

MT. CRESTED BUTTE
WATER & SANITATION DISTRICT

STANDARDS AND SPECIFICATIONS
FOR WATER SYSTEM CONSTRUCTION

APRIL 8 2008

TABLE OF CONTENTS

SPECIFICATIONS	<u>Page No</u>	Tab
DIVISION 1. GENERAL		
Section 01010	Summary of Work. 01010-1 : 01010-4	1
Section 01020	General Requirement 01020-1 : 01020-6	2
Section 01570	Traffic Regulation. 01570-1 : 01570-2	3
Section 01600	Materials, Equipment and Workmanship. 01600-1 : 01600-2	4
Section 01656	Disinfection of Domestic Water Lines 01656-1 : 01656-3	5
Section 01666	Testing Piping Systems 01666-1 : 01666-2	6
Section 01720	Project Record Documents 01720-1 : 01720-1	7
DIVISION 2. SITE WORK		
Section 02000	Water System Design Criteria. 02000-1 : 02000-7	8
Section 02221	Trenching, Backfilling and Compacting. 02221-1 : 02221-8	9
Section 02224	Pipe Boring and Jacking 02224-1 : 02224-2	10
Section 02441	Sprinkler & Irrigation Systems 02441-1 : 02441-5	11
Section 02612	Field Welding Procedure for Steel Pipe. 02612-1 : 02612-2	12
Section 02615	Ductile Iron Pipe 02615-1 : 02615-4	13
Section 02641	Valves 02641-1 : 02641-3	14
Section 02644	Hydrants 02644-1 : 02644-2	15
Section 02646	Service Lines, Meters & Appurtenances 02646-1 : 02646-5	16
Section 02713	Water Distribution System 02713-1 : 02713-4	17
Section 02720	Booster Pump Station. 02720-1 : 02720-4	18
DIVISION 3. CONCRETE		
Section 03300	Cast-In-Place Concrete 03300-1 : 033300-7	19
STANDARD DETAIL DRAWINGS	APPENDIX A	20
(Includes PRV vault dwgs., 16.1 - 16.3)		
SECTION 17-39 MT. CRESTED BUTTE TOWN CODE	APPENDIX B	21

SECTION 01010

SUMMARY OF WORK

PART 1 - GENERAL

1.1 SCOPE

- A. The purpose of this document is to present the Mt. Crested Butte Water and Sanitation District's criteria for the construction of 6 inch through 12 inch water mains, water services, and all appurtenances associated with these mains and services. It is for the use of owners, developers, design engineers, and contractors for the design and construction of said mains, services, and appurtenances.
- B. These Specifications are intended to be sufficiently detailed to provide adequate definition of the work to be performed and to insure the quality of that work.
 - 1. The contractor shall make himself thoroughly familiar with the provisions and the content of these Specifications.
- C. The Specifications are composed of written Material Specifications and Standard Drawings. The interpretation of these Specifications shall be made by the District.
 - 1. Every attempt will be made to avoid conflicts between standards, and drawings during design. However, when a conflict occurs an interpretation shall be made by the District.

1.2 SPECIFICATION DOCUMENTS

- A. Definitions
 - 1. DISTRICT ENGINEER- Wherever the term Engineer or District Engineer is used, it shall mean the authorized representative of Mount Crested Butte Water and Sanitation District.
 - 2. DISTRICT- Mount Crested Butte Water and Sanitation District.
 - 3. PROVIDE- furnish and install complete in space.
 - 4. REMOVE- remove and dispose.
 - 5. OR EQUAL- as approved equal by District Engineer.
 - 6. OWNER- the developer, corporation, association partnership, or individual who has entered into an Agreement with the District and has entered into an Agreement with the Contractor to perform the work.
 - 7. DESIGN ENGINEER- the partnership, corporation, or individual who is registered as a professional engineer, according to Colorado statutes, and who is hired by the Owner, and is empowered to act as his agent for the project.
 - 8. CONSULTANT- the partnership, corporation, or individual who is hired by the Owner and is empowered to act as his agent for the project.
 - 9. CONTRACTOR- the corporations, association, partnership, or individual who has entered into an Agreement with the Owner to perform the work.
 - 10. CONSTRUCTION DRAWINGS- detailed and working drawings, including plan, profile, and detail sheets of proposed utility improvements, approved by the Engineer.
 - 11. DRAWINGS OF RECORD- detailed drawings which have been prepared by the Design Engineer, and show actual construction and contain field dimensions, elevations, details, changes made to the construction drawings by modification, details which were not included on the construction drawings, and horizontal and vertical locations of underground utilities.

12. SHALL- a mandatory condition.
13. WORK- the entire completed construction or the various separately identifiable parts required to be furnished for the project. Work is the result of performing services, furnishing the labor and furnishing and incorporation materials and equipment into the construction.
14. ABILITY- that which a person can do on the basis of present development and training.
15. COMPETENT- a person who has the natural powers, physical or mental, or meet the demands of a situation or work; the word is widely used to describe the ability to meet all requirements, natural, legal or other of a given task.
16. QUALIFIED- acquired abilities; skill, knowledge, experience, that fits a person for a position, office or profession.
17. ACI- American Concrete Institute.
18. ASTM- American Society for Testing and Materials.
19. ANSI- American National Standards Institute.
20. AASHTO- American Association of State Highway and Transportation Officials.
21. CDOT STANDARDS- Colorado Department of Transportation Standard Specifications for Road and Bridge Construction.
22. OSHA- Occupational Safety and Health Administration.

B. Interpretation

1. These Specifications contain many command sentences which are directed at the Contractor unless otherwise stated.
2. The Contractor shall request clarification, in writing, of all apparent conflicts by contacting the District.

1.3 NOTIFICATIONS

- A. Contact Mount Crested Butte Water and Sanitation District, all other utilities and concerned agencies at least 48 hours (exclusive of holidays and weekends) prior to working in areas near underground utilities or pole lines.
- B. Have all utilities field located.
- C. Inspections and testing: Give the District Engineer 24 hours (exclusive of holidays and weekends) notice prior to inspections and testing.
- D. Contractor shall notify the Town of Mt. Crested Butte a minimum of one week prior to beginning work in any street.
 1. Approved traffic control plans are required prior to beginning work in any public right-of-way.

1.4 SPECIAL REQUIREMENTS

- A. All work must be inspected, tested and accepted by the District prior to connecting to the existing system.
 1. Provide all plugs and other items required to isolated new construction in order to accomplish a total separation of new construction.
- B. All items and work not covered by these Specifications shall be discussed with the District and receive District approval prior to commencing the work.

- C. All work must be acceptable to the District.
- D. District furnished material
 - 1. If District furnishes any materials, the Contractor shall be responsible for such materials once they have been provided by the District.
 - 2. Contractor shall replace such materials if damaged or stolen at his own expense.
- E. Contractor shall warrant all work for a period of two years after final completion and initial acceptance of the work.
 - 1. Contractor may perform such maintenance and repairs by subcontract.
 - a. If the Contractor choose to subcontract the warranty work, he shall submit to the Engineer a copy of the subcontract or the work authorization as evidence of the Contractor's faithful intention to perform any repairs which may become necessary during the two (2) year warranty period.
- D. Field changes from the approved plans shall not be permitted without prior permission from the District.

1.5 SAFETY AND PROTECTION

- A. Contractor shall be responsible for initiating, maintaining and supervising all safety precautions and programs in connection with the Work. Contractor shall take all necessary precautions for the safety of, and shall provide the necessary protection to prevent damage, injury or loss to:
 - 1. All employees on the Work and other persons who may be affected thereby.
 - 2. All the Work, materials and equipment to be incorporated therein, whether in storage on or off the site.
 - 3. Other property at the site or adjacent thereto, including trees, shrubs, lawns, walks, pavements, roadways, structures and utilities not designated for removal, relocation or replacement in the course of construction.
- B. Contractor shall comply with all applicable laws, ordinances, rules, regulations and orders of any public body having jurisdiction for the safety of persons or property or to protect them from damage, injury or loss; and shall erect and maintain all necessary safeguards for such safety and protection.
 - 1. All work done in the District shall be governed by OSHA regulations appropriate for that work.

1.6 ACCEPTANCE OF CONSTRUCTION

- A. Prior to acceptance of mains, laterals, special structures and appurtenances constructed, extended or modified under Section 5 et. al., the landowners, subdividers or developers of the property served or encumbered by such facilities shall:
 - 1. Deed the lines and appurtenances to the District, free and clear of all liens and encumbrances. Convey to te District all water and sewer facilities constructed along with adequate and necessary easements and rights of way for the purpose of construction, maintenance and repair for the water facilities and sewer facilities.
 - 2. Provide as-built drawings in the form of three (3) sets of "D" size; scale, 1" = 50' and one or more CDs of spatial data in digital format as per District specifications, compatible with the Districts CAD mapping system.

3. Provide a maintenance bond for eighteen (18) months following the date of the completion of the project, in an amount prescribed by the District determined to be adequate to cover potential maintenance costs for the new facilities and paper / CAD formatted as per 5.2.2.
4. Provide to the District or the District's attorney, all deeds, easements and other documents, as required, for recording with the clerk and recorder of Gunnison County, Colorado. The costs of recording will be borne by the Landowners, subdividers or developers.
5. In no event will the District accept any construction, extension or modification until a minimum of eighteen (18) months has elapsed, following the completion of the facilities, without significant occurrence of maintenance or repair problems. If significant maintenance or repair problems occur, the acceptance period will be extended for successive periods of one (1) year, until a full year will have elapsed without such repair and maintenance problems.

END OF SECTION

SECTION 01020

GENERAL REQUIREMENTS

PART 1 – GENERAL

1.1 DESCRIPTION

- A. The requirements outlined herein apply to consulting engineers and developers seeking approval of civil construction plans.
- B. All plans and calculations submitted to the District for review must be prepared by, or under the direct supervision of, a Professional Engineer duly registered and licensed to practice engineering in the State of Colorado. All plans and calculations should indicate this by being signed by a licensed professional engineer along with their registration number and seal.
- C. Approval by the District shall in no way relieve the Design Engineer of the responsibility for errors or omissions in the design, plans or field surveys. Any errors shall be corrected by the Design Engineer to the satisfaction of the District at no cost or expense to the District.
- D. District's review and approval will only be to determine if the plans and construction conform to the District's requirements. District's review and approval will not relieve Design Engineer and Contractor from responsibility for any variation from the District requirements. The District's review and approval shall not constitute any assumption of responsibility or liability for the design or construction.

PART 2 – SUBMITTAL

2.1 PRELIMINARY SUBMITTAL

- A. Three (3) copies of the preliminary plans, accompanied by one (1) copy of the AutoCAD files, version 2007 or older, request for review and recommendations, and such other information as the District may deem necessary shall be submitted to the District for review. Concurrently, preliminary plans will be sent to the District's Consulting Engineers in a form and quantity they shall determine. After review is complete, comments for revision will be sent to Design Engineer.
- B. Three (3) copies of the revised construction plans, accompanied by one (1) copy of the AutoCAD files, version 2007 or older, shall be resubmitted until approved.

2.2 FINAL SUBMITTAL

- A. Upon approval from the District, three (3) copies of the final plans, one of which is to be 3 mil, minimum, reproducible, double-matte mylar, and one (1) copy of the AutoCAD files, version 2004 or older, shall be submitted to the District. All plan sets submitted must be signed and sealed by a Colorado Registered Professional Engineer.

- B. Prior to final acceptance of the project, as-build drawings shall be submitted to the District. As-build drawings shall include all plan revisions and field changes made during construction.

2.3 REJECTING A SUBMITTAL

- A. When items required by these Standards are not submitted or not fully addressed within the plan set, the District may choose to reject the entire plan set and return it to the Design Engineer for completion, prior to any further review.

PART 3 – CONSTRUCTION DRAWINGS REQUIREMENTS

3.1 GENERAL

- A. All construction plan submitted to the District for review shall be on 24" x 36" sheets with scribed lettering and include but not be limited to the following.
 1. TITLE BLOCK- The subdivision name and filing number; site plan name and its Town file number (if applicable); the type of improvement; name, address, including zip code, telephone number of the Consultant; name, address, including zip code and telephone number of contact for the Owner; sheet number (consecutive, beginning with the cover sheet); revision box shall be included in the title block. Where the plans do not relate to a specific subdivision, the name of the street or channel, as well as the limits of the project, shall be clearly indicated. The title block shall be located in the extreme lower right-hand corner of each sheet.
 2. SCALE- The scales listed are minimum. Larger scales may be required where necessary to clearly show details. Use a standard engineering scale. All plan drawings shall have the proper bar scale legibly shown on the plan sheet.

All plan and profile drawings:
Horizontal 1" = 30'. Vertical 1" = 10'

Overall utility plan:
1" = 100'

3. DATE OF PLAN- The original date of the plan and any subsequent revision
4. NORTH ARROW- North arrow shall point towards the top of applicable sheet
5. SEAL AND SIGNATURE- The seal and signature of the Professional Engineer, registered in the state of Colorado, under whose supervision the plans were prepared.
6. BENCH MARK- The benchmark description and number shall be placed on each sheet that shows any form of vertical design.
7. KEY MAP- Key map at minimum scale of 1" = 500' shall show the location and name of all roadways within and adjacent to the proposed development with the area design pertains to defined. The map shall be oriented north. Key map shall be placed on all sheets except cover sheet and detail sheet(s). If the proposed improvements are shown on a single sheet, no key map is required.

3.2 COVER SHEET

A. Cover sheet shall include but not be limited to the following.

1. Notes.

Cover sheet shall include but not be limited to the following notes:
All waterline and sewer line construction shall conform to the MCBWSD Standards.

a. MCBWSD shall be notified of construction activities related to water and sewer forty-eight (48) hours before commencement.

2. VICINITY MAP- A vicinity map should show the location and name of all major roads within 1 mile of the proposed development at a minimum scale of 1" = 2000' with north arrow. The development area shall be indicated. The map shall be oriented north.

3. INDEX Each cover sheet shall include index of all sheets within the plan set.

4. LEGEND- Each cover sheet shall show legend of symbols pertaining to the plan set.

3.3 OVERALL UTILITY PLAN

A. An overall utility plan of the proposed development, including all off-site construction areas shall include but not be limited to the following.

1. In plan view depict the entire development and include all exterior boundaries of the project, rights of ways, easements, lot lines, lot and block numbers, roadways and roadways names, handicapped ramps, sidewalks, curb and gutter, retaining walls, bike paths, street lightning, existing and proposed contours.

2. Existing and proposed water distribution facilities with all related appurtenances, fire hydrants and service lines including but not limited to the size and material of waterlines.

3. Existing and proposed sanitary sewer facilities with all service lines including but not limited to length, size, material, slope of the pipe; manhole numbers, rim elevations, inverts of all pipes entering and exiting a manhole. Pipe length shall represent distance between sanitary sewer manholes measured between centerlines of the manholes.

4. Existing and proposed storm sewer facilities including inlet locations.

5. Any other public or private utilities within proposed development.

6. Phase lines and phase labels (if applicable).

3.4 PLAN DRAWINGS

A. The plan shall include but not be limited to the following.

1. Property lines, right-of-way lines, and easements. Type and dimension of an easement shall be clearly labeled.
2. Roadways and roadway names.
3. Proposed and existing utilities and structures including, but not limited to: water valves, fire hydrants, thrust blocks, service lines, sanitary sewer manholes, sanitary sewer lift stations, storm drainage facilities, telephone, gas, electric, cable TV lines, ditches or swales, curbs and gutters, pavement limits, bridges or culverts, guardrails, fences, retaining walls etc.
4. Stationing shall be continuous for the entire length of the utility. Centerline of roadway shall be the basis for stationing whenever possible.
5. All waterline changes in horizontal direction as well as locations of fire hydrants, tees, crosses, and caps shall be labeled. Label shall include fitting type, station, offset (if centerline of roadway is used as basis for stationing), and deflection angle. If waterline is located outside of public right-of-way or centerline of roadway is not used as basis for stationing, include northern and easting coordinates in the label.
6. Length, size, and material of waterline between fittings/deflection points.
7. Curvilinear segments of waterline shall have curve data. Curve data shall include:
 1. Curve length
 2. Curve radius
 3. Curve angle in the following format XX degrees XX minutes XX seconds.
8. Existing and proposed contours.
9. Match lines and sheet numbers.

