

DIVISION 33 – UTILITIES

33 00 00 – UTILITIES GENERAL INFORMATION

- A. The University owns most of the utility distribution systems on its campuses. New buildings shall connect to University-owned utilities unless approved otherwise. Consult with Facilities Management, Utilities Services through the University Project Manager/Representative for questions and clarifications.
- B. The following process applies to the water, sanitary sewer, stormwater, natural gas, chilled water, and steam utilities, and shall be followed during project procurement, design, and construction phases:
 - 1. Preliminary meeting. There shall be a preliminary meeting between designers and Utilities Services to establish needs for the project, and how the project will integrate into the campus utility systems or the systems of outside providers. Preliminary routes will be established at this time.
 - 2. Design. During the design phase, designers shall provide estimated loads for the relevant utilities. The new loads will be modeled within the existing systems by Utilities Services. Necessary scope will be identified to accommodate the loads. Routes and elevations will be established. Utilities Services reserves sole authority in utility routing on University property.
 - 3. Review and Acceptance. The completed construction documents shall be submitted to Utilities Services for review and comment. Documents shall include plans, specifications, and drainage reports. When all comments have been satisfied, Utilities Services shall approve the documents. Construction shall not commence until the approval is received. Utilities Services reserves sole approval authority.
- C. The following process applies to the electric utility, and shall be followed during project procurement, design, and construction phases:
 - 1. CSU Facilities Management Engineering section shall design all electric primary utilities.
 - 2. Unless otherwise stated during the Request for Proposal (RFP) and/or pre-design conference, CSU Facilities Management shall furnish and install primary duct bank, vaults, 15kV sectionalizing switches, 15kV cable, transformer and transformer pad.
 - 3. Utilities Services reserves sole authority to delegate all or part of the electric utility scope stated above.
- D. If coordination with outside utility providers (e.g. City of Fort Collins Utilities, Xcel Energy, ditch companies, or telecom companies) is necessary during the design or construction of a project, coordination shall be done through Utilities Services.
- E. All incoming utilities shall have proper means for building service isolation both at utility mains and immediately after entering the building.
- F. 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

CSU HOUSING & DINING SERVICES TECHNICAL STANDARDS
DIVISION 33 – UTILITIES

- above the slab and shall be sealed water tight to the slab. Sleeve shall be filled with a flexible, gas-tight sealant.
- G. Excavations shall conform to Division 31 – Earthwork.
 - H. Backfill for all utilities shall conform to requirements described in Division 32 – Exterior Improvements.
 - I. CSU maintains its own advanced metering infrastructure (AMI) for the electric, water and gas utilities. This smart metering network is a 900MHz wireless mesh network using Elster devices such as gatekeepers, repeaters and meters. All electric, water, and gas utility meters shall connect to this system. See utility paragraphs below for specific requirements.
 - J. CSU maintains a LAN network for chilled water and steam utility meter communication. All chilled water and steam meters shall connect to this network. See utility paragraphs below for specific requirements.

33 05 00 – COMMON WORK RESULTS FOR UTILITIES

- A. Manholes
- B. Vaults
- C. Trenchless Installation
 - 1. Directional Boring
 - 2. Jack Boring
 - 3. Pipe Bursting
- D. Tracer Wire
 - 1. Acceptable Products:
 - a. Direct bury application: Copperhead SuperFlexCCS with HDPE 30 mil insulation or approved equal.
 - b. Directional bore application: Copperhead SoloShot EHS-CCS HDPE 45 mil or approved equal.
 - c. Connectors: Copperhead SnakeBite and 3M DBR moisture displacement or approved equal.
 - d. Grounding Rods: Copperhead ANO-14 magnesium drive-in anode or approved equal.
 - 2. Products Not Allowed
 - a. Any THHN wire.
 - 3. Discussion
 - a. All new utility lines outside the building foundation shall include a tracer wire, centered and secured to the top of the pipe or conduit to indicate the utility's location to tracing equipment.

CSU HOUSING & DINING SERVICES TECHNICAL STANDARDS
DIVISION 33 – UTILITIES

- b. Tracer wire must be exposed at either end of the utility above grade and be prominently marked in a tracer wire box after backfill is completed. The University Project Manager/Representative and Facilities Management Utility Inspector will coordinate with the Contractor to determine the appropriate point and method of termination for the tracer wire (e.g. grounding rod, box), as field conditions may vary.
 - c. The Utility Inspector will also determine if this requirement will apply to certain lines of new irrigation installations.
 - d. Tracer wires shall not be twisted together and wrapped with electrical tape. Corrosion will occur over time and the locate signal will be lost to ground at the connection.
 - e. Insulation color shall meet the APWA color code standard for identification of buried utilities.
- E. Utility Line Signs, Markers, and Flags
- 1. Marker Posts should be similar to Carsonite CRM-375 with reflective labels. The Utility Inspector will determine on a case by case basis if marker posts are needed.

33 08 00 – COMMISSIONING OF UTILITIES

A. General Information

- 1. Inspections are required on all underground utility installations. Coordinate site inspections with the Utility Inspector by contacting CSU Facilities Dispatch at 491-0077 at least 48 hours in advance.
- 2. A part of the inspection process is the GPS cataloging of all underground utility installations for mapping purposes. GPS location will be performed by Facilities Management personnel and will be coordinated through the Utility Inspector. GPS location must be done before backfill.
- 3. GPS location by Facilities Management is not a substitute for thorough and accurate as-built drawings.

B. Commissioning of Water Utilities

- 1. New water mains and service lines, including fire lines, shall be disinfected in accordance with the University's disinfection requirements, including superchlorination and coliform testing with associated documentation, before being placed into service. Coordinate disinfection and disinfection requirements with the Utility Inspector.
- 2. Flushing of superchlorinated lines may require dechlorination. Contractor shall provide all equipment and personnel to perform the dechlorination. Coordinate dechlorination and dechlorination requirements with the Utility Inspector.
- 3. If a water main cannot be isolated or if it is required to minimize time that customers are without water, the new pipe, fittings, and valves required for a connection shall be spray-disinfected or swabbed with a minimum of one percent Hypochlorite solution.
- 4. Great care shall be taken to prevent dirt, water, and debris from entering water piping during construction, both inside and outside the trench.

