

POSITION STATEMENT

INTERNAL INSPECTION OF STATIONARY VACUUM-JACKETED STORAGE TANKS FOR CRYOGENIC AND REFRIGERATED LIQUIDS

Question

Should stationary vacuum-jacketed storage tanks for cryogenic and refrigerated liquids be subjected to regular internal inspection?

Answer

The Compressed Gas Association (CGA) *does not recommend* that stationary vacuum-jacketed storage tanks for cryogenic and refrigerated liquids be subjected to regular internal inspection for the following reasons.

Reasons

1. Stationary vacuum-jacketed storage tanks for cryogenic and refrigerated liquids, which are constructed with an inner cryogenic vessel and an outer jacket, have been used successfully for more than 40 years using the integrity checks described in Reason 2 to verify their safe operating condition. Additional internal inspection has not been warranted for the following reasons:
 - The cryogenic liquids such as liquid nitrogen, liquid oxygen, liquid argon, liquid helium, liquid hydrogen, and liquefied natural gas and refrigerated liquids such as nitrous oxide and carbon dioxide that are stored in these vacuum-jacketed storage tanks are noncorrosive;
 - These vacuum-jacketed storage tanks are designed, fabricated, tested, inspected, and stamped in accordance with Section VIII, Division 1 of the *ASME Boiler & Pressure Vessel Code* [1];
 - Allowable working stresses for the inner cryogenic vessels built to the referenced ASME Code are based upon a minimum safety factor of 3.5. Inner cryogenic vessels built before 1999 have a minimum safety factor of 4; and
 - The materials used in the construction of this type of inner cryogenic vessel have excellent fracture toughness at cryogenic temperatures. Thermal and pressure cycling are minimal. Thus, any undetected existing fabrication flaw will not grow to a critical size by stress corrosion cracking and/or a fatigue crack growth mechanism.
2. There are other, more practical, ways to determine the condition of the vacuum-jacketed storage tank.
 - Minute leakage from either the inner cryogenic vessel or outer jacket of vacuum-jacketed storage tanks causes vacuum decay and loss of thermal performance. Routine periodic checking of the vacuum and checking for frost spots during each fill of the tank identifies defects; they are the best indicators of a container's performance and suitability for continuous service.
 - The outer jacket provides structural protection to the inner cryogenic vessel and will show signs of external damage such as dents, gouges, scratches, atmospheric corrosion, etc., that would precede any such effects on the inner vessel.

3. There are possible unintended consequences from internal inspection. Introducing pressure cycles and the potential for internal contamination, necessary to perform internal inspection, would only increase the risk of vessel damage.
 - These vacuum-jacketed storage tanks are ASME Section VIII, Division 1 (noncyclic) designs. It is the rarity of full thermal and pressure cycles, combined with noncorrosive service, which gives these tanks their long service life. Internal inspection would require depressurization of the inner cryogenic vessel. Subjecting tanks to frequent full depressurization in order to perform internal inspections would induce pressure cycles and fatigue not considered in the design.
 - Depressurizing the inner vessel could allow contaminants to enter the system.

NOTE—CGA takes the position that internal inspection of stationary vacuum-jacketed storage tanks for cryogenic and refrigerated liquids should be conducted any time there is indication that tank integrity could have been compromised [2].

References

Unless otherwise specified, the latest edition shall apply.

[1] *ASME Boiler & Pressure Vessel Code*, American Society of Mechanical Engineers. www.asme.org

[2] *CGA PS-4, Position Statement on Periodic Proof Testing of Stationary, Cryogenic Liquid, Vacuum-Jacketed Tanks*, Compressed Gas Association, Inc. www.cganet.com

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