

## DIVISION 33 – UTILITIES

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### 33 05 00 COMMON WORK RESULTS FOR UTILITIES

RESERVED

### 33 11 00 WATER UTILITY DISTRIBUTION PIPING

A. **Design Considerations**

RESERVED

B. **Special Documentation Requirements**

1. A CONTRACTOR'S MATERIAL AND TEST CERTIFICATE FOR UNDERGROUND PIPE shall be completed and submitted by the Contractor to the University Construction Code Official, Factory Mutual Engineering, and the Office of University Facilities and Capital Planning representative responsible for the project, on an approved form. The contractor shall provide a hydraulic design placard at the main riser base.

C. **Materials and Methods of Construction**

1. Fire Protection:
  - a. Reference Standards: Installation of underground fire protection mains shall comply with the following standards:
    - 1) NFPA No. 24, *Private Fire Service Main and Their Appurtenances*
    - 2) Factory Mutual Data sheet 3-10, *Fire Service Mains*
  - b. Underground mains shall be cement lined ductile iron class 52 with mechanical joints. Retaining glands shall be the mechanical joint wedge action type.
  - c. Use a pressed flange when transitioning from ductile iron to any other material. Uniflanges are not permitted.
  - d. Depth of Cover: The depth of cover over fire protection water mains shall be not less than 4 1/2 feet, measured from the top of the pipe to finished grade. SK-45 and SK-46 of Rutgers

Design Standards provide the details for the installation of underground fire service mains installations as well as details for warning tape and tracer wire.

e. Pipe Joints: All bolted joint assemblies shall be cleaned and thoroughly coated with asphalt or other corrosion-retardant material after installation of the assembly and prior to inspection and backfilling.

f. Anchoring: Mechanical joints shall be utilized on all tees, plugs, hydrant branches and bends. These joints on underground pipe shall be restrained against movement. Restraint shall be via threaded rods and riser clamps.

g. Flushing: Underground mains and lead-in connections to system risers shall be flushed thoroughly before connection is made to sprinkler, standpipe, or other fire protection system piping in order to remove foreign materials which may have entered the pipe during the course of the installation. The minimum rate of flow shall be not less than the demand rate of the system or the following rates, whichever is the greater:

Pipe Size	Flow Rate
4"	400 gpm
5"	600 gpm
6"	750 gpm
8"	1000 gpm

h. Fire Hydrant: The University standard fire hydrant is Model A-423 (Centurion), manufactured by the Mueller Company. The hydrant shall contain one 4-1/2" National Standard Fire Hose Thread (NST) pumper outlet and two 2-1/2" NST hose outlets. The pumper outlet shall be adjusted to face in the direction prescribed by the University Construction Code Official, and such adjustment, if necessary, shall be made by the installing contractor prior to acceptance of the installation by the University Construction Code Official.

1) All fire hydrants shall be set on a gravel bed of at least 12" deep, minimum to ensure quick drainage from the ports provided near the base of the hydrant barrel.

2) The center of the pumper connection shall be not less than 12" above final grade.

- i. Inspections and Tests: No underground fire protection pipe assembly or fire hydrant shall be backfilled prior to inspection and approval of the installation by the University Construction Code Official or his designee.
  - 1) A hydrostatic test shall be performed on the underground fire protection pipe assembly upon completion of the installation. All components, such as valves, fittings, hydrants, etc. shall be installed prior to the final test. The Contractor may conduct preliminary testing for his benefit; however the University will not accept such preliminary testing in lieu of the final required inspections and tests. The hydrostatic test shall be performed for not less than two hours, and shall be witnessed by the Construction Code Official or his designee. A Utilities representative should also witness the hydrostatic test.

