STEAM DISTRIBUTION SYSTEM

Campus Steam Distribution System: UNK, UNL and UNO campuses are served by central utility plants. These plants produce steam which is distributed to the campus via an underground distribution system.

System Temperatures/Pressures: Steam temperature / pressure available at each plant are as follows:

<u>UNK Campus:</u>
90 PSIG, (saturated, no superheat)

<u>UNL City Campus:</u>
33 PSIG, 325 Deg F (<u>45 degrees of superheat)</u>

<u>UNL East Campus:</u>
60 PSIG, 307 Deg F (saturated, no superheat)

<u>UNO Campus:</u>
75 PSIG, (saturated, no superheat)

Note: that these values are valid at the plants or in close proximity. Contact NU Engineering for specific conditions that may be encountered in remote locations. Generally speaking, size building systems for an available steam pressure <u>minimum 15 psi less</u> than the above listed values. Also, since UNL City Campus steam is superheated, a general rule of thumb for sizing a steam-to-water heat exchanger is to oversize the exchanger by 2% for every 10 deg F of superheat. Note too that is it also likely that steam can be saturated at times when it reaches the building.

For all campuses, use a 450 deg F maximum design temperature for expansion calculations. Call out pipe cold springing as a witness inspection point during construction.

Condensate Return System: A dedicated pumped condensate return system parallels the steam distribution system. The pressure in this system fluctuates a great deal. However, for the sake of consistency and interchangeability, a condensate system pressure of 20 PSIG shall be assumed. This represents the head that must be overcome after a branch condensate line enters the condensate main. Any pipe head losses from the receiver to the main should be added to this head.

All steam-utilizing systems/equipment on campus shall be designed and installed to return 100% of the condensate back to the utility plant through the central condensate return system. Steam condensate is metered at each building. See also *33 63 00 - 01 Steam Distribution System Drip Trap Detail.*

Distribution Piping:

<u>Within Tunnels</u>
Steam (2” and under) – Schedule 80 carbon steel
Steam (over 2”) Schedule 40 carbon steel
Condensate (all sizes) – Schedule 80 carbon steel

<u>Direct Buried</u>
Factory pre-insulated system (coordinate with FPC Engineering)

Building Steam Service Entrance: A “stop valve” shall be installed in each steam/condensate line just inside each building at its service entrance.

Steam stop valves 6” and larger shall include a 1” warmup line consisting of two carbon steel ball valves and a forged steel needle valve.

Steam stop valves located at a low point relative to campus distribution piping shall have a drip leg installed upstream of the valve with a steam trap discharging to the condensate return line.

Steam or Condensate Meters: These are required at all steam services entrances buildings. See *Utility Metering* within these Design Guidelines for details.

Tunnel System: We prefer that walkable tunnels be provided in conjunction with large diameter steam lines (i.e. 12” or larger) and/or multiple steam lines. Anticipated future development of the system shall be considered when making this assessment. Buried steam / condensate conduits can be considered for a dedicated run-out to a single building.

All decisions regarding using tunnels versus direct buried steam/condensate lines shall be coordinated with NU Engineering.

Within practical limits, each utility tunnel shall be sized and configured to accommodate the installation of larger or additional utility piping in the future. All tunnels shall be constructed to meet AASHTO HS20-44 truckload rating. Minimum cross sectional dimensions shall be 5’ x 7’ (W x H). All electrical components within a tunnel system, including lighting, shall be designed for high temperature and humidity conditions. A man-entrance shall be provided at each point where a tunnel terminates at a building foundation wall.

Tunnel spalling and/or cracks/leaking can be an issue. Design tunnel to minimize spalled concrete and/or cracks that can allow dirt/sand/silt in the tunnel, which makes a mess and clogs sump pumps, flooding tunnel, causing boiling water in tunnel, destroying insulation and electrical, and hammering the piping via high condensing rates. Also consider using a concrete additive (Xypex or similar) to eliminate concrete porosity.

Where steam can flow in either direction (a loop in the distribution piping), either temporary or as distribution piping expands, design piping so steam can flow in either direction.

Drip Traps: Drip trap assemblies shall be provided for condensate removal from distribution piping at intervals not to exceed 300 ft. as well at all locations where required by proper design practice. See *Drawing 33 63 00 - 01 Steam Distribution System Drip Trap Detail.*

Steam Vaults: See *General Utilities Guidelines* for specific information related to vault construction. Provide steam vault every 300 ft. on direct buried installations for drip traps and associated valving.

Tunnel / Vault Access: Each tunnel/vault entrance shall incorporate a heavy-duty lockable door such that access is limited to appropriate employees. Outside entrance doors shall be weatherproof and inside doors shall be insulated. The lock serving each door shall be keyed to the standard utility tunnel key. Permanent ladders shall be provided at vertical entrances.

Distribution Valving*:* An isolation valve shall be installed in each branch steam distribution or central condensate return line near the point where it connects to a main. Where a main connects to another main, or main branch (i.e. a branch that serves multiple facilities) connects to a main.

On isolation valves 6” and larger, a separate “warm-up” line and isolation valve arrangement is required. Valves connected to campus steam distribution system shall be compliant with ASME B16.34 and applicable UNL valve specifications

Expansion Compensation:

Within Tunnels
Slip-type expansion joints (Advance Thermal Systems TP or approved equivalent). Be sure to provide adequate access to packing connections.

Direct Buried
Expansion loops or slip expansion joints where loops are not feasible. All expansion joints must be located within a vault. Minimize uphill expansion loops, as condensate can build up at the loops, increasing chances for hammer.

Both Tunnels and Direct Buried
On loops, detail the cold springing of pipe on plans to be at neutral force at halfway between cold and operating temperatures (to make it obvious to contractor how to properly cold spring). On Slip-type joints, detail on plans to keep equal expansion margin at both ends of temperate range.

Be sure to consider possible ambient temperatures of installation, and include table corrections for various ambient temperatures.

Anchors to be 5-10x stronger than calculated loads (to handle hammer situations). For UNL campuses, use max temp 450 Deg F for expansion calculations.