

# —Mechanical Homeowner's Guide—

*The Following is an Informational Document Only.*

## **May I do my own Mechanical (Heating, Ventilation, and Air-Conditioning or HVAC) work?**

A homeowner may do his or her own mechanical work provided these three criteria are met:

1. It is a single-family dwelling.
2. The person resides at this residence.
3. The person doing the work actually owns the dwelling.

*A friend or family member may not obtain the Homeowner's Mechanical Permit.*

## **When do I need to obtain a mechanical permit?**

Permits are required before any alterations are made to an existing mechanical system or if a new system is installed. A mechanical system is defined as a system that is specifically addressed and regulated by the code and is composed of components, devices, appliances, and equipment. Some examples would be a furnace, exhaust fan, duct system, fireplace, or vent system.

## **When and where do I get a permit?**

Permits are issued at the Building Services Department on ground floor of City Hall. City Hall is located at 224 West Ninth Street. Office hours are between 8 a.m. and 5 p.m., Monday through Friday, excluding holidays. The office personnel can issue homeowners permits and answer general questions. The phone number for the office is 605-367-8670. The mechanical inspectors are typically in the office to answer more technical questions from 8 a.m. to 9 a.m. The mechanical inspectors' phone number is 367-8252.

## **Active Permits.**

Your permit only pertains to the work described on the permit application. Homeowner mechanical permits have a life period of two years maximum, after the two-year time period has elapsed, a new permit will be required. In order for the permit to remain active for the duration of the two-year period, a required inspection by a division of Building Services (building, plumbing, mechanical, or electrical) shall be performed within 180 days of issuance and within each consecutive 180-day time period. It is the permittee's responsibility to make all required corrections and call for reinspection within a 30-day time period. No permit shall be cancelled, abandoned, or have occupancy granted with outstanding violations.

## **Do I have to do the work, or may I hire a friend or family member to do it for me?**

The only person a homeowner's permit allows to do the work is the actual homeowner. Any person who receives monetary compensation for doing any mechanical work in the city of Sioux Falls must be employed by a mechanical contractor licensed in the City of Sioux Falls and must be doing the work for said mechanical contractor. In simpler terms, the work must be run through the mechanical contractor's business and he may **not** do the work on the side.

## **What if I have already done my mechanical work without obtaining any permits or receiving any inspections?**

Work done without permits is always a problem for both the homeowner and the inspectors. The inspector cannot inspect the work if it cannot be seen; hence, you will be required to remove wall and/or ceiling coverings to the extent that a proper inspection may be obtained. If any code violations are noticed during the inspection process, said violations will be required to be corrected.

**Inspections. Rough-in.** After all of the ducts and vents for the water heater and furnace are installed, a rough-in inspection is required. This is before any insulation or wall coverings are installed. The inspector will either give you the "okay" to cover it up or if there are corrections, said corrections will need to be fixed and the inspector will need to be called for a reinspection.

**Final.** After all the registers are set, the venting for the furnaces and water heaters are complete, the air conditioner is hooked up, and the combustion air is installed, a final inspection is required to be obtained. The inspector will either give you a final or if there are corrections, you will need to fix the problems and then call the inspector for a reinspection.

**Requesting an Inspection.** It is the responsibility of the permit applicant to provide accessibility to the work. One should always keep in mind "If the inspector cannot see the work, the work cannot be inspected." The City of Sioux Falls is not liable for expenses entailed in the removal or replacement of any material required to allow inspection. There are separate inspectors for the electrical, plumbing, building, and mechanical divisions. All of the applicable inspectors must approve the rough-in or framing of their specific division before anything is covered.

The permit holder must notify the mechanical inspector when the work is ready for inspection. To request an inspection, call 367-8252 or 367-8670 a minimum of 24 hours prior to the day the inspection is requested for. Inspection requests after office hours can be logged in on the answering machine at 367-8670 and can be faxed to 367-6045.

When calling for inspection, be prepared to give the following information:

- Street address.
- Owner's name.
- Type of inspection needed (rough-in, final).
- Date and time that the inspection will be requested for. Keep in mind that the inspectors may not enter an occupied dwelling unit unless an adult or contractor with authority over the dwelling is present and gives permission to enter.
- Daytime phone number that the permit holder may be reached at.

