil to be stockpiled separately from excavated materials.
- C. Pavement Removal – Asphalt and bituminous pavements to be saw cut to the full depth of pavement. The vertical face of the cut shall be a straight line parallel to the limit of excavation. Cuts shall be made with a flat-bladed air hammer, concrete saw, or as approved by the water system manager. The method used should provide a straight, true cut. All asphalt located within trench limits to be hauled off site.

Concrete pavements, including curbs, gutters and sidewalks, to be saw cut to the full depth of pavement. The vertical face of the cut shall be a straight line parallel to the limit of excavation.

All pavement removal shall be disposed of off site. Broken pavement not to be used in backfill material.

### **VI.3.2 Trench Excavation**

- A. Limits of Excavation – Trenches to be excavated along lines and grades as approved by the Town of Breckenridge. Trench widths for pipe loading to be measure 12 inches above top of pipe.

Minimum trench width to be the outside diameter of the pipe or conduit plus 16 inches.

Maximum trench width to be the outside diameter of the pipe or conduit plus: 1), 24 inches for outside pipe diameter of 24 inches or less; and 2), 30 inches for outside pipe diameter of 24 inches or greater.

Trench excavation not to be completed more than 100 feet in advance of pipe installation. Backfill to be completed within 20 feet of pipe installation by the end of any working day.

- B. Groundwater Control – Contractor to maintain facilities on site to remove all groundwater from trench. Water shall be kept at least 12 inches below the trench bottom, to a point such that a firm base for pipe or conduit installation exists. Facilities shall be maintained until all concrete is cured and backfilling is in place at least 24 inches above anticipated water levels before water removal is discontinued. All water removal shall be subject to approval by the Town of Breckenridge.
- C. Stockpile Excavated Material – Excavated material to be stockpiled so as not to endanger the work or public safety. Maintain existing vehicular and pedestrian traffic with minimum disruption. Maintain emergency access and access to existing fire hydrants and water valves. Maintain natural drainage courses and street gutters.
- D. Clay Barriers – Install a one foot thick clay barrier, or approved equal, in place of aggregate, 4” below and 12” above pipe, every 500 feet for all water mains.

### **VI.3.3 Bottom Preparation**

- A. Where soils are suitable and have adequate strength, bottom to be graded and hand-shaped such that the pipe barrel rests uniformly on embedment material.
- B. Bell Holes – Material to be removed to allow installation of all fittings and joint projections without affecting placement of pipe.
- C. Over-excavation – Whenever trench is over-excavated to eliminate point bearing rocks or stones or when undisturbed grade tolerances of 0.1 feet are exceeded, the Contractor is to reestablish grade using aggregate bedding materials.
- D. Unstable Materials – Materials which are not capable of supporting super-imposed loadings are defined as unstable materials. Should unstable materials be encountered during excavation, immediately notify the Town of Breckenridge. If unstable material is encountered, the trench bottom shall be over-excavated (minimum 6 inches) and backfilled with a clean ½” to 1 ½” rock. The rock backfill provides increased water movement and helps stabilize the trench bottom.

- E. Rock Excavation – Rock shall be removed to a four inch depth below in bottom pipe grade. Additionally, all rock loosened during jacking, blasting, etc., shall be removed from the trench.

#### **VI.3.4 Backfilling**

- A. Tamping Equipment – Except immediately next to the pipe, mechanical or air operated tamping equipment is to be used. Hand equipment, such as T-bar, is to be used next to pipe if necessary. Care is to be taken when compacting under, alongside and immediately above pipe to prevent crushing, fracturing, or shifting of the pipe. The Contractor is to note densities required for materials being backfilled and shall use appropriate approved equipment to obtain those densities.
- B. Moisture Control – Generally, maintain moisture of the backfill material within  $\pm$  2% of optimal moisture content as determined by ASTM D698. Maintain close tolerances as needed to obtain densities required.
- C. Compaction – Maximum density (100%) based upon ASTM D698 or AASHTO T99.
  - 1) Bedding Material – Includes material used for over-excavation of any kind: 95% standard proctor.
  - 2) Select Material: 95% standard proctor.
  - 3) Backfill beneath existing or proposed pavements, roadways, sidewalks, curbs, utility lines and other improvements or within five feet horizontally of such improvements: 95% standard proctor.
  - 4) Backfill within public or designated right-of-way: 90% standard proctor or as shown on the Drawings for those areas outside of No. 3 above.
  - 5) Backfill within undeveloped, green or designated area: 85% standard proctor.
- D. Placing Backfill – The maximum loose lifts of backfill material to be as follows (use smaller lifts where necessary to obtain required densities):
  - 1) Bedding and select material – 6 inches.
  - 2) Backfill Material: 24 inches where 95% compaction required; 48 inches where less than 95% compaction required.
- E. Maintenance of Backfill – Contractor to maintain all backfill in a satisfactory condition during the extent of the contract and warranty period. The Contractor will be responsible for repairing any deterioration or settlement of the road surface. Notification of the required repairs will be issued by the Town of Breckenridge. All costs for repair and all liability, as a result of surface deterioration or settlement, shall be the responsibility of the Contractor.
- F. Absolutely no frozen backfill material permitted.

#### **VI.3.5 Surface Restoration** – All existing surface improvements and site disturbed or damaged during construction to be restored to a condition equal to pre-construction condition. All restoration costs are considered incidental to the excavation and backfill.

- A. Improvements – Replace, repair or reconstruct all improvements as required. Work will not be accepted until restoration is accepted by the Town of Breckenridge and all effected property owners. Improvements include, by example, other utilities, culverts, structures, curb & gutter, mailboxes, signs, etc.

- B. Roadways – All roadways to be restored to original condition with the following minimum depths required.
  - 1) Minimum base course material on gravel roadways or minimum depth gravel on hard surface roadway to be 8”.
  - 2) Minimum bituminous surfacing to be 3”.
  - 3) Minimum concrete paving to be 6”.

#### VI.4 QUALITY CONTROL - FIELD

**VI.4.1 Compaction** – It should be fully understood that it will be the sole responsibility of the Contractor to achieve the specified densities for all embedment and backfill materials placed. Contractor will be responsible for ensuring that correct methods are being used for the placement and compaction of said materials. Correct backfill methods include, but are not limited to:

- A. Use of proper equipment for existing soil condition encountered.
- B. Moisture content of existing soils; determination if water should be added or if soil should be air-dried to reduce moisture content.
- C. Thickness of backfill lift.

Contractor may, at his own expense, have an approved geotechnical engineer monitor the methods of backfill and compaction used to ensure that the desired densities are being obtained.

**VI.4.2 Inspection and Testing** – Inspection and testing to be performed at the direction of the Town of Breckenridge. Contractor to cooperate fully with all persons engaged in testing. Contractor to excavate as required allowing testing. Contractor to backfill all test excavations in accordance with these regulations.

#### **VI.4.3 Density Testing and Control**

- A. Reference Standards – Density/moisture relationships to be developed for all soil types encountered according to ASTM D698 or ASSHTO T99.
- B. Field Testing – Testing for density during compaction operations to be done in accordance with ASTM D2922 using nuclear density methods.
- C. Frequency of Testing – Minimum of one test for each 100 feet of trench or as directed by the Town of Breckenridge. Contractor to excavate to depths required by Engineer for testing and backfill test holes to density specified. Testing to be paid for by the Contractor.

### **VII. PRESSURE TESTING AND FLOW TESTING**

#### VII.1 GENERAL

**VII.1.1 Scope** – This section shall include furnishing all materials, labor, equipment, and miscellaneous necessary to perform pressure and leakage tests all distribution, transmission, and service lines as specified herein for the Town of Breckenridge.



**VII.1.2 Hydrostatic Tests** – Pressure and leakage tests shall be conducted on all newly laid pipe and service lines. Contractor shall furnish all the necessary equipment and materials to conduct the test. Contractor will be responsible for installing the appropriate taps used in the test. Pressure tests are not allowed to be done through a fire hydrant.

The test shall be conducted between valved sections of the pipeline, or as approved by the Town of Breckenridge. Water service lines will be tested up to the closed curb stop. A visual inspection of the water service connection, at the water main and at the curb stop, will be performed to check for leakage.

Furnish the following equipment and material for the tests:

<u>Amount</u>	<u>Description</u>
2	Approved graduated containers
2	Pressure gauges
1	Hydraulic force pump approved by the water Manager
1	Additional 3/4" pressure tap for Town's test gauge Suitable hose and suction pipe as required

Conduct the tests after the trench has been backfilled or partially backfilled with the joints left exposed for inspection, or when completely backfilled, as permitted by the Town. Where any section of pipe is provided with concrete reaction blocking, do not make the pressure test until at least 5 days have elapsed after the concrete thrust blocking is installed. If high-early cement is used for the concrete thrust blocking, the time may be cut to two days.

Conduct pressure test in the following manner unless otherwise approved by the Town: After the trench has been backfilled as specified, fill the pipe with water, expelling all air during the filling. The test pressure shall be 1 1/2 times normal static system working pressure of the pipe at the point of lowest elevation (test minimum 150 psi).

- A. Duration
  - 1) The duration of each pressure test shall be two hours, unless otherwise directed by the Town.
- B. Procedure
  - 1) Slowly fill the pipe with water and allow to stand for 24 hours. Expel all air from the pipe. Apply and maintain the specified test pressure by continuous pumping if necessary for the entire test period. The test pressure shall be calculated for the point of lowest elevation, or as specified by the Town. The pump suction shall be in a barrel or similar device, or metered so that the amount of water required to maintain the test pressure may be measured accurately.
  - 2) Before the line is pressurized, the Town shall verify that all the necessary main line valves are open or closed with regard to the section of line being tested. In addition, the Town shall verify that all hydrant auxiliary valves are closed.

C. Leakage

- 1) Leakage shall be defined as the quantity of water necessary to hold the specified test pressure for the duration of the test period. No pipe installation will be accepted if the leakage is greater than the number of gallons per hour as determined by the following formula:

$$L = \frac{SD\sqrt{P}}{133,200}$$

In the above formula:

L = Allowable leakage

S = Feet of pipe test

D = Nominal diameter of pipe, in inches

P = Average test pressure during the leakage test, in pounds per square inch gauge

H = Hours of test time

D. Correction of Excessive Leakage

- 1) Should any test of pipe laid disclose leakage greater than that allowed, locate and repair the defective joints or pipe until the leakage of a subsequent test is within the specified allowance.

E. Air Expulsion

- 1) Always provide a 3/4" tap at high point in line for air expulsion.

**VII.1.3** Flow Test – The Town will conduct a fire flow test out of the hydrants after the pressure test is completed to gather data and verify that the system meets required fire flow and design criteria.

## VIII. DISINFECTION OF POTABLE WATER LINES

### VIII.1 GENERAL

**VIII.1.1** Scope – Work under this section shall include furnishing all materials, labor, equipment, and miscellaneous items necessary to disinfect all raw water, potable water transmission, and distribution pipelines, service lines, and appurtenances as specified herein for the Town of Breckenridge.

**VIII.1.2** Standard – Flush and disinfect potable water lines in accordance with the procedures set forth in AWWA C601-68, Disinfecting Water Mains.

**VIII.1.3** Pipe Cleaning – If the pipe contains dirt or heavy encrusted matter that in the opinion of the Town will not be removed during the flushing operation, the Contactor shall clean and swab the interior of the pipe with a five percent (50,000 ppm) chlorine solution.

- A. Preliminary Flushing – Flush pipeline except when the tablet method is used, to remove all remaining foreign material. The flushing operation shall develop a minimum velocity of 2.5 ft/sec.

**VIII.1.4 Chlorine Application** – In general, chlorine shall be applied using the continuous feed method. However, on large diameter lines where this would not be practical, the slug method may be used. The tablet method may be used on short extensions (up to 2,500 ft) of small diameter mains (12" and smaller).

- A. Continuous Feed Method – Introduce water into the line at a constant rate while adding chlorine at a minimum concentration of 50 mg/liter. Maintain the chlorinated water in the pipeline for a minimum of 24 hours after which period the treated water shall contain no less than 25 mg/liter of chlorine throughout the entire length. Repeat the above procedure if the residual at the end of 24 hours fails to meet the minimum concentration.
- B. Slug Method – Introduce water with a minimum chlorine concentration of 300 mg/liter at a constant measured rate into the pipeline. Apply the chlorine for a sufficient length of time to develop a solid column or slug of chlorinated water that will, as it passes along the line, expose all interior surfaces for a period of 3 hours. Check the application at the upstream end of the line.
- C. Tablet Method – This method shall not be used if trench water or foreign material has entered the line or if the water is below 5°C (41°F). Because preliminary flushing cannot be used, this method shall only be used when approved by the water manager.

Place tablets in each section of pipe in sufficient number to produce a dose of 50 mg/liter. Refer to Table 3 of AWWA C601 for the required minimum number of tablets. All tablets within the main must be attached at the top of the pipe. Adhesive for attaching tablets to the top of pipe will be a non-toxic water-soluble adhesive. Introduce water into the pipeline at a rate no less than 1 ft/sec and retain the water in the pipeline for a period of 120 hours (5 days due to time needed to fully dissolve tablets in cold water). After 120 hours, a residual chlorine test shall be performed. The located water shall contain no less than 25 mg/liter of chlorine throughout the entire length. If the residual amount of chlorine at the end of 24 hours fails to meet the minimum concentrations, the line must be retested using the slug method.

