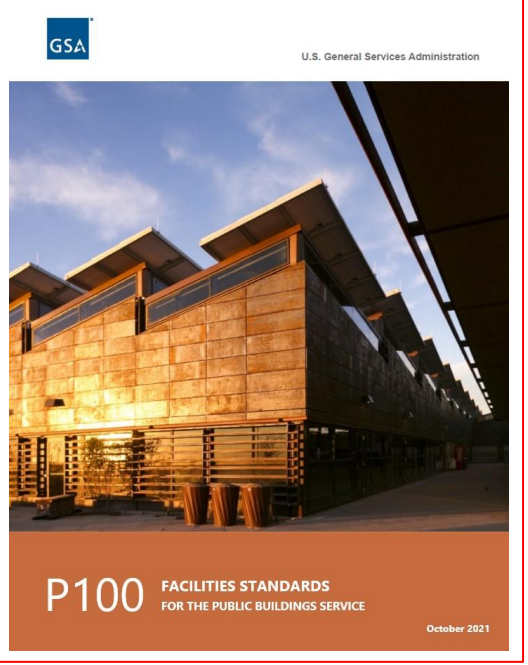
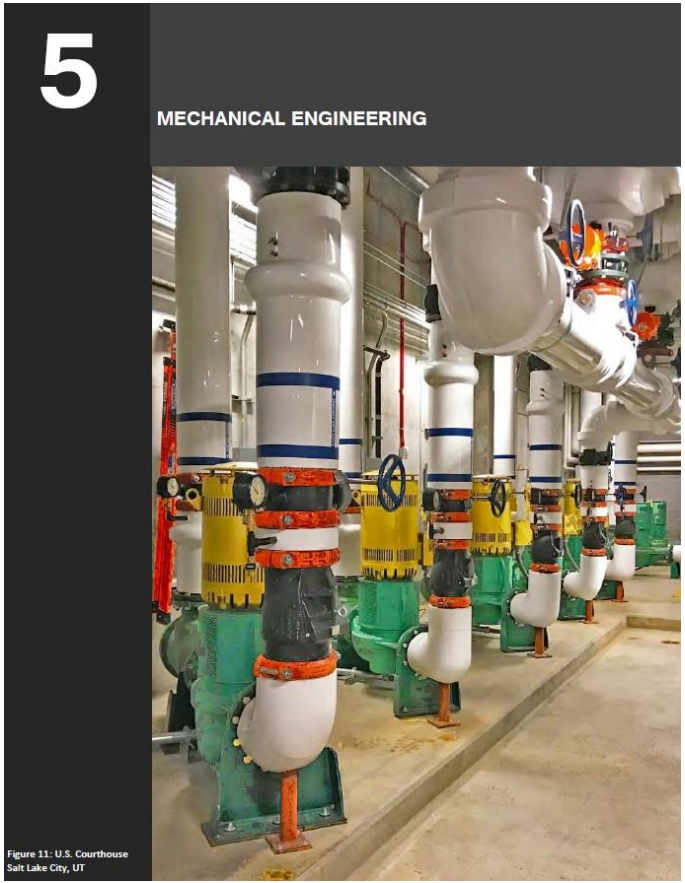
P100 - Training 2021

The Facilities Standards for the Public Buildings Service

This session is being recorded.