3.5 PROFILE DRAWINGS

- A. Profile is required on all water mains and service lines 6" and larger. The profile shall include but not be limited to the following.
 1. Original ground (dashed) and design grade (solid). Both grades are to be plainly labeled, existing and proposed.
 2. All design elevations shall be invert of pipe. Top of pipe is acceptable for existing utilities.
 3. Stationing shall be continuous for the entire length of the utility. Centerline of roadway shall be the basis for stationing whenever possible.
 4. Type, size and location of all existing utilities, particularly where crossed, with as-built elevations, stations and clearance between utilities. It is contractor's responsibility to field verify the existence and location of all existing underground utilities prior to construction. Contractor shall exercise care when working in order to protect all underground interference and shall be fully responsible for any and all damage caused by his operation.
 5. Type, size and location of all proposed utilities, particularly where crossed, with

elevations, stations and clearance between utilities.

6. Station and elevation of grade breaks, beginning and end of vertical curves.

7. Match lines and sheet numbers.

3.6 DETAILS

A. Detail sheet(s) shall include but not be limited to details of any critical connections, crossings, or special fittings and appurtenances, and any other details that are deemed necessary by the District.

3.7 PRIVATE IMPROVEMENTS

A. Private improvements shall be clearly shown and labeled as such on each sheet. The note below shall appear on each sheet of the development plans where private improvements occur. The District shall not be liable for the maintenance of * _____.
(* Insert name of specific private improvement). These facilities may not meet District standards and are to remain in private maintenance.

PART 4 – DRAFTING STANDARDS

4.1 LETTERING

A. Letter height shall not be less than 0.10" (No. 100 Leroy template). All lettering shall be done with ink. When lettering sizes are less than 0.14" (No. 140 Leroy template), lettering shall be in upper case only. Fonts allowed shall include standard Leroy lettering fonts or fonts included with AutoCAD licenses.

4.2 LINE WIDTH AND COLOR

- A. Proposed and existing features shall be represented on drawings using black lines with a minimum line width of 0.01".
- B. Different line weight/type shall be used to distinguish between existing contours, proposed contour, existing utilities, and proposed utilities.

4.3 LAYERING

4.3.1 WATER SYSTEM LAYERING

Layer Name	Layer Color	Line Type
ADDRESS	4 (cyan)	CONTINUOUS
BLOCK-NUMBER	7 (white)	CONTINUOUS
BOUNDARY- DISTRICT	253	CONTINUOUS
BOUNDARY- SUBDIVISION	1 (red)	CONTINUOUS
BOUNDARY-TOWN	253	DASHED
DRIVE-WAY	7 (white)	CONTINUOUS
ESMT-UTILITY	1 (red)	DASHED2

ESMT-UTILITY-TEXT	7 (white)	CONTINUOUS
LOT-LINE	7 (white)	CONTINUOUS
LOT-NUMBER	7 (white)	CONTINUOUS
PAVEMENT-EDGE	1 (red)	CONTINUOUS
ROW	3 (green)	CONTINUOUS
SECTION-CORNER	7 (white)	CONTINUOUS
SECTION-LINE	2 (yellow)	CONTINUOUS
STREET-NAME	3 (green)	CONTINUOUS
WATER-AIR-RELIEF-VALVE	140	CONTINUOUS
WATER-AIR-RELIEF-VALVE-TEXT	7 (white)	CONTINUOUS
WATER-BLOWOFF	140	CONTINUOUS
WATER-BLOWOFF-TEXT	7 (white)	CONTINUOUS
WATER-FIRE-HYDRANT	140	CONTINUOUS
WATER-FIRE-HYDRANT-TEXT	7 (white)	CONTINUOUS
WATER-MAIN	4 (cyan)	CONTINUOUS
WATER-PRV	140	CONTINUOUS
WATER-PRV-TEXT	7 (white)	CONTINUOUS
WATER -PRETAP	3 (green)	CONTINUOUS
WATER -TEXT	7 (white)	CONTINUOUS
WATER-VALVE	140	CONTINUOUS
WATER-VALVE-TEXT	7 (white)	CONTINUOUS
VALLEY-PAN	253	CONTINUOUS

END OF SECTION

SECTION 01570

TRAFFIC REGULATION

1.1 GENERAL

- A. Conformance: "Manual on Uniform Traffic control Devices", U.S. Department of Transportation, or applicable statutory requirements of authority having jurisdiction.
- B. Operations on or about traffic areas and provisions for regulating traffic will be subject to the regulations of governmental agencies having jurisdiction over the affected areas.
- C. Keep traffic areas and rights-of-way free of excavated material, construction equipment, pipe, and other materials and equipment.
- D. Keep fire hydrants and water control valves free from obstruction and available for use at all times.
- E. Conduct operations in a manner to avoid unnecessary interference with public and private roads, walkways, drives and parking lots.
 - 1. Provide and maintain temporary approaches or crossings and intersections with roads, streets, businesses, parking lots, residences, garages, etc.
- F. Permits shall be obtained from all government agencies having jurisdiction over the affected areas.

1.2 FLAGMEN

- A. Required to provide for public safety and the regulation of traffic.
- B. Properly equipped and certified.

1.3 WARNING SIGNS AND LIGHTS

- A. Protect all roadways by effective barricades on which are placed acceptable warning signs.
- B. Provide suitable barricades and warning signs for open trenches, other excavations and obstructions.
- C. Illuminate, by means of warning lights, all barricades and obstructions from sunset to sunrise.

1.4 MAINTENANCE OF OPERATION

- A. All Roadways
 - 1. Conduct operations so that only one side of the existing roadway will be denied to traffic at any time.
 - 2. In making open cut street crossings, do not block more than one-half of the street at a time.

1.5 DETOURS

- A. Where required that traffic be maintained in a public street, road or highway and the traffic cannot be maintained on the alignment of the original roadway during the performance of the Work, construct and maintain a detour around the construction work, where suitable R.O.W. exists.
- B. Include with each detour all necessary bridges, barricades, guard rails, approaches, lights, signals, signs, flagmen, and all devices and precautions necessary for protection of the Project and safety of the public.

1.6 TEMPORARY BRIDGES

- A. Whenever it is necessary to cross, obstruct or close public or private roads, walkways or drives, provide suitable and safe bridges, detours or other temporary expedients for the accommodation of public and private travel. Such facilities will not be required when Contractor has obtained permission from the owner of private property, or from the authority having jurisdiction over public property involved to obstruct traffic at the designated point.
 - 1. Provide substantial guard rails and suitably protected approaches.
 - 2. Foot bridges will not be less than 4 feet wide, provided with handrails and uprights of dressed lumber.
- B. Maintain in place as long as conditions require their use for the convenience and safety of the public:
 - 1. Bridges may be relocated or temporarily removed for such periods as required when necessary for the proper execution of the Work in the immediate vicinity of a bridge.

1.7 PARKING

- A. Provide suitable parking areas for the use of all construction workers and others performing work or furnishing services in connection with the Project so as to avoid interference with public traffic, Owner's operations or construction activities.

1.8 ROADWAY USAGE BETWEEN OPERATIONS

- A. At all times when Work is not actually in progress, Contractor shall make passable and shall open to traffic such portions of the Project and temporary roadways or portions thereof as may be agreed upon between Contractor and Owner, and all authorities having jurisdiction over any properties involved.

END OF SECTION

SECTION 01600

MATERIAL, EQUIPMENT AND WORKMANSHIP

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section concerns the material, equipment, and workmanship needed to complete the construction of the water main and all associated appurtenances.

1.2 MATERIALS AND EQUIPMENT

- A. Contractor shall furnish all materials, equipment, labor, and all other facilities and incidentals necessary for the execution, testing and completion of the work.
- B. Materials and equipments shall be of good quality and new, except as otherwise provided in these specifications.
 - 1. The Contractor shall furnish satisfactory evidence (including manufacturer's certification) as to the kind and quality of materials and equipment, and their compliance with these specifications.
 - a. The Engineer may test any manufacturer's material he deems necessary.
 - b. It is the Contractor's responsibility to insure the manufacturer's materials meet these specifications.
- C. All materials and equipment shall be installed and used in accordance with the instructions of the applicable manufacturer, fabricator, supplier, or distributor.
- D. The materials and equipment in these specifications are representative of a quality of performance, operation and construction which acceptable of the District.
- E. The District shall evaluate all written requests for products substitution, and shall do so in a timely manner.
 - 1. Requests for product substitution shall include detailed product literature and a description of benefits which might be achieved by this substitution.
- F. By approving materials or equipment for installation, the District assumes no responsibility for injury or claims resulting from failure of the materials or equipment to comply with applicable National, State, and local safety codes or requirements, or the safety requirements of a recognized agency; or failure due to faulty design concepts, or defective workmanship.

1.3 WORKMANSHIP

- A. Contractor shall provide competent, disciplined, suitable qualified personnel to lay out the work and perform the construction.
 - 1. Any workmen deemed not qualified to perform the task he is assigned, in the opinion of the Engineer, shall not be allowed to perform that task.

- B. The construction standards, tests and methods outlined in these specifications are considered adequate to produce the product desired by the District.
 - 1. The District may evaluate alternative methods of construction upon written request, and shall do so in a timely manner.
 - a. Requests for alternative methods of construction shall include detailed descriptions of the equipment, methods and controls needed for the alternative, and a description of the benefits which might be achieved by this substitution.

END OF SECTION

SECTION 01656

DISINFECTION OF DOMESTIC WATER LINES

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Perform disinfection of water mains.

1.2 QUALITY ASSURANCE

- A. Source Quality Assurance:
 - 1. Perform Work in connection with disinfection under direction of experienced supervisor.
 - 2. Use equipment in proper working condition and adequate for specified work.
 - 3. Method of disinfection for water containment devices and piping systems shall conform to AWWA C651-86.
- B. Reference Standards:
 - 1. American Water Works Association (AWWA):
 - a. AWWA C651-86 - Standard for Disinfecting Water Mains.

1.3 SUBMITTALS

- A. Prior to starting disinfection work, furnish detailed outline of proposed sequence of operation, manner of filling and flushing units, source and quality of water to be used, and disposal of wasted water.

PART 2 PRODUCTS

2.1 CHLORINE SOURCE

- A. Chlorine gas-water solution or direct chlorine feed is preferred for disinfection.
- B. Use of high test calcium hypochlorite or tablet method of disinfection shall be approved by ENGINEER and in accordance with AWWA procedures.
- C. Tablet form calcium hypochlorite may be used only for water lines up to 12 in. in diameter and less than 2,500 ft in length.

PART 3 - EXECUTION

3.1 CHLORINE PREPARATION

- A. Liquid Chlorine:
 - 1. Apply chlorine gas-water solution by means of solution feed chlorinating device or, if approved by ENGINEER, dry gas may be fed directly through proper devices for regulating rate of flow and providing effective diffusion of gas into water within unit being treated.

2. Provide chlorinating devices for feeding solutions of chlorine gas that prevent backflow of water into chlorine cylinder.
- B. Calcium Hypochlorite:
1. Prepare granular calcium hypochlorite as water mixture before introduction into unit. First make dry powder into paste and then thin to approximately 1% chlorine solution.
 2. To prepare 1% chlorine solution, add 1 lb of calcium hypochlorite (65% to 70% available Cl_2) to 7-1/2 gals water.

3.2 PIPELINE PREPARATION

- A. After pressure and leakage tests complete, flush units thoroughly to remove foreign material.
- B. Release entrapped air at high points and fill units with disinfecting agent and water to allow disinfecting agent to come in contact with interior surfaces.
- C. If complete venting cannot be accomplished through available outlets, provide necessary corporation cocks and vent piping.

3.3 APPLICATION OF DISINFECTANT

- A. Point of Application:
 1. Apply chlorinating agent at supply end of unit being disinfected.
 2. For pipes, apply disinfectant through corporation cock installed in top of pipe. Place tablets in accordance with AWWA C651.
- B. Rate of Application:
 1. Introduce water at controlled rate in order to regulate chlorine dosage.
 2. Proportion rate of chlorine mixture flow to rate of water entering unit so chlorine dose applied produces at least 25 mg/l chlorine residual after period of 24 hrs.
 3. Method of determining rate of flow of water into unit being disinfected shall be approved by ENGINEER.
- C. Isolating Systems:
 1. Manipulate valves to keep strong chlorine solution and contaminated water from flowing into units previously chlorinated or flushed.
- D. Quality:
 1. Retain chlorinated water in unit long enough to destroy nonspore-forming bacteria. Minimum retention period shall be 24 hrs with chlorine residual at end of this period of not less than 25 mg/l (ppm).
- E. Disinfecting Valves:
 1. Operate valves and appurtenances while line or unit is being disinfected to ensure surfaces of valves are disinfected.
- F. Swabbing:
 1. Flush and swab pipe, fittings, or valves that must be placed in service immediately

with strong (5%) solution of calcium hypochlorite immediately prior to assembly. Approval must be secured from ENGINEER before this method of disinfection will be accepted.

3.4 FINAL FLUSHING AND TEST

- A. Following chlorination, flush unit until replacement water in system is proven to be comparable in quality to water which will enter unit or system.
- B. Acceptable condition of water delivered by each unit or system shall continue for at least 2 days, as demonstrated by laboratory examination of samples. Laboratory tests shall show chlorine residual after final flushing of less than 1 mg/l (ppm).
- C. Repetition of Flushing and Testing:
 - 1. If initial treatment results in unsatisfactory bacterial test, repeat disinfection until satisfactory results are obtained.

3.5 FIELD QUALITY ASSURANCE

- A. Prevent admission of contaminated water into previously disinfected units.

END OF SECTION

SECTION 01666

TESTING PIPING SYSTEMS

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section covers the hydrostatic testing of water mains.
- B. Conduct pressure test and leakage test concurrently.
- C. Do not test until at least 7 days have elapsed after the last concrete thrust restraint has been cast.
 - 1. Thirty Six (36) hours minimum shall elapse if high-early-strength cement is used.
- D. Conduct tests in increments not to exceed distance between line valves without written permission of the ENGINEER.
- E. No allowance shall be made for pressure reductions accomplished by means of pressure reducing valves or other mechanical means.
- F. Commence test procedures when the following conditions are met.
 - 1. Test with the hydrant main valve closed and the auxiliary line valve open.
 - 2. All line valves within the test section shall be fully open.
 - 3. Pipe section to be tested is clean and free of dirt, sand or other foreign material.
 - 4. Brace plugs at end of pipe line to prevent blowouts.
 - 5. Pressurizing equipment shall include regulator set to avoid over-pressurizing and damaging otherwise acceptable line.

1.2 PRESSURE TEST

- A. Pressure test water main, including hydrants and valves in accordance with AWWA C600.
- B. Preparation
 - 1. Slowly fill pipe with water.
 - 2. Remove all air.
 - a. Install corporation cocks at high points to evacuate the air if permanent air vents are not located there.
 - 3. Leave pipe filled with water for minimum of 24 hours prior to the hydrostatic pressure test if mortar lined steel is being tested.
- C. Test Pressure
 - 1. For ductile iron pipe and cast iron pipe use a test pressure of 1½ times the working pressure measured at the lowest elevation of the pipeline test section or the working pressure plus 50 psi, whichever is greater.
 - 2. Maintain the test pressure within ± 5 psig of the test pressure for at least two (2) hours.
 - 3. CAUTION: Do not exceed a test pressure of 125 percent of the maximum working pressure at the highest elevation in the test section.

