Protecting Service Equipment

Introduction

Houses are typically provided with a variety of building support service equipment, including the following:

- electrical systems (wiring, switches, outlets, fixtures, fuse and circuit breaker panels, meters)
- telephone and cable TV lines
- water and sewer lines and drains
- natural gas lines
- septic tanks
- heating, ventilating, and cooling (HVAC) equipment (air conditioning compressors, heat pumps, furnaces, ductwork, hot water heaters, fuel storage tanks)
- appliances (washing machines, dryers, freezers, refrigerators)

Some of this equipment is normally found inside the house, such as furnaces, ductwork, hot water heaters, and appliances; some is found outside, such as propane tanks, air conditioning and heat pump compressors, heat pumps, and septic tanks; and some includes components found in both locations, such as electrical systems; plumbing, gas, telephone, and cable TV lines; and oil storage tanks.

The original placement of service equipment in and around your house was probably based on standard construction practice and the economic concerns of the builder. As a result, in floodprone houses, service equipment is often installed in areas where it will be exposed to flood waters, such as in a basement or crawlspace or at ground level outside the house.

Elevation, wet floodproofing, and dry floodproofing protect the structure of your house from damage by flood waters. But these methods, unlike relocation and the construction of levees or floodwalls, do not prevent flood waters from reaching the house. For this reason, protecting service equipment below the expected flood level is an essential part of a retrofitting project.

NOTE

For more information about elevating electrical systems and heating, ventilating and cooling equipment, refer to the following Federal Emergency Management Agency (FEMA) Hazard Mitigation Fact Sheets: *Raise Electrical System Components* and *Raise or Floodproof HVAC Equipment.*

Methods of Protection

You can protect interior and exterior service equipment in several ways: by elevating it, relocating it, or protecting it in place.

Elevation

Service equipment installed outside your house can often be elevated above the flood level. Equipment mounted on an exterior wall, such as an electric meter and incoming electric, telephone, and cable TV lines, usually can be mounted higher up on the same wall. Equipment normally placed on the ground, such as heat pumps and air conditioning compressors, can be raised above the flood elevation on pedestals or platforms (see Figures 8-1 and 8-2).

When you elevate service equipment, you should always consider incorporating at least 1 foot of freeboard into your Flood Protection Elevation (FPE), just as you should when you protect your house with one of the methods described in this guide. Elevating service equipment an additional 1 or 2 feet often will not increase your retrofitting costs significantly.

The feasibility of elevating equipment inside a basement or garage will depend largely on the flood level. If the flood level is only 1 to 2 feet above the floor, large pieces of equipment such as furnaces, hot water heaters, and appliances can be elevated on platforms constructed of concrete or masonry block. As the height of the flood level above the floor increases,

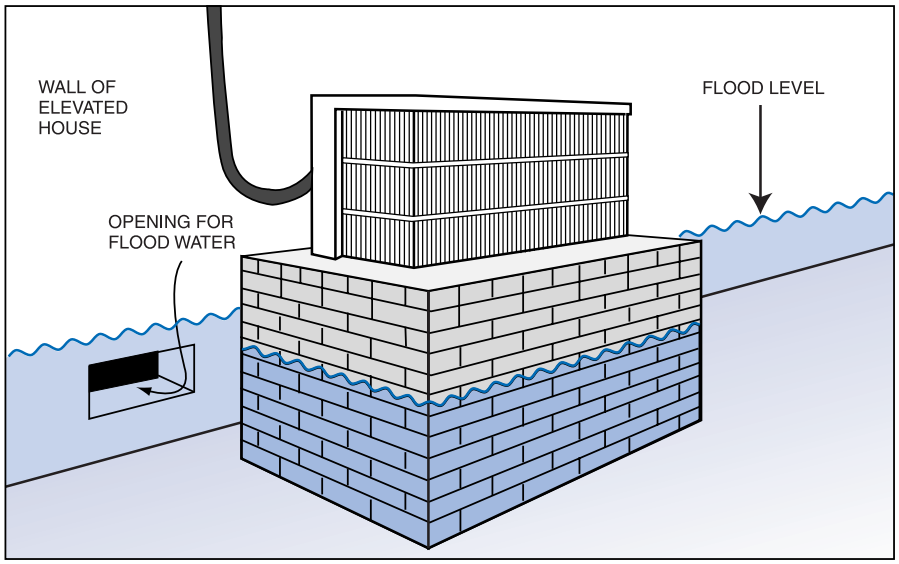

Figure 8-1
An air conditioning/ heat pump compressor mounted on a brick pedestal outside an elevated house.

