DOMESTIC WATER SYSTEM

CONSTRUCTION SPECIFICATIONS

MARCH 1, 2017

DESERT WATER AGENCY
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BE ADVISED THAT BASIC SPECIFICATIONS AND STANDARD DRAWINGS CONTAINED HEREIN APPLY TO ALL PROJECTS UNLESS OTHERWISE STATED IN WRITING. THIS INFORMATION IS SUBJECT TO CHANGE AT ANY TIME WITHOUT NOTICE. CONTRACTORS AND SUPPLIERS FURNISHING WORK AND/OR MATERIAL FOR CONSTRUCTION OF DESERT WATER AGENCY FACILITIES ARE REQUIRED TO ADHERE TO THE LATEST ISSUE OF THE AGENCY'S BASIC SPECIFICATIONS AND STANDARD DRAWINGS.

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GENERAL REQUIREMENTS

1. Definitions

Whenever the terms herein defined occur in these Specifications or other related documents, they shall have the meanings here given.

a. "Agency" or "Owner" shall mean the DESERT WATER AGENCY, Post Office Box 1710, 1200 Gene Autry Trail South, Palm Springs, California 92263, its Manager, and any other person or persons designated by the Owner to act on its behalf.

b. "Manager" shall mean the person designated by the Board of Directors of the DESERT WATER AGENCY to have charge, supervision, and administration of said Owner.

c. "Contractor" shall mean the person, firm, or corporation responsible for the construction of facilities and improvements or any portions thereof to be integrated into Owner's facilities, either on behalf of the Owner or on behalf of a Developer.

Contractor shall at all times be represented on the Work in person or by a duly designated agent or superintendent. Contractor shall hold a valid Contractor's License in accordance with the provisions of Division 3, Chapter 9 of the Business and Professions Code of the State of California, and any amendments thereto.

d. "Work" shall mean all Work to be performed by Contractor and shall be as specified by these Specifications and the Construction Drawings, Special Requirements, and Specific Directions for any particular project.

The Owner may at any time during Work, by written order, make such changes as found necessary in the character, quality, or quantity of the Work to be furnished.

e. "Construction Drawings" shall mean those drawings approved by the Owner showing dimensions, details, features, and requirements of the Work. Said Construction Drawings shall be used in conjunction with Special Requirements or Specific Directions and shall be augmented by these Specifications and the Standard Drawings.

f. "Special Requirements" shall mean those requirements describing Work not specified by Construction Drawings or Specific Directions, clarifying Work as shown by Construction Drawings or as described by Specific Directions, or supplementing or modifying these Specifications. Said requirements may be written or verbal.

g. "Specific Directions" shall mean those instructions of the Owner supplementing or modifying the Construction Drawings, Special Requirements, and Specifications and shall include all Work not specified by Construction Drawings or Special Requirements. Said instructions may be written or verbal.

h. "Specifications", also "Construction Specifications", shall mean the requirements contained herein and shall apply to all Work, where applicable, unless specified otherwise, in the Construction Drawings, Special Requirements, or Specific Directions. Said Specifications shall augment Construction Drawings, Special Requirements, or Specific Directions and shall pertain to all methods and materials of construction.

i. "Standard Drawings" shall mean all drawings referenced as such and bound with the Specifications. Said Standard Drawings shall be considered an integral part of the Specifications.

j. "Standard Specifications" shall mean the Standard Specifications for Public Works Construction, latest edition, as published by Building News, Inc, Los Angeles, California. The Standard

Specifications shall augment, not supersede, the "Construction Specifications". As used herein, the Standard Specifications shall not apply to measurement, payment, schedule, delays, or extra work.

2. Abbreviations

Whenever used in these Specifications, the following abbreviations shall refer to the agency shown:

a.	AASHTO	American Association of State Highway and Transportation Officials
b.	ACI	American Concrete Institute
c.	AISC	American Institute of Steel Construction
d.	AISI	American Iron and Steel Institute
e.	ANSI	American National Standards Institute
f.	API	American Petroleum Institute
g.	ASTM	American Society for Testing Materials
h.	AWWA	American Water Works Association
i.	AWS	American Welding Society
j.	CRSI	Concrete Reinforcement and Steel Institute
k.	DIPRA	Ductile Iron Pipe Research Institute
l.	EIA	Electronic Industries Association
m.	IEEE	Institute of Electrical and Electronic Engineers
n.	IPCEA	Insulated Power Cable Engineers' Association
o.	NBFU	National Board of Fire Underwriters
p.	NEC	National Electrical Code
q.	NEMA	National Electrical Manufacturing Association
r.	REA	Rural Electrification Administration
s.	SSPC	Steel Structures Painting Council
t.	UL	Underwriters' Laboratories

All references to Specifications of any of the above agencies shall mean the latest editions thereof.

3. Permits, Certificates, Laws, and Ordinances

Unless specified otherwise, Contractor shall at no cost to the Owner obtain all necessary permits, certificates, and licenses from such Federal, State, and local agencies as required to perform the Work. Contractor shall comply with all laws, ordinances, or rules and regulations of said agencies in performance of the Work.

4. Contractor's Liability

Contractor shall be responsible, and the Owner shall not be answerable or accountable in any manner, for any loss or damage that may happen to the Work performed by Contractor, subcontractors, or those associated with or working under Contractor, or for any of materials or equipment used or employed in performing the Work, or for injury to any person or persons, including employees, the public, or others, or for damage to property from any cause which might have been prevented by Contractor, subcontractors, or those associated with or working under Contractor. Contractor having control over such Work must properly guard and does indemnify and hold the Owner harmless, and will defend the Owner therefrom at Contractor's own expense, against all injuries or damages to persons and property.

Contractor shall indemnify, defend, and hold the Owner harmless from any and all claims, demands, fines, and penalties imposed or levied by any Federal, State, or local agency associated with or related to the taking (as defined by the United States Fish and Wildlife Service and, or the California Department of Fish and Game) of any protected animal or plant species or habitat by Contractor, subcontractors, or those associated with or working under Contractor.

5. Rights-of-Way

a. Permanent Rights-of-Way

For Developer financed Work, Developer shall provide the Owner with all permanent rights-of-way or permanent easements in a form approved by the Owner, unless specified otherwise.

For Owner financed Work, Owner will obtain all permanent rights-of-way or permanent easements as required to perform the Work unless specified otherwise. Said rights-of-way will not include rights-of-way for which permits, certificates, and licenses are required from Federal, State, and local agencies, unless specified otherwise.

b. Access or Temporary Rights-of-Way

Contractor shall, at no cost to the Owner, obtain all access or construction rights-of-way of a temporary nature other than specified.

6. Interferences

Any and all crossings of public utility facilities such as water mains, sewer lines, gas lines, electrical or control cables and/or conduits, telephone and/or telegraph cables and/or conduits shall be made by Contractor in accordance with requirements and Specifications of appropriate agencies. Contractor shall obtain any necessary permits, licenses, and/or agreements required by said agencies.

Whenever facilities are encountered by Contractor, he shall ascertain the ownership thereof and shall make all necessary arrangements with the owners for the protection, removal, relocation, and/or replacement thereof. Contractor shall give the owners due notice of his requirements and shall give them convenient access and cooperate with them in every way while any work of removal and/or replacement is being performed.

7. Sanitation

All parts of the Work shall be maintained in a neat, clean, sanitary condition. Fixed and portable toilets, inaccessible to insects, shall be provided wherever needed for use by employees and their use shall be strictly enforced. All waste and refuse from sanitary facilities or from any source related to Contractor's operations shall be disposed of in a sanitary manner satisfactory to the Owner and in accordance with laws and regulations pertaining thereto. Contractor shall rigorously prohibit and prevent committing of nuisance within the Work area or upon the Owner's right-of-way or adjacent private property. Contractor shall furnish all facilities and means for proper sanitation for the Work and shall indemnify, protect, and save the Owner harmless from any liability resulting from improper or insufficient sanitation.

8. Accident Prevention and First Aid

Contractor shall provide a safe working environment for all persons working on or affected by the Work. Contractor shall take precautions for the protection of persons and property at all times during the course of the Work. Contractor shall exercise and observe the safety provisions of applicable laws and building and construction codes. Contractor shall maintain in good and safe operating condition all equipment and facilities required for proper execution and inspection of the Work.

Contractor shall guard machinery, equipment, and hazards in accordance with safety provisions of the Manual of Accident Prevention in Construction, published by the Associated General Contractors of America, the Construction Safety Orders and Trench Construction Safety Orders as issued by the Division of Industrial Safety of the Department of Industrial relations of the State of California, and Chapter 8 ("Traffic Control and Protection of Workmen") of the Manual of Instruction for the Maintenance Department of the State of California Department of Transportation, to the extent that such provisions are not inconsistent with applicable laws or regulations.

All warning signs, lights, barricades, and other measures designed to protect the traveling public shall be erected and maintained in good order by Contractor in accordance with applicable provisions of Chapter 21 ("Maintenance Signs, Barricades, and Traffic Control") of the Manual of Instruction for the Maintenance Department of the State of California Department of Transportation and of the applicable ordinances of the public agency having jurisdiction over the maintenance and policing of highways, thoroughfares, and streets. Special regard shall be given to the rights and convenience of the traveling public and the property owners and residents in the area of Work. Cross-over boards or steel plates approved by the Owner shall be placed and other precautions taken whenever necessary to provide for at least one-way traffic along all traveled streets and to provide access to driveways and residences, unless specified otherwise.

9. First Aid Facilities

Contractor shall keep first aid facilities and supplies on the jobsite. Contractor shall provide instruction in first aid as required by State regulations. Contractor shall provide emergency first aid treatment and supplies for his employees sufficient to comply with all applicable laws.

10. Materials

Contractor shall furnish only approved materials as listed in the Owner's approved material list. All materials to be furnished by Contractor shall be new and of the best quality for their intended use. All like materials shall be of one manufacture for any particular project.

Contractor shall submit 3 copies of all material lists to the Owner for approval thereof. Said material lists shall include manufacturer's name, designation, description, and related information of all materials to be furnished and installed or otherwise used by Contractor in the performance of the Work. Said material lists shall be submitted at or prior to project preconstruction meeting and said lists shall be approved by the Owner prior to beginning construction.

11. Construction

Contractor alone shall be responsible for the safety, efficiency, and adequacy of his plant, equipment, appliances, and methods and for any damage which may result from their failure or their improper construction, maintenance, or operation.

Contractor shall be responsible for examining all Construction Drawings, Specifications, Standard Drawings, Work site, delivery routes, and local conditions which may affect the Work.

Before proceeding with the Work, Contractor shall furnish the Owner any information required of him by the Construction Drawings, Specifications, Standard Drawings, Special Requirements, and Directions of the Owner.

Contractor shall keep at jobsite a complete set of Construction Drawings, Specifications, Standard Drawings, permits, certificates and licenses for the Work, and all other data required by the Owner. Contractor shall be responsible for checking all dimensions and quantities on said drawings or schedules and shall notify the Owner of any errors and omissions found.

Until acceptance of the Work by the Owner, Contractor shall bear the risk of injury or damage to any part of the Work by action of the elements or from any other cause and Contractor shall rebuild, repair, restore, and make good any injuries or damages to the Work except as limited in the Contract Appendix.

Contractor shall cooperate with other contractors who are working in the project area as the Owner may specify and he shall comply with all orders of the Owner. Contractor shall employ only competent and skillful persons to perform the Work. Said persons shall be qualified or certified to perform the Work in accordance with requirements of said person's trade.

Contractor shall submit to the Owner for approval a construction schedule covering all Work based on normal work periods. Contractor shall not deviate from approved schedule without prior permission from the Owner. Whenever Contractor arranges to work at night or at any time other than normal work periods or to vary the period during which Work is to be carried on each day, he shall obtain special permission from the Owner to do so and he shall keep the Owner properly informed of his activities. Construction schedule shall show the order in which Contractor proposes to carry out Work, dates of anticipated commencement and completion of Work and salient components thereof, and estimated percentage of Work to be completed at any time during the construction period.

12. Records of Construction

Contractor shall maintain at least one complete set of Construction Drawings on the jobsite during the course of construction upon which he shall note any changes in the Work as they occur. Contractor shall maintain said Drawings so that the Owner may at any time during the course of construction ascertain the changes that have occurred. Said Construction Drawings shall be the basis of the two sets of record drawings that Contractor shall provide the Owner upon completion of the Work.

13. Inspection

All materials and equipment furnished and all Work performed shall be subject to rigid inspection by the Owner. Contractor may be required to remove and replace under proper inspection any Work performed in the absence of prescribed inspection, with the entire cost being borne by Contractor irrespective of whether such Work is found to be defective. Work covered up without authority of the Owner shall, upon order of the Owner, be uncovered to the extent required to permit inspection, repair, or replacement and thereafter be recovered, and Contractor shall bear entire cost.

14. Examination of Work

Contractor shall furnish the Owner every reasonable facility for ascertaining whether Work is being accomplished in accordance with the requirements and intention of the Construction Drawings, Specifications, Standard Drawings, Special Requirements, and Directions of the Owner.

15. Right to Occupy Work

The Owner may wish to occupy or place in service portions of the Work before its final completion and shall be at liberty to do so. Such occupancy or placing in service of any portion of the Work shall not relieve Contractor of his responsibility of protection and care of all Work until final completion and acceptance provided, however, that expense directly attributable to operation and placing portions of Work in service shall not be chargeable to Contractor.

16. Maintenance and Guarantee

Contractor shall guarantee that all Work performed by him meets all requirements specified as to character, quality, and quantity of materials and workmanship. Contractor shall replace all materials and pay all installation costs made necessary by defects in materials or workmanship supplied by him that become evident within one year after acceptance of the facilities or the date of final payment, whichever occurs later.

Contractor shall replace all defective materials promptly upon receipt of written notice from the Owner. If Contractor fails to replace all defective materials promptly, the Owner may secure the service of others to perform the Work and Contractor shall be liable to the Owner for any costs including removal and replacement thereof.

17. Construction Power

Contractor shall provide all necessary power required for his operations, and shall provide and maintain in good order such modern power equipment and installation as shall be adequate, in the opinion of the Owner, to perform the required Work in a safe and satisfactory manner.

18. Construction Water

Unless specified otherwise, the Owner will provide construction water to Contractor from its existing system at established rates. Contractor shall furnish and install all necessary piping and appurtenances necessary to convey water from the Owner's metered service connection to place of use.

19. Welding

Welding shall be done by the electric arc method using a process which excludes the atmosphere from the molten metal, except where otherwise approved by the Owner. Welding electrodes used for manual welding shall be an approved type. Except as modified herein, welding process qualification and operator qualification shall comply with the applicable requirements of the "Code for Arc and Gas Welding in Building Construction" of the AWS.

Each weld shall be uniform in width and size throughout its entire length. Each layer shall be smooth, free from slag, cracks, pinholes, and undercut and shall be completely fused to adjacent weld beads and base metal. Cover pass shall be completely free of course ripples, irregular surfaces, non-uniform bead pattern, high crown, deep ridges, or valleys between beads, and shall blend smoothly and gradually into surface of base metal. Butt welds shall be slightly convex, of uniform height, and shall have full penetration. Fillet welds shall be of size indicated, with full throat, and with each leg of equal length. Repair, chipping, or grinding of welds shall not gouge, groove, or reduce base metal thickness.

20. Environmental Factors

Contractor shall take all reasonable precautions to protect the environment.

a. Air Pollution

Contractor shall use only machinery and equipment which is equipped with suitable air pollution control devices so that undue quantities of pollutants are not added to the atmosphere in the vicinity of the Work site. Contractor's equipment shall meet all Federal, State, and local requirements for air quality emissions and Contractor shall comply with all applicable Federal, State, and local air pollution control regulations.

Contractor shall also take all necessary precautions to control dust created by construction operations. Contractor shall be especially diligent in implementing his dust control program and he shall be prepared to respond immediately and positively to any instructions for corrective action given by the Owner. Contractor shall use dust palliatives if necessary to satisfactorily control dust; however, Contractor shall secure the Owner's approval for use of dust palliatives other than water.

b. Explosives

Contractor shall handle, transport, store, and use explosives in accordance with applicable Federal, State, and local laws and regulations. Contractor shall be responsible for and make good any damage caused by his use of explosives.

c. Fires

Contractor shall exercise all precautions necessary to prevent unauthorized fires within or adjacent to the limits of the Work. Contractor shall be responsible for all damage resulting from fire due directly or indirectly to his or his employees' activities or the activities of his subcontractors or their employees.

d. Drainage and Flooding

Contractor shall manage excavation and spoil banks such that existing drainage conditions are not impaired. Contractor shall provide drainage in all cases where the existing drainage conditions are being unavoidably altered or disturbed by his operations. Temporary diversions, ditches, checks, swales, or other drainage structures or features necessary to ensure proper drainage and flood control shall be provided by Contractor at no extra cost to the Owner.

e. Historical and Archaeological Sites

If Contractor should encounter any evidence of historical or archaeological significance, he shall immediately cease construction, notify the Owner, and refrain from any activity until the Owner orders Work to resume. The Owner will assume full responsibility for any delays caused by historical or archaeological investigations.

f. Noise Pollution

Contractor shall equip all machinery and equipment used for construction with noise control devices such as mufflers for internal combustion engines or other suitable noise suppressors. Noise produced by construction operations shall be kept to a minimum and shall be consistent with reasonable human health requirements considering time of day and location of Work site. Contractor shall comply with all applicable Federal, State, and local noise pollution control regulations.

Unless specified otherwise, noise levels in connection with the Work shall not exceed 75 dB(A) at a distance of one hundred (100) feet for relatively continuous exposure and they shall not exceed 90 dB(A) at that same distance for relatively infrequent intermittent exposure. Contractor shall be prepared to respond immediately and positively to any instructions for corrective action given by the Owner particularly with respect to complaints from the public.

g. Public Relations

Contractor shall give due consideration to the comfort and convenience of the public and he shall instruct his employees to be polite and respectful in their dealings with the public at the Work site and in traveling to and from the Work site.

h. Traffic

Contractor shall adequately protect the public using any roads which are involved in Contractor's operations and he shall maintain safe traffic flow in the vicinity of the Work. Contractor shall use signs, barricades, delineators, flashers, and flagmen, all in strict compliance with Federal, State, and local rules and regulations regarding traffic control. Public roadways shall not be barricaded

or blockaded except in accordance with requirements of public agencies having jurisdiction over same. Contractor shall provide access to all walkways, sidewalks, driveways, and streets at all times. If requested by the Owner, Contractor shall furnish a traffic control program for the Work.

i. Vegetation and Wildlife

Contractor shall not destroy or disturb any vegetation or habitat unless absolutely necessary for the performance of the Work. Contractor shall take all steps necessary to ensure that his employees do not destroy or disturb any vegetation or wildlife in the prosecution of the Work or incidental thereto, including travel to and from the Work site.

j. Water Pollution

Contractor shall discard materials which might adversely affect ground or surface water at approved dump sites only. Chemicals and other water pollutants shall not be discharged into natural watercourses or on land tributary to said watercourses. Contractor shall comply with all applicable Federal, State, and local water pollution control regulations.

k. Cleanup

Contractor shall keep the premises occupied by him in a neat, clean condition free from unsightly accumulation of rubbish. Contractor shall maintain all Work areas within or without the project limits free from dust which would cause a hazard to the Work, operations of other contractors, or other persons or property. Upon completion of the Work, Contractor shall at his own expense satisfactorily dispose of or remove from the vicinity of the Work all plants, building, rubbish, unused materials, concrete forms, and other equipment and materials belonging to him or used under his direction during construction and, if he fails to do so, the same may be removed and disposed of by the Owner at Contractor's expense.

BASIC CONCRETE SPECIFICATIONS

PART 1 - GENERAL

1.01 General Requirements

A. Contractor shall furnish all materials for concrete in accordance with the provisions of this Section and shall form, mix, place, cure, repair, finish, and do all other work as required to produce finished concrete, all in accordance with the requirements of the Contract Documents.

B. All cast-in-place concrete falls into one of the following categories and shall comply with all requirements of this basic specification.

1. Structural Concrete (or Class "A" Concrete). Concrete to be used in all cases except where noted otherwise in the Contract Documents.

2. Sitework Concrete (or Class "B" Concrete). Concrete to be used for curbs, gutters, catch basins, sidewalks, pavements, fence and guard post embedment, underground duct bank encasement and all other concrete appurtenant to electrical facilities unless otherwise shown.

3. Lean Concrete (or Class "C" Concrete). Concrete to be used for thrust blocks, pipe trench cut-off blocks and cradles, where the preceding items are detailed on the drawings as unreinforced. Concrete to be used as protective cover for dowels intended for future connection.

C. Only one class of concrete shall be present at the job site at any one time.

1.02 Reference Specifications, Codes, and Standards

A. Specifications

Items specified elsewhere in these Contract Documents:

Concrete Formwork - See Section 03100, Basic Concrete Formwork Specifications.

Concrete Reinforcement - See Section 03200, Basic Concrete Reinforcement Specifications.

B. Codes

The Building Code, as referenced herein, shall be the California Building Code (CBC), of the California Building Standards Commission, latest edition.

C. Commercial Standards

Where not covered in this specification, all work shall comply with the following standards, latest editions:

ACI 214	Evaluation of Strength Test Results of Concrete
ACI 301	Specifications for Structural Concrete
ACI 315	Details and Detailing of Concrete Reinforcement

ACI 347	Guide to Formwork for Concrete
ACI 318	Building Code Requirements for Structural Concrete and Commentary
ACI 350	Code Requirements for Environmental Engineering Concrete Structures and Commentary
ASTM C 494	Standard Specification for Chemical Admixtures for Concrete

1.03 Contractor Submittals

All submittals shall be in accordance with the Section 01300, Contractor Submittals and Requests Technical Specifications.

A. Mix Designs

Prior to beginning the work, Contractor shall submit to Engineer, for review, preliminary concrete mix designs which shall show the proportions and gradations of all materials proposed for each class and type of concrete to be used on the job. The mix designs shall be designed by an independent testing laboratory acceptable to Engineer. All costs related to such mix design shall be borne by the Contractor.

B. Certified Delivery Tickets

Where ready-mix concrete is used, Contractor shall provide certified delivery tickets at the time of delivery of each load of concrete. Each certificate shall show the total quantities (by weight) of cement, sand, each class of aggregate, and admixtures, and the amounts of water (by gallons) in the aggregate and added at the batching plant as well as the amount of water allowed to be added at the site for the specific design mix. Each certificate shall, in addition, state the mix number, total yield in cubic yards, and the time of day, to the nearest minute, corresponding to when the batch was dispatched, when it left the plant, when it arrived at the job, the time that unloading began, and the time that unloading was finished.

1.04 Quality Assurance

A. Tests on component materials and for compressive strength of concrete will be performed as specified herein. Test for determining slump will be in accordance with the requirements of ASTM C 143.

B. The cost of all laboratory tests on concrete will be borne by the Owner. However, Contractor shall be charged for the cost of any additional tests and investigation on work performed which fails to meet specification.

C. Concrete for testing shall be supplied by Contractor at no cost to the Owner, and Contractor shall provide assistance to the Engineer in obtaining samples, and disposal and cleanup of excess material.

D. Field Compression Tests

1. Compression test specimens will be taken during construction from the first placement of each class of concrete specified herein and at intervals thereafter as selected by the Engineer to insure continued compliance with these specifications. Each set of test specimens will be a minimum of 4 cylinders.

2. Compression test specimens for concrete shall be made in accordance with ASTM C 31. Specimens shall be 6" diameter by 12" high cylinders.

3. Compression tests shall be performed in accordance with ASTM C 39. One test cylinder will be tested at 7 days and two will be tested at 28 days.

   The remaining cylinder will be held to verify test results, if needed.

E. Evaluation and Acceptance of Concrete

1. Evaluation and acceptance of the compressive strength of concrete shall be according to the requirements of ACI 350, Chapter 5, "Concrete Quality, Mixing, and Placing", and as specified herein.

2. If any concrete fails to meet these requirements, immediate corrective action shall be taken to increase the compressive strength for all subsequent batches of the type of concrete affected.

3. All concrete which fails to meet the ACI requirements and these specifications is subject to removal and replacement at the cost of the Contractor.

F. Construction Tolerances

Contractor shall set and maintain concrete forms and perform finishing operations so as to insure that the completed work is within the tolerances specified herein. Surface defects and irregularities are defined as finishes and are to be distinguished from tolerances. Tolerance is the specified permissible variation from lines, grades, or dimensions shown. Where tolerances are not stated in the specifications, permissible deviations will be in accordance with ACI 347.

G. The following construction tolerances are hereby established and apply to finished walls and slab unless otherwise shown:

Item	Tolerance
Variation of the constructed linear outline from the established position in plan	In 10 feet: 1/4 inch; In 20 feet or more: 1/2 inch
Variation from the level or from the grades shown	In 10 feet: 1/8 inch; In 20 feet or more: 1/4 inch
Variation from the plumb	In 10 feet: 1/8 inch; In 20 feet or more: 1/4 inch
Variation in the thickness of slabs and walls	Minus 1/4 inch; Plus 1/2 inch
Variation in the locations and sizes of slab and wall openings	Plus or minus 1/4 inch

Regardless of the tolerances listed herein, it shall be the responsibility of the Contractor to limit deviations in line and grade to tolerances which will permit proper installation and operation of mechanical equipment and piping.

PART 2 - PRODUCTS

2.01 Concrete Materials

A. Materials shall be delivered, stored, and handled so as to prevent damage by water or breakage. Only one brand of cement shall be used. Cement reclaimed from cleaning bags or leaking containers shall not be used. All cement shall be used in the sequence of receipt of shipments.

B. All materials furnished for the work shall comply with the requirements of Section 4.2.1 of ACI 301.

C. Storage of materials shall conform to the requirements of Section 4.1.4 of ACI 301.

D. Materials for concrete shall conform to the following requirements:

1. Cement shall be standard brand portland cement conforming to ASTM C 150 for Type II or Type V. Portland cement shall contain not more than 0.60 percent alkalies. A single brand of cement shall be used throughout the work, and prior to its use, the brand shall be acceptable to the Engineer. The cement shall be suitably protected from exposure to moisture until used. Cement that has become lumpy shall not be used. Stacked cement shall be stored in such a manner so as to permit access for inspection and sampling. Certified mill test reports for each shipment of cement to be used shall be submitted to the Engineer if requested regarding compliance with these specifications.

2. Fly Ash or other pozzolans are not permitted as a component in the concrete mix.

3. Water shall be potable, clean, and free from objectionable quantities of silty organic matter, alkali, salts and other impurities. The water shall be considered potable, for the purposes of this section only, if it meets the requirements of the local governmental agencies. Agricultural water with high total dissolved solids (over 1000 mg/l TDS) shall not be used.

4. Aggregates shall be obtained from pits acceptable to the Engineer, shall be non-reactive, and shall conform to ASTM C 33. Maximum size of coarse aggregate shall be as specified in Part 2.07B herein. Lightweight sand for fine aggregate will not be permitted.

   a. Coarse aggregates shall consist of clean, hard, durable gravel, crushed gravel, crushed rock or a combination thereof. The coarse aggregates shall be prepared and handled in two or more size groups for combined aggregates with a maximum size greater than 3/4". When the aggregates are proportioned for each batch of concrete the two size groups shall be combined.

   b. Fine aggregates shall be natural sand or a combination of natural and manufactured sand that are hard and durable.

   c. Combined aggregates shall be well graded from coarse to fine sizes, and shall be uniformly graded between screen sizes to produce a concrete that has optimum workability and consolidation characteristics. Where a trial batch is required for a mix design, the final combined aggregate gradations will be established during the trial batch process.

5. Ready-mix concrete shall conform to the requirements of ASTM C 94.

6. Air-entraining agent meeting the requirements of ASTM C 260, shall be used. Sufficient air-entraining agent shall be used to provide a total air content of 4 to 6 percent; provided

that, when the mean daily temperature in the vicinity of the worksite falls below 40°F for more than one day, the total air content provided shall be 5 to 7 percent. The Owner reserves the right, at any time, to sample and test the air-entraining agent received on the job by the Contractor. The air-entraining agent shall be added to the batch in a portion of the mixing water. The solution shall be batched by means of a mechanical batcher capable of accurate measurement.

7. Admixtures shall be required as stated herein and at the Engineer's discretion or, if not required, may be added at the Contractor's option to control the set, effect water reduction, and increase workability. In either case, the addition of an admixture shall be at the Contractor's expense. The use of an admixture shall be subject to acceptance by the Engineer. Concrete containing an admixture shall be first placed at a location determined by the Engineer. If the use of an admixture is producing an inferior end result, Contractor shall discontinue use of the admixture. Admixtures specified herein shall conform to the requirements of ASTM C 494. The required quantity of cement shall be used in the mix regardless of whether or not an admixture is used. Admixtures shall contain no free chloride ions, be non-toxic after 30 days, and shall be compatible with and made by the same manufacturer as the air entraining admixture.

   a. Low range water reducer shall be used in all structural and sitework concrete and shall conform to ASTM C 494, Type A. It shall be either a hydroxylated carboxylic acid type or a hydroxylated polymer type. The quantity of admixture used and the method of mixing shall be in accordance with the manufacturer's instructions and recommendations.

   b. Set controlling admixture shall be either with or without water-reducing properties. Where the air temperature at the time of placement is expected to be consistently over 80°F, a set retarding admixture such as Sika Chemical Corporation's Plastiment, BASF's Pozzolith 300R, or equal shall be used. Where the air temperature at the time of placement is expected to be consistently under 40°F, a set accelerating admixture such as Sika Chemical Corporation's Plastocrete 161FL, BASF's Pozzolith 122HE, or equal shall be used.

   c. High range water reducer may be used if approved by Engineer. If allowed it shall be sulfonated polymer conforming to ASTM C 494, Type F or G.

      High range water reducing agent shall only be added to the concrete at the batch plant. It shall be second generation type, Daracem 100 as manufactured by W.R. Grace & Co., Rhedbuild 1000 as manufactured by BASF, or equal. High range water reducer shall be added to the concrete after all other ingredients have been mixed and initial slump has been verified.

      Concrete shall be mixed at mixing speed for a minimum of 30 mixer revolutions after the addition of the high range water reducer.

8. Calcium Chloride shall not be added to or used in concrete.

9. Floor Hardener shall be provided where specified on the Drawings. Floor hardener shall be natural aggregate dry shake hardener for concrete. Hardener shall be composed of crushed, washed, and specially graded quartz silica aggregate, cementitious binders, plasticizers, dispersing agents and stable colorants. Contractor shall coordinate adjustments in concrete mix design necessary to accommodate proposed floor hardener, including air entrainment and admixtures. Unless specified otherwise, hardener color shall be natural light gray.

Floor hardener shall be ConColor by ChemMasters, Lithochrome by L.M. Scofield Co., Colorcron by Master Builders, or equal. Floor hardener shall be applied in strict accordance with the manufacturer's printed instructions.

2.02 Curing Materials

Materials for curing concrete shall conform to the following requirements:

A. Concrete curing compound shall be Resi-Chem manufactured by Symons, or approved equal. The curing compound shall contain a fugitive dye so that areas of application will be readily distinguishable.

B. Polyethylene sheet for use as concrete curing blanket shall be white, and shall have a nominal thickness of 6 mils. The loss of moisture when determined in accordance with the requirements of ASTM C 156 shall not exceed 0.055 grams per square centimeter of surface.

C. Polyethylene-coated waterproof paper sheeting for use as concrete curing blanket shall consist of white polyethylene sheeting free of visible defects, uniform in appearance, having a nominal thickness of 2 mils and permanently bonded to waterproof paper conforming to the requirements of Federal Specification UU-B-790A (Int. Amd. 1). The loss of moisture, when determined in accordance with the requirements of ASTM C 156, shall not exceed 0.055 gram per square centimeter of surface.

D. Polyethylene-coated burlap for use as concrete curing blanket shall be 4 mil thick, white opaque polyethylene film impregnated or extruded into one side of the burlap. Burlap shall weigh not less than 9 ounces per square yard. The loss of moisture, when determined in accordance with the requirements of ASTM C 156, shall not exceed 0.055 grams per square centimeter of surface.

E. Curing mats for use in Curing Method 6 as specified in Part 3.09G herein, shall be heavy shag rugs or carpets or cotton mats quilted at 4" on center. Curing mats shall weigh a minimum of 12 ounces per square yard when dry.

F. Evaporation retardant shall be a material such as Confilm as manufactured by BASF, Cleveland, OH; or equal.

2.03 Waterstop

A. Contractor shall provide waterstops at all construction and expansion joints in all water holding structures. Waterstop shall be Greenstreak PVC Style 732, 6" wide, or Style 735, 9" wide, as specified on Drawings.

B. Contractor shall heat fuse joints and connections in strict compliance with manufacturer's instructions using heating tools and devices recommended by same. Waterstops shall be continuous in joints, following offsets and angles in joint until spliced to waterstops at intersecting joints, completely sealing the structure. Waterstops shall be aligned and centered in joints. Contractor shall secure flanges of waterstops to reinforcing bars with 18 gauge wire ties spaced maximum 18" on center. Waterstop joints shall be properly heat-spliced at ends and crosses to preserve continuity. Contractor shall locate waterstops where shown on drawings and in all waterbearing walls and slabs where common to: earth-bearing or earth-support; occupied areas; or above-grade exposed surfaces.

C. All joints with waterstops involving more than 2 ends to be jointed together, and all joints which involve an angle cut, alignment change, or the joining of 2 dissimilar waterstop sections shall be prefabricated by the Contractor prior to placement in the forms, allowing not less than 24" long strips of waterstop material beyond the joint. Upon being inspected and approved, such

prefabricated waterstop joint assemblies shall be butt welded to the straight run portions of waterstop.

D. Waterstop splices shall have a tensile strength of not less than 60 percent of the unspliced materials tensile strength.

2.04 Expansion Joints

A. Contractor shall provide expansion joints where indicated on Construction Drawings. Expansion joints shall consist of joint filler material and joint sealant. Filler material shall be held down 1/2" for sealant unless otherwise shown.

B. Expansion joint filler material shall be preformed sponge neoprene or cork conforming to ASTM D 1752. Filler material containing asphalt shall not be used.

2.05 Joint Sealant

A. Joint sealant for use in construction, control, and expansion joints shall be Sika-Flex 1a as supplied by the Sika Corporation, or approved equal.

Joint primer shall be as produced and/or recommended by sealant manufacturer.

B. Contractor shall clean all locations where sealant is placed by sandblasting and be free from oil, foreign materials, and moisture. Lower surfaces of joints shall be isolated with a bond breaker such as polyethylene, polyethylene tape, or equal as recommended by sealant manufacturer.

C. Sealant shall be placed in strict accordance with manufacture's recommendations by a firm specializing in this type of work, or by the Contractor under direct supervision of the manufacturer. If the Contractor chooses to apply sealant, manufacturer's technical representative shall be present at the beginning of sealant placement to observe and advise on methods for mixing, joint preparation, and application of sealant.

2.06 Concrete Bond Breaker

A. Bond breaker shall be Spec Tilt WB Bond Breaker as manufactured by SpecChem; Tilt-EEZ WB Bond Breaker as manufactured by Conspec; or approved equal. It shall contain a fugitive dye so that areas of application will be readily distinguishable.

B. Contractor shall strictly follow manufacturer's application guidelines. Just prior to application, joint shall be thoroughly soaked so that concrete contains approximately the same surface moisture as newly cast concrete. Bond breaker shall be brush applied with a minimum of two coats. Extreme care must be taken to prevent any bond breaker from contacting waterstops. If necessary, wrap waterstop during bond breaker application.

2.07 Concrete Design Requirements

A. General

Concrete shall be composed of cement, admixtures, aggregates and water. These materials shall be of the qualities specified. The exact proportions in which these materials are to be used for different parts of the work will be determined during the trial batch. In general, the mix shall be designed to produce a concrete capable of being deposited so as to obtain maximum density and minimum shrinkage and, where deposited in forms, to have good consolidation properties and maximum smoothness of surface. Mix designs shall not contain more than 43 percent of sand of the total weight of fine and coarse aggregate. The aggregate gradations shall be formulated to

provide fresh concrete that will not promote rock pockets around reinforcing steel or embedded items. The proportions shall be changed whenever necessary or desirable to meet the required results at no additional cost to the Owner. All changes shall be approved by Engineer.

B. Water-Cement Ratio and Compressive Strength

The minimum compressive strength and cement content of concrete shall be not less than that specified in the following tabulation.

Type of Work	Min. 28-Day Compressive Strength (psi)	Max. Size Aggregate (in.)	Min. Cement per cu yd (sacks)	Max. W/C Ratio (by wt.)
Structural Concrete (Class "A"):				
Walls, floor slabs, columns, and footings of hydraulic (water or wastewater) bearing structures	4,000	1	6.2	0.45
Walls, roof slabs, floor slabs, columns, and footings and all other concrete items not specified elsewhere	4,000	1	6.2	0.48
Sitework concrete (Class "B"):	3,000	1	5.5	0.52
Lean concrete (Class "C"):	2,000	1	4.0	0.60

Note: One sack of cement equals 94 lbs.

C. Adjustments to Mix Design

Mixes used shall be changed whenever such change is necessary or desirable to secure required strength, density, workability, and surface finish and Contractor shall be entitled to no additional compensation because of such changes. Approval shall be obtained from Engineer prior to any changes.

2.08 Consistency

The quantity of water entering into a batch of concrete shall be just sufficient, with a normal mixing period, to produce concrete which can be worked properly into place without segregation, and which can be compacted by vibratory methods herein specified to give desired density, impermeability and smoothness of surface. The quantity of water shall be changed as necessary, with variations in the nature of moisture content of the aggregates, to maintain uniform production of desired consistency. The consistency of the concrete in successive batches shall be determined by slump tests in accordance with ASTM C 143. The slumps shall be as follows:

Part of Work	Slump
Structural concrete	3" (±1")
Other work	4" (±1")

With high range water reducer added 8" max.

2.09 Ready-Mixed Concrete

A. At Contractor's option, ready-mixed concrete may be used provided it meets all requirements as to materials, batching, mixing, transporting, and placing as specified herein and in accordance with ASTM C 94, including the supplementary requirements specified in Parts 2.09B through 2.09F herein.

B. Ready-mixed concrete shall be delivered to the site of the work, and discharge shall be completed within 90 minutes after the addition of the cement to the aggregates or before the drum has been revolved 250 revolutions, whichever is first. In hot weather (ambient temperature above 95°F) or under conditions contributing to quick stiffening of the concrete, or when the temperature of the concrete is 85°F or above, the time between the introduction of the cement to the aggregates and discharge shall not exceed 45 minutes.

C. Truck mixers shall be equipped with electrically-actuated counters by which the number of revolutions of the drum or blades may be readily verified. The counter shall be of the resettable, recording type, and shall be mounted in the driver's cab. The counters shall be actuated at the time of starting mixers at mixing speeds.

D. Each batch of concrete shall be mixed in a truck mixer for not less than 70 revolutions of the drum or blades at the rate of rotation designated by the manufacturer of equipment. Additional mixing, if any, shall be at the speed designated by the manufacturer of the equipment as agitating speed. All materials including mixing water shall be in the mixer drum before actuating the revolution counter for determining the number of revolution of mixing.

E. Truck mixers and their operation shall be such that the concrete throughout the mixed batch as discharged is within acceptable limits of uniformity with respect to consistency, mix, and grading. If slump tests taken at approximately the 1/4 and 3/4 points of the load during discharge give slumps differing by more than 1" when the specified slump is 4" or less, or if they differ by more than 2" when the specified slump is more than 4", the mixer shall not be used on the work unless the causing condition is corrected and satisfactory performance is verified by additional slump tests. All mechanical details of the mixer, such as water measuring and discharge apparatus, condition of the blades, speed of rotation, general mechanical condition of the unit, and clearance of the drum, shall be checked before a further attempt to use the unit will be permitted.

F. Each batch of ready-mixed concrete delivered at the job site shall be accompanied by a certified weighmaster delivery ticket furnished to the Engineer in accordance with Part 1.03B herein.

G. Non-agitating equipment for transporting ready-mixed concrete shall not be used. Combination truck and trailer equipment for transporting ready-mixed concrete shall not be used. The quality and quantity of materials used in ready-mixed concrete and in batch aggregates may be subject to continuous inspection at the batching plant by the Engineer.

H. Transit mix trucks delivering concrete to the site shall have full water tanks upon arrival at the site. Any addition of water must be approved by Engineer. Added water must be incorporated by additional mixing of at least 35 revolutions.

PART 3 - EXECUTION

3.01 Proportioning and Mixing

A. Proportioning

Proportioning of the concrete mix shall conform to the requirements of Section 4.2.3 of ACI 301; provided, that the maximum slump for any concrete shall not exceed 4" except when the use of high range water reducer is permitted which increases the maximum slump to 8".

B. Mixing

Mixing of concrete shall conform to the requirements of Section 4.3.1 of ACI 301 specifications.

C. Slump

Maximum slumps shall be as specified in Part 2.08A herein.

D. Retempering

Concrete or mortar which has partially hardened shall not be retempered.

3.02 Preparation of Surfaces for Concreting

A. General

Earth surfaces shall be thoroughly wetted by sprinkling, prior to placing any concrete, and these surfaces shall be kept moist by frequent sprinkling up to the time of placing concrete thereon. These surfaces shall be free from standing water, mud, and debris at the time of placing concrete.

B. Joints in Concrete

The location of all construction joints not specifically noted or shown shall be approved by Engineer. Concrete surfaces upon or against which concrete is to be placed, where the placement of the old concrete has been stopped or interrupted so that, as determined by the Engineer, the new concrete cannot be incorporated integrally with that previously placed, are defined as construction joints. The surfaces of horizontal joints shall be given a compacted, roughened surface for good bond. Except where the drawings call for joint surfaces to be coated, the joint surfaces shall be cleaned of all laitance, loose or defective concrete, and foreign material. Such cleaning shall be accomplished by sandblasting to remove laitance and to provide a uniform surface texture with approximately 1/4" of surface sandblasted off. Sandblasting shall be followed by thorough washing. All pools of water shall be removed from the surface of construction joints before the new concrete is placed.

C. Placing Interruptions

When placing of concrete is to be interrupted long enough for the concrete to take a set, the working face shall be given a shape by the use of forms or other means, that will secure proper union with subsequent work; provided that construction joints shall be made only where acceptable to the Engineer.

D. Embedded Items

1. Concrete shall not be placed until all formwork, installation of parts to be embedded, reinforcement steel, and preparation of surfaces involved in the placing have been

completed and accepted by the Engineer at least 4 hours before placement of concrete. All surfaces of forms and embedded items that have become encrusted with dried grout from concrete previously placed shall be cleaned of all such grout before the surrounding or adjacent concrete is placed.

2. All reinforcement, anchor bolts, sleeves, inserts, and similar items shall be set and secured in the forms where shown on Contract Drawings and shall be acceptable to the Engineer before any concrete is placed. Accuracy of placement is the responsibility of the Contractor.

3. Anchor Bolts shall be accurately set, and shall be maintained in position by templates while being embedded in concrete.

4. Concrete anchor bolts and expansion anchors shall be ASTM type A-316 stainless steel and shall be inserted to the minimum depths listed below, unless noted otherwise:

Size	Reinforced Concrete
1/4"	3"
3/8"	4"
1/2"	5"
3/4"	6"

5. Expansion anchors shall be stainless steel Hilti Kwik Bolt TZ, or equal.

6. All smooth dowels shall have at least one side coated with a bond breaker. Dowel bond breaker shall be a heavy duty industrial grease hand applied. A wax paper or PVC sleeve may be used at the Contractor's option if specifically manufactured to create slip dowels. Paper tubing shall be multi-ply stock and heavily impregnated with paraffin. Maximum sleeve thickness shall be 1/16" and sleeve shall fit snugly over dowel.

E. Casting New Concrete Against Old

1. Where new concrete is to be cast against existing (old) concrete (concrete which is greater than 60 days of age), surfaces of old concrete shall be roughened by mechanical means to provide an aggregate-fractured surface with a 1/4" (min.) profile and cleaned of all loose concrete and dust. The remaining surface shall be saturated in advance of concrete placement but be free of standing water. A bonding agent such as Sika Armatec 110 shall be applied to the interface between old and new concrete just prior to concrete placement.

2. Overlays of existing concrete and repair of holes, cavities, and depressions in existing concrete due to removal of existing facilities or installation of new facilities shall be as follows:

   a. Remaining concrete surfaces shall be prepared as specified in Part 3.02E.1 herein.

   b. A bonding agent shall be applied to all concrete and metal surfaces to receive repair mortar or concrete. Bonding agent shall be Sika Armatec 110, or equal.

   c. Overlays, holes, cavities, and depressions shall be filled with Sika Monotop 611 mortar, or equal. For placements greater than 1" in depth, 3/8" coarse aggregate shall be added to the mortar to create a repair concrete. Vertical surfaces shall

be formed. Horizontal surfaces, including slab overlays, shall be hand trolled and finished to match adjacent concrete.

d. Bonding agent and repair mortar/concrete shall be mixed and installed in strict accordance with the manufacturer's printed instructions.

F. Concrete shall not be placed in any old or new structure until all water entering the space to be filled with concrete has been properly cut off or has been diverted by pipes, or other means, and carried out of the forms, clear of the work. Concrete shall not be deposited underwater nor shall the Contractor allow still water to rise on any concrete until the concrete has attained its initial set. Water shall not be permitted to flow over the surface of any concrete in such a manner and at such velocity as to injure the surface finish of the concrete. Contractor shall provide pumping or other necessary dewatering operations for removing groundwater, if required, with methods subject to review by Engineer.

G. Corrosion Protection

Pipe, conduit, dowels, and other ferrous items required to be embedded in concrete construction shall be so positioned and supported prior to placement of concrete that there will be a minimum of 2" clearance between said items and any part of the concrete reinforcement. Contractor shall not secure such items in position by wiring or welding them to the reinforcement.

H. Cleaning

Surfaces of all metalwork to be in contact with concrete shall be thoroughly cleaned of all dirt, grease, loose scale and rust, grout, mortar, and other foreign substances immediately before concrete is placed.

3.03 Handling, Transporting, and Placing

A. General

Placing of concrete shall conform to the applicable requirements of Section 5.3.2 of ACI 301 and the requirements of this Section.

B. Non-Conforming Work or Materials

Concrete which upon or before placing is found not to conform to the requirements specified herein shall be rejected and immediately removed from the work. Concrete which is not placed in accordance with these specifications, or which is of inferior quality, shall be removed and replaced by and at the expense of the Contractor.

C. Unauthorized Placement

Concrete shall not be placed except in the presence of duly authorized representative of the Engineer. Contractor shall notify Engineer at least 24 hours in advance of placement of any concrete.

