TECHNICAL SAFETY BC

DIRECTIVE

DESIGN AND CONSTRUCTION OF ANHYDROUS AMMONIA PRESSURE VESSELS IN CLOSED-CIRCUIT REFRIGERATION SYSTEMS

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The following directive is being issued by a provincial safety manager pursuant to section 30 of the Safety Standards Act (the Act) to clarify the design requirements applicable to anhydrous ammonia pressure vessels in closed circuit refrigeration systems.

General Details

The 2023 edition of the CSA B52 establishes an exemption from certain design requirements contained within the CSA B51 for anhydrous ammonia pressure vessels in refrigeration service when specific alternative requirements have been met. The 2024 edition of the CSA B51 has introduced a new structure which has seen many clauses moved to new locations. Because of this, the exemption references listed within the 2023 edition of the CSA B52 are no longer accurate. In addition, the 2023 edition of the CSA B52 does not elaborate on requirements or responsibilities related to manual purging.

The purpose of this directive is to clarify the following:

- The exempted clause in CSA B51 if alternative requirements contained within CSA B52 have been met, and
- The requirements and responsibilities surrounding manual purging as a method for the removal of oxygen and other non-condensable gases.

Specific Details

CSA B51, clause 5.2.7.3, includes additional design requirements for pressure vessels handling anhydrous ammonia. These requirements have been introduced to address the unique nature and risks associated with the handling of anhydrous ammonia and are applicable to all ammonia service types.

CSA B52, recognizing the unique nature of closed-circuit ammonia refrigeration applications and the need for alternative risk reduction measures, has introduced an alternative pathway that provides an exemption to the additional design requirements of CSA B51 if specific conditions are met.

Clause 5.6.1.1 of the CSA B52 exempts pressure vessels used in closed circuit ammonia refrigeration systems from the requirements of CSA B51, clause 5.2.7.3 and 6.2.6.1, provided they are manufactured and operated in accordance with the following conditions to minimize the risk of stress corrosion cracking:

a) Manufactured with hot formed heads or cold formed heads that have been stress relieved;

b) Manufactured with all welds being post-weld heat treated as practical; and

c) Operated with a means of removing oxygen and other non-condensable gases from the system, such as an auto purger, or inspection with manual purge.

Note: An example of vessel construction that cannot be post-weld heat treated is a vessel with materials, such as gaskets, used for internals which cannot tolerate temperatures used for post-weld heat treatment. For further information, refer to Appendix H in IIAR 2.

If manual purge is selected as the means of removing oxygen and other non-condensable gases from the system, the owner shall be responsible for developing a procedure and scheduled plan for manual purging. The procedure must also include provisions for record keeping of such manual purging events.

All ammonia-containing pressure vessel that does not meet all of the conditions listed in CSA B52, clause 5.6.1.1 shall follow all applicable requirements of CSA B51 and the code of construction.

Provincial Safety Manager – Boilers, Pressure Vessel, and Refrigeration

References:
Safety Standards Act
CSA B51:2024 - Boiler, pressure vessel, and pressure piping code
CSA B52:2023 - Mechanical refrigeration code