

Summary of Modifications/Changes in this Update

This Summary of Changes is for information only.
It is not a part of the referenced document, and should not be used for project documentation.

U.S. Department of Veterans Affairs ♦ Office of Construction & Facilities Management

DATE OF THIS VERSION:

March 1, 2024

TITLE OF DOCUMENT:

PG-18-10 HVAC Design Manual

DATE OF VERSION BEING SUPERSEDED (old):

November 1, 2023

DESCRIPTION OF DOCUMENT (previous title, number, other identifying data):

HVAC Design Manual

SUMMARY OF CHANGES IN THIS VERSION:

1. Revised AHU Data Sheets (Chapter 6 and 508 Compliant Chapter 6 Table) to require MERV 13 filtration (PF2) where MERV 11 was the highest level of filtration.
2. Revised text in 4.2.1.2.b. and 4.3.3.4.e. to require refrigerants utilized are approved by the EPA.
3. Revised text in 3.6 and 3.6.4. to clarify approval of Energy Recovery and Restrictions/Exceptions of Energy Recovery.
4. Revised Emergency Department Room Data Sheets in 508 Compliant Chapter 6 Table to match Chapter 6 Emergency Department Room Data Sheets.
5. Revised OIT Data Sheets (Chapter 6 and 508 Compliant Chapter 6 Table).

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DATE OF THIS VERSION:

November 1, 2023

TITLE OF DOCUMENT:

PG-18-10 HVAC Design Manual

DATE OF VERSION BEING SUPERSEDED (old):

August 1, 2023

DESCRIPTION OF DOCUMENT (previous title, number, other identifying data):

HVAC Design Manual

SUMMARY OF CHANGES IN THIS VERSION:

1. Chapters 2, 3, and 4 were revised to update references to ASHRAE Handbooks.
2. Paragraph 3.2.2.15 was deleted.
3. Section 3.3 revised to further clarify use of terminal cooling systems.
4. Paragraph 4.3.1 was revised to clarify the approval authority for usage of DX cooling systems.
5. Chapter 6 Room Data Sheets for Compounding Pharmacy areas revised to require ACH derived from HEPA filtered supply air for both positive and negative spaces.

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DATE OF THIS VERSION:

August 1, 2023

TITLE OF DOCUMENT:

PG-18-10 HVAC Design Manual

DATE OF VERSION BEING SUPERSEDED (old):

May 1, 2023

DESCRIPTION OF DOCUMENT (previous title, number, other identifying data):

HVAC Design Manual

SUMMARY OF CHANGES IN THIS VERSION:

1. Paragraph 3.2.1.4. was revised to clarify the prohibition of rooftop air handling units.
2. Paragraph 3.8 was revised to correct typographical error.
3. Paragraph 3.8.1.4 was revised to include MRI Exam Room Emergency Exhaust in the list of Special (Dry) Exhaust System Applications.
4. Paragraph 4.2.1.7 was revised to add detail to design coordination required.
5. AHU Systems Data Sheets and Room Data Sheets were revised to require a %RH MIN of 30% in lieu of 20%.
6. Table for Section 6 (Section 508 compliant) was updated to meet Section 6 data in the manual.

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DATE OF THIS VERSION:

May 1, 2023

TITLE OF DOCUMENT:

PG-18-10 HVAC Design Manual

DATE OF VERSION BEING SUPERSEDED (old):

January 1, 2023

DESCRIPTION OF DOCUMENT (previous title, number, other identifying data):

HVAC Design Manual

SUMMARY OF CHANGES IN THIS VERSION:

1. The HVAC Design Manual was updated to incorporate changes made during a recent update of the Research and Development (R&D) Design Guide. Section 3 and Section 6 received significant updates.
2. The HVAC Design Manual was updated to incorporate changes to achieve consistency with OIT document, Infrastructure Standard for Telecommunications Spaces. Section 1 was updated.
3. The HVAC Design Manual was updated to revise references to ASHRAE Standard 90.1. Version 90.1-2019 will be utilized as described throughout the manual. Sections 1, 2, 3, 4, 5 and 6 were updated.
4. Changes to the TOC reflect required page number changes.