CSU HOUSING & DINING SERVICES TECHNICAL STANDARDS
DIVISION 33 – UTILITIES

5. Once the pipeline has been filled and disinfected, and backfilling has been completed and approved, a hydrostatic pressure test shall be conducted. The Contractor shall provide all equipment and personnel to perform the hydrostatic test. Coordinate the pressure test and testing requirements with the Utility Inspector.
 6. If the tests disclose leakage greater than the maximum allowed, the defective materials and joints shall be located and repaired. The tests shall be repeated until the leakage is less than the maximum allowed.
 7. All new fire hydrants shall have pressure and flow tests. Test results must meet the University's minimum level of acceptance. Coordinate the hydrant test and testing requirements with the Utility Inspector.
- C. Commissioning of Sanitary Sewer Utilities
1. A low pressure air test shall be conducted on sanitary pipelines. The Contractor shall provide all equipment and personnel to perform the test. Coordinate the pressure test and testing requirements with the Utility Inspector.
 2. Sanitary manholes shall be vacuum tested before the ring and cover and grade adjustment rings are installed, and after backfill and compaction are complete. The Contractor shall provide all equipment and personnel to perform the test. Coordinate the vacuum test and testing requirements with the Utility Inspector.
 3. If the tests disclose leakage greater than the maximum allowed, the defective materials and joints shall be located and repaired. The tests shall be repeated until the leakage is less than the maximum allowed.
 4. All new sanitary piping shall be cleaned and televised at the completion of testing and before the lines are placed into service.
- D. Commissioning of Storm Drainage Utilities
1. A low pressure air test shall be conducted on stormwater pipelines. The Contractor shall provide all equipment and personnel to perform the test. Coordinate the pressure test and testing requirements with the Utility Inspector.
 2. Stormwater manholes shall be vacuum tested before the ring and cover and grade adjustment rings are installed, and after backfill and compaction are complete. The Contractor shall provide all equipment and personnel to perform the test. Coordinate the vacuum test and testing requirements with the Utility Inspector.
 3. If the tests disclose leakage greater than the maximum allowed, the defective materials and joints shall be located and repaired. The tests shall be repeated until the leakage is less than the maximum allowed.
 4. At the end of the project, all stormwater piping, including both new piping installed during the project as well as piping downstream of the new connections to a point defined by the Utility Inspector, shall be cleaned and televised. No soil or debris shall be flushed out of dirty lines and into the system.
- E. Commissioning of Natural Gas Utilities

CSU HOUSING & DINING SERVICES TECHNICAL STANDARDS
DIVISION 33 – UTILITIES

1. A pneumatic pressure test shall be conducted on all new gas piping. The Contractor shall provide all equipment and personnel to perform the test. Coordinate the pressure test and testing requirements with the Utility Inspector.
2. If the tests disclose leakage greater than the maximum allowed, the defective materials and joints shall be located and repaired. The tests shall be repeated until the leakage is less than the maximum allowed.
3. At the Utility Inspector's discretion, some gas piping may be required to be pigged. The intention is to eliminate any water that may have entered the piping during construction.

F. Commissioning of Chilled Water Utilities

1. All new piping shall be cleaned before filling.
2. A hydrostatic pressure test shall be conducted on all new chilled water piping. The Contractor shall provide all equipment and personnel to perform the hydrostatic test. Coordinate the pressure test and testing requirements with the Utility Inspector.
3. If the tests disclose leakage greater than the maximum allowed, the defective materials and joints shall be located and repaired. The tests shall be repeated until the leakage is less than the maximum allowed.

G. Commissioning of Steam Utilities

1. All new piping shall be thoroughly blown out with steam to remove dirt, rust, scale or other contaminants.
2. A pneumatic pressure test shall be conducted on all new steam and condensate carrier piping as well as conduit piping. The Contractor shall provide all equipment and personnel to perform the hydrostatic test. Coordinate the pressure test and testing requirements with the Utility Inspector.
3. If the tests disclose leakage greater than the maximum allowed, the defective materials and joints shall be located and repaired. The tests shall be repeated until the leakage is less than the maximum allowed.
4. Place the steam system in operation and waste the condensate for a period of three hours. Following approval by the Utility Inspector, return condensate to the collection system.

H. Commissioning of Electric Utilities

33 10 00 – WATER UTILITIES

A. General Information

1. All water main and service line materials shall conform to applicable AWWA standards and manufacturer recommendations for installation.
2. 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.
3. 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.

CSU HOUSING & DINING SERVICES TECHNICAL STANDARDS
DIVISION 33 – UTILITIES

4. 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. See Division 22 – Plumbing.
- B. Water Utility Distribution Piping
1. Acceptable Products:
 - a. Direct bury application: PVC DR14, pressure rating 305, with push-on joints or Ductile Iron Pipe (DIP), pressure class 350, with push-on joints.
 - b. Directional bore application: Certa-Lok PVC or HDPE SDR 11.
 2. Products Not Allowed
 - a. Fusible PVC.
 3. Discussion
 - a. PVC piping shall be manufactured in accordance with AWWA C900.
 - b. All PVC water piping shall be “blue” color.
 - c. DIP shall be manufactured in accordance with AWWA C151/ANSI A21.51.
 - d. DIP shall have a bituminous coating, minimum thickness of 1 mil, on the pipe exterior.
 - e. DIP shall have standard thickness cement mortar linings in accordance with AWWA Standard C104/A21.4.
 - f. DIP may need corrosion protection. The need for protection shall be evaluated during design.
 - g. HDPE piping and fittings shall be manufactured in accordance with AWWA C906.
 - h. Nominal laying lengths of direct bury pipe shall be minimum 18 feet.
 - i. Except when making closure connections to fittings, random/cut lengths of pipe are not allowed.
 - j. Fittings and couplings for PVC and DIP shall be manufactured in accordance with AWWA C104, C110, and C111.
 - k. All fittings of direct bury pipe shall be mechanical joint.
 - l. Fittings and couplings shall be made of ductile iron, and have a minimum working pressure rating of 250 psi.
 - m. Couplings between a branch on a cross or tee and a valve shall be a manufactured type coupling.
 - n. Mechanical joint restraint devices may be either full concentric circle or wedge load types.

