MEP.3 PRESSURE PIPING

MEP.3.1 SUSPENDED PRESSURE PIPING (ENGINEERING REQUIRED)

TYPICAL CAUSES OF DAMAGE:

Details

- Improperly supported pipes can become dislodged and fall.
- Pipes are particularly vulnerable to damage at joints, bends, penetrations through walls or structural members, and connections to equipment.
- Unbraced piping can sway and impact adjacent items.
- Fluids may leak from damaged joints or broken pipe; property losses and business outages are often attributed to fluid leaks from piping.

DAMAGE EXAMPLES

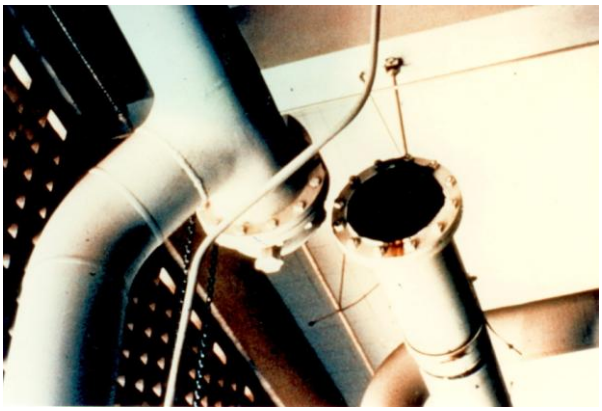

Figure MEP.3.1-1 Earthquake Damage: Pipe joint failure. 1971, San Fernando, California.

Figure MEP.3.1-2 Earthquake Damage: Leakage caused by pipe damage at joint. 1994 Northridge, California

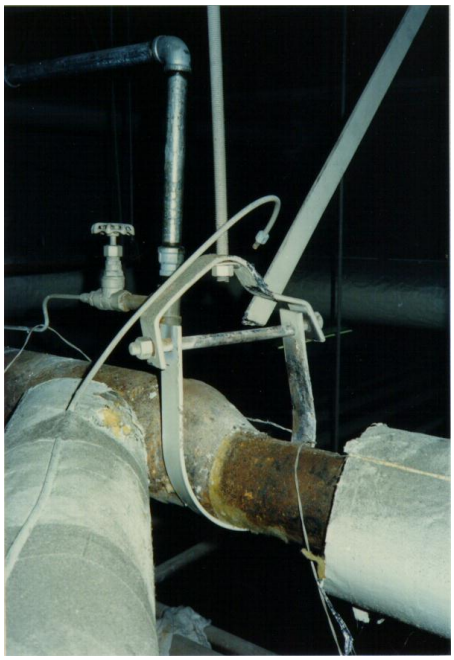

Figure MEP.3.1-3 Earthquake Damage: Pipe brace failed at connection; insulation removed prior to photo

MITIGATION EXAMPLES

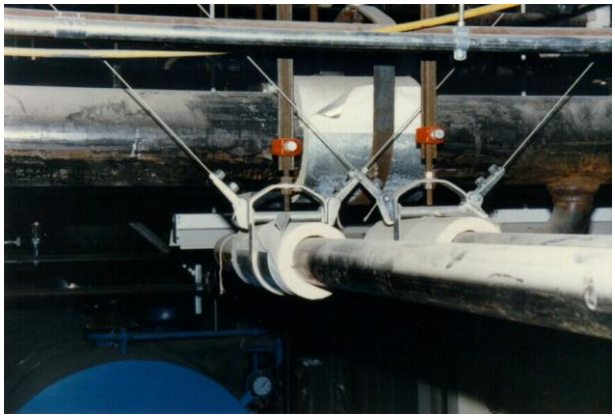

Figure MEP.3.1-4 Seismic Mitigation: Single clevis hanger support with cable transverse bracing at the restraining bolt

Figure MEP.3.1-5 Seismic Mitigation: Pipe clamp supports with transverse and longitudinal angle braces.

Figure MEP.3.1-6 Seismic Mitigation: Transverse bracing with J-hanger and strut at the restraining bolt. Note that longitudinal brace shown is ineffective because the J-hanger can slip along the length of the pipe.