D. Placement in Wall Forms

Concrete shall not be dropped through reinforcement steel or into any deep form, whether reinforcement is present or not, causing separation of the coarse aggregate from the mortar on account of repeatedly hitting rods or the sides of the form as it falls, nor shall concrete be placed in any form in such a manner as to leave accumulation of mortar on the form surfaces above the placed concrete. In such cases, some means such as the use of hoppers and, if necessary, vertical

ducts of canvas, rubber, or metal shall be used for placing concrete in the forms in a manner that it may reach the place of final deposit without separation. In no case shall the free fall of concrete exceed 4' below the ends of ducts, chutes, or buggies. Concrete shall be uniformly distributed during the process of depositing and in no case after depositing shall any portion be displaced in the forms more than 6' in horizontal direction. Concrete in forms shall be deposited in uniform horizontal layers not deeper than 2'; and Contractor shall take care to avoid inclined layers or inclined construction joints except where such are required for sloping members. Each layer shall be placed while the previous layer is still soft.

E. Placement in Slabs

Concrete placed in sloping slabs shall proceed uniformly from the bottom of the slab to the top, for the full width of the placement. As the work progresses, concrete shall be vibrated and carefully worked around the slab reinforcement, and the surface of the slab shall be screeded in an up-slope direction.

F. Temperature of Concrete

Temperatures of concrete when it is being placed shall be not more than 90°F nor less than 40°F in moderate weather, and not less than 50°F in weather during which the mean daily temperature drops below 40°F. Concrete ingredients shall not be heated to a temperature higher than that necessary to keep the temperature of the mixed concrete, as placed, from falling below the specified minimum temperature. If concrete is placed when the weather is such that the temperature of the concrete would exceed 90°F, Contractor shall employ effective means, such as precooling of aggregates and mixing water using ice or placing at night, as necessary to maintain the temperature of the concrete, as it is placed, below 90°F. Contractor shall be entitled to no additional compensation on account of the foregoing requirements.

G. Cold Weather Placement

Earth foundations shall be free from frost or ice when concrete is placed upon or against them. Fly ash concrete shall not be placed when the air temperature falls below 50°F.

3.04 Pumping of Concrete

A. General

If the pumped concrete does not produce satisfactory end results, Contractor shall discontinue the pumping operation and proceed with the placing of concrete using conventional methods.

B. Pumping Equipment

Pumping equipment must have 2 cylinders and be designed to operate with one cylinder only in case the other one is not functioning. In lieu of this requirement, Contractor may have a standby pump on the site during pumping.

C. The minimum diameter of hose (conduits) shall be 4".

D. Contractor shall replace pumping equipment and hoses (conduits) that are not functioning properly.

E. Contractor shall not use aluminum conduits for conveying the concrete.

F. Proportioning

Minimum compressive strength, cement content, and maximum size of aggregates shall be as specified in Part 2.07 herein.

G. Gradation of coarse aggregates shall conform to ASTM C 33 and shall be as close to the middle range as possible.

H. Gradation of fine aggregate shall conform to ASTM C 33, with 15 to 30 percent passing the number 50 screen and 5 to 10 percent passing the number 100 screen. The fineness modules of sand used shall not be over 3.00.

I. Water and slump requirements shall conform to Parts 2.01D.2 and 2.07B herein for water and Part 2.08A herein for slump.

J. Cement and admixtures shall conform to Part 2.01D herein.

3.05 Order of Placing Concrete

The order of placing concrete in all parts of the work shall be acceptable to the Engineer. In order to minimize the effects of shrinkage, the concrete shall be placed in units as bounded by construction joints shown. The placing of units shall be done by placing alternate units in a manner such that each unit placed shall have cured before the contiguous unit or units are placed, as follows:

A. Foundations

Foundation forms shall remain in place for a minimum of 48 hours after the end of a placement. Thereafter, forms may be removed and construction of adjacent formwork or wall formwork may commence. Concrete for foundation sections shall not be placed until a minimum of 7 days have elapsed from the end of the adjacent placement. Concrete for walls above foundations may be placed after a minimum of 72 hours have elapsed, provided the footings have attained at least 50% of their design strength as demonstrated by testing of concrete cylinders.

B. Walls

Concrete for walls may be placed on top of foundations as described in Part 3.05A herein. Concrete for subsequent wall placements located vertically above new walls may be placed after a minimum of 72 hours have elapsed, provided the walls have attained at least 50% of their design strength as demonstrated by testing of concrete cylinders. Concrete for wall sections shall not be placed until a minimum of 7 days have elapsed from the end of the adjacent placement.

C. Roof Slabs, Decks, and Walkways

Concrete for roof slabs, decks, and walkways may be placed on top of walls after a minimum of 72 hours have elapsed, provided slabs, decks, and walkways are supported by formwork. Concrete for slab, deck, and walkway sections shall not be placed until a minimum of 7 days have elapsed from the end of the adjacent placement.

3.06 Tamping and Vibrating

A. As concrete is placed in the forms or in excavations, Contractor shall insure it is thoroughly settled and compacted, throughout the entire depth of the layer which is being consolidated, into a dense, homogeneous mass, filling all corners and angles, thoroughly embedding the reinforcement, eliminating rock pockets, and bringing only a slight excess of water to the exposed surface of

concrete during placement. Vibrators shall be high speed power vibrators (8000 to 10,000 rpm) of an immersion type in sufficient number and with (at least one) standby units as required.

B. Contractor shall take care in placing concrete around waterstops. Contractor shall carefully work concrete by rodding and vibrating to make sure that all air and rock pockets have been eliminated. Where flat-strip type waterstops are placed horizontally, the concrete shall be worked under the waterstops by hand, making sure that all air and rock pockets have been eliminated. Concrete surrounding the waterstops shall be given additional vibration, over and above that used for adjacent concrete placement to assure complete embedment of the waterstops in the concrete.

C. Concrete in walls shall be internally vibrated and at the same time rammed, stirred, or worked with suitable appliances, tamping bars, shovels, or forked tools until it completely fills the forms or excavations and closes snugly against all surfaces. Subsequent layers of concrete shall not be placed until the layers previously placed have been worked thoroughly as specified. Vibrators shall be inserted vertically into the concrete and pulled out slowly, penetrating 1/3 of the layer depth of the layer previously placed. Vibrators shall be provided in sufficient numbers, with standby units as required, to accomplish the results herein specified within 15 minutes after concrete of the prescribed consistency is placed in the forms. The vibrating head shall be kept from contact with the surfaces of the forms. Care shall be taken not to vibrate concrete excessively or to work it in any manner that causes segregation of its constituents.

3.07 Finishing Concrete Surfaces

A. General

Surfaces shall be free from fins, bulges, ridges, offsets, honeycombing, or roughness of any kind, and shall present a finished, smooth, continuous hard surface. Allowable deviations from plumb or level and from the alignment, profiles, and dimensions shown are defined as tolerances and are specified in Parts 1.04F and 1.04G herein. These tolerances are to be distinguished from irregularities in finish as described herein. Aluminum finishing tools shall not be used.

B. Edges

All exposed edges of columns, beams, walls, roof slabs, elevated walkways, and foundations shall have a 3/4" chamfer, unless noted otherwise.

C. Formed Surfaces

Upon removal of forms, all surfaces shall be cured in accordance with Part 3.09 herein. After the curing period, all surfaces shall be sandblasted to expose air pocket voids and surface defects, and then repaired in accordance with Part 3.12 herein. After repairs are completed, surfaces shall be given an architectural finish in accordance with Part 3.08 herein.

D. Unformed Surfaces

After proper and adequate vibration and tamping, all unformed top surfaces of slabs, floors, walls, and curbs shall be brought to a uniform surface with suitable tools. The classes of finish specified for unformed concrete surfaces are designated and defined as follows:

1. Class "1". After the floated surface (as specified for Class "3") has hardened sufficiently to prevent excess of fine material from being drawn to the surface, steel troweling shall be performed with firm pressure such as will flatten the sandy texture of the floated surface and produce a dense, uniform surface free from blemishes, ripples, and trowel marks. The finish shall be smooth and free of all irregularities.

2. Class "2". Steel trowel finish (as specified for Class "1") without local depressions or high points. In addition, the surface shall be given a light hairbroom finish with brooming perpendicular to drainage unless otherwise shown. The resulting surface shall be rough enough to provide a nonskid finish.

3. Class "3". After sufficient stiffening of the screeded concrete, surfaces shall be float finished with wood or metal floats or with a finishing machine using float blades. Contractor shall not excessively float concrete surfaces while the concrete is plastic or dust concrete surfaces with dry cement and sand to absorb excess moisture. Floating shall be the minimum necessary to produce a surface that is free from screed marks and is uniform in texture. Surface irregularities shall not exceed 1/4". Joints and edges shall be tooled where shown or as determined by the Engineer.

4. Class "4". Contractor shall provide sufficient leveling and screeding to produce an even, uniform surface with surface irregularities not to exceed 3/8". No further special finish is required.

Contractor shall finish unformed surfaces according to the following schedule unless otherwise shown or specified:

Unformed Surface Finish Schedule

Area	Finish
Grade slabs and foundations to be covered with concrete or fill material	Class "4"
Floors to be covered with grouted tile or topping grout	Class "3"
Slabs which are water bearing with slopes 10 percent and less	Class "1"
Sloping slabs which are water bearing with slopes greater than 10 percent	Class "2"
Slabs not water bearing	Class "2"
Slabs to be covered with built-up roofing	Class "3"
Interior slabs and floors to receive architectural finish/flooring	Class "3"

3.08 Architectural Finish

A. Smooth Sacked Finish

Contractor shall provide architectural finish for exposed to view concrete surfaces. Exposed concrete surfaces include the exterior of structures beginning 1' below grade, the tops of walls, and the interior of water holding structures from the floor to the top of the walls. Architectural finish shall also be provided for interior exposed to view concrete surfaces. All other incidental exposed to view concrete surfaces shall be provided with an architectural finish such as concrete stairways, concrete containment facilities around chemical storage tanks, elevated walkways, and the like. Architectural finish (i.e., smooth sacked finish) shall also be provided where shown.

B. Immediately after the forms have been stripped, the concrete surface shall be inspected by Engineer and treated and cured in accordance with in Parts 3.09 and 3.12 herein.

C. After the concrete has cured at least 14 days, Contractor shall sandblast the surfaces and repair same in accordance with Part 3.12 herein. Thereafter, the surfaces shall be wetted, and a grout shall be applied with a brush. The grout shall be made by mixing one part portland cement and one part of fine sand that will pass a No. 16 sieve with sufficient water to give it the consistency of thick paint. The cement used in said grout shall be 1/2 gray and 1/2 white portland cement, as determined by the Engineer. White portland cement shall be Atlas white, or equal, furnished by the Contractor. The freshly applied grout shall be vigorously rubbed into the concrete surface with a wood float filling all small air holes. After all the surface grout had been removed with a steel trowel, the surface shall be allowed to dry and, when dry, shall be vigorously rubbed with burlap to remove completely all surface grout so that there is no visible paint-like film of grout on the concrete. The entire cleaning operation for any area shall be completed the day it is started, and grout shall not be left on the surface overnight.

D. Surface Overnight

Cleaning operations for any given day shall be terminated at panel joints. Contractor shall insure that the various operations be carefully timed to secure the desired effect which is a light-colored concrete surface of uniform color and texture without any appearance of a paint or grout film.

E. In the event that improper manipulation results in an inferior finish, Contractor shall rub such inferior areas with carborundum bricks.

F. Before beginning any of the final treatment on exposed surfaces, Contractor shall treat in a satisfactory manner a trial area of at least 200 square feet in some inconspicuous place selected by the Engineer and shall preserve said trial area undisturbed until the completion of the job.

G. All architecturally-treated concrete surfaces shall conform to the accepted sample in texture, color, and quality. It shall be the Contractor's responsibility to maintain and protect the concrete finish.

3.09 Curing and Dampproofing

A. General

All concrete shall be cured for not less than 14 days after placing in accordance with the methods specified herein for the different parts of the work as follows:

Surface to be Cured or Dampproofed	Method
Unstripped forms	1
Wall sections with forms removed	4
Construction joints between footings and walls, and between floor slab and columns	2
Encasement concrete and thrust blocks	3
All concrete surfaces not specifically provided for elsewhere in this Part	4

Surface to be Cured or Dampproofed	Method
Floor slabs on grade in hydraulic structures	5
Roof and slabs not on grade	6

B. Method 1

Wooden forms shall be wetted immediately after concrete has been placed and shall be kept wet with water until removed. If steel forms are used the exposed concrete surfaces shall be kept continuously wet until the forms are removed. If forms are removed within 14 days of placing the concrete, curing shall be continued in accordance with Method 4, Part 3.09E herein.

C. Method 2

The surface shall be covered with burlap mats which shall be kept wet with water for the duration of the curing period, until the concrete in the walls has been placed. No curing compound shall be applied to surfaces cured under Method 2.

D. Method 3

The surface shall be covered with moist earth not less than 4 hours, nor more than 24 hours, after the concrete is placed. Earthwork operations that may damage the concrete shall not begin until at least 7 days after placement of concrete.

E. Method 4

The surface shall be sprayed with a liquid curing compound.

1. Curing compound shall be applied in accordance with the manufacturer's printed instructions at a maximum coverage rate of 175 square feet per gallon and in such a manner as to cover the surface with a uniform film which will seal thoroughly. Two spray coats shall be applied, with the second coat sprayed at right angle direction from first coat.

2. Where the curing compound method is used, care shall be exercised to avoid damage to the seal during the curing period. Should the seal be damaged or broken before the expiration of the curing period, Contractor shall repair break immediately by the application of additional curing compound over the damaged portion.

3. Wherever curing compound may have been applied by mistake to surfaces against which concrete subsequently is to be placed and to which it is to adhere, said compound shall be entirely removed by wet sandblasting just prior to the placing of new concrete.

4. Where curing compound is specified, it shall be applied as soon as the concrete has hardened enough to prevent marring on unformed surfaces, and within 2 hours after removal of forms from contact with formed surfaces. Repairs required to be made to formed surfaces shall be made within the said 2-hour period; provided, however, that any such repairs which cannot be made within the said 2-hour period shall be delayed until after the curing compound has been applied. When repairs are to be made to an area on which curing compound has been applied, the area involved shall first be wet-sandblasted to remove the curing compound, following which repairs shall be made as specified herein.

F. Method 5

Immediately after the concrete has been screeded, it shall be treated with a liquid evaporation retardant. The retardant shall be used again after each work operation as necessary to prevent drying shrinkage cracks.

1. Immediately after each square foot of the concrete has been finished, it shall be given a coat of curing compound in accordance with Method 4, Part 3.09E herein. Not less than one hour nor more than 4 hours after the coat of curing compound has been applied, the surface shall be wetted with water delivered through a fog nozzle, and concrete-curing blankets shall be placed on the slabs. The curing blankets shall be polyethylene sheet, polyethylene-coated waterproof paper sheeting or polyethylene-coated burlap. The blankets shall be laid with the edges butted together and with the joints between strips sealed with 2" wide strips of sealing tape or with edges lapped not less than 3" and fastened together with a waterproof cement to form a continuous watertight joint.

2. Curing blankets shall be left in place during the 14 day curing period and shall not be removed until after concrete for adjacent work has been placed. Should the curing blankets become torn or otherwise ineffective, Contractor shall replace damaged sections. During the first 3 days of the curing period, Contractor shall not allow traffic of any nature or depositing, temporary or otherwise, of any materials on the curing blankets. During the remainder of the curing period, foot traffic and temporary depositing of materials that impose light pressure will be permitted only on top of plywood sheets 5/8" minimum thickness, laid over the curing blanket. Contractor shall add water under the curing blanket as often as necessary to maintain damp concrete surfaces at all times.

G. Method 6

Concrete slabs shall be treated with an evaporation retardant as specified in Method 5. The concrete shall be kept continuously wet by the application of water for a minimum period of at least 14 consecutive days beginning immediately after the concrete has been placed or forms removed. Heavy curing mats shall be used as a curing medium to retain the moisture during the curing period. The curing medium shall be weighted or otherwise held in place to prevent being dislodged by wind or any other causes. Until the concrete surface is covered with the curing medium, the entire surface shall be kept damp by applying water using nozzles that atomize the flow so that the surface is not marred or washed. Curing blankets and concrete shall be kept continuously wet by the use of sprinklers or other means both during and after normal working hours. Immediately after the application of water has terminated at the end of the curing period, the curing medium shall be removed and curing compound immediately applied in accordance with Method 4, Part 3.09E herein. Contractor shall dispose of excess water from the curing operation to avoid damage to the work.

3.10 Protection

Contractor shall protect all concrete against injury until final acceptance by the Owner. Fresh concrete shall be protected from damage due to rain, hail, sleet, or snow. Contractor shall provide such protection while the concrete is still plastic and whenever such precipitation is imminent or occurring. Immediately following the first frost in the fall, Contractor shall be prepared to protect all concrete against freezing. After the first frost, and until the mean daily temperature in the vicinity of the worksite falls below 40°F for more than one day, the concrete shall be maintained at a temperature not lower than 50°F for at least 72 hours after it is placed.

3.11 Curing in Cold Weather

A. Water curing of concrete may be reduced to 6 days during periods when the mean daily temperature in the vicinity of the worksite is less than 40°F; provided that, during the prescribed period of water curing, when temperatures are such that concrete surfaces may freeze, water curing shall be temporarily discontinued.

B. Concrete cured by an application of curing compound will require no additional protection from freezing if the protection at 50°F for 72 hours is obtained by means of approved insulation in contact with the forms or concrete surfaces; otherwise, concrete shall be protected against freezing temperatures for 72 hours immediately following 72 hours protection at 50°F. Concrete cured by water curing shall be protected against freezing temperatures for 3 days immediately following the 72 hours of protection at 50°F.

C. Discontinuance of protection against freezing temperatures shall be such that the drop in temperature of any portion of the concrete will be gradual and will not exceed 40°F in 24 hours. In the spring, when the mean daily temperature rises above 40°F for more than 3 successive days, the specified 72 hour protection at a temperature not lower than 50°F may be discontinued for as long as the mean daily temperature remains above 40°F; provided, that the concrete shall be protected against freezing temperatures for not less than 48 hours after placement.

D. Where artificial heat is employed, Contractor shall take special care to prevent the concrete from drying. Use of unvented heaters will be permitted only when unformed surfaces of concrete adjacent to the heaters are protected for the first 24 hours from an excessive carbon dioxide atmosphere by application of curing compound; provided, that the use of curing compound for such surfaces is otherwise permitted by these specifications.

3.12 Treatment of Surface Defects

A. As soon as forms are removed, all exposed surfaces shall be carefully examined by Engineer and any irregularities shall be immediately rubbed or ground by the Contractor in a satisfactory manner in order to secure a smooth, uniform, and continuous surface. Contractor shall not plaster or coat surfaces to be smoothed. Concrete shall then be cured for the specified curing period in accordance with Part 3.09 herein. After the curing period, all surfaces shall be sandblasted to remove curing compound (if utilized), concrete paste film, and laitance, and to expose all air pocket voids and surface defects. Repairs shall not be made until after inspection by the Engineer. Contractor shall not in any case perform extensive patching of honeycombed concrete. Concrete containing minor voids, holes, or similar depression defects with a maximum depth of 1/4" may be filled with the grout used for the architectural finish, or if below grade on the exterior, may be left unfilled. Concrete containing minor voids, holes, honeycombing, or similar depression defects deeper than 1/4" with a maximum depth of 3/4" and/or a maximum surface area of 2 square inches shall be repaired as specified in Section 3.12B. Concrete containing extensive voids, holes, honeycombing, or similar depression defects, shall be repaired utilizing a repair material specifically manufactured for such use (such as Sikatop 121) subject to approval by Engineer, or completely removed and replaced. All repairs and replacements herein specified shall be promptly executed by the Contractor at its own expense.

B. Defective surfaces to be repaired as specified in Part 3.12A herein, shall be cut back from trueline a minimum depth of 1/2" over the entire area. Edges shall not be feathered. Where chipping or cutting tools are not required in order to deepen the area properly, the surface shall be prepared for bonding by the removal of all laitance or soft material, and not less than 1/32" depth of the surface film from all hard portions, by means of an efficient sandblast. After cutting and sandblasting, the surface shall be wetted sufficiently in advance of applying cement mortar so that while the repair material is being applied, the surfaces under repair will remain moist, but not so wet as to

overcome the suction upon which a good bond depends. The concrete shall then be patched as follows:

A bonding material such as acryl 60 shall be applied to the surface of the area to be repaired just prior to application of the repair mixture. The repair mixture shall consist of one part of Type II, low alkali, portland cement to 3 parts concrete sand. Mix solution shall contain 1/3 bonder, such as acryl 60, to 2/3 water and added in quantities sufficient to allow placement but not cause hairchecking or slippage. Quantities prepared should be limited to that able to be completed within 30 minutes. Areas repaired shall be compacted with a wood ramming device and cured with the water/acryl 60 solution. Repair mixture shall be applied in maximum 1" lifts.

For exposed walls, the cement shall contain such a proportion of Atlas white portland cement as is required to make the color of the patch match the color of the surrounding concrete.

C. Holes left by tie-rod cones shall be reamed with suitable toothed reamers so as to leave the surfaces of the holes clean and rough. These holes then shall be repaired as described in Part 3.12B herein.

D. All repairs shall be built up and shaped in such a manner that the completed work will conform to the requirements of Part 3.08 or 3.09 herein, as applicable, using approved methods which will not disturb the bond, cause sagging, or cause horizontal fractures.

3.13 Joint Sealant in Hydraulic Structures

Joint sealant shall be placed in all horizontal and vertical joints of all cast-in-place walls exposed to water. Provide 1" wide x 1/2" deep formed groove for joint sealant. Sealant strip material and installation procedure shall be per Part 2.05 herein.

3.14 Installation of Epoxy Rebar Dowels and Anchor Bolts

Epoxy rebar dowels and anchor bolts shall be bonded with the Hilti Hit-RE 500-SD System, or equal. Unless noted otherwise, rebar dowels shall be ASTM A615 Grade 60 steel and anchor bolts shall be 316 stainless steel threaded rod. Rebar dowels and anchor bolts shall be installed to the depths shown on the Drawings or equipment manufacturer's shop drawings. Prior to injecting epoxy, each drilled hole shall be cleaned out with a nylon brush. Contractor shall install dowels and anchor bolts in strict accordance with the manufacturer's printed instructions.

3.15 Backfilling Against Concrete Structures

All curing shall be in accordance with Part 3.09 herein.

A. Foundations

Minimum time to begin backfilling against foundations is 72 hours from completion of placement.

B. Walls

For non-hydraulic structures, backfilling may commence after 7 days and 75% of design strength have been reached, as demonstrated by testing of field cured concrete cylinders. Backfill height shall not exceed one half of wall height until wall has attained 100% of design strength. Hydraulic structures shall not be backfilled until after hydrostatic leak testing has been completed and accepted.

C. Shear Rings and Thrust Blocks

Shear rings and thrust blocks shall be cured 24 hours minimum prior to backfilling. No pipeline pressure testing shall be performed until 7 days after the last concrete placement.

3.16 Testing of Hydraulic Structures

A. General

Contractor shall water test all concrete tanks, hydraulic channels, sumps, basins, and other structures designed to contain water prior to backfilling. Testing shall be accomplished by filling the structure with water. Testing shall not be performed until roof is in place (if applicable) and all concrete has attained full design strength. Contractor shall provide the following:

1. All pumps, power, piping, and any other equipment required to fill tanks for testing.

2. Necessary provisions to dispose of test water after testing, including pumping if necessary. At completion of tests all temporary piping and connections shall be removed. Waste water shall be disposed of without creating a nuisance or damage to adjacent property.

B. Test Procedure

The structure shall be full to high water level at beginning of test. Contractor may elect to keep the tank full of water for as long as 48 hours prior to the test to allow for water absorption by the concrete. Test period shall be 5 consecutive 24 hour periods totaling 5 consecutive days. Liquid level shall be accurately measured at the beginning and end of test to determine amount of leakage. All visible leaks shall be marked for repair after draining. Permissible leakage from the structure shall not exceed 0.5 gpm per million gallon storage capacity in each 24 hour period over a period of 5 consecutive days after allowance is made for evaporation. If the leakage exceeds the permissible amount, the structure shall be emptied, leaks shall be repaired (in a manner acceptable to the Engineer), and the test rerun. Even if structure passes water loss test, all visible leaks shall be repaired and the test rerun to demonstrate all visible leaks have been repaired.

C. Leak Repair

All visible leaks shall be repaired from the structure interior utilizing epoxy injection. The hydraulic structure shall be drained, and a surface seal shall be applied to the area where leak commences; thereafter, the crack(s) shall be injected with epoxy in accordance with the manufacturer's recommendations. After injection process is completed, the structure shall be refilled and checked for visible leakage. If structure continues to leak, this process shall be repeated until no visible leaks are present.

3.17 Care and Repair of Concrete

Contractor shall protect all concrete against injury or damage from excessive heat, lack of moisture, overstress, or any other cause until final acceptance of the Owner. Particular care shall be taken to prevent the drying of concrete and to avoid roughening or otherwise damaging the surface. Any concrete found to be damaged, or which may have been originally defective, or which becomes defective at any time prior to the final acceptance of the completed work, or which departs from the established line or grade, or which, for any other reason, fails to conform to the requirements of the Contract Documents, shall be satisfactorily repaired or removed and replaced with acceptable concrete at the Contractor's expense.

BASIC CONCRETE FORMWORK SPECIFICATIONS

PART 1 - GENERAL

1.01 General Requirements

Contractor shall furnish all materials for concrete formwork, bracing, shoring, and supports and shall design and construct all falsework, all in accordance with the provisions of the Contract Document.

1.02 Reference Specifications, Codes, and Standards

A. Codes

The Building Code, as referenced herein, shall be the California Building Code (CBC) of the California Building Standards Commission, latest edition.

B. Commercial Standards

ACI 347 Guide to Formwork for Concrete, latest edition.

1.03 Contractor Submittals

All submittals shall be in accordance with Section 01300, Contractor Submittals and Requests Technical Specifications.

A. Falsework Calculations and Drawings

Contractor shall comply with the provisions of Section 1717 of the Division of Industrial Safety, Construction Safety Orders, as revised November 1973, which requires that all falsework or vertical shoring installations where the heights of the falsework or vertical shoring, as measured from the top of the sills to the soffit of the superstructure, exceeds 14 feet, or where individual horizontal span lengths exceed 16 feet, or provision for vehicular or railroad traffic through falsework or vertical shoring is made, shall be approved and signed by a Civil Engineer, registered in the State of California; provided further, that a copy of the falsework plan or shoring layout shall be available on the job site at all times.

B. Contractor shall submit detailed plans of the falsework proposed to be used. Such plans shall be in sufficient detail to indicate the general layout, sizes of members, anticipated stresses, grade of materials to be used in the falsework, and typical soil conditions.

1.04 Quality Assurance

Tolerances

The variation from established grade, line, plumbness, or thickness shall be as set forth in Part 1.04F of Section 03300, Basic Concrete Specifications, and there shall be no offsets or visible waviness in the finished surface. All other tolerances shall be as specified in Chapter 3 of ACI 347.

PART 2 - PRODUCTS

2.01 General

Except as otherwise expressly accepted by the Engineer, all lumber brought on the job site for use a forms, shoring, or bracing shall be new materials. All forms shall be smooth surface forms and shall be of the following materials:

Walls	-	Steel or plywood panel
Columns	-	Steel, plywood, or fiber glass
Roof and Floor slabs	-	Plywood
All other work	-	Steel panels, plywood or tongue and groove lumber

2.02 Form and Falsework Materials

A. Materials for concrete forms, formwork, and falsework shall conform to the following requirements:

1. Lumber shall be Douglas Fir or Southern Pine, construction grade or better, in conformance with U.S. Product Standard PS20, American Softwood Lumber Standard.

2. Plywood for concrete formwork shall be new, waterproof, synthetic resin bonded, exterior type Douglas Fir or Southern Pine plywood manufactured especially for concrete formwork and shall conform to the requirements of PS 1, Structural Plywood, for Concrete Forms, Class I, and shall be edge sealed.

3. Form materials shall be metal, wood, plywood, or other approved material that will not adversely affect the concrete and will facilitate placement of concrete to the shape, form, line, and grade shown. Metal forms shall be an approved type that will accomplish such results. Wood forms for surfaces to be painted shall be Medium Density Overlaid plywood, MDO Ext. Grade.

B. Unless otherwise shown, exposed edges and corners in concrete members shall be provided with 3/4-inch chamfers. Re-entrant corners in concrete members shall not have fillets unless otherwise shown.

C. Forms and falsework to support the roof and floor slabs shall be designed for the total dead load, plus a live load of 30 psf (minimum).

2.03 Form Ties

A. Form ties with integral waterstops shall be provided with a plastic cone or other suitable means for forming a conical hole to insure that the form tie may be broken off back of the face of the concrete. The maximum diameter of removable cones for rod ties, or of other removable form-tie fasteners having a circular cross-section, shall not exceed 1-1/2 inches; and all such fasteners shall be such as to leave holes of regular shape for reaming.

B. Form ties for water-retaining structures shall have integral waterstops. Removable taper ties may be used when approved by the Engineer. A preformed neoprene or polyurethane tapered plug sized to seat at the center of the wall shall be inserted in the hole left by the removal of the taper tie.

PART 3 - EXECUTION

3.01 General

A. Forms to confine the concrete and shape it to the required lines shall be used wherever necessary. Contractor shall assume full responsibility for the adequate design of all forms, and any forms which are unsafe or inadequate in any respect shall promptly be removed from the work and replaced at the Contractor's expense. A sufficient number of forms of each kind shall be provided to permit the required rate of progress to be maintained. The design and inspection of concrete forms, falsework, and shoring shall comply with applicable local, state and federal regulations. Plumb and string lines shall be installed before concrete placement and shall be maintained during placement. Such lines shall be used by the Contractor's personnel and by the Engineer and shall be in sufficient number and properly installed. During concrete placement, the Contractor shall continually monitor plumb and string line form positions and immediately correct deficiencies.

B. Concrete forms shall conform to the shape, lines, and dimensions of members as called for on the Contract Drawings, and shall be substantial, free from surface defects, and sufficiently tight to prevent leakage. Forms shall be properly braced or tied together to maintain their position and shape under a load of freshly-placed concrete. If adequate foundation for shores cannot be secured, trussed supports shall be provided.

3.02 Form Design

All forms shall be true in every respect to the required shape and size, shall conform to the established alignment and grade, and shall be of sufficient strength and rigidity to maintain their position and shape under the loads and operations incident to placing and vibrating the concrete. Suitable and effective means shall be provided on all forms for holding adjacent edges and ends of panels and sections tightly together and in accurate alignment so as to prevent the formation of ridges, fins, offsets, or similar surface defects in the finished concrete. Plywood, 5/8-inch and greater in thickness, may be fastened directly to studding if the studs are spaced close enough to prevent visible deflection marks in the concrete. Forms shall be tight so as to prevent the loss of water, cement and fines during placing and vibrating of the concrete. Specifically, the bottom of wall forms that rest on concrete footings or slabs shall be provided with a gasket to prevent loss of fines and paste during placement and vibration of concrete. Such gasket may be a 1 to 1-1/2 inch diameter polyethylene rod held in position to the underside of the wall form. Adequate clean-out holes shall be provided at the bottom of each lift of forms. The size, number, and location of such clean-outs shall be as acceptable to the Engineer.

3.03 Construction

A. Vertical Surfaces

All vertical surfaces of concrete members shall be formed, except where placement of the concrete against the ground is shown. Not less than 1-inch of concrete shall be added to the thickness of the concrete member as shown where concrete is permitted to be placed against trimmed ground in lieu of forms. Such permission will be granted only for members of comparatively limited height and where the character of the ground is such that it can be trimmed to the required lines and will stand securely without caving or sloughing until the concrete has been placed.

B. Construction Joints

Concrete construction joints shall not be placed at locations other than those shown or specified, except as may be acceptable to the Engineer. When a second lift is placed on hardened concrete, special precautions shall be taken in the way of the number, location, and tightening of ties at the top of the old lift and bottom of the new to prevent any unsatisfactory effect whatsoever on the concrete. Pipe stubs and anchor bolts shall be set in the forms where required.

C. Form Ties

1. Embedded Ties: Holes left by the removal of form tie cones shall be reamed with suitable toothed reamers so as to leave the surface of the holes clean and rough before being filled with mortar as specified in Part 3.12C of Section 03300, Basic Concrete Specifications. Wire ties for holding forms shall not be used. Form-tying devices or parts thereof, other than metal, shall not be left embedded in the concrete. Ties shall not be removed in such manner as to leave a hole extending through the interior of the concrete members. Contractor shall not use snap-ties which cause spalling of the concrete upon form stripping or tie removal. If steel panel forms are used, rubber grommets shall be provided where the ties pass through the form in order to prevent loss of cement paste. Where metal rods extending through the concrete are used to support or to strengthen forms, the rods shall remain embedded and shall terminate not less than 1-inch back from the formed face or faces of the concrete.

2. Removable Ties: Where taper ties are approved for use, the larger end of the taper tie shall be on the wet side of walls in water retaining structures. After the taper tie is removed, the hole shall be thoroughly cleaned and roughened for bond. A precast neoprene or polyurethane tapered plug shall be located at the wall centerline. The hole shall be completely filled with non-shrink grout for water bearing and below-grade walls. The hole shall be completely filled with non-shrink or regular cement grout for above-grade walls which are dry on both sides. Exposed faces of walls shall have the outer 2 inches of the exposed face filled with a cement grout which shall match the color and texture of the surrounding wall surface.

3.04 Reuse of Forms

Forms may be reused only if in good condition and only if acceptable to the Engineer. Light sanding between uses will be required wherever necessary to obtain uniform surface texture on all exposed concrete surfaces. Exposed concrete surfaces are defined as surfaces which are permanently exposed to view. In the case of forms for the inside wall surfaces of hydraulic/water retaining structures, unused tie rod holes in forms shall be covered with metal caps or shall be filled by other methods acceptable to the Engineer.

3.05 Removal of Forms

Careful procedures for the removal of forms shall be strictly followed, and this work shall be done with care so as to avoid injury to the concrete. Contractor shall not apply heavy loading on green concrete. In the case of roof slabs and above-ground floor slabs, forms shall remain in place until test cylinders for the roof concrete attain a minimum compressive strength of 75 percent of the 28-day strength specified in Section 03300, Basic Concrete Specifications; provided, that no forms shall be disturbed or removed under an individual panel or unit before the concrete in the adjacent panel or unit has attained 75 percent of the specified 28-day strength and has been in place for a minimum of 14 days. The time required to establish said strength shall be as determined by the Engineer who will make several test cylinders for this purpose from concrete used in the first group of roof panels placed. If the time so determined is more than the 14-day minimum, then that time shall be used as the minimum length of time. Forms for all vertical foundations, walls, and columns shall remain in place at least 48 hours after the concrete has been placed (commencing from the time the last concrete is placed for that day). Forms for all parts of the work not specifically mentioned herein shall remain in place for periods of time as determined by the Engineer.

3.06 Maintenance of Forms

Forms shall be maintained at all times in good condition, particularly as to size, shape, strength, rigidity, tightness, and smoothness of surface. Forms, when in place, shall conform to the established alignment and grades. Before concrete is placed, forms shall be thoroughly cleaned. Form surfaces shall be treated with a nonstaining mineral oil or other lubricant acceptable to the Engineer. Any excess lubricant shall be

satisfactorily removed before placing the concrete. Where field oiling of forms is required, Contractor shall perform the oiling at least two weeks in advance of their use. Oil shall be kept off the surfaces of steel reinforcement and other metal items to be embedded in concrete. If oil is inadvertently placed on said metal surfaces, Contractor shall remove oil by sandblasting.

3.07 Falsework

A. Contractor shall be responsible for the design, engineering, construction, maintenance, and safety of all falsework, including staging, walkways, forms, ladders, and similar appurtenances, which shall equal or exceed the applicable requirements of the provisions of the OSHA Safety and Health Standards for Construction, the requirements of the Construction Safety Orders of the California Division of Industrial Safety, and the requirements specified herein.

B. All falsework shall be designed and constructed to provide the necessary rigidity and to support the loads. Falsework for the support of a superstructure shall be designed to support the loads that would be imposed if the entire superstructure were placed at one time.

C. Falsework shall be placed upon a solid footing, safe against undermining, and protected from softening. When the falsework is supported on timber piles, the maximum calculated pile loading shall not exceed 20 tons. When falsework is supported on any portion of the structure which is already constructed, the load imposed by the falsework shall be spread, distributed, and braced in such a way as to avoid any possibility of damage to the structure.

BASIC CONCRETE REINFORCEMENT SPECIFICATIONS

PART 1 - GENERAL

1.01 General Requirements

Contractor shall furnish, fabricate, and place all concrete reinforcement steel, welded wire reinforcement, couplers, and concrete inserts for use in reinforced concrete and masonry construction and shall perform all appurtenant work, including all the wires, clips, supports, chairs, spacers, and other accessories, all in accordance with the Contract Documents.

1.02 Reference Specifications, Codes, and Standards

A. Codes

The Building Code, as referenced herein, shall be the California Building Code (CBC) of the California Building Standards Commission, latest edition.

B. Commercial Standards

Where not covered in this specification, all work shall comply with the following standards, latest editions:

ACI 315	Details and Detailing of Concrete Reinforcement.
ACI 318	Building Code Requirements for Structural Concrete and Commentary.
WRI	Manual of Standard Practice for Structural Welded Wire Reinforcement.
AWS D1.4	Structural Welding Code - Reinforcing Steel.
CRSI	Manual of Standard Practice.

1.03 Contractor Submittals

All submittals shall be in accordance with Section 01300, Contractor Submittals and Requests Technical Specifications.

A. Contractor shall furnish shop bending diagrams, placing lists, and drawings of all reinforcement steel prior to fabrication.

B. Details of concrete reinforcement steel and concrete inserts shall be submitted by the Contractor at the earliest possible date after receipt by the Contractor of Notice to Proceed. Said details of reinforcement steel for fabrication and erection shall conform to ACI 315 and the requirements specified and shown. Shop bending diagrams shall show the actual lengths of bars, to the nearest inch measured to the intersection of the extensions (tangents for bars of circular cross section) of the outside surface. Shop drawings shall include bar placement diagrams which clearly indicate the dimensions of each bar splice.

C. Where mechanical couplers are required or permitted to be used to splice reinforcement steel, Contractor shall submit manufacturer's literature which contains instructions and recommendations for installation for each type of coupler used; certified test reports which verify the load capacity of

each type and size of coupler used; and shop drawings which show the location of each coupler with details of how they are to be installed in the formwork.

D. If reinforcement steel is spliced by welding at any location, Contractor shall submit mill test reports which shall contain the information necessary for the determination of the carbon equivalent as specified in AWS D1.4. Contractor shall submit a written welding procedure for each type of weld for each size of bar which is to be spliced by welding; merely a statement that AWS procedures will be followed is not acceptable.

1.04 Quality Assurance

A. If requested by the Engineer, Contractor shall provide samples from each heat of reinforcement steel delivered in a quantity adequate for testing. Costs of initial tests will be paid by the Owner. Costs of additional tests due to material failing initial tests shall be paid by the Contractor.

B. If reinforcement steel is spliced by welding at any location, Contractor shall submit certifications of procedure qualifications for each welding procedure used and certification of welder qualifications, for each welding procedure, and for each welder performing the work. Such qualifications shall be as specified in AWS D1.4.

C. If requested by the Engineer, Contractor shall provide samples of each type of welded splice used in the work in a quantity and of dimensions adequate for testing. At the discretion of the Engineer, radiographic testing of direct butt welded splices will be performed. Contractor shall provide assistance necessary to facilitate testing. Contractor shall repair any weld which fails to meet the requirements of AWS D1.4. The costs of testing will be paid by the Owner; except, the costs of all tests which fail to meet specified requirements shall be paid by the Contractor.

PART 2 - PRODUCTS

2.01 Reinforcement Steel

A. All reinforcement steel for all cast-in-place reinforced concrete construction shall conform to the following requirements:

1. Bar reinforcement shall conform to the requirements of ASTM A 615 for Grade 60 Billet Steel Reinforcement with supplementary requirement S-1, or as otherwise shown.

2. Welded wire reinforcement shall conform to the requirements of ASTM A 185 and the details shown; provided, that welded wire reinforcement with longitudinal wire of W9.5 size wire shall be either furnished in flat sheets or in rolls with a core diameter of not less than 10 inches; and provided further, that welded wire reinforcement with longitudinal wires larger than W9.5 size shall be furnished in flat sheets only.

3. Spiral reinforcement shall be cold-drawn steel wire conforming to the requirements of ASTM A 82.

B. Accessories

1. Accessories shall include all necessary chairs, slab bolsters, concrete blocks, tie wires, dips, supports, spacers, and other devices to position reinforcement during concrete placement. Slab bolsters shall have gray plastic-coated legs.

2. Concrete blocks (dobies), used to support and position reinforcement steel, shall have the same or higher compressive strength as specified for the concrete in which it is located.

Where the concrete blocks are used on concrete surfaces exposed to view, the color and texture of the concrete blocks shall match that required for the finished surface. Wire ties shall be embedded in concrete block bar supports.

2.02 Mechanical Couplers

A. Mechanical couplers shall be provided where shown and where approved by the Engineer. The couplers shall develop a tensile strength which exceeds 125 percent of the yield strength of the reinforcement bars being spliced at each splice.

B. Where the type of coupler used is composed of more than one component, all components required for a complete splice shall be supplied. This shall apply to all mechanical splices, including those splices intended for future connections.

C. The reinforcement steel and coupler used shall be compatible for obtaining the required strength of the connection.

D. Couplers which are located at a joint face shall be a type which can be set either flush or recessed from the face as shown. The couplers shall be sealed during concrete placement to completely eliminate concrete or cement paste from entering. After the concrete is placed, Contractor shall plug and seal couplers intended for future connections to prevent any contact with water or other corrosive materials. Threaded couplers shall be plugged with plastic plugs which have an O-ring seal.

2.03 Welded Splices

A. Welded splices shall be provided where shown and where approved by the Engineer. All welded splices of reinforcement steel shall develop a tensile strength which exceeds 125 percent of the yield strength of the reinforcement bars which are connected.

B. All materials required to perform the welded splices to the requirements of AWS D1.4 shall be provided.

PART 3 - EXECUTION

3.01 General

All reinforcement steel, welded wire reinforcement, couplers, and other appurtenances shall be fabricated, and placed in accordance with the requirements of the Building Code and the supplementary requirements specified herein.

3.02 Fabrication

A. <u>General</u>

Reinforcement steel shall be accurately formed to the dimensions and shapes shown, and the fabricating details shall be prepared in accordance with ACI 315 and ACI 318, except as modified by the Drawings. Stirrups and tie bars shall be bent around a pin having a diameter not less than 1-1/2 inch for No. 3 bars, 2-inch for No. 4 bars, and 2-1/2 inch for No. 5 bars. Bends for other bars shall be made around a pin having a diameter not less than 6 times the minimum thickness, except for bars larger than 1 inch, in which case the bends shall be made around a pin of 8 bar diameters. Bars shall be bent cold.

B. Contractor shall fabricate reinforcement bars for structures in accordance with bending diagrams, placing lists, and placing drawings.

C. Fabricating Tolerances

Bars used for concrete reinforcement shall meet the following requirements for fabricating tolerances:

1. Sheared length: ± 1 inch

2. Depth of truss bars: + 0, - 1/2 inch

3. Stirrups, ties, and spirals: ± 1/2 inch

4. All other bends: ± 1 inch

3.03 Placing

A. Placing

Reinforcement steel shall be accurately positioned as shown, and shall be supported and wired together to prevent displacement, using annealed iron wire ties or suitable clips at intersections. All reinforcement steel shall be supported by concrete, plastic or metal supports, spaces or metal hangers which are strong and rigid enough to prevent any displacement of the reinforcement steel. Where concrete is to be placed on the ground, supporting concrete blocks (or dobies) shall be used, in sufficient numbers to support the bars without settlement, but in no case shall such support be continuous. All concrete blocks used to support reinforcement steel shall be tied to the steel with wire ties which are embedded in the blocks. For concrete over formwork, Contractor shall furnish concrete, metal, plastic, or other acceptable bar chairs and spacers.

B. The portions of all accessories in contact with the formwork shall be made of concrete, plastic, or steel coated with a 1/8 inch minimum thickness of plastic which extends at least 1/2 inch from the concrete surface. Plastic shall be gray in color.

C. Tie wires shall be bent away from the forms in order to provide the specified concrete coverage.

D. Bars additional to those shown which may be found necessary or desirable by the Contractor for the purpose of securing reinforcement in position shall be provided by the Contractor at its own expense.

E. Placing Tolerances

Unless otherwise specified, reinforcement placing tolerances shall be within the limits specified in Section 7.5, Placing Reinforcement, of ACI 318 except where in conflict with the requirements of the Building Code.

F. Bars may be moved as necessary to avoid interference with other reinforcement steel, conduits, or embedded items. If bars are moved more than one bar diameter, or enough to exceed the above tolerances, the resulting arrangement of bars shall be as acceptable to the Engineer.

G. Welded wire reinforcement placed over horizontal forms shall be supported on slab bolsters having gray, plastic-coated standard type legs as specified in Part 3.03B herein. Slab bolsters shall be spaced not less than 30 inches on centers, shall extend continuously across the entire width of the reinforcement mat, and shall support the reinforcement mat in the plane shown.

H. Welded wire reinforcement placed over the ground shall be supported on wired concrete blocks (dobies) spaced not more than 3 feet on centers in any direction. Contractor shall not utilize the construction practice of placing welded wire reinforcement on the ground and hooking into place in the freshly placed concrete.

3.04 Spacing of Bars

A. The clear distance between parallel bars (except in columns and between multiple layers of bars in beams) shall be not less than the nominal diameter of the bars nor less than 1-1/3 times the maximum size of the coarse aggregate, nor less than 1 inch.

B. Where reinforcement in beams or girders is placed in 2 or more layers, the clear distance between layers shall be not less than 1 inch.

C. In columns, the clear distance between longitudinal bars shall be not less than 1-1/2 times the bar diameter, not less than 1-1/2 times the maximum size of the coarse aggregate, nor less than 1-1/2 inches.

D. The clear distance between bars shall also apply to the distance between a contact splice and adjacent splices or bars.

3.05 Splicing

A. General

Reinforcement bar splices shall only be used at locations shown. When it is necessary to splice reinforcement at points other than where shown, the character of the splice shall be as acceptable to the Engineer.

B. Splices of Reinforcement

The length of lap for reinforcement bars, unless otherwise shown shall be in accordance with ACI 318, Section 12.15.1 for a Class B splice.

C. Laps of welded wire reinforcement shall be in accordance with the ACI 318. Adjoining sheets shall be securely tied together with No. 14 tie wire, one tie for each 2 running feet. Wires shall be staggered and tied in such a manner that they cannot slip.

D. Splices in column spiral reinforcement, when necessary, shall be made by welding or by a lap of 1-1/2 turns.

E. Bending or Straightening

Reinforcement shall not be straightened or rebent in a manner which will injure the material. Bars with kinks or bends not shown shall not be used. All bars shall be bent cold, unless otherwise permitted by the Engineer. No bars partially embedded in concrete shall be field-bent except as shown or specifically permitted by the Engineer.

3.06 Cleaning and Protection

A. Reinforcement steel shall at all times be protected from conditions conducive to corrosion until concrete is placed around it.