1.3 LEAKAGE TEST

A. Definition: Leakage is the quantity of water that must be added to the pipeline to maintain pressure within 5 psi of the specified test pressure after the air has been expelled and the pipe is filled with water.

B. Maximum Allowable leakage

1. For ductile iron pipe and cast iron pipe.

$$L = \frac{ND \sqrt[7]{HP}}{7400} \wedge 0.5$$

Where:

L = maximum allowable leakage in gallons

N = Number of joints in the length of pipeline

tested

D = Nominal pipe diameter in inches

P = Average test pressure during the leakage test in psig.

H = Number of test hours.

2. When testing against closed metal-sealed valves, an additional leakage per closed valve of 0.0078 gal/hour/inch of nominal valve size will be allowed.

3. There will be no additional leakage allowance for resilient seated valves.

1.4 ACCEPTANCE

A. Acceptance shall be on the basis of maximum allowable leakage.

B. Locate and repair defective materials and joints if the tests disclose leakage greater than that specified.

C. Repeat test until the leakage is within the permitted allowance.

END OF SECTION

SECTION 01720

PROJECT RECORD DOCUMENT

1.1 MAINTENANCE OF DOCUMENTS

- A. Store documents apart from documents used for construction.
- B. File submitted documents in accordance with the specification's section numbers.
- C. Maintain documents in a clean, dry, legible condition and in good order. Do not use record documents for construction purposes.

1.2 RECORDING

- A. Label each document "PROJECT BOUND" in neat large printed letters.
- B. Record information concurrently with construction progress.
 - 1. Do not cover Work until required information is recorded.
- C. Marking of Project Records.
 - 1. Legible and with a dark pen or pencil.
 - 2. Ink shall not be water based or subject to easy smearing.
- D. Mark Drawings to record actual construction.
 - 1. Field dimensions, elevations and details.
 - 2. Changes made by a Notification.
 - 3. Details not on original Drawings.
 - 4. Horizontal and vertical locations of underground utilities and appurtenances, referenced to a minimum of two permanent surface improvements.
 - 5. Depths of various elements of work in relation to project datum.

1.3 SUBMISSION

- A. Accompany submittal with transmittal letter in duplicate containing:
 - 1. Date.
 - 2. Project title and number.
 - 3. Contractor's name, address and telephone number.
 - 4. Title and number of each Record Document.
 - 5. Signature of Contractor or his authorized representative.
- B. The District requires a set of Drawings of Record on 3 mil, minimum, reproducible, double-matte mylar prior to acceptance of the project.

END OF SECTION

SECTION 02000

WATER SYSTEM DESIGN CRITERIA

1. DESIGN FLOW RATES

A. Residential

1. Basis for developing design flow rates for water distribution system.

Property Description	SFD		Number of Units		People per Unit		Average Day Demand (gallons/ person/ day)		Peaking Factor			Water Peak Flow (gpd)
									day	hr		
Single Family	1*	x	Number of Units	x	3.5	x	85	x	1.4	2.5	=	
Multi-Family	1*	x	Number of Units	x	1.8	x	85	x	1.4	2.5	=	
Townhouse	1*	x	Number of Units	x	1.8	x	85	x	1.4	2.5	=	
Apartment	1*	x	Number of Units	x	1.8	x	85	x	1.4	2.5	=	
Duplex	1*	x	Number of Units	x	1.8	x	85	x	1.4	2.5	=	

*Include supplemental single (SFD) family dwelling values per the supplemental SFD schedule. Does not include irrigation requirements.

2. Water demand supplemental SFD schedule.

Description	SFD Value
Swimming pool: for every 500 SF of surface area, or fraction of	0.18
Residence: for every additional 500 SF of floor space above 2000 SF, or fraction of	0.25

3. Residential Remodel SFD Schedule

Base SFD Schedule.

Property Description	SFD Value
Single Family Residence Unit	1
Multi-Family Residence Unit	1

Supplemental SFD schedule.

Additional fixture unit / room	SFD Value
Toilet	0.11
Lavatory	0.03
Tub	0.06
Shower stall	0.06
Tub/shower	0.06
Sink (excluding kitchen)	0.03

Kitchen	0.16
Bedroom	0.20
Hot tub (single family)	0.05
Hot tub (multi-family)	0.10

B. Commercial

1. Industrial and commercial area flows will be determined using an equivalent SFD schedule as Determined by the District based on type of business.

Property SFD Schedule.

Property Description	Units	SFD Value / unit
Restaurant / Bar	Seat	0.04
Hotel / Motel / Lodge		
room w/o kitchen	Room	0.35
room w/ kitchen	Room	0.50
accessory area	1000 SF	0.26
hot tub	Each	0.10
swimming pool	1000 SF	0.36
Retail, Office, Commercial	1000 SF	0.50
Public Restroom	Toilet or Urinal	0.20
Laundry		
20 lb or less capacity	machine or hook-up	0.50
20.1 – 30 lb capacity	up	0.85
30 lb or more capacity	machine or hook-up	1.30
up	machine or hook-up	
up	machine or hook-up	
Service Stations		
per pump nozzle	each	0.20
or per pump island	each	1.50
plus car wash bay	each	1.50

C. Fire flow

1. No fire flow is provided by the District. Fire Marshall shall be contacted to establish fire flow requirements.

D. Hydrostatic pressure ranges

1. Maximum main design pressure shall be 150 p.s.i.
2. Minimum main design pressure shall be 40 p.s.i.
3. Minimum fire flow shall be specified by the Fire Marshall
4. Residual p.s.i. during fire flow shall be 40 p.s.i.

2. HYDRAULIC DESIGN

A. All public water mains will be a minimum of six (6) inches in diameter. Where a fire hydrant is to be installed, the water main will be a minimum of (eight) 8 inches in diameter.

B. A variety of peak demand, or critical demand conditions, exist for different types of developments. Peak conditions shall be reviewed by the Designing Engineer with the

highest demand condition being used to size water lines. Some typical peak demand conditions include peak hour demand and peak day demand plus fire flow.

- C. Dead-end public water mains shall be a minimum of four (4) inches in diameter. Where a fire hydrant is to be installed, the water main will be a minimum of six (6) inches in diameter. Based on flow projections from the District, the length of the dead-end water main, the number of water services on the main, and fire flow specified by the Fire Department, these water mains may need to be larger than the minimum requirements listed above.

3. LAYOUT

3.1 DEPTH

- A. All waterlines including fire hydrant branches and water services shall have at least seven (7) feet of ground cover from the top of the pipe to the finished ground surface.
- B. In cases where seven (7) feet of cover cannot be achieved, insulation is required. Reference Detail Drawing No.W-2, Typical Insulated Trench Detail. In no case shall the depth of cover be less than five (5) feet.

3.2 ALIGNMENT

- A. All waterlines shall be laid, when possible, on north or east side of the street, from the point of beginning to where the line ends.
 - 1. Permissible Deflection at Joints.
 - a. Install pipe to allow for expansion and contraction without stressing pipe or joints. No deflection is allowed at pipe bends, tees, crosses, and valves. Maximum deflection of joints shall not exceed 50-percent of AWWA C600 requirements as listed below:

DUCTILE IRON PIPE

Pipe Size	Maximum Deflection	Radius of Curvature		5°
		L=18'	L=20'3" - 12"	
205'	230'14" - 42"	3°	340'	380'

- B. Minimum horizontal separation between potable waterline and sanitary sewer line measured edge to edge shall be ten (10) feet.
- C. Minimum vertical separation between potable waterline and sanitary sewer line measured edge to edge shall be eighteen (18) inches.
- D. No waterline shall be located closer than three (3) feet from the lip of a cross pan, gutter, storm drain manhole or other structure. In cases where this cannot be achieved, insulation is required. Reference Detail Drawing No. W-2, Typical Insulated Trench Detail.
- E. No waterline shall be laid parallel to or under any bearing wall that might thereby be weakened during installation or in the event of a line break.
- F. All water mains shall be looped, unless approved otherwise in writing by the District.

4. INTERRUPTION OF WATER SERVICE

- A. The Contractor shall notify the District forty-eight (48) hours in advance when installing any connection which will result in the interruption of water service to an existing customer.
- B. Fire Department shall be notified at least twenty-four (24) hours in advance of any water shut off. A description of the boundaries of the affected area and the location of all fire hydrants in the area shall be provided to the Fire Department.
- C. All affected customers shall be notified twenty-four (24) hours in advance in writing. The notices shall be delivered to each customer by the Contractor. An attempt shall be made to deliver the notice personally to the customer; otherwise the notice shall be left at the customer's door.
- D. A normal outage shall be a maximum of four (4) hours. If the outage will be greater than four (4) hours, then work shall be done in a manner so as to minimize the inconvenience to the customer, and shall be subject to the approval of the District. The District shall notify the Contractor of the timing of the connection. Off hours and weekends may be required by the District.
- E. In commercial areas any disruption of service shall be undertaken only after said disruption has been coordinated with the District and the private property owner(s).
- F. If there exists a business or building that cannot be out of water, the Contractor shall be required to provide an appropriate means of providing water to the affected customer during the installation of the connection.

5. VALVING

- A. Valves shall be located at a point on the main which would be intersected by the extension of a property line, an easement line or a right-of-way line if possible.
- B. Valves located outside of pavement shall be marked using treated wood post. The top of valve shall be set at an elevation four (4) to six (6) inches above final grade. A concrete collar shall be installed around the valve box top section.
- C. Minimum distance between a valve and any fitting shall be two (2) feet.
- D. In-line tee connections shall not have less than two (2) valves.
- E. In-line cross connections shall not have less than three (3) valves.
- F. Valves shall be the same size as the line for which they serve.
- G. Valves will be placed on main lines no more than four hundred (400) feet apart. Each fire hydrant shall have a hydrant valve on the branch line and on the main line to permit main flushing.
- H. The valving of the main lines must be accomplished to prevent more than one hydrant and 20 customers from being out of service in the event of a mainline break or shutdown.

5.1 BLOW OFF VALVE

- A. In all installations where the main will be permanently dead-ended, a blow-off assembly or fire hydrant shall be installed. Where the main will be temporarily dead-ended, for example the boundary of a subdivision filing, a blow-off shall be installed, unless a fire hydrant, which can serve additionally as a blow off, is located at the main's temporary end. Additionally, blow off valve shall be installed at all low points of the main line. Reference Detail Drawing No. W-15.

5.2 AIR RELIEF/VACUUM RELIEF VALVE

- A. Air relief/vacuum relief valve shall be installed at all high points of main line. Reference Detail Drawing No. W-14.

6. TERMINATION OF WATERLINE.

- A. When waterline is terminated, a valve, joint restraint, thrust block and blow off assembly shall be installed at the end of the line.

7. FIRE HYDRANTS

- A. Fire hydrants shall be located at the northeast corner of intersections or on lot line extended in mid-block locations if possible. If the hydrant is located on a road in which snow will be plowed to the downhill side, the hydrant shall be located on the uphill side. Fire hydrants shall be located no closer than eighteen (18) inches to property line, an easement line or a right-of-way line. All fire hydrant street valves shall be six (6) inches and shall be located on the tee from the mainline.
- B. Minimum clearances must be maintained around fire hydrants to facilitate their use. It shall be the responsibility of property owners to maintain a seven (7) foot clearance on either side where 2 1/2" connectors are located; ten (10) foot clearance in front where the 4 1/2" connection is located; four (4) foot clearance in back, to include retaining walls and landscaping; twenty five (25) foot clearance above all fire hydrants. The breakaway fitting must be six (6) inches above finish grade. Reference Detail Drawings W-3 & W-4.
- C. Fire hydrants shall be fed from a looped waterline unless fire hydrant serves as a blow off at the end of the line.

8. EASEMENTS

- A. Easements are required wherever water main is not located in public right-of-way.
- B. Easement width shall be calculated using the following formula:

$$W = O.D. + 20" + 3*(D-1'), \text{ where}$$

W – easement width.

O.D. – pipe outside diameter.

D – depth of cover measured from the top of the pipe to the finished ground surface, in feet.

(NOTE: Formula is based on 1.5H:1V trench side slope. Trench walls are vertical from the bottom of the trench to the point 1' above of the top of pipe according to Section 02221, 3.2-D. 20" came from Section 02221, 3.2-B.)

- C. No water main shall be located less than ten (10) feet from the edge of an easement, measured from the centerline of the pipe, without written approval from the District.
- D. Permanent water main easement shall be minimum twenty (20) feet in width.
- E. Construction water main easement shall be minimum forty (40) feet in width.

END OF SECTION

SECTION 02221

TRENCHING, BACKFILLING, AND COMPACTING

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section covers excavation and trenching; including subsurface drainage, dewatering, preparation of subgrades, pipe bedding, backfilling, compacting, and finish grading for underground pipelines, service lines and appurtenances.
- B. Excavation, trenching and backfilling within the Town of Mt. Crested Butte shall be in accordance with this section or the Town of Mt. Crested Butte Code Section 17-39 which ever is the more stringent. Section 17-39 of the Town of Mt. Crested Butte Code is attached as Appendix B
- C. Reference Water Detail No. W-1.

1.2 QUALITY ASSURANCE

- A. Soil compaction tests shall be performed in accordance with the following specifications or the latest revision thereof:
 - 1. ASTM D698 - Standard Method of Test for Moisture Density Relations of Soils.
 - 2. ASTM D2049 - Standard Method of Test for Relative Density of Cohesionless Soils.
- B. Construction Staking.
 - 1. Construction staking shall be performed with qualified, competent personnel.
 - 2. All survey notes and construction staking notes shall be entered into bound, hard cover field books.
 - 3. Staking of the work shall be at 50 foot stations (maximum) and adequate to provide acceptable horizontal and vertical control.
 - 4. Offsets shall be staked so that vertical and horizontal alignment may be checked.
 - 5. All survey data, which is developed in performing surveys which are required by the work, shall be available to the District for examination throughout the construction period.

1.3 JOB CONDITIONS

- A. Drainage and groundwater.
 - 1. Contractor shall obtain all necessary permits prior to starting dewatering operations.
 - a. If ground water will be discharged into an irrigation ditch, pond, stream or other waterway, or will eventually drain to an irrigation ditch, pond, stream or waterway, a dewatering permit will be required.
 - b. Permit applications are available from:
Colorado Department of Health
WQCD-PE-B2
4300 Cherry Creek Drive South
Denver, CO 80222-1530

2. All excavations and trenches shall be kept free from excess groundwater during construction.
3. Any water which is encountered in the trench shall be removed to the extent necessary to provide a firm subgrade, to permit joints to be made in the dry, and to prevent the entrance of water into the pipeline.
4. Surface runoff shall be diverted as necessary to keep excavations and trenches free from water during construction.
5. The excavation or trench shall be kept free from water until the structure, or pipe to be installed therein, is completed to the extent that no damage from hydrostatic pressure, flotation, or other cause will result.
6. Sumps shall be provided to prevent upward flow of water into the excavation when water is creating unstable trench bottom conditions. The bottom of sumps shall be a minimum of 2-feet below the bottom of the trench.
7. Water shall be prevented from entering into previously constructed pipe.
8. The pipe under construction shall not be used for dewatering.
9. Contractor shall be responsible for any damage to, and the restoration of curbs and gutters and drainage systems resulting from ground and surface waters.

