Mark up version (all changes in red)

OPTION	DESCRIPTION	CREDIT(S)	
		All Other	Group R-2[b]
3.12[cg]	The thermostat controlling the primary heating or cooling system of each dwelling unit shall be provided with a demand responsive control capable of communicating with the Virtual End Node (VEN) using a wired or wireless bi-directional communication pathway that provides the occupant the ability to voluntarily participate in utility demand response programs, where available. The thermostat shall be capable of executing the following actions in response to a demand response signal: 1. Automatically increasing the zone operating cooling set point by the following values: 1°F (0.5°C), 2°F (1°C), 3°F (1.5°C) and 4°F (2°C). 2. Automatically decreasing the zone operating heating set point by the following values: 1°F (0.5°C), 2°F (1°C), 3°F (1.5°C) and 4°F (2°C). Thermostats controlling single-stage HVAC systems shall be provided with a demand responsive control that complies with the communication protocol required by a controlling entity, such as a utility or service provider, to participate in an automated demand response program. If there is no communication protocol by a controlling entity, then the thermostats should comply with one of the following: 1. Certified OpenADR 2.0a VEN, as specified under Clause 11, Conformance. 2. Certified OpenADR 2.0b VEN, as specified under Clause 11, Conformance. 3. Certified by the manufacturer as being capable of responding to a demand response signal from a certified OpenADR 2.0b VEN by automatically implementing the control functions requested by the VEN for the equipment it controls. 4. IEC 62746-10-1. 5. The physical configuration and communication protocol of CTA 2045-A or CTA-2045-B. Thermostats controlling variable-capacity, multistage and two-stage HVAC systems shall be provided with a demand responsive control that complies with the communication and performance requirements of AHRI 1380.	0.5	0.5

Add to Table R406.3:

R503.1.2 Heating and cooling systems. New heating and cooling systems and *ductwork* that are part of the alteration shall comply with Section R403 and this section. *Alterations* to existing heating and cooling systems and *ductwork* shall comply with this section.

Exceptions:

1. Where *ductwork* from an existing heating and cooling system is extended, duct systems with less than 40 linear feet in unconditioned spaces shall not be required to be tested in accordance with Section R403.2.2.
2. Existing duct systems constructed, insulated or sealed with asbestos.

R503.1.2.1 Ductwork. HVAC *ductwork* newly installed as part of an *alteration* shall comply with Section R403.

Exception: Where *ductwork* from an existing heating and cooling system is extended.

R503.1.2.2 System sizing. New heating and cooling equipment that is part of an *alteration* shall be sized in accordance with Section R403.7 based on the *existing building* features as modified by the *alteration*.

Exception: Where it has been demonstrated to the *code official* that compliance with this section would result in heating or cooling equipment that is incompatible with the remaining portions of the existing heating or cooling system.

R503.1.2.3 Duct system leakage. Where an *alteration* includes any of the following, *duct systems* shall be tested in accordance with Section R403.3.7 and shall have a total leakage less than or equal to 12.0 cubic feet per minute (339.9 L/min) per 100 square feet (9.29 m2) of *conditioned floor area*:

1. Twenty-five percent or more of the registers that are part of the *duct system* are relocated.
2. Twenty-five percent or more of the total length of all *ductwork* in the *duct system* is relocated.
3. The total length of all *ductwork* in the *duct system* is increased by 25 percent or more.
4. Cooling system alterations complying with Section R503.1.2.5.2.~~1~~

Exception:

1. If it is not possible to meet the duct sealing requirements, all accessible leaks shall be sealed and verified through a visual inspection and a smoke test by a RS-33 certified tester.
2. *Duct systems* located entirely inside a *conditioned space* in accordance with Section R403.3.4.

R503.1.2.4 Controls. New heating and cooling equipment that is part of the *alteration* shall comply with Sections R403.1 and R403.2.

R503.1.2.5 Cooling Systems. When an *alteration* of an existing space conditioning system includes the installation or replacement of a~~n~~ ducted air-conditioner, the altered system shall comply with either Section R503.1.2.5.1 or Section R503.1.2.5.2.

