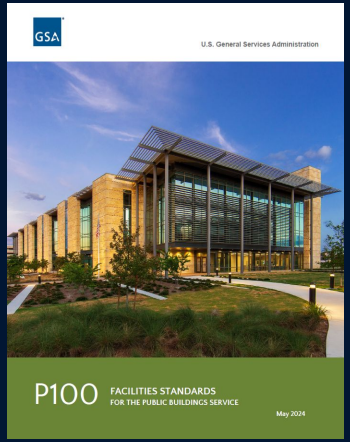
2024 P100 Training



This session is being recorded.

P100 A+E Training Series Ground Rules

- Attendance will be taken automatically; there is no sign-in sheet
- GSA Participants who attend 95% of the session will be provided CLPs
- If you join by phone, please email your name and the phone number you joined with so we can record your attendance. Address email to: mark.kutchi@gsa.gov & benjamin.pisarcik@gsa.gov
- Mute microphone when not speaking
- Use Q & A to ask questions or “raise hand” for questions as the P100 changes are addressed, we encourage an open dialog.

P100 A+E Training Series Ground Rules

- Approach each topic in a positive and constructive manner
- Slides and recordings will be made available after the session internally on Insite and publicly on: www.gsa.gov/p100.
- Slides will be added in a few days but recordings will take a few weeks.
- We are starting the meeting recording, please leave the meeting if you do not consent to being recorded.

Training

Mechanical Engineering

This session is being recorded.

Presenters

Mark Kutchi
Mechanical Engineer

Bobby Wager
Mechanical Engineer

| 01 – 2024 P100 Updates

Chapter 5 Mechanical Engineering

Here is what's new...

5.1.2 Humidity Control

Revised Section:

- Modified requirements to require M&V for baseline and all tiers

5.1.2 Humidity Control	
Performance	
Baseline	Maximum 55F dew point – occupied, 60F dew point – unoccupied
Tier 1	(For the preservation of “medium vulnerability” woodwork; this does not necessarily require humidification equipment) RH setpoint (Historic annual average at indoor dry bulb temperature = 21ºC (70ºF), default 50%RH), Class C (ASHRAE Applications) control (no short-term RH range), 25% to 75% seasonal setpoint adjustment, and 13ºC (55ºF) dew point maximum.
Tier 2	(For the preservation of “high vulnerability” woodwork. No archival storage of fabrics, books, film, or photos is considered.) RH setpoint (Historic annual average at indoor dry bulb temperature = 21ºC (70ºF), default 45%RH), Class B (ASHRAE Applications) controlled range of +/- 10% RH short term, +/- 10% seasonal setpoint adjustment, and 13ºC (55ºF) dew point maximum.
Tier 3	(Preservation of “high vulnerability” woodwork, small risk to archival storage items e.g. fabrics, books, film, or photos.) RH setpoint (Historic annual avg at indoor DB temperature = 21ºC (70ºF), default 45%RH,
	Class A, controlled range of +/- 5% RH short term, +/- 10% seasonal setpoint adjustment (OR +/- 10% RH and NO seasonal setpoint adjustment), and 13ºC (55ºF) dew point max.
M & V	Yes

5.1.3 Cooling Robustness (Redundancy)	
	Performance
Baseline	Failure of one machine (chiller, pump, cooling tower, etc.) will result in a building dry bulb temperature rise of no more than 5°F, and building maximum humidity <60% Relative Humidity (RH).
Tier 1	Failure of one machine (chiller, pump, cooling tower, etc.) will not result in a rise of building dry bulb temperature, and building maximum humidity <60% RH.
Tier 2	N/A
Tier 3	N/A
M & V	Commission cooling system at the most extreme temperatures and humidity levels possible, measuring performance with one of each equipment type turned off. Only one piece of equipment (chiller, pump, or cooling tower) should be turned off in each test.
Plans & Specs	
Calculations & Analysis	Show calculations for system performance upon failure of the largest of each type of machine, calculating performance at 0.4% cooling design dry bulb temperature at mean coincident wet bulb, at 0.4% design dehumidification dewpoint temperature at mean coincident dry bulb temperature, and (for evaporative machines) at the 0.4% evaporation design wet bulb temperature at mean coincident dry bulb temperature. Where chilled and condenser water temperatures change upon failure of the largest piece of equipment, consider the performance degradation from when deviating from design water temperatures. Upon an indoor dew point rise above 60%, the chilled water temperature reset function will be locked out.
References	ASHRAE Fundamentals Handbook, Chapter 14; ASHRAE HVAC Systems and Equipment Handbook.
Basis of Design	Show cooling capacity and operating parameters that will result in the performance indicated in the selected performance Tier.
Construction Verification	See M&V.

