



# HVAC DESIGN MANUAL

## For:

- New Hospitals
- Replacement Hospitals
- Ambulatory Care
- Clinical Additions
- Energy Centers
- Outpatient Clinics
- Animal Research Facilities
- Laboratory Buildings

### Department of Veterans Affairs



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**AMENDMENT B to**  
**HVAC Design Manual - March 2011**

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**1**

**Introduction**

These changes primarily affect the room data sheets in Chapter 6 for three different areas. The main purpose for the alterations is to update the rooms in question to reflect changes in ASHRAE Standards.

**2**

**Summary of Changes**

**Spinal Cord Injury/Disorders Center**

- (a) Revised the Room Data Sheets for the following rooms:
  - 1. Multipurpose Room (Page 6-64)
  - 2. Therapeutic Pool – Female Dressing Room (Page 6-66)
  - 3. Therapeutic Pool – Male Dressing Room (Page 6-66)

**Supply, Processing and Distribution (SPD)**

- (a) Revised the Room Data Sheet for the following rooms:
  - 1. Bulk Storage Room (Page 6-72).
  - 2. ETO Sterilizer/Aerator Room (Page 6-73).
  - 3. Decontamination Area (Page 6-76)
- (b) SPD AHU System Data Sheet included for completion purposes.

**Common AHU Room Data Sheet Patient Examination, Treatment, and Procedure Rooms**

- (a) Revised the room data sheets for Special Procedure Rooms (Pages 6-93 and 6-93a)

SPINAL CORD INJURY/DISORDERS CENTER - ROOM DATA SHEET														
ROOM NAME	INDOOR TEMPERATURE				INDOOR RELATIVE HUMIDITY		MIN TOTAL ACH	MIN OA ACH	ROOM AIR	MAX NOISE LEVEL NC	ROOM AIR BALANCE	INDIVIDUAL ROOM CONTROL		
	COOLING		HEATING		% RH MAX	% RH MIN			RETURN EXHAUST (G) EXHAUST (S)			TEMP	FLOW	
	F	C	F	C										
Multipurpose Room	72	22	82	28	60	20	6	2	Exhaust (G)	40	(o)	Yes	VAV	
<b>Note 1 - Room Temperature Control</b> Where the room is equipped with folding partitions, provide individual room temperature control on either side of the partition.														
<b>Note 2 - Energy Conservation Initiative</b> Evaluate the feasibility of using a carbon-dioxide (CO <sub>2</sub> ) and/or occupancy sensor to conserve energy during part load conditions. The control sequence shall be project-specific.														
Nourishment Kitchen	NA	NA	NA	NA	NA	NA	6	NA	Exhaust (G)	40	(-)	No	CV	
<b>Note 1 - Exhaust System</b> Connect exhaust to a common general exhaust system. Provide 100% transfer air for the exhaust from the adjoining space.														
Nurse Station/Ward Clerk	72	22	82	28	60	20	6	2	Return	40	(o)	Yes	VAV	
<b>Note - None</b>														
Outpatient Urodynamics Clinic Clean Utility Room	NA	NA	NA	NA	NA	NA	4	NA	Return	35	(+)	No	CV	
<b>Note 1 - Room Air Balance</b> Provide supply air from adjoining air terminal unit.														
Patient (Litter) Bathroom	75	24	70	21	NA	NA	15	NA	Exhaust (G)	40	(-)	Yes	CV	
<b>Note 1 - Exhaust System</b> Connect the room exhaust to a common general exhaust system. Transfer air from adjoining spaces to maintain negative air balance.														
Resident Dining/Serving	72	22	82	28	60	20	6	2	Return	40	(-)	Yes	VAV	
<b>Note - None</b>														
Resident Storage	72	22	82	28	60	20	4	NA	Exhaust (G)	40	(-)	Yes	CV	
<b>Note 1 - Room Temperature Control and Air Balance</b> Room temperature control is optional; can be served by a common terminal unit. Transfer air from adjoining space for negative balance.														

