1323.0403 SECTION C403, BUILDING MECHANICAL SYSTEMS.

Subpart 1. **IECC section C403.1.1 Calculation of heating and cooling loads.** IECC section C403.1.1 is amended to read as follows and by adding Table C403.1.1:

> **C403.1.1 Calculation of heating and cooling loads.** Design loads associated with heating, ventilating, and air conditioning of the building shall be determined in accordance with ANSI/ASHRAE/ACCA Standard 183 or by an approved equivalent computational procedure using the design parameters specified in Table C403.1.1. Heating and cooling loads shall be adjusted to account for load reductions that are achieved where energy recovery systems are utilized in the HVAC system in accordance with the ASHRAE HVAC Systems and Equipment Handbook by an approved equivalent computational procedure.

TABLE C403.1.1

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 C403.4.1.4 Heated or cooled vestibules (mandatory).** IECC section C403.4.1.4 is amended to read as follows:

> **C403.4.1.4 Heated or cooled vestibules (mandatory).** The heating system for heated vestibules and air curtains with integral heating shall be provided with controls configured to shut off the source of heating when the outdoor air temperature is greater than 60°F (16°C). Vestibule heating and cooling systems shall be controlled by a thermostat located in the vestibule configured to limit heating to a temperature not greater than 68°F (20°C) and cooling to a temperature of not less than 85°F (29°C).

Exception: Control of heating or cooling provided by site-recovered energy or transfer air that would otherwise be exhausted.

Subp. 2a. **IECC section C403.4.1.5 Hot water boiler outdoor temperature setback control (mandatory).** IECC section C403.4.1.5 is amended by adding an exception to read as follows:

Exception: Boiler systems used for service water heating.

Subp. 3. **IECC section C403.4.2.1 Thermostatic setback.** IECC section C403.4.2.1 is amended to read as follows:

C403.4.2.1 Thermostatic setback. 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 85°F (29°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 C403.4.3.3.2 Heat rejection.** IECC section C403.4.3.3.2, item 3, is amended to read as follows:

3. Where an open-circuit or closed-circuit cooling tower is used in conjunction with a separate heat exchanger to isolate the open-circuit or closed-circuit cooling tower from the heat pump loop, heat loss shall be controlled by shutting down the circulation pump on the cooling tower loop.

(The exception remains unchanged.)

Subp. 5. [Renumbered subp 7]

Subp. 5. **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. 6. [Renumbered subp 8]

Subp. 6. **IECC section C403.6.5 Supply-air temperature reset controls.** IECC section C403.6.5 is amended to read as follows:

C403.6.5 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.

Subp. 7. [Renumbered subp 11a]

Subp. 7. **IECC section C403.7.4 Energy recovery ventilation systems (mandatory).** IECC section C403.7.4 is amended to read as follows:

C403.7.4 Energy recovery ventilation systems. Where the supply airflow rate of a fan system exceeds the values specified in Table C403.7.4, the system shall include an energy recovery system. The energy recovery system shall be configured 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 that permit operation of the economizer as required by section C403.5.

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 volumes 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, with 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 C403.7.4.

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. 8. [Renumbered subp 12a]

Subp. 8. **Table C403.7.4 Exhaust Air Energy Recovery.** IECC Table C403.7.4(1) and Table C403.7.4(2) are deleted and replaced with the following:

TABLE C403.7.4

EXHAUST AIR ENERGY RECOVERY

	Percent (%) Outdoor Air At Full Design Airflow Rate							
Climate Zone	≥10 and <20%	≥20 and <30%	≥30% and <40%	≥40% and <50%	≥50% and <60%	≥60% and <70%	≥ 70% and <80%	≥80%
	Design Supply Fan Airflow Rate (cfm)							
6A	NR	NR	≥5,500	≥4,500	≥3,500	≥2,000	≥1,000	≥0
7	NR	NR	≥2,500	≥1,000	≥0	≥0	≥0	≥0

For SI: 1 cfm = 0.4719 L/s

NR = Not Required

Subp. 9. [Renumbered subp 15]

Subp. 9. **IECC section C403.7.7 Shutoff dampers (mandatory).** The exception to IECC section C403.7.7 is amended to read as follows:

Exception: Nonmotorized gravity dampers shall be an alternative to motorized dampers for exhaust and relief openings as follows:

1. In buildings less than three stories in height above grade plane.

2. Where the design exhaust capacity is not greater than 300 cfm (142 L/s).

Each nonmotorized gravity damper shall also meet one of the following requirements:

1. The damper shall have a maximum air leakage rate of 20 cfm/ft^2 (101.6 L/s • m^2) where not less than 24 inches in either dimension and 40 cfm/ft^2(203.2 L/s • m^2) where less than 24 inches in either dimension. The rate of air leakage shall be determined at 1.0-inch water gauge (249 Pa) when tested in accordance with AMCA 500D for such purpose.

2. The damper shall be for an exhaust duct eight inches (203 mm) in diameter or smaller and shall be equipped with a spring-loaded backdraft damper and a weather hood at the point of discharge.

Subp. 10. **IECC section C403.9.4 Tower flow turndown.** IECC section C403.9.4 is amended by adding an exception to read as follows:

Exception: An increase in the water flow rate is permitted during freezing conditions.

Subp. 11. [Repealed, 44 SR 763]

Subp. 11a. **IECC section C403.11.1 Duct and plenum insulation and sealing.** IECC section C403.11.1 is amended to read as follows:

C403.11.1 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 C403.11.1, located in subpart 12a.

Exception: Where located within equipment.

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

Subp. 12. [Repealed, 44 SR 763]

Subp. 12a. **IECC Table C403.11.1 Minimum required duct and plenum insulation.** IECC section C403.11 is amended by adding Table C403.11.1 to read as follows:

TABLE C403.11.1

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-12, V and W	R-12, V and W	R-12, V and W

Attics, garages, and ventilated crawl spaces	R-12 and V	R-12 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-12, V and W
Attics, garages, and ventilated crawl spaces (except exhaust ducts)	R-12 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 the IMC . 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 the temperature rise is greater than 3°F from the supply air connection of the air handling unit to the furthest outlet, duct insulation shall be required for the entire length or for sufficient length to limit the temperature rise to 3°F.

Subp. 13. [Renumbered subp 5]

Subp. 13. **IECC section C403.11.2 Duct construction (mandatory).** IECC section C403.11.2 is amended to read:

C403.11.2 Duct construction. Ductwork shall be constructed and erected in accordance with Minnesota Rules, chapter 1346.

C403.11.2.1 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 Minnesota Rules, chapter 1346.

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.

C403.11.2.2 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 C403.11.1. Pressure classifications specific to the duct system shall be clearly indicated on the construction documents in accordance with Minnesota Rules, chapter 1346.

C403.11.2.3 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 C403.11.1. 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 4-8.

(Equation 4-8) $CL=F/P^{0.65}$

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. 14. [Renumbered subp 6]

Subp. 14. **IECC Table C403.11.3 Minimum pipe insulation thickness.** IECC Table C403.11.3 is amended to add a footnote "d" to read as follows:

d. Insulation requirements do not apply to those sections of piping used as the radiant heat source for radiant heating systems.

Subp. 15. **IECC section C403.11.3.1 Protection of piping insulation.** IECC section C403.11.3.1 is amended to read as follows:

C403.11.3.1 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.

Statutory Authority: *MS s 326B.02; 326B.101; 326B.106*

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