B. The surfaces of all reinforcement steel and other metalwork to be in contact with concrete shall be thoroughly cleaned of all dirt, grease, loose scale and rust, grout, mortar and other foreign

substances immediately before the concrete is placed. Where there is delay in depositing concrete, reinforcement shall be reinspected and, if necessary recleaned.

BASIC CONCRETE MASONRY SPECIFICATIONS

PART 1 - GENERAL

1.01 General Requirements

A. Contractor shall furnish all labor, material, and equipment and perform all operations necessary to execute all concrete masonry construction as required in the Contract Documents.

B. Contractor shall make all preparations and do all work necessary to receive and adjoin other work.

C. Contractor shall give the work his personal supervision and shall keep a competent foreman on the job at all times.

D. Contractor shall inspect and verify position of all dowels required for masonry on other construction including foundations.

E. Contractor shall arrange necessary storage space for construction materials at the job site.

F. Contractor shall call for all inspections required in the course of his work.

1.02 Reference Codes, Specifications, and Standards

A. Codes

Whenever reference is made herein to Building Code, it shall mean the Uniform Building Code (UBC), latest edition, as published by the International Conference of Building Officials.

B. Specifications

Whenever reference is made herein to Standard Specifications, it shall mean the Standard Specifications for Public Works Construction, latest edition, as published by Building News Incorporated of Los Angeles, California.

C. Commercial Standards

Whenever reference is made herein to ASTM, it shall mean the Annual Book of ASTM Standards, latest edition, as published by the American Society for Testing and Materials.

1.03 Quality Assurance

A. All concrete masonry shall comply with the Building Code and reference material published by the Masonry Institute of America.

B. Contractor shall submit samples of the block units for approval of type and color by Owner prior to commencing with work.

C. Certification

Concrete block manufacturer shall certify that the masonry units furnished meet or exceed the requirements of this specification

D. Sample Panel

Contractor shall build a sample panel, approximately 4 feet by 6 feet, for review and approval by Engineer before any masonry construction is performed. Said sample panel may be part of the project and incorporated into the wall system. Full size concrete masonry units which have been selected and approved by the Engineer to show color range, maximum texture range, bond, mortar, tooling of joints, and quality of workmanship shall be used in the sample panel. Sample panel shall remain on the project for comparison purposes with the actual masonry work.

If the sample panel is not part of the wall system, it shall be demolished and removed from the site after completion and acceptance for the project concrete masonry work, unless Contractor is directed otherwise by Owner.

E. Testing of Grout

1. Test Specimens and Samples

a. Contractor shall take field samples on the first day of masonry construction, at any change in materials during construction, and whenever, in the judgment of the Engineer, tests are necessary to determine the quality of the materials.

b. Contractor shall prepare three grout specimens per sample. Each grout specimen shall be a square prism, nominally 3 inches or larger on the sides and twice as high as the width.

2. Procedures

a. Contractor shall construct samples in the presence of the Engineer or his representative. The same personnel who lays the block in the structure shall construct the grout specimens.

b. Contractor shall prepare each specimen in a mold consisting of masonry units proposed for construction with the same moisture condition as those being laid. The units shall form a space with dimensions of 3-5/8 inches by 3-5/8 inches by 7-5/8 inches. The space shall be lined with a permeable paper (such as a paper towel) or porous separator to prevent bonding to the masonry units, but still allowing the excess water to be absorbed.

Contractor shall place a representative sample of the grout into the molds, puddle, and keep damp and undisturbed for 48 hours. After 48 hours, Owner's Representative will transport the specimens to a test laboratory for storage.

1.04 Product Storage

Contractor shall store and protect all materials as follows:

A. Masonry Units

Masonry units shall be carefully stacked prior to use and shall be properly protected from weather by cover or inside storage. All units shall be handled with reasonable care to prevent marring or damaging of faces, edges, and corners of units. All marred or damaged units shall be discarded.

B. Lime and Cement

Lime and cement shall be delivered in original packages and stored on platforms above ground, protected against moisture.

C. Aggregates

Aggregates shall be stored on platforms so as to exclude dirt.

D. Reinforcing Steel

Reinforcing steel shall be stored above ground to prevent bending or rusting.

PART 2 - PRODUCTS

2.01 Materials

All products shall conform to the following requirements:

A. Concrete Masonry Units

1. Masonry units shall be Grade N-1 units conforming to ASTM C90, latest, and manufactured in accordance with requirements of the Concrete Masonry Association Specifications.

2. Masonry units shall have maximum shrinkage of .08 of 1% from the saturated to the oven dry condition.

3. Masonry units shall be lightweight aggregate (or sand-gravel aggregate) units manufactured by a member of the Concrete Masonry Association. Masonry units may be high temperature steam cured. Owner shall select color of masonry units.

B. Cement

1. Cement for mortar shall be Type I (or Type II, or Type III) portland cement conforming to ASTM C150, latest.

2. Air-Entrained Portland Cement for mortar shall be Type I-A (or II-A, or III-A) conforming to ASTM C175, latest. (Note: When using air-entrained cements, mortar shall not contain more than 1/10 part lime putty).

3. Plastic cement shall have less than 12% total volume in approved plasticizing agents and shall conform to all of the requirements for portland cement in ASTM C150, latest, except with respect to limitations on insoluble residue, air-entrained, and additions subsequent to calcination.

C. Aggregate

1. Aggregate shall be clean, sharp, and well graded, and free from injurious quantities of dust, lumps, shale, alkali, surface coatings, and organic matter.

2. Sand shall conform to ASTM C144, latest.

3. Pea gravel shall be graded with 100% passing the 3/8 inch sieve and not more than 5% passing the No. 8 sieve.

D. Lime Putty

1. Lime putty shall be made from approved hydrated lime or quicklime and shall weigh not less than 83 pounds per cubic foot.

2. Hydrated lime shall conform to ASTM C207, latest.

3. Quicklime shall conform to ASTM C5, latest. Quicklime shall be slaked and then screened through a 16-mesh sieve. After slaking, screening, and before using, it shall be stored and protected for minimum 10 days.

E. Admixtures

Admixtures shall not be used in mortar or grout unless specifically approved by Engineer.

F. Reinforcing Steel

1. Reinforcing steel shall be Grade 60 deformed bars conforming to ASTM A615, latest, except that 1/4 inch ties may be plain bars.

2. Reinforcing steel shall be clean and free from loose rust, scale, and dirt, and coatings that reduce bond.

2.02 Mortar & Grout

A. Mortar

Mortar shall be freshly prepared and uniformly mixed in ratio 1 part portland cement, 1/4 part lime putty, and 3-1/2 parts sand. Mortar shall conform to ASTM C270, latest.

B. Grout

1. Grout shall have minimum compressive strength of 2,000 psi.

2. Grout shall be of fluid consistency and mixed in ratio 1 part cement, 3 parts sand for grout spaces less than 4 inches in any dimension. Grout shall be of fluid consistency and mixed in ratio 1 part cement, 2 parts sand, and 2 parts pea gravel for grout spaces greater than 4 inches.

3. Fluid consistency shall mean that consistency of fluid shall be enough for pouring and yet not so fluid that the constituent parts of the grout separate when grout is poured (slump equals 9 inches $\pm$ 1 inch).

PART 3 - EXECUTION

3.01 Workmanship

A. Masonry work shall be started only when horizontal and vertical alignment of foundation is within 1 inch of plumb or line.

B. Contractor shall prevent grout and mortar stains. Contractor shall keep wall continually clean. If grout runs over, Contractor shall clean wall immediately.

C. All masonry shall be laid true, level and plumb in accordance with the Construction Drawings.

D. Contractor shall cut all masonry units accurately to fit all openings, conduit, ducts, and plumbing. All holes shall be neatly patched.

E. Construction support shall not be attached to the wall except where specifically permitted by the Engineer.

F. The top surface of the concrete foundation shall be clean and free of laitance and the aggregate exposed by sandblasting prior to starting masonry construction.

G. Where no bond pattern is shown, walls shall be laid up in straight, uniform courses with regular half or running bond.

H. All work, bond patterns, or special details shown on the Construction Drawings shall be accurately and uniformly executed.

3.02 Protection of the Work

A. Contractor shall protect all sills, ledges, and offsets from mortar droppings or other damage during construction.

B. Contractor shall prevent visible mortar and grout stains on the exterior of the work. Contractor shall remove stains immediately if they occur.

3.03 Masonry Units

A. All masonry units shall be sound, free of cracks, or other defects that would interfere with the proper placing of the unit or impair the strength of construction.

B. All masonry units shall be stored on the job so that they are kept off the ground and protected from the elements. Wetting of units is not permitted.

C. Proper masonry units shall be used to provide for all windows, doors, bond beams, lintels, pilasters, and knockouts, with a minimum unit cutting.

D. Where masonry unit cutting is necessary, Contractor shall utilize a masonry saw making all cuts neat and true.

3.04 Joints

A. Starting joints on foundations shall be laid with full mortar coverage on the bed joints except that the area where grout occurs shall be free from mortar so that the grout will be in contact with the foundation.

B. Mortar joints shall be straight, clean, and uniform in thickness and shall be tooled as specified.

C. Contractor shall tool exposed wall joints with a round bar (or V-shaped bar) 2 feet long to produce a dense, slightly concave surface well bonded to the block at the edges.

D. Tooling shall be done when the mortar is partially set but sufficiently plastic to bond. All tooling shall be done with a tool which compacts the mortar, pressing the excess mortar out of the joint rather than dragging it out.

E. Where walls are to receive plaster, Contractor shall strike joints flush.

F. Where joints are to be concealed under paint, Contractor shall fill joints flush and then sack to produce a dense surface without sheen.

G. Unless otherwise specified, horizontal and vertical mortar joints shall be 3/8 inch thick with full mortar coverage on the face shells and on the webs surrounding cells to be filled.

H. Vertical head joints shall be buttered well for a thickness equal to the face shell of the block and these joints shall be shoved tightly so that the mortar bonds well to both blocks. Joints shall be solidly filled from the face of the block to the depth of the face shell.

I. If it is necessary to move a block so as to open a joint, Contractor shall remove block from wall and set in fresh mortar.

J. Intersecting masonry walls and partitions shall be bonded by the use of steel ties at 24 inch centers maximum.

K. Where stack bond is specified, approved metal ties shall be provided horizontally at 24 inch centers maximum.

3.05 Reinforcing

A. When a foundation dowel does not line up with a vertical core, it shall not be sloped at more than one horizontal to six vertical. Dowels shall be grouted into a core in vertical alignment even though it is in an adjacent cell to the vertical wall reinforcing.

B. Reinforcing bars shall be straight except for bends around corners or where bends or hooks are detailed on the drawings.

C. Reinforcing steel where spliced shall be lapped a minimum of 40 bar diameters.

D. When full length vertical bars are used, they shall be held in position at top and bottom at intervals not exceeding 48 inches along the reinforcement.

E. Horizontal reinforcing shall be laid on the webs of bond beam units and shall be solidly grouted in place. Reinforcing in channel units shall be spaced off the bottom of the unit.

F. Vertical reinforcing shall have a minimum clearance of 1/4" from the masonry.

G. Wire reinforcement shall be completely imbedded in mortar or grout. Mortar joints with wire reinforcement shall be at least twice the thickness of the wire.

H. Wire reinforcement shall be lapped at least 8 inches at splices and shall contain at least 1 cross wire at each piece of reinforcement in the lap distance.

3.06 Grouting

A. Reinforcing steel shall be in place and inspected by Engineer before grouting starts.

B. Unless specified otherwise on drawings, all walls shall be solid grouted. Unless specifically allowed on drawings, height of grout pours shall not exceed 4 feet. All debris and projecting mortar shall be cleaned out before pouring grout. Pours shall be stopped 1-1/2 inches below the top of a course to form a key at pour joints.

C. Contractor shall consolidate grout by mechanical vibration during placement before loss of plasticity in a manner to fill the grout space. Grout pours greater than 12 inches shall be reconsolidated by mechanical vibration after 3 to 5 minutes to minimize voids due to water loss. Grout pours 12 inches or less in height shall be mechanically vibrated or puddled.

D. Vertical cells to be filled shall have vertical alignment to maintain a continuous unobstructed cell area not less than 2 inches by 3 inches.

E. When higher pours are specified, grout lifts shall not exceed 8 feet. A cleanout hole shall be provided at the bottom of each cell to be poured.

F. Contractor shall grout beams over openings in a continuous operation.

G. Contractor shall cover the tops of unfilled cell columns under a horizontal masonry beam with metal lath, or special units shall be used to confine the grout fill to the beam section.

H. Contractor shall install all bolts, anchors, and similar wall inserts prior to grouting and solidly grout them in place.

3.07 Cleaning and Protection

A. Masonry walls are to be left bare or unpainted unless otherwise specified; Contractor shall prevent mortar splotches.

B. Construction supports shall not be attached to the wall except where specifically permitted by Engineer.

C. All forms shall be made tight (special attention is necessary for bottom form of block bond beams) and concrete and grout spilled on the wall shall be washed off immediately.

D. Walls shall have their surfaces dampened for three days with a light fog spray during the mortar curing period. They shall not be saturated with water for curing or any other purposes.

E. At the conclusion of work, Contractor shall clean down all masonry walls, remove his scaffolding and equipment used in the work, clean up all debris, refuse, and surplus material, and remove them from the premises.

BASIC EARTHWORK SPECIFICATIONS

PART 1 - GENERAL

1.01 Scope

Contractor shall furnish all labor, equipment, and material and perform all operations necessary for earthwork construction including clearing, excavating, filling, backfilling, compacting, and grading specified or reasonably required. All debris or material unsuitable for construction shall be removed from site.

Adequate drainage shall be provided at all times and accumulation of water in excavated areas shall be prevented. All work shall be protected by pumping, ditching, and other measures required for the removal of exclusion of water. Any work damaged by the effects of rain runoff or other weather conditions during any phase of construction shall be reconstructed to conform to the specified requirements. Contractor shall not pass equipment over or alongside facilities that are not protected by ample fill material, properly compacted.

Unless otherwise specified or herein modified, all earthwork shall conform to Section 300 of the Standard Specifications for Public Works Construction, published by Building News, Inc., Los Angeles, California, latest edition, hereinafter "Standard Specifications". References in the Standard Specifications to Measurement and Payment shall not apply.

1.02 Definitions

A. Compaction

The degree of compaction is specified as percent compaction. Maximum of relative densities refer to dry soil densities obtainable at optimum moisture content.

B. Excavation Slope

Excavation slope shall be defined as an inclined surface formed by removing material from below existing grade.

C. Embankment Slope

Embankment slope shall be defined as an inclined surface formed by placement of material above existing grade.

1.03 Quality Assurance

A. References

This section references the following documents. They are a part of this section insofar as specified and modified herein. In case of conflict between the requirements of this section and the listed documents, the requirements of this section shall prevail.

Reference	Title
AASHTO T176	Plastic Fines in Graded Aggregates and Soils by use of the Sand Equivalent Test
ASTM C136	Method of Test for Sieve or Screen Analysis of Fine and Coarse Aggregates

ASTM D420	Standard Recommended Practice for Investigating and Sampling Soil and Rock for Engineering Purposes
ASTM D1557	Method of Test for Moisture-Density Relations of Soils, Using 10 lb (4.5 kg) Hammer and 18 in. (457 mm) Drop
ASTM D2049	Standard Test Method for Relative Density of Cohesionless Soils
ASTM D2419	Standard Test Method for Sand Equivalent Value of Soils and Fine Aggregate
ASTM D3017	Method of Test for Moisture Content of Soil and Soil Aggregates In Place by Nuclear Methods (Shallow Depth)

B. Tests

The Approved Testing Laboratory will take samples and perform moisture content, gradation, compaction, and density tests during placement of backfill materials to check compliance with these specifications as directed by the Engineer. The Contractor shall remove surface material at locations designated by the Engineer and provide such assistance to the Testing Laboratory as necessary for sampling and testing. The Engineer may direct the Contractor to construct inspection trenches in compacted or consolidated backfill to determine that the Contractor has complied with these specifications. The Contractor shall bear the costs for sampling and testing specified in this paragraph including costs associated with retesting due to the Contractor's failure to comply with the specifications shall be paid by the Contractor.

1.04 Protection of Existing Work

Before beginning any cutting or demolition work for removals, Contractor shall carefully survey the existing work and examine the drawings and Specifications to determine the extent of the work. Contractor shall take all necessary precautions to insure against damage to existing work to remain in place or to be reused and any damage to such work shall be repaired or replaced as approved by Owner at no additional cost to Owner. Contractor shall carefully coordinate the work of this section with all other work and construct and maintain shoring, bracing, and supports as required. Contractor shall insure that structural elements are not overloaded and be responsible for increasing structural supports or adding new supports as may be required as a result of any cutting, removal, or demolition work performed under any part of this Contract.

PART 2 - MATERIALS

2.01 Fill Materials

A. Type A

Type A material shall be a clean granular material free from organic matter and shall conform to the following gradation:

U.S. Standard Sieve Size	Percent by Weight Passing
3/4 inch	100
3/8 inch	80-100
No. 4	55-100
No. 10	35-95
No. 40	10-55
No. 100	0-2

B. Type B

Type B material shall be a select nonexpansive, granular material free from organic matter and of such size and gradation that the specified compaction can be readily obtained. Material shall have a liquid limit of less than 20 and a plasticity index of less than 10 and shall conform to the following gradation:

U.S. Standard Sieve Size	Percent by Weight Passing
3 inch	100
3/4 inch	80-100
No. 4	50-100
No. 10	35-95
No. 40	15-75
No. 200	5-35

C. Type C

Type C material shall be unclassified material and may be obtained from excavation on site. The material shall be free from peat, wood, roots, bark, debris, garbage, rubbish or other extraneous material. The maximum size of stone shall not exceed 6 inches.

D. Type D

Type D material shall be granular material commonly known as drain rock and shall conform to the following gradation:

U.S. Standard Sieve Size	Percent by Weight Passing
1-1/2 inch	100
3/4 inch	30-75
1/2 inch	15-55
1/4 inch	0-5

Type D material shall be composed of hard, durable, sound pieces which have a specific gravity of not less than 2.65.

PART 3 - EXECUTION

3.01 General

A. Grade Control

Contractor shall furnish all construction staking required to perform the Work. Contractor shall utilize survey control as shown on the Drawings. Benchmarks, monuments, and other reference points, if disturbed or destroyed by Contractor, will be restored by Owner at Contractor's expense.

B. Excavation

1. Contractor shall excavate to the elevations and dimensions indicated, plus ample space for construction operations and inspection of facilities. All facilities to be constructed shall bear on undisturbed natural ground or material compacted to the relative compaction specified which shall not be less than 90% relative compaction. If so ordered in writing by Owner, Contractor shall perform additional excavation beyond limits originally specified. Concrete shall not be placed in any excavation which has not been approved by Owner. Care shall be taken not to disturb the excavation prepared for concrete and excess material shall not be

removed to make grade until just before concrete is to be placed. This work shall conform to Sections 300-2 and 300-3 of the Standard Specifications unless otherwise specified.

2. Due to Contractor's operations, should the excavation be carried below the lines and grades specified on the drawings or should the bottom of the excavation be disturbed because of the Contractor's operations and require overexcavation and backfill, the Contractor shall refill such excavated space with compacted backfill in accordance with Table A of Part 3.01I herein. Backfill and compaction shall be at Contractor's expense.

C. Removal of Obstructions

The Contractor shall remove all brush, roots and grass where the proper construction and completion of the work require their removal. The Contractor shall also remove all rocks, stones, broken concrete and pavement, debris and all obstructions of whatsoever kind or character, whether natural or artificial, encountered in the work.

Material that is removed as hereinbefore specified, and is not to be incorporated in the work, shall be properly disposed of off the site.

D. Surplus Material

Unless otherwise specified, surplus excavated material shall be disposed of in accordance with applicable ordinances and environmental requirements.

The Contractor shall satisfy himself that there is sufficient material available for the completion of the required earthwork before disposing of any material inside or outside the site. Shortage of material, caused by premature disposal of any material by the Contractor, shall be replaced by the Contractor.

Material shall not be stockpiled to a depth greater than 5 feet above finished grade within 25 feet of any excavation or structure. The Contractor shall maintain stability of the soil adjacent to any excavation.

E. Fill and Backfill

Fill and backfill shall not be placed until all work to be concealed has been inspected and approved by Owner. No fill or backfill material shall be deposited against concrete structures until the concrete has developed its design strength unless authorized by Owner.

Fill and backfill around structures shall be placed in uniform horizontal layers not exceeding 12 inches in loose thickness before compaction and shall be brought up uniformly on all sides of the structure. Regardless of the specified depth of the layers of material to be compacted, Contractor shall place the material at depths required to obtain the specified relative compaction. Each layer of material shall be moistened as required and thoroughly tamped, rolled, or otherwise compacted to the relative compaction specified.

Fill and backfill shall be made with clean, unclassified material excavated from site as approved by Owner. Unless permitted otherwise, said material shall consist of loose earth or sand free from stones, clods, or other deleterious materials larger than 8 inches in greatest dimension.

Whenever permitted by Owner, rock may be placed in certain fills. Rock fragments or boulders up to 24 inches in greatest dimension may be utilized provided that the specified degree of compaction is obtained in the fill material surrounding the rock. The rock fragments or boulders shall be placed in rows on the fill surface so that they are not in contact with one another and fill material shall be placed between and over the rows of rock fragments or boulders and compacted with a sheeps foot or other suitable rollers. Ample water and compactive effort shall be applied so that the resulting fill is free of uncompacted material surrounding the rock. The rows of rock fragments or boulders shall be as

specified with regard to spacing and location within any fill; however, subsequent rows shall be staggered so that one row does not lie directly over another row.

F. Borrow Material

If the quantity of acceptable material from excavation is not sufficient to construct the embankments required by the work, the quantity of material needed to complete the embankments shall consist of imported borrow conforming to specified requirements.

G. Hauling

When hauling is done over highways or city streets, the loads shall be trimmed and the vehicle shelf areas shall be cleaned after each loading. The loads shall be watered after trimming to eliminate dust.

H. Finish Grading

Finish surfaces shall be smooth, compacted and free from irregularities. The degree of finish shall be that normally obtainable with a blade-grader.

Finished grade shall be as specified by the contours, plus or minus 0.10 foot, except where a local change in elevation is required to match sidewalks, curbs, and manholes, or to ensure proper drainage.

When the work is at an intermediate stage of completion, the lines and grades shall be as specified plus or minus 0.5 foot to provide adequate drainage.

I. Control of Erosion

The Contractor shall maintain earthwork surface true and smooth and protected from erosion. Where erosion occurs, the Contractor shall provide fill or shall excavate as necessary to return earthwork surfaces to the grade and finish specified.

TABLE A

Fill Class	Material Type	Maximum Uncompressed Layer Depth (Inches)	Minimum Relative Compaction (Percent)	General Application
A1	A	12	95	Slabs on grade (other than specified for Class E1 or shown for Class D1)
B1	B or C	12	95	Structural backfill
C1	C	12	90	Site fill
D1	D	-	*	Drain rock
E1	E	12	90	Pervious backfill

*Drain rock to be place under structure shall be compacted with 2 to 4 passes of a vibrating roller into an even surface to minimize migration of finer material that may be placed on top of the rocks.

BASIC PAINTING SPECIFICATIONS

1. Scope

Contractor shall provide all labor, material, and equipment and perform all operations necessary for all painting work specified including the painting of concrete block walls, reinforced concrete walls, concrete slab floors, and exposed iron and steel work including pumping units, electrical switchgear, piping, valves and miscellaneous metal.

2. Materials

a. Contractor shall deliver all painting materials to the work site in original containers with seals and labels intact. Containers shall not be opened until after they have been inspected by Owner.

b. Painting materials shall be in accordance with Owner's Approved Paint System.

c. Contractor shall submit a color chart to Owner, who in turn will verify compliance with specified finish color(s) or in the alternative select finish color(s) where unspecified.

d. Prepared material shall be used without cutting or diluting except as specified herein or as directed by manufacturer and approved by Owner.

3. Workmanship

All work shall be done by thoroughly qualified painters in a neat and workmanlike manner. All work which shows carelessness or lack of skill in execution or is defective due to any other cause will be rejected. Said work shall be redone to satisfaction of Owner prior to acceptance of work.

4. Application

a. Unless otherwise specified paint shall be applied by brush or spray. The prime / barrier coat shall have a minimum dry film thickness or 3 mils. The finish coat shall have a minimum dry film thickness of 5 mils. Unless otherwise specified, the total dry film thickness of the complete system shall be 8 mils minimum.

b. Paint shall be applied only on thoroughly clean and dry surfaces, unless specified otherwise. Paint shall not be applied in extreme heat, cold, damp, or humid weather or in dust or smoke-laden air.

c. Paint materials shall be kept sealed or covered when not in use. Oily rags or waste shall be kept in covered containers and disposed of at frequent intervals.

d. If brushes are used, they shall have sufficient body and length of bristle to spread paint in a uniform coat. Paint shall be evenly spread and thoroughly brushed out, and no residual brush marks shall remain. On surfaces which are inaccessible for brushing, paint shall be applied by spray, sheepskin daubers, or other means as approved by Owner.

e. If a spray method is used, the operator shall be thoroughly qualified in use of the equipment required. Air compressors employed in spray painting shall be equipped with suitable trapping devices to keep water, oil, and other impurities from entering air lines. Runs, sags, thin areas, or other imperfections in paint coat shall be considered as cause for rejection and Contractor shall be required to make all necessary corrections to satisfaction of Owner.

f. All exposed iron and steel work together with pumping units, electrical switchgear, piping, valves, and miscellaneous metal shall receive a prime coat(s), shop applied if possible, before installation.

After installation, said materials shall be cleaned and all welds, tool marks, and other defects shall receive a touch-up prime coat. Said materials shall then receive two finish coats.

g. Surface preparation of all concrete and masonry surfaces shall not begin until at least 30 days after the concrete or masonry has been placed.

h. Prior to work on all previously coated surfaces, the existing coating shall be tested for compatibility by applying thinner to a small test portion of the areas to be coated. If, after 30 minutes, the existing coating has begun to lift or wrinkle, the manufacturer shall be consulted before performing any work. If the existing coating has not begun to lift or wrinkle, allow an additional 24 hours drying time. Upon completion of drying time, verify adhesion capabilities.

i. The minimum drying time between prime / barrier coats and finish coat shall be 24 hours.

j. The drying time between finish coats shall be in accordance with the manufacturer's specifications and shall not be less than 24 hours.

k. When two or more coats of coating or paint are specified, each coat shall be of a slightly different shade to facilitate inspection of surface coverage of each coat.

5. Paint Systems

a. Previously Uncoated Masonry, Concrete Walls / Ceilings

1) All loose concrete, mortar splatter and protrusions shall be removed to leave only sound, firmly bonded concrete or masonry. All cracks and voids shall be filled with an approved concrete / masonry patching compound and cured a minimum of 7 days thereafter. Surfaces shall then be cleaned with steam or with a commercial cleaner. The final surface shall be smooth and free of all voids, cavities, dirt, grease, oil or other contaminants.

2) The prime coat shall be applied to all thoroughly clean and dry surfaces.

3) The finish coat shall be applied in sufficient quantity to achieve specified thickness (two coats minimum).

b. Previously Coated Masonry, Concrete Walls, Ceilings

1) All surfaces shall be scraped to remove deteriorated coatings and other deleterious materials. All cracks and voids shall be filled with an approved concrete / masonry patching compound and cured a minimum of 7 days thereafter. Surfaces shall then be cleaned with steam or with a commercial cleaner. The final surface shall be smooth and free of all voids, cavities, dirt, grease, oil or other surface contaminants.

2) The prime coat shall be applied to all thoroughly clean and dry bare spots.

3) The finish coat shall be applied in sufficient quantity to achieve specified thickness (two coats minimum).

c. Previously Uncoated Concrete Floors

1) All loose concrete, mortar splatter and protrusions shall be removed to leave only sound, firmly bonded concrete or masonry. All cracks and voids shall be filled with an approved concrete / masonry patching compound and cured a minimum of 7 days thereafter.

2) All surfaces shall be cleaned and etched, in accordance with the manufacturer's recommendations, for removal of all surface contaminants.

3) The first finish-coat shall be applied to thoroughly clean and dry surfaces, after it has been thinned approximately 20% with thinner.

4) In accordance with the manufacturer's recommendations, a second, unthinned, finish coat shall thereafter be applied. The total dry film thickness of the finish coating shall be a minimum of 10 mils.

d. Previously Coated Concrete Floors

1) All surfaces shall be scraped to remove deteriorated coatings and other deleterious materials. All cracks and voids shall be filled with an approved concrete / masonry patching compound and cured a minimum of 7 days thereafter. Surfaces shall then be cleaned with steam or with a commercial cleaner. The final surface shall be smooth and free of all voids, cavities, dirt, grease, oil or other surface contaminants.

2) The prime coat shall be applied to all thoroughly clean and dry bare spots.

3) The finish coat shall be applied in sufficient quantity to achieve specified thickness (two coats minimum).

e. Galvanized Metal

1) Surfaces shall be cleaned with commercial cleaner, dried thoroughly, and treated with a metal conditioner. (Minimum of 0.5 mils.)

2) The prime coat shall be applied in one very thin coat.

3) The finish coat shall be applied in sufficient quantity to achieve specified thickness (two coats minimum).

f. Ductile Iron / Bare Steel

1) All surfaces shall be field sandblasted in conformance with Steel Structures Painting Council Specifications SSPC-SP10 and National Association of Corrosion Engineers Surface Finish NACE No. 2 (Near-white blast cleaning) to achieve a 1.5 - 2.5 mil (40-60 micron) blast profile. Surfaces shall be cleaned with a commercial cleaner to remove all dirt, grease, oil or other surface contaminants.

2) The prime coat shall be applied to all thoroughly clean and dry surfaces.

3) The finish coat shall be applied in sufficient quantity to achieve specified thickness (two coats minimum).

g. Bare Bronze / PVC

1) Surfaces shall be cleaned with commercial cleaner to remove all dirt, grease, oil or other surface contaminants.

2) The prime / barrier coat shall be applied to all thoroughly clean and dry surfaces.

3) The finish coat shall be applied in sufficient quantity to achieve specified thickness (two coats minimum).

h. Previously Painted Metal Surfaces

1) All surfaces shall be scraped / wire brushed to remove deteriorated coatings and other deleterious materials. Surfaces shall be cleaned with commercial cleaner to remove all dirt, grease, oil, or other surface contaminants.

2) The prime / barrier coat shall be applied to all thoroughly clean and dry welds, toolmarks and bare spots.

3) The finish coat shall be applied in sufficient quantity to achieve specified thickness (two coats minimum).

6. Protection

a. Contractor shall protect freshly painted surfaces from accumulation of dust, dirt, water or other foreign materials, whatever the cause or source. Any damaged surfaces shall be wiped clean, sanded, or stripped to a clean, dry condition and repainted to satisfaction of Owner.

b. Contractor shall protect all parts of the work site during his operation. Tarps and cloths shall be placed where required to protect floors and equipment from spatter and droppings. Electric switchplates, lighting fixtures, nameplates, hardware, glass, vehicles and all other items not to be painted shall be removed, covered, or otherwise protected during painting operations. Contractor shall clean or otherwise restore any surfaces which are painted as a result of Contractor's failure to provide proper protection and said restoration shall be performed to satisfaction of Owner.

7. Data to be Submitted by Contractor

Contractor shall submit a material list for all materials required for painting work and said list shall include manufacturer's name, designation, description, color charts, and related data. Contractor shall also submit appropriate catalog data including applicable material specifications. Contractor shall furnish five (5) copies of material list and two (2) copies of catalog data to Owner and obtain approval therefore before beginning construction.

BASIC PAVING SPECIFICATIONS

1. Scope

Contractor shall furnish all labor, materials, and equipment and perform all operations necessary for construction of pavement surfacing and resurfacing in all areas of construction as specified by the Owner or as shown by the Drawings. Drawings shall consist of construction drawings, standard drawings, and clarifying diagrams or sketches.

Whenever pavement surfacing or resurfacing is to be constructed in rights-of-way not under jurisdiction of the Owner (public highways, thoroughfares, streets), it shall be constructed in accordance with permits issued by the agency having jurisdiction (State, County, City).

Whenever pavement surfacing or resurfacing is to be constructed in rights-of-way over which the Owner has jurisdiction (pumping plants, reservoirs, service yards, access roads), it shall be constructed in accordance with the specifications.

Whenever the words "Standard Specifications" are used herein, they shall mean the Standard Specifications for Public Works Construction as published by Building News, Inc., Los Angeles, California, latest edition. The Standard Specifications shall augment, not supersede, these specifications. As used herein, the Standard Specifications shall not apply to measurement, payment, schedule, delays, or extra work.

2. New Pavement Surfacing

New pavement surfacing shall be asphalt concrete or Portland cement concrete placed on a prepared surface in accordance with the specifications and in conformance with the lines, grades, and dimensions as specified in the Drawings.

A. Subgrade Preparation

Subgrade shall be brought to proper grade, prepared, and compacted in conformance with the requirements of Subsection 301-1 of the Standard Specifications. All organic material shall be removed and discarded at legal disposal site(s), at Contractor's expense. The top 12 inches of such subgrade material shall be scarified, cultivated and then compacted to not less than 95 percent relative compaction (ASTM D1557).

B. Aggregate Base

1) General

Aggregate base material shall be furnished, placed, and compacted at the locations and thickness as specified in the Contract Documents.

2) Materials

Aggregate base material shall consist of crushed aggregate base conforming to requirements of Subsection 200-2.2 of the Standard Specifications.

3) Placement of Aggregate Base

Aggregate base material shall be spread and compacted in conformance with the requirements of Subsection 301-2.3 of the Standard Specifications. Aggregate base material shall be compacted to a relative compaction of not less than 95 percent (ASTM D1557).

C. Asphalt Concrete Pavement

1) General

Asphalt concrete pavement shall be furnished, placed, and compacted at the locations and thicknesses specified.

2) Materials

a. Asphalt

Asphalt to be mixed with mineral aggregate shall conform to Subsection 203-6.2.1 of the Standard Specifications. The viscosity grade shall be AR-4000 unless specified otherwise.

b. Aggregate

Aggregate shall conform to the requirements in Subsection 203-6.2.2 of the Standard Specifications. Course aggregate shall be crushed rock.

The grading of combined aggregates and percentage asphalt shall be in accordance with Subsection 203-6.3 of the Standard Specifications. Unless otherwise specified the following asphalt concrete mixtures shall be used:

All asphalt concrete except overlays shall be C1-AR-4000

Overlays (2" maximum, leveling courses and overlaps) DI-AR-4000

3) Placement of Asphalt Concrete

a. General

All construction methods shall conform to the requirements of Subsection 302-5 of the Standard Specifications. Along all pavement edges which will not abut existing concrete paving, building foundations, curbs, gutters, or other similar structures, a firmly staked 2 inch x 4 inch redwood header shall be placed unless specified otherwise.

b. Weed Killer

Weed killer, "SPIKE" (manufactured by Dow Elanco) or equal shall be applied to the area to be paved at the rate of 100 gallons per 10,000 square feet. The mixture applied shall consist of 1 pound of chemical per 100 gallons of water or per manufacturer's recommendations. Contractor shall obtain a permit to use "SPIKE" weed killer prior to its application.

c. Prime Coat

A prime coat consisting of grade SC-250 liquid asphalt shall be applied at a rate between 0.10 and 0.25 gallons per square yard. Grade SC-70 liquid asphalt may be used when approved by the Owner. Unless otherwise specified prime coat shall be required on all aggregate base material or untreated subgrade on which asphalt concrete pavement is to be directly placed. The prime coat shall be

allowed to cure 24 hours and any excessively oily areas shall be blotted with sand in preparation for application of asphalt concrete.

d. Tack Coat

A tack coat shall be required at all joints, overlays and overlaps. Tack coat shall conform to the requirements of Subsection 302-5.4 of the Standard Specifications and shall be Grade SS-1h emulsified asphalt. Tack coat shall be applied at approximate rates of 0.05 gallon per square yard for leveling courses and overlays, and 0.10 gallon per square yard for asphalt concrete roll berms and dikes.

e. Geotextile Fabric

Geotextile fabric shall conform to the requirements in Subsections 213 and 302-7 of the Standard Specifications. Geotextile fabric shall be placed such that wrinkles large enough to cause laps do not occur. Geotextile fabric shall be placed in accordance with manufacturer's recommendations.

f. Fog Seal Coat

A seal coat shall be applied to surface of all asphalt concrete no sooner than 24 hours nor later than 14 days after placement. Seal coat shall consist of an emulsion paving asphalt (Grade SS-1h) conforming to test requirements of Subsection 203-3.2 of the Standard Specifications. Seal coat shall be applied to provide a coverage of 0.10 gallon per square yard. Seal coat shall not be applied when weather conditions are unsuitable or when atmospheric temperature is below 40°F. Seal coat shall be applied to only one traffic lane at a time and the entire width of the lane shall be covered in one operation. The cut off of asphaltic emulsion shall be made on building paper or similar suitable material spread over the surface. Traffic shall not be allowed on seal coat until emulsion breaks and seal coat is sticky to the touch and will not be picked up by traveling vehicles.

g. Rolling

Unless specified otherwise, at least 2 operational steel drum pavement rollers shall be present during all paving operations.

4) Temporary Surfacing

Unless permanent pavement is to be placed immediately, temporary surfacing 2 inches thick, or as otherwise specified, shall be placed and properly maintained as determined by the Owner until the permanent pavement is placed at locations specified. In any event, in paved streets where immediate access is required to provide for public or private use, Contractor shall place and maintain said temporary pavement. Temporary pavement shall be placed at all locations which are not barricaded and are open to traffic. When Contractor delays the placing or repairing of temporary pavement, Owner reserves the right to have such pavement placed or repaired at Contractor's expense.

Temporary resurfacing shall conform to Subsection 306-1.5.1 of the Standard Specifications and shall be placed as soon as trench backfill is 95% compacted and shall remain in place until permanent resurfacing is placed. Prior to permanent resurfacing, temporary resurfacing shall be removed and discarded at legal disposal site(s) at Contractor's expense. The cost of furnishing, placing, maintaining, removing and

disposing of temporary resurfacing shall be included in the Contractor's bid price for related work if no bid item is specifically called out in the bid sheets.

At the end of each day, temporary striping shall be placed complying with the Drawings and State, County, or City requirements. Temporary striping shall conform with Section 214 of the Standard Specifications.

5) Permanent Resurfacing

Unless otherwise specified, all permanent resurfacing shall be 1" or greater in thickness than the original surfacing removed. Contractor shall remove all loose pieces of existing pavement prior to placing any pavement. Said pavement shall be replaced in accordance with requirements of the agency (State, County, City) having jurisdiction over the roadway.

D. Portland Cement Concrete Pavement

1) General

Portland cement concrete shall comply with the Basic Concrete Specifications unless specified otherwise. Construction methods shall comply with Subsection 302-6 of the Standard Specifications. Portland cement concrete shall be furnished and placed at the locations and thicknesses specified.

2) Concrete Design Mix

All concrete shall be 520-C-2500 concrete in accordance with Subsection 201-1.1.2 of the Standard Specifications. Design mix shall be approved by the Owner prior to purchase or placing of concrete.

3) Reinforcement

Replacement concrete pavement shall have equal or better reinforcement than original concrete pavement. Reinforcement shall be provided whenever and wherever specified. Grade 60 reinforcing steel shall be used unless specified otherwise.

4) Admixtures

Admixtures shall conform to Subsection 201-1.2.4 of the Standard Specifications. Unless otherwise specified, concrete mixtures shall have airentrainment of 5% $\pm$ 1%.

5) Placing Concrete

Concrete shall be placed on an aggregate base sufficiently dampened to ensure that no moisture will be absorbed from the newly placed concrete. Concrete shall be placed on the aggregate base to specified uniform depth.

6) Finishing

Concrete shall be distributed uniformly between forms as soon as it is placed, struck off, and tamped. Tamping shall continue until concrete is thoroughly consolidated into the specified cross-section and sufficient mortar for finishing purposes has been brought to the surface. After tamping, surface of concrete shall be floated and finished. Where the concrete placed is to abut existing concrete surfaces, it shall be finished to match existing concrete as nearly as practical. Vat black or other approved pigments shall be added to

concrete to obtain required result. Edges which do not abut existing concrete shall be rounded to a 1/2 inch radius. Upon completion of final finishing, work surface shall be free of any unevenness greater than 1/8 inch when checked with a 10-foot straightedge placed on the surface.

7) Curing

Pavement shall be cured by a pigmented sealing compound method. Curing shall commence as soon as free water leaves the concrete surface but no later than 3 hours following initial placement of concrete upon aggregate base. Curing compound shall be applied to the entire surface by spraying at the rate of one gallon per 200 square feet. All curing compounds shall be approved by the Owner. Curing compound shall conform to the requirements of Subsection 201-4 of the Standard Specifications.

8) Temporary Striping

At the end of each day, temporary striping shall be placed complying with the Drawings and State, County, or City requirements. Temporary striping shall conform with Section 214 of the Standard Specifications.

3. Pavement Removal

Pavement removal shall be limited to the maximum trench width as shown by the standard drawings plus a reasonable allowance for sloping sides of trench as required by appropriate safety standards or as otherwise specified.

Pavement shall be removed to clean straight lines. Pavement edges shall be saw cut unless an acceptable alternative method is permitted. Contractor shall discard all removed pavement at legal disposal site(s) at Contractor's expense. Removal and disposal of materials shall conform to the requirements of Subsection 300-1.3 of the Standard Specifications.

4. Finishing Pavement Surfaces

A. General

Upon completion of all construction operations the entire roadway area or newly surfaced areas shall be finished, cleaned, and left in a neat, presentable condition.

B. Shoulders

The shoulders around paved surfaces shall be trimmed and shaped to produce a smooth uniform cross section. Shoulders shall be finished, graded, and compacted so as to match the finish grade of the newly paved surfacing. Excess earth, debris, or other waste material shall be removed and discarded at legal disposal site(s) at Contractor's expense.

C. Paved Surfaces

All finished paved surfaces shall be clean of all dirt, debris, and foreign material. All manholes, boxes, and covers, shall be raised to finished grade. All curbs, gutters, and cross gutters shall be broomed clean and flushed with water to insure proper drainage. All street signs and striping shall comply with the construction drawings, specifications, and Section 214 of the Standard Specifications.

D. Survey Monuments

Prior to construction, Contractor shall have a registered civil engineer or licensed land surveyor set at least 4 ties for each monument within the construction area. After construction, Contractor shall have the same civil engineer or licensed land surveyor use the aforementioned ties to replace any monuments which have been disturbed or destroyed. Contractor shall file a corner record for all replaced monuments. Contractor shall also place monument wells in compliance with City or County standards over all monuments in the construction area.

BASIC PIPELINE SPECIFICATIONS

1. Scope

Contractor shall furnish all pipe, fittings, materials, equipment, and labor and perform all operations necessary to construct pipelines and appurtenances as specified by the Owner as shown by the Drawings. Drawings shall consist of construction drawings, installation drawings, laying drawings, standard drawings, detailed drawings, layout drawings, fabrication drawings, shop drawings, and clarifying diagrams or sketches.

The Work shall consist of all traffic control (including furnishing and installing all barricades, signs, delineators, arrow boards, and flagmen); all utility location and verification (excavating, exposing, and verifying locations, depths, and dimensions of utility facilities); all pavement removal and disposal; all earthwork (including trenching, shoring, dewatering if required, blasting if required, bedding, backfilling, and compacting); furnishing and installing all pipe, fittings, appurtenances, and making all related connections; protecting in place or removing and replacing all existing utilities and public and private improvements; removing and replacing all asphalt and Portland cement concrete pavement; pavement striping and restriping as required; disinfecting and testing all pipelines; disposing of excess soil and rock material; and restoring all areas and improvements to pre-construction conditions.

Contractor shall, upon completion of pipeline construction and appurtenances required herein, initially operate all components of the Work installed or furnished and installed by him, and make any additional adjustments, corrections, repairs, replacements, and reconstructions necessary to provide the Owner with complete, correctly operating pipelines and appurtenances.

2. Survey Monuments and Construction Stakes

Contractor shall not disturb or destroy any existing monuments or bench marks. If any survey monuments or bench marks need to be removed and replaced, Contractor shall have all necessary services performed by a registered civil engineer or a licensed land surveyor. If Contractor fails to comply, the Owner will have said services performed at Contractor's expense.

Before removing any monuments in preparation for construction, Contractor shall have a registered civil engineer or licensed land surveyor set at least four ties for each monument to be removed and replaced; after construction Contractor shall have the same registered civil engineer or licensed land surveyor replace each monument using the aforementioned ties and file a corner record for each replaced monument.

Unless specified otherwise, Contractor shall use construction stakes and cut sheets for pipeline construction and the Owner will use them for construction inspection. All construction stakes shall be set by a registered civil engineer or licensed land surveyor. The Owner must approve cut sheets before actual construction. Contractor shall protect all construction stakes set for construction and he shall restore any construction stakes destroyed or disturbed. If Contractor fails to comply, the Owner will have services performed at Contractor's expense.

3. Traffic Control

Contractor shall prepare, submit, and provide traffic control drawings for construction. Said traffic control drawings shall be approved by the Owner and agencies having jurisdiction over highways, thoroughfares, and streets prior to starting construction.

Traffic control requirements may be modified by the Owner or said agencies as conditions warrant. Contractor shall modify traffic control as required by the Owner or said agencies at no additional cost. Throughout the Work, Contractor shall inspect traffic control equipment (signs, barricades, arrowboards, and delineators) and shall maintain same in accordance with said traffic control drawings.

All construction signing, lighting, and barricading shall comply with State of California, Department of Transportation "Manual of Traffic Controls, Warning Signs, Lights, and Devices for Use in Performance of Work Upon Highways", latest edition.

4. Underground Utilities (Subsurface Installations)

Where underground utility facilities (conductors or conduits for water, gas, sewer, telephone, electric power, cable television, or other utilities) are shown on construction drawings, Contractor shall assume that service facilities (services or laterals for water gas, sewer, telephone, electric power, cable television, or other utilities) extend from each utility facility to each parcel or property whether or not service facilities are shown.

At least two working days but no more than fourteen calendar days before commencing any excavation on the Work, Contractor shall request Underground Service Alert (1-800-227-2600) and non-member companies or utilities to mark or otherwise indicate the locations of their subsurface facilities including, but not limited to, structures including vaults, main conductors or conduits, and service connections or facilities.

Contractor shall comply with applicable laws pertaining to subsurface installations, especially with respect to excavations and permits. Contractor shall specifically comply with applicable provisions of Sections 4215 through 4216.9 of the Government Code. Contractor shall take all actions necessary to maintain a valid inquiry identification number during the Work.

At least ten days in advance, or 1,000 feet minimum ahead of pipeline trenching, Contractor shall excavate, expose, and determine ("pothole") the exact locations, depths, and dimensions of each and every potential interference, including, but not limited to, all facilities shown specifically (depth and location) on construction drawings, or which have been marked by their respective owners.

Upon learning of the existence or location of any utility facility omitted from or shown incorrectly on construction drawings, or improperly marked or otherwise indicated, Contractor shall immediately notify the Owner, providing full details as to depth, location, size, and function. Contractor shall immediately notify utility having jurisdiction over facility.

