CODES & STANDARDS

PART THREE OF MANY:
REFRIGERATION STANDARDS & CODES

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In the last issue, I presented a brief history of ASHRAE15 and its preceding standards. In this issue, I will discuss the American Society of Mechanical Engineers' (ASME) code for Pressure Piping and its Section B31.5, which is the Refrigeration Piping and Heat Transfer Components Code.

After the development and publication of the Boiler and Pressure Vessel Code (B&PVC) in 1915, the American Standards Institute, in conjunction with ASME began to develop a code for pressure piping in 1926. The first edition of B31 was published in 1935. Initially, all of the sections were combined as separate chapters in B31, but in 1955, separate sections began to be split off into independent codes. Initially, the following pressure piping codes were created by the split.

- B31.1: Power Piping – includes central and district heating and cooling
- B31.2: Fuel Gas Piping – inactive and superseded by ANZI Z223.1
- B31.3: Process Piping – process piping including chemical and cryogenic plants
- B31.4: Pipeline Transportation Systems for Liquids and Slurries – covers ammonia plants
- B31.5: Refrigeration Piping and Heat Transfer Components – covers refrigerant, heat transfer components, and secondary coolant piping whether erected on premises or as factory assembled, unlisted, systems.
- B31.6: Chemical Plant Piping – now combined with B31.3
- B31.7: Nuclear Power Plant Piping – inactive and superseded by the B&PVC, Section III.
- B31.8: Gas Transmission and Distribution Piping Systems
- B31.9 – Building Services Piping
- B31.10 – Cryogenic Piping – now combined with B31.3
- B31.11: Slurry Transportation Piping – inactive and superseded by the B31.4
- B31.12: Hydrogen Piping & Pipelines

Of these codes, the obvious one that applies to our ammonia refrigeration systems is B31.5, the Refrigeration Piping and Heat Transfer Components Code. However, depending upon the specific application in which the system operates, it is possible that B31.3 or even B31.1 may apply. The key point to remember is that a facility can choose their Recognized and Generally Accepted Good Engineering Practices (RAGAGEP) if their chosen RAGAGEP addresses all the hazards of the process.

So, B31.5 was first split off from B31 in 1962. Prior to that, it's provisions were contained in Section 5 of B31. B31.5 covers piping materials, pipe system design, pipe system fabrication, assembly, erection, testing, and inspection.

B31.5 was first adopted by reference in the model codes

- International Mechanical Code – adopted B31.5 in 2015
- NFPA1 – adopted B31 as a whole in 2003
- Uniform Mechanical Code – adopted B31.5 in 2009
- International Fire Code – has not adopted B31.5

With these adoptions, the provisions of B31.5 officially became enforceable as law when these editions of the model codes were first adopted by authorities having jurisdiction. Some of the more commonly violated provisions include Section 527.3.1, which states that "No welding shall be done if the weld area is wet or exposed to high wind or at a metal temperature below 32°F (0°C)." Another commonly violated section is 538.4.2, Pressure Testing. In paragraph (e), the code states that "the pneumatic test pressure used shall be at least 110% of the design pressure. The test pressure shall not exceed 130% of design pressure of any component of the system." So, if the design pressure of the high side of the system is 300 psig, then the test pressure must be no less than 330 psig and no more than 390 psig. Paragraph (f) states that "the test pressure shall be continuously maintained for at least 10 min. It may then be reduced to the leak test pressure." Bear in mind that a lower pressure held for a longer time does not make it a valid pressure test.

Section 538.4.3 goes on to describe leak testing. It states in paragraph (a) that "examination for leaks shall be by the gas and bubble formation testing as detailed in ASME B&PVC, Section V, Article 10, or by other means of equal sensitivity. Here's where it gets interesting. In paragraph (c), it states that "the pressure used for leak tests shall be either the design pressure or a pressure specified in the engineering design." I have yet to see an engineering design that specifies at leak test pressure other than compliance with B31.5. So, if our high side design pressure is 300 psig, then we must leak test at 300 psig.

What about the closure welds you say? We can't pressure or leak test them without evacuating more of the system. As long as the section of the system that is being installed or replaced is pressure and leak tested appropriately, Section 538.4.4 addresses testing of the closure welds by allowing for the closure weld to be examined in accordance with Section 536.6.2 while the weld is in process, to pass with 100% radiographic examination in accordance with Section 536.6.3, or to pass with 100% ultrasonic examination in accordance with Section 536.6.4. Note that these test methods MUST be documented thoroughly.

In the next issue, I will discuss the history of the International Institute of Ammonia Refrigeration's suite of standards for ammonia refrigeration systems. Please feel free to email me with questions at NH3isB2L@gmail.com.

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