2. Domestic Water:

- a. Reference Standards: Installation of underground domestic water mains shall comply with the following standards:
  - 1) Factory Mutual requirements
- b. Underground mains shall be class 52 ductile iron cement lined with mechanical joints. Retaining glands shall be the mechanical joint wedge action type.
- c. Use a pressed flange when transitioning from ductile iron to any other material. Uniflanges are not permitted.
- d. Depth of Cover: The depth of cover over domestic water mains shall be not less than 3 1/2 feet, measured from the top of the pipe to finished grade. SK-45 and SK-46 of Rutgers Design Standards provide the details for the installation of underground water mains installations as well as details for warning tape and tracer wire.
- e. Pipe Joints: All bolted joint assemblies shall be cleaned and thoroughly coated with asphalt or other corrosion-retardant material after installation of the assembly and prior to inspection and backfilling.
- f. Anchoring: Mechanical joints shall be utilized on all tees, plugs, hydrant branches and bends. These joints on underground pipe

shall be restrained against movement. Restraint shall be via threaded rod and riser clamps.

- g. Flushing: Underground mains and lead-in connections to system risers shall be flushed thoroughly before connection is made in order to remove foreign materials which may have entered the pipe during the course of the installation. The minimum rate of flow shall be not less than the demand rate of the system or the following rates, which- ever is the greater:

Pipe Size	Flow Rate
4"	400 gpm
5"	600 gpm
6"	750 gpm
8"	1000 gpm

- h. Inspections and Tests: No underground domestic water line shall be backfilled prior to inspection and approval of the installation by the University Construction Code Official or his designee.
  - 1) A hydrostatic test shall be performed on the underground domestic water pipe assembly upon completion of the installation. All components, such as valves, fittings, etc. shall be installed prior to the final test. The Contractor may conduct preliminary testing for his benefit; however the University will not accept such preliminary testing in lieu of the final required inspections and tests. The hydrostatic test shall be performed for not less than two hours, and shall be witnessed by the Construction Code Official or his designee. A Utilities representative should also witness the hydrostatic test.

### **33 21 00 WATER SUPPLY WELLS**

**RESERVED**

### **33 30 00 SANITARY SEWERAGE UTILITIES**

#### **A. Design Considerations**

**RESERVED**

**B. Special Documentation Requirements**

**RESERVED**

**C. Materials and Methods of Construction**

1. Hubless cast iron pipe is not acceptable below grade. SDR-35 shall be used for underground gravity flow sanitary lines.
2. Underground force mains shall be class 52 ductile iron cement lined with mechanical joints. Retaining glands shall be the mechanical joint wedge action type.
3. All sanitary lines, warning tape, and tracer wire shall be installed in accordance with SK-44 of Rutgers Design Standards.
4. Minimum cover under roads for Sanitary Sewer systems shall be 3'-6" and minimum slope shall be 1" in 15'-0" (.55% slope).
5. All new sanitary lines exiting a building shall go to a manhole. Interlock gaskets shall be used for manhole penetrations.
6. On 4" pipe or less, there should be a clean-out every 75 feet or change of direction greater than 45 degrees.

### **33 32 13 PACKAGED UTILITY LIFT STATIONS**

**A. Design Considerations**

**RESERVED**

**B. Special Documentation Requirements**

**RESERVED**

**C. Materials and Methods of Construction**

1. All sanitary sewage pump stations over 8,000 gpd shall be a wet well/dry well system as manufactured by Smith and Loveless or approved equal.
2. All sanitary sewage pump stations must include an Interlink Monitoring System connected to the existing Interlink Monitoring System at the University. The installation shall include one Remote Transmitting Unit with battery back-up, surge protection for AC power and telephone line in NEMA 3 enclosure.