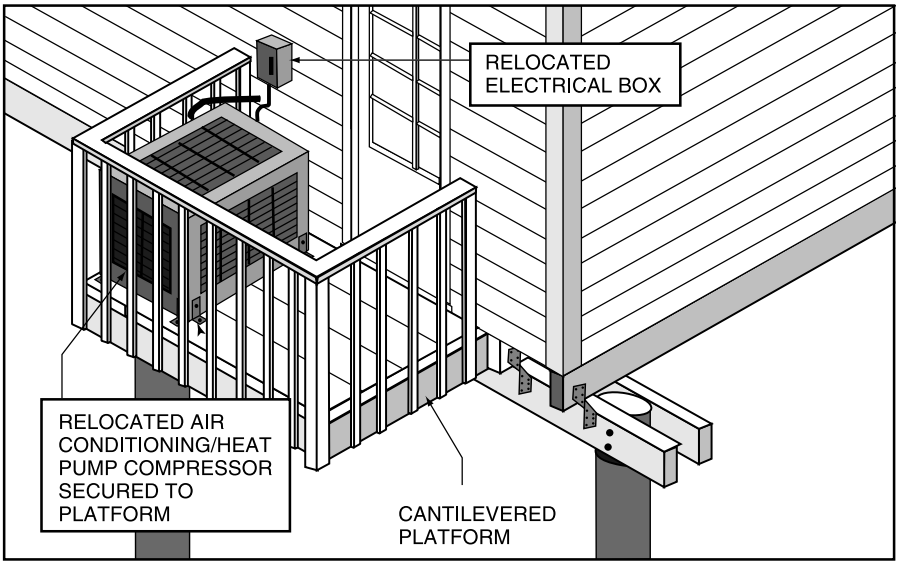

Figure 8-2
Air conditioning/ heat pump compressor mounted on a cantilevered platform attached to a house elevated on an open foundation.

the amount of space available above the flood level diminishes and elevation will be feasible only for smaller pieces of equipment such as electrical system components, ventilation ductwork, or specialized equipment such as furnaces designed to be suspended from the ceiling. If the flood level is at or near the ceiling, elevation in lower areas will not be possible. Instead equipment will have to be relocated or protected in place as described in the following sections.

Keep in mind that most service equipment must remain accessible for routine maintenance. For example, your fuel company must be able to reach your fuel tank to fill or empty it. Before elevating any service equipment, your contractor should check with the utility company to find out whether it has any requirements that would prohibit elevation or restrict elevation height.

Also, remember that any large equipment elevated on platforms or pedestals, both inside and outside your house, may be more vulnerable to wind and earthquake damage. Before these elevation methods are used, a design professional must determine the expected wind and earthquake forces at the site and account for them in the design of the elevation method. This precaution is especially important for elevated fuel storage tanks, which could rupture if they were dislodged or toppled by wind and earthquake forces. In earthquake-prone areas, fuel storage tanks are sometimes equipped with cutoff valves that can help prevent leaks when supply lines are ruptured. Your utility service provider can give you more information about cutoff valves and other ways to protect fuel storage tanks from natural hazards.

NOTE

The fact sheet referred to above, *Raise or Floodproof HVAC Equipment*, also discusses the relocation of HVAC equipment to an upper floor.

Relocation

When space permits, you can move service equipment from a basement or other area below the flood level to an upper floor of the house or even an attic. Relocation will usually require more extensive changes to both your house and the equipment being moved, but it often provides a greater level of flood protection because the relocated equipment will be farther above the flood level. In some situations, you may also be able to relocate outside equipment to higher ground, but only when the slope of your lot and other site conditions permit.

Another relocation option is to build a new, elevated utility room as an addition to your house. The addition could be built on an open foundation or extended foundation walls.

Protection in Place

When elevation and relocation are infeasible or impractical, you can protect service equipment in place with low floodwalls and shields and with anchors and tiedowns that prevent flotation. Plumbing systems can be protected with valves that prevent wastewater from backing up into the house.

Floodwalls and Shields

NOTE

For more information about floodwalls and shields, see Chapter 7.

Floodwalls and shields are normally components of dry floodproofing systems (Chapter 7) used to protect entire buildings. However, in wet floodproofing, they can be used for the protection of small areas within a building that contain service equipment that is not elevated or relocated. For example, a you can build a concrete floodwall that surrounds one or more pieces of service equipment, such as a furnace and hot water heater (see Figure 8-3).

If the expected depth of flooding is less than about 8 inches, the floodwall would be low enough that you could step over it to reach the protected equipment. A higher floodwall can include an opening equipped with a removable shield, as shown in Figure 8-3. The opening permits easy access to the protected equipment. In this example, the shield does not interfere with the normal operation of the equipment, so it should be left in place and removed only when necessary. Leaving the shield in place allows the barrier to function without human intervention.

