STUDY SESSION

3

2024 IMC Sections 304.6 through 308

General Regulations II

OBJECTIVE: To gain an understanding of the general code requirements governing the support of piping, access and service to appliances and equipment, the disposal of condensate, and reductions to the required clearances to combustible materials.

REFERENCE: Sections 304.6 through 308, 2024 *International Mechanical Code* (IMC)

KEY POINTS:

- If a motor vehicle is able to pass under an appliance, what additional requirement has to be met?
- How high above the floor does an appliance have to be installed in a private garage? When does the exception apply?
- What regulates the protection for boiler rooms and furnace rooms?
- What governs the clearances from combustibles to heat-producing equipment and appliances? Is it possible to reduce such clearances?
- What is the requirement for the placement of equipment and appliances at grade level?
- If equipment or appliances are suspended above grade, what is the minimum required clearance?
- What loads are taken into account when determining the strength of pipe hangers and supports?
- Pipe hangers and supports are required to be of compatible material to prevent what from occurring?
- Which code table is used for regulating the spacing of supports? Is there another standard that may be used for the installation of supports?
- Clearances around appliances and equipment are for what purposes?
- What is the minimum size required for a working space adjacent to an appliance? What side of the appliance is it required to be located on?

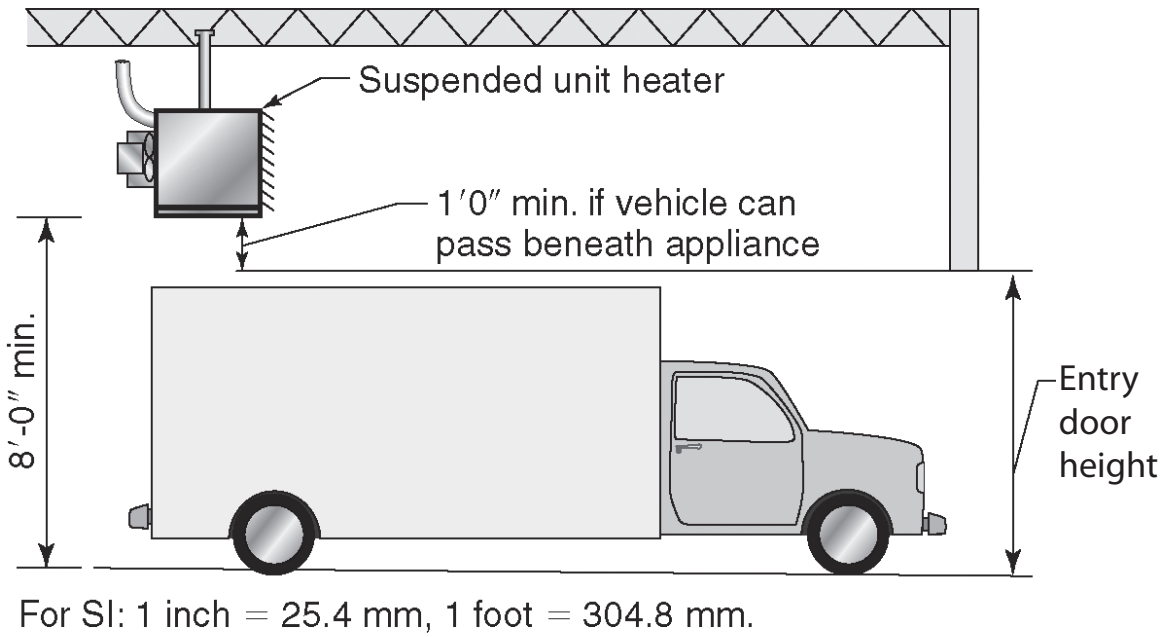
KEY POINTS: (Cont'd)

- Where an appliance is in a room, what is the minimum width of the passageway and door to access the equipment?
- What is the minimum required size of an attic access opening where an appliance is located in the attic space?
- What is the maximum distance from an attic access opening to an appliance located in the attic?
- What is the minimum required size of the access opening serving an appliance located under the floor? How close is it required to be to the appliance?
- When appliances requiring access are installed on roofs, at what height is permanent access required?
- What is the maximum height of any obstruction to rooftop access? What is the maximum slope permitted for a roof used for access purposes?
- What are the minimum requirements for permanent ladders and catwalks used to provide access to equipment or appliances on roofs or elevated structures?
- Ladders over 30 feet in height are required to comply with what additional provisions?
- How are by-products of condensing appliances to be handled and controlled?
- What type of material is required for the condensate piping? What is the minimum size required? When piping passes through a bored hole in a stud, when are shield plates required? When shield plates are installed at top plates, how far must they extend below the penetration?
- What is the minimum size of the drain line? What limitation applies?
- What is required when drain pipes are manifolded together?
- When are auxiliary drain pans required? What are the minimum sizing options for auxiliary drain pans?
- In the case where an auxiliary pan cannot be used, what is required?
- When is a condensate pump required to shut down the appliance if the pump fails?
- Reduced clearances are to be achieved through the use of what type of material?
- Spacers used for reduced clearances shall be of what type of material?
- For listed and labeled appliances, what governs the reduction of required clearances to combustible assemblies or combustible materials?
- Where required clearances are not listed in Table 308.4.2, is linear interpolation permitted? Is extrapolation below the range of the table permitted?

Topic: Public Garages	**Category:** General Regulations
Reference: IMC 304.6	**Subject:** Installation

Code Text: *Appliances located in public garages, motor fuel-dispensing facilities, repair garages or other areas frequented by motor vehicles, shall be installed not less than 8 feet (2438 mm) above the floor. Where motor vehicles are capable of passing under an appliance, the appliance shall be installed at the clearances required by the appliance manufacturer and not less than 1 foot (305 mm) higher than the tallest vehicle garage door opening.* See the exception for appliances protected from motor vehicle impact.

Discussion and Commentary: Protection of suspended appliances is necessary, as impact from a vehicle could not only cause damage to the appliance, but also initiate a fire or explosion. The 8-foot measurement is intended to prevent vehicle impact; however, the requirement for the 1 foot minimum clearance above the tallest vehicle garage door opening should assure the necessary protection.