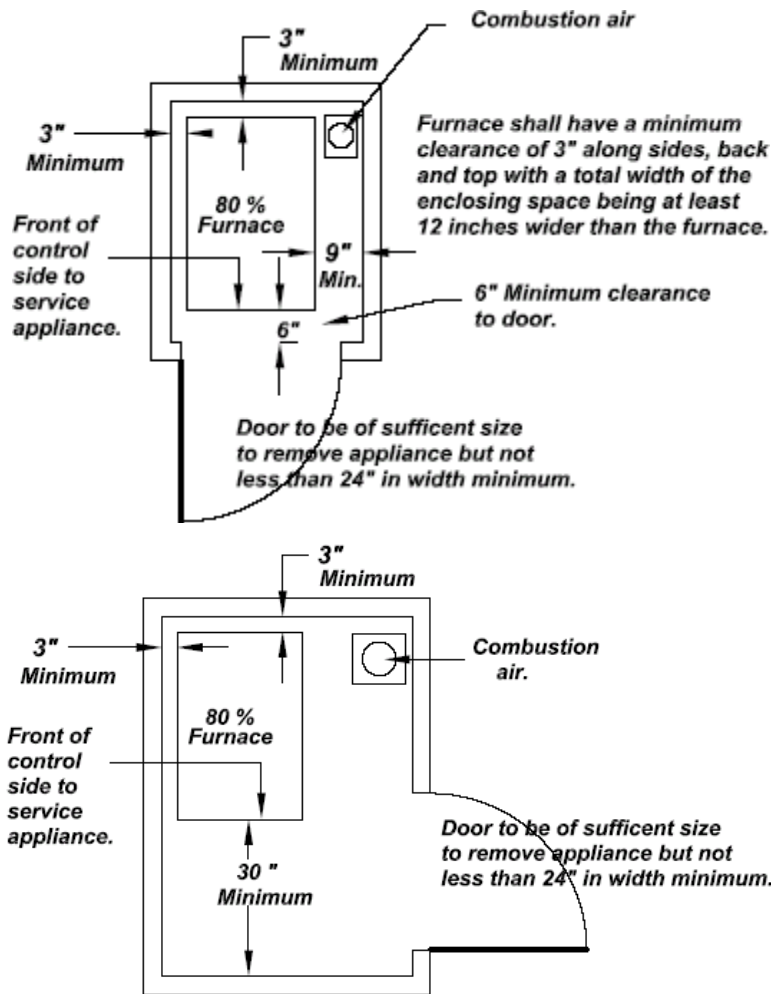
**Reinspection Fee.** A fee may be assessed, and must be paid before any further inspection will be made, for any of the following reasons:

- When work, for which an inspection is called, is not completed or ready for inspection.
- When corrections called for are not made.
- When access to the premises is not provided on the requested inspection date.
- For deviating from the approved plans.
- When work is concealed from access or sight before it has been inspected.
- When work is done in phases which require additional inspections, a fee will be charged per inspection; additional fees must be paid prior to inspection.

**Appliances.** All types of appliances, which is defined as a device or apparatus that is manufactured and designed to utilize energy, shall be listed and bear the label of an approved agency. An approved agency is generally accepted as being Underwriter's Laboratory (UL). An example of an unlisted appliance would be the old wood stove out of Grandpa's workshop that has no label on it because it was built back in 1910.

**Appliance Access.** A level working space at least 30 inches deep and 30 inches wide shall be provided in front of the control side to service an appliance.

**Furnaces in Closets.** The reference to a closet means a confined room only for the furnace, not a room used for storage. Furnaces that are installed in a closet require a minimum of 3 inches of working space on the sides, rear, and top. The total width of working space along the sides shall be a minimum of 12 inches. An example would be if you could only obtain the minimum of 3 inches on the left side of the furnace, then a minimum of 9 inches is required on the right side. Furnaces that have an open firebox shall have a minimum of 6 inches of clearance from the front of the furnace to the door.



**Appliances in Rooms.** Appliances installed in rooms shall have a door opening not less than 24 inches wide; however, it must be large enough to remove the largest appliance in said room.

**Prohibited Locations.** Fuel-fired appliances shall not be located in sleeping rooms, bathrooms, toilet rooms, storage closets, or in a space that opens only into a bedroom or bathroom. An exception to that is if the appliance is a direct-vent appliance and installed in accordance with its manufacturer's listing. Another exception is if the door between the furnace room and a prohibited room is a solid core, weather-stripped door and provided with an approved self-closing device, and all combustion air is obtained from the outdoors.

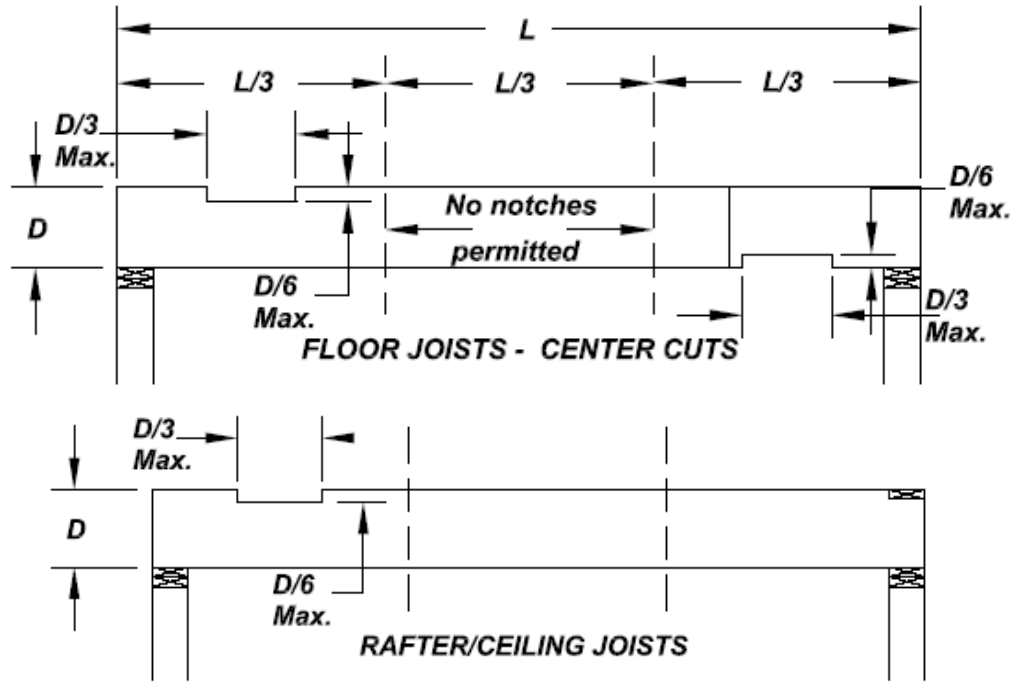
**Appliances in Attics.** Attics containing appliances shall have a clear and unobstructed passageway large enough to remove the largest appliance. Under no circumstances shall said passageway be less than 30 inches high and 22 inches wide. The minimum size opening into the attic shall be 30 inches by 20 inches; however, it must be large enough to remove the largest appliance. The appliance shall not be located more than 20 feet, measured at the center of the passageway from the appliance to the attic opening. However, if the passage way is 6 feet in height, then the passageway may be extended to 50 feet in length. The passageway shall be continuous solid flooring not less than 24 inches wide and shall have a minimum of a 30-inch by 30-inch service space on all sides of the appliance where access is required. There shall be a switch at the attic opening controlling a light in the attic and a receptacle shall also be provided at or near the appliance.