5.1.4 Heating Robustness (Redundancy)	
	Performance
Baseline	Failure of one machine (boiler, pump, etc.) will result in a building temperature drop of no more than 5°F.
Tier 1	Failure of one machine (boiler, pump, etc.) will not result in a drop of building temperature.
Tier 2	N/A
Tier 3	N/A
M & V	Commission heating system at the most extreme temperatures possible, measuring performance with one of each equipment type turned off. Only one piece of equipment (boiler or pump) should be turned off in each test.
Plans & Specs	

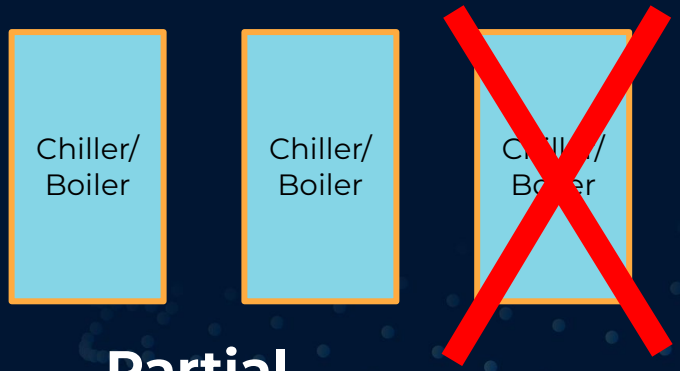
5.1.3 Cooling Robustness
5.1.4 Heating Robustness

NEW Section:

- Require cooling and heating plant equipment arrangement to be sized based on temperature and humidity criteria to cover the desired level of redundancy for the facility

Baseline

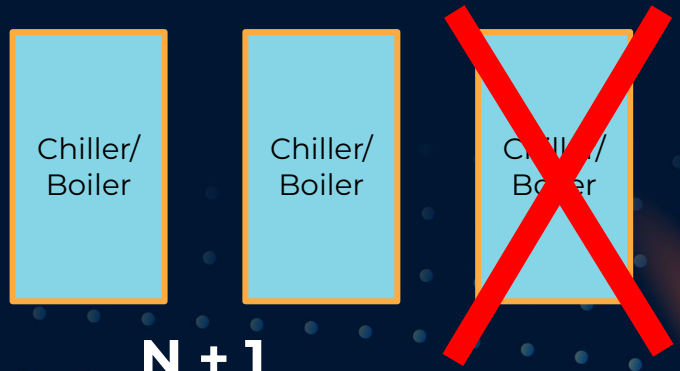
Failure of one (1) machine results in a temperature rise/drop of **NO MORE** than 5 degree Fahrenheit + RH less than or equal to 60%



Partial Redundancy

Tier 1

Failure of one (1) machine results **NO** temperature rise/drop + RH less than or equal to 60%



N + 1

5.1.8 Filtration

Revised Section:

- MERV-A filter classifications are now required
- Added a Tier 1 filtration standard for Wildland Urban Interface areas, requiring filter racks and fan performance that can accommodate MERV-15 bag filters

References:
MERV vs MERV-A Filter Efficiency Ratings Explained

Image Source:
https://www.camfil.com/en-us/products/general-ventilation-filters/compact-filter_-box-type/airopac-traditional/aeropac-_-47728

5.1.10 HVAC Operational Efficiency

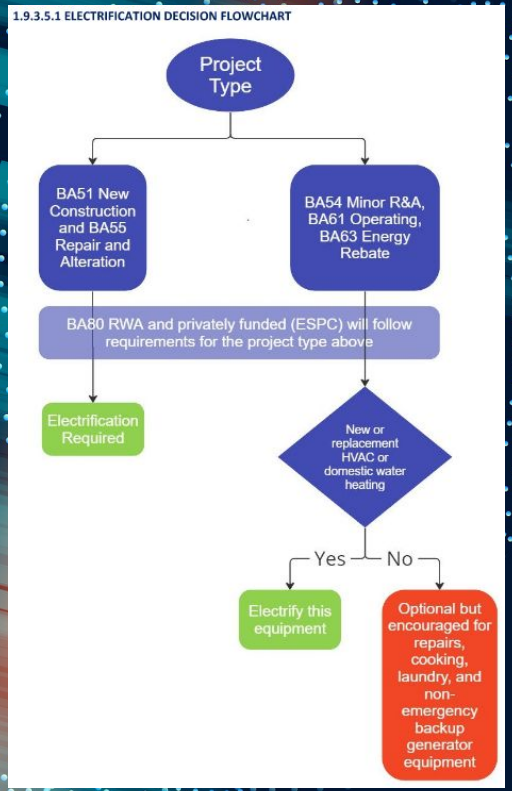
Revised Section:

- Revised requirement to comply with the more stringent version ASHRAE Standard 90.1 Minimum Efficiencies
- Require compliance with current version of FEMP Minimum Efficiency Requirements
- Provided clarification on how chiller efficiencies need to comply with ASHRAE 90.1 and FEMP

5.2.8 Treating Biological Growth

Revised Section:

- Added requirement to comply with *ASHRAE Standard 188, Legionellosis: Risk Management for Building Water Systems*



5.3.2 HVAC Systems

Revised Section:

- Expanded on GSA's electrification requirements by referencing the new 1.9.3.5 Electrification section of P100 and consolidating language in Chapter 5

1.9.3.5 ELECTRIFICATION

GSA defines building electrification of its owned inventory as the elimination of emissions generated directly by heating, ventilation, and air conditioning (HVAC), and by domestic water heating, cooking, laundry, and demand-response generators powered on site. Fossil fuel–powered emergency backup generators are not included in electrification requirements regarding these scope 1 emissions.

