MEMORANDUM

Dear Committee Members:

After the circulation of votes, the final ballot results are as follows on the attached ballot matrix:

28 Members Eligible to Vote
5 Ballots were not received for Technical Merit by the Final Closing Date of November 7, 2017
5 Ballots were not received for Emergency Nature by the Final Closing Date of November 7, 2017

Technical Merit
14 Affirmative
9 Negative
0 Abstain

According to Section 5-4 of the Regulations Governing Committee Projects, the final results of the TIA # 003-18 ballot did not achieve the necessary three-fourths majority for affirmative vote (18) on Technical Merit (28 eligible - 5 not returned - 0 abstain = 23 x 75% = 17.25 or **18**).

Emergency Nature
12 Affirmative
11 Negative
0 Abstain

According to Section 5-4 of the Regulations Governing Committee Projects, the final results of the TIA # 003-18 ballot did not achieve the necessary three-fourths majority for affirmative vote (18) on Emergency Nature (28 eligible - 5 not returned - 0 abstain = 23 x 75% = 17.25 or **18**).

Please feel free to contact me by phone at (909) 230-5535 or by email at enrique.gonzalez@iapmo.org, if you have questions.

Regards,

Enrique Gonzalez
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2018 Uniform Mechanical Code
TIA # 003-18
Final Ballot Results

Ballot Name:	TECHNICAL MERIT UMC TIA # 003-18
Ballot Status:	Ballot has closed.
Members Eligible to Vote:	28
Vote Summary	
Option	Count
Affirmative	14
Negative	9
Abstain	0
Did not vote	5
Voter Name	**Vote**
Wiseman, Bob	Affirmative
Koerber, Ralph	Affirmative
Lovell, Vickie	Affirmative
Hargis, Shawn	Affirmative
Feehan, Pennie	Affirmative
Taylor, Don	Affirmative
Trafton, April	Affirmative
Chang, Ian	Affirmative
Smith, Christopher	Affirmative
Surrena, Donald	Affirmative
Cudahy, Michael	Affirmative
Scarano, Anthony	Affirmative
Howard, III, Eli	Affirmative
Carroll, Marguerite	Affirmative
Mann, David	Negative w/ comment
Adler, Bob	Negative w/ comment
Delaquila, David	Negative w/ comment
Dias, David	Negative w/ comment
Berger, Donald	Negative w/ comment
Ribbs, Phil	Negative w/ comment
Sewell, Robert	Negative w/ comment
Young, Randy	Negative w/ comment
Afonso, Mike	Negative w/ comment
Van Rite, Chris	Did not vote
Garcia, Roel	Did not vote
Kreitenberg, Harvey	Did not vote
Nielsen, John	Did not vote
Pavesic, James	Did not vote

Ballot Name:	EMERGENCY NATURE UMC TIA # 003-18
Ballot Status:	Ballot has closed.
Members Eligible to Vote:	28
Vote Summary	
Option	Count
Affirmative	12
Negative	11
Abstain	0
Did not vote	5
Voter Name	**Vote**
Wiseman, Bob	Affirmative
Koerber, Ralph	Affirmative
Hargis, Shawn	Affirmative
Feehan, Pennie	Affirmative
Trafton, April	Affirmative
Chang, Ian	Affirmative
Smith, Christopher	Affirmative
Surrena, Donald	Affirmative
Cudahy, Michael	Affirmative
Scarano, Anthony	Affirmative
Howard, III, Eli	Affirmative
Carroll, Marguerite	Affirmative
Lovell, Vickie	Negative w/ comment
Mann, David	Negative w/ comment
Adler, Bob	Negative w/ comment
Taylor, Don	Negative w/ comment
Delaquila, David	Negative w/ comment
Dias, David	Negative w/ comment
Berger, Donald	Negative w/ comment
Ribbs, Phil	Negative w/ comment
Sewell, Robert	Negative w/ comment
Young, Randy	Negative w/ comment
Afonso, Mike	Negative w/ comment
Van Rite, Chris	Did not vote
Garcia, Roel	Did not vote
Kreitenberg, Harvey	Did not vote
Nielsen, John	Did not vote
Pavesic, James	Did not vote

UNIFORM MECHANICAL CODE TIA FORM - 2018

Reference Code Section: E 503.1.3 – E 503.5.11.3, ASHRAE 90.1-2016

Submitter Name: April Trafton
Company: Donald Dickerson Associates
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Proposed language for TIA:

Modify language as follows:

ASHRAE **E 503.1.3 Alterations to Heating, Ventilating, Air-Conditioning, and Refrigeration in Existing Buildings.** New HVACR equipment as a direct replacement of existing HVACR equipment shall be in accordance with the ~~minimum requirements~~ following sections as applicable ~~to~~ for the equipment being replaced~~.~~:

(1) Section E 503.3
(2) Section E 503.4
(3) Section E 503.4.6
(4) Section E 503.4.6.2
(5) Section E 503.4.6.3
(6) Section E 503.4.6.4
(7) Section E 503.4.6.8
(8) Section E 503.4.6.9
(9) Section E 503.4.6.11
(10) Section E 503.5.1
(11) Section E 503.5.3
(12) Section E 503.5.3.1
(13) Section E 503.5.6.1.2
(14) Section E 503.5.6.2
(15) Section E 503.5.6.5
(16) Section E 503.5.7
(17) Section E 503.5.7.2
(18) Section E 503.5.8.1. [ASHRAE 90.1:6.1.1.3.1]

E 503.4.6 Zone Thermostatic Controls. The supply of heating and cooling energy to each zone shall be individually controlled by thermostatic controls responding to temperature within the zone. For the purposes of Section E 503.4.6, a dwelling unit shall be permitted to be considered a single zone.

Exceptions: Independent perimeter systems that are designed to offset only building envelope loads shall be permitted to serve one or more zones also served by an interior system provided:

(1) ~~T~~the perimeter system includes not less than one thermostatic control zone for each building exposure having ~~exterior~~ walls facing only one orientation for 50 contiguous feet (15 240 mm) or more~~.~~ and
(2) ~~T~~the perimeter system heating and cooling supply is controlled by ~~a~~ thermostatic control~~(s)~~ located within the zones~~(s)~~ served by the system.

