

6.4 MECHANICAL, ELECTRICAL, AND PLUMBING COMPONENTS

6.4.2 STORAGE TANKS AND WATER HEATERS

6.4.2.3 COMPRESSED GAS CYLINDERS

This category includes single or multiple gas cylinders. These may be attached to piping, anchored to carts for mobility, or stored for future use.

TYPICAL CAUSES OF DAMAGE

- Unanchored tanks may slide, overturn, and roll; connected piping may be damaged.
- Contents may be flammable or hazardous; leaking cylinders may be dangerous.
- Tank installations equipped with chains or straps are still susceptible to damage unless the chains or straps are properly secured around the tanks.

Damage Examples



Figure 6.4.2.3-1 Unanchored tanks inside fenced enclosure in the 1994 magnitude-6.7 Northridge Earthquake (Photo courtesy of OSHPD).

SEISMIC MITIGATION CONSIDERATIONS

- Wall restraint detail shown at top of Figure 6.4.2.3-8 is a non-engineered detail for tank storage; this detail does not provide sufficient restraint for tanks attached to piping.
- Engineered details with additional restraints are required for tanks attached to piping; see corral detail at bottom of Figure 6.4.2.3-7 or scheme shown in Figures 6.4.2.3-2 and 6.4.2.3-3.

Mitigation Examples



Figure 6.4.2.3-2 Gas cylinder anchorage with attached gas lines undamaged in the 2001 magnitude-8.4 Peru Earthquake (Photo courtesy of Eduardo Fierro, BFP Engineers).



Figure 6.4.2.3-3 Detail of undamaged gas cylinder installation (Photo courtesy of Eduardo Fierro, BFP Engineers).



Figure 6.4.2.3-4 Wall-mounted cylinder restraints upgraded with stiffener plates following the 2001 Peru Earthquake(Photo courtesy of Eduardo Fierro, BFP Engineers).



Figure 6.4.2.3-5 Steel tube supports for mobile gas cylinder carts (Photo courtesy of Eduardo Fierro, BFP Engineers).

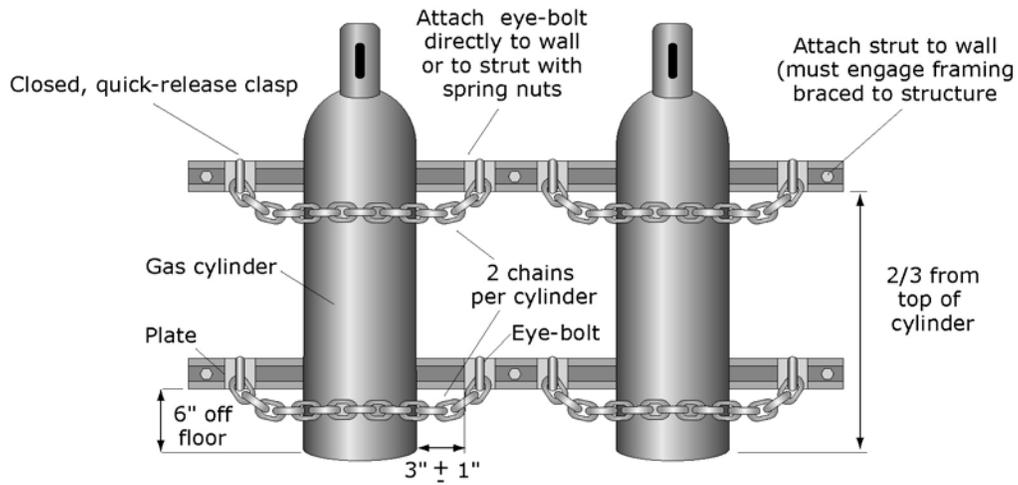


Figure 6.4.2.3-6 Detail of steel tube supports and chains (Photo courtesy of Eduardo Fierro, BFP Engineers).

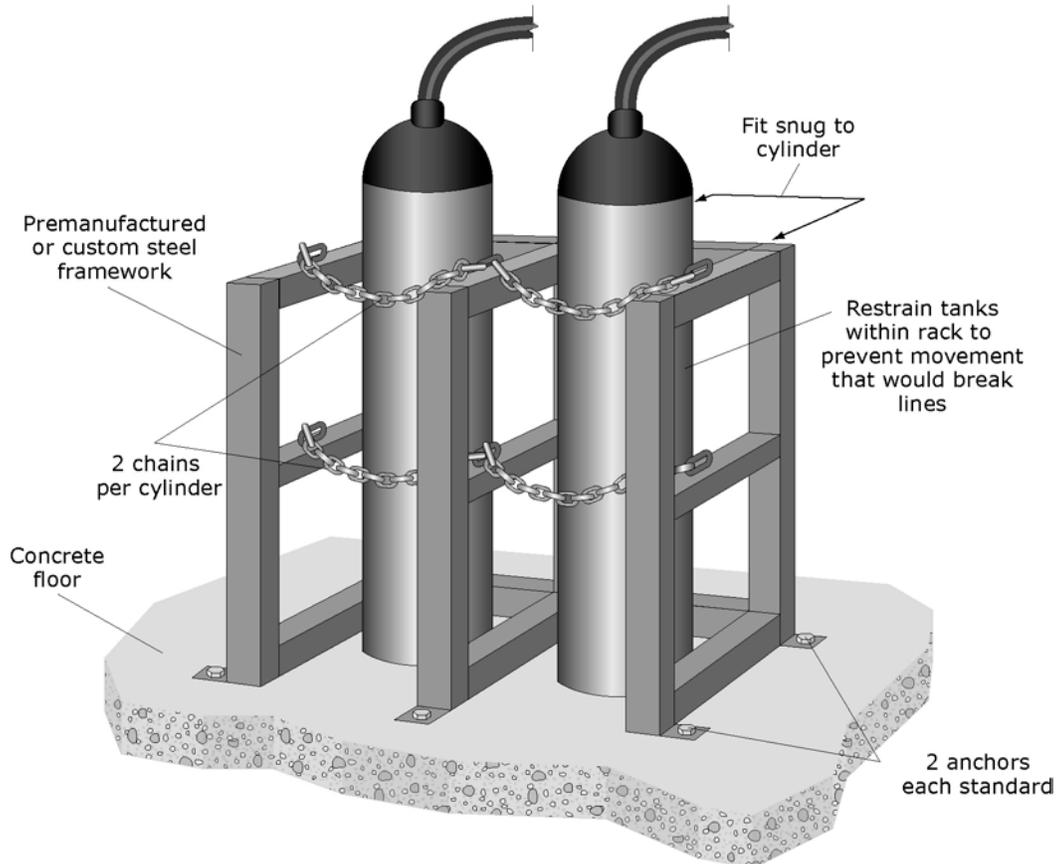


Figure 6.4.2.3-7 Detail of enclosures for airgas tanks in a hospital; chains attached with quick release hooks (Photo courtesy of Maryann Phipps, Estructure).

Mitigation Details



Restraint for Gas Cylinder Against Wall



Restraint for Freestanding Gas Cylinders

Figure 6.4.2.3-8 Compressed gas cylinders (ER).