



## Avoiding Earthquake Damage: A Checklist for Homeowners

FEDERAL EMERGENCY MANAGEMENT AGENCY

Once an earthquake hits, it's too late to protect your home and belongings. But there are ways to limit future earthquake damage. Sometimes only a little time and a few dollars are all you need.

This homeowners' checklist will help you learn how to protect your home and belongings from earthquakes. It does not cover every method. If you're building or remodeling a home, there are many other options to consider for protecting your property.

To learn more, call your local emergency management office and building department. Other sources of information include professional home builders, architects, structural engineers and building supply retailers. And remember to ask your building department about building permit requirements.

### ▶ **Do you know your earthquake risk?**

Ask your local emergency management office, building department or American Red Cross Chapter about earthquakes in your area. They'll have information about protecting your family and property.

### ▶ **Is the house securely anchored to the foundation?**

If your home has a perimeter foundation, make sure the sill plate of the house is securely bolted to the foundation. Consult with your building department before deciding what to do.

If your house has wood studs that extend from the foundation to the underside of the first floor (known as cripple walls), make sure they have adequate bracing, such as plywood or structural grade particle-board. The bottom of the bracing should be nailed to the sill plate.

A variety of products called "hold downs" are available for securing walls to the foundation.

Test the wood near the foundation by probing it with a pointed instrument. If you can penetrate the wood easily, it probably has wood decay and should be replaced with new pressure-treated wood.

Have a contractor inspect any deep cracks in the foundation.

### ▶ **Is the chimney properly secured?**

Masonry chimneys pose a real hazard in earthquakes, especially the free-standing section above the roof line. To prevent the chimney from breaking away from the house, you may need to have it secured to the framing of the roof with sheet metal straps and angle bracing. Have the chimney inspected by a professional to determine the best method.

### ▶ **Are pictures, mirrors, shelves and light fixtures properly secured?**

Anchor eyebolts to wall studs for hanging heavy items such as pictures, mirrors and shelving. Make sure picture wires are securely attached to picture frames. Hang things away from beds and places where people sit. Make sure overhead light fixtures and hanging plants are anchored to the structural support above the ceiling.

### ▶ **Are televisions, computers and stereo equipment properly secured?**

There are a variety of products designed to protect home equipment in an earthquake. These include adhesive-backed latches; nylon and elastic cords; wire, plastic and elastic guardrails; and shelf edges to prevent equipment from falling on the floor.

### ◆ Are fuel tanks and wood-burning stoves securely anchored?

Fuel oil and propane tanks can slide or overturn in an earthquake, rupturing the tank or breaking the supply line and causing a fire. They should be securely anchored to the floor. Propane tanks are the property of the propane company, so you'll need written permission to anchor them. Ask whether the company can do it first.

Move tall, heavy objects that could fall and rupture the fuel tank in an earthquake. Have a contractor install a flexible hose connection between the tank and supply line, and where the supply line enters the house.

Wood-burning and other free-standing stoves also pose a fire hazard in an earthquake and should be anchored to the floor. Fasten stovepipe sections together to prevent separation.

You will most likely need a contractor for this work. Make sure all work conforms with local building codes.

### ◆ Is the water heater securely strapped in place?

Strapping the water heater to wall studs and having flexible gas and water lines installed will greatly reduce the risk of fire and water damage in an earthquake.

