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# Missoula Water Standard Specifications



Missoula Water

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# Section 1 – General Requirements

These specifications are the latest adopted by Missoula Water. The specifications are to be used in conjunction with Missoula Water detail drawings as well as Department of Environmental Quality (DEQ) and American Water Works Association (AWWA) standards for the design and installation of water works facilities.

The specifications and detail drawings shall be made a part of the contract documents for construction of water mains and/or other appurtenances.

Any reference to an AWWA standard contained within these Specifications implies the latest edition of the standard. All contract documents must be completed and signed prior to the beginning of any construction.

## 1.1 Field Engineering

Prior to disturbing any existing street monuments, Contractor shall contact the County or other responsible party with sufficient time to allow them to document the location(s). Contractor shall also inform them when the monuments can be reset.

Contractor shall use a licensed land surveyor to replace all property corners or other monuments that are destroyed by the work.

## 1.2 Submittals

Contractor shall submit Shop Drawings for all products to be used on the project to the Engineer for review and approval prior to the start of construction. Data shown on the Shop Drawings shall be complete with respect to quantities, dimensions, specified performance and design criteria, materials, and similar data to show Engineer the services, materials, and equipment the Contractor proposes to provide. Any substitutions to previously approved items shall be submitted to the Engineer for review and approval.

## 1.3 Traffic Control

All traffic control devices must meet the requirements of the latest editions of the “Manual of Uniform Traffic Control Devices” and the “Traffic Control Devices Handbook.”

### 1.3.1 Barricades and Lights

All barricades, signs, and lights, and other protective devices shall be installed and maintained in conformity with applicable statutory requirements, and where located in railroad and highway rights-of-way, as required by the authorities having jurisdiction.

All public thoroughfares, which are closed to traffic, shall be protected by means of effective barricades on which shall be placed acceptable warning signs.

All open trenches and other excavations shall be provided with suitable barriers, chain link fencing, signs, and lights to the extent that adequate protection is provided to the public. Obstructions, such as material piles and equipment, shall be provided with similar warning signs and lights.

Materials stored upon or alongside public streets and highways shall be so placed, and the work at all times shall be so conducted as to cause the minimum obstruction and inconvenience to the traveling public.

### 1.3.2 Maintenance of Traffic

The contractor will conduct work so as to interfere as little as possible with public travel, whether vehicular or pedestrian. Whenever it is necessary to cross, obstruct, or close roads, driveways, and walks, whether public or private, detours or other temporary expedients shall be set for the accommodation of public and private travel. The contractor shall give reasonable notice to owners of

public drives before interfering with them. Such maintenance of traffic will not be required when the contractor has obtained permission from the owner and tenant of private property, or from the authority having jurisdiction over public property involved to obstruct traffic at the designated point.

### **1.3.3 Traffic Control Plans**

All traffic control plans must be submitted to and approved by the City or County, whichever has jurisdiction over the public property located within the project, prior to the start of construction. A copy of the approved traffic control plan shall be submitted to Missoula Water. No work shall be performed until the approved traffic control plan has been executed at the site.

## **1.4 Backflow/Cross Connection**

There shall be no connection between the potable water system and pipes, pumps, hydrants, tanks, or other appurtenances owned by the water user whereby other water sources or other materials can be directly or indirectly introduced into the potable water system. It shall be the responsibility of the customer or contractor to install the proper backflow prevention assembly on all potable water lines as required by the Administrative Rules of Montana (ARM), the Uniform Plumbing Code, the Montana Department of Environmental Quality, and the Missoula Water Backflow Prevention Program. It is also the responsibility of the customer to contact Missoula Water for information regarding the proper type of backflow assembly to address specific backflow hazards as well as the installation requirements for each type of assembly.

No main connections or taps will be allowed until the proper backflow assembly has been installed and inspected by Missoula Water.

State law requires on any property on which there is a source of water other than the potable supply, all potable lines must be equipped with an approved and properly installed reduced pressure principle backflow prevention assembly (RPBA) even if there are not cross-connections between the potable supply and the auxiliary supply.

Contact Missoula Water for assembly installation specifications and approved assembly information.

All new commercial connections and any service line connected to a frost free hydrant or stop and waste valve must be equipped with appropriate backflow preventers in accordance with Missoula Water's current backflow requirements. Each backflow prevention assembly must be tested by a licensed and approved Backflow Assembly Tester within ten days of being put into service as required by the ARM. All backflow prevention assemblies on premises serving customers must be tested at least annually and any time they are taken out of service for any reason.

## **1.5 Construction Water**

Missoula Water has designated certain hydrants in the water system for use for construction water. Contact Missoula Water for a current list of hydrants available for use and instructions on setting up a construction water account.

Construction water will be provided on a case by case basis and must be prearranged with Missoula Water prior to use. Metering and backflow protection will also be required to be in place prior to any construction water use.

For contractor convenience, a fill station may be installed on or near the project site provided all metering and backflow requirements have been met.

## **1.6 Permits**

Necessary permits shall be obtained from the City or County of Missoula and/or the Montana Department of Transportation for construction of all projects. The obtainment and cost of these permits shall be the responsibility of the contractor.

Contractor is also responsible for meeting all asphalt requirements of the City, County, and/or State to include all penalties and/or assessments applicable to a given project. The costs of these requirements, penalties, and/or assessments shall be the responsibility of the Contractor.

## **1.7 Change Orders**

All changes during construction shall be approved by Missoula Water by change order. Whenever feasible, change orders shall be approved prior to the work being done.

## **1.8 Tie-ins to Existing System**

It is imperative that all connections to Missoula Water's existing system be performed in an efficient and timely manner with minimal interruption to existing customers. All tie-ins to the existing system will be overseen by Missoula Water personnel.

### **1.8.1 Operation of Existing Facilities**

All operation of existing system valves shall be performed by Missoula Water employees unless otherwise previously arranged.

### **1.8.2 Taps into Existing System**

All taps necessary to tie-in to Missoula Water's existing system will be performed by Missoula Water personnel unless otherwise previously arranged. The contractor is responsible for providing a job site that meets all local, state, and federal laws, statutes, and regulations. A properly sloped trench or a trench box with adequate room to complete the tap is required.

### **1.8.3 Cathodic Protection**

Cathodic protection shall be provided using 32 pound magnesium anodes cad-welded to the main anytime an existing steel main is exposed. Unless otherwise noted, a single anode jumpered across a new connection is sufficient for tie-ins to existing mains.

### **1.8.4 Notification**

A minimum of 24 hours' notice for residential customers and 48 hours for commercial customers shall be required prior to any disruption of water service except in emergency circumstances. Notification of customers shall be coordinated with Missoula Water personnel.

### **1.8.5 Pipe Materials Containing Asbestos**

All activities involving asbestos cement (AC) pipe, related fixtures containing asbestos pipe materials and steel pipe with lining containing asbestos shall be performed in accordance with all Local, State, and Federal regulations. A licensed, bonded and accredited in Montana asbestos abatement contractor shall be used to perform the required work including the transport and disposal of any asbestos-containing waste materials.

## **1.9 Construction Photographs**

At a minimum, construction photos shall be taken at all fittings and valves. Photos shall be taken before the fitting is wrapped to create a record of the connections and after the tie downs and thrust blocks are in place for future reference as to size and construction. Additional photos shall be taken as necessary to document

construction. Photos shall be clearly annotated for future identification of location and orientation using a whiteboard, noting the date, station and items(s) pictured.

### 1.10 Temporary Water

Under no circumstances shall temporary water be provided to a customer through another customer’s connection, a fire hydrant, or other means unless specifically approved by Missoula Water Quality personnel. Bottled water shall be provided in the event a customer will be out of water for an extended period of time.

Should a temporary water system be necessary for construction or other purposes, it shall be tapped directly to an existing Missoula Water main, equipped with backflow, disinfected, tested for bacteriologic contaminants in accordance with Section 4 of these Specifications, and pressure tested as approved by Missoula Water Quality personnel and in accordance with all applicable DEQ standards including DEQ 1, Section 8.15, Temporary Water Distribution. No such systems shall be provided without prior approval by Missoula Water.

## Section 2 – Excavation, Trenching, & Backfilling

For all excavation, trenching, and backfilling activities, contractor shall strictly adhere to the most current OSHA requirements.

