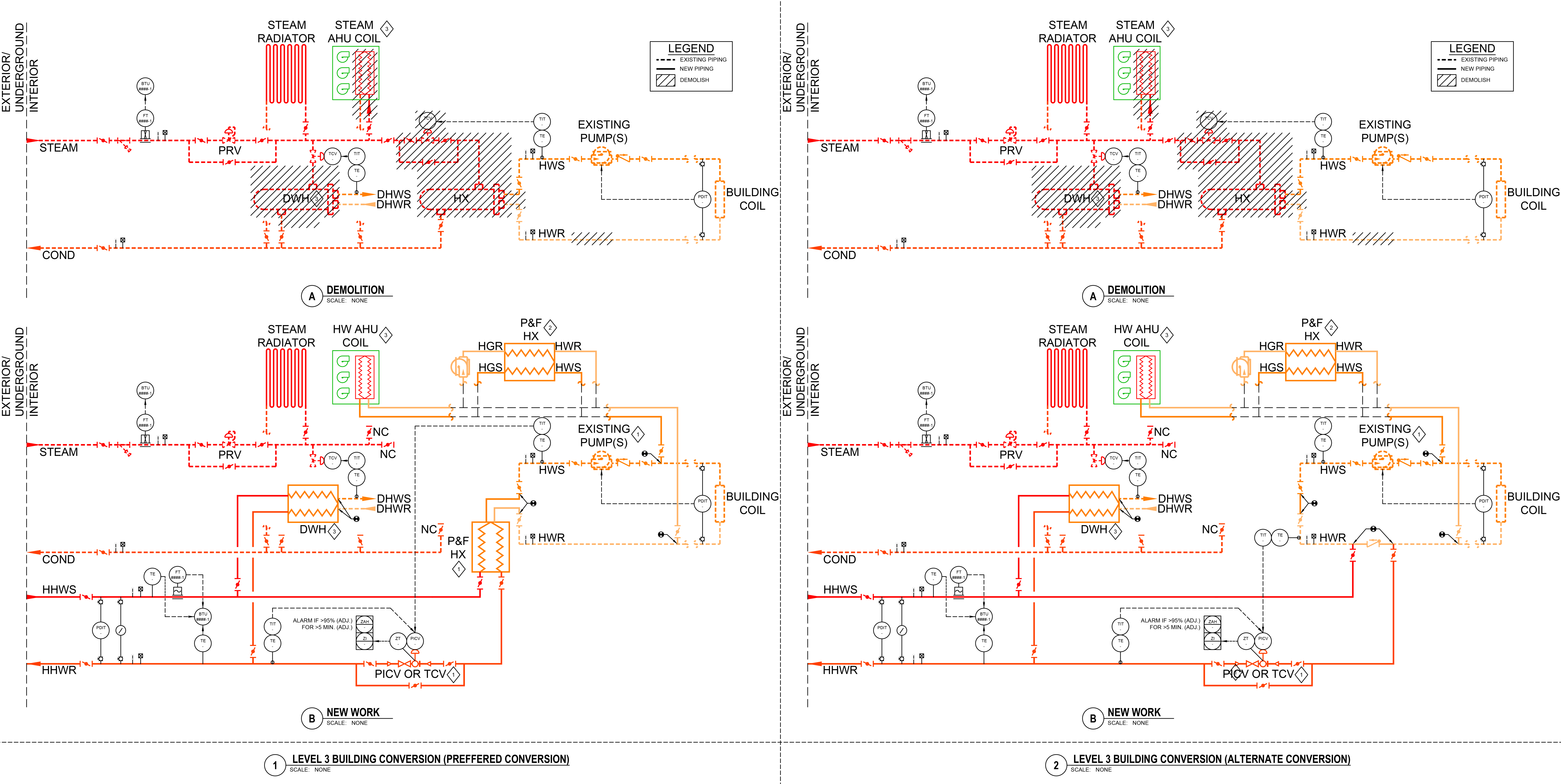


 ELECTRIFICATION PLAN EQUIPMENT REPLACEMENTS
For Projects in Buildings Which Have NOT Yet Undergone Steam-to-HHW Conversion