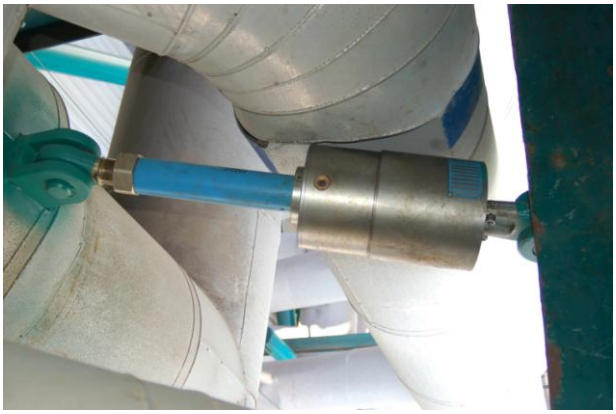

Figure MEP.3.1-6 Seismic Mitigation: Viscous damper used as restraint on large insulated pipe.

TYPICAL SEISMIC ANCHORAGE DETAILS

- Details shown are for overhead attachments for suspended piping. Seismic detailing for pipes requires both transverse and longitudinal braces; while these are shown here as separate details, both types of bracing are required. Note that the longitudinal braces require a pipe clamp or equivalent that does not slip along the length of the pipe.
- The spacing of pipe bracing is dependent on the level of seismicity, location in a building, size of the pipe, type of pipe, and strength of connections to the structure.
- ASCE 7 contains a number of exemptions for suspended piping where the hangers are less than 12 inches long or "high-deformability piping" is used and the pipe diameter is small (anywhere from 1" to 3" diameter depending on the building location and occupancy). If piping is unbraced, provisions must be made to accommodate anticipated movement (such as by providing flexible connections – See MEP.3.3)
- Details for other conditions such as pipe risers and floor or wall mounted pipes can be found in FEMA 414. Many vendors supply specialized hardware for seismic anchorage of piping including load rated anchorage assemblies, spring loaded hangers, pipe dampers, etc.

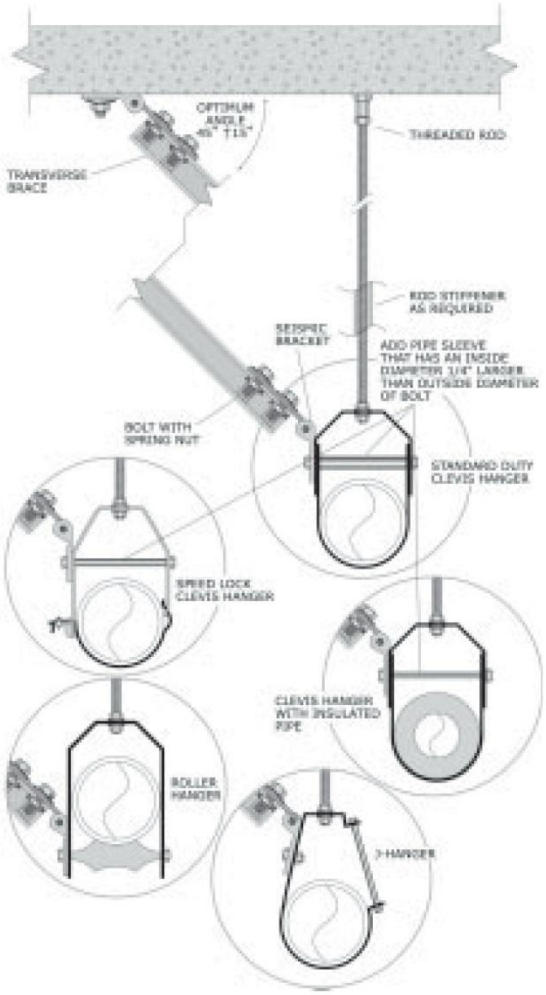

Figure 61: Single clevis hanger support with strut or angle transverse bracing at the restraining bolt.