Mechanical Engineering



Mark Kutchi

Mechanical Engineer

Mike Sullivan

Mechanical Engineer

Robert Wager

Mechanical Engineer

Table of Contents

01
2021 P100 Updates

Chapter 5 Mechanical Engineering, what's new

5.1 Performance Tables

Format changed from cluttered columns to user-friendly rows

Attribute	Baseline	★ Tier 1 High Performance	★★ Tier 2 High Performance	★★★ Tier 3 High Performance	Measurement & Verification	Plans & Specs	Calculations & Analysis	Design	Construction
5.2.1 Temperature									
Reference	ASHRAE 55	ASHRAE 55	ASHRAE 55	ASHRAE 55	ASHRAE 0 & 1.1 SMACNA TAB Procedural Guide	ASHRAE 0 & 1.1 SMACNA TAB Procedural Guide			
Performance	24±2ºC (75±3ºF) cooling, 22±2ºC (72±3ºF) heating, Allowance for unoccupied hour setup and setback optimized with re-occupancy pick-up and pull-down energy demands within a range of 13ºC to 28ºC (55ºF to 83ºF). Thermal zones limited to 42 m^2 (450 ft^2) at the perimeter 5m (15ft) (or no more than 3 private offices on the same solar orientation) and 140 m^2 (1500 ft^2) interior	Baseline features and add passive control of surface radiant temperature to provide surface radiant temperatures ±4ºC (±7ºF) of the air temperature. Thermal zones limited to 42 m^2 (450 ft^2) at the perimeter 5 m (15ft) (or no more than 3 private offices on the same solar orientation) and 75 m^2 (800 ft^2) interior	Tier 1 High Performance features and add building automation system control of surface radiant temperatures to provide surface radiant temperatures ±3ºC (±5ºF) of the air temperature, or inversely offset expanded air temperature ranges and do not form condensation.	Tier 2 High Performance and individual occupant controlled surface radiant temperatures within optimized limits determined by a BAS and optimized air at 24-27 ºC (75-80ºF) cooling 18-22 ºC (65-72ºF) heating	Baseline: No Tier 1 High Performance: No Tier 2 High Performance: Yes Tier 3 High Performance: Yes	Baseline: Yes Tier 1 High Performance: Yes Tier 2 High Performance: Yes Tier 3 High Performance: Yes	Provide calculations of the transient coupled one-dimensional heat and moisture transport in multi-layer building components exposed to natural weather using WUFI-ORNL/IBP for each construction condition.	Show proposed zoning and corresponding square footage for all conditioned spaces. Show temperature range for each zone and interior surface temperatures, when applicable.	After occupancy, provide 2 weeks of 15 minute trend history of space and surface temperature (when controlled).
5.2.2 Humidity Control									
Reference	ASHRAE 55, graphic comfort zone method	ASHRAE 55, Michalski (1998), 2011 ASHRAE Handbook – HVAC Applications, Chapter 23, Museums, Galleries, Archives, and Libraries	ASHRAE 55, Michalski (1998), 2011 ASHRAE Handbook – HVAC Applications, Chapter 23, *Museums, Galleries, Archives, and Libraries*	ASHRAE 55 Michalski (1998), 2011 ASHRAE Handbook – HVAC Applications, Chapter 23, *Museums, Galleries, Archives, and Libraries*	ASHRAE 0 & SMACNA TAB Procedural Guide	ASHRAE 0 ASHRAE 1.1			
Performance	Maximum 13ºC (55ºF) dew point	[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.	[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.	[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.	Baseline: No Tier 1 High Performance: No Tier 2 High Performance: Yes Tier 3 High Performance: Yes	Baseline: Yes Tier 1 High Performance: Yes Tier 2 High Performance: Yes Tier 3 High Performance: Yes		Show relative humidity control range for each zone and describe method of control when applicable.	After occupancy, provide 2 weeks of 15 minute trend history of space relative humidity (when controlled).

Temperature	
	Performance
Baseline	24±2ºC (75±3ºF) cooling, 22±2ºC (72±3ºF) heating, Allowance for unoccupied hour setup and setback optimized with re-occupancy pick-up and pull-down energy demands within a range of 13ºC to 28ºC (55ºF to 83ºF). Thermal zones limited to 42 m^2 (450 ft^2) at the perimeter 5m (15ft) (or no more than 3 private offices for the interior zones, and no more than 3 private offices on the same solar orientation for the exterior zones) and 140 m^2 (1500 ft^2) interior
Tier 1	Baseline features and add passive control of surface radiant temperature to provide surface radiant temperatures ±4ºC (±7ºF) of the air temperature. Thermal zones limited to 42 m^2 (450 ft^2) at the perimeter 5 m (15ft) (or no more than 3 private offices on the same solar orientation) and 75 m^2 (800 ft^2) interior
Tier 2	Tier 1 AND building automation system control of surface radiant temperatures to provide surface radiant temperatures ±1ºC (±2ºF) of the air temperature, or inversely offset expanded air temperature ranges and do not form condensation
Tier 3	Tier 2 AND individual occupant controlled surface radiant temperatures within optimized limits determined by a BAS and optimized air at 24-27 ºC (75-80ºF) cooling 18-22 ºC (65-72ºF) heating
M & V	Baseline: No Tier 1: No Tier 2: Yes Tier 3: Yes
Plans & Specs	Yes
Calculations & Analysis	Provide calculations of the transient coupled one-dimensional heat and moisture transport in multi-layer building components exposed to natural weather using WUFI-ORNL/IBP for each construction condition.
References	ASHRAE 55, ASHRAE & SMACNA Procedural Guide
Basis of Design	Show proposed zoning and corresponding square footage for all conditioned spaces. Show temperature range for each zone and interior surface temperatures, when applicable.
Construction Verification	After occupancy, provide 2 weeks of 15 minute trend history of space and surface temperature (when controlled).