Device to be Replaced	Action at Time of Project	Subsequent Action at Time of Conversion
AHU with Steam Coil	Assess case-by-case. Options include: • Replace AHU and steam coil, ensure replacement has adequate casing space for future HHW, continue to use campus steam • Replace AHU with HHW coil, provide local secondary HHW loop and steam-to-HHW heat exchanger. Refer to "AHU with HHW Coil", below, for sizing criteria. • Convert building out of sequence	Dependent on action at time of project. If building was NOT converted, refer to the enclosed <i>Electrification Diagram</i> .
Steam-to-HHW HX	Assess case-by-case. In all cases, ensure there is adequate space for a plate-and-frame HX to be installed at the time of building conversion. Actions include: • Replace in kind • Convert building out of sequence	Dependent on action at time of project. If building was NOT converted, refer to the enclosed <i>Electrification Diagram</i> .
Steam-to-DHW Heater	Assess case-by-case. Options include: • Replace in kind, continue to use campus steam • Convert building out of sequence	Dependent on action at time of project. If building was NOT converted, refer to the enclosed <i>Electrification Diagram</i> .
Steam Terminal Unit	Assess case-by-case. Options include: • Replace in kind, continue to use campus steam • Replace with HHW terminal unit, provide local secondary HHW loop and steam-to-HHW heat exchanger. Refer to "HHW Terminal Unit", below, for sizing criteria. • Convert building out of sequence	Meet with the Columbia University Energy & Engineering Department.
Steam Humidifier	Assess case-by-case. Options include: • Replace in kind, continue to use campus steam • Replace with local electric humidifier	Meet with the Columbia University Energy & Engineering Department.
Steam Process Equipment (Autoclaves, Cart / Rack / Cage Washers, Dishwashers etc.)	Assess case-by-case. Options include: • Replace in kind, continue to use campus steam • Replace with local electric device	Meet with the Columbia University Energy & Engineering Department.
AHU with HHW Coil	• Select replacement HHW coil for 120F HHWS / 20F dT • Select control valve for operation at building current HHW loop temperature and 120F HHWS / 20F dT	NA
HHW Terminal Unit	• Select replacement HHW coil for 120F HHWS / 20F dT • Select control valve for operation at building current HHW loop temperature and 120F HHWS / 20F dT	NA

For Projects in Buildings Which Have Undergone Steam-to-HHW Conversion

Device to be Replaced	Action
Steam Terminal Unit	• Replace steam coil with HHW coil • Size HHW coils for 120F HHWS / 20F dT • Select control valve for operation at building current HHW loop temperature and 120 HHW / 20F dT
Steam Humidifier	Meet with the Columbia University Energy & Engineering Department.
Steam Process Equipment (Autoclaves, Cart / Rack / Cage Washers, Dishwashers etc.)	Meet with the Columbia University Energy & Engineering Department.
AHU with HHW Coil	• Select replacement HHW coil for 120F HHWS / 20F dT, • Select control valve for operation at building current HHW loop temperature and 120 HHW / 20F dT
HHW Terminal Unit	• Select replacement HHW coil for 120F HHWS / 20F dT, • Select control valve for operation at building current HHW loop temperature and 120 HHW / 20F dT



GENERAL NOTES:

1. PUMP CAPACITIES, PIPE SIZES, CONTROL VALVES AND BRANCH LOCATIONS SHALL BE ASSESSED WITH THE NEW HEATING HOT WATER LOAD FOR A FUTURE LEVEL 4 CONVERSION. EXISTING EQUIPMENT SHALL BE REPLACED WHERE ADDITIONAL CAPACITY IS NEEDED OR THE EQUIPMENT IS AT END-OF-LIFE.
2. AIR HANDLER UNITS WITH 100% OUTSIDE AIR SHALL BE PROVIDED WITH A GLYCOL HOT WATER SYSTEM.
3. REFER TO AIR HANDLING UNIT AND DOMESTIC HOT WATER EQUIPMENT SCHEDULE FOR CAPACITIES, QUANTITIES AND LOCATIONS.

Existing Building-level System Served by Plant Steam	Action	Conversion Level	Building HHW Supply Temp			Plant HHW Supply	
			Current	Gamma' Day 1	Future (Note 4)	Gamma' Day 1	Future
Hydronic Heating	Convert steam-to-HHW HX to HHW-to-HHW HX	2	180	165	120	170	125
DHW	Convert steam-to-DHW HX to HHW-to-DHW HX	3	140	120	120	170	125
AHU Steam Coils	Convert to HHW	3	NA	165	120	NA	
Steam Terminal Units	Convert to HHW	4	NA	NA	120		

Notes

- 1 Size new heat exchangers and coils for future temperatures. Ensure that new equipment can accommodate higher Day 1 temperatures.
- 2 Initial testing of a sub-set of building systems indicates that existing building level HHW equipment will perform as required with a HHW supply temperature of 165°F. Test remaining existing building-level HHW equipment to ensure that it can accommodate Day 1 temperatures.
- 3 Assume 3°F temperature loss between plant and buildings.
- 4 Assume 2 degree F approach across HX
- 5 The future HHW building supply temperature at 120°F may be modified upward on a building specific basis. The goal is to return HHW back to the CUP as low a temperature as practical for as many buildings loads as possible.
- 6 Provide 1/3 - 2/3 control valves to accommodate low flow conditions on HW coils and HX's.
- 7 Distribution pipe mains were sized for "Level 4" hot water building conversions for all buildings. Building hot water pipes shall be sized to be Level 4 ready, so that terminal units can be converted to HHW over time without infrastructure changes