

Residential Mechanical Final

This Tip Sheet reflects code requirements of the 2018 International Residential Code (IRC), 2018 Uniform Plumbing Code (UPC), 2020 National Electric Code (NEC) and the 2018 Washington State Energy Code (WSEC) with Washington State Amendments.

(References to the IRC are indicated by: R = Residential; M = Mechanical; G = Gas)

Please verify the following before calling for a mechanical final inspection. It is important that you reference the appropriate rough in checklist for code application questions or the jurisdiction that issued the permit and will be conducting the inspection.

Permits and Plans

- Job address shall be posted in a visible location. (R319.1)
- Permit, approved plans, and mechanical construction documents are on site and accessible to the inspector. (R105.7, R106.1.1, R106.3.1)
- Permit information is correct (e.g., address, permit number, description of work, etc.). (R106.1.1)
- Prior required mechanical rough-in inspections are approved. (R109.1.2)
- The duct test report required by the 2018 WSEC must be on site and completed by a qualified technician. (R104.4) (R403.3.3) (WSU RS-33)

Garage

- Source of ignition on gas appliances (water heaters, furnaces, and dryers) must be a minimum of 18 inches above the floor unless listed as flammable vapor ignition resistant (FVIR). (M1307.3) (G2408.2)
- Exposed ducts to be a minimum of 26-gauge sheet metal or other approved material with no openings into garage. (R302.5.2)
- All ducts in attic, garage, crawl space, or other unconditioned spaces, insulated with minimum R-8. (WSEC R403.3.5)
- Bollard or wheel stop required if equipment is subject to mechanical damage. (M1307.3.1)

Gas Piping

- Drip legs installed at each appliance or where condensation could collect. (G2419.2)
- Sediment trap shall be installed downstream of the appliance shutoff valve as close to the inlet of the appliance as practical. (Except for illuminating appliances, ranges, clothes dryers, and outdoor grills). (G2419.4)
- Unions or flex connectors are installed between shut-off valve and appliance. (G2422.1.4) (G2422.1)
- Unions or flex connectors cannot be concealed within or extend through a wall, floor, partition or appliance housing. (G2422.1.2.3)
- One flex connector up to 6' long is allowed on each appliance. (G2422.1.2.1)
- A shut-off valve is required in for each appliance, upstream of union and accessible. (G2420.5)
- Steel Pipe Support: (Table G2424.1)
 - 1/2-inch pipe supported every 6 feet
 - 3/4 inch – 1 inch support every 8 feet
 - 1-1/4 inch or larger support every 10 feet
 - 1-1/4 inch or larger (vertical) support at every floor level. CSST per manufacturer.
- Piping cannot be installed in or through a ducted supply, return, supply or exhaust, or clothes chute, chimney or gas vent, ventilating duct, dumbwaiter or elevator shaft. Piping installed downstream of the point of delivery shall not extend through any townhouse unit other than the unit served by such piping. (G2415.3)
- Vent piping for relief vents and breather vents must be vented directly, and independently to the outdoors. Vent piping for breather vents only can be connected to manifold arrangement where sized in accordance with an approved design (manufacturer installation instructions. The vent must be designed to prevent the entry of insects, water and foreign objects). (G2421.3.1.)

Appliance Vents

- Gravity venting system of equivalent area to the vent collar on the appliance. Performance standards can reduce the vent size. (G2428.2.2)
- Single wall vents or B vents connecting to flue collars or draft hoods shall be connected by screws or secured as recommended by the manufacturer. (M2427.10.6)
- Vents connected to common vent system within the same story require inlets to be at the highest level consistent with headroom and clearance to combustibles. Vent system area cannot be less than the area of the largest vent plus 50% of the smaller flue collar added. (G2427.10.3.4)