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DATE OF THIS VERSION (new)

January 1, 2023

TITLE OF DOCUMENT (new title if applicable):

PG-18-10 HVAC Design Manual

DATE OF VERSION BEING SUPERSEDED (old):

November 1, 2022

DESCRIPTION OF DOCUMENT (previous title, number, other identifying data):

HVAC Design Manual

SUMMARY OF CHANGES IN THIS VERSION:

1. An update to the Emergency Department (ED) Design Guide has caused an update of HVAC Design Manual. Three additional pages have been added to HVAC Design Manual. ED Room Data Sheets: 6-65a, 6-65b, 6-65c were added due to additional rooms being added.
2. Chapter 6 has been updated as well to reflect the changes.

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DATE OF THIS VERSION (new)

November 1, 2022

TITLE OF DOCUMENT (new title if applicable):

PG-18-10 HVAC Design Manual

DATE OF VERSION BEING SUPERSEDED (old):

October 1, 2022

DESCRIPTION OF DOCUMENT (previous title, number, other identifying data):

HVAC Design Manual

SUMMARY OF CHANGES IN THIS VERSION:

1. Updated Page 4-15, 4.4.1.4 (b):
 - a. Removed as shown: "PRV station noise generation ~~shall~~ be less than ~~80~~ db and the turndown ratio shall be limited to 10:1."
 - b. Added as shown: "PRV station noise generation will be less than 85 db and the turndown ratio shall be limited to 10:1."
2. Updated Page 4-15, 4.4.1.4 (g):
 - a. Removed as shown: "Install a bypass loop with a globe valve designed for steam service and sized ~~for the flow of the largest valve in the~~ PRV station."
 - b. Added as shown: "Install a bypass loop with a globe valve designed for steam service and sized to meet the combined capacity of the two PRV's in the PRV station."
3. Updated Page 4-16, 4.4.1.4 (i):
 - a. Removed as shown: "Size the safety valve ~~to handle the maximum flow of the largest PRV or the bypass.~~"
 - b. Added as shown: "Size the safety valve to meet the combined capacity of the two PRV's or the bypass."
4. Updated Pharmacy Service pg 6-116 and 117

- a) Pharmacy Service pg 6-116 – Modified Air Flow Relationships and Legend.
 - i) “3: XXXX: Oncology Drug Preparation Area Air Lock (+)” was removed.
 - ii) “4: PHBS2: STORAGE AND CLEAN / STORAGE HAZARDOUS DRUGS (-)” replaced as “3: PHBS2: STORAGE AND CLEAN / STORAGE HAZARDOUS DRUGS (-)”.
- b) Pharmacy Service pg 6-117 – Modified Air Flow Relationships and Legend
 - i) “5: XXXX: Oncology Drug Preparation Area Air Lock (+)” was removed.
 - ii) “6: PHBS2: STORAGE AND CLEAN / STORAGE HAZARDOUS DRUGS (-)” was replaced as “5: PHBS2: STORAGE AND CLEAN / STORAGE HAZARDOUS DRUGS (-)”

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DATE OF THIS VERSION (new)

October 1, 2022

TITLE OF DOCUMENT (new title if applicable):

PG-18-10 HVAC Design Manual

DATE OF VERSION BEING SUPERSEDED (old):

March 1, 2022

DESCRIPTION OF DOCUMENT (previous title, number, other identifying data):

HVAC Design Manual

SUMMARY OF CHANGES IN THIS VERSION:

1. Updated Room Data Sheets:
 - a) Pharmacy Service pg 6-123 – Modified Note 2: Dual Purpose Anteroom.
 - i) “airlock” was removed.
 - ii) “anteroom” replaced “airlock”.
 - b) Pharmacy Service pg 6-124 – Modified
 - i) Title, “USP 800 Anteroom Lock for Oncology Buffer”
 - (1) “Air lock” was removed.
 - (2) “Anteroom” replaced “Air lock”.
 - ii) Note 2: General
 - (1) “air lock is placed between the ante space and the oncology buffer and it” was removed.
 - (2) “the Anteroom” replaced “air lock is placed between the ante space and the oncology buffer and it”.

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DATE OF THIS VERSION:

March 1, 2022

TITLE OF DOCUMENT:

PG-18-10 HVAC Design Manual

DATE OF VERSION BEING SUPERSEDED (old):

November 1, 2021

DESCRIPTION OF DOCUMENT (previous title, number, other identifying data):

PG-18-10 HVAC Design Manual

SUMMARY OF CHANGES IN THIS VERSION:

Chapter 2 – Changes:

2.3.1.2. Acoustic Mitigation Measures – HVAC Interior Systems, prohibited use of duct lining.

2.3.1.4 Unitary Equipment, prohibited use of duct lining.

Chapter 3 – Changes:

3.2.2.13 Filtration, Table 3-2 Filter Schedule, added After Filter.

3.7.1.6 Flexible Ducts, restricts the use of flexible ducts.

Chapter 6 – Changes:

AHU System Data Sheets:

- SURGICAL SUITE – Restricted use of acoustic sound lining, and modified supply air requirements.
- NON-PATIENT CARE AREAS – Modified prefilter requirements.