Exterior walls and semiexterior walls are considered to have different orientations where the ~~directions~~ exposures they face differ by more than 45 degrees (0.79 rad). [ASHRAE 90.1:6.4.3.1.1]

E 503.4.6.1 Dead Band. Where used to control both heating and cooling, zone thermostatic controls shall be capable of ~~providing~~ and configured to provide a temperature range or dead band of not less than 5°F (3°C) within which the supply of heating and cooling energy to the zone is shut off or reduced to a minimum.

Exceptions:

(1) Thermostats that require manual changeover between heating and cooling modes.
(2) Special occupancy or special applications where wide temperature ranges are not acceptable (such as retirement homes, process applications, museums, some areas of hospitals) and are approved by the Authority Having Jurisdiction. [ASHRAE 90.1:6.4.3.1.2]

E 503.4.6.2 Setpoint Overlap Restriction. Where ~~the~~ heating and cooling to a zone are controlled by separate zone thermostatic controls located within the zone, means (such as limit switches, mechanical stops, or, for DDC systems, software programming) shall be provided to prevent the heating setpoint from exceeding the cooling setpoint minus ~~an~~ any applicable proportional band. [ASHRAE 90.1:6.4.3.2]

E 503.4.6.3.2 Setback Controls. Heating systems shall be equipped with controls capable of and configured to automatically restart and temporarily operate the system as required to maintain zone temperatures above an adjustable heating setpoint of not less than 10°F (6°C) below the occupied heating setpoint. Cooling systems shall be equipped with controls capable of and configured to automatically restart and temporarily operate the mechanical cooling system as required to maintain zone temperatures below an adjustable cooling setpoint of not less than 5°F (3°C) above the occupied cooling setpoint or to prevent high space humidity levels.

Exception: Radiant heating systems capable of and configured with a setback heating setpoint at not less than 4°F (2°C) below the occupied heating setpoint. [ASHRAE 90.1:6.4.3.3.2]

E 503.4.6.3.4 Zone Isolation. HVAC systems serving zones that are intended to operate or be occupied nonsimultaneously shall be divided into isolation areas. Zones shall be permitted to be grouped into a single isolation area provided it does not exceed 25 000 square feet (2322.6 m^2) of conditioned floor area and does not include more than one floor. Each isolation area shall be equipped with isolation devices capable of and configured to automatically ~~shutting~~ shut off the supply of conditioned air and outdoor air to and exhaust air from the area. Each isolation area shall be controlled independently by a device meeting the requirements of Section E 503.4.6.3.1. For central systems and plants, controls and devices shall be provided to allow stable system and equipment operation for any length of time while serving only the smallest isolation area served by the system or plant.

Exceptions: Isolation devices and controls are not required for the following:

(1) Exhaust air and outdoor air connections to isolation zones where the fan system to which they connect is not more than 5000 ft^3/min (2.3597 m^3/s).

(2) Exhaust airflow from a single isolation zone of less than 10 percent of the design airflow of the exhaust system to which it connects.

(3) Zones intended to operate continuously or intended to be inoperative only ~~where~~ when all other zones are inoperative. [ASHRAE 90.1:6.4.3.3.4]

E 503.4.6.4 Ventilation System Controls. Stair and elevator shaft vents shall be equipped with motorized dampers that are capable of and configured to ~~being~~ automatically close~~d~~ during normal building operation and are interlocked to open ~~in accordance with~~ as required by fire and smoke detection systems. [ASHRAE 90.1:6.4.3.4.1]

E 503.4.6.4.1 Shutoff Damper Controls. Outdoor air intake and exhaust systems shall be equipped with motorized dampers that will automatically shut ~~where~~ when the systems or spaces served are not in use. Ventilation outdoor air and exhaust or relief dampers shall be capable of and configured to automatically shut~~ting~~ off during preoccupancy building warm-up, cooldown, and setback, except ~~where~~ when ventilation reduces energy costs or ~~where~~ when ventilation shall be supplied to ~~be in accordance with the requirements of this code~~ comply with the code requirements.

Exceptions:

(1) Backdraft gravity (nonmotorized) dampers shall be permitted for exhaust and relief in buildings less than three stories in height~~,~~ and for ventilation air intakes and exhaust and relief dampers in buildings of any height located in ~~c~~Climate ~~z~~Zones ~~1 through zone~~ 0, 1, 2 and 3. Back-draft dampers for ventilation air intakes shall be protected from direct exposure to wind.

(2) Back-draft gravity (nonmotorized) dampers shall be permitted in systems with a design outdoor air intake or exhaust capacity of 300 ft^3/min (0.142 m^3/s) or less.

(3) Dampers shall not be required in ventilation or exhaust systems serving unconditioned spaces.

(4) Dampers shall not be required in exhaust systems serving Type 1 kitchen exhaust hoods. [ASHRAE 90.1:6.4.3.4.2]

TABLE E 503.4.6.4.2
MAXIMUM DAMPER LEAKAGE
(cubic foot per minute per square foot) at 1.0 in. w.g
[ASHRAE 90.1: TABLE 6.4.3.4.3]

CLIMATE ZONE	VENTILATION AIR INTAKE		EXHAUST/RELIEF	
	NONMOTORIZED*	MOTORIZED	NONMOTORIZED*	MOTORIZED
0, 1, 2	–	–	–	–
any height	20	4	20	4

(portion of table not shown remain unchanged)

E 503.4.6.4.3 Ventilation Fan Controls. Fans with motors more than 0.75 hp (0.56 kW) shall have automatic controls in accordance with Section E 503.4.6.3.1 that are capable of and configured to shut~~ting~~ off fans ~~where~~ when not required.