**Clearances from Combustibles.** Unprotected combustible materials shall be maintained a minimum distance to all appliances in accordance with said appliance's listing and the manufacturer's installation instructions. This is especially critical for single-wall and Type B (double-wall) vent pipe which require a minimum of 6 inches and 1 inch to combustibles respectively. There are ways to reduce the required clearance to combustibles; however, they are too detailed to outline in this document—if it is needed, please call the mechanical inspectors for details.

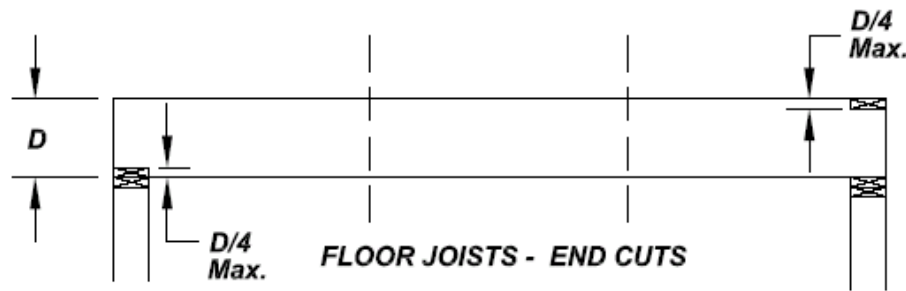
**Appliance Installation.** All appliances shall be installed in accordance with their listing, label, and manufacturer's installation instructions.

**Garage Furnaces.** Appliances located in garages or in rooms directly off of the garage that are not part of the living space are required to have all sources of ignition a minimum of 18 inches above the floor. A source of ignition would be the pilot light, burners, or even the motor for the blower. Furnaces in the garage are required to have vehicle barriers installed such that they are protected from any vehicular impact.

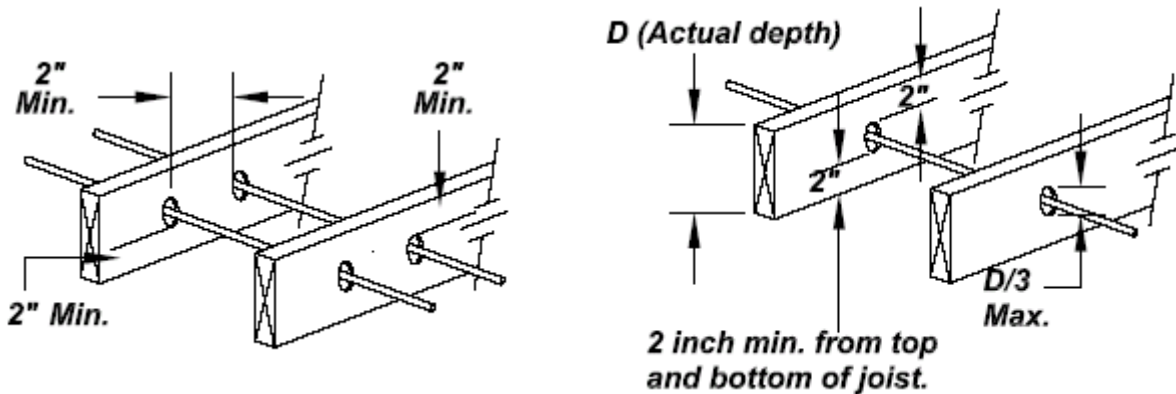
**Protection of Structure. Notching Joists.** Notches in sawn lumber (2x4, 2x6, 2x8, etc.) shall not exceed one-sixth of the depth of the member, shall not be longer than one-third of the depth of the member, and shall not be located in the middle one-third of the span.