**CSU HOUSING & DINING SERVICES TECHNICAL STANDARDS
DIVISION 33 – UTILITIES**

- o. The push-on joint both upstream and downstream of a change in direction shall be restrained.
 - p. Coordinate bedding material with Utilities Services during design.
 - q. All water line crossings shall conform to CDPHE” Design Criteria for Potable Water Systems” (e.g. encasement, separation).
- C. Water Service Connections
- D. Water Utility Distribution Valves
 - 1. Acceptable Products:
 - a. Muller 2360 series with powder epoxy coating both inside and out, American Flow Control, Clow Valve Company, or approved equal.
 - 2. Products Not Allowed
 - a. None listed.
 - 3. Discussion
 - a. All distribution valves shall be resilient-seat gate valves manufactured in accordance with AWWA Standard C509.
 - b. 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.
 - c. Valves shall be Right-Hand Open.
 - d. Valves in roadways and sidewalks shall have valve box lids set flush with the paving.
- E. Water Utility Distribution Fire Hydrants
 - 1. Acceptable Products:
 - a. Mueller Super Centurion No. A-423, AVK Series 27 Modern Style, Watrous Pacer 100, or approved equal.
 - 2. Products Not Allowed
 - a. None listed.
 - 3. Discussion
 - a. Fire hydrants shall be manufactured in accordance with AWWA Standard C502.
 - b. Fire hydrants shall be installed in accordance with AWWA Manual M17.
 - c. Hydrants shall be three-way. Outlets shall be National Standard as follows:
 - i. Two (2) 2-1/2-inch hose couplings with 7-1/2 threads per inch.
 - ii. One (1) 4-1/2-inch steamer hose coupling with 4 threads per inch.

CSU HOUSING & DINING SERVICES TECHNICAL STANDARDS
DIVISION 33 – UTILITIES

- d. Main valve opening size 5-1/4", compression type.
- e. Operating nut shall be 1 inch square.
- f. Hydrants shall be Right-Hand Open.
- g. Hydrant connection shall be either 6" flanged or mechanical joint.
- h. Hydrant service leg shall include a 6" isolation valve at the main.
- i. Standard bury length shall be 5 feet.
- j. The exposed portion of the hydrant shall be painted with Devoe Safety Yellow No. 58158-01.

F. Water Utility Metering

- 1. Acceptable Products:
 - a. Sensus OMNI C2 or approved equal.
- 2. Products Not Allowed
 - a. Hersey.
- 3. Discussion
 - a. Meter shall include integral strainer and digital pulse signal output.
 - b. Meter shall be provided and installed as a part of the project.
 - c. Coordinate meter sizing and start-up with Utilities Services through the University Project Manager/Representative.
 - d. Provide a straight run of piping, the length of which shall conform to manufacturer's recommendations, upstream and downstream of the meter.
 - e. The meter shall be oriented per manufacturer's recommendations.
 - f. Register shall be installed at the same time as the meter. If a compound meter, make sure that the high- and low-flow registers are correctly installed.
 - g. Utilities Services staff will install the necessary AMI module after the contractor installation is complete and passes inspection.
 - h. There shall be a lockable bypass around all water meters. The size of the bypass shall be half the size of the water line being metered.

33 20 00 – WELLS

A. Monitoring Wells

- 1. All groundwater monitoring wells shall be permitted and installed in accordance with the Colorado Division of Water Resources "*Rules and Regulations for Water Well Construction, Pump Installation, Cistern Installation and Monitoring and Observation Hole/Well Construction*", 2 CCR 402-2.

**CSU HOUSING & DINING SERVICES TECHNICAL STANDARDS
DIVISION 33 – UTILITIES**

33 30 00 – SANITARY SEWER UTILITIES

- A. General Information
- B. Sanitary Sewer Utility Piping
 - 1. Acceptable Products:
 - a. PVC DR35 with push-on joints.
 - 2. Products Not Allowed
 - a. None listed.
 - 3. Discussion
 - a. All sewer main and service line materials shall conform to applicable ASTM standards and manufacturer recommendations for installation.
 - b. All PVC sewer piping shall be “green” color.
 - c. Plastic gravity wastewater pipe and all fittings shall be manufactured in accordance with ASTM D3034.
 - d. Joints shall be of the push-on bell and spigot type, and shall be manufactured in accordance with ASTM D3212.
 - e. Gaskets shall be of O-ring type and manufactured in accordance with ASTM F477.
 - f. Bells shall be formed integrally with the pipe and shall contain a factory installed elastomeric gasket, which is positively retained.
 - g. Coordinate bedding material with Utilities Services during design.
 - h. All water line crossings shall conform to CDPHE” Design Criteria for Potable Water Systems” (e.g. encasement, separation).
- C. Sanitary Sewer Service Connections
 - 1. All service connections shall be made at a manhole. If a manhole does not exist at a connection point, one shall be installed.
 - 2. A two-way cleanout shall be installed at the building entry.
- D. Sanitary Sewer Utility Pumping Stations
 - 1. Not preferred. Coordinate with Utilities Services if pumping stations are unavoidable.
- E. Sanitary Sewer Utility Force Mains
 - 1. Not preferred. Coordinate with Utilities Services if pumping stations are unavoidable.
- F. Septic Tanks
 - 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

CSU HOUSING & DINING SERVICES TECHNICAL STANDARDS
DIVISION 33 – UTILITIES

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. 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.
- G. Sanitary Sewer Utility Manholes, Covers, and Cleanouts
1. Manholes shall not be located in areas subject to flooding or ponding from surface runoff.
 2. If the possibility of surface runoff cannot be avoided or if a manhole is located in the 100-year flood plain the manhole shall have a watertight, bolted cover with an integral O-ring gasket.
 3. Manhole bases, benches and inverts shall be true to line and grade and smoothed with a light broom finish.
 4. All manhole sections shall have two gaskets per section joint (one inside and one outside).
 5. Preformed plastic gaskets shall conform to AASHTO M198 and Federal Specification SS-S-00210(210A).
 6. Gaskets must be pliable at the time of installation.
 7. Primer is required on all joints. Primer shall be supplied by the gasket manufacturer.
 8. Provide manholes at all sewer line junctions and changes in direction. In some cases, cleanouts may be allowed for lines 4" and smaller, but only upon specific approval of Utilities Services.
 9. All drop manholes shall conform to standard detail in the Drawing Appendix.
 10. Manhole lids shall have Aurora or Denver pick hole (concealed edge pry) to fit a lifter for removal.

