

(Effective until March 15, 2024)

WAC 51-11R-40320 Section R403.3—Ducts.

R403.3 Ducts. Ducts and air handlers shall be installed in accordance with Sections R403.3.1 through R403.3.7.

R403.3.1 Insulation. Ducts outside the building thermal envelope shall be insulated to a minimum of R-8. Ducts within a concrete slab or in the ground shall be insulated to R-10 with insulation designed to be used below grade.

EXCEPTION: Ducts or portions thereof located completely inside the *building thermal envelope*. Ducts located in crawl spaces do not qualify for this exception.

R403.3.2 Sealing. Ducts, air handlers, and filter boxes shall be sealed. Joints and seams shall comply with either the *International Mechanical Code* or *International Residential Code*, as applicable.

EXCEPTIONS: 1. Air-impermeable spray foam products shall be permitted to be applied without additional joint seals.
2. For ducts having a static pressure classification of less than 2 inches of water column (500 Pa), additional closure systems shall not be required for continuously welded joints and seams, and locking-type joints and seams of other than the snap-lock and button-lock types.

R403.3.2.1 Sealed air handler. Air handlers shall have a manufacturer's designation for an air leakage of no more than 2 percent of the design air flow rate when tested in accordance with ASHRAE 193.

R403.3.3 Duct testing. Ducts shall be leak tested in accordance with WSU RS-33, using the maximum duct leakage rates specified.

EXCEPTIONS: 1. The total leakage or leakage to the outdoors test is not required for ducts and air handlers located entirely within the building thermal envelope. For forced air ducts, a maximum of 10 linear feet of return ducts and 5 linear feet of supply ducts may be located outside the conditioned space. All metallic ducts located outside the conditioned space must have both transverse and longitudinal joints sealed with mastic. If flex ducts are used, they cannot contain splices. Flex duct connections must be made with nylon straps and installed using a plastic strapping tensioning tool. Ducts located in crawl spaces do not qualify for this exception.
2. A duct air leakage test shall not be required for ducts serving heat or energy recovery ventilators that are not integrated with the ducts serving heating or cooling systems.

A written report of the results shall be signed by the party conducting the test and provided to the *code official*.

R403.3.4 Duct leakage. The total leakage of the ducts, where measured in accordance with Section R403.3.3, shall be as follows:

1. Rough-in test: Total leakage shall be less than or equal to 4 cfm (113.3 L/min) per 100 square feet (9.29 m²) of conditioned floor area when tested at a pressure differential of 0.1 inches w.g. (25 Pa) across the system, including the manufacturer's air handler enclosure. All registers shall be taped or otherwise sealed during the test. If the air handler is not installed at the time of the test, total leakage shall be less than or equal to 3 cfm (85 L/min) per 100 square feet (9.29 m²) of conditioned floor area.

2. Postconstruction test: Leakage to outdoors shall be less than or equal to 4 cfm (113.3 L/min) per 100 square feet (9.29 m²) of conditioned floor area or total leakage shall be less than or equal to 4 cfm (113.3 L/min) per 100 square feet (9.29 m²) of conditioned floor area when tested at a pressure differential of 0.1 inches w.g. (25 Pa) across the entire system, including the manufacturer's air handler enclosure. All register boots shall be taped or otherwise sealed during the test.

R403.3.5 Building cavities. Building framing cavities shall not be used as ducts or plenums. Installation of ducts in exterior walls, floors or ceilings shall not displace required envelope insulation.

R403.3.6 Ducts buried within ceiling insulation. Where supply and return air ducts are partially or completely buried in ceiling insulation, such ducts shall comply with all of the following:

1. The supply and return ducts shall have an insulation *R*-value not less than *R*-8.

2. At all points along each duct, the sum of the ceiling insulation *R*-value against and above the top of the duct, and against and below the bottom of the duct, shall be not less than *R*-19, excluding the *R*-value of the duct insulation.

EXCEPTION: Sections of the supply duct that are less than 3 feet (914 mm) from the supply outlet shall not be required to comply with these requirements.

R403.3.6.1 Effective *R*-value of deeply buried ducts. Where using a simulated energy performance analysis, sections of ducts that are: Installed in accordance with Section R403.3.6; located directly on, or within 5.5 inches (140 mm) of the ceiling; surrounded with blown-in attic insulation having an *R*-value of *R*-30 or greater and located such that the top of the duct is not less than 3.5 inches (89 mm) below the top of the insulation, shall be considered as having an effective duct insulation *R*-value of *R*-25.