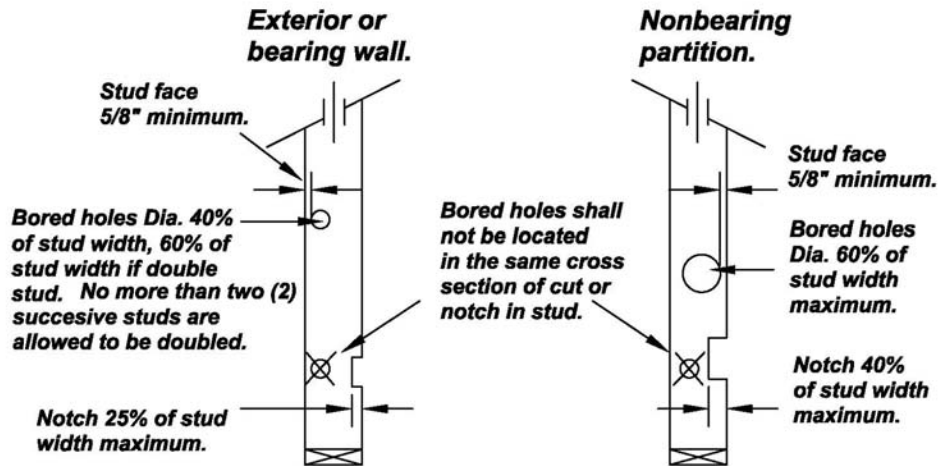
Notches on the ends of sawn lumber shall not be notched over one-fourth the depth of the member.



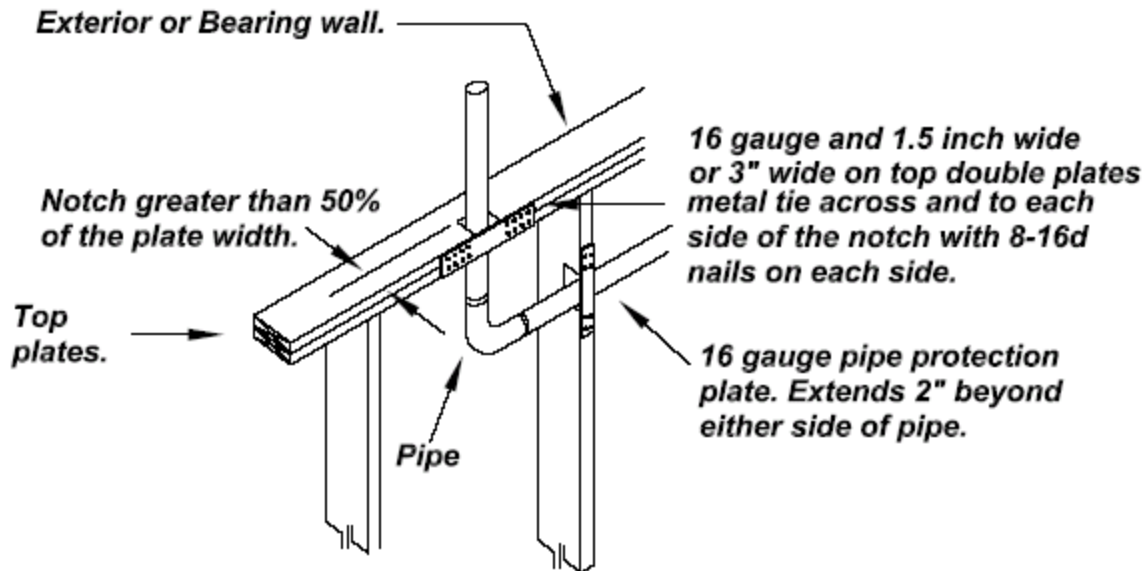
**Holes in Joists.** Holes drilled in sawn lumber shall not be larger than one-third the depth of the member. The holes may not be closer than 2 inches to the bottom or top of the member. Any two holes may not be closer than 2 inches from each other and any hole may not be closer than 2 inches from a notch.



**Drilling and Notching Studs.** A maximum of 25 percent of the width of a stud may be cut or notched in an exterior wall or interior load bearing wall. A maximum of 40 percent of the width of a stud may be cut or notched in a non-load-bearing wall. A bored or drilled hole in a stud may not exceed 40 percent of the width of the stud (exterior, load-bearing, or non-load-bearing), provided the hole is no closer than 5/8 inch to the edge of the stud and the hole is not located in the same section as a cut or notch.



**Drilling and Notching of Top Plate.** When the top plate of an exterior wall or interior load bearing wall is drilled or notched by more than 50 percent of its width, a galvanized metal tie is required to be installed. The metal tie shall be a minimum of 16 gauge, 1 1/2 inches wide, and shall be fastened on each side of the notch or hole by a minimum of eight 16d nails.



**Pipe Protection.** Piping that is installed in holes of studs, joists, rafters, or similar members that are less than 1 1/2 inches from the nearest edge shall be protected by a shield plate. The plate shall be a minimum of 16 gauge steel, cover the area of the member that is notched or bored, and shall extend a minimum of 2 inches above bottom plates and below top plates.

**Heating and Cooling Equipment. General.** All heating and cooling equipment and appliances shall be installed in accordance with the manufacturer's installation instructions and the requirements of this code.