Exception: HVAC systems intended to operate continuously. [ASHRAE 90.1:6.4.3.4.4]

E 503.4.6.8 Freeze Protection and Snow or Ice Melting Systems. Freeze protection systems, such as heat tracing of outdoor piping and heat exchangers, including self-regulating heat tracing, shall include automatic controls capable of and configured to shut~~ting~~ off the systems ~~where~~ when outdoor air temperatures are more than 40°F (4°C) or ~~where~~ when the conditions of the protected fluid will prevent freezing. Snow- and ice-melting systems shall include automatic controls capable of and configured to shut~~ting~~ off the systems ~~where~~ when the pavement temperature is more than 50°F (10°C) and no precipitation is falling, and an automatic or manual control that will allow shutoff ~~where~~ when the outdoor temperature is more than 40°F (4°C) so that the potential for snow or ice accumulation is negligible. [ASHRAE 90.1:6.4.3.7]

E 503.4.6.9 Ventilation Controls for High-Occupancy Areas. Demand control ventilation (DCV) shall be required for spaces that are more than 500 square feet (46.45 m^2) and with a design occupancy for ventilation of not less than 25 people per 1000 square feet (92.9 m^2) of floor area and served by systems with one or more of the following:

(1) ~~An a~~Air~~-side~~ economizer.

(2) ~~An a~~Automatic modulating control of ~~the~~ outdoor air damper.

(3) ~~A d~~Design outdoor airflow more than 3000 ft^3/min (1.4158 m^3/s).

Exceptions:

(1) Systems with exhaust air energy recovery in accordance with Section E 503.5.10.

(2) Multiple-zone systems without DDC of individual zones communicating with a central control panel.

(3) Systems with a design outdoor airflow less than 750 ft^3/min (0.3540 m^3/s).

(4) Spaces where more than 75 percent of the space design outdoor airflow is required for makeup air that is exhausted from the space or transfer air that is required for makeup air that is exhausted from other space~~(s)~~.

(5) Spaces with one of the following occupancy categories in accordance with Chapter 4 or ASHRAE 62.1: correctional cells~~;~~, daycare sickrooms~~;~~, science labs~~;~~, barbers~~;~~, beauty and nail salons~~;~~, and bowling alley seating. [ASHRAE 90.1:6.4.3.8]

E 503.5 Prescriptive Path, Economizers. Cooling systems ~~that have fans~~ shall include either an air ~~or water~~ economizer or fluid economizer in accordance with Section E 503.5.1 through Section E 503.5.4.1.

Exceptions: Economizers shall not be required for the following systems:

(1) Individual fan-cooling units with a supply capacity less than the minimum listed in Table E 503.5(1)~~ for comfort cooling applications and Table E 503.5(2) for computer room applications~~.

(2) Chilled-water cooling systems without a fan or that use induced airflow, where the total capacity of these systems is less than 1 000 000 Btu/h (293 kW) in Climate Zones 0, 1B, and 2 through 4; less than 1 400 000 Btu/h (410 kW) in Climate Zones 5 through 8; or any size in Climate Zone 1A.

(~~2~~3) Systems that include nonparticulate air treatment in accordance with ASHRAE 62.1.

(~~3~~4) In hospitals and ambulatory surgery centers, where more than 75 percent of the air designed to be supplied by the system is to spaces that are required to be humidified more than 35°F (2°C) dew-point temperature ~~in accordance~~ to comply with applicable codes or accreditation standards~~. In~~; in all other buildings, where more than 25 percent of the air designed to be supplied by the system is to spaces that are designed to be humidified more than 35°F (2°C) dew-point temperature to satisfy process needs. This exception shall not apply to computer rooms.

(~~4~~5) Systems that include a condenser heat recovery system with a minimum capacity in accordance with Section E 503.5.10.1.2.

(~~5~~6) Systems that serve residential spaces where the system capacity is less than five times the requirement listed in Table E 503.5(1).

(~~6~~7) Systems that serve spaces whose sensible cooling load at design conditions, excluding transmission and infiltration loads, is less than or equal to transmission and infiltration losses at an outdoor temperature of 60°F (16°C).

(~~7~~8) Systems expected to operate less than 20 hours per week.

(~~8~~9) Where the use of outdoor air for cooling will affect supermarket open refrigerated casework systems.

(~~9~~10) For comfort cooling where the cooling efficiency is not less than the efficiency improvement requirements in accordance with Table ~~E 503.5(3)~~ E 503.5(2).

(~~10~~11) Systems primarily serving computer rooms where in accordance with one of the following:

(a) The total design cooling load of all computer rooms in the building is less than 3 000 000 Btu/h (879 kW) and the building in which they are located is not served by a centralized chilled water plant.

(b) The room total design cooling load is less than 600 000 Btu/h (176 kW) and the building in which they are located is served by a centralized chilled water plant.

(c) The local water authority does not permit cooling towers.

(d) Less than 600 000 Btu/h (176 kW) of computer room cooling equipment capacity is being added to an existing building.

(~~11~~12) Dedicated systems for computer rooms where a minimum of 75 percent of the design load serves one of the following:

(a) Spaces classified as an essential facility.

(b) Spaces having a ~~mechanical cooling~~ design of Tier IV in accordance with TIA 942.

(c) Spaces classified as ~~c~~Critical ~~o~~Operations ~~p~~Power ~~s~~Systems (COPS) in accordance with NFPA 70.

(d) Spaces where core clearing and settlement services are performed such that their failure to settle pending financial transactions is capable of systemic risk in accordance with "The Interagency Paper on Sound Practices to Strengthen the Resilience of the US Financial System"~~,~~ (April 7, 2003)."~~"~~ [ASHRAE 90.1:6.5.1]

TABLE E 503.5(1)
MINIMUM FAN-COOLING UNIT SIZE WHERE AN ECONOMIZER IS REQUIRED ~~FOR COMFORT COOLING~~
[ASHRAE 90.1: TABLE 6.5.1-1]

CLIMATE ZONES	COOLING CAPACITY WHERE AN ECONOMIZER IS REQUIRED
0a, 0b, 1a, 1b	No economizer requirement
2a, 2b, 3a, 4a, 5a, 6a, 3b, 3c, 4b, 4c, 5b, 5c, 6b, 7, 8	≥54 000 Btu/h

For SI units: 1000 British thermal units per hour = 0.293 kW

~~**TABLE E 503.5(2)**~~
~~**MINIMUM FAN-COOLING UNIT SIZE WHERE AN ECONOMIZER IS REQUIRED FOR COMPUTER ROOMS**~~
~~**[ASHRAE 90.1: TABLE 6.5.1-2]**~~

~~CLIMATE ZONES~~	~~COOLING CAPACITY WHERE AN ECONOMIZER IS REQUIRED~~
~~1a, 1b, 2a, 3a, 4a~~	~~No economizer requirement~~
~~2b, 5a, 6a, 7, 8~~	~~≥135 000 Btu/h~~
~~3b, 3c, 4b, 4c, 5b, 5c, 6b~~	~~≥65 000 Btu/h~~

~~For SI units: 1000 British thermal units per hour = 0.293 kW~~

TABLE E ~~503.5(3)~~ 503.5(2)
ELIMINATE REQUIRED ECONOMIZER FOR COMFORT COOLING BY INCREASING COOLING EFFICIENCY
[ASHRAE 90.1: TABLE ~~6.5.1-3~~ 6.5.1-2]

* Where a unit is rated with an IPLV, IEER or SEER, to eliminate the required ~~air or water~~ economizer, the minimum cooling efficiency of the HVAC unit shall be increased by the percentage shown.Where the HVAC unit is rated with a full load metric like EER~~ or COP~~ cooling, these shall be increased by the percentage shown.