R403.3.7 Ducts located in conditioned space. For ducts to be considered as being located inside a conditioned space, such ducts shall comply with the following:

1. All duct systems shall be located completely within the continuous air barrier and within the *building thermal envelope*.

2. All heating, cooling and ventilation system components shall be installed inside the conditioned space including, but not limited to, forced air ducts, hydronic piping, hydronic floor heating loops, convectors and radiators. Combustion equipment shall be direct vent or sealed combustion.

3. For forced air ducts, a maximum of 10 linear feet of return ducts and 5 linear feet of supply ducts is permitted to be located outside the conditioned space, provided they are insulated to a minimum of *R*-8.

3.1. Metallic ducts located outside the conditioned space must have both transverse and longitudinal joints sealed with mastic.

3.2. If flex ducts are used, they cannot contain splices. Flex duct connections must be made with nylon straps and installed using a plastic strapping tensioning tool.

[Statutory Authority: RCW 19.27A.020, 19.27A.045, 19.27A.160 and chapter 19.27 RCW. WSR 20-01-047, § 51-11R-40320, filed 12/9/19, effective 7/1/20. Statutory Authority: RCW 19.27A.025, 19.27A.045, 19.27A.160, and 19.27.074. WSR 17-10-063, § 51-11R-40320, filed 5/2/17, effective 6/2/17. Statutory Authority: RCW 19.27A.020, 19.27A.045, 19.27A.160, and 19.27.074. WSR 16-02-127, § 51-11R-40320, filed 1/6/16, effective 7/1/16. Statutory Authority: RCW 19.27A.020, 19.27A.045 and chapters 19.27 and 34.05 RCW. WSR 13-04-055, § 51-11R-40320, filed 2/1/13, effective 7/1/13.]

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R403.3 Ducts. Ducts and air handlers shall be installed in accordance with Sections R403.3.1 through R403.3.7.

R403.3.1 Ducts located outside conditioned space. Supply and return ducts located outside *conditioned space* shall be insulated to and R-value of not less than R-8 for ducts 3 inches (76 mm) in diameter and larger and not less than R-6 for ducts smaller than 3 inches (76 mm) in diameter. Ducts buried beneath a building shall be insulated as required per this section or have an equivalent thermal distribution efficiency. Ducts within a concrete slab or in the ground shall be insulated to R-10 with insulation designed to be used below grade. Underground ducts utilizing the *thermal distribution efficiency* method shall be listed and labeled to indicate the R-value equivalency.

R403.3.2 Ducts located in conditioned space. For ducts to be considered as being located inside a conditioned space, such ducts shall comply with the following:

1. All duct systems shall be located completely within the *continuous air barrier* and within the *building thermal envelope*.

2. All heating, cooling, and ventilation system components shall be installed inside the conditioned space including, but not limited to, forced air ducts, hydronic piping, hydronic floor heating loops, convectors and radiators. Combustion equipment shall be direct vent or sealed combustion.

3. For forced air ducts, a maximum of 10 linear feet of return ducts and 5 linear feet of supply ducts is permitted to be located outside the conditioned space, provided they are insulated to a minimum of R-8.

3.1. Metallic ducts located outside the conditioned space must have both transverse and longitudinal joints sealed with mastic.

3.2. If flex ducts are used, they cannot contain splices. Flex duct connections must be made with nylon straps and installed using a plastic strapping tensioning tool.

4. Ductwork in floor cavities located over unconditioned space shall comply with all of the following:

4.1. A *continuous air barrier* installed between unconditioned space and the duct.

4.2. Insulation installed in accordance with Section R402.2.7.

4.3. A minimum R-19 insulation installed in the cavity width separating the duct from unconditioned space.

5. Ductwork located within *exterior walls* of the *building thermal envelope* shall comply with the following:

5.1. A *continuous air barrier* installed between unconditioned space and the duct.

5.2. A minimum R-10 insulation installed in the cavity width separating the duct from unconditioned space.

5.3. The remainder of the cavity insulation shall be fully insulated to the drywall side.

R403.3.3 Ducts buried within ceiling insulation. Where supply and return air ducts are partially or completely buried in ceiling insulation, such ducts shall comply with all of the following:

1. The supply and return ducts shall have an insulation R-value not less than R-8.

2. At all points along each duct, the sum of the ceiling insulation R-value against and above the top of the duct, and against and below the bottom of the duct, shall be not less than R-19, excluding the R-value of the duct insulation.

EXCEPTION: Sections of the supply duct that are less than 3 feet (914 mm) from the supply outlet shall not be required to comply with these requirements.