5.1 Filtration

Revised section:

- HVAC filter MERV rating changed from MERV 8 to MERV 13

5.1 Filtration

Added:

- Ultraviolet Germicidal Irradiation (UVGI) or (UV) lights added for central air handling unit cooling coils

5.1 Filtration

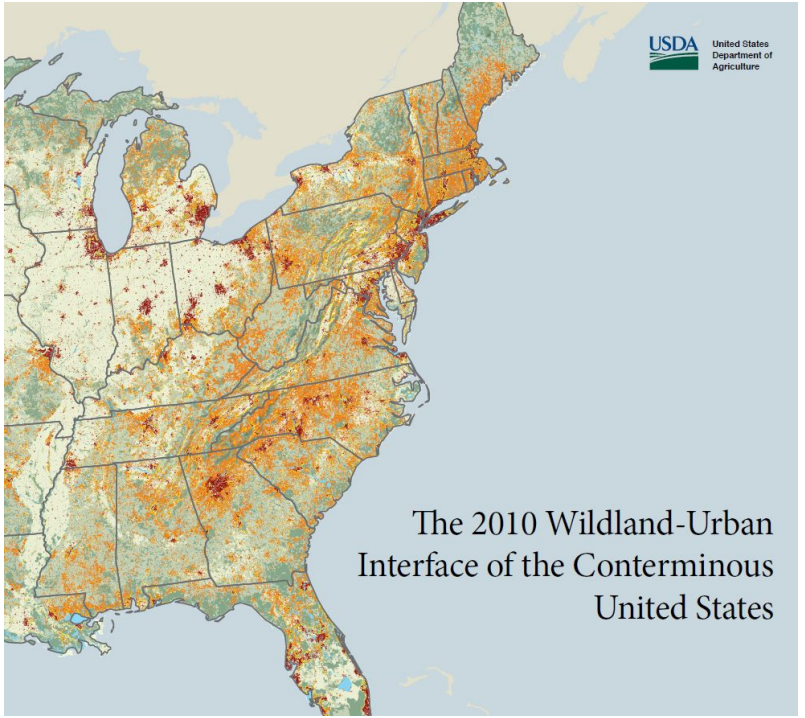
Added:
In wildfire locations with smoke risks,

- HVAC filter section with carbon filter rack for installation of carbon filters when needed for smoke control
- Outdoor air intake/ductwork with filter rack for installation of MERV 13 filters when needed for smoke control

Note: See section 1.4.6 Wildland Urban Interface to determine locations that have smoke risks

1.4.6 Wildland Urban Interface

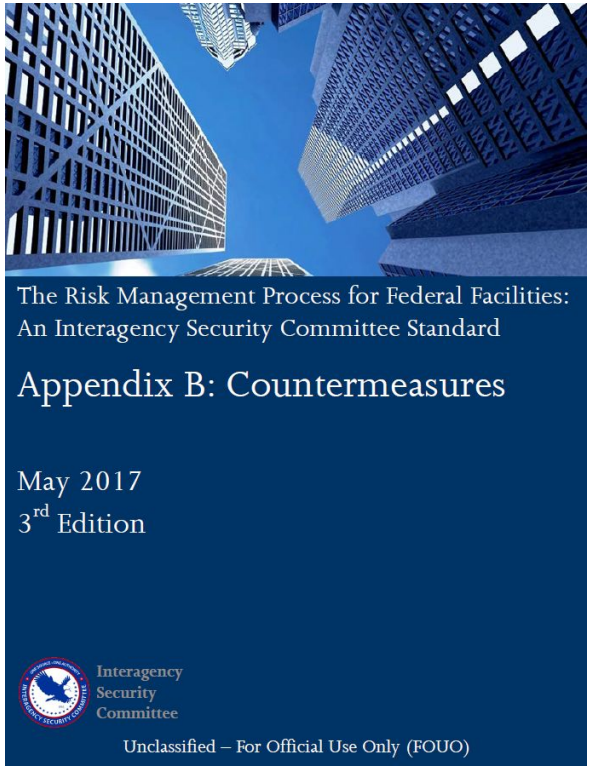
Each building must comply with the latest edition of the International Wildland-Urban Interface Code (IWUIC), promulgated by the International Code Council, if the building is at moderate or greater wildfire risk as defined in the IWIUC, using the USDA "The 2010 Wildland-Urban Interface of the Conterminous United States" map.



5.1 Filtration

Added reference:

- New P100 section 1.4.7 Interagency Security Committee, Risk Management Process for Federal Facilities for the Interagency Security Committee (ISC) Standard filter requirements that supersede these requirements based on the building Facility Security Level
- New P100 table 1.1 Physical Security Countermeasures, mechanical security criterion



