DIVISION 33 – UTILITIES

33 00 00 - UTILITIES

A. Utility Line Tracer Wire:

1. All new nonmetallic, ductile iron and cast iron utility lines outside the building envelope shall include an insulated 16 gauge tracer wire 12” above the utility to indicate the utility's location to tracing equipment. Tracer wire must be exposed at either end of the utility above grade and be prominently marked with flagging after backfill is completed. The University Representative and Facilities Management utility locator will coordinate with the Contractor to determine the appropriate point and method of termination for the tracer wire, as field conditions may vary.

2. The University Representative will also determine if this requirement will apply to certain lines of new irrigation installations, or other utilities, as conditions may warrant.

B. Isolation of Utilities:

1. All incoming utilities shall have proper means for isolation before entering the building.

C. Utility Sleeves:

1. Provide tubing or pipe (not sheet metal) sleeves for all utility services passing through structural walls and slabs. All sleeves passing through slab floors shall project a minimum of 4 inches above the slab and shall be sealed watertight to the slab.

2. Sleeve shall be filled with a flexible, gas-tight sealant.

33 10 00 – WATER UTILITIES

A. Water Mains and Service Lines:

1. All water main and service line materials shall conform to applicable AWWA standards.

B. Fire Hydrants and Auxiliary Valves:

1. Fire hydrants shall be AWWA type conforming to AWWA Standard C502. Hydrants shall be three-way, two hose 2-1/2 inch and one pumper 4-1/2 inch nozzle. Main valve opening size 5-1/4 inches, compression type; hydrant shall open by turning left (CCW). Inlet connection to the main shall be 6 inches flanged or mechanical joints. Standard bury length shall be 5 feet. Operating nut shall be 1 inch square. Outlets shall be National Standard as follows:

   Two (2) 2-1/2 inch hose couplings with 7-1/2 threads per inch.

   One (1) 4-1/2 inch steamer hose coupling with 4 threads per inch.

   The above specifications are intended to meet City of Fort Collins’ Standard, except for open left requirement for valves. The exposed portion of the hydrant shall be painted with Devoe Safety Yellow No. 58158-01.

2. Fire Hydrants - Mueller Super Centurion No. A-423, Clow Medallion No. F-2545, Watrous Pacer 100 or equal, complete with 6” auxiliary valve.
3. All new fire hydrants shall have pressure and flow tests. Test results must meet Poudre Fire Authority minimum level of acceptance. Test results shall be submitted to the University Representative and a copy included in O & M manual.

C. Auxiliary Valves

1. All auxiliary gate valves shall be manufactured in accordance with AWWA Standard C509. Valves shall be equipped with 2 inch square operating nuts and buffalo valve boxes 5-1/4 inches in diameter, complete with bonnet. The word "Water" shall be cast in the valve box cover.

D. Water Meters - Badger or Neptune Truflow.

E. Water Systems

1. Most University buildings are served via University-owned, master metered distribution system operated at about 60 to 90 psig unless otherwise noted on Utilities drawings.

2. Design of building shall include exterior fire hydrants, interior fire protection, main line tap and valve, main building shut-off valve inside and outside, and water meter located in the building near point of water entrance.

3. Provide tubing or pipe (not sheet metal) sleeves for all water services passing through structural walls. All penetrations shall be approved by Structural Engineer.

4. Support exterior water mains at building entrances to avoid shear stress. Support shall be a poured concrete block resting on undisturbed soil and shall be designed to support the water main over its entire length between the building entrance point and unexcavated ground.

5. Reduced pressure backflow prevention devices shall be installed for all main water services to University buildings, except residential buildings of less than four stories, which shall have either reduced pressure or double check backflow prevention devices.

6. Water distribution system piping and appurtenances shall be stored, installed, disinfected and tested in accordance with AWWA standards and CSU’s distribution system disinfection requirements prior to being placed in to service.

7. The Plumbing Contractor shall be required to clean and disinfect all domestic hot and cold water systems, including fire systems connected to the domestic water systems. For buildings already occupied, the procedure shall be modified as required to accommodate the occupants. Contractor shall prepare the appropriate forms through Utilities Services. After disinfection the University Representative shall notify Environmental Health Services for sampling and bacteriological testing.