In general, barriers and shields of the type shown in Figure 8-3 are practical only when flood depths are less than about 3 feet. The greater hydrostatic pressure exerted by deeper water requires barriers and shields that are more massive, have more complex designs, and are therefore more expensive. As discussed in Chapter 7, all floodwalls should provide at least 1 foot of freeboard above the expected flood elevation.

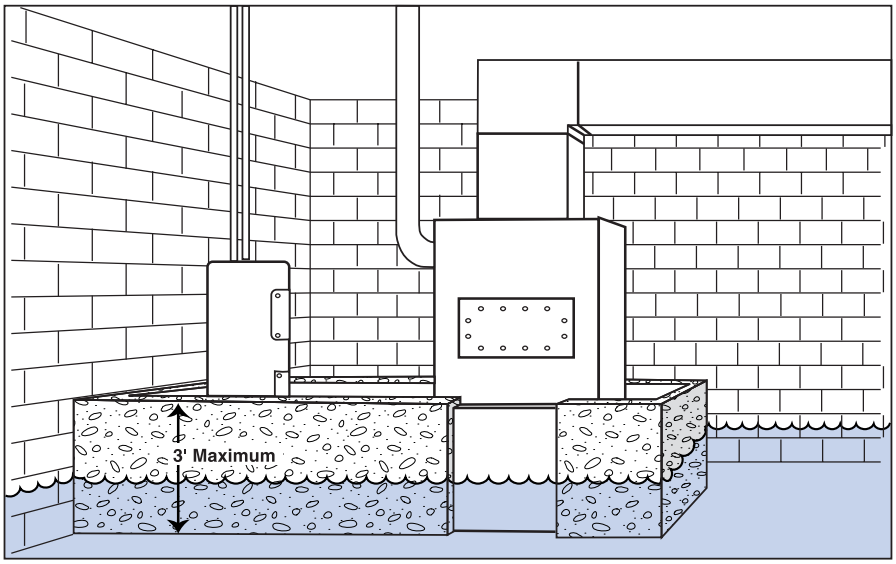

Figure 8-3
Hot water heater and furnace protected by a concrete floodwall with opening and shield.

Regardless of the height of the barrier, the area it protects should be equipped with a sump pump that will remove any water that accumulates through seepage.

Anchors and Tiedowns

Anchors and tiedowns are used primarily for aboveground fuel storage tanks that are not elevated above the flood level and for belowground tanks. Both types are extremely vulnerable to flotation. Flood waters act directly on aboveground tanks; belowground tanks can be forced out of the ground by the buoyancy force of saturated soils. When either type of tank is displaced, its connections can be severed and the escaping fuel can cause hazardous conditions.

Aboveground tanks can be anchored with metal straps or cables that cross over the tank and connect to ground anchors. The length and type of ground anchor you need will depend largely on the type of soil at the site. A design professional can advise you about anchors. Another way to anchor an aboveground tank is to embed its legs in a concrete slab (see Figure 8-4).

Ground anchors can also be used for belowground tanks. This method involves excavating the soil above the tank, placing steel I-beams across it, and connecting them to ground anchors. Again, check with a design professional concerning the required size and type of anchor. Belowground tanks can also be anchored with a concrete slab similar to the one shown in Figure 8-4. Installing the slab, involves excavating around the tank and removing it temporarily while the slab is poured.

NOTE

For more information about anchoring fuel storage tanks, refer to the FEMA Mitigation Fact Sheet *Anchor Fuel Tanks*.