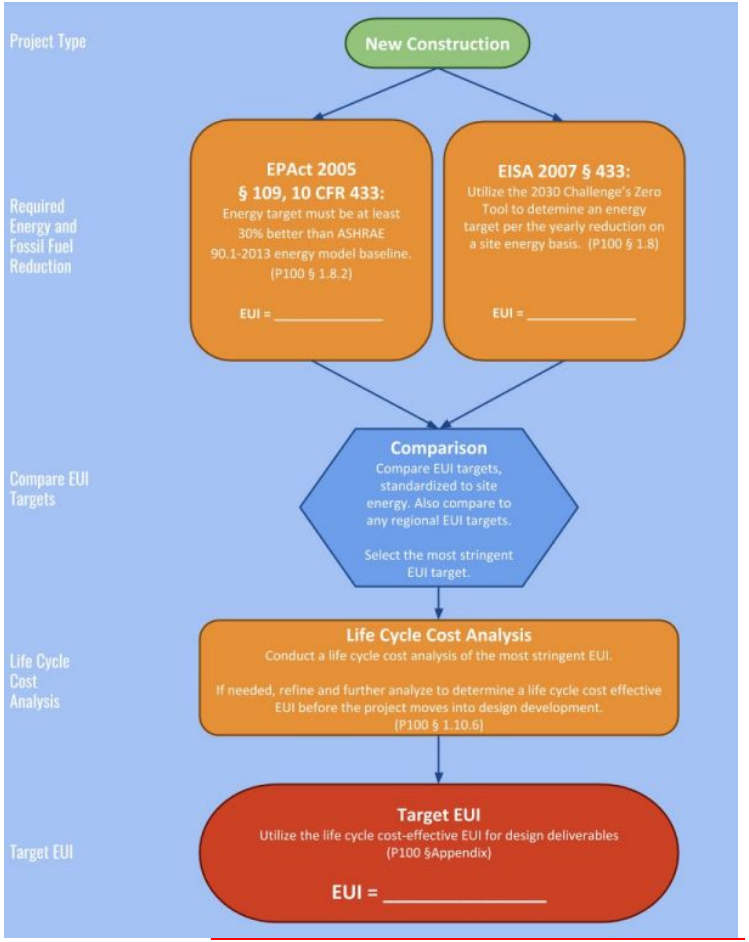
Building HVAC Energy Performance

Moved to new section 1.9.3 Energy Use Targets

- GSA Energy Use Target Guidance is located on InSite

GSA Energy Use Intensity Explained April 2020

Link to GSA InSite 2020 Energy Use Target Guidance



1.4.8 ASHRAE 90.1

The ASHRAE Standard 90.1 listed in 10CFR433 (code of federal regulations) at the time of project solicitation will be used for the project

Link to 10CFR433

PART 433 - ENERGY EFFICIENCY STANDARDS FOR THE DESIGN AND CONSTRUCTION OF NEW FEDERAL COMMERCIAL AND MULTI-FAMILY HIGH-RISE RESIDENTIAL BUILDINGS

Authority: 42 U.S.C. 6831-6832, 6834-6835; 42 U.S.C. 7101 *et seq.*

Source: 71 FR 70281, Dec. 4, 2006, unless otherwise noted.

§ 433.1 Purpose and scope.

(a) This part establishes an energy efficiency performance standard for the new Federal commercial and multi-family high-rise buildings, for which design for construction began on or after January 3, 2007, as required by section 305(a) of the Energy Conservation and Production Act, as amended (42 U.S.C. 6834(a)).

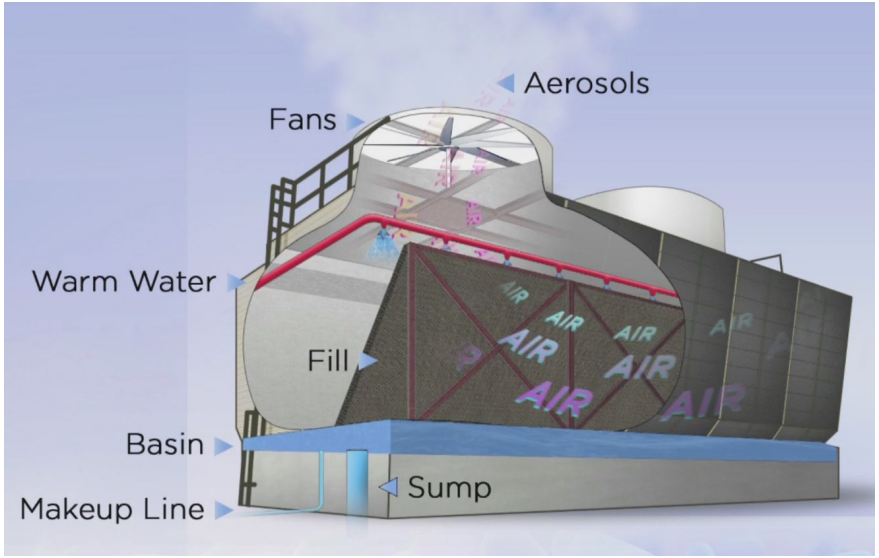
(b) [Reserved]

(c) This part also establishes green building certification requirements for new Federal buildings that are commercial and multi-family high-rise residential buildings and major renovations to Federal buildings that are commercial and multi-family high-rise residential buildings, for which design for construction began on or after October 14, 2015.