### 2.1 Products

#### 2.1.1 Bedding Materials

Unless otherwise shown on the drawings, pipe bedding material shall be placed in a thickness equal to 1/4 x pipe O.D. below the pipe (4 inches minimum) to 6 inches above the pipe. In rock areas, the minimum bedding below the pipe shall be 6 inches. Bedding material shall be clean, non-cohesive, natural, unwashed gravel, sand or crushed hard stone graded as follows:

SIEVE SIZE	PERCENT (%) PASSING
1"	100
#4	40-70
#200	Less than 10

In cases where groundwater is encountered at the trench bottom, the embedment material shall be washed, crushed rock passing a 1-inch screen. All pipe bedding material shall be imported, meeting the above specifications.

Native trench material shall not be used for pipe bedding material.

Bedding material shall be compacted to 95% of theoretical maximum proctor density as determined by AASHTO T-99.

Special pipe embedment may be required when shown on the drawings. Washed rock may be used as support bedding for groups of fittings when deemed necessary by the inspector representing Missoula Water.

#### 2.1.2 Trench Backfill Material

Unless otherwise shown on the drawings, trench backfill material shall be excavated material or imported material as required to meet compaction requirements. Large stones may be placed in the remaining trench backfill of non-compacted areas only if well separated so that no interference with backfill settlement will result.

### **2.1.3 Flowable Fill**

Flowable fill may be required under certain circumstances as called out on specific project plans or as requested by the engineer representing Missoula Water. If used, flowable fill shall meet the requirements of Montana Public Works Standard Specifications Section 02225, Flowable Fill.

## **2.2 Excavation**

All excavations shall be performed to the elevations indicated on the drawings or as specified herein. During excavation, material suitable for back-filling shall be piled in an orderly manner a sufficient distance from the banks of the trench to avoid overloading and to prevent slides or cave-ins. All excavated materials not required or not suitable for backfill shall be removed from the trench area and disposed of where shown on the drawings or as directed. Excavated materials shall be piled on the opposite side of the trench with respect to property corners and control stakes.

### **2.2.1 Trench Excavation**

Trenches shall be of the necessary width for proper laying of the water line. Except as hereinafter specified for wet or otherwise unstable material, over depths shall be backfilled and compacted with materials specified for special bedding around the pipe. Whenever wet or otherwise unstable material that is incapable of properly supporting the pipe is encountered in the bottom of the trench, such material shall be over excavated to a depth to allow for construction of stable pipe bedding.

The width of the trench at and below the top of the pipe shall be such that the clear space between the barrel of the pipe and the trench wall will be limited to the minimum required for proper pipe installation.

### **2.2.2 Excavation for Appurtenances**

Excavation for manholes, valve pits, or similar structures shall be sufficient to leave ample room for work activities. Any over depth excavation below specified grade shall be refilled with select material specified in Section 2.1.a and compacted to 95% of maximum density.

## **2.3 Existing Underground Utilities and Structures**

Pipe lines and other existing underground installations and structures in the vicinity of the work to be done hereunder are indicated on the plans according to information available to Missoula Water. Pre-construction locations shall be the responsibility of the contractor. The Contractor shall be responsible for all damage to substructure whether shown or not. Contractor shall verify the location of all utilities before commencing the job.

All utilities, when encountered, shall be supported, shored, and protected wherever exposed in the trench or other excavation. Any existing utility which is damaged during excavation shall be immediately repaired by the Contractor or utility company.

## **2.4 Removal of Water**

The contractor shall provide and maintain adequate dewatering equipment to remove and dispose of all surface and ground water entering excavations, trenches or other parts of the work. Each excavation shall be kept dry during subgrade preparation and continually thereafter until the structure to be built, or the pipe to be installed therein, is completed and backfilled to the extent that no damage from hydrostatic pressure, flotation, contamination or other cause will result.

All excavations for concrete structures or pipelines, which extend down to or below static ground water elevations, shall be dewatered by lowering and maintaining the ground water surface at the bottom of the excavation.

Surface water shall be diverted or otherwise prevented from entering excavated areas or trenches to the greatest extent practicable without causing damage to adjacent property.

## **2.5 Open Trenches**

The contractor shall not open more trench in advance of pipe laying than is necessary to expedite the work. Any trenches left open for an extended period of time shall be protected in accordance with Section 1.3.

Except where tunneling is shown on the plans, is specified, or is permitted by the Engineer, all trench excavations shall be open cut from the surface.

## **2.6 Excavation Protection**

Contractor shall take the following precautions to protect all excavations:

- Maintain excavations and warning barricades at all times to guard against and prevent injury to employees and the public in accordance with appropriate safety practices for utilities construction.
- Prevent accumulation of water in excavated area.
- Complete construction and backfill without delay.
- Do not proceed with excavations unless materials are on hand for immediate installation.

## **2.7 Rights-of-Way**

The contractor shall confine construction operations to the limits of the rights-of-way shown on the plans, and shall use due care in placing construction tools, equipment, excavated materials, and pipe line materials and supplies, so as to cause the least possible damage to property and interference with traffic.

Rights-of-way across private property will be as indicated on the plans. When necessary the boundaries of rights-of-way across private property will be marked with stakes set by the Engineer for the subdivision. The stakes shall be protected and maintained until backfilling and clean-up have been completed.

If it is necessary or desirable that the contractor use land outside of the right-of-way, the contractor shall obtain consent from, and shall execute a written agreement with, the owner/tenant of the land. The contractor shall not enter for pipe delivery or occupy for any other purposes with people, tools, equipment, construction materials, or with material excavated from the pipe trench, any private property outside the designated right-of-way boundaries without permission from the owner or tenant.

## **2.8 Fences**

All existing fences which interfere with the construction operations shall be maintained by the contractor until the completion of the work affected thereby unless written permission is obtained from the owner thereof to leave an interfering fence dismantled for an agreed period of time. Where fences must be maintained across the right-of-way, adequate gates shall be installed. Gates shall be kept closed and locked at all times when not in use.

On completion of the work across any tract of land, the contractor shall restore all fences to their original or better condition.

## **2.9 Trench Backfilling**

Trenches shall not be backfilled until all systems have been installed per specifications and have been approved for backfilling by the Engineer.

Bedding material as specified in Section 2.1.a shall be placed and compacted as required by this Section and Section 2.10. Excavations for pipe bells and fittings will be required to assure proper bedding of all pipe and fittings.

The remainder of the trench shall be backfilled in accordance with Section 2.1.b of these specifications.

Backfill around structures (i.e. manholes, valve boxes, etc.) shall be to the density as required in Section 2.10.c. No rock or stone larger than 8 inches in maximum dimension shall be placed within 2 feet of the structure.

### **2.9.1 Buried Warning Tape**

Contractor shall bury warning tape with all pipeline and service lines. Tape shall be 3 inches wide, blue, marked "Caution Water Line Buried Below" and shall be placed directly over the pipeline 18 inches below the finished surface. Warning tape shall not be required for any lines that are tunneled or pushed beneath roadways.

### **2.9.2 Trace Wire**

Contractor shall bury trace wire with all pipeline and service lines. Trace wire shall be at minimum #14 solid copper direct bury wire and shall be blue color. Trace wire shall be taped to the top center of the pipeline prior to backfilling. Trace wire connections will be made by twisting the wires, installing a silicone-filled water resistant wire nut, and wrapping the connection with electrical tape. Trace wire shall be brought to the surface at each valve or other appurtenance that is at the ground surface. Small diameter PVC conduit shall be used in valve boxes to house the trace wire brought to the surface.

Where new water service line transitions to existing galvanized service line, the new tracer wire should be attached to the galvanized pipe using a Christy's or approved equal UL approved bronze grounding clamp suitable for direct burial.

## **2.10 Soil Compaction**

Soil compaction shall be performed in accordance with the specifications outlined in this section and in accordance with the requirements of the City, County, or other entity having jurisdiction in the project area.

### **2.10.1 Pipe Bedding**

Bedding material shall be placed to the centerline of the pipe and hand-tamped under haunches. Then, from the centerline of the pipe to a depth of 6 inches above the top of the pipe, the bedding material shall be placed in one lift to prevent pipe displacement. Compact to 95% maximum soil density as determined by AASHTO-T-99.