**VIII.1.5 Final Flushing** – After the required retention period, flush all heavily chlorinated water from the main until the chlorine concentration is no higher than that prevailing in the system, or less than 1 mg/liter. Once the main line has been properly flushed, service lines shall be flushed at the curb stop.

**VIII.1.6 Bacteriologic Tests** – After completion of the final flushing and prior to placing the pipeline in service, collect samples from the end of the line and test for bacteriologic quality to show the absence of coliform organisms. The number and frequency of samples shall conform to the requirements of the public health authority having jurisdiction but in no case shall the number be less than one for chlorinated supplies.

Collect samples in sterile bottles from a standard corporation stop furnished and installed by the Contractor in the main. Do not collect samples using hose or fire hydrant.

**VIII.1.7 Repetition of Procedure** – If the original disinfection fails to produce satisfactory samples, repeat the disinfection procedure until satisfactory results are obtained.

## **IX. SPECIAL CONSTRUCTION**

### **IX.1 GENERAL**

**IX.1.1 Scope** – This section shall include the design and construction of aerial crossings, river crossings, storage tanks, pressure reducing vaults and booster stations. Because each of these structures will require an engineered design to meet field conditions and individual design criteria, this section will not attempt to provide complete design guidelines and specifications. Rather, it will provide a general listing of guidelines that must be followed unless the Town approves an equivalent alternative.

### **IX.2 AERIAL CROSSING**

**IX.2.1 General** – This section shall cover the design criteria to be used on aerial crossings including water lines suspended from existing and proposed bridges, and lines aerially supported over steep canyons and arroyos. In both of the above crossings, an underground or river crossing will be required unless special circumstances render the below grade alternative prohibitive. If it is determined that a bridge crossing is acceptable to the Town, the following design criteria shall be followed.

**IX.2.2 Pipe Supports** – If pipe is to be supported from an existing bridge, a structural analysis shall be performed to determine if the bridge can withstand the additional loading. If being installed on a new bridge, then additional pipe loading should be included as a dead load consideration.

Pipe shall be supported with a pipe hanger that allows longitudinal movement. Support shall be an adjustable steel yoke pipe roll or approved equal. In addition, a horizontal support from pipe hanger to the bridge shall be provided so that the pipe assembly will not move horizontally due to wind loads, etc. The spacing of the pipe hangers shall depend upon the maximum recommended load of hanger.

**IX.2.3 Pipe Insulation** – Aerial pipelines shall be prevented from freezing by pipe insulation. The insulation R value and thickness shall be designed to a generally accepted standard for the Breckenridge area. The insulation should have a minimum R value of 20. The insulation shall be non-absorbing to water.

**IX.2.4 Insulation Protection** – Provide an aluminum jacket with moisture barrier strapped with stainless steel bands. Jacketing thickness shall be a minimum of 16 mil. Provide insulation protection shields.

**IX.2.5 Pipe** – Provide Class 52 ductile pipe with flanged joints, ANSI B 16.1, AWWA C151.

**IX.2.6 Expansion Coupling** – Provide a restrained expansion coupling between each rigidly supported point of the pipe. Follow all manufacturers' recommendations when

installing. Expansion couplings shall be accessible to water department personnel for maintaining and making adjustments in couplings.

**IX.2.7 Air and Vacuum Vaults** – If bridge crossing is at a high point in line, install all air and vacuum valves appropriate for design conditions. See Detail Drawings.

**IX.2.8 Isolation Valves** – An isolation valve shall be provided on either end of the bridge. If a break occurs, the line can be easily isolated.

**IX.2.9 Accessibility** – Generally, the pipe should be placed in a location where personnel can easily access and maintain the pipe.

### **IX.3 RIVER CROSSINGS**

**IX.3.1 General** – This section covers the design criteria to be used on river crossings.

**IX.3.2 Encasement** – Pipe shall be encased in concrete for the length of pipe underneath 25-year storm high water mark. See Detail Drawings.

**IX.3.3 Pipe** – For river crossing, the pipe joints shall be push-on joints with joint restraint, Class 52 D.I.P. Manufacturer's reference – Griffin Snap-Lok pipe or equal.

**IX.3.4 Bend Restraint** – All vertical bends shall be restrained with vertical reaction blocks and all thread rods between bends or between bends and concrete thrust tie.

**IX.3.5 Permits** – Generally, a river crossing will require a 404 Permit or Nationwide Utilities Permit from the Army Corps of Engineers. The Applicant should begin the permit process as soon as possible, as the process can take from 30-90 days to secure the permit.

### **IX.4 STORAGE RESERVOIRS**

**IX.4.1 General** – This section covers the design criteria to be used on storage reservoirs. The Town may allow either a buried concrete or above ground steel tank depending on the field conditions, size and location of the tank. The Town Water Master Plan shall be used as a planning tool to determine the size and location of storage tanks.

**IX.4.2 Foundation Design** – A soil and geological report shall be provided which make recommendations on the required foundation.

**IX.4.3 Structural Design** – Complete structural design, with calculations and shop drawings submitted by a professional engineer shall be provided. If a welded steel tank is provided, it shall conform to ANSI/AWWA D100-79.

**IX.4.4 CDH Requirements** – All Colorado Department of Health, Water Quality Control Division "Design Criteria for Potable Water Systems" shall be followed.

**IX.4.5 Flow Measuring** – A magnetic flow meter capable of measuring flow in both directions shall be provided. Two remote recording charts with totalizers shall be provided at the

Town water treatment plant or at the pump station. The flow meter shall be housed in a vault outside the tank. The vault shall conform to the same basic requirements as a PRV vault (see 4.00 of this section). The vault shall contain heat, lights, and two 110-volt outlets. Install lighting arresters on mag meter power and sensor lines to eliminate surge and transient voltages (located at both ends).

**IX.4.6 Tank Insulation** – All above ground tanks shall be insulated with a minimum of R-11 urethane foam insulation with a rubberized silicone coating that will not deteriorate under ultraviolet rays. All manufacturers' recommendations shall be followed on installation and application of foam and coating.

**IX.4.7 Steel Tank Painting** – Use an AWWA approved paint system for tank interior and exterior coating on all steel tanks.

## **IX.5 PRESSURE REDUCING VAULTS (PRV)**

**IX.5.1 General** – This section shall cover the design criteria to be used on pressure reducing vaults. The Town Water Master Plan shall be used as a planning tool to determine the location of PRV's.

**IX.5.2 PRV Valve** – The 8" PRV valve shall be a Clayton valve as manufactured by the Cla-Valve Company only. The main valve shall be a single seated, hydraulically operated, pilot controlled diaphragm-type globe valve. Epoxy coated inside, position indicator, 8" size, stainless steel trim.

**IX.5.3 Pilot Control System** – Cast bronze ASTM B62 with 303 stainless steel trim. Install isolation cocks, opening speed control – 2" only and strainers on pilot controls.

**IX.5.4 Pressure Gauges** – Install two 2 ½" dial, stainless steel, liquid filled, hermetically sealed pressure gauges with pressure snubbers, and isolation cocks. Locate at main inlet and outlet of vault so that if one PRV is isolated, gauges will still register.

**IX.5.5 Bypass Piping** – Install a 2" bypass PRV (Cla-Valve only) around main PRV valve so that mainline can be filled and service maintained with PRV valve out of service. Bypass and open speed control shall be installed with an isolation valve and its own PRV.

**IX.5.6 Pressure Relief Valve** – If damaging downstream pressure can result when PRV is stuck in open position, then a pressure relief valve shall be installed on downstream side of PRV on either the main line or bypass line. Pressure relief valve to be piped to daylight with ¼" drain from outlet side to bedding zone.

**IX.5.7 Isolation Valves** – Install isolation resilient seat gate valves inside of vault so that main PRV valve can be isolated.

**IX.5.8 Air Release** – Install an air release and vacuum valve at the top of the pipe on both inlet and outlet of pipe in vault. Each air release valve to have an isolation valve and shall be positioned on the top of the main line pipe.

**IX.5.9 PRV Vault** – All valves, appurtenances and pipe to be enclosed in a concrete or steel vault. Install link seal or equivalent between pipe inlets, outlets and vaults. Provide aluminum manhole lid marked “WATER” on concrete vaults. Aluminum MH rungs shall be provided on concrete vault. Install adjustable pipe supports under PRV’s, tees and valves (See Detail Drawings). Concrete vaults: 6 ft X 8 or 10 ft X 7 ft tall – inside dimensions.

**IX.5.10 Rods** – Three-quarter nickel/cadmium steel all thread rods shall be anchored to the outside of the vault wall and connected to the first flange of the piping inside. They shall be coated with a bituminous tar coating.

**IX.5.11 Connection for Air/Vac Valve and Bypass PRV** – This connection can be made to the pipe with a direct tap, a saddle tap or a flanged tee. It shall point up vertically for proper air/vac valve operation.

## **IX.6 BOOSTER STATIONS**

**IX.6.1** To be detailed by Arvada Pump Company, Kent Knight; Rocky Mountain Consultants, Larry Swenson; and Fred Barker, Barker Electric.

## **IX.7 VALVE INSERTION**

**IX.7.1 GENERAL** - This may be required by the Water Division for relocating water mains or inserting valves without needing to take the main out of service.

## **X. BACKFLOW PREVENTION**

### **X.1 GENERAL**

**X.1.1 Scope** – This section shall include the use of backflow prevention devices to prevent cross connection.

**X.1.2 Requirements** – All work within the Town of Breckenridge must comply with the Colorado State Health Department Law CRS 1973: Title 25-2-114; “The Primary Drinking Water Regulations for the State of Colorado”, October 1981, Section 11.1.2, “Hazardous Cross Connections and the Cross Connection Control Manual” published by the Colorado Department of Health, March 1983.

In general, the law states that it is illegal to have or to maintain a cross connection on a public water supply. Cross connection is defined as any connection which would allow water to flow from any pipe, plumbing fixture or water system into a water system supplying drinking water to the public.

**X.1.3 Types of Cross Connections** – The following are common (but not limited) cross connections and required devices to prevent backflow:

- A. Hose bibs – Vacuum breaker.
- B. Irrigation lines – Vacuum breaker or double check valve assembly.

- C. Fire sprinkler systems – Approved double check valve assemblies on water only lines. Approved reduced pressure principal backflow assembly on any branch line with any chemicals.
- D. Boiler systems – Reduced pressure principal backflow assembly.
- E. Dishwashers – Reduced pressure principal backflow assembly.
- F. Solar homes using potable water as heat source – Double check valve assembly, water only. Reduce pressure principal backflow assembly if any chemicals are used.
- G. Photographic processors and developers – Reduced pressure principal backflow assembly.

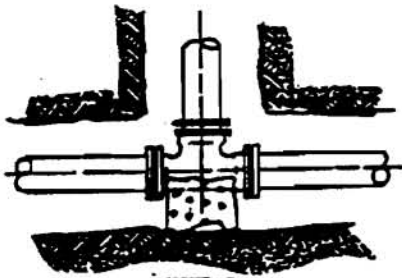
**X.1.4 Backflow Preventers** – Be advised that each cross connection will require different types of backflow prevention devices, and is beyond the scope of these regulations. Approval of backflow preventers must be given by Town Water Manager and/or Town Engineer.

The following approved devices can be used as backflow preventers.

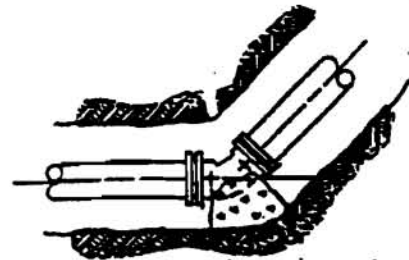
- A. Air gap
- B. Double-check valve assembly
- C. Vacuum breaker
- D. Reduced pressure principal backflow assembly

**X.1.5 Testing** – State law requires that the backflow prevention devices be tested annually by the supplier or Owner and records kept by the supplier of such test. The devices should be tested by someone certified as a backflow prevention device tester.

