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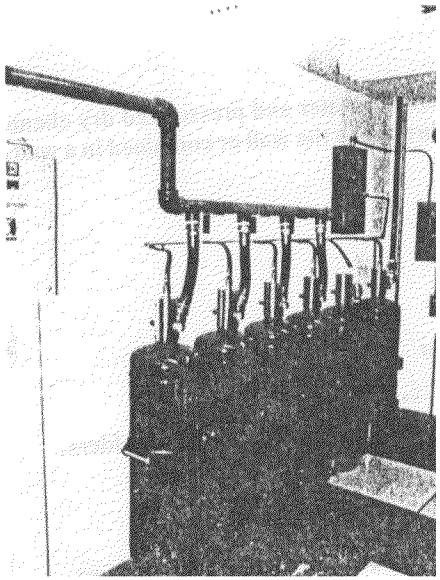

FIGURE 3.56. Adequate tank anchorage and flexible line connections such as those shown here increase the operability potential for this fire suppression system.

MOST LIKELY TYPE OR CONSEQUENCE OF DAMAGE FOR INADEQUATELY PROTECTED EQUIPMENT

- Toppled chemical bottles if bottles are inadequately anchored.
- Ruptured lines if flexible connections are not used.
- Potentially inoperable fire protection system.

Fire Protection Systems

Deluge Equipment

Deluge equipment (Figure 3.57) is required to provide large quantities of water in short order for special hazardous areas where flash fires are likely. All piping and valving should be designed with low flange loads to prevent pipe ruptures. Piping should pass freely from space to space and not be tightly restrained by walls or floors.

EQUIPMENT SEISMIC CATEGORY

- "A" critical equipment

SEISMIC SPECIFICATION

- SDS-1.

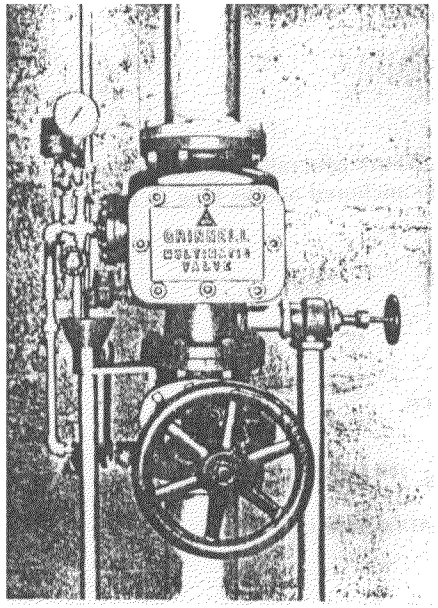

FIGURE 3.57. Example deluge valve. Photograph courtesy of Grinnell Fire Protection Systems Company, Inc.

SEISMIC QUALIFICATION APPROACH

- Equivalent static coefficient analysis.
  - Pipe hangers
  - Lateral bracing
- Stress analysis.
  - Flange loads.
- Design team judgment.
  - Provide flexible connections at fixed end joints where possible.

REFERENCE FIGURE FOR INSTALLATION DETAILS

- 4.87, 4.88, 4.89, 4.90, 4.91, 4.92, 4.93, 4.94, 4.95.

RELATIVE DEGREE OF DAMAGE OF INADEQUATELY PROTECTED EQUIPMENT

- Major.

MOST LIKELY TYPE OR CONSEQUENCE OF DAMAGE FOR INADEQUATELY PROTECTED EQUIPMENT

- Ruptured lines
- Serious flooding

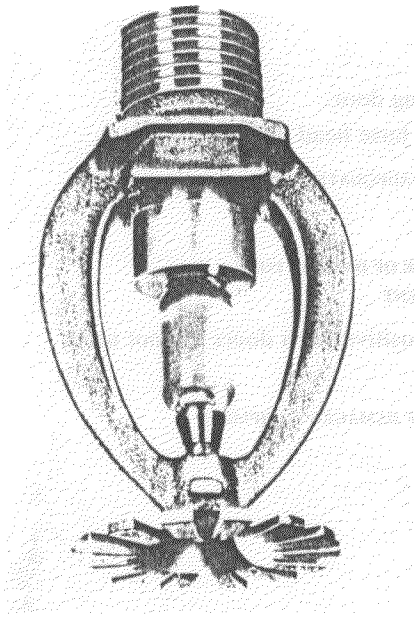

FIGURE 3.61. Pendant sprinkler Photograph courtesy of Grinnell Fire Protection Systems Company, Inc.