R403.3.3.1 Effective R-value of deeply buried ducts. Where using a simulated energy performance analysis, sections of ducts that are: Installed in accordance with Section R403.3.3; located directly on, or within 5.5 inches (140 mm) of the ceiling; surrounded with blown-in attic insulation having an R-value of R-30 or greater and located such that the top of the duct is not less than 3.5 inches (89 mm) below the top of the insulation, shall be considered as having an effective duct insulation R-value of R-25.

R403.3.4 Sealing. Ducts, air handlers, and filter boxes shall be sealed. Joints and seams shall comply with either the *International Mechanical Code* or *International Residential Code*, as applicable.

EXCEPTIONS: 1. Air-impermeable spray foam products shall be permitted to be applied without additional joint seals.
2. For ducts having a static pressure classification of less than 2 inches of water column (500 Pa), additional closure systems shall not be required for continuously welded joints and seams, and locking-type joints and seams of other than the snap-lock and button-lock types.

R403.3.4.1 Sealed air handler. Air handlers shall have a manufacturer's designation for an air leakage of no more than 2 percent of the design air flow rate when tested in accordance with ASHRAE 193.

R403.3.5 Duct testing. Ducts shall be leak tested in accordance with WSU RS-33, using the maximum duct leakage rates specified.

EXCEPTION: A duct air leakage test shall not be required for ducts serving ventilation systems that are not integrated with the ducts serving heating or cooling systems.

A written report of the results shall be signed by the party conducting the test and provided to the *code official*.

R403.3.6 Duct leakage. The total leakage of the ducts, where measured in accordance with Section R403.3.3, shall be as follows:

1. Rough-in test: Total leakage shall be less than or equal to 4.0 cfm (113.3 L/min) per 100 square feet (9.29 m²) of conditioned floor area when tested at a pressure differential of 0.1 inches w.g. (25 Pa) across the system, including the manufacturer's air handler enclosure. All registers shall be taped or otherwise sealed during the test. If the air handler is not installed at the time of the test, total leakage shall be less than or equal to 3.0 cfm (85 L/min) per 100 square feet (9.29 m²) of conditioned floor area.

2. Postconstruction test: Leakage to outdoors shall be less than or equal to 4.0 cfm (113.3 L/min) per 100 square feet (9.29 m²) of conditioned floor area or total leakage shall be less than or equal to 4.0 cfm (113.3 L/min) per 100 square feet (9.29 m²) of conditioned floor area when tested at a pressure differential of 0.1 inches w.g. (25 Pa) across the entire system, including the manufacturer's air handler enclosure. All register boots shall be taped or otherwise sealed during the test.

3. Test for ducts within thermal envelope: Where all ducts and air handlers are located entirely within the *building thermal envelope*, total leakage shall be less than or equal to 8.0 cubic feet per minute (226.6 L/min) per 100 square feet (9.29 m²) of conditioned floor area. For forced air ducts, a maximum of 10 linear feet of return ducts and 5 linear feet of supply ducts may be located outside the conditioned space. All metallic ducts located outside the conditioned space must have both transverse and longitudinal joints sealed with mastic. If flex ducts are used, they cannot contain splices. Flex duct connections must be made with nylon straps and installed using a

plastic strapping tensioning tool. Ducts located in crawl spaces do not qualify for this exception.

R403.3.7 Building cavities. Building framing cavities shall not be used as ducts or plenums. Installation of ducts in exterior walls, floors or ceilings shall not displace required envelope insulation.

[Statutory Authority: RCW 19.27A.020, 19.27A.045, 19.27A.160, and chapter 19.27A RCW. WSR 23-02-060, 23-12-102, and 23-20-022, § 51-11R-40320, filed 1/3/23, 6/7/23, and 9/25/23, effective 3/15/24. Statutory Authority: RCW 19.27A.020, 19.27A.045, 19.27A.160 and chapter 19.27 RCW. WSR 20-01-047, § 51-11R-40320, filed 12/9/19, effective 7/1/20. Statutory Authority: RCW 19.27A.025, 19.27A.045, 19.27A.160, and 19.27.074. WSR 17-10-063, § 51-11R-40320, filed 5/2/17, effective 6/2/17. Statutory Authority: RCW 19.27A.020, 19.27A.045, 19.27A.160, and 19.27.074. WSR 16-02-127, § 51-11R-40320, filed 1/6/16, effective 7/1/16. Statutory Authority: RCW 19.27A.020, 19.27A.045 and chapters 19.27 and 34.05 RCW. WSR 13-04-055, § 51-11R-40320, filed 2/1/13, effective 7/1/13.]