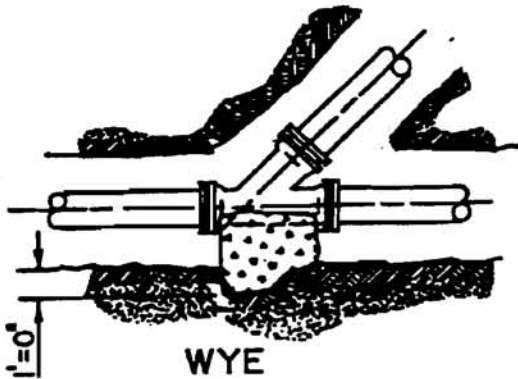




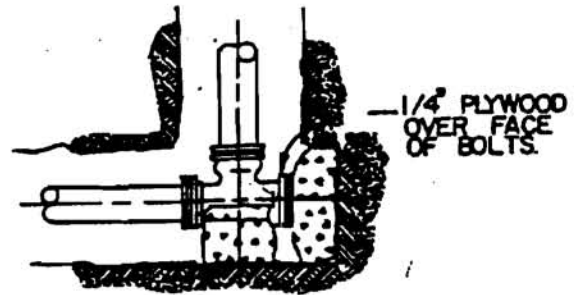
TEE



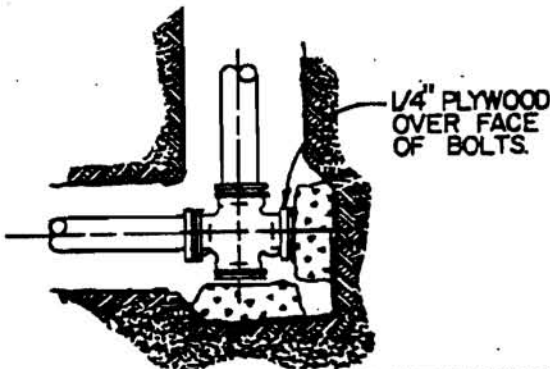
90°, 45°, 22 1/2° or 11 1/4°  
ELBOW, HORIZONTAL or  
BOTTOM OF VERTICAL



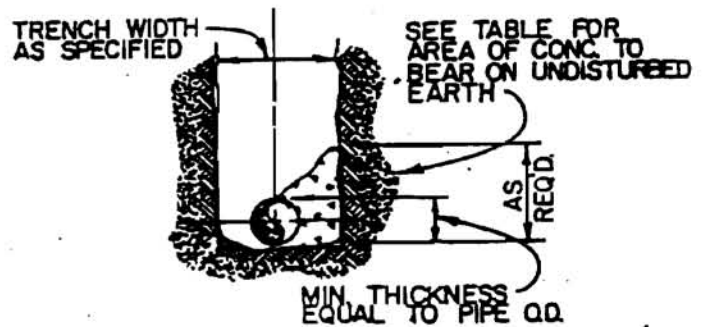
WYE



TEE W/DEAD END ON RUN

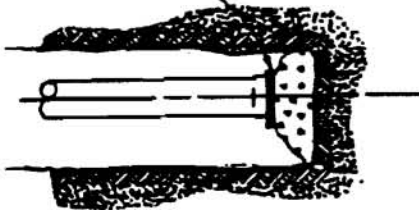


CROSS W/DEAD END BRANCHES



SECTION  
(TYPICAL)

1/4" PLYWOOD OVER FACE  
OF BOLTS.

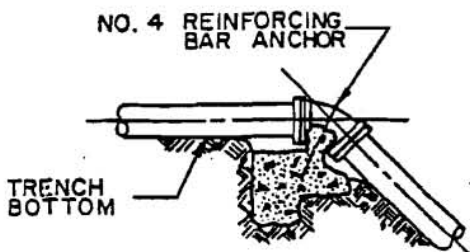


DEAD END

# TYPICAL CONCRETE REACTION BLOCK DETAILS

SIZE (INCHES)	ELBOWS				TEES & DEAD ENDS	GATE VALVES
	90° (ft <sup>2</sup> )	45° (ft <sup>2</sup> )	22 1/2° (ft <sup>2</sup> )	11 1/4° (ft <sup>2</sup> )		
4	1.8	1.0	0.5	0	1.3	0.5
6	4.0	2.2	1.1	0	2.8	0.7
8	7.1	3.8	2.0	1.0	5.0	2.4
10	11.1	6.0	3.0	1.5	7.8	4.5
12	16.0	8.6	4.4	2.2	11.3	7.3
14	21.7	11.8	6.0	3.0	15.4	11.0

TABLE OF BEARING AREAS IN SQ. FT. FOR CONCRETE  
REACTION BLOCK



TOP OF VERTICAL BEND

NOTE:

VOLUMES SHOWN IN TABLE ARE BASED ON 100 P.S.I. INTERNAL STATIC PRESSURE. VALUES FOR ANY PRESSURE MAY BE OBTAINED BY MULTIPLYING TABULATED VALUES BY A CORRECTION FACTOR "F".  
F = ACTUAL SPECIFIED TEST PRESSURE ÷ 100.

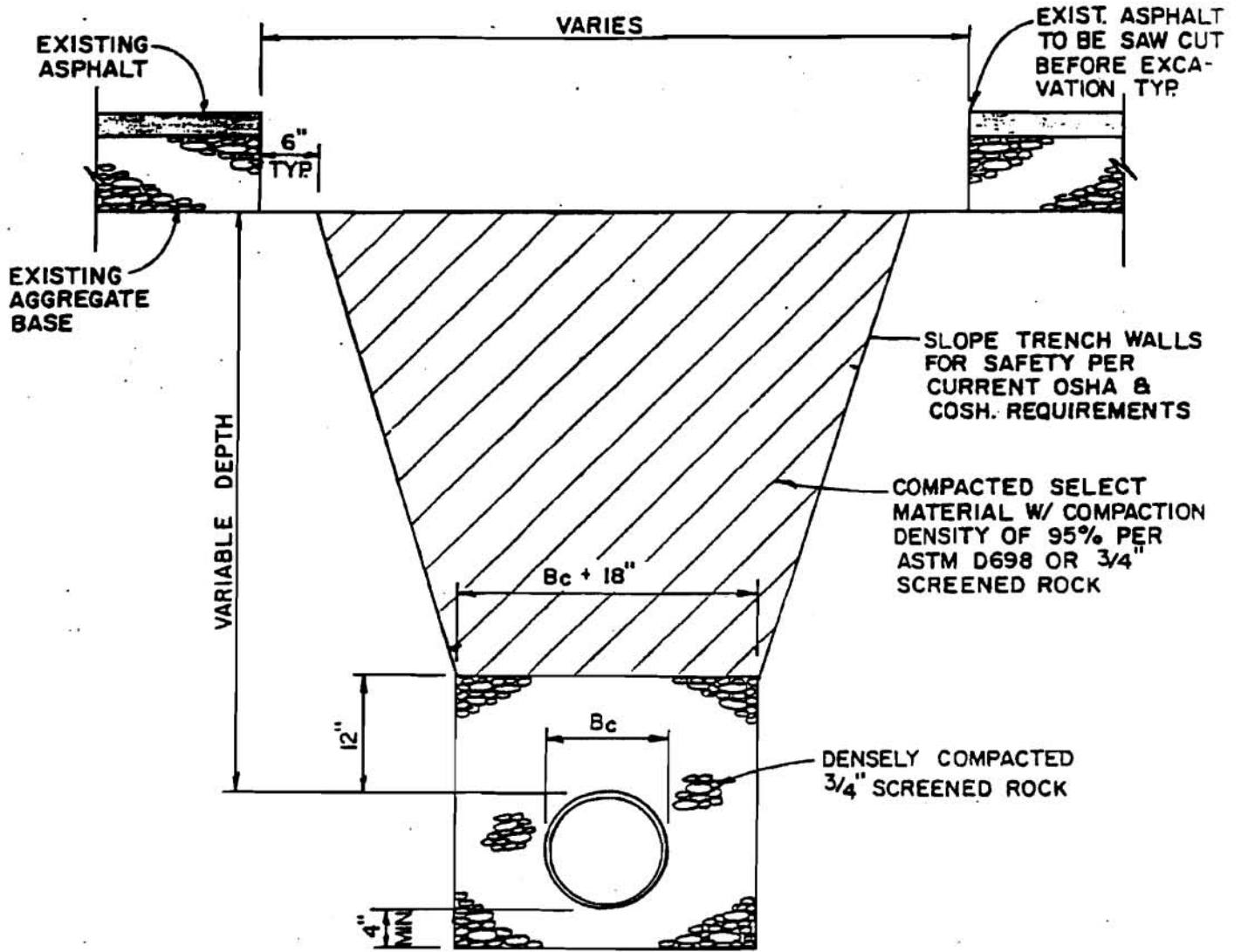
(REQUIRED FOR VERTICAL BEND ANCHOR BLOCKS FOR 100 P.S.I. PRESSURE.)

BAR SIZES FOR 100 P.S.I.		
LESS THAN	NO. OF BARS & SIZE	
60 CF	1	1/2"
90 CF	1	5/8"
133 CF	1	3/4"
200 CF	1	1"
400 CF	2	1"
600 CF	3	1"

SIZE (INCHES)	BENDS		
	45° (ft <sup>3</sup> )	22 1/2° (ft <sup>3</sup> )	11 1/4° (ft <sup>3</sup> )
4	6.5	3.3	1.7
6	14.6	7.5	3.7
8	26.0	13.2	6.6
10	40.5	20.7	10.3
12	58.5	30.0	14.8
14	79.5	40.7	20.2