#### Water heater in corner or closet

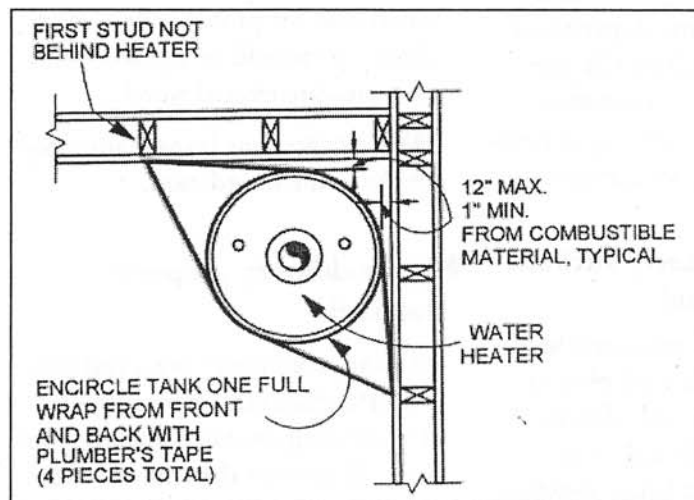
##### Materials

- 3/4" x 24 gauge perforated steel plumber's tape

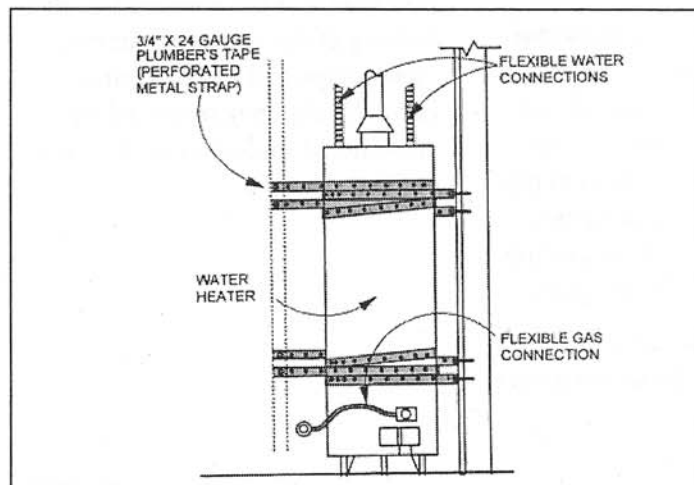
- 1/4" diameter x 3" lag screws and flat washers or 1/4" expandable anchors with 2" embedment for concrete or masonry walls

#### Directions

- The water heater should be 1" to 12" away from the corner walls.
- Locate the wall studs on both sides of the water heater (not behind it).
- Anchor plumber's tape (a flexible steel strap) to a wall stud with a 1/4" diameter x 3" lag screw and flat washer.
- From about 9" from the top of the tank, wrap the plumber's tape all the way around the tank in a clockwise direction. Then anchor the tape to the stud on the other wall. Make sure the tape is tight.
- Repeat the process, again about 9" from the top of the tank, but this time wrap the tape in a counter clockwise direction.
- Repeat the process two more times about 4" from the bottom of the tank. Wrap one band of tape in a clockwise direction and the other band of tape in a counter clockwise direction.



Overhead view of water heater in corner



Side view of water heater in corner

## Water heater on straight wall

### Materials

- 3/4" x 24 gauge perforated steel plumber's tape
- 1/2" diameter conduit
- 1/4" diameter x 1" round head machine screws with nuts and flat washers
- 1/4" diameter x 3" lag screws and flat washer or 1/4" expandable anchors with 2" embedment for concrete or masonry walls

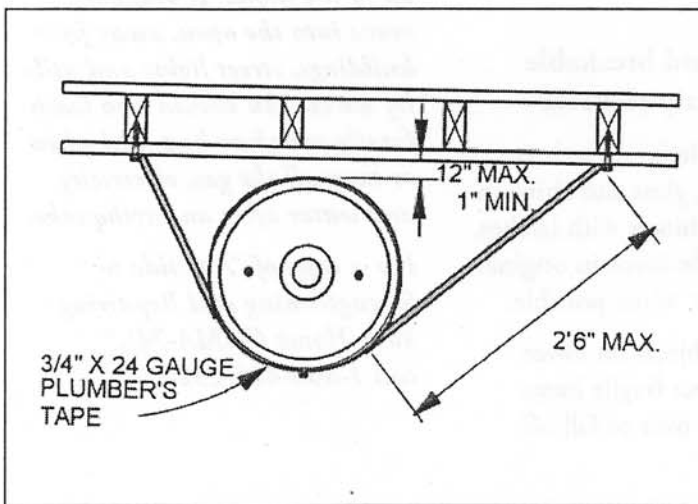
### Directions

- The water heater should be 1" to 12" away from the wall.
- Locate the wall studs on both sides of the water heater (not behind it).
- Wrap plumber's tape around the tank 9" from the top and 4" from the bottom. Secure tape with round head machine screw, flat washers and nut.
- Cut four pieces of conduit to size. The conduit is used as angle bracing from the wall studs to the tank.