F. Cross-connection and Backflow Prevention

1. Cross-connection conditions are prohibited and backflow prevention devices shall be used in accordance with the "Colorado Cross-Connection Control Manual" and the "City of Fort Collins Cross Connection Control Manual" to prevent and address cross connection contamination conditions. See Division 22 - Plumbing for more information.
33 30 00 – SANITARY SEWERAGE UTILITIES

A. Sanitary Sewerage:

1. Provide manholes at major junctions of exterior sewer lines and cleanouts on all other junctions.
   a. Cleanouts in vehicle traffic areas must be a traffic rated two way type as referenced in Part IV Drawings Appendix

2. Manholes shall have “aurora pick hole” (concealed edge pry) in lid to fit a lifter for removal.

3. See Division 22 – Plumbing for additional information concerning nonallowable discharges into the sanitary system.

33 36 00 – SEPTIC SYSTEMS

A. Domestic Sewage Systems:

1. Septic systems with average design capacity of 2,000 gallons per day or less, consisting of a tank/vault, auto-siphon chamber (if needed) and absorption bed shall be constructed in accordance with Larimer County Department of Health and Environment Individual Sewage Disposal System (ISDS) Regulations. Where a municipal sanitary sewer exists within 400 feet of the project, the building’s sanitary drain system must connect to the sanitary sewer unless written permission is granted by the Larimer County Department of Health and Environment to connect to a septic or other soil treatment and disposal system.

2. Design shall be performed and certified by a Colorado registered Professional Engineer in accordance with ISDS Regulations and good engineering practice.

3. Systems with a design capacity of greater than 2,000 gallons per day must obtain Site Approval from Colorado Department of Public Health and Environment and shall be designed and constructed accordingly. All Site Approval reviews and approvals must be completed before construction can commence. Adequate time must be allotted as the Site Approval process can take 12 months.

4. Construction of septic systems receiving wastes other than domestic sewage is prohibited without first obtaining a Class V Underground Injection Permit from the US Environmental Protection Agency (EPA).

5. The Contractor shall coordinate with the design engineer for site inspections during construction. Contractor shall provide the University with a letter from the design engineer certifying the system was installed in conformance with the drawings and specifications.

6. Where site conditions are favorable, the University encourages the design and construction of non-standard systems, such as evapo-transpiration beds and constructed wetland systems, provided Larimer County Department of Health and Environment reviews and approves the design prior to construction. If the system is a constructed wetland, an individual domestic wastewater discharge permit must be obtained before construction can commence.

33 40 00 – STORM DRAINAGE UTILITIES

A. Storm Drainage Systems:

1. Storm sewer catch basins and inlets shall be permanently labeled “No Dumping. Drains to River”
using either an embossed lid or stamped wording in the surrounding concrete. CSU’s concrete stamp may be used for this purpose.

2. Permanent Best Management Practices (BMPs) for stormwater quality improvement shall be incorporated into each project as appropriate. Runoff that may be contaminated must be treated through a permanent BMP before entering any storm drain or gutter. Permanent BMPs shall be designed in general conformance with the “Urban Storm Drainage Criteria Manual, Volume 3 – Best Management Practices”, Urban Drainage and Flood Control District, Denver, Colorado, September 1999, revised April 2008. However, site-specific BMPs such as constructed wetlands, bioswales, etc. may be designed using design guidance from other sources, as approved by CSU.

3. Storm sewer piping of 8-inch diameter and smaller shall be designed with long sweeps at bends.

B. Storm Sewer Protection During Construction:

1. Storm sewer inlets shall be protected from excessive sediment and debris during construction projects through erosion control efforts such as bales of hay, river rock, barricades, holding ponds, etc.

2. Erosion Control Plans shall be required and submitted to the University Representative for all projects that have the potential for erosion. For additional information on Temporary Facilities and Controls, see Division 01 General Requirements.