Contractor shall not interrupt or disturb any utility facility without written permission from the Utility or written order from the Owner. Where protection is required to ensure integrity of utility facilities located as shown on construction drawings or visible to Contractor or marked or otherwise indicated as stated herein, Contractor shall, unless otherwise provided, furnish and place all necessary protection at his expense.

Contractor is advised that the Owner has no knowledge or information about trench backfill conditions of utility facilities adjacent to or parallel with pipeline being constructed pursuant to these Specifications; therefore, Contractor shall protect against adjacent or parallel trench backfill failure. If adjacent or parallel trench fails, Contractor shall, at his expense, remove and replace said backfill material in accordance with trench backfill requirements herein and remove and replace asphalt concrete pavement and any other improvements damaged in connection therewith.

5. Storage of Equipment and Materials

Contractor shall not store equipment or materials on private or public property without written permission from property owner(s) approving such use. Said permission shall be submitted to and approved by the Owner before Contractor moves equipment or materials onto site.

Contractor shall not park equipment or store materials in public right-of-way except while performing Work. Contractor shall remove equipment from public right-of-way and place it in Contractor's storage or construction yard by the end of each work day. Contractor shall keep materials in Contractor's storage or construction yard until they are needed for the Work.

Storage site or construction yard shall be completely fenced prior to moving any equipment or materials onto site or into yard. Contractor shall control dust in construction yard at all times, from establishing construction yard through construction, and until all Work has been completed and Contractor has moved all equipment, materials, and fencing from site.

6. Trench Excavation

A. General

Unless specified otherwise, pipelines and appurtenances shall be installed in open trench excavations to the depth and in the direction specified by the construction drawings. Excavation for trenches shall include removal of all material of any nature as required for installation of pipe, fittings, or appurtenances and shall include blasting, either sloping or shoring, and all necessary dewatering, if any, all at Contractor's expense.

Contractor is advised that unsuitable earth may be encountered during trenching operations. Where such material is encountered, Contractor shall, at his expense, remove such material, discard it at legal disposal site(s), and thereafter replace it with approved backfill material.

B. Excavation Safety Drawings

Before excavating any earth or soil to a depth of five (5) feet or more, Contractor shall, pursuant to Labor Code Section 6705, submit to the Owner detailed drawings (hereafter referred to as excavation safety drawings) showing design of shoring, bracing, sloping, or other provisions to be made for worker, individual, or property protection. Said excavation safety drawings shall comply with OSHA Construction Safety Orders (Cal/OSHA or Federal OSHA, whichever is applicable at time of construction) and shall be prepared and certified by a registered civil or structural engineer, engaged by Contractor at his expense, who shall affix his signature and seal to each sheet of said excavation safety drawings. Contractor shall not excavate until the Owner has received and acknowledged properly certified excavation safety drawings. Contractor shall comply with all other applicable requirements of Labor Code Section 6705 and, as therein provided, no requirements of that Section shall be construed to impose tort liability on Owner or Owner's representatives, including Owner's Engineer.

C. Trench and Bell Hole Sloping or Shoring

Trenches and bell holes shall be adequately sloped or shored so that earth will not slide or settle into trench, so that all existing improvements and utilities (above and below ground) will be fully protected from damage, and so that workers and individuals are protected from injury. At minimum, Contractor shall keep toe of trench spoil at least 5 feet from top of trench. Contractor shall assume full responsibility for all damages caused by inadequate sloping or shoring. Contractor shall make all necessary repairs or perform all reconstruction at his expense and he shall bear all other expenses resulting from such damages.

D. Trench Length, Width, and Depth

Unless specified otherwise, trenches shall be excavated not more than 1,000 feet in advance of pipe laying and open trenches shall be properly barricaded and signed as required for individual and property protection. Trenches shall not be excavated or left open nights, weekends, or holidays.

Unless specified otherwise, all pipeline trenches within pipe zone shall, wherever possible, have vertical sides and minimum widths as specified on the standard drawings, however, trenches shall be sloped or shored as required for worker, individual, and property protection.

Whenever maximum allowable trench width, as shown by the Drawings, is exceeded for any reason, the Owner may, at its discretion, require Contractor, at his expense, to cradle pipe (Class B Portland cement concrete) or to provide higher class bedding to support pipe as required to limit load on pipe to allowable supporting strength. The Owner shall approve method of support prior to its use.

Trenches shall be excavated to depths specified by or shown on construction drawings or as otherwise directed by the Owner. If trench excavation is carried below grade without direction or permission, Contractor shall, at his expense, refill trench to proper grade with moist clean sand, sand and gravel, or other suitable material as approved by the Owner, tamped in place to 90 percent relative compaction minimum. Excess excavated material shall be incorporated in backfill or discarded at legal disposal site(s) by Contractor at his expense.

E. Excavated Materials

All material excavated from trench shall be placed for minimum obstruction to traffic (automobile and pedestrian). Gutters shall be kept clear and other provisions shall be made for street or road drainage. Excess excavated material, including material rejected by the Owner for use as backfill, shall be discarded at legal disposal site(s) by Contractor at his expense.

If pipe, fittings, or appurtenances belonging to the Owner are uncovered or removed during excavation, they shall be salvaged and deposited as directed by the Owner. If the Owner determines that certain materials need not be salvaged, said materials shall be discarded at legal disposal site(s) by Contractor at his expense.

F. Blasting

Blasting for excavation will be permitted only with approval of the Owner and only after proper precautions have been taken for protection of persons and property, provided Contractor has secured all necessary permits. Blasting shall be limited to specific periods as approved by the Owner. Any damage caused by blasting shall be repaired by Contractor at his expense. Contractor's blasting methods and procedures shall conform with State and local laws and County and municipal ordinances. Contractor shall post signs warning radio equipment operators that blasting operations are in progress and advising that radio transmissions are prohibited during blasting operations.

7. Trench Bedding

A. General

Trenches shall have flat bottoms conforming with grades to which pipe is to be laid. Trench bottoms shall be uniform and provide firm and uniform bearing for installed pipeline.

Pipe shall be laid so that pipe barrel bears evenly on trench bottom. Bell holes shall be excavated in trench bottom and sides as necessary to permit satisfactory construction and inspection of pipe joints.

B. Unsuitable Soil

Where unstable soil consisting of loose, soft, spongy, or organic earth is encountered, it shall be removed from trench bottom to depth determined in field by the Owner and trench shall be refilled to proper grade with moist clean sand, sand and gravel, or other suitable material as approved by the Owner, tamped in place to 90 percent relative compaction minimum. Trench bottom shall be graded flat and prepared to provide firm and uniform bearing for pipe.

Where unyielding soil consisting of rock, rocky earth, or cemented earth is encountered, it shall be removed from trench bottom to at least 9 inches below grade and trench shall be refilled to proper grade with moist clean sand, sand and gravel, or other suitable material as approved by the Owner, tamped in place to 90 percent relative compaction minimum. Trench bottom shall be graded flat and prepared to provide firm and uniform bearing for pipe.

Unless specified otherwise, Contractor shall, at his expense, remove unsuitable soil, replace it with suitable soil, and discard unsuitable soil at legal disposal site(s). Contractor shall not deposit or store unsuitable soil on private or public property without written permission of property owner(s) and without applicable governmental permits pertaining to earthwork, including compaction, and the environment. Before placing any material on private or public property, Contractor shall provide the Owner with evidence of written permission to do so and he shall then obtain the Owner's written approval for same.

8. Trench Backfill

A. General

In addition to meeting backfill requirements specified herein, Contractor shall also comply with backfill requirements established through permits issued by jurisdictions (State, County, City) having control over rights-of-way in which construction is taking place. Whenever the separate requirements conflict with one another, the more stringent shall apply. Backfill shall not commence without prior approval of the Owner.

Backfill material shall be either select excavated material, screened or washed if necessary, or commercially processed material. Backfill material shall meet separate specific requirements for backfill within pipe zone and backfill above pipe zone. Backfill material meeting pipe zone requirements may be used for above pipe zone backfill material but not the reverse.

After sheeting, shoring, or shields have been removed, all backfill material including pipe zone backfill material shall be compacted to 90 percent relative compaction minimum except that the upper 12 inches of backfill material shall be compacted to 95 percent relative compaction minimum, as verified by field compaction tests. Relative compaction shall be based on maximum dry density determined in accordance with ASTM D-1557, latest. The Owner will specify where (number & location) compaction tests are to be taken.

Unless specified otherwise, the Owner will have all necessary compaction tests performed by soils engineer of its choosing. The Owner will pay for all passing tests; Contractor shall pay for all failing tests. Contractor shall notify the Owner when any segment of backfill has been compacted and is ready for compaction testing and the Owner will then have such tests performed.

Unless determined otherwise, compaction tests will be taken along the pipeline, in the pipe zone, above the pipe zone, and at ground surface or subgrade at 300 foot intervals maximum and along all service runs and fire hydrant runs. Contractor shall assist, at no additional cost to the Owner, soils engineer in taking all compaction tests. Contractor shall furnish all equipment (including shoring), labor, and materials needed for such assistance. Compaction testing shall be completed and accepted by the Owner prior to hydrostatic and leakage testing of pipelines and appurtenances.

Within highways, thoroughfares, and streets, Contractor shall, at the end of each work day and by 5:00 PM, unless permitted otherwise, completely backfill trenches with material sufficiently compacted to support traffic. Contractor shall then place 2 inch minimum thickness temporary asphalt concrete pavement over trench; it shall be compacted, rolled smooth with a steel wheeled pavement roller and placed flush with adjacent pavement. Contractor shall maintain and repair backfilled and paved areas to prevent potholes or pavement failures. Highways, thoroughfares, and streets shall be completely open to traffic at night (after 5:00 PM), on weekends, on holidays, and whenever Contractor is not actively working in specific area.

Contractor shall not excavate trenches or install pipe in highways, thoroughfares, and streets on weekends and holidays. Holidays include union holidays, Owner holidays, and County and municipal holidays. Contractor shall not leave any excavation open overnight or on weekends or holidays.

B. Backfill Within Pipe Zone

Unless specified otherwise, select excavated material, screened or washed if necessary, shall be used and it shall consist of moist clean, loose earth, sand, or gravel (1 inch maximum size) free of clay and silt as well as brush, roots, and organic substances.

Initial backfilling shall be performed as soon as possible after pipe has been laid. Loose, moist backfill material shall be placed in trench simultaneously on each side of pipe to a depth not greater than pipe centerline (springline) or 12 inches (loose measurement), whichever is less, and it shall then be tamped under pipe so that all voids are eliminated and material is compacted to 90 percent relative compaction minimum.

Subsequent backfilling shall be performed immediately following initial backfilling. Loose, moist backfill material shall continue to be placed in trench simultaneously on each side of pipe in lifts not exceeding 12 inches in thickness (loose measurement), with each lift being tamped, until the pipe has been covered by at least 12 inches of well compacted material. Alternatively, backfill material may be densified by water settlement until the pipe has been covered by at least 12 inches of well densified material. Backfilled material shall be tamped or settled to 90 percent relative compaction minimum.

Regardless of compaction or densification technique, care in backfilling shall be exercised to avoid any damage to pipe, fittings, and appurtenances, to avoid any damage to persons or property, and to achieve relative compaction of backfilled material of at least 90 percent minimum.

C. Backfill Above Pipe Zone

Backfill material shall consist of moist clean loose earth, sand, gravel, or rock free of clay and silt as well as brush, roots, and organic substances. From the top of selected backfill in the pipe zone to within 1 foot of ground surface or pavement subgrade, backfill material shall be free of material exceeding 8 inches in greatest dimension. It shall also be compacted to 90 percent relative compaction minimum. Within 1 foot of ground surface or pavement subgrade, backfill material shall be free of material exceeding 2 inches in greatest dimension and it shall be compacted to 95 percent relative compaction minimum. Rocks shall be mixed with suitable soil to eliminate voids; they shall not be nested. Backfill material shall be well graded.

Backfill material shall be placed in lifts not exceeding 12 inches in thickness (loose measurement) and each lift shall be compacted to 90 percent relative compaction minimum by hand tampers, pneumatic tampers, or mechanical compactors except that the upper 12 inches of backfill shall be compacted with mechanical compactors or compaction equipment, excluding stompers, to 95 percent relative compaction. Alternatively and except for the upper 12 inches of backfill, sandy,

granular soils may be densified by water settlement. Trench to be backfilled by water settlement shall be diked at suitable intervals not exceeding 100 feet. Impounded water shall be of sufficient depth so that earth pushed or shoveled into trench will at all times fall into water, becoming completely saturated. If necessary, jetting may augment flooding. Backfill densified by water settlement shall be densified to 90 percent relative compaction minimum. Contractor shall use mechanical compactors or compaction equipment, excluding stompers, to achieve required compaction if required densification is not achieved by water settlement.

D. Imported Backfill Material

Whenever excavated material is unsuitable as backfill material and Contractor is unable to process or screen such material for backfill material or whenever excavated material is insufficient to accomplish backfill and Contractor must secure additional material, Contractor shall import such material and the material and its source shall be approved by the Owner.

Unless specified otherwise, imported backfill material shall be commercially processed and it shall be selected, clean, loose earth, sand, or gravel (1 inch maximum size). Said material shall be granular and it shall be free of clay, silt, and fine sand. It shall be suitable for compaction with minimum effort.

E. Backfill Completion

Where pavement is not required, trench backfill shall be brought to grade of existing surface and dressed to provide firm, stable, and even surface without ruts or irregularities. It shall conform with grades of existing surface. Where pavement is required, trench backfill shall be brought to subgrade for pavement structure. Pavement shall then be placed in accordance with paving requirements.

9. Pipelines and Appurtenances

A. Construction Materials

Contractor shall furnish only approved materials as listed in the Owner's approved materials list. All materials shall be new and of the best quality for their intended use. All like materials shall be of one manufacture for any particular project.

Contractor shall, in addition to furnishing other data herein required, submit three signed and dated copies of the list of materials to be used in pipeline and appurtenance construction including but not limited to pipeline installations, pipeline valve installations, air valve installations, blowoff installations, manway installations, service installations, fire hydrant installations, and related appurtenances.

B. Pipeline Construction

1) Pipelines and Appurtenances

Pipelines and appurtenances shall be constructed in accordance with these Specifications and the Drawings and as specified by the Owner.

2) Valves and Appurtenances

Pipeline valves at pipeline intersections shall be connected directly to pipeline intersection fittings (cross or tee) and, unless specified otherwise, all mainline or side outlet valves shall be located 3 feet minimum from any curb face. Pipeline valves shall not be placed under curb or gutter or in parkway unless approved by the Owner.

All appurtenances, including but not limited to air valve installations, blowoff installations, and related facilities, such as fire hydrants, fire services, and water services, shall not be installed within 5 feet of curb returns, curb depressions, and driveway approaches, or in inaccessible locations or locations where interferences may restrict facility operation, unless permitted otherwise by the Owner.

Unless specified otherwise, air valve installations shall be constructed at all pipeline high spots and blowoff installations shall be constructed at all pipeline low spots. Contractor shall construct, at his expense, air valve installations and blowoff installations in addition to those specified, if necessary to accommodate his work and schedule.

3) Pipeline Length

All pipeline lengths noted by the construction drawings or otherwise specified or referenced shall mean net horizontal constructed lengths and said lengths shall extend through all fittings and appurtenances including bends, outlets, tees, flanges, and valves. Contractor shall provide all pipe necessary to accommodate any vertical alignment of the pipeline and said pipe shall be represented by the net horizontal constructed length.

4) Pipeline Alignment

All pipelines shall be constructed with no basic variation in horizontal alignment as shown by the Drawings or as specified by the Owner. Pipelines shall be constructed parallel with centerlines of streets or rights-of-way and appurtenances shall be constructed perpendicular thereto unless the construction drawings specify otherwise. Pipelines may be constructed by the use of pulled joints, short joints, bevels, bends, and elbows, provided pipelines are constructed as specified.

In all non-critical areas and subject to the Owner's approval, pipelines may be constructed at variance with vertical alignment as shown by the construction drawings by the use of pulled joints, short joints, bevels, bends, and elbows provided pipelines are constructed as specified at pipeline connections and underground interferences, and where pipeline cover is limited. The Owner will not approve any variation in vertical alignment until it has determined that proposed alignment is proper and modifications are in order.

5) Pipeline Tolerances

With regard to vertical alignment, pipelines shall be constructed so that actual flow line elevations, measured at pipe joints, are within 0.1 foot of design flow line elevations. Pipelines, when installed, shall have continuous slope upgrade or downgrade, corresponding with design slope, without any high spots.

With regard to horizontal alignment, pipelines shall be constructed so that actual pipeline centerlines, measured at pipe joints, are within 0.1 foot of design pipeline centerlines. Pipelines, when installed, shall closely follow specified horizontal alignment.

Pipeline construction shall conform with construction drawings and layout, shop, fabrication, installation, or laying drawings (design drawings which show flow line elevations and pipeline centerlines) in accordance with the above specified tolerances. Contractor shall make or assist the Owner in making all necessary measurements, as determined by the Owner, to confirm or verify compliance with construction tolerances.

6) Pipeline Cover

Pipeline cover as shown by the construction drawings is hereby defined as design cover over pipeline. If field conditions determined during construction staking show that pipe grade changes are required to provide design cover, Contractor shall, at his expense, make required changes in pipeline grade and construct pipeline accordingly.

Pipeline cover from top of pipe to ground surface over pipeline shall not be less than 36 inches. Where future ground surface elevation over pipeline has been established and where actual ground surface is greater, pipeline cover shall be referenced to future (established) ground surface elevation, not actual ground surface elevation.

10. Pipe Materials and Pipe Installation

A. Ductile Iron Pipe

1) Scope

Ductile iron pipe and fittings shall conform with applicable provisions of AWWA C104, C105, C110, C111, C115, C150, C151, and C153, latest, as modified herein, by the Drawings, or by the Owner.

All ductile iron pipe shall be manufactured by organizations which have had not less than ten years successful experience in the manufacture of the type of pipe specified. The Owner shall approve manufacturer's product before its use.

2) Data to be Submitted by Contractor

Contractor shall furnish three copies of an Affidavit of Compliance in accordance with Section 51-5, AWWA C151, latest. Contractor shall also furnish certifications, three copies each, of the following:

a. Material Certification

(1) Grade of iron (chemical requirements)
(2) Flanges
(3) Nuts and bolts
(4) Flange gaskets
(5) Rubber Gaskets

b. Manufacturing Certification

(1) Hydrostatic Test Reports
(2) Tensil Test Reports
(3) Impact Test Reports

Unless specified otherwise, Contractor shall furnish detailed installation or laying drawings showing pipe, fittings, appurtenances, station, and elevation for each fitting, and each change in alignment or slope. Contractor shall submit the installation or laying drawings to the Owner for acceptance in all cases in time sufficient to allow review and acceptance as hereinafter specified and to accommodate the Contractor's construction schedule.

Installation or laying drawings shall be submitted in triplicate. Owner will return one (1) set of drawings to Contractor within fifteen (15) days marked either "Accepted", "Rejected", "Revise and Resubmit", "Submit Specified Item", or "Furnish as Corrected". In the last case, all revisions will be clearly shown on the returned set of drawings which shall be considered the accepted drawings and only drawings or prints so corrected shall be used for installation. Contractor shall furnish Owner five (5) sets of all accepted drawings.

3) Pipe

All pipe shall be ductile iron and shall conform with AWWA C151 (ANSI A21.5, and applicable portions of ASTM A536, Grade 60-42-10), latest, as modified herein by the Drawings, or by the Owner.

a. Pipe, including standard, random, and special short lengths, shall be Class 150 minimum and, unless specified otherwise, shall have push on joints. Minimum pipe wall thickness shall be as noted by the construction drawings or specified by the Owner; it shall not be less than noted by the standard drawings. Pipe wall thickness shall be increased if necessary to accommodate threads or grooves or if required for extremely shallow (less than 2.5 feet) or excessively deep (more than 14 feet) pipeline cover. 90 percent of all pipe of any specific class and size, excluding special short lengths, shall be furnished in standard lengths. The remaining 10 percent may be furnished in random lengths.

b. Standard lengths shall have nominal lengths of 18 feet up to 36 inches in diameter and 20 feet above 36 inches in diameter, plus or minus 1 inch. Random lengths of pipe may be up to 2 feet shorter than standard lengths. Special short lengths shall only be furnished where needed to accommodate specified fittings.

c. Pipe shall have an interior cement mortar lining of double thickness in accordance with AWWA C104 (ANSI A21.4), latest, except that interior mortar lining shall not be asphalt seal coated. Said lining shall be full thickness throughout pipe except for bell which shall be cleaned and lightly sprayed or brushed with an asphaltic or bituminous coating in accordance with AWWA C151 (ANSI A21.51). The interior cement mortar lining shall be moisture cured for at least two days before shipment. To prevent moisture loss during the curing period, ends of pipe shall be kept closed with plastic caps or covers which shall remain in place until installation.

Steam curing may be substituted for moisture curing, providing one hour of steam curing is equivalent to six hours moisture curing and ambient vapor is maintained at relative humidity of 85 percent with temperature ranging between 110 degrees Fahrenheit and 150 degrees Fahrenheit for minimum steam curing period of six hours, after which exterior coating may be applied. The lining shall then be cured for another twelve hours before shipment. Other methods of curing the cement mortar lining may be used providing they are acceptable to the Owner.

Temperature and shrinkage cracks in cement mortar lining less than 1/16 inch in width or 24 inches in length need not be repaired. Cracks wider than 1/16 inch or longer than 24 inches shall be repaired unless it can be demonstrated to the satisfaction of the Owner that the cracks will heal autogenously under continuous soaking in water.

d. Pipe shall have an exterior asphaltic or bituminous coating in accordance with AWWA C151 (ANSI A21.51), latest.

e. All pipe shall be furnished with rubber gasketed push-on type joints unless mechanical joints or flanged joints are otherwise specified or permitted. Joint restraints may be required as specified by the Owner. All joints shall comply with AWWA C111 (ANSI A21.11), latest, as approved by the Owner.

f. Rubber gaskets shall conform AWWA C111 (ANSI A21.11) latest.

g. Each pipe shall be marked with the weight, class, or nominal thickness and casting period. The manufacturers mark, year in which pipe was produced and the letters "DI" or "ductile" shall be cast or stamped on the pipe. All required markings shall be clear and legible and all cast marks shall be on or within 2 feet of bell ends.

h. Where restrained joints are required, they shall be accomplished with boltless restrained joint gaskets or components. Restrained joints shall be ductile iron in accordance with applicable provisions of AWWA C111 and C151 (ANSI A21.11 and A21.51, respectively), latest, except as to manufacturer's proprietary dimensions. Set screws shall not be utilized for any application.

Each restrained joint for pipe 4 inches through 12 inches shall consist of a gasket system where stainless steel locking segments molded within the gasket provide restraint for pipe joints or fitting joints.

Each restrained joint for pipe 14 inches through 24 inches shall consist of a gasket system where stainless steel locking segments molded within the gasket provide restraint for pipe joints or fitting joints, or, alternatively, a boltless restrained push-on joint system where ductile iron locking segments inserted through slots in the bell face provide positive axial lock between the bell interior surface and the spigot retainer weldment or gripper ring.

Each restrained joint for pipe 27 inches and larger shall consist of a boltless restrained push-on joint system where ductile iron locking segments inserted through slots in the bell face provide positive axial lock between the bell interior surface and the spigot retainer weldment or gripper ring.

All restraining components must make full contact around the circumference of the pipe, even if it has deflected. Field cut kits shall be composed of full ring gripper rings with serrated edges and shall be compatible with the pipe joints and fitting joints.

4) Fittings

All fittings shall be ductile iron except where fabricated cement mortar lined and cement mortar coated welded steel pipe fittings are specifically permitted or specified. Fabricated cement mortar lined and cement mortar coated fittings shall be flanged and

they shall conform with the cement mortar lined and cement mortar coated welded steel pipe fittings specified herein.

Ductile iron fittings shall conform with AWWA C110, C111, and C153 (ANSI A21.10, A21.11, and A21.53, respectively), latest. Unless specified otherwise, fittings shall be push-on joint and comply with AWWA C111 (ANSI A21.11).

Fittings shall have an asphaltic outside coating in accordance with AWWA C110 or C153 (ANSI A21.10 or A21.53), latest, and cement mortar lining in accordance with AWWA C104 (ANSI A21.4), latest. Fittings shall have standard lining thickness and shall be seal coated with asphaltic material or other approved material. The lining process must produce a dense, compacted lining that shall be bonded to the interior of the fitting and have a smooth surface.

Where restrained joints are required, they shall be accomplished with boltless restrained joint gaskets or components and shall comply with all requirements of Section 10.A.3.h. of the Basic Pipeline Specifications. Restrained joint fittings shall be of same joint design as the restrained joint pipe. Restrained joints shall be ductile iron in accordance with applicable provisions of AWWA C110 and C153 (ANSI A21.10 and A21.53), latest, except as to manufacturer's proprietary dimensions.

5) Testing

All pipe, including standard, random, and special short lengths, furnished shall be tested in the United States in accordance with AWWA C151, latest.

6) Inspection

The Owner shall at all times have the right to inspect all Work and materials during the course of manufacture. Manufacturer shall furnish the Owner reasonable facility for obtaining such information as he may desire regarding the progress and manner of the Work and the character and quality of materials used.

7) Loading, Transporting, and Unloading

After the pipe has been tested in accordance with Section 5 above, it shall be loaded on rubber-tired vehicles, and adequately supported and chocked to prevent any damage during transportation, and delivered to the Work site. During loading, unloading, and stringing operations, pipe and fittings shall be moved with care to prevent damage thereto. Unloading shall be accomplished in a workmanlike manner as directed by the manufacturer. Under no circumstances are pipe and fittings to be dropped or bumped in handling.

8) Defective or Damaged Material

Pipe and fittings shall be carefully inspected for defects. Any pipe found to be defective in workmanship or materials or so damaged as to make repair and use impossible shall be rejected and removed from the Work site.

In the event that pipe is damaged, damaged portions may be removed, as approved by the Owner, and discarded. Remaining sound portions may be used with ductile iron fittings. Contractor shall be responsible for any and all damage to material and he shall stand the expense of repairing or replacing same. Contractor shall take proper precautions to assure that rubber gaskets are protected from oxidation or undue deterioration.

9) Installation

Pipe manufacturer, fitting manufacturer, and material supplier, in addition to the Owner and the Owner's representative, shall have access to the Work during installation. Contractor shall use assistance provided by either manufacturer or supplier where required for proper installation of pipe, fittings, or materials; however, Contractor shall limit role of either manufacturer or supplier to advisory service.

All pipe shall be laid true to line and grade and at the locations shown by the construction drawings or as specified. Pipe shall be installed in accordance with applicable provisions of AWWA C600, latest, applicable provisions of Ductile Iron Pipe Research Association "Guide for the Installation of Ductile Iron Pipe", latest, and manufacturer's directions. Bell ends shall be placed uphill unless otherwise permitted.

After pipe has been set in trench, exterior of spigot and interior of bell shall be thoroughly cleaned. Lubricant recommended by pipe manufacturer and as approved by the Owner shall be applied to rubber gasket. Lubricant shall be water soluble, nontoxic, shall impart no objectionable taste or odor to the water, shall have no deteriorating effects on the rubber gaskets, and shall not support growth of bacteria. Excess lubricant shall be removed. Pipe ends shall be aligned, and spigot shall be pulled into bell with come-along devices, or hoists with chains and slings, unless permitted otherwise. If either the pry bar or the backhoe bucket method is permitted, a timber header shall be placed between the pipe and the pry bar or backhoe bucket before the spigot is pushed into bell.

Curved alignment by use of pulled joints will be permitted. Maximum joint deflection shall be 3 degrees. For purposes of reducing angular deflections at pipe joints, Contractor may install pipe sections of less than standard length.

Whenever cutting of pipe is required, it shall be done with a special cutting tool specifically made for cutting and machining ductile iron pipe. Cut ends and rough edges shall be ground smooth and beveled for push-on joints.

Whenever specified, pipe shall be encased with 8 mil (0.2 mm) thick minimum polyethylene tube lapped 1 foot minimum, and valves and fittings shall be wrapped with polyethylene tube or with polyethylene sheets lapped 1 foot minimum. Polyethylene tube and polyethylene sheets shall be secured in place with suitable adhesive tape. All polyethylene tube and polyethylene sheet encasements shall be installed in accordance with AWWA C105, latest.

As Work progresses, a pipe cleaning tool as approved by the Owner shall be drawn through pipe to remove dirt, rocks, or other foreign material. At the end of each day's work, all openings in the pipeline shall be plugged with watertight expandable plugs or approved equal.

B. Welded Steel Pipe (Cement Mortar Lined and Cement Mortar Coated)

1) Scope

All welded steel pipe shall conform with applicable provisions of AWWA C200, C205, C206, C207, and C208, latest, and applicable portions of M11 "Steel Pipe Manual", latest, as modified herein, by the Drawings, or by the Owner.

All welded steel pipe shall be manufactured by organizations with at least ten years successful experience in manufacturing, fabricating, lining, and coating the type of pipe specified. Owner shall approve manufacturer's methods, equipment, facilities, and

operations before performance of any work and manufacturer's completed product before its use.

Standard or special pipe sections and standard or special connections, outlets, and fittings may be manufactured at a single plant, or they may be manufactured at two separate plants (Plant 1: manufacturing of standard sections of lined, coated, and cured steel pipe consisting of steel pipe cylinder formation and lining, coating, and curing; Plant 2: fabricating special pipe sections and standard or special connections, outlets, and fittings using standard sections of manufactured lined, coated, and cured steel pipe). Special pipe sections and standard or special connections, outlets, and fittings fabricated at a separate manufacturing plant shall be comprised of standard pipe cylinders that have been formed, lined, coated, and cured at a single manufacturing plant. The separate manufacturing plant shall use facilities and methods for lining and coating repair and curing equal to the facilities and methods of the manufacturer of the standard sections of lined, coated, and cured steel pipe.

2) Data to be Submitted by Contractor

Contractor shall furnish three copies of an affidavit of compliance in accordance with Section 1.12, AWWA C200, latest, and Section 1.7 AWWA C205, latest. Contractor shall also furnish certifications, three copies each, of the following:

a. Material Certification

(1) Steel Skelp
(2) Flanges
(3) Nuts and Bolts
(4) Flange Gaskets
(5) Rubber Gaskets

b. Manufacturing Certification

(1) Pipe Mill Reports
(2) Production Weld Test Reports
(3) Hydrostatic Test Reports
(4) Outlet Reinforcement Calculations*
(5) Pipe Wall Thickness Calculations*

* If not shown by the Drawings.

Unless specified otherwise, Contractor shall furnish detailed layout and shop or fabrication drawings showing pipe, lining, coating, reinforcement, joints, fittings, appurtenances, and station and elevation for each fitting and outlet and for each pipe joint at each change in pipe class, alignment, or slope. Contractor shall submit detailed layout and shop or fabrication drawings to the Owner for acceptance in all cases in time sufficient to allow review and acceptance as hereinafter specified and to accommodate the Contractor's construction schedule.

Installation or laying drawings shall be submitted in triplicate. Owner will return one (1) set of drawings to Contractor within fifteen (15) days marked either "Accepted", "Rejected", "Revise and Resubmit", "Submit Specified Item", or "Furnish as Corrected". In the last case, all revisions will be clearly shown on the returned set of drawings which shall be considered the accepted drawings and only drawings or prints so corrected shall be used for installation. Contractor shall furnish Owner five (5) sets of all accepted drawings.

Revisions shown on the shop drawings shall be considered changes necessary to meet the requirements of these Specifications and shall not be taken as the basis of claims for extra charges. Contractor shall accept such revisions or submit others for acceptance. When delays are caused by resubmissions of shop drawings, Contractor shall not be entitled to any damages or extensions of time for such delays.

The Owner's acceptance of detailed layout and shop or fabrication drawings shall apply only to general arrangement and general compliance and not to specific details and dimensions and their correctness and compatibility. Contractor shall correct any misfits due to any errors in the detailed shop or fabrication drawings. Any fabrication in advance of receipt of detailed layout and shop or fabrication drawings marked "Accepted" or "Furnish as Corrected" shall be at Contractor's risk. Contractor shall furnish the Owner five sets of all accepted layout and shop or fabrication drawings.

3) Pipe and Fittings

All pipe and fittings furnished shall conform with applicable provisions of AWWA C200, C205, C206, C207, and C208, latest, and applicable portions of AWWA M11, "Steel Pipe Manual", latest, as modified herein, by the Drawings, or by the Owner.

a. Pipe and fittings shall be Class 150 minimum. Minimum steel cylinder thickness shall be as noted by the construction drawings or specified by the Owner; it shall not be less than 10 gage or as noted by the standard drawings. All pipe and fittings shall be machine cement mortar lined and machine cement mortar coated.

b. Curved alignment by use of pulled joints will be permitted. Maximum pull permitted from normal closure on one side of joint shall not exceed 1/2 inch for 8 inch pipe or smaller, 3/4 inch for 10 inch through 21 inch pipe, and 1 inch for 24 inch pipe and larger. Maximum joint deflections shall not exceed manufacturer's recommendation or 3 degrees; the more restrictive or lesser deflection shall apply.

c. Where greater curvature is required, Contractor may use fabricated bends as specified by the construction drawings or ordered by the Owner. For the purpose of reducing angular deflections at pipe joints, Contractor may use pipe sections of less than standard length. Closing courses and short sections of pipe shall be fabricated and installed by Contractor as found necessary in the field.

d. All fittings shall be shop fabricated unless the construction drawings indicate that fittings may be field fabricated, Contractor describes methods of fabrication, and the Owner specifically approves field fabrication. All fittings shall be fabricated from individual pipe sections, welded together, and lined and coated as described hereafter.

e. Lining of Fittings

(1) The application of cement mortar lining to miters, angles, bends, reducers, and other special sections, the shape of which precludes application by the machine spinning process, shall be accomplished by mechanical placement, pneumatic placement, or hand application and finished to produce a smooth, dense surface.

(2) If the interior of the fitting has not been previously machine lined, wire-fabric reinforcement or ribbon-mesh reinforcement shall be applied to the interior of fittings larger than 24 inches and shall be secured at frequent intervals by tack welding to pipe, by clips or by wire. Repaired areas of machine applied linings at miters, pipe ends, outlets, and other cuts made in the lining for fabrication of the fittings need not be reinforced if the width of the repair area does not exceed 12 inches. Repairs for widths exceeding 6 inches shall be bonded to the steel and adjacent faces of the lining with an approved bonding agent.

Immediately after lining has been completed, pipe and fittings shall be water cured without being disturbed for at least one day before applying the exterior coating, if such a coating is specified. If cement mortar coating is not specified, the lining shall be kept moist for four days before shipment. In either case, the lining shall be cured for at least four days before shipment. To prevent moisture loss during the curing period, ends of the pipe sections shall be kept closed with plastic end caps or covers which will remain in place until time of installation. The date of lining and class of pipe shall be plainly marked on the inside of each fitting.

f. Coatings of Fittings

Mortar coating for pipe bends and other special sections not adaptable to the application of spiral-wire coating reinforcement shall be reinforced with wire fabric or ribbon mesh. The wire fabric or ribbon mesh shall be applied over the surface of the pipe to be coated, and may be held away from the pipe shell with self-furring mesh, furring clips, or an equivalent method. The application of the mortar coating shall be by mechanical or pneumatic means to the specified thickness, except that hand application may be substituted for all specials. After the outside coating has been applied, the pipe and fittings shall be kept continually moist by continuous spraying for at least four days. Provisions shall be made to protect the coating from erosion during sprinkling. The date of coating and class of pipe shall be plainly marked on the inside of each fitting.

4) Pipe Joints

Unless specified otherwise, joints shall conform to the following types. Joints shall be as specified on the construction drawings or by the Owner. All joints shall be continuity bonded.

a. Rubber Gasket Joints

All rubber gasket joints shall conform with AWWA C200, latest.

b. Flanged Joints

All flanges 4 inches through 12 inches shall conform with AWWA C207, latest, Class E (ring) or ANSI B16.5 Class 150. All flanges larger than 12 inches shall conform with AWWA C207, latest, Class E (ring). All flange bolts shall be standard hex head machine and conform with ASTM A325. All flange nuts shall be heavy hex cold pressed semi-finished steel and conform with ASTM A194-2, 2H.

All flanges shall be fully welded to pipe on both faces, one pass minimum on the inside, and two passes minimum on the outside. Pipe linings shall extend to mating faces of flanges. Bolt threads shall be lubricated with an approved anti-seize compound. Flanges together with bolts and nuts, shall be, once installed, coated with an approved bitumastic material.

c. Swedged Lap Welded Joints

Bell ends shall be formed integrally with pipe cylinders, being swedged out by machine. Bell ends shall be designed and fabricated to withstand design pressure of class of pipe specified and to permit spigot ends (plain end) to enter belled ends approximately 1 inch with clearance of approximately 1/32 inch.

d. Banded Lap Welded Joints

Where lap welded joints are required and swedged lap welded joints cannot be fabricated, belled ends shall be formed by welding steel bands to outside circumferences of plain ends of pipe. Bell ends shall be designed and fabricated to withstand design pressure of class of pipe specified and to permit spigot ends (plain ends) to enter belled ends approximately 1 inch with a clearance of approximately 1/32 inch.

e. Sleeve Couplings

Where sleeve couplings are required, they shall conform with the construction drawings. Pipe coatings at pipe ends shall be held back 12 inches and pipe shall have weld seams ground flush within 12 inches from pipe ends, unless specified otherwise. For above ground applications, pipe ends and sleeve couplings shall be painted. For below ground applications, pipe ends and sleeve couplings shall be coated with an approved bitumastic material. An approved bitumastic coating shall be substituted for mortar coating within 12 inches of pipe ends. After joints have been coupled, sleeve couplings shall be coated with an approved bitumastic material.

f. Cut-to-Fit Joints

Where cut-to-fit joints are required, they shall conform with the standard drawings and the construction drawings. Pipe coatings at cut-to-fit joints shall be held back as required to permit construction of joints; pipe coatings shall thereafter be added in the field. Field applied pipe coatings shall match manufactured pipe coatings. Contractor shall provide, at his expense, cut-to-fit joints, in addition to those specified, if necessary to accommodate his work and schedule.

g. Shop Testing of Joints and Joint Ends

Every pipe section, standard, or special, shall be hydrostatically tested after joint ends have been completely shop formed and attached in place by welding, as applicable, or dye check tested provided pipe cylinders had been previously hydrostatically tested.

5) Cement Mortar Lining and Cement Mortar Coating

a. General

Cement mortar lining and cement mortar coating shall conform with AWWA C205, latest.

b. Surface Preparation

Prior to lining and coating, pipe shall be cleaned of all loose mill scale, moisture, rust, sand, dust, oil, grease, and other deleterious or objectionable matter both inside and outside.

c. Cement Mortar Lining

(1) Mortar

Mortar shall consist of one part Portland cement to three parts (by weight) clean, sharp sand. Unless specified otherwise, cement used for cement mortar shall conform with ASTM C-150, latest, Type II. Sand shall consist of clean, inert, sharp, durable material, maximum grain size being no more than one-half specified minimum lining thickness. Mortar shall be thoroughly mixed and made workable with clear, potable water. All cement mortar shall develop a minimum compressive strength of 2,600 psi minimum at seven days and 4,500 psi minimum at twenty-eight days.

(2) Application and Treatment

Cement mortar shall be applied to interior surfaces of pipe with equipment specifically designed for that purpose. Said equipment shall have a retracting feed line that will provide uniform cement mortar distribution throughout pipe length. Pipe shall be slowly rotated in horizontal position while cement mortar is being applied. Each end shall be provided with suitable end dam during spinning operation to control lining thickness and provide square-finished lining end.

Following application of mortar, pipe shall be rotated at sufficient speed to compact lining mortar. Said speed shall be maintained until all excess water has been forced to lining surface. During the spinning operation, surplus water shall be expelled from pipe by blower or other suitable means. Peripheral speed and spinning time shall be sufficient to obtain dense, well compacted lining with smooth surface free from defects. Minimum lining thickness shall be as shown by the standard drawings.

Immediately after lining has been completed, pipe shall be water cured without being disturbed for at least one day. Moisture loss shall be prevented during the curing period.

d. Cement Mortar Coating

(1) Mortar

Mortar shall consist of one part Portland cement to three parts (by weight) clean, sharp sand. Materials for cement mortar coating shall be the same as materials for cement mortar lining. All cement mortar shall develop a minimum compressive strength of 2,600 psi minimum at seven days and 4,500 psi minimum at twenty-eight days.

(2) Application and Treatment

After pipe interior has been lined, cement mortar shall be applied to outside of pipe through fixed nozzles to form an even, dense, and tightly adhering coating. During coating operation, pipe shall be rotated and moved beneath said fixed nozzles to obtain uniform coating free from defects. Minimum coating thickness shall be as shown by the standard drawings.

Cement mortar coating shall be reinforced with spirally wound steel (reinforcing) wire embedded midway within coating. Reinforcing wire shall be bright basic wire comprised of low carbon, open hearth steel, unannealed after the last draw, with an approximate ultimate tensile strength of 80,000 psi. Said wire shall be No. 14 gage minimum and it shall be placed at a pitch of 1-1/2 inch maximum in the middle third of the coating.

Immediately after coating has been completed, each end of each section shall be cleansed to bare metal and cement mortar shall be troweled and shaped suitable for joint being used. All exposed bare metal shall be cleaned and coated and painted for protection against corrosion. Completed pipe shall then be water cured for at least four days without being disturbed.

6) Manufacturing Inspection

The Owner shall at all times have the right to inspect Work and materials during the course of manufacture. Manufacturer shall furnish the Owner reasonable facility for obtaining such information as it may desire regarding progress and manner of work and character and quality of materials used.

7) Loading, Transporting, and Unloading Pipe and Fittings

After pipe and fittings have been manufactured as set forth above, they shall be braced at the plant with wooden struts of adequate size to protect against excessive deflection. Each set of struts (two struts minimum to a set) shall be nailed together at right angles as a unit. Wooden wedges may be used to accomplish proper tight fit for the struts. Bracing shall be located 1 foot in from each end of each pipe section for pipe 24 inches and smaller, and additionally at mid point for pipe 30 inches and larger.

After the struts have been installed, pipe shall be loaded on rubber-tired vehicles, adequately supported and choked to prevent damage during transportation, and delivered to Work site. All bracing shall remain in place until each pipe section has been bedded and backfilled to at least 1 foot above the top of the pipe for pipe 24 inches and larger.

Plastic end caps or covers shall be placed over the ends of pipe following installation of braces to prevent moisture loss during loading, transporting, unloading, and installing; they shall remain in place until installation. If the plastic and caps or covers are damaged (perforated), they shall be replaced immediately.

During loading, unloading, and stringing operations, pipe and fittings shall be moved with care to prevent damage thereto. They shall be moved with nylon chokers or straps of sufficient width, placed at third points (one-third length of pipe from each end), to prevent damage to exterior coating, and they shall be handled in such manner to prevent damage to interior lining. Steel slings shall not be used.

Unloading shall be accomplished in a workmanlike manner by Contractor and every precaution shall be taken to prevent damage to pipe and fittings. Under no circumstances are pipe sections to be dropped or bumped in handling. Any pipe section that becomes damaged shall be repaired if possible and, if not possible in the opinion of the Owner, it shall be replaced with an undamaged pipe section. When strung, pipe shall be adequately supported and chocked to avoid movement until it is installed. It shall also be placed to avoid damage during construction.

8) Pipe Installation

Pipe manufacturer, fitting manufacturer, and material supplier, in addition to the Owner and the Owner's representative, shall have access to the Work during installation. Contractor shall use assistance provided by either manufacturer or supplier where required for proper installation of pipe, fittings, or materials; however, Contractor shall limit role of either manufacturer or supplier to advisory service.

Contractor shall not move pipe using dozer blades, backhoe buckets, or the like (sharp metal surfaces). Contractor shall use nylon chokers or straps, not steel slings, in moving, placing, or setting pipe. Nylon chokers or straps shall be placed at third points (one-third length of pipe from each end).

All out-of-round pipe shall be rejected and removed from the Work site immediately. Rejected pipe shall be replaced immediately. Contractor shall not use hammers, bars, wrenches, or other tools to modify pipe ends to accommodate installation.

All pipe ends shall be secured with plastic covers. Said plastic covers shall be left in place until pipe is prepared for installation. If any plastic covers are damaged or destroyed before pipe has been installed, they shall be immediately replaced.

All pipe and fittings shall be laid true to line and grade and at the locations shown by the construction drawings or as specified. Pipe and fittings shall be installed in accordance with applicable sections of AWWA M11, "Steel Pipe Manual". Bell ends shall be placed uphill unless otherwise permitted.

All flanges shall be fully welded to pipe on both faces, one pass minimum on the inside and two passes minimum on the outside. Pipe linings shall extend to mating faces of flanges and pipe coatings shall extend to backs of flanges, tapered as necessary for installation of bolts and nuts. All exposed steel shall be field coated with an approved bitumastic material.

Special care shall be taken to avoid damaging lining or coating during lowering of pipe into trench and making of field joints. Unless specified otherwise, field joints shall be bell and spigot rubber gasket joints, continuity bonded (two evenly spaced bonding clips per joint minimum). Flanged joints, welded joints, and mechanical joints may be required for particular applications.

After pipe has been set in trench, exterior of spigot and interior of bell shall be thoroughly cleaned. Lubricant as recommended by pipe manufacturer and as approved by the Owner shall be applied to rubber gasket, and said gasket shall then be snapped into place and excess lubricant removed. Lubricant shall be water soluble, nontoxic, shall impart no objectionable taste or odor to water, shall have no deteriorating effects on the rubber gaskets, and shall not support the growth of bacteria.

Before inserting spigots into bells, to make joints, bells shall be hand mortared with quick setting non-shrink commercial grout mixed with an approved bonding agent. Once

spigots have been inserted into bells, joints shall be gauged to ensure that gaskets have been properly seated.

For pipe 24 inches and larger, Contractor shall relieve (equalize) gaskets before laying to prevent gaskets from being tight on one side of pipe and slack on the other side, and adversely affecting seal. Contractor shall lift gaskets with a round blunt tool (like the shaft of a screwdriver) and roll it around the circumference of the spigot end at least once and preferably twice.

For pipe less than 24 inches in diameter, sufficient quantities of moist cement mortar shall be placed on interior joining ends of pipe to completely fill space between respective mortar linings. Moist mortar shall be placed only after respective mortar linings have been properly wetted. Moist mortar shall not be placed against dry mortar linings. Excess mortar shall be removed by drawing an approved pipe cleaning tool through the pipe after joints have been made (pipe sections have been joined). For fully welded joints, pipe sections shall be pulled together and restrained with come-along devices, or hoists with chains and slings, and mortar shall be allowed to set for twenty minutes before welding joint. Once joint has been pulled closed and cleaning tool has been drawn through pipe sections, pipe alignment shall not be adjusted, nor shall pipe be bounced or hammered. Come-along devices, or hoists with chains and slings, shall be removed only after joint has been fully welded.

