PART 1: GENERAL

1.01 RELATED SECTIONS

A. Section 01004 – Energy Guidelines
B. Section 15550 – Heat Generation

1.02 RELATED STANDARD DETAILS

A. Detail 3.2.1, Clean Steam Generator Piping

1.03 GENERAL

A. In the early 1980’s, complaints started arising of eye irritation and dermatitis in facilities with humidification systems; the cause was ultimately attributed to reactions to Diethylaminoethanol (DEAE), a treatment chemical used in the central campus steam system to inhibit corrosion. This lead to Cornell requiring the use of separate steam generating systems that eliminate the direct release of central steam into a space, and was further extended to situations where contact with food is expected. The scope of this standard is to detail requirements for these type of clean steam systems. For general steam heating applications, see further details in Standard Section 15550, Steam Generation.

B. For the purposes of this standard, Low Pressure means delivery pressures 15 psig and below; and High Pressure means delivery pressures above 15 psig.

C. A life cycle cost analysis shall be conducted for the proposed building clean steam system to determine the type of clean steam system to be installed in the building (centralized vs. point of use). See Section 01004 – Energy Guidelines for information on conducting this analysis.

D. Generally, steam to steam generators driven by campus steam are the preferred choice to provide building clean steam due to their lower operating cost. Please refer to Standard Detail 3.2.1 for the preferred piping arrangement.

E. Hybrid systems utilizing a combination of steam to steam generators and natural gas boilers are acceptable. When utilized, the natural gas boilers shall be sized to provide 100% of the building clean steam demand (both high and low pressure) for uninterrupted service during periods of campus steam shutdowns.
F. For equipment using central steam as a driven source, please note that the central system is shut down for a period of approximately 3 days on an annual basis for maintenance and repairs. This shutdown typically occurs right after graduation the last week in May. The effect of this shutdown on the building clean steam system must be evaluated. If it is expected that clean steam is required during this shutdown, an alternate or back-up source of clean steam must be provided.

G. The equipment shall be sized to meet the maximum daily requirements of the facility with 20% spare capacity.

H. For critical demands, redundancy in equipment or back-up service shall be accounted for in the design.

I. When clean steam boilers are provided, the Consultant shall investigate cross-connecting the clean steam boilers with the campus steam heating system. This will allow the building heating systems to be temporarily fed from the clean steam boilers in the event of a campus system failure, or as needed during the annual campus steam shutdown. For this scenario, all the condensate returned from the system shall be sent to drain to avoid contamination of the clean steam system.

PART 2: PRODUCTS

2.01 STEAM SOURCE

A. General Building Humidification:

1. Preferred: Steam to steam converter, driven by campus steam.

2. Secondary: Point of use Steam to Steam humidifiers, or point of use Liquid to Steam humidifiers depending on outcome of life cycle cost analysis.

3. Equipment shall be selected using 35-40 psig entering steam pressure, and 40°F entering water temperature. See Standard Section 15550, Heat Generation for additional information.

B. Sterilization, Autoclaving, Cage and Tunnel Washing

1. Preferred: A mix of steam sources should be used. For any shell/jacket heating not in contact with devices to be sterilized, use low pressure building steam, sized for 35-40 psig entering steam pressure. A local electric source steam generator should be used for any steam injected that will come in contact with the devices being sterilized. The Consultant shall review the impacts, most specifically longer sterilization cycles, of using lower pressure steam with the user groups.
2. Secondary: Natural gas fired boilers with de-aerator, DA storage tank, duplex feed pumps (lead/standby), water level control, high and low water cut-offs, on/off cycling (on pressure), modulating single point control (+20:1 turndown), FM approved flame safety and purging, and a powered stack damper (with limit switch).

   a. Boiler blowdown shall be via timed control or flow control. Calibration on TDS controllers is difficult to maintain, therefore, this type of blowdown control is not preferred.

3. Tertiary: Electric generators packaged with the equipment, or low pressure steam kit options depending on outcome of the life cycle cost analysis.

2.02 FEED WATER TREATMENT

A. Cornell raw water averages 100 ppm of CaCO₃, but can exceed 200 ppm for several weeks. Contact Facilities Management for a water analysis.

B. All Applications: Pre-treatment with a water softening system.

C. Humidification in Research Facilities: In addition to a water softening system, provide a Reverse Osmosis (RO) unit.

D. Injection Feed water used in a low pressure Sterilization, Autoclaving, Cage and Tunnel Washing system: In addition to a water softening system, provide a Reverse Osmosis (RO) unit.

E. Packaged electric steam generators used in Sterilization, Autoclaving, Cage and Tunnel Washing systems: In addition to a water softening system, provide a Reverse Osmosis (RO) unit.

F. High Pressure Boilers:

   1. Provide pre-treatment with a water softening system.
   2. Provide a Reverse Osmosis (RO) unit after the pre-treatment system. The Reverse Osmosis unit shall condition the feed water to a maximum of 5 ppm of total dissolved solids (TDS).
   3. Provide boiler chemical treatment, consisting of sodium sulfite and polymers. These chemicals do not carry-over into the distribution system.
   4. On systems where condensate return is expected, the use of a dealkalyzer may be warranted. Contact Facilities Engineering to discuss.

G. RO water is aggressive to ferrous metals. Proper considerations shall be taken to prevent corrosion of system components. Wetted parts on the equipment shall be constructed of stainless steel, but a welded carbon steel piping system is sufficient for clean steam distribution.
H. Deionized water is not to be used as a source of feed water.

I. The water treatment company shall be approved by Facilities Engineering.

1. The bid documents shall specify a one-year water treatment maintenance agreement.

2. The requirements of the agreement shall be spelled out in the bid documents in terms of scope, chemistry, testing, and frequency of visits.