33 51 00 – NATURAL GAS DISTRIBUTION

A. Service

1. Most academic buildings on the Main Campus are served via a University-owned master metered distribution system. Main gas pressure is about 6 psig. Design systems for 4 psig pressure. The University Central Heating Plant is served with a 50 psig building service gas line which is reduced to 20 psig for operation within the plant.

2. Most buildings on the Foothills Campus are served by a public utility. Contact the University Representative for information.

3. All new building gas service will include a meter and a regulator to be provided and installed by the Contractor. Provide insulated dielectric union above ground ahead of the regulator. Keep all fuel runs from the meter to the building as short as possible to reduce the need for additional cathodic protection. If fuel piping from meter to building goes underground, an insulated dielectric union shall be provided inside building. Cathodic protection may be required; contact the University Representative.

B. Material

1. Exterior gas piping shall be approved polyethylene (PE) or black ASTM A53, Grade B seamless, plain end with Fusion Bonded Mill Coating.

2. Coating material, application procedures and marking shall meet the requirements of NAPCA Bulletin 12-78 and the following requirements:

   b. Material:
      i. Napko Pipe Coating Division, Nap-Guard Mark X Product No. 7-2501.
      ii. Electro Products Division/3M, Scotchkote Brand 217, 205, or 206N pipe coatings.

c. Thickness: nominal 10 or 12 mils.
d. Application specifications shall be as recommended by the coating manufacturer, and include instructions for pipe surface preparation, coating application, inspection, holiday repair, storage, handling and shipping.

e. Marking of coating shall comply with NAPCA Bulletin 4-68, Pipe Identification "Data Code" except type coating marking should be in accord with NAPCA Bulletin 7-69.

3. The Engineer shall specify joint wrap and primer.

33 56 00 - FUEL STORAGE TANKS

A. Underground Tanks:

1. Tanks which hold petroleum products shall meet the following requirements.

2. Underground storage tanks are not permitted without approval of Facilities Management through the University Representative.


4. Tanks shall be installed by contractors licensed by the State Oil Inspector.

5. Storage systems (including piping) must have corrosion protection, leak detection and overfill prevention.

6. Advance permits from OPS are required prior to installation, repair, upgrade, removal or abandonment.

7. Contractor shall prepare notification and tank registration forms for University review and signature. The forms shall be sent to OPS by the University upon completion of installation of new tanks.

B. Above Ground Fuel tanks:


C. Propane Tanks and Cylinders

1. Compressed Gas Tanks, Unfired Pressure Vessels and Air Receivers shall conform to NFPA 1, 55 and 58 (liquefied petroleum gas), OSHA 29 CFR 1910.101 (general), 1910.102 (acetylene), 1910.103 (hydrogen), 1910.104 (oxygen), 1910.105 (nitrous oxide), 1910.111 (anhydrous ammonia), and 1910.169 (air receivers), and ASME Boiler and Pressure Vessel Code.)
PART III - CSU TECHNICAL STANDARDS

DIVISION 33 – UTILITIES

33 60 00 – HYDRONIC AND STEAM ENERGY UTILITIES

A. Steam and Condensate Distribution Systems:

1. Steam is distributed from the Central Heating Plant in utility tunnels and direct buried lines. Nominal distribution pressure is 40 psig, but under extreme operating conditions may drop to 30 psig. Steam systems should be designed for future 150 psig steam supply. All building mains shall be dripped and branches back-graded to the main.

2. At this time steam is available 24 hours per day, 7 days per week. Future plans may involve shut down of the steam system during summer months. Where practical, new installations should make provisions for alternate sources of heat or steam. Confirm with the University Representative.

3. All steam and condensate lines in tunnels and trenches shall be insulated. Valves, strainers, and other equipment shall be insulated with removable preformed insulated casings or jackets.

4. Provide main building shut off valves.

5. Before placing a steam piping system in service the piping must be thoroughly blown out with steam to remove dirt, rust, scale or other contaminants.

6. Place the steam system in operation and waste the condensate for a period of three hours. Following approval by the University Representative return condensate to collection system.

