

NC State University Design and Construction Guidelines

Division 33 Utilities

1.0 Purpose

- A. These guidelines provide methods and requirements to ensure that the connections, attachments, extensions, or other site utility modifications meet NC State standards.
- B. NC State is responsible for the operation and maintenance of most site utilities associated with project development. Centralized utilities are available on each of the campuses. All projects shall connect to these central utilities.

2.0 General Requirements

A. Storm Water

- 1. NC State is located in the Neuse River Watershed and is subject to the Neuse River Buffer Rules. The university operates its own stormwater system under a system-wide Municipal Separate Storm Sewer System permit. Under the NC State permit, the Environmental Health and Safety Center - Environmental Affairs group must approve the stormwater design proposal for all projects.
- 2. Campus stormwater management is managed as an integrated systems approach. Stormwater management for each project site shall be studied in context with the entire watershed and subsequent impacts downstream.
 - a) Each project shall incorporate a combination of methods to minimize the production of stormwater runoff and to slow and infiltrate water near the source rather than relying on one large device to control stormwater for the entire watershed.
 - b) Stormwater devices shall be incorporated into the landscape plan.
 - c) Maintenance access shall be provided to all stormwater management devices.
- 3. Designs of stormwater control shall minimize erosive grades and large contiguous areas of impervious surface. Designer shall employ Best Management Practices (BMP's) that infiltrate or retain and filter the first inch of runoff on the site.
- 4. BMP's shall be designed in accordance with the most recent version of North Carolina Division of Water Quality Stormwater Best Management Practices Manual.
- 5. Stormwater piping and conveyance systems shall be RCP unless an alternative is explicitly approved by the piping system owner.

B. Domestic Water & Sewer

- 1. NC State owns the domestic water and fire service on campus. The distribution system is connected to the City of Raleigh.
- 2. North, Central, and CBC campuses shall require individual metering and cross-connection protection for each individual building. Building meters may be inside the building but must be accessible to maintenance personnel. Main backflow preventers shall be located inside the building and where possible dual backflows in parallel should be installed.