For pipe 24 inches in diameter and larger, cement mortar shall be placed on interior joining ends from inside pipe after it has been set. Moist mortar shall be applied only after mortar linings have been properly wetted. Moist mortar shall not be placed against dry mortar linings. Excess mortar and debris shall be removed by hand or by other means acceptable to and approved by the Owner.

For cement mortar coated pipe, joint exteriors shall be coated with cement mortar utilizing a joint diaper. Said diaper shall be furnished by pipe manufacturer and shall be centered over joint and securely fastened to pipe. Cement mortar joint mix consisting of one part Portland cement to two parts (by weight) clean, sharp sand, shall contain just enough water to allow mix to be poured into diaper and flow around circumference of joint. Said mix shall be allowed to set prior to backfilling around joint.

Joints shall be completed to provide continuous interior lining and exterior coating. Field lining and coating must equal or exceed shop lining and coating when completed with respect to strength, uniformity, and density and there shall be no voids between lining or coating and steel cylinder.

If cement mortar lining has to be removed, Contractor shall scribe, chisel, and remove the lining using appropriate tools. If cement mortar coating has to be removed, Contractor shall first scribe, then saw cut said coating 3/4 of its thickness, and then remove coating using a chisel driven by a hammer, chipping gun, or other suitable tool. Impact shall be applied parallel with pipe barrel, not perpendicular thereto.

At the end of each day's work, all openings in the pipeline shall be plugged with watertight, expandable plugs or approved equal. Said plugs shall be secured in place so that they cannot be removed by children or animals.

9) Field Welding

Whenever field welding is required, Contractor shall attach welding machine ground to pipe only with clamps or other means acceptable to the Owner unless an alternative means is specified.

Unless specified otherwise, field welded or thrust restrained joints shall consist of flanged joints or fully welded joints. All flanges shall be fully welded to pipe on both faces, one pass minimum on the inside and two passes minimum on the outside. Welded joints shall be made with pipe having ends belled for welding, or alternatively, ends belled for rubber gasket joints, provided pipe manufacturer furnished filler rods of proper diameter, length, and curvature are installed in accordance with pipe manufacturer's recommendations, as approved by Owner. Belled ends shall not be deformed to accomplish fully welded joints. Full welds for all joints shall be accomplished with two welding passes (beads) minimum.

10) Field Cement Mortar Lining and Cement Mortar Coating

Whenever field cement mortar lining and cement mortar coating is permitted by the Owner for either repair or fabrication, Contractor shall comply with the following procedures:

a. Cement Mortar Lining

(1) Contractor shall square the edge of the remaining lining, leaving no feather edge, and shall clean metal surfaces with a stiff wire brush.

(2) Contractor shall apply approved bonding agent to both steel area and edges of adjacent lining. Cement mortar shall then be applied to the area being patched and worked and finished with a trowel until smooth. Contractor shall brush on approved curing compound over the surface of the patch to prevent rapid evaporation of moisture. Otherwise, Contractor shall keep the patched mortar moist by covering it with wet burlap. The pipe shall not be moved until the cement mortar achieves its initial set, not less than three hours.

(3) Cement mortar shall consist of not less than one part cement to three parts sand, thoroughly mixed before any water addition. Cement mortar may be approved commercial, packaged dry mortar mix. Cement mortar shall be mixed separately for each area to be patched. Quantity

of water shall be just sufficient so that when mortar is firmly compressed into a ball, it will hold its shape without slump.

b. Cement Mortar Coating

(1) Exterior coating which requires removal around the complete circumference of the pipe shall be repaired by:

a) Removing the coating by chipping with a hammer or chisel, squaring the edges to accept repair patch.

b) Wrapping the area with 2 x 4 x 14 GA self-furring wire mesh or an approved stucco netting and guniting the area being patched.

or

Wrapping the mesh as above and hand troweling mortar onto the area being patched.

c) Applying an approved curing compound to the patched area.

d) Avoiding movement and protecting the pipe until the cement mortar achieves its initial set, not less than three hours.

(2) Exterior coating that does not extend around the entire circumference of the pipe shall be repaired by:

a) Removing the coating by chipping with a hammer and chisel, squaring the edges to accept repair patch.

b) Applying by brush an approved bonding agent to both the steel area and the edges of the remaining coating.

c) Applying cement mortar to the area being patched and thoroughly compacting it, with finished patch mounding up above and overlapping (at least 1 inch on all sides) the surrounding coating.

d) Applying an approved curing compound to the patched area. If the repair patch is made on pipe in the ditch, it shall be covered with wet burlap, heavy cloth, or similar material, and dirt shall be placed around and over the patched area by hand before proceeding with placing backfill material.

(3) The cement mortar mix proportions shall be the same as for lining repair.

(4) If the area to be patched exceeds over half of the pipe circumference, 2 x 4 x 14 GA self-furring wire mesh or an approved stucco netting shall be attached to the pipe prior to the application of the cement mortar.

c. Installation of Repaired Pipe

After the repaired area has achieved initial set, not less than six hours, the pipe section can be installed, providing the patched area of the coating is backfilled with water saturated or wetted soil.

11. Valves

A. Air Valves

Air valves shall be manufactured in accordance with AWWA C512, latest, except as specified herein or as shown by the standard drawings.

Unless specified otherwise, air valves shall be combination air or combination air and vacuum valves (air, vacuum, and automatic release). They shall permit automatic escape of large quantities of air from pipeline when it is being filled, permit large quantities of air to enter pipeline when it is being emptied, and allow accumulating air to escape while pipeline is in operation and under pressure.

Air valves shall have ductile iron bodies and covers, stainless steel floats rated 1,000 psi minimum, stainless steel internal working parts, stainless steel pressure seats, and white Viton "O" rings or seats. Unless specified otherwise, air valves shall be service rated at cold water working pressure of 300 psi minimum. Unless specified otherwise, resilient seats shall be service rated for 150 psi maximum operating pressure.

Air valve interiors shall be completely fusion bonded epoxy coated (12 mils minimum) in accordance with AWWA C550, latest. The Owner shall approve epoxy coating material and methods before application. Completed coating shall be free from all defects and shall be inspected by use of low voltage holiday detectors and non-destructive thickness gauges.

Air valve inlets shall be flanged or threaded as specified and outlets shall be threaded at the same nominal sizes as the inlets, minimum. Air valves shall be subjected to factory hydrostatic test at pressure equal to 200 percent rated working pressure with no harmful deflections or other defects.

Air valve outlets shall be adequately screened to prevent entrance of foreign substances or materials. Screens shall be installed in accordance with the standard drawings. Where valves contain more than a single outlet, each outlet shall be adequately screened.

Air valves shall be tagged or labeled with the manufacturer's name, size, model number, pressure rating and other specialty features as listed above or as specified by the Owner. Contractor shall provide manufacturer's certification that all materials used in valves produced under AWWA 512, latest, conform with Section 2.1 of said standard.

Air valves shall be kept clean and free from dirt, earth, debris, and other deleterious materials prior to, during, and after installation and construction. Until in operation, each valve shall be protected by the use of an approved canvas or plastic bag or sack completely covering valve and securely fastened to valve riser.

B. Butterfly Valves (Buried Service)

Butterfly valves shall be manufactured in accordance with AWWA C504, latest, except as specified herein or as shown by the standard drawings. Butterfly valves shall be capable of buried service; they shall be equipped with valve boxes in accordance with the standard drawings.

Unless specified otherwise, butterfly valves shall be short laying length pattern with ANSI B16.1 Class 125 flanges. Butterfly valves shall have heavy duty ductile or grey iron bodies in accordance with ASTM A536 and 316 stainless steel edged ductile or grey iron discs. Valve stems, each with

2 inch square operating nut, shall turn counterclockwise to open. Unless specified otherwise, butterfly valves shall be service rated at cold water working pressure of 150 psi minimum.

Valve shafts shall be manufactured of Type 304 stainless steel with stainless steel journals. Valves shall contain synthetic rubber seats (Buna N or equal) mounted in valve bodies. Internal retaining rings and screws used with rubber seats shall be Type 304 (18-8) stainless steel.

Butterfly valves shall be epoxy coated (8 mils minimum) inside and outside in accordance with AWWA C550, latest. The Owner shall approve epoxy coating materials and methods before application. Completed coating shall be free from all defects and shall be inspected by use of low voltage holiday detectors and non-destructive thickness gages.

Butterfly valves shall be tagged or labeled with the manufacturer's name, size, model number, pressure rating and other specialty features as listed above or as specified by the Owner. Contractor shall provide manufacturer's certification that all material used in valves produced under AWWA C504, latest, conform with Section 2.2 of said standard.

C. Gate Valves (Buried Service)

Gate valves shall be manufactured in accordance with AWWA C509, latest, except as specified herein or as shown by the standard drawings. Gate valves shall be capable of buried service; they shall be equipped with valve boxes in accordance with the standard drawings.

Gate valves shall have ductile iron bodies, resilient seats, and ANSI B16.1 Class 125 flanges. Valve stems, each with 2 inch square operating nut, shall be nonrising and shall turn counterclockwise to open. Gate valves shall have "O" ring seals, non-shock cold water working pressure of 200 psi, minimum.

Gate valves shall be fusion bonded epoxy coated (8 mils minimum) inside and outside in accordance with AWWA C550, latest. The Owner shall approve epoxy coating materials and methods before application. Completed coating shall be free from all defects and shall be inspected by use of low voltage holiday detecting and non-destructive thickness gauges.

Gate valves shall be tagged or labeled by the manufacturer with the manufacturer's name, size, model number, pressure rating and other specialty features as listed above or as specified by the Owner. Contractor shall provide manufacturers certification that all materials used in valves produced under AWWA C509, latest, conform with Section 2.1 of said standard.

12. Services

A. Service Taps

Service taps shall be on line with meter boxes which shall be perpendicular to mains. Service and other taps shall be made not closer than 2 feet to a bell, coupling, joint, fitting, or other service. Service taps will be permitted only where complete services are to be installed. Under no circumstances will Contractor be allowed to tap existing mains which are in service. Contractor shall tap existing mains only when said mains are out of service and only when specifically permitted by the Owner.

1) Ductile Iron Pipe Mains

Service outlets may be directly tapped and threaded (AWWA tapered threads) into mains for 1 inch outlets on all mains, regardless of size, and for 2 inch outlets on mains 16 inches and larger. Service outlets for 2 inch outlets on mains 12 inches and smaller shall be accomplished with double strap bronze service saddles with iron pipe threads. Alternatively, double strap bronze service saddles with iron pipe threads may be used on all mains, regardless of size, subject to Owner's approval.

2) Welded Steel Pipe Mains

Service taps shall be made with couplings welded to the pipe, either during pipe fabrication or field construction, as shown by the standard drawings. Tapping shall be accomplished with a shell cutter. Care shall be exercised to minimize damage to linings and coatings. Damaged linings and coatings shall be repaired or replaced.

3) Testing and Disinfection

Service taps used for testing and disinfection shall comply with service tap requirements for ductile iron or welded steel pipe, whichever is applicable. Unless specified otherwise, they shall be made at top of pipe. Once testing and disinfection have been completed, they shall be plugged. Plug threads shall be wrapped with Teflon tape and plugged tap shall then be coated with approved bitumastic material.

B. Services Extensions

In addition to a service tap, each service shall include a corporation stop, service pipe, a meter stop, a meter box, and all other materials specified by the standard drawings. Unless specified otherwise, service piping shall be continuous from corporation stop to meter stop; it shall not be spliced.

C. Meter Boxes

Meter boxes shall be equal to and interchangeable with those shown on the standard drawings and shall be installed as shown on the standard drawings. They shall be set true to line and grade and shall be flush with concrete curbs and sidewalks.

Meter boxes shall be installed whenever services are installed, even prior to construction of street improvements including concrete curbs and sidewalks. Meter boxes shall be brought to grade upon construction of concrete curbs and sidewalks.

D. Meter Installation

Except as otherwise indicated on the construction drawings or as specified by the Owner, all meters shall be installed by the Owner following application for service in accordance with the Owner's regulations governing water service and any amendments thereto.

13. Field Hydrostatic Test and Leakage Test

A. Hydrostatic Test

Upon completion of pipeline construction and at least seven days after last concrete thrust device has been placed, pipelines and appurtenances constituting the Work shall be filled with water for twenty-four hours minimum. During filling, Contractor shall see that all air valves are open and operating. After pipelines have been completely filled, they shall be allowed to stand for twelve hours minimum under slight pressure for sufficient time to permit all air to escape. During that same period, Contractor shall examine all fittings, flanges, handholes, and connections for leaks. If any leaks are found, they shall be eliminated.

Test pressure, 225 psi minimum for Class 150 pipe and 150 percent of pipe class for other classes of pipe, shall then be applied to test sections as directed by the Owner. Test pressures shall be maintained for four hours minimum. Test sections will be selected which give, as nearly as possible, constant pressure throughout section being tested. Normally test pressures will be measured at lowest elevations.

B. Leakage Test

After pressure test has been satisfactorily completed, pipelines and appurtenances shall be tested for leakage at pressure equal to the pressure class of pipe. Contractor shall test pipelines and appurtenances in test sections as designated by the Owner and required pressures shall be maintained for two hours minimum during which time leakage shall be accurately measured.

Measured leakage shall not exceed the limits set by the following formula unless otherwise specified by the construction drawings.

$$L = \frac{ND(P)^{1/2}}{5000}$$

L is the allowable leakage in gallons per hour for section of pipeline being tested; N is the number of joints (rubber gasket, flanged, or mechanical joints, not swedged or banded lap welded joints) where leakage could occur in the section of pipeline being tested; D is the nominal diameter (inches) of the pipeline being tested; and P is the weighted average test pressure (psi gauge) within the section of pipeline being tested during the leakage test.

C. General Requirements

1) Required test pressures shall be applied by pump connected to pipeline sections being tested. The Owner shall approve pump connections to pipeline before testing begins. As part of the Work, and unless specified otherwise, Contractor shall install, at his expense, top outlets (service taps) required for testing.

   Contractor shall provide calibrated meters for measurement of leakage, and all pumps, piping, fittings, bulkheads, plugs, valves, gages, power equipment, and manpower necessary for conducting all tests required, all at his expense. Contractor shall furnish the Owner three copies of all records of all tests performed.

2) Unless specified otherwise, Contractor shall test against test plates for pipelines 12 inches and smaller. Contractor shall not remove said test plates until pipelines have been tested, disinfected, and accepted by the Owner.

3) Contractor, at his expense, shall locate and repair leaks or other defects which may develop or become apparent during test. Contractor shall excavate, including removal of backfill already placed, and make all repairs necessary for required water tightness, and then replace all excavated material, after which Contractor shall retest repaired pipeline section. Pipeline sections shall be repeatedly repaired and tested until they meet requirements set forth herein.

4) Pipe manufacturer and fitting manufacturer shall have free access to the Work during testing. Any improper act on the part of Contractor which the pipe and fitting manufacturer may observe shall be reported to the Owner. Pipe and fitting manufacturer shall be free to observe and verify all tests.

5) After completed pipeline and appurtenances or test sections have successfully met test requirements to the satisfaction of the Owner, the entire pipeline or each test section shall be filled or shall remain filled with water until completion of the Work, unless otherwise ordered by the Owner.

14. Disinfection of Pipelines and Appurtenances

Contractor shall furnish all equipment, labor, and materials for the proper disinfection (chlorination and flushing) of all pipelines and appurtenances. As part of the Work, and unless specified otherwise, Contractor shall install, at his expense, top outlets (service taps) for required disinfection and sampling. Testing and disinfection must be completed before any pipelines are connected to the existing system.

Contractor may disinfect pipelines and appurtenances either before or after they have been subjected to hydrostatic and leakage tests, unless specified otherwise. If Contractor elects to disinfect before hydrostatic and leakage tests, and he must repair or replace pipelines as a result of said hydrostatic or leakage tests, Contractor shall again disinfect all or portions of the previously tested pipelines.

Disinfection shall conform with provisions of AWWA C651, latest. The chlorinating agent, liquid chlorine or chlorine gas, shall be applied or injected as approved by the Owner at locations no more than 10 feet from existing water system as selected by or designated by the Owner. Concentration of the dosage applied to the water within the pipeline shall be at least 50 ppm and it shall not exceed 200 ppm.

Chlorinated water must be retained in the pipeline long enough to destroy all non-spore-forming bacteria. Said period shall be at least 24 hours but not more than 72 hours. After the chlorine-treated water has been retained for the required time, the chlorine residual at the pipe extremities and at other representative locations shall be at least 25 ppm.

Following chlorination, Contractor shall flush all pipelines and appurtenances in the manner and with the procedure prescribed or approved by the Owner. During flushing, all valves shall be in full open free discharge position. Flushing shall continue until all chlorine, debris, and foreign materials have been removed from pipelines and appurtenances.

If so directed by the Owner, Contractor shall remove portions of certain appurtenances such as air valve installations, blowoff installations, and service installations in order to accomplish complete flushing; Contractor shall replace same without adversely affecting disinfected pipelines and appurtenances.

Following flushing, water shall be maintained in the pipeline for at least twenty-four hours, thereafter, bacteriological samples shall be taken and analyzed by a certified independent laboratory as approved by the Owner. If initial treatment fails to produce satisfactory disinfection as evidenced by bacteriological analysis, chlorination and flushing shall be repeated until acceptable results have been obtained.

Contractor shall arrange and pay for chlorine residual and bacteriological quality tests. Contractor shall obtain the Owner's prior approval of the times, places, locations, and numbers of samples or tests. The Owner shall witness all sampling. Contractor shall provide an Affidavit of Compliance (in triplicate) to the Owner evidencing satisfactory disinfection.

Following disinfection, pipelines and appurtenances shall remain isolated from any operational water system facilities until evidence has been submitted to the Owner demonstrating that said pipelines and appurtenances have been adequately and properly disinfected. Said evidence shall consist of aforementioned Affidavits of Compliance together with said bacteriological test results, as submitted by the approved certified laboratory. Normally, said pipelines and appurtenances shall be isolated for at least 48 hours, longer if so determined by the Owner.

15. Conductor Casings and Carrier Pipes

Wherever required, conductor casings shall be installed. Said casings shall be comprised of either welded steel pipe or reinforced concrete pipe, as specified. Conductor casings shall be bored and jacked into place unless open trench installations are permitted; conductor casings shall not be sluiced or jetted into place. Conductor casings shall be bored and jacked into place from one direction only.

Conductor casings shall be installed to the lines, grades, and depths specified. Unless specified otherwise, Contractor will be permitted a tolerance from horizontal alignment and from vertical alignment of 0.5 percent of conductor length but no more than 1 foot maximum regardless of conductor length.

Unless specified otherwise, methods and equipment used shall be as selected by Contractor and as approved by the Owner. Said approval shall not relieve Contractor of any responsibility with regard to conductor casing construction. Conductor casings shall have minimum inside diameters at least 12 inches larger than maximum outside diameters of carrier pipes.

Prior to any boring and jacking operations, Contractor shall submit to the Owner a construction plan consisting of a schedule of operations, details of methods of construction, types of equipment to be used, details of boring and jacking pit including lengths, widths and depths, and shoring and bracing. Said construction plan shall be approved as to sufficiency by the Owner before any construction is commenced.

Boring and receiving pits shall be shored in accordance with OSHA standards. A 6 foot high chain link fence shall be erected around said pits and said pits shall be protected with Type K barriers. Barriers shall be placed to direct traffic around the pits.

Prior to constructing pits, Contractor shall excavate both sides of each crossing to determine exact locations of facilities to be crossed (horizontal and vertical). Contractor shall adjust casing locations to accommodate crossings based on Contractor's field measurements.

Contractor shall schedule his operation to prevent pits from being open on weekends or holidays. Contractor shall provide traffic control around the pits in accordance with Contractor's approved traffic control drawings.

Contractor shall take all necessary precautions to prevent subsidence of or lifting of existing roadbeds, roadways, and pavements during or following installation of conductor casings. Material excavated during boring and jacking operations shall be removed carefully so as to avoid caving. Voids created during boring and jacking shall be grouted with an approved grout from within the casing once the casing has been installed. Couplings shall be welded to steel casing to permit grouting. Following grouting, threaded plugs shall be inserted into said couplings.

After conductor casing has been constructed, carrier pipe shall be equipped with approved plastic or steel casing isolators or spacers of uniform size and spacing and then installed in conductor casing in accordance with aforementioned construction plan as approved by the Owner. Annulus between conductor casing and carrier pipe shall be filled with sand and the ends shall be capped with plastic or steel end seals or plugged with brick and mortar. Weepholes shall be placed in the bottoms of the end seals or brick and mortar plugs.

Contractor shall backfill boring and jacking pits with material specified for pipeline backfill. Said backfill material shall be compacted to the relative compaction specified which shall be not less than 90%. Contractor shall remove conductor casing and carrier pipe remnants, shoring materials, asphalt, concrete and all other Work related debris. Contractor shall restore paved surfaces.

16. Miscellaneous Requirements

A. Connections to Existing Watermains

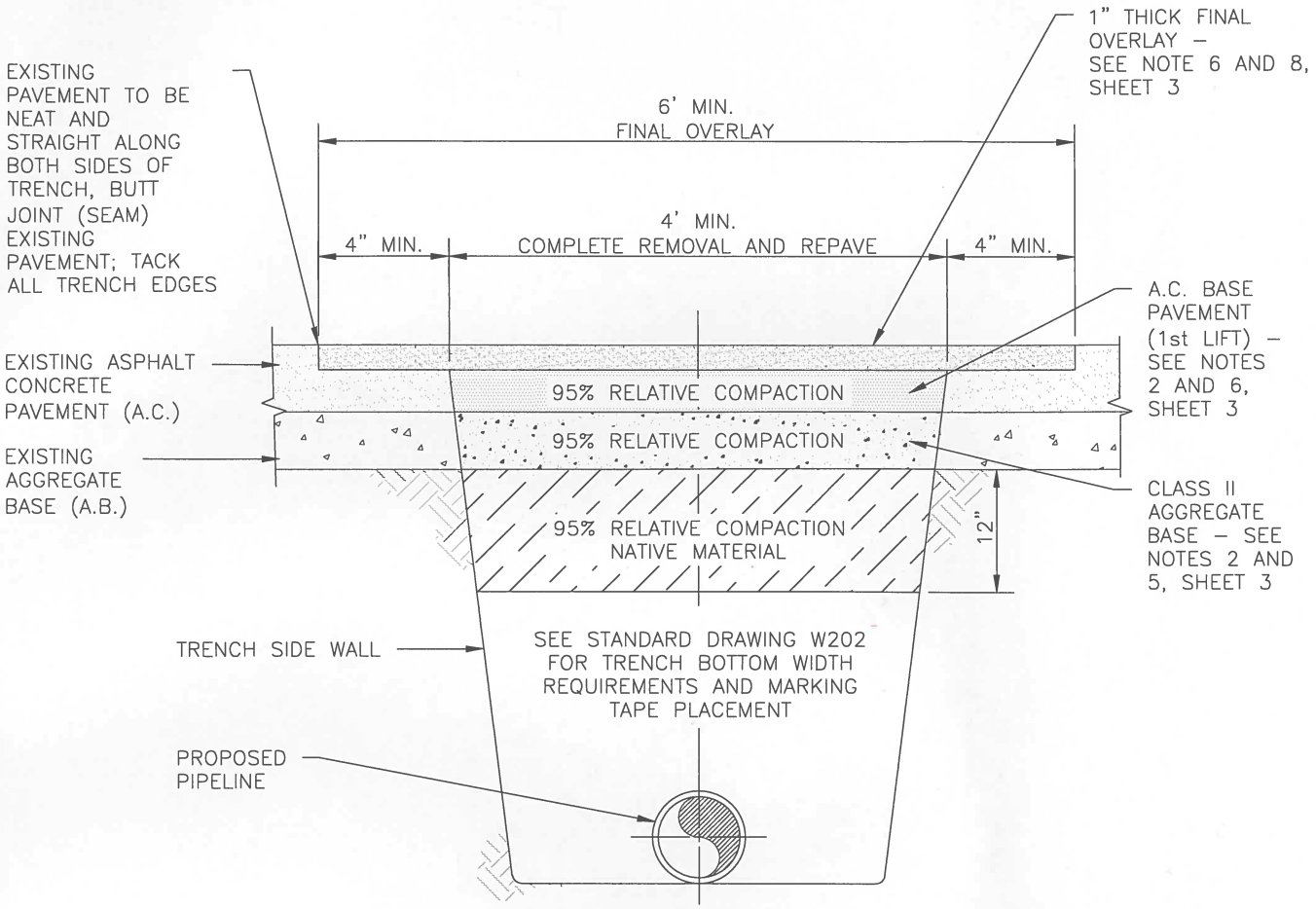
The Owner will make all connections to existing watermains except where otherwise specified. Where a gate valve is required but not specified, the Owner will install gate valve but will not guarantee it against field hydrostatic and leakage test.

To safeguard against failure of the Owner's valve, Contractor may at his option install a test plate for the aforementioned test and, after satisfactory test, remove said test plate and replace it with a

1/8 inch thick minimum ring gasket. The use of any other test appurtenances shall be as approved by the Owner.

B. Field Painting

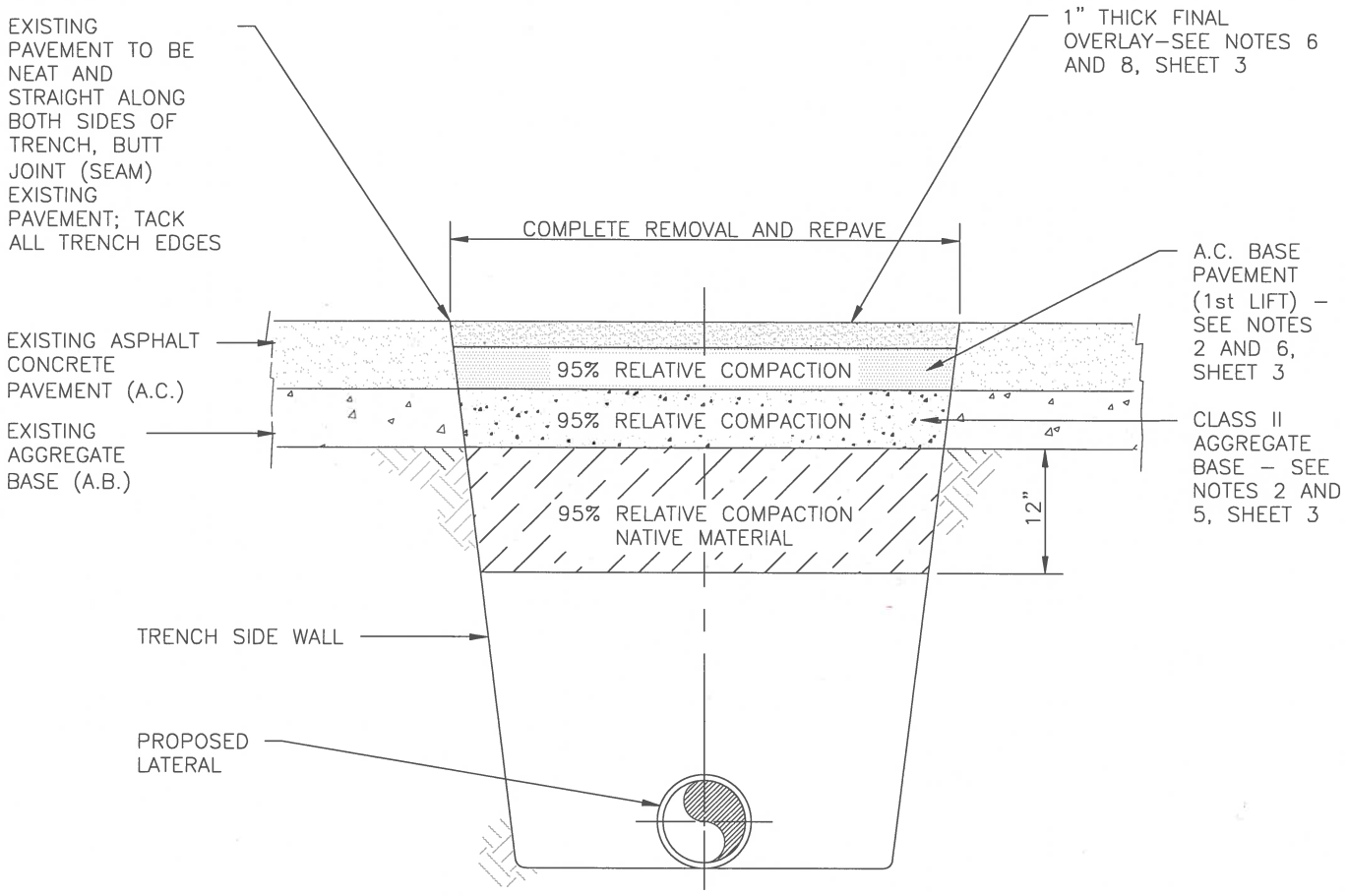
Contractor shall field paint all aboveground, bare, or exposed piping and appurtenances in accordance with the applicable specifications and drawings.



TYPICAL TRENCH SECTION

SEE DWA STD DWG W201, SHEET 3 FOR NOTES

APPROVED 3/31/2020 Mark A Krause RCE. 46700 GENERAL MANAGER, CHIEF ENGINEER			**DESERT WATER**
			TRENCH PAVEMENT REPLACEMENT
REVISION	BY	DATE	STANDARD DRAWING **W201** SHEET 1 OF 3



TYPICAL LATERAL TRENCH SECTION

SEE DWA STD DWG W201, SHEET 3 FOR NOTES

APPROVED 3/31/2020

Mark L Krause RCE. 46700

GENERAL MANAGER, CHIEF ENGINEER

REVISION	BY	DATE

DESERT WATER

LATERAL TRENCH PAVEMENT REPLACEMENT

STANDARD DRAWING

W201

SHEET 2 OF 3

NOTES

1) UNLESS OTHERWISE SPECIFIED IN CONTRACT DOCUMENTS, THIS STANDARD IS TO BE USED WITHIN THE CITY OF PALM SPRINGS AND/OR CITY OF CATHEDRAL CITY BOUNDARIES.

2) ALL ASPHALT CEMENT (A.C.) PAVEMENT AND AGGREGATE BASE (A.B.) SHALL BE COMPACTED TO 95% RELATIVE COMPACTION, MINIMUM.

3) PRIOR TO PIPELINE INSTALLATION, CONTRACTOR SHALL GRIND PIPELINE MAINLINE TRENCH PAVEMENT A MINIMUM OF 4' IN WIDTH. WHERE TRENCH EDGES SLUFF AND PAVEMENT BREAKS AWAY DURING THE COURSE OF CONSTRUCTION, IT SHALL BE SAW CUT PRIOR TO PERMANENT PAVEMENT REPAIR.

4) REMOVE AND REPLACE EXISTING ASPHALT CEMENT (A.C.) PAVEMENT (EXCLUDING AGGREGATE BASE (A.B.)) WHICH IS LESS THAN 3' IN WIDTH BETWEEN TRENCH EDGE AND EDGE OF CURB, GUTTER, OR EDGE OF PAVEMENT.

5) IF EXISTING AGGREGATE BASE IS REMOVED, CONTRACTOR SHALL REPLACE COMPACTED AGGREGATE BASE LAYER IN KIND AND DIMENSION. IF AGGREGATE BASE IS NOT PRE-EXISTING, CLASS II AGGREGATE BASE MATERIAL SHALL BE INSTALLED BASED ON THE LOCAL JURISDICTION'S STREET DESIGNATION.

6) UNLESS OTHERWISE SPECIFIED, THE FINAL OVERLAY SHALL BE PLACED AFTER ALL PIPELINE WORK IS COMPLETED. THE CONTRACTOR SHALL FLUSH PAVE THE 1st LIFT. THE COMPACTED A.C. PAVEMENT SECTION SHALL BE 4" THICK MINIMUM WHEN EXISTING PAVEMENT IS 4" THICK OR LESS. THE COMPLETED A.C. PAVEMENT SECTION SHALL BE 1" THICKER THAN EXISTING WHEN EXISTING IS GREATER THAN 4" THICK. THE 1st LIFT SHALL BE B PG 70-10 A.C. PAVEMENT. THE FINAL OVERLAY SHALL BE D2 PG 70-10 PLACED 1" THICK. THE FINAL OVERLAY SHALL BE INSTALLED USING A BARBER GREENE, OR APPROVED EQUAL. IF APPROVED BY THE AGENCY, CONTRACTOR MAY, IN ONE OPERATION, PLACE THE 1st LIFT AND FINAL OVERLAY.

7) THE FINAL OVERLAY FOR THE MAINLINE TRENCH SHALL EXTEND IN WIDTH 4" MINIMUM BEYOND THE TRENCH EDGES. IN NO CASE SHALL THE FINAL OVERLAY WIDTH FOR THE MAINLINE TRENCH BE LESS THAN 6' IN WIDTH.

8) A.C. PAVEMENT SHALL BE ¼ INCH ABOVE LIP OF GUTTER IN ACCORDANCE WITH CITY AND AGENCY STANDARDS.

9) AFTER FINAL PAVING HAS BEEN COMPLETED, CONTRACTOR SHALL APPLY TACK IN NEAT, STRAIGHT LINES ALONG ALL MAINLINE AND LATERAL TRENCH EDGES.

APPROVED 3/31/2020 Mark A Krause RCE. 46700 GENERAL MANAGER, CHIEF ENGINEER			DESERT WATER
			TRENCH PAVEMENT REPLACEMENT NOTES
REVISION	BY	DATE	

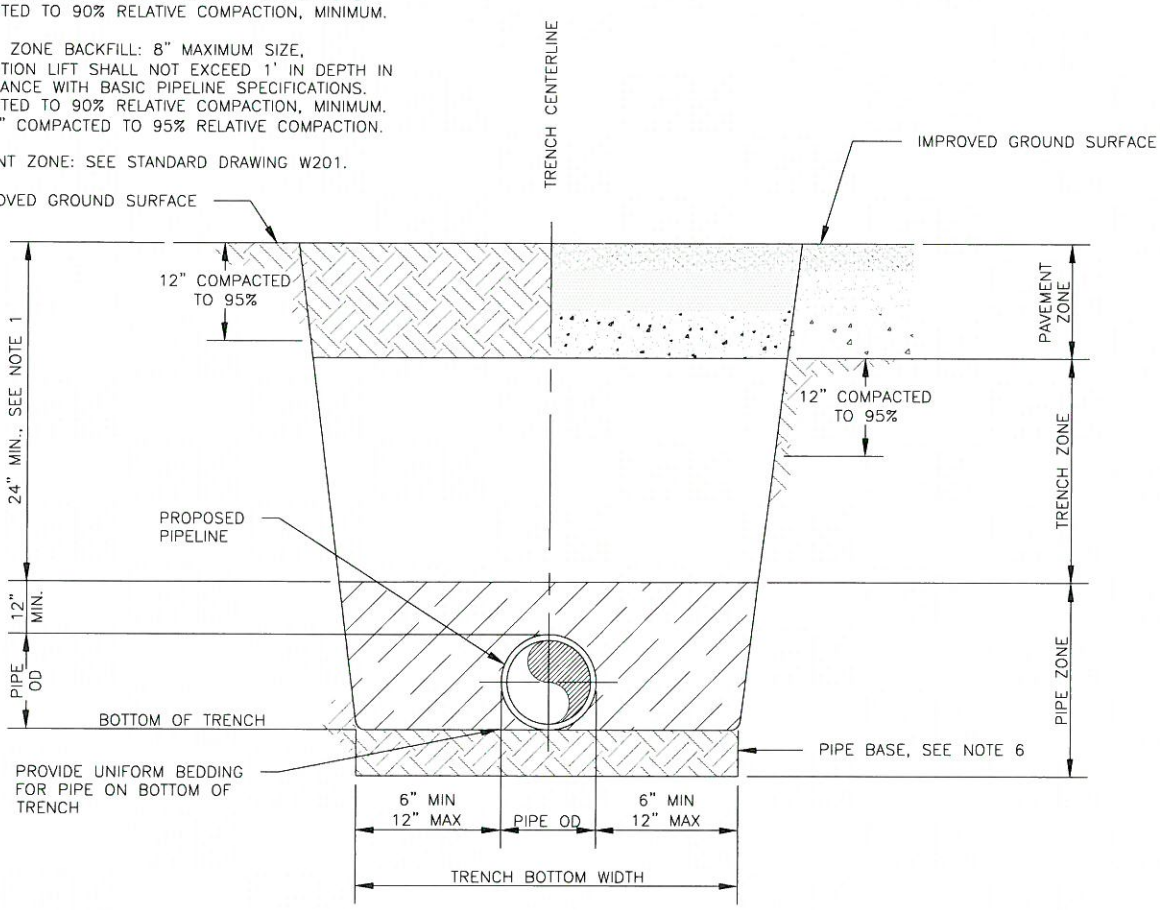
STANDARD DRAWING

W201

SHEET 3 OF 3

BACKFILL CRITERIA

- PIPE ZONE BACKFILL: 1" MAXIMUM SIZE IN ACCORDANCE WITH BASIC PIPELINE SPECIFICATIONS. COMPACTED TO 90% RELATIVE COMPACTION, MINIMUM.
- TRENCH ZONE BACKFILL: 8" MAXIMUM SIZE, COMPACTION LIFT SHALL NOT EXCEED 1' IN DEPTH IN ACCORDANCE WITH BASIC PIPELINE SPECIFICATIONS. COMPACTED TO 90% RELATIVE COMPACTION, MINIMUM. TOP 12" COMPACTED TO 95% RELATIVE COMPACTION.
- PAVEMENT ZONE: SEE STANDARD DRAWING W201.

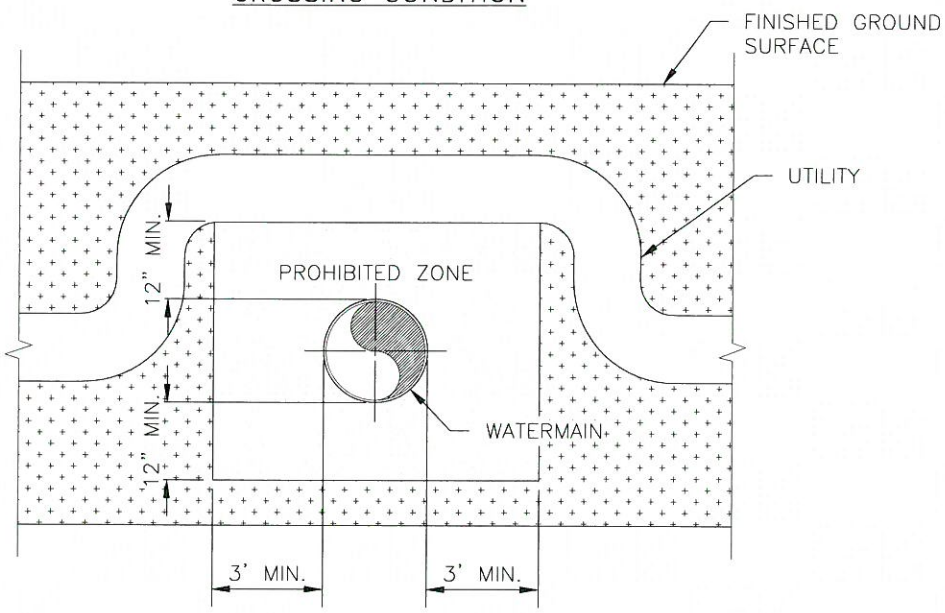


NOTES

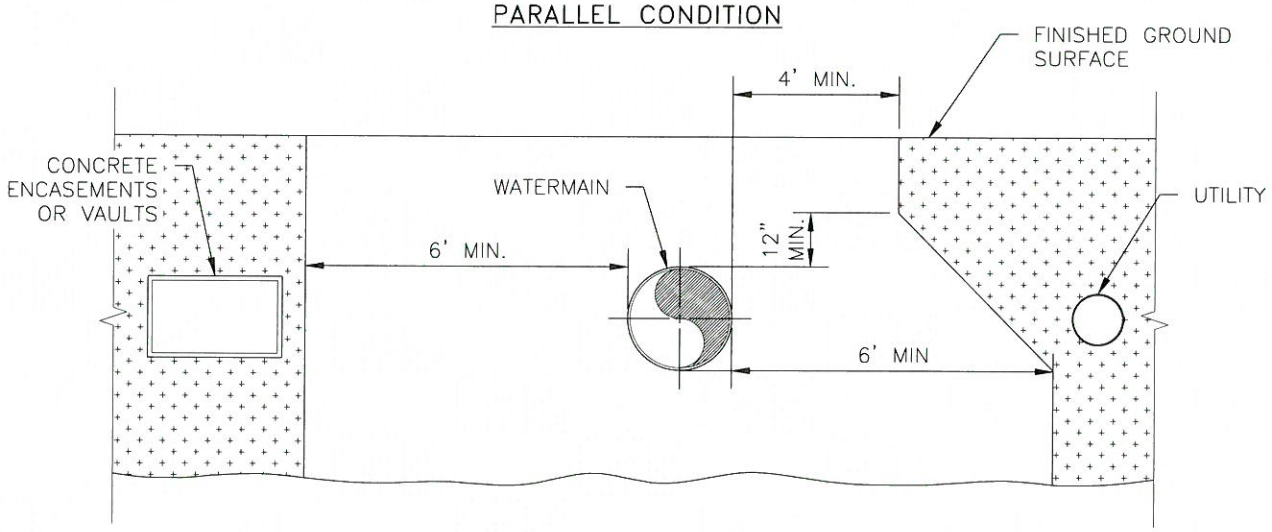
1) PIPELINE COVER SHALL BE 36" MINIMUM FOR PIPE OD 8" OR LESS UNLESS SPECIFIED OTHERWISE. PIPE OD 12" OR LARGER MAY BE SPECIFIED AT A GREATER DEPTH BY DESERT WATER AGENCY ENGINEERING.
2) TRENCH SIDES SHALL BE SLOPED OR SHORED IN ACCORDANCE WITH CAL OSHA CONSTRUCTION SAFETY ORDERS FOR TRENCH DEPTHS 5' AND GREATER.
3) ALL EXISTING PAVEMENT SHALL BE SAWCUT PRIOR TO TRENCHING, AND WHERE TRENCH SIDES SLUFF AND PAVEMENT BREAKS AWAY, IT SHALL BE SAWCUT PRIOR TO PERMANENT PAVEMENT REPAIR.
4) WHENEVER EXISTING CURBS ARE BEING USED FOR GRADE CONTROL, PIPELINES SHALL BE LAID ON PROJECTED CONTINUOUS SLOPES THROUGH LOCALIZED HILLS, HUMPS, AND MOUNDS AS AT STREET INTERSECTIONS AND CHANNEL BERMS. PIPELINE GRADES SHALL BE SELECTED TO MAINTAIN MINIMUM COVER WITH CONTINUOUS PIPELINE SLOPE. PIPELINE TRENCH DEPTHS SHALL BE INCREASED TO ACCOMPLISH SAME AND PIPELINE COVER SHALL BE INCREASED ACCORDINGLY.
5) REFER TO STANDARD DRAWING W203 AND STANDARD DRAWING W204 FOR UTILITY SEPARATION REQUIREMENTS.
6) WHERE BOTTOM OF EXCAVATION IS IN ROCK OR UNSUITABLE SOIL WHICH CANNOT BE EXCAVATED TO PROVIDE UNIFORM BEDDING FOR THE PIPE, TRENCH SHALL BE OVER EXCAVATED 8" MINIMUM AND REFILLED WITH SELECT EXCAVATED MATERIAL OR IMPORTED BACKFILL MATERIAL COMPACTED TO 90% MINIMUM RELATIVE COMPACTION.

APPROVED	3/31/2020	DESERT WATER	STANDARD DRAWING
Mark A Krause	RCE. 46700		
GENERAL MANAGER, CHIEF ENGINEER			
		PIPELINE TRENCH	W202
REVISION	BY DATE		SHEET 1 OF 1

CROSSING CONDITION



PARALLEL CONDITION



NOTES

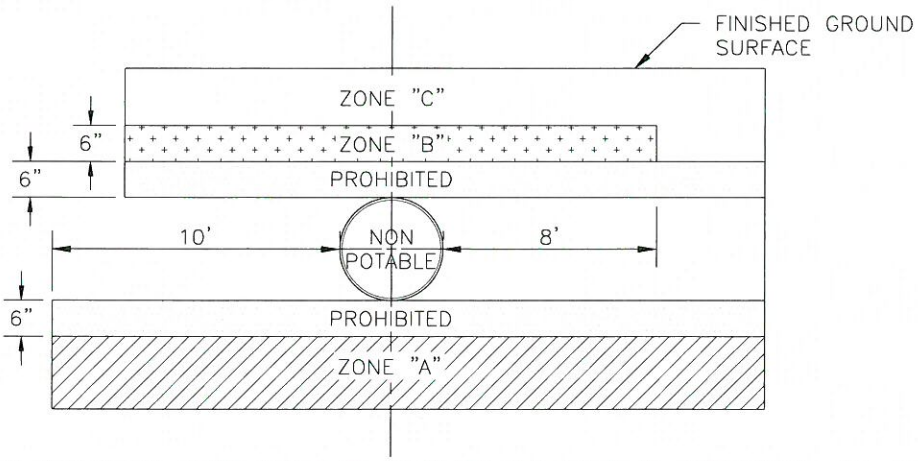
1) CHANGES MAY BE PERMITTED BY THE AGENCY IN CASES OF CONFLICTING FACILITIES.

2) FOR SEWER/NON-POTABLE SEPARATION, REFER TO STD DWG W204 FOR WATER MAIN AND NON-POTABLE WATER SEPARATION.

3) ALL MAINLINE OR SIDE OUTLET VALVES SHALL BE LOCATED THREE (3) FEET MINIMUM FROM ANY CURB FACE.

APPROVED	3/31/2020	DESERT WATER	STANDARD DRAWING
Mark A Krause GENERAL MANAGER, CHIEF ENGINEER	RCE. 46700		W203
		UTILITY SEPARATION	
REVISION	BY / DATE		SHEET 1 OF 1

EXISTING NON-POTABLE PIPE CROSSING CONDITION



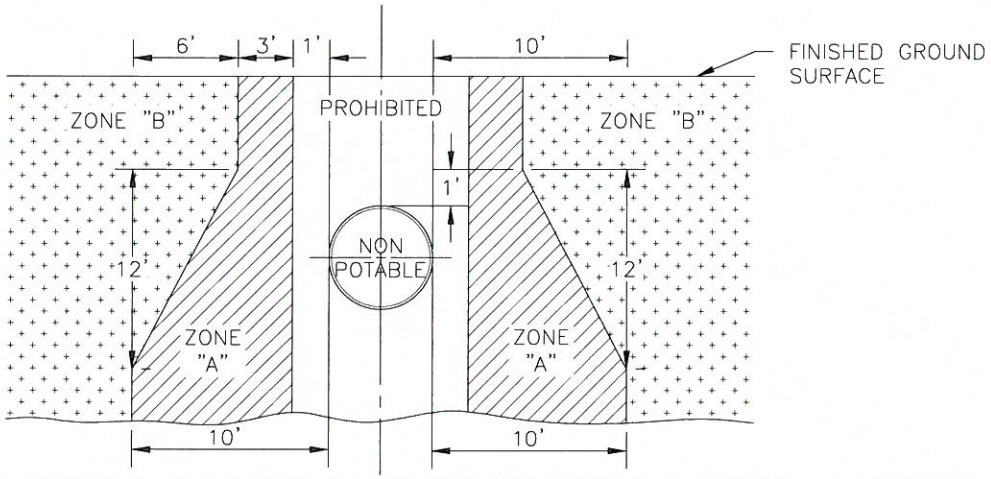
CROSSINGS LESS THAN 45° HORIZONTAL ANGLE SHALL BE INSTALLED PER PARALLEL CONDITIONS. ALL MAINS TO BE INSTALLED PER DWA BASIC PIPELINE SPECIFICATION FOR DUCTILE IRON PIPE WITH BITUMINOUS COATING.

