STANDARD

ANSI/ASHRAE Standard 218-2019

Method of Test for Lubricant and Refrigerant Miscibility Determination

Approved by ASHRAE and the American National Standards Institute on April 18, 2019.

 ISSN 1041-2336

Approved American National Standard
ANSI
www.ansi.org

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c. offering constructive criticism for improving the Standard, or
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NOTE

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

(This foreword is not part of this standard. It is merely informative and does not contain requirements necessary for conformance to the standard. It has not been processed according to the ANSI requirements for a standard and may contain material that has not been subject to public review or a consensus process. Unresolved objectors on informative material are not offered the right to appeal at ASHRAE or ANSI.)

FOREWORD

Lubricant and refrigerant miscibility is a liquid/liquid property under a prescribed temperature and composition. It is relevant to an HVAC system when the refrigerant is in the liquid phase. When a liquid refrigerant and lubricant are mixed together and remain a single-phase solution, they are then referred to as "miscible." Adequate miscibility between the lubricant and refrigerant is desired in most HVAC system designs to maintain performance. With lubricant being miscible within the refrigerant, viscosity is greatly reduced. This promotes circulation of the lubricant throughout the system and its return to the compressor. It also minimizes the lubricant film thickness coating the heat exchanger coils, which helps promote maximum heat transfer.

1. PURPOSE

The purpose of this standard is to establish a test procedure to determine the critical solution locus of miscible properties of a lubricant and refrigerant mixture.

2. SCOPE

This standard applies to pure-component refrigerant and lubricants and multicomponent refrigerant and lubricant mixtures.

3. DEFINITIONS

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 tube, degas the lubricant, add refrigerant along with the test materials, and seal it. 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.

lubricant: a stable fluid that is compatible with system components, will form a friction reducing film between rubbing surfaces and seal critical clearances, and has low temperature transport properties suitable for the application in which it is used[1].

personal