# Building Steam Systems and Utilization Design Criteria

Note: Change title of Appendix U from **"High Pressure Steam System Hot Water Converter and Steam Meter"** to **"Building Steam Systems and Utilization Design Criteria"**

## 1) GENERAL:

a) This Appendix has been developed primarily for the OSU Columbus Campus buildings and systems that use steam from the McCracken Power Plant. However, it may be considered as a guideline for buildings with other sources of steam generation.

b) The Design Criteria that shall be used for the steam supply to these buildings is as follows:

i) 200 psig @ 600$^{o}$F is the normal steam condition leaving McCracken Power Plant (superheated steam). The pressure relief at McCracken is set at 230 psig; therefore, design for 250 psig @ 680$^{o}$F.

ii) There is no chemical treatment of the steam at McCracken; therefore the pH levels of the condensate can be as low as **4.5 to 5.5**.

iii) **[OSUWMC: *Steam shall be reduced as soon as it enters the building and then desuperheated for distribution to equipment for heating, domestic water, sterilization, humidification, other secondary needs as required.]***

c) It is the responsibility of the Design Engineer to apply the following guideline system concepts properly. The Design Engineer shall also show the necessary accessories on their design drawings that are required for proper operation and items that enhance system maintainability (e.g. isolation of sub-systems); this includes the location of visual aids that need to be installed on the system to help the maintenance personnel troubleshoot the systems (e.g. temperature and pressure gauges).

d) The Design Engineer shall be responsible for generating a "System Manual" that includes "System Concept" drawings that also show, for example, what the "normal" temperature and pressure readings should be; again, the purpose of this requirement is to enhance system maintainability.

## 2) DESIGN CONCEPT APPLICATIONS:

a) The A/E team shall submit their design concept, at the beginning of the Schematic Design Phase, for the conversion of the campus steam heat source to heating hot water and/or domestic hot water. The design concept shall be submitted to the University Engineer for review and approval before proceeding with the Design.

**[OSUWMC: The Medical Center Facilities Engineering shall be included in the review for Medical Center projects.]**

**[Ohio State Energy Partners shall be included in the review for all projects requiring campus steam.]**

The design concepts to consider include, but are not limited to, the following:

i) A desuperheater steam conditioning system to maintain a steam temperature below 330°F to 340°F all building systems.
**[OSUWMC: Considerations for higher temperatures due to sterilization and other equipment needs should be addressed for Medical Center projects.]**

ii) Heating Hot Water [HHW] Systems:
(1) Conventional horizontal heating hot water converter using desuperheated steam
(2) Flooded heat exchanger using steam to heating hot water converter using superheated steam or desuperheated steam.

iii) Domestic Hot Water [DHW] Systems:
(1) Conventional horizontal DHW converter using desuperheated steam
(2) Water-to-water DHW heater (using heating hot water as the heating source).
(3) Flooded heat exchanger using steam to DHW converter using superheated steam or desuperheated steam.
(4) Instantaneous DHW heaters are preferred in lieu of storage type DHW systems.
**[OSUWMC: Instantaneous DHW heaters with N+1 (redundant) system requirements are mandatory for Medical Center projects.]**

iv) Sterilization Equipment
(1) Most steam sterilizers require saturated steam in order to function properly. The A/E should establish the exact design criteria for this process application.
**[OSUWMC: The A/E shall coordinate the design criteria with the Medical Center Facilities Engineering for Medical Center projects.]**

b) Example System Concept Drawings are included at the end of this Appendix. These drawings are for presenting general concepts and do not include all necessary accessories (e.g. thermometers, pressure gauges, sensor locations, valves, etc.).