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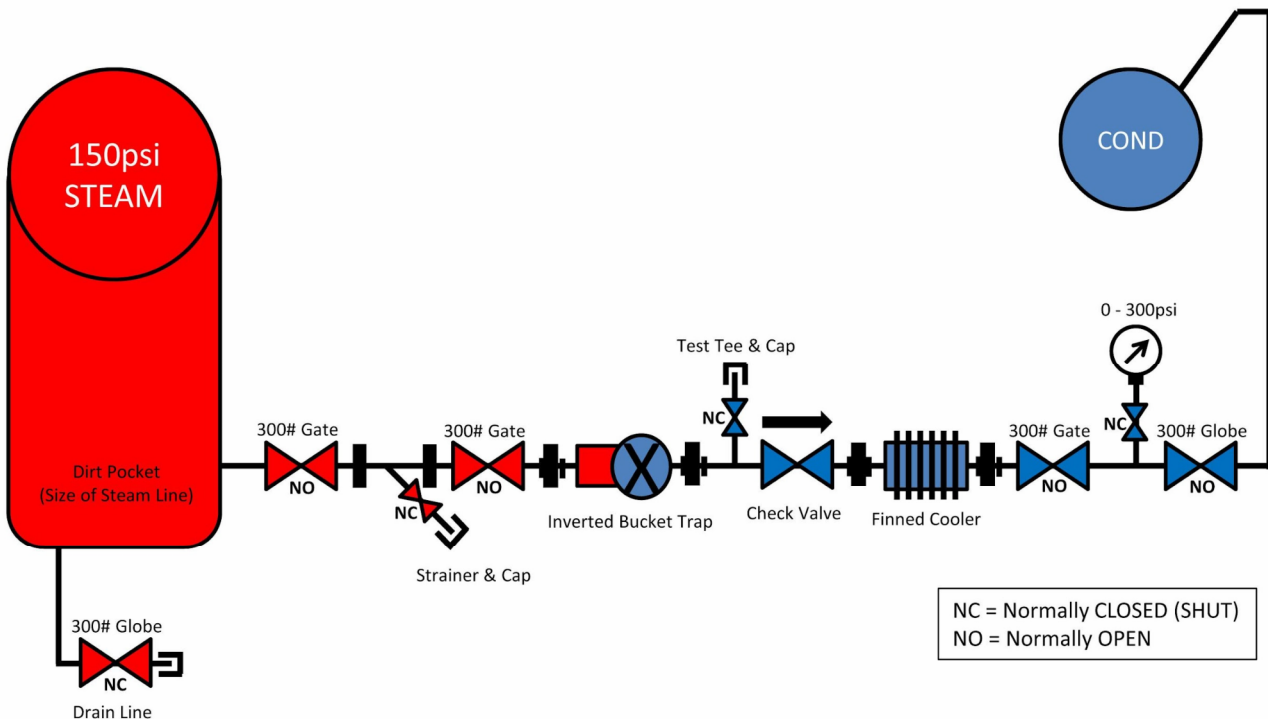
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3. South, Centennial, and West campus except for CBC have a variety of conditions. Designers shall contact NC State prior to beginning design for utilities available and connections.
 4. Standard piping material for water main distribution piping shall be ductile iron piping. All exceptions should be explicitly approved by the system owner.
 5. Fire hydrants should be specified as the NCSU preferred brand with Storz connection. An isolation valve shall be installed prior to each fire hydrant.
 6. Building laterals that are 3" and smaller shall be type K hard copper.
 7. NC State owns the sanitary sewer collection system on campus, which connects to the City of Raleigh system. Buildings with separate lab waste systems shall include a sampling manhole outside of the building prior to combination with the normal building waste stream. Installation and design shall comply with NC State wastewater collection permit.
 8. Standard piping material for sanitary sewer shall be ductile iron. All exceptions should be explicitly approved by the system owner.
 9. Grease traps shall adhere to the most current City of Raleigh standards.
- C. Steam and Condensate
1. Documentation shall include detailed information on existing distribution system conditions. Profile drawings of new and existing utilities shall be provided.
 2. All steam, condensate, and domestic water lines within the building envelope shall be insulated. Chases and stack areas carrying heating lines shall be ventilated to prevent overheating.
 3. All connections to mains shall be valved, both at the connection to the main and in the mechanical room of the building.
 4. All new piping shall conform to the NC State color scheme for mechanical identification and be stenciled with type of service and direction of flow.
 5. Process/transmission lines shall be designed to accommodate 150 psig. Actual distribution pressure varies by campus. Process steam is available year round.
 6. Process steam generation shall be independent of the building heating system.
 7. All new buildings shall have steam flow meters with insulated removable jackets. Reference Division 23 – Energy Management guideline.
 8. Condensate meters shall be placed on the discharge side of the condensate pump and measure all condensate discharged. A three-valve bypass around steam and condensate meters should be provided.
 9. Campus Steam Distribution
 - a) Exterior steam and condensate lines shall be installed in semi-accessible precast concrete tunnels or fully accessible walkable concrete utility tunnels.
 - (1) Triple-wall, pre-insulated piping systems will be reviewed on a project specific basis.
 - b) Expansion loops shall be used.
 - c) Steam pipe shall be schedule 40 black steel pipe with 300 pound rated fittings to the building's first pressure reducing station. Steam piping shall be all welded construction.