B. Sequencing.

1. Pipeline installation shall be performed within 300 linear feet of trench excavation.
 - a. If construction is occurring in an open field, this distance may be amended, at the District's discretion.
2. Initial trench backfill shall be performed within 50 linear feet of pipeline installation.
 - a. If construction is occurring in an open field, this distance may be amended, at the District's discretion.
3. Where excavation is a hazard to automotive or pedestrian traffic, the amount of open trench and the time duration of that opening is to be minimized.
 - a. The contractor shall coordinate the amount and duration of road closure with the applicable jurisdiction.

C. Underground obstructions.

1. Contractor shall field verify all Drawing of Record information obtained from the District.
2. Contractor shall notify each utility owner and request utilities to be field located by surface reference at least 48 hours prior to trenching or excavation.
3. Where conflicts may exist, the contractor shall expose and verify the size, location, and elevation of underground utilities and other obstructions, sufficiently in advance of construction to permit changes to be made to the Construction Drawings.
 - a. In the case of a conflict, the Contractor shall notify the District, Design Engineer, and the affected utility company.
 - b. In the case of a conflict, the proposed work may be modified, at the District's discretion.
4. Existing improvements, adjacent property, utilities, trees, and plants that are not to be removed shall be protected from injury or damage resulting from the Contractor's operations.
5. If the Contractor removes any underground obstructions, the following shall apply:
 - a. Drainage culverts may be salvaged, stored and reused in the original location, if approval is obtained from the Town of Mt. Crested Butte.
 - 1) All other underground obstructions shall be replaced with new materials.

- b. The area in which the underground obstruction was located shall be restored to original condition, or better.
 - 6. Contractor shall obtain permission from the Town of Mt. Crested Butte prior to removing any trees within the Town of Mt. Crested Butte.
- D. Bridging of Excavations and Trenches
 - 1. In street locations where the Town of Mt. Crested Butte deems necessary, trenches and excavations shall be bridged to permit an unobstructed flow of traffic. Bridging shall be approved by the Town of Mt. Crested Butte and meet the following requirements:
 - a. Bridging shall be secured against displacement by using adjustable cleats, angles, bolts or other devices.
 - b. Bridging shall be installed to operate with minimum noise.
 - c. The trench shall be adequately shored to support the bridging and traffic.
 - d. Steel plates used for bridging shall extend one foot beyond the edges of the trench and meet the minimum thickness requirements listed in Table 3-1. Temporary paving materials shall be used to feather the edges of the plates to minimize wheel impact.

Table 3-1

MINIMUM STEEL PLATE THICKNESS FOR BRIDGING

Width of Trench	Minimum thickness of Steel Plates
1.0 ft	1/2 inch
1.5 ft	3/4 inch
2.0 ft	7/8 inch
3.0 ft	1 inch
4.0 ft	1-1/4 inch

1.4 MAINTENANCE AND CORRECTION

- A. Contractor shall maintain and repair all trench settlement and make necessary repairs to pavement, sidewalks or other structures which may be damaged as a result of backfill settlement.
 - 1. Contractor shall warrant work for a period of five (5) years after final completion and acceptance of the work.
- B. Contractor may perform such maintenance and repairs by subcontract.
 - 1. If the contractor chooses to subcontract the warranty work, he shall submit to the District, a copy of the subcontract, or the work authorization, as evidence of the contractor's faithful intention to perform any repairs which may become necessary during the five-year warranty period.

PART 2 - MATERIALS

2.1 STABILIZATION MATERIAL

- A. If the existing soil in the trench bottom is judged to be unsuitable by the District, the top 6-inches of the pipe subgrade shall be removed and replaced with a stabilization material.
1. Stabilization material is crusher-run rock, conforming to ASTM D448, or CDOT #357.

SIZE	PERCENT PASSING
2"	95-100
1"	35- 70
1/2"	10- 30
#4	0- 5

2. Or an approved substitute.

- B. Geotextile fabric may be used in conjunction with stabilization material, with the prior written approval of the Town of Mt. Crested Butte.

1. Acceptable types of geotextile fabric and their manufacturers are:
 - a. Mirafi 140 and 500 x, by "Celanese".
 - b. Bidim C-28 and C-34.
 - c. True Tex M G-100, by "True Temper".
 - d. Fibretex Grade 150, by "Crown Zellerbach".
 - e. TS700 or TS420, by "ADS".
 - f. Or an approved equal.

2.2 BEDDING MATERIALS

- A. Pipe shall be bedded in a uniformly graded material, conforming to CDOT #67.

SIZE	PERCENT PASSING
1"	100
3/4"	90-100
3/8"	20- 55
#4	0- 10
#8	0- 5

- B. Select soil.
1. Excavated material which is free from rocks, clods, and stones greater than 1 1/2 inch in any dimension, and which meets other requirements of trench backfill material.
 2. Granular material.
 - a. Reference paragraph 2.2.A.
- C. Hydrant gravel.
1. Reference Section 02644.

2.3 GROUND WATER BARRIERS

- A. Clay shall be used for ground water barriers and meet the following soil classification.
1. GC - clayey gravels, gravel-sand-clay mixtures.
 2. SC - clayey sands, sand-clay mixtures.
 3. CL - inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, clean clays.
 4. Material may be finely divided, suitable, job excavated material free from stones, organic matter and debris.

2.4 TRENCH BACKFILL MATERIAL

- A. Trench backfill material shall be placed from a point 12-inches above the pipe to 8-inches below the ground surface for gravelled streets or to the bottom of the pavement for paved streets.
- B. Trench backfill material shall be either soil excavated from the trench, or imported soil.
 - 1. Any soil used for trench backfill, shall be free from frozen matter, stumps, roots, brush, other organic matter, cinders or other corrosive material, debris, and any rocks or stones which are larger than 6-inches, in any dimension.
 - a. Rocks or stones which are larger than 3-inches, in any dimension, shall not be placed within one foot of pipe, pavement subgrade, or finished surface of unpaved areas.
 - 2. If imported soil is used for trench backfill within the town of Mt. Crested Butte, it shall meet CDOT specifications for Class #6 material, and shall conform to the Town of Mt. Crested Butte Section 17-39 Code. Reference Appendix B

PART 3 - EXECUTION

3.1 PREPARATION

- A. Topsoil shall be stripped and stockpiled from areas which are to be disturbed by construction.
 - 1. Topsoil shall be segregated from non-organic trench excavation material, and debris.

3.2 TRENCHING

- A. Trenches shall be excavated by open cut methods, except where boring or tunneling is approved by the District.
- B. Trench width shall be not less than pipe O.D. plus 20 inches for 12" and smaller pipe.
- C. Care shall be used when operating mechanical equipment in locations where it may cause damage to trees, buildings, culverts, or other existing property, utilities, or structures above or below ground.
- D. Mechanical equipment shall be designed and operated in such a manner that the bottom elevation of the trench can be controlled with uniform trench widths and vertical sidewalls which extend from the bottom of the trench to an elevation one foot above the top of the installed pipe.
 - 1. Contractor shall follow the most current regulations concerning excavations set forth by OSHA; 29 CFR Part 1926. The shoring shall not place any stress on the completed work until completed work construction has proceeded far enough to provide ample strength.
- E. Trench alignment shall be sufficiently accurate to permit pipe to be aligned properly with an 8 inch minimum clearance between the pipe and the sidewalls of the trench or trench box.
 - 1. The trench sidewall shall not be undercut in order to obtain clearance.
- F. Preparation of trench bottom.

1. Trench bottoms shall be graded uniformly to provide clearance for each section of pipe.
2. Loose material, water, and foreign objects shall be removed from the trench.
3. The contractor shall provide a firm subgrade, which is suitable for application of bedding material.
4. Wherever unstable material is encountered in the bottom of the trench, said material shall be over-excavated to a depth suitable for construction of a stable subgrade.
 - a. The depth suitable for construction of a stable subgrade shall be determined by the District's Engineer.
 - b. The over-excavation shall be backfilled with stabilization material and compacted as required by the District.
 - 1) Reference paragraph 2.1.

G. Stockpiling excavated materials.

1. Suitable material for backfilling shall be stockpiled in an orderly manner, and a minimum of 2 feet from the edge of the trench.
2. Excess excavated materials not suitable or not required for backfilling shall be removed and disposed properly.
3. Excavated material shall not be stockpiled against existing structures or appurtenances.

3.3 PIPE BEDDING

A. Placement and compaction.

1. Reference Detail Drawings No. W-1 & W- 2.
2. Bedding material shall be distributed and graded to provide uniform and continuous support beneath the pipe at all points between bell holes, or pipe joints.
 - a. Pipe shall not be supported by the bells.
 - b. A minimum of 4-inches of bedding shall be placed prior to the installation of pipe.
 - c. Bedding material shall not be dropped on pipe which is supported only at each end.
3. To prevent lateral displacement, granular bedding material shall be deposited and compacted uniformly and simultaneously on each side of the pipe.
4. Granular bedding material shall be to the spring line for water lines.
5. Granular bedding material shall be compacted in accordance with these Specifications.

3.4 GROUND WATER BARRIERS

A. Ground water barriers shall be constructed in such a manner as to impede passage of water through bedding material for the full depth of the granular bedding material, and the full width of the trench.

1. Ground water barriers shall be approximately four (4) feet long and spaced not more than 400 feet apart.
2. Trench excavated clay material will be suitable for barriers.

3.5 BACKFILLING AND COMPACTION

A. Trenches shall be backfilled promptly after the pipe has been installed and inspected.

1. All trench backfill shall be compacted as stipulated in this section.

2. Backfill around manholes, valve boxes, and appurtenances shall be compacted with hand-operated equipment capable of producing the required compaction.
 3. Reference paragraph 1.3.B.2.
 4. Excavations in streets shall be paved with a hot mix asphalt within 24 hours of backfilling unless street was unpaved prior to excavation.
- B. Sheeting removal (if the Contractor elects to use sheeting).
1. Do not remove sheeting prior to backfilling.
 2. Use effective methods to protect the construction, other structures, utilities and properties during sheeting removal.
 3. Voids left by sheeting removal shall be filled with dry sand.
 4. Sheeting which is left in place shall be cut off at an elevation 1-1/2 feet below the finish grade of unpaved areas, or the subgrade of paved areas.
- C. Backfill material shall be deposited in uniform horizontal layers which may not exceed six (6) inches (compacted depth), in all areas.
1. Other thickness may be used with the prior written approval of the Town of Mt. Crested Butte.
- D. Methods and equipment which are appropriate for the backfill of material shall be employed.
1. Backfill equipment or backfilling methods which transmit damaging shocks to the pipe, are not to be used.
- E. Compaction shall not be performed by jetting or water settling.
- F. If compaction can not be obtained with job excavated material, trench backfill material shall be imported.
- G. Topsoil shall be replaced to the depth of stripping.
- H. Excess excavated materials and materials not suitable for backfill shall be disposed properly.

3.6 FIELD QUALITY CONTROL

- A. Field compaction control.
1. Field tests will be conducted to determine compliance of compaction methods with specified density in accordance with ASTM D2922 (Tests for Density of Soil and Soil-Aggregate In Place by Nuclear Methods).
 2. Moisture/density tests will be performed by a private Geotechnical Consultant retained by Owner.
 - a. Test results shall be submitted to the District by the Geotechnical Consultant the day of the tests.
 - b. Copies of the field work sheets are acceptable.
 - c. Summarized test results shall be submitted to the District prior to the initial acceptance of the trenched areas.
 3. Compaction tests shall be performed at a depth of 1.5 feet above the top of the pipe and in 1 foot vertical increments up to the finish grade.
 - a. Compaction tests shall be performed at least once every 100 linear feet, as measured along the length of the pipe.

- b. If the Town of Mt. Crested Butte determines that reliable and uniform results are produced by the Contractor's construction techniques, the frequency of testing may be changed to once every 300 feet.
 - 4. Moisture/density tests in the vicinity of manholes, valve boxes and appurtenances shall be performed at a maximum of one (1) foot away from the structure.
 - a. A test shall be made in all four directions from the structure.
 - b. A minimum of one test shall be performed for every two (2) feet of backfill material.
 - c. The Contractor may be required to dig up portions of the trench for compaction tests below the top surface of the backfill material.
 - 5. All failed test areas shall be recompact and retested.
- B. Compaction shall be to the following minimum densities: (Reference ASTM D698 or AASHTO T99 unless otherwise indicated).
 - 1. Barrier material: 95% of maximum density.
 - 2. Pipe bedding.
 - a. Compacted granular material: 80% of maximum relative density (ASTM D2049).
 - b. Carefully compacted select soil: 95% of maximum density.
 - 3. Trench backfill.
 - a. All Locations: 95% of maximum density.
- C. Moisture content.
 - 1. All compacted backfill shall be within 2% (+/-) of the optimum moisture content of the soil as determined by ASTM D698.
 - 2. Water shall be added to the material, or the material shall be harrowed, disced, bladed, or otherwise worked to insure a uniform moisture content, as specified.

END OF SECTION

SECTION 02224

PIPE BORING AND JACKING

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section covers the furnishing and installation of casing pipe by boring or jacking.
- B. Reference Detail Drawing W-9.

1.2 QUALITY ASSURANCE

- A. Design Criteria
 - 1. Specified thicknesses for pipe and casing are based upon the superimposed loads and not upon the loads which may be placed on the pipe as a result of jacking operations.
 - 2. Provide increased pipe strength necessary to withstand jacking loads.
- B. Requirements of Regulatory Agencies
 - 1. Obtain the necessary permits from the appropriate jurisdiction.
 - 2. Obtain bonds or indemnity required by the permits for protection against damage and interference with traffic and service by construction activities.

1.3 SUBMITTALS

- A. Certification: Submit manufacturer's certification that materials meet referenced standards.
- B. Shop Drawings: Submit manufacturer's drawings and specifications on the materials.

1.4 ALTERNATIVES

- A. Bid shall be based upon new pipe. However, request for substitution of "reject" or used pipe in lieu of new pipe may be made after award of the Contract. Used pipe shall be clean, free from heavy corrosion, patches, cuts and holes, and shall be straight and true in centerline alignment and circular in cross section. Pipe shall in all other respects meet the requirements specified for new pipe. Acceptance of all pipe shall be at the discretion of the District Engineer.

PART 2 - PRODUCTS

2.1 CASING PIPE

- A. Smooth Steel Pipe
 - 1. Minimum Yield Point: 35,000 psi.
 - 2. Wall Thickness: Minimum allowable.

<u>Diameter, inches</u>	<u>Thickness, inches</u>
24 inch or smaller	0.250
30	0.250
36	0.312

3. Ends: Beveled for field welding.
4. Exterior Coating: Coal tar enamel, AWWA C203, Section 2.

2.2 ACCESSORIES

- A. Casing Seals
 1. Materials: High density rubber with stainless steel strap.
 2. Manufacturer: Pipeline Seal and Insulator Co., Model W, or equal.
- B. Casing Chocks
 1. Materials: Stainless steel casing chock
 2. Manufacturer: Pipeline Seal and Insulator Company, Model 4810, or equal.
- C. Bands: Stainless steel straps.

PART 3 - EXECUTION

3.1 CASING INSTALLATION

- A. General
 1. Install the casing by jacking or tunneling through the earth.
 2. Open trench excavation shall not be permitted where boring or jacking is specified.
 3. Remove earth displaced by the casing through the interior by hand, by auger, or other acceptable means.
 4. Where indicated on the drawings install the casing by open-cut methods in accordance with Section 02221.
- B. Smooth Steel Pipe
 1. Provide adequate equipment to insure a smooth, continuous and uniform casing with no exterior voids.
 2. Weld each section of pipe with a full penetration butt weld around the entire circumference of the joint to form a continuous conduit capable of resisting all stresses, including jacking stresses.