Figure MEP.3.1-7 Single clevis hanger support with strut or angle transverse bracing at the restraining bolt.

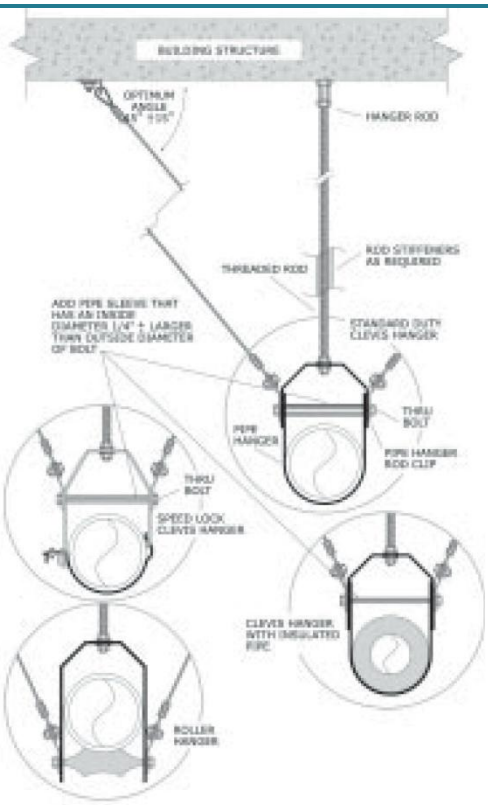

Figure 62: Single clevis hanger support with cable transverse bracing at the restraining bolt.

Figure MEP.3.1-8 Single clevis hanger support with cable transverse bracing at the restraining bolt.

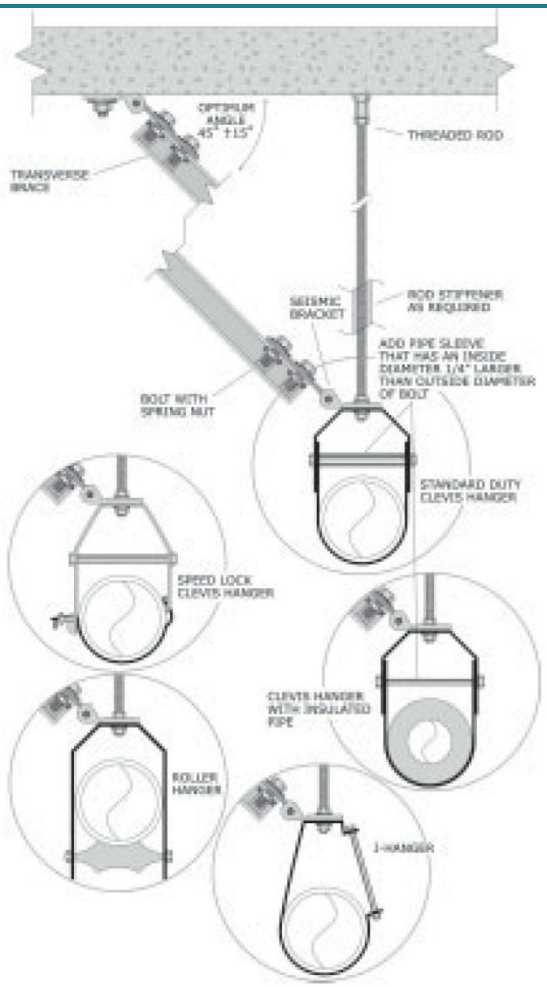

Figure 63: Single clevis hanger support with strut or angle transverse bracing at hanger rod.

Figure MEP.3.1-9 Single clevis hanger support with strut or angle transverse bracing at hanger rod.