(portions of table not shown remain unchanged)

E 503.5.1 Air Economizers, Design Capacity. Air economizer systems shall be capable of and configured to ~~modulating~~ modulate outdoor air and return air dampers to provide up to 100 percent of the design supply air quantity as outdoor air for cooling. [ASHRAE 90.1:6.5.1.1.1]

E 503.5.1.1 Control Signal. Economizer ~~dampers~~ controls shall be capable of and configured to ~~being~~ sequence~~d~~ the dampers with the mechanical cooling equipment and shall not be controlled by only mixed air temperature.

Exception: The use of mixed air temperature limit control shall be permitted for systems controlled from space temperature (such as single-zone systems). [ASHRAE 90.1:6.5.1.1.2]

E 503.5.1.2 High-Limit Shutoff. Air economizers shall be capable of and configured to automatically ~~reducing~~ reduce outdoor air intake to the design minimum outdoor air quantity where outdoor air intake will no longer reduce cooling energy ~~usage~~ use. High-limit shutoff control types and associated setpoints for specific climate zones shall be chosen from Table E 503.5.1.2. [ASHRAE 90.1:6.5.1.1.3]

E 503.5.2 ~~Water~~ Fluid Economizers, Design Capacity. ~~Water~~ Fluid economizer systems shall be capable of ~~cooling supply air by indirect evaporation and~~ providing up to 100 percent of the expected system cooling load at outdoor air temperatures of not more than 50°F (10°C) dry bulb or 45°F (7°C) wet bulb.

Exceptions:

(1) Systems primarily serving computer rooms in which 100 percent of the expected system cooling load at the dry bulb and wet bulb temperatures in accordance with Table E 503.5.2 is ~~achieved~~ met with ~~evaporative~~ water-cooled fluid economizers.

(2) Systems primarily serving computer rooms in which 100 percent of the expected system cooling load at the dry bulb temperatures ~~in accordance with~~ listed in Table E 503.5.2 is ~~achieved~~ met with ~~dry cooler water~~ air-cooled fluid economizers.

(3) Systems where dehumidification requirements are not capable of being met using outdoor air temperatures of 50°F (10°C) dry bulb or 45°F (7°C) wet bulb~~,~~ and where 100 percent of the expected system cooling load at 45°F (7°C) dry bulb or 40°F (4°C) wet bulb is ~~achieved~~ met with ~~evaporative~~ water-cooled fluid economizers. [ASHRAE 90.1:6.5.1.2.1]

E 503.5.2.1 Maximum Hydronic Pressure Drop. Precooling coils and ~~water~~fluid-to-water heat exchangers used as part of a ~~water~~ fluid economizer system shall either have a water-side pressure drop of less than 15 feet of water (45 kPa), or a secondary loop shall be created so that the coil or heat exchanger pressure drop is not seen by the circulating pumps where the system is in the normal cooling (non-economizer) mode. [ASHRAE 90.1:6.5.1.2.2]

E 503.5.3 Integrated Economizer Control. Economizer systems shall be integrated with the mechanical cooling system and be capable of and configured to ~~providing~~ provide partial cooling even where additional mechanical cooling is required to be in accordance with the remainder of the cooling load. Controls shall not false load the mechanical cooling systems by limiting or disabling the economizer or by other means, such as hot gas bypass, except at the lowest stage of mechanical cooling.

Units that include an air economizer shall comply with the following:

(1) Unit controls shall have the mechanical cooling capacity control interlocked with the air economizer controls such that the outdoor air damper is at the 100 percent open position when mechanical cooling is on, and the outdoor air damper does not begin to close to prevent coil freezing due to minimum compressor run time until the leaving air temperature is less than 45°F (7°C).

~~(2) DX units that control the capacity of the mechanical cooling directly based on occupied space temperature shall have a minimum of two stages of mechanical cooling capacity per the following effective dates:~~

~~(a) Not less than 75 000 Btu/h (22kW) Rated Capacity—Effective 1/1/2014~~

~~(b) Not less than 65 000 Btu/h (18kW) Rated Capacity—Effective 1/1/2016 [ASHRAE 90.1:6.5.1.3]~~

(2) DX units with a rated capacity no less than 65 000 Btu/h (18 kW) that control the capacity of the mechanical cooling directly based on occupied space temperature shall have not less than two stages of mechanical cooling capacity.

(3) ~~**E 503.5.3.1 Other DX Units.**~~ Other DX units, including those that control space temperature by modulating the airflow to the space, shall comply with the requirements of Table E 503.5.3~~.1~~. [ASHRAE 90.1:~~6.5.1.4~~6.5.1.3]

TABLE E 503.5.3~~.1~~
DX COOLING STAGE REQUIREMENTS FOR MODULATING AIRFLOW UNITS
[ASHRAE 90.1: TABLE ~~6.5.1.4~~6.5.1.3]

RATING CAPACITY, (Btu/h)	MINIMUM NUMBER OF MECHANICAL COOLING STAGES	MINIMUM COMPRESSOR DISPLACEMENT*
≥65 000 and <240 000	3	≤35% of full load
≥240 000	4	≤25% full load

For SI units: 1000 British thermal units per hour = 0.293 kW

* For mechanical cooling stage control that does not use variable compressor displacement the percent displacement shall be equivalent to the mechanical cooling capacity reduction evaluated at the full load rating conditions for the compressor.