3.2 CARRIER PIPE INSTALLATION

- A. Install pipe in accordance with the applicable pipe specification sections.
- B. Attach 3 pipe chocks to each pipe length with a maximum spacing of 6 feet and insert carrier pipe. Reference Detail Drawing W-9.
- C. Seal the ends of the casing with casing seals.

END OF SECTION

SECTION 02441

SPRINKLER & IRRIGATION SYSTEMS

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section covers the furnishing and installation of buried sprinkler and irrigation systems.

1.2 QUALITY ASSURANCES

- A. All pipe, pipe fittings, valves and sprinkler materials shall be of the type, class and model as shown on the plans or specified by the Engineer.
- B. All sprinkler equipment shall be of the same manufacturer and shall be guaranteed for a period of one (1) year.

1.3 SUBMITTALS

A. Shop Drawings

- 1. Submit complete drawings and specifications covering the valves and sprinkler materials.
- 2. For pipe, submit manufacturer's material specifications, general piping, layout and details of fittings, specials, connections, joints and harnesses.

B. Certifications

- 1. Submit manufacturer's certification that products meet the requirements of referenced standards.

C. Instructions and Record Drawings

- 1. After the completion of the pipe installation, the contractor shall furnish the Owner with an "As Buy It" drawing showing the correct location of the following:
 - a. All piping
 - b. Valves
 - c. Sprinkler heads
 - d. Control line locations
 - e. Other critical dimensions
- 2. The Contractor shall furnish the Owner with two bound folders which shall include the following:
 - a. Operation and Maintenance Manual
 - b. Instruction Sheets
 - c. Parts list for all equipment

1.4 PRODUCT DELIVERY AND STORAGE

- A. The Contractor shall exercise care in handling, loading, unloading, and storing the pipe and fittings.
 - 1. The pipe and fittings shall be stored under cover, unless specific permission is granted for open, uncovered or unprotected storage.

2. Pipe shall be stored in accordance with the manufacturer's recommendations regarding skids, blocking, etc., to prevent damage to the pipe.

PART 2 - PRODUCTS

2.1 PIPE MATERIALS

All pipe and pipe fittings shall be furnished complete with all couplings, gaskets, follower rings, feeder gauges, lubricant, solvent, cement, bolts, etc., to complete all connection or joining in accordance with the manufacturer's recommendations.

A. Polyvinyl Chloride Pipe

1. All pipe shall be extruded from 100 percent virgin unplasticized type I, normal impact polyvinyl chloride.
2. Shall bear the U.S.F. Seal of Approval.
3. Shall conform to Commercial Standard C.S. 356-63.
4. P.V.C. Cement and Thinner shall be of the type recommended by the pipe manufacturer. All cement and thinner shall be delivered in unopened cans and guaranteed satisfactory for use.
5. Pipe fittings shall conform to the same specifications as the pipe.

B. Polyethylene Pipe

1. All pipe shall conform to requirements for Type II polyethylene pipe set by Commercial Standard C.S. 255-63.
2. All pipe shall bear the N.S.F. Seal of Approval.
3. Class 80 pipe shall be used unless noted otherwise.
4. All polyethylene pipe shall be installed with brass, galvanized iron, or stainless steel fittings.

C. Copper Pipe

1. All pipe shall be manufactured in accordance with ASTM Specification B-42.
2. Type K or M copper shall be used as specified.
3. Wrot copper fittings shall be "Nibco" or equal.
4. Flared copper fittings shall be "Mueller" or equal.

D. Cast Iron Pipe

1. Pipe shall be in accordance with Federal Specifications WW-P=421 lb., Class 150 and shall be dipped in or painted with two (2) coats of asphalt or coal tar and oil preparation.

2.2 VALVES

All valves shall be furnished complete with all necessary gaskets, follower rings, bolts, nuts, operator device and valve box and cover where directed.

A. Valves and Keys

1. The installation of all valves shall include excavation, backfill, furnishing, installing and testing of risers, fittings, and valves, and the removal and/or restoration of existing improvements.
2. All manual angle valves and manual angle drain valves shall be installed with a length of 2 inch PVC plastic pipe of length required to extend from the top of the valve to finish grad line. A locking type valve marker shall be installed in the top of

- the 2 inch pipe for easy location of the valve and for access for operation of the valve.
3. The manual angle drain valves shall be provided with proper gravel sump at the outlet of sufficient size to provide proper drainage, or if conditions are such, the outlet shall be piped to a drainage tile, drainage ditch or pond to provide proper drainage.

2.3 SPRINKLERS

Where discharge requirements are indicated, sprinklers shall be equipped with suitable nozzle configurations to perform as specified. All sprinklers shall be furnished complete.

PART 3 - EXECUTION

3.1 PIPE INSTALLATION

A. Laying Polyvinyl Chloride Pipe

1. Each section of pipe shall rest along the entire length of the barrel with recesses excavated to accommodate the couplings.
2. The bottom of the trench shall be free from rocks, clods or other sharp edged objects which may damage the pipe.
3. Plastic pipe shall be joined with a solvent that is recommended by the pipe manufacturer, and all surface preparation and jointing shall be done as set forth by the manufacturer.
4. All solvent welded joints shall be given at least fifteen minutes curing time before moving or handling.
5. No testing shall be made on pipe which has not cured at least 24 hours.

B. Laying Polyethylene Pipe

1. Each roll shall be inspected to detect any "kinking" or other damage caused by shipping or handling. Any pipe found defective shall be rejected.
2. All pipe shall be joined with stainless steel clamps.
3. Single clamps may be used on pipe sizes through 1¼ inches in diameter.
4. All pipe sizes larger than 1¼ inches shall require double clamps.
5. Do not use any other lubricant other than water.
6. All pipe shall rest along its entire length in the trench.
7. The bottom of the trench shall be free from any rocks, clods, or other sharp edged objects which may damage the pipe.

C. Laying Copper Pipe

1. All copper pipe shall be installed in accordance with the manufacturer's recommendations.
2. Copper pipe shall be connected by flared joints in all underground areas.
3. Connections for copper pipe within an accessible area may be flared, brazed or soldered.
4. All copper to threaded pipe joints shall be made by use of brass adapter fittings.

D. Laying Cast Iron Pipe

1. All unplugged ball and spigot or bell-bell bonds, tees, wyes, etc., shall be provided with thrust blocks, joint harness or other anchorage adequate to prevent movement of the pipe caused by internal pressure.

E. Frost Protection

1. All lateral lines shall be sloped to drain to the mainline through the control valves.
2. The Contractor shall slope all main and lateral lines at a minimum slope of three inches per 100 feet.
3. All drain sumps shall be of sufficient volume to assure complete drainage of each contributing area.
4. The minimum drain pit shall be not less than two (2) cubic feet in diameter.
5. The sump pit shall consist of 3/4 inch No. 2 gravel or approved equal.
6. A cover of polyethylene sheeting, building paper or other approved material shall be placed over the pit prior to backfilling to prevent the infiltration of dirt into the drain pit.

F. Deviations for Utility Structures

1. Whenever existing utility structures, conduits, ducts, pipes or other obstructions to grade and alignment of the pipe are encountered, they shall be permanently supported, protected, removed or reconstructed by the Contractor through the cooperation of the utility company involved.

3.2 SPRINKLER INSTALLATION

- A. All sprinklers and quick coupling valves shall be installed in strict accordance with the manufacturer's recommendations.
- B. Sprinkler piping shall be thoroughly flushed before the heads are installed.
- C. Contractor shall provide the Owner with two (2) additional complete sprinkler head assemblies for each different head installed.

3.3 ACTIVATING THE SYSTEM

A. Backflow Prevention and Connection to Main

1. Unless otherwise specified, the Contractor shall make the connection to the building's interior water service, downstream of the water meter.
2. If connection to the District water main is required, it shall be made by an experienced, licensed plumber and be separately metered.
3. An approved backflow prevention assembly shall be installed on all domestic waterline connections.

B. Hydrostatic Tests

1. After the pipe has been laid, backfilled to springline and center, located with earth free from rocks and clods, the mainlines shall be connected to the water supply, flushed out, valves connected or ends plugged, all of the outlets closed and made ready for testing.
2. A test pressure of 115 psi shall be applied to the system in the presence of the Owner or his representative, and all exposed piping, fittings, valves, joints and appurtenances examined for leaks.
3. After visual inspection has been completed, and any leaks repaired, the Contractor shall reapply the test pressure, and then isolate the system.
4. The installation shall be considered acceptable for backfilling when the test pressure has been maintained without loss for a period of one (1) hour.

C. System Adjustment

1. Adjustment of the sprinkler heads, control systems, and performance tests, shall be done by the contractor to provide the Owner with a most professional, complete installation.
2. All performance tests shall be made in the presence of the Owner or his representative.
3. The Contractor shall pay particular attention to coverage and system operation.
4. Any areas which do not conform to designed operation requirements due to unauthorized changes or poor installation practices, shall be immediately corrected by the Contractor at no additional cost to Owner.

END OF SECTION

SECTION 02612

FIELD WELDING PROCEDURES FOR STEEL PIPE

PART 1. DESCRIPTION

A. This section covers requirements and techniques for satisfactory manual, semiautomatic, and automatic field welding by the metal arc-welding processes for steel water pipe manufactured in accordance with AWWA C200.

PART 2. CONFORMANCE

A. All welds shall conform to AWWA C206 and AWWA M11.

PART 3. JOINT INSTALLATION

A. Lap joints.

1. Lap joints shall be single welded joints welded from the outside of the pipe.
2. Field joints shall be assembled so that seams in adjacent pipe sections are offset from each other by at least five times the thickness of the thinner of the pipes being joined.
3. Clearance between faying surfaces of lap joints shall not exceed 1/8 inch at any point around the periphery. The minimum overlap of the assembled bell-and-spigot sections of the joint shall be 1 inch or three times the thickness of the belled pipe, whichever is greater. No part of any field weld shall be closer than 1 inch to the nearest point of tangency to a bell radius.

B. Butt joints.

1. Butt joints shall be single-groove, full penetration butt welds welded from the outside of the pipe.
2. Field joints shall be assembled so that seams in adjacent pipe sections are offset from each other by at least five times the thickness of the thinner of the pipes being joined.
3. Backing rings shall be used to assist in proper alignment unless otherwise prohibited. The exterior backing ring should remain after welding unless otherwise required.
4. Butt joints shall be accurately aligned and retain in position during the welding operation so that, in the finished joint, the abutting pipe sections shall not be misaligned by more than 20 percent of the pipe wall thickness or a maximum of 1/8 inch, whichever is less.

C. Butt-strap joints.

1. The butt strap shall be welded from the outside of the pipe.
2. The butt straps shall have a minimum plate thickness equal to the thinnest member being joined and shall be fabricated from material equal in chemical and physical properties to the thinnest member being joined. Strap width shall be not less than four (4) inches. The minimum lap between pipe ends and the edge of the butt strap shall be one (1) inch. Longitudinal seams of butt straps shall be joined by full-penetration groove ends.
3. Butt strap joints shall be fillet welded on the exterior with a circumferential watertight fillet weld being at least equal in cross-section to the wall thickness of the steel pipe.

- D. During welding, the coating shall be protected by draping an 18 inches wide strip of heat resistant material over the top half of the pipe on each side of the coating holdback to avoid damage to the coating by hot weld splatter. No welding ground shall be made on the coated part of the pipe.
- E. The exterior surface of all welded joints shall be coated with Canusa Aqua-Shield heat shrink sleeve or approved equal.

PART 4. Preparation of surfaces.

- A. Surfaces to be welded shall be free from water, scale, slag, heavy rust, grease, coating, paint, cement, or any other foreign material. Joint surfaces shall be smooth, uniform, and free from defects that adversely affect proper welding. After wire brushing, any residual light film of rust remaining on the cut or sheared edges to be welded need not be removed. Surfaces that were previously torch cut or air-arc gouged shall be ground to remove slag and oxidation.

PART 5. WEATHER CONDITION

- A. Welding shall not be performed when the ambient temperature is less than 0°F or when surfaces are wet from rain, condensation, snow, or ice, or during periods of high wind, unless the operator and the work are properly protected. Regardless of the ambient conditions, the metal temperature in the pipe wall shall not be less than 50°F at any point within 3 inches of the point of welding or four times the pipe wall thickness, whichever is greater.

PART 6. PREHEATING

- A. When preheating is required, it shall extend ahead of the point of welding a minimum distance of four times the plate thickness, but not less than 3 inches on each side of the seam.

PART 7. APPLICATION OF WELD

- A. The welds shall be applied by means of continuous stringer beads, or a weave pattern according to ANSI/AWS D1.1. Each bead shall be cleaned and descaled before the succeeding bead is applied. Welded joints shall not be covered or coated until welding is completed and the weld accepted.

PART 8. FIELD QUALITY CONTROL

- A. Leakage test.
 - 1. Reference Section 01666 Testing Piping Systems.
- B. Provide information in reference to training and certification requirements of personal conducting welding procedure to join steel pipe.

END OF SECTION

SECTION 02615

DUCTILE IRON PIPE

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section covers ductile iron pipe. Furnish pipe complete with all fittings, flanges, specials and other accessories.

1.2 SUBMITTALS

- A. Certification: Submit manufacturer's certification that products meet the referenced standards.
- B. Shop Drawings: Submit manufacturer's specifications and details for all ductile iron and cast iron piping and accessories. Submit complete layout drawings and details of connections for all piping installed within the limits of structures.

1.3 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Handling
 1. Use slings, pipe tongs or skids.
 2. Do not drop pipe or fittings including dropping on old automobile tire or other cushions.
 3. Do not skid or roll pipe into pipe already on the ground.
 4. Do not damage coating or lining.
 5. Do not use hooks.
- B. Storage
 1. Maintain lubricant in a sanitary condition during storage.
 2. Store rubber gaskets in a cool, dark location away from grease, oil and ozone producing electric motors.
 3. Do not exceed maximum stacking heights listed in AWWA C600, Table 1.

PART 2 - PRODUCTS

2.1 PIPE

- A. Ductile Iron Pipe
 1. Standard: ANSI(AWWA C151)21.51-93.
 2. Class 52 standard thickness for mechanical and push-on joint piping.
 3. Class 53 for flanged piping.

- B. Flanged Ductile Iron Pipe
 1. Standard: ANSI(AWWA C115)A21.15-88, flat faced.

2.2 FITTINGS

- A. Flanged, Mechanical Joint, Push-on.
 1. Standard: ANSI(AWWA C110)A21.10-93.
 2. Dimensions: Shorter laying lengths will be acceptable except where longer lengths are indicated on the Drawings.

- B. Threaded
 - 1. Standard: ANSI B16.4, ANSI B16.14.

2.3 JOINTS

- A. Mechanical and Push-On
 - 1. Standard: ANSI(AWWA C111)A21.11-90.
 - 2. Gaskets: Synthetic Rubber.
 - 3. Lubricant: Furnished by pipe manufacturer.
- B. Flanged
 - 1. Standard: ANSI(AWWA C115)A21.15-88.
 - 2. Flanges: ANSI B16.1
 - 3. Drilling: 125 lb., unless otherwise indicated.

2.4 COUPLINGS

- A. Mechanical Couplings
 - 1. Type Mechanical compression sleeve.
 - 2. Omit pipe stop unless indicated otherwise on the Drawings.
 - 3. Gaskets: Synthetic Rubber.
 - 4. Dresser Style 38, Smith-Blair Type 41 Baker Series 400, or equal.
- B. Flanged Coupling Adapters
 - 1. Three (3) inch through 12 inch: Dresser Style 127; Smith-Blair Type 912; or equal with locking pins unless indicated otherwise on the Drawings.
 - 2. Gaskets: Synthetic Rubber.
- C. Transition Couplings
 - 1. Dresser Style 162, or equal.
- D. Wall Castings
 - 1. Mechanical joint with waterstop and tapped holes.
 - 2. Plug all holes with plastic plugs.

