SECTION 02552
UNDERGROUND CHILLED WATER SYSTEM

PART 1 GENERAL

1.1 RELATED WORK

A. Section 02200: Site Preparation

B. Section 02300: Earthwork

C. Section 02321: Trenching, Backfilling and Compacting

D. Section 02510: Domestic & Lake Water Systems

E. Section 02512: Cathodic Protection for Metallic Fittings and Laterals on Non-metallic pipe

G. Section 02740: Asphalt Concrete Paving

H. Section 02750: Concrete Paving, Curbs and Ramps

I. Section 02950: Site Restoration and Rehabilitation

1.2 SYSTEM DESCRIPTION

A. Chilled Water Distribution Systems: The Stanford Campus is served by a central plant chilled water system. Steam-powered absorption and electric chillers provide chilled water for most of the central campus buildings as well as the Stanford University Medical Center. Variable-speed pumps deliver water to a loop distribution system from which the separate buildings are served.

1.3 REFERENCES

A. American Water Works Association (AWWA):

B. C104 Cement-Mortar Lining for Ductile-Iron and Gray-Iron Pipe and Fittings for Water

C. C105 Polyethylene Encasement for Gray and Ductile Cast-Iron Piping for Water and Other Liquids

D. C111 Rubber-Gasket Joints for Ductile-Iron and Gray-Iron Pressure Pipe and Fittings

E. C115 Flanged Ductile-Iron and Gray-Iron Pipe with Threaded Flanges
F. C151 Ductile-Iron Pipe, Centrifugally Cast in Metal Molds or Sand-Lined Molds, for Water and Other Liquids

G. C153 Ductile Iron Compact Fittings 4 inch through 12 inch for Water and Other Liquids

H. C504 Rubber Sealed Butterfly Valves

I. C509 Resilient-Seated Gate Valves, 3 inch through 12", for Water and Sewage Systems

J. C600 Installation of Ductile-Iron Water Mains and their Appurtenances

K. C605 Underground Installation of Polyvinyl Chloride (PVC) Pressure Pipe and Fittings for Water

L. M. C900 Polyvinyl Chloride (PVC) Pressure Pipe, 4 inch through 12", for Water

N. C905 Polyvinyl Chloride (PVC) Pressure Pipe, 14” through 24”, for Water

1.4 SUBMITTALS

A. Provide manufacturers’ specification and literature for all materials furnished.

B. Contractor shall submit manufacturers' Certificates of Compliance for all materials furnished from suppliers not specifically listed in this specification or as shown on the contract drawings.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Delivery and Storage:

1. Contractor shall be responsible for inspecting materials delivered to site for damage.

2. Materials shall be stored on site in enclosures or under protective coverings. Materials shall not be stored directly on ground.

3. Plastic piping and rubber gaskets shall be stored under cover, out of direct sunlight.

B. Handling:

1. Pipe, fittings, valves, and other accessories shall be handled in such a manner as to ensure delivery to the job site in sound, undamaged condition.

2. Special care shall be taken to avoid injury to coatings and linings on pipe and fittings. The Contractor shall repair damaged coatings and linings to the satisfaction of the Owner.
PART 2 PRODUCTS

2.1 CHILLED WATER PIPING, VALVES AND APPURTEYNANCES

A. General: All underground piping for chilled water system distribution shall be a minimum Ductile iron pipe (DIP): Pipe shall conform to AWWA C151, minimum pressure class 250. All ductile iron pipe shall be cement mortar lined in conformance with AWWA C104 and shall have a 1 mil thick exterior petroleum asphaltic coating. Pipe shall be of domestic manufacture: U.S. Pipe, American Ductile Iron pipe, or Pacific States. No substitutions.

B. Polyvinyl Chloride Pipe (PVC): Pipe shall conform to AWWA C900 / AWWA C905 Class 150, cast-iron O.D. sizes. Pipe shall be of domestic manufacture: JM Mfg. Co., PW Pipe, or Certainteed Fluid Tite; no substitutions. Pipe shall be furnished with integral bells. Spigot end pipe with separate double hub couplings is not acceptable.

