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EQUIPMENT SEISMIC CATEGORY

- “C” support equipment.

SEISMIC SPECIFICATION

- SDS-2.

SEISMIC QUALIFICATION APPROACH

- Equivalent static coefficient analysis.
 - Base anchorage.
- Dynamic analysis or seismic test.
 - Manufacturers may wish to undertake more ambitious generic qualification programs to protect their equipment from operation failures and subsequent expensive repairs.

REFERENCE FIGURE FOR INSTALLATION DETAILS

- 4.75.

RELATIVE DEGREE OF DAMAGE OF INADEQUATELY PROTECTED EQUIPMENT

- Minor —because of its geometry, this equipment is generally anchored;

MOST LIKELY TYPE OR CONSEQUENCE OF DAMAGE FOR INADEQUATELY PROTECTED EQUIPMENT

- Potential operational failure.
- Base anchorage failure if underdesigned.
- General cleanup required.

Medical Systems**Cold Storage**

Cold storage equipment (Figure 3.92), whether it be for the Pathology Laboratory or for pharmaceuticals, is generally tall, slender, and heavy. Doors need positive latches, not magnetic catches. Rolling or sliding internal drawers should have stops and lips to prevent the contents from being spilled.

EQUIPMENT SEISMIC CATEGORY

- “C” support equipment.

SEISMIC SPECIFICATION

- SDS-2.

SEISMIC QUALIFICATION APPROACH

- Equivalent static coefficient analysis.
 - Base and top anchorage.

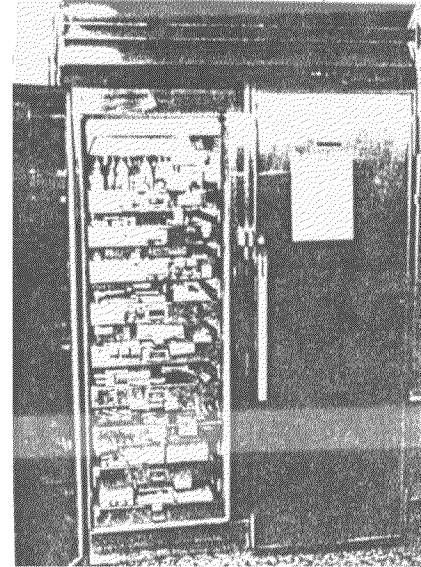


FIGURE 3.92. Unsecured example of a cold storage unit.

- Design team judgment.
 - Provide positive latch doors and drawer stops.

REFERENCE FIGURES FOR INSTALLATION DETAILS

- 4.70, 4.71.

RELATIVE DEGREE OF DAMAGE OF INADEQUATELY PROTECTED EQUIPMENT

- Minor to moderate.

MOST LIKELY TYPE OR CONSEQUENCE OF DAMAGE FOR INADEQUATELY PROTECTED EQUIPMENT

- Toppled storage unit.
- Spilled contents.
- General cleanup required.

Medical Systems**Crash Cart**

Crash carts (Figure 3.93) contain essential medicines and tools for in hospital emergency treatment.

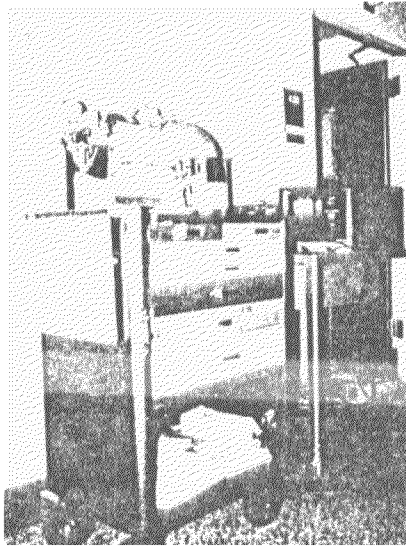


FIGURE 3.93 Wheel-mounted crash cart without anchorage provisions. This vital piece of equipment is likely to be upset during an earthquake.

EQUIPMENT SEISMIC CATEGORY

- "A" critical equipment.

SEISMIC SPECIFICATION

- SDS-1

SEISMIC QUALIFICATION APPROACH

- Design team judgment.
 - Design restraining system for times when equipment is not in use.
- Equivalent static coefficient analysis.
 - Anchorage of restraining system.

REFERENCE FIGURE FOR INSTALLATION DETAILS

- 4.69.

RELATIVE DEGREE OF DAMAGE OF INADEQUATELY PROTECTED EQUIPMENT

- Minor to moderate.

MOST LIKELY TYPE OR CONSEQUENCE OF DAMAGE FOR INADEQUATELY PROTECTED EQUIPMENT

- Toppled carts.
- Runaway carts.