ZONE "A" –NO CONNECTION JOINTS FOR 10' ON EITHER SIDE OF NON-POTABLE PIPE.

ZONE "B" –NO CONNECTION JOINTS FOR 8' ON EITHER SIDE OF THE-NON POTABLE PIPE. (AS PERMITTED BY AGENCY)

ZONE "C" –NO SPECIAL CONDITIONS REQUIRED.

EXISTING NON-POTABLE PIPE PARALLEL CONDITION



CROSSINGS LESS THAN 45° HORIZONTAL ANGLE SHALL BE INSTALLED PER PARALLEL CONDITIONS. ALL MAINS TO BE INSTALLED PER DWA BASIC PIPELINE SPECIFICATION FOR DUCTILE IRON PIPE WITH BITUMINOUS COATING.

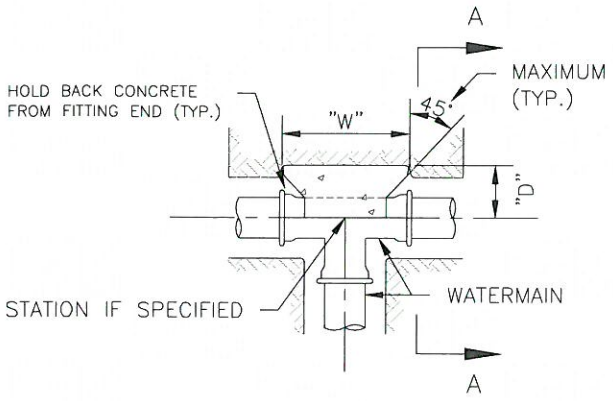
ZONE "A" –NO WATER MAINS SHALL BE CONSTRUCTED WITHOUT SPECIAL PERMISSION FROM STATE DEPARTMENT OF HEALTH SERVICES.

ZONE "B" –NO SPECIAL CONDITIONS REQUIRED.

NOTE: NON-POTABLE – CONVEYING UNTREATED, PRIMARY OR SECONDARY TREATED SEWAGE, DISINFECTED SECONDARY OR TERTIARY RECYCLED WATER, HAZARDOUS FLUIDS & STORM DRAINAGE, ETC.

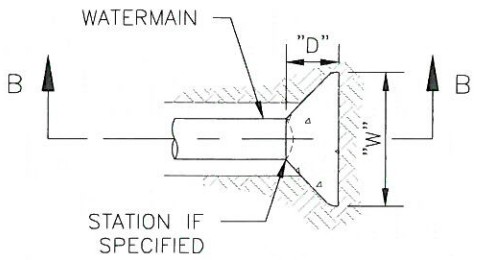
APPROVED 3/31/2020 Mark L Krause GENERAL MANAGER, CHIEF ENGINEER RCE. 46700			**DESERT WATER**	STANDARD DRAWING **W204**
			WATER MAIN & NON -POTABLE SEPARATION	
REVISION	BY	DATE		SHEET 1 OF 1

TEE

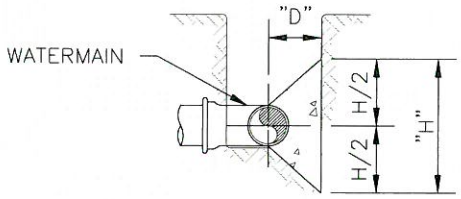


PLAN

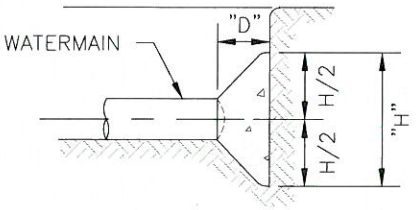
END



PLAN

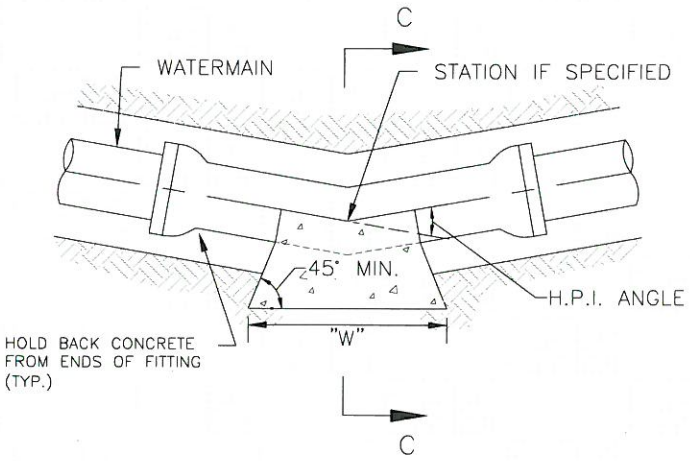


SECTION A–A

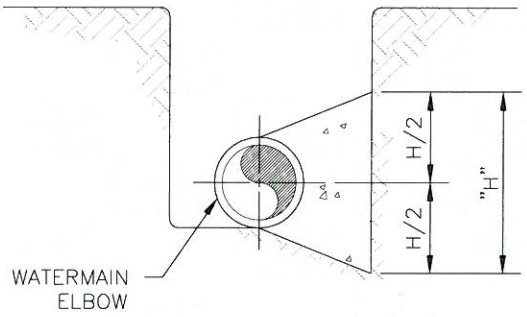


SECTION B–B

HORIZONTAL BEND



PLAN



SECTION C–C

NOTE: RESTRAINED JOINTS REQUIRED FOR DUCTILE IRON WATERMAINS. SEE STD DWG W221 FOR DISTANCES.

APPROVED 3/31/2020

Mark L Krause
GENERAL MANAGER,
CHIEF ENGINEER

RCE. 46700

REVISION	BY	DATE

DESERT WATER

THRUST BLOCK DETAIL

STANDARD DRAWING

W205

SHEET 1 OF 2

TEE AND END

BLOCK DIMENSIONS													
PIPE SIZE (INCHES)	6	8	10	12	14	16	18	20	24	27	30	33	36
"H" (FEET)	2.0	2.5	3.0	3.30	3.8	4.2	4.7	5.0	5.3	5.5	5.8	6.0	6.3
"W" (FEET)	2.0	2.5	3.0	4.0	4.5	5.0	5.5	6.0	7.8	9.0	10.0	11.3	12.3
"D" (FEET)	1.0	1.0	1.0	1.3	1.5	1.5	1.8	2.0	2.0	2.0	2.0	2.0	2.0

HORIZONTAL BEND

BLOCK DIMENSIONS									
PIPE SIZE (INCHES)	6	8	10	12	14	16 & 18	20 & 24	27 & 30	33 & 36
H.P.I. (DEG)	5–12	5–12	5–12	5–12	5–12	5–12	5–12	5–12	5–12
	13–38	13–38	13–38	13–38	13–38	13–38	13–38	13–30	13–30
	39–63	39–63	39–63	39–63	39–63	39–63	39–63	31–44	31–44
	64–90	64–90	64–90	64–90	64–90	64–90	64–90	45–63	45–63
								64–90	64–90
H (FEET)	1.0	1.0	1.0	2.5	2.0	2.5	3.0	3.5	4.0
	1.5	2.0	2.0	3.0	3.0	4.0	5.0	5.5	6.5
	2.0	2.0	3.0	3.0	3.5	4.5	5.0	5.5	6.5
	2.0	2.0	3.0	3.0	4.0	4.5	5.0	6.0	6.5
								6.0	6.5
W (FEET)	1.0	1.5	2.0	2.0	2.0	2.5	3.0	3.5	4.0
	1.5	2.0	3.0	3.0	4.0	4.5	5.2	5.5	6.5
	2.0	3.0	3.1	4.5	6.0	6.0	8.5	8.0	9.0
	2.5	4.0	4.2	6.0	8.0	8.0	11.6	10.0	12.3
								13.8	16.7

NOTES

1) USE OF THRUST BLOCKS INSTEAD OF RESTRAINED JOINTS REQUIRES AGENCY APPROVAL AND WILL BE EVALUATED ON A CASE BY CASE BASIS.

2) CONCRETE SHALL BE CLASS C (2,000 PSI MIN.) IN ACCORDANCE WITH BASIC CONCRETE SPECIFICATIONS. THRUST BLOCK DIMENSIONS SHOWN ARE MINIMUM.

3) THRUST BLOCKS SHALL BE FORMED WITH TRIMMED EARTH, SAND BAGS, OR LUMBER TO ACHIEVE REQUIRED CONFIGURATION. ALL LUMBER SHALL BE REMOVED PRIOR TO BACKFILLING.

4) THRUST BLOCKS SHALL BEAR AGAINST UNDISTURBED EARTH OR REPLACED EARTH HAVING 95% RELATIVE COMPACTION, MINIMUM.

5) BACKFILL AROUND AND OVER BLOCKS SHALL BE COMPACTED TO 95% RELATIVE COMPACTION, MINIMUM.

6) COMPACTED EARTH SHALL EXTEND TO DEPTH AND WIDTH (W) OF BLOCK AND TO DISTANCE W/2 BEFORE AND PAST BLOCK. THRUST BLOCK SHALL NOT EXCEED 10% OF BLOCK DIMENSIONS.

APPROVED 3/31/2020

Mark A Krause RCE. 46700

GENERAL MANAGER, CHIEF ENGINEER

REVISION	BY	DATE

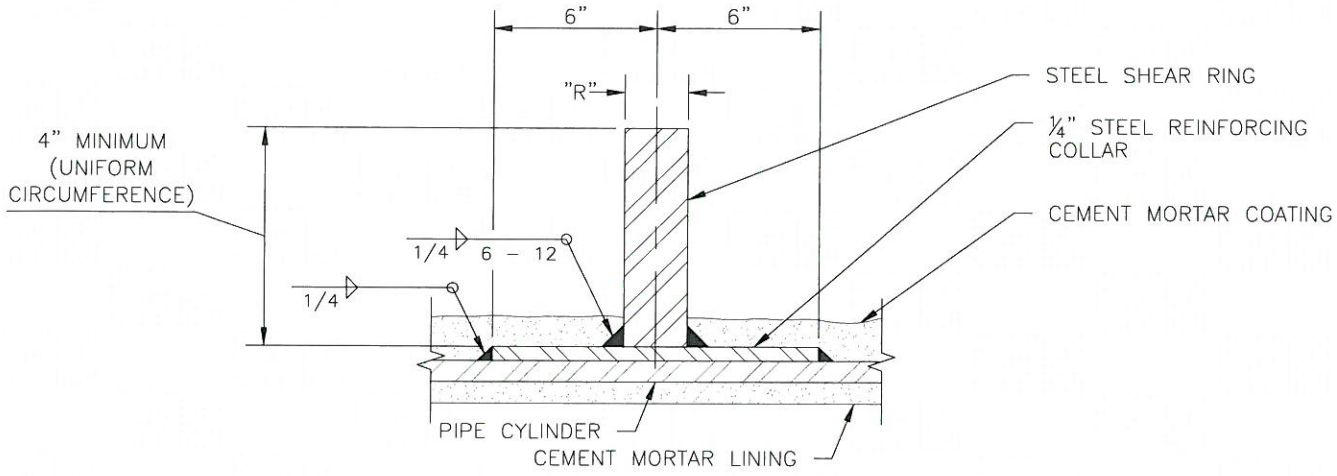
DESERT WATER

THRUST BLOCK DIMENSIONS AND NOTES

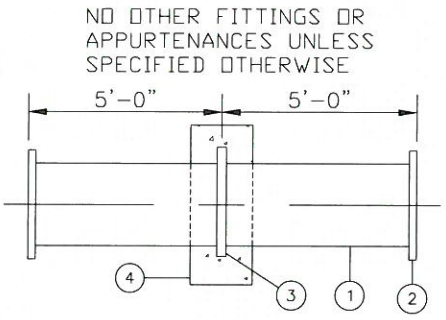
STANDARD DRAWING

W205

SHEET 2 OF 2



TYPICAL SHEAR RING DETAIL



SHEAR SPOOL – STEEL PIPE

ITEM	QTY	DESCRIPTION	APPROVED MATERIALS LIST
1	1	CEMENT MORTAR LINED AND CEMENT MORTAR COATED WELDED STEEL PIPE, UNLESS OTHERWISE SPECIFIED.	A–01/D–01
2	2	FLANGE	C–01
3	1	STEEL SHEAR RING. SEE DETAIL ABOVE HEREON.	N/A
4	1	SHEAR RING THRUST BLOCK. SEE SHEET 2.	N/A

APPROVED 3/31/2020

Mark L Krause
GENERAL MANAGER, CHIEF ENGINEER

RCE. 46700

REVISION	BY	DATE

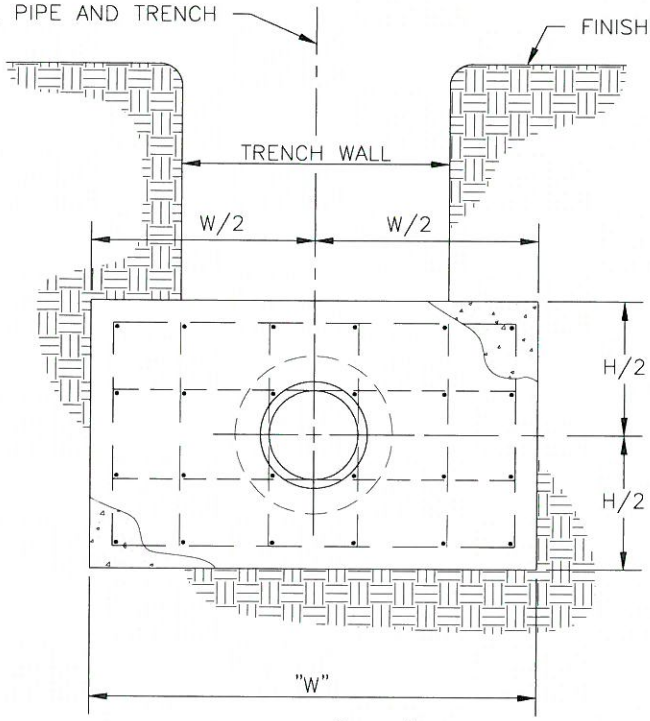
DESERT WATER

SHEAR SPOOL/RING AND THRUST BLOCK DETAIL

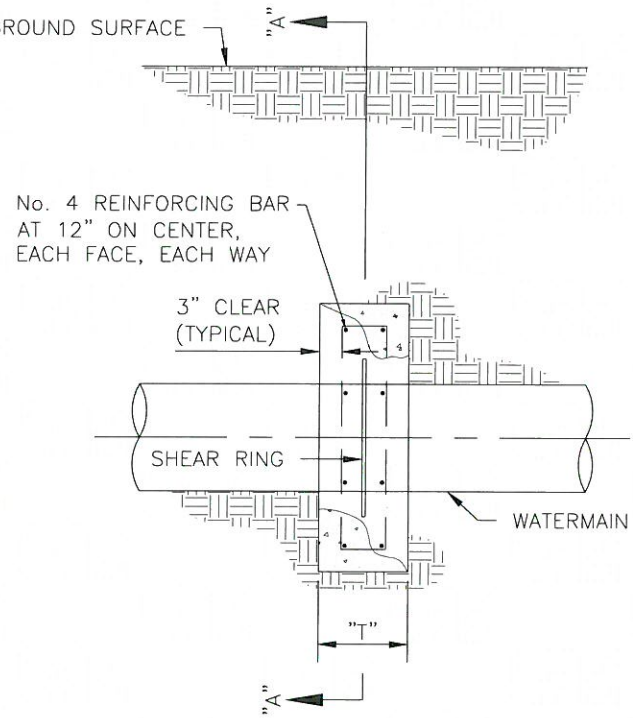
STANDARD DRAWING

W206

SHEET 1 OF 2



SECTION "A–A"



PLAN

PIPE SIZE (INCHES)	"H" (FEET) MIN.	"W" (FEET) MIN.	"T" (FEET) MIN.	"T" (FEET) MAX.	SHEAR RING THICKNESS "R" (INCHES)
8 OR LESS	2.0	4.5	1.0	1.5	½
10	2.5	4.5	1.0	1.5	
12	3.0	5.0	1.0	1.5	
14	3.5	5.2	1.3	1.8	¾
16	3.8	6.0	1.3	1.8	
18	4.8	6.0	1.5	2.0	
20	4.8	7.0	1.5	2.0	
24	4.8	8.0	1.8	2.2	
27	5.6	9.0	1.8	2.2	1
30	6.0	11.0	2.0	2.5	
36	7.0	12.0	2.0	2.5	

NOTES

1) ALL STEEL PIPE EXCEPT FLANGES OR ADAPTERS SHALL BE FULLY CEMENT MORTAR COATED OR ENCASED.
2) CONCRETE SHALL BE CLASS C (2,000 PSI MIN.) IN ACCORDANCE WITH BASIC CONCRETE SPECIFICATIONS. BLOCK DIMENSIONS SHOWN ARE MINIMUM.
3) THRUST BLOCKS SHALL BE FORMED WITH TRIMMED EARTH, SAND BAGS, OR LUMBER TO ACHIEVE REQUIRED CONFIGURATION. ALL MATERIALS USED TO FORM SHALL BE REMOVED PRIOR TO BACKFILLING.
4) THRUST BLOCKS SHALL BEAR AGAINST UNDISTURBED EARTH OR REPLACED EARTH HAVING 95% RELATIVE COMPACTION, MINIMUM.
5) BACKFILL AROUND AND OVER THRUST BLOCKS SHALL BE COMPACTED TO 95% RELATIVE COMPACTION, MINIMUM.
6) COMPACTED EARTH SHALL EXTEND TO DEPTH AND WIDTH (W) OF BLOCK AND TO DISTANCE W/2 BEFORE AND PAST THRUST BLOCK.

APPROVED 3/31/2020 DATE

Mark L Krause RCE. 46700

GENERAL MANAGER,
CHIEF ENGINEER

REVISION	BY	DATE

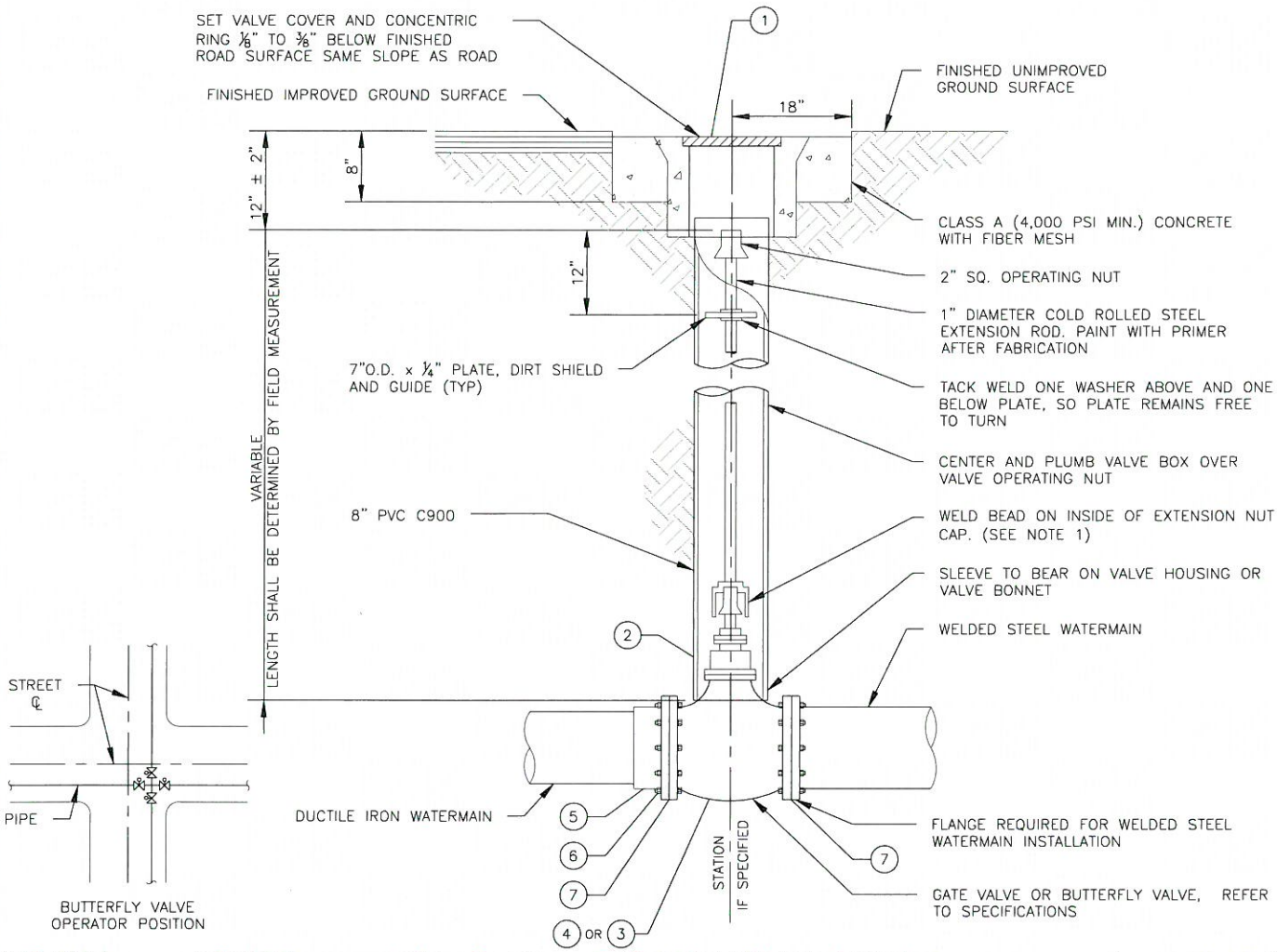
DESERT WATER

SHEAR SPOOL/RING AND THRUST BLOCK DETAIL

STANDARD DRAWING

W206

SHEET 2 OF 2



ITEM	DESCRIPTION	APPROVED MATERIALS LIST
1	HEAVY TRAFFIC BOX – COVER MARKED "DWA". TRAFFIC BOX COVERS FOR FIRE HYDRANT INSTALLATIONS SHALL BE PAINTED IN ACCORDANCE WITH THE AGENCY APPROVED PAINT SYSTEM.	E-04
2	VALVE BOX EXTENSION.	E-05
3	FLANGED GATE VALVE. VALVE STEM SHALL BE NONRISING WITH 2" SQUARE OPERATING NUT AND SHALL TURN COUNTER-CLOCKWISE TO OPEN. VALVES SHALL HAVE "O" RING SEALS AND NON-SHOCK COLD WATER WORKING PRESSURE OF 200 PSI.	B-01
4	FLANGED BUTTERFLY VALVE. VALVE STEM SHALL TURN COUNTER-CLOCKWISE TO OPEN. VALVE SHALL BE LOCATED SO THAT OPERATOR AND OPERATING NUT ARE SITUATED ON STREET OR EASEMENT CENTERLINE SIDE OF VALVE.	B-02
5	PUSH-ON X FLANGE ADAPTER REQUIRED FOR DUCTILE IRON WATERMAIN.	H-02
6	NUTS AND BOLTS. BOLT THREADS SHALL BE LUBRICATED WITH AN APPROVED ANTI-SEIZE COMPOUND. ALL EXPOSED STEEL SHALL BE FIELD COATED WITH AN APPROVED BITUMASTIC.	H-06/H-18
7	FLANGE RUBBER GASKETS	H-04

NOTES

1) EXTENSION ROD REQUIRED WHENEVER TOP OF VALVE IS MORE THAN 36" BELOW FINISHED IMPROVED/UNIMPROVED GROUND SURFACE. WHEN EXTENSION ROD IS REQUIRED, OPERATING NUT SHALL BE 12" ± 2" BELOW TOP OF TRAFFIC BOX. REQUIRED LENGTH FOR EXTENSION ROD SHALL BE DETERMINED BY FIELD MEASUREMENT. EXTENSION ROD SHALL BE SECURED TO VALVE OPERATING NUT BY WELDING A BEAD ON THE INSIDE OF THREE WALLS OF THE EXTENSION NUT CAP.

APPROVED 3/31/2020

Mark A Krause RCE. 46700

GENERAL MANAGER, CHIEF ENGINEER

REVISION	BY	DATE

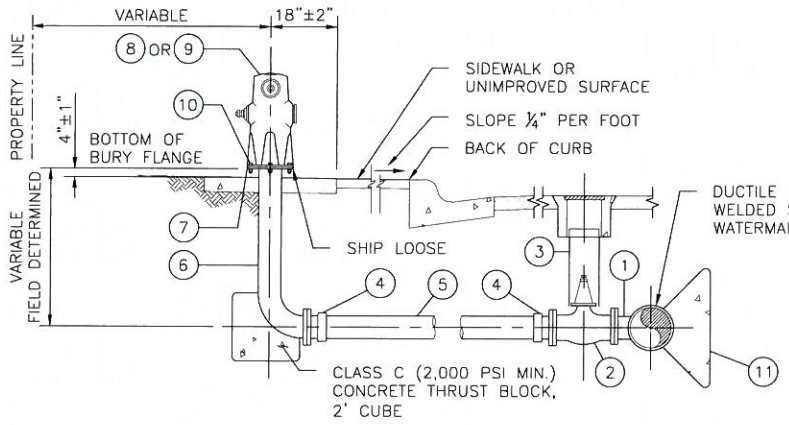
DESERT WATER

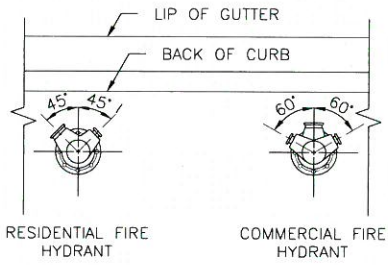
VALVE BOX AND VALVE INSTALLATION

STANDARD DRAWING

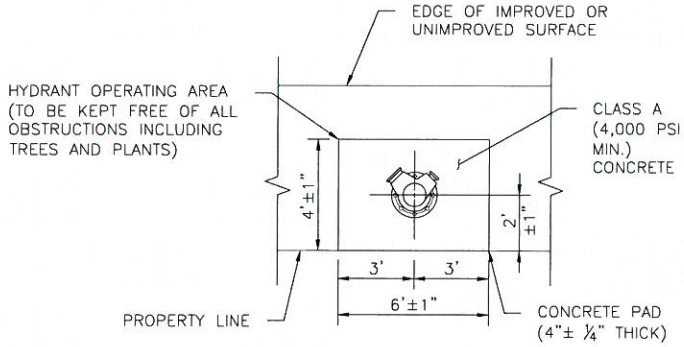
W207

SHEET 1 OF 1



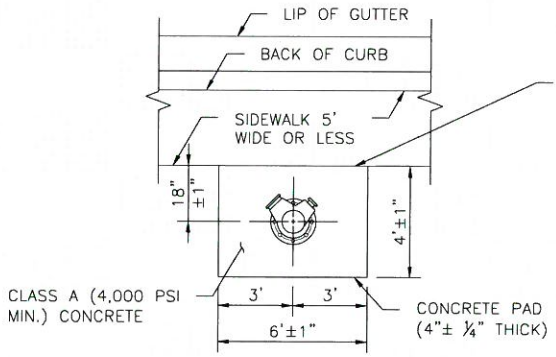


OUTLET ORIENTATION



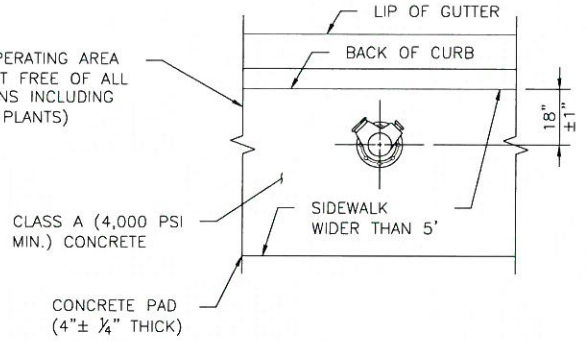
HYDRANT WITHOUT CURB

IF NO CURB EXISTS, HYDRANT SHALL BE INSTALLED 2' FROM PROPERTY LINE.



HYDRANT BEHIND SIDEWALK OR NO SIDEWALK

IF SIDEWALK IS 5' OR LESS IN WIDTH, HYDRANT SHALL BE PLACED BEHIND SAID SIDEWALK AS SHOWN ABOVE.



HYDRANT BEHIND CURB

IF SIDEWALK IS GREATER THAN 5' IN WIDTH, HYDRANT SHALL BE PLACED 18" BEHIND BACK OF CURB.

APPROVED 3/31/2020

Mark A Krause RCE. 46700

GENERAL MANAGER, CHIEF ENGINEER

REVISION	BY	DATE

DESERT WATER

6" FIRE HYDRANT INSTALLATION

STANDARD DRAWING

W208

SHEET 1 OF 2

ITEM	QTY	DESCRIPTION	APPROVED MATERIALS LIST
1	1	6" FLANGED DUCTILE IRON TEE ON DUCTILE IRON WATERMAIN OR 6" DIAMETER FLANGED SIDE OUTLET ON WELDED STEEL WATERMAIN.	N/A
2	1	6" DIAMETER FLANGED GATE VALVE PER STANDARD DRAWING W207.	SEE DWG W207
3	1	VALVE BOX INSTALLATION PER STANDARD DRAWING W207.	SEE DWG W207
4	3	6" DUCTILE IRON PUSH-ON X FLANGE ADAPTER.	H-02
5	VARIES	6" DIAMETER DUCTILE IRON PIPE AND FITTINGS WITH RESTRAINED JOINTS.	A-03/ D-03/H-04
6	1	6" DIAMETER STANDARD WEIGHT CEMENT MORTAR LINED AND CEMENT MORTAR COATED WELDED STEEL PIPE WITH SMOOTH 90° ELBOW.	A-02/D-02
7	1	6" 6 BOLT FLANGE (DRILLED TO MATCH 6 BOLT HYDRANT FLANGE). FLANGE SHALL BE SHIPPED LOOSE.	C-01
8	1	RESIDENTIAL: WET BARREL FIRE HYDRANT WITH 6" 6 BOLT FLANGED INLET, ONE 4" PUMPER OUTLET AND ONE 2-½" HOSE OUTLETS.	F-01
9	1	COMMERCIAL: WET BARREL FIRE HYDRANT WITH 6" 6 BOLT FLANGED INLET, ONE 4" PUMPER OUTLET AND TWO 2-½" HOSE OUTLETS.	F-02
10	6	⅝" DIAMETER BREAKAWAY BOLTS.	H-06
11	1	THRUST BLOCK PER STANDARD DRAWING W205 (NEW HYDRANT ON EXISTING MAIN).	SEE DWG W205
–	–	FIRE HYDRANT AND FLANGE GASKETS SHALL BE AS SPECIFIED.	H-04/ H-05
–	–	NUTS AND BOLTS. BOLT THREADS SHALL BE LUBRICATED WITH AN APPROVED ANTI-SIEZE COMPOUND. ALL BURIED EXPOSED STEEL SHALL BE FIELD COATED WITH AN APPROVED BITUMASTIC.	H-06/H-18

NOTES

1) FIRE HYDRANT LOCATIONS NOTED HEREON ARE GENERAL. SPECIFIC LOCATIONS SHALL CONFORM TO THE REQUIREMENTS OF AGENCY HAVING FIRE PROTECTION RESPONSIBILITY, NAMELY THE CITY OF PALM SPRINGS, THE CITY OF CATHEDRAL CITY, THE STATE DIVISION OF FORESTRY, COUNTY FIRE DEPARTMENT OR FIRE PROTECTION DISTRICT WITHIN THE COUNTY. SAID AGENCIES SHALL APPROVE ALL FIRE HYDRANT LOCATIONS.

2) ALL ABOVE-GROUND EXPOSED METAL SURFACES SHALL BE PAINTED IN ACCORDANCE WITH AGENCY APPROVED PAINT SYSTEMS.

3) RISER SHALL BE CEMENT MORTAR COATED WITH COATING TAPERED TO A 6" FLANGE TO ALLOW FOR BREAKAWAY BOLTS.

4) FOR NEW DEVELOPMENTS, FIRE HYDRANT SHALL BE INSTALLED BEHIND SIDEWALK.

5) FIRE HYDRANTS ON NEW DUCTILE IRON WATERMAINS REQUIRE 20 FEET OF RESTRAINED JOINTS ON BOTH SIDES OF TEE IN LIEU OF THRUST BLOCK.

APPROVED 3/31/2020

Mark S. Krause RCE. 46700

GENERAL MANAGER, CHIEF ENGINEER

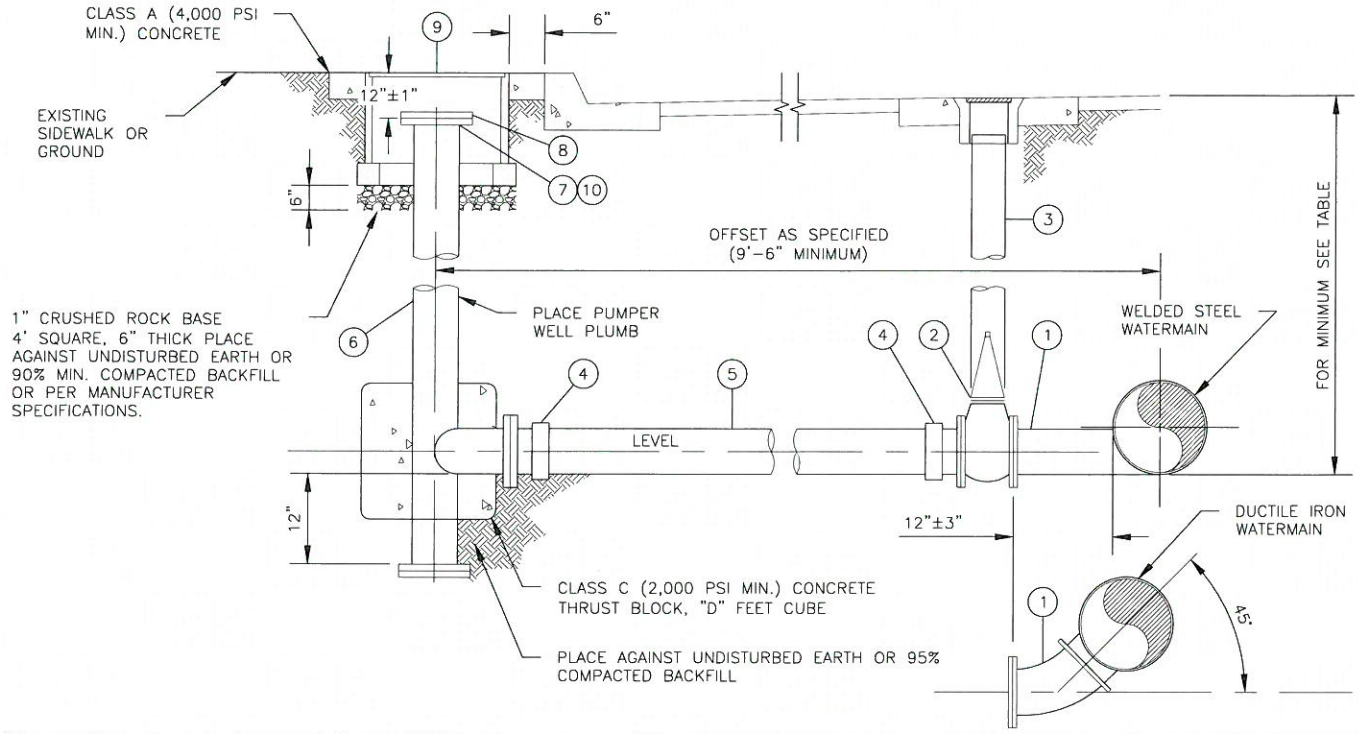
REVISION	BY	DATE

DESERT WATER

6" FIRE HYDRANT INSTALLATION

STANDARD DRAWING

W208



ITEM	QTY	DESCRIPTION	APPROVED MATERIALS LIST
1	1	FLANGED DUCTILE IRON TEE WITH FLANGED DUCTILE IRON 45° ON DUCTILE IRON WATERMAIN OR FLANGED TANGENTIAL SIDE OUTLET ON WELDED STEEL WATERMAIN.	N/A
2	1	FLANGED VALVE PER STANDARD DRAWING W207.	SEE DWG W207
3	1	VALVE BOX INSTALLATION PER STANDARD DRAWING W207.	SEE DWG W207
4	2	DUCTILE IRON PUSH-ON X FLANGE ADAPTER.	H-02
5	VARIES	DUCTILE IRON PIPE AND FITTINGS WITH RESTRAINED JOINTS.	A-03/D-03/H-04
6	VARIES	CEMENT MORTAR LINED AND CEMENT MORTAR COATED 10 GAGE WELDED STEEL PUMPER WELL. CENTER IN VAULT.	A-01/D-01
7	1	AWWA CLASS E FLANGE.	C-01
8	1	AWWA CLASS E BLIND FLANGE.	C-04
9	1	BLOWOFF VAULT WITH TRAFFIC RATED LID. MINIMUM INSIDE DIMENSION 46" x 28" x 39" (L x W x D).	E-07/E-08
10	1	2' CUT-TO-FIT, SHIP FLANGE LOOSE.	N/A
–	–	BOLTS AND NUTS. BOLT THREADS SHALL BE LUBRICATED WITH AN APPROVED ANTI-SIEZE COMPOUND. ALL EXPOSED STEEL SHALL BE FIELD COATED WITH AN APPROVED BITUMASTIC.	H-06/H-18

WATERMAIN			VALVE		BLOWOFF		THRUST BLOCK
SIZE (INCHES)	MINIMUM FLOWLINE DEPTH (FEET)	OUTLET SIZE (INCHES)	SIZE (INCHES)	TYPE	RUN SIZE (INCHES)	PUMPER WELL SIZE (INCHES)	D (FEET)
6	4	6	6	GATE	6	8	2
8 – 12	4	8	8	GATE	8	8	2
14 – 20	4.67	8	8	GATE	8	8	2
24 – 30	5.5	12	12	BUTTERFLY	12	12	2.7
33 – 42	7	16	16	BUTTERFLY	16	16	3.4

NOTES

1) VARIABLE DIMENSIONS SHALL BE FIELD MEASURED BY CONTRACTOR AND APPROVED BY AGENCY PRIOR TO FABRICATION UNLESS SUFFICIENT DIMENSIONS ARE CONTAINED ON CONSTRUCTION DRAWINGS. FIELD JOINTS MAY BE FLANGED OR WELDED BUT SHALL NOT PERMANENTLY IMPAIR INTERIOR LINING OF PIPE.

2) ALL EXPOSED PIPING AND INTERIOR OF VAULT COVER SHALL BE FIELD PAINTED IN ACCORDANCE WITH THE AGENCY APPROVED PAINT SYSTEMS.

APPROVED 3/31/2020

Mark A Krause
GENERAL MANAGER, CHIEF ENGINEER

RCE. 46700

REVISION	BY	DATE

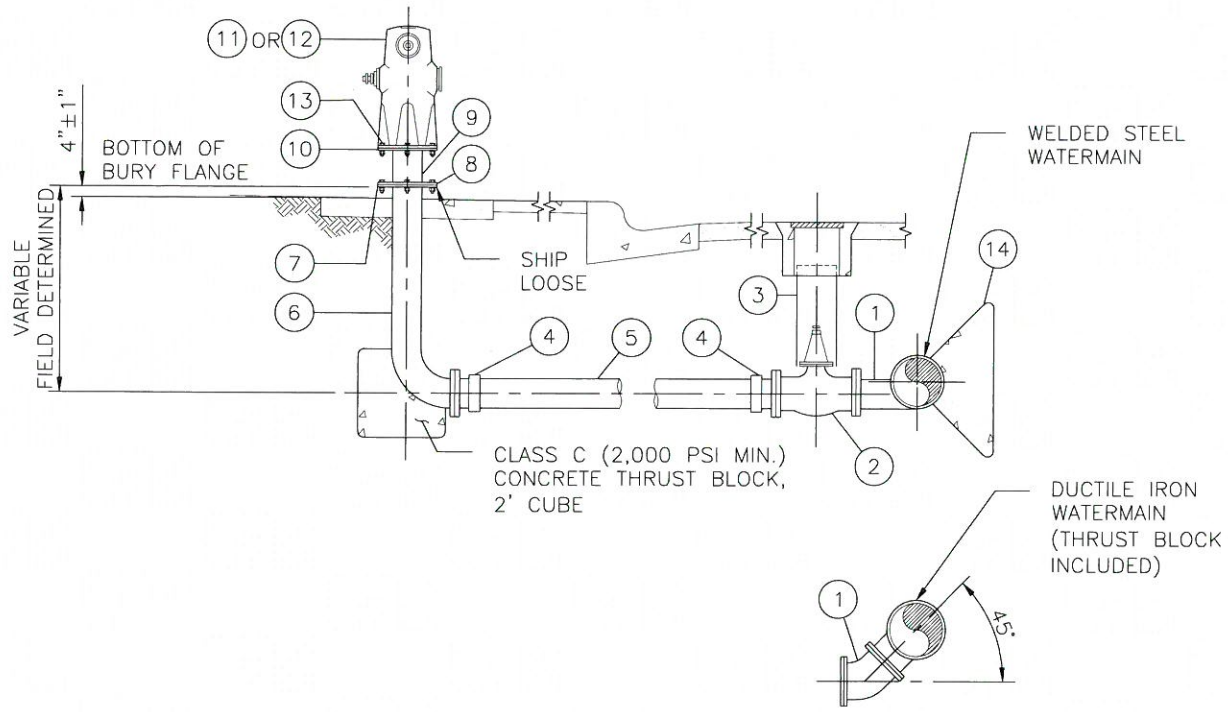
DESERT WATER

6"–16" BLOWOFF INSTALLATION (PARKWAY OR SIDEWALK)

STANDARD DRAWING

W209

SHEET 1 OF 1



ITEM	QTY	DESCRIPTION	APPROVED MATERIALS LIST
1	1	DUCTILE IRON MAIN – DUCTILE IRON TEE WITH 8" FLANGED OUTLET AND 8" FLANGED DUCTILE IRON 45° ELL. STEEL MAIN – FLANGED TANGENTIAL 8" SIDE OUTLET	N/A
2	1	8" DIAMETER FLANGED GATE VALVE PER STANDARD DRAWING W207.	SEE DWG W207
3	1	VALVE BOX INSTALLATION PER STANDARD DRAWING W207.	SEE DWG W207
4	2	8" DUCTILE IRON PUSH-ON X FLANGE ADAPTER.	H-02
5	VARIES	8" DIAMETER DUCTILE IRON PIPE AND FITTINGS WITH RESTRAINED JOINTS.	A-03/D-03 /H-04
6	1	8" DIAMETER STANDARD WEIGHT CEMENT MORTAR LINED AND CEMENT MORTAR COATED WELDED STEEL PIPE WITH SMOOTH 90° ELBOW.	A-02/D-02
7	1	8" A.W.W.A. CLASS E FLANGE. FLANGE SHALL BE SHIPPED LOOSE.	C-01
8	1	8"x6" REDUCING FLANGE	C-02
9	1	6" LONG 6" DIAMETER STANDARD WEIGHT CEMENT MORTAR LINED AND COATED SPOOL.	N/A
10	1	6" 6 BOLT FLANGE (DRILLED TO MATCH 6 BOLT HYDRANT FLANGE). FLANGE SHALL BE SHIPPED LOOSE.	C-01
11	1	RESIDENTIAL: WET BARREL FIRE HYDRANT WITH 6" 6 BOLT FLANGED INLET, ONE 4" PUMPER OUTLET AND ONE 2-½" HOSE OUTLETS.	F-01
12	1	COMMERCIAL: WET BARREL FIRE HYDRANT WITH 6" 6 BOLT FLANGED INLET, ONE 4" PUMPER OUTLET AND TWO 2-½" HOSE OUTLETS.	F-02
13	6	⅝" DIAMETER BREAKAWAY BOLTS.	H-06
14	1	THRUST BLOCK PER STANDARD DRAWING W205.	SEE DWG W205
–	–	FIRE HYDRANT AND FLANGE GASKETS SHALL BE AS SPECIFIED.	H-04/H-05
–	–	NUTS AND BOLTS. BOLT THREADS SHALL BE LUBRICATED WITH AN APPROVED ANTI-SIEZE COMPOUND. ALL BURIED EXPOSED STEEL SHALL BE FIELD COATED WITH AN APPROVED BITUMASTIC.	H-06/H-18

NOTES

1) FIRE HYDRANT/BLOWOFF TO BE INSTALLED ON MAINS 8"-20" IN DIAMETER AND ONLY WHERE APPROVED BY AGENCY. FOR MAINS LARGER THAN 20" DIAMETERS, OR MAINS GREATER THAN 8 FEET IN DEPTH, SHALL HAVE BLOWOFF ASSEMBLIES PER STD DWG W209.

2) FOR HYDRANT LOCATION WITH RESPECT TO THE BACK OF THE CURB OR THE SIDEWALK WIDTH AND HYDRANT OUTLET ORIENTATION SEE STANDARD DRAWING W208.

3) ALL ABOVE-GROUND EXPOSED METAL SURFACES SHALL BE PAINTED IN ACCORDANCE WITH AGENCY APPROVED PAINT SYSTEMS.

4) SPOOL SHALL BE CEMENT MORTAR COATED WITH COATING TAPERED TO A 6" FLANGE TO ALLOW FOR BREAKAWAY BOLTS.