**Heat Pumps.** The minimum unobstructed total area of the outside and return air ducts to a heat pump shall not be less than 6 square inches per 1,000 Btu/h output rating. The outdoor unit for a heat pump shall be mounted a minimum of 3 inches above grade to permit the free drainage of defrost water.

**Cooling Coils.** Cooling coils shall not be located upstream from any heat exchangers unless said heat exchanger is listed and labeled for such use. The condensate drain from cooling coils shall be piped from the drain pan outlet to an approved drain. The drain line shall not discharge to a street, alley, or any place it will cause a nuisance. The drain line shall not have an inside diameter less than 3/4 inch, it shall not decrease in size from the drain pan to the outlet, and may be made of copper, PVC, polybutylene, polyethylene, or galvanized steel. If the cooling coil is installed in a location such that if the

drain was plugged, it could cause damage to any building component, then a secondary drain or drain line will be required to be installed. For the specific requirements for a secondary pan and/or drain line, please call the mechanical inspectors.

**Exhaust Systems. Clothes Dryers Exhaust.** The clothes dryer exhaust duct shall terminate at the exterior of the building not less than 3 feet in any direction from openings into the building, without any type of screen, but with a backdraft damper. The duct shall **not** be connected with sheet metal screws or by any other means that will extend into the duct such that lint would catch. The duct shall be rigid metal with a smooth interior surface. The metal shall have a thickness of not less than 28 gauge. The maximum length of the dryer vent shall be 35 feet. Five feet shall be reduced from the maximum length for each 90-degree elbow and 2 1/2 feet for every 45-degree angle. The vent shall be measured from the transition duct off of the dryer, or the dryer itself, if the duct is connected directly to it and the termination point. One exception to the dryer vent length is if the dryer make and model are known and the vent is installed per the manufacturer's installation instructions. The transition duct is the duct that extends from the dryer to the dryer vent. The transition duct shall not be longer than 8 feet in length, may not be installed in a concealed location, and must be listed and labeled in accordance with UL 2158A.

**Range Hoods.** The duct for range hoods shall discharge directly to the exterior. They may not, under any circumstances, terminate in an attic or crawl space. The duct shall be metal, have a smooth interior surface, be airtight, and have a backdraft damper. The range hood shall be capable of exhausting a minimum of 100 cfm.

**Microwave Ovens.** A microwave oven that is installed above a cooking appliance shall conform to the microwave oven's listing, label, and the manufacturer's installation instructions. Said oven shall conform to UL 923.

**Open-Top Broilers.** Domestic open-top broiler units shall be provided with a metal exhaust hood, not less than 28 gauge. There shall be a minimum of 24 inches from the cooking surface to any combustible material, cabinets, etc. The hood shall be at least as long and wide as the broiler unit, and it shall maintain a minimum of 1/4 inch between the hood itself and any combustible material. The exhaust air shall be discharged directly to the outdoors and a backdraft damper is required. If the broiler unit has its own exhaust system and is listed and labeled for use without an exhaust hood, then a hood is not required.

**Exhaust Rates.** Bathrooms and/or toilet rooms shall be supplied with an exhaust fan capable of a minimum of 50 cfm if the fan runs intermittently, and 20 cfm if it runs continuously. When a kitchen is provided with exhaust, the fan shall be capable of 100 cfm if the fan runs intermittently and 25 cfm if it runs continuously. Exhaust ducts for bath or toilet fans shall not discharge into an attic, crawl space, or other areas inside the building; they must terminate to the exterior of the building.

**Duct Systems. Metal Ducts.** Round ducts that are 14 inches or less shall be made of no less than 30 gauge galvanized sheet metal. Exposed rectangular ducts that are 14 inches or less shall be made of no less than 28 gauge galvanized sheet metal and if it is over 14 inches, the minimum shall be 26 gauge.

**Flexible Ducts.** Factory-made ducts, the most common being **INSULATED** flex duct, shall be installed in accordance with the manufacturer's installation instructions. The duct shall bear a listing and label indicating compliance with UL 181 and UL 181A or UL 181B. **The plastic hose that is commonly used for the bathroom exhaust is not considered a duct. It is listed as an air connector and is not allowed.** Insulated flex duct is required to be hung with a strap no less than 1 inch wide every 4 feet. The duct is allowed a maximum of 1/2 inch of droop per 1 foot of horizontal run; hence, it must be stretched quite tight. The maximum length for flexible duct is 14 feet.

**PVC Ducts.** PVC pipe may be used for underground duct only. It may not be used in any above-ground applications, including bathroom exhaust fans.