- Offsets in gravity vents installed with as many offsets as required that do not exceed 45 degrees from vertical, except no more than one of 60 degrees is allowed and horizontal runs don't exceed 75% of the vertical height of the venting system. (G2427.6.9.2)
- Vent connectors serving Category 1 appliances are not connected to any portion of a mechanical draft system operating under positive pressure. (G2427.10.4)
- Gas vents less than 12 inches in diameter in roofs with pitches less than or equal to 6/12 can terminate a minimum of 12 inches above the roof as long as such vents are at least 8 feet from a vertical wall or similar obstruction. See Figure G2427.6.4 for distances from vertical objects including roof pitch. (G2427.6.4)
- Vent clearances to combustibles per manufacturer's listing or performance standards. (M1803.3.4) (M1306.2) (G2427.7.8)
- Single wall vents cannot penetrate a wall, floor or ceiling without a thimble and piping limited to the space the equipment is located to the roof or exterior wall. (M1803.3.1) (G2427.7.7)
- Vent terminations installed per the manufacturer's listing. (M1804.2) (G2427.6.2)
- Mechanical draft venting systems shall be installed in accordance with their listing, and: terminate not less than 4 feet below or 4 feet horizontally from, and not less than 1 foot above a door, an operable window or a gravity air inlet into a building, nor within 10 feet of a forced air intake nor within 12 inches above grade. (M1804.2.6)
- Where vents extending into an attic pass through insulated assemblies, an insulation shield of 26 gage sleeve not less than 2 inches above the insulation to be secured in place and maintain required clearances to combustibles. (G2426.4)
- Direct vent terminations. See manufacturer's installation instructions (M1804.2.5)
- Vent connector clearance to combustibles installed per Table G2427.10.5.
- Single wall connectors do not originate in an attic or concealed space or pass through an attic, inside a wall or concealed space. (G2427.7.6)
- When a vent connector of a gas appliance with a draft hood is located within or passes through a cold area, that portion of the connector is a type B or type L vent. (G2427.10.2.2)
- B vent chimneys supported above the roof per manufacturer's requirements. (G2427.6.9)
- Type B or L vents terminate at least 5 feet in vertical height above the highest connected equipment draft hood or flue collar. (G2427.6.5)

Gas Water Heaters

- See the Water Heater Tip Sheet 7 for additional information.
- If a gas water heater has been installed it is a mechanical inspection but may include plumbing if piping was moved.
- If an electric water heater is installed, it is a plumbing inspection and will be covered on the Residential Plumbing Final Checklist.
- Temperature and pressure relief valve required on water heaters (UPC 504.6). The drain from the relief valve must be able to drain by gravity. (UPC 608.5)
- The pipe for the drain to be equal size of the outlet valve. (UPC 608.5)
- The drain terminates outside the building 6 inches—24 inches above grade and has a soldered/glued (copper/plastic) on elbow as needed to direct the flow toward the ground or terminates at an approved drain. It may not be directly connected to a sanitary sewer. (UPC 608.5) (UPC 805.1)
- Water heaters located in a garage to be raised so that the source of ignition is at least 18 inches above the floor unless listed as flammable vapor ignition resistant (FVIR). (M1307.3) & UPC (507.13)
- Seismic strapping will be installed per Water Heater Tip Sheet 7. Two straps, 1 in lower 1/3 and 1 in upper 1/3 and 3/4-inch wide. Straps to be 22-gauge metal with each end of strap lag bolted onto two different studs. Lower point strapping at 4 inches minimum distance above the controls. (M1307.2; UPC 507.2)
- A water heater when installed in the normal path of a vehicle requires protection. (M1307.3.1; G2408.3)
- Water heaters in attics, attic-ceiling assembly, floor-ceiling assembly, or floor/subfloor assembly where damage may result from a leaking water heater, a watertight pan of corrosion resistant material is installed with a 3/4-inch drain that is piped to an approved location. (UPC 507.5)
- Any water system provided with a check valve, backflow prevention or a pressure regulating device which does not have a bypass feature at its source is provided with an approved, listed, adequately sized expansion tank or other approved device having a similar function to control thermal expansion. (UPC 608.3). Exception: Instantaneous hot water systems install per manufacturer.
- Mechanical rooms with a floor drain or a standpipe and subject to infrequent use require trap primers or other approved automatic means of maintaining their water seals. The trap primer valve is accessible. Check to see that it is working by verifying water is in the trap. UPC (1007.1)

- Combustion Air: See “[General](#)” for details.
- Fuel fired water heaters can’t be installed in a room used as a storage closet. A water heater installed in a bedroom or bathroom needs to be installed in a sealed enclosure so that combustion air will not be taken from the living space. Direct-vent water heaters are not required to be installed within an enclosure. (G2406.2; UPC 504.1)

Furnace

- Furnace and Air Handler minimum working space is 30 inches wide and 30 inches deep on the control side of an appliance, except replacement appliances. (M1305.1)
- Maintain required clearances to combustible construction as specified in the listing. (M1402.2) (M1306.1)
- Clearance from grade: Equipment supported on concrete pad or approved material extending a minimum 3 inches above the adjoining ground. (M1305.1.1)
- Condensate lines are required to drain by gravity to an approved drain or condensate pump. (G2427.9; M1411.3). Secondary condensate disposal provided per M1411.3.1.
- Condensing Appliances: Vent per installer’s instruction. (G2427.8, Item 4)
- Seal ducts to prevent leaks (WSEC R403.3.2) and test per RS-33 (WSEC R403.3.3) unless located entirely within the conditioned space of the building.