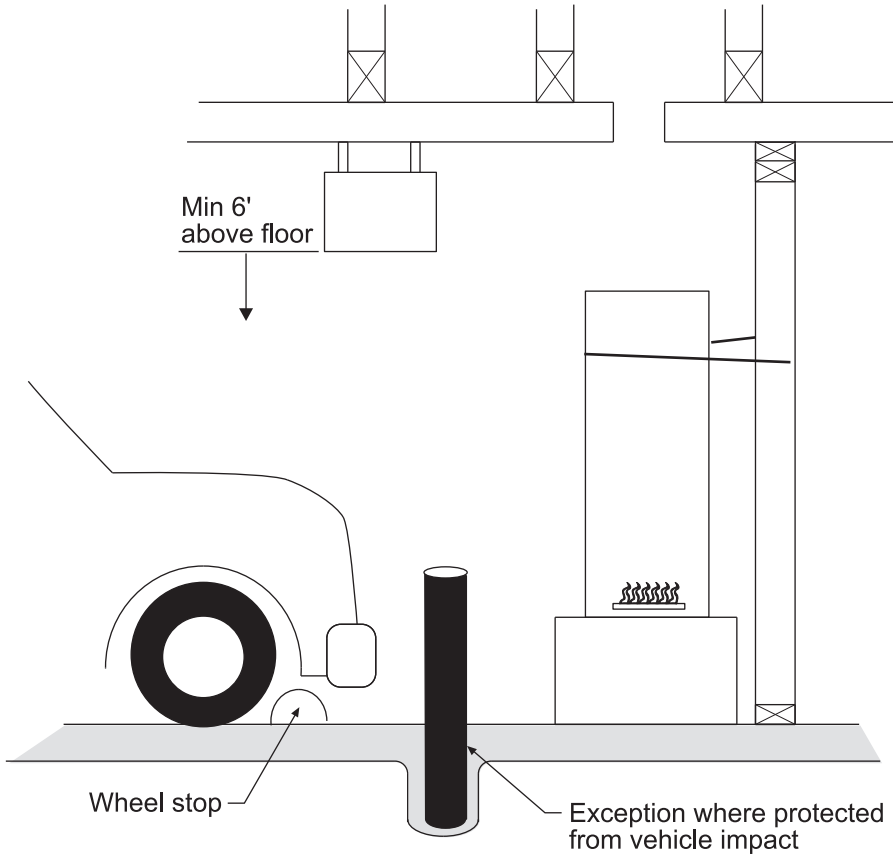
Appliance Installation in a Public Garage

Where another means of protection is provided to eliminate the potential for vehicle impact, such as a vehicle barrier, the appliance need not be located at the minimum prescribed height. It is, however, necessary that the appliance comply with Section 304.3 and NFPA 30A.

Topic: Private Garages	**Category:** General Regulations
Reference: IMC 304.7	**Subject:** Installation

Code Text: *Appliances located in private garages and carports shall be installed with a minimum clearance of 6 feet (1829 mm) above the floor.* See the exception addressing appliances that are protected from motor vehicle impact and installed in accordance with Section 304.3.

Discussion and Commentary: The limitation addressing appliance clearance in private garages and carports applies when the appliance is located in an area where impact from a vehicle may occur. It is possible, however, that the 6-foot minimum height requirement may not be adequate when considering the height of sport/utility and recreational vehicles.



For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm.

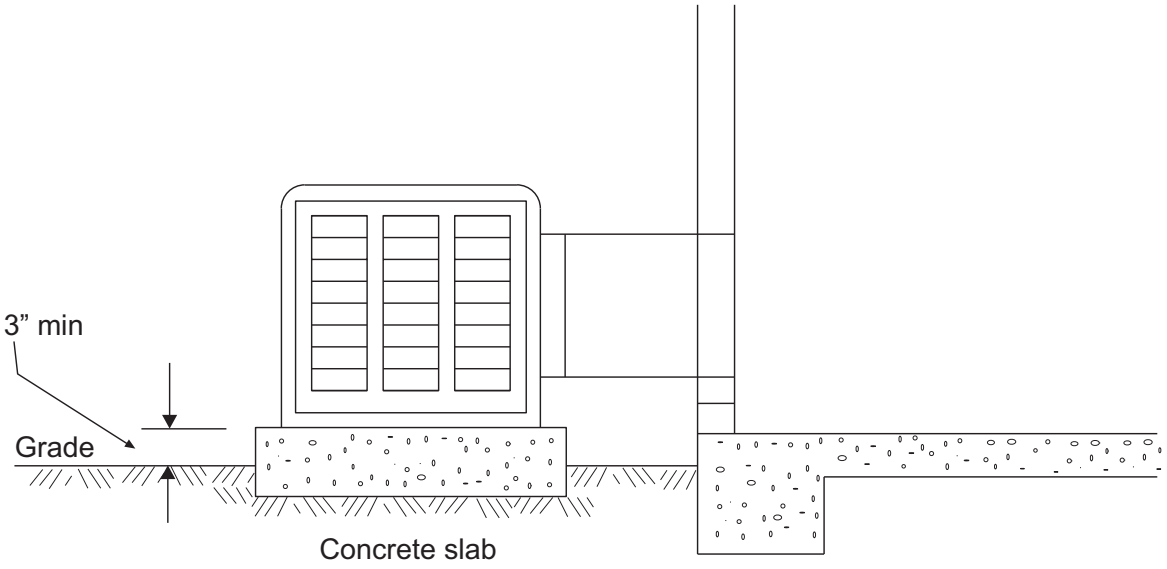
Locating an appliance where it is not subject to vehicle impact complies with the exception. The height of the garage door also limits the height of the vehicle and potential impact problems.

Topic: Clearances from Grade | **Category:** General Regulations

Reference: IMC 304.10 | **Subject:** Installation

Code Text: *Equipment and appliances installed at grade level shall be supported on a level concrete slab or other approved material extending not less than 3 inches (76 mm) above adjoining grade or shall be suspended not less than 6 inches (152 mm) above adjoining grade. Such support shall be in accordance with the manufacturer's installation instructions.*

Discussion and Commentary: Where located on grade in exterior locations, the equipment or appliances must be a minimum of 3 inches above the adjacent grade. Where suspending the equipment or appliance, a minimum clearance of 6 inches is mandated. Under both conditions, the resulting clearance will help protect the appliance or equipment from damage and prevent soil or water contact. It must also comply with the manufacturer's instructions.



For SI: 1 inch = 25.4 mm.