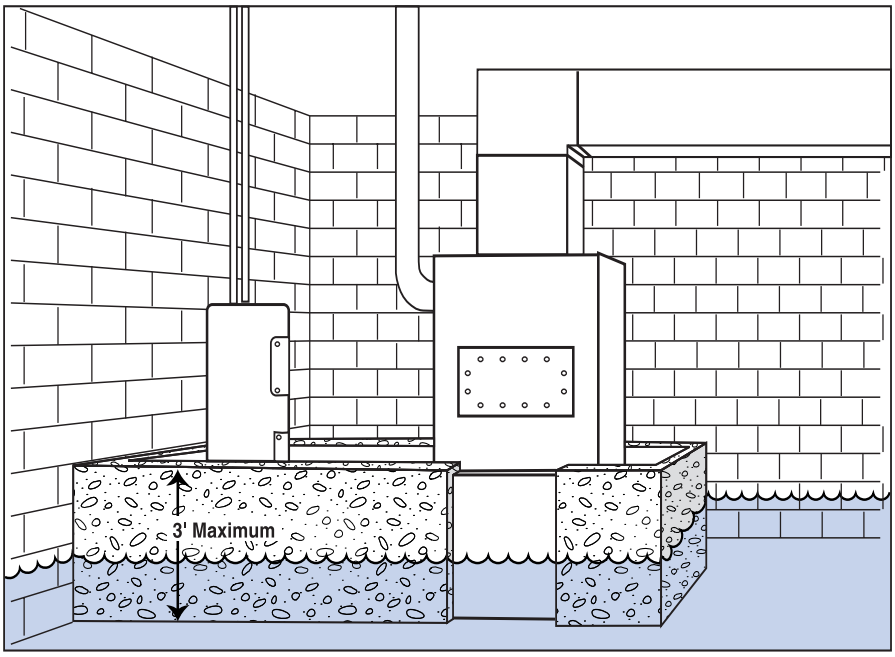

Figure 8-4 Anchoring a fuel storage tank with a concrete slab.

WARNING

Be especially careful when anchoring storage tanks or other service equipment in floodways, V zones, and other high-risk areas. You must consider the effects of high flow velocities, wave action, fast moving floodborne debris, and extensive erosion and scour wherever these hazards are likely to occur.

Another alternative is to excavate down to the tank and pour a concrete slab on top, making sure not to cover access openings.

On all tanks below the flood level, both aboveground and belowground, flexible connections must be used between the tank and the supply line. Also, the vent and filler tubes must extend above the FPE (see Figure 8-4). If you have adequate warning of an impending flood, top off the tank. A full tank will be less susceptible to corrosion from accumulated moisture and will be heavier and better able to resist buoyancy.

Although anchoring is particularly important for storage tanks, remember that the levels of future floods can exceed your FPE and inundate service equipment that you have elevated, relocated, or protected in place. For this reason, service equipment should be anchored whenever possible so that it will remain in place when acted on by flood forces.

Backflow Valves

Flooding can often inundate and overload sanitary sewer systems and combined sanitary/storm sewer systems. As a result, water can flow backward through sewer lines and out through toilets or drains. The best solution to this problem is usually to install a backflow valve. These valves include check valves, gate valves, and dual backflow valves.

Check valves operate without human intervention. Under normal conditions, they allow waste water to flow from the house to the main sewer line. When flooding causes the flow to reverse, a flap or other check mechanism in the valve prevents water from flowing back into the house. A disadvantage of check valves is that they can become blocked open by debris and fail to operate. For this reason, check valves must be inspected regularly and cleaned as necessary.

Gate valves are manually operated, provide a better seal, and are unlikely to be blocked open. However, they are more expensive than check valves and require human intervention.

The third alternative, dual backflow valves, combine the benefits of the check valve and the gate valve. As the most expensive of the three types, the dual backflow valve should be considered primarily for use in houses subject to repeated backflow flooding. Gate valves and dual backflow valves are usually installed outside the house in a valve pit (see Figure 8-5).

NOTE

The installation of backflow valves and other plumbing modifications is usually regulated by State and local building codes. A plumber or contractor licensed to work in your area will know about the code requirements that apply to your retrofitting project.

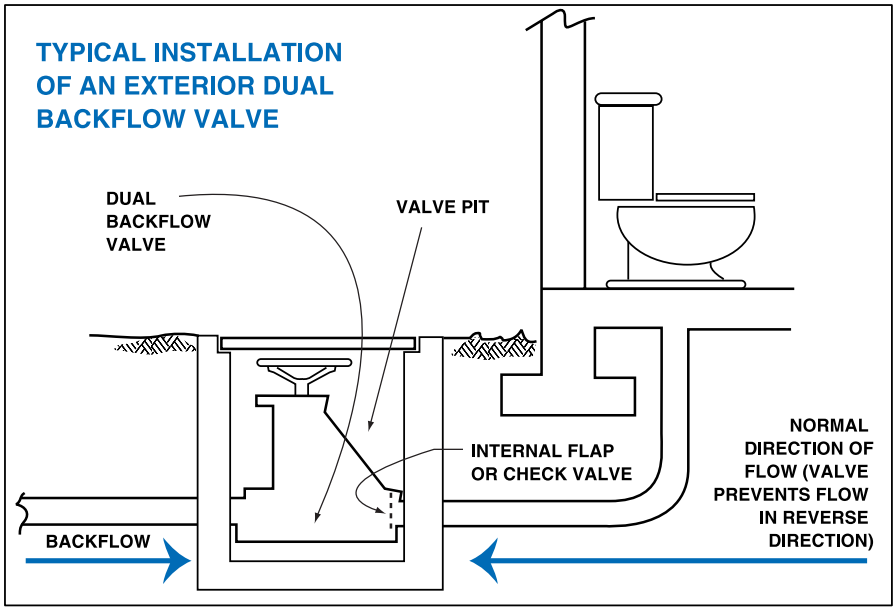

Figure 8-5
Dual backflow valve installed in exterior valve pit.