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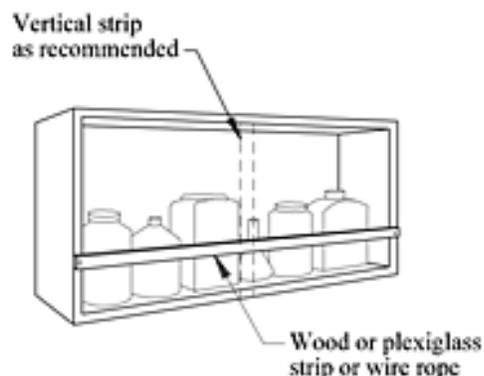
Chemicals

Purpose

To reduce the potential for risks from chemical spills.

Strip - Recommendation

Install wood or Plexiglas strips or wires to restrain containers on open shelves.



Supplies Required

- Wood or Plexiglas strip—1/8" x 1"
- Wood or sheet metal screws—No. 10 x 1"
- Wire rope—No. 12 gage

Strip - Installation

1. Attach a wood or Plexiglas strip to the shelf with wood or sheet metal screws.
OR
Attach wire rope to the shelf with wood or sheet metal screws.
2. Secure the wire rope with three tight turns at each end.
3. Provide intermediate vertical strips where horizontal strips span more than 3'. Attach vertical strips to each shelf.
4. Place horizontal restraint high enough to restrain tall objects while allowing easy access. Provide additional horizontal restraint as required for shorter objects.

Mechanical Latches - Recommendation

Secure cabinet doors with mechanical latches.

Supplies Required

- Mechanical latches

Mechanical Latches - Installation

1. Provide mechanical latches on all doors. Test latches to assure that they can remain closed during severe shaking.
2. Replace magnetic latches with mechanical latches.

Glass Containers - Recommendation



Wrap fragile bottles or dangerous materials with foam rubber or rubber bands to protect

OR

Replace glass containers with unbreakable containers.

Supplies Required

- Foam rubber or rubber
- Rubber bands

Note

- Store acids and other volatile chemicals separately and as close to the ground as possible.
- Store heavy containers as close to the ground as possible.
- For more information on storage of chemicals and chemical interaction contact the Indiana Department of Environmental Management (IDEM). For instance, the Washington State Department of Ecology has the following publication: Step-By-Step Guide for to Better Laboratory Management Practices, Publication No. 97-431, July 1997.

Source: School Facilities Manual Nonstructural Protection Guide

Cylinders

Purpose

To store and secure compressed gas cylinders or large fire extinguishers.

Recommendation

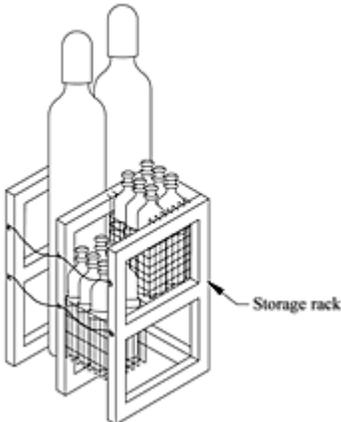
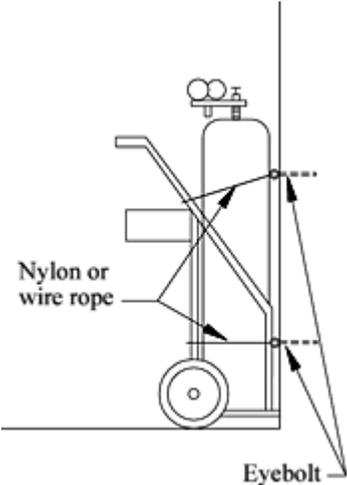
Secure cylinders with wire or rope.

Supplies Required

- Wire or nylon rope
- Eye-bolts—1/4" diameter

Installation

1. Strap top and bottom of cylinder and carrier with wire or nylon rope.
2. Secure rope with eye-bolts to the stud on each side of the canister.
3. For groups of cylinders, provide storage racks. Attach rope to racks.



Source: School Facilities Manual Nonstructural Protection Guide

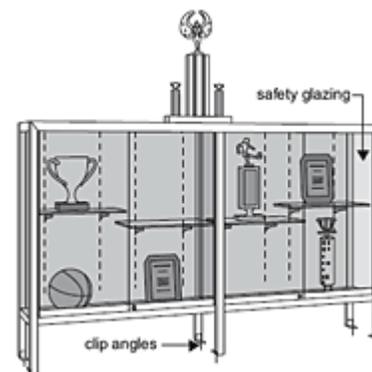
Display Cases

Hazards

- Unsecured display and potted plant may fall, striking nearby occupants or blocking doors and exit ways for evacuation during an emergency.

Recommendations

- Secure display case to floor.
- Use angle bracket if needed.
- Secure contents to shelves using hook-and-loop or similar devices.
- Secure art objects or potted plants with ropes, chains or cables attached to eyebolts installed into wall studs or blocking.



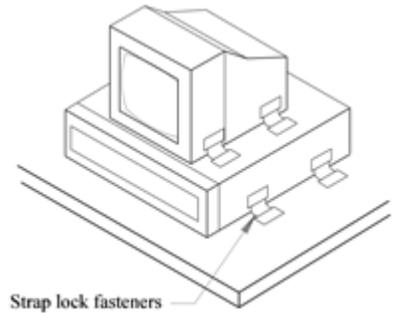
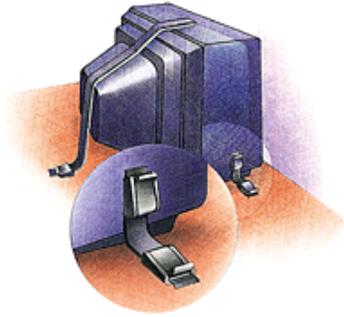
Notes

- Display case must have safety glass.
- Shelves in display case must be secured.

Source: *School Facilities Manual Nonstructural Protection Guide*

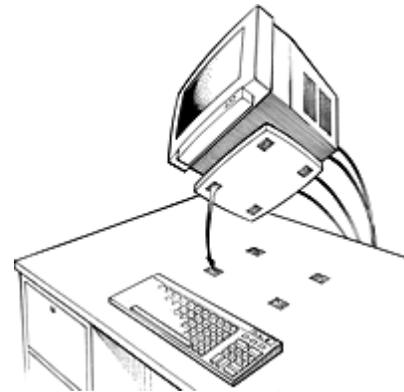
TVs, Computers, and Electronics

Televisions, stereos, computers and microwaves and other electronics are heavy and costly to replace. They can be secured with flexible nylon straps and buckles for easy removal and relocation.



The ground swells and rolls of an earthquake can cause anything resting on shelf or counter tops to fall – TVs, stereos, computers, microwaves, lamps, etc. An easy way to protect against these types of losses is to use Velcro™ or other similar products.

- Choose a Velcro™-type product that has adhesive on the back.
- Cut the Velcro™ into large squares. You will need four squares to secure most items, one for each leg or corner of the item.
- Press the two sides of the Velcro™ together.
- Remove the paper from the backs of the Velcro™ to expose the adhesive.
- With the Velcro™ still pressed together, stick it on the legs or corners of the item, and then place the item on the shelf or counter top where you want it located.