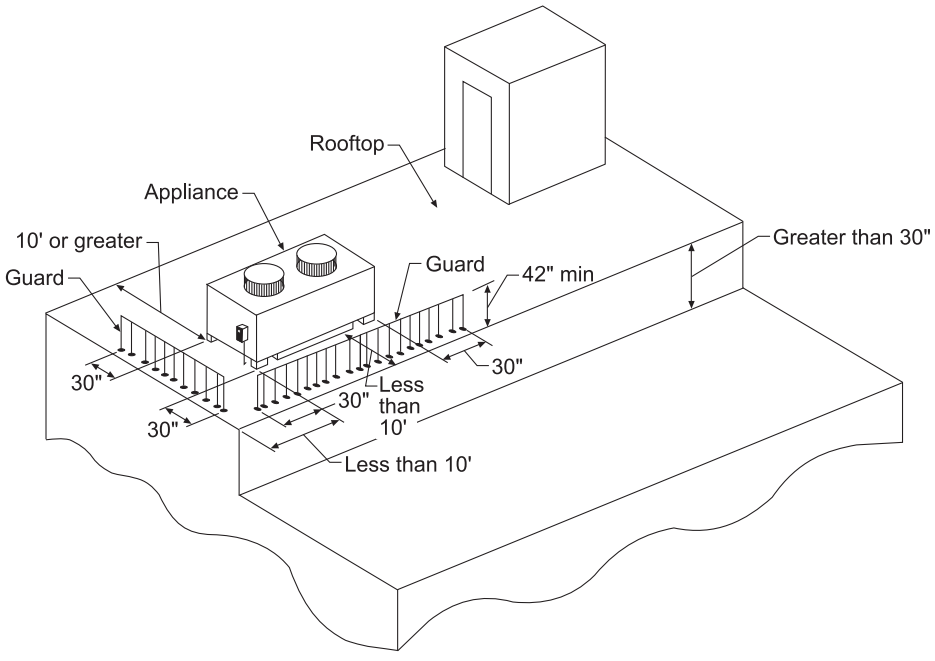
Verification of the minimum clearances is an important part of the “final” inspection. These clearances are necessary for the protection of the appliances and equipment.

Topic: Guards | **Category:** General Regulations

Reference: IMC 304.11 | **Subject:** Installation

Code Text: *Guards shall be provided where various components that require service and roof hatch openings are located within 10 feet (3048 mm) of a roof edge or open side of a walking surface and such edge or open side is located more than 30 inches (762 mm) above the floor, roof or grade below. The guard shall extend not less than 30 inches (762 mm) beyond each end of components that require service and each end of the roof hatch parallel to the roof edge. The top of the guard shall be located not less than 42 inches (1067 mm) above the elevated surface adjacent to the guard. The guard shall be constructed so as to prevent the passage of a 21-inch-diameter (533 mm) sphere and shall comply with the loading requirements for guards specified in the* International Building Code*.* See the exception where fall restraint devices are installed.

Discussion and Commentary: The provision requiring guards is intended to protect service personnel from the possibility of a dangerous fall while accessing or servicing elevated appliances or equipment. The minimum 30-inch extension of the guard is provided to add an increased level of protection for service, installation or maintenance personnel. The scope of this requirement is limited to locations where equipment or appliances are installed within 10 feet of a roof edge or other elevated walking surface and the vertical drop to the level below exceeds 30 inches.



For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm.

Permanent fall arrest/restraint connector devices are considered equivalent to guards for worker safety on a roof. Service personnel in safety harnesses can connect to the restraint anchors to prevent injury from falls.

Topic: Interval of Support | **Category:** General Regulations

Reference: IMC 305.4, Table 305.4 | **Subject:** Piping Support

Code Text: *Piping shall be supported at distances not exceeding the spacing specified in Table 305.4 or in accordance with ANSI/MSS SP-58.*

Discussion and Commentary: As an alternative to Table 305.4, the Manufacturer's Standardization Society of the Valve and Fitting Industry (MSS) Standard SP-58, Pipe Hangers and Supports, may be used for determining the maximum permitted horizontal and vertical piping support spacing. The limit on support spacing is intended to reduce any sag or stress that could develop.

TABLE 305.4—PIPING SUPPORT SPACING[a]

PIPING MATERIAL	MAXIMUM HORIZONTAL SPACING (feet)	MAXIMUM VERTICAL SPACING (feet)
ABS pipe	4	10[c]
Aluminum pipe and tubing	10	15
Cast-iron pipe[b]	5	15
Copper or copper-alloy pipe	12	10
Copper or copper-alloy tubing	8	10
CPVC pipe or tubing, 1 inch and smaller	3	10[c]
CPVC pipe or tubing, $1^1/_4$-inches and larger	4	10[c]
Lead pipe	Continuous	4
PE-RT 1 inch and smaller	$2^2/_3$ (32 inches)	10[c]
PE-RT $1^1/_4$ inches and larger	4	10[c]
PEX tubing 1 inch and smaller	$2^2/_3$ (32 inches)	10[c]
PEX tubing $1^1/_4$ inches and larger	4	10[c]
Polypropylene (PP) pipe or tubing, 1 inch and smaller	$2^2/_3$ (32 inches)	10[c]
Polypropylene (PP) pipe or tubing, $1^1/_4$ inches and larger	4	10[c]
PVC pipe	4	10[c]
Steel pipe	12	15
Steel tubing	8	10

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm.

a. See Section 301.18.

b. The maximum horizontal spacing of cast-iron pipe hangers shall be increased to 10 feet where 10-foot lengths of pipe are installed.

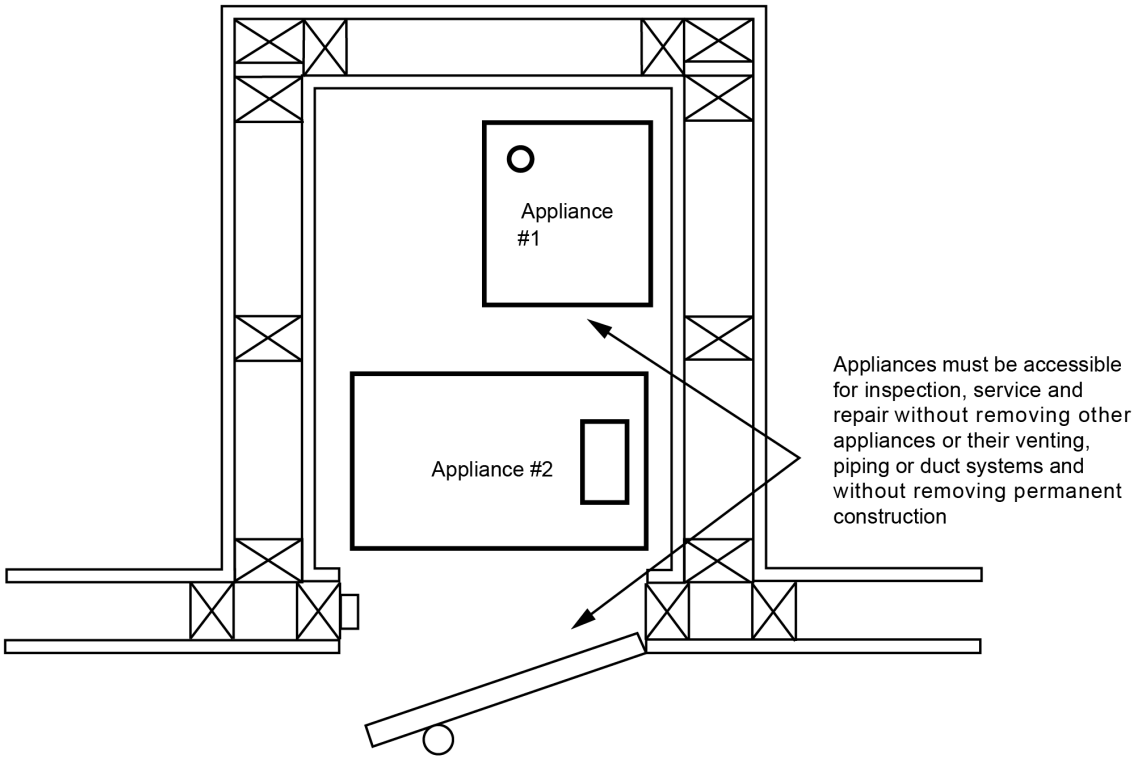
c. Mid-story guide.