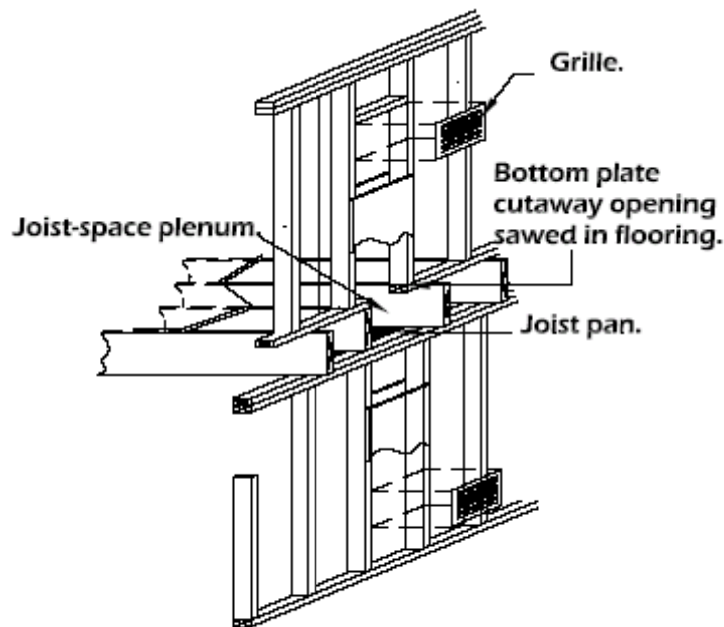
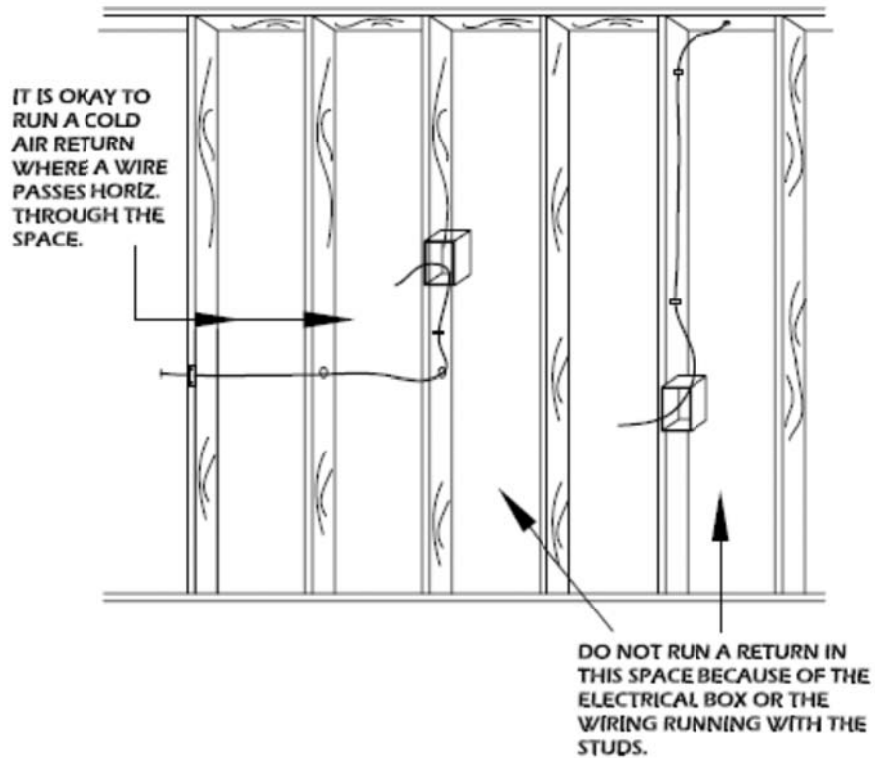
**Sealing.** All return ducts located in the mechanical room or within 10 feet of any appliance in an open basement, along with the plenum/coil cabinet connections on the supply, shall be airtight, sealed by means of tapes, mastics, gasketing, or other approved closure system. Closure systems used with flexible air ducts shall comply with UL 181B. Crimp joints for round ducts shall have a lap of not less than 1 1/2 inches and shall be fastened by not less than three sheet metal screws or rivets spaced evenly around the joint. Tape used to seal the duct must comply with UL 181A.

**Support.** Metal ducts shall be supported at intervals not greater than 10 feet with 1-inch-wide 24-gauge, 1 1/2-inch-wide 26-gauge strap, or 2 x 4's if between joists or trusses. Telescoping "Basset" brackets can be used on individual runs.

**Return-Air.** Return air shall not be obtained from a closet, toilet room, bathroom, kitchen, garage, mechanical room, furnace room, or from another dwelling unit. Stud wall cavities shall not convey air from more than one floor. In simpler terms, if a joist space is utilized as the return air plenum, said joist space may not have holes conveying air from both the upper level and the lower level. Ductwork must be run from both areas to a common return air plenum. Return air shall be located a minimum of 10 feet away from the firebox of any solid fuel-burning appliances.