3. The sanitary sewage pump station shall include one exterior strobe and horn to be seen from the closest roadway.

### **33 36 00 UTILITY SEPTIC TANK SYSTEMS**

**RESERVED**

### **33 40 00 STORM DRAINAGE UTILITIES**

#### **A. Design Considerations**

1. During design identify and calculate stormwater running onto the site in addition to the anticipated runoff from the site. Prepare calculations to support a stormwater system of capacity to control both. Calculations shall be prepared early in the design process and be integral in the establishment of finish exterior elevations.
2. Trench type storm drains are to be avoided.
3. Road grates shall be Campbell Foundry Company #2617, or approved equal. These grates are bicycle safe grates and in accordance with NJPDES Phase 2 Compliant Stormwater guidelines.
4. The top of lawn grates shall be set 1/2" below finished grade level to facilitate drainage. Lawn grates shall be round.
5. Specify that Contractor shall clean interior of piping after installation.
6. Manholes: Specify precast concrete, 4000 psi minimum with rubber gasket joints. Wall to be 5" thick with aluminum drop front ladder rungs, 12" oc.
  - a. Base, as a minimum, shall be 6" thick with #4 bars 12" o. c. both ways. Manhole openings shall be 30" diameter with roadway type frame and cover by Campbell or Neenah Foundries, or approved equal. Entire interior concrete surface shall receive 2 coats "Drycon" as manufactured by I. P. A. Systems, Inc. See sketch in Part IV.
7. Where down spouts are utilized, these should be tied into adjacent storm drainage.

## **33 46 00 SUBDRAINAGE**

**RESERVED**

## **33 47 13 POND AND RESERVOIR LINERS**

**RESERVED**

## **33 51 00 NATURAL-GAS DISTRIBUTION**

**RESERVED**

## **33 52 00 LIQUID FUEL DISTRIBUTION**

**RESERVED**

## **33 52 13 FUEL-OIL DISTRIBUTION**

### **A. Design Considerations**

**RESERVED**

### **B. Special Documentation Requirements**

1. All documentation requirements shall be coordinated with REHS.

### **C. Materials and Methods of Construction**

1. Underground Storage Tanks:
  - a. All Installations, Modifications and Upgrades of Underground Storage Tank (UST) Systems shall be done in accordance with the UST regulations as required by the New Jersey Administrative Code (N.J.A.C.) 7:14B. Any questions concerning Environmental Regulations governing the removal or remediation of UST's should be addressed by contacting Rutgers Environmental Health and Safety Department.
  - b. Use # 2 fuel oil type systems.
  - c. All new underground tank installations shall consist of double wall underground tank with a primary welded steel tank and a secondary FRP laminate outer tank, as manufactured by Plasteel Elutron or approved equal. The tank shall meet all required UL and Factory Mutual standards. At a minimum, the tank shall

include a tank access manway, piping sump, fill port, interstitial monitoring port and vent connections.

- d. The hold-down concrete pad shall be sized to prevent the underground tank from floating. Preferred backfill material is pea gravel. However, the backfill material shall be as confirmed with the equipment manufacturers.
- e. All product piping shall be double wall piping system. All components of the piping system shall be made of non-corrosive materials, or if metallic, such as fittings and couplings, isolated from corrosion causing agents. The piping shall be sloped back to the sump mounted on the underground tank and monitored by the tank monitoring system.
- f. All underground vent piping shall be non-corrosive, non-degradable, and resistant to attack from microbial growth. The piping shall have sufficient strength to withstand design underground burial loads. Above ground vent riser piping shall be Schedule 40 galvanized steel piping.
- g. All tank systems shall include a tank monitoring system. The system shall monitor the interstitial of the underground tank, the interstitial of the underground piping, and the amount of product in the tank. The system shall also be capable of performing tank tightness tests. Audible and visual alarms shall be a part of the monitoring system. The monitoring system shall be a Veeder Root TLS 350. For tank installations 1,000 gallons or smaller, a Veeder Root TLS 300 may be used.
- h. The tank shall include a grade level spill containment manhole with a cover color-coded to meet NJDEP regulations.
- i. The vent line shall include an overfill prevention valve.
- j. A concrete pad shall be appropriately designed and installed over the tank at grade level to protect the tank from anticipated loading.
- k. All above ground tanks shall be a double wall tank with an interstitial monitoring port or shall be a tank inside a self contained dike. The double wall tanks may be a concrete encased steel tank or a double wall steel tank. The secondary tank shall be 110% of the primary tank capacity. If a self-contained dike is used, provisions must be made to keep water from collecting inside the dike. The dike shall be sized to



maintain 110% of the tank capacity. All above ground tanks must meet UL and Factory Mutual standards. A tank tightness test shall be conducted on each tank and its associated piping after completion of the installation.