CSU HOUSING & DINING SERVICES TECHNICAL STANDARDS
DIVISION 33 – UTILITIES

11. Manhole lids for sanitary service shall have “SEWER” stamped into the lid.
12. Manholes in roadways and sidewalks shall have smooth lids set flush with the paving.
13. Cleanouts in vehicle traffic areas must be a traffic rated two-way type as referenced in Drawings Appendix.

33 40 00 – STORMWATER UTILITIES

A. General Information

1. Stormwater drainage is regulated by the University’s MS4 permit administered by the Colorado Department of Public Health and Environment.
2. Refer to the “*Stormwater Utility Service Agreement between Colorado State University and City of Fort Collins Utilities Fort Collins, Colorado for Colorado State University’s Main, South and West Campuses*” (Stormwater IGA) to determine whether the project is within the IGA boundary. Projects located outside the IGA boundary and within the City of Fort Collins are subject to City of Fort Collins stormwater requirements for detention and water quality as set forth in the City Municipal Code. Projects located outside the IGA and outside the City of Fort Collins Boundary are subject to the stormwater requirements of the City or County having jurisdiction.
3. Colorado State University’s Main Campus contains a 100-year floodplain administered by CSU Facilities Management according to Colorado Department of Natural Resources, Colorado Water Conservation Board (CWCB) Rules and Regulations for Regulatory Floodplains in Colorado. The following requirements apply to new construction or redevelopment of existing structures:
 - a. During the Conceptual Design and Design Development phases of a project, the designer must contact the CSU floodplain manager and evaluate the potential impact of the project to the CSU floodplain. If the project boundary intersects with any portion of the CSU floodplain, the project is required to retain CSU’s floodplain consultant to model the floodplain in the immediate vicinity of the project, taking into account the project structures and associated grading, and develop appropriate mitigation.
 - b. All CSU building openings (e.g. doors) within the Main Campus boundary that touch the CSU floodplain are required to be protected with 2-feet of freeboard.
 - c. Upon completion of work in the CSU floodplain, a final certification survey and letter is required to be prepared and submitted to the University Project Manager/Representative documenting the final grades and elevations of all exterior portions of the project and all building openings.
 - d. Projects not within or impinging on the Main Campus CSU floodplain boundary may be subject to floodplain requirements under other authorities having jurisdiction, for example City of Fort Collins, or FEMA. All floodplain use permits and requirements must be met during design and construction.
4. 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

CSU HOUSING & DINING SERVICES TECHNICAL STANDARDS
DIVISION 33 – UTILITIES

District, Denver, Colorado, most recent edition. However, site-specific BMPs such as constructed wetlands, bioswales, etc. may be designed using design guidance from other sources, as approved by CSU.

5. Storm sewer inlets shall be protected from excessive sediment and debris during construction projects through erosion control efforts such as filter fabric, bales of hay, river rock, barricades, holding ponds, etc.
6. Erosion Control Plans shall be required and submitted to the University Project Manager/Representative for all projects that have the potential for erosion. For additional information on Temporary Facilities and Controls, see Division 01 General Requirements.

B. Stormwater Utility Piping

1. Acceptable Products:

- a. PVC DR35 with push-on joints.
- b. Reinforced Concrete Pipe (RCP) with push-on joints.

2. Products Not Allowed

- a. None listed.

3. Discussion

- a. Stormwater main and service lines smaller than 18" nominal size shall be PVC. Lines 18" and larger nominal size shall be RCP.
- b. All stormwater main and service line materials shall conform to applicable ASTM standards and manufacturer recommendations for installation.
- c. All PVC stormwater piping shall be "green" color.
- d. Plastic gravity stormwater pipe and all fittings shall be manufactured in accordance with ASTM D3034.
- e. Joints for PVC pipe shall be of the push-on bell and spigot type, and shall be manufactured in accordance with ASTM D3212.
- f. Gaskets shall be of O-ring type and manufactured in accordance with ASTM F477.
- g. Bells on PVC pipe shall be formed integrally with the pipe and shall contain a factory installed elastomeric gasket, which is positively retained.
- h. RCP shall be manufactured in accordance with ASTM C76.
- i. RCP joints shall incorporate an o-ring or profile type gasket manufactured in accordance with ASTM C443. Gaskets shall be pre-lubricated, or lubricated per manufacturer's instructions.
- j. Coordinate bedding material with Utilities Services during design.
- k. All water line crossings shall conform to CDPHE" Design Criteria for Potable Water Systems" (e.g. encasement, separation).

CSU HOUSING & DINING SERVICES TECHNICAL STANDARDS
DIVISION 33 – UTILITIES

- C. Service Connections
 - 1. All service connections shall be made at a manhole. If a manhole does not exist at a connection point, one shall be installed.
 - 2. A two-way cleanout shall be installed at the building entry.
- D. Culverts
- E. Stormwater Utility Catchbasins
 - 1. Acceptable Products:
 - a. None listed.
 - 2. Products Not Allowed
 - a. None listed.
 - 3. Discussion
 - a. Stormwater 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.
- F. Stormwater Utility Pumping Stations
 - 1. Not preferred. Coordinate with Utilities Services if pumping stations are unavoidable.
- G. Stormwater Detention and Water Quality Infrastructure
 - 1. Projects within the Stormwater IGA boundary are subject to the following requirements:
 - a. Stormwater Detention: define the project boundary, with approval from the University Project Manager/Representative, and design stormwater detention that is designed to detain the 100-year developed condition, with a release rate that matches the 2-year pre-developed condition. Prepare and submit to the University Project Manager/Representative for review and approval a drainage report showing pre-development conditions, developed conditions and stormwater detention and release rate calculations. If the stormwater detention requirements cannot be met within the project boundary, project funds shall be contributed to the CSU Utilities Regional Stormwater Detention fund in an amount calculated by Facilities Management Utilities Services.
 - b. Water quality: treat at least 50 percent of the project’s impervious area using Low Impact Development (LID) mechanisms (e.g. raingardens, bioswales, etc.). Detain 100 percent of the Water Quality Capture Volume (WQCV) on site, calculated per the Urban Drainage and Flood Control District’s “*Criteria Manual – Volume 3*” most recent edition. Incorporate permeable pavers, pervious pavers and/or pervious asphalt wherever feasible in areas to be paved. Use permeable pavers for at least 50 percent of the project’s bicycle parking areas.
 - c. Prohibited Elements: due to premature failure likelihood, CSU prohibits the inclusion of permeable concrete. Due to maintenance burden, corrosion likelihood and the