SPINAL CORD INJURY/DISORDERS CENTER - ROOM DATA SHEET														
ROOM NAME	INDOOR TEMPERATURE				INDOOR RELATIVE HUMIDITY		MIN TOTAL ACH	MIN OA ACH	ROOM AIR	MAX NOISE LEVEL NC	ROOM AIR BALANCE	INDIVIDUAL ROOM CONTROL		
	COOLING		HEATING		% RH MAX	% RH MIN			RETURN EXHAUST (G) EXHAUST (S)			TEMP	FLOW	
		F	C	F	C									
Therapeutic Pool - Female Dressing Room	78	26	82	28	NA	NA	6	2	Exhaust (G)	40	(-)	Yes	CV	
<b>Note 1 - Supply Air Volume</b> Adjust supply and transfer air volumes as required to meet the exhaust requirements of the shower, toilet, and lockers.														
Therapeutic Pool - Male Dressing Room	78	26	82	28	NA	NA	6	2	Exhaust (G)	40	(-)	Yes	CV	
<b>Note 1 - Supply Air Volume</b> Adjust supply and transfer air volumes as required to meet the exhaust requirements of the shower, toilet, and lockers.														
<b>Therapy Rooms</b>														
Kinesiotherapy Treatment Clinic	72	22	82	28	60	20	6	2	Return	40	(o)	Yes	VAV	
Occupational Therapy	72	22	82	28	60	20	6	2	Return	40	(o)	Yes	VAV	
Physical/Kinesiology Therapy 30 Beds	72	22	82	28	62	20	6	2	Return	40	(o)	Yes	VAV	
Physical/Kinesiology Therapy 60 Beds	72	22	82	28	62	20	6	2	Return	40	(o)	Yes	VAV	
Physical Therapy Treatment Clinic	72	22	82	28	60	20	6	2	Return	40	(o)	Yes	VAV	
<b>Note - None</b>														
Transfer Equipment Storage	78	26	70	21	NA	NA	4	NA	Exhaust (G)	40	(-)	Yes	CV	
<b>Note 1 - Exhaust System</b> Connect exhaust to a general exhaust system serving other spaces. Transfer air from the adjoining spaces to maintain negative air balance.														
<b>Note 2 - Room Temperature Control</b> Individual room temperature control is optional. The room can be served by a common air terminal unit with similar load characteristics.														

SPD CLEAN - ROOM DATA SHEET													
ROOM NAME	INDOOR TEMPERATURE				INDOOR RELATIVE HUMIDITY		MIN TOTAL ACH	MIN OA ACH	ROOM AIR	MAX NOISE LEVEL NC	ROOM AIR BALANCE	INDIVIDUAL ROOM CONTROL	
	COOLING		HEATING		% RH MAX	% RH MIN			RETURN EXHAUST (G) EXHAUST (S)			TEMP	FLOW
	F	C	F	C									
<b>General:</b> The rooms and their relative locations with adjoining spaces are based on information given in the VA Design Guide for the SPD Service dated February 2010.													
Ante Room	NA	NA	NA	NA	NA	NA	10	10	Exhaust (G)	40	(+)	No	CV
<b>Note 1 - Room Air Balance</b> Provide supply air from an adjoining air terminal unit, as individual room temperature control is not required. Direct air flow towards exterior doors. Do not exhaust air from this room.													
Assistant Chief	75	24	70	21	60	20	4	4	Exhaust (G)	35	(o)	Yes	CV
<b>Note - None</b>													
Bulk Storage	73	23	73	23	60	20	4	4	Exhaust (G)	40	(o)	Yes	CV
<b>Note 1 - None</b>													
Case Cart Holding	72	22	72	22	60	20	4	4	Exhaust (G)	40	(+)	Yes	CV
<b>Note 1 - None</b>													
Chief	75	24	70	21	60	20	4	4	Exhaust (G)	35	(o)	Yes	CV
<b>Note - None</b>													
Clean HAC	NA	NA	NA	NA	NA	NA	10	10	Exhaust (G)	40	(- -)	No	CV
<b>Note 1 - Room Air Exhaust</b> Use 100% transfer air from the clean areas to exhaust the HAC.													
Clean Lockers - Men	NA	NA	NA	NA	NA	NA	6	6	Exhaust (G)	40	(-)	No	CV
<b>Note 1 - Room Air Balance</b> Maintain locker rooms under negative air balance with respect to PPE and positive air balance with respect to the connecting Clean Toilet/Shower - Men.													