2. Manufacturers of oil storage tanks, piping and appurtenances must be approved by Rutgers.

### **33 61 00 HYDRONIC ENERGY DISTRIBUTION**

#### **A. Design Considerations**

**RESERVED**

#### **B. Special Documentation Requirements**

**RESERVED**

#### **C. Materials and Methods of Construction**

1. Low Temperature Hot Water:
  - a. Certified welders are required for LTW work.
  - b. All new LTW. systems should be the Xtru-Therm Custom Perma-Pipe System.
  - c. Materials for Low Temperature Water Systems:
    - 1) Service Pipe:
 

2" and larger	Under 2" and smaller
Schedule 40	Schedule 80
ASTM A 53, Grade B	ASTM A 53, Grade B
Black	Black
Seamless	Electric Resistance Welded
    - 2) Service Pipe Fittings
 

2" and larger	Under 2"
Schedule 40	3,000 pound
Seamless	Forged Carbon Steel
Butt-welded type	Socket weld
ASTM B 16.9	ASTM B 16.11

ASTM A 234 Grade B    ASTM A 105 Grade II

Weld ells shall be long-radius pattern

- b.            Service Pipe Insulation: Polyurethane foam for all sizes.
- c.            Insulation Jacket: High Density Polyurethane (HDPE)

2.    Domestic Hot Water:

- a.            Certified welders are required for domestic hot water work.
- b.            All new domestic hot water systems should be the Xtru-Therm Custom Perma-Pipe System.

c.            Materials for Domestic Hot Water Systems:

1)    Service Pipe:

All sizes

Type AL Copper Tubing  
ASTM B88

2)    Service Pipe Fittings

All Sizes

Wrought Copper Fittings  
ASME ANSI B16.22

3)    Service Pipe Insulation: Polyurethane foam for all sizes.

4)    Insulation Jacket: High Density Polyurethane (HDPE)

3.    Chilled Water and Condenser Water:

- a.            Underground chilled water and condenser water mains 3" and above shall be class 52 ductile iron cement lined, mechanical joint with wedge action retaining glands.
- b.            All underground chilled water and condenser water fittings shall be mechanical joint with wedge action retaining glands.
- c.            Use a pressed flange when transitioning from ductile iron to any other material. Uniflanges are not permitted.

- d. **Depth of Cover:** The depth of cover over chilled water and condenser water mains shall be not less than 3 1/2 feet, measured from the top of the pipe to finished grade. SK-45 and SK-46 of Rutgers Design Standards provide the details for the installation of underground water mains installations as well as details for warning tape and tracer wire.
- e. **Pipe Joints:** All bolted joint assemblies shall be cleaned and thoroughly coated with asphalt or other corrosion-retardant material after installation of the assembly and prior to inspection and backfilling.
- f. **Anchoring:** Mechanical joints shall be utilized on all tees, plugs, branches and bends. These joints on underground pipe shall be restrained against movement. Restraint shall be via threaded rod and riser clamps.
- g. **Flushing:** Underground mains and lead-in connections to system risers shall be flushed thoroughly before connection is made in order to remove foreign materials which may have entered the pipe during the course of the installation. The minimum rate of flow shall be not less than the demand rate of the system or the following rates, whichever is the greater:

Pipe Size	Flow Rate
4"	400 gpm
5"	600 gpm
6"	750 gpm
8"	1000 gpm

- h. **Inspections and Tests:** No underground chilled water and condenser water line shall be backfilled prior to inspection and approval of the installation by the University Construction Code Official or his designee.
  - 1) A hydrostatic test shall be performed on the underground chilled water and condenser water pipe assembly upon completion of the installation. All components, such as valves, fittings, etc. shall be installed prior to the final test. The Contractor may conduct preliminary testing for his benefit; however the University will not accept such preliminary testing in lieu of the final required inspections and tests. The hydrostatic test shall be performed for not less that two hours, and shall be

witnessed by the Construction Code Official or his designee. A Utilities representative should also witness the hydrostatic test.