TABLE E 503.5.1.2
HIGH-LIMIT SHUTOFF CONTROL SETTINGS FOR AIR ECONOMIZERS2
[ASHRAE 90.1: TABLE 6.5.1.1.3]

CONTROL TYPE	ALLOWED ONLY IN CLIMATE ZONE AT LISTED SETPOINT	REQUIRED HIGH LIMIT (ECONOMIZER OFF WHERE):	
		EQUATION	DESCRIPTION
Fixed dry bulb temperature	0b, 1b, 2b, 3b, 3c, 4b, 4c, 5b, 5c, 6b, 7, 8	T_{oa} > 75°F	Outdoor air temperature exceeds 75°F
	5a, 6a	T_{oa} > 70°F	Outdoor air temperature exceeds 70°F
	0a, 1a, 2a, 3a, 4a	T_{oa} > 65°F	Outdoor air temperature exceeds 65°F
Differential dry bulb temperature	0b, 1b, 2b, 3b, 3c, 4b, 4c, 5a, 5b, 5c, 6a, 6b, 7, 8	T_{oa}>T_{ra}	Outdoor air temperature exceeds return air temperature

(portions of table not shown remain unchanged)

TABLE E 503.5.2
WATER FLUID ECONOMIZER SIZING DRY-BULB AND WET-BULB REQUIREMENTS FOR COMPUTER ROOMS*
[ASHRAE 90.1: TABLE 6.5.1.2.1]

CLIMATE ZONE		~~EVAPORATIVE WATER ECONOMIZER WATER COOLED~~		~~DRY COOLER WATER ECONOMIZER~~ AIR COOLED
		DRY BULB, °F	WET BULB, °F	DRY BULB, °F
0	A	NR		NR
0	B	NR		NR

(portions of table not shown remain unchanged)

E 503.5.4.1 Economizer Humidification System Impact. Systems with hydronic cooling and humidification systems designed to maintain inside humidity at a dew-point temperature more than 35°F (2°C) shall use a ~~water~~ fluid economizer where an economizer is required in accordance with Section E 503.5 through Section E 503.5.4.1. [ASHRAE 90.1:~~6.5.1.6~~ 6.5.1.5]

E 503.5.5 Simultaneous Heating and Cooling Limitation, Zone Controls. Zone thermostatic controls shall prevent the following:

(1) Reheating.
(2) Recooling.
(3) Mixing or simultaneously supplying air that has been previously mechanically heated and air that has been previously cooled, either by mechanical cooling or by economizer systems.
(4) Other simultaneous operation of heating and cooling systems to the same zone.

Exceptions:

(1) Zones ~~without DDC~~ for which the volume of air that is reheated, recooled, or mixed is less than the larger of the following:
   (a) ~~Thirty~~ Twenty percent of the zone design peak supply ~~rate~~ for systems with DDC and 30 percent for other systems.
   (b) The outdoor airflow rate required to be in accordance with the ventilation requirements of Chapter 4 or ASHRAE 62.1 for the zone.
   (c) A higher rate that is capable of demonstrating, to the satisfaction of the Authority Having Jurisdiction, to reduce overall system annual energy usage by offsetting reheat or recool energy losses through a reduction in outdoor air intake for the system.
   (d) The airflow rate required to be in accordance with applicable codes or accreditation standards, such as pressure relationships or minimum air change rates.
(2) (remaining text unchanged)
(3) (remaining text unchanged)
(4) (remaining text unchanged) [ASHRAE 90.1:6.5.2.1]

E 503.5.5.2.3 Hydronic (Water Loop) Heat Pump Systems. Hydronic heat pumps connected to a common heat pump water loop with central devices for heat rejection (e.g., cooling tower) and heat addition (e.g., boiler) shall have the following:

(1) Controls that are capable of and configured to ~~providing~~ provide a heat pump water supply temperature dead band of not less than 20°F (11°C) between initiation of heat rejection and heat addition by the central devices (e.g., tower and boiler).
(2) (remaining text unchanged) [ASHRAE 90.1:6.5.2.2.3]

E 503.5.5.3 Dehumidification. Where humidity controls are provided, such controls shall prevent reheating, mixing of hot and cold airstreams, or other means of simultaneous heating and cooling of the same airstream.

Exceptions:

(1) The system is capable of and configured to reduce supply air volume to 50 percent or less of the design airflow rate or the minimum outdoor air ventilation rate in accordance with ASHRAE 62.1 or other applicable federal, state, or local code or recognized standard, whichever is larger before simultaneous heating and cooling takes place.
(2) The individual fan cooling unit has a design cooling capacity of not more than 65 000 Btu/h (19 kW) and is capable of and configured to ~~unloading~~ unload to 50 percent capacity before simultaneous heating and cooling takes place.
(3) The individual mechanical cooling unit has a design cooling capacity of not more than 40 000 Btu/h (11.7 kW). An individual mechanical cooling unit is a single system composed of a fan or fans and a cooling coil capable of providing mechanical cooling.

(4) Systems serving spaces where specific humidity levels are required to satisfy process needs, such as vivariums, museums, surgical suites, pharmacies, and buildings with refrigerating systems, such as supermarkets, refrigerated warehouses, and ice arenas, and where the building includes site-recovered energy or site solar energy ~~source~~ that provide energy equal to 75 percent or more of the annual energy for reheating or for providing warm air in mixing systems. This exception shall not apply to computer rooms.
(5) Not less than 90 percent of the annual energy for reheating or for providing warm air in mixing systems is provided from ~~a~~ site-recovered energy (including condenser heat) or site-solar energy ~~source~~.
(6) Systems where the heat added to the airstream is the result of the use of a desiccant system and 75 percent of the heat added by the desiccant system is removed by a heat exchanger, either before or after the desiccant system with energy recovery. [ASHRAE 90.1:6.5.2.3]