Room Data Sheets:

- NON-PATIENT ROOMS – Modified Note 2.
- STERILE PROCESSING SERVICE – Modified room names for SRS05 and SRS04.

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U.S. Department of Veterans Affairs ♦ Office of Construction & Facilities Management

DATE OF THIS VERSION:

November 1, 2021

TITLE OF DOCUMENT:

PG-18-10 HVAC Design Manual

DATE OF VERSION BEING SUPERSEDED (old):

November 1, 2017

DESCRIPTION OF DOCUMENT (previous title, number, other identifying data):

This update includes changes to various HVAC requirements in response to COVID-19 and similar pandemics. This version also includes other miscellaneous edits throughout the manual relating to dispersion analysis, rooftop air handling units, constant volume systems, fan coil units, energy recovery wheels, indoor design relative humidity, pressure differential, air balance/airflow relationship diagram, and room data sheets.

SUMMARY OF CHANGES IN THIS VERSION:

INTRODUCTION – Changes:

- Reworded the first paragraph to inform users of COVID-19 changes in the November 1, 2021 version of this manual.

Chapter 2 – Changes:

2.3.2.1

- Provided further clarification on “DISPERSION ANALYSIS” requirements, including CFD modeling and wind tunnel analysis.

Chapter 3 – Changes:

3.2.1.4

- Provided more restrictions on use of rooftop air handling units.
- Replaced “Hurricane areas” with “Hurricane-Prone Regions” and updated reference to Physical Security Manual.

3.2.3.2

- Delineated further between low pressure and medium pressure constant volume systems.

3.3.1.3

- Provided more restrictions on use of fan coil units.

3.6.2.1

- Prohibited use of energy recovery wheels.

Chapter 5 – Changes:

5.7.2.1 (m)

- Deleted “Sensible and Total Enthalpy Energy Recovery Wheels” from the list.

Chapter 6 – Changes:

6.2

- Added “Dental Clinic” and “Pharmacy Compounding Suite” to the list of dedicated air handling units.

6.4

- Defined Designated Emergency Epidemic Air Handling Units.

6.5.1

- Clarified the source for some of the indoor design conditions.

6.5.1.1

- Deleted the range for indoor design temperature.

6.5.1.1 (a), (c), and (d)

- Changed humidification “Set Point” to “Design Condition”.

6.5.1.1 (g)

- Provided sizing requirements for Humidifier Capacity.

6.5.2.1 (b)

- Clarified differential pressure designations, i.e., “0”, “-”, “- -”, “+”, and “++”.

6.5.2.1 (i)

- Included requirement to provide complete air balance/airflow relationship diagram(s).

AHU System Data Sheets:

- Referenced paragraph 6.5.1.1 for Humidifier Capacity.
- AUTOPSY SUITE – Clarified the requirement for serving the area from a 100% OA AHU.
- Enhanced After-Filter filtration during emergency epidemic mode from MERV 14 to MERV 16A for the areas indicated below. Provided notes on configuring and sizing AHU components to accommodate the enhanced filtration.
 - CARDIOVASCULAR LAB SERVICE
 - ELECTROENCEPHALOGRAPHY LABORATORY (EEG) SPACES
 - EYE CLINIC SPACES
 - MENTAL HEALTH REHABILITATION TREATMENT PROGRAM FACILITY
 - NURSING WING (Enhanced filtration applicable to AHUs without 100% OA capability. See note for AHU quantities with 100% OA capability.)
 - OUTPATIENT MENTAL HEALTH SERVICES
 - PATIENT CARE AREAS
 - PHARMACY SERVICE
 - POLYTRAUMA OUTPATIENT UNIT
- Required use of air handling units capable of delivering 100% OA during emergency epidemic for the areas indicated below. Also, referred to new paragraph 6.4 DESIGNATED EMERGENCY EPIDEMIC AIR-HANDLING UNITS for detailed requirements such as AHU operation, sizing, utilities, return/relief fan(s) location, isolation dampers, and cleaning and disinfection.
 - COMMUNITY LIVING CENTER
 - DENTAL CLINIC SPACES
 - DIALYSIS TREATMENT SPACES
 - DIGESTIVE DISEASES ENDOSCOPY SUITE
 - DOMICILIARY
 - EMERGENCY CARE UNIT
 - IMAGING SERIES
 - INFECTIOUS ISOLATION ROOMS / PROTECTIVE ENVIRONMENTS
 - KITCHEN (FOOD PRODUCTION)
 - MAIN ENTRANCE LOBBY
 - INPATIENT MENTAL HEALTH UNIT
 - NURSING WING (See note for AHU quantities with 100% OA capability.)
 - POLYTRAUMA REHABILITATION CENTER INPATIENT NURSING UNIT
 - SPINAL CORD INJURY/DISORDERS CENTER
 - SURGICAL SUITE
- For the following areas, required use of dedicated AHU if the non-dedicated AHU is not capable of operating at 100% OA during emergency epidemic mode, or if the AHU does not meet the requirements of the hours of operation and filtration:
 - COMMUNITY LIVING CENTER
 - DIALYSIS TREATMENT SPACES
 - DIGESTIVE DISEASES ENDOSCOPY SUITE
 - DOMICILIARY
 - INFECTIOUS ISOLATION ROOMS / PROTECTIVE ENVIRONMENTS
 - INPATIENT MENTAL HEALTH UNIT
- DENTAL CLINIC SPACES – Required dedicated AHU.
- NURSING WING - Recommended use of a set of double doors as entry vestibule at each entry into the designated Emergency Epidemic Nursing Unit. Provided requirements for vestibule air pressurization, airflow rate, and pressure monitoring devices.

- SURGICAL SUITE – Required four return air inlets in lieu of two in operating rooms and cystoscopy rooms. Also, referenced paragraph 6.5.2 AIR BALANCE for space pressure differential control.
- NON-PATIENT CARE AREAS – Enhanced AHU filtration by requiring MERV 14 in lieu of MERV 11 for PF-2 filter.

Room Data Sheets:

- Raised minimum indoor relative humidity level to 30% everywhere previously indicated as 20%.
- AUTOPSY SUITE:
 - Autopsy Room - Changed MIN OA ACH from 2 to 12.
 - Gross Specimen Storage Room - Changed MIN OA ACH from 2 to 6.
- DENTAL CLINIC:
 - Sterile Instrument Storage - Changed cooling and heating indoor temperatures from 70 F and 70 F to 66 F and 72 F, respectively.
- STERILE PROCESSING SERVICE:
 - Sterile Durables Storage & Sterile Storage - Changed cooling and heating indoor temperatures from 70 F and 70 F to 66 F and 72 F, respectively.

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DATE OF THIS VERSION:

March 1, 2020

TITLE OF DOCUMENT:

VA HVAC Design Manual

DATE OF VERSION BEING SUPERSEDED (old):

November 1, 2017

DESCRIPTION OF DOCUMENT (previous title, number, other identifying data):

This update includes minor edits throughout the manual.

SUMMARY OF CHANGES IN THIS VERSION:

Table of Contents – Changes:

3.6

- Updated the title of this section.

Chapter 2 – Changes:

2.2.4.3

- Replaced “VAV box” with “air terminal boxes”.

Chapter 3 – Changes:

Chapter 3: Table of Contents:

- 3.6 – Replaced “HEAT” with “ENERGY”.
- 3.6.4 - Replaced “HEAT” with “ENERGY”.

3.1

- Replaced “Heat” with “Energy”.

3.2.3.2

- Clarified the required components for medium pressure constant volume systems.

3.5.1

- Replaced “heat” with “energy”.

3.6.2.2

- Added fixed membrane heat exchanger as allowable sensible and latent heat transfer device.

3.6

- Replaced “HEAT” and “heat” with “ENERGY” and “energy”, respectively.

3.6.1.1

- Reworded “Runaround” to “Run-around”.

3.6.2.1

- Replaced “heat” with “energy”.

3.6.3

- Replaced “heat” with “energy”.

3.6.4

- Replaced “HEAT” and “heat” with “ENERGY” and “energy”, respectively.
- Replaced “not permitted” with “prohibited”.
- Added Sterile Processing Service (SPS) and Pharmacy Department Exhausts to the list of systems for which use of energy recovery systems are prohibited.
- Further clarified application of energy recovery systems.