Using Table 305.4 sometimes requires knowledge of both the type of piping materials and the size of the pipe being supported. For some types of piping materials, as the pipe diameter increases, the maximum permitted distance between supports also increases.

Topic: Access	**Category:** General Regulations
Reference: IMC 306.1	**Subject:** Access and Service Space

Code Text: *Appliances, controls devices, heat exchangers and HVAC system components that utilize energy shall provide access for inspection, service, repair and replacement without disabling the function of a fire-resistance-rated assembly or removing permanent construction, other appliances, venting systems or any other piping or ducts not connected to the appliance being inspected, serviced, repaired or replaced. A level working space not less than 30 inches deep and 30 inches wide (762 mm by 762 mm) shall be provided in front of the control side to service an appliance.*

Discussion and Commentary: The minimum clearances around appliances are established in the manufacturer's installation instructions. This section supplements those requirements by ensuring that appliances are located so they can be inspected, serviced and repaired or replaced without the need for removing or disconnecting any other appliances or any permanent construction in order to perform these anticipated tasks.

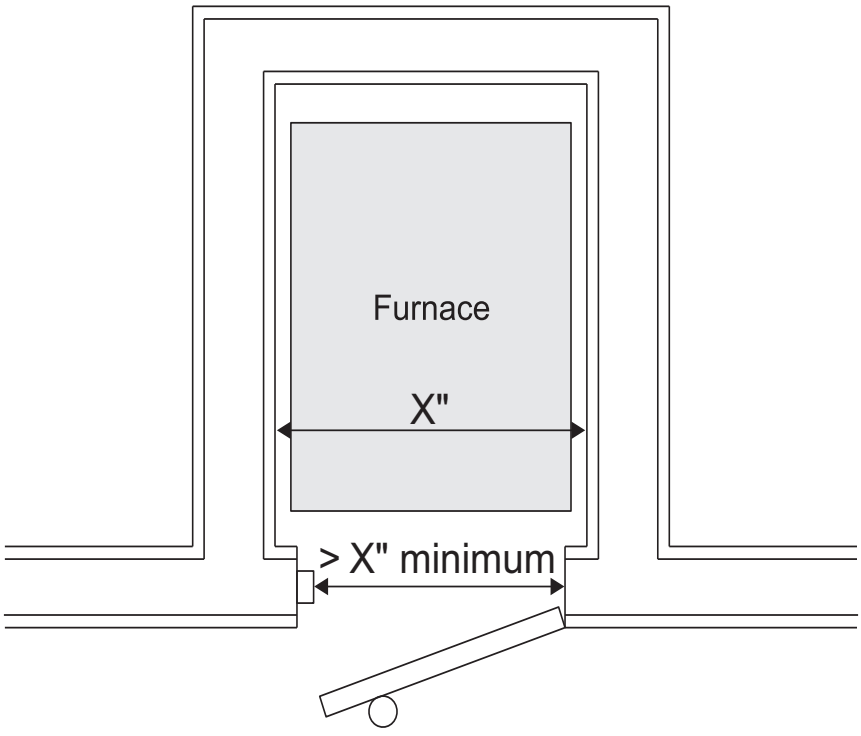


Besides access to the appliance, a working space that is a minimum of 30 inches by 30 inches (762 mm by 762 mm) in area must be provided adjacent to the control side of the appliance.

Topic: Appliances in Rooms	**Category:** General Regulations
Reference: IMC 306.2	**Subject:** Access and Service Space

Code Text: *Rooms containing appliances shall be provided with a door and an unobstructed passageway measuring not less than 36 inches (914 mm) wide and 80 inches (2032 mm) high.* See the exception for appliances installed within dwelling units, which permits a 24 inch-wide (610 mm) door, provided it is wide enough to allow removal of the largest appliance in the space.

Discussion and Commentary: The minimum measurements for access to an appliance located within a room are intended to allow for the maintenance, repair or replacement of equipment and appliances without having to remove portions of the enclosure.

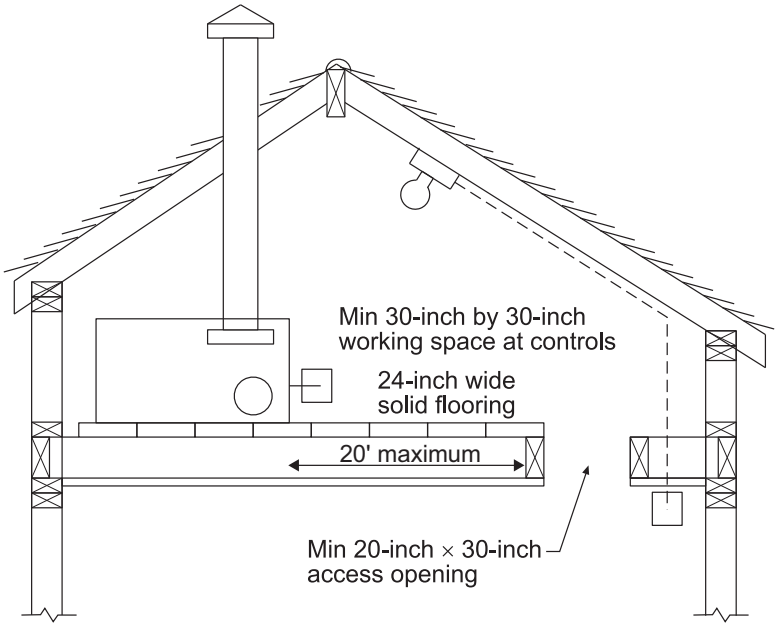


Both the 24-inch access width for dwelling units and the 36-inch access width for other occupancies are considered minimum requirements. Where the actual width of the appliance or equipment exceeds these minimum widths, the size of the appliance or equipment determines the minimum required width.