### **2.10.2 Main Trench**

Place in layers and compact to 95% maximum soil density as determined by AASHTO-T-99. Compacted backfill shall be placed and leveled in 12 inch maximum lifts. Thinner lifts shall be used if necessary to obtain the required compaction. Compacted backfill shall have moisture content within +/- 3% of optimum moisture. Deeper lifts may be allowed if Contractor can demonstrate that required compaction is being obtained.

### **2.10.3 Backfill of Appurtenances**

Backfill around structures shall be compacted to 95% maximum soil density as determined by AASHTO-T-99 by tamping or other means approved by the Engineer. Material for backfill shall be as specified under Section 2.9.

#### **2.10.4 Testing**

Compaction testing shall be performed at intervals not greater than 200 feet and at varying depths where practicable or as required by the City, County, or other entity having jurisdiction in the area. Compaction testing shall also be performed around appurtenances such as at valve clusters.

Unless otherwise specified in the bid package, initial testing shall be paid for by the Owner. In the event testing results are unsatisfactory, Contractor shall, at his own expense, correct the deficient areas and re-test until satisfactory results are achieved.

## **Section 3 – Waterline & Appurtenances**

All materials shall be new and shall be supplied by the contractor unless otherwise arranged. Where lead free components are commercially available, all materials used in the installation or repair of the water system shall be lead free (not more than 0.25% lead). Service saddles and valves over 2 inches are not subject to the lead free requirement.

### **3.1 Mains**

#### **3.1.1 Products**

All pipe shall be Class 350 Ductile Iron Pipe in accordance with AWWA C150 and C-151, unless otherwise directed by the Engineer with approval by Missoula Water. The interior of the pipe shall be cement mortar lined in accordance with AWWA C104. The outside coating shall be bituminous coating in accordance with AWWA C151 or in accordance with the most current AWWA standard.

All Ductile Iron Pipe shall be encased in 8 mil polyethylene wrap in accordance with AWWA C105 and manufacturer's recommendations. The polyethylene encasement shall prevent contact between the pipe and the surrounding backfill and bedding material, but it is not intended to be a completely airtight or watertight enclosure. Lumps of clay, mud, cinders, etc., on the pipe surface shall be removed prior to installation of the polyethylene wrap. During installation, soil or embedment material shall not be trapped between the pipe and the polyethylene. Cuts, tears, punctures, or other damage to the polyethylene shall be repaired with adhesive tape or with a short length of polyethylene wrapped around the pipe to cover the damaged area and secured in place in accordance with AWWA C105.

Joints may be either rubber ring gasket push-on or mechanical in accordance with AWWA C111. Fittings shall be in accordance with AWWA C110. Fittings shall be coated and encased the same as the pipe. Joints for fittings shall be the same as the pipe.

All mains in residential areas shall be minimum 8 inches diameter and all mains in commercial areas shall be minimum 12 inches diameter unless otherwise approved.

#### **3.1.2 Installation**

Installation shall be in accordance with AWWA C600.

All water lines shall be buried a minimum depth of six feet without specific approval by Missoula Water. If Missoula Water approves shallower bury depths, insulation may be required in accordance with Section 3.1.c. Depth should typically be less than 7.5 feet from finished grade to top of pipe, except where otherwise indicated on the plans. Where water and sewer lines must cross, both shall be installed in accordance with Section 3.1.e.

Where conditions do not permit the required bury minimum of 6 feet, pipe shall be insulated sufficiently to protect against freezing in accordance with the requirements shown on the project plans.

Measures shall be taken during installation to prevent the entrance of contaminants into the water lines.

### **3.1.3 Insulation**

If insulation is required by Missoula Water due to shallow bury depth or close proximity to storm inlets or storm drains, the thickness and type of insulation shall be identified on the plans by the Engineer. The specified insulation shall have a compressive strength of no less than 35 psi if installed in traffic areas.

### **3.1.4 Disinfection and Bacteriological Testing**

Disinfection and bacteriological testing shall be performed in accordance with Section 4 of these specifications.

### **3.1.5 Pressure Testing**

No hydrostatic pressure test will be made against any portion of the system until satisfactory bacteriological sample reports are received. All bacteriological test results for the section of line to be statically tested must be in possession of the Engineer prior to beginning the test. The test must be observed, recorded, and certified by either the project engineer or a representative of Missoula Water.

All pressure testing shall be in accordance with AWWA Standard C600 as follows:

- A. After the pipe has been laid and bacteria testing successfully completed, all newly laid pipe or any valved section of pipe shall be subjected to a hydrostatic pressure of not less than 1.5 times the stated working pressure at the lowest elevation of the test section. The pressure test shall be at least 2 hours in duration.
- B. Pressure testing of all newly laid pipe shall include service lines up to the curb box. The contractor may choose to pressure test the main line prior to connecting the service lines. In this case, a subsequent pressure test will be required to include the service lines up to the curb box.
- C. Test pressures shall:
  - 1) Not exceed the thrust restraint design pressures or 1.5 times the pressure rating of the pipe or joint, whichever is less.
  - 2) Not vary by more than +/- 5 psi.
  - 3) Not exceed the rated working pressure of the valves or hydrants when the pressure boundary of the test section includes closed, resilient-seated gate valves, butterfly valves, or hydrants.
  - 4) Not be less than 1.5 times the stated working pressure at any time during the test. If the test pressure drops below 1.5 times the stated working pressure, the test shall be terminated and re-started at a higher pressure.
- D. Each valved section of pipe shall be filled with water slowly and the specified test pressure, based on the elevation of the lowest point of the line or section under test and corrected to the elevation of the test gauge, shall be applied by means of a pump connected to the pipe in a manner satisfactory to Missoula Water.
- E. Before applying the specified test pressure, air shall be expelled completely from the pipe, valves, and hydrants. If permanent air vents are not located at all high points, the contractor shall install corporation cocks at such points so that the air can be expelled as the line is filled with water. After all air has been expelled, the corporation cocks shall be closed and

the test pressure applied. At the conclusion of the pressure test, the corporation cocks shall be removed and plugged, or left in place at the discretion of the owner.

F. All exposed pipe, fittings, valves, hydrants, and joints shall be examined carefully during the test. Any damaged or defective pipe, fittings, valves, or hydrants that are discovered following the pressure test shall be repaired or replaced with sound material and the test shall be repeated until it is satisfactory Missoula Water.

G. Determination of acceptable leakage rate shall be performed as follows:

1) Leakage shall be defined as the quantity of water that must be supplied into the newly laid pipe, or any valved section thereof, to maintain pressure within 5 psi of the specified test pressure after the air in the pipeline has been expelled and the pipe has been filled with water.

2) Allowable leakage. No pipe installation will be accepted if the leakage is greater than that determined by the following formula:

$$L = \frac{S \times D \times \sqrt{P}}{148,000}$$

in which **L** is the allowable leakage, in gallons per hour; **S** is the length of the pipeline tested, in feet; **D** is the nominal diameter of the pipe, in inches; and **P** is the average test pressure during the leakage test in pounds per square inch.

3) When testing against closed metal seated valves, an additional leakage per closed valve of 0.0078 gallon/hour/inch of nominal valve size shall be allowed.

4) When hydrants are in the test section, the test shall be made against the closed hydrant.

5) Acceptance shall be determined on the basis of allowable leakage. If any test of pipe laid discloses leakage greater than that specified in G.2 of this section, the contractor shall, at his own expense, locate and repair the defective material until the leakage is within the specified allowance.

6) All visible leaks must be repaired regardless of the amount of leakage.

### **3.1.6 Separation of Water and Sewer Lines**

This section covers the horizontal and vertical separation of water mains and all sewer lines. It is the intent of this specification to meet the requirements of the State of Montana.

#### *Horizontal Separation*

Where water and sewer lines are shown to run parallel on the plans they shall be separated by a minimum horizontal distance of ten feet as measured from the edges of the pipe. If the minimum separation cannot be maintained, a deviation request must be approved by DEQ. All installations must be performed in accordance with the conditions set forth in the deviation approval.

#### *Vertical Separation*

Unless otherwise shown on the plans, water mains shall be adjusted in burial depth so as to cross over sewer lines. The bottom of the water main shall be at least 18 inches above the top of the sewer line.

