



GUIDELINE

ASHRAE Guideline 38-2018

Guideline for Using Metal Pressure Vessels to Test Materials Used in Refrigeration Systems

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NOTE

Approved addenda, errata, or interpretations for this guideline can be downloaded free of charge from the ASHRAE website at www.ashrae.org/technology.

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FOREWORD

It is important to understand the compatibility of materials and chemicals used in refrigeration and air-conditioning systems through testing at designated conditions. ANSI/ASHRAE Standard 97-2007, Sealed Glass Tube Method to Test the Chemical Stability of Materials for Use within Refrigerant Systems, has been used for decades to evaluate materials and chemicals in systems but is limited to size of components, control of pressure of test condition, and magnitude of pressure that can be achieved¹. Because Standard 97 uses glass tubes, a different method to test at elevated temperature and pressure was desired. Testing in metal pressure vessels alleviates the challenges associated with glass tube testing and can be performed in a safer manner. Lack of proper evaluation can lead to incompatibility of materials and chemicals in refrigeration and air-conditioning systems, which can lead to reduced system performance. This guideline allows a dynamic look at compatibility with fewer limitations on testing due to size and pressure, along with potentially controlling the pressure of the test condition. Larger sample size can allow for an increased number of evaluation techniques and eliminate the need to prepare multiple glass tubes.

1. PURPOSE

This guideline is intended to establish a test procedure using metal pressure vessels for the evaluation of materials used in refrigeration systems. The use of metal vessels allows for the testing of a variety of materials, regulation of the pressure of the test, use of a realistic sample size to oil/refrigerant ratio, and other analytical tests, such as extraction.

2. SCOPE

This guideline describes the preparation of metal pressure vessels and the procedure for charging them with refrigerant and with the materials to be tested. A procedure for heating the metal vessel and regulating the pressure is described. Post-test evaluations can be performed quantitatively and/or qualitatively by observing the metal vessel contents to gain information for determining the compatibility, suitability, or chemical stability of materials in the refrigerant environment. The technique described can be used to evaluate many different types of materials. The guideline does not describe the detailed preparation of the materials to be tested prior to placing them in the metal vessel. The materials to be tested can be aged over a broad range of temperatures and pressures that fall within the safety limits of the vessel. Detailed safety precautions are included. Properly performing this test requires careful attention to the detailed experimental technique and careful adherence to safety procedures.

3. DEFINITIONS

metal pressure vessel (metal vessel): equipment used to contain lubricant, materials, and refrigerant under pressure.

lubricant: a stable fluid that is compatible with system components, forms a friction reducing film between rubbing surfaces and seal critical clearances, and has low temperature transport properties suitable to the application in which it is used.

refrigerant: the working fluid used for heat transfer in a refrigerating system; the refrigerant absorbs heat and transfers it at a higher temperature and a higher pressure, usually with a phase change. Substances added to provide other functions, such as lubrication, leak detection, absorption, or drying, are not refrigerants.

American Society for Testing and Materials (ASTM): an international standards organization that develops and publishes voluntary consensus technical standards for a wide range of materials, products, systems, and services.

plastic: any of various organic compounds produced by polymerization, capable of being molded, extruded, cast into various shapes and films, or drawn into filaments used as textile fibers.

charging apparatus: a device that allows the accurate vacuum transfer of small volumes of gaseous refrigerants to the sealed tube (or metal test cell) containing precharged lubricant. This apparatus consists of a manifold (metal or glass), vacuum pump, pressure gage, high vacuum gage, refrigerant cylinder, valves, and filling ports. The function of this apparatus is to evacuate the metal vessel, degas the lubricant, and add refrigerant. It is calibrated so that the required mass of refrigerant is added very accurately by following the change in pressure on the pressure gage as refrigerant is added to the tube.

personal protective equipment (PPE): equipment worn to minimize exposure to a variety of hazards. Examples of PPE include items such as gloves, foot and eye protection, protective hearing devices (earplugs, muffs) hard hats, respirators, face shields, safety shields, and full-body suits.

refrigeration equipment: systems containing refrigerant and lubricant for use in HVAC&R applications.

4. SAFETY

Failure to follow proper safety procedures and use proper pressure vessels may result in loss of property, personal injury, or even death.

- a. Use pressure vessel manufacture guidelines for the selection of appropriate metal vessels.
- b. Pressure vessels should be used with the appropriate pressure relief mechanisms sized according to vessel size, temperature, and pressure level. If correct charge amounts and vessel sizing practices are followed, it is unusual for a safety release, or burst disc, to release during testing; however, this condition may be caused by unexpected reaction byproducts.
- c. Use sufficient engineering practices for the requirements of health and safety.