Whole House Ventilation Systems

- Each dwelling unit shall be equipped with a ventilation system. The whole-house mechanical ventilation systems shall be designed in accordance with Sections M1505.4.1 through M1505.4.4. The whole-house ventilation system shall operate continuously at the minimum ventilation rate determined per Section M1505.4.2 unless configured with intermittent off controls per Section M1505.4.3.2.

Range Cooktop

- Distance above top of cook top to unprotected combustible material not less than 30 inches and 24 inches if exceptions are met. (M1901.1, G2447.5)
- Clearance to adjacent combustibles surfaces per the manufacturer’s installation instructions. (M1901.2, G2447.1)

Fireplace

- Factory built fireplaces certified, listed and labeled. Tested and certified to WA. St. Bldg. Code standard 31-2. Testing performed by WA ST. DOE, and US. EPA accredited laboratory. (R1004.1.1, WA State Amendment)
- Certified Masonry and Concrete fireplaces, and heaters - tested and certified to WA. St. Bldg. Code standard 31-2. Testing performed by WA ST. DOE, and US. EPA accredited laboratory. (R1004.1.2, WA State Amendment)
- Solid Fuel burning appliances and fireplaces – tight fitting metal / ceramic doors, and certified to test No. 11-Negative pressure test, Section 12.3, of ULCS627-M1984 for outside combustion air–duct 4 inches min., and 20 feet max. length. (R1006.6, WA State Amendment)
- Hearth extensions are to be readily distinguishable from the surrounding floor and in accordance with the fireplace listing. (R1004.2)
- Installed per manufacturer’s installation instructions when installed in a solid fuel burning fireplace. (Decorative Gas Fireplace) (G2432.1)
- Appliance shutoff valves shall be located in the same room, and within 6 feet of the appliance. Appliance shutoff valves located in fireplace firebox shall be installed per the appliance manufacturer’s instructions. Shutoff valves for vented decorative appliances and room heaters shall be permitted to be installed in a remote area from the appliance where such valves are provided with ready access, permanent identification, and serve no other appliance. Shutoff valve installed at a manifold–within 5 feet of appliance, but other requirements apply, as above. (G2420.5.1; G2420.5.3)
- Decorative shrouds used at chimney terminations are to be listed and labeled for use with specific chimney system. (R1004.3; R1005.2)
- Gas logs in solid fuel burning fireplace are installed per manufacturer’s instructions. (G2432.1)
- Gas logs, when equipped with a pilot, have a listed safety shutoff valve. (G2432.2)

Laundry Room

- A 4-inch metal dryer exhaust duct is installed with smooth interior. Install per the manufacturer's instructions. (G2439.7.1; M1502.4.1)
- Approved flexible listed metal duct connector up to 8 feet long, may connect the dryer to the vent, but may not extend into wall, floor or ceiling. (G2439.7.3; M1502.4.3)
- Minimum 100 square inches of makeup air for closets designed for the installation of clothes dryers that exhaust more than 200 CFM. (G2439.5)
- Two methods for determining dryer duct length:
 - 1) Exhaust duct doesn't exceed 35 feet for natural gas dryers. Deduct 2.5 feet for each 45-degree elbow and 5 feet for each 90-degree bend;
 - 2) Max. length determined by the manufacturer's installation instructions when make and model of dryer are provided to the code official at rough in. (M1502.4.5; G2439.7.4, Exception.)

Crawl Space and Attic

With limited exceptions all new duct work that is subject to installation under the 2018 WSEC is required to be installed within the conditioned space. Contact the local jurisdiction to determine what code cycle will be used for inspection.

- Flex duct is supported per manufacturer's installation instructions (a maximum of every 4 feet) and is installed without kinks or tight bends. (M1601.4.4; SMACNA Standards)
- Ducts in crawl spaces are supported at least 4 inches above the ground. (M1601.4.8) or conform to (M1601.1.2)
- Ducts, boots, and connectors used for heating or cooling insulated to R-8 (WSEC R403.3.1).
- Insulate all exhaust ducts in unconditioned spaces with R-8 (bathroom, range, etc.) (WSEC R403.3.1)
- When equipment is installed in a crawl or attic space, a light switch and outlet is required at or near appliance (M1305.1.4.3; M1305.1.2.1)
- Verify that the passageway of continuous solid flooring not less than 24 inches wide from attic access to 30 inches wide work platform in front of furnace has been installed. (M1305.1.3; M1305.1.2)
- Access opening large enough to remove largest piece of equipment, but not less than 30 inches by 22 inches. (M1305.1.3; M1305.1.2)
- Access opening not more than 20 feet from equipment. (M1305.1.3, M1305.1.2)