5.2.8 Treating Biological Growth in Water Systems

Added new section:

- Building water systems must comply with ASHRAE Guideline 12, Minimizing the Risk of Legionellosis Associated with Building Water Systems



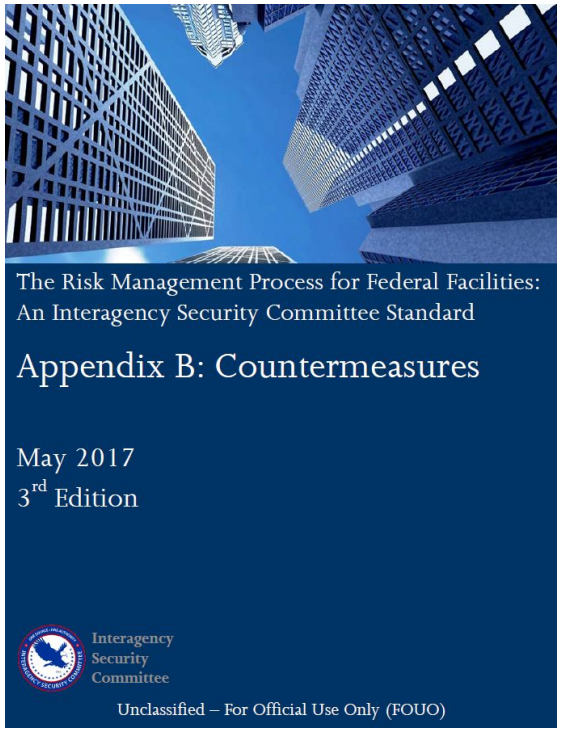
5.3 Mechanical Prescriptive Requirements

Added reference:

- Refer to the ISC for mechanical system requirements per the facility security level (FSL)

Refer to New P100 table 1.1 Physical Security Countermeasures and the ISC Standard Appendix B: Countermeasures for the following mechanical security criterion based on the facility security level (FSL):

- Protection of Air Intakes
- Isolated Ventilation Systems
- HVAC Control
- CBR Detection Technology
- Biological Filtration - General Building
- Biological Filtration - Lobbies and Mailrooms
- Chemical Filtration
- Security of Ventilation Equipment and Controls
- Location of Utilities and Feeders
- Protection of Water Supply



5.3.2.1 Chiller Plant

Revised section:

- Three equally sized chillers
- No oversizing/spare capacity
- Any design must meet a Turndown to 10%, stable operation
- Valving for unit isolation
- Two chillers sized for 66% of load if life cycle cost < three chillers

5.3.2.2 Boiler Plant

Revised section:

- Three equally sized boilers
- Turndown to 10%, stable operation
- Valving for unit isolation

5.3.2.3 Cooling Towers

Revised section:

- Fans must be equipped with VFDs

5.3.2.5 Roof-Mounted Equipment

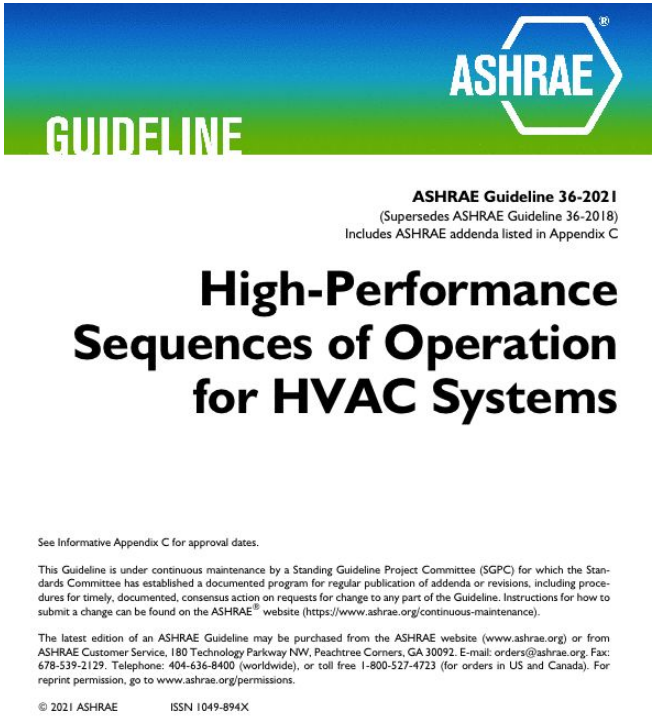
Revised section:

- Land Port of Entry (LPOE) vehicle inspection booths permitted roof-mounted equipment if easily accessible and lanes not blocked during maintenance