## 2) SYSTEM AND EQUIPMENT DESIGN CRITERIA

a) Building Heating Hot Water (HHW) Systems – Design Criteria

i) Capable of supplying the building systems with 180°F or other temperatures as appropriate to the systems served.

ii) N+1 system design is preferred (i.e. failure of one heat exchanger system does not reduce the total system required building heating system design capacity below 100%]. For “non-critical” building systems, consider at least partial redundancy.
**[OSUWMC: N+1 system design is required at the Medical Center, to include but not limited to desuperheaters, heat exchangers, pumps, condensate return systems.]**

iii) Buildings with terminal reheat systems shall have year-round HHW available.

(1) HHW supply may be reset from outside air for energy conservation.
(2) Consider a separate (secondary) pumping circuit for reheat systems
(3) The distribution supply temperature should be considered for the specific application to avoid "hunting", for example, of the terminal unit control valve.
(4) Perimeter heating systems (e.g. finned tube radiation) that are only required during the heating season shall be on a separate (secondary) pumping circuit, or other means of isolation, to allow the system to be OFF during the non-heating season and shall be capable of HHW Supply temperature reset from outside air temperature.

iv) Heat exchanger tubes in contact with the McCracken Power Plant steam shall be 316 SS.

b) Domestic Hot Water (DHW) Systems – Design Criteria

i) New Building Construction:
(1) The temperature of the DHW distributed within the building shall be between 135°F and 140°F. The intent of this temperature requirement is to address the growth of Legionella, whose count must be 0 to 100 CFU (colony-forming units) or as required by OSU Environmental Health and Safety
**[OSUWMC: The temperature of the Medical Center DHW shall be generated at 140°F, with the capability of heating up to 160°F. A master mixing valve shall be provided to temper and distribute the DHW as appropriate for each building (consult with Medical Center Facilities Engineering). Systemic water treatment shall be considered (consult with Medical Center Facilities Engineering). See Medical Center Appendix, Division 22 for more information.]**

(2) Automatic thermostatic mixing valves shall be provided at each public plumbing fixtures or group of fixtures within one restroom or locker room facility. The DHW shall be delivered to these fixtures at 110°F to 105°F. [NOTE: This mixed water temperature may be increased in the future to 125°F if acceptable to the Authority Having Jurisdiction.]
**[OSUWMC: Automatic thermostatic mixing valves shall be minimized and used only where necessary within the Medical Center.]**

ii) Existing Building Renovation:
(1) Total Renovation Projects should follow the same guidelines as "New Construction".
(2) Partial Renovation Projects: A/E should make recommendations to the OSU Project Manager and address the goal of avoiding Legionella.
**[OSUWMC: Consult with OSU Facilities Engineering at the Medical Center for building specific plans related to domestic water distribution and hot water generation.]**

iii) Heat exchanger tubes in contact with the McCracken Power Plant steam shall be 316 SS.
**[OSUWMC: Any building equipment and accessories in contact with steam from McCracken Power Plant shall be rated for 600°F at the Medical Center.]**

iv) Refer to BDS (OSU Building Design Standards) Division 22

c) Desuperheaters

i) Refer to BDS Division 23

d) Steam Condensate Movers

i) Refer to BDS Division 23

e) Steam Piping

i) Building steam piping downstream of the "OSEP/Building" steam demarcation point: Refer to BDS Division 23 and "Example Building Steam Service" diagram (see below).

ii) Steam piping upstream of the "OSEP/Building" steam demarcation point: Refer to BDS Division 33 and "Example Building Steam Service" diagram (see below).