General

- Weather protect exterior gas line. (G2415.9) (G2415.11)
- Appliances installed in outdoor locations—listed or protected from outdoor environmental factors. G2406.3 and M1401.4)
- Louvers and grills are to be sized to account for the net free area of the grill. Wood louvers will be assumed to have 25% free areas and metal louvers and grills will have a 75% free area. Screens are not to have a mesh size smaller than 1/4-inch. (G2407.10)
- Combustion air ducts from outside of the building. GENERAL RULES FOR SUPPLYING COMBUSTION AIR ARE BELOW. For specific application contact the local jurisdiction
 - 1) For vertical ducts: (2) openings, each having 1 square inch per 4000 Btu/h of total input of all appliances in the space. (M2407.6.1)
 - 2) For horizontal ducts: (2) openings each having 1 square inch per 2000 Btu/h of total input of all appliances in the space. (M2407.6.1)
 - 3) One opening in the upper 12 inches and one opening in the lower 12 inches of the room. (M2407.6.1)
 - 4) When the one opening method is used, locate the opening within 12 inches from top of enclosure and provide 1 square inch per 3000 Btu/h or total input rating of all appliances in the space. (G2407.6.2)
 - 5) The minimum cross-sectional area of each vent opening is 3 inches.(M2407.6)
- Combustion air obtained from outside of the building, when the building is of ordinary construction (homes built prior to 1986) and the area of the room is less than 50 cubic feet per 1000 Btu/h of aggregate input rating of appliances. (G2407)) See also Construction Tip Sheet 7, Water Heaters.
 - 1) The minimum cross-sectional area of each vent opening is 3 inches.
 - 2) One opening in upper 12 inches and one opening in lower 12 inches of room.
 - 3) Where vertical ducts are used each opening requires 1 square inch per 4,000 Btu/h of total input rating of all appliances in the space. (G2407.6.1)
 - 4) Where horizontal ducts are used each opening requires 1 square inch per 2,000 Btu/h or total input rating of all appliances in the space. (G2407.6.1)
 - 5) When the one opening method is used, locate the opening 12 inches from top of enclosure and provide 1 square inch per 3000 Btu/h or total input rating of all appliances in the space. (G2407.6.2)

- When the building is of ordinary construction and the area of a confined space is less than 50 cubic feet per 1000 Btu/h of aggregate input rating of appliances, combustion air can be taken from an adjacent space when installed as follows: (G2407.5. thru G2407.5.3.2)
 - 1) Minimum of 100 square inches of combustion air is required. (G2407.5.3.1)
 - 2) One opening in upper 12 inches and one opening in lower 12 inches of room. (2407.5.3.1)
- All appliances secured in place per manufacturer's listing. (M1307.2) (M1401.1)
- Confirm that there is a heat source in each habitable room (R303.9)

Energy Code Requirements

- Verify on approved plans specific types of heating and cooling including efficiency requirements for any equipment and any energy credits required.
- Ducts located in conditioned space. For ducts to be considered as inside a conditioned space, such ducts shall comply with either of the following: (WSEC 403.3.7)
 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 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.
- 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. (WSEC R403.3)
- HVAC supply and return register boots shall be sealed to the sub floor, wall covering, or ceiling penetrated by the boot. (WSEC Table R402.4.1)
- All detached one- and two-family dwellings and multiple single-family dwellings (townhouses) up to three stories in height above grade plane using electric zonal heating as the primary source shall install a inverter-driven ductless mini-split heat pump in the largest zone in the dwelling. (WSEC 403.7.1)

- Additional Energy Efficiency Requirements (Energy Credits) Additional energy efficiency requirements for all new construction shall comply so as to achieve the following minimum number of credits:
 1. Small Dwelling Unit: 3.0 credits
 - Dwelling units less than 1500 square feet in conditioned floor area with less than 300 square feet of fenestration area. Additions to existing building greater than 500 square feet of heated floor area but less than 1500 square feet
 2. Medium Dwelling Unit: 6.0 credits
 - All dwelling units that are not included in Options 1, 3 or 4
 3. Large Dwelling Unit: 7.0 credits
 4. Dwelling units serving R-2 occupancies: 4.5 credits
 5. Additions less than or equal to 500 square feet: 1.5 credits
- The drawings included with the building permit application shall identify which options have been selected and the point value of each option, regardless of whether separate mechanical, plumbing, electrical or other permits are utilized for the project. (WSEC 406.3)
- For more information, go to <http://www.energy.wsu.edu/BuildingEfficiency/EnergyCode.aspx> for more information on the Washington State Energy Code requirements.