HVAC and domestic water heating system electrification analyses of alternatives must include Life Cycle Cost Analyses (LCCA) and operational (scope 1 and 2) greenhouse gas emissions of each alternative. Reference A.6 Life Cycle Cost Analysis Requirements. These analyses and LCCAs must include heat pump technologies. These selected systems may not use fossil fuels (per Table 1.2) and must be life cycle cost effective for implementation (including electric resistance heating).

Table 1.2 Electrification

Project Type Per Funding Code	BA51 New Construction and BA55 Repair and Alteration projects	BA54 Minor Repairs and Alterations, BA61 Operating Funds, and BA63 Energy Rebate Projects	Other funding legislation or sources including BA80 Reimbursable Work Authorization and privately funded projects (e.g. ESPCs)
Electrification	Required	Required for any new or replacement HVAC or domestic water heating equipment. Optional but encouraged for repairs, cooking, laundry, and non-emergency backup generator equipment.	Follow the electrification requirements for the project type (e.g. major R&A or limited scope) that aligns with funded scope

5.3.2.1 Chiller Plant

Revised Section:

- Consolidated the language of this section to align with the new Robustness performance requirements in Section 5.1
- Removed minimum requirements to provide three (3) equally sized machines
- Removed domestic construction material requirements when a waiving BAA or per requirements of FAR 25.2

5.1.3 Cooling Robustness (Redundancy)	
Performance	
Baseline	Failure of one machine (chiller, pump, cooling tower, etc.) will result in a building dry bulb temperature rise of no more than 5°F, and building maximum humidity <60% Relative Humidity (RH).
Tier 1	Failure of one machine (chiller, pump, cooling tower, etc.) will not result in a rise of building dry bulb temperature, and building maximum humidity <60% RH.
Tier 2	N/A
Tier 3	N/A
M & V	Commission cooling system at the most extreme temperatures and humidity levels possible, measuring performance with one of each equipment type turned off. Only one piece of equipment (chiller, pump, or cooling tower) should be turned off in each test.
Plans & Specs	
Calculations & Analysis	Show calculations for system performance upon failure of the largest of each type of machine, calculating performance at 0.4% cooling design dry bulb temperature at mean coincident wet bulb, at 0.4% design dehumidification dewpoint temperature at mean coincident dry bulb temperature, and (for evaporative machines) at the 0.4% evaporation design wet bulb temperature at mean coincident dry bulb temperature. Where chilled and condenser water temperatures change upon failure of the largest piece of equipment, consider the performance degradation from when deviating from design water temperatures. Upon an indoor dew point rise above 60%, the chilled water temperature reset function will be locked out.
References	ASHRAE Fundamentals Handbook, Chapter 14; ASHRAE HVAC Systems and Equipment Handbook.
Basis of Design	Show cooling capacity and operating parameters that will result in the performance indicated in the selected performance Tier.
Construction Verification	See M&V.

5.3.2.6 Roof-Mounted Equipment

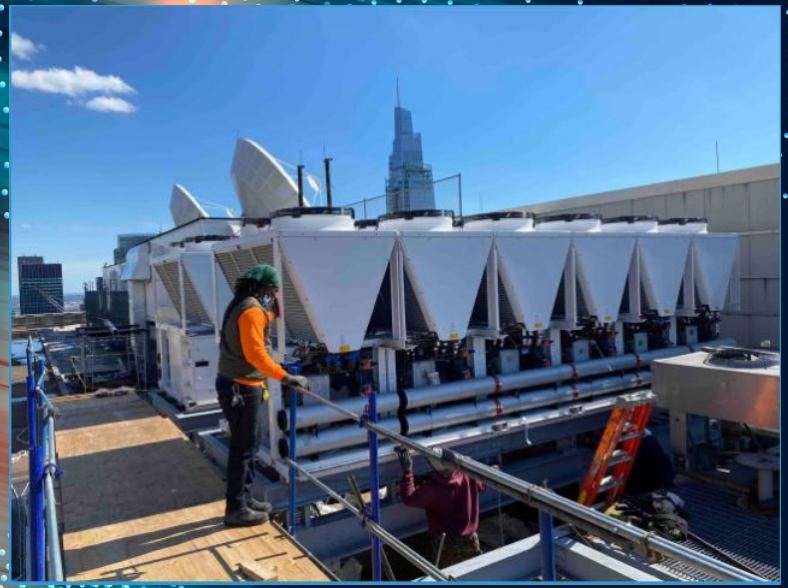


Image Source:
https://highmark.co/insights/case-studies/compact-flexible-aermec-nyb-chillers-installed-in-nyc-skyscraper/

Revised Section:

- Added air-source heat pumps, condensing units and condensers to list of permitted roof mounted equipment
- Added reference to Chapter 3, Roofing and Horizontal Waterproofing-Membrane System for membrane requirements