SPD CLEAN - ROOM DATA SHEET

Room Name	Indoor Temperature				Indoor Relative Humidity		Min Total ACH	Min OA ACH	Room Air	Max Noise Level NC	Room Air Balance	Individual Room Control	
	Cooling		Heating		% RH Max	% RH Min			Return			Temp	Flow
	F	C	F	C					Exhaust (G) Exhaust (S)				
Clean Lockers - Women	NA	NA	NA	NA	NA	NA	6	6	Exhaust (G)	40	(-)	No	CV
<b>Note 1- Room Air Balance</b> Maintain locker rooms under negative air balance with respect to PPE and positive air balance with respect to the connecting Clean Toilet/Showers - Women.													
Clean Toilet/Showers - Men	NA	NA	NA	NA	NA	NA	10	10	Exhaust (G)	40	(--)	No	CV
<b>Note 1- Room Air Balance</b> Do not provide supply air to the toilet. Exhaust this space using 100% transfer air from the adjoining Clean Lockers - Men.													
Clean Toilet/Showers - Women	NA	NA	NA	NA	NA	NA	10	10	Exhaust (G)	40	(--)	No	CV
<b>Note 1- Room Air Balance</b> Do not provide supply air to the toilet. Exhaust this space using 100% transfer air from the adjoining Clean Lockers - Women.													
Dispatch Area	75	24	70	21	60	20	4	4	Exhaust (G)	40	(o)	Yes	CV
<b>Note - None</b>													
ETO Sterilizer/Aerator Room	72	22	72	22	60	20	10	10	Exhaust (S)	40	(-)	Yes	CV
<b>Note 1 - General</b> Provide a dedicated exhaust system to serve the ETO Sterilizer Room and abator. See AHU System Data Sheet for details. Provide transfer air from the Preparation, Assembly, and Sterilization Area to maintain negative air balance.													
<b>Note 2 - Flammable Storage Cabinet</b> Provide exhaust ventilation through the flammable storage cabinet (approximately 50 CFM [24 L/s]). The cabinet exhaust shall be connected to the ETO exhaust system. Ensure compliance with NFPA 30 and applicable OSHA Regulations.													
<b>Note 3 - Alarms and Controls</b> Provide an alarm panel outside the ETO Sterilizer Room to sound a local alarm and remote alarm at the ECC in the event of loss or interruption of exhaust airflow. Integrate ETO gas leakage alarm with the exhaust system alarm.													
First Clerk Office	NA	NA	NA	NA	NA	NA	4	4	Exhaust (G)	40	(o)	No	CV
<b>Note 1 - Room Air Balance</b> Provide supply air from an adjoining air terminal unit.													

# SPD SOILED (DIRTY) - ROOM DATA SHEET

ROOM NAME	INDOOR TEMPERATURE				INDOOR RELATIVE HUMIDITY		MIN TOTAL ACH	MIN OA ACH	ROOM AIR	MAX NOISE LEVEL NC	ROOM AIR BALANCE	INDIVIDUAL ROOM CONTROL	
	COOLING		HEATING		% RH	% RH			RETURN			TEMP	FLOW
	F	C	F	C	MAX	MIN			EXHAUST (G) EXHAUST (S)				
<b>General:</b> The rooms and their relative locations with adjoining spaces are based on information given in the VA Design Guide for the SPD Service dated February 2010.													
Automatic Cart Washer	NA	NA	NA	NA	NA	NA	10	10	Exhaust (S)	45	(-)	No	CV
<b>Note 1 - Special Exhaust System</b> See Manual Equipment Wash.													
Decontamination Ante Room	NA	NA	NA	NA	NA	NA	10	10	No	40	(+)	No	CV
<b>Note 1 - Room Air Balance</b> Provide supply air from an adjoining air terminal unit, as individual room temperature control is not required. Direct air flow towards interior doors. Do not exhaust air from this room.													
Decontamination Area	72	22	68	20	60	20	6	6	Exhaust (G)	40	(-)	Yes	CV
<b>Note 1 - Room Air Changes per Hour</b> Minimum (total and outdoor) air changes specified for this room are based on ASHRAE Standard 170 - 2008. Actual air changes may vary based on the transfer air requirements of the adjoining spaces, cooling load to meet the space temperature, and transfer air from the adjoining spaces to maintain negative air balance.													
<b>Note 2 - Room Air Balance</b> Provide simple devices, such as, ball-in-tube or flutter strips to show airflow direction. Devices shall be installed between the Decontamination Area and the following rooms: Decontamination Ante Room, Preparation, Assembly, and Sterilization Area, and Decontamination/Ante Room/PPE. Provide airflow control valves in the exhaust air ducts to measure and monitor the design air balance.													
<b>Note 3 - Room temperature</b> The constant volume air terminal unit will be set up such that when the cooling set point is 72° F [22° C] the reheat will not activate until the room temperature reaches 68° F [20° C].													
Decontamination HAC	NA	NA	NA	NA	NA	NA	10	10	Exhaust (G)	40	(- -)	No	CV
<b>Note 1 - Room Air Balance</b> Use 100% transfer air from the Decontamination Area to exhaust this room.													