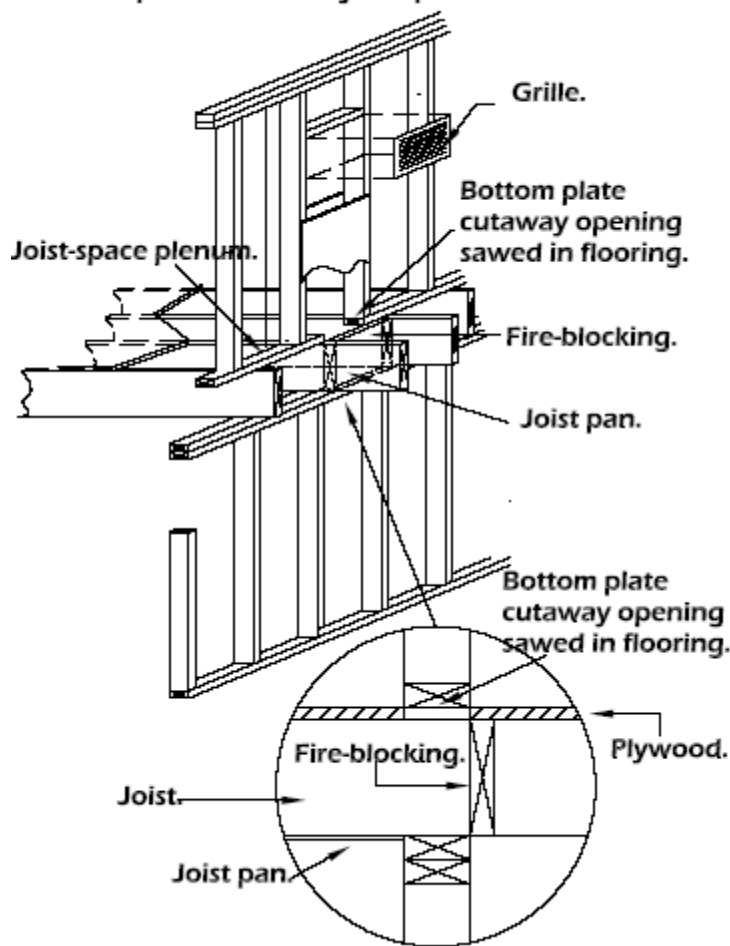
Cardboard panning (thermo-pan) may not be used on walls or in concealed locations. Existing cardboard panning that will be concealed must be replaced with 1/2-inch drywall, 3/4-inch plywood, or 28-gauge metal.

Electrical wire may pass through a return-air cavity provided it is installed such that it passes through the cavity in the shortest possible measurement, typically perpendicular to the direction of air travel.



**Stacked stud cavity returns will accelerate the spread of smoke and fire and is not acceptable.**

**Acceptable stud and joist-space installation.**



*Outside Air.* Outside air shall not be obtained from within 10 feet of an appliance vent outlet, a vent for a plumbing drainage system, or the discharge of an exhaust fan. The exception to this is if the outside air intake is no less than 3 feet below the openings described above. Outside air shall not obtain air unless it is a minimum of 10 feet above the surface of any abutting public way, driveway, or where there is the presence of flammable vapors, or where located at grade level by a sidewalk, street, alley, or driveway.

**Combustion Air.** Combustion air is the air necessary for complete combustion of a fuel-burning appliance; therefore, combustion air must be supplied for all fuel-burning appliances. The exception to this is a direct vent appliance that obtains its own combustion air from the outdoors. Combustion air shall be provided in one of the following manners:

*Indoor Air.* The minimum volume of indoor air for combustion air shall be calculated at 50 cubic feet for every 1,000 Btu/h of appliance input. If the furnace room is not large enough for the required volume of combustion air, openings into adjacent rooms may be installed. Said openings shall be located within 12 inches of the top and within 12 inches of the bottom of the enclosure. The size of the openings shall be based on 1 square inch for every 1,000 Btu/h input rating of all fuel-burning appliances; however, the minimum size of the opening shall be 100 square inches with no one dimension less than 3 inches. Unless the louver specifically gives the free area, it is assumed that it is 75 percent free area for a metal grill and 25 percent for a wood grill.

*Outdoor Air.* The City of Sioux Falls has adopted the following chart for determining the opening size for the combustion air to the outdoors:

Total Input of Appliances 1 Thousand of Btu/h	Required Free Area of Air Supply Opening or Duct, Square Inches 2
25 (26.4 KJ/h)	7 (4,516 mm <sup>2</sup> )
50 (52.8 KJ/h)	7 (4,516 mm <sup>2</sup> )
75 (79.1 KJ/h)	11 (7,097 mm <sup>2</sup> )
100 (106 KJ/h)	14 (9,032 mm <sup>2</sup> )
125 (132 KJ/h)	18 (11,610 mm <sup>2</sup> )
150 (158 KJ/h)	22 (14,190 mm <sup>2</sup> )
175 (185 KJ/h)	25 (16,130 mm <sup>2</sup> )
200 (211 KJ/h)	29 (18,710 mm <sup>2</sup> )
225 (237 KJ/h)	32 (20,650 mm <sup>2</sup> )
250 (264 KJ/h)	36 (23,230 mm <sup>2</sup> )
275 (290 KJ/h)	40 (25,810 mm <sup>2</sup> )
300 (317 KJ/h)	43 (27,740 mm <sup>2</sup> )

1. For total inputs that fall between the listing figures, use the next largest listed input.
2. These figures are based on the maximum equivalent duct length of 20 feet (6.1 m). For equivalent duct lengths in excess of 20 feet (6.1 m) to and including a maximum of 50 feet (15.2 m), increase the round duct diameter by one size. A square or rectangular duct may be considered only where the required duct size is 9 in<sup>2</sup> (5,800 mm<sup>2</sup>) or larger and the smaller dimension must be not less than 3 inches (76.2 mm).
3. The combustion air duct is required to be upsized one diameter size when a dryer is installed in the same room as the combustion air.