ALTERNATE SOLUTION

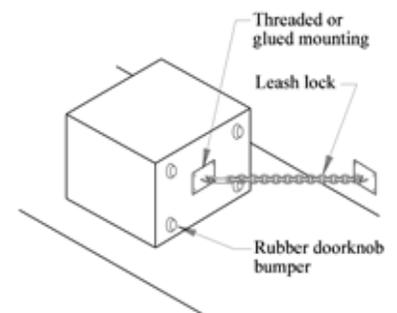
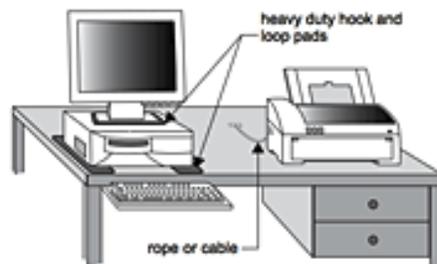
Recommendation

Install one of the following:

- Bungee cord
- Strap/lock fasteners
- Leash locks
- Earthquake pads

Note

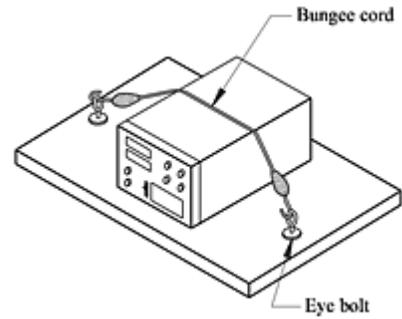
- Use leash locks for equipment that may be moved (for example, telephones, keyboards, laptops.)



- Fasten near the top and near the bottom if equipment is more than two times as tall as it is wide.

Supplies Required

- Bungee cord
- Eye-bolts—3/16" diameter
- Versa Grip fasteners
- Lease locks
- Rubber doorknob bumpers
- Threaded or glued mounting



Source: SPAN Disaster Services, Inc.; *School Facilities Manual Nonstructural Protection Guide*

Filing Cabinets

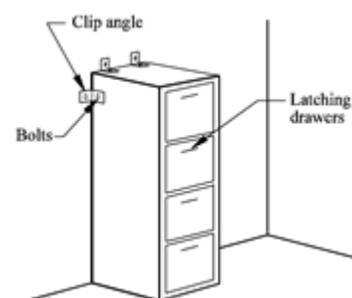
Secure the tops of all top-heavy furniture, such as bookcases and file cabinets, to a wall. Be sure to anchor to the stud, and not just to the drywall. Flexible fasteners such as nylon straps allow tall objects to sway without falling over, reducing the strain on the studs. Loose shelving can also be secured by applying earthquake putty on each corner bracket.

Recommendation

Anchor the file cabinets with clip angles.

Supplies Required

- Clip angles—2" x 2" x 3/16"
- Lag bolts—1/4" diameter x 3" (for wood walls)
- Expansion bolts—3/8" diameter x 2" (for concrete walls)
- Top clips—2" x 3/32"
- Sheet metal screws—No. 10
- Leash Locks for drawers without latching locks **OR**
- Thumb Lock latches

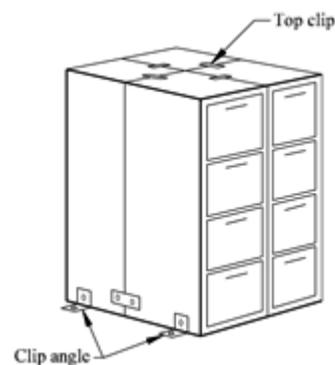


Installation

1. Anchor file cabinets with four or more drawers to wall stud with clip angles.
2. Use lag bolts for wood walls. **OR**
Use expansion bolts for concrete walls.
3. Connect adjacent cabinets with top clips and sheet metal screws. Use clips near the cabinet bases.

Note

- Fill file cabinets from the bottom up if it is not full.
- Locate cabinets away from exits and hallways.
- Do not place file cabinets so that the drawer opens toward the occupants of the room.
- Keep cabinet drawers shut, locked, or secure with latches.



Floor-Mounted Objects

Purpose

To secure floor-mounted objects which weigh less than 40 pounds.

Recommendation

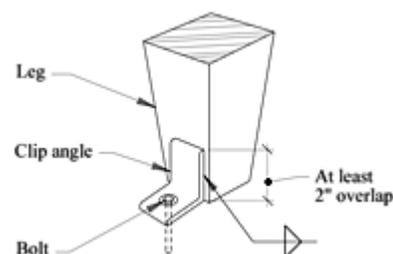
Install a clip angle or a metal plate.

Caution

When anchoring to post-tensioned slab, locate and avoid reinforcing.

Supplies Required

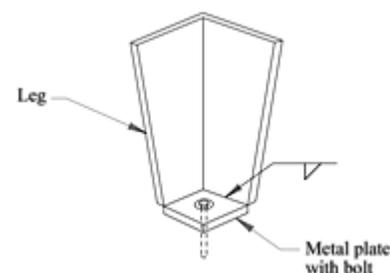
- Clip angle—3" x 3" x 1/4"
- Metal plate—1/4" x 3" x 3"
- Expansion bolts—3/8" or 1/2" diameter x 2" to 4" (for concrete floors) **OR**
- Lag bolts—1/2" diameter x 4" (for wood floors)



Installation

Clip Angle Installation

1. Weld a clip angle to leg (4" of 1/8" fillet). **OR** Secure clip angle with a lag bolt for wood legs or a machine bolt or steel legs.
2. Overlap clip angle 2" with the floor mounted object.
3. Secure horizontal leg of angle with a lag bolt to wood or an expansion bolt to concrete.



Metal Plate Installation

1. Weld the metal plate inside the leg of the object (4" of 1/8" fillet).
2. Secure the metal plate with a lag bolt to wood or an expansion bolt to concrete.

Note

- If object is marked **DO NOT BOLT TO FLOOR**, locate it away from classrooms and people.

Food Safety

Protecting stored foods when the power goes out

- Keep refrigerator and freezer doors closed as much as possible. A full refrigerator will maintain safe temperatures for up to six hours. A full freezer will maintain safe temperatures for up to two days; a half-full freezer for one day. Discard at-risk refrigerated foods that are warmer than 45° Fahrenheit. If in doubt, throw it out.
- If you think the power will be out for several days, try to find some ice to pack inside the refrigerator and freezer. Remember to keep your raw foods separate from your ready-to-eat foods.

Foods to be concerned about

Foods are categorized into groups:

- A. Potentially hazardous foods are the most important. These include meats, fish, poultry, dairy products, eggs and egg products, soft cheeses, cooked beans, cooked rice, cooked potatoes, cooked pasta, custards, puddings, etc.
- B. Some foods may not be hazardous but the quality may be affected. These foods include salad dressings, mayonnaise, butter, margarine, produce, hard cheeses, etc.
- C. Some foods are safe. These are carbonated beverages, unopened bottled juices, ketchup, mustard, relishes, jams, peanut butter, barbecue sauces, etc.