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- d) Condensate pipe shall be schedule 80 black steel pipe with schedule 80 fittings. Condensate piping shall be all welded construction to the first valve in the drip leg. Threaded fittings are permitted for use on the drip leg after the first valve.
- e) Provide valves at each intersection of mains.
- f) Steam trap assembly shall follow diagram below:



10. Steam Manholes

- a) Minimum manhole size shall be eight feet by eight feet by eight feet. Manhole sizes shall accommodate clearance and service space around piping, valves, fittings, traps, etc. Construction shall be poured-in-place concrete. Manhole base slab shall be waterproofed with a water seal at the key joint.
- b) Manholes may be used for anchor points if specifically designed to accommodate the load.
- c) Two manhole covers shall be provided and shall be located diagonally from one another. One cover shall be a minimum of 24 inches in diameter for personnel access. Personnel access into the manhole shall be a welded steel ladder securely anchored to the top, wall and floor of the manhole. The second cover shall be a minimum of 30 inches in diameter and will be located over a sump pit. All manhole covers will be cast with the word "STEAM". Piping, valves, traps, etc. shall not be located below either manhole access point.
- d) Manhole sump pits shall be 24 inch by 24 inch and 24 inches deep. Sumps shall drain by gravity to the sanitary sewer system. If gravity flow is not

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possible, sump pumping can be used on a project specific basis. Sump drain piping shall be ductile iron.

- e) Power to sump piping shall be routed from the closest panel and should use a GFCI breaker. Power should be run to the steam manhole to an outlet.

11. Drip Legs

- a) Inverted bucket traps shall be used.
- b) High-pressure condensate from the drip legs shall not be introduced to the pumped wet condensate return system. A high pressure drip line shall be used.

12. Insulation

- a) Insulation material on steam and condensate piping in tunnels shall be calcium silicate. Manholes should be insulated using aerogel or equivalent.
- b) Insulation in manholes shall be provided on all piping, flanges, valves, and appurtenances.
- c) Aluminum jacket shall be used in manholes on all piping, fittings, and appurtenances. Aluminum jacket shall be provided on valve bodies up to the flanges for the gland packing.
- d) Thirty-pound asphalt-impregnated felt jacket shall be installed over insulation of pipes in inaccessible spaces. In high traffic areas, where insulated pipes are subject to mechanical abuse, metal covering or structural protection shall be provided. Wire used for securing pipe coverings shall be solid copper or stainless steel.

13. Field Welds

- a) All field welds shall be tested to B31.1 standard using UT-Phased Array or X-Ray. Any deviation from this standard must be reviewed and approved by NC State Utilities & Engineering.

D. Chilled Water

1. Ductile Iron Pipe shall conform to AWWA C151 minimum class 50 with a minimum four (4) inch diameter. All ductile iron pipe shall be cement mortar lined in accordance with AWWA C104. Piping 4" – 12" shall have 350 psig minimum working pressure. Piping 14" – 24" shall have a 300 psig minimum working pressure.
2. Fittings shall be ductile iron mechanical joint type manufactured in accordance with C104/A21.10, rated for 250 psi working pressure. Straight pipe joints and fittings to be a combination of push-type and restrained joint-type. Joints and fittings shall be flexible and shall be designed to provide positive restraint against end-wise separation due to thrust. Fittings shall be cement mortar lined equivalent to the pipe lining.
3. Push type joints shall be equal to American Fastite joint or U.S. Pipe Tyton joint, ANSI/AWWA C111/A21.11, tapered bell opening, 5 degrees lateral offset capability. Gasket material shall be Styrene-butadiene Rubber (SBR) with two (2) hardness; 85 durometer hardness for smaller end of gasket and 65 durometer hardness for larger end of gasket.