B. Steam Meters: see Sole Source Appendix.

1. Steam meters are sole sourced and shall be insertion turbine type. All installations shall have a pressure transmitter for pressure compensations due to supply line pressure changes. Processor shall be installed in a NEMA 4 enclosure and factory power supply. Factory start up shall be required.

2. Provide straight pipe run of at least 15 pipe diameters in length. Run must be located downstream of building isolation valve and upstream of any branching lines, taps or PRV’s.

3. Steam meter tap shall be 2” thread-o-let. Tap location shall have at least 10 pipe diameters of straight pipe run upstream and 5 pipe diameters of straight pipe run downstream.

4. Provide 4” long, schedule 80 steel nipple and 2” steel ball valve for steam meter isolation. Gate valves are not acceptable.

5. Provide clearance of at least 4’ outward from meter tap for meter insertion and extraction.

6. Provide pressure transmitter with 4-20 mA output and zero/span adjustment. Transmitter shall have span of 100 psi and have ¼” male or female threads.

7. Processor shall be mounted by contractor on equipment room wall, near steam meter installation. Contractor shall install 120V, single-phase power to processor, on a dedicated circuit.

8. Steam meter rotor shall be installed and steam meter inserted only by CSU personnel, or by a manufacturer’s representative. Meter and pressure transmitter wiring and processor program shall be installed only by CSU personnel or by a manufacturer’s representative.

C. Condensate

Rev: 4-May-15

BUILDING CONSTRUCTION STANDARDS MANUAL
COLORADO STATE UNIVERSITY
1. Steam condensate is returned to the Central Heating Plant through piping in utility tunnels or direct buried lines. Condensate in a particular building should be returned to a central receiver by gravity and then pumped to the utility tunnel or direct buried line and connected to the main return line therein. Condensate return systems are described in Division 23 – HVAC.

2. The required condensate pump discharge pressure will be 30 psig minimum. Higher discharge pressures may be required.

3. Condensate receivers with mechanical pumps are not permitted without approval by Facilities Management-Utilities Services through the University Representative. If pumps are used, they shall be of the centrifugal duplex type with cast iron receiver. Switching for alternate service shall be accomplished by a float operated mechanical alternator. Receiver capacity shall be sized for 25 percent future capacity. Flash tanks shall be installed ahead of receivers.

4. Specific methods and locations of trapping shall be specified.

D. Central Plant Control Air System

1. Colorado State University distributes control and process air from the Heating Plant to most buildings. The air distribution lines typically follow the route of the steam lines. When installing new steam lines provide for or coordinate the installation of these air lines. Refer to Division 23 – HVAC for more information on process and control air systems.

33 61 33 – HYDRONIC ENERGY DISTRIBUTION

A. Building Chilled Water Utility Meter

1. Thermal energy / BTU meter transit-time ultrasonic flow meter. Note that light selection and installation is critical for accurate measurement.

   a. Manufacturer: Innova-Sonic Thermal Energy Flow Meter
   b. P/N: 205-Modbus-1-S-30-PRTDI
   c. Installation: Wall Mount
   d. Display: 20*2, alphanumeric, backlit LCD
   e. Flow Range: ±0 to 40 ft/s (±0 to 12 m/s)

33 70 00 – ELECTRICAL UTILITIES

A. Underground Electrical Service

1. CSU Facilities Electrical Engineers shall design most power distribution building services to include the primary electrical, transformer, and utility metering. Underground electrical primary shall meet the requirements outlined in this section.

2. Service (primary) - Primary distribution is owned by the University. The systems in use at the University are 13.2 KV ungrounded Wye. Assume all systems are ungrounded in cable specifications. Check with Facilities Management Electrical Engineer through the University Representative for further information. Transformers connected to these systems shall have Delta primaries.

3. Unless otherwise stated during the pre-design conference, the University shall provide an underground junction point or switch point within the contract limits (or close by) for termination of primary building feeder. Contractor shall provide and install raceway and conductors.
between said junction point and the building transformer. Owner shall make cable terminations at said junction point and shall specify type of terminals and supervise termination makeup at transformer.