- Collision with other equipment
- Potential for personnel injury
- General cleanup required

Medical Systems

Culture Incubator, Counter Top

Counter top culture incubators (Figure 3.94) require anchorage to prevent their toppling to the floor.

EQUIPMENT SEISMIC CATEGORY

- "C" support equipment.

SEISMIC SPECIFICATION

- SDS-2

SEISMIC QUALIFICATION APPROACH

- Design team judgment.
 - Provide for adequate installation space.
 - Use positive latch doors, magnetic catches and some friction catches do not work well in earthquakes (the doors open and the contents spill out)
- Equivalent static coefficient analysis.
 - Anchorage of counter.
 - Anchorage of incubator to counter

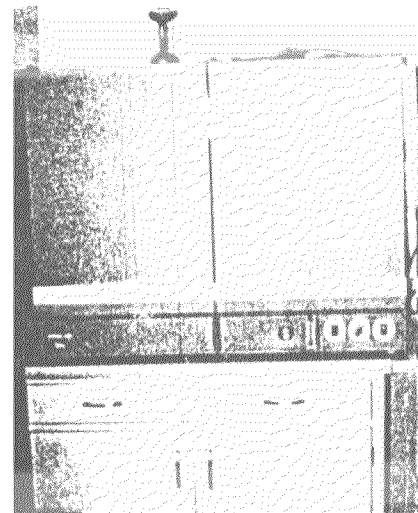


FIGURE 3.94. Unsecured example of a culture incubator atop a small counter.

REFERENCE FIGURES FOR INSTALLATION DETAILS

- 4.60, 4.61, 4.62, 4.63.

RELATIVE DEGREE OF DAMAGE OF INADEQUATELY PROTECTED EQUIPMENT

- Minor to moderate.

MOST LIKELY TYPE OR CONSEQUENCE OF DAMAGE FOR INADEQUATELY PROTECTED EQUIPMENT

- Toppled equipment.
- Possibly inoperative incubator.
- Spilled contents.
- General cleanup required.

*Medical Systems**Exam Equipment, Specialized*

This equipment (Figure 3.95) is generally needed for regular patients on a day-to-day basis, but nonetheless deserves consideration for its own protection.

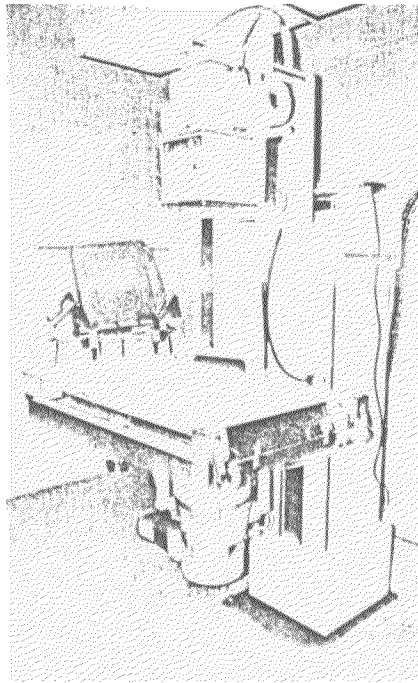


FIGURE 3.95. Specialized examination equipment such as the radiology table shown here typically has geometries that produce extreme motions during an earthquake. Note the base anchorage employed on this equipment.

EQUIPMENT SEISMIC CATEGORY

- “C” support equipment.

SEISMIC SPECIFICATION

- SDS-2.

SEISMIC QUALIFICATION APPROACH

- Dynamic analysis.
 - Because of the expense of equipment, the major concern is to keep such equipment anchored (it is commonly modeled as an inverted pendulum with appendages) and damped to reduce wild excursions.

REFERENCE FIGURE FOR INSTALLATION DETAILS

- 4.75.

RELATIVE DEGREE OF DAMAGE OF INADEQUATELY PROTECTED EQUIPMENT

- Minor to moderate.

MOST LIKELY TYPE OR CONSEQUENCE OF DAMAGE FOR INADEQUATELY PROTECTED EQUIPMENT

- Toppled equipment.
- Internal mechanical damage to tracks, and so on.
- Possibly inoperative equipment.
- General cleanup required.

*Medical Systems**Gas Cylinders*

High-pressure gas cylinders (Figure 3.96) could prove lethal should their valves break upon falling. The lightweight chains commonly used around the gas bottles do not keep them from falling.

EQUIPMENT SEISMIC CATEGORY

- “C” support equipment.

SEISMIC SPECIFICATION

- SDS-2.

SEISMIC QUALIFICATION APPROACH

- Design team judgment.
 - Cylinders must be kept from falling during shaking. Nylon straps or lightweight chains will not keep cylinders standing on end.
- Equivalent static coefficient analysis.
 - Design of anchorage systems.