Where burial depth is inadequate over water mains or where it is shown on the plans that the water main must pass below the sewer line, the vertical separation between the top of the water main and the bottom of the sewer line shall be at least 18 inches.

When water or sewer pipe is installed, lengths shall be centered at the point of crossing so as to maximize the distance that all pipe joints are from the crossing. No pipe joints shall be allowed at the point of crossing.

### **3.1.7 Abandonment of Water Lines**

Where existing water lines are to be abandoned in place, contractor shall install a watertight cap or plug.

### **3.1.8 Dead end mains**

All water mains shall be looped where possible. Permanent dead end mains should be less than 500 feet long unless otherwise approved in writing by Missoula Water. All dead end mains shall terminate with a blowoff sized in accordance with Section 3.5 or with a fire hydrant. Automatic flushing devices may be required on long dead ends.

### **3.1.9 Main stubs for future extension**

Water main stubs intended for future extension should include a valve that will allow the new main to be installed without draining mains serving customers. The stub should also include a minimum 10-ft section of pipe downstream of the valve with a blowoff on the end and no services shall be installed between the valve and blowoff. If the isolation valve is not flanged to a tee or cross, the valve should be thrust blocked as described in Section 3.3 and there should be a minimum of 36 feet of restrained pipe adjacent to the end of the stub.

Any tees installed for future extensions should have a minimum of a 5-ft stick of pipe followed by a blowoff. At least two valves shall be installed at the tee, which will allow the future extension to be made without putting customers out of water. No blind flanges or caps are allowed on tees.

## **3.2 Fittings/Bends**

### **3.2.1 Deflection at Fittings and Couplings**

Deflections at couplings shall not exceed 60% of the pipe manufacturer's recommendations. Install bends and other fittings as may be required.

### **3.2.2 Thrust Restraint**

Thrust restraint shall be required at all changes in direction as at tees and bends (greater than 11.25 degree), changes in size (at reducers), stops and dead ends. Thrust restraint shall consist of restrained joints and thrust blocking at all valves and fittings unless otherwise specified. Refer to the Missoula Water Standard Detail Drawings.

Thrust blocking shall be in accordance with design criteria contained herein and in accordance with other approved pipe manufacturer's recommendations.

Concrete thrust blocks in accordance with Section 03310 – Structural Concrete of the latest edition of the Montana Public Works Standard Specifications must be used unless otherwise specified. Steel tie backs and welds must be in accordance with pipe manufacturer's recommendations and approved by the Engineer. All thrust restraint must be approved by the Engineer prior to backfilling.

## **3.3 Valves**

All valves shall be installed in accordance with the manufacturer's recommendations and as shown in the Missoula Water Standard Drawings. Valves shall be flanged, mechanical joint, or a combination thereof as specified for the particular application. Valve spacing shall be a maximum of 800-feet in residential areas and 500-ft in commercial and industrial areas. Valves shall also be placed near the end of mains planned for

extension in the near future (i.e. at phase boundaries in multi-phased developments), such that no customers are out of water when the main is extended.

### **3.3.1 Gate Valves**

Gate valves shall be used for applications 10 inches and smaller and 12-inch gate valves may also be used. Valves shall be rated for 350 psig maximum working pressure. Mueller or AVK Resilient Wedge gate valve or approved equal shall be used and shall meet or exceed AWWA C509.

### **3.3.2 Butterfly Valves**

Butterfly valves shall be used for applications 12 inches and larger, although 12-inch gate valves will also be accepted. Valves shall be rated for 250 psig maximum working pressure. Mueller Lineseal XP11, AVK, or approved equal butterfly valves shall be used and shall meet or exceed AWWA C504.

### **3.3.3 Valve Boxes**

Valve boxes shall be cast iron, adjustable stem, marked with word "WATER" on lid. All valve boxes shall be 3 piece, screw type with 5-1/4 inch shaft compatible with the valve and shall not rest on the pipe. All boxes shall be set plumb and to the finish grade of surrounding material.

### **3.3.4 Thrust Restraint**

All valves 4 inches and greater shall be tied down in accordance with the Missoula Water Standard Drawings and Section 3.2.b of these specifications unless they are flanged to a tee or cross connected to branch piping in at least two directions. Each piping branch must be at least 18 feet from the tee or cross to the first unrestrained joint.

## **3.4 Fire Hydrants**

### **3.4.1 Fire Hydrant Assembly**

Fire hydrants shall be Mueller Super-Centurion or newer, AVK, or approved equal meeting all requirements of AWWA Standard C502 and as follows:

- A. Valve opening shall be minimum 5-1/4 inches.
- B. Hydrant shall be three-way with two 2-1/2 inch hose nozzles (National Standard Thread) and one 4-1/2 inch pumper nozzle (National Standard Thread).
- C. Pumper nozzle shall be equipped with a Storz adapter as shown in the Standard Drawings.
- D. Hydrants shall have 1-1/2 inch pentagon operating nut, opening left.
- E. Flanged or mechanical joint inlet connection shall be 6 inches diameter or greater.
- F. The hydrant shall be of the breakaway type so that in case of barrel breakage, the main valve will remain closed.
- G. Fire hydrants shall be painted yellow.
- H. The hydrant assembly shall be rated for for working pressure 250 psig.
- I. Hydrant bury depths should be called out on plan and profile drawings by the engineer.

### **3.4.2 Fire Hydrant Valve**

Gate valves with approved manufactured boxes shall be in accordance with Section 3.3. Valves will be Mueller resilient-seat gate valves or approved equal; flanged, mechanical joint, or a combination thereof as specified for the particular application.

### 3.4.3 Fire Hydrant Lead Pipe

Lead pipe shall be Class 350 Ductile Iron Pipe meeting all pertinent provisions of Section 3.1. Electrical continuity shall be maintained from the water main to the hydrant with trace wire in accordance with Section 2.9.b. Trace wire shall be brought to the surface at the hydrant. No unrestrained joints shall be allowed on a hydrant lead pipe.

### 3.4.4 Fire Hydrant Installation

Fire hydrants shall be installed in accordance with the manufacturer's recommendations and as shown on the Missoula Water Standard Detail Drawings and in accordance with the current regulations of the City, County, or other Fire Department having jurisdiction.

The hydrant shall be positioned with the bury line on the hydrant set to finished grade with a minimum bury at 6 feet. Contractor is responsible for providing a hydrant of appropriate barrel length and installing the hydrant to final grade.

Bends may be used to get the fire hydrant to finished grade. **Hydrant extensions are to be avoided and will only be allowed with written permission of Missoula Water** In the event the hydrant is installed below finished grade. If allowed, Missoula Water personnel will install an extension as necessary at the cost of the Contractor.. Fire hydrants shall be installed plumb.

Fire hydrants shall be located in the street right-of-way as shown on the plans unless otherwise specified.

No fire hydrant shall be set in a concrete sidewalk or concrete curbing unless specifically indicated on the project plans. Unless conditions otherwise dictate, hydrants shall be a minimum of 2 feet behind curb, sidewalk, or edge of asphalt.

Valves and boxes shall be installed in accordance with Section 3.3 and shall be a minimum of 3 feet from the hydrant.

Lead pipe shall be installed in accordance with Section 3.1. Pipe shall be sized to assure minimum flow loss to the hydrant.

## 3.5 Blow-offs

Blow-offs shall be installed at the end of each dead end main to allow for proper flushing and maintenance both during and after installation.

Blow-offs shall be installed flush with finished grade in accessible locations that provide adequate drainage for flushing. A minimum of 5 feet shall be maintained between the blow-off and other system appurtenances including, but not limited to, tees, valves and service taps. A minimum of 5 feet shall also be maintained between blow-offs and any concrete curbs and sidewalks.

Blow-off valves shall be Mueller A-2360 resilient wedge gate valve THD x THD with a 2 inch operating nut or approved equal. Valves shall meet or exceed AWWA C509.

Blow-offs shall be sized as shown in the Table 1 to achieve the minimum flushing requirements of 3 ft/sec.

Table 1 – Blow-off size required to achieve minimum flushing requirements

Pipe Diameter (inches)	Size of Blow-off (inches)*
8	3
10	3
12	3
14	4
16	4
20	6
24	6
30	8

\*Based on pressure of 80 psi in main

### 3.6 Manual Air-Relief Valves

Manual air-relief valves shall be installed at all apparent high points along a newly installed water main and in any location during repairs or other activities where an apparent high point has been created.