2.2 WATER LINES 2-INCH AND SMALLER DIAMETER

A. Pipe shall be annealed (soft) Type "K" copper (Cu). No hard copper tubing is permitted.

2.3 POLYETHYLENE ENCASEMENT

A. Where shown on plans buried ductile iron pipe and fittings shall be encased in polyethylene in accordance with AWWA C105.

2.4 COUPLINGS AND SLEEVES

A. General: All couplings and sleeves for plain end pipe, and accessories shall be of domestic manufacture; U.S. Pipe, Tyler/Union Foundry, Smith-Blair; no substitutions.

2.5 DUCTILE IRON AND PVC PIPE:

A. Solid sleeves shall be mechanical joint type conforming to AWWA C153 as manufactured by Tyler/Union Foundry, or US Pipe. No substitutions.

B. Couplings: Quantum Couplings as manufactured by Smith-Blair, Inc. No substitutions.

C. Unless otherwise noted, flanges on all DIP spools shall conform to AWWA C115.

D. Solid sleeves shall be mechanical joint type conforming to AWWA C153 as manufactured by Tyler/Union Foundry, or US Pipe. No substitutions.

2.6 COPPER TUBING:

Couplings and pipe thread adaptors for copper tubing shall be Mueller 110 Compression Connection; no substitutions. Soldered joints are not permitted.
2.7 ASSEMBLY BOLTS AND NUTS:

Bolts and nuts for above ground flanges shall be standard hex head, cadmium plated machine bolts with American Standard Heavy, hot pressed, cadmium plated hexagonal nuts. Buried flange nuts and bolts shall be as above except they shall be of Type 304 stainless steel. Bolts and nuts for mechanical joints shall be high-strength, low-alloy corrosion resistant steel conforming to ASTM A 325 (type 3).

2.8 FITTINGS

A. Fittings for pipe sizes 4-inches thru 12-inches shall be mechanical joint, AWWA Cl53, 350 psi working pressure rated, ductile iron for use with the type of pipe specified. Fittings shall be cement mortar lined per AWWA C104 and shall have a 1 mil thick exterior petroleum asphaltic coating. T-bolts shall be AWWA C111, high strength, low alloy steel. Fittings and all accessories shall be of domestic manufacture; U.S. Pipe TrimTyte, Union Foundry, Tyler; no substitutions.

B. Fittings for pipe sizes 14-inches thru 36-inches shall be mechanical joint, AWWA Cl53, 350 psi working pressure rated, ductile iron for use with the type of pipe specified. Fittings shall be cement mortar lined per AWWA C104 and shall have a 1 mil thick exterior petroleum asphaltic coating. T-bolts shall be AWWA C111, high strength, low alloy steel. Fittings and all accessories shall be of domestic manufacture; U.S. Pipe TrimTyte, Union Foundry, Tyler; no substitutions.

C. Fittings used at intersections of water mains where valves are required shall be cement lined, flanged fittings. Valves at these locations shall have flange by mechanical joint ends. Flange bolts and nuts at these locations shall be stainless steel.

D. Fittings for PVC pipe 2-inches in diameter and smaller shall be Schedule 40 PVC. Fittings shall be solvent weld socket fittings except where there is a change in pipe material.

2.9 MECHANICAL JOINT RESTRAINTS

A. Mechanical joint restraints for Ductile Iron pipe and PVC pipe sizes 4-inches thru 24-inches shall be Mega-Lug® type as manufactured by EBAA, Inc. Series 1100 for Ductile Iron pipe and series 2000 for PVC pipe. No Substitutions.

2.10 GATE VALVE

A. Buried gate valves 4-inches thru 12-inches diameter shall be Mueller resilient wedge gate valve model A 2360 series, 250 psi working pressure, non rising stem with square operating nut (turned counterclockwise to open), and –“O” ring packing; no substitutions. 3-inches size shall be by an approved manufacturer.

B. Gate valves 2-inches and smaller shall be Milwaukee with handwheel, no substitutions.
C. For above ground gate valves in domestic and fire service systems, including backflow prevention assemblies and other locations with handwheel, see Section 2.13 below.

2.11 BUTTERFLY VALVES

A. Buried Butterfly valves 14-inches thru 36-inches diameter shall be AWWA C504, Class 150B Mueller Line Seal III, No substitutions.