R503.1.2.5.1 Heat Pump. A ducted heat pump shall be configured to be the primary heating source and shall be sized to be the greater of either: ~~according to Section R403.7. Supplemental heating may be provided by a gas furnace or electric resistance heating.~~

~~**Exception:** Where the required capacity of a heat pump to meet the system sizing required by R403.7 is at least 12,000 Btu/h more than either:~~

A. The required capacity of an air conditioner to meet the design cooling load, or
B. The capacity of the existing air conditioner,

~~then the heat pump should be sized to meet the greater of these two capacities.~~ The existing heating system shall be configured to meet ~~can handle~~ the remaining heating load. Documentation of the existing air conditioner's capacity and the heating and cooling load calculations per R403.7 must be submitted to the enforcement agency before permitting the heat pump ~~and proposed air conditioner~~.

R503.1.2.5.2 Air Conditioner. A~~n~~ ducted air conditioner shall meet all the requirements of either Section R503.1.2.5.2.1 or Section R503.1.2.5.2.2

R503.1.2.5.2.1 Systems with Existing Duct Distribution Systems. Systems with existing duct distribution systems shall comply with all of the requirements of this section.

a. The duct system measured air leakage shall meet the requirements of Section R503.1.2.3.
b. Demonstrate, in every control mode, airflow greater than or equal to 300 CFM per ton of nominal cooling capacity through the return grilles, and an air-handling unit fan efficacy less than or equal to 1.2 CFM/W. The airflow rate and fan efficacy requirements in this section

shall be confirmed through field verification and diagnostic testing, following the procedures outlined in R403.6.

Exceptions:

1. Systems unable to comply with the minimum airflow rate and system efficacy requirements shall demonstrate compliance by installing a system thermostat that complies with the credit option 3.12 in Table R406.3;
2. Multispeed compressor systems or variable speed compressor systems shall verify air flow (cfm/ton) and fan efficacy (Watt/cfm) for system operation at the maximum compressor speed and the maximum air handler fan speed.
3. Gas furnace air-handling units manufactured prior to July 3, 2019 shall comply with a fan efficacy value less than or equal to 0.58 W/cfm as confirmed by field verification and diagnostic testing in accordance with the procedures outlined in R403.6.

c. Vented attic insulation shall be replaced as specified in Section R402. Luminaires not rated for insulation contact must be replaced or retrofitted as specified by Section R402.5.3.

Exceptions:

1. Dwelling units with at least R-38 existing insulation installed at the ceiling level.
2. Dwelling units where the alteration would directly cause the disturbance of asbestos unless the alteration is made in conjunction with asbestos abatement.
3. Dwelling units with knob and tube wiring located in the vented attic.
4. Where the accessible space in the attic is not large enough to accommodate the required R-value, the entire accessible space shall be filled with insulation provided such installation does not violate Section 806.3 of the *International Residential Code*.

d. Air seal all accessible areas of the ceiling plane between the attic and the conditioned space including all joints, penetrations and other openings that are potential sources of air leakage by caulking, gasketing, weather-stripping or otherwise sealing to limit infiltration and exfiltration.

Exceptions:

1. Dwelling units with at least R-38 existing insulation installed at the ceiling level.
2. Dwelling units where the alteration would directly cause the disturbance of asbestos unless the alteration is made in conjunction with asbestos abatement.
3. Dwelling units with atmospherically vented space heating or water heating combustion appliances located inside the pressure boundary of the dwelling unit.

R503.1.2.5.2.2 Entirely New or Complete Replacement Duct Systems: Systems with new or complete replacement of duct systems shall comply with all of the requirements of this section.

a. The duct system measured air leakage shall meet the requirements of Section R503.1.2.3.

b. If the air handler and ducts are located within a vented attic, the vented attics shall have insulation replaced as specified in Section R402. Luminaires not rated for insulation contact must be replaced or retrofitted as specified by Section R402.5.3.