Topic: Appliances in Attics	**Category:** General Regulations
Reference: IMC 306.3	**Subject:** Access and Service Space

Code Text: *Attics containing appliances shall be provided with an opening and unobstructed passageway large enough to allow removal of the largest appliance. The passageway shall be not less than 30 inches (762 mm) high and 22 inches (559 mm) wide and not more than 20 feet (6096 mm) in length measured along the centerline of the passageway from the opening to the appliance. The passageway shall have continuous solid flooring not less than 24 inches (610 mm) wide. A level service space not less than 30 inches (762 mm) deep and 30 inches (762 mm) wide shall be present at the front or service side of the appliance. The clear access opening dimensions shall be not less than 20 inches by 30 inches (508 mm by 762 mm), and large enough to allow removal of the largest appliance.* See the exceptions for (1) appliances capable of being serviced and removed through the required opening, and (2) extended passageway length where additional height is provided.

Discussion and Commentary: The minimum requirements for appliances located within attics are intended to provide access and service space without endangering the service personnel. They also assist the installer and the code official in determining if the attic has adequate space for the appliance. When wood trusses are used, appropriate verification from the truss supplier is necessary. It must be shown that the additional loading that occurs due to the passageway, service space and appliance is taken into consideration during the truss design.



For SI: 1 inch = 25.4 mm.

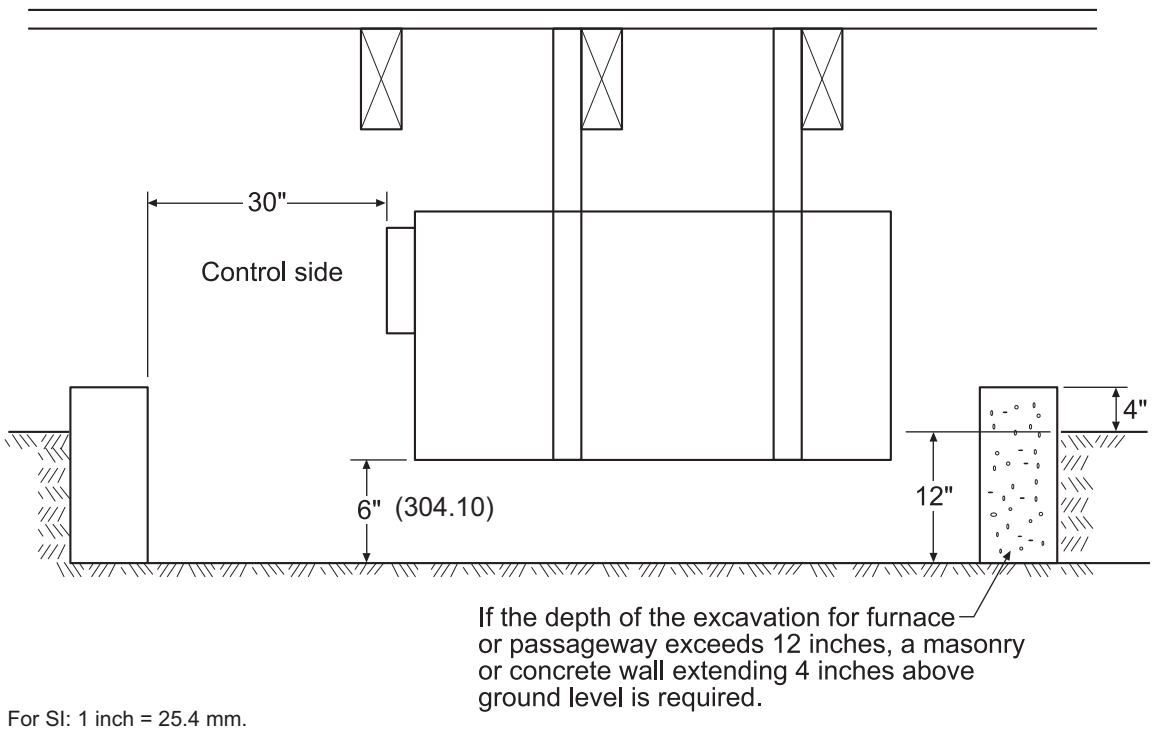
Appliances to be located in attics are required to be listed for such installations. Minimum clearances are required, and compliance with the manufacturer's installation instructions is necessary for code compliance.

Topic: Appliances under Floors | **Category:** General Regulations

Reference: IMC 306.4 | **Subject:** Access and Service Space

Code Text: *Underfloor spaces containing appliances shall be provided with an access opening and unobstructed passageway large enough to remove the largest appliance. The passageway shall be not less than 30 inches (762 mm) high and 22 inches (559 mm) wide, nor more than 20 feet (6096 mm) in length measured along the centerline of the passageway from the opening to the appliance. A level service space not less than 30 inches (762 mm) deep and 30 inches (762 mm) wide shall be present at the front or service side of the appliance. If the depth of the passageway or the service space exceeds 12 inches (305 mm) below the adjoining grade, the walls of the passageway shall be lined with concrete or masonry. Such concrete or masonry shall extend not less than 4 inches (102 mm) above the adjoining grade and shall have sufficient lateral-bearing capacity to resist collapse. The clear access opening dimensions shall be not less than 22 inches by 30 inches (559 mm by 762 mm), and large enough to allow removal of the largest appliance.* See the exceptions for (1) appliances capable of being serviced and removed through the required opening, and (2) extended passageway length where additional height is provided.

Discussion and Commentary: Appliances located under floors are subject to the same minimum requirements for access and service space as appliances located in attics. However, additional requirements for underfloor installations address the potential of contact or damage from soil. By lining the location with a wall of concrete or masonry, the appliance should be adequately protected.



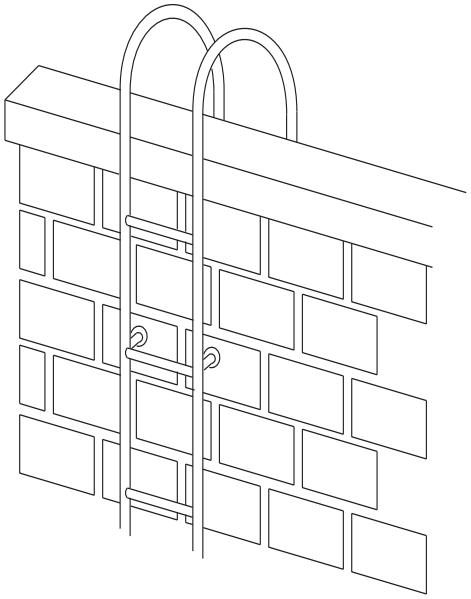
For SI: 1 inch = 25.4 mm.

When a furnace is installed under the floor, verification of any flood hazard conditions should be a determining factor.