2.5 PIPE LINING

- A. Cement Mortar
 - 1. Standard: ANSI(AWWA C104)A21.4-90.
 - 2. Thickness: Not less than 1/16 inch.

2.6 PIPE COATINGS

- A. Underground or Submerged Locations: ANSI/AWWA 151/A21.51-91
 - 1. Type: Bituminous.
 - 2. Thickness: Approximately 1 mil.

B. Polyethylene Encasement

1. Polyethylene encasement shall be used whenever the resistivity of the native soil is less than 2,500 ohm-centimeters, or as required by the District.
2. Standard: ANSI(AWWA C105)A21.5-93
3. Thickness: 8 mil.
4. Method: A.

2.7 ACCESSORIES

A. Tie Rods

1. Rods: ASTM A307.
2. Steel Rods: ASTM A120, standard weight.
3. Washers: ANSI B18.22.1, plain steel.

PART 3 - EXECUTION

3.1 INSPECTION

A. Examine pipe and fittings and do not use individual section's containing:

1. Cracks.
2. Flaws.
3. Broken or loose lining.
4. Other defects.

B. Mark defective pipe and remove from the site.

3.2 INSTALLATION

A. Install pipe in accordance with Section 02713.

B. Cutting the pipe.

1. Cut pipe smooth, straight and at right angles to the pipe axis.
2. Do not damage the pipe or cement lining.
3. Use a saw, abrasive wheel, or oxyacetylene torch for ductile iron pipe.
4. Do not use an oxyacetylene torch for cutting holes for saddles.
5. Grind out ends and rough edges smooth.
6. Bevel the cut end for push-on joints.

C. Field Joints

1. Use push-on mechanical joints in underground locations unless indicated otherwise on the Drawings.
2. Use flanged joints at other locations unless indicated otherwise on the Drawings.
3. All joints shall be watertight and free from leaks.
4. Repair each leak discovered within one year after final acceptance.
5. Do not deflect joints beyond the maximum values specified in AWWA C600, Tables 5 and 6.

D. Polyethylene Encasement

1. Install polyethylene encasement on ductile iron pipe as noted.

3.3 JOINT INSTALLATION

A. Push-On Joints

1. Clean the inside of the bell and the outside of the spigot to remove dirt, oil, excess coating and other foreign matter.
2. Insert the gasket.
3. Apply a thin film of lubricant to either the inside surface of the gasket, the spigot end of the pipe or both.
4. Do not permit the joint surface to come in contact with the ground.
5. Assure that pipe is marked with a depth mark before assembly to assure the spigot end is inserted the full depth of the joint.
6. Complete the joint making certain the spigot is inserted to the depth mark.

B. Mechanical Joints

1. Remove all dirt, oil, grit, excess coating and other foreign matter from the inside of the bell and the outside of the spigot.
2. Apply a thin film of lubricant to the inside of the bell, the outside of the spigot and the gasket.
3. Tighten nuts alternately on opposite sides of the pipe to produce equal pressure on all parts of the gland.
4. Use a torque limiting wrench and do not exceed the maximum torque values listed in AWWA C600 Table 4.
5. Holes in mechanical joint bells shall straddle the top (or side for vertical piping) centerline.

C. Flanged Joints

1. Extend pipe completely through screwed-on flanges.
2. Machine finish the pipe end and flange face in a single operation.
3. Eliminate any restraints on the pipe which would prevent uniform gasket compression or cause unnecessary stress in the flanges.
4. Do not assemble mechanical connections until all flanged joints affected thereby have been tightened.
5. Alternately tighten bolts spaced on opposite sides of the pipe to assure uniform gasket compression.
6. Holes in flanges shall straddle the top (or side for vertical piping) centerline.

D. Mechanical Couplings

1. Clean and smooth pipe ends.
2. The gap between pipe ends being coupled shall be less than one inch and greater than $\frac{1}{4}$ inch.

END OF SECTION

SECTION 02641

VALVES

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section covers valves, valve operators, valve boxes, and appurtenances used for water distribution and transmission lines.

1.2 SUBMITTALS

- A. Shop Drawings
 - 1. Submit complete drawings and specifications covering the valves and their appurtenances.
- B. Certification
 - 1. Submit manufacturer's certification that products meet the referenced standards.

1.3 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Take precautions so as not to damage materials during delivery or storage.
- B. Store valves off the ground and away from materials that could contaminate potable water systems.
- C. Take precautions to keep joints and internal parts clean.

PART 2 - PRODUCTS

2.1 GATE VALVES

- A. Conformance: AWWA C509.
 - 1. Type: Resilient seat.
 - 2. Stem: Non rising
 - 3. Direction of opening: Open left.
 - 4. Valve ends: Conform to the type of pipe material used.
 - 5. Operator: 2" operating nut.
- B. Acceptable Manufacturers
 - 1. Waterous
 - 2. Kennedy

2.2 BUTTERFLY VALVES

- A. Conformance: AWWA C504
 - 1. Type of body: Conform to the type of pipe material used, flanged valves shall be short body.
 - 2. Class: As noted.
 - 3. Type of operator for valves in vaults: Manual operators with 12 inch handwheels.

4. Direction of opening: Open left
5. Valve operator arrangement and position:
 - a. For use in horizontal position.
 - b. Operator horizontal to valve.
6. Flanges shall conform to ANSI B16.1, Class 125.

B. Acceptable Manufacturers.

1. Pratt
2. Dresser Industries, Inc.

2.3 VALVE BOXES

A. Materials and Construction

1. Type: Cast iron or ductile iron, extension sleeve type.
2. Shaft size: Four (4) inch minimum.
3. Thickness: 3/16 inch minimum at any point.
4. Furnish with suitable cast iron bases and covers.
5. Cast appropriate name designation of service in cover.
6. Coating: Dip in bituminous varnish.

B. Water Valve Extensions

1. Valve extensions are required where the depth from valve box cover to the operating nut top is greater than 5 feet. Reference Detail Drawing No. W- 17.

2.4 AIR RELIEF/VACUUM RELIEF VALVES

A. Materials and Construction

1. Type: Integral type assembly which functions both as an air release and vacuum valve.
2. Rating: Working pressure of 150 psi and a minimum hydrostatic test pressure of 300 psi.
3. Size: As noted, 1 inch minimum.
4. Connections:
 - a. Inlet: Threaded.
 - b. Outlet: Threaded, protect to minimize entry of debris and dirt.
5. Body: Cast iron or ductile iron.
6. Working parts and seats: Brass, stainless steel or non-corroding material.
7. Float: Non-corroding, high resilience.
8. Watertight at 300 psi.

B. Acceptable Manufacturers.

1. Apco Combination Air Release Valve, by Valve and Primer Corporation.
2. Crispin Universal Air Valve, by Multiplex Manufacturing.
3. Approved equal.

2.5 BLOW OFF VALVES

A. Materials and Construction

1. Type: TF500.
2. Size: As noted.
3. Connections
 - a. Inlet: Threaded.

- b. Outlet: 2" NPT nozzle.
- 4. Direction of opening: Open counterclockwise.
- 5. Working parts: lead-free brass.

B. Acceptable Manufacturers

- 1. The Kupferle Foundry Company, St. Louis, MO.
- 2. Reference Detail Drawing No. W- 15.

2.6 PRESSURE REDUCING VALVE

A. Materials and Construction

- 1. Type: CLA-VAL 90-01AB, CLA-VAL 90-01AS
- 2. Rating: Maximum pressure of 300 p.s.i.
- 3. Size: As noted.
- 4. Connections
 - a. Inlet: Flanged.
 - b. Outlet: Flanged.
- 5. Body: Cast iron.
- 6. Working parts and seats: Bronze.
- 7. Coating: Internally and externally epoxy-coated.

B. Approved Manufacturers

- 1. Valve: CLA- VAL
- 2. Coating: APCO, CRISPIN

PART 3 - EXECUTION

3.1 VALVE BOXES

- A. Install valve boxes on buried valves.
- B. Install so that no stress is transmitted to valve.
- C. Set plumb and directly over the valve with the top between 1/4 inch and 3/8 inch below finished grade.

3.2 AIR RELIEF/VACUUM VALVES

- A. Install at high points where indicated on the Drawings.

3.3 BLOW OFF VALVES

- A. Install at low points where indicated on the Drawings.

3.4 PRESSURE REDUCING VALVE

- A. Install to isolate different pressure zones and maintain readjusted downstream pressures with varying rates of flow and upstream pressure without causing water hammer.

END OF SECTION

SECTION 02644

HYDRANTS

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section covers dry-barrel fire hydrants intended for use in public water supply systems where freezing temperatures occur.
- B. Reference Detail Drawings W- 3 and W-4.

1.2 SUBMITTALS

- A. Certification: Submit manufacturer's certification that products meet the referenced standards.

1.3 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Handle, store and protect in a manner to prevent damage to materials, coatings and finishes.
- B. Do not drop or dump materials into trench.
- C. Keep fittings and joints free from dirt.

PART 2 - PRODUCTS

2.1 GENERAL

- A. Conformance: AWWA C502.
- B. Acceptable manufacturers:
 - 1. Kennedy 81 AM, Mountain Specification.

2.2 MATERIALS AND CONSTRUCTION

- A. Type: Dry barrel with break-away traffic flange.
- B. Outlet size: Two (2) 2½ inch hose nozzles and one (1) 4½ inch pumper nozzle.
- C. Outlet threads: Conformity with National Standard Thread.
- D. Hydrant size: 5¼ inch.
- E. Shoe inlet size: Six (6) inch, mechanical joint with retainer gland.
- F. Bury: Seven (7) feet, six (6) inches
- G. Operation: Open left. (Counter-clockwise).

H. Color: Selected by Owner.

I. Operating Nut: One and one quarter (1¼) inch pentagon.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Set plumb.

B. Set traffic flange two and one half (2½) inches above finished grade.

C. Reference the details on the Drawings.

3.2 OPERATION

A. Hydrants shall be closed or fully open.

B. Do not operate hydrants partially open.

END OF SECTION

SECTION 02646

SERVICE LINES, METERS AND APPURTENANCES

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section covers the materials and installation of corporation stops, service lines, meters, yokes, meter boxes and pressure reducing valves for services.

1.2 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Handle, store and protect in a manner to prevent damage to materials, coating and finishes.
- B. Keep materials clean and free from dirt.

PART 2 - PRODUCTS

2.1 CORPORATION STOPS

- A. Conformance: AWWA C800
 1. All brass construction.
 2. All Corporation outlets shall use a compression connection.
 3. Threads suitable for coupling or saddle to which the connection is being made.

2.2 COPPER SERVICE LINES

- A. Conformance: Appendix to AWWA C800
 1. Type K.
 2. For sizes two (2) inches in diameter and smaller.

2.3 METERS

- A. Shall be furnished by the District for installation by the Contractor unless otherwise specified.

2.4 METER SETTERS

- A. Materials and Construction
 1. Shall be furnished by the District for installation by the Contractor unless otherwise specified.
 2. Furnish with an angle stop with wing locks in the influent side of the meter.
 3. All end connections complete for immediate installation of the meter of the size called for shall be modified to receive pressure reducing valves.
- B. Approved Manufacturers
 1. Ford Meter Box Company.
 2. Mueller.

2.5 METER PITS

- A. Materials and Construction
 - 1. Polyvinyl chloride.
 - 2. Twenty (20) inches in diameter.
- B. Approved Manufacturers
 - 1. Sonoco.
 - 2. Approved equal.

2.6 METER PIT COVERS

- A. Materials and Construction
 - 1. Type: Frostproof cover.
 - 2. Material: Aluminum (cast iron will be accepted).
 - 3. All meter pit covers shall have a 27/32" worm-lock with a Standard Waterworks pentagon head.
- B. Approved Manufacturers
 - 1. D & L Supply Co. No. L-2262
 - 2. Castings, Inc. No. M-70-AL
 - 3. Ford No. 43

2.7 CURB STOPS

- A. Materials and Construction
 - 1. The top thread for all curb stops shall be Minneapolis type.
 - 2. Curb stops shall have compression connections.
- B. Approved Manufacturers
 - 1. Ford No. 844
 - 2. Mueller No. H-15155.

2.8 VALVE BOXES FOR CURB STOPS

- A. Materials and Construction
 - 1. Minneapolis pattern shall be used for all curb stops.
- B. Approved Manufacturers
 - 1. Muller No. H-10302.

2.9 PRESSURE REDUCING VALVES

- A. Shall be furnished by the District for installation by the Contractor unless otherwise specified.

2.10 BACKFLOW PREVENTION DEVICES

- A. Shall be furnished by the District for installation by the Contractor unless otherwise specified.

2.11 FITTINGS FOR SERVICE LINES AND METERS

- A. Materials and Construction
 - 1. Fittings shall be brass or copper alloy.

2.12 TAPPING SADDLES

- A. Materials and construction
 - 1. Type: 306 double bolt stainless steel service saddle.
 - 2. Materials:
 - a. Shells: 304 Stainless steel per ASTM A 240, fully passivated. Guages ranging from 24 gauge to 16 gauge depending on pipe diameter.
 - b. Sidebars: Heavy gauge 304 Stainless Steel per ASTM A 240, GTAW welded to form permanent fusion with shell.
 - c. Lugs: 304 Stainless Steel per ASTM A 240, fused to sidebars by GMAW welding.
 - d. Bolts: Bolts: UNC rolled thread, 304 stainless steel per ASTM A 193. Fasteners coated to prevent galling.
 - e. Nuts: UNC thread, 304 Stainless steel per ASTM A 194. Nuts shall be coated to prevent galling.
 - f. Lifter Bars: 304 Stainless Steel per ASTM A 240, lip curved to hold position while tightening. Heavy gauge. Serves as bearing surface for nuts.
 - g. Washers: 304 Stainless steel per ASTM A 240 to increase bolt pull and plastic lubricating washers to reduce friction at nut.
 - h. Gasket: Nitrile Butadiene Rubber (NBR) per ASTM D 2000 MBC 610, compounded for water service.
 - i. Tapped Outlet: 304 Stainless steel per ASTM A 240. Fused to pad with GMAW welding. Thread to meet AWWA C800.
 - j. Welds: Type GMAW and GTAW. 308L stainless steel filler wire shall be used as appropriate. All welds shall be fully passivated for enhanced corrosion resistance.
- B. Approved Manufacturers
 - 1. Romac Industries, Inc.
 - 2. Approved equal.

PART 3 - EXECUTION

3.1 PRE-TAPS (SERVICE CONNECTIONS)

- A. Pre-Taps, or Service Connections, are not a requirement of this District but may be required by the entities served by the District.
 - 1. All service lines shall be extended at a constant grade to property line.
 - 2. Mark the location of each unconnected service line with a FRC utility marker extending from the branch vertically to three (3) feet above the ground surface. Maintain in a vertical position during embedment to the depth indicated on the marker. Marker shall be supplied in the standard APWA color for water. Reference Detail Drawing W-10.