The following shows the square inches of a round duct to determine the required opening to the exterior:

4 inch round = 12.57 square inches

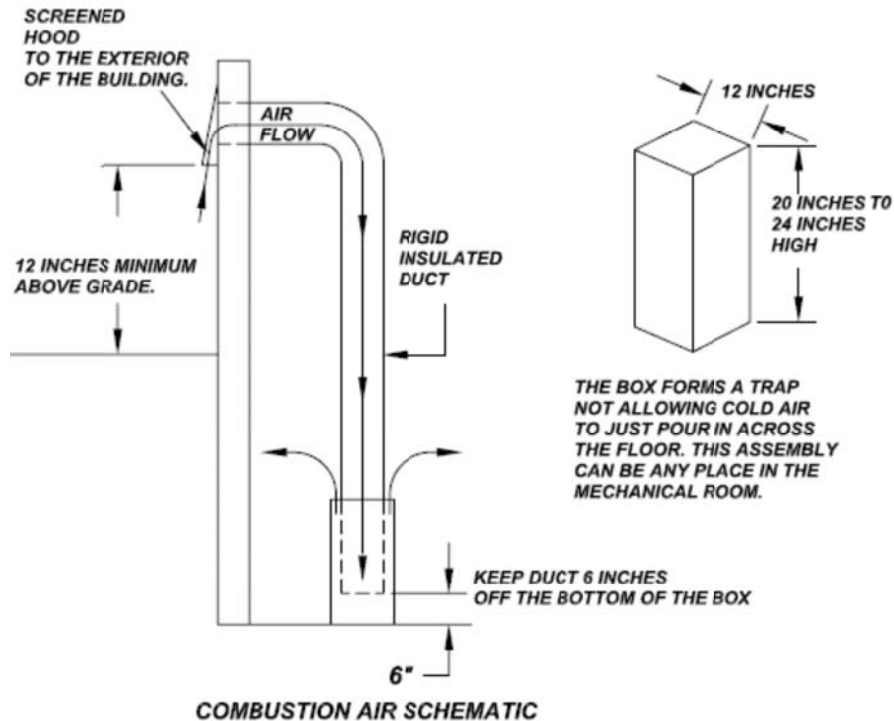
5 inch round = 19.63 square inches

6 inch round = 28.27 square inches

7 inch round = 38.48 square inches

8 inch round = 50.27 square inches

*Combustion Air Ducts.* Combustion air ducts shall be made of galvanized metal or an equivalent corrosion-resistant material. **Flexible air ducts are not allowed to be used for combustion air.** Ducts that terminate in an attic space shall not have a screen on it. The intake of a combustion air that terminates on the exterior of a building shall not be located less than 12 inches above grade and 3 feet from a gas meter regulator. Ducts shall terminate in an unobstructed space allowing free movement of combustion air to the appliances. Combustion air supplied from the outdoors shall be properly supported at intervals no greater than 10 feet with metal 1-inch straps, a basset hanger, or a 2 x 4 wood member. It is suggested that said duct is insulated with a vapor barrier because if it is not, it will condensate. The insulation sleeve from flexible duct is an acceptable insulation.



**Venting.** Venting of Category I-type appliances; i.e., water heaters, unit heaters, and 80 percent efficient furnaces, is very complicated and too extensive to go into detail in this document; therefore, contact a mechanical inspector for the correct information concerning this type of venting.

Category IV-type furnaces; i.e., plastic vented furnaces, shall be vented in accordance with that specific appliance's manufacturer's installation instructions.

Fireplaces shall be installed and vented in accordance with its manufacturer's installation instructions.

**Unvented Room Heaters.** Unvented room heaters are permitted to be used provided they meet the following provisions.

1. Not used as the sole source of heat.
2. Not rated for an input of more than 40,000 Btu/h.
3. Not installed in a sleeping room, bathroom, toilet room, or storage closet.
4. The heater shall not exceed 20 Btu/h input rating per cubic foot of volume in said room.
5. The heater is equipped with an oxygen-depletion-sensitive safety device.

**Gas Piping.** Every appliance shall have a shutoff valve installed within 6 feet of said appliance and shall be installed upstream from the union. The shutoff shall not be installed in a concealed location and shall be installed so as to provide access for operation. One-half-inch steel gas pipe shall be supported at intervals not exceeding 6 feet and 3/4 inch or 1-inch pipe at a distance not greater than 8 feet.

### Electrical Bonding.

**310.1 Pipe and tubing other than CSST.** Each above-ground portion of a gas piping system other than corrugated stainless steel tubing (CSST) that is likely to become energized shall be electrically continuous and bonded to an effective ground fault current path. Gas piping other than CSST shall be considered to be bonded where it is connected to appliances that are connected to the equipment grounding conductor of the circuit supplying that appliance.

**310.1.1 CSST.** Corrugated stainless steel tubing (CSST) gas piping systems shall be bonded to the electrical service grounding electrode system at the point where the gas service enters the building. The bonding jumper shall be not smaller than 6 AWG copper wire or equivalent.