Topic: Appliances on Roofs/Elevated Structures **Category:** General Regulations
Reference: IMC 306.5 **Subject:** Access and Service Space

Code Text: *Where equipment requiring access or appliances are located on an elevated structure or the roof of a building such that personnel will have to climb higher than 16 feet (4877 mm) above grade to access such equipment or appliances, an interior or exterior means of access shall be provided. Such access shall not require climbing over obstructions greater than 30 inches (762 mm) in height or walking on roofs having a slope greater than 4 units vertical in 12 units horizontal (33 percent slope). Such access shall not require the use of portable ladders. Where access involves climbing over parapet walls, the height shall be measured to the top of the parapet wall.*

Discussion and Commentary: The requirement for a permanent method of access to a roof or elevated structure is intended to eliminate the use of portable equipment to gain access when vertical travel exceeds 16 feet. Permanent ladders utilized for such access are regulated by prescriptive requirements that have been taken from the Occupational Safety and Health Administration (OSHA) requirements.



Permanent ladders providing roof access shall:

1. Have side railings that extend at least 30 inches above the roof edge, parapet or landing platform not less than 42 inches.
2. Have rungs spaced not less than 10 inches and not to exceed 14 inches on center.
3. Have a minimum toe spacing not less than 7 inches and not more than 12 inches.
4. Be a minimum of 16 inches between rails.
5. Have rungs at least 0.75 inches in diameter and capable of withstanding 300-lb load.

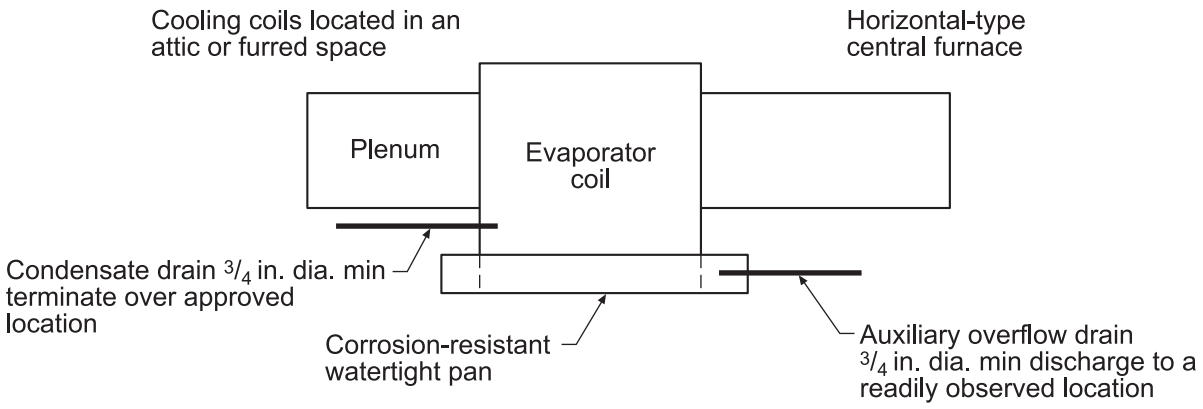
For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm.

Additional requirements are in place for those permanent ladders that exceed 30 feet in height. Along with the general provisions addressing all permanent ladders, all ladders over 30 feet in height must be provided with offset sections and landings.

Topic: Auxiliary and Secondary Drainage	**Category:** General Regulations
Reference: IMC 307.2.3	**Subject:** Condensate Disposal

Code Text: *In addition to the requirements of Section 307.2.1, where damage to any building components could occur as a result of overflow from the equipment primary condensate removal system*, an auxiliary protection method is required.

Discussion and Commentary: Condensate drains serving evaporators and cooling coils, as well as some fuel-fired appliances, have a history of clogging that is due to loose materials from the air-handling equipment. It is not unusual for this stoppage to cause damage to the building where the system is located. Three different secondary drainage methods are set forth in the code, allowing for a choice in the approach to supplementing the primary disposal method. An additional option allows for the installation of an approved water-level detection device that will shut down the appropriate equipment if the primary drain is blocked.



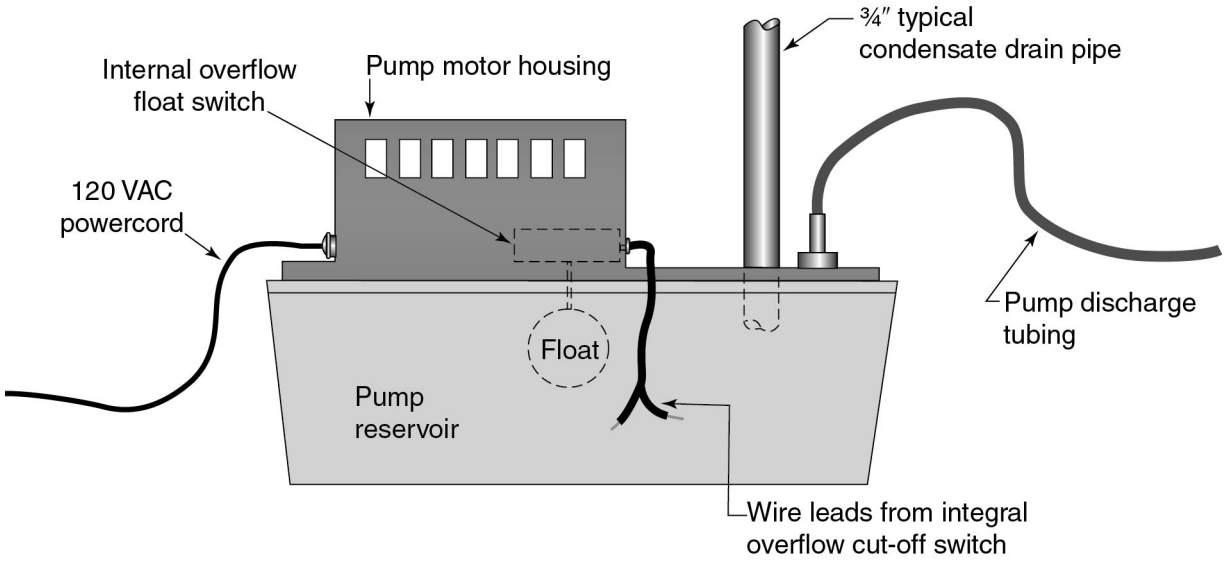
For SI: 1 inch = 25.4 mm.

Auxiliary drainage methods 1 and 2 both require the point of discharge to be in an easily observable location, resulting in an early alert to building occupants when there is a stoppage of the primary drain.