E 503.5.6 Air System Design and Control. HVAC air system design and control ~~systems having a total fan system motor nameplate horsepower (hp) exceeding 5 hp (3.7 kW)~~ shall be in accordance with the provisions of Section E 503.5.6.1 through Section ~~E 503.5.6.5~~ E 503.5.6.6. ~~[ASHRAE 90.1:6.5.3]~~
E 503.5.6.1 Fan System Power and Efficiency. Each HVAC system~~s at fan system design conditions shall not exceed the allowable~~ having a total fan system motor nameplate horsepower (kW) exceeding 5 hp (3.7 kW) at fan system design conditions shall not exceed the allowable fan system motor nameplate horsepower (kW) (Option 1) or fan system brake horsepower (kW) (Option 2) as shown in Table E 503.5.6.1(1). This shall include supply fans, return or relief fans, exhaust fans, and fan-powered terminal units associated with systems providing heating or cooling capability that operate at fan system design conditions. Single-zone ~~variable-air-volume~~ VAV systems shall comply with the constant-volume fan power limitation.
Exceptions:
(1) Hospital, vivarium, and laboratory systems that utilize flow control devices on exhaust, return, or both 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 (0.7 kW) or less. [ASHRAE 90.1:6.5.3.1.1]

TABLE E 503.5.6.1(2)
FAN POWER LIMITATION PRESSURE DROP ADJUSTMENT
[ASHRAE 90.1: TABLE 6.5.3.1-2]

DEVICE	ADJUSTMENT
CREDITS	
~~Fully ducted return, exhaust, or both air systems~~ Return or exhaust systems required by code or accreditation standards to be fully ducted, or systems required to maintain air pressure differentials between adjacent rooms	0.5 in. w.c. (2.15 in w.c. for laboratory and vivarium systems)
Energy recovery device, other than coil runaround loop	For each airstream [(2.2 x ~~energy recovery effectiveness~~ enthalpy recovery ratio) - 0.5] in w.c. ~~for each airstream~~

(portions of table not shown remain unchanged)

E 503.5.6.1.1 Motor Nameplate Horsepower. For ~~a~~ each fan, the selected fan motor shall be not larger than the first available motor size more than the brake horsepower (bhp) (kW). The fan brake horsepower shall be indicated on the design documents to allow for compliance verification by the Authority Having Jurisdiction.
Exceptions:
(1) For fans less than 6 bhp (4.5 kW), where the first available motor larger than the bhp (kW) has a nameplate rating within 50 percent of the bhp (kW), the next larger nameplate motor size shall be selected.
(2) For fans 6 bhp (4.5 kW) and larger, where the first available motor larger than the bhp (kW) has a nameplate rating within 30 percent of the bhp (kW), the next larger nameplate motor size shall be selected.
(3) Systems that are in accordance with Section E 503.5.6.1, Option 1.
(4) Fans with motor nameplate horsepower of less than 1 hp (0.7 kW). [ASHRAE 90.1:6.5.3.1.2]
E 503.5.6.1.2 Fan Efficiency. Fans shall have a fan efficiency grade (FEG) of 67 or more, based on manufacturers' certified data in accordance with AMCA 205. The total efficiency of the fan at the design point of operation shall be within 15 percentage points of the maximum total efficiency of the fan.
Exceptions:
(1) ~~Single~~ Individual fans with a motor nameplate horsepower of 5 hp (3.7 kW) or less that are not part of a group operated as the functional equivalent of a single fan.
(2) through (7) remain unchanged

[ASHRAE 90.1:6.5.3.1.3]

E 503.5.6.2.2 VAV Setpoint Reset. For multiple-zone VAV systems having a total fan system motor nameplate horsepower exceeding 5 hp (3.7 kW) with DDC of individual zones reporting to the central control panel, static pressure setpoint shall be reset based on the zone requiring the most pressure, such as the setpoint is reset lower until one zone damper is nearly wide open. Controls shall provide the following:

(1) Monitor zone damper positions or other indicator of need for static pressure.
(2) Automatically detect those zones that are capable of excessively driving the reset logic and generate an alarm to the system operator.
(3) Readily allow operator removal of zone~~(s)~~ from the reset algorithm. [ASHRAE 90.1:6.5.3.2.3]

TABLE E 503.5.6.2
~~EFFECTIVE DATES FOR~~ FAN AIRFLOW CONTROL
[ASHRAE 90.1: TABLE 6.5.3.2.1]

COOLING SYSTEM TYPE	FAN MOTOR SIZE, (hp)	MECHANICAL COOLING CAPACITY, (Btu/h)	~~EFFECTIVE DATE~~
DX cooling	Any	~~≥110 000~~ ≥ 65 000	
		~~≥75 000~~	~~1/1/2014~~
		~~≥65 000~~	~~1/1/2016~~
Chilled-water and evaporative cooling	~~≥5~~	~~Any~~	
	≥ 1/4	Any	~~1/1/2014~~

For SI units: 1000 British thermal units per hour = 0.293 kW, 1 horsepower = 0.746 kW, 1 cubic foot per minute = 0.00047 m^3/s

E 503.5.7.1 Hydronic Variable Flow Systems. ~~HVAC pumping~~ Chilled- and hot-water distribution systems that include three or more control valves designed to modulate or step open and close as a function of load shall be designed for variable fluid flow and shall be capable of and configured to reduce pump flow rates to not more than the larger of 25 ~~50~~ percent ~~or less~~ of the design flow rate or the minimum flow required by the heating/ cooling equipment manufacturer for the proper operation of equipment. Individual or parallel pumps serving variable-flow heating-water or chilled-water systems, where the nameplate horsepower of the motor or combined parallel motors is not less than the power shown in Table E503.5.7.1, ~~5 hp (3.7 kW)~~ shall have controls~~,~~ or devices~~, or both~~ that will result in pump motor demand of not more than 30 percent of design wattage at 50 percent of design water flow. The controls or devices shall be controlled as a function of desired flow or to maintain a minimum required differential pressure. Differential pressure shall be measured at or near the most remote heat exchanger or the heat exchanger requiring the greatest differential pressure. The differential pressure setpoint shall not exceed 110 percent of that required to achieve design flow through the heat exchanger. Where differential pressure control is used to ~~be in accordance~~ comply with this section, and DDC systems are used, the setpoint shall be reset downward based on valve positions until one valve is nearly wide open.

