TECHNICAL SAFETY BC

DIRECTIVE

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

Date of Issue: July 2, 2025 **NO: D-BP 2024-06 REV 1**

The following directive is being issued by a provincial safety manager pursuant to section 30 of the Safety Standards Act (the Act) to interpret 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 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, or evaluating the practicality of post-weld heat treatment.

The purpose of this directive is to provide an interpretation of the following:

- The exempted clauses in CSA B51 if alternative requirements contained within CSA B52 have been met;
- The responsibilities for evaluating the practicality of post-weld heat treatment; 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:

CSA B52:23

5.6.1.1

Refrigerant-containing pressure vessels (e.g., heat exchangers, refrigerant storage tanks) shall comply with CSA B51. Refrigerant-containing pressure vessels in ammonia service shall be exempt from CSA B51, Clause 7.6.3, if all of the requirements in Clause 5.6.1.2 of this Standard are met.

5.6.1.2

Pressure vessels containing ammonia, except for vessels primarily containing oil, shall be manufactured, and operated as follows to minimize 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.

Refrigerant-containing pressure vessels in ammonia service shall be exempt from CSA B51:24, clauses 5.2.7.3 and 6.2.6.1, if all of the requirements in Clause 5.6.1.2 of the CSA B52 are met.

It is the responsibility of the manufacturer to evaluate the practicality of the post-weld heat treatment, and the risks associated with not performing post-weld heat treatment if it is deemed to be impractical. If post-weld heat treatment is determined to be impractical and safe to proceed without, the rationale for the decision must be included in the design registration submission.

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 vessels that do not meet all of the conditions listed in CSA B52, clause 5.6.1.2 shall follow all applicable requirements of CSA B51 and the code of construction.

Additional requirements related to ammonia-containing pressure vessels in the CSA B51 and CSA B52 are not applicable to pressure vessels primarily containing oil, including, but not limited to oil separators, oil filters, oil pots and oil coolers (oil side).

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