CSU HOUSING & DINING SERVICES TECHNICAL STANDARDS
DIVISION 33 – UTILITIES

- reduction of pervious surface, CSU prohibits underground stormwater detention facilities.
2. All stormwater detention systems that are subject to reporting in the State's Notification Compliance Portal established pursuant to CRS 37-92-602(8) must meet the following criteria:
 - a. Continuously release or infiltrate at least 97 percent of all runoff from a rainfall event that is less than or equal to a 5-year storm within 72 hours after the event
 - b. Continuously release or infiltrate at least 99 percent of all runoff from a rainfall event that is greater than a 5-year storm (up to and including a 100-year storm event within 120 hours after the end of the event.
 - c. Be submitted to the portal for review and approval by Colorado State University's stormwater representative.
- H. Stormwater Utility Manholes, Covers, and Cleanouts
1. Manhole bases, benches and inverts shall be true to line and grade and smoothed with a light broom finish.
 2. All manhole sections shall have two gaskets per section joint (one inside and one outside).
 3. Preformed plastic gaskets shall conform to AASHTO M198 and Federal Specification SS-S-00210(210A).
 4. Gaskets must be pliable at the time of installation.
 5. Primer is required on all joints. Primer shall be supplied by the gasket manufacturer.
 6. Provide manholes at all stormwater line junctions and changes in direction. In some cases, cleanouts may be allowed for lines 4" and smaller, but only upon specific approval of Utilities Services.
 7. All drop manholes shall conform to standard detail in the Drawing Appendix.
 8. Manhole lids shall have Aurora or Denver pick hole (concealed edge pry) to fit a lifter for removal.
 9. Manhole lids for stormwater service shall have "STORM" stamped into the lid.
 10. Manholes in roadways and sidewalks shall have smooth lids set flush with the paving.
 11. Cleanouts in vehicle traffic areas must be a traffic rated two-way type as referenced in Drawings Appendix.
- I. Subdrainage
1. Permanent groundwater dewatering should be avoided.
 2. Systems that require groundwater treatment on a permanent basis are prohibited. Alternative construction shall be implemented to avoid permanent groundwater pumping that requires treatment. To determine whether treatment may be required, evaluate the

CSU HOUSING & DINING SERVICES TECHNICAL STANDARDS
DIVISION 33 – UTILITIES

groundwater within the project footprint through sampling and analysis, and review the most current State regulations and policies.

3. Groundwater dewatering during construction shall be managed in accordance with Division 01, Section 01 50 00 Part I.

33 50 00 – NATURAL GAS UTILITIES

A. General Information

1. Operational and building design information for the Main Campus natural gas utility:
 - a. System pressure east of the Center Avenue mall: 5 psig.
 - b. System pressure west of the Center Avenue mall: 20 psig.
 - c. Coordinate with Utilities Services on available capacity.
 - d. Natural gas utilities on South, Foothills, and ARDEC campuses may or may not be owned by the University. Coordinate with Utilities Services.
2. All new building gas services shall include a meter and a regulator to be provided and installed by the Contractor.

B. Natural Gas Utility Piping

1. Acceptable Products:
 - a. Polyethylene (MDPE) with butt fused joints.
2. Products Not Allowed
 - a. Metal piping of any kind.
 - b. Compression fittings of any kind.
3. Discussion
 - a. All MDPE natural gas piping shall be “yellow” in color.
 - b. MDPE piping shall be manufactured in accordance with ASTM D2513 and IAPMO standards where applicable.
 - c. Coordinate bedding material with Utilities Services during design.

B. Natural Gas Risers

1. Risers shall be anodeless with an MDPE fusion connection.
2. Compression fittings are prohibited.

C. Natural Gas Regulators

1. Acceptable Products
 - a. Sensus series 243 or series 143-80.

**CSU HOUSING & DINING SERVICES TECHNICAL STANDARDS
DIVISION 33 – UTILITIES**

2. Products Not Allowed
 - a. No substitutions are allowed.
 3. Discussion
 - a. Integral low-pressure cutoffs are prohibited.
 - b. Coordinate with Utilities Services on regulator choice.
- D. Natural Gas Utility Metering
1. Acceptable Products:
 - a. For smaller loads: Sensus Sonix model 600, 800, or 2000.
 - b. For larger loads: Dresser Roots Rotary Series B3 with pressure compensation and ES3 Electronic Temperature Compensated Index.
 2. Products Not Allowed
 - a. No substitutions are allowed.
 3. Discussion
 - a. Coordinate with Utilities Services to coordinate meter choice with load sizing.
 - b. Meter shall be provided and installed as a part of the project.
 - c. Coordinate meter sizing and start-up with Utilities Services.
 - d. The meter shall be installed per manufacturer's recommendations.
 - e. Utilities Services staff will install the necessary AMI module after the contractor installation is complete and passes inspection.

33 56 00 – FUEL STORAGE TANKS

- A. Above Ground Fuel Storage Tanks
 1. Shall conform to Colorado Department of Labor and Employment (CDL&E) Division of Oil and Public Safety (OPS) Storage Tank Regulations, NFPA 30, 31 and 54, OSHA 29 CFR 1910.106 and 1910.110 (LPG), NFPA 1 and NFPA 58 (LPG).
- B. Underground Fuel Storage 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 Project Manager/Representative.
 3. Shall conform to Colorado Department of Labor and Employment (CDL&E) Division of Oil and Public Safety (OPS) Storage Tank Regulations, NFPA 1, OSHA 29CFR1910.106 (flammable liquids) and 29CFR1910.110 (LPG).

CSU HOUSING & DINING SERVICES TECHNICAL STANDARDS
DIVISION 33 – UTILITIES

4. Tanks of a capacity greater than 660 gallons shall be registered with CDL&E OPS by the contractor on behalf of the Owner.
 5. Tanks shall be installed by contractors licensed by the State Oil Inspector.
 6. Storage systems (including piping) must have corrosion protection, leak detection and overfill prevention.
 7. Advance permits from OPS are required prior to installation, repair, upgrade, removal or abandonment.
 8. 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.
- C. Compressed Storage Tanks
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).