16      92      50      26

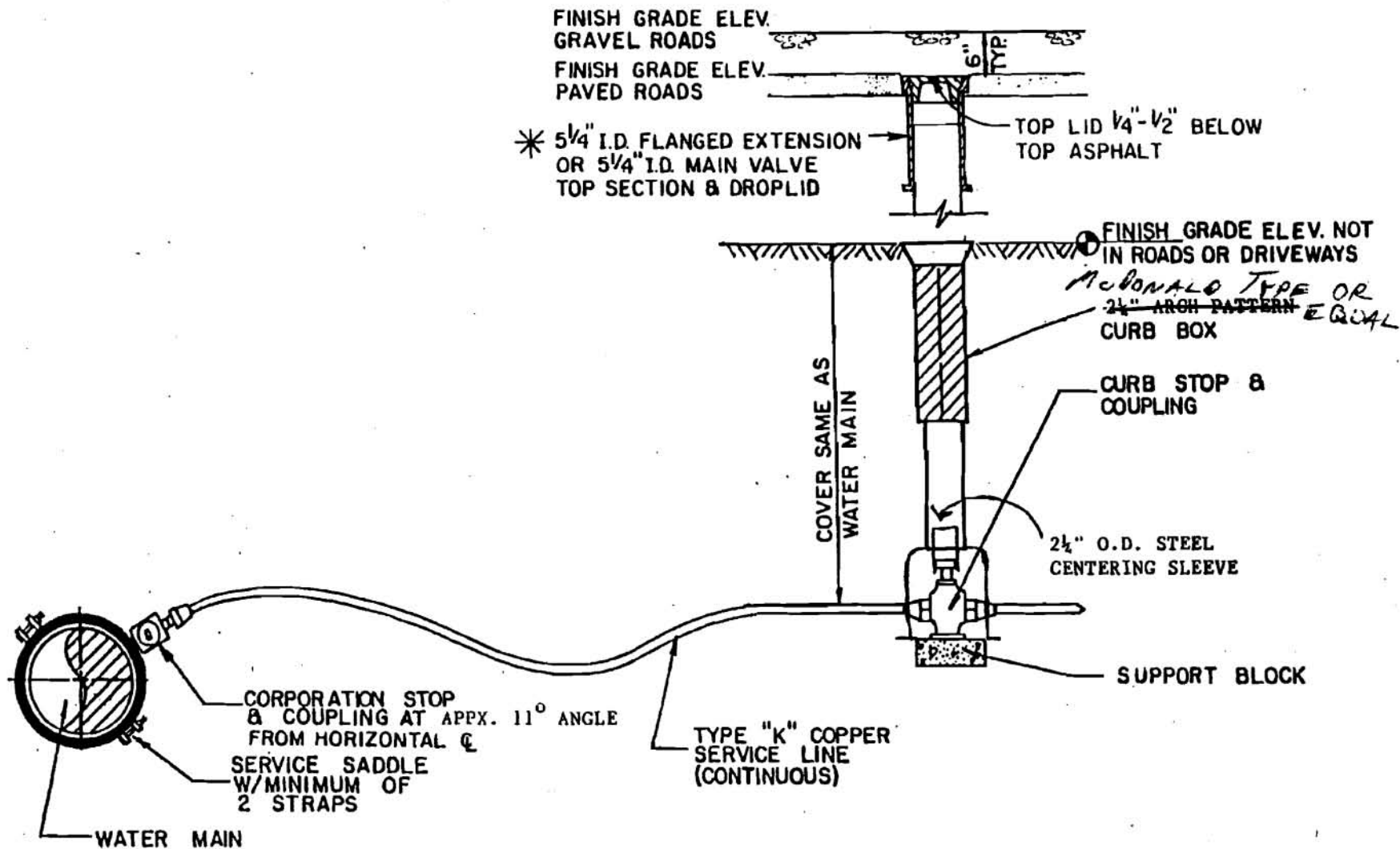
TABLE OF VOLUMES IN CU. FT. FOR CONCRETE  
ANCHOR BLOCKS



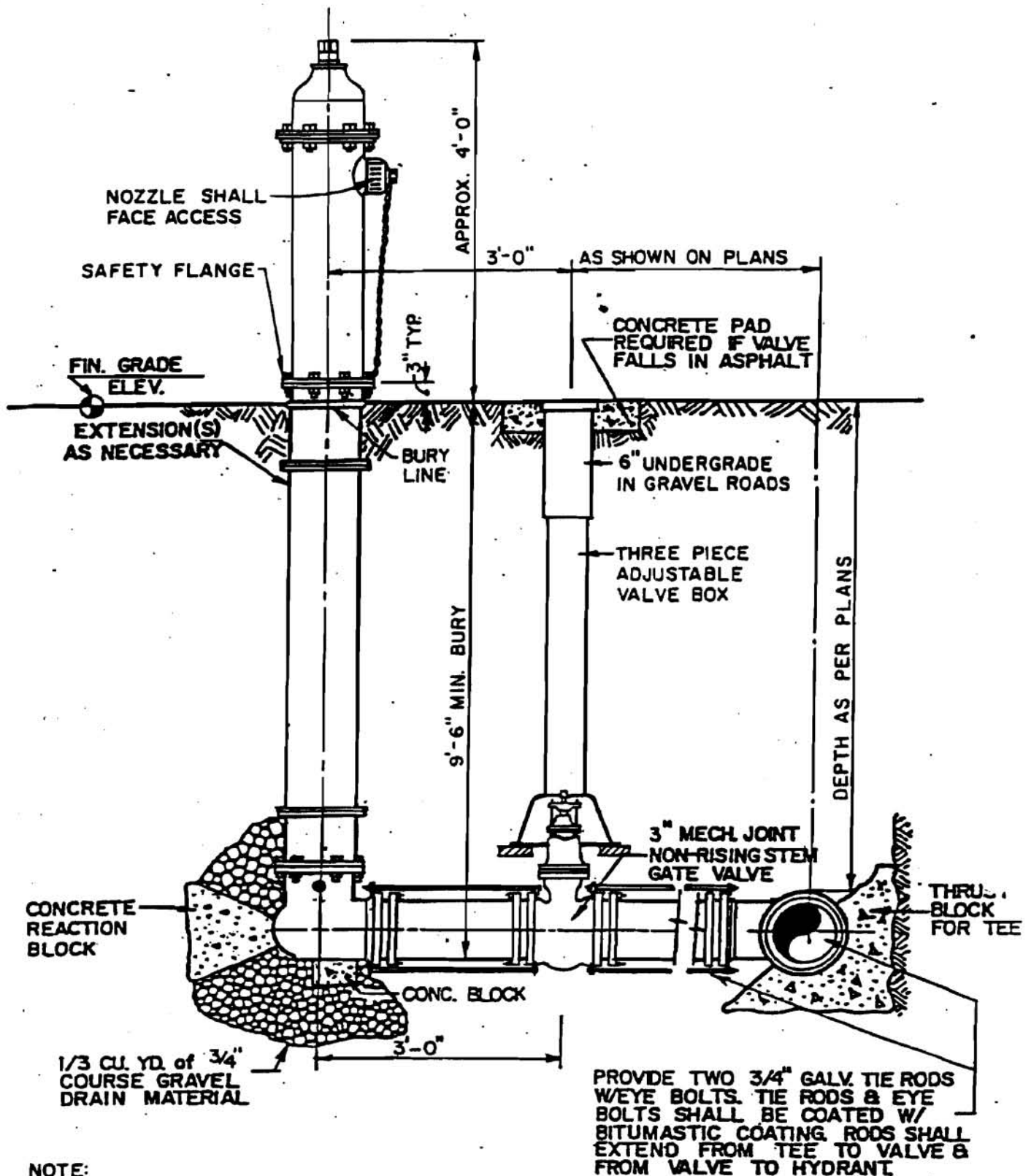
## TRENCH CROSS SECTION

SCALE: 3/4" = 1'-0"

DETAIL 4



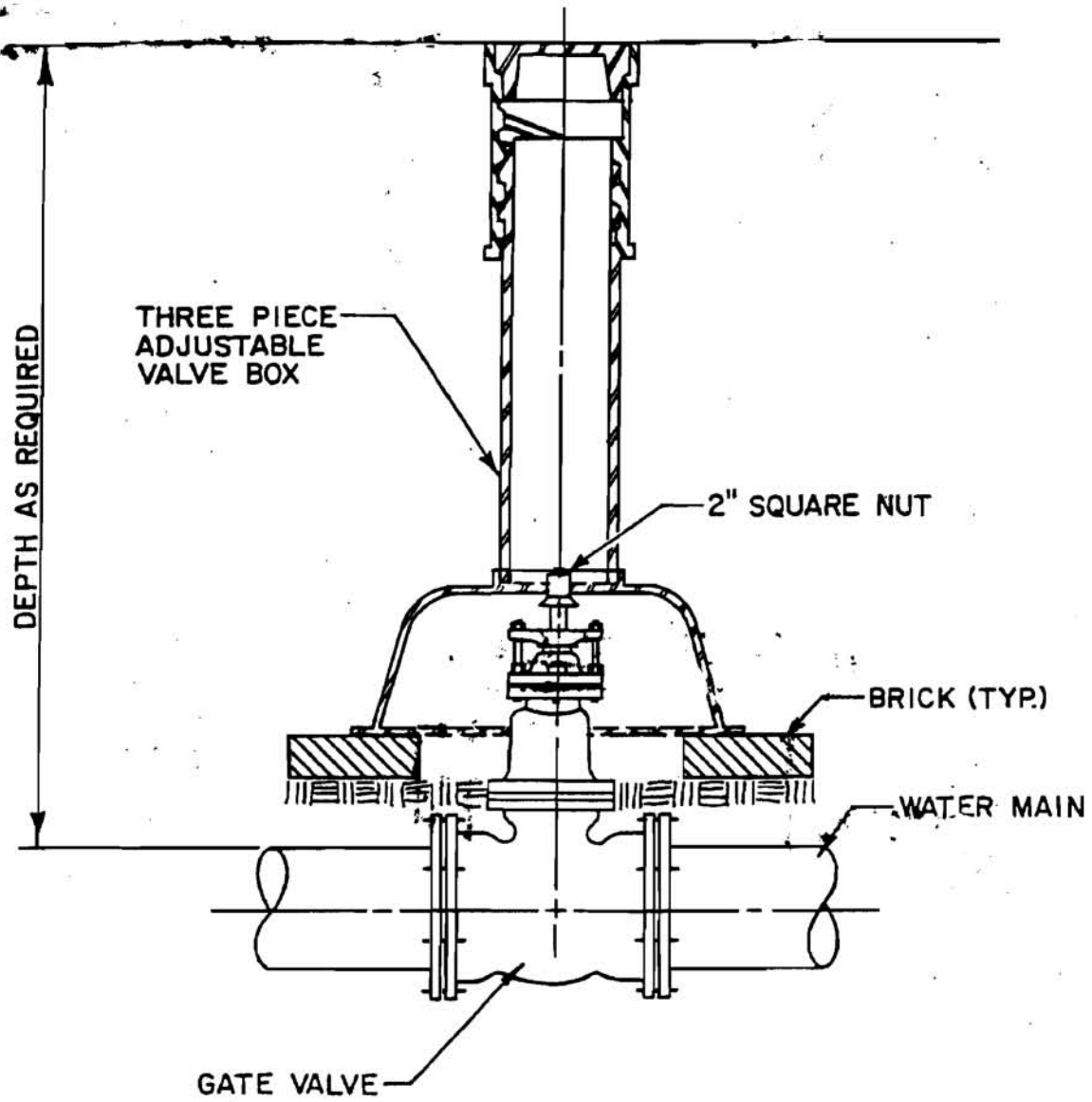
## TYPICAL WATER SERVICE DETAIL



**NOTE:**

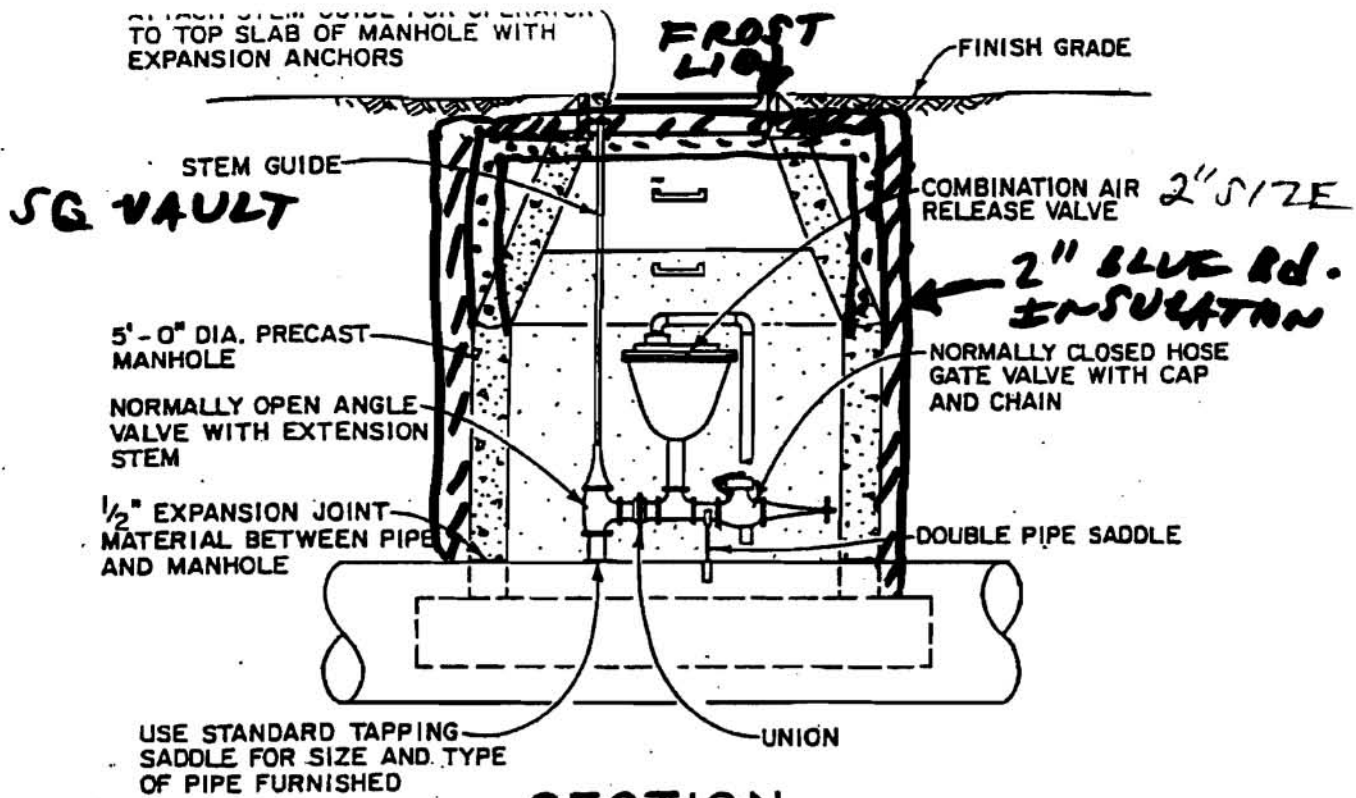
THE HYDRANT CAN BE ADJUSTED TO FINISHED GRADE BY EITHER INSTALLING 45° BENDS ON THE 6" MAIN FEEDING IT OR BY INSTALLING APPROPRIATE EXTENTIONS ON HYDRANT BARRELL