5.3.2.7 Controls / Building Automation Systems

Revised Section:

- Clarified the use of LonTalk protocol if existing systems is LonWorks

5.3.2.8 Coordination of Digital Control Systems

Revised Section:

- Added requirement to coordinate with the Regional Smart Building Team or primary Smart Building POC
- Prohibit use of external/commercial network connection

5.3.2.7 Controls / Building Automation Systems

Revised Section:

- Clarified the use of LonTalk protocol if existing systems is LonWorks

5.3.2.8 Coordination of Digital Control Systems

Revised Section:

- Clarified the use of LonTalk protocol if existing systems is LonWorks

5.3.2.9 Building Automation System Software

Revised Section:

- Added requirements to follow Smart Building system requirements and reference to the Building Technologies Technical Reference Guide

5.3.2.10 Building Automation System Controllers

Revised Section:

- Added reference to the Building Technologies Technical Reference Guide

5.3.2.12 Integrated Sequences of Operation (ISOO)

Revised Section:

- Clarified marking of CO2 sensors and added requirement to clearly identify all pressure sensors controlling air and water side VFDs

5.3.2.13.2 Occupancy Counting

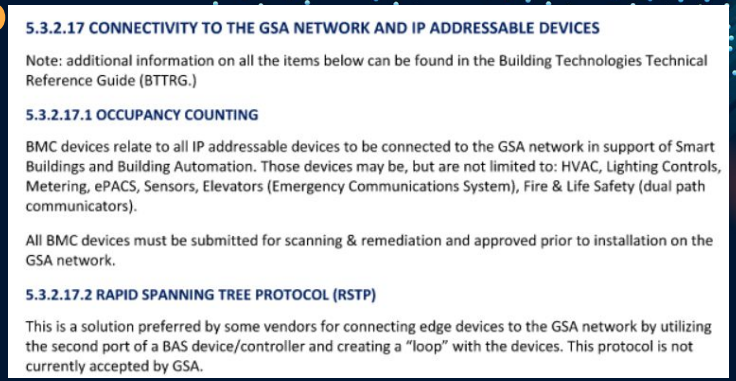
Revised Section:

- Clarified guidance on occupancy counting and integration with the the GSA Unified Interface
- Clarified that devices monitoring egress systems must not impede such means of egress
- Require all occupancy counting devices to comply with GSA IT + Smart Building system requirements and be Scan and Remediation of all IP addressable devices

5.3.2.17 Connectivity to the GSA Network and IP Addressable Devices

NEW Section + Subsections:

- Guidance on connectivity standards to GSA Network
- Additional information can be found in the Building Technologies Technical Reference Guide (BTTRG)



5.3.2.17 CONNECTIVITY TO THE GSA NETWORK AND IP ADDRESSABLE DEVICES

Note: additional information on all the items below can be found in the Building Technologies Technical Reference Guide (BTTRG.)

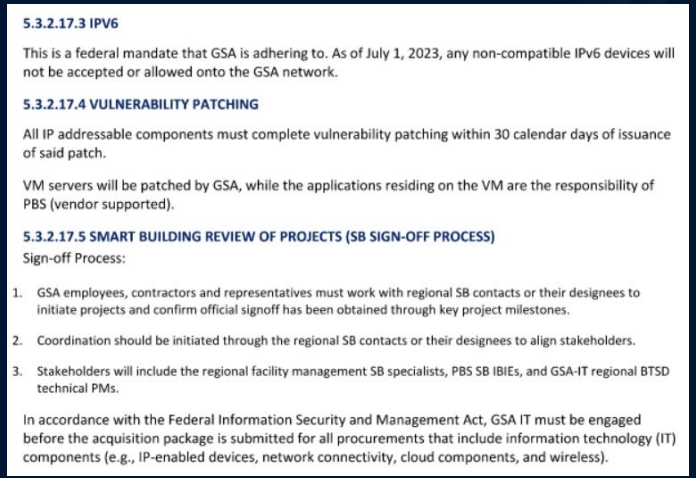
5.3.2.17.1 OCCUPANCY COUNTING

BMC devices relate to all IP addressable devices to be connected to the GSA network in support of Smart Buildings and Building Automation. Those devices may be, but are not limited to: HVAC, Lighting Controls, Metering, ePACS, Sensors, Elevators (Emergency Communications System), Fire & Life Safety (dual path communicators).

All BMC devices must be submitted for scanning & remediation and approved prior to installation on the GSA network.

5.3.2.17.2 RAPID SPANNING TREE PROTOCOL (RSTP)

This is a solution preferred by some vendors for connecting edge devices to the GSA network by utilizing the second port of a BAS device/controller and creating a "loop" with the devices. This protocol is not currently accepted by GSA.



5.3.2.17.3 IPV6

This is a federal mandate that GSA is adhering to. As of July 1, 2023, any non-compatible IPv6 devices will not be accepted or allowed onto the GSA network.

5.3.2.17.4 VULNERABILITY PATCHING

All IP addressable components must complete vulnerability patching within 30 calendar days of issuance of said patch.