33 61 00 – CHILLED WATER UTILITIES

- A. General Information
1. District Energy chilled water utilities exist on both Main and South Campuses.
 2. Operational and building design information for the Main Campus chilled water utility. Buildings connecting to this utility shall be designed to meet these parameters:
 - a. Supply Temperature: 43°F at building
 - b. Return Temperature: 63°F at building peak load
 - c. Delta Temperature: 20°F at building peak load
 - d. System Static Pressure: 40-50 psig
 - e. System Dynamic Pressure: maximum 15 psig differential across building; depending on building location within the distribution system, booster pumping may be necessary.
 - f. System Flow: Variable flow, constant pressure differential
 - g. System Fluid: Water - no glycol
 3. Operational and building design information for the South Campus chilled water utility. Buildings connecting to this utility shall be designed to meet these parameters:
 - a. Supply Temperature: 43°F at building
 - b. Return Temperature: 63°F at building peak load
 - c. Delta Temperature: 20°F at building peak load

CSU HOUSING & DINING SERVICES TECHNICAL STANDARDS
DIVISION 33 – UTILITIES

- d. System Static Pressure: 40-50 psig
 - e. System Dynamic Pressure: maximum 15 psig differential across building; depending on building location within the distribution system, booster pumping may be necessary.
 - f. System Flow: Variable flow, constant pressure differential
 - g. System Fluid: 30% propylene glycol
4. In general, central equipment in basement or ground level equipment rooms may be connected directly to the chilled water utilities. Rooftop and distributed equipment shall be separated from the utility by a flat plate heat exchanger with associated pumping and accessories on the building side loop.
 5. Control valves on all direct connected loads (coils, heat exchangers) shall be Flow Control Industries DP Valve. No substitutions are allowed.
- B. Chilled Water Utility Piping
1. Acceptable Products:
 - a. High Density Polyethylene (HDPE), SDR 11.0 conforming to ASTM D3350, F714 or API 5LE.
 2. Products Not Allowed
 - a. No other piping materials allowed.
 3. Discussion
 - a. Identify the nominal pipe size on all drawings, schedules and in specifications. Do not use the I.D. or O.D. of the pipes.
 - b. Piping and fittings shall be butt-fused, unless an exception is approved by District Energy through the University Project Manager/Representative.
 - c. All fittings shall be HDPE, SDR 11.0, to match the adjoining pipe.
 - d. Transition to valves shall be by HDPE butt-fused flange adapter. Use stainless steel slip-on flange with stainless steel nuts and bolts.
 - e. For situations where butt fusion is not possible, an HDPE butt-fused flange adapter with stainless steel slip-on flanges shall be used.
 - f. Electric fusion couplings are prohibited. Requests for variance shall be made to District Energy through the University Project Manager/Representative and will be approved only when other connection methods are not possible.
 - g. Distribution and branch piping configuration: For all supply and return pairs, the supply piping shall be either the east or south pipe. The return piping shall be either the west or north pipe.
 - h. Coordinate bedding material with District Energy during design.

CSU HOUSING & DINING SERVICES TECHNICAL STANDARDS
DIVISION 33 – UTILITIES

- i. All water line crossings shall conform to CDPHE” Design Guide for Potable Water Systems” (e.g. encasement, separation). Chilled water is considered raw water with respect to regulation.
- C. Chilled Water Utility Service Connections
- 1. Site conditions will dictate the configuration of the taps and associated branch lines. Coordinate with District Energy via the University Project Manager/Representative on all taps.
 - 2. In general, service connections must be hot tapped. Coordinate with District Energy via the University Project Manager/Representative on the possibility of shut-downs of mains.
 - 3. Supply and return service taps onto distribution mains shall be done with either epoxy coated mechanical saddle or electrofusion saddle.
 - 4. Bottom taps are prohibited.
- D. Chilled Water Utility Valves
- 1. Acceptable Products:
 - a. Butterfly Valves: K-Flo Model 504, DeZurik BAW, or approved equal.
 - b. Gate Valves: Muller 2360 series with powder epoxy coating both inside and out, American Flow Control, Clow Valve Company, or approved equal.
 - 2. Products Not Allowed
 - a. None listed.
 - 3. Discussion
 - a. All valve connections shall be flanged.
 - b. All valves shall be Right-Hand Close.
 - c. Butterfly valves shall meet or exceed AWWA C504 standard.
 - d. Gate valves shall meet or exceed AWWA C509 standard and be rated for 150 PSIG.
 - e. For butterfly valve installation, pressure rated HDPE beveled flanges or beveled spacers shall be used. Modifying un-beveled HDPE flanges is prohibited.
 - f. All buried valves shall be field tested to ensure that the valve has full operation from open to closed, without any binding or blockage, both before and after the valve is buried.
- E. Chilled Water Utility Metering
- 1. Acceptable Products:
 - a. Dynasonics TFX Ultra Transit-Time ultrasonic energy meter.
 - 2. Products Not Allowed

CSU HOUSING & DINING SERVICES TECHNICAL STANDARDS
DIVISION 33 – UTILITIES

- a. No other products are allowed.
- 3. Discussion
 - a. Site selection and installation are critical for accurate measurement.
 - b. Provide straight pipe run of at least 15 pipe diameters in length, 10 upstream, 5 downstream, for the chilled water metering location.
 - c. Chilled water meters are read remotely over a CSU network using Modbus over TCP/IP protocol. Using a Modbus to Modbus TCP/IP converter, several meters require only one TCP/IP connection. Each converter is connected to the building LAN in accordance to CSU Telecom's best practices and standards.
 - d. Provide a CAT-6 drop from the building IDF to the chilled water meter location for communication.
 - e. If there is both a steam and chilled water meter in the building, only one CAT-6 drop is necessary for both meters.
 - f. Meter installation shall include factory start-up.
 - g. Coordinate metering locations with District Energy through the University Project Manager/Representative.
 - h. Specification:
 - i. Meter
 - (i) Part number: DTFXE-ZN-AKED-NA
 - (ii) Remote mount, universal power input 95 to 246 VAC, 4-button keypad, advance communication Modbus RTU and 10/100 Base-T (Ethernet/IP, BACnet/IP, Modbus TCP/IP), temperature range 4 to 85 °F, include cable gland kit.
 - ii. General Purpose Remote Flow Transducers
 - (i) Part number: DTTR-###-N-000-N, ### = cable length.
 - (ii) Cable length: 20 ft. = 020, 50 ft. = 050, 100 ft. = 100.
 - (iii) Standard transmitter type (1 MHz), 250 °F (121 °C) max temp, bare Twinax cable.
 - iii. Surface Mount RTD Kits
 - (i) Part number: D010-3000-120, 20 ft cable length.
 - (ii) Part number: D010-3000-121, 50 ft cable length.
 - (iii) Part number: D010-3000-122, 100 ft cable length.
 - (iv) Clamp on, 266 °F, 1,000 Ohm cable.