When do I save and when do I throw out food?

- Refrigerated foods should be safe as long as the power is out no more than a few hours and the doors have been kept closed. Potentially hazardous foods should be discarded if they warm up above 45°F.
- Frozen foods which are still frozen are not a problem. If potentially hazardous foods are thawed but still have ice crystals, you should use them as soon as possible.
- If potentially hazardous foods are thawed and warmer than 45°F, you should discard them.

How do I know if the food is unsafe to eat?

- You cannot rely upon appearance or odor. Never taste food to determine its safety.
- Some foods may look and smell fine, but if they've been warm too long, food poisoning bacteria may have grown enough to make you sick.
- If possible, use a thermometer to check the temperature of the foods. If potentially hazardous foods are colder than 45°F, they are safe.

What happens when the power goes back on?

Allow time for refrigerators to reach the proper temperature of lower than 45°F before restocking. Start with all fresh foods.

Remember - when in doubt, throw it out.

Source: SPAN Disaster Services Inc.

Garage Items and Hazardous Chemicals

Items stored in garages and utility rooms can fall, causing injuries, damage, and hazardous spills or leaks. They can also block access to vehicles and exits. Move flammable or hazardous materials to lower shelves or the floor.

Household chemicals - potentially lethal

The ground movement of earthquakes can cause chemical products you have stored in the garage and under household sinks to spill and potentially mix. These materials can be silent killers or can cause serious injury.

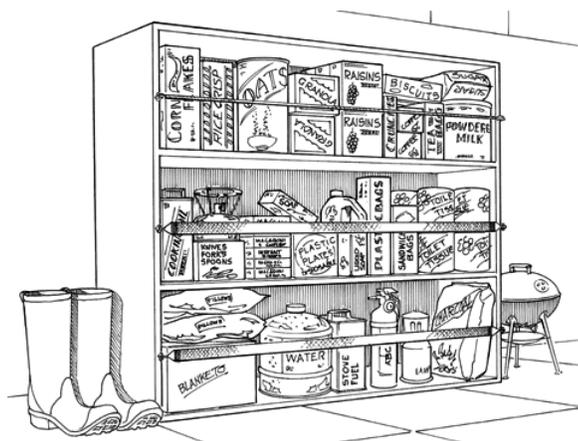
Before a disaster - safety with chemicals

Secure all chemicals so that they cannot fall, break, and mix.

- Identify poisons, toxins, and solvents in breakable containers on open shelves.
- Remove all heavy objects from upper shelves, especially around the car.
- Secure open shelves with nylon webbing (available at hardware stores, boating supply stores, and many camping supply stores) or bungee-type straps. (Do not use regular bungee straps with the heavy metal hooks at either end. These may become dislodged and cause serious eye or other injuries.)
- Store paints, gasoline, and other flammable liquids away from natural gas water heaters.
- Read the labels on all products you purchase.
- Separate the chemicals according to manufacturers' suggestions to prevent harmful interactions if broken containers should allow the chemicals to mix. For example, household bleach mixed with ammonia creates extremely deadly chlorine gas.
- Know what steps to take if chemicals are spilled.
- Dispose of any hazardous materials that are no longer used.

After a disaster - safety with chemicals

- Always assume that spilled chemicals are toxic.
- Do not immediately approach spilled chemicals in your haste to clean them up. Mixed chemicals can be extremely hazardous.
- Close off the room where the spill has occurred.
- Mark the outside of the room with the problem, for example, "spilled chemicals inside - use caution."
- Notify your authorities, if available, and neighbors of the spill.



Ways hazardous materials enter the body:

- inhalation (breathing) - the most common way
- absorption - through skin or eyes
- ingestion - swallowing
- injection - penetrating the skin or falling on something that punctures the skin

Indicators that a spill has taken place

- pungent or noxious odor - never intentionally get close enough to smell it
- bubbling liquid
- vapor - anything that is releasing a vapor is having a chemical reaction and should be avoided

Source: SPAN Disaster Services Inc.

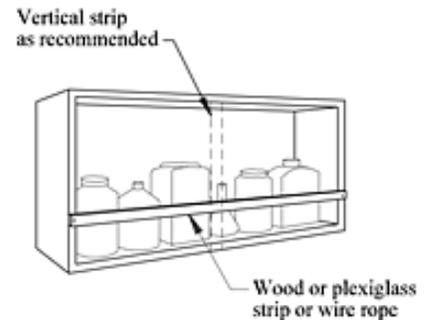
Glass Windows or Objects

Purpose

To reduce risks from breaking glass.

Note

- Large windows pose the greatest risk to safety.
- Locate seating away from windows to avoid injuries from shattering glass or untreated windows.
- Lower window blinds or close drapes if possible.



Caution

- Consult a structural engineer to determine if window frame is designed to support glass in the vent of a building.
- Do not coat or replace any glass panes if the coating or new glass would cause a large pane to drop as a unit.

Recommendation

- To reduce the risks at glass windows, doors with glass, display cases, and skylights, follow the steps below.
- Store glassware or glass objects in closed cabinets or restrain them on open shelves.
- Refer to wall-mounted objects to secure mirrors.

Supplies Required

- Wood or Plexiglas strip — 1/8" x 1"
- Wood or sheet metal screws — No. 10 x 1"
- Wire rope — No. 12 gage

Installation

1. Reinforce glass with polyester film or similar material.
OR
Replace glass with Plexiglas or safety glass.
2. Place film on one side of the glass only.
3. Secure items in the display cases.
4. Anchor the display case to the wall (as explained in tall furniture/bookcases).

Kitchen Appliances

Gas appliances should have flexible connectors to reduce the risk of fire. Secure refrigerators and other major appliances to walls using earthquake appliance straps.

Refrigerators

Recommendation

Install angle brackets or pronged zee clips.

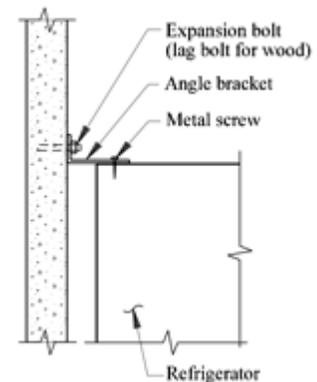
Supplies Required

- Angle bracket—4" x 2" x 1/8"
- Lag bolts—3/8" diameter x 4" (for wood)
- Expansion bolts—1/2" diameter x 4" (for concrete)
- Metal screws—No. 14
- Pronged zee clip

Installation

Angle Bracket Installation

1. Secure the angle bracket to a wood wall with a lag bolt for wood. **OR** Secure to a concrete wall with an expansion bolt for concrete.
2. Use a metal screw to attach bracket to the refrigerator.



Pronged Zee Clip Installation

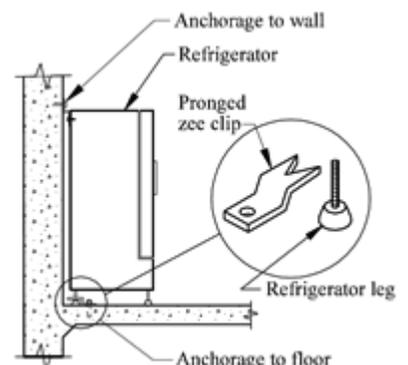
1. Align the angle of the clip with the leg of the refrigerator.