Manual air-relief valves shall be Mueller A-2360 resilient wedge gate valve THD x THD with a 2 inch operating nut or approved equal. Tap shall be made directly on top of the pipe for maximum air release.

### 3.7 Service Taps

#### 3.7.1 Tapping Saddles

All tapping saddles shall be C.C. thread, stainless steel. The following tapping saddles or approved equal are approved for installation:

OD Steel Pipe	ROMAC – 101NS Style SMITH BLAIR - 315
Ductile Iron Pipe	ROMAC – 101NS Style FORD – FC101 Style SMITH BLAIR - 315
PVC C900 Pipe	ROMAC – 202NS Style FORD – FC202 Style SMITH BLAIR - 397

Before a tapping sleeve is installed, the exterior of the main to be tapped shall be thoroughly cleaned and the interior surface of the sleeve shall be lightly dusted with calcium hypochlorite powder or sprayed with sodium hypochlorite solution.

NOTE: Tapping sleeves are used to avoid shutting down the main to be tapped. After the tap is made, it is impossible to disinfect the annulus without shutting down the main and removing the sleeve. The space between a tapping sleeve and the tapped pipe is normally 1/2 inch, more or less, so that as little as 100 mg of calcium hypochlorite powder per square foot will provide a chlorine concentration of over 50 mg/L.

Where multiple taps are to be installed, the minimum distance required between taps is 12 inches on steel and ductile iron mains and 18 inches on PVC mains. Multiple taps on PVC mains shall be staggered around the circumference of the main such that no two lie in the same plane.

All taps shall be properly bedded in accordance with Section 2.10.a of these specifications.

#### 3.7.2 Tapping Sleeves for main connections

Tapping sleeves shall be provided by the Contractor and shall be Romac SSTIII stainless steel tapping sleeves or approved equal.

#### 3.7.3 Corporation Stops

Corporation stops shall be Mueller 300 Series Ball Valves, Ford FB 400 Series, or approved equal with C.C. inlet and male I.P. outlet and shall be 1 inch minimum.

### **3.7.4 Taps on Existing Mains**

All service taps or main taps on existing mains will be made by Missoula Water unless otherwise and previously arranged. Missoula Water will provide and install the corporation stop and saddle for service taps 2 inches and smaller. Missoula Water will provide the saddle but not the valve for service taps larger than 2 inches. The Contractor shall provide the tapping sleeve for any mainline connection except for projects being performed on a time and materials basis for Missoula Water. The contractor must apply for and schedule taps a minimum of 48 hours in advance. One week notice will be required for taps 2 inches and larger. It shall be the Contractor's responsibility to connect the service line to the corporation stop as required, install the service line, curb valve and box, meter pit and turn on corporation. Curb box, stop and service line to main must be in place and exposed prior to Missoula Water installing the tap. Trace wire as defined in Section 2.9.b shall be attached to the corporation stop or to a stripped portion of the trace wire on the main.

### **3.7.5 Taps on New and Replacement Mains**

Taps on new and replacement mains shall be made by and the materials provided by the contractor. For taps on new mains, a tap agreement as discussed in Section 3.7.e of these standards must be completed prior to the scheduling of a preconstruction meeting.

Contractor shall thoroughly flush service lines and take all other necessary precautions to eliminate all filings and other debris resulting from the tapping procedure.

## **3.8 Service Lines**

### **3.8.1 Service Line Materials**

Service lines shall be Polyethylene (PE) water service pipe and shall meet the requirements and provisions of AWWA C901 , NSF 61, ASTM D2239 and PE4710. The pipe shall have a Standard Inside Dimension Ratio (SIDR) of 7 and provide a pressure rating of 250 psi. PVC pipe may be used for all water service and/or fire lines having diameters of 4 inches to 10 inches. If used, PVC pipe shall be pressure class 200 psi as per AWWA C900.

Ductile iron pipe meeting the requirements of Section 3.1.a may be used for service lines 4 inches in diameter or greater.

Galvanized or copper pipe shall be used ONLY with written approval from Missoula Water. Polywrap tape will be permitted for copper and galvanized services, when approved, provided the wrap is continuous for this type of pipe, no bare pipe is exposed to adjacent soil, and wrap overlap is no less than 1/2 the width of the polywrap tape. Swing joints shall be completely wrapped to prevent corrosion at pipe threads.

Trace wire as defined in Section 2.9.b shall be installed with all service lines as shown on the Missoula Water Standard Detail Drawings. Trace wire must maintain continuity from main to inside of building. Leave 10 feet minimum of wire in building for connection to plumbing. Buried water line warning tape as defined in Section 2.9.a shall be installed with all service lines.

When indoor plumbing is plastic, trace wire shall be connected directly to metal pipe leading to an outside hose bib to facilitate service line location from outside the building.

Service line fittings may be connected with Mueller Pack Joint or compression-type couplers or approved equal. Mueller INSTA-TITE fittings are not allowed.

### **3.8.2 Abandonment of Existing Water Service Lines**

A service line that is to be abandoned shall be excavated at the tap on the water main, the corporation stop shut off, and the service line cut and capped at the corporation. The packing nut must also be tightened. Abandonment must be inspected by a Missoula Water employee. Any visible leak at the

corporation shall be repaired prior to backfill. If a service is abandoned by hydro-excavation methods, it is acceptable not to cap the service line after it is cut off.

It shall be the responsibility of the owner of the new service line to abandon the old service at the main. Failure to abandon service lines not in use will result in termination of water service to the property. Any unused service line must be disconnected at the main either prior to or within 2 weeks after replacement tap is made.

### **3.8.3 Service Line Repair Standards**

Service lines encountered during construction activities shall be repaired in accordance with the Service Line Repair Standards found in Appendix A.

### **3.8.4 Curb Stops and Boxes**

Curb stops and boxes shall be located 2 feet outside the property line as shown on the project plans. The box shall be final set so the top of the box is at finished ground elevation. In areas of new construction, each box shall be marked with a blue painted 2 inch X 4 inch board 4 feet long set vertically in the ground to extend 2 feet above the ground or with a blue painted metal fence post. Trace wire as defined in Section 2.9.b shall be looped loosely over the curb box. Curb stops must be operable. Contractor is responsible for all costs, including damages due to improperly installed curb boxes.

Curb stop shall be Mueller 300 Series Ball Valve, Ford B Series, or approved equal.

Curb box shall be extension type, stationary rod, Minneapolis pattern, 1-1/2 inches diameter and shall be Mueller H-10302 or approved equal. Curb box lids must have cast iron plugs. No plastic or brass plugs will be allowed.

### **3.8.5 Residential Meter Pits**

Meter pits are required on all new residential services and shall be located 2 feet to 5 feet inside the property line as shown on the project plans. Exceptions to the typical location may be made upon written approval of the City's Utility Engineer. Costs are the responsibility of the customer or developer. It is the responsibility of the contractor installing the service line to install the pit. Missoula Water personnel will inspect the pit installation for conformance to requirements and will do the meter installation. A minimum 4 foot radius clear area around the meter pit must be maintained to allow access by Missoula Water personnel for maintenance of the meter. Meter pits must not be buried nor access obstructed by fences or landscaping materials. Meter pits shall not be installed in areas with vehicle traffic nor in permanent walkways such as sidewalks.

Meter pits shall be Mueller, AY McDonald or approved equal. The lids shall be plastic and an insulation blanket shall be provided.

Any meter larger than 1 inch will require a Missoula Water approved concrete pit or to be installed at an approved inside location.

### **3.8.6 Commercial Meter Pits**

Any apartment or apartment complex that will need a 1-1/2 inch or larger meter must have the meter installed in a readily accessible location inside the building.

Meters for commercial buildings will be installed inside the building regardless of size and must be in an accessible location. Meters cannot be installed in a crawl space. Bypass will be required on any 1-1/2 inch and larger meter. If the meter can't be installed in a readily accessible location inside, it must be installed in a Missoula Water approved meter pit. A bypass will be required in this pit also.

### **3.8.7 Irrigation Meters**

Meters for irrigation can be installed inside the building or in meter pits provided they meet Missoula Water requirements. These requirements are the same as for commercial meters except no bypass is required.