SUPPLY PROCESSING AND DISTRIBUTION (SPD) - AIR HANDLING UNIT	
AHU System Data Sheet	
Air Handling Type	Constant Volume
Indoor Design Temperature	Room Data Sheets
Indoor Design Relative Humidity	Room Data Sheets
Minimum Total Air Changes Per Hour	Room Data Sheets
Minimum Outdoor Air Changes Per Hour	100%
Return Air Permitted	No
Exhaust Air Required	Yes
Air Economizer Cycle Required	No
Heat Recovery System Required	ASHRAE Standard 90.1 - 2007
Filtration - Pre-Filters (PF-1 and PF-2)	PF 1 = MERV 7 and PF 2 = MERV 11
Filtration - After-Filter (AF)	AF = MERV 14
Cooling Source	Chilled Water
Heating Source	Steam and/or Hot Water
Humidification Source	Plant Steam or "Clean Steam"
General Exhaust System Required	Yes
Special Exhaust System Required	Yes
Emergency Power Required	Yes
Individual Room Temperature Control Required	Room Data Sheets
Room Air Balance	Room Data Sheets
<b>Note 1 - General Coordination</b>	
Coordinate equipment heat gain and utility requirements with the selected equipment. The abator is supplied with the ETO Sterilizer. Mechanical drawings shall indicate duct, pipe and utility connections.	
<b>Note 2 - General Exhaust System</b>	
Provide a dedicated, general exhaust system for the spaces identified in the Room Data Sheets.	
<b>Note 3 - Wet Exhaust System</b>	
Provide a dedicated (space) exhaust system for the Manual Equipment Wash and Automatic Cart Washer Rooms.	
<b>Note 4 - Wet Exhaust System (Automatic Cart Wash Equipment)</b>	
Provide a dedicated (equipment) exhaust system for the Automatic Cart Wash Equipment. The system capacity shall be based on the actual selected equipment.	



## SUPPLY PROCESSING AND DISTRIBUTION (SPD) - AIR HANDLING UNIT

### AHU System Data Sheet

#### Note 5 - Ethylene Oxide (ETO) Exhaust System

##### (a) General - New Construction and Major Renovations of the SPD Department

Per VHA (Veterans Health Administration) Directive, under processing and concurrence, the following measures shall be implemented:

For all new construction and major renovations, provide an Abator for each Ethylene Oxide (ETO) sterilizer to convert the ETO exhaust into water vapor and carbon-dioxide. Per Directive in all existing ETO sterilizer installations, abators shall be installed by 2015. No ETO sterilizers shall be used without abators after 2015.

##### (b) Abator

Abator is a pollution control device. Vent line from each ETO sterilizer is connected to its own abator to split ethylene oxide into water vapor and carbon-oxide by an exothermic reaction. Per VHA direction, each sterilizer shall be equipped with its own abator to avoid a single point of failure and facilitate on-line maintenance.

