"Documento original en mal estado"

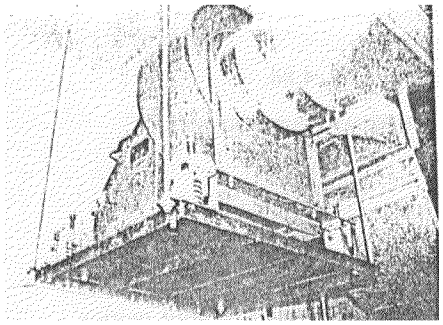

FIGURE 3.14. Suspended fan unit with motion restraints on the vibration isolators, flexible duct connections and fixed anchorage to the adjacent structural wall at the bottom left.

RELATIVE DEGREE OF DAMAGE OF INADEQUATELY PROTECTED EQUIPMENT

- Major.

MOST LIKELY TYPE OR CONSEQUENCE OF DAMAGE FOR INADEQUATELY PROTECTED EQUIPMENT

- Damage potential to adjacent equipment from excessive swaying
- Fallen fan units
- Potential for injured personnel
- Potential for equipment damaged by falling fan units
- General cleanup required

Air Handling Systems

Mixing Boxes

Mixing boxes (Figure 3.15) need lateral bracing and flexible joints at ducting interface.

EQUIPMENT SEISMIC CATEGORY

- "C" support equipment.

SEISMIC SPECIFICATION

- SDS 2

SEISMIC QUALIFICATION APPROACH

- Design team judgment
  - Flexible connections
- Equivalent static coefficient analysis.
  - Bracing and support.

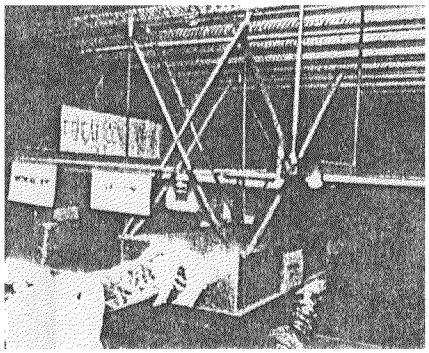

FIGURE 3.15. Air mixing box showing lateral bracing.

REFERENCE FIGURES FOR INSTALLATION DETAILS

- 4.7.

RELATIVE DEGREE OF DAMAGE OF INADEQUATELY PROTECTED EQUIPMENT

- Minor.

MOST LIKELY TYPE OR CONSEQUENCE OF DAMAGE FOR INADEQUATELY PROTECTED EQUIPMENT

- Dislodged mixing box
- Severed ducting connections.
- Inoperative portions of air system
- General cleanup required.

Air Handling Systems

Vibration Isolators

Vibration isolation on reciprocating air handling equipment (Figure 3.16) should receive motion restraint considerations. A commonly held misconception is that vibration isolation allows equipment to "float" through the earthquake unscathed. Nothing could be further from the truth! Vibration isolators commonly have spring systems with natural frequencies coincident with the vibrations produced by earthquakes. Without some snubbing device, the spring mass system is likely to go into resonance and eventually destroy itself through wild and uncontrolled vibration. Also see Motion Restraint Systems in this chapter.

EQUIPMENT SEISMIC CATEGORY

- "B" support equipment.

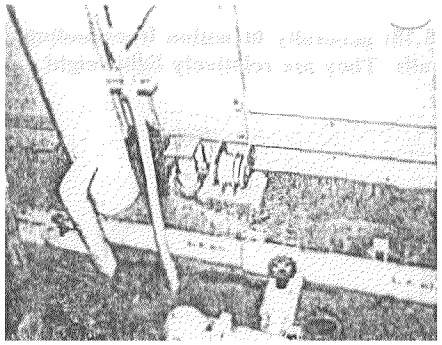

FIGURE 3.16 Air handling unit illustrating vibration isolation on the left and motion restraint (snubber) on the right

SEISMIC SPECIFICATION

- SDS-1.

SEISMIC QUALIFICATION APPROACH

- Dynamic analysis.
  - For vibration isolation, if not provided by vibration isolation manufacturer. Employ motion restraint of some sort
- Follow vibration isolation manufacturer's suggestions for motion restraint.

REFERENCE FIGURES FOR INSTALLATION DETAILS

- 4.78, 4.79, 4.80, 4.81, 4.82, 4.83, 4.84, 4.85.

RELATIVE DEGREE OF DAMAGE OF INADEQUATELY PROTECTED EQUIPMENT

- Major.

MOST LIKELY TYPE OR CONSEQUENCE OF DAMAGE FOR INADEQUATELY PROTECTED EQUIPMENT

- Equipment that employs vibration isolators without motion restraint almost always fails during strong motion.
- Inoperative equipment likely.
- Serious damage may result from "flying" springs that have failed
- General cleanup required.

REFERENCE FIGURES FOR EXAMPLES OF DAMAGED EQUIPMENT

- 3.174, 3.175, 3.177.

Communications Systems

Adequate communications are a necessary function following any major disaster. Communications systems require thorough qualification programs to provide reasonable assurance that they will remain operational. In cases such as ambulance and fire control, trucks must rely on police facilities to direct them to the emergency area by way of unblocked roads. Without operational communication systems, calls for help might go unanswered

SYSTEM SEISMIC CATEGORY

- "A" critical system

SYSTEM FOUND IN

- Communication centers
- Emergency operating centers.
- Fire stations.
- Government administration buildings.
- Hospitals
- Police stations.

Communications Systems

Antennas

Antenna whip can lead to its potential collapse and is a major concern for this type of equipment (see Figure 3.17)

EQUIPMENT SEISMIC CATEGORY

- "A" critical equipment.

SEISMIC SPECIFICATION

- SDS-1.

SEISMIC QUALIFICATION APPROACH

- Dynamic analysis
  - Base anchorage determination
  - Guying where possible

REFERENCE FIGURE FOR INSTALLATION DETAILS

- 4.8.

RELATIVE DEGREE OF DAMAGE OF INADEQUATELY PROTECTED EQUIPMENT

- Moderate.

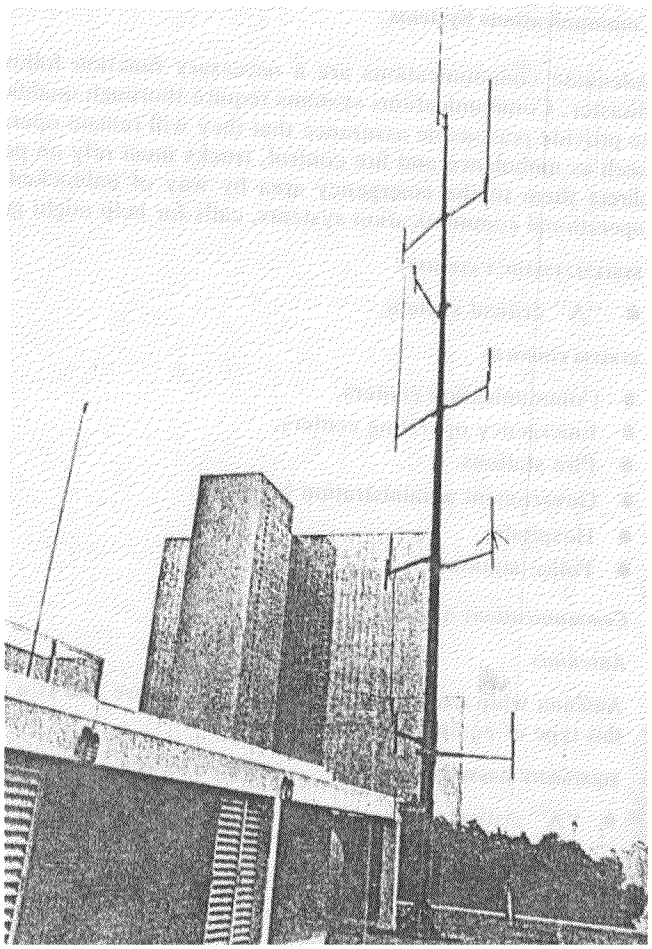

FIGURE 3.17 Roof top antenna without midpoint bracing

MOST LIKELY TYPE OR CONSEQUENCE OF DAMAGE FOR INADEQUATELY PROTECTED EQUIPMENT

- Severe whipping of antenna
- Collapse of antenna.
- Inoperative equipment

Communications Systems

Antennas, Cavitated

Cavitated antennas (Figure 3.18) generally fit within freestanding cabinets or are attached directly to walls. They are relatively lightweight

EQUIPMENT SEISMIC CATEGORY

- "A" critical equipment.

SEISMIC SPECIFICATION

- SDS-1.

SEISMIC QUALIFICATION APPROACH

- Equivalent static coefficient analysis.
  - Anchorage within cabinet or to building walls.

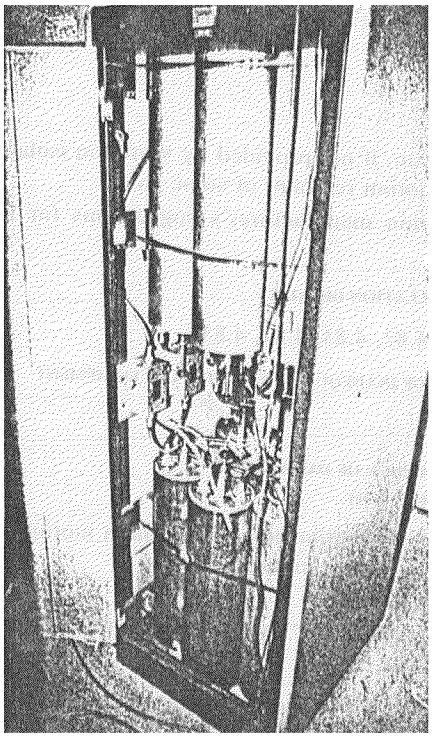

FIGURE 3.18. These lightweight cavitated antennae are not adequately anchored within their cabinet and the cabinet has not been base anchored. Note the base anchorage holes provided by the cabinet manufacturer