B. Furnish with enclosed operators with two-inches square operating nut. Nut turned counter-clockwise (left) to open.

2.12 TAPPING SLEEVE AND VALVE

A. Tapping sleeves for 4-inches thru 12-inches mains shall be cast iron, 200 psi working pressure; Mueller H 615/H 619; no substitutions.

B. Tapping valves shall be Mueller resilient wedge gate valve model A 2360-16, 250 psi working pressure, non rising stem with 2-inches square operating nut (turned counterclockwise to open), and "O" ring packing; no substitutions, with flanged or mechanical joint ends.

C. Tapping sleeves and valves for mains 14-inch diameter and larger shall be Mueller H 615/H 619 or approved equal.

2.13 SERVICE SADDLES

A. Service saddles for pipes 4-inches thru 12-inches diameter shall be Mueller BR2B Double strap bronze with AWWA I.P. thread. Tap diameter to match service connection size. No substitutions.

B. Pipes 14-inches thru 36-inches diameter shall be Smith Blair model 317 with fusion nylon coated body, 2 inches IP threaded outlet, double stainless steel straps and stainless steel bolts and nuts.

2.14 AIR RELEASE VALVES

A. Air release valves shall be two inches (2-inches), cast-iron body, threaded inlets, stainless steel trim, floats, seats, and linkage. Air release valves shall be universal air-vacuum type, Val-Matic 200 series, no substitutions

B. Corporation stops (for use with air release valve connections): Corporation stops shall be two inches (2-inches) size, cast bronze body, plugs, and trim, and IP threaded for saddles, Mueller H-15023, no substitutions.
2.15 ACCESSORIES

A. Valve Extension Handles: Extension handles for supply valves shall stop not less than three feet (3') from grade. Extension handles for return valves shall stop not less than two (2') feet from grade.

B. Valve Boxes: A valve box shall be provided for each buried valve. Water valve boxes shall be pre-cast concrete box with cast iron traffic cover; Christy box #G5 with C275 cover; no substitutions. Valve boxes shall be marked "CWS" and "CWR" welded on the rims for chilled water supply and chilled water return valves respectively. Letters shall be one-inch (1") high minimum.

C. Wall Penetration Sleeves: 1/8 inch hot-dip galvanized steel sleeve with 1/8 inch continuously welded two inch (2") weep ring shall be provided.

D. Wall Penetration Seals: Elastomeric link-type mechanical seal; Thunderline Link-Seal, no substitutions.

2.16 TRACER WIRE:

A. No. 8 AWG insulated copper wire, solid or stranded, shall be provided in sufficient length to be continuous over each separate run of pipe and looped into each valve box.

2.17 MARKING TAPE

All buried pipelines shall have plastic warning tape installed a minimum of 12-inches above the top of the pipelines. The warning tape shall be a minimum of 2-inches wide. Blue with black lettering reading “CAUTION, CHILLED WATER MAIN BURIED BELOW

PART 3 EXECUTION

3.1 INSTALLATION

A. Except as noted herein or on the plans, all water system structures, components, and appurtenances shall be constructed and installed in accordance with the applicable AWWA specifications.

B. Connections to Buildings:

1. Buried connections to buildings shall be made with ductile iron pipe and flange assemblies in accordance with Standard Drawing.

2. Pipe entering the building shall be anchored to the building wall or otherwise restrained against hydrostatic forces resulting from unrestrained joints in the pipe system external to the building.
3.2 MINIMUM COVER FOR UNDERGROUND LINES

A. Lines 4-inch and greater diameter: 42-inches minimum cover.

B. Lines less than 4-inch diameter: Paved areas: 42-inches minimum cover; Landscaped and unimproved areas: 36-inches minimum cover.

3.3 VALVE INSTALLATION:

A. Valves, extension handles, and valve boxes shall be installed in accordance with AWWA C600, AWWA C605 and applicable Standard Drawings for valve and fitting installation.

B. Insides of valve boxes and bottoms of covers shall be painted yellow for supply valves and red for return valves.

C. Air release valves shall be installed as detailed on Standard Drawing CS-104.

D. Valve Box Installation: Valve boxes shall be installed in accordance with Standard Drawing CS-102, with asphalt or concrete surface, as the site requires. When boxes are set in pairs, the "CWS" and "CWR" markings on the rims shall be placed at points closest to each other to indicate valve pairs.