FIGURE 3.96 Unsecured gas cylinders such as these could be dangerous to both life and property during an earthquake.

REFERENCE FIGURE FOR INSTALLATION DETAILS

- 4.59.

RELATIVE DEGREE OF DAMAGE OF INADEQUATELY PROTECTED EQUIPMENT

- Minor to major.

MOST LIKELY TYPE OR CONSEQUENCE OF DAMAGE FOR INADEQUATELY PROTECTED EQUIPMENT

- Cylinders fall and roll around.
- Although no cases have been reported, there is enough energy available in some fully pressurized bottles to propel them through partition walls should the valve be broken off.
- General cleanup required.

REFERENCE FIGURE FOR EXAMPLE OF DAMAGED EQUIPMENT

- 3.190.

Medical Systems

General Lab Equipment

General laboratory equipment (Figure 3.97) is especially vulnerable. The cleanup can be time consuming and some spills may be potentially toxic.

EQUIPMENT SEISMIC CATEGORY

- “C” support equipment.

SEISMIC SPECIFICATION

- SDS-2.

SEISMIC QUALIFICATION APPROACH

- Equivalent static coefficient analysis.
 - Base anchorage for heavy equipment.
- Design team judgment.
 - Shelf retaining wires, lips, and so on.

REFERENCE FIGURES FOR INSTALLATION DETAILS

- 4.53, 4.54, 4.55, 4.56, 4.57, 4.60, 4.61, 4.62, 4.63, 4.68, 4.69, 4.73.

RELATIVE DEGREE OF DAMAGE OF INADEQUATELY PROTECTED EQUIPMENT

- Minor to moderate.

MOST LIKELY TYPE OR CONSEQUENCE OF DAMAGE FOR INADEQUATELY PROTECTED EQUIPMENT

- Spilled chemicals.
- Broken glassware.
- Spilled shelves.
- Toppled counter top items.
- General cleanup required.

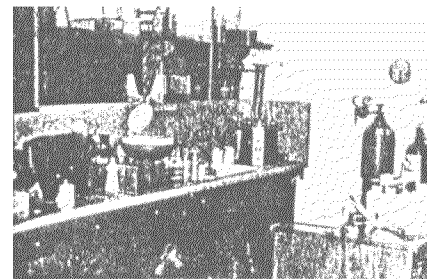


FIGURE 3.97. Typical laboratory scene.

REFERENCE FIGURES FOR EXAMPLES OF DAMAGED EQUIPMENT

- 3.170, 3.171

*Medical Systems**Gurney*

Gurneys (Figure 3.98) should be restrained when not in use.

EQUIPMENT SEISMIC CATEGORY

- "D" support equipment.

SEISMIC SPECIFICATION

- SDS-2.

SEISMIC QUALIFICATION APPROACH

- Design team judgment.
 - Provide storage space for unused equipment.
- Equivalent static coefficient analysis.
 - Method of anchorage when equipment is unused.

REFERENCE FIGURE FOR INSTALLATION DETAILS

- 4.69.

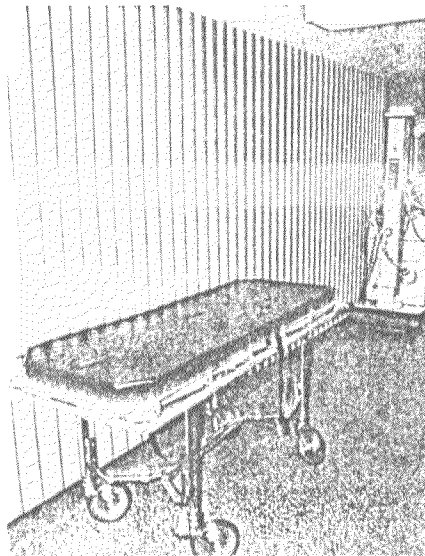


FIGURE 3.98. Unrestrained gurney stored in corridor

RELATIVE DEGREE OF DAMAGE OF INADEQUATELY PROTECTED EQUIPMENT

- Minor.

MOST LIKELY TYPE OR CONSEQUENCE OF DAMAGE FOR INADEQUATELY PROTECTED EQUIPMENT

- Runaway rolling equipment
- Topped equipment.
- Collision with other equipment or personnel.
- General cleanup.

*Medical Systems**Histology Console*

The histology console shown in Figure 3.99 has potential problems similar to those of other consoles. They tend to be top heavy, are seldom anchored, and are subject to operational failures.

EQUIPMENT SEISMIC CATEGORY

- "C" support equipment.



FIGURE 3.99. Unsecured histology console