### **3.8.8 Ditch cards**

Ditch card information must be provided for all new, replaced, and relocated service lines. A ditch card template is available in Appendix B.

## **Section 4 – Disinfection**

This standard presents essential procedures for disinfecting new and repaired water mains. All new water mains shall be disinfected before they are placed in service. All water mains taken out of service for inspecting, repairing, or other activity which might lead to contamination of water shall be disinfected before they are returned to service. Disinfection of water mains shall be in accordance with the guidelines set forth in this Section and with AWWA C651.

### **4.1 Forms of Chlorine**

The forms of chlorine that may be used in the disinfection operations are sodium hypochlorite solution and calcium hypochlorite granules or tablets.

#### **4.1.1 Sodium Hypochlorite**

Sodium hypochlorite is available in liquid form in glass, rubber-lined, or plastic containers of 5 gallons. Larger sizes may be available in some areas. Sodium hypochlorite contains approximately 5% to 15% available chlorine, but care must be used in control of conditions and length of storage to minimize its deterioration. (Note: Available chlorine is expressed as a percent of weight when the concentration is 5% or less and usually as a percent of volume for higher concentrations. Percent x 10 = grams of available chlorine per liter of hypochlorite.)

#### **4.1.2 Calcium Hypochlorite**

Calcium hypochlorite is available in granular form and contains approximately 65% available chlorine by weight. Calcium hypochlorite tablets are not allowed to be used. The materials should be stored in a cool, dry, and dark environment to minimize its deterioration. Calcium hypochlorite should not come into contact with any oily substances as this could lead to spontaneous combustion.

### **4.2 Basic Disinfection Procedure**

The basic disinfection procedure consists of:

- Preventing contaminating materials from entering the water main during storage, construction, or repair.
- Removing by flushing or other means those materials that may have entered the water main.
- Chlorinating any residual contamination that may remain and flushing the chlorinated water from the main.
- Determining the bacteriological quality by certified laboratory test after disinfection.

### **4.3 Preventive and Corrective Measures During Construction**

Heavy particulates may contain bacteria and will prevent very high concentrations of chlorine from contacting and killing such organisms. It is therefore essential that the procedures of this section be observed to assure that a water main and its appurtenances are thoroughly clean for the final disinfection by chlorination.

#### **4.3.1 Keeping Pipe Clean and Dry**

Precautions shall be taken to protect the interiors of pipes, fittings, and valves against contamination. Pipe delivered for construction shall be strung so as to minimize entrance of foreign material. All openings in the pipeline shall be closed with watertight plugs when pipe laying is stopped at the close of the day's work or for other reasons such as rest breaks or meal periods. Rodent-proof plugs may be used where it is determined that watertight plugs are not practicable and where thorough cleaning will be performed by flushing or other means.

Delay in placement of delivered pipe invites contamination. The more closely the rate of delivery is correlated to the rate of pipe laying, the less likelihood of contamination.

#### **4.3.3 Gaskets**

All gaskets and lubricants shall meet NSF Standard 61 for water contact materials. Gaskets shall be handled in a manner which avoids contamination. The lubricant used in the installation of sealing gaskets shall be suitable for use in potable water. It shall be delivered to the job in closed containers and shall be kept clean.

#### **4.3.4 Cleaning and Swabbing**

If dirt enters the pipe that, in the opinion of Missoula Water's engineer or job superintendent, will not be removed by the flushing operation, the interior of the pipe shall be cleaned by mechanical means and then shall be swabbed with a 1% hypochlorite disinfecting solution.

#### **4.3.5 Wet-Trench Construction**

If it is not possible to keep the pipe and fittings dry during installation, every effort shall be made to assure that any of the water that may enter the pipe joint spaces contains an available chlorine concentration of approximately 25 mg/L. This may be accomplished by adding calcium hypochlorite granules or tablets to each length of pipe before it is lowered into a wet trench or by treating the trench with hypochlorite tablets.

#### **4.3.6 Flooding by Storm or Accident during Construction**

If the main is flooded during construction, it shall be cleared of the flood water by draining and by flushing with potable water until clean. The section exposed to the flood water shall then be filled with chlorinated potable water which at the end of the 24-hour holding period will have a free chlorine residual of not less than 25 mg/L. The chlorinated water may then be drained or flushed from the main. After construction is completed, the main shall be disinfected using the continuous feed or slug method.

### **4.4 Dechlorination**

Discharge of chlorinated water shall be performed in accordance with the Missoula Valley Water Quality District's Policy Statement on "Allowable non-stormwater discharges", included in Appendix C. Any chlorinated water discharged to sumps does not require dechlorination. Chlorinated water discharged to conveyances connected to surface water must be dechlorinated to below 0.01 ppm. As discussed in Appendix C, analytical results showing concentrations less than or equal to 0.1 ppm total residual chlorine (TRC) are considered to be in compliance. Missoula Water staff shall assist with dechlorination where required. Discharges to surface water (including irrigation ditches) must be coordinated with the irrigation ditch owner and the MDEQ.

## 4.5 Methods of Chlorination

Three chlorination methods are given: granules method, continuous feed, and slug method. The tablet method gives an average chlorine dose of approximately 25 mg/L; the continuous feed method gives a 24-hour chlorine residual of not less than 10 mg/L; and the slug method gives a 3-hour exposure of not less than 50 mg/L free chlorine.

Care should be taken not to exceed the limits specified herein.

### 4.5.1 Granules Method

The granules method consists of placing calcium hypochlorite granules in the water main as it is being installed and then filling the main with potable water when installation is completed. The granules used must be approved for potable water use. This method may be used only if the pipes and appurtenances are kept clean and dry during construction.

**WARNING: THIS PROCEDURE MUST NOT BE USED ON SOLVENT WELDED PLASTIC OR ON SCREWED JOINT PIPE BECAUSE OF THE DANGER OF FIRE OR EXPLOSION FROM THE REACTION OF THE JOINT COMPOUNDS WITH THE CALCIUM HYPOCHLORITE.**

During construction, granules shall be placed at the upstream end of the first section of pipe, at the upstream end of each branch main, and at 500 foot intervals. The quantity of granules shall be as shown in Table 2.

Table 2 - Quantity of calcium hypochlorite granules to be placed at beginning of main and at each 500-foot interval

Pipe Diameter (inches)	Calcium Hypochlorite Granules (ounces)
4	0.5
6	1.0
8	2.0
12	4.0
16 and larger	8.0

When installation has been completed, the main shall be filled with water at a rate such that water within the main will flow at a velocity no greater than 1 fps. Precautions shall be taken to assure that air pockets are eliminated. This water shall remain in the pipe for at least 24 hours. If the water temperature is less than 5°C (41°F) the water shall remain in the pipe for at least 48 hours.

Valves shall be positioned so that the strong chlorine solution in the main being treated will not flow into water mains in active service.

All chlorinated water being discharged shall be dechlorinated in accordance with Section 4.4

### 4.5.2 Continuous Feed Method

The continuous feed method consists of placing calcium hypochlorite granules in the main during construction (optional), completely flushing the main to remove particulates, and filling the main with potable water chlorinated so that after a 24-hour holding period in the main there will be a free chlorine residual of not less than 10 mg/L.

At the option of the engineer, calcium hypochlorite granules shall be placed in pipe sections as specified in Section 4.4.a Tablet Method. The purpose of this procedure is to provide a strong chlorine concentration in the first flow of flushing water that flows down the main. This procedure is recommended particularly where the type of pipe is such that this first flow of water will flow into annular spaces at pipe joints.

Prior to being chlorinated, the main shall be filled to eliminate air pockets and shall be flushed to remove particulates. The flushing velocity in the main shall be not less than 2.5 fps unless Missoula Water’s engineer or job superintendent determines that conditions do not permit the required flow to be discharged to waste. Table 4 shows the rates of flow required to produce a velocity of 2.5 fps in pipes of various sizes. Note: Flushing is not a substitute for preventive measures during construction. Certain contaminants such as caked deposits resist flushing at any feasible velocity.

In mains of 24 inches or larger diameter, an acceptable alternative to flushing is to broom sweep the main, carefully removing all sweepings prior to chlorinating the main.