4. High Temperature Hot Water:

- a. Certified welders are required for HTW work or high pressure work.
- b. All new HTHW systems should be the Multi-Therm 500 Perma-Pipe System.
- c. Materials for High Temperature Water Systems:

1) Service Pipe:

3" and larger	Under 3" and smaller
Schedule 40	Schedule 80
ASTM A 53, Grade B	ASTM A 53, Grade B
Black	Black
Seamless	Electric Resistance Welded

2) Service Pipe Fittings

2" and larger	Under 2"
Schedule 40	3,000 pound
Seamless	Forged Carbon Steel
Butt-welded type	Socket weld
ASA B 16.9	ASA B 16.11
ASTM A 234 Grade B	ASTM A 105 Grade II

Weld ells shall be long-radius pattern

3) Service Pipe Insulation: Pittsburg Corning Foamglass for all sizes.

- 4) Conduit, Coating and Insulation
- |                         |                         |
|-------------------------|-------------------------|
| 6" to 26"               | 28" to 36"              |
| 10 Gauge                | 6 Gauge                 |
| 2 – 4 mils zinc         | 2 – 4 mils zinc         |
| Polyurethane Insulation | Polyurethane Insulation |
| FRP outer jacket        | FRP outer jacket        |
- 5) Flanges (all sizes) in manholes: 300 pound class, forged steel, welding neck type, ASA B 16.5 ASTM A 181 Grade 1
- 6) Gaskets (all sizes): Spiral wound, type 304 stainless steel, non-asbestos filled, 3/16" thick with centering guide, 300 pound class, Flexitallic style CG, or approved equal.
- 7) Bolts and Studs: Alloy steel studs threaded full length and fitted with two hexagon nuts per stud for all flanged joints. Bolting to conform to ASTM A 193 Grade B-7, threads class 7 fit. Nuts shall be semi-finished hexagonal, ASA B 18.2 ASTM A 194 Grade 2H.
- 8) Do not use sheet metal sleeves through outside walls. Sleeves shall be pipe conforming to ASTM A 120. At outside walls provide "leak plate" and install "Linkseal".
- 9) Minimum cover for High Temperature Hot Water (HTHW) lines shall be 4'-0" from top of pipe to finished grade. Road crossing shall have a reinforced concrete slab 8" thick or cover shall be extended to 6'-0" below road surface.
- 10) For additional high temperature hot water piping requirements refer to *Section 23 21 13 – Hydronic Piping*.

### **33 63 00 STEAM ENERGY DISTRIBUTION**

**RESERVED**

## 33 71 19 ELECTRICAL UNDERGROUND DUCTS AND MANHOLES

### A. Design Considerations

1. The planned location of new electrical duct banks shall be such as to maintain a minimum of 10 feet from all underground heat sources such as high temperature hot water and domestic hot water piping and to minimize the number of crossings between electrical duct banks and these piping systems.

### B. Special Documentation Requirements

1. The A/E firm of record shall provide a single utility plan drawing to Rutgers Utilities which shows the following:
  - a. all existing and proposed underground utilities (including storm water and sanitary sewer systems)
  - b. existing and proposed site grading
  - c. elevations of proposed manholes, piping and duct banks
  - d. cross section details of areas of multiple crossings indicating piping and duct bank elevations and clearances between utilities for field coordination purposes. (These sections can be on a separate drawing sheet.)

### C. Materials and Methods of Construction

1. Duct banks shall be poured in place concrete/conduit assemblies on undisturbed native soil or mechanically compacted soil. Proper ASTM compaction must be followed when installation is on any fill. Frozen fill of any type is unacceptable.
2. Conduits shall be 5" PVC Schedule 40 (or as noted otherwise) and assembled in configurations as shown on the project drawing details. Spacers/chairs shall be placed at intervals along the duct bank not to exceed 8 feet to ensure uniform spacing of conduits and maintain minimum conduit height of 3" off bottom of trench. Conduits, wood or other materials shall not be used to provide spacing of conduits.
3. A #4/0 bare grounding conductor shall be run along with the duct bank conduits and encased in the duct bank concrete. A #4/0 conductor shall also be run with each set of conductors pulled in the duct bank conduits.

