Coffee Break Training - Fire Protection Series

Hazardous Materials: Cryogenic Fluid Containers

No. FP-2014-10 March 11, 2014

Learning Objective: *The student will be able to describe some of the construction requirements for cryogenic liquids containers.*

As a result of the special conditions under which extremely cold cryogenic liquids must be stored, there are special construction requirements found in National Fire Protection Association 55, *Compressed Gases and Cryogenic Fluids Code.*

These containers are insulated to help keep the cryogenic carbon dioxide liquid cold.

Cryogenic fluid containers should be designed, fabricated, tested, marked (stamped) and maintained in accordance with one or more of the following requirements:

- United States Department of Transportation hazardous materials regulations.
- Transport Canada, Transportation of Dangerous Goods Regulations.
- The American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code, "Rules for Construction of Unfired Pressure Vessels."

Containers for cryogenic liquids typically contain an inner vessel and an outer shell, with the annular space (between the inner tank and outer shell) employed for insulation. The cryogenic vessel's operating principle is similar to a vacuum bottle. Inner tanks generally are made from nickel steel, aluminum or stainless steel, while the outer tanks most often are made from carbon steel.

The inner vessel should be designed and constructed in accordance with Section VIII, Division 1 of the ASME Boiler and Pressure Vessel Code. The outer vacuum jacket should be designed to withstand the maximum internal and external pressure to which it will be subjected under operating conditions, to include emergency pressure relief of the annular space between the inner vessel and the outer vessel.

Stationary tanks should be provided with concrete or masonry foundations or structural steel supports on firm concrete or masonry foundations. They should be supported to prevent the concentration of excessive loads on the supporting portion of the shell and to accommodate container expansion and contraction. Foundations should be designed to withstand soil and frost conditions as well as the anticipated seismic, snow, wind and hydrostatic loading under operating conditions.

Pressure relief devices should be provided to protect containers and systems containing cryogenic fluids from rupture in the event of overpressure. They should also be provided for heat exchangers, vaporizers, insulation casings surrounding containers, vessels, and coaxial piping systems where liquefied cryogenic fluids could be trapped due to leakage from the primary container.

For additional information, consider attending the National Fire Academy's "Hazardous Materials Code Enforcement" (R0615) class. Information can be found at http://apps.usfa.fema.gov/nfacourses/catalog/details/10504.