APPROVED 3/31/2020

Mark A Krause RCE. 46700

GENERAL MANAGER, CHIEF ENGINEER

REVISION	BY	DATE

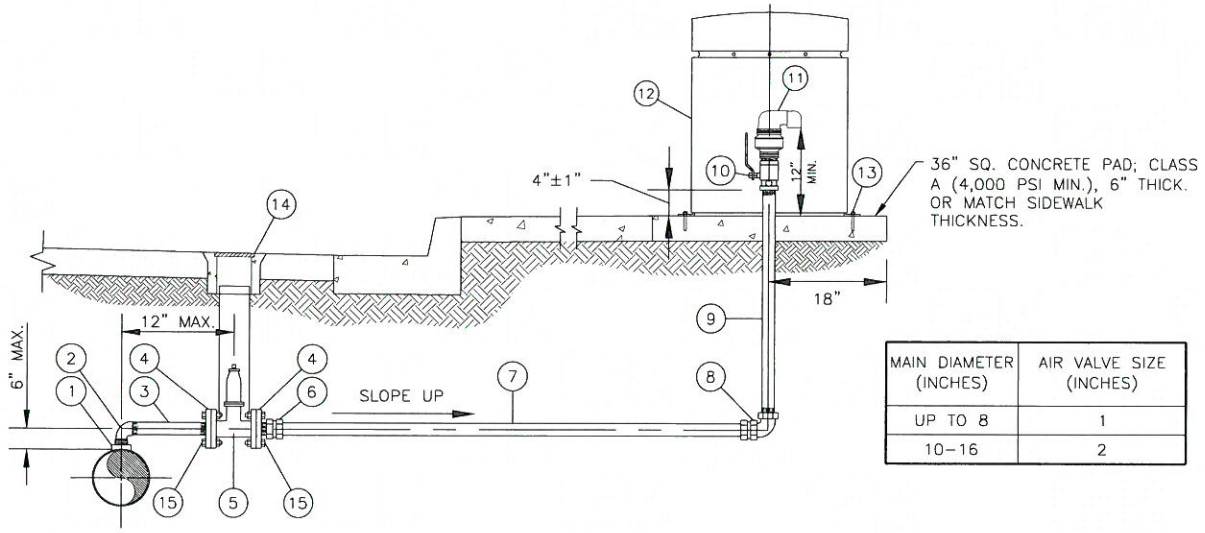
DESERT WATER

COMBINATION FIRE HYDRANT/BLOWOFF

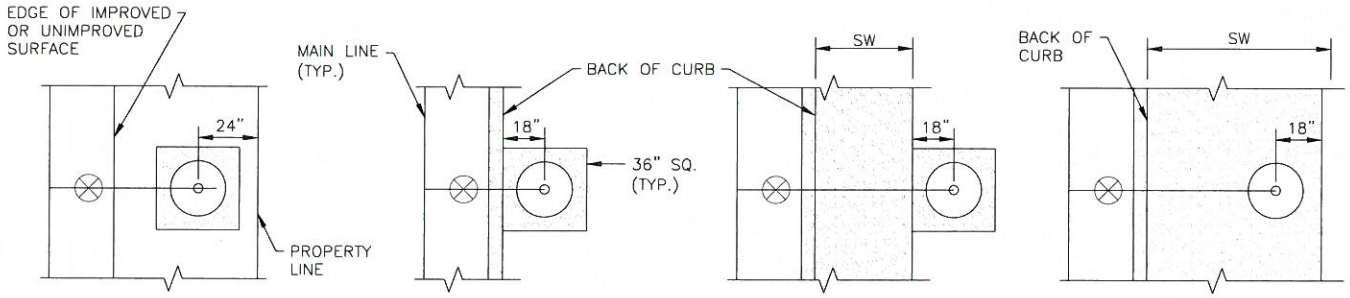
STANDARD DRAWING

W210

SHEET 1 OF 1



MAIN DIAMETER (INCHES)	AIR VALVE SIZE (INCHES)
UP TO 8	1
10–16	2



NO CURB AND GUTTER | NO SIDEWALK | SIDEWALK WIDTH 8' OR LESS | SIDEWALK WIDTH GREATER THAN 8'

ITEM	QTY	DESCRIPTION	APPROVED MATERIALS LIST
1	1	2" TOP OUTLET PER STANDARD DRAWING W213	SEE DWG W213
2	1	2" BRASS 90° STREET ELL, TAPE WRAPPED	D–05
3	1	2"x12" BRASS NIPPLE, TAPE WRAPPED	A–06
4	2	2"x2" DUCTILE IRON COMPANION FLANGE	C–03
5	1	2" FLANGED GATE VALVE PER STANDARD DRAWING W207	SEE DWG W207
6	1	2" STRAIGHT COUPLING, M.I.P.xCOMP.	D–05
7	VARIES	2" TYPE "K" RIGID COPPER PIPING	A–05
8	1	2" QUARTER BEND COUPLING, F.I.P.xCOMP.	D–05
9	1	2" BRASS RISER (CUT AND THREADED TO FIT)	A–06
10	1	2" BRASS BALL VALVE W/TEST COCK (ADD 2"x1" BRASS BUSHING FOR 1" AIR VALVE)	B–17/(D–05)
11	1	1" OR 2" COMBINATION AIR VALVE (SEE TABLE HEREON)	B–11/B–12
12	1	AIR VALVE COVER	H–16
13	3	⅜"x3" CONCRETE WEDGE ANCHOR BOLTS (3 EA. AT 120° APART)	N/A
14	1	VALVE BOX PER STANDARD DRAWING W207	SEE DWG W207
15	8	NUTS AND BOLTS. BOLT THREADS SHALL BE LUBRICATED WITH AN APPROVED ANTI–SEIZE COMPOUND. ALL EXPOSED STEEL SHALL BE FIELD COATED WITH AN APPROVED BITUMASTIC.	H–06/H–18

APPROVED 3/31/2020

Mark A Krause
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RCE. 46700

REVISION	BY	DATE

DESERT WATER

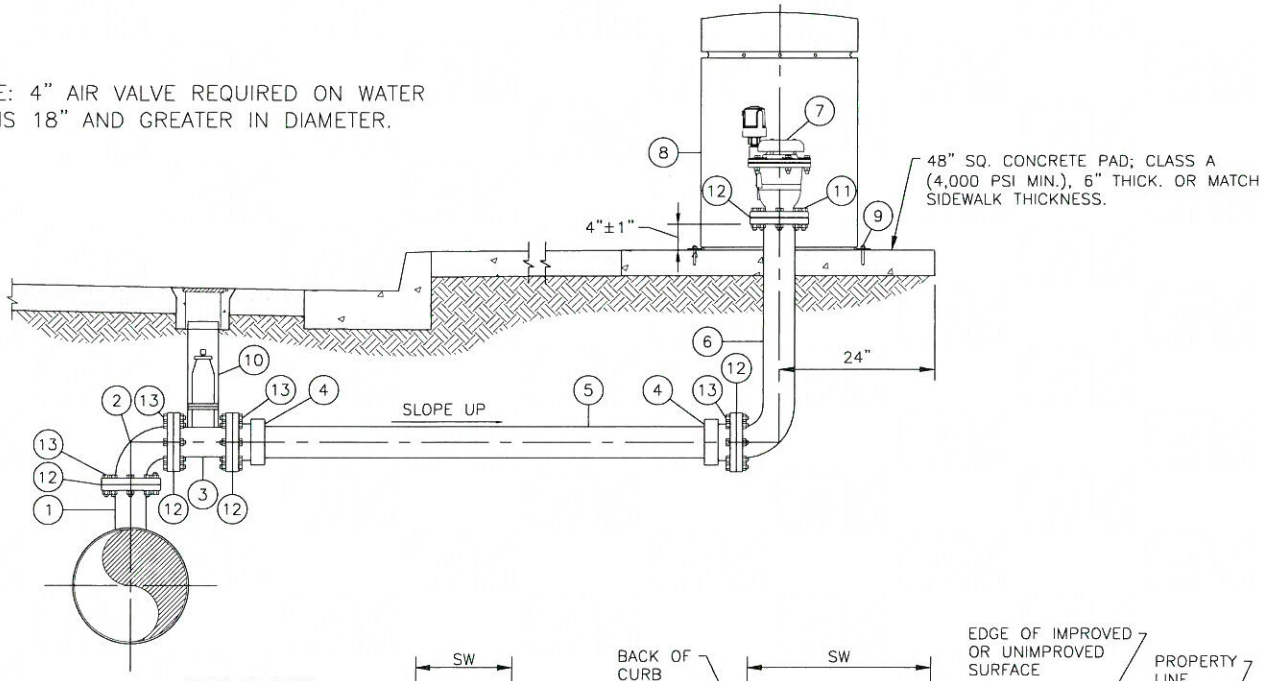
1" OR 2" AIR VALVE INSTALLATION

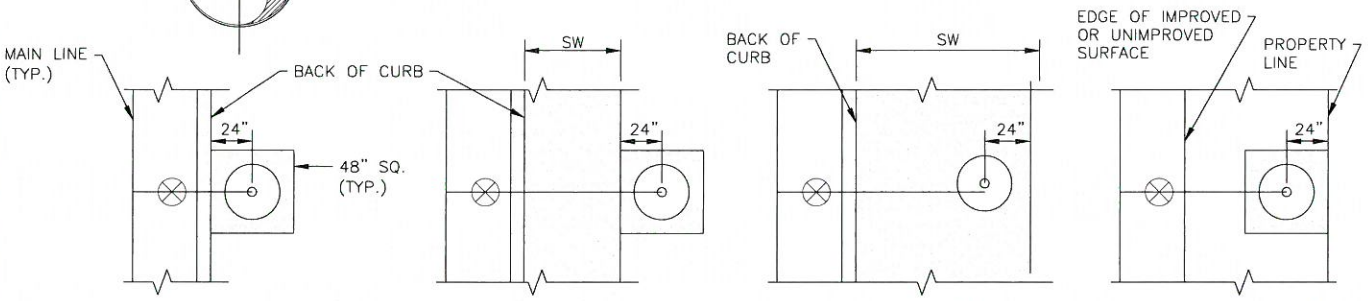
STANDARD DRAWING

W211

SHEET 1 OF 1

NOTE: 4" AIR VALVE REQUIRED ON WATER MAINS 18" AND GREATER IN DIAMETER.





NO SIDEWALK | SIDEWALK WIDTH 8' OR LESS | SIDEWALK WIDTH GREATER THAN 8' | NO CURB AND GUTTER

ITEM	QTY	DESCRIPTION	APPROVED MATERIALS LIST
1	1	4" FLANGED TEE	D-03
2	1	4" FLANGED 90°	D-03
3	1	4" FLANGED GATE VALVE PER STANDARD DRAWING W207	SEE DWG W207
4	2	4" PUSH-ON X FLANGE ADAPTER (DUCTILE IRON LATERAL) / 4" FLANGE (STEEL LATERAL)	H-02/C-01
5	1	4" DUCTILE IRON PIPE AND FITTINGS WITH RESTRAINED JOINTS OR CML/CMC 10 GA. STEEL PIPE	A-03/D-03/H-04 /A-01/D-01
6	1	4" DIAMETER STANDARD WEIGHT CEMENT MORTAR LINED AND CEMENT MORTAR COATED WELDED STEEL PIPE WITH SMOOTH 90° ELBOW (FLANGED END).	A-02/D-02
7	1	4" COMBINATION AIR VALVE	B-13
8	1	AIR VALVE COVER	H-16
9	3	⅜"x3" CONCRETE WEDGE ANCHOR BOLTS (3 EA. AT 120° APART)	N/A
10	1	VALVE BOX PER STANDARD DRAWING W207	SEE DWG W207
11	8	BREAK AWAY BOLTS/NUTS	H-06
12	5	FLANGE GASKET	H-04
13	32	NUTS AND BOLTS. BOLT THREADS SHALL BE LUBRICATED WITH AN APPROVED ANTI-SEIZE COMPOUND. ALL EXPOSED STEEL SHALL BE FIELD COATED WITH AN APPROVED BITUMASTIC.	H-06

APPROVED 3/31/2020

GENERAL MANAGER, CHIEF ENGINEER RCE. 46700

REVISION	BY	DATE

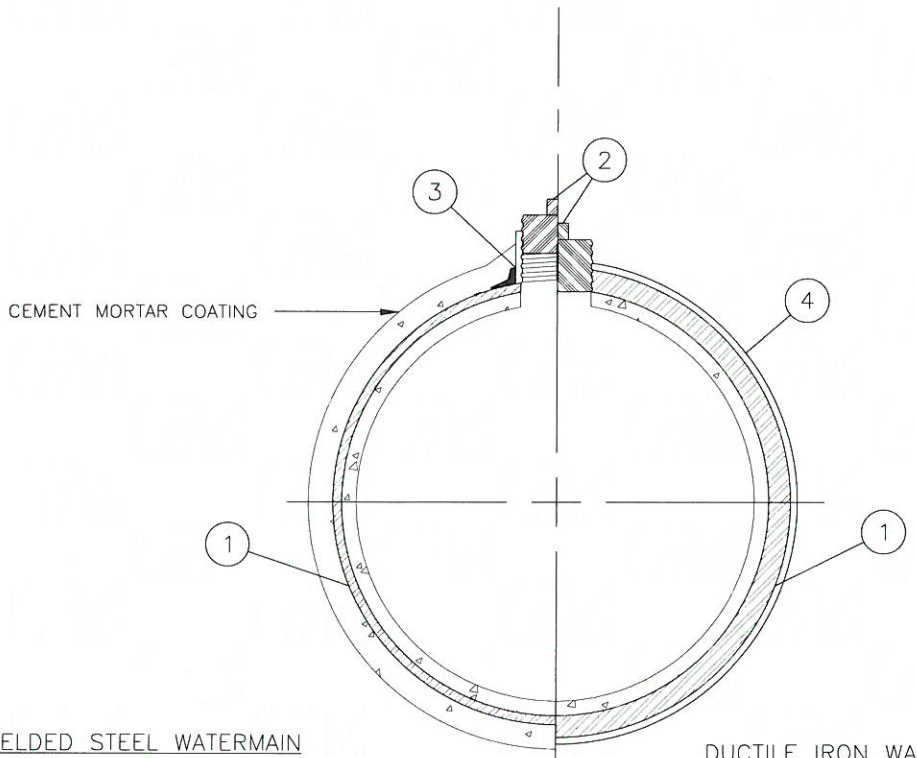
DESERT WATER

4" AIR VALVE INSTALLATION

STANDARD DRAWING

W212

SHEET 1 OF 1



WELDED STEEL WATERMAIN

DUCTILE IRON WATERMAIN

- DOUBLE STRAP (IPT) BRONZE SERVICE CLAMP OR DIRECT TAPPED AND TAPER THREADED CORP STOP FOR 1" OUTLET. ALL SIZE MAINS.
- DOUBLE STRAP (IPT) BRONZE SERVICE CLAMP FOR 2" OUTLET ON MAINS 12" AND SMALLER
- DOUBLE STRAP (IPT) BRONZE SERVICE CLAMP OR DIRECT TAPPED AND TAPER THREADED CORP STOP FOR 2" OUTLET ON MAINS LARGER THAN 12".

ITEM	QTY	DESCRIPTION	APPROVED MATERIALS LIST
1	1	STANDARD STEEL COUPLING WELDED TO STEEL WATERMAIN AND CEMENT MORTAR COATED, OR TAPPED AND TAPER THREADED DUCTILE IRON PIPE.	D-02/A-03
2	1	1" OR 2" STANDARD BRASS SQUARE HEAD PLUG.	D-05
3	VARIES	1" OR 2" STANDARD WEIGHT BLACK PIPE THREADED COUPLING. WELDED TO TOP OF WELDED STEEL WATERMAIN AND COVERED WITH PIPE COATING.	D-02
4	1	DOUBLE STRAP (I.P.T.) BRONZE SERVICE CLAMP.	H-01

NOTES

1) TOP OUTLET SHALL BE USED BY CONTRACTOR FOR TESTING AND DISINFECTION OR AS OTHERWISE SPECIFIED BY AGENCY. CONTRACTOR SHALL PROVIDE CURB STOP OR CORPORATION STOP FOR TESTING AND DISINFECTION AND CONTRACTOR SHALL REPLACE SAID STOP WITH AN APPROVED PLUG AFTER SUCCESSFULLY TESTING AND DISINFECTING PIPELINE.

2) STEEL WATERMAIN AND THREADED COUPLING SHALL BE CEMENT MORTAR COATED.

APPROVED 3/31/2020

Mark R Krause RCE. 46700

GENERAL MANAGER, CHIEF ENGINEER

REVISION	BY	DATE

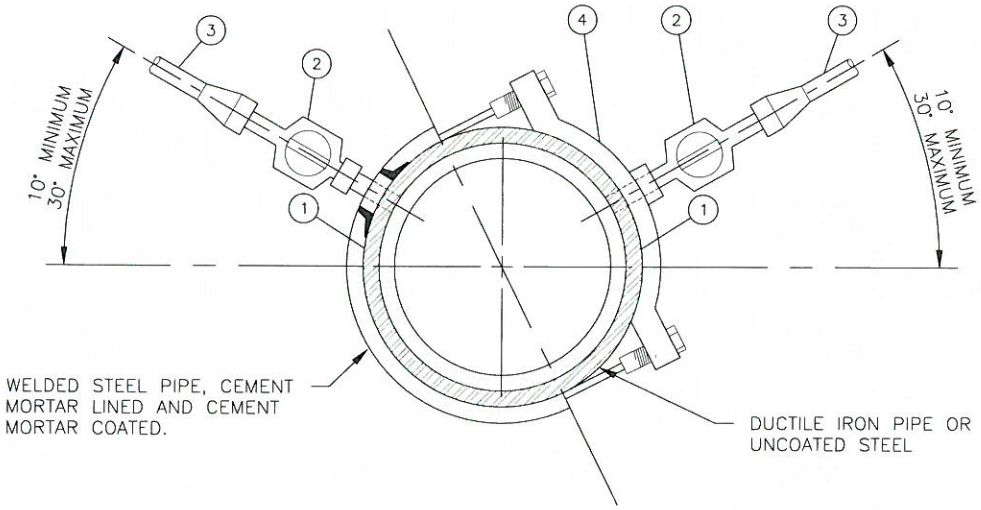
DESERT WATER

1" AND 2" TOP OUTLET

STANDARD DRAWING

W213

SHEET 1 OF 1



WELDED STEEL WATERMAIN

- WELD ON BLACK STEEL COUPLING FOR 1" AND 2" SERVICES. ALL SIZE MAINS.

DUCTILE IRON WATERMAIN

- DOUBLE STRAP (IPT) BRONZE SERVICE CLAMP OR DIRECT TAPPED AND TAPER THREADED CORP STOP FOR 1" OUTLET. ALL SIZE MAINS.
- DOUBLE STRAP (IPT) BRONZE SERVICE CLAMP FOR 2" OUTLET ON MAINS 12" AND SMALLER
- DOUBLE STRAP (IPT) BRONZE SERVICE CLAMP OR DIRECT TAPPED AND TAPER THREADED CORP STOP FOR 2" OUTLET ON MAINS LARGER THAN 12".

ITEM	QTY	DESCRIPTION	APPROVED MATERIALS LIST
1	1	STANDARD STEEL COUPLING WELDED TO STEEL WATERMAIN AND CEMENT MORTAR COATED, OR TAPPED AND TAPER THREADED DUCTILE IRON PIPE.	D-02/A-03
2	1	CORPORATION STOP IRON PIPE THREAD INLET AND COMPRESSION OUTLET FOR STEEL WATERMAINS AND DUCTILE IRON PIPE WITH SERVICE CLAMP. CORPORATION STOP (AWWA TAPER) THREADED INLET AND COPPER COMPRESSION OUTLET FOR TAPPED DUCTILE IRON PIPE. ALL THREADED JOINTS SHALL INCLUDE JOINT COMPOUND.	B-03/B-04, H-11
3	VARIES	TYPE "K" SOFT COPPER TUBING.	A-05
4	1	DOUBLE STRAP (I.P.T.) BRONZE SERVICE CLAMP.	H-01

NOTES

1) STANDARD STEEL COUPLING SHALL BE IRON PIPE THREADED. DUCTILE IRON PIPE SHALL BE TAPPED AND THREADED FOR CORPORATION STOP (AWWA TAPER) PIPE THREAD OR UTILIZE SERVICE CLAMP.

2) SERVICE AND OTHER TAPS SHALL NOT BE MADE CLOSER THAN 2 FEET TO A BELL, COUPLING, JOINT, FITTING, OR OTHER SERVICE.

APPROVED 3/31/2020

GENERAL MANAGER, CHIEF ENGINEER

RCE. 46700

REVISION	BY	DATE

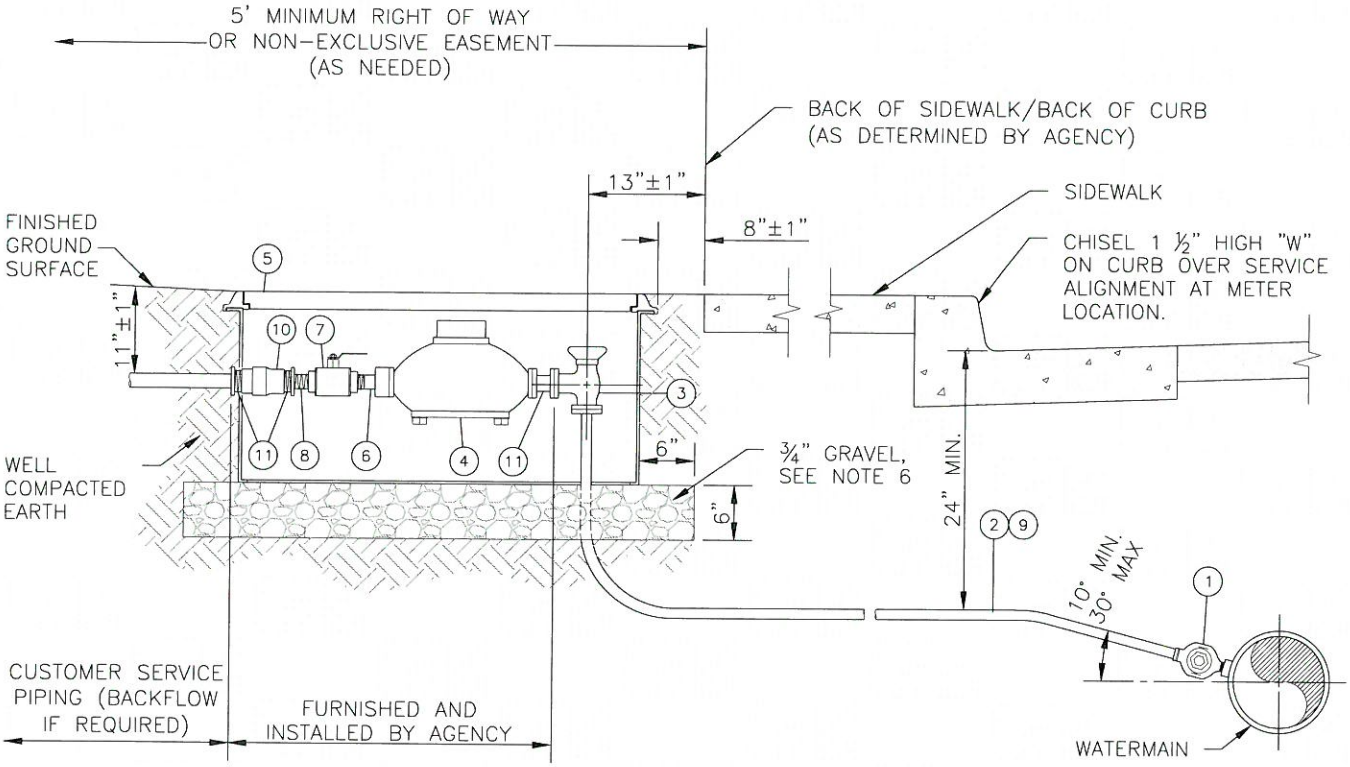
DESERT WATER

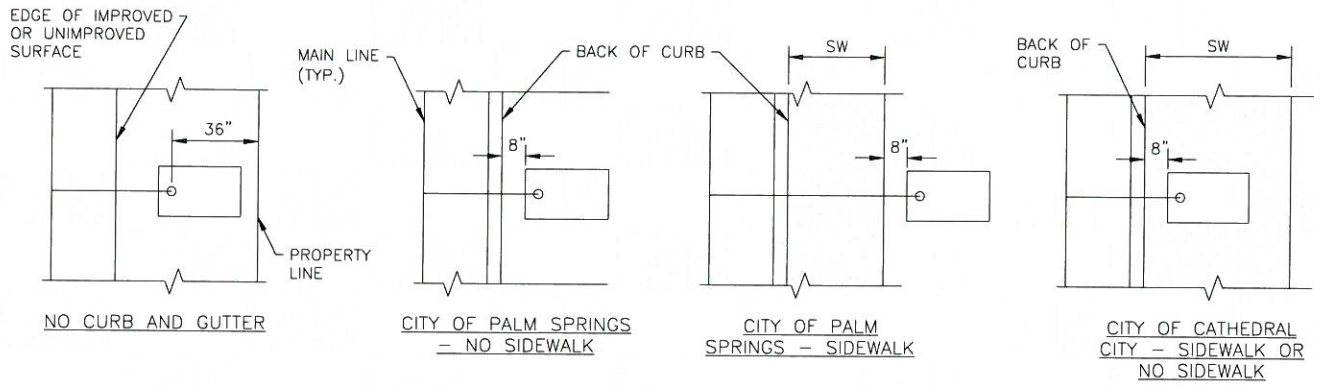
1" & 2" SERVICE CONNECTION (NEW MAIN)

STANDARD DRAWING

W214

SHEET 1 OF 1





APPROVED 3/31/2020 Mark A Krause RCE. 46700 GENERAL MANAGER, CHIEF ENGINEER	DESERT WATER	STANDARD DRAWING
	1" SINGLE SERVICE INSTALLATION	W215
REVISION / BY / DATE		SHEET 1 OF 2

ITEM	QTY	DESCRIPTION	APPROVED MATERIALS LIST
1	1	1" SERVICE CONNECTION PER STANDARD DRAWING W214	SEE DWG W214
2	VARIES	1" TYPE "K" SOFT COPPER TUBING.	A-05
3	1	1" ANGLE METER STOP.	B-05
4	1	METER (SIZE AND TYPE AS SPECIFIED). (BY AGENCY)	N/A
5	1	METER BOX WITH LID MARKED "DWA".	E-01
6	1	1" METER SWIVEL NUT X MALE IRON PIPE THREAD (BY AGENCY)	H-14
7	1	1" CUSTOMER CONTROL BALL VALVE (BY AGENCY)	B-08
8	1	1" X 2" X CLOSE NIPPLE (BY AGENCY)	D-05
9	1	ONE INLINE COUPLING MAY BE PERMITTED WHEN APPROVED BY AGENCY (BY AGENCY)	H-12
10	1	1 ¼" INLINE SINGLE CHECK VALVE (BY AGENCY)	G-04
11	3	BRASS BUSHING (SIZE VARIES). (BY AGENCY)	D-05

NOTES

1) COPPER SERVICE TUBING SHALL BE LAID STRAIGHT AND AT RIGHT ANGLES TO THE WATERMAIN.

2) METER BOX SHALL BE AT LEAST 5' FROM EDGE OF DRIVEWAY (CURB DROP) OR FROM DRIVEWAY RADIUS AND AT LEAST 18" FROM ALL OTHER UTILITY CONDUITS, BOXES, AND PADS.

3) PIPE THREADS SHALL BE CLEAN AND SHARP AND SEALED WITH AN APPROVED JOINT COMPOUND.

4) INSTALLATION OF APPURTENANCES FROM ANGLE METER STOP THROUGH INLINE SINGLE CHECK VALVE WILL BE BY AGENCY.

5) CUSTOMER CONTROL VALVE SHALL BE BEHIND BACKFLOW DEVICE IF BACKFLOW DEVICE IS REQUIRED.

6) ¾" GRAVEL SHALL BE INSTALLED WHEN METER BOX IS LOCATED WITHIN A TRAVEL WAY OR BEHIND ROLL CURB.

APPROVED 3/31/2020

GENERAL MANAGER, CHIEF ENGINEER RCE. 46700

REVISION	BY	DATE

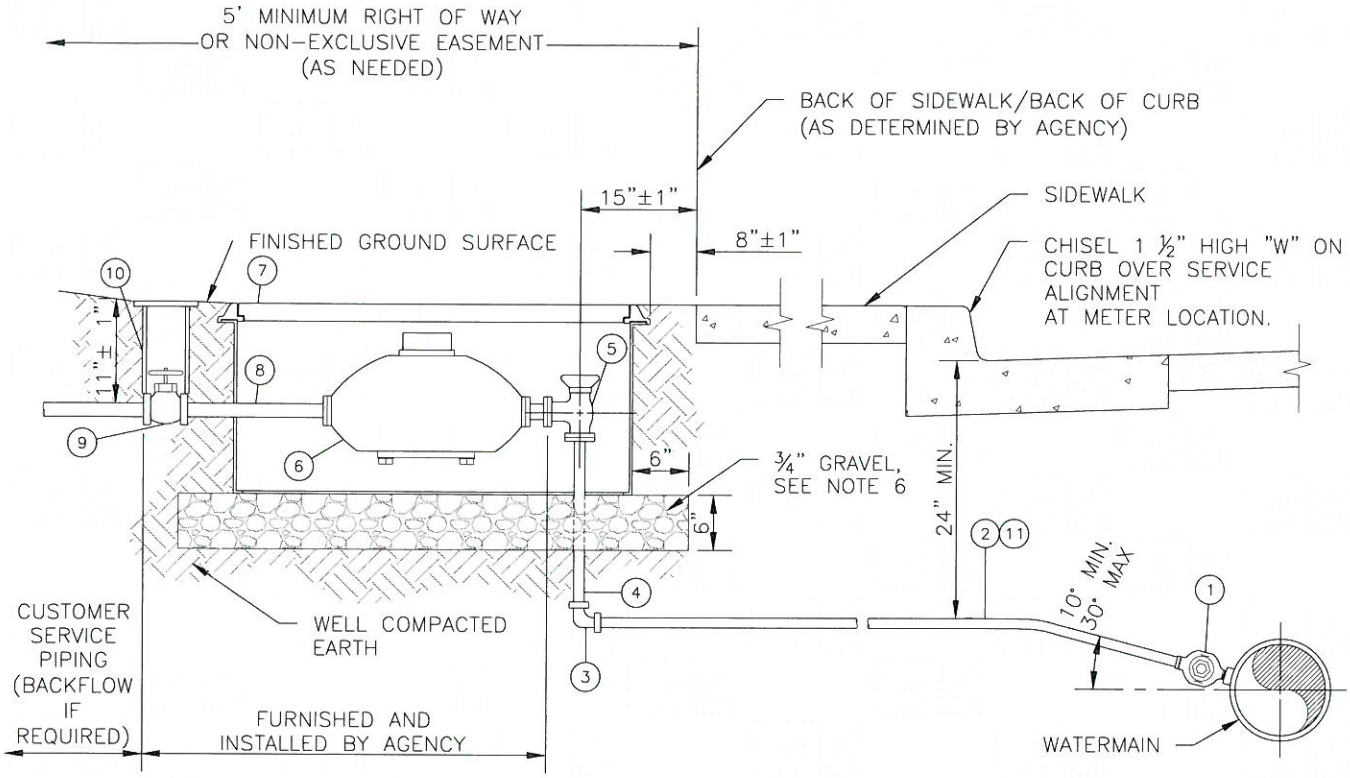
DESERT WATER

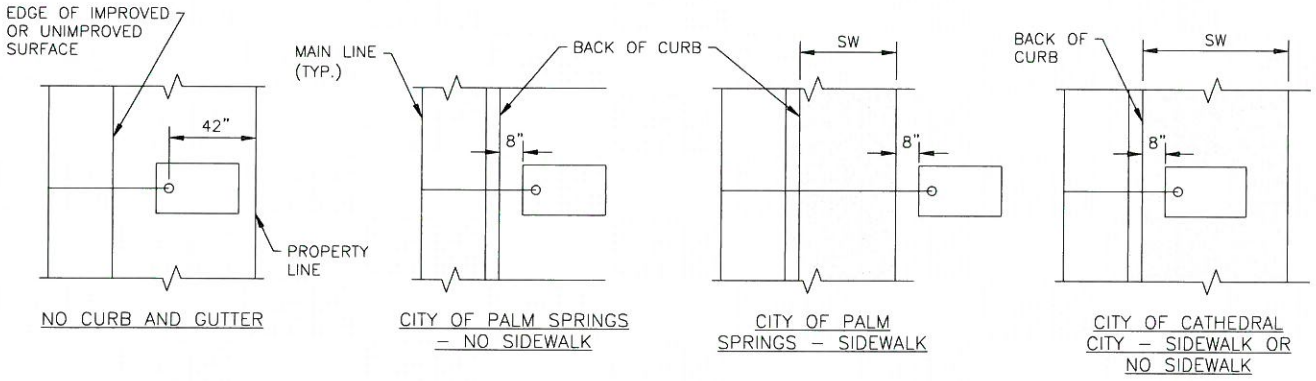
1" SINGLE SERVICE INSTALLATION

STANDARD DRAWING

W215

SHEET 2 OF 2





APPROVED 3/31/2020

Mark L. Krause RCE. 46700

GENERAL MANAGER, CHIEF ENGINEER

REVISION	BY	DATE

DESERT WATER

2" SINGLE SERVICE INSTALLATION

STANDARD DRAWING

W216

SHEET 1 OF 2

ITEM	QTY	DESCRIPTION	APPROVED MATERIALS LIST
1	1	2" SERVICE CONNECTION PER STANDARD DRAWING W214.	SEE DWG W214
2	VARIES	2" TYPE "K" SOFT COPPER TUBING.	A-05
3	1	2" STANDARD WEIGHT BRONZE ELL.	H-09
4	1	2" BRASS RISER, THREADED BOTH ENDS.	A-06
5	1	2" ANGLE METER STOP WITH SLOTTED HOLES.	B-07
6	1	METER SIZE AND TYPE AS SPECIFIED (BY AGENCY).	N/A
7	1	METER BOX WITH LID MARKED "DWA".	E-02
8	1	STANDARD WEIGHT BRASS PIPE, 18" LONG (BY AGENCY).	A-06
9	1	CUSTOMER SERVICE VALVE (BY AGENCY).	B-09/B-10
10	1	PRECAST CONCRETE VALVE BOX (BY AGENCY).	E-06
11	1	ONE INLINE COUPLING MAY BE PERMITTED WHEN APPROVED BY AGENCY.	H-12

NOTES

1) COPPER SERVICE TUBING SHALL BE LAID STRAIGHT AND AT RIGHT ANGLES TO THE WATERMAIN.

2) METER BOX SHALL BE AT LEAST 5' FROM EDGE OF DRIVEWAY (CURB DROP) OR FROM DRIVEWAY RADIUS AND AT LEAST 18" FROM ALL OTHER UTILITY CONDUITS, BOXES AND PADS.

3) PIPE THREADS SHALL BE CLEAN AND SHARP AND SEALED WITH AN APPROVED JOINT COMPOUND.

4) INSTALLATION OF APPURTENANCES FROM ANGLE METER STOP THROUGH CUSTOMER SERVICE VALVE WILL BE BY AGENCY.

5) CUSTOMER CONTROL VALVE SHALL BE BEHIND BACKFLOW DEVICE IF BACKFLOW DEVICE IS REQUIRED.

6) ¾" GRAVEL SHALL BE INSTALLED WHEN METER BOX IS LOCATED WITHIN A TRAVEL WAY OR BEHIND ROLL CURB.

APPROVED 3/31/2020

Mark A Krause RCE. 46700

GENERAL MANAGER, CHIEF ENGINEER

REVISION	BY	DATE

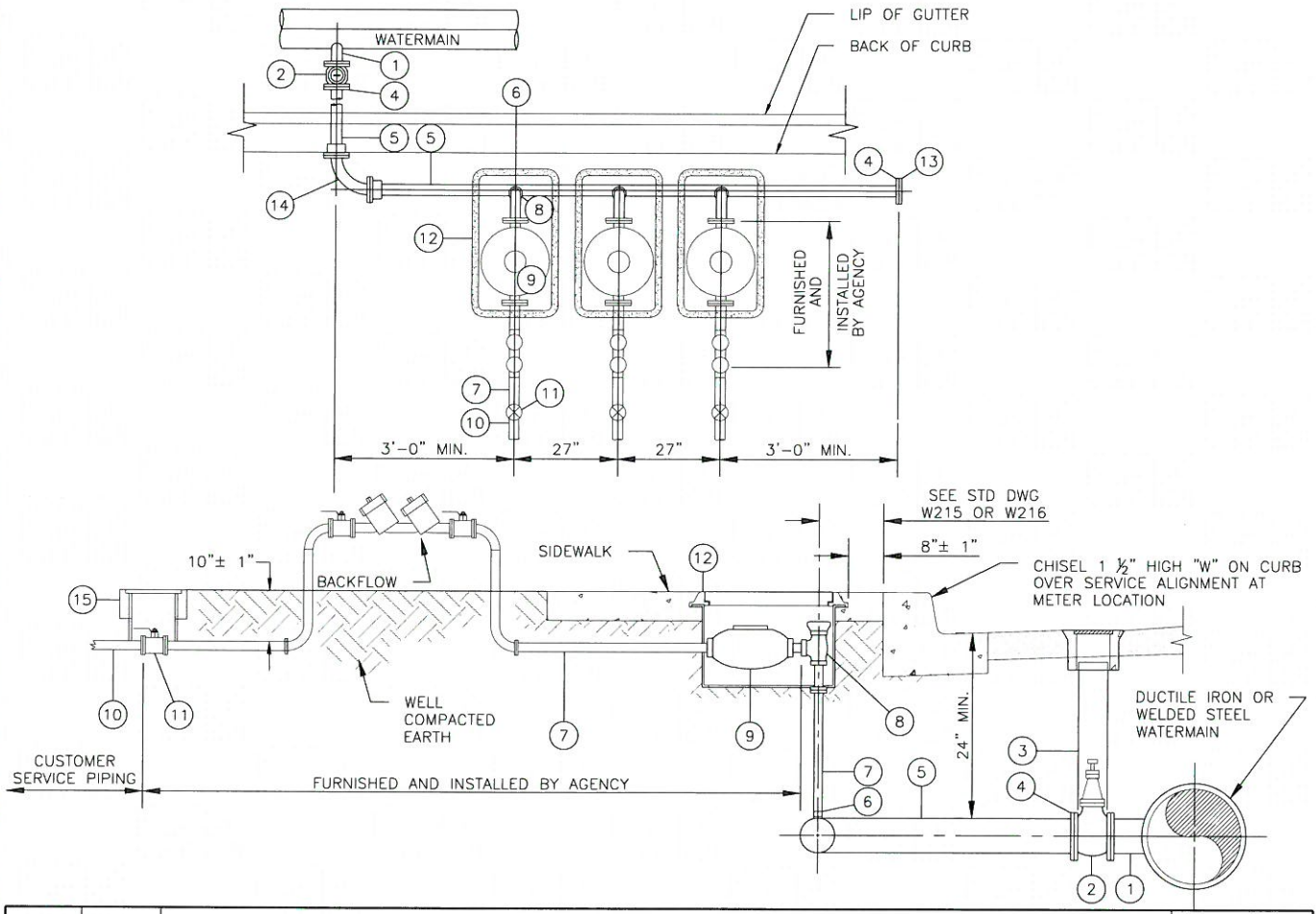
DESERT WATER

2" SINGLE SERVICE INSTALLATION

STANDARD DRAWING

W216

SHEET 2 OF 2



ITEM	QTY	DESCRIPTION	APPROVED MATERIALS LIST
1	1	4" FLANGED DUCTILE IRON TEE ON DUCTILE IRON WATERMAIN OR 4" FLANGED OUTLET ON WELDED STEEL WATERMAIN.	N/A
2	1	4" FLANGED GATE VALVE PER STANDARD DRAWING W207.	SEE DWG W207
3	1	VALVE BOX PER STANDARD DRAWING W207.	SEE DWG W207
4	4	AWWA. CLASS E FLANGE.	C-01
5	VARIES	4" DIAMETER DUCTILE IRON PIPE AND FITTINGS WITH RESTRAINED JOINTS OR CML/C 10GA. STEEL PIPE.	A-03/D-03/H-04 /A-01/D-01
6	VARIES	DOUBLE STRAP (I.P.T.) BRONZE SERVICE CLAMP, TAPPED VERTICALLY.	SEE DWG W213
7	VARIES	STANDARD WEIGHT BRASS PIPE, SIZE AS SPECIFIED. BRASS PIPE SHALL BE REAMED AFTER BEING CUT AND THREADED. PIPE THREADS SHALL BE CLEAN, SHARP, AND SEALED WITH AN APPROVED JOINT COMPOUND.	A-06/H-11
8	VARIES	ANGLE METER STOP, SIZE AS SPECIFIED.	B-06 OR B-07
9	VARIES	WATER METER, SIZE AND TYPE AS SPECIFIED.	N/A
10	VARIES	CUSTOMER SERVICE PIPE AND FITTINGS.	N/A
11	VARIES	CUSTOMER CONTROL VALVE, SIZE AS SPECIFIED.	B-08, B-09, OR B-10
12	VARIES	METER BOX WITH LID MARKED "DWA". (BY CONTRACTOR)	E-01/E-02
13	1	AWWA CLASS E BLIND FLANGE.	C-04
14	1	4" FLANGED DUCTILE IRON 90° ELBOW OR FLANGED CML/C 10GA. STEEL FITTING.	D-03/D-01
15	1	PRECAST CONCRETE VALVE BOX.	E-06

NOTES

1) THE MINIMUM NUMBER OF 1" SERVICES SHALL BE 5 AND THE MAXIMUM NUMBER SHALL BE 10.

2) THE MINIMUM NUMBER OF 2" SERVICES SHALL BE 2 AND THE MAXIMUM NUMBER SHALL BE 3.

3) CUSTOMER CONTROL VALVE SHALL BE BEHIND BACKFLOW DEVICE.

APPROVED 3/31/2020

Mark A Krause RCE. 46700

GENERAL MANAGER, CHIEF ENGINEER

REVISION	BY	DATE

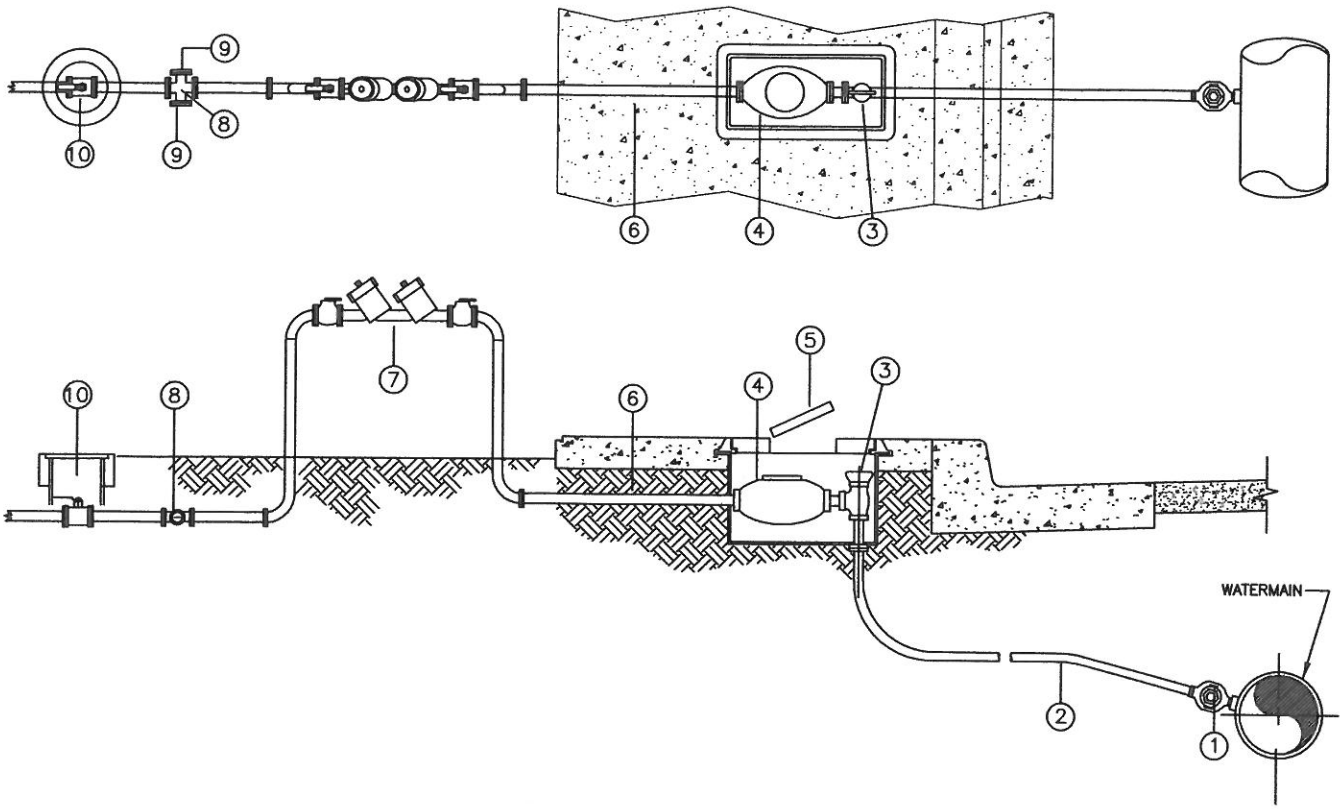
DESERT WATER

4" MULTIPLE SERVICE INSTALLATION

STANDARD DRAWING

W217

SHEET 1 OF 1



ITEM	NO. REQ'D.	DESCRIPTION	APPROVED MATERIALS LIST NO.
1	1	SERVICE CONNECTION PER STANDARD DRAWING W124 OR STANDARD DRAWING W125.	SEE DWG. W124 OR W125
2	VARIES	TYPE "K" SOFT COPPER TUBING.	A–05
3	1	ANGLE METER STOP WITH DWA SEAL.	B–05
4	1	METER (SIZE AND TYPE AS SPECIFIED).	N/A
5	1	METER BOX WITH LID MARKED "DWA".	E–01
6	1	STANDARD WEIGHT BRASS PIPE	A–06
7	1	BACKFLOW DEVICE WITH LOCKS	B–08
8	1	BRASS CROSS	E–06
9	1	CAPPED OUTLET FOR FUTURE FIRE SERVICE PIPING AND FUTURE SERVICE	D–05
10	1	CUSTOMER CONTROL VALVE AND PRECAST CONCRETE VALVE BOX	H–12

NOTES

1) COPPER SERVICE TUBING SHALL BE LAID STRAIGHT AND AT RIGHT ANGLES TO THE WATERMAIN.
2) METER BOX SHALL BE AT LEAST 5' FROM EDGE OF DRIVEWAY (CURB DROP) OR FROM DRIVEWAY RADIUS.
3) PIPE THREADS SHALL BE CLEAN AND SHARP AND SEALED WITH AN APPROVED JOINT COMPOUND.
4) INSTALLATION OF APPURTENANCES FROM ANGLE METER STOP THROUGH CUSTOMER SERVICE VALVE WILL BE BY AGENCY.
5) CUSTOMER CONTROL VALVE SHALL BE BEHIND BACKFLOW DEVICE IF BACKFLOW DEVICE IS REQUIRED.