VM servers will be patched by GSA, while the applications residing on the VM are the responsibility of PBS (vendor supported).

5.3.2.17.5 SMART BUILDING REVIEW OF PROJECTS (SB SIGN-OFF PROCESS)

Sign-off Process:

1. GSA employees, contractors and representatives must work with regional SB contacts or their designees to initiate projects and confirm official signoff has been obtained through key project milestones.
2. Coordination should be initiated through the regional SB contacts or their designees to align stakeholders.
3. Stakeholders will include the regional facility management SB specialists, PBS SB IBIEs, and GSA-IT regional BTSD technical PMs.

In accordance with the Federal Information Security and Management Act, GSA IT must be engaged before the acquisition package is submitted for all procurements that include information technology (IT) components (e.g., IP-enabled devices, network connectivity, cloud components, and wireless).

5.3.3.4 Cooling and Heating Coils

NEW text added to Section for coil protection from fossil fuel combustion products:

- *For urban environments and combined urban/marine environments, aluminum fins with electro coating are preferable to copper fins for NOx/SOx corrosion protection from fossil fuel combustion products.*

References:
NOx: nitrogen oxide
SOx: sulfur oxide
Whole Building Design Guide - Corrosion Toolbox

5.3.3.6 Copper Pipe Fittings

NEW text added to Section referencing refrigeration system safety standards:

- *Installation must comply with all requirements of ASHRAE Standard 15 Safety Standard for Refrigeration Systems and ASHRAE Standard 34 Designation and Safety Classification of Refrigerants, refrigerant concentration limits.*
- *ASHRAE Standard 15 and ASHRAE Standard 34 refrigerant concentration limit calculations must be provided for each space containing refrigeration piping for each design phase submittal.*

References:
Link to HVAC System Refrigerant Safety Calculations

HVAC System Refrigerant Safety Calculations

The following items must be included in the analysis:

1. *Identify the refrigerant containing system components located in the conditioned space*
2. *Identify the refrigerant piping located in the conditioned space*
3. *Determine the refrigeration system's classification: high-probability system or low-probability system*
4. *Determine the refrigerant safety classification (e.g. A1, A2, etc.) and the refrigeration concentration limit (RCL)*
5. *Determine the occupancy type in which equipment and/or piping will be located*
6. *Determine the total volume of refrigerant that could be leaked into each space*

HVAC System Refrigerant Safety Calculations

The following items must be included in the analysis:

7. *Determine the maximum allowable quantity of refrigerant based on the type of refrigerant, system classification and occupancy for each space*
8. *Determine the geometry and volume of each space and each connected space*
9. *Determine the leaked refrigerant RCL of each space*
10. *Verify the leaked refrigerant RCL for each space is below the maximum allowable RCL*
11. *Identify connecting spaces and list the dimensions and location of the permanent openings between the spaces and the air movement that achieves compliance with the RCL*

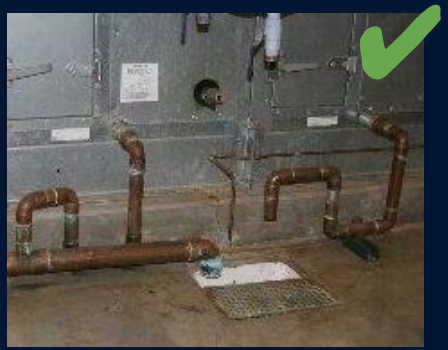
HVAC System Refrigerant Safety Calculations

Systems designed using ASHRAE Standard 15-2019 or earlier	Systems designed using ASHRAE Standard 15-2022
The standards do not address the size and location of permanent openings (e.g. door undercuts or transfer openings) needed to protect the safety of a room's occupants.	The standard contains natural ventilation opening prescriptive size and location requirements. • Lower edge of the natural ventilation opening between rooms shall be located a maximum of 12-inches above the finished
Provide a detailed study or modeling for each space verifying the size and location of the permanent openings that will safely dissipate the leaked refrigerant to be less than the maximum allowable RCL at the breathing zone.	Provide natural ventilation opening area calculations and drawings showing the size and location of the natural ventilation openings (e.g. door undercuts and transfer openings) and effective dispersal volume charge (EDVC) calculations.

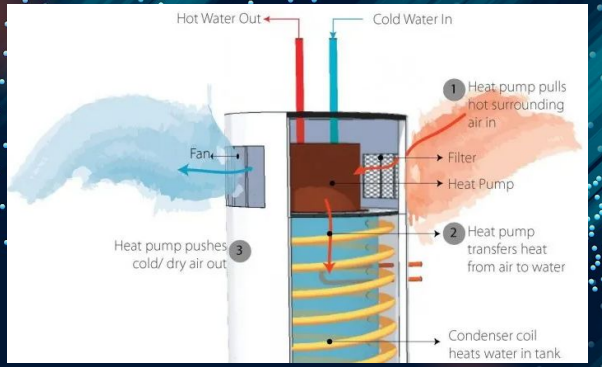
5.3.3.6 Copper Pipe Fittings

NEW text added to Section:

- *Refrigerant piping must be installed in accessible areas (i.e. corridors, machine rooms, etc.) and be located at a ceiling height that would make the piping accessible for repair and replacement.*
- *Cooling coil condensate piping must be Type L copper.*



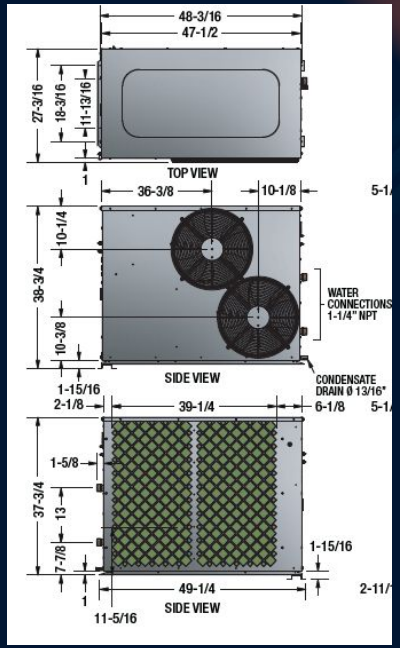
5.3.3.13 Air Source Heat Pump Condenser Discharge



NEW section added:

- *Where practical and cost effective, cold discharge air from an air source heat pump condenser operating in heating mode must be recovered and diverted into adjacent electrical rooms, mechanical rooms, I.T. / Telecom closets, etc. via ductwork and/or louvers, for supplemental cooling service.*

- *This supplemental source of cooling must not be the only means of cooling for the space, as it is intended to complement the primary cooling source as an energy recovery measure.*



5.3.4.3 Duct Construction

NEW section added:

- *All conventional supply, return and exhaust air ductwork must be fabricated of galvanized sheet metal, unless otherwise indicated*

5.3.4.4 Flexible Duct Connectors

NEW section added:

- *Flexible duct connectors must be limited to a maximum of 5-feet of distribution and are only permitted to make final connections between terminal branch ductwork and air outlet.*

- *The use of flexible ductwork is not permitted above hard ceilings that are not easily accessible.*

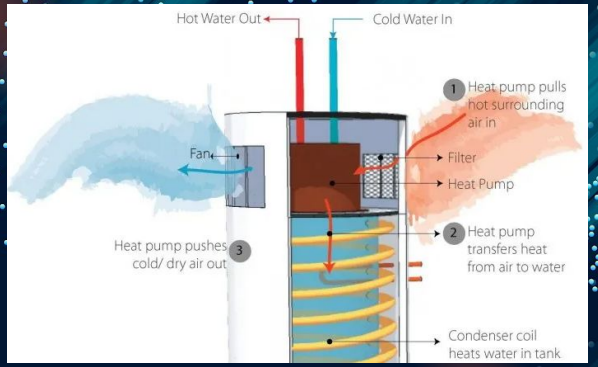
5.4 Plumbing

Revisions to section:

- ~~*Fossil fuels may only be used to supplement electric-powered capacity: (a) during emergency backup situations; or (b) when low outdoor air temperatures prevent installed electric equipment from meeting the tenant's minimum service water heating water temperature*~~.
- *See Chapter 1, Electrification*

Section 1.9.3.5 Electrification

5.4 Plumbing



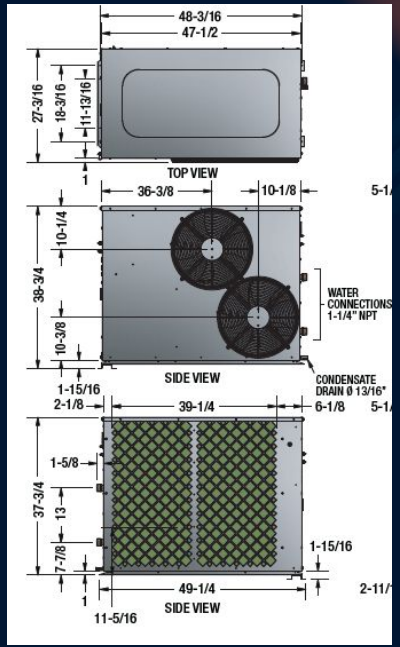
1.9.3.5 ELECTRIFICATION

GSA defines building electrification of its owned inventory as the elimination of emissions generated directly by heating, ventilation, and air conditioning (HVAC), and by domestic water heating, cooking, laundry, and demand-response generators powered on site. Fossil fuel–powered emergency backup generators are not included in electrification requirements regarding these scope 1 emissions.

HVAC and domestic water heating system electrification analyses of alternatives must include Life Cycle Cost Analyses (LCCA) and operational (scope 1 and 2) greenhouse gas emissions of each alternative. Reference A.6 Life Cycle Cost Analysis Requirements. These analyses and LCCAs must include heat pump technologies. These selected systems may not use fossil fuels (per Table 1.2) and must be life cycle cost effective for implementation (including electric resistance heating).