3.4 THRUST BLOCK

A. Thrust block locations may not be shown on the drawings, but blocks shall be provided for all pressure pipe fittings, changes in pipe alignment/direction, and at all other points where there is a possibility of joint separation under pressure and no other method of restraint is specified. Provide anchors and supports where necessary for fastening work into place. Make proper provisions for expansion or contraction of pipelines. Thrust blocks shall be placed between solid ground and the pipe or fittings to be anchored as detailed. Thrust blocks shall be as detailed on the drawings, or where not detailed, in accordance with AWWA C600 and pipe manufacturer's recommendations.

B. Where concrete thrust blocking is not possible due to space limitations or unstable soil conditions, the Contractor shall provide an alternate means of thrust restraint. Thrust restraint methods shall conform to NFPA 24 requirements. Acceptable methods include mechanical joint ductile iron retainer glands, restrained mechanical joints, and restrained push on joints. Tie rods shall not be used unless tie rod materials, tie rod arrangement, and corrosion protection methods have been specifically submitted and approved by the Stanford Utilities Department for the actual field conditions encountered.

C. Backfilling operations at thrust blocks may begin as soon as the concrete has set sufficiently to remain in position and withstand the weight of the earth. Concrete shall not be disturbed or pressure loaded for at least five (5) days after placing unless otherwise permitted by the Owner.
3.5 UNDERGROUND PENETRATIONS OF BUILDING AND MANHOLE WALLS:

A. Penetrations of concrete walls shall be core-drilled holes or cast-in-place PVC or galvanized steel sleeves with seals.

B. Penetrations of masonry walls shall be galvanized steel sleeves with seals.

C. Seals shall be installed in accordance with manufacturer's instructions.

3.6 FLUSHING

A. Prior to hydrostatic testing, pipe system shall be flushed with fresh water until piping is free of dirt and foreign matter. Piping shall not be flushed using water from the chilled water system. Dechloraminate prior to discharge of domestic water to storm drainage. Contractor shall provide all necessary hoses and connections between the domestic water system and the chilled water system. Contractor shall be responsible for properly disposing of flush water. Sterilization of chilled water system piping is not required.

B. After flushing chilled water main Contractor shall demonstrate main is free of debris with video camera inspection or other method approved by the owner.

3.6 HYDROSTATIC PIPELINE TESTING

A. After the pipe has been laid and backfilled it shall be subjected to hydrostatic pressure tests. Tests shall not be conducted until at least 12 hours have elapsed since pipe laying and at least five (5) days have elapsed since placing of concrete thrust blocks. The pipe shall be filled with water, which shall remain without external application of pressure for 24 hours before tests are conducted.

B. Prior to hydrostatic testing, flush pipe system with fresh water until piping is free of dirt and foreign matter.

C. Pressure shall be applied by a pump and measured by a test gage. The Contractor shall furnish all necessary apparatus and labor for conducting the pressure and leakage tests.

D. The Contractor is responsible to ensure the release of air from the line during filling, as well as the prevention of collapse due to vacuum when dewatering the line.

E. For pressure test, use a hydrostatic pressure not less than 200 psi. The duration of the test shall not be less than 4 hours. The pressure shall not vary by more than 5 psi for the duration of the test.

F. For portions of new mains with butterfly valves, use a hydrostatic test pressure of not less than 150-psi. The duration of the test shall not be less than 4 hours. The pressure shall not vary by more than 5-psi for the duration of the test.
G. Leakage Defined. Leakage shall be defined as the quantity of water that must be supplied into a newly laid pipe or any valved section to maintain pressure within 5-psi of the specified test pressure after the pipe has been filled with water and the air expelled. A drop in pressure in the test section shall not measure leakage over a period of time.

H. Allowable Leakage. No pipe installation will accepted if the leakage is greater than that determined by the following formula per AWWA C600-93:

\[ L = \frac{(S \times D \times \sqrt{P})}{133,200} \]

Where:

L = allowable leakage, in gallons per hour

S = length of pipe, feet

D = pipe diameter, inches

P = test pressure, psi

I. Acceptance. Acceptance shall be determined on the basis of allowable leakage. If any test of laid pipe discloses leakage greater than specified in section 3.05.H, repairs or replacements shall be made by the contractor’s at his own expense.

END OF SECTION