Note

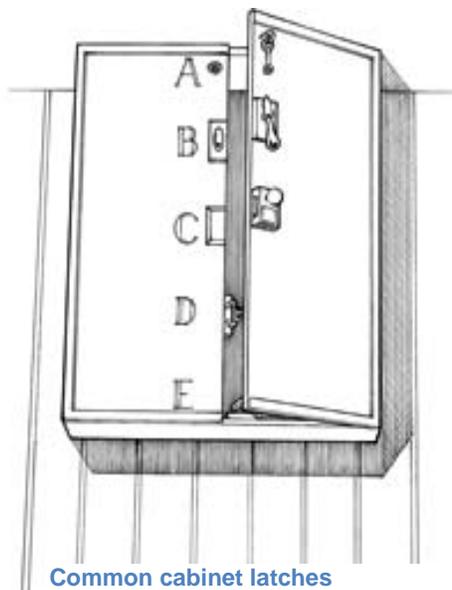
- Place refrigerators and vending machines away from exits and hallways if possible.
- Enclose refrigerators in a confined space (if possible) to prevent the machine(s) from tipping over.

Caution

When anchoring to post-tensioned slab, locate and avoid reinforcing.



Kitchen Cabinets



Unsecured cabinet doors fly open during earthquakes, allowing glassware and dishes to crash to the floor. Many types of latches are available to prevent this: child-proof latches, hook and eye latches, or positive catch latches designed for boats. Gas appliances should have flexible connectors to reduce the risk of fire. Secure refrigerators and other major appliances to walls using earthquake appliance straps.

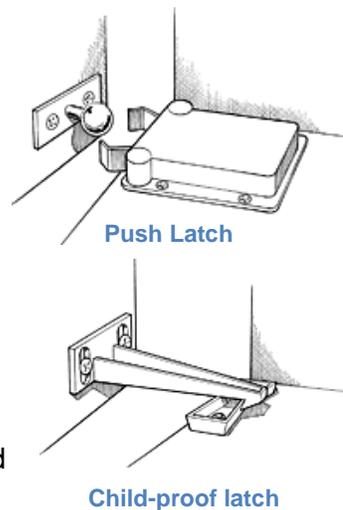
Kitchen cabinets

The ground undulation and acceleration of an earthquake can cause cabinet doors to fly open and contents to spill onto the floor. Glass jars and dishes can shatter and cause injuries and damage. Heavy objects can fly across the room, injuring any in their path or damaging counter tops, floors, or walls.

Securing kitchen cabinets

To prevent cabinet doors from flying open, install one of the following types of latches:

- A. Hook and eye – inexpensive; you may not close it every time
- B. Standard latch – mounts to the front of the door; you may not close it every time
- C. Standard latch – closes automatically; mounts to the front of the door
- D. Push latches – mounts inside the door; holds the door firmly shut; opens by being pushed gently inward
- E. Child-proof – inexpensive; closes automatically; requires an extra action when you open the door; takes some getting used to – must reach inside cabinet to release latch



Securing cabinet contents

The contents of cabinets may shift and break in the movement of an earthquake. To help prevent this movement, line your cabinets with rubberized shelf mats. This typically is sold in rolls or pre-cut squares at hardware and variety stores. It is also available at recreational vehicle or boating equipment supply stores.

To **protect stacked china plates**, place a square of this rubberized matting between each plate in the stack.

Source: SPAN Disaster Services

Lockers and Storage Cabinets

Purpose

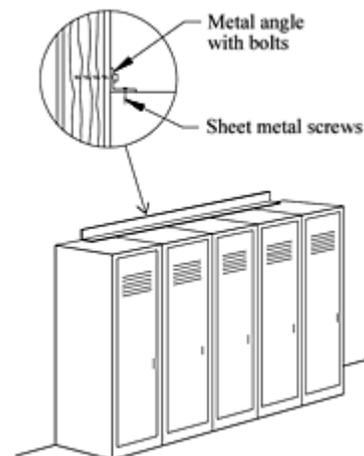
To anchor lockers and cabinets.

Recommendation

Install a metal angle.

Supplies Required

- Metal angle—2" x 2" x 3/16"
 - Sheet metal screws—No. 10 x 1-1/2"
 - Lag bolts—1/4" diameter x 3" (for wood walls)
- OR
- Expansion bolts—3/8" diameter (for concrete walls)



Installation

1. Anchor metal angle to wall stud.
2. Use lag bolt for each stud in wood wall. OR
Use expansion bolts at 32" on center for concrete walls.
3. Attach metal angle to each locker section with two sheet metal screws.

Note

- If lockers or cabinets cannot be anchored, place them away from hallways and doors.
- If lockers or cabinets are internally secured to walls, ensure that the attachments are directly to wall studs, masonry, or concrete. Toggle bolts to sheetrock will not prevent the lockers from topping.



Natural Gas Appliances and Gas Valve Shutoff

The Problem

Natural gas piping and appliances can be damaged during earthquakes, causing gas leaks.

If ignited, this can result in fires which can burn part of, or, the entire building.

About one in four fires after an earthquake is related to natural gas leaks.

Gas leaks after an earthquake are more likely if:

- There are structural weaknesses
- Gas appliances are not anchored
- Flexible pipe connections are not used.

The primary concern is property loss from fire damage.

The potential for life loss is limited since most commercial properties have several safe exits.

How to Identify

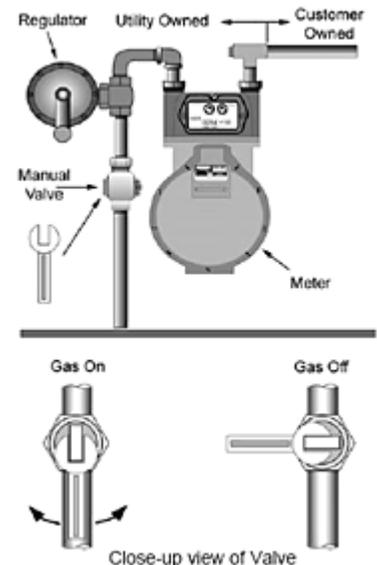
- Examine all natural gas appliances (water heaters, dryers, stoves, ovens, furnaces) to see if they are anchored to the floor or walls, and have flexible pipe connections.

Plan Ahead

1. Locate your gas meter outside your building.
2. Identify the exact location of the shutoff valve and make sure that you have access to it.
3. Make sure you have a wrench that is readily available to turn off the gas when needed.

Manual Gas Shutoff

- The most cost-effective way to manage the risk from natural gas is to know how and when to manually shut off the gas.
- Use the wrench to turn off the manual valve located at the gas meter (See drawing above).
- Shut off your gas only if you:
 - Smell gas
 - Hear gas escaping
 - Suspect a broken gas pipe, appliance, vent, or flue.
- Manually shutting off gas to commercial and manufacturing buildings should be included in emergency response procedures for trained maintenance personnel.



Remember

- Once the gas has been shutoff, service can be restored only by utility personnel or qualified plumbers.
- Restoration of gas service by qualified persons should include the inspection and repair of damaged systems.
- High demands for qualified personnel after an earthquake can lead to substantial delays in restoring natural gas service.

Resources

- Seismic Gas Shut-Off Valve Requirements in Los Angeles, City of Los Angeles, Department of Building & Safety, Information Bulletin #P/PC 2002-001, April 30, 2003.
- Improving Natural Gas Safety in Earthquakes, California Seismic Safety Commission, Publication #CSSC-02-03, July 2002.
- Gas Shutoff Valve Certification Program, Division of the State Architect.

Automatic Gas Shutoff Options

There are a variety of automatic gas shut-off valves available. These cost more than manual shutoff valves and may provide additional safety but may also have some disadvantages including the potential for delays in service restoration and shutoffs when hazardous conditions may not exist.

The types of valves available include:

- Earthquake shake-actuated valves
- Excess flow valves
- Methane detectors
- Hybrid systems
- Others

These can be installed on the "customer owned" side of the gas meter.

Consult your local Building Department because:

- Some installations will require building permits.
- Some local jurisdictions have adopted ordinances requiring automatic gas shutoff devices at the time of sale or during significant renovations.

Objects on Closed Shelves (Shelf Contents)

Purpose

To secure shelf contents.

Recommendation

Use metal edge angles to secure large items or to secure items stored in high areas. Secure computers or typewriters to tables or shelves without lips with net restraint, or choose between Velcro™ patches or a seismic mat. Install one of the following or a combination:

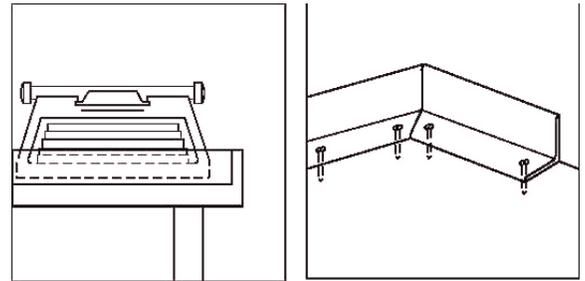
- Metal edge angle
- Net restraints
- Clips, cords, Velcro™, seismic mat, or shelf lip

Metal Edge Angle - Supplies Required

- Metal edge angle—1-1/2" x 1-1/2" x 10" gauge
- Small wood screws—No. 10 x 3/4"

Metal Edge Angle - Installation

1. Add metal edge angles to shelving.
2. Screw platform with wood screws at 18" on center.



Shelf Lip

Metal Edge Angle

Net Restraint - Recommendation

Use net restraints for items that are bulky or stored high.

Net Restraint - Supplies Required

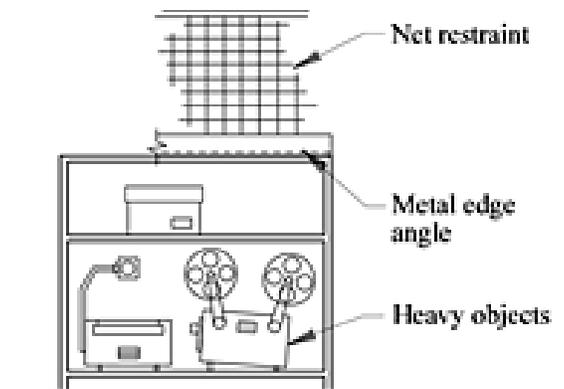
- Net restraints—nylon netting
- Eye-hooks

Net Restraint - Installation

Secure nylon netting with eye-hooks.

Note

- Do not use metal edge angles where top heavy items are stored.
- Store heavy objects as low as possible.
- Restrain boxes on shelves.



Clips/Cords/Velcro™/Shelf Lip - Recommendation

Use zee clips, bungee cords, or Velcro™ to secure small items.

OR

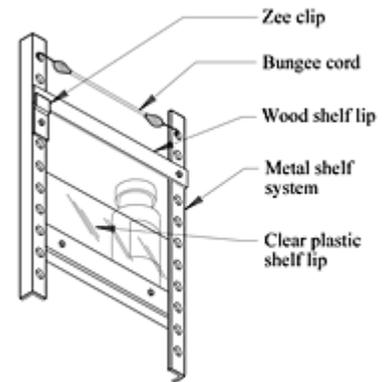
Use shelf lip for small items.

Clips/Cords/Velcro™/Shelf Lip - Supplies Required

- Zee clips OR Shelf lip
- Bungee cord or wire
- Velcro™
- Clear plastic or wood shelf lip
- Nylon netting

Note

- Make sure shelving is securely attached to walls.
- Contain small items in boxes.



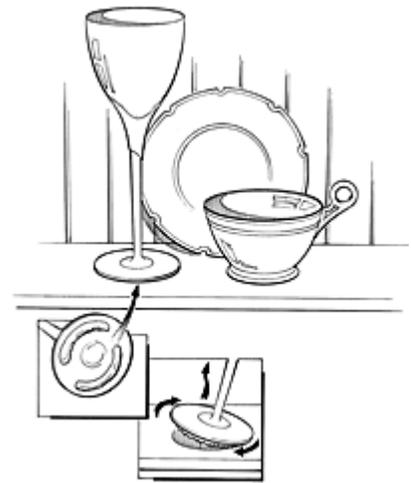
Source: School Facilities Manual Nonstructural Protection Guide

Objects on Open Shelves or Table Tops

Collectibles, pottery objects, and lamps can become deadly projectiles. Move heavy items and breakables to lower shelves. Use either hook and loop fasteners on the table and object, or non-damaging adhesives such as earthquake putty, clear quake gel, or microcrystalline wax to secure breakables in place.



In addition to causing injuries, damage to your more delicate items like knickknacks, Grandmother's china, or crystal vases can be both a financial and an emotional loss. This is preventable. If you chose products like Quake Hold™ or Museum Wax™ to secure your items, they are available at many hardware stores.



Source: SPAN Disaster Services Inc.

Propane Tanks

Purpose

To secure propane tanks.

Caution

Large propane tanks will expand and contract. This may stress the tank wall or seismic connections.

Consult a structural engineer and your propane supplier for assistance.

Note

- Store gas cylinders in a separate area.
- Store cylinders away from people and exits.

Recommendation

Install expansion bolts through existing brackets or provide steel pipe bollards. Steel pipe bollards are recommended for all large tanks.

Supplies Required

- Reinforcing steel—No. 4
- Expansion bolts
- Concrete (2,000 psi minimum)
- A36 steel pipe—6" diameter

Installation

Expansion Bolt

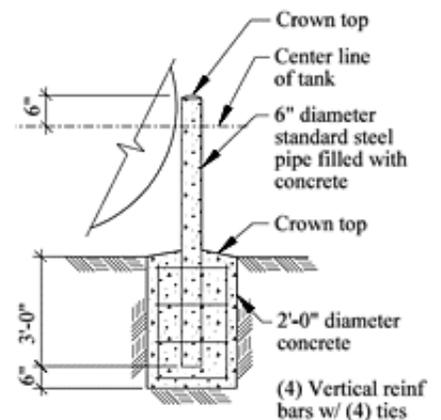
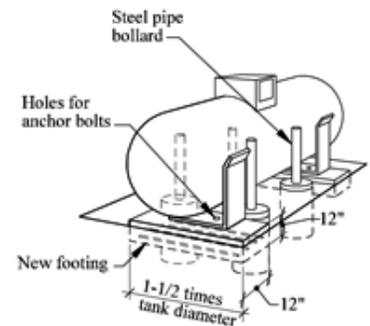
1. Provide new footings (if none exist) at each bracket.
2. Install expansion bolts in existing bracket holes. Fill the hole with the largest diameter bolt possible.

Steel Pipe Bollard

1. Provide bollards at one-quarter points on two sides of tank.
2. See steel pipe bollard figure for dimensions.

Note

Provide flexible supply line connections.



Source: School Facilities Manual Nonstructural Protection Guide

Shelf Units

Purpose

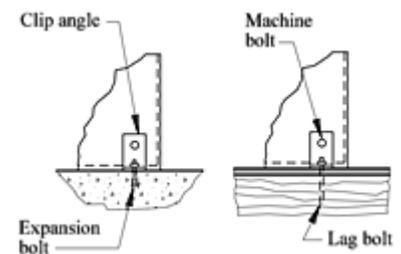
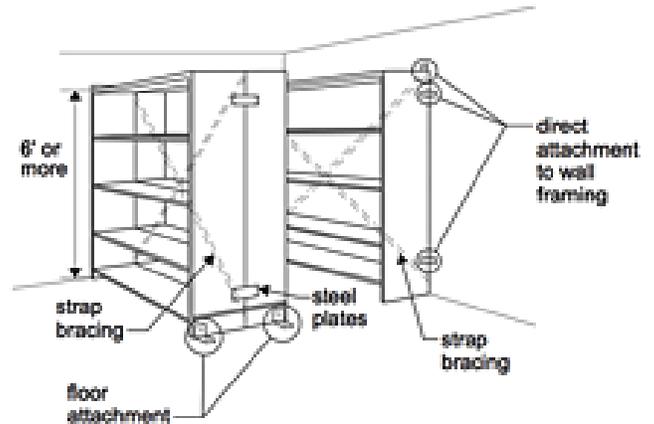
To secure shelf units.

Recommendation

Install clip angles and steel struts for shelf units weighing less than 250 pounds.

Supplies Required

- Clip angles—1-1/2" x 1-1/2" x 1/8" (4' maximum spacing)
- Lag bolts—3/8" diameter (for wood shelving)
- Expansion bolts—3/8" diameter (for concrete floors and walls)
- Steel strut—1-1/2" x 1-1/2" x 1/8"
- Sheet metal screws—No. 10 x 3/4"
- Machine bolts—1/4" diameter
- Wood screws—No. 10 x 3/4"
- Steel plates—1/8" x 3" x 6"
- Strap bracing—16 gage x 1"



Concrete or Masonry Floor (left)
Wood Floor (right)

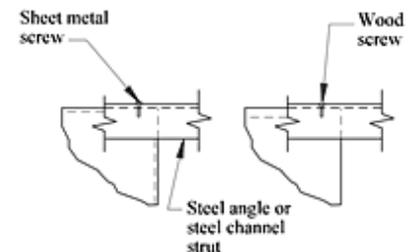
Installation

Clip Angle - Wall Attachment

1. Attach the shelf unit directly to the wall with a clip angle.
2. Secure the unit to the wall with a lag bolt for wood. Embed it into a stud at least 2". (Do not attach to gypsum wallboard only.) OR Secure to wall with an expansion bolt for concrete.

Clip Angle - Floor Attachment

Attach a clip angle to a concrete floor with expansion bolts. OR Attach a clip angle to a wood floor with lag bolts.



Metal Shelving (left); Wood Shelving (right)

Caution

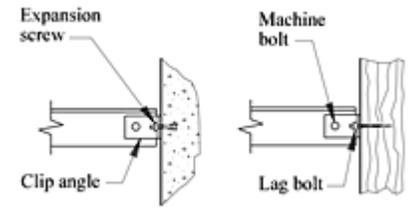
When anchoring to post-tensioned slab, locate and avoid reinforcing.

Overhead Steel Strut Installation

Secure overhead strut with screws to shelving.

Note

- For shelf units that weigh over 250 pounds (including contents), consult a structural engineer.
- Attach shelving to frames.
- Connect adjacent shelf units with steel plates and machine bolts.
- Install strap bracing across back of shelving. Provide three screws at each end of the bracing.



Concrete or Masonry Floor (left);
Wood Floor (right)

Source: *School Facilities Manual Nonstructural Protection Guide*

Shop/Gym Equipment

Hazards

- Unsecured shop/gym equipment may fall, injuring nearby occupants, or blocking doors or exit ways for evacuation during an emergency.

Recommendations

- Secure equipment to concrete floor with concrete drill-in anchor bolt at each leg.
- Secure equipment to wood floor with lag bolt at each leg. Lag bolt must be installed into floor joists or blocking.
- When clip angle is required, screw clip angle to equipment and fasten to floor with either concrete drill-in anchor or lag bolts.

Notes

- Do not store weights or bar bells on press bench. Store weights in weight rack that is secured to the floor.



Source: *Guide and Checklist for Nonstructural Earthquake Hazards in California Schools, 2003*

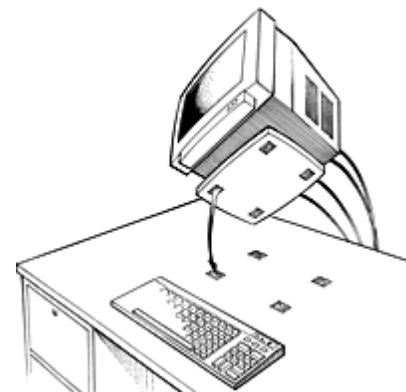
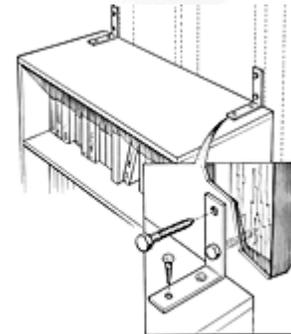
Tall Furniture/Bookcases

Secure the tops of all top-heavy furniture, such as bookcases and file cabinets, to a wall. Be sure to anchor to the stud, and not just to the drywall. Flexible fasteners such as nylon straps allow tall objects to sway without falling over, reducing the strain on the studs. Loose shelving can also be secured by applying earthquake putty on each corner bracket.

Securing bookcases and all things tall

Tall pieces of furniture, such as bookcases, china hutches, and armoires are very likely to fall when the ground is rolling and shaking. You can prevent them from falling on someone you care about, and save their contents, by completing these simple steps:

1. Secure the furniture item to the wall stud.
 - Locate the wall studs using a stud finder
 - Secure each furniture piece to at least two wall studs, depending on size and weight, using:
 - Commercially available kits utilizing nylon strapping
 - Also recommended as an inexpensive option (but screws can cause damage to furniture such as an antique bookcase):
 - 4" L-brackets and
 - 3" lag screws, available at all hardware stores
2. Place heavy and/or large items on lower shelves to prevent them from flying around the room in an earthquake.
3. The ground swells and rolls of an earthquake can cause anything resting on shelf or counter tops to fall – see TVs, computers, and electronics to learn how to secure these items. For more delicate items like china, crystal or pottery – consult our page about objects on open shelves or table tops.



Vending Machines

Purpose

To secure vending machines.

Recommendation

Use angle brackets and pronged zee clips.

Caution

When anchoring to post-tensioned slab, locate and avoid reinforcing.

Supplies Required

- Angle bracket—4" x 2" x 1/8"
- Lag bolts—3/8" diameter (for wood)
- Expansion bolts—1/2" diameter x 4" (for concrete)
- Metal screws—No. 14
- Pronged zee clip

Installation

Angle Bracket Installation

Contact vending service company to install angle brackets.

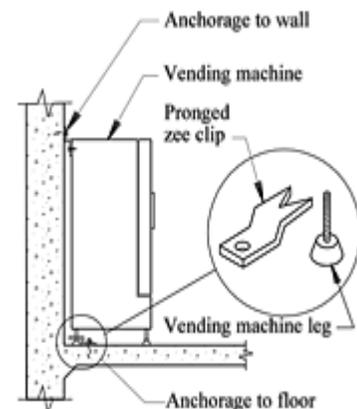
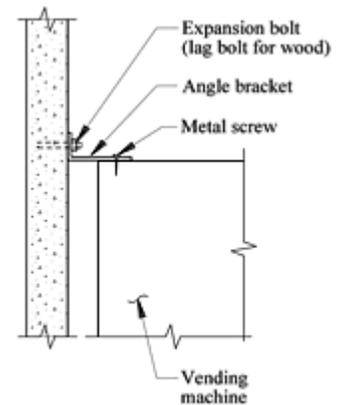
1. Secure angle bracket to wall with a lag bolt for wood.
OR
Secure to wall with an expansion bolt for concrete.
2. Attach bracket to the vending machine with metal screws.

Pronged Zee Clip Installation

Align the clip with the leg of the vending machine.

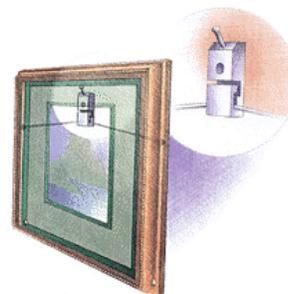
Note

- Locate vending machines away from exits and hallways if possible.
- Enclose vending machine in confined space (if possible) to prevent the machine(s) from tipping over. Do not locate machine so as to impede servicing.



Wall Hangings (Wall-Mounted Objects)

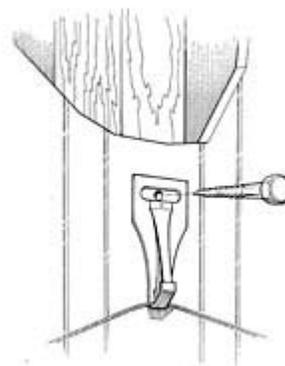
Mirrors, framed pictures, and other objects should be hung from closed hooks so that they can't bounce off the walls. Pictures and mirrors can also be secured at their corners with earthquake putty. Only soft art such as tapestries should be placed over beds or sofas.



Framed pictures — securing them helps prevent cut feet

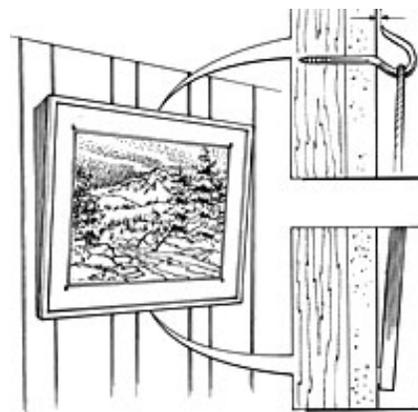
The ground swells and rolls of major earthquakes easily can knock heavy pictures and mirrors off the walls. This can be especially dangerous in the night if these unsecured items are located close to your bed, or during the day if they are located close to your favorite chair or sofa.

Cut feet from broken framing glass and mirrors is one of the most common injuries resulting from major earthquakes. Securing your pictures helps prevent this common injury.



Securing artwork, pictures, and mirrors

- Use a stud finder to find the closest wall stud.
- Screw a screw hook into the wall stud so that there is barely enough room to slide the framing wire between the wall and the hook. This will help prevent the wire from jumping off the hook during the potentially violent movement of an earthquake.
- If the artwork or mirror is large and / or heavy, you may want to consider securing it to two wall studs.
- Secure the bottom corners of these items with Quake-Hold-type products to keep them from banging against the wall. This helps keep the framing glass from breaking and damaging the artwork or photo.

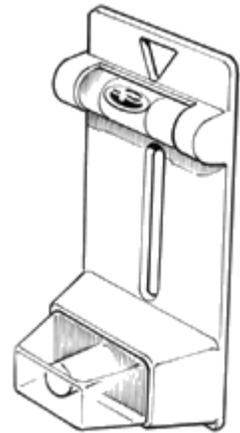


Screw hook into wall, leaving just enough space to slide the wire onto the hook; secure bottom corners with Quake-Hold™ or similar product

Securing hanging objects

Carefully check the location of all hanging plants and other objects. Determine if these objects are close enough to windows to strike them in the wild motion of an earthquake. If they are, consider moving them.

- Find the ceiling stud by using a stud finder.
- Screw the hook directly into the ceiling stud.
- Hang the object from this hook.
- Close the opening in the hook with a pair of pliers to prevent the object from leaping off the hook during an earthquake.



Stud finder

Another Solution

Purpose

To secure wall-mounted objects.

Recommendation

- Secure wall-mounted objects to the wall using either brackets, toggle bolts, or retention straps.
- Secure projection screen by attaching it to a wall with two brackets.
- Secure artwork by attaching it to a wall with four toggle bolts.

Supplies Required

- Brackets (including screws)
- Toggle bolts — 1/4" diameter
- Retention strap with Velcro pull tab, grommet, and 1-1/2" x 1/8" diameter screw

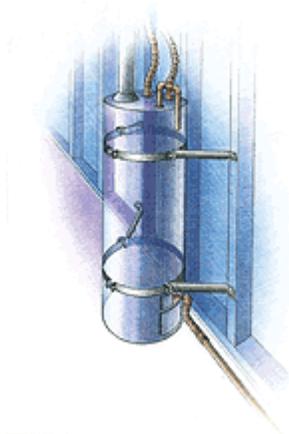


Source: SPAN Disaster Services Inc., *School Facilities Manual Nonstructural Protection Guide*

Water Heater

Unsecured water heaters often fall over, rupturing rigid water and gas connections. If your water heater does not have two straps that wrap completely around it and are screwed into the studs or masonry of the wall, then it is not properly braced. This illustration shows one method of bracing a water heater.

Bracing kits are available that make this process simple. Also, have a plumber install flexible (corrugated) copper water connectors, if not already done.



Protected source of water – or a puddle

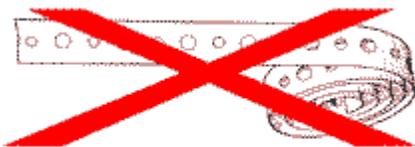
Fresh water after a disaster may be as close as your water heater – provided, of course, that it remains standing upright. A typical water heater holds 30 to 50 gallons of water.

However, this supply of water is extremely vulnerable to the ground undulation (swells and rolls) and ground acceleration of earthquakes, causing them to tip over.

You can protect this valuable resource by securing your water heater to the wall studs.

Changes to strapping recommendations

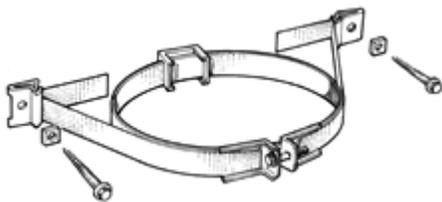
Your tank may be strapped, but incorrectly, as old methods are no longer recommended. Experts recommend these two important changes:



Do NOT use this - this is plumber's tape. Use heavy gauge steel strapping instead.

1. Secure both the top and the bottom, rather than just the top or just the middle, of the hot water tank.
2. Use heavy-gauge metal strapping rather than plumber's tape. Many water heaters in both the 1989 and the 1994 earthquakes broke through the plumber's tape that was intended to keep them secure. The thin metal in plumber's tape has been found to be too brittle to be effective.

Securing your hot water tank

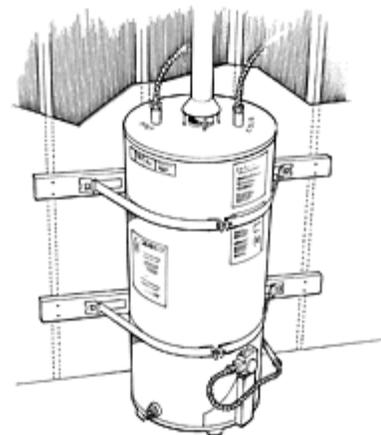


Commercially available kits like this one come complete with the strapping, lag screws, washers, spacers, and tension bolts. These kits can be purchased at many local hardware stores, and are recommended.

Make sure the strap wraps around the water heater 1 1/2 times! Water heaters are an excellent supply of emergency water. Water can be accessed from the drain spout - this is made easier by connecting a garden hose to the drain spout. Open a faucet somewhere in the house to allow the water to drain easier. Make sure the electricity or natural gas is shut off before opening the drain.

Secure your water heater.

- There should be very little space between the water heater and the wall. If there is more than 1 or 2 inches, attach a wooden block to the wall studs with long lag screws (see illustration on page 20). The purpose is to prevent the heater from tipping backwards.
- Wrap the heavy-gauge metal strapping 1 1/2 times around the tank. Start by placing the strapping at the back of the tank. Bring it to the front and then take it back to the wall (see illustration below).
- Secure this strapping to the wall studs or the wood block using several 1/4" x 3" or longer lag screws with oversized washers. If you are securing it directly into concrete, use 1/4" expansion bolts in place of the screws.
- Replace all copper and metal piping with flexible natural gas and water line connectors.



Another Solution for Water Heaters

The Problem

If water heaters are not properly braced, they can topple over during an earthquake causing:

- Broken gas lines and gas leaks
- Fires causing major damage to homes
- Broken water lines and flooding

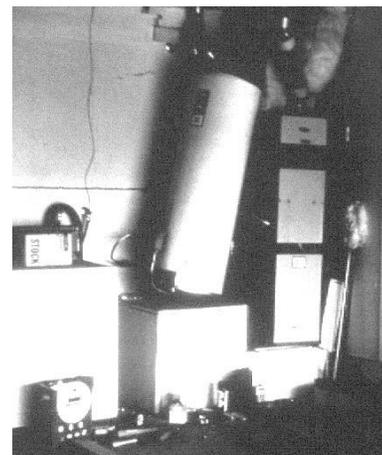


How to Identify

- Is the water heater free-standing?
- Are there straps or other types of restraints securing the water heater?
- Are there straps or restraints bolted to the studs?
- If the water heater is secured, was it completed properly using updated recommendations?
- Are there flexible pipes for water and gas connected to the water heater?

Remember

- Replacing a water heater after an earthquake can cost more than \$500.
- Repairing fire damage and flooding damage can cost several thousand dollars, including the entire cost of your home!
- Check with your local Building Department for details of local requirements.
- Know where your main water valve is so that you can shut it off if you have a water leak.
- Know where your main gas valve is so that you can shut it off if you hear or smell a gas leak.



The Solution

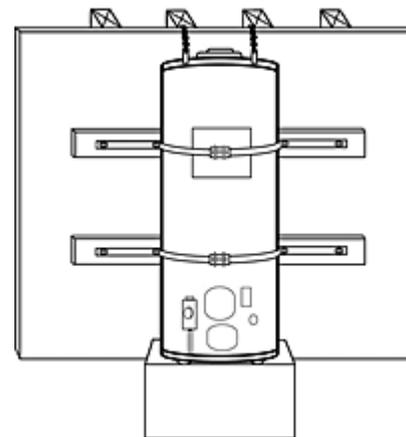
There are recommended solutions – all relatively inexpensive.

- Purchase and install a strap kit or bracing kit from your local hardware store.
- Other options include:
 - Have a licensed plumber strap your water heater according to code.
 - Use metal tubing or heavy metal strapping and lag screws and washers to secure the water heater to the wall studs.

The gas and water lines should also have flexible pipes. These are safer than rigid pipes during an earthquake.

Be sure to check the straps once a year. They may come loose due to vibrations, or other causes.

Source: SPAN Disaster Services Inc.; California Seismic Safety Commission, Homeowner's Guide to Earthquake Safety (HOG), 2005 edition



Wheel-Mounted Furniture

Purpose

To secure wheel-mounted furniture.

Note

- As shaking increases, furniture may slide or— if it is top heavy—it may overturn.
- Position wheel-mounted furniture away from occupants in the room.

Recommendation

Install restraints.

Supplies Required

- Eye-screws—1/4" diameter x 3" OR
- Eye-screws—1/2" diameter (for furniture over 1,000 lbs.)
- Restraints—Bungee cord or 1/8" diameter wire

Installation

Wheel Lock - Installation

Follow manufacturer's instructions.

Note

- Wheel locks can prevent furniture from rolling during moderate shaking.
- Be consistent in setting wheel locks, returning furniture to storage, and tethering furniture.
- The need to move of furniture may eliminate permanent restraint options.

Restraint - Installation

1. Tether each leg to a wall or floor with bungee cord or wire when the furniture is not in use.
2. Tie a cord or wire to an eye-screw that has been screwed into the wall. Attach the cord or wire to the eye screw.