Table 4 – Required flow and openings to flush pipelines with 40 psi residual in main<sup>(a)</sup>

Pipe Diameter (inches)	Flow required to produce 2.5 fps velocity (gpm)	Size of tap on main <sup>(b)</sup> (inches)	Hydrant Outlets	
			Number	Size (inches)
4	100	15/16	1	2 ½
6	220	1 3/8	1	2 ½
8	390	1 7/8	1	2 ½
10	610	2 5/16	1	2 ½
12	880	2 13/16	1	2 ½
16	1565	3 5/8	2	2 ½
20	2450	-	-	-

(a) With 40 psi pressure in the main with the hydrant flowing to atmosphere, a 2-1/2 inches hydrant outlet will discharge approximately 1000 gpm and a 4-1/2 inch hydrant nozzle will discharge approximately 2500 gpm.

(b) Size of tap on main with no significant length of discharge piping

Water from the existing distribution system shall be made to flow at a constant measured rate into the newly laid water main. In the absence of a meter, the rate may be approximated by methods such as placing a pitot gauge in the discharge, measuring the time to fill a container of known volume or measure the trajectory of the discharge and using the formula shown in Figure 1.

At a point not more than 10 feet downstream from the beginning of the new main, water entering the new main shall receive a dose of chlorine fed at a constant rate such that the water will have not less than 25 mg/L chlorine concentration. To assure that this concentration is provided, the chlorine concentration should be measured at regular intervals in accordance with the procedures described in the current edition of Standard Methods of AWWA M12-Simplified Procedures for Water Examination or using appropriate test kits.

Figure 1 Suggested Combination Blow-off and Sampling Tap

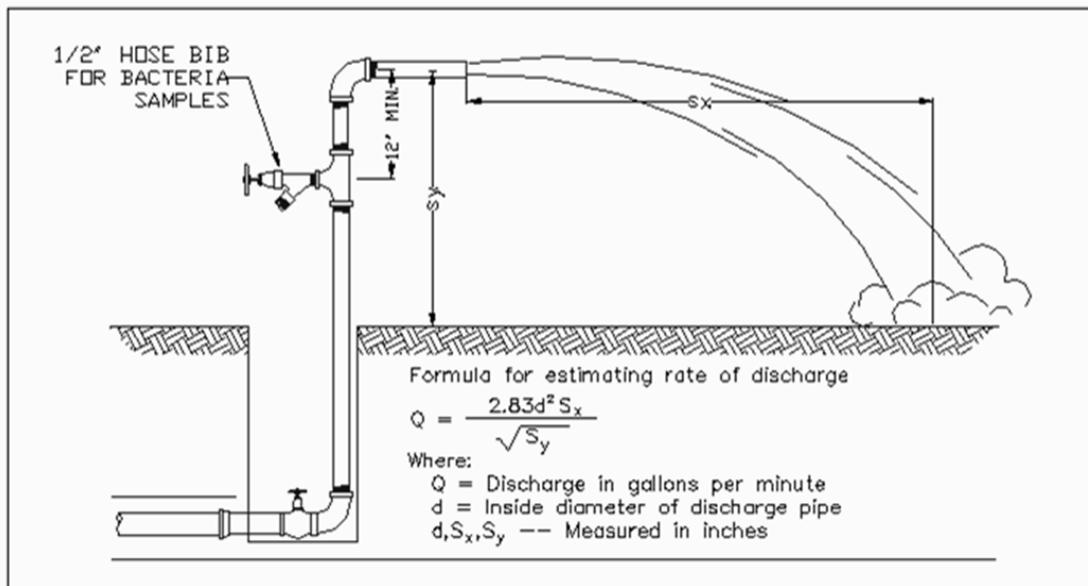


Table 5 gives the amount of chlorine required for each 100 feet of pipe of various diameters. Solutions of 1% chlorine may be prepared with sodium hypochlorite or calcium hypochlorite. The latter solution requires 1 pound of calcium hypochlorite in 8 gallons of water.

Table 5 - Chlorine at 1% concentration required to produce 25 mg/L concentration in 100 feet of pipe

Pipe Diameter (in)	1% Chlorine Solution (gal)
4	.16
6	.36
8	.65
10	1.02
12	1.44
16	2.60
20	3.57

During the application of chlorine, valves shall be positioned so that the strong chlorine solution in the main being treated will not flow into water mains in active service. Chlorine application shall not cease until the entire main is filled with heavily chlorinated water. The chlorinated water shall be retained in the main for at least 24 hours, during which time all valves and hydrants in the section treated shall be operated in order to disinfect the appurtenances. At the end of the 24-hour period, the treated water in all portions of the main shall have a residual of not less than 10 mg/L free chlorine.

All chlorinated water being discharged shall be dechlorinated in accordance with Section 4.4

#### 4.5.3 Slug Method

The slug method consists of placing calcium hypochlorite granules in the main during construction, completely filling the main to eliminate all air pockets, flushing the main to remove particulates, and slowly flowing through the main a slug of water dosed with chlorine to a concentration of 100 mg/L, in order that all parts of the main and its appurtenances will be exposed to the highly chlorinated water for a period not less than 3 hours.

Placing of calcium hypochlorite granules, preliminary flushing, and chlorinating the main shall be done in accordance with the procedures outlined in Section 4.4.b Continuous Feed Method.

At a point not more than 10 feet downstream from the beginning of the new main, water entering the new main shall receive a dose of chlorine fed at a constant rate such that the water will have not less than 100 mg/L free chlorine. To assure that this concentration is provided, the chlorine concentration should be measured at regular intervals. The chlorine shall be applied continuously and for a sufficient period to develop a solid column or “slug” of chlorinated water that will, as it moves through the main, expose all interior surfaces to a concentration of approximately 100 mg/L for at least 3 hours.

The free chlorine residual shall be measured in the slug as it moves through the main. If at any time it drops below 50 mg/L the flow shall be stopped, chlorination equipment shall be relocated at the head of the slug and as flow is resumed, chlorine shall be applied to restore the free chlorine in the slug to not less than 100 mg/L.

As the chlorinated water flows past fittings and valves, related valves and hydrants shall be operated so as to disinfect appurtenances and pipe branches.

All chlorinated water being discharged shall be dechlorinated in accordance with Section 4.4

## **4.6 Final Flushing**

After the applicable retention period, the heavily chlorinated water shall be flushed from the main until chlorine measurements show that the concentration in the water leaving the main is no higher than that generally prevailing in the system. All chlorinated water being discharged shall be dechlorinated in accordance with Section 4.4

## **4.7 Bacteriological Tests**

### **4.7.1 Standard Conditions**

After final flushing and confirmation that the chlorine residual is 0.5 ppm or less, and before the water main is placed in service, bacteriological tests must be performed to certify the water sampled from the main to be free of coliform bacteria contamination. In accordance with Missoula Water’s Disinfection Manual, two consecutive samples collected 24 hours apart shall be required from the new main and each branch thereof. In the case of extremely long mains, it is desirable that samples be collected along the length of the line as well as at its end. Each sample will be collected by both the project engineer for processing at a certified lab and Missoula Water personnel for processing at the Missoula Water lab. Prior to proceeding with a pressure test, it must be determined that all samples are free of bacterial contamination. Samples processed by a certified lab must be free of bacterial contamination in accordance with the requirements of the specific tests performed. Given the tests performed in the Missoula Water lab, the first sample must be free of bacterial contamination for a period of 48 hours and the second sample must be free of bacterial contamination for a period of 24 hours. A standard plate count may be required at the option of the Engineer.

### **4.7.2 Special Conditions**

If, during construction, trench water has entered the main, or if in the opinion of Missoula Water’s engineer or job superintendent, excessive quantities of dirt or debris have entered the main, bacteriological samples shall be taken at intervals of approximately 200 feet and shall be identified as to location. Samples shall be taken of water that has stood in the main for at least 16 hours after flushing has been completed.

### **4.7.3 Sampling Procedures**

Samples for bacteriological analysis shall be collected in sterile bottles treated with sodium thiosulfate as required by Standard Methods. No hose or fire hydrant shall be used in collection of samples unless specifically approved. A suggested combination blow off and sampling tap useful for main up to and

including 8 inch diameter is shown in Figure 1. A corporation cock may be installed in the main for sampling use.