3.7.1.2

- Provided further clarification on ductwork and equipment in surgery and pharmacy applications.

3.10.4.2 (I)

- Replaced “Heat” with “Energy”.

Chapter 4 – Changes:

4.2.1.2 (a)

- Replace “heat” with “energy”.

APPENDIX 4-A:

4-A.1

- Reword “wrap around loop heat recovery” to “run-around energy recovery”.

4-A.1.1 (d)

- Reword “Wrap Around Loop” and “Heat Recovery” to “Run-around Loop” and “Energy Recovery”, respectively.

Chapter 5 – Changes:

5.7.2.1 (m)

- Replace “Heat” and “heat” with “Energy” and “energy”, respectively.

5.8

- Replace “heat” with “energy”.

Chapter 6 – Changes:

Chapter 6 Table of Contents:

- 6.4.4 - Change the title to “ROOM DATA SHEET CLARIFICATIONS”.

6.2

- Replace “Heat” with “Energy”.
- Added a paragraph to relax of the requirements for dedicated air handling units in smaller facilities.

6.4.2.1 b

- Provided further clarification on the design intent.

6.4.2.1 h

- Corrected a minor typo.

6.4.2.2 e

- Removed the last sentence and provided a new sentence to clarify the requirements for CV terminal units.

6.4.4

- Replaced the entire paragraph to include all the room air designations used in the room data sheets.
- Provided clarification on Minimum Outside Air.
- Provided clarification on the use of Differential Pressure Monitoring Devices.

DEDICATED AHU SYSTEM DATA SHEETS AND ROOM DATA SHEETS:

- Provided minor update to all AHU Data Sheets.
- Provided minor updates to the Room Data Sheets for the following medical departments:
 - CENTRAL LAUNDRY FACILITY
 - DIGESTIVE DISEASES ENDOSCOPY SUITE
 - INFECTIOUS ISOLATION AND PROTECTIVE ENVIRONMENT
 - NURSING WING

- PATIENT EXAMINATION, TREATMENT, AND PROCEDURE ROOMS
- PHARMACY SERVICE
- PULMONARY MEDICINE SERVICE
- SPINAL CORD INJURY/DISORDERS CENTER
- STERILE PROCESSING SERVICE
- SURGICAL SUITE

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U.S. Department of Veterans Affairs ♦ Office of Construction & Facilities Management

DATE OF THIS REVISION

May 1, 2019

TITLE OF DOCUMENT (new title if applicable):

VA HVAC Design Manual

DATE OF VERSION BEING REVISED:

November 1, 2017

DESCRIPTION OF DOCUMENT (previous title, number, other identifying data):

This is a minor update of the 2017 HVAC Design Manual to correct errata.

SUMMARY OF CHANGES IN THIS VERSION:

1. Page 7-4 was updated to correct the summer wet bulb temperature in Washington DC.

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DATE OF THIS VERSION:

November 1, 2017

TITLE OF DOCUMENT:

2017 HVAC Design Manual

DATE OF VERSION BEING SUPERSEDED (old):

March 1, 2011

DESCRIPTION OF DOCUMENT (previous title, number, other identifying data):

VA 2011 HVAC Design Manual for New, Replacement, Additions, and Renovations of Existing VA Facilities (March 2011 with Amendments A and B); HVAC Design Manual for Community Living Centers and Domiciliary (March 2011)

SUMMARY OF CHANGES IN THIS VERSION:

1. The new 2017 HVAC Design Manual is a consolidation of the 2011 HVAC Design Manual for New, Replacement, Additions, and Renovations of Existing VA Facilities (March 2011 with Amendments A and B), and HVAC Design Manual for Community Living Centers and Domiciliary (March 2011). Use of this manual will result in meeting the primary objective of providing environmental comfort to patients, staff, and visitors. These manuals are revised so as to combine both documents into one comprehensive manual and to incorporate changes generally resulting from the following:
 - International Building Code (IBC) Including IMC and IPC
 - ASHRAE Standard 170 – 2013 (Ventilation of Health Care Facilities)
 - HVAC Design Criteria Revisions – Surgery Suite, SPS Suite, Animal Research, Procedure Rooms, etc.
 - Coordination with Current VA Design Guides, VHA Directives, Miscellaneous Corrections and Users' Input and requirements of VA Sustainable Design Manual

