1323.0403 SECTION C403, BUILDING MECHANICAL SYSTEMS.

Subpart 1. **IECC section C403.2.1 Calculation of heating and cooling loads.** IECC section C403.2.1 is amended to read as follows:

> **C403.2.1 Calculation of heating and cooling loads.** Design loads shall be determined in accordance with the procedures described in ANSI/ASHRAE/ACCA Standard 183, Peak Cooling and Heating Load Calculations in Buildings Except Low-Rise Residential Buildings, and by using the design parameters specified in Table C403.2.1.

TABLE C403.2.1 Climatic Data Design Conditions

City	Summer Db/Wb °F	Winter Db °F
Aitkin	82/72	-24
Albert Lea	85/72	-15
Alexandria	86/70	-21
Bemidji	84/68	-24
Cloquet	82/68	-20
Crookston	84/70	-27
Duluth	81/67	-20
Ely	82/68	-29
Eveleth	82/68	-26
Faribault	86/73	-16
Fergus Falls	86/71	-21
Grand Rapids	81/67	-23
Hibbing	82/68	-19
International Falls	83/67	-28
Litchfield	85/71	-18
Little Falls	86/71	-20
Mankato	86/72	-15
Minneapolis/St. Paul	88/72	-15
Montevideo	86/72	-17
Mora	84/70	-21
Morris	84/72	-21

New Ulm	87/73	-15
Owatonna	86/73	-16
Pequot Lakes	84/68	-23
Pipestone	85/73	-15
Redwood Falls	89/73	-17
Rochester	85/72	-17
Roseau	82/70	-29
St. Cloud	86/71	-20
Thief River Falls	82/68	-25
Tofte	75/61	-14
Warroad	83/67	-29
Wheaton	84/71	-20
Willmar	85/71	-20
Winona	88/74	-13
Worthington	84/71	-14

Db = dry bulb temperature, degrees Fahrenheit

Wb = wet bulb temperature, degrees Fahrenheit

Subp. 2. **IECC section C403.2.2 Equipment and system sizing.** IECC section C403.2.2 is amended by adding a third exception to read as follows:

> 3. Heating and cooling equipment sizing is permitted to be up to ten percent greater than the calculated peak heating and cooling loads to allow for building pickup and cool down after temperature setback conditions.

Subp. 3. **IECC section C403.2.4.3.1 Thermostatic setback capabilities.** IECC section C403.2.4.3.1 is amended to read as follows:

> **C403.2.4.3.1 Thermostatic setback capabilities.** Heating systems shall be equipped with controls that have the capacity to automatically restart and temporarily operate the systems to maintain zone temperatures above a heating setpoint adjustable down to 55°F (13°C) or lower. Cooling systems shall be equipped with controls that have the capacity to automatically restart and temporarily operate the system to maintain zone temperatures below a cooling setpoint adjustable up to 90°F (32°C) or higher or to prevent high space humidity levels.

Exceptions:

1. Radiant floor and radiant ceiling heating systems.

2. Spaces where constant temperature conditions must be maintained.

Subp. 4. **IECC section C403.2.4.5 Snow melt system controls.** IECC section C403.2.4.5, the title and the body, are amended to read as follows:

C403.2.4.5 Freeze protection and snow melt system controls. Freeze protection systems, such as heat tracing of outdoor piping and heat exchangers, including self-regulating heat tracing, shall include automatic controls capable of shutting off the system when outdoor air temperatures are above 40°F (4°C) or when the conditions of the protected fluid prevent freezing. Snow and ice-melting systems, supplied through energy service to the building, shall include automatic controls capable of shutting off the system when the pavement temperature is above 50°F (10°C) and no precipitation is falling and an automatic or manual control that will allow shutoff when the outdoor temperature is above 40°F (4°C), so the potential for snow or ice accumulation is negligible.

Subp. 5. **IECC section C403.2.6 Energy recovery ventilation systems.** IECC section C403.2.6 is amended to read as follows:

C403.2.6 Energy recovery ventilation systems. Where the supply airflow rate of a fan system exceeds the values specified in Table C403.2.6, the system shall include an energy recovery system. The energy recovery system shall have the capability to provide a change in the enthalpy of the outdoor air supply of not less than 50 percent of the difference between the outdoor air and return air enthalpies, at design conditions. Where an air economizer is required, the energy recovery system shall include a bypass or controls which permit operation of the economizer as required by section C403.4.