MOST LIKELY TYPE OR CONSEQUENCE OF DAMAGE FOR INADEQUATELY PROTECTED EQUIPMENT

- Dislodged water lines.
- Ruptured water lines.
- Facility flooding.
- Inoperable fire system
- General cleanup required

Kitchen Systems

Kitchens, especially those found in essential facilities or facilities that could be called on to perform essential functions after an earthquake (schools, etc.), need to continue production in the earthquake aftermath. Failure of some equipment, such as deep fryers, poses a special hazard to kitchen personnel. The Sheet Metal Manufacturers Association of America has produced design guide manuals for equipment that has been reproduced in part in Appendix 3.

SYSTEM SEISMIC CATEGORY

- "C" support equipment

SYSTEM FOUND IN

- Business establishments.
- Government administration buildings
- Hospitals
- Schools.

Kitchen Systems

Deep Fryer

A toppled deep frying unit (Figure 3.62) poses an obvious threat to kitchen personnel.

EQUIPMENT SEISMIC CATEGORY

- "C" support equipment.

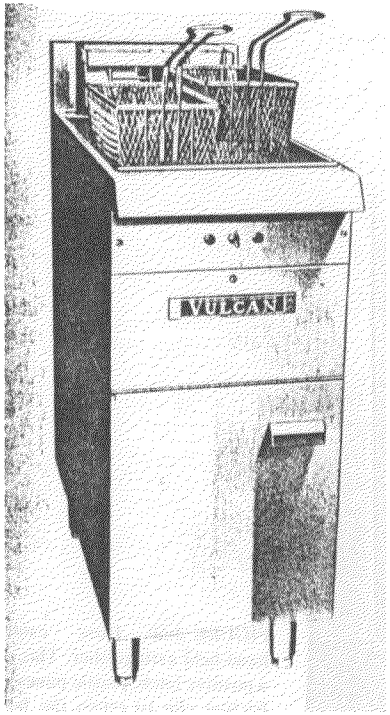

FIGURE 3.62. Toppling of deep fryers and the sloshing of hot oil pose a threat unless this equipment is adequately protected. Photograph courtesy of Vulcan-Hart Corporation.

- Cabinet held extinguishers may fall through glass doors.
- General cleanup required.

REFERENCE FIGURE FOR EXAMPLE OF DAMAGED EQUIPMENT

- 3.163.

Fire Protection Systems

Extinguishers, Hoses

Generally the only effect dynamic motions have on hoses is to cause them to fall out of their cabinets. This is a special problem for cabinets with glass panes. Provision for positive latching doors (Figure 3.60) with plastic panes can keep the hoses securely in place.

EQUIPMENT SEISMIC CATEGORY

- "A" critical equipment.

SEISMIC SPECIFICATION

- SDS-1

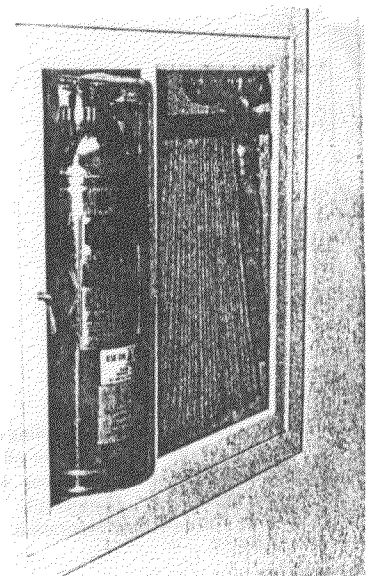

FIGURE 3.60. Hose cabinet with hand-held extinguisher. This cabinet has a positive latch, plastic panes, and a tight friction clip to retain the hose. Photograph courtesy of Rohnert Evans Rohnert Associates.

SEISMIC QUALIFICATION APPROACH

- Design team judgment
  - Provide positive latching door.
  - Provide positive catch hose head holder.

RELATIVE DEGREE OF DAMAGE OF INADEQUATELY PROTECTED EQUIPMENT

- Minor.

MOST LIKELY TYPE OR CONSEQUENCE OF DAMAGE FOR INADEQUATELY PROTECTED EQUIPMENT

- Hose ends up on floor if positive latch doors are not used.
- General cleanup required.

REFERENCE FIGURE FOR EXAMPLE OF DAMAGED EQUIPMENT

- 3.163.

Fire Protection System

Sprinklers

The sprinkler piping must remain attached to the structural system of the building and the sprinkler heads (Figure 3.61) themselves should not be damaged by architectural elements such as swaying suspended ceilings.

EQUIPMENT SEISMIC CATEGORY

- "A" critical equipment.

SEISMIC SPECIFICATION

- SDS-1.

SEISMIC QUALIFICATION APPROACH

- Equivalent static coefficient analysis.
  - Pipe restraints.
- Design team judgment.
  - Protect sprinkler heads from damage caused by adjacent equipment such as suspended ceilings, air ducts, and lights.

REFERENCE FIGURES FOR INSTALLATION DETAILS

- 4.47, 4.87, 4.88, 4.89, 4.90, 4.91, 4.92, 4.93, 4.94, 4.95.

RELATIVE DEGREE OF DAMAGE OF INADEQUATELY PROTECTED EQUIPMENT

- Minor to major.

SEISMIC SPECIFICATION

- SDS 2

SEISMIC QUALIFICATION APPROACH

- Equivalent static coefficient analysis.
  - Base anchorage
  - Top bracing.
- Design team judgment.
  - SMACNA recommendations.
  - Keep grease unit covered when not in use

REFERENCE FOR INSTALLATION DETAILS

- Appendix 3

RELATIVE DEGREE OF DAMAGE OF INADEQUATELY PROTECTED EQUIPMENT

- Minor to moderate.

MOST LIKELY TYPE OR CONSEQUENCE OF DAMAGE FOR INADEQUATELY PROTECTED EQUIPMENT

- Displaced equipment.
- Toppled equipment.
- Grease spills from sloshing or toppling
- Potential for severe burns.

Kitchen Systems

Dishwashers

Toppled dishwashers can cause flooding in the kitchen from broken water lines. Figure 3.63 illustrates a typical cabinet type dishwasher.

EQUIPMENT SEISMIC CATEGORY

- "C" support equipment.

SEISMIC SPECIFICATION

- SDS 2.

SEISMIC QUALIFICATION APPROACH

- Equivalent static coefficient analysis
  - Base anchorage.
- Design team judgment.
  - Flexible water line connections.

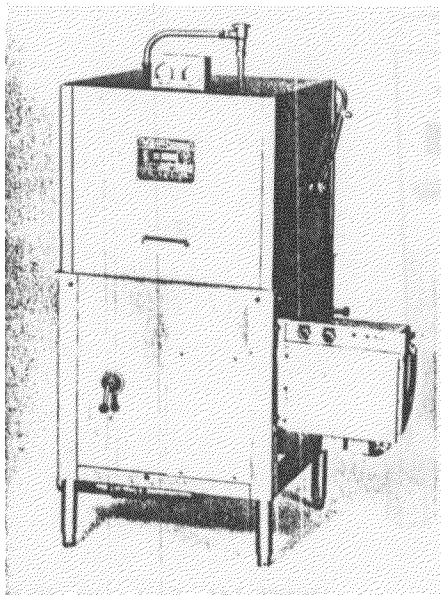

FIGURE 3.63. Example dishwashing unit. Photograph courtesy of Vulcan-Hart Corporation.

REFERENCE FOR INSTALLATION DETAILS

- Appendix 3.

RELATIVE DEGREE OF DAMAGE OF INADEQUATELY PROTECTED EQUIPMENT

- Minor to major.

MOST LIKELY TYPE OR CONSEQUENCE OF DAMAGE FOR INADEQUATELY PROTECTED EQUIPMENT

- Potential for flooding from broken water lines.
- Toppled equipment.
- General cleanup required.

Kitchen Systems

Food Mixers

Base anchorage of food mixers (Figure 3.64) reduces the potential for toppled equipment spills. Dislodged mixing bowls can also cause spills.

EQUIPMENT SEISMIC CATEGORY

- "C" support equipment.

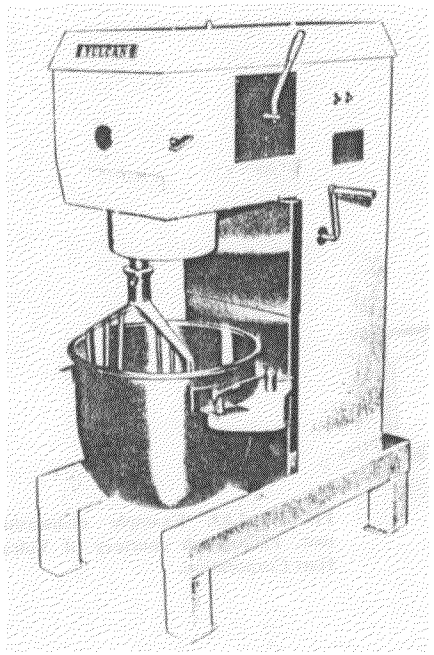

FIGURE 3.64. Food mixer with base anchorage provisions. Photograph courtesy of Vulcan-Hart Corporation.

SEISMIC SPECIFICATION

- SDS-2.

SEISMIC QUALIFICATION APPROACH

- Equivalent static coefficient analysis.
  - Base anchorage.

REFERENCE FOR INSTALLATION DETAILS

- Appendix 3.

RELATIVE DEGREE OF DAMAGE OF INADEQUATELY PROTECTED EQUIPMENT

- Minor to moderate

MOST LIKELY TYPE OR CONSEQUENCE OF DAMAGE FOR INADEQUATELY PROTECTED EQUIPMENT

- Shifted mixers
- Toppled mixers.
- Spilled food
- General cleanup required.

Kitchen Systems

Kettles, Console Construction

Console-type kettles (Figure 3.65), even though large, can be dislodged and should be anchored. Kettle covers should be employed to reduce spillage.

EQUIPMENT SEISMIC CATEGORY

- "C" support equipment.

SEISMIC SPECIFICATION

- SDS-2.

SEISMIC QUALIFICATION APPROACH

- Design team judgment.
  - Provide nonpermanent base anchorage if the unit is to remain portable.
  - Flexible service line connections
- Equivalent static coefficient analysis.
  - Provide permanent base anchorage if the equipment does not need to be portable.

REFERENCE FOR INSTALLATION DETAILS

- Appendix 3.

RELATIVE DEGREE OF DAMAGE OF INADEQUATELY PROTECTED EQUIPMENT

- Minor to moderate

MOST LIKELY TYPE OR CONSEQUENCE OF DAMAGE FOR INADEQUATELY PROTECTED EQUIPMENT

- Dislodged equipment.
- Spilled contents.
- General cleanup required.

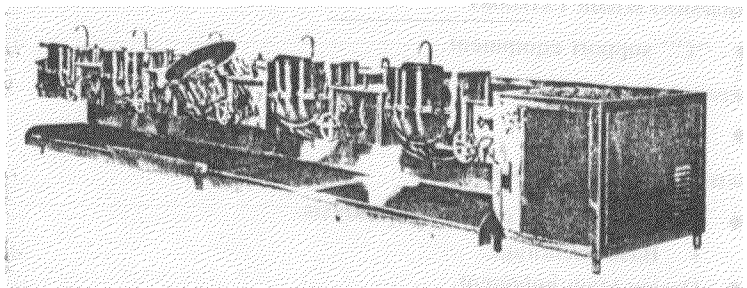

FIGURE 3.65. Wall mounted kettles. Photograph courtesy of Groen, a division of the Dover Corporation.