33 63 00 – STEAM UTILITIES

CSU HOUSING & DINING SERVICES TECHNICAL STANDARDS
DIVISION 33 – UTILITIES

A. General Information

1. Steam is distributed on Main Campus from the District Energy central steam plant in utility tunnels and direct buried lines. Steam condensate is returned to the Main Campus District Energy central steam plant through piping in utility tunnels or direct buried lines.
2. Operational and building design information for the steam utility:
 - a. Steam distribution pressure: 45 psig.
 - b. Steam distribution pressure variation: +/- 5 psig.
 - c. Steam and condensate piping, fittings, valves, and specialties shall be rated for 150 psig.
 - d. Condensate distribution piping is gravity return to the plant.
 - e. Condensate back-pressure in the mains may be as high as 30 psig during peak load times.
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.

B. Steam and Condensate Piping

1. Acceptable Products:
 - a. Perma-Pipe Multi-Therm 750 Supreme or Rovanco Insul-800 Elite.
2. Products Not Allowed:
 - a. No substitutions allowed.
3. Discussion
 - a. Either FRP or HDPE wrap is acceptable.
 - b. Steam carrier piping shall be schedule 40, A53B Style S or A106B.
 - c. Condensate carrier piping shall be schedule 80, A53B Style S or A106B.
 - d. Both Steam and condensate carrier piping shall be butt welded for sizes 2-1/2" and larger and socket welded for 2" and below.
 - e. All utility steam piping thermal expansion shall be designed for 150 psig saturated steam (366°F).
 - f. All utility condensate piping thermal expansion shall be designed for 15 psig saturated steam (250°F).
 - g. Piping runs shall be comprised of one manufacturer only. Switching between manufacturers is only acceptable in vaults and tunnels.
 - h. All straight sections, fittings, anchors and other accessories shall be factory prefabricated to job dimensions.

CSU HOUSING & DINING SERVICES TECHNICAL STANDARDS
DIVISION 33 – UTILITIES

- i. End seals, gland seals and anchors shall be designed and factory prefabricated to prevent the ingress of moisture into the system. All subassemblies shall be designed to allow for complete draining and drying of the conduit system.
 - j. Each system layout shall be computer analyzed by the piping system manufacturer to determine stresses and movements of the service pipe.
 - k. The system design shall be in strict conformance with ANSI B31.1, latest edition, and stamped by a Registered Professional Engineer.
 - l. Flanged connections shall utilize spiral wound gaskets and B-7 Stud Bolts w/XH Nuts. Threads shall be anti-seized.
 - m. Coordinate bedding material with District Energy during design.
- C. Steam and Condensate Service Connections
- 1. All service connections shall be made at an existing anchor point.
 - 2. All service connections shall originate from a vault or tunnel. If no vault exists, one shall be installed.
- D. Steam and Condensate Valves
- 1. Acceptable Products:
 - a. Steam Butterfly Valves: Jamesberry, Keystone K-LOK Model 362 with lugged carbon body, 316ss disc and seat and gear actuator with hand wheel, and Vanessa 30,000 or 32,500 series, or approved equal.
 - b. Steam Gate Valves: Crane, Jenkins, Lunkenheimer, Milwaukee, Stockham, Walworth, or approved equal.
 - c. Condensate Butterfly Valves: Jamesberry, Keystone K-LOK Model 362 with lugged carbon body, 316ss disc and seat and gear actuator with hand wheel, and Vanessa 30,000 or 32,500 series, or approved equal.
 - d. Condensate Gate Valves: Crane, Jenkins, Lunkenheimer, Milwaukee, Stockham, Walworth, or approved equal.
 - 2. Products Not Allowed
 - a. None listed.
 - 3. Discussion
 - a. Butterfly valves are allowed for branch line isolation up to 6". Butterfly valves shall be handwheel operated. Lever operation is not allowed.
 - b. Butterfly valves shall include a bypass with globe valve for warming.
 - c. Gate valves with rising stems shall be installed unless space does not allow. If space does not allow, then non-rising stems are acceptable.
- E. Steam and Condensate Piping Specialties – Traps

**CSU HOUSING & DINING SERVICES TECHNICAL STANDARDS
DIVISION 33 – UTILITIES**

1. Acceptable Products:
 - a. Armstrong 2011 inverted bucket with universal block on all distribution drip legs.
 2. Products Not Allowed
 - a. No substitutions allowed.
 3. Discussion
 - a. Specific methods and locations of trapping shall be specified in design plans.
 - b. Pipe materials for trap assemblies shall be schedule 80 A53-B Style S or A106-B. Trap assemblies may be socket weld or thread.
- F. Steam and Condensate Piping Specialties – Expansion
1. Acceptable Products:
 - a. Advanced Thermal Systems, Inc. Thermal Pak TP2, Hyspan, or approved equal.
 2. Products Not Allowed
 - a. None listed.
 3. Discussion
 - a. None listed.
- G. Steam Metering
1. Acceptable Products:
 - a. VORTEK Instruments Pro-V series.
 2. Products Not Allowed
 - a. No other products are allowed.
 3. Discussion
 - a. Selection of in-line versus insertion meters will be determined based on each application per steam flow rates. Proper sizing, selection, and installation are critical for accurate measurement. Steam piping sections may need to be reduced in diameter to achieve optimal metering flow rates.
 - b. Site selection and installation are critical for accurate measurement.
 - c. Provide straight pipe run of at least 15 pipe diameters in length, 10 upstream, 5 downstream, for the steam metering location. Run must be located downstream of building isolation valve and upstream of any branching lines, taps or PRV's.
 - d. Steam meters are read remotely over a CSU network using Modbus over TCP/IP protocol. Using a Modbus to Modbus TCP/IP converter, several meters require only one TCP/IP connection. Each converter is connected to the building LAN in accordance to CSU Telecom's best practices and standards.