Exception: An energy recovery ventilation system shall not be required in any of the following conditions:

1. Where energy recovery systems are prohibited by the International Mechanical Code, as amended in Minnesota Rules, chapter 1346.

2. Laboratory fume hood systems that include at least one of the following features:

2.1 Variable-air-volume hood exhaust and room supply systems capable of reducing exhaust and makeup air volume to 50 percent or less of

design values except when higher volumes are required to maintain safe operating conditions.

2.2 Direct makeup (auxiliary) air supply equal to at least 75 percent of the exhaust rate, heated no warmer than 2°F (1.1°C) above room setpoint, cooled to no cooler than 3°F (1.7°C) below room setpoint, no humidification added, and no simultaneous heating and cooling used for dehumidification control.

3. Systems serving spaces that are heated to less than 60°F (15.5°C) and are not cooled.

4. Where more than 60 percent of the outdoor heating energy is provided from site-recovered or site solar energy.

5. Heating energy recovery in Climate Zones 1 and 2.

6. Cooling energy recovery in Climate Zones 3C, 4C, 5B, 5C, 6B, 7, and 8.

7. Systems requiring dehumidification that employ energy recovery in series with the cooling coil.

8. Where the largest source of air exhausted at a single location at the building exterior is less than 75 percent of the design outdoor air flow rate.

9. Systems expected to operate less than 20 hours per week at the outdoor air percentage covered by Table C403.2.6.

10. Systems exhausting paint fumes; toxic, flammable, or corrosive fumes; or dust.

11. Commercial kitchen hoods used for collecting and removing grease vapors and smoke.

Subp. 6. **IECC Table C403.2.6 Energy recovery requirement.** IECC Table C403.2.6 is amended by modifying the title to read:

TABLE C403.2.6 EXHAUST AIR ENERGY RECOVERY REQUIREMENT.

Subp. 7. **IECC section C403.2.7 Duct and plenum insulation and sealing.** IECC section C403.2.7 is amended to read as follows:

C403.2.7 Duct and plenum insulation and sealing. Insulation shall be protected from damage, including damage from sunlight, moisture, equipment maintenance, and wind. Insulation exposed to weather shall be suitable for outdoor service and shall be protected by aluminum, sheet metal, painted canvas, plastic cover, or other similar materials approved by the building official. Cellular foam insulation shall be protected as required by this subpart or painted with a coating that is water-retardant and provides shielding from solar radiation that causes degradation

of the material. All supply, return, exhaust, and relief air ducts and plenums shall be insulated according to Table C403.2.7, located in subpart 13.

Exception: Where located within equipment.

All ducts, air handlers, and filter boxes shall be sealed. Joints and seams shall comply with section 603.9 of the International Mechanical Code, as amended in Minnesota Rules, chapter 1346.

C403.2.7.1 Duct construction. Ductwork shall be constructed and erected in accordance with the International Mechanical Code, as amended.

C403.2.7.1.1 Low-pressure duct systems. All longitudinal and transverse joints, seams, and connections of supply and return ducts operating at a static pressure less than or equal to 2 inches water gauge (w.g.) (500 Pa) shall be securely fastened and sealed with welds, gaskets, mastics (adhesives), mastic-plus-embedded-fabric systems, or tapes installed in accordance with the manufacturer's installation instructions. Pressure classifications specific to the duct system shall be clearly indicated on the construction documents in accordance with the International Mechanical Code, as amended.

Exception: Continuously welded and locking-type longitudinal joints and seams on ducts operating at static pressure less than 2 inches water gauge (w.g.) (500 Pa) pressure classification.

C403.2.7.1.2 Medium-pressure duct systems. All ducts and plenums designed to operate at a static pressure greater than 2 inches water gauge (w.g.) (500 Pa) but less than or equal to 3 inches water gauge (w.g.) (750 Pa) shall be insulated and sealed in accordance with section C403.2.7. Pressure classifications specific to the duct system shall be clearly indicated on the construction documents in accordance with the International Mechanical Code, as amended.