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4. Restrained type joint fittings shall be equal to Series 1100 Megalug restraint systems for mechanical joint ductile iron piping, fittings and valves. Gasket material shall be SBR All underground piping for chilled water system distribution shall have a minimum diameter of four (4) inches and shall be cement lined ductile iron.
 5. Butterfly valves shall comply with AWWA C504. Valve shaft to be type 304 stainless steel. Cast valves shall be gray or ductile iron with interior coated. Valves shall be furnished with buried service gearbox operator, shaft extensions, ground level position indicators and valve boxes.
 6. Gate valves shall comply with AWWA C509. Stem shall be non-rising cast bronze. Valve body and wedge shall be ductile iron, coated inside and outside with epoxy. The coating shall meet or exceed AWWA C550. Valves shall have a minimum pressure rating of 250 psi. Gate valves shall be equal to U.S. Pipe.
 7. Valve boxes shall be two (2) piece cast iron with heavy duty traffic weight lid marked "CHILLED WATER" and the valve number. Valve boxes not in paving shall be supplied with a pre-cast concrete mowing ring.
 8. Submittal shall include complete calculations for underground chilled water pipe joints indicating the requirements for restrained and push-on joints. Submission of output data shall be from an approved NC State vendor computer selection/calculation program and will be required to justify the use of push-on joints in certain locations. This program shall utilize the depth of cover indicated on the profile drawings.
 9. Select backfill material shall be provided for bedding and backfill 12 inches above pipe.
 10. System drains at low points and system vents at high points shall be provided.
- E. Natural Gas
1. Natural gas is available throughout most of the campuses from PSNC Energy. Designer shall ascertain natural gas availability on a project specific basis. Metering and lateral piping shall be included in the project. PSNC Energy shall perform tapping of mains and shall supervise all work on main lines.
 2. The natural gas distribution network shall include a pressure-reducing station that is valved on both sides. Meters shall be located on the outside of the building. A three-valve bypass piping arrangement shall be supplied around the meter.
- F. Identification of Underground Utilities and Piping
1. All underground piping and utilities, except lawn irrigation lines, shall have two stages of identification and/or warning by a combination of non-detectable and detectable warning tapes.
 2. Identification Tape (non-detectable warning tape) shall be six inches (6") wide, and buried 18" to 30" above the service pipe, and a minimum of 10" below finished grade. It shall consist of multiple layers of polyethylene with an overall thickness of three to five (3-5) mils. It shall be installed continuous from valve box to valve box or manhole to manhole, and shall terminate a maximum of six (6) inches away from valve box or manhole wall. The black colored lettering on the warning tape shall be abrasion resistant and be imprinted on a color-coded

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background that conforms to American Public Waterworks Association (APWA) color code standards.

3. Warning Tape (detectable warning tape) shall be six inches (6") wide, installed directly on top of the pipeline and permanently secured to the pipeline at 10 foot intervals. The tape shall consist of aluminum foil core or stainless steel tracer wires laminated between multiple layers of polyethylene tape with an overall thickness of four to six (4-6) mils. Detectable core or tracer wire "circuit" shall be continuous from valve box to valve box or manhole to manhole. Tape manufacturers' approved splice kits shall be used for long runs. Warning tape shall terminate just inside of valve box cover or manhole ring cover and be accessible for "clip-on" type utility location meters. The black colored lettering on the warning tape shall be abrasion resistant and be imprinted on a color-coded background that conforms to APWA color code standards.
4. Trace Wire shall be installed on all non-metallic pipe, including lawn irrigation lines, and metallic pipe with compression gasket fittings installed underground shall have a tracer wire installed along the length of the pipe. The wire shall be taped to the bottom of the pipe at a maximum of 10 foot intervals. Tracer wire shall be single-conductor, 10 gauge minimum, copper single-conductor wire with type "UF" (Underground Feeder) insulation, and shall be continuous along the pipeline passing through the inside of each valve box.

G. Identification of Underground Electric Utilities

1. All electrical utilities, shall have identification and/or warning via detectable warning tapes.
2. Identification Tape shall be six inches (6") wide, and buried 18" to 30" above the electrical utility line, and a minimum of 10" below finished grade. It shall consist of multiple layers of polyethylene with an overall thickness of three to five (3-5) mils. It shall be installed continuous from junction box to junction box or manhole to manhole, and shall terminate a maximum of six (6) inches away from junction box or manhole. The black colored lettering on the warning tape shall be abrasion resistant and be imprinted on a color-coded background that conforms to the National Electric Safety Code (NESC) or the National Electric Code (NEC) color standards.