3.2 CORPORATION STOPS

A. In Ductile Iron Pipe

1. The Contractor shall not make any taps without permission from the District.
2. Reference Detail Drawing No. 10 for services of less than 3 inches in diameter.
3. 3/4 inch and 1 inch taps shall be installed by direct tapping.
4. 1 1/2 inch and 2 inch taps shall be installed by one of the following methods:
 - a. Taps on new construction shall be a mechanical joint tapped tee with an iron pipe thread inlet corporation.
 - b. Taps on existing lines shall be made with a tapping saddle.
5. Tapping saddle installation procedure.
 - a. Check the saddle parts to insure that no damage has occurred during transit and that no parts are missing.
 - b. Check the diameter of the pipe and the range marked on the saddle to insure that correct size saddle is used.
 - c. Thoroughly clean pipe surface that will be covered by the saddle. A suitable gasket lubricant should be used on rough surface pipe to assure proper seal.
 - d. Back off nut to the end of the bolt – do NOT remove. Separate the ends of the saddle and position the tap such that the outlet is in the correct location.
 - e. Slide lifter bar up the receiver lug profile and snap into place over the sidebar edge. Make sure the gasket has seated itself flat onto the pipe face.
 - f. Tighten all nuts evenly in torque increments of 20 ft-lbs. Use a wrench with at least a 12 inch handle. 50 - 60 ft-lbs torque shall be applied if waterline diameter is 6 inches and larger.
 - g. Backfill and compact carefully around saddle and service line.

3.3 SERVICES

A. Location and Alignment of Service.

1. Water service lines shall be located so as to take the most direct route (preferably perpendicular to the main) from the water main or pretap to the structure. Water service lines shall not be located under any driveway or service road *and shall not be closer than five (5) feet to a property corner*. All water lines shall have a minimum 7 feet of cover wherever possible. No service lines shall be laid parallel to any bearing wall that might thereby be weakened. The water service line shall be laid at a uniform grade and in a straight alignment. Any variances to this policy shall be reviewed by the *District* and decided on a case by case basis.
2. Each building and each subdivided lot shall be served by a separate service line. No compound services are allowed.
3. Water services shall be located on the up-hill side from sanitary sewer services or underdrain.
4. Minimum distance between service line and a valve or fitting shall be two (2) feet. Minimum distance between service line and sanitary sewer manhole, storm drain manhole or other structure shall be five (5) feet.

B. Service Line Separation.

1. Ten (10) feet of separation must be maintained between parallel water and sewer service lines. At locations where water and sewer lines cross, sewer service line joints within a ten (10) foot distance of the water line must be encased in

accordance with Colorado Department of Public Health and Environment and District standards. Reference Detail Drawings W-6,7 & 8.

- C. Pre-taps.
 - 1. Where the water main has been pre-tapped (a service line has been extended to the lot property line and terminated with a curb valve and box), the service line from the building shall connect to the water line pre-tap. The *property owner* or contractor must locate the pre-tap. Reference Detail Drawing W-10, W-11.

- D. Direct Tap to the Main.
 - 1. Where water pre-taps are not present, service line construction will require the following.
 - a. Tapping a District main, which is permitted only between April 15 to October 15 annually.
 - b. Installation of a curb stop valve and valve box located at the property line, or as otherwise approved by the District, with easy access to the District.
 - 2. Curb box valve tops must be Mueller # H-10302 or equivalent. Permits for excavation within any Right Of Way of the Town of Mt. Crested Butte of Gunnison County are the sole responsibility of the contractor.
 - 3. A curb stop located within a pavement travel lane must be installed inside a District standard valve box assembly. Assembly can exclude the base, but must include a cover with the label "Water". The curb stop shall be mounted so that it is six (6) inches below the rim.

- E. Specifications.
 - 1. Service lines shall be of a size which is adequate to satisfy the requirements of the property being served. The minimum size allowable for a service line shall be 3/4 inch.
 - 2. Service lines up to 2 inches in diameter shall be constructed of Type-K copper. Service lines larger than 2 inches in diameter shall be constructed of Ductile Iron Pipe (D.I.P.). Copper service lines shall be one continuous line with no joints if possible. Splices are allowed where the distance exceeds 100 feet. There shall be no splices between the curb stop and the main.

- F. Inspections.
 - 1. The applicant for water service or their representative shall notify the District when the service line/tap connection is ready for inspection. Appointments for inspection and connection should be scheduled twenty-four (24) hours in advance (not to include weekends). Under supervision of a District representative, the water service line will be inspected and pressure tested at normal operating pressure from the water main (or curb valve when pre-tapped) to the building prior to backfill.

- G. Water Meter Requirements.
 - 1. All service connections to the District's water system will be metered, including structures, outside faucets and lawn/landscape irrigation systems. All permanent meter installations will be located so as to measure all water flowing through the entire length of the service line.

H. Water Meter Installation.

1. Water meters and meter setters will be provided by the District. All meters will be installed by the owner or contractor. All meter installations must be in freeze proof, convenient and easily accessible areas. If located in a crawl space, the meter must be within 10 feet of an access hatch. There must be a clear area of at least one foot above, one foot below and three feet in front of the meter. All meters must be installed in the horizontal position with the flow directional arrow pointed towards the end use. Care should be taken when cutting, threading, or joining pipe that cuttings, pipe dope, solder, or other debris do not get into the pipe. Reference Detail Drawing W-13.

3.4 METER SETTINGS

- A. Meter shall be located within residence or building unless otherwise approved by the District.
- B. The meter pit shall be supported on four bricks evenly spaced around the circumference of the box.
- C. The meter pits shall be installed not more than two (2) feet inside the road right-of-way, unless otherwise approved by Engineer.
- D. Valves, where required, shall be installed in the meter pits on the influent side of the meters.
- E. Meter pit covers shall be set on top of the PVC pit, and the top elevation of the cover shall be that of the adjacent ground.
- F. Reference Detail Drawings W-11 & W-12.

3.5 SERVICE LINES

- A. All service lines shall be laid with a minimum of 7'0" cover over the pipe.
- B. A gooseneck shall be formed in the service line at the corporation stop.

END OF SECTION

SECTION 02713

WATER DISTRIBUTION SYSTEM

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section covers the installation of water distribution lines.

1.2 QUALITY ASSURANCE

- A. Do not deviate from alignment more than 0.5 feet.
- B. Do not deviate from grade more than 0.3 feet where the pipeline is laid to grade.
 - 1. Measure at the pipe invert for grade.

1.3 SUBMITTALS

- A. Certification: Submit manufacturer's certification that products meet the requirements of referenced specifications.

1.4 JOB CONDITIONS

- A. Use effective measures to prevent foreign material from entering the pipe.
- B. Do not place debris, tools, clothing, or other material in the pipe.
- C. Close the open ends of pipe with a blocked, watertight plug when pipe laying is not in progress to prevent the entrance of water, debris and animals into the pipe.
- D. Use effective measures to prevent uplifting or floating of the pipeline prior to completion of backfilling operations.
- E. Keep fire hydrants and water control valves free from obstruction and available for use at all times.
- F. Do not lay pipe under the following conditions:
 - 1. In water.
 - 2. Unsuitable weather conditions.
 - 3. Unsuitable trench conditions.

1.5 ALTERNATIVES

- A. No interchange of pipe material shall be allowed, except where another type of pipe material is specifically indicated in the Contract Documents.
- B. Contractor may use restrained joints when approved by the District.

PART 2 - PRODUCTS

2.1 PIPE

- A. Reference Section 02615.

2.2 VALVES

- A. Reference Section 02641.

2.3 HYDRANTS

- A. Reference Section 02644.

2.4 SERVICE LINES, METERS, APPURTENANCES

- A. Reference Section 02646.

2.5 MARKER POST MATERIALS

- A. Reference drawing W- 10.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Perform trenching, backfilling and compaction in accordance with Section 02221.
- B. Connections: Where connections are to be made to existing pipes or appurtenances, the exact location of which cannot be determined without exposing the existing pipe or appurtenance, excavate and expose the existing improvement before installing any pipe.
 - 1. Engineer will examine the existing pipe or appurtenance and specify any necessary adjustments in line or grade of the proposed pipe to accomplish the connection.

3.2 PIPE INSTALLATION

- A. Pipe Laying
 - 1. Lay pipe with the bells pointing in the direction the Work is progressing.
 - a. On down slopes of 10% or more:
 - 1) Hold the last pipe laid in place by some means, such as a winch, while joining the next pipe to it to prevent moving or reverse the direction of pipe laying.
 - 2) Take effective measures to prevent opening of joints during bedding and backfilling operations.
 - 2. Complete the joint in accordance with the applicable pipe material specification and adjust the pipe to the correct line and grade as each length of pipe is placed in the trench.
 - a. Make adjustments in line and grade by scraping away or filling pipe bedding under the entire length of the pipe, except at bells and not be wedging, blocking, or mounding up the pipe or bells.

3. Secure the pipe in place with the specified bedding tamped under and around the pipe except at the joints.
 - a. Do not disturb the pipe after the jointing has been completed.
4. Install the pipeline so that a positive or negative grade is maintained between high and low points.
 - a. Record the location of high and low points so that they may be readily located if permanent air vents or blow-offs are not provided.
5. Provide a minimum depth cover from finished grade to top of pipe of 7 feet, except as otherwise indicated.
6. All fittings and valves shall be wrapped with polyethylene film to prevent corrosion.

B. Connections to Existing Pipelines

1. Make each connection at a time authorized by Owner which will least interfere with service.
2. Use suitable fittings for the conditions encountered.
3. Dewater and dispose of water from dewatered lines.
4. Use effective measures to prevent contamination to existing potable water lines.
 - a. Do not permit trench water and or other contaminating substances to enter pipelines.
5. Swab the interior of new pipe, fittings and valves installed in existing pipelines with a solution of five (5) percent (50,000 ppm) chlorine solution prior to installation.
6. Only District shall operate existing valves, hydrants, blow-offs, curb stops and other control units.

C. Encasements

1. Provide concrete encasement where indicated on the drawings or required by these specifications.
2. Sewer line crossings.
 - a. Where water mains cross sewer lines and the sewer is above the water main or less than 18 inches clear distance vertically below the water main, construct the crossing by one of the following methods:
 - 1) Install one length of ductile iron pipe in the sewer line centered on the intersection with the water main. Ductile iron pipe shall be the same size as sewer line. Use approved adapters for joints between the ductile iron pipe and the sewer line or encase the joints in a concrete collar. Reference Detail Drawing No. W-7.
 - 2) Encase the sewer pipe with reinforced concrete at least 6 inches thick at all locations within 10 feet either side of the water main. Reference Detail Drawing No. W-8.
 - b. Provide suitable backfill or other structural protection to preclude settling or failure of the higher pipe.
3. Reference Section 03300.

3.3 THRUST RESTRAINT

A. Anchorage and Blocking

1. Provide concrete thrust blocks and anchors for preventing pipe movement at push-on or mechanical joint plugs, wyes, tees, crosses, bends deflecting 1 1/4 degrees or more, reducers and valves.
2. Thrust block bearing shall be excavated into undisturbed soil.

3. The location to receive the thrust block shall be carefully shaped to provide a uniform bearing surface of the required size. Thrust block sides shall be vertical.
4. Thrust blocks shall be formed to provide access to fittings, valves and hydrants.
5. Concrete to be separated from fittings by 8 mm polyethylene film. No concrete shall be poured directly on or over fittings to be blocked.
6. Reference Detail Drawing W-5.

B. Restrained Joints

1. Do not use flanged or other rigid joints.
2. Pressure rating: 250 psi.

3.4 INSTALLATION OF PIPELINE APPURTENANCES

A. Install valves, meters, hydrants and appurtenances to the water distribution lines at the locations shown on the Drawings or as designated by Engineer to accommodate field conditions.

1. Record measurements of the actual location of appurtenances prior to backfill.

3.5 PROTECTION OF METAL SURFACES

A. Apply two coats of coal tar paint to ferrous metal rods, rebars, clamps, bolts, nuts and other accessories subject to submergence or contact with earth or fill material and not encased in concrete.

1. Apply first coat to dry, clean surface.
2. Allow first coat to dry before applying second coat.

B. Loose Polyethylene Encasement

1. Standard: AWWA C105.
2. Methods, any of the following:
 - a. A or B (tube type encasement involving advancing a bunched length of material around each length of newly laid pipe).
 - b. C (sheet encasement wrapped around newly laid pipe to produce an overlapping seam at top of pipe).
3. Repair rips, punctures or other damage with adhesive tape or with a short length of polyethylene encasement wrapped around pipe and secured in place.
4. Maintain a sealed encasement with the polyethylene taped to the pipe at existing lines and at the ends of the encasement section.
5. Use loose polyethylene encasement at the following locations:
 - a. Valves and fittings with flanged or mechanical joints.
 - b. Bolted fittings, such as couplings.
 - c. Tie rods and joint harnesses.

END OF SECTION

SECTION 02720

BOOSTER PUMP STATIONS

PART 1- GENERAL

1.1 DESCRIPTION

- A. This Section covers furnishing and installation of pressure booster pumps to be installed in the District's water system as a permanent system to be owned and operated by the District. The pumps shall be housed in a permanent structure and be installed complete with electric power wiring and piping connections for a complete pump and piping system.
- B. The pump station will be furnished and installed by the Contractor as part of the Work and must be field tested after completion to the satisfaction of the District for acceptance.

1.2 DEFINITIONS

- C. All the equipment specified herein is intended to be standard equipment as modified by this specification for the uses described. All pumps will be used to pump liquids under the conditions of service specified by a professional engineer, licensed in Colorado.

1.3 QUALITY ASSURANCE

- A. Definition of terms and other hydraulic considerations are as set forth of the Hydraulic Institute Standards.
- B. Use the same manufacturer for similar components of all systems to facilitate maintenance and stocking of repair parts.
- C. Accepted manufacturer and model
 - 1. Grundfos Model, duplex pump station.
 - a. Supplier: McLemore Pump.

1.4 SUBMITTALS

- A. Drawings.
 - 2. Submit complete three (3) copies of shop drawings to the District.
 - 3. Submit the following information:
 - a. Pump.
 - 1) Name of manufacturer.
 - 2) Type and model.
 - 3) Rotative speed.
 - 4) Size of suction nozzle.
 - 5) Size of discharge nozzle.
 - 6) Type of bearings.
 - 7) Net weight of single pump.
 - 8) Size of shafting at impeller.
 - 9) Net weight of complete assembly including control panel and piping.
 - 10) Certified typical performance curves showing capacity, head, NPSH requirements, efficiency, and bhp requirements for each type of unit.

- b. Motors
 - 1) Name of manufacturer
 - 2) Type and model
 - 3) Rated size of motor hp.
 - 4) Type of bearings and lubrication
 - 5) Efficiency at full load and rated pump conditions
 - 6) Temperature rating and service factor.

- B. Operations and Maintenance Manual
 - 1. Supply three (3) copies of operation and maintenance manual.

1.5 PRODUCT DELIVER, STORAGE AND HANDLING

- A. Protect equipment from exposure to elements and keep all items thoroughly dry at all times.
- B. Store pumps, motors, and electrical equipment in weathertight warehouses at maintained temperature of 50°F minimum.

1.6 JOB CONDITIONS

- A. Liquid pumped
 - 2. To be specified by Design Engineer.

1.7 SPECIAL WARRANTY

- A. The pump and motor manufacturer shall warrant the units against defects in the workmanship and material for a period of three years for the pumps and one year for the motor from successful operation or 18 months after installation, whichever date falls first. All materials, equipment, and workmanship shall be free from defects in material or workmanship.