5.3.2.1 Integrated Sequences of Operations (ISOO)

Added to section:

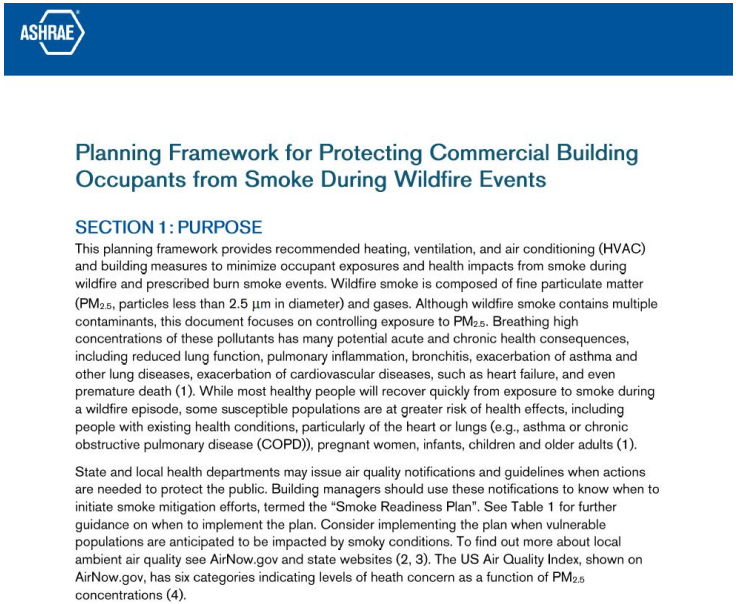
- Follow ASHRAE Guideline 36 High-Performance Sequences of Operation For HVAC Systems



5.3.2.13 Wildfire Smoke Mode

Added new section:

- New and existing buildings which house mission critical activities that are in or adjacent to wildfire-prone areas must have the capability to readily adapt to a "Smoke Mode" operation during these events
- Comply with ASHRAE Planning Framework for Protecting Commercial Building Occupants from Smoke During Wildfire Events



ASHRAE

Planning Framework for Protecting Commercial Building Occupants from Smoke During Wildfire Events

SECTION 1: PURPOSE

This planning framework provides recommended heating, ventilation, and air conditioning (HVAC) and building measures to minimize occupant exposures and health impacts from smoke during wildfire and prescribed burn smoke events. Wildfire smoke is composed of fine particulate matter ($PM_{2.5}$, particles less than 2.5 µm in diameter) and gases. Although wildfire smoke contains multiple contaminants, this document focuses on controlling exposure to $PM_{2.5}$. Breathing high concentrations of these pollutants has many potential acute and chronic health consequences, including reduced lung function, pulmonary inflammation, bronchitis, exacerbation of asthma and other lung diseases, exacerbation of cardiovascular diseases, such as heart failure, and even premature death (1). While most healthy people will recover quickly from exposure to smoke during a wildfire episode, some susceptible populations are at greater risk of health effects, including people with existing health conditions, particularly of the heart or lungs (e.g., asthma or chronic obstructive pulmonary disease (COPD)), pregnant women, infants, children and older adults (1).

State and local health departments may issue air quality notifications and guidelines when actions are needed to protect the public. Building managers should use these notifications to know when to initiate smoke mitigation efforts, termed the "Smoke Readiness Plan". See Table 1 for further guidance on when to implement the plan. Consider implementing the plan when vulnerable populations are anticipated to be impacted by smoky conditions. To find out more about local ambient air quality see AirNow.gov and state websites (2, 3). The US Air Quality Index, shown on AirNow.gov, has six categories indicating levels of heath concern as a function of $PM_{2.5}$ concentrations (4).

GSA

5.3.2.14 Testing, Adjusting and Balancing

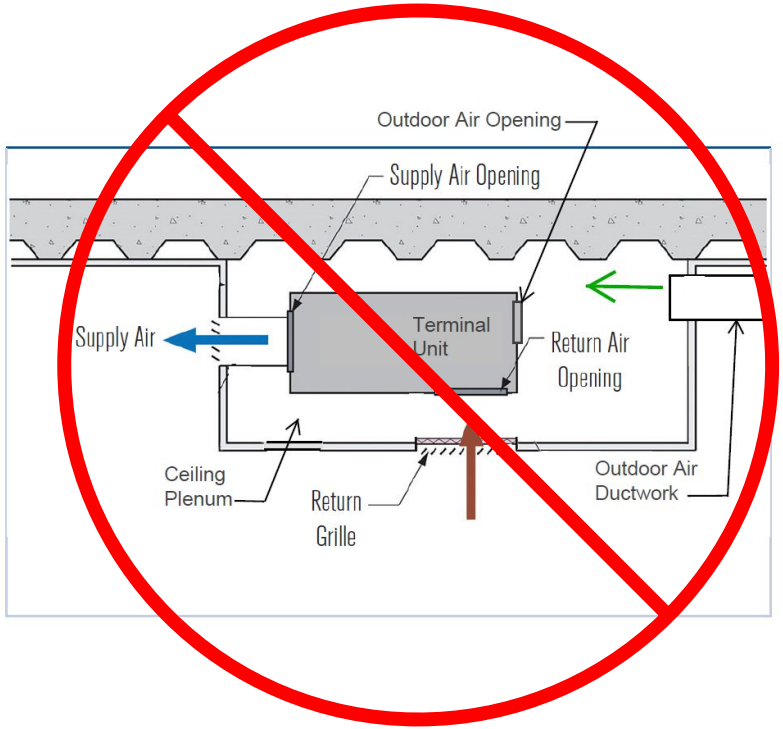
Added new section:

- TAB contractor must be AABC, NEBB or TABB certified

5.3.3.2 Outdoor Air Intake Locations

Added to section:

- Outdoor air intake must be ducted directly to terminal unit
- Ceiling plenum cannot be used as an outdoor air intake plenum



5.3.3.6 Hydronic, Steam, Natural Gas, and Fuel Oil Piping & 5.4.5 Plumbing Piping

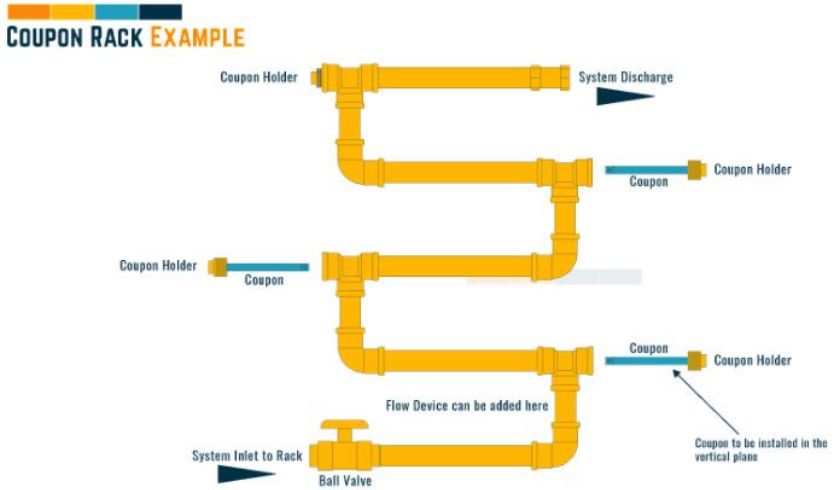
Added to section:

- Definition for concealed locations
- Access doors do not change the definition of a hard ceiling to accessible
- Interlocking ceiling tile systems are considered inaccessible
- Typical acoustical ceiling tile is considered accessible except in locations where sprinkler heads, lighting fixtures and diffusers prevent the removal of the ceiling tiles

5.3.5.4 Corrosion Monitoring

Added to section:

- Install coupon racks, or an equivalent electronic monitoring system for steam condensate loops in addition to coupon racks already required for condenser water loops, heating hot water loops, and the building main chilled water loop



5.4 Plumbing

Removed from section:

- Water closet, urinal and lavatory code requirement paragraphs

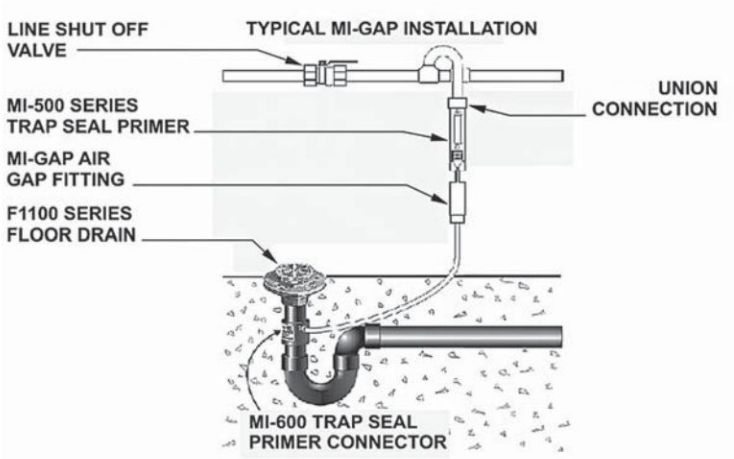
Added to section:

- Plumbing Fixtures and Fittings must comply with IgCC-2018 Section 601.3.2.1 (6.3.2.1)
- Water Closet flush valves must be manual dual-flush

5.4.6 Floor Drains

Added new section:

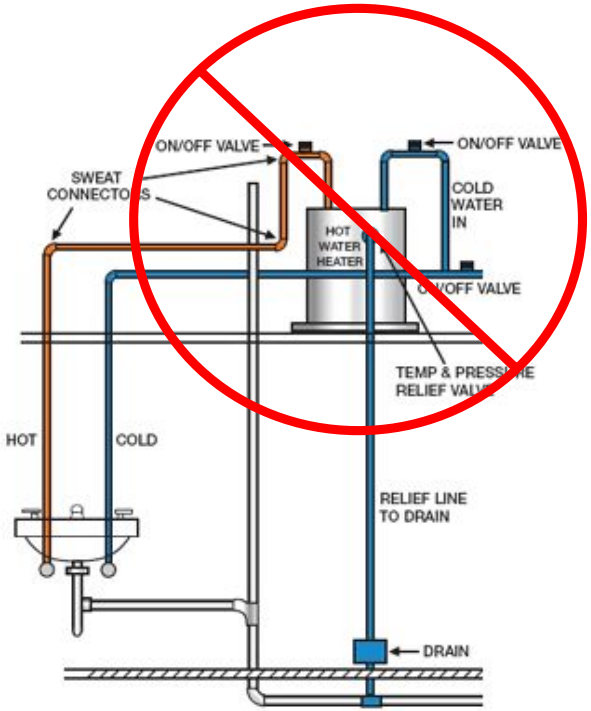
- Floor drains must be provided in all bathrooms, mechanical rooms, kitchens, and other rooms provided with domestic water
- Floor drains must have either deep traps, trap primers or waterless trap primers



5.5.1 Accessible for Maintenance

Added to section:

- Do not install domestic hot water heaters or equipment with condensing coils above ceilings



02 Common Waiver Requests

Return Ducts in return air plenums

Increasing Cooling/Heating Zone size

Duct Liners for Acoustical Purposes

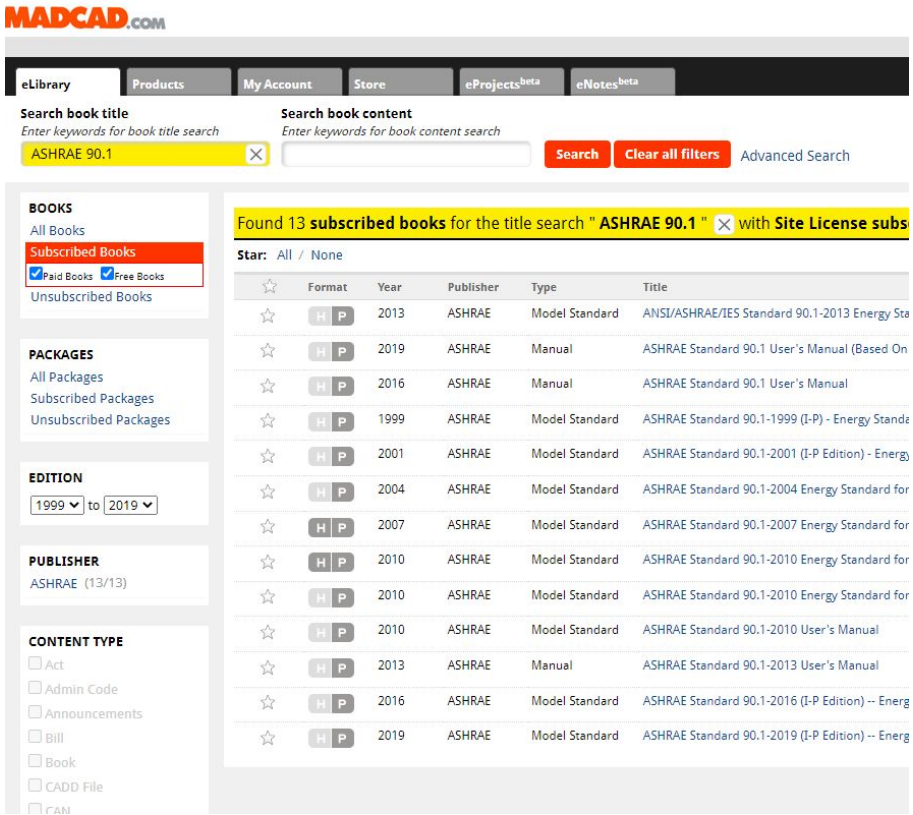
Rooftop HVAC equipment

MADCAD online document reference library

If you do not have a current MADCAD account you will need to request a username by sending an email from your gsa.gov email account to support@madcad.com. Include in the email that you are requesting access to GSA's national subscription.

Link to GSA InSite page

For more information, contact Ben Pisarcik (Benjamin.pisarcik@gsa.gov).



Thanks!

Do you have any questions?

mark.kutchi@gsa.gov
michael.sullivan@gsa.gov
robert.wager@gsa.gov