Topic: Condensate Pumps	**Category:** General Regulations
Reference: IMC 307.3	**Subject:** Condensate Disposal

Code Text: *Condensate pumps located in uninhabitable spaces, such as attics and crawl spaces, shall be connected to the appliance or equipment served such that when the pump fails, the appliance or equipment will be prevented from operating. Pumps shall be installed in accordance with the manufacturer's instructions.*

Discussion and Commentary: Condensate pumps are often located in attics and crawl spaces and above ceilings where they are not readily observable. If they fail, the condensate overflow can cause damage to building elements. The majority of such pumps are equipped with simple float controls that can be wired in series with the appliance control circuit. When the pump system fails, the float rises in the reservoir and opens a switch, shutting down the appliance before the condensate starts to overflow the reservoir. The *International Mechanical Code* requires condensate pumps installed in uninhabitable spaces to have this feature and be connected to the appliance or equipment to prevent overflow.



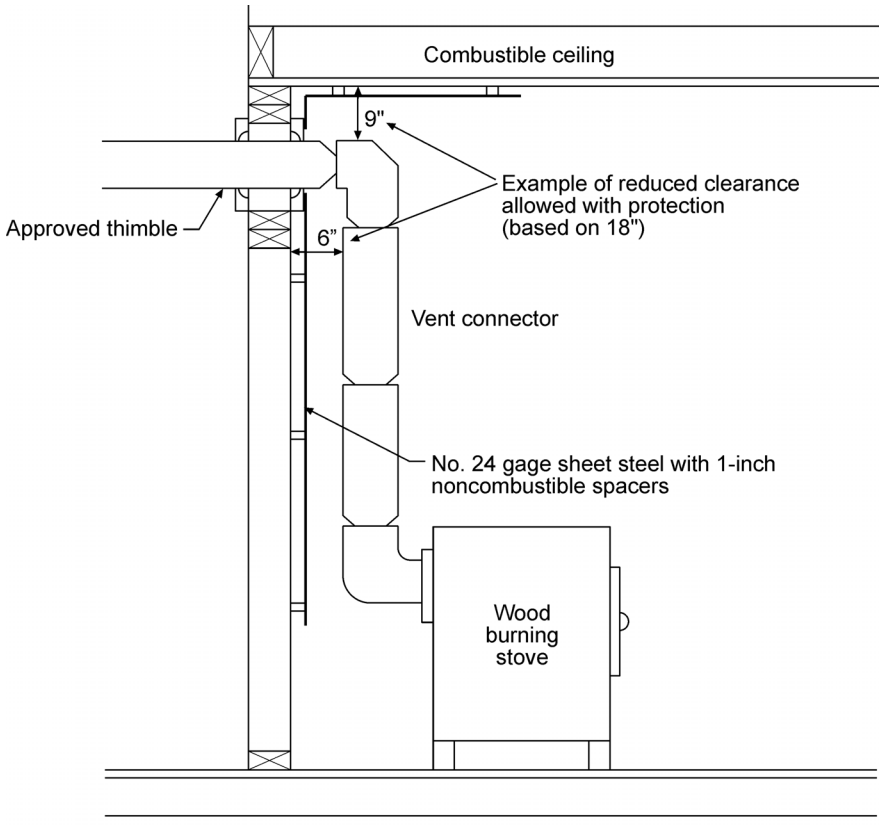
For SI: 1 inch = 25.4 mm.

Condensate pumps must be installed in accordance with the manufacturer's instructions.

Topic: Protective Construction	**Category:** General Regulations
Reference: IMC 308.3	**Subject:** Clearance Reduction

Code Text: *Reduced clearance protective assemblies, including structural and support elements, shall be constructed of noncombustible materials. Spacers utilized to maintain an airspace between the protective assembly and the protected material or assembly shall be noncombustible. Where a space between the protective assembly and protected combustible material or assembly is specified, the same space shall be provided around the edges of the protective assembly and the spacers shall be placed so as to allow air circulation by convection in such space. Protective assemblies shall not be placed less than 1 inch (25 mm) from the mechanical appliances, devices or equipment, regardless of the allowable reduced clearance.*

Discussion and Commentary: Most of the methods listed in Table 308.4.2 for reducing the clearance to combustible construction utilize the movement of air through convection as a part of the protection of the underlying structural members. The requirement for the space around the edges is critical to the convective cooling process.



For SI: 1 inch = 25.4 mm.

Regardless of the type of protective assembly installed, if an airspace is required as a portion of the protection requirements, a similar size airspace shall be maintained around the perimeter. At least 1 inch of clearance must always be provided between the protective assembly and the appliance, device or equipment.

Topic: Reduction Table | **Category:** General Regulations

Reference: IMC 308.4.2, Table 308.4.2 | **Subject:** Clearance Reduction

Code Text: *The allowable clearance reduction shall be based on one of the methods specified in Table 308.4.2. Where required clearances are not listed in Table 308.4.2, the reduced clearances shall be determined by linear interpolation between the distances listed in the table. Reduced clearances shall not be derived by extrapolation below the range of the table.*

Discussion and Commentary: When using the methods of Table 308.4.2, the clearance is to be measured from the heat source to the face of the combustible surface. In the case of listed equipment, the required clearances are intended to be clear airspace and not to be filled with insulation or any other material. This is especially important where clearances are required from appliances and equipment that rely on the airspace for convection cooling and to maintain its proper operation.

TABLE 308.4.2—CLEARANCE REDUCTION METHODS[b]

TYPE OF PROTECTIVE ASSEMBLY[a]	REDUCED CLEARANCE WITH PROTECTION (inches)[a]							
	Horizontal combustible assemblies located above the heat source				Horizontal combustible assemblies located beneath the heat source and all vertical combustible assemblies			
	Required clearance to combustibles without protection (inches)[a]				Required clearance to combustibles without protection (inches)			
	36	18	9	6	36	18	9	6
Galvanized sheet steel, having a minimum thickness of 0.0236 inch (No. 24 gage), mounted on 1-inch glass fiber or mineral wool batt reinforced with wire on the back, 1 inch off the combustible assembly	18	9	5	3	12	6	3	3
Galvanized sheet steel, having a minimum thickness of 0.0236 inch (No. 24 gage), spaced 1 inch off the combustible assembly	18	9	5	3	12	6	3	2
Two layers of galvanized sheet steel, having a minimum thickness of 0.0236 inch (No. 24 gage), having a 1-inch airspace between layers, spaced 1 inch off the combustible assembly	18	9	5	3	12	6	3	3
Two layers of galvanized sheet steel, having a minimum thickness of 0.0236 inch (No. 24 gage), having 1 inch of fiberglass insulation between layers, spaced 1 inch off the combustible assembly	18	9	5	3	12	6	3	3
0.5-inch inorganic insulating board, over 1 inch of fiberglass or mineral wool batt, against the combustible assembly	24	12	6	4	18	9	5	3
$3^1/_2$-inch brick wall, spaced 1 inch off the combustible wall	—	—	—	—	12	6	6	6
$3^1/_2$-inch brick wall, against the combustible wall	—	—	—	—	24	12	6	5

For SI: 1 inch = 25.4 mm, °C = [(°F) – 32]/1.8, 1 pound per cubic foot = 16.02 kg/m^3, 1.0 Btu × in/(ft^2 × h × °F) = 0.144 W/m^2 × K.

a. Mineral wool and glass fiber batts (blanket or board) shall have a minimum density of 8 pounds per cubic foot and a minimum melting point of 1,500°F. Insulation material utilized as part of a clearance reduction system shall have a thermal conductivity of 1.0 Btu × in/(ft^2 × h × °F) or less. Insulation board shall be formed of noncombustible material.

b. For limitations on clearance reduction for solid fuel-burning appliances, masonry chimneys, connector pass-throughs, masonry fireplaces and kitchen ducts, see Sections 308.4.2.1 through 308.4.2.5.