Exceptions:

(1) Differential pressure set-point reset is not required where valve position is used to comply with Section E 503.5.7.3.
(2) Variable-pump flow control is not required on heating-water pumps where more than 50 percent of annual heat is generated by an electric boiler.
(3) Variable flow is not required for primary pumps in a primary/secondary system.
(4) Variable flow is not required for a coil pump provided for freeze protection.
(5) Variable flow is not required for heat recovery coil runaround loops. [ASHRAE 90.1:6.5.4.2]

TABLE E 503.5.7.1
PUMP FLOW CONTROL REQUIREMENTS
[ASHRAE 90.1: Table 6.5.4.2]

CHILLED WATER PUMPS IN THESE CLIMATE ZONES	HEATING WATER PUMPS IN THESE CLIMATE ZONES	MOTOR NAMEPLATE HORSEPOWER
0A, 0B, 1A, 1B, 2B	NR	≥2 hp
2A, 3B	NR	≥3 hp
3A, 3C, 4A, 4B	7, 8	≥5 hp
4C, 5A, 5B, 5C, 6A, 6B	3C, 5A, 5C, 6A, 6B	≥7.5 hp
-	4A, 4C, 5B	≥10 hp
7, 8	4B	≥15 hp
-	2A, 2B, 3A, 3B	≥25 hp

-	1B	≥100 hp
-	0A, 0B, 1A	≥200 hp

For SI units: 1 horsepower = 0.746 kW

TABLE E 503.7.2
MINIMUM DUCT INSULATION R-VALUE[1]
[ASHRAE 90.1:TABLE 6.8.2]

CLIMATE ZONE	DUCT LOCATION		
	EXTERIOR[2]	UNCONDITIONED SPACE AND BURIED DUCTS	INDIRECTLY CONDITIONED SPACE[3, 4]
SUPPLY AND RETURN DUCTS FOR HEATING AND COOLING			
0 to 4	R-8	R-6	R-1.9
5 to 8	R-12	R-6	R-1.9
SUPPLY AND RETURN DUCTS FOR HEATING ONLY			
0 to 1	none	none	none
2 to 4	R-6	R-6	R-1.9
5 to 8	R-12	R-6	R-1.9
SUPPLY AND RETURN DUCTS FOR COOLING ONLY			
0 to 6	R-~~6~~8	R-6	R-1.9
7 to 8	R-1.9	R-1.9	R-1.9

Notes:

1. Insulation R-values, measured in [°F•h•ft^2/(Btu•in)] [(m•K)/W], are for the insulation as installed and do not include film resistance. The required minimum thicknesses do not consider water vapor transmission and possible surface condensation. Where ~~exterior walls~~ portions of the building envelope are used as a plenum ~~walls~~ enclosure, ~~wall~~ building envelope insulation shall be ~~in accordance with~~ as required by the most restrictive condition of Section ~~E 503.4.7~~ E 503.4.7.1 or ASHRAE 90.1, depending on whether the plenum is located in the roof, wall, or floor. Insulation resistance measured on a horizontal plane in accordance with ASTM C518 at a mean temperature of 75°F (24°C) at the installed thickness.
2. Includes attics above insulated ceilings, parking garages and crawl spaces.
3. Includes return air plenums, with or without exposed roofs above.
4. Return ducts in this duct location do not require insulation.

E 503.5.10 Exhaust Air Energy Recovery. ~~A~~ Each fan system shall have an energy recovery system where the design supply fan airflow rate exceeds the value listed in Table E 503.5.10(1) and Table E 503.5.10(2), based on the climate zone and percentage of outdoor ~~airflow rate~~ air at design airflow conditions. Table E 503.5.10(1) shall be used for all ventilation systems that operate less than 8000 hours per year and Table E 503.5.10(2) shall be used for all ventilation systems that operate 8000 or more hours per year.

Energy recovery systems required by this section shall ~~have 50 percent or more energy recovery effectiveness~~ result in an enthalpy recovery ratio of not less than 50 percent. A f~~F~~ifty percent ~~energy~~ enthalpy recovery ~~effectiveness~~ ratio shall ~~be the~~ mean a change in the enthalpy of the outdoor air supply equal to 50 percent of the difference between the outdoor air and ~~return~~ entering exhaust air enthalpies at design conditions. Provision shall be provided to bypass or control the energy recovery system to permit air economizer operation in accordance with Section E 503.5.1.

Exceptions:

(1) Laboratory systems that are in accordance with Section E 503.5.11.3.
(2) Systems serving spaces that are not cooled and that are heated to less than 60°F (16°C).
(3) Where more than 60 percent of the outdoor air heating energy is provided from site-recovered energy or site-solar energy.
(4) Heating energy recovery in Climate Zones 0, 1, and 2.
(~~3~~ 5) Cooling energy recovery in climate zones 3~~c~~C, 4~~c~~C, 5~~b~~B, 5~~c~~C, 6~~b~~B, 7, and 8.
(~~4~~ 6) Where the sum of the airflow rates exhausted and relieved within 20 feet (6096 mm) of each other is less than 75 percent of the design outdoor airflow rate, excluding exhaust air that is
  (a) used for another energy recovery system,
  (b) not allowed by ASHRAE 170 for use in energy recovery systems with leakage potential, or
  (c) of Class 4 as defined in ASHRAE 62.1.
(~~5~~ 7) Systems requiring dehumidification that employ energy recovery in series with the cooling coil.
(~~6~~ 8) Systems expected to operate less than 20 hours per week at the outdoor air percentage in accordance with Table E 503.5.10(1). [ASHRAE 90.1:6.5.6.1]

TABLE E 503.5.10(1)
EXHAUST AIR ENERGY RECOVERY REQUIREMENTS FOR VENTILATION SYSTEMS OPERATING LESS THAN 8000 HOURS PERYEAR*
[ASHRAE 90.1: TABLE 6.5.6.1-1]

CLIMATE ZONE	PERCENT OUTDOOR AIR AT FULL DESIGN AIRFLOW RATE							
	≥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 (cubic feet per minute)							
0A, 1A, 2A, 3A, 4A, 5A, 6A	≥26 000	≥16 000	≥5500	≥4500	≥3500	≥2000	≥1000	~~>0~~ ≥120
7, 8	≥4500	≥4000	≥2500	≥1000	~~>0~~ ≥140	~~>0~~ ≥120	~~>0~~ ≥100	~~>0~~ ≥80

(portion of table not shown remains unchanged)