##### (c) Exhaust System

The dedicated exhaust system serving the ethylene oxide sterilizer installation shall include exhaust through the sterilizer room, abator, and the flammable storage cabinet required to house the ETO canisters.

##### (d) ETO Sterilizer Room Exhaust

Exhaust through or over the sterilizer by an integral plenum is not required, as the VA Standard Operating Procedure permits opening of the sterilizer door only after the specified time limit has expired at the end of each operating cycle. Provide ceiling-mounted exhaust register over the sterilizer door to exhaust the room at 10 air changes per hour.

##### (e) Exhaust through the Abator

Each abator admits 50 cfm [24 L/s] room air through its intake nozzle and discharges it through its exhaust nozzle at very high temperature, approximately at 480 F [250 C]. Room air is mixed at the rate of 150 cfm [71 L/s] with the hot air discharge discharged by the abator to dilute the hot air. This is accomplished by a three-way mixing nozzle supplied by the equipment manufacturer.

##### (f) Exhaust through the Flammable Storage Cabinet

Admit room air into the cabinet through the cabinet doors and connect the cabinet exhaust nozzle to the exhaust system. Ensure that enough air is exhausted to create -0.06 in [-15 Pa] negative air pressure. The approximate nozzle size is 4 in [100 mm] and the exhaust air volume is 40 to 50 cfm [19 to 24 L/s].

##### (g) Abator Vent Pipe

Each abator is equipped with its own vent pipe, operative during emergency only when the intended chemical reaction to break the ETO into water and CO<sub>2</sub> does not materialize. Coordinate vent pipe size, material, fittings, and equivalent length limitations with the ETO manufacturer. Coordinate vent termination details with the equipment manufacture.

##### (h) Exhaust Fan and Ductwork

Provide a non-ferrous, spark-proof construction centrifugal fan with a backward inclined wheel. The fan motor shall be mounted outside the exhaust air stream. Maintain complete exhaust air ductwork under negative air balance. Provide an airflow control valve to ensure accurate air balance. Locate the fan and abator vent exhaust pipe at least 25 ft [8 m] from any outdoor air intake, unsealed doors and windows, driveways, and walkways. Modify the discharge requirements if so recommended by the dispersion analysis.

## SUPPLY PROCESSING AND DISTRIBUTION (SPD) - AIR HANDLING UNIT

### AHU System Data Sheet

#### **Note 6 - Air Distribution Requirements**

(a) Air distribution system design is vital to ensure contamination control. The design should demonstrate the directions and magnitude of the supply, exhaust, make-up, and relief air flows. Provide automatic airflow control valves, as required, to accomplish the design objective. It is vital to ensure that the supply air inlets and exhaust air outlets are judiciously located.

(b) See Figure 6-1, SPD Airflow, for further information.

#### **Note 7 - Automatic Controls**

##### **(a) Room Temperature Control**

Provide individual room temperature control as shown in the Room Data Sheets.

##### **(b) Room Relative Humidity Control**

Not Required.

##### **(c) Supply Air Temperature Control**

Select and control the supply air temperature to maintain 72 F [22 C] at 55% RH. While 60% RH is the maximum permissible relative humidity, base the psychometric analysis on 55% RH. Direct control of the overall space relative humidity is not required in the dehumidification mode.

##### **(d) Relative Humidity Control - Humidification Mode**

Provide a unit-mounted, central steam humidifier to control and maintain the overall space relative humidity at 30% RH by a relative humidity sensor located in the main general exhaust duct.

##### **(e) High-Limit Relative Humidity Control - Humidification Mode**

Activate high-limit relative humidity control when the overall space relative humidity exceeds 60%. Provide project-specific measures to lower the relative humidity below 60% RH.

##### **(f) High-Low Limit Controls and Alarms**

Provide high and low limit local and remote alarms and initiate the corrective actions to control high and low limit alarms. Integrate ETO sterilizer controls with the building controls using a BACNET open protocol system.