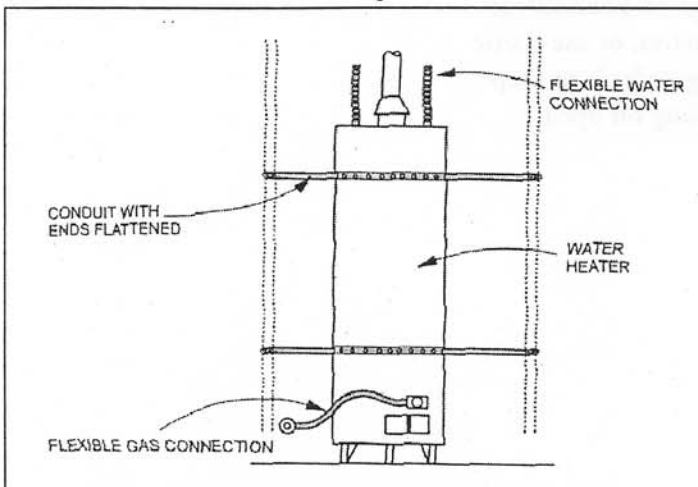
- Flatten 1" at each end of the conduit and bend 45 degrees. Drill holes 1/2" from each end.
- Anchor the conduit to the wall studs. Use 1/4" diameter x 3" lag screw and flat washer. Then anchor the conduit to the plumber's tape. Use 1/4" diameter x 1" round head machine screw, washer and nut.

If you're using gas, have your utility company or a licensed plumber install a flexible hose where the gas line connects to the water heater at its base.

Install flexible hoses for the water connections as well.



Overhead view of water heater on straight wall



Side view of water heater on straight wall

## Is heavy, tall furniture away from high risk areas?

Consider each piece of heavy, tall furniture in the house, such as bookcases, china hutches and storage racks. Ask yourself whether the item could fall over, hurt someone or block an exit in an earthquake. You can reduce the risk by moving furniture away from doors and places where people spend the most time such as couches and beds. You should also secure tall furniture to wall studs, as described in the next answer.

▶ **Are kitchen and laundry equipment securely anchored?**

All large kitchen and laundry equipment should be securely anchored to the floor, wall or countertop, depending on the item. Such equipment includes stoves and ovens, built-in and countertop microwave ovens, garbage compactors, dishwashers, refrigerators and freezers, clothes washers and dryers, and ironing equipment.

▶ **Is heavy, tall furniture securely fastened to wall studs?**

Anchor heavy, tall furniture to vertical wall studs, concrete or masonry with steel angle brackets. Even large, heavy objects that appear stable should be secured to the wall. The heavier the furniture, the stronger the restraints need to be. A heavily loaded file cabinet requires much stronger restraints to keep it from overturning than a light file cabinet with the same dimensions.

Make sure the screws penetrate the studs behind the wall.

Gypsum board, drywall, plaster and other wall coverings are not strong enough to hold heavy furniture during an earthquake.

For wood studs (typically located 16 or 24 inches on centers), use a minimum 1/4" diameter by 3"

lag screws. For metal studs, use #12 sheet-metal screws long enough to penetrate the flange material. For concrete or masonry walls, use concrete anchor bolts.

If wall studs do not line up with the furniture, consider installing a wood 2"x4" or steel horizontal mounting strip to the studs near the top of the items to be anchored. Furniture can then be anchored to the mounting strip without regard to the stud locations.

When possible, bolt file cabinets together (and to the wall studs) to form a more stable shape.

▶ **Are heavy and breakable items properly secured?**

Store breakable items such as bottled foods, glass and china in low, closed cabinets with latches. Keep breakable items in original packing boxes, when possible.

Keep heavy objects on lower shelves. Protect fragile items that could tip over or fall off shelves.

Install edge restraints (such as wood molding) on bookshelves and storage shelves, or use elastic cords or wire guardrails to keep items from falling off open shelves.

Install latches on kitchen drawers and cabinets to prevent them from flying open in an earthquake.

▶ **Are hazardous materials stored in secure places?**

Store weed killers, pesticides and flammable products in closed cabinets with latches and on bottom shelves. Move incompatible chemicals to prevent mixing if the containers break.

*If an earthquake occurs, take cover under a sturdy table or desk, cover your head and hold on to the table. If outdoors, move into the open, away from buildings, street lights and utility wires. You should also teach family members how and when to turn off the gas, electricity and water after an earthquake.*

*For a copy of "A Guide to Strengthening and Repairing Your Home (FEMA-74)," call 1-800-480-2520.*