# FIRE HYDRANT ASSEMBLY

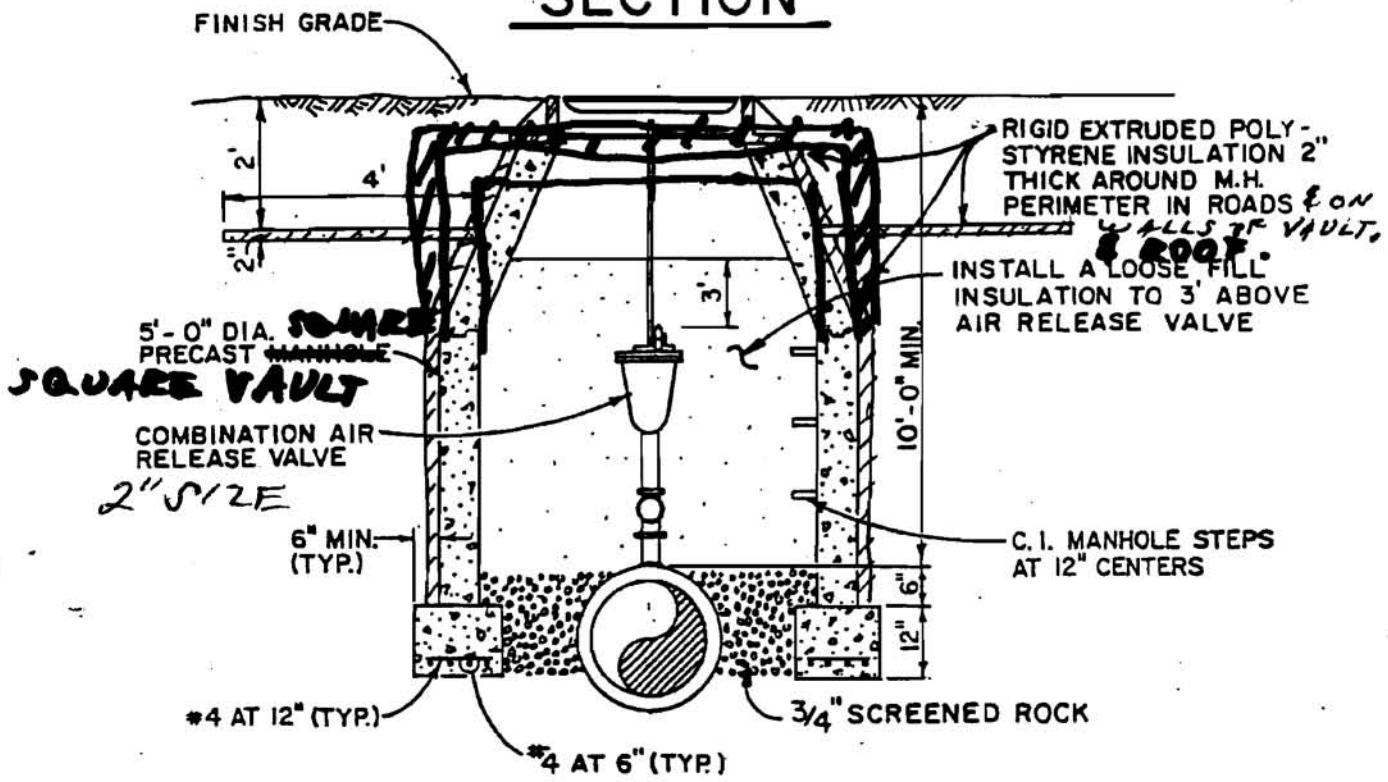


DETAIL FOR MAIN LINE  
GATE VALVES

N. T. S.



**SECTION**

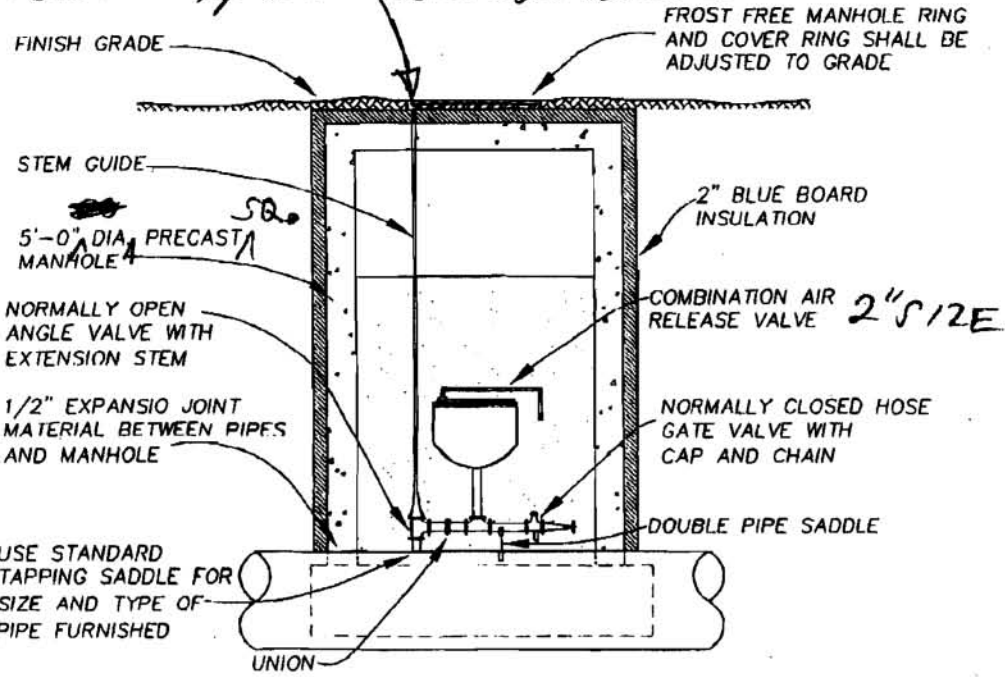


**SECTION**

**AIR & VACUUM VALVE VAULT**



*anchor stem to top slab of manhole with expansion anchors*



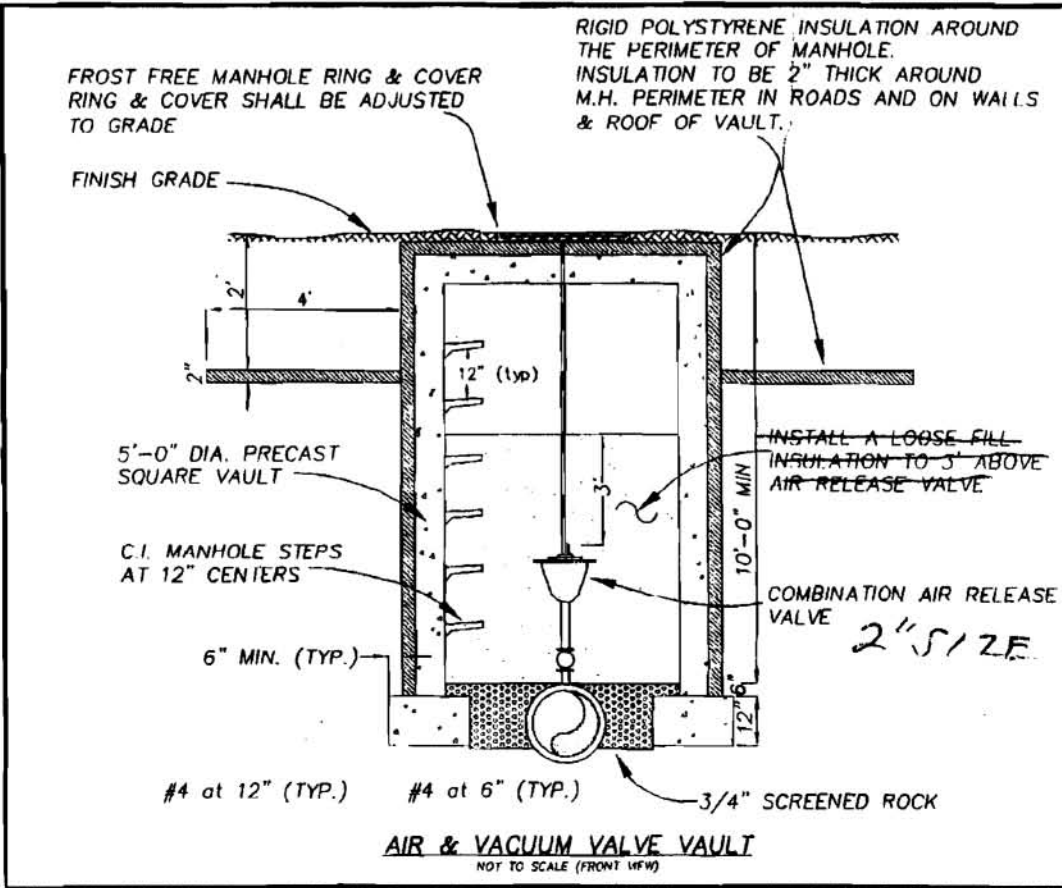
**AIR & VACUUM VALVE VAULT**  
NOT TO SCALE (SIDE VIEW)

To:  
Gary Roberts

Wellington  
Neighborhood

From:  
Tetra  
Tech

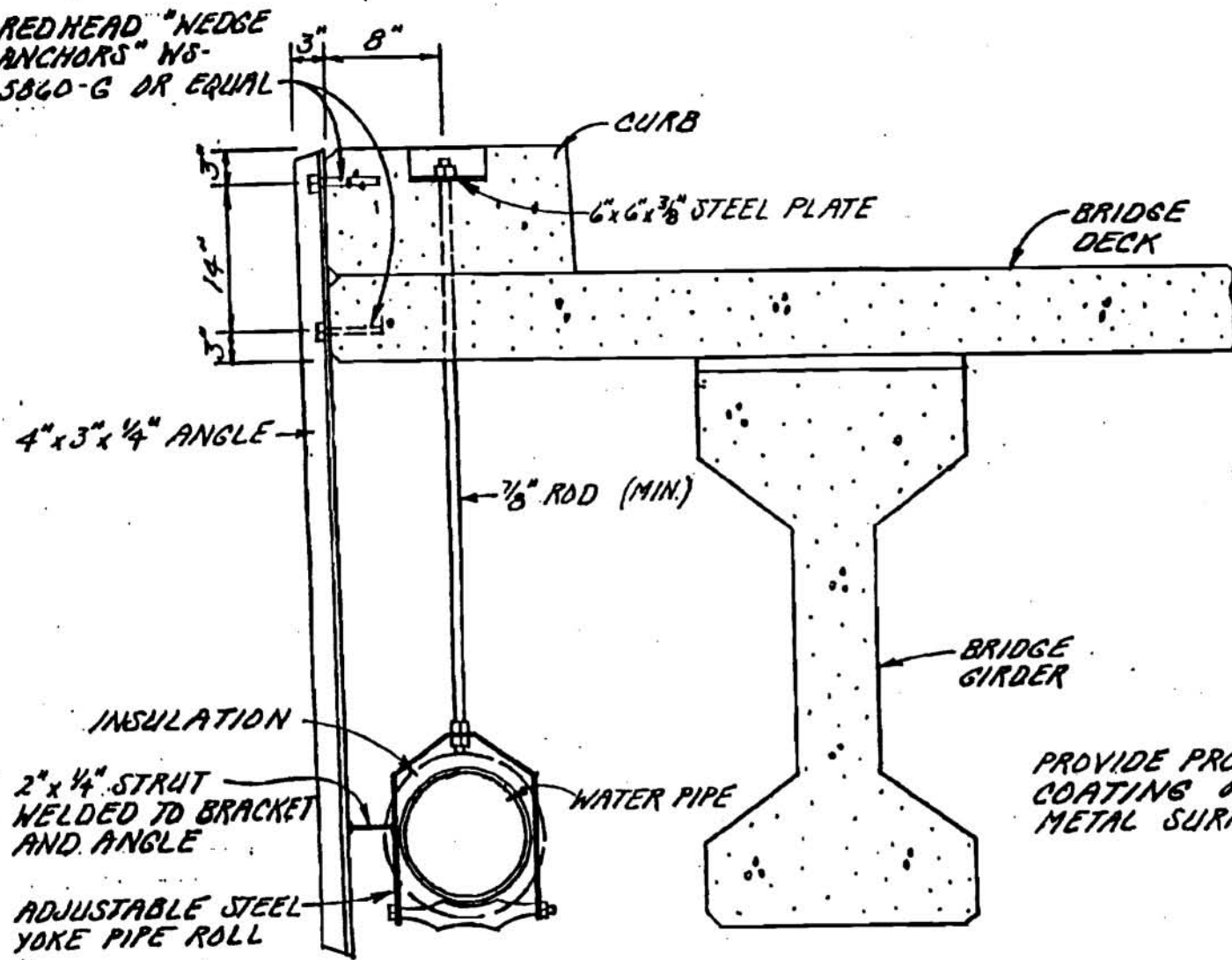
Tom  
Schuermann



**AIR & VACUUM VALVE VAULT**  
NOT TO SCALE (FRONT VIEW)

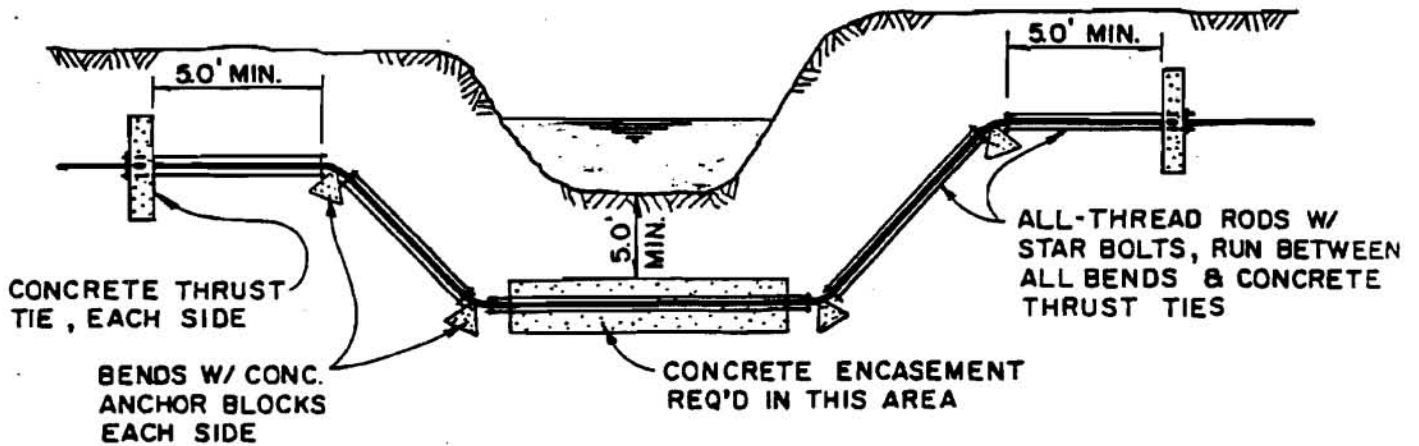


RED HEAD "WEDGE  
ANCHORS" WS-  
5860-G OR EQUAL



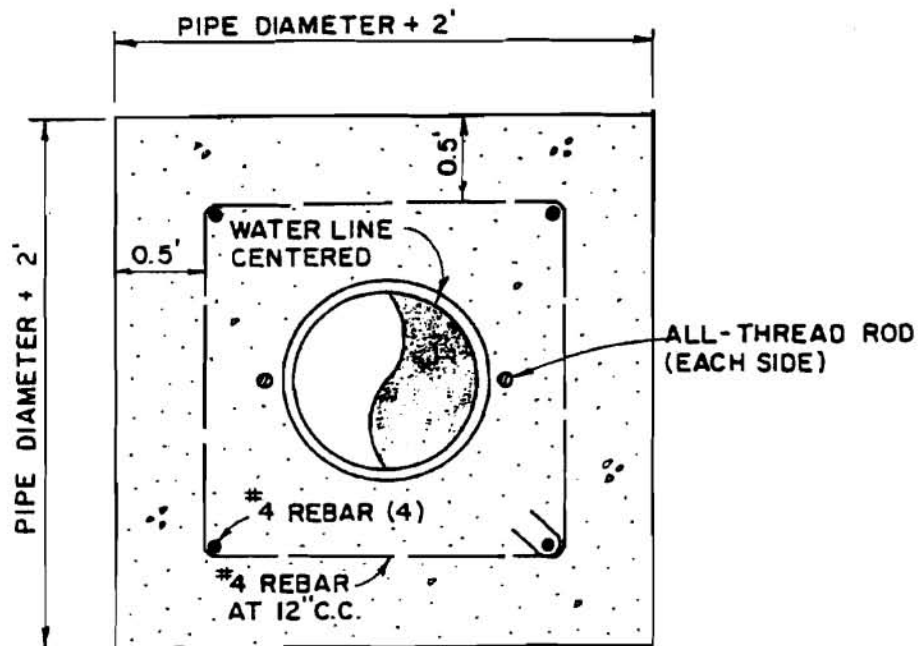
PROVIDE PROTECTIVE  
COATING ON ALL  
METAL SURFACES.