TABLE E 503.5.10(2)
EXHAUST AIR ENERGY RECOVERY REQUIREMENTS FOR VENTILATION SYSTEMS OPERATING NOT LESS THAN 8000 HOURS PER YEAR*
[ASHRAE 90.1: TABLE 6.5.6.1-2]

CLIMATE ZONE	PERCENT OUTDOOR AIR AT FULL DESIGN AIRFLOW RATE							
	≥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 (cubic feet per minute)							
0B, 1B, 2B, 3B, 4C, 5C	NR	≥19 500	≥9000	≥5000	≥4000	≥3000	≥1500	~~>0~~ ≥ 120
0A, 1A, 2A, 3A, 4B, 5B	≥2500	≥2000	≥1000	≥500	~~>0~~ ≥ 140	~~>0~~ ≥ 120	~~>0~~ ≥ 100	~~>0~~ ≥ 80
4A, 5A, 6A, 6B, 7, 8	~~>0~~ ≥ 200	~~>0~~ ≥ 130	>0 ≥ 100	~~>0~~ ≥ 80	~~>0~~ ≥ 70	~~>0~~ ≥ 60	~~>0~~ ≥ 50	~~>0~~ ≥ 40

1 cubic foot per minute = 0.00047 m^3/s
* NR—Not required

E 503.5.11.2.1 Kitchen or Dining Facility. Where a kitchen or dining facility has a total kitchen hood exhaust airflow rate more than 5000 ft3/min (2.3597 m^3/s), then one of the following shall be provided:

(1) Fifty percent or more of all replacement air is transfer air that would otherwise be exhausted.
(2) Demand ventilation system~~(s)~~ ~~provide~~ on 75 percent or more of the exhaust air. Such systems shall be capable of and configured to provide 50 percent or more reduction in exhaust and replacement air system airflow rates, including controls necessary to modulate airflow in response to appliance operation and to maintain full capture and containment of smoke, effluent, and combustion products during cooking and idle.
(3) Listed energy recovery devices that result in a sensible ~~heat~~ energy recovery ~~effectiveness~~ ratio of 40 percent or more on 50 percent or more of the total exhaust airflow. A 40 percent sensible energy recovery ratio shall mean a change in the dry-bulb temperature of the outdoor air supply equal to 40 percent of the difference between the outdoor air and entering exhaust air dry-bulb temperatures at design conditions. [ASHRAE 90.1:6.5.7.2.3]

E 503.5.11.3 Laboratory Exhaust Systems. Buildings with laboratory exhaust systems having a total exhaust rate of more than 5000 ft^3/min (2.3597 m^3/s) shall include not less than one of the following features:

(1) VAV laboratory exhaust and room supply systems capable of and configured to reduce exhaust ~~airflow rates,~~ and makeup airflow rates, ~~or both~~ incorporate a heat recovery system to precondition makeup air from laboratory exhaust, or both, and shall be in accordance with the following:

$$A+B\bullet(E/M) \geq 50\% \qquad \text{(Equation E 503.5.11.3)}$$

Where:
A = Percentage that the exhaust and makeup airflow rates are capable of being reduced from design conditions.
B = Sensible energy recovery ~~effectiveness~~ ratio.
E = Exhaust airflow rate through the heat recovery device at design conditions.
M = Makeup airflow rate of the system at design conditions.

(2) VAV laboratory exhaust and room supply systems that are required to have minimum circulation rates to be in accordance with the codes or accreditation standards shall be capable of ~~reducing~~ and configured to reduce zone exhaust and makeup airflow rates to the regulated minimum circulation values, or the minimum required to maintain pressurization relationship requirements. Systems serving nonregulated zones shall be capable of

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and configured to reduce exhaust and makeup airflow rates to 50 percent of the zone design values, or the minimum required to maintain pressurization relationship requirements.

(3) Direct makeup (auxiliary) air supply of 75 percent or more of the exhaust airflow rate, heated not more than 2°F (1°C) below room setpoint, cooled to not less than 3°F (2°C) above room setpoint, no humidification added, and no simultaneous heating and cooling are used for dehumidification control. [ASHRAE 90.1:6.5.7.3]

Substantiation:
Technical Merit:
Current requirements in Appendix E were extracted from ASHRAE 90.1-2016. However, the provisions do not correlate completely with ASHRAE 90.1.

During the cooling season vestibules do not serve a functional purpose if the setpoint for the vestibule is the same as the adjacent space. Allowing the air in the vestibule to be tempered by transfer air is beneficial because that air-conditioned space within the vestibule is destined to be exhausted. The modified provisions add vestibule limits for mechanical cooling to 85 degrees F when the vestibule is tempered with transfer air or heated with recovered energy.

A detailed economic analysis was performed to justify the expanded requirements for the use of economizers using commercial HVAC; however, since there were no benchmark building defined requirements for computer rooms, the requirements from ASHRAE 90.1-2007 were used. Due to concerns about humidity control in computer rooms and having to humidify the outside free cooling air, the use of economizers was cut off when the ambient wet-bulb was below 35°F wb. Using the data and the cost model developed for the justification of ASHRAE 90.1-2007, the scalar economic analysis was updated using the new economic criteria developed for the 2013 to 2016 ASHRAE 90.1 cycle.

One can justify the elimination of the computer room economizer size criteria, and the use of the HVAC economizer table for all products can easily be justified. As such, ASHRAE 90.1-2016 eliminates Table 6.5.1-2 and requires that table 6.5.1-1 be used for both HVAC and computer room units. See ASHRAE 90.1-2013 addendum “i” for more details. Other updates include changing “water economizer” to “fluid economizer” to account for refrigerant-based economizers and adding requirements for Climate Zone 0.

Emergency nature: The emergency nature of this proposed TIA is supported by Section 5-2(a) of the Regulations Governing Committee Projects, “*The document contains an error or an omission that was overlooked during a regular revision process*.” The current Uniform Mechanical Code does not provide the exception to limit the mechanical cooling in vestibules to 85 degrees F when the vestibule is tempered with transfer air or heated with recovered energy. Furthermore, the current Mechanical Code currently has a separate table for indicating when an economizer is required for computer rooms and will conflict the latest requirements of ASHRAE 90.1-2016, latest edition, which now uses “one” table to determine when economizers are needed.

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