## **4.8 Redisinfection**

If the initial disinfection fails to produce satisfactory bacteriological samples, the main shall be refushed and shall be resampled in accordance with Section 4.6.a. If check samples show the presence of coliform organisms, then the main shall be rechlorinated by the continuous feed or slug method of chlorination until satisfactory results are obtained.

NOTE: High velocities in the existing system, resulting from flushing the new main may disturb sediment that has accumulated in the existing mains. When check samples are taken, it is well to sample water entering the new main.

## **4.9 Disinfection Procedures When Cutting into or Repairing Existing Mains**

The following procedures apply primarily when mains are wholly or partially dewatered. After the appropriate procedures have been completed, the main may be returned to service prior to completion of bacteriological testing in order to minimize the time customers are out of water. Leaks or breaks that are repaired with clamping devices while the mains remain full of water under pressure present little danger of contamination and require no disinfection.

### **4.9.1 Swabbing with Hypochlorite Solution**

The interior of all pipe and fittings used in making the repair (particularly couplings and sleeves) shall be swabbed or sprayed with a 1% hypochlorite solution before they are installed.

### **4.9.2 Flushing**

Thorough flushing is the most practical means of removing contamination introduced during repairs. If valve and hydrant location permit, flushing toward the work location from both directions is recommended. Flushing shall be started as soon as the repairs are completed and shall be continued until discolored water is eliminated.

### **4.9.3 Slug Chlorination**

Where practical in addition to the procedures above, a section of main in which the break is located shall be isolated, all service connections shut off, and the section flushed and chlorinated as described in Section 4.4.c, except that the dose may be increased to as much as 300 mg/L and the contact time reduced to as little as 15 minutes. After chlorination, flushing shall be resumed and continued until discolored water is eliminated and the water is free of noticeable chlorine odor.

### **4.9.4 Sampling**

Bacteriological samples shall be taken after repairs to provide a record by which the effectiveness of the procedures used can be determined. If the direction of flow is unknown, samples shall be taken each side of the main break. If positive samples are recorded, daily sampling shall be continued until two consecutive negative samples are recorded. Positive samples shall be evaluated by the engineer for corrective action.

## **Section 5 – Asphalt**

For standards related to asphalt and curb and gutter, refer to Section 02500 on Paving and Surfacing of the Montana Public Works Standard Specification latest edition.

## **Section 6 – Concrete**

For standards related to structural concrete, refer to Division 3 – Concrete of the Montana Public Works Standard Specification latest edition.

# Appendix A – Requirements for working around existing water mains and service lines

## Requirements for working around utility-owned mains

- Any construction work causing disturbance of backfill materials beneath cast iron or asbestos cement (AC) water mains shall be backfilled up to the bottom of the water main with flowable fill meeting Montana Public Works (MPW) Standard Specifications requirements.
- Any construction work causing steel water mains to be exposed shall require installation of sacrificial anodes on the steel mains. Missoula Water will provide the anodes and will perform the cad welding to install the anodes at the request of the Contractor. The Contractor shall provide 48 hours' notice prior to the time the anodes will need to be installed. The Contractor shall provide all required safety devices prior to Missoula Water personnel entering a trench.
- Only Missoula Water personnel are allowed to operate water main valves
- Valve boxes shall be left flush with the road surface final grade. Missoula Water Division will supply risers as needed to bring boxes up to the road surface for asphalt overlay projects
- Imported pipe bedding shall be placed around any portion of a water main exposed in accordance with Missoula Water specifications.
- Only Missoula Water approved Contractors are allowed to make repairs to Missoula Water owned facilities.

## Requirements for working around privately-owned water services

- Notice shall be provided with an appropriate door hanger tag a minimum of 24 hours prior to a shutdown of a residential water service and 48 hours prior to a shutdown of a commercial water service.
- Property owners own their water service from the corporation stop at the water main to the house, with the exception of the meter. Thus, repairs or modifications to water services shall be performed as directed by the property owner in accordance with Missoula Water specifications for service line installations.
- All fittings and appurtenances to be buried shall be designed for direct burial applications (ex. Ball valves).
- Any repaired services lines shallower than 6 feet shall be insulated sufficiently with blue board insulation to protect against freezing.
- If galvanized service pipe is repaired with polyethylene pipe, electrical continuity of the galvanized pipe shall be maintained by connecting #6 tracer wire to the galvanized pipe on both sides of the repair using LH Dottie DB25 bare ground clamps or equivalent direct bury-rated ground clamps.
- The Contractor shall protect and/or replace trace wire along mains in accordance with Missoula Water Standard Specifications.
- The Contractor shall make every effort to minimize contamination of water service lines and prevent foreign material from entering the pipe. Where there is concern of contamination from sanitary or storm sewer, all materials installed in the service lines shall be disinfected with bleach solution.
- Water service line repairs shall be performed in accordance with all applicable City of Missoula requirements.

- Contractor shall provide Missoula Water with updated ditch card information any time a service line or curb box is disturbed or relocated. The ditch card form located in Appendix B shall be completed for each service line with all available information.

## Appendix B – Ditch Card Template

DATE AND INITIALS	STREET	ADDRESS	LOT #

### WATER SERVICE PIPE STATISTICS – MISSOULA

DATE TAP MADE \_\_\_\_\_

SKETCH

TAP MADE BY \_\_\_\_\_

CONTRACTOR \_\_\_\_\_

C.B. TO MAIN MEAS. \_\_\_\_\_

SIZE AND TYPE OF MAIN \_\_\_\_\_

SIZE AND TYPE OF SERVICE \_\_\_\_\_

DEPTH OF SERVICE AT MAIN \_\_\_\_\_

DEPTH OF SERVICE AT C. BOX \_\_\_\_\_

CURB BOX MEAS. \_\_\_\_\_

METER PIT MEAS. \_\_\_\_\_

**Notice:** The City of Missoula is not responsible for insuring or guaranteeing the accuracy of the compilation of this information and shall not be held accountable for the accuracy of these records and/or for any expenses or damages incurred from any reliance on these records by anyone.

# Appendix C – Allowable Non-Stormwater Discharges



Missoula City-County Health Department

WATER QUALITY DISTRICT

301 West Alder Street | Missoula MT 59802-4123  
www.co.missoula.mt.us/wq

Phone | 406.258.4890

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Revised June 16, 2016

Policy Statement: Allowable non-stormwater discharges

The Missoula Valley Water Quality District (MVWQD) is charged with protection of surface and groundwater quality within its designated boundaries. Within 5 miles of the City of Missoula's administrative boundaries, the Missoula Valley Water Quality Ordinance (MMC 13.26) prohibits activities that threaten surface and groundwater quality or potentially cause soil contamination. It is recognized that certain water-generating activities and discharges are necessary and are non-consequential in threats to the environment. It is the policy of the MVWQD to consider the following water-generating activities to be allowable non-stormwater discharges permitted to enter stormwater structures and conveyances within the Water Quality Ordinance boundaries:

- *water line flushing\**
- *landscape irrigation*
- *rising ground waters*
- *uncontaminated pumped ground water*
- *discharge from potable water sources\**
- *foundation/footing drains*
- *air conditioning condensation*
- *irrigation water, springs*
- *de-chlorinated swimming pool discharges \**

\*Disposal of Chlorinated Water

- Planned discharges to **conveyances** connected to surface waters must be dechlorinated to below .01 ppm. Per the Montana DEQ-issued General Permit for Dechlorination Water and Hydrostatic Testing, the daily effluent limit for Total Residual Chlorine (TRC) is 0.011 mg/L and the limit of detection for TRC is 0.1 mg/L. Accordingly, analytical results showing concentrations less than or equal to .1 mg/L TRC are considered to be in compliance with this policy. Discharges to injection wells are acceptable without de-chlorination
- Discharges to surface water (including irrigation ditches) must be coordinated with the respective irrigation districts/owners and Montana Department of Environmental Quality (MDEQ). Discharges may be subject to discharge permitting from MDEQ.
- Discharge to surface water may not exceed surface water standards established in Circular DEQ-7

Building washing and other discharges that could result in deleterious effects to surface or groundwater must be reviewed and approved by the MVWQD.

If well-development water containing sediment is to be discharged to a publicly owned storm drain network, injection well or directly to surface water, approval must be obtained from the city/county engineer and the MVWQD and may be subject to discharge permitting from the Montana Department of Environmental Quality.