BRIDGE CROSSING DETAIL



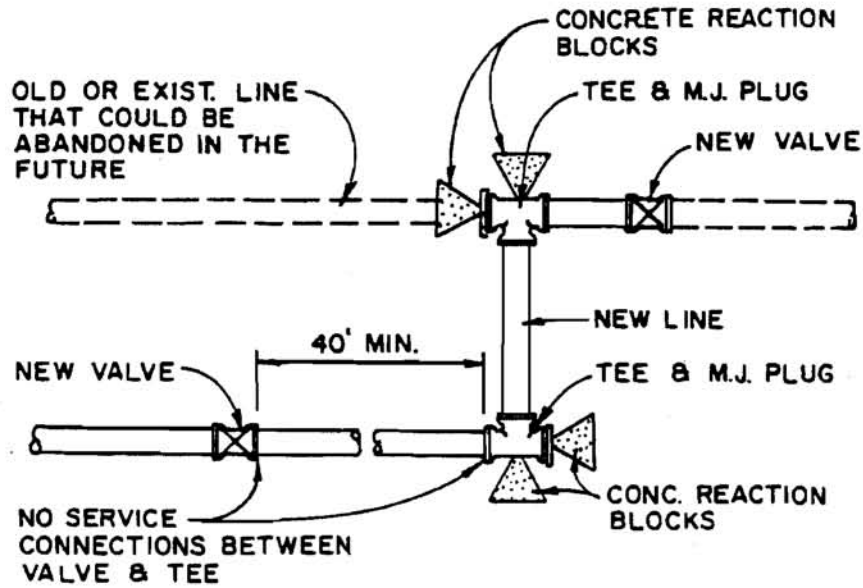
## RIVER CROSSING DETAIL

N.T.S.



## CONCRETE ENCASEMENT DETAIL

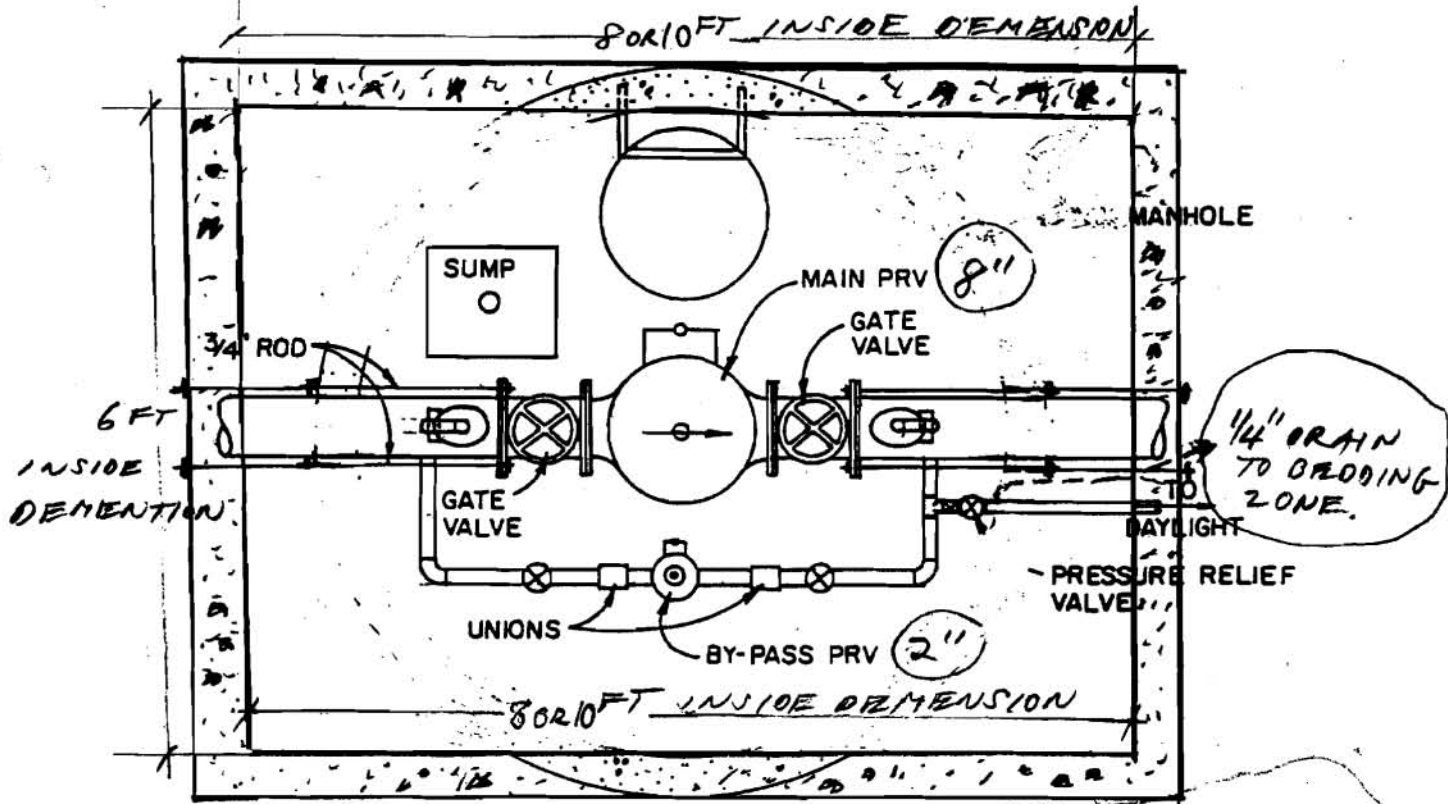
N.T.S.



NOTE: FOR NEW DEAD END LINES: (USE ONLY THE LOWER PORTION OF DETAIL WITHOUT A TEE IF NO EXIST. LINE IS BEING REPLACED).

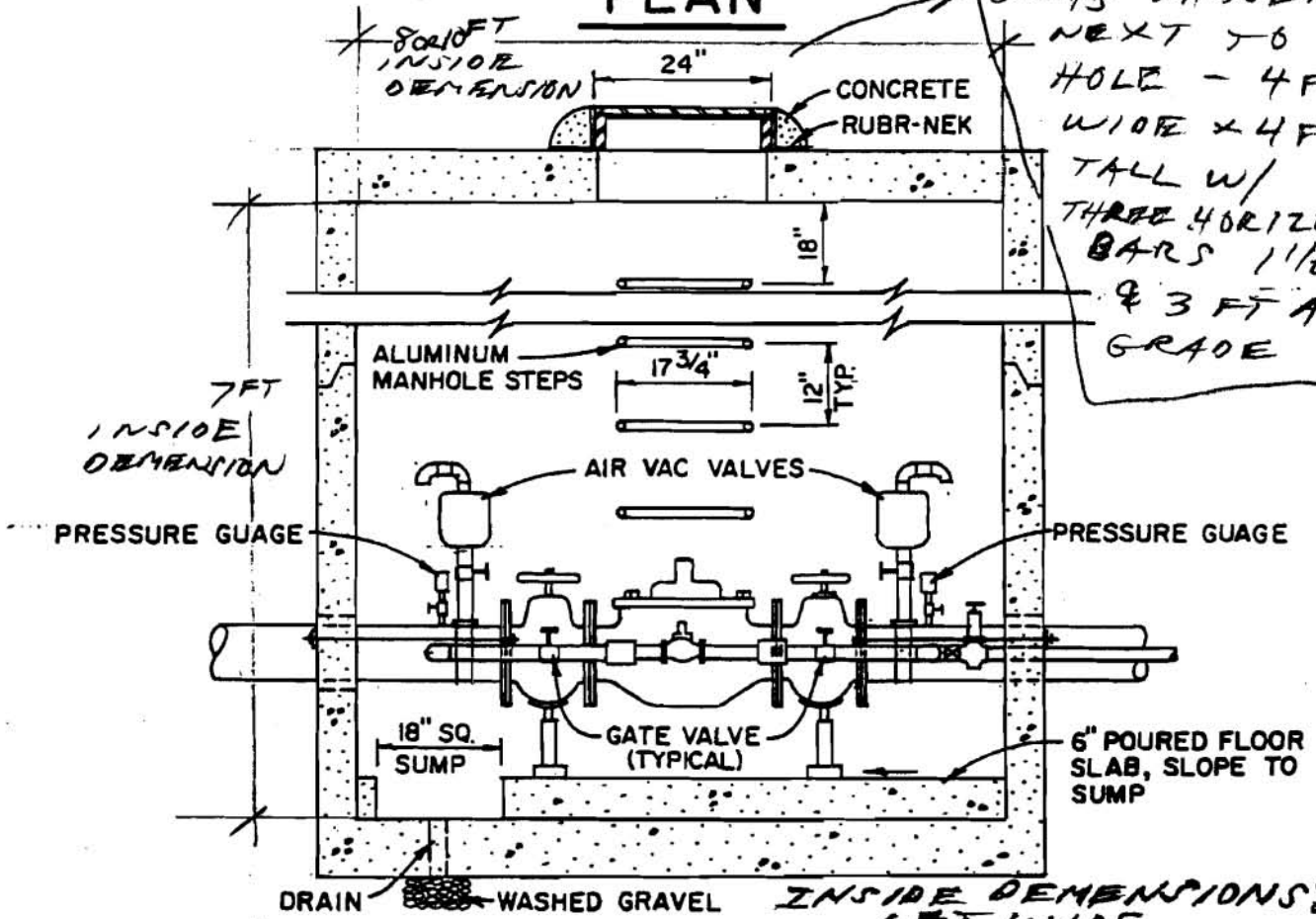
## CONNECTION TO EXISTING MAIN

N.T.S.



**PLAN**

GRAB LADDER  
NEXT TO  
HOLE - 4 FT  
WIDE x 4 FT  
TALL W/  
THREE HORIZONTAL  
BARS 1 1/2 FT  
& 3 FT ABOVE  
GRADE

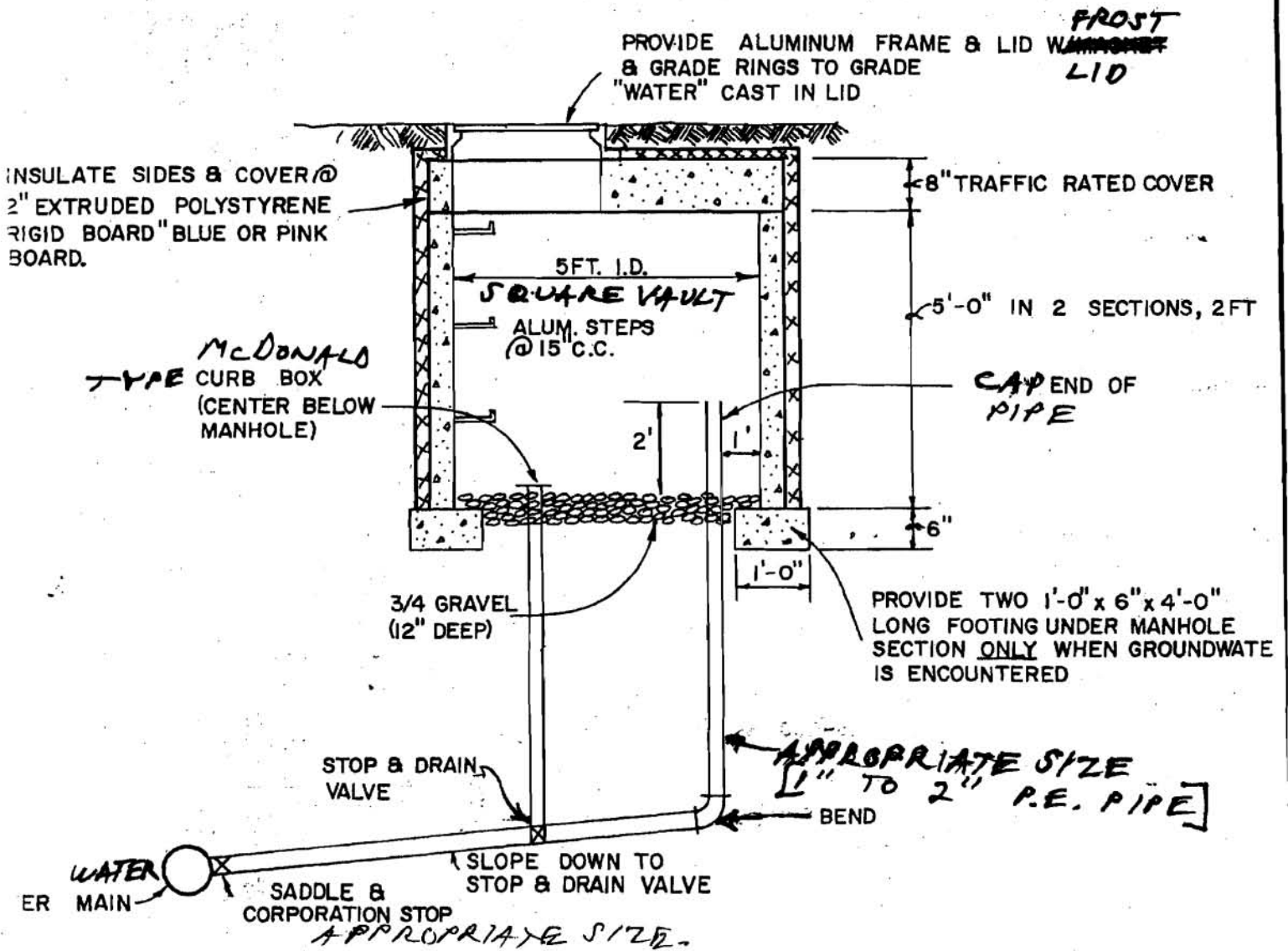


MNF. REF.:  
AM COR # UV2-8080  
6' x 8' x 7'