C403.2.7.1.3 High-pressure duct systems. Ducts designed to operate at static pressures in excess of 3 inches water gauge (w.g.) (750 Pa) shall be insulated and sealed in accordance with section C403.2.7. In addition, ducts and plenums shall be leak-tested in accordance with the SMACNA HVAC Air Duct Leakage Test Manual with the rate of air leakage (CL) less than or equal to 4.0 as determined in accordance with Equation 4-5.

(Equation 4-5) $CL=F/P^{0.65}$

where:

F = The measured leakage rage in cfm per 100 square feet of duct surface area.

P = The static pressure of the test, which is equal to the design duct pressure class rating, inches w.g.

Documentation shall be furnished by the designer demonstrating that representative sections totaling at least 25 percent of the duct area have been tested and that all tested sections meet the requirements of this section. Positive pressure leakage testing is acceptable for negative pressure ductwork.

Subp. 8. **IECC Table C403.2.7 Minimum required duct and plenum insulation.** IECC section C403.2 is amended by adding Table C403.2.7 to read as follows:

TABLE C403.2.7

MINIMUM REQUIRED DUCT AND PLENUM INSULATION

Ducts for Other Than Dwelling Units[a,b]	**Supply Duct Requirements[c,d]**	**Return Duct Requirements[c,d]**	**Exhaust Duct and Relief Duct Requirements[c,d,e]**
Exterior of building	R-8, V and W	R-8, V and W	R-8, V and W
Attics, garages, and ventilated crawl spaces	R-8 and V	R-8 and V	R-6 and V
TD greater than 40°F	R-5 and V	None	R-5 and V
TD greater than 15°F and less than or equal to 40°F	R-3.3 and V	None	R-3.3 and V
Within concrete slab or within ground	R-3.5 and V	R-3.5 and V	None
Within conditioned spaces	None[f]	None	None
TD less than or equal to 15°F	None	None	None

Ducts for Dwelling Units[a]	**Requirements[c,d]**
Exterior of building	R-8, V and W
Attics, garages, and ventilated crawl spaces (except exhaust ducts)	R-8 and V

Exhaust ducts in attics, garages, and ventilated crawl spaces	R-3.3 and V
Outdoor air intakes within conditioned spaces	R-3.3 and V
Exhaust ducts within conditioned spaces[e]	R-3.3 and V
Within concrete slab or within ground	R-3.5 and V
Within conditioned spaces	None

a. Ducts located within the building thermal envelope shall be located completely on the conditioned side of the air barrier.

b. TD = Design temperature difference between the air in the duct and the ambient temperature outside of the duct, unless the duct type and location are specifically identified above.

c. V = Vapor retarder required in accordance with IMC section 604.11. When a vapor retarder is required, duct insulation required by this section shall be installed without respect to other building envelope insulation.

d. W = Approved weatherproof barrier.

e. Insulation is only required in the conditioned space for a distance of 3 feet (914 mm) from the exterior or unconditioned space.

f. If temperature rise is greater than 3°F from supply air to furthest outlet, duct insulation shall be required.

Subp. 9. **IECC section C403.2.8.1 Protection of piping insulation.** IECC section C403.2.8.1 is amended to read as follows:

> **C403.2.8.1 Protection of piping insulation.** Piping insulation shall be protected from damage, including damage from sunlight, moisture, equipment maintenance, and wind, and shall provide shielding from solar radiation to deter degradation of the material. Adhesive tape shall not be permitted. Piping insulation shall comply with both of the following requirements:
>
> 1. Insulation exposed to weather shall be suitable for outdoor service and shall be protected by aluminum, sheet metal, painted canvas, plastic cover, or other similar materials approved by the building official. Cellular foam insulation shall be protected as above or painted with a coating that is water-retardant and provides shielding from solar radiation; and

2. Unless the insulation is vapor-retardant, insulation covering chilled-water piping or refrigerant suction piping located outside the conditioned space shall include a vapor retardant located outside the insulation. All penetrations and joints shall be sealed.