PATIENT EXAMINATION, TREATMENT, AND PROCEDURE ROOMS - ROOM DATA SHEET														
ROOM NAME	INDOOR TEMPERATURE				INDOOR RELATIVE HUMIDITY		MIN TOTAL ACH	MIN OA ACH	ROOM AIR	MAX NOISE LEVEL NC	ROOM AIR BALANCE	INDIVIDUAL ROOM CONTROL		
	COOLING		HEATING		% RH MAX	% RH MIN			RETURN EXHAUST (G) EXHAUST (S)			TEMP	FLOW	
	F	C	F	C										
Procedure Room/Class A Operating	75	24	70	21	60	20	15	3	Return	35	(+)	Yes	CV	
<b>Note 1 - Air Distribution</b> Provide overhead supply and return air distribution.														
<b>Note 2 - Room Air Balance</b> Provide negative air balance where required by the application.														
<b>Note 3 - Minimum Filter Requirement</b> Provide MERV 7 and MERV 11 pre-filter and MERV 14 after-filter.														
Pulmonary Exercise Room	75	24	70	21	60	20	10	2	Exhaust (G)	40	(-)	Yes	VAV	
Note - None														
Special Procedure Rooms														
Pentamidine Administration	73	23	68	20	60	20	12	2	Exhaust (G)	35	(-)	Yes	CV	
Bronchoscopy	73	23	68	20	60	20	12	2	Exhaust (G)	35	(-)	Yes	CV	
Sputum Collection	73	23	68	20	60	20	12	2	Exhaust (G)	35	(-)	Yes	CV	
Note - None														
Colonoscopy	73	23	68	20	60	20	6	2	Return	35	(+)	Yes	CV	
Proctoscopy	73	23	68	20	60	20	6	2	Return	35	(+)	Yes	CV	
Sigmoidoscopy	73	23	68	20	60	20	6	2	Return	35	(+)	Yes	CV	
Gastrointestinal Endoscopy Procedure	73	23	68	20	60	20	6	2	Return	35	(+)	Yes	CV	
<b>Note 1 - General</b> The above four procedures are generally performed in the same room. ASHRAE 2011 Handbook of Applications and/or ASHRAE 2008 Standard 170 and its amendments do not list all above four rooms.														
<b>Note 2 - Room Air Balance</b> (a) The above stipulation of the positive air balance (clean room environment) is based on the assumption that the instruments shall be cleaned and sterilized in a separate after the procedure. This separate cleaning room shall be maintained under negative air balance. (b) If the above procedures are performed on a patient suspected of tuberculosis or similar infectious disease, the procedure room must be maintained under negative air balance and the room air should be exhausted outdoors without mixing with any other general exhaust.														

PATIENT EXAMINATION, TREATMENT, AND PROCEDURE ROOMS - ROOM DATA SHEET													
ROOM NAME	INDOOR TEMPERATURE				INDOOR RELATIVE HUMIDITY		MIN TOTAL ACH	MIN OA ACH	ROOM AIR	MAX NOISE LEVEL NC	ROOM AIR BALANCE	INDIVIDUAL ROOM CONTROL	
	COOLING		HEATING		% RH MAX	% RH MIN			RETURN EXHAUST (G)			TEMP	FLOW
	F	C	F	C					EXHAUST (S)				
Cystoscopy	75	24	70	21	60	20	15	3	Return	35	(+)	Yes	CV
<b>Note 1 - General</b> Use the above design parameters when cystoscopy room is located outside the surgery suite (Example: Outpatient Clinic) and classified Special Procedure Room. When located within the surgery suit, the HVAC design parameters for the cystoscopy room are the same as the operating room. Refer to Page 6-83 for the cystoscopy													
Cardiac Catheterization	75	24	70	21	60	20	15	3	Return	35	(+)	Yes	CV
<b>Note - None</b>													
Fluoroscopy	75	24	70	21	60	20	8	2	Exhaust (G)	35	(-)	Yes	CV
<b>Note 1 - General</b> This room is not listed in ASHRAE Standard 170 and ASHRAE Handbook Applications. It is classified under X-Ray (Diagnostic and Treatment) and kept at neutral air balance.													
<b>Note 2 - Alternate Exhaust System</b> Provide a special exhaust system and maintain the room under negative air balance if the procedure involves the use of noxious gases and/or chemical vapors, generally contained in a hood. Coordinate hood size and type with the equipment drawings.													