33 71 19 – ELECTRICAL UNDERGROUND DUCTS AND MANHOLES

1. For some projects, the Contractor may have to provide a new underground vault, and possibly a 15KV-sectionizing switch. Whenever vaults and/or switches are required, the details shall be discussed at the pre-design conference. 15KV-sectionizing switches shall be Trayer Engineering Corporation. See Appendix F – Sole Source Product List. Specifications for vaults and 15kV switch equipment shall be provided by Facilities Management Electrical Engineer.

2. Duct Bank (primary) - Underground 13.2 KV raceway shall be encased in concrete.
   a) All concrete must be at least 3000-psi compressive strength. Encasement concrete envelope shall be natural color, 3000 psi minimum compressive strength and installed with a minimum of 4 inch cover on all sides of the raceway. (Example: 4-inch raceway would require 12 inch cross section of concrete.)
   b) The minimum acceptable raceway shall be PVC Type 1 or equivalent. All elbows shall be rigid metal conduit (RMC) or continuous strand epoxy fiberglass with long radius only. All underground RMC conduits shall be tar coated or PVC jacketed.
   c) Provide bare copper #4 AWG ground wire above all conduits in the top section of concrete duct bank. See Drawing Appendix for details. Connect to ground rod systems at the vault and transformer.

3. All conduits entering or exiting any structure below grade shall be full-wall galvanized rigid steel. The steel shall extend a minimum of 5 feet out from the underground structure to minimize shearing risk. A transition to other types of conduit can be made at any point beyond this 5-foot minimum distance.

4. Warning tape shall be buried a minimum of 6 inches above all buried electrical, data and control wiring or encasement. The tape shall be inert plastic film highly resistant to alkalis, acids, or other destructive chemical components likely to be encountered in soils. The tape shall be 3 inches wide, colored red and imprinted with "CAUTION: BURIED ELECTRIC LINE BELOW."

5. All galvanized steel conduits shall be either PVC jacketed or tar coated with an asphalt base compound.

6. Any individual entering existing or new manholes shall first notify CSU Electric Shop at 970-491-0130. Call Facilities Management 970-491-0077 dispatch if no one answers call at Electric Shop. Follow safety rules for entry to confined space.

7. New vaults shall have a ground rod installed and connected to the primary grounding system. Check ground resistance for the installed ground rod. If the resistance exceeds the NEC requirements, install up to four ground rods, one in each corner to meet NEC requirements. All connections and splicing on primary grounding shall be by exothermic weld (e.g. Cadweld).

33 71 49 - MEDIUM VOLTAGE WIRING

A. Acceptable Products:

1. Okonite
PART III - CSU TECHNICAL STANDARDS

DIVISION 33 – UTILITIES

2. General Cable

B. Medium Voltage Wiring

1. Main Campus Central: 15 KV class cable shall be single aluminum or copper conductor, 220 mil/133% insulated for ungrounded type service, shielded, 105 C rated, EPR with PVC outer jacket.

2. Main Campus South and Foothills Campus: 15 kV class cable shall be single aluminum or copper conductor, 220 mil insulated for ungrounded type service, 1/3 concentric neutral, 105 C rated cable.

3. Color-coding shall be: A Phase (black), B Phase (red), C Phase (blue).

4. Terminations: 15 KV class unless otherwise requested by Facilities Management. Provide drain wires on terminations with #10 AWG used on 200 ampere and #6 AWG used on 600-ampere terminations.

5. On Main Campus Central only, specify No. 2 AWG with type THWN 600 volt insulation copper wire in raceway with primary service to building. Tie said ground wire to common system ground of building transformer.

6. All 15kV cables shall be high pot tested.

33 73 00 - UTILITY TRANSFORMERS

A. Acceptable Products:

1. Primary transformers (liquid cooled) – ABB, GE, Cooper, CG.

B. Products Not Permitted:

1. Primary Transformers – Square D Company.

C. Primary Transformers:

1. Transformers used to step down from the University primary voltage to the building secondary voltage shall be non-PCB liquid-cooled and insulated and installed in accordance with Article 450 of the NEC.