Subp. 10. **IECC section C403.2.10.1 Allowable fan motor horsepower.** IECC section C403.2.10.1 is amended to read as follows:

C403.2.10.1 Allowable fan motor horsepower. Each HVAC system at fan system design conditions shall not exceed the allowable fan system motor nameplate hp (Option 1) or fan system bhp (Option 2) as shown in Table C403.2.10.1(1). This includes supply fans, return/relief fans, exhaust fans, and fan-powered terminal units associated with systems providing heating or cooling capability. Single zone variable-air-volume systems shall comply with the constant volume fan power limitation.

Exceptions: The following fan systems are exempt from allowable fan motor horsepower requirements:

1. Hospital, vivarium, and laboratory systems that utilize flow control devices on exhaust or return to maintain space pressure relationships necessary for occupant health and safety or environmental control shall be permitted to use variable volume fan power limitation.

2. Individual exhaust fans with motor nameplate horsepower of 1 hp or less.

Subp. 11. **IECC Table C403.2.10.1(2) FAN POWER LIMITATION PRESSURE DROP ADJUSTMENT.** Table C403.2.10.1(2) is amended to read as follows:

TABLE C403.2.10.1(2) FAN POWER LIMITATION PRESSURE DROP ADJUSTMENT

DEVICE	ADJUSTMENT
Credits	
Fully ducted return and/or exhaust air systems	0.5 inch w.c. (2.15 in w.c. for laboratory and vivarium systems)
Return and/or exhaust air flow control devices	0.5 inch w.c.
Exhaust filters, scrubbers, or other exhaust treatment	Pressure drop of device calculated at fan system design conditions
Particulate filtration credit: MERV 9 to 12	0.5 inch w.c.

Particulate filtration credit: MERV 13 to 15	0.9 inch w.c.
Particulate filtration credit: MERV 16 and greater and electronically enhanced filters	Pressure drop calculated at 2 times clean filter pressure drop at fan system design condition
Carbon and other gas-phase air cleaners	Clean filter pressure drop at fan system design condition
Biosafety cabinet	Pressure drop of device at fan system design condition
Energy recovery device, other than coil runaround loop	(2.2 x energy recovery effectiveness) - 0.5 inch w.c. for each airstream
Coil runaround loop	0.6 inch w.c. for each airstream
Evaporative humidifier/cooler in series with another cooling coil	Pressure drop of device at fan system design conditions
Sound attenuation section	0.15 inch w.c.
Exhaust system serving fume hoods	0.35 inch w.c.
Laboratory and vivarium exhaust systems in high-rise buildings	0.25 inch w.c./100 feet of vertical duct exceeding 75 feet
Air blender	0.30 inch w.c.
Preheat coil	0.10 inch w.c.

w.c. = water column

For SI: 1 inch w.c. = 249 Pa; 1 inch = 25.4 mm

Subp. 12. **IECC section C403.4.2.1 Static pressure sensor location.** IECC section C403.4.2.1 is amended to read as follows:

> **C403.4.2.1 Static pressure sensor location.** Static pressure sensors used to control VAV fans shall be placed in a position such that the controller setpoint is no greater than one-third the total design fan static pressure, except for systems with zone reset control complying with section C.403.4.2.2. Sensors shall be located in a position so the controller setpoint is optimized to maintain the minimum static pressure required for system operation throughout its range.

Subp. 13. **IECC section C403.4.3.3.3 Two-position valve.** IECC section C403.4.3.3.3 is amended to read as follows:

C403.4.3.3.3 Two-position valve. Each hydronic heat pump shall have a two-position automatic valve interlocked to shut off the water flow when the compressor is off.

Subp. 14. **IECC section C403.4.5.4 Supply-air temperature reset controls.** IECC section C403.4.5.4 is amended to read as follows:

C403.4.5.4 Supply-air temperature reset controls. Multiple zone HVAC systems shall include controls that automatically reset the supply-air temperature in response to representative building loads, or to outdoor air temperature. The controls shall be capable of resetting the supply-air temperature at least 25 percent of the difference between the design supply-air temperature and the design room air temperature. Zones with constant loads shall be designed for the fully reset supply temperature.

Exceptions:

1. Systems that prevent reheating, recooling, or mixing of heated and cooled supply air.

2. 75 percent of the energy for reheating is from site-recovered or site solar energy sources.

3. Zones with peak supply air quantities of 300 cfm (142 L/s) or less.

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