- Addition of Requirements for Central Laundries, Warehouses, and Office Buildings
2. The new HVAC Manual revisions are made to rearrange the text sections to improve the flow of the text, to change words for clarity, and to respond to comments regarding improvements.
 - Updated references to latest energy design guidance, codes and technologies. The Manual is in compliance with all applicable safety standards, meets the Section 508 of the Rehabilitation Act of 1973 requirements, compatible with SEPS and includes prescribed noise and vibration levels. Revised all embedded HTML links to referenced documents in the VA Technical Information Library (TIL) and revised and updated cover sheet.
 3. Significant updates to all chapters (1-8). See attached chapter summaries. These summaries indicate significant items for each chapter and are not all inclusive.

Chapter 1 – Changes:

General:

- Updated references, codes, and standards throughout the chapter.
- Re-organized the list of VA Standards under paragraph 1.7 to show standards in numerical / alphabetical order.
- Added current documents to the list of VA Standards under paragraph 1.7.

The following highlights the more significant changes made to the chapter:

1.1

- Updated the synopsis on this paragraph to reflect the more significant changes.
- Clarified / reinforced the definition of “the VA Authority”.
- Added the list of required deliverables as well as a request for deviation from the manual.

1.2.1

- Updated to match the current Federal Energy Program administrative requirements for new construction.

1.2.2

- Updated to match the current Federal Energy Program administrative requirements for major renovations.

1.3.3

- Clarified and verified TLCC requirements. The A/E is now directed to use the NIST Manual.

1.6

- Added references to the VA Whole Building Commissioning Process Manual and Sustainable Design Manual.
- Added all the VA Design Guides.
- Reorganized the references.

Chapter 2 – Changes:

General:

- Updated references, codes, and standards throughout the chapter.

The following highlights the more significant changes made to the chapter:

2.1

- Condensed introduction information.

2.2.1.1

- Expanded and clarified the list and use of outside weather conditions for load calculations.

2.2.1.2

- Expanded and clarified the list and use of outside weather conditions for mixed air calculations.

2.2.3.2

- Provided additional directions for calculating occupant heat loads.
- Added directions for the calculating animal heat loads in laboratories.

2.2.3.3

- Added requirement for submitting a list of equipment with associated heat dissipation for each space.

2.2.3.5

- Updated the list of ventilation criteria.
- Provided additional requirements for building pressure calculation.
- Provided additional requirements for calculating building air balance and added new Table 2-1.
- Renamed existing Table 2-1 and Table 2-2, and added columns for minimum airflow and maximum reheat temperature.

2.2.4

- Provided criteria for determining the suitability of load and energy calculation software.

2.2.4.4

- Clarified air handling unit sizing and removed duplicated information.

2.2.5.2

- Provided additional spaces to the list of Individually Temperature Controlled Spaces.

2.2.5.4

- Clarified the definition of “exterior zone.”

2.2.6.2

- Added wall radiant panels to the list of allowed perimeter heating systems.
- Increased requirements for sequencing cooling and perimeter heating.

2.2.6.3

- Provided further clarification on the use of hot water as heating medium.

2.3.1.2

- Modified requirements for interior HVAC systems acoustical analysis.
- Added requirement for reactive sound attenuation.

2.3.1.3

- Modified requirements for exterior equipment analysis.

2.3.2.1

- Made dispersion analysis mandatory for all projects that affect exhaust or intake.
- Defined the type of dispersion analysis required.
- Added ASHRAE reference and acceptable software.

2.5

- Deleted the paragraph relating to the building thermal envelope to avoid information duplication.

2.6.1

- Clarified the required references.
- Provided additional scope of services.

2.6.2

- Clarified the required references.
- Provided additional scope of services.

2.6.3

- Clarified the required references.
- Provided additional scope of services.

2.6.4

- Clarified the required references.
- Provided additional scope of services.

2.7.1

- Added references.

2.7.2.1

- Added instruction to design for maintainability.

2.7.2.2

- Added the requirement for equipment maintainability.

2.7.2.6

- Updated requirement for elevator shaft venting.

2.8.1.3

- Added and defined requirements for pre-design TAB.
- Defined pre-design TAB report requirements.

2.8.2.1

- Provided more directions for the use of existing radiators when possible.

2.8.2.2

- Added prohibition of dual duct systems for HVAC system replacements and new facilities.

2.8.2.4 (NEW)

- Clarified / expanded requirements for re-using existing ductwork.