f) Steam Condensate Piping

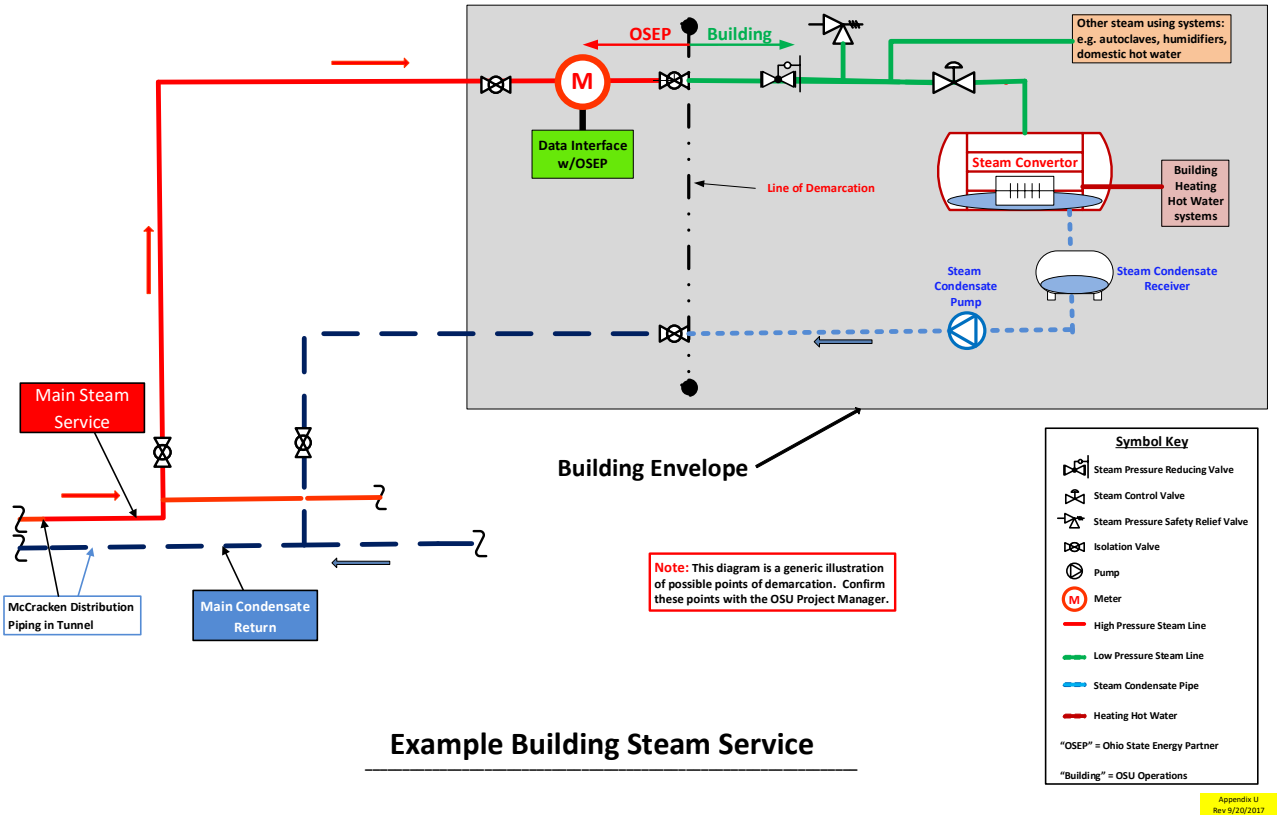
i) Building Systems: Refer to BDS Division 23

ii) Plant Systems: Refer to BDS Division 33

**3) MAIN CAMPUS STEAM UTILITY: BUILDING CONNECTIONS AND INSPECTIONS**

a) Ohio State Energy Partners (OSEP) is responsible for the high pressure steam piping distribution on campus, some locations may include portions of the building piping system after the steam meter. High pressure steam (nominal 200 psig and 600°F) piping and its appurtenances that are not the responsibility of Ohio State Energy Partners (i.e. past the line of demarcation) shall be inspected by a qualified inspector who meets the requirements of ASME B31.1 for power piping. Their inspection and final report shall be submitted to the University and Ohio State Energy Partners for review and acceptance. Prior to Steam Service being restored from the Utility (OSEP), the project shall satisfy all necessary requirements laid out in the Steam Service Connection Checklist in order for the Utility (OSEP) to restore steam service. Currently this checklist can be found on FOD's website at: **https://fod.osu.edu/resources**

b) NOTE: The A/E shall include the above information and checklist in the Project Manual to inform all project participants and the Contractor of the required procedures.




**Example Building Steam Service**