

## 33 61 00 – Chilled Water Distribution

### 1. Introduction

- A. Campus chilled water leaves the central chilled water plants at 40°F with pressures up to 125 psi and is returned to the chilled water plants at 56°F.
- B. Campus chilled water distribution systems will be designed in accordance with master plans developed by the Duke Utilities and Engineering Services (DUES) Department.
- C. Planning for utility requirements to support projects must start in the programming stages to ensure the work is coordinated with ongoing projects and there is adequate capacity to support the project.
- D. All proposed system modifications and extensions shall be coordinated with the DUES Department. Final approval of any system modifications and extensions require the final review and approval of the Chilled Water Systems Manager.

### 2. References

- A. AWWA Standards

### 3. Design Standards

- A. Buried piping systems shall withstand HS-20 highway loading with 3 feet of compacted backfill over top of conduit. Mark each section of buried conduit with fabricator's name, product identification and publications to which the items conform. Provide each section of carrier pipe including factory-applied insulation and conduit, with waterproof conduit ends at both ends of each section of carrier pipe, except for piping systems which have the field joints insulated and covered with waterproof shrink sleeves.
- B. End Seals: Each length of pre-insulated pipe shall be fitted with a watertight mastic end seal at jacket and pipe surfaces. All field cuts to be sealed with a field applied end seal. For non-insulated joints, the end seal shall have certification from an independent testing laboratory that all have been tested and certified to be watertight. Testing shall be by means of 20 feet of head pressure over the entire surface for a minimum of 48 hours.
- C. Considerations in developing pipe routing:
  - 1. Hydraulic analysis will be performed by DUES appointed engineering firm.
  - 2. Proper locations of drain and fill assemblies shall be identified to allow for the complete drainage of the campus chilled water distribution system in its entirety.
  - 3. Determine if there is a need for redundant points of service.

- D. Provide factory pre-insulated piping system with HDPE (high density polyethylene) outer jacket for all underground chilled water distribution supply piping (return piping is not insulated or jacketed).
1. Carrier Pipe: Provide cement lined ductile iron piping. Provide AWWA C 151 and Federal Specification WW-P421-D pipe class 150 in nominal 20 foot lengths. Joints shall be of the push-on gasket type with gaskets made of Styrene Butadiene Rubber (SBR).
    - a. Pipe, fittings, flanges and couplings shall be marked with manufacturer's name, product identification and publication to which items conform.
  2. Insulation: Provide polyurethane foam with a minimum K factor of 0.13 and a density of 2 pcf. Closed cell content to be 90-95% in conformance with MIL-I-24172 completely filling the annular space between the carrier pipe and jacketing.
  3. Jacket Pipe: Outer casing shall be polyethylene of 80-mil minimum thickness. Fiberglass jacketing is not allowed and is not considered to be an equal. All jackets shall be polyethylene NO EXCEPTIONS.
  4. Fittings: Provide uninsulated fittings conforming to AWWA C110 or AWWA CL II that are furnished by the contractor and approved by the pre-insulated pipe manufacturer.
  5. Restraints: All fittings shall be provided with "Megalug" torque type restraints. Pressure test and approve piping joints.
    - a. Mechanical joint restraint shall be incorporated into the design of the follower gland. The restraining mechanism shall consist of individually actuated wedges that increase their resistance to pull-out pressure as pressure or external forces increase. The device shall be capable of full mechanical joint deflection during assembly and the flexibility of the joint shall be maintained after burial.
    - b. The joint restraint ring and its wedging components shall be made of grade 60-42-10 ductile iron conforming to ASTM A536-84.
    - c. The wedges shall be heat-treated to a minimum hardness of 370 BHN.
    - d. Dimensions of the gland shall be such that it can be used with the standardized mechanical joint bell fitting conforming to ANSI/AWWA C111 /A21.11 and ANSI/AWWA C153/A21.53 of the latest revision.
    - e. Torque limiting twist-off nuts shall be used to insure proper actuation of the restraining wedges.
    - f. The mechanical joint restraint shall be available in the three through forty-eight inch sizes.

- g. They shall have a rated working pressure of 350 psi in sizes sixteen inch and smaller and 250 psi in sizes eighteen inch through forty-eight inch.
            - h. The devices shall be listed by UL up through twenty-four inch and approved by Factory Mutual up through twelve-inch size.
            - i. Restrained joint: Restrained type joint gasket assembly rated up to 250 psi conforming to ANSI/AWWAC111/A21.11 standard. All gaskets shall be similar to U.S. Pipe FIELD LOK Gasket. Stainless steel locking segment vulcanized into the gasket.
6. Chilled Water Valves: System isolation valves shall be buried service valves. All valves shall be high pressure rated and capable of bubble tight shutoff capacity of 150-psig differential pressure in either direction.
4. Documentation and Review Requirements
- A. Provide manufacturer's pre-insulated piping catalog data showing thermal properties for pipe, fittings and end connections.
5. Installation and Performance Requirements
- A. Duke University is registered with the State of North Carolina's "One-Call System." All contractors, prior to excavation on any University project, shall contact North Carolina One-Call System at 800-632-4949.
  - B. Buried piping systems shall withstand HS-20 highway loading with no less than 3 feet of compacted backfill over top of conduit.
  - C. Utility contractor shall extend chilled water piping inside building envelope to a blind-flanged connection. This shall be a factory made flanged pipe, not field installed "uni-flange."
  - D. Upon completion of the project, Chilled water piping requires spiral washing and witnessed hydro-testing to a minimum of 200 psig for 2 hours.
6. Manufacturers and Basis of Design
- A. To establish a level of quality for performance comparisons, the following are considered the basis of design and approved equals for conduit systems:
    - a. Basis of design: ROVANCO ductile iron system insulated by Thermacor Process Ltd.
  - B. To establish a level of quality for performance comparisons, the following are considered the basis of design and approved equals for torque type restraints:

- a. Basis of design: Megalug Series 1100 as manufactured by EBBA Iron Sales, Inc.
  - b. Field LOK gasket as manufactured by U.S. Pipe.
- C. Ductile Iron Pipe:
- a. U.S.Pipe
  - b. Tyler Pipe
  - c. HARCO, Inc.
  - d. American Ductile
  - e. Grinnell

7. Buried Warning and Identification Tape Requirements

- A. Provide detectable aluminum foil plastic backed tape or detectable magnetic plastic tape manufactured specifically for warning and identification of buried piping. Tape shall be detectable by an electronic detection instrument. Provide tape in rolls, 3 inches minimum width, color coded for the utility involved with warning and identification imprinted in bold black letters continuously and repeatedly over entire tape length. Warning and identification shall read "CAUTION BURIED PREINSULATED WATER PIPING BELOW" or similar wording. Use permanent code and letter coloring unaffected by moisture and other substances contained in trench backfill material.