2.8.2.4 (OLD)

- Deleted the paragraph.

2.9.1

- Added phasing requirements.

2.11.2

- Updated design guidelines for outside air intakes.

Chapter 3 – Changes:

General:

- Updated references, codes, and standards throughout the chapter.
- Included additional Heat Recovery Systems.
- Moved Air Distribution Systems design criteria from section 3.10 to section 3.7.
- Moved Exhaust Systems from section 3.7 to section 3.8.
- Moved Fume Hoods from section 3.8 to section 3.10.
- Moved Biological Safety Cabinets (BSC) from section 3.9 to section 3.11.
- Referenced chapter 4- section 4.4 for the application of electric heating coils.

The following highlights the more significant changes made to the chapter:

3.1:

- Replaced Minimum Ventilation Air Handling Units (100% Outdoor Air) with Dedicated Outdoor Air Systems (DOAS).
- Added limitations to the use of Rooftop Air Handling Units (3.2.1.4).

3.2.1.1

- Included additional information and requirements for a LCCA.

3.2.1.3

- Updated figure 3-1 to reflect changes in AHU configuration.

3.2.1.4

- Added limitations to the use of RTUs in extreme weather locations.

3.2.2.1

- Updated information regarding plenum fans.

3.2.2.5

- Updated AHU casing to require foam injected insulation.

3.2.2.7

- Provided clarification and further guidance on use of blender section.

3.2.2.9

- Added requirement for stainless steel cooling coil support frames.

3.2.2.14

- Added clarification on when to utilize boiler plant steam for humidification.

3.2.3.1

- Added requirements for single zone VAV air handling units.

3.2.3.3

- Changed minimum flow for VAV terminals to a minimum heating capacity.

3.3.1

- Terminal cooling systems: Use of radiant (cooling) panels, chilled beams (active and passive) and valance systems are now allowed with the approval from the VA Authority.

3.3.2.3

- Changed filtration reference to room data sheets in chapter 6.

3.5

- Increased largest single square diffuser to 600 cfm.

3.6.2.2

- Added fixed membrane heat exchanger as allowable sensible and latent heat transfer device.

3.7

- Added reference to NFPA 90A for compliance.

3.7.1.10

- Updated duct sizing criteria table.

3.9

- Added the new section to cover Laboratories and Animal Facilities.

3.10

- Updated requirements for fume hoods.

Chapter 4 – Changes:

General:

- Updated references, codes, and standards throughout the chapter.

The following highlights the more significant changes made to the chapter:

4.2.1.1

- Rearranged content and added information regarding small chiller plants.

4.2.1.2

- Updated requirements for chilled water optimization study.
- Updated list of acceptable refrigerants based on current industry positions.

4.2.1.3

- Clarified Chilled Water Plant sizing requirements.
- Added information regarding special cooling applications.

4.2.1.5

- Re-defined N+1 to include system components and piping arrangements.

4.2.1.6

- Provided additional information regarding small chillers and associated minimum chilled water system volume requirement.

4.2.1.7

- Added a new paragraph relating to process chillers.

4.2.1.8 (OLD)

- Deleted table from ASHRAE 90.1.

4.2.2 (NEW)

- Provided guidance on sustainable practices, and system reliability and maintainability.

4.2.3.1

- Added a requirement to furnish NPSHA calculations with design analysis.

4.2.3.2

- Expanded selection criteria and other design requirements for cooling towers.

4.2.3.3

- Expanded chilled water treatment system requirements.

4.2.3.4

- Expanded condenser water treatment system requirements.

4.2.4.1

- Clarified ASHRAE Standard 90.1 requirements.

4.2.5.1

- Clarified use of glycol solution for chilled water system application.

4.2.5.2

- Included more potential options for freeze protection.

4.3.3.2:

- Added a requirement for multiple compressors in DX systems.
- Added hot gas controls considerations.
- Added low ambient control considerations.

4.3.3.4

- Added requirements for Sustainability and Serviceability.

4.4

- Added reference to the Steam Heating, Hot Water, and Outside Distribution System Design Manuals.

4.4.1.3

- Updated suggested steam operating pressures.
- Added a requirement for a steam pressure reduction strategy.

4.4.2

- Updated requirements for Steam Heating, Hot Water, and Outside Distribution systems.

4.4.2.3

- Removed information regarding hot water boilers and referenced the Steam Heating, Hot Water, and Outside Distribution System Design Manuals.