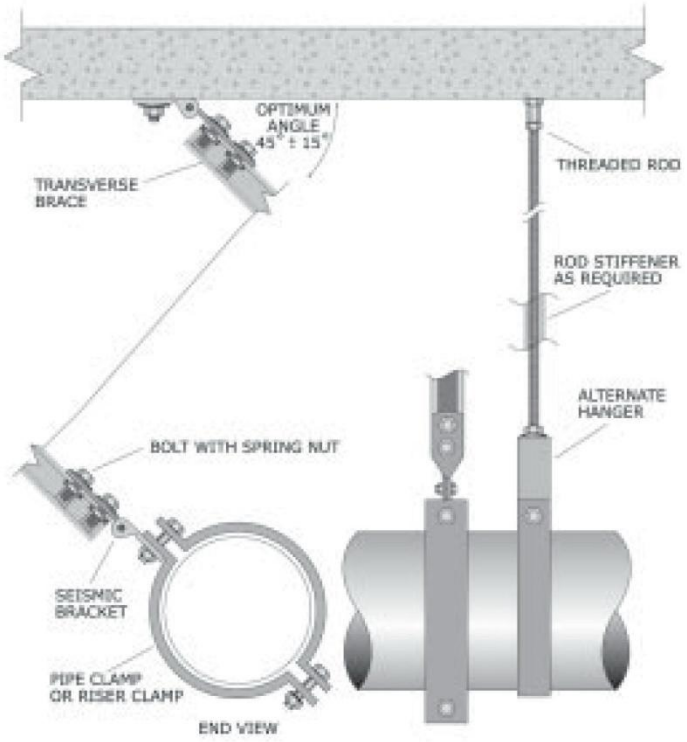

Figure 64: Pipe clamp supports with transverse strut or angle, transverse brace and hanger rod.

Figure MEP.3.1-10 Pipe clamp supports with transverse strut or angle, transverse brace and hanger rod.

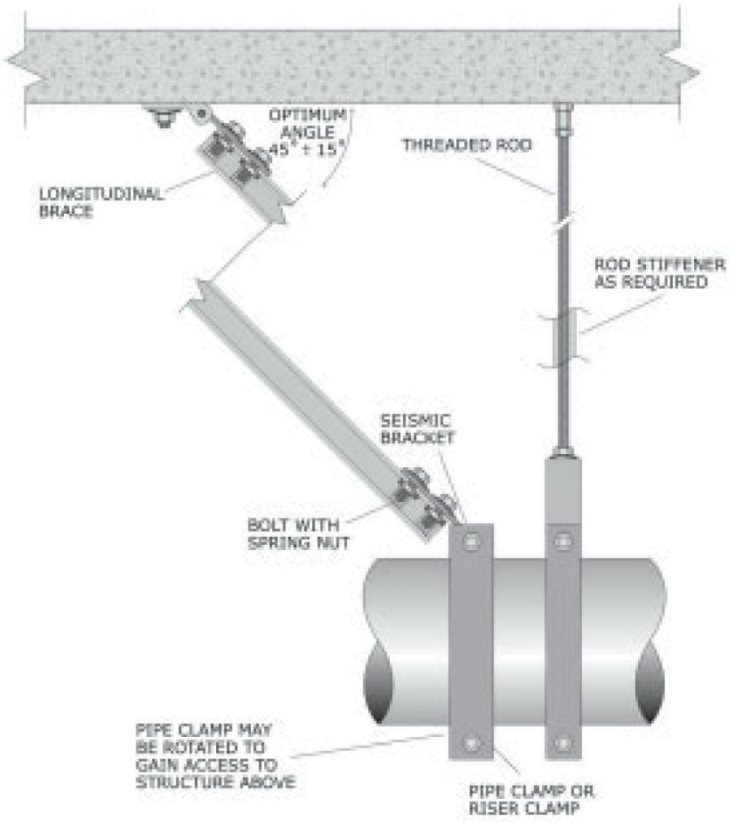

Figure 65: Pipe clamp supports with longitudinal strut or angle, longitudinal brace and hanger rod.

Figure MEP.3.1-11 Pipe clamp supports with longitudinal strut or angle, longitudinal brace and hanger rod.