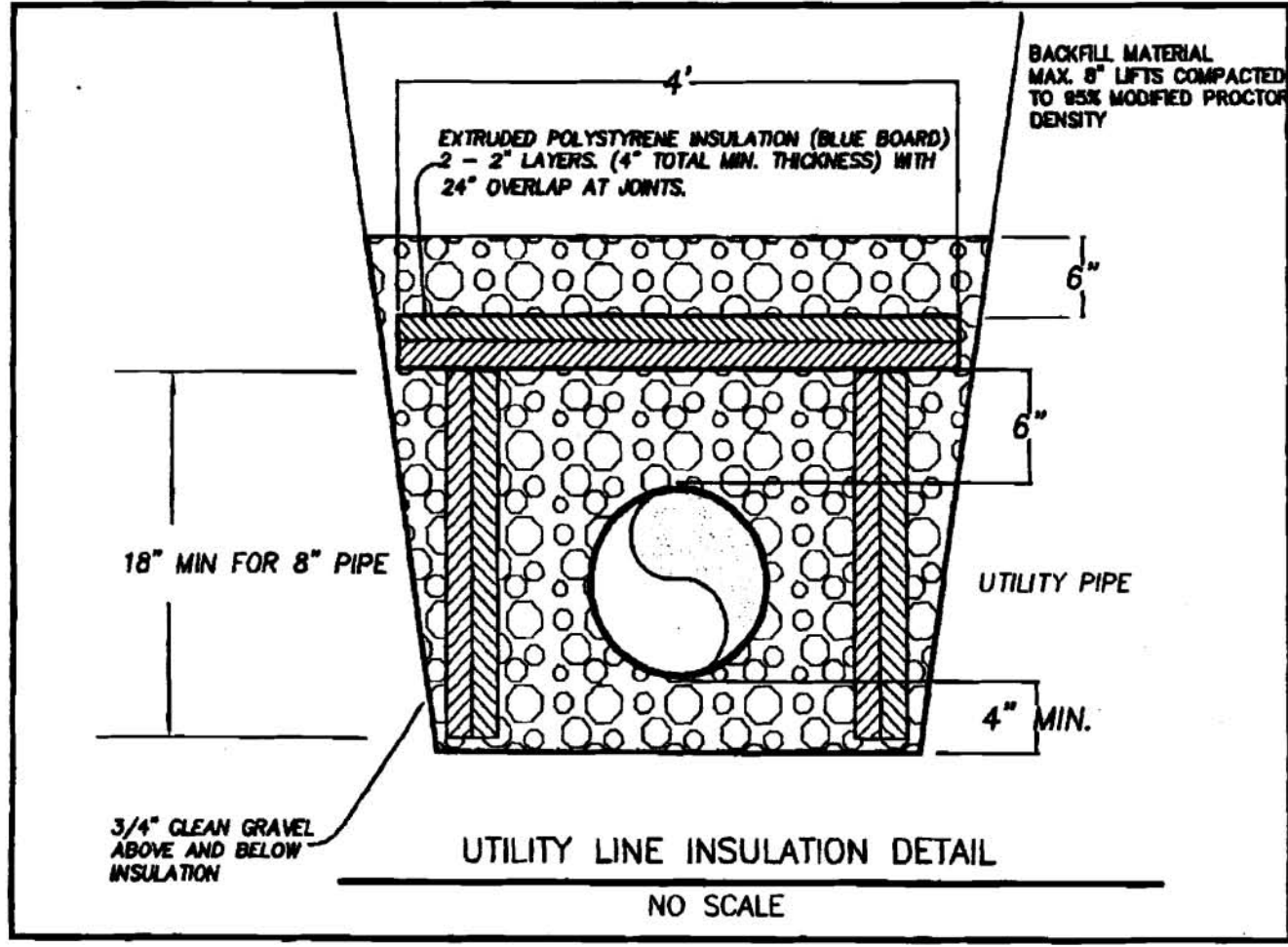
**PRV VAULT**

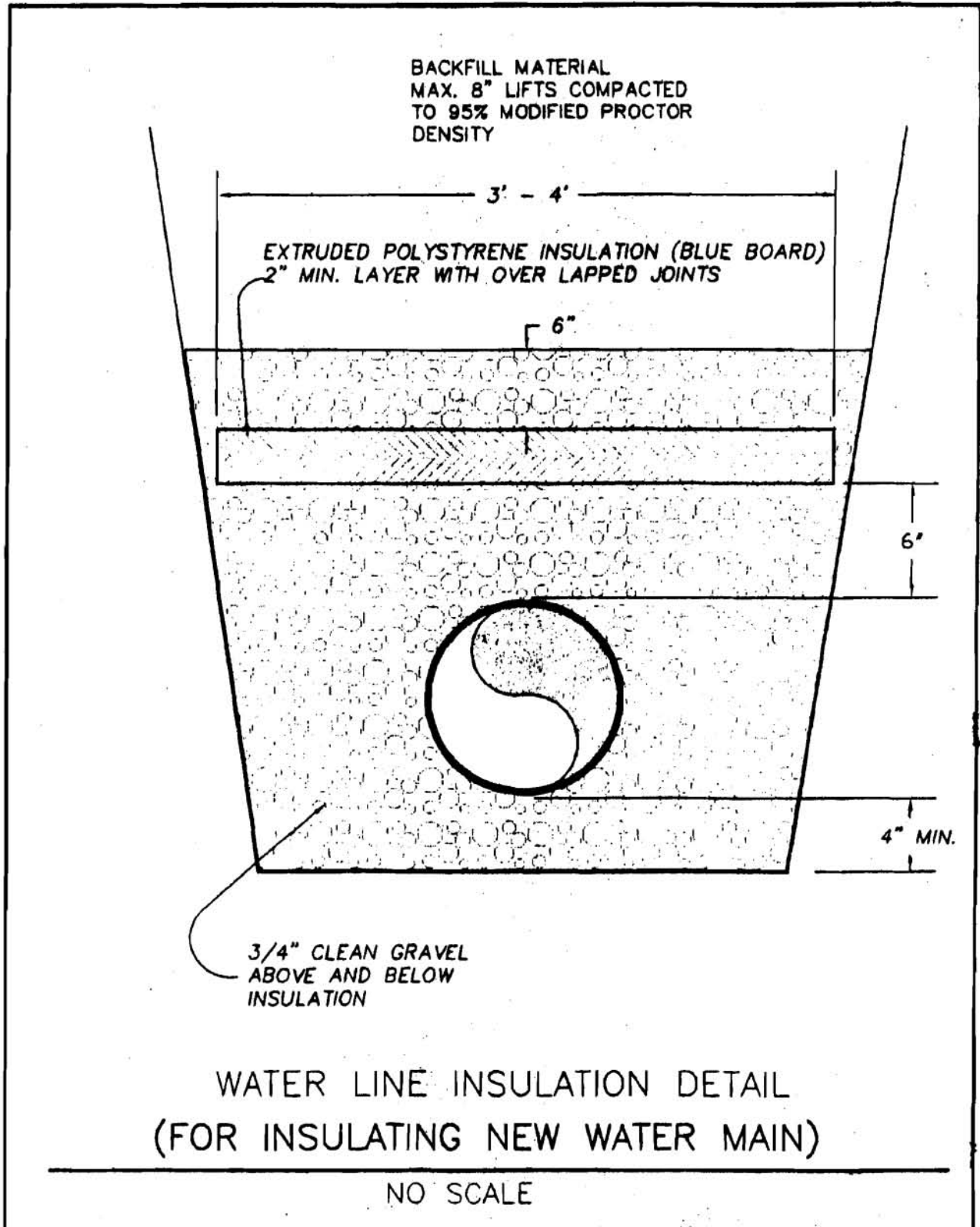
INSIDE DIMENSIONS:  
6 FT WIDE  
8 or 10 FT LONG  
7 FT TALL

REVISED  
4/95

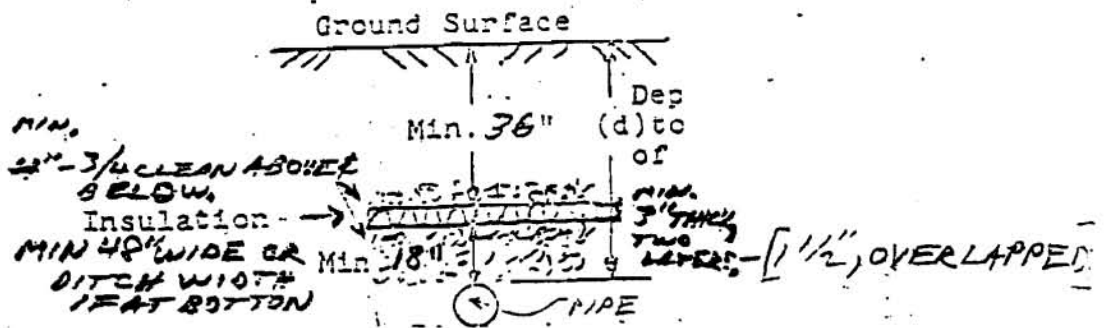


## SPRINKLER VAULT DETAIL





TYPICAL INSULATION - EXISTING PIPES  
DETAIL ABOVE PIPES

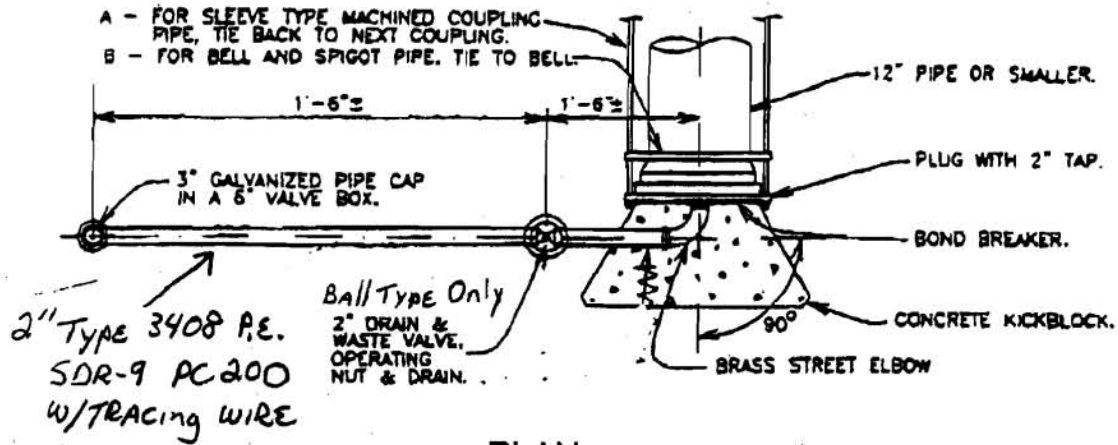


INSULATION SPECIFICATION:  
EXTRUDED POLYSTYRENE (COMMONLY  
REFERRED TO AS "BLUE BOARD" OR "PINK BOARD")

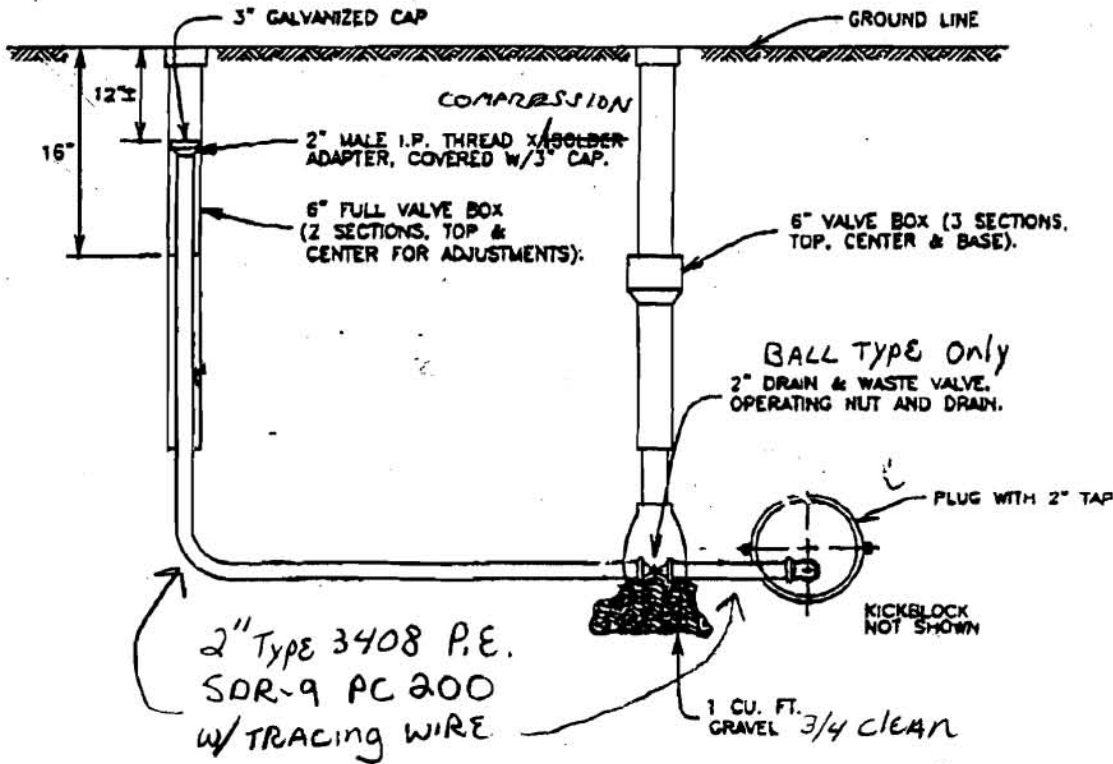


**NOTE:**

PLUG SHALL BE MECHANICALLY RESTRAINED:

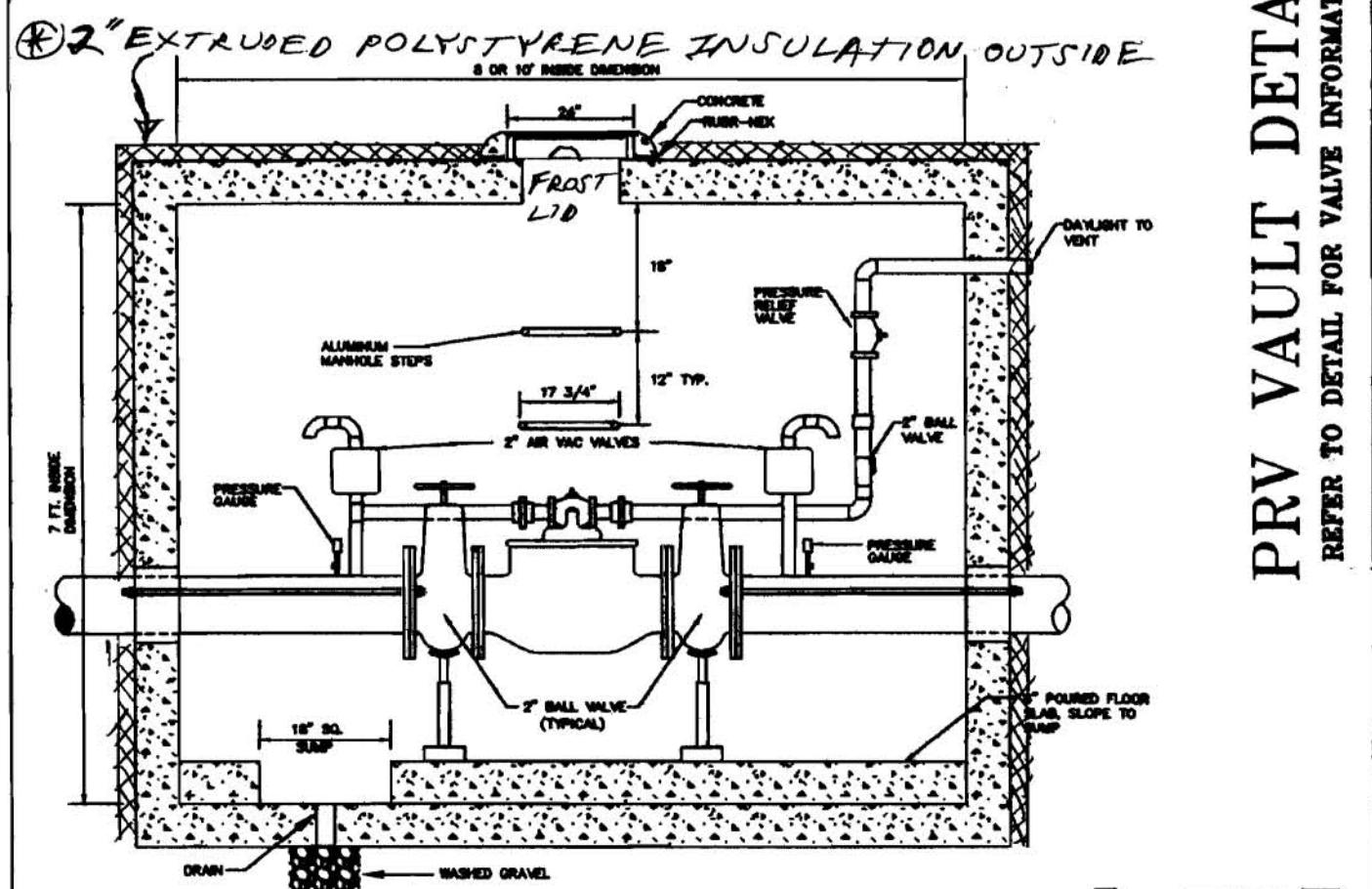
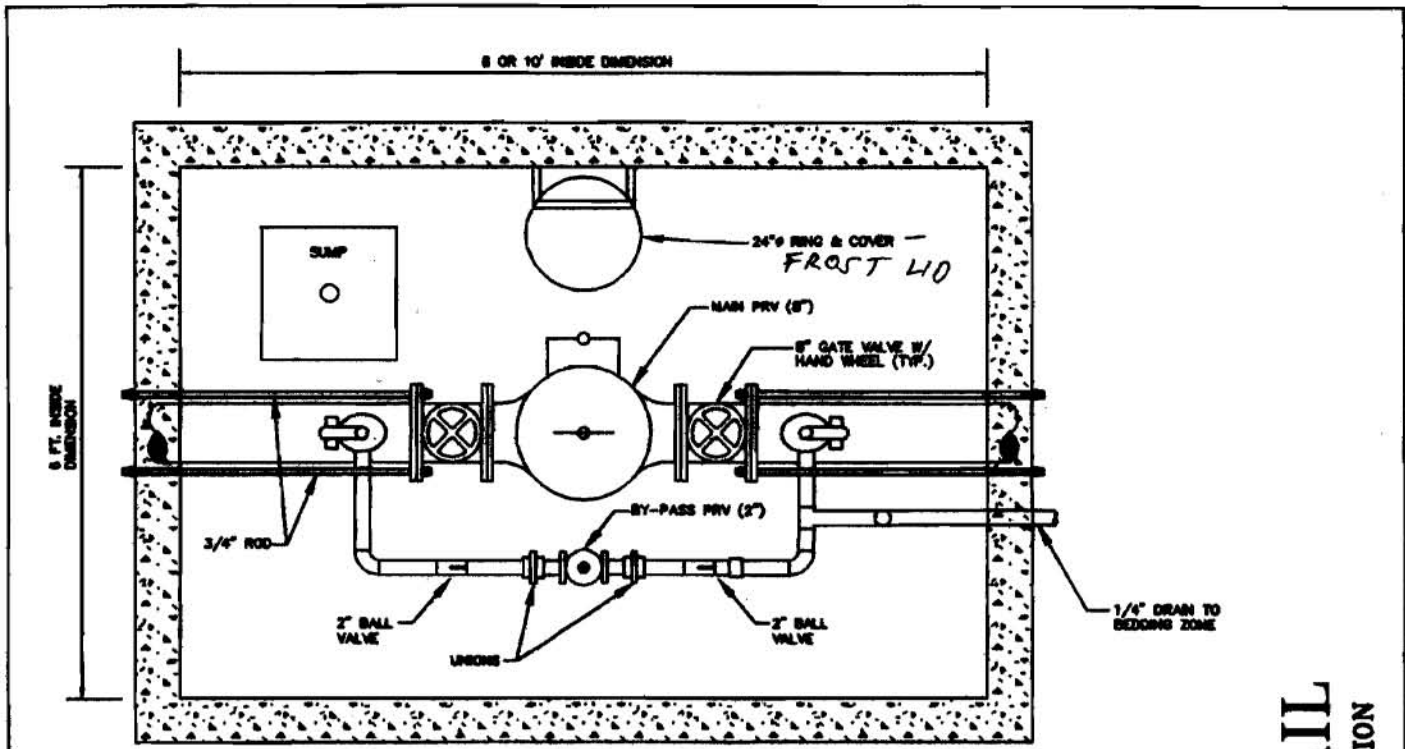


PLAN



ELEVATION

DENVER WATER <small>1000 West 12th Avenue, Denver, CO 80202-1500</small>			
<b>BLOW-OFF INSTALLATION FOR 12" AND SMALLER PIPE</b>			
SCALE: <u>  NONE  </u>	DATE: <u>  JUNE 1995  </u>		
DRN: <u>  C.B.B.  </u>	TR: <u>          </u>	CK: <u>  R.D.C.  </u>	
APP: <u>  M. Bennett  </u>	DR: <u>  127  </u>	No: <u>  35  </u>	

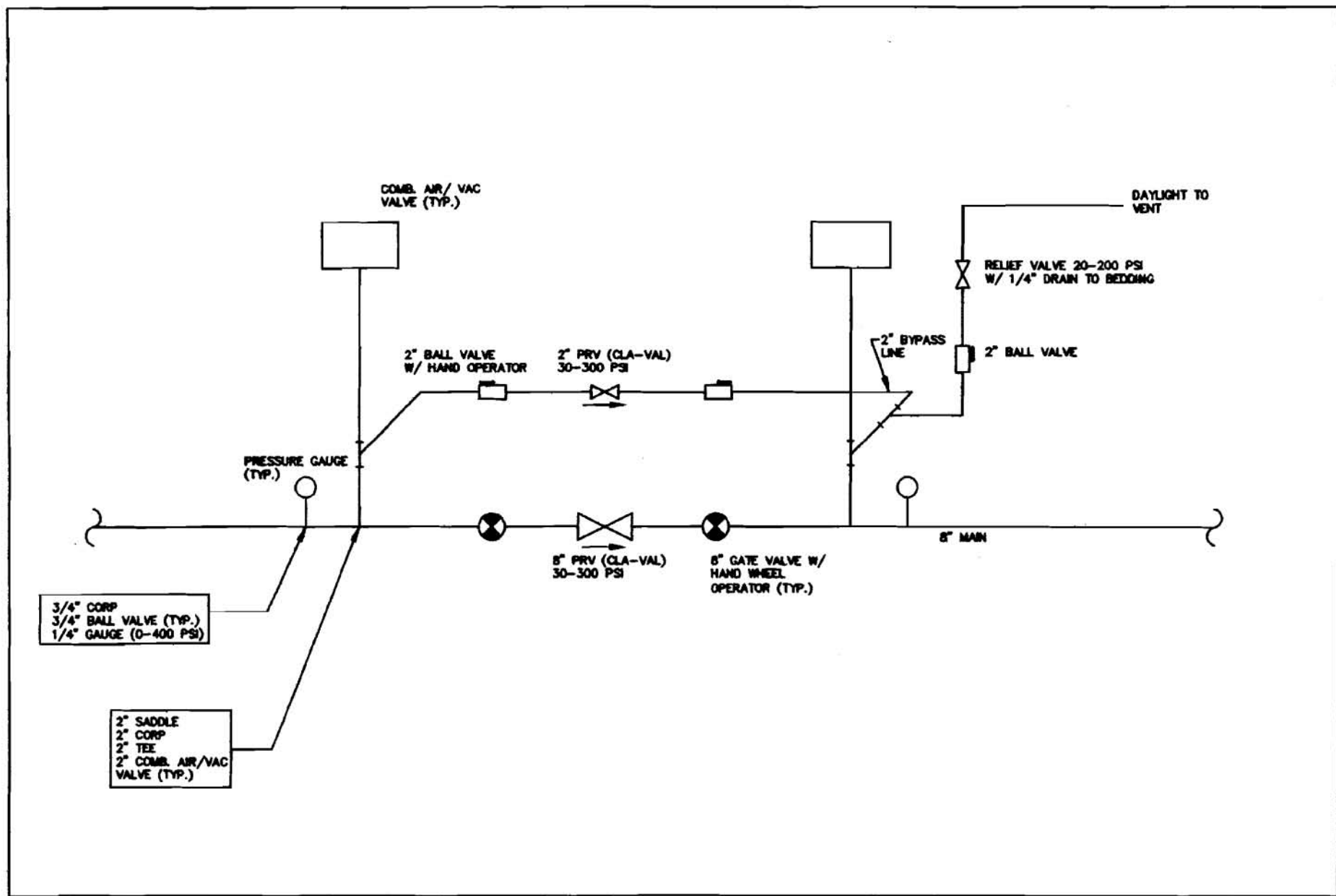


**PRV VAULT DETAIL**  
 REFER TO DETAIL FOR VALVE INFORMATION

CONCRETE VAULT:  
 \*MFG REF: AMCOR #JV2-8080  
 \*DIMENSIONS: 6'x8'x7' (INSIDE)

\* BLUE BOARD OR PINK BOARD

**AEI**  
 BOARDWALK MFG. UNIT 6 P.O. BOX 4688  
 FRENCO, COLORADO 80445  
 (878) 688-2124 FAX (878) 688-2170



PRV VALVE DETAIL