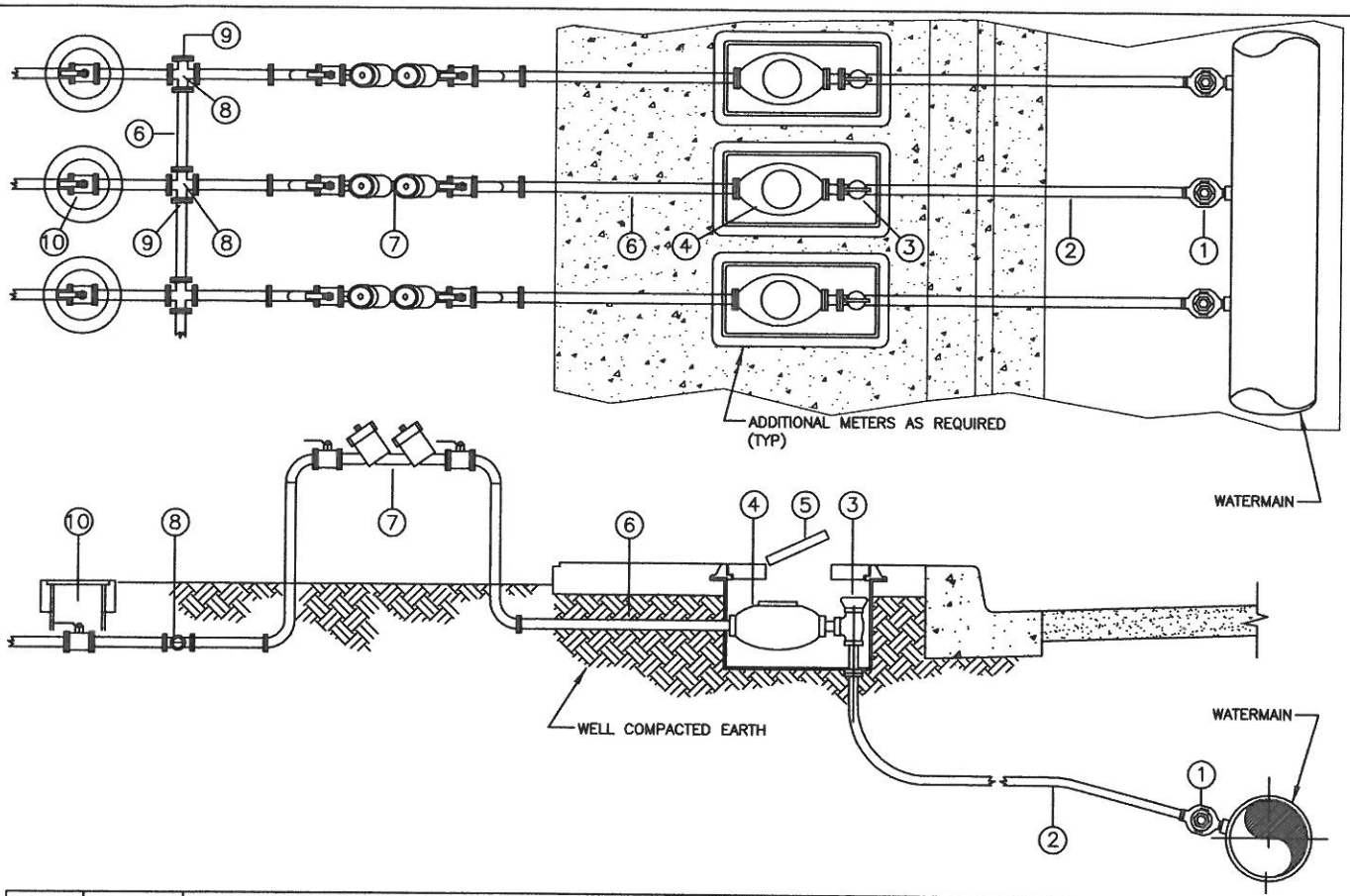
APPROVED _____ DATE 10/29/07
OPERATIONS ENGINEER
RCE NO. 58514

REVISION	BY	DATE

DESERT WATER AGENCY
PALM SPRINGS, CALIFORNIA

MULTI–FAMILY SERVICE INSTALLATION WITH FIRE SERVICE

STANDARD DRAWING W128



ITEM	NO. REQ'D.	DESCRIPTION	APPROVED MATERIALS LIST NO.
1	1	SERVICE CONNECTION PER STANDARD DRAWING W124 OR STANDARD DRAWING W125.	SEE DWG. W124 OR W125
2	VARIES	TYPE "K" SOFT COPPER TUBING.	A–05
3	1	ANGLE METER STOP WITH DWA SEAL.	B–05
4	1	METER (SIZE AND TYPE AS SPECIFIED).	N/A
5	1	METER BOX WITH LID MARKED "DWA".	E–01
6	1	STANDARD WEIGHT BRASS PIPE	A–06
7	1	BACKFLOW DEVICE WITH LOCKS	B–08
8	1	BRASS CROSS	D–05
9	1	CAPPED OUTLET FOR FUTURE FIRE SERVICE PIPING AND FUTURE SERVICE	E–06
10	1	CUSTOMER CONTROL VALVE AND PRECAST CONCRETE VALVE BOX	H–12

NOTES

1) COPPER SERVICE TUBING SHALL BE LAID STRAIGHT AND AT RIGHT ANGLES TO THE WATERMAIN.
2) METER BOX SHALL BE AT LEAST 5' FROM EDGE OF DRIVEWAY (CURB DROP) OR FROM DRIVEWAY RADIUS.
3) PIPE THREADS SHALL BE CLEAN AND SHARP AND SEALED WITH AN APPROVED JOINT COMPOUND.
4) INSTALLATION OF APPURTENANCES FROM ANGLE METER STOP THROUGH CUSTOMER SERVICE VALVE WILL BE BY AGENCY.
5) CUSTOMER CONTROL VALVE SHALL BE BEHIND BACKFLOW DEVICE IF BACKFLOW DEVICE IS REQUIRED.

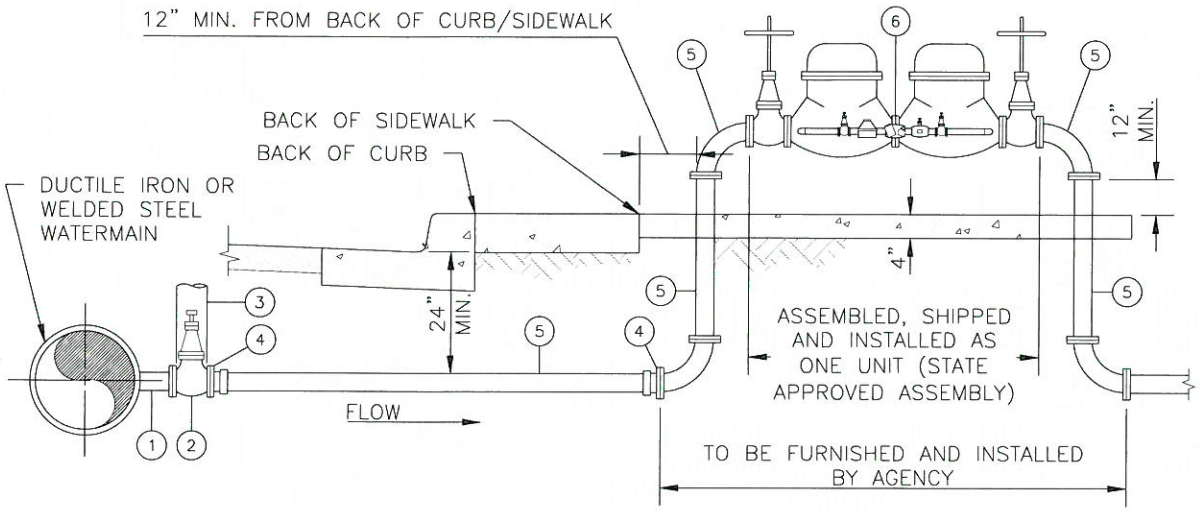
APPROVED _____ DATE 10/29/07
OPERATIONS ENGINEER
RCE NO. 58514

REVISION	BY	DATE

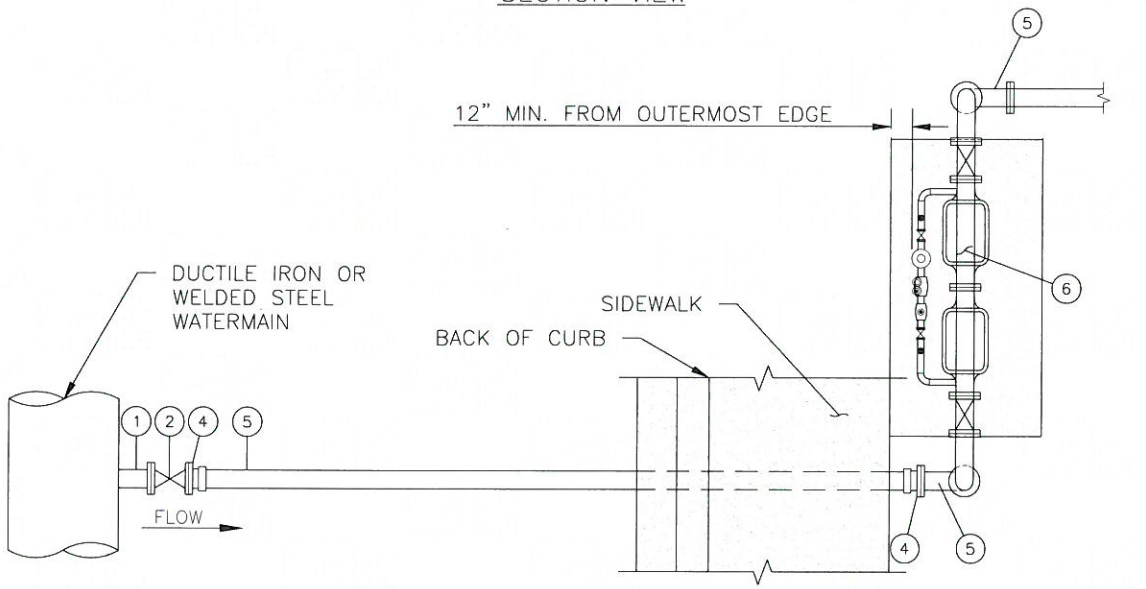
DESERT WATER AGENCY
PALM SPRINGS, CALIFORNIA

MULTI–FAMILY SERVICE INSTALLATION WITH MANIFOLD FIRE SERVICE

STANDARD DRAWING W129



SECTION VIEW



PLAN VIEW

ITEM	QTY	DESCRIPTION	APPROVED MATERIALS LIST
1	1	FLANGED DUCTILE IRON TEE ON DUCTILE IRON WATERMAIN OR FLANGED OUTLET ON WELDED STEEL WATERMAIN. SIZE AS SPECIFIED.	N/A
2	1	FLANGED GATE VALVE PER STANDARD DRAWING W207. SIZE AS SPECIFIED.	SEE DWG W207
3	1	STANDARD VALVE BOX PER STANDARD DRAWING W207.	SEE DWG W207
4	2	PUSH-ON X FLANGE ADAPTERS (DUCTILE IRON LATERAL ONLY) OR AWWA CLASS E FLANGE.	H-02/D-03
5	VARIES	DUCTILE IRON PIPE AND FITTINGS WITH RESTRAINED JOINTS OR CML/C 10GA. STEEL PIPE. SIZE AS SPECIFIED BY DESERT WATER AGENCY. SIZE AS SPECIFIED (ABOVE GROUND PIPING SHALL NOT BE CEMENT MORTAR COATING AND SHALL BE FIELD PAINTED IN ACCORDANCE WITH APPROVED AGENCY PAINT SYSTEMS).	A-03/D-03/H-04 /A-01/D-01
6	1	DOUBLE CHECK VALVE AND DETECTOR CHECK WITH BYPASS METER ASSEMBLY. TYPE AND SIZE OF STATE APPROVED ASSEMBLY TO BE SPECIFIED BY DESERT WATER AGENCY.	G-03

APPROVED 3/31/2020

Mark A Krauss RCE. 46700

GENERAL MANAGER, CHIEF ENGINEER

REVISION	BY	DATE

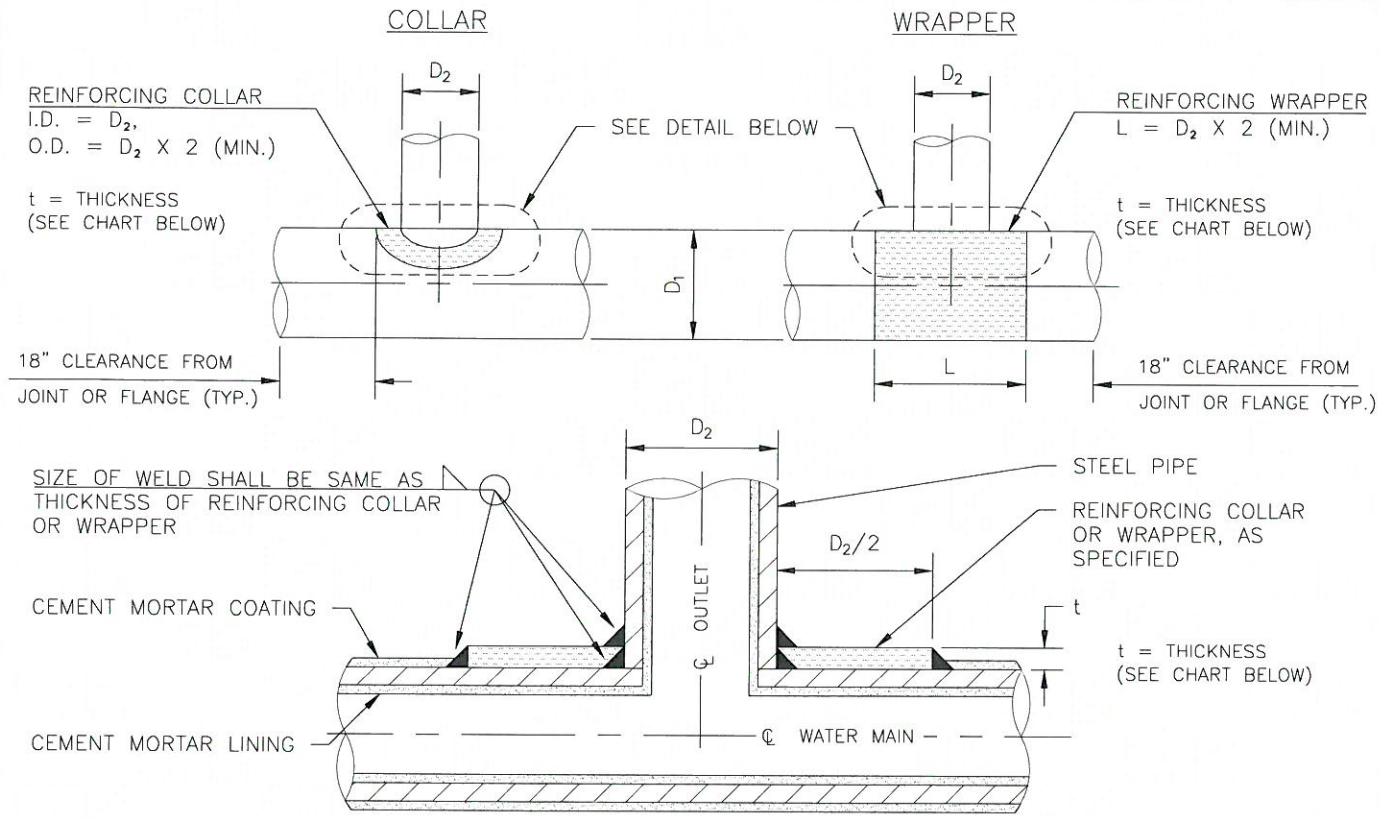
DESERT WATER

DETECTOR CHECK (ABOVE GROUND)

STANDARD DRAWING

W218

SHEET 1 OF 1



D_1 (INCHES MIN.)	D_2 (INCHES MIN.)		t (INCHES MIN.)
	COLLAR	WRAPPER	
4–8	N/A	4–8	0.1345
10	4	6–10	
12	4	6–12	
14	4–6	8–14	
16	4–6	8–16	
18	4–8	10–18	
20	4–8	10–20	
24	4–10	12–24	0.1875
30	4–14	16–30	0.2500
36	4–16	18–36	0.3125
42	4–20	24–42	

NOTES

1) ALL FERROUS METALS SHALL BE COATED PER SECTION 10B PIPELINE SPECIFICATIONS, COATINGS OF FITTINGS. APPLY REINFORCED MORTAR COATING AFTER COMPLETION.

2) SLEEVES USED FOR UNCOATED STEEL PIPE.

3) EDGE OF COLLAR OR WRAPPER TO BE PLACED A MINIMUM OF 18" FROM EDGE OF ANY BELL COUPLING, VALVE FITTING OR OTHER OBSTRUCTION.

APPROVED 3/31/2020

Mark A Krause RCE. 46700

GENERAL MANAGER,
CHIEF ENGINEER

REVISION	BY	DATE

DESERT WATER

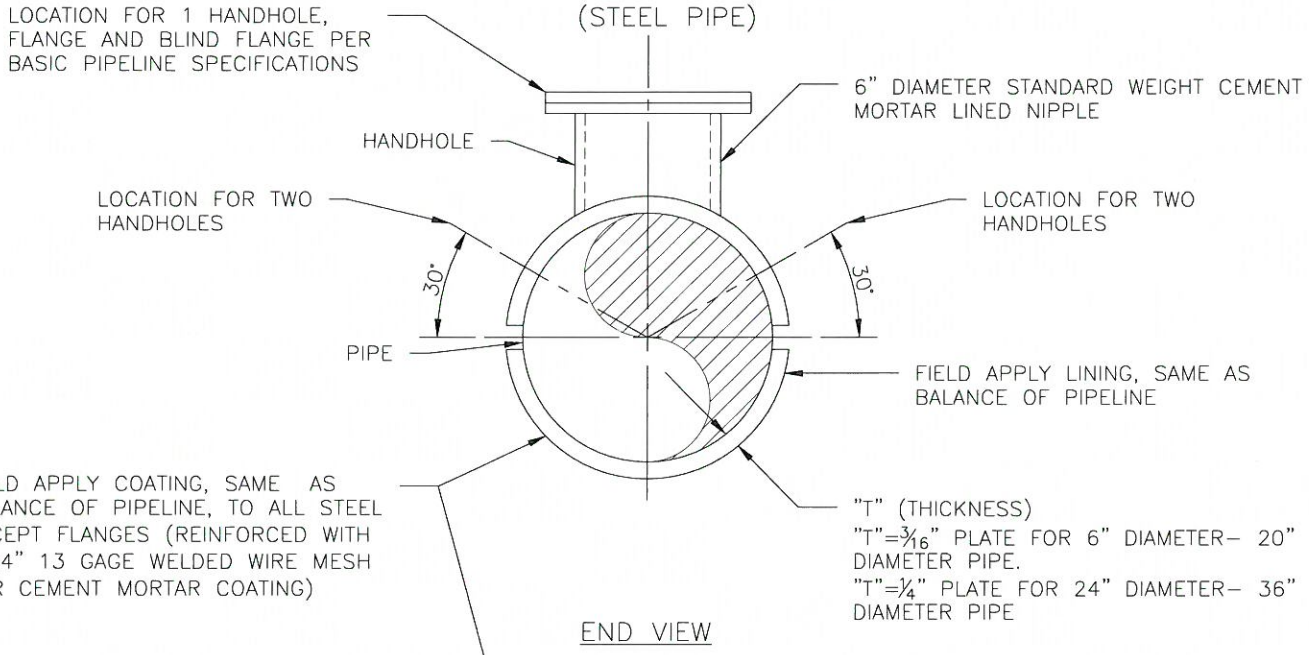
WELDED STEEL PIPE REINFORCING DETAIL

STANDARD DRAWING

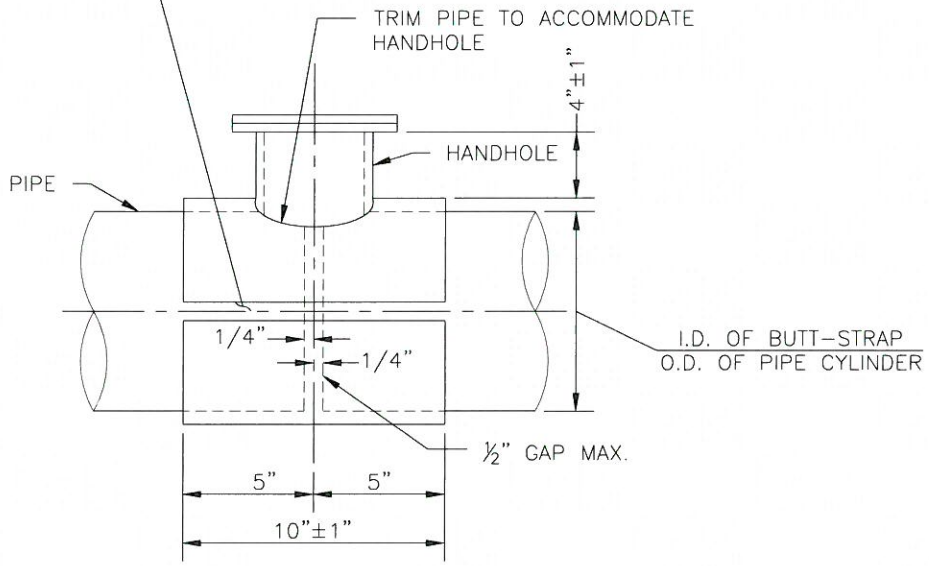
W219

SHEET 1 OF 1

TYPICAL BUTT–STRAP WITH HANDHOLES (STEEL PIPE)



END VIEW



SIDE VIEW

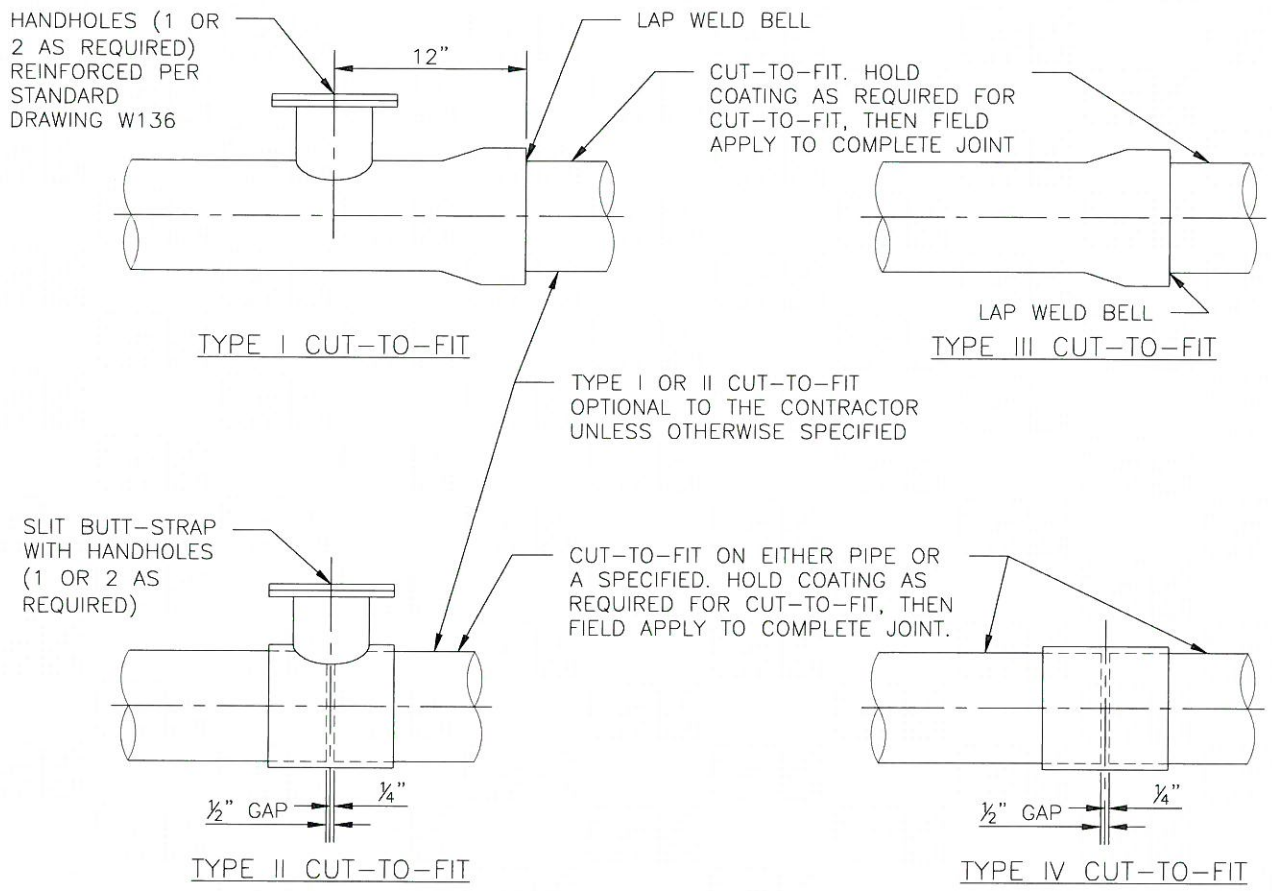
NOTES

1) FOR PIPE 6"–18", LOCATE 1 HANDHOLE ON TOP OF PIPE.
   FOR PIPE 20"–36", LOCATE 2 HANDHOLES AT 30° ABOVE PIPE SPRING LINE.

2) INSTALL HANDHOLE(S) (1 OR 2 AS REQUIRED) REINFORCEMENT PER STANDARD DRAWING W219.

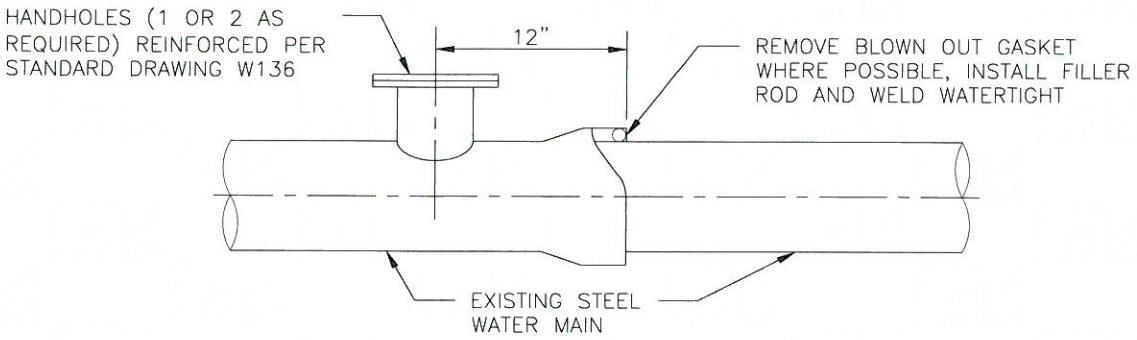
APPROVED	3/31/2020	DESERT WATER	STANDARD DRAWING
Mark A. Krause GENERAL MANAGER, CHIEF ENGINEER	RCE. 46700		W220
REVISION	BY / DATE	CUT–TO–FIT & JOINT REPAIR DETAIL	SHEET 1 OF 3

TYPICAL CUT–TO–FIT DETAILS
(STEEL PIPE)

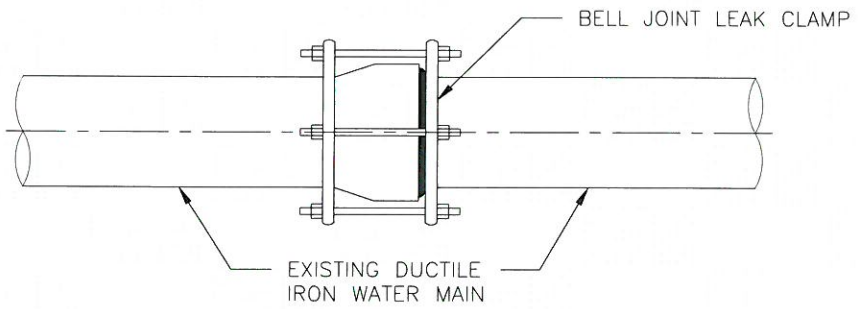


APPROVED 3/31/2020 Mark A Kearns RCE. 46700 GENERAL MANAGER, CHIEF ENGINEER			DESERT WATER
			CUT–TO–FIT & JOINT REPAIR DETAIL
REVISION	BY	DATE	STANDARD DRAWING W220 SHEET 2 OF 3

TYPICAL STEEL PIPE JOINT REPAIR DETAIL
(FIELD CONSTRUCTION)

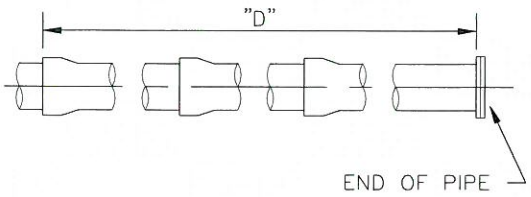


TYPICAL DUCTILE IRON JOINT REPAIR DETAIL
(FIELD CONSTRUCTION)

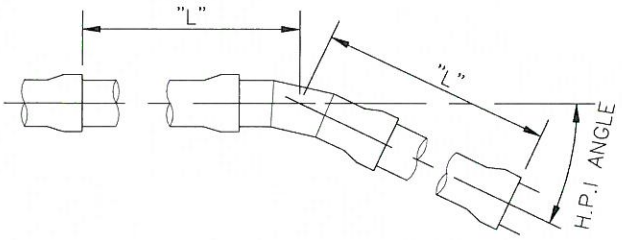


APPROVED 3/31/2020 Mark A. Krause RCE. 46700 GENERAL MANAGER, CHIEF ENGINEER			DESERT WATER
			CUT–TO–FIT & JOINT REPAIR DETAIL
REVISION	BY	DATE	STANDARD DRAWING W220 SHEET 3 OF 3

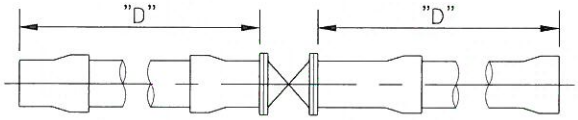
DEAD END



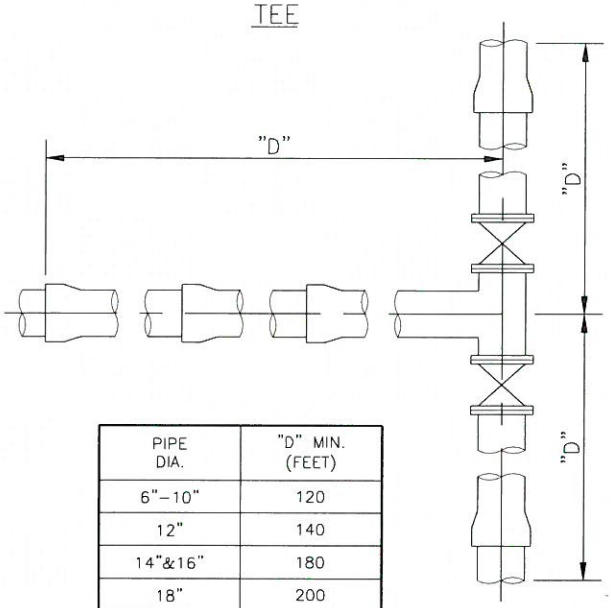
HORIZONTAL BEND



IN-LINE VALVE



TEE



PIPE DIA.	"D" MIN. (FEET)
6"–10"	120
12"	140
14"&16"	180
18"	200
20"	240
24"	280
30"	340
36"	420

PIPE DIA.	H.P.I. (DEGREES)	"L" MIN. (FEET)
6"	5–30	10
	31–60	40
	61–90	80
8"	5–30	15
	31–60	50
	61–90	100
10"&12"	5–30	20
	31–60	80
	61–90	140
14"&16"	5–30	30
	31–60	100
	61–90	200
18"&20"	5–30	30
	31–60	120
	61–90	220
24"	5–30	30
	31–60	140
	61–90	260
27"&30"	5–30	40
	31–60	160
	61–90	300
33"&36"	5–30	50
	31–60	180
	61–90	340

* SEE SHEET 2 OF 2 FOR NOTES

APPROVED 3/31/2020

Mark J. Krause RCE. 46700

GENERAL MANAGER, CHIEF ENGINEER

REVISION	BY	DATE

DESERT WATER

WELDED JOINTS AND RESTRAINED JOINT THRUST PROTECTION

STANDARD DRAWING

W221

THRUST PROTECTION FOR WELDED STEEL PIPE NOTES

1) WELDED STEEL PIPE WITH DIAMETERS 16" AND LESS SHALL HAVE TACK WELDED JOINTS WITHIN LIMITS SHOWN IN TABLES ON SHEET 1 OF THIS STANDARD DRAWING.

2) WELDED STEEL PIPE WITH DIAMETERS 18" AND GREATER SHALL HAVE FULLY WELDED JOINTS WITHIN LIMITS SHOWN IN TABLES ON SHEET 1 OF THIS STANDARD DRAWING.

RESTRAINED JOINTS FOR DUCTILE IRON PIPE NOTES

1) RESTRAINED JOINTS FOR DUCTILE IRON PIPE SHALL BE INSTALLED IN THE FOLLOWING SITUATIONS:
   - ON ALL FITTINGS PER THE LIMITS SHOWN IN TABLES ON SHEET 1 OF THIS STANDARD DRAWING.
   - IN ALL NON-PAVED AREAS.
   - ON ALL FIRE HYDRANT AND/OR BLOWOFF ASSEMBLIES.
   - ON ANY PIPE LOCATED UNDERNEATH DECORATIVE PAVING AND/OR CONCRETE.

2) PIPE LENGTHS AS SHOWN IN THE TABLES ON SHEET 1 OF THIS STANDARD DRAWING REPRESENT THE MINIMUM PIPE LENGTH REQUIRED. IF PIPE LENGTH INDICATED FALLS IN THE MIDDLE OF A STICK OF PIPE, RESTRAINED JOINTS SHALL EXTEND TO THE END OF SAID STICK OF PIPE.

3) RESTRAINED JOINTS SHALL BE FIELD LOK UNLESS OTHERWISE APPROVED BY DESERT WATER AGENCY.

4) FIRE HYDRANTS SHALL UTILIZE BOTH A TEE THRUST BLOCK AND RESTRAINED JOINTS AT A DISTANCE OF 20 FEET ON EITHER SIDE OF TEE.

5) WITH THE EXCEPTION OF FIRE HYDRANTS, THRUST BLOCKS DO NOT NEED TO BE INSTALLED ON RESTRAINED JOINT DUCTILE IRON PIPE UNLESS OTHERWISE SPECIFIED BY DESERT WATER AGENCY.

APPROVED 3/31/2020

Mark A Krause RCE. 46700

GENERAL MANAGER, CHIEF ENGINEER

REVISION	BY	DATE

DESERT WATER

THRUST PROTECTION AND JOINT RESTRAINT

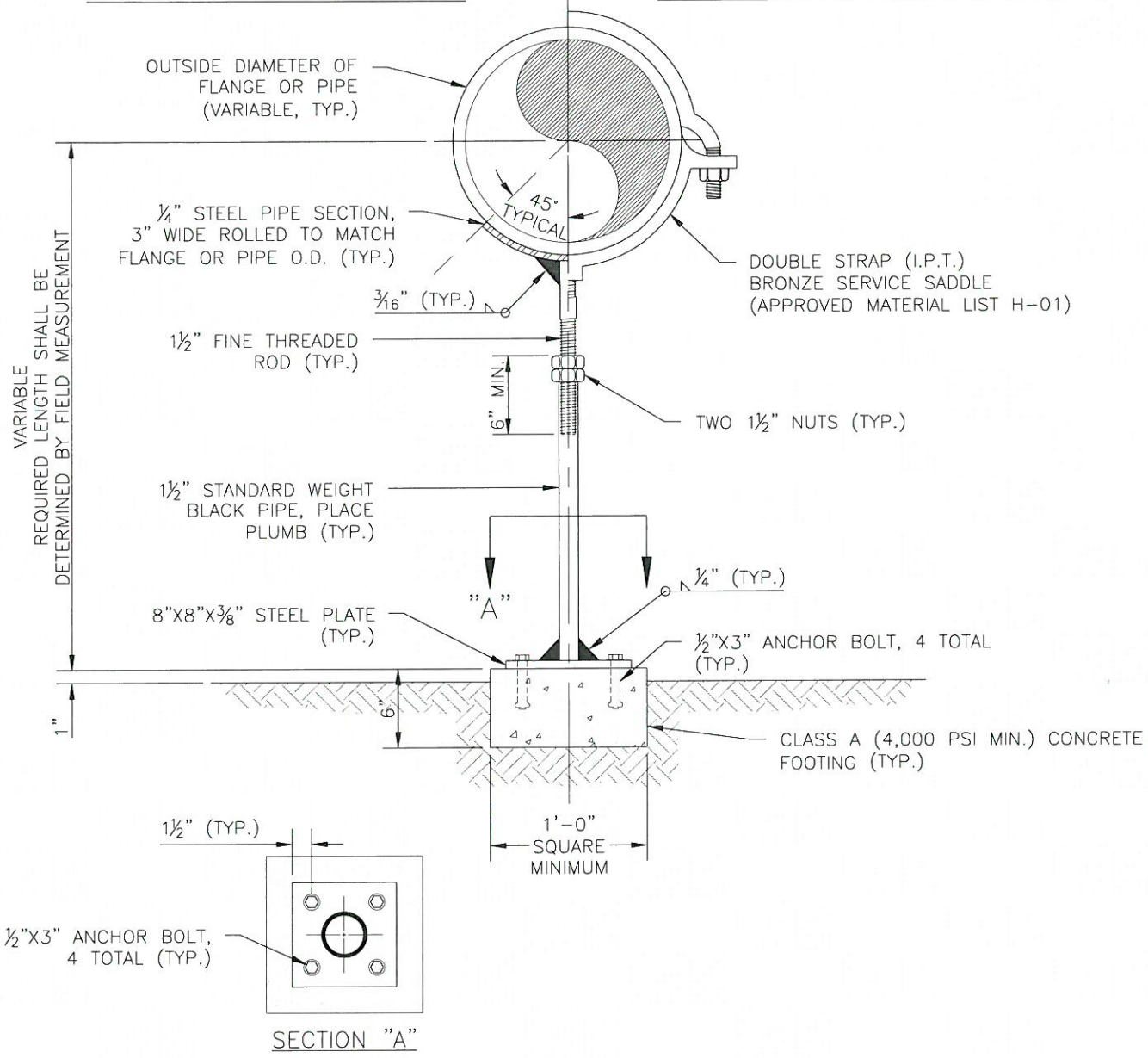
STANDARD DRAWING

W221

SHEET 2 OF 2

CRADLED PIPE SUPPORT

STRAPPED PIPE SUPPORT



SECTION "A"

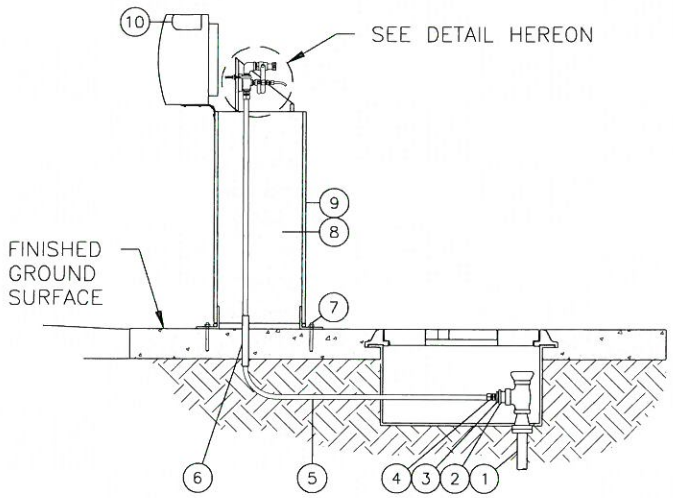
NOTES

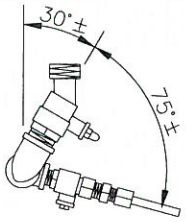
1) PAINT WITH PRIME COAT AND FINISH COAT AFTER FABRICATION IN ACCORDANCE WITH APPROVED AGENCY PAINT SYSTEMS. FINISH COAT SHALL BE SAME AS SUPPORTED PIPE, UNLESS OTHERWISE DIRECTED BY AGENCY.

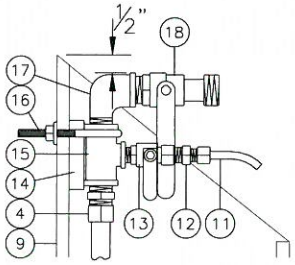
2) USE TO BE PRE APPROVED BY DWA.

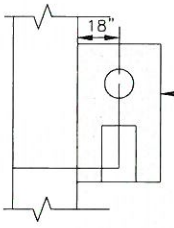
3) CRADLE OR STRAP TO BE DETERMINED BY DWA.

APPROVED 3/31/2020 Mark A Krause GENERAL MANAGER, CHIEF ENGINEER RCE. 46700	DESERT WATER	STANDARD DRAWING W222	
REVISION / BY / DATE	CRADLED OR STRAPPED PIPE SUPPORT	SHEET 1 OF 1	

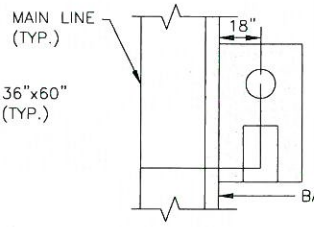




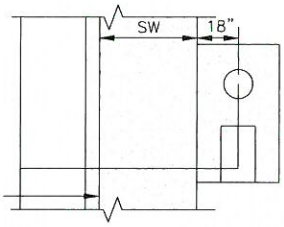




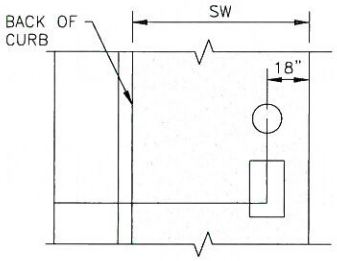
NO CURB & GUTTER



NO SIDEWALK



SIDEWALK WIDTH 8' OR LESS



SIDEWALK WIDTH GREATER THAN 8'

ITEM	NUMBER REQUIRED	DESCRIPTION	APPROVED MATERIAL LIST NO.
1	1	1" SINGLE SERVICE INSTALLATION PER STD DWG. W215 (W/OUT METER)	SEE DWG W215
2	1	1" METER ADAPTER	N/A
3	1	1"x½" BRASS BUSHING REDUCER	N/A
4	2	½" BRASS COMPRESSION MALE CONNECTOR	J-1
5	VARIES	½" COPPER TUBING	J-6
6	VARIES	1" PVC CONDUIT (ENDS SHALL BE SEALED W/SILICON)	N/A
7	3	⅜"x3" CONCRETE WEDGE ANCHOR BOLTS (3 EA. AT 120° APART)	N/A
8	–	CLASS II BASE	N/A
9	1	WATER QUALITY SAMPLE STATION COVER	J-2
10	1	DWA DECAL (TO BE APPLIED BY DWA FORCES)	N/A
11	VARIES	¼" COPPER TUBING	N/A
12	1	¼" BRASS COMPRESSION MALE CONNECTOR	N/A
13	1	¼" BRASS BALL VALVE	N/A
14	1	½"x2" PRESSURE TREATED WOOD SPACER	N/A
15	1	½"x¼" FIP BRASS TEE	N/A
16	1	⅜"x2½"x3½" STAINLESS STEEL U HOOK	N/A
17	1	½" BRASS 90° STREET ELL	N/A
18	VARIES	½" BRASS ¼ TURN NO-KINK HOSE BIB	N/A

APPROVED 3/31/2020 DATE

Mark A Krause RCE. 46700

GENERAL MANAGER, CHIEF ENGINEER

REVISION	BY	DATE

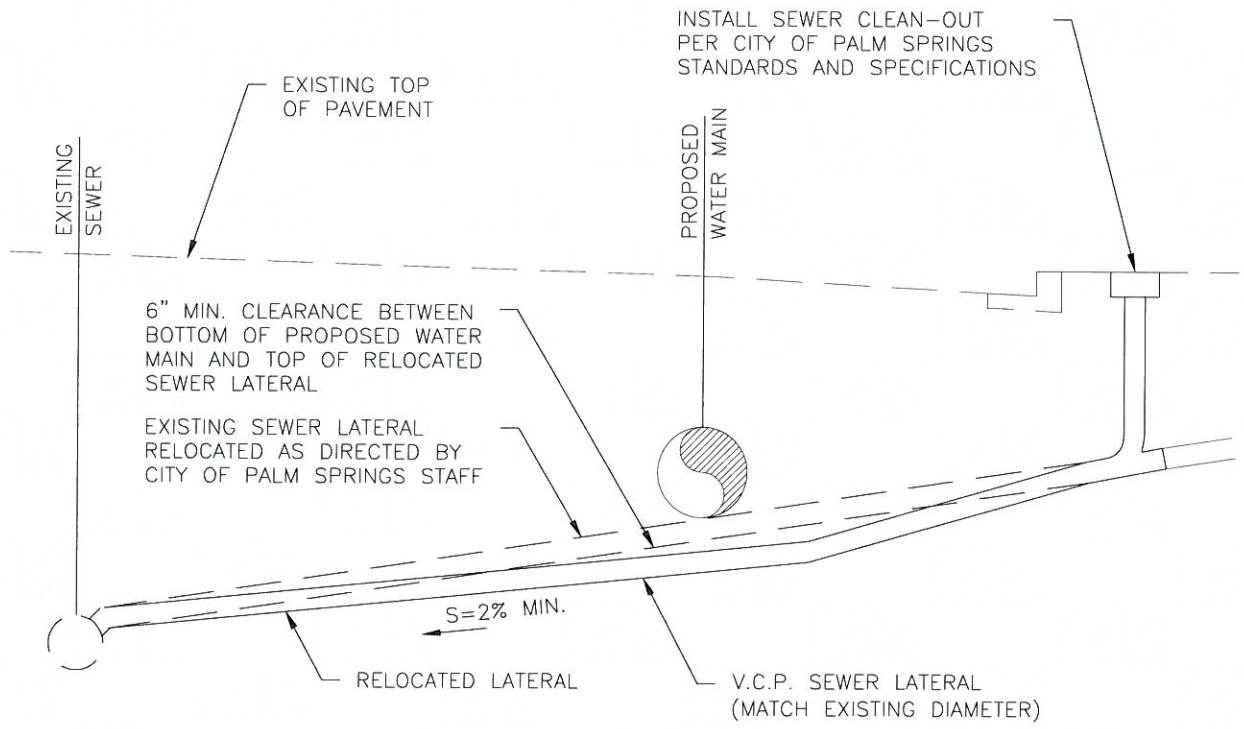
DESERT WATER

WATER QUALITY SAMPLE STATION

STANDARD DRAWING

W223

SHEET 1 OF 1



NOTES

1) IF EXISTING UTILITIES ARE LOCATED BEHIND CURB AND GUTTER. CONTRACTOR SHALL PROTECT SAID FACILITIES IN PLACE.

2) ADDITIONAL FITTINGS, MATCHING EXISTING V.C.P. SEWER LATERAL DIAMETER, MAY BE REQUIRED, AS DIRECTED BY AGENCY. ALL FITTINGS TO BE APPROVED BY AGENCY PRIOR TO INSTALLATION.

APPROVED 3/31/2020 Mark A Krause RCE. 46700 GENERAL MANAGER, CHIEF ENGINEER			DESERT WATER	STANDARD DRAWING
			SEWER LATERAL RELOCATION DETAIL	W224
REVISION	BY	DATE		SHEET 1 OF 1