4. Duct banks running under roadways and driveways shall include metal re-bar reinforcement. Reinforcement shall consist of (4) #4 rebars run along the length of duct bank, one at each corner with #4 rebar crossties placed 18" on center.
5. Duct bank route should be planned to use only large radius bends. Field bends shall be made using a "hot box" with a minimum radius of 50 ft. Factory made 45 and 90 degree elbows shall not be used in horizontal runs unless approved by the Rutgers Project Engineer. Vertical 90 degree elbows installed into transformer or switch pads shall be minimum 48" radius type.
6. Galvanized rigid steel conduit and elbows shall be used where duct banks penetrate a building wall or floor slab (e.g. service entrance). All conduit penetrations shall be sealed with Link-Seal® modular seals. Where directly buried, two coats of asphaltic compound shall be applied. Provide approved electrically conductive corrosion resistant compound on all threads.
7. Depth of duct banks shall be 36" below finished grade to top of concrete duct bank. Depth may be increased or decreased depending on field conditions or utility crossings and shall be approved by the Rutgers Project Engineer.
8. Duct banks shall cross below gas lines and be kept a minimum of 10 feet away from high temperature water utilities. Where duct bank is less than 10 feet from high temperature water lines, conduit shall be "Champion" Type MW fiberglass instead of PVC. Where duct bank crosses high temperature water lines duct bank conduits shall be Type MW fiberglass for a distance of 10 feet on either side of the existing high temperature water line.
9. Duct banks shall be sloped away from building entry points and sloped toward manholes.
10. All conduit assemblies and spacers shall be adequately tied down and secured prior to concrete pour to prevent floating of the conduit assembly.
11. Conduit duct banks shall be inspected by a Rutgers electrical inspector or authorized representative prior to the pouring of concrete.
12. Concrete shall be 4000psi strength and surround the conduit assembly on all sides to a thickness of 3". The sides of the trench can be used as "forms" for the pour provided no large voids exist along the sides of the trench. Otherwise wooden forms should be used in those areas.

13. Where duct banks enter manholes, manhole windows or walls shall be core drilled for each conduit and the duct bank shall be pinned into the outer wall of the manhole using (4) #4 rebar to prevent shearing of the duct bank. Pinning rebars shall be continuous for a minimum of 5 feet outside of manholes.
14. Red oxide pigment shall be spread on top of the concrete immediately after pouring.
15. Contractor shall allow a minimum cure time of 24 hours prior to backfilling.
16. A metallic lined bright red warning tape not less than 6" wide with lettering reading "Caution-Buried Electric Line Below" shall be placed no more than 12" below grade along the entire length of all duct banks.
17. All large rocks and debris shall be removed from soil prior to using for backfill.
18. During construction, contractor shall be responsible for keeping debris out of conduits, capping ends of completed duct bank sections, shoring of trench sides where necessary and removal of all rain/ground water in trenches.
19. Completed duct bank conduits shall be cleaned with flexible mandrels, brushes and then vacuumed.
20. Manholes shall be precast reinforced concrete with minimum internal dimensions of 8 foot x 8 foot x 7 foot high with 6" thick walls, floor and top. Top and bottom halves shall be provided with suitable gasket material between halves. Round centered opening on top shall be 36" diameter. Manholes shall meet AASHTO HS-20 loading.
21. Manhole rims and covers shall be cast steel. Cover diameter shall be 36" diameter and have the word "ELECTRIC" cast into it. Rim and cover assembly shall be set on at least four courses of brick or concrete rings to allow adjustment to finish grade.
22. Each manhole shall be provided with two pulling irons on the floor per side and two pulling irons on the top per side.
23. Heavy duty non-metallic cable racks as manufactured by Underground Devices, Inc. shall be installed on each wall. Installation shall consist of (2) 36" vertical stanchions (Cat #CR36-B) per wall with (2) 14" arms (Cat #RA14) provided per stanchion. Stanchions shall be installed



according to manufacturer's instructions using manufacturer supplied drop-in anchors and stainless steel hardware.

24. A 12" x 12" x 4" sump pit shall be precast into the center of the floor of the manhole with floor sloped toward it.
25. All manholes and conduit penetrations shall be made watertight.