4.4.2.4

- Changed recommended heating water temperature upper range to 180 F.

4.4.2.8

- Added requirements for Sustainability and Serviceability.

4.4.3.1

- Added a requirement for written approval from the VA Authority for the use of electric resistance heaters.

4.4.4.1

- Added a requirement for written approval from the VA Authority for the use of natural gas or LPG as a direct heating source.

4.4.5

- Removed language regarding Geothermal heating. Provided further guidance on the use of Geothermal systems.

4.5.2

- Added steam pipe sizing criteria table.

Figure 4-5

- Added steam to hot water hydronic hot water distribution figure.

Figure 4-6

- Updated Hydronic Hot Water Distribution figure.

Chapter 5 – Changes:

5.1

- Added requirements and level of AE coordination with the VA Medical Center Representative.
- Added various DDC Controls Options and potential site specific LAN Options.

5.5.1

- Prohibited pneumatic actuators except when rebuilding existing actuators.
- Added information regarding selection of actuators and their normal position.

5.5.2

- Added a requirement to coordinate with the specifications for control valves selection.
- Added information regarding types of valves (modulating vs open-close).

5.5.3

- Added selection criteria for damper type.
- Added sizing criteria for proper damper control authority.

5.5.4

- Added requirements for the use of end switches.

5.5.5

- Added general information about the application of alarms and safeties.
- Added a list of required alarms and safeties.

5.5.6

- Added requirements for control wiring type and installation.

5.5.7

- Added design requirements for air flow measurement stations.

5.5.9

- Deleted prescriptive PC computer hardware information.
- Added a requirement to refer to VA specifications for Controls PC and associated hardware.

5.5.10

- Deleted prescriptive laptop computer hardware information.
- Added a requirement for the laptop computer to match the PC specifications.

5.5.15

- Added requirements for equipment status monitoring.

5.5.16

- Added recommendations for type and location of space temperature sensors.

5.6

- Added design requirements for relative humidity measurement and control.

5.6.1

- Added requirements for metering systems.

5.7.2 .1 f

- Added Integral Face and Bypass coil control.

5.7.2.1 i

- Added demand control ventilation.
- Added minimum outside air damper control.

5.7.2.1 k

- Added missing filter alarm.
- Added filter Maintenance alarms.

5.7.2.1 m

- Added heat recovery wheels.
- Added bypass system for heat recovery.

5.7.2.1 n

- Added desiccant systems.

5.7.2.1 o

- Added special systems.

5.7.3 c

- Added additional control points for boiler systems.

5.8

- Added suggestions on medical center level control standardization.

Chapter 6 – Changes:

General:

- Updated references, codes, and standards throughout the chapter.
- Reorganized the room and air handling unit data sheets to be alphabetical by clinical / support function.
- Revised HVAC Room Data Sheets to include spaces from VA Design Guides and PG 18-9, with HVAC design criteria from the following:
 - VA Design Guides and Directives
 - ASHRAE Standard 170-2013
 - Coordination with SMEs
- Added Room Data Sheets for animal laboratories and main laundries, with reference to sources outside the VA. Design criteria was applied from:
 - ASHRAE Standard 170-2013
 - American Association for Accreditation of Laboratory Animal Care (AAALAC)
 - Coordination with SMEs
- Deleted SPS (formerly SPD) air flow schematic.
- Added air flow schematic for SPS and other spaces with significant pressure gradient requirements.

The following highlights the more significant changes.

6.1

- Modified to match the revised space organization.

6.2

- Added a paragraph to relax of the requirements for dedicated air handling units in smaller facilities.

6.3

- Expanded the paragraph to relax of the requirements for dedicated air handling units in smaller facilities

6.4.1.1

- Clarified the general intent of indoor design temperatures.
- Clarified the general intent of indoor design relative humidity.
- Clarified the general intent of indoor relative humidity control scheme (sequence).

6.4.2.2 c

- Expanded paragraph to require designers to consider construction type when designing space pressurization systems.
- Clarified the intent of pressure and directional air control.

Chapter 7 – Changes:

General:

- Verified and updated weather data to match ASHRAE Handbook of Fundamentals 2013.
- Added locations for new facilities (closest ASHRAE Handbook of Fundamentals 2013 locations used in all cases).
- Replaced old data from Army TM 5-785 with ASHRAE Data.

Chapter 8 – Changes:

General:

- Updated Abbreviations.