2. Transformers shall be designed and manufactured in accordance with the requirements of ANSI/IEEE C57.12.00 and certified and labeled by Factory Mutual Research Corporation as meeting the requirements of Approval Standard 3990, insulated with an approved less-flammable fluid all in compliance with the current NEC 450-23. Special attention shall be given to NEC 450-23, which requires protection of combustible building parts, and building openings from fires originating in less-flammable liquid-insulated transformers.

3. Electrical transformers shall be included as part of the site design and shall be located on the exterior of the building rather than inside the building. The transformer shall be located a minimum of 10 feet from a building. If this is not possible, special requirements per Factory Mutual must be followed to protect the building.

4. Transformer windings can be copper or aluminum. At a minimum the transformer shall have an efficiency based on Code of Federal Regulations 10CFR Part 431-DOE.
5. Primary bushings for the pad mount transformers shall be dead front, load break, loop feed type. The transformer shall have a switching configuration consisting of three (3) 15 kV on-off switches: one for the transformer, one for feeder A, and one for Feeder B. See Appendix for One line diagram of transformer configuration.

6. Where transformers are set in a radial feed configuration, provide lightning arresters on the second set of bushings. Arresters shall be 10 KV MOV (Metal Oxide Varistor) rated, phase to ground.

7. See Drawing Appendix for transformer layout details and transformer pad sizes.

8. Transformer paint color shall be one of the following:
   a. Cooper RTE, Safari Tan
   b. Hentzen Coatings, Suntone Tan, Part A Base 16095TPA
   c. Sherwin-Williams Company, Totally Tan, FC082011
   d. Or approved equal.

9. Where building transformer is to be furnished under the building contract, the size is to be determined by Facilities Management Electrical Engineers. All sizing is to be approved by Facilities Management Electrical Engineer through the University Representative.

10. Impedances of transformers shall be determined and specified as described in CSU Design Standards - Short Circuit Calculations.

11. See Drawing Appendix for transformer layout details and transformer pad sizes.

33 75 00 – ELECTRIC METERING

A. Acceptable Products:

1. Elster AMI meters.

B. Electric Metering

1. In general, metering will be furnished and installed by CSU’s Electric Shop. CT’s will be installed on the transformer secondary cables and the AMI meters will be mounted on the outdoor pad mounted transformer.
2. Coordinate termination of secondary cables with CSU Electric shop.
3. Meters shall utilize the Elster wireless mesh network for two way communication and remote reading.

33 77 00 - MEDIUM VOLTAGE UTILITY SWITCHGEAR AND PROTECTION DEVICES

A. Acceptable Products:

1. Switchgear – Trayer
2. See CSU Facilities Management Electrical Engineer for Switchgear specifications.

33 80 00 – COMMUNICATION UTILITIES

A. Communication Transmission
1. The University owns and maintains its telephone and communications distribution system. The CSU Department of Telecommunications is responsible for managing the telecommunications network, including publication of design and construction standards; determination of suitability of proposed uses; compliance with its standards and appropriate codes; periodic removal and replacement of network components; and additions to the network.

2. The Architect / Engineer shall adhere to the Telecommunications Standards published by the Department of Telecommunications for all communication utility and distribution design.

3. The Contractor shall comply with the Telecommunications Standards published by the Department of Telecommunications for all communication utility and distribution construction.

4. A link to the most current Telecommunications Standards can be found at the Department of Telecommunications website at www.telecom.colostate.edu

5. For communication systems distribution standards, see Division 27 – Communications.

6. Coordinate with CSU Office of Telecommunications and Academic Computing and Network Services (ACNS) for number and size of conduits and installation from building to the telecommunications and data network. Confirm size, location and origin of conduit and conductors with the University Representative. See Part III – CSU Technical Standards, Division 27 – Communications and Division 33 for Communications Utilities.

7. Coordinate with Facilities Management Environment Group for building systems automation, fire alarm and security data transmission requirements. Confirm size, location and origin of conduit and conductors with the University Representative. See Division 23 - HVAC and Division 28 – Electronic Safety and Security.