The clearance reduction methods specified in Table 308.4.2 cannot be used to reduce the clearances required for masonry chimneys, chimney connector pass-throughs, masonry fireplaces or kitchen exhaust ducts enclosed in a shaft.

Quiz

Study Session 3

IMC Sections 304.6 through 308

1. Unless adequately protected from impact, appliances in a public garage shall be located a minimum of _____ feet above the floor.

   a. 4 b. 6

   c. 8 d. 10

   Reference _____

2. In public garages where vehicles are capable of passing under an appliance, the appliance shall be installed a minimum of _____ inches higher than the tallest vehicle garage door opening.

   a. 6 b. 12

   c. 18 d. 24

   Reference _____

3. Unless protected from impact, appliances located in private garages shall be installed with a minimum clearance above the floor of _____ feet.

   a. 4 b. 6

   c. 8 d. 10

   Reference _____

4. Suspended mechanical equipment shall be installed a minimum of _____ inches above adjoining grade.

   a. 3 b. 4

   c. 5 d. 6

   Reference _____

5. Where appliances are located on roofs, any required guards shall be constructed so as to prevent the passage of a _____ -inch-diameter sphere.

   a. 6 b. 8

   c. 12 d. 21

   Reference _____

6. Horizontal ABS piping shall be supported at maximum intervals of _____ feet.

   a. 3 b. 4

   c. 5 d. 6

   Reference _____

7. The maximum horizontal spacing of supports for 3/4-inch CPVC tubing shall not exceed _____ feet.

   a. 3 b. 4

   c. 5 d. 6

   Reference _____

8. A shield plate is required to protect against damage where piping other than cast-iron or steel is run through a bored hole in a stud, and the distance to the nearest edge of the member is less than _____ inch(es).

   a. 5/8 b. 7/8

   c. 1 d. 1 1/4

   Reference _____

9. Where a CPVC pipe passes through a bored hole in a top plate near enough to the edge to require protection, the protective steel shield plate shall cover the area of the pipe and shall extend not less than _____ inch(es) below the top plates.

   a 5/8 b. 1

   c. 1 1/2 d. 2

   Reference _____

10. In other than within a dwelling unit, a door and an unobstructed passageway measuring a minimum of _____ inches in width and 80 inches in height shall be provided for access to an appliance located in a room.

    a. 22
    b. 24
    c. 32
    d. 36

    Reference _____

11. Appliances installed in a basement of a dwelling unit shall be accessed by an opening or door and an unobstructed passageway measuring a minimum of _____ inches in width.

    a. 22
    b. 24
    c. 32
    d. 36

    Reference _____

12. In general, attics containing equipment shall be provided with an unobstructed passageway at least _____ inches in width.

    a. 22
    b. 24
    c. 28
    d. 30

    Reference _____

13. Unless a minimum 6-foot-high by 22-inch-wide passageway is provided, equipment installed in underfloor areas shall be located a maximum of _____ feet from the access opening.

    a. 18
    b. 20
    c. 24
    d. 30

    Reference _____

14. Where the opening dimensions are large enough to allow removal of the largest appliance, the clear access opening to the underfloor area containing the equipment shall be a minimum of _____.

    a. 18 inches by 24 inches
    b. 22 inches by 24 inches
    c. 22 inches by 30 inches
    d. 30 inches by 30 inches

    Reference _____

15. Regardless of whether the access is interior or exterior, a permanently installed means of access is required where an appliance is installed on a roof that requires personnel to climb higher than _____ feet above grade.

    a. 8
    b. 12
    c. 14
    d. 16

    Reference _____

16. In other than Group R-3 occupancies, catwalks installed to provide the required rooftop equipment access shall be a minimum of _____ inches wide and have railings as required for service platforms.

    a. 12
    b. 18
    c. 24
    d. 30

    Reference _____

17. Platforms for service of appliances installed on roofs with a minimum slope of 3:12 and a platform edge more than 30 inches above grade shall be a minimum of _____ in size.

    a. 18 inches by 24 inches
    b. 22 inches by 24 inches
    c. 22 inches by 30 inches
    d. 30 inches by 30 inches

    Reference _____

18. Condensate waste and drain lines shall be a minimum of _____-inch pipe size.

    a. 1/2
    b. 5/8
    c. 3/4
    d. 1

    Reference _____

19. Where an auxiliary drain pan with a separate drain line is utilized for condensate disposal, it shall have a minimum pan depth of _____ inches.

    a. 1 1/2
    b. 2
    c. 3
    d. 4

    Reference _____

20. Condensate piping serving fuel-burning condensing appliances shall maintain a minimum horizontal slope of _____ unit vertical in 12 units horizontal.

    a. 1/8
    b. 1/4
    c. 1/2
    d. 1

    Reference _____

21. Nonmetallic auxiliary drain pans for condensate disposal shall have a minimum thickness of _____ inches.

    a. 0.0276
    b. 0.0625
    c. 0.1025
    d. 0.125

    Reference _____

22. An automatic appliance shut-off device is required for condensate pumps located _____.

    a. in a finished basement
    b. in an attic
    c. in a mechanical room
    d. more than 10 feet from the condensing appliance

    Reference _____

23. Reduced clearance protective assemblies for mechanical appliances shall be placed a minimum of _____ inch(es) from the appliance.

    a. 1/2
    b. 1
    c. 1 1/2
    d. 2

    Reference _____

24. Where a solid fuel-burning appliance is labeled for a minimum clearance of 16 inches to combustible construction, the clearance reduction methods shall not reduce the clearance to less than _____ inches.

    a. 2
    b. 3
    c. 6
    d. 12

    Reference _____

25. Where two layers of No. 24 gage galvanized sheet steel are installed on a ceiling located above the heat source with a 1-inch air space between the layers and a 1-inch air space off of the combustible ceiling assembly, a generally required 36-inch clearance above the heat source may be reduced to _____ inches.

    a. 9
    b. 12
    c. 18
    d. 24

    Reference _____