CSU HOUSING & DINING SERVICES TECHNICAL STANDARDS
DIVISION 33 – UTILITIES

- e. Provide a CAT-6 drop from the building IDF to the steam meter location for communication.
- f. If there is both a steam and chilled water meter in the building, only one CAT-6 drop is necessary for both meters.
- g. Meter installation shall include factory start-up.
- h. Coordinate metering locations with District Energy through the University Project Manager/Representative.
- i. Specification for in-line meters (pipe section size 3" or less):
 - i. P/N: M22-VTP-##-S-150-Feature #5-DD-AC-1AM-ST-PT
 - ii. Multivariable Options: "VTP" Velocity, Temperature and Pressure Sensors.
 - iii. Flow Body: 1/2" = 04, 3/4" = 06, 1" = 08, 1 1/2" = 12, 2" = 16, 3" = 24, normal bore.
 - iv. Meter Body Material: "S" 316 Stainless Steel
 - v. Process Connection: "150" ANSI 150# Flange
 - vi. Electronics Enclosure: "L" NEMA 4X IP66 Enclosure OR "R ()" Remote Electronics NEMA 4X, IP66, Specify cable length in parentheses. Location may require enclosure remote mount option if not accessible.
 - vii. Display Options:" DD" Digital Display and Programming Button.
 - viii. Input Power: "AC" 100-240 VAC, 50/60 Hz line power, 5W max.
 - ix. Output: "1AM" One analog output (4-20 mA), one alarm, one pulse, MODBUS Communication Protocol.
 - x. Temperature Options: "ST" Standard temperature. Process temperature -330° to 500°F
 - xi. Pressure Options: "P2" Maximum 100 psia.
- j. Specification for insertion meters (pipe section size greater than 3"):
 - i. P/N: M23-VTP-SL-#-DD-AC-1AM-ST-PNPTR
 - ii. Multivariable Options: "VTP" Velocity, Temperature and Pressure Sensors.
 - iii. Probe Length: "SL" Standard length probe.
 - iv. Electronics Enclosure: "L" NEMA 4X, IP66 Enclosure mounted on flow body OR "R" Remote Electronics NEMA 4X, IP66, specify cable length in parentheses "location may require remote mount option if not accessible".
 - v. Digital Options. "DD" Digital Display and Programming Buttons.
 - vi. Input Power: "AC" 100-240 VAC, 50/60 Hz line power, 5W max

CSU HOUSING & DINING SERVICES TECHNICAL STANDARDS
DIVISION 33 – UTILITIES

- vii. Output: “1AM” One analog output (4-20 mA), one alarm, one pulse, MODBUS Communication Protocol.
- viii. Temperature Options: “ST” Standard temperature, Process temperature –330 to 500°F.
- ix. Pressure Options: “P2” Maximum 100 psia.
- x. Process Connections: “PNPTR” Packing Gland, 2 inch NPT, Retractor.
- xi. Factory supplied installation Hardware for insertion type:
 - (i) Full Port Bronze Gate Valve, 2-inch Female NPT nipple.
 - (ii) Mounting Kit includes: Two 2x3-inch nipples, one 2-inch female NPT mounting adapter and one pipe coupler.

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 Project Manager/Representative for further information. Transformers connected to these systems shall have Delta primaries.
- 3. Unless otherwise stated during the Request for Proposal (RFP) and/or pre-design conference, CSU Facilities Management shall furnish and install primary duct bank, vaults, 15kV sectionalizing switches, 15kV cable, transformer and transformer pad. CSU’s Electric Shop shall make cable terminations at utility junction point and building transformer.
- 4. The cost of the primary duct bank, vault(s), 15kV sectionalizing switch(es), 15kV cable, transformer and transformer pad and installation shall be a part of the project budget.

33 71 19 – ELECTRICAL UNDERGROUND DUCTS AND VAULTS

- A. For some projects, the Contractor may have to provide a new underground vault(s) and primary duct bank. Whenever vault(s) and/or primary duct bank are required, the details shall be discussed at the pre-design conference. Design drawings and specifications for vaults and primary duct bank shall be provided by Facilities Management Electrical Engineer.
- B. Duct Bank (primary) - Underground 13.2 KV raceway shall be encased in concrete.
 - 1. 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.)

CSU HOUSING & DINING SERVICES TECHNICAL STANDARDS
DIVISION 33 – UTILITIES

2. 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 48" long radius only. All underground RMC conduits shall be tar coated or PVC jacketed.
 3. 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.
- C. 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. All galvanized steel conduits shall be either PVC jacketed or tar coated with an asphalt base compound.
- D. Vaults (primary) shall be either poured in place or precast. See Drawing Appendix for vault details.
- E. 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."
- F. Any individual entering existing or new vaults 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.
- G. 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).
- H. All conduits shall be cleaned and a correct size mandrel run through each conduit. A pulling string shall be installed in all conduits.

33 71 49 - MEDIUM VOLTAGE WIRING

- A. Acceptable Products:
1. Okonite
 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/133% 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).

CSU HOUSING & DINING SERVICES TECHNICAL STANDARDS
DIVISION 33 – UTILITIES

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.
- C. Installation and Testing
1. CSU Facilities Management shall furnish and install 15 kV cables.
 2. All 15 kV 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.

CSU HOUSING & DINING SERVICES TECHNICAL STANDARDS
DIVISION 33 – UTILITIES

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 Project Manager/Representative.
 10. Impedances of transformers shall be determined and specified as described in CSU Design Standards Chapter 22 – Electrical Drawings.
 11. See Drawing Appendix for transformer layout details and transformer pad sizes.
- D. Transformer shall be furnished and installed by CSU Facilities Management.

33 75 00 – ELECTRIC METERING

- A. Acceptable Products:
 1. Elster AMI meters.
- B. Products not allowed:
 1. No substitutions allowed.
- C. Electric Metering
 1. The cost of the meter, meter socket, CT cabinet, CT's, and installation shall be a part of the project budget.
 2. The metering components listed above shall be ordered and installed by CSU Facilities Management.
 3. Coordinate termination of secondary cables with CSU Electric Shop.
 4. 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.
 3. The 15kV sectionalizing switch shall be furnished and installed by CSU Facilities Management.

CSU HOUSING & DINING SERVICES TECHNICAL STANDARDS
DIVISION 33 – UTILITIES

33 80 00 – COMMUNICATIONS 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 Project Manager/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 Project Manager/Representative. See Division 23 - HVAC and Division 28 – Electronic Safety and Security.