Pressurized Systems Safety Guide

Pressurized systems at MTU include everything from small unheated low pressure laboratory setups to large, extremely high pressure heated metal vessels weighing several tons. The stored energy associated with these systems has the potential to cause injuries ranging from eye injuries to multiple fatalities. A pressure vessel as small as a few liters volume at 200 psi contains enough stored energy to cause fatal injuries as a result of a catastrophic failure.

The primary causes of failure in pressurized metal vessels and components are fatigue cracking due to cyclic loading, overheating, and stress-enhanced corrosion cracking. Pressurized glass components typically fail as a result of corrosion, manufacturing and assembly stresses, and scratches on the glass surface due to improper handling. In both types of materials, failure can occur after a period of use at the originally designed pressure and temperature and without warning.

It is critical, therefore, that pressurized systems be designed by a person knowledgeable in the properties of materials under room and elevated temperature stress and fatigue conditions and who are experienced in pressurized system design. Except for small low pressure laboratory setups and compressed gas distribution systems, this means it is best to purchase the system rather than design it in-house. In all cases, it is best to work closely with the manufacturer of the components and materials to ensure that they are suited to the intended conditions of use.

The following guidelines should be followed in the design, construction, and use of pressurized systems.

Small-Scale Laboratory Setups

- Retain all manufacturer's documentation related to environmental, temperature, and pressure ratings of each component in the system and retain it with other written design specifications for future reference.

- Limit the maximum allowable working pressure, MAWP, and temperature to that of the lowest rated component in the system.

- Use the minimum size system possible to minimize the amount of stored energy.

- Make sure all components, including soldered or brazed joints, in the system are rated for the chemical environment(s) to which they will be exposed.

- Use pressure relief devices set at or below the MAWP of the system unless it is impossible to be overpressurized. A gas regulator is not a pressure relief device.

- Isolate hazardous substances, components, and operations through the use of barricades, shielding, gas cabinets, or remote operation if the consequences of component failure or a process gas leak are unacceptable.

- Do not subject glass equipment to pressure above atmospheric, except under the following

conditions:

- Specially constructed glassware for pressure use which is thoroughly shielded on all sides.

- Pyrex "Double-Tough" glass pipe may be used at temperatures not exceeding 450 degrees Fahrenheit and pressures up to 50 PSI in sizes through 3 inches.

Large-Scale or High Pressure Setups

In addition to the guidelines for small-scale laboratory setups.

Vessel Construction:

- All pressure vessels and piping must be constructed, repaired, altered, or tested according to the ASME Boiler and Pressure Vessel Code.

- Protect all pressure equipment by adequate pressure- relieving devices which vent to a safe location.

- Set safety or relief valves to blow at a pressure not to exceed the MAWP set for the intended operating temperature.

- Be sure the capacity of the pressure-relieving device is sufficient to carry off the maximum quantity of liquid or gas that can be generated in or supplied to the attached equipment without permitting a rise in pressure in the vessel to more than 10% above the maximum allowable working pressure.

- Take the nature of the vessel's contents into account in the design of pressure-relieving devices.

- Do not install a valve between a safety valve or similar device and the vessel being protected by it.

- Test safety valves at frequent intervals.

- Locate apparatus to be used under pressure only in areas specifically designed for that purpose.

Vessel Operation and Maintenance

- Do not subject pressure equipment to any pressure exceeding the maximum allowable working pressure as determined by the ASME Boiler and Pressure Vessel Code or as recommended by the manufacturer.

- If pressure equipment is to be used above 650 degrees Fahrenheit, display the maximum allowable working pressure on the apparatus.

- Follow the manufacturer’s recommended maintenance and inspection procedures.