PART 2- PRODUCTS

2.1 DESIGN REQUIREMENTS

- A. Performance and Design Requirements
 - 1. Pumping unit shall have a stable head capacity curve and be free of cavitation and objectionable noise throughout the specified operating full head and capacity range.
 - 2. Design pump station to operate at elevation of job site.
 - 3. Pump station must be designed by a licensed professional engineer. The following conditions shall be specified:

- a. Number of units: 2 Minimum
- b. Pump Type: TBD by Design Engineer
- c. Type of Drive: TBD by Design Engineer
- d. Discharge Size (in): TBD by Design Engineer
- e. Suction Size (in): TBD by Design Engineer
- f. Design Capacity (gpm): TBD by Design Engineer
- g. Design TDH (ft): TBD by Design Engineer

- h. Maximum Pump Speed (rpm): 3450
- i. Motors shall be designed for interval operation, capable of sustaining a maximum of 10 starts per hour.
- j. Maximum motor speed (rpm): 3450
- k. Nameplate rating (hp): TBD by Design Engineer

2.2 MATERIALS

A. General

- 1. Housing Cast iron, ASTM 25 B
- 2. Impel Stainless steel, AISI 304
- 3. Impeller Wear Ring / Impeller Wear Plate Heat treated stainless steel, 350 Brinell Hardness minimum
- 4. Drive Shaft Heat treated stainless steel
- 5. Shaft Sleeve Heat treated stainless steel
- 6. Seal Type Mechanical
- 7. Bearing Housing Cast iron or fabricated steel
- 8. Baseplate Stainless steel
- 9. Pipe Headers Stainless steel
- 10. Fasteners Galvanized steel, or cadmium Plated steel

2.3 CONSTRUCTION

A. General

- 1. Manufacturer equipment as per manufacturer's standard practice
- 2. Assembly bolts and anchor bolts.
 - a. Hot-dip galvanized assembly and anchor bolts, nuts and washers per
 - 1) ASTM 153 and A 385, or
 - 2) Cadmium plate, ASTM 165, Type NS, or
 - 3) Zinc plate, ASTM B633, Type GS.

2.4 ACCESSORIES

A. Pump station will be furnished with the following accessories:

- 1. Plugged gage cock connections at suction and discharge lines.

B. Flow Meter: Micrometer UltraMag electromagnetic flow meter, with grouting rings.

2.5 FABRICATION

A. Balance.

- 1. Accurately machine rotating parts and place these parts in as near perfect rotational balance as practicable.
- 2. Excessive vibration shall be sufficient cause for rejection of equipment.
- 3. Distribute mass of unit such that resonance at normal operating speeds is avoided.
- 4. Ratio of rotative speed to critical speed of all units or components shall be less than 0.8 or more than 1.3 at all operating speeds.

PART 3- EXECUTION

3.1 INSTALLATION

- A. Factory Assembly
 - 1. The pumps shall be factory assembled to the maximum practical extent. Factory assembly shall include all pipe and wire that is possible to be factory assembled.
- B. Install pump system in accordance with coordination Supplier's Shop Drawings. The system shall be installed in accordance with the manufacturer's written instructions.
- C. The Contractor shall be responsible for installing equipment that the manufacturer could not ship assembled as an integral part of the system due to shipping restrictions. These items shall be identified on the manufacturer's approval drawings.
- D. Rigidly mount piping and components to walls, columns, roof members. Use pipe supports fabricated in accordance with the standard industry accepted for Supports and Anchors.
- E. Mount equipment on support stands, brackets, or concrete base pad.
- F. Painting - paint per manufacturer's recommendations.

3.2 TESTING

- A. Manufacturer's field representatives shall furnish to Owner, with copies to Contractor, a written Equipment Check-Out Report.
 - 1. Certify that the equipment:
 - a. Has been properly installed and lubricated.
 - b. Is in accurate alignment.
 - c. Is free from any undue stress imposed by connecting piping or anchor bolts.
 - 2. Include table of measured line currents and corresponding phase-to-phase voltages.
 - 3. State motor nameplate amps.
- B. Testing
 - 1. Field test pump system when Contractor has completed installation of all interconnect pipelines.

3.3 MANUFACTURER'S FIELD SERVICES

- A. Manufacturer's field representatives shall visit Work at appropriate times to assist Contractor in installing and operating the equipment. The manufacturer's services shall include, but not be limited to, the following:
 - 2. Perform a check of the completed installation; supervise initial startup, adjustments and testing.
 - 3. Measure three-phase line currents and phase voltages to demonstrate balanced electrical operating conditions.
 - a. Motor readings shall be taken at the motor.

- B. Contractor shall furnish skilled workers and attendants as required to complete activities that must be performed.
- C. Submit index of all training offered by equipment manufacturers including operation and maintenance.
- D. Contractor will provide the Owner's personnel with up to 4 hours of on-site, hands-on training during or after the pump is in operation. The training will comprehensively cover all operations and controls of the pumps.

END OF SECTION

SECTION 03300

CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section covers all cast-in-place concrete, including forms, reinforcing steel, finishing, curing and other appurtenant Work.

1.2 QUALITY ASSURANCE

- A. Reference Standards
 - 1. Except as modified or supplemented in these Specifications, all structural concrete shall meet the requirements of the following standards. Refer to the standards for detailed requirements.
 - a. ACI 301 Specification for Structural Concrete for Buildings.
 - b. ACI 347 Recommended practice for Concrete Formwork (Chapters 1 through 5).

1.3 SUBMITTALS

- A. Submit for approval the proposed mix proportions to meet 2.2A before any concrete is ordered for concrete structures.
- B. Submit delivery tickets for each load at the time of delivery indicating the following:
 - 1. Quantity delivered.
 - 2. Quantity of each material in the batch.
 - 3. Outdoor temperature in the shade.
 - 4. Time at which the water was added.
- C. Shop Drawings
 - 1. Show sizes, quantity and dimensions for fabrication and placing of reinforcing bars and bar supports.
 - 2. Indicate bar schedules, stirrup and tie spacing, and diagrams of bent bars.

1.4 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Cement:
 - 1. Store in weather-tight enclosures and protect against dampness, contamination and warehouse set. Do not use cement that has become caked or lumpy.
- B. Aggregates:
 - 1. Stock pile to prevent excessive segregation or contamination with other materials or other sizes of aggregates.
 - 2. Use only one supply source for each aggregate stock pile.
 - 3. Do not use the bottom six (6) inches of aggregate piles in contact with the ground.
- C. Admixtures:
 - 1. Store to prevent contamination, evaporation or damage.
 - 2. Protect liquid admixtures from freezing or harmful temperature ranges.
 - 3. Agitate emulsions prior to use.

- D. Mixing and Transporting Ready-mixed Concrete:
 1. The maximum elapsed time from the time water is added to the mix until the concrete is in place shall not exceed 1½ hours when concrete is transported in revolving-drum truck bodies.

- E. Reinforcing Steel:
 1. Deliver to site in bundles marked with metal tags indicating bar size and length.
 2. Carefully handle and store on supports which will keep the steel from coming in contact with the ground.
 3. Remove all mud, oil, loose rust or mill scale and other foreign materials prior to placing concrete.
 4. Rust or mill scale which is "tight" will be permissible without cleaning or brushing, provided weight dimensions, cross sectional area and tensile properties meet the requirements of ASTM A615.

1.5 JOB CONDITIONS

- A. Environmental Requirements
 1. Do not place concrete during rain, sleet or snow unless adequate protection is provided.
 2. Do not allow rain-water to increase the mixing water or damage the surface finish.

- B. Cold Weather Concreting
 1. Conformance: ACI 306, "Recommended Practice for Cold Weather Concreting."
 2. Temperature of concrete when placed shall not be less than the following:

Air Temp. °F	Minimum Concrete Temp. °F Sections with least dimension Under 12"
30 to 45	60
0 to 30	65
Below 0	70

3. When placed, heated concrete shall not be warmer than 80°F.
 4. Prior to placing concrete, all ice, snow, surface and subsurface frost shall be removed and the temperature of the surfaces to be in contact with the new concrete shall be raised above 35°F.
 5. Protect concrete during specified curing period.
 6. Heated enclosures shall be strong and windproof to insure adequate protection of corners, edges and thin sections.
 7. Do not permit heating units to locally heat or dry the concrete.
 8. Do not use combustion heaters during the first 24 hours unless the concrete is protected from exposure to exhaust gases which contain carbon dioxide.
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- C. Hot Weather Concreting
 1. Conformance: ACI 305 "Recommended Practice for Hot Weather Concreting."
 2. Take precautions when the ambient air temperature is 90°F or above.
 3. Temperature of concrete, when placed, shall not exceed 85°F.
 4. Cool forms and reinforcing to a maximum of 90°F by spraying with water prior to placing concrete.
 5. Do not use cement that has reached a temperature of 170°F or more.
 6. Prevent plastic shrinkage cracking due to rapid evaporation of moisture.

7. Do not place concrete when the evaporation rate (actual or anticipated) equals or exceeds 0.20 pounds per square foot per hour, as determined by Figure 2.1.4 of ACI 305.
8. Approved set-retarding and water reducing admixtures may be used when ambient air temperature is 90°F or above to offset the accelerating effects of high temperature.

PART 2 - PRODUCTS

2.1 CONCRETE MATERIALS

- A. Cement: ASTM C150
 1. Sidewalks and other surface pavement: Type IA.
 2. Sewer inverts and collars: Type IIA.
 3. Below grade water structures and thrust blocks: Type IIA
- B. Aggregates:
 1. Fine aggregate AASHTO M-6 Sieve size, range 3/8" to #100.
 2. Coarse aggregate AASHTO M-80 sieve designation #67, range 1" to #4.
- C. Water: Clean and fresh.
- D. Air-entraining Agent: ASTM C260.
- E. Ready-mixed Concrete: Mixed and delivered, ASTM C94.
- F. Batching and Mixing Equipment: ACI 304, "Recommended Practice for Measuring, Mixing, Transporting and Placing Concrete."

2.2 CONCRETE MIX DESIGN

- A. Concrete Mix: Measure and combine cement, aggregates, water, and admixtures in accordance with ASTM C94.
 1. Class A:
 - a. Minimum Cement Content: 6.0 bags/cu. yd.
 - b. Minimum 28-day Strength: 4,000 psi.
 - c. Air Content: 6%, ± 1%.
 - d. Maximum Slump: 4 in.
 2. Class B:
 - a. Minimum Cement Content: 5.0 bags/cu. yd.
 - b. Minimum 28-day Strength: 3,000 psi.
 - c. Air Content: 6%, ± 1%.
 - d. Maximum Slump: 4 in.
- B. Concrete Usage:
 1. Class A: Valve vaults and location not specified for class B.
 2. Class B: Manhole bases, buried thrust blocks, and where specifically stated.

2.3 FORM MATERIALS

- A. Forms
 1. Plywood - PSI, waterproof, resin-bonded, exterior type, Douglas Fir.

2. Lumber - straight, uniform width and thickness, free from knots, off-sets, holes, dents and other surface defects.
 3. Designed to produce hardened concrete having the shape, lines and dimensions shown on the Drawings.
- B. Form Oil
1. Light colored paraffin oil, or other non-staining material. For exposed surfaces not in contact with earth backfill, acceptable chemical release agents are Protex Industries, "Pro-Cote", Symons Corp., "Magic-Kote", L & M, "Debond", or equal.
- C. Form Ties
1. Commercially manufactured permanently embedded type with removable ends for all exposed surfaces.
 2. Permanently embedded portion shall terminate not less than one inch from the face of the concrete.

2.4 REINFORCING MATERIALS

- A. Bars: ASTM A615, Grade 40 or 60 unless specified otherwise.
- B. Welded Wire Fabric: ASTM A185 or A497.
- C. Fabrication ACI 315 and 318 unless shown otherwise on Drawings.

2.5 NON-SHRINK GROUT

- A. Ferrolith G.D.S. grout by Sonneborn Building Products, Inc., Embecco Grout by Master Builders Co., Vibrofoil by W.R. Grace Co., Construction Materials Division, or equal.

2.6 CURING AND SEALING COMPOUNDS

- A. ASTM C309, Type 1, Class B.
- B. Use Protec "Triple Seal", Symons Corp., "Cure and Seal", or equal.

PART 3 - EXECUTION

3.1 ERECTION OF FORMS

- A. Brace or tie to maintain desired position, shape and alignment before, during and after concrete placement.
- B. Construct forms of beams and slabs supported by concrete columns so the column forms can be removed without disturbing the beam or slab supports.
- C. Provide temporary openings at the bottom of columns and wall forms and at other locations where necessary to facilitate cleaning and inspection.
- D. Where concrete is placed against rock, remove loose pieces of rock and clean the exposed surface with a high pressure air hose.

- E. Place chamfer strips in forms to bevel salient edges and concrete corners of exposed surfaces except the top edges of walls and slabs which are to be tooled. Unless otherwise noted on the Drawings, bevels shall be 3/4 inches wide.
- F. Remove mortar or grout from previous concrete and other foreign material from the surfaces. Coat form surfaces with approved coating material before either the reinforcing steel or concrete is placed.
- G. Do not allow form coating to:
 - 1. Stand in puddles in the forms.
 - 2. Come in contact with the reinforcing steel.
 - 3. Come in contact with adjacent hardened concrete against which fresh concrete is to be placed.

3.2 REMOVAL OF FORMS

- A. Do not remove or disturb forms until the concrete has attained sufficient strength to safely support all dead and live loads.
- B. Remove forms with care to avoid surface gouging, corner or edge breakage, and other damage to the concrete.

3.3 REINFORCING

- A. Installation
 - 1. Accurately place reinforcing bars and maintain in proper position while concrete is being placed and compacted.
- B. Bar Supports
 - 1. Provide minimum number of supports as required by ACI 315.
 - 2. Do not use pebbles, pieces of broken stone, common or face brick, metal pipe or wood blocks to support reinforcement.
 - 3. On ground, where necessary, supporting solid concrete bricks may be used.
 - 4. Use concrete, metal, plastic or other approved bar chairs, bolsters and spacers over flat form surfaces.
 - 5. Where the concrete surface will be exposed to the weather in the finished structure, the portions of all accessories within 1/2 inch of the concrete surface shall be non-corrosive or protected against corrosion.

3.4 CONCRETE PLACEMENT

- A. Conveying
 - 1. Convey to the point of final deposit by methods which will prevent the separation or loss of ingredients.
 - 2. During and immediately after placement, concrete shall be thoroughly compacted, worked around reinforcements and embedments and worked into all corners of the forms.
 - 3. Compact using immersion-type vibrators, vibrating screeds, or other acceptable mechanical compaction equipment.

3.5 FINISHING FORMED SURFACES

- A. Rough Form Finish

1. Rough form finish is acceptable for surfaces not exposed to view such as surfaces in contact with earth backfill.
2. Patch tie holes with mortar.
3. Repair defects.
4. Smooth form finish is acceptable alternative.

3.6 FINISHING UNFORMED SURFACES

- A. Slabs, Pavements, Sidewalks, Driveways, Curb and Gutters and Similar.
1. Screed and give an initial float finish as soon as concrete has stiffened sufficiently for proper working.
 2. Remove coarse aggregates disturbed by the initial floating or which cause a surface irregularity and replace with mortar.
 3. Initial floating shall produce a surface of uniform texture and appearance.
 4. Follow with a second floating at the time of initial set. This floating shall produce a finish of uniform texture and appearance.
 5. In areas where concrete is to remain exposed, follow the second floating with a broomed treatment to the surface to provide a uniform abrasive texture of constant color, except where steel trowel surface is indicated.

3.7 DEFECTIVE CONCRETE

- A. Repair in accordance with ACI 301, Chapter 9.

3.8 CURING

- A. Keep concrete continuously moist for at least 7 days after placement by use of:
1. Ponding or continuous sprinkling.
 2. Wet burlap, wet absorptive mats or wet sand.
 3. Waterproof sheets.
 4. Polyethylene film.
 5. Membrane curing compound.
 - a. Do not use membrane curing compounds when the surface is to be painted or other material is to be bonded to the surface.
- B. Maintain concrete within 50° to 70° range during curing.
- C. Apply coating and sealing compounds in accordance with manufacturers's instructions.

3.9 FIELD QUALITY CONTROL

- A. Test Cylinders
1. Make a set of test cylinders (three 6"x 12") each 50 cubic yards place or portion thereof.
 2. Deliver test cylinders to testing laboratory.
 3. Comply with ASTM C192.

END OF SECTION