Table 1.2 Electrification

Project Type Per Funding Code	BA51 New Construction and BA55 Repair and Alteration projects	BA54 Minor Repairs and Alterations, BA61 Operating Funds, and BA63 Energy Rebate Projects	Other funding legislation or sources including BA80 Reimbursable Work Authorization and privately funded projects (e.g. ESPCs)
Electrification	Required	Required for any new or replacement HVAC or domestic water heating equipment. Optional but encouraged for repairs, cooking, laundry, and non-emergency backup generator equipment.	Follow the electrification requirements for the project type (e.g. major R&A or limited scope) that aligns with funded scope



5.4 Plumbing

Added to section:

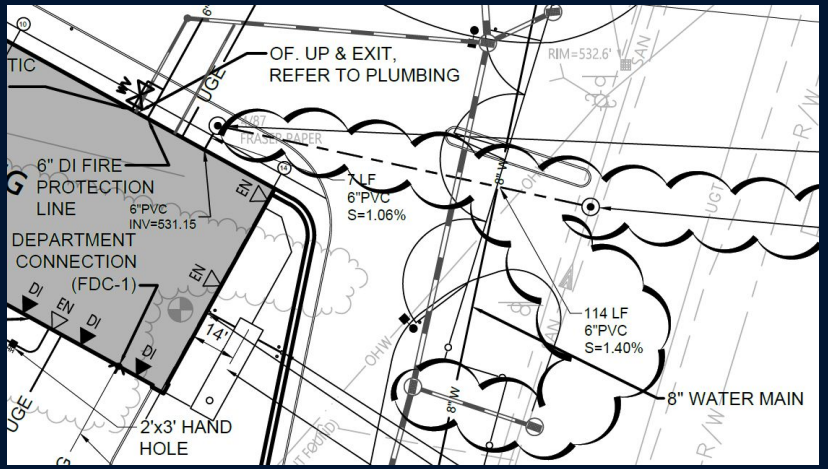
- *Modifications to point-of-use water outlets used for human consumption or washing purposes must include post-installation flushing and testing procedures that comply with the most current version of the PBS Drinking Water Policy and Desk Guide.*
- *Dead legs are prohibited in potable water plumbing, to lessen the risk of Legionella proliferation.*
- *Janitorial closets must be provided with domestic hot and cold water.*

References:
Link to PBS Drinking Water Policy and Desk Guide

5.4.5 Plumbing Piping

Added to section:

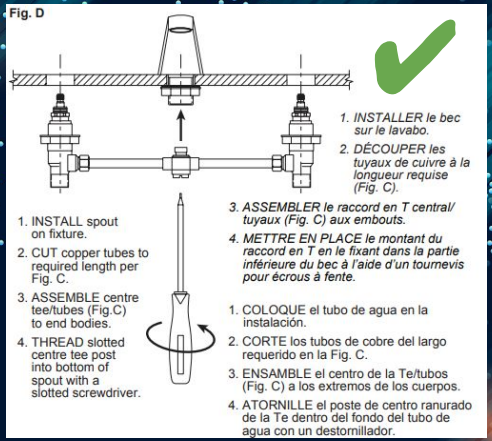
- *SANITARY, WASTE, VENT, AND STORM PIPING*
  - *Any project scope related to piping up to five (5) feet outside of the building, reference Chapter 4, Site Utilities.*

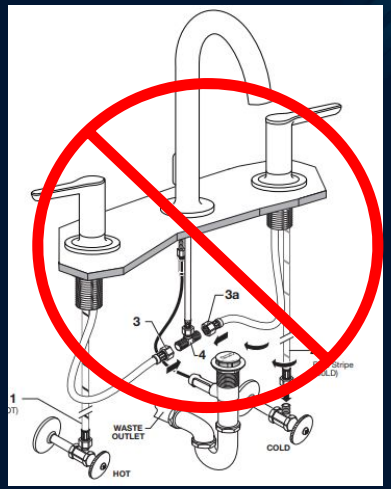


5.4.5 Plumbing Piping

Added to section:

- *DOMESTIC WATER PIPING*
  - *Solid copper supply lines must be installed from the fixture shut off valve to the fixture connection.*
  - *Flexible water connectors from the fixture shut off valve to the fixture connection are not permitted.*
  - *Plumbing fixtures with factory provided flexible water connectors are not permitted.*





5.4.5 Plumbing Piping

Added to section:

- *DOMESTIC WATER PIPING*
  - *Provide a recirculation loop on all cold-water risers and major branch distribution ends, for flushing purposes.*

5.4.6 Isolation Valves

New section:

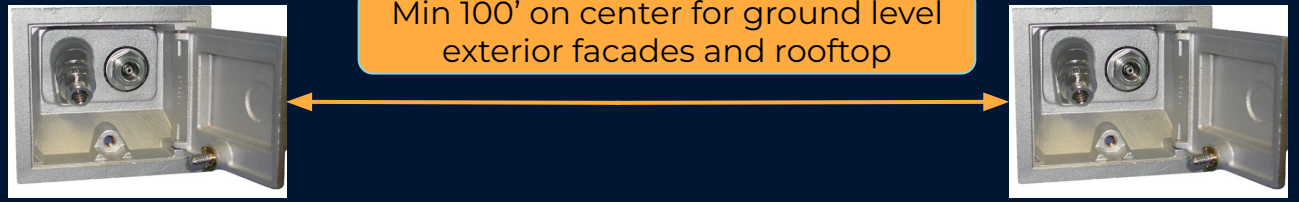
- *Isolation valves must be provided on all lateral piping entering all bathrooms, mechanical rooms, kitchens, and other rooms provided with domestic water where there is at least more than one fixture.*
- *These valves must be in areas that can be reached without the use of a ladder, and are easily accessed, in case of an emergency.*
- *All locations must be identified with a printed sign.*
- *Valves must be exercised regularly.*

- *For detention areas in courthouses, isolation valves must not be in prisoner holding cells.*

5.4.7 Hose Bibbs

New section:

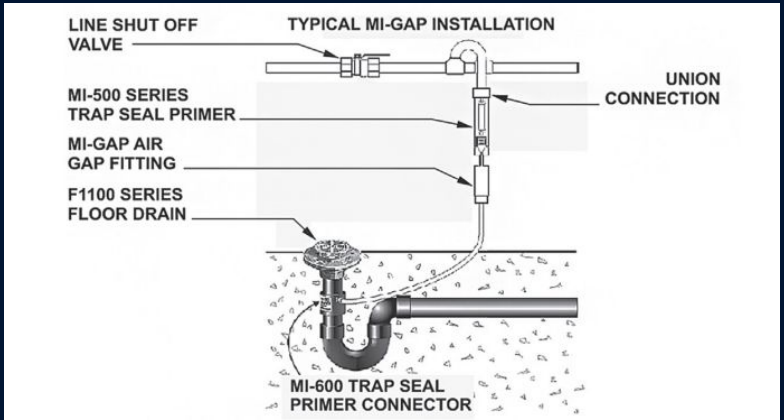
- *Hose bibbs must be provided along all exterior facades at ground level and rooftop level of the building at a minimum increment of 100 FT on center.*
- *Hose bibb locations and distance to be determined based on design and input from the regional GSA facility management team.*
- *Hose bibbs must also be provided in mechanical rooms and parking structures.*
- *Ensure that hose bibbs are easily accessible and able to be isolated for future repair/replacement without having to perform an entire system drain down.*



5.4.8 Floor Drains

Added to section:

- *Floor drains must be provided in all bathrooms, mechanical rooms, kitchens, **kitchenettes, lactation rooms** and other rooms provided with domestic water.*



5.4.9 Overflow Pans

New section:

- *Overflow pans are required to be furnished under all domestic hot water heaters.*
- *Pans are required to be equipped with water sensing controllers that will shut off water to the units and send an alarm to the BAS system, or produce an audible alarm if the BAS is not capable.*

Deletion

2021 P100 section 5.4.7 Gas and Fuel Oil deleted:

- ~~*See section 5.3.3.6 for gas and fuel oil piping requirements.*~~

5.5.1 Accessible for Maintenance

Added to section:

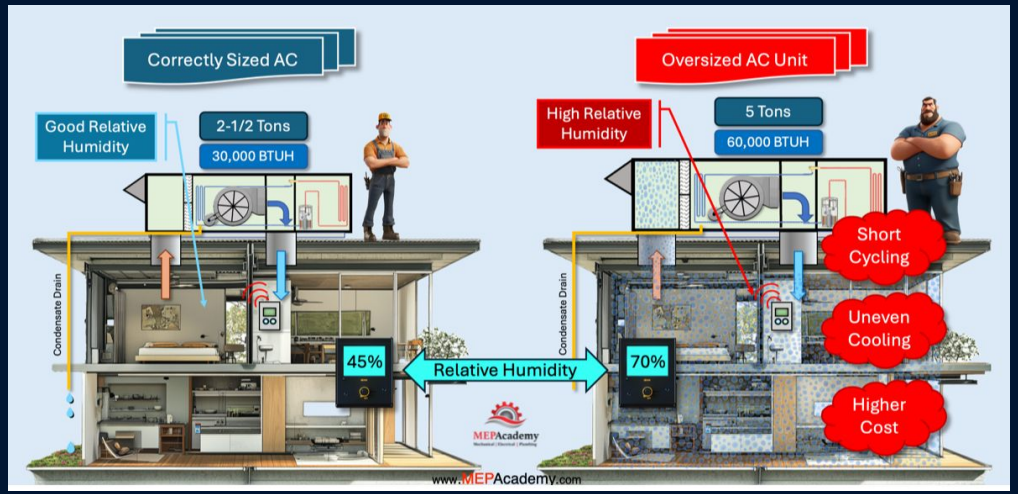
- *Split air-cooled systems providing cooling to a space must reject heat outside of the building envelope.*

5.6 Alterations to Existing Buildings

Added to section:

- *Direct replacement-in-kind of equipment that is aged out is prohibited.*
- *Any new equipment installation must be specifically sized for the current programmatic needs of the spaces served.*

Project SOW should include new heating & cooling calculations for sizing new equipment



Questions

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