Exceptions:

1. Dwelling units with at least R-19 existing insulation installed at the ceiling level.
2. Dwelling units where the alteration would directly cause the disturbance of asbestos unless the alteration is made in conjunction with asbestos abatement.
3. Dwelling units with knob and tube wiring located in the vented attic.
4. Where the accessible space in the attic is not large enough to accommodate the required R-value, the entire accessible space shall be filled with insulation provided such installation does not violate Section 806.3 of the *International Residential Code*.

c. Air seal all accessible areas of the ceiling plane between the attic and the conditioned space including all joints, penetrations and other openings that are potential sources of air leakage by caulking, gasketing, weather-stripping or otherwise sealing to limit infiltration and exfiltration.

Exceptions:

1. Dwelling units with at least R-19 existing insulation installed at the ceiling level.
2. Dwelling units where the alteration would directly cause the disturbance of asbestos unless the alteration is made in conjunction with asbestos abatement.
3. Dwelling units with atmospherically vented space heating or water heating combustion appliances located inside the pressure boundary of the dwelling unit.

Clean Version (all changes accepted)

Add to Table R406.3:

R503.1.2 Heating and cooling systems. New heating and cooling systems and *ductwork* that are part of the alteration shall comply with Section R403 and this section. *Alterations* to existing heating and cooling systems and *ductwork* shall comply with this section.

Exceptions:

1. Where *ductwork* from an existing heating and cooling system is extended, duct systems with less than 40 linear feet in unconditioned spaces shall not be required to be tested in accordance with Section R403.2.2.
2. Existing duct systems constructed, insulated or sealed with asbestos.

R503.1.2.1 Ductwork. HVAC *ductwork* newly installed as part of an *alteration* shall comply with Section R403.

Exception: Where *ductwork* from an existing heating and cooling system is extended.

R503.1.2.2 System sizing. New heating and cooling equipment that is part of an *alteration* shall be sized in accordance with Section R403.7 based on the *existing building* features as modified by the *alteration*.

Exception: Where it has been demonstrated to the *code official* that compliance with this section would result in heating or cooling equipment that is incompatible with the remaining portions of the existing heating or cooling system.

R503.1.2.3 Duct system leakage. Where an *alteration* includes any of the following, *duct systems* shall be tested in accordance with Section R403.3.7 and shall have a total leakage less than or equal to 12.0 cubic feet per minute (339.9 L/min) per 100 square feet (9.29 m2) of *conditioned floor area*:

1. Twenty-five percent or more of the registers that are part of the *duct system* are relocated.
2. Twenty-five percent or more of the total length of all *ductwork* in the *duct system* is relocated.
3. The total length of all *ductwork* in the *duct system* is increased by 25 percent or more.
4. Cooling system alterations complying with Section R503.1.2.5.2.~~1~~

Exception:

1. If it is not possible to meet the duct sealing requirements, all accessible leaks shall be sealed and verified through a visual inspection and a smoke test by a RS-33 certified tester.
2. *Duct systems* located entirely inside a *conditioned space* in accordance with Section R403.3.4.

R503.1.2.4 Controls. New heating and cooling equipment that is part of the *alteration* shall comply with Sections R403.1 and R403.2.

R503.1.2.5 Cooling Systems. When an *alteration* of an existing space conditioning system includes the installation or replacement of a ducted air-conditioner, the altered system shall comply with either Section R503.1.2.5.1 or Section R503.1.2.5.2.

R503.1.2.5.1 Heat Pump. A ducted heat pump shall be configured to be the primary heating source and shall be sized to be the greater of either:

A. The required capacity of an air conditioner to meet the design cooling load, or
B. The capacity of the existing air conditioner,

The existing heating system shall be configured to meet the remaining heating load. Documentation of the existing air conditioner's capacity and the heating and cooling load calculations per R403.7 must be submitted to the enforcement agency before permitting the heat pump

R503.1.2.5.2 Air Conditioner. A ducted air conditioner shall meet all the requirements of either Section R503.1.2.5.2.1 or Section R503.1.2.5.2.2

R503.1.2.5.2.1 Systems with Existing Duct Distribution Systems. Systems with existing duct distribution systems shall comply with all of the requirements of this section.

a. The duct system measured air leakage shall meet the requirements of Section R503.1.2.3.

b. Demonstrate, in every control mode, airflow greater than or equal to 300 CFM per ton of nominal cooling capacity through the return grilles, and an air-handling unit fan efficacy less than or equal to 1.2 CFM/W. The airflow rate and fan efficacy requirements in this section shall be confirmed through field verification and diagnostic testing, following the procedures outlined in R403.6.

Exceptions:

1. Systems unable to comply with the minimum airflow rate and system efficacy requirements shall demonstrate compliance by installing a system thermostat that complies with the credit option 3.12 in Table R406.3;
2. Multispeed compressor systems or variable speed compressor systems shall verify air flow (cfm/ton) and fan efficacy (Watt/cfm) for system operation at the maximum compressor speed and the maximum air handler fan speed.
3. Gas furnace air-handling units manufactured prior to July 3, 2019 shall comply with a fan efficacy value less than or equal to 0.58 W/cfm as confirmed by field verification and diagnostic testing in accordance with the procedures outlined in R403.6.

c. Vented attic insulation shall be replaced as specified in Section R402. Luminaires not rated for insulation contact must be replaced or retrofitted as specified by Section R402.5.3.

Exceptions:

1. Dwelling units with at least R-38 existing insulation installed at the ceiling level.
2. Dwelling units where the alteration would directly cause the disturbance of asbestos unless the alteration is made in conjunction with asbestos abatement.
3. Dwelling units with knob and tube wiring located in the vented attic.
4. Where the accessible space in the attic is not large enough to accommodate the required R-value, the entire accessible space shall be filled with insulation provided such installation does not violate Section 806.3 of the *International Residential Code*.

d. Air seal all accessible areas of the ceiling plane between the attic and the conditioned space including all joints, penetrations and other openings that are potential sources of air leakage by caulking, gasketing, weather-stripping or otherwise sealing to limit infiltration and exfiltration.

Exceptions:

1. Dwelling units with at least R-38 existing insulation installed at the ceiling level.
2. Dwelling units where the alteration would directly cause the disturbance of asbestos unless the alteration is made in conjunction with asbestos abatement.
3. Dwelling units with atmospherically vented space heating or water heating combustion appliances located inside the pressure boundary of the dwelling unit.

R503.1.2.5.2.2 Entirely New or Complete Replacement Duct Systems: Systems with new or complete replacement of duct systems shall comply with all of the requirements of this section.

a. The duct system measured air leakage shall meet the requirements of Section R503.1.2.3.

b. If the air handler and ducts are located within a vented attic, the vented attics shall have insulation replaced as specified in Section R402. Luminaires not rated for insulation contact must be replaced or retrofitted as specified by Section R402.5.3.

Exceptions:

1. Dwelling units with at least R-19 existing insulation installed at the ceiling level.
2. Dwelling units where the alteration would directly cause the disturbance of asbestos unless the alteration is made in conjunction with asbestos abatement.
3. Dwelling units with knob and tube wiring located in the vented attic.

4. Where the accessible space in the attic is not large enough to accommodate the required R-value, the entire accessible space shall be filled with insulation provided such installation does not violate Section 806.3 of the *International Residential Code*.

c. Air seal all accessible areas of the ceiling plane between the attic and the conditioned space including all joints, penetrations and other openings that are potential sources of air leakage by caulking, gasketing, weather-stripping or otherwise sealing to limit infiltration and exfiltration.

Exceptions:

1. Dwelling units with at least R-19 existing insulation installed at the ceiling level.
2. Dwelling units where the alteration would directly cause the disturbance of asbestos unless the alteration is made in conjunction with asbestos abatement.
3. Dwelling units with atmospherically vented space heating or water heating combustion appliances located inside the pressure boundary of the dwelling unit.