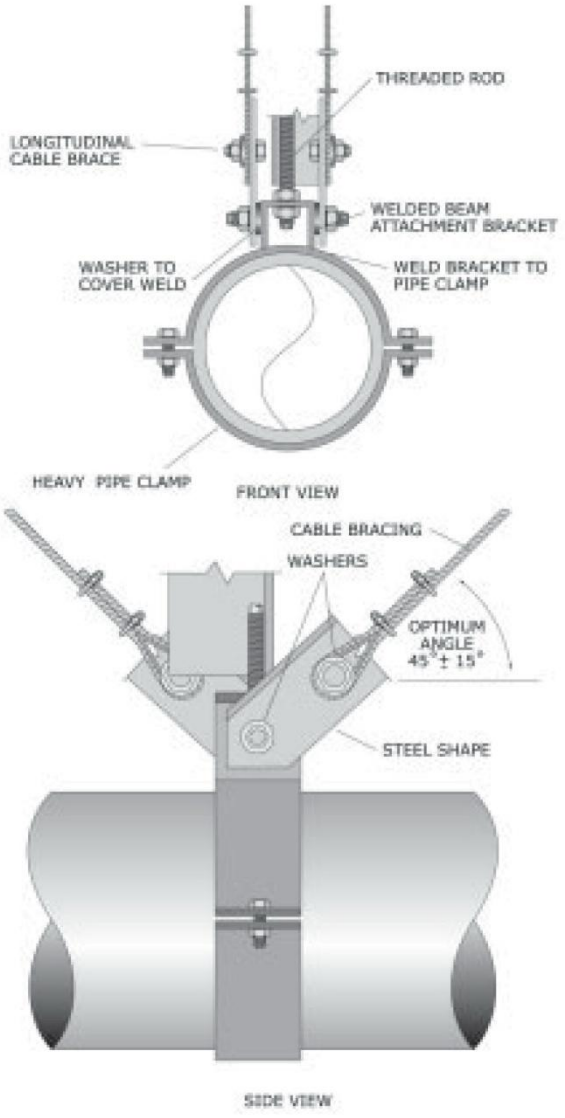

Figure 66: Pipe clamp supports with longitudinal cable brace and hanger rod.

Figure MEP.3.1-12 Pipe clamp supports with longitudinal cable brace and hanger rod.

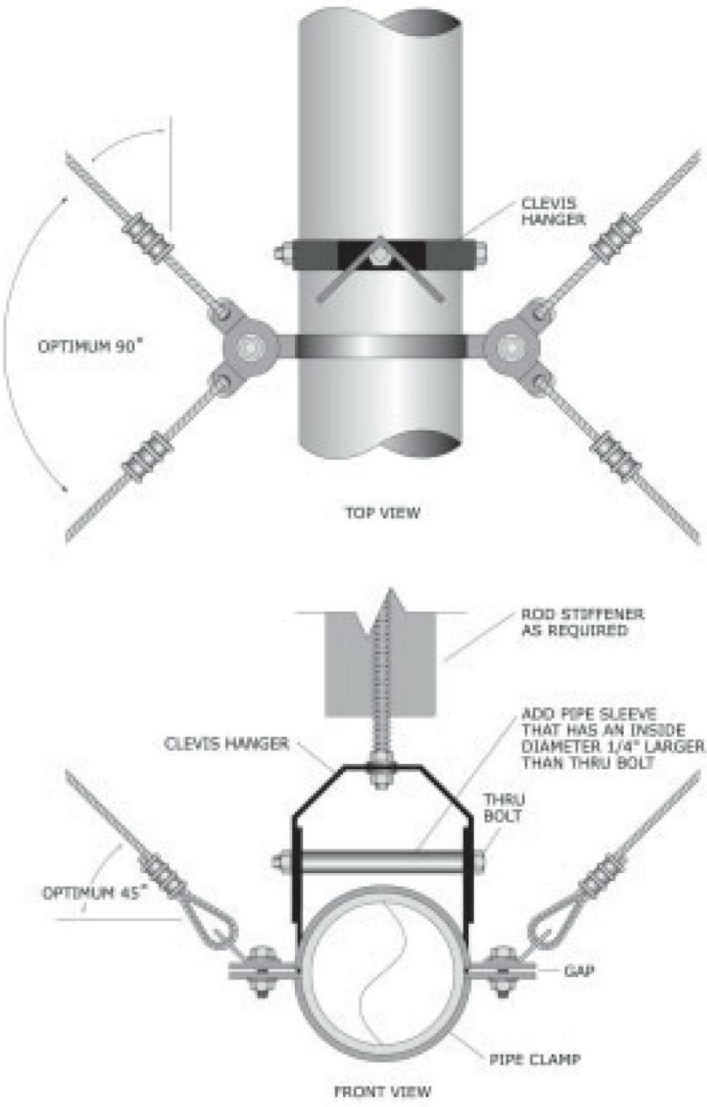

Figure 67: Pipe clamp supports with all directional brace and hanger rod.

Figure MEP.3.1-13 Pipe clamp supports with all-directional brace and hanger rod.

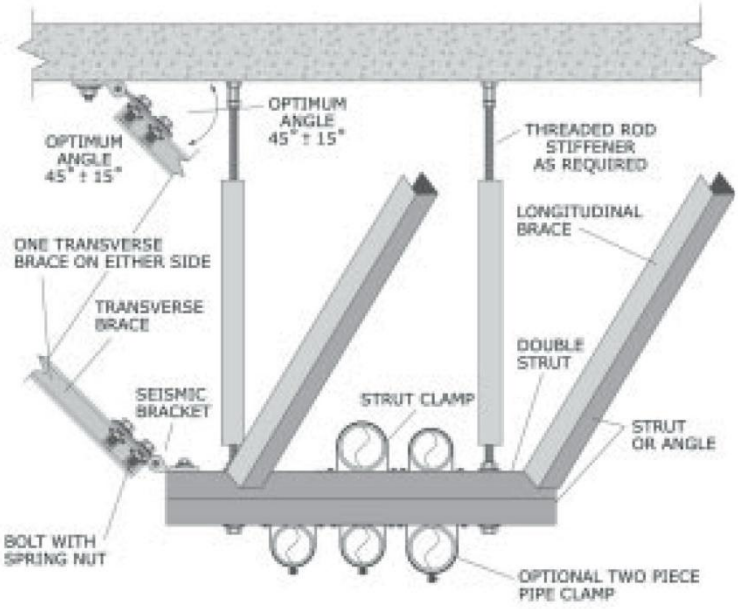

Figure 69: Trapeze support with strut or angle lateral supports.

Figure MEP.3.1-14 Trapeze support with strut or angle lateral supports.

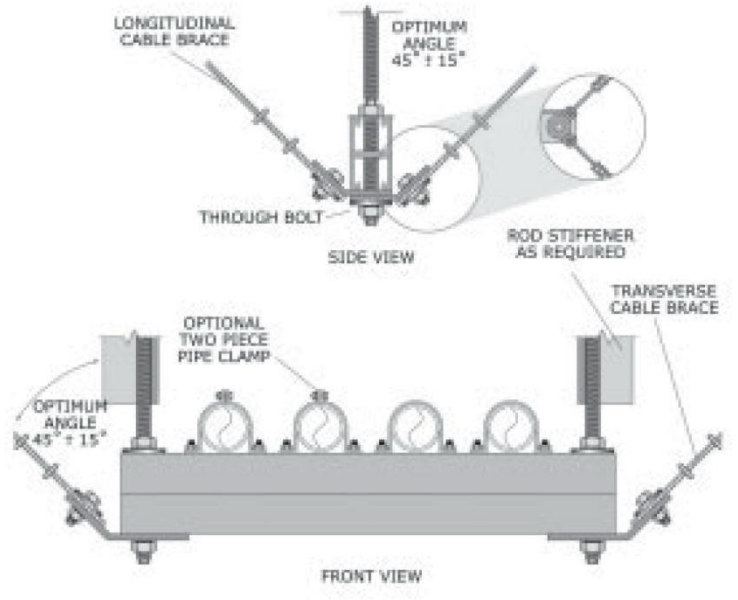

Figure 70: Trapeze support with cable lateral brace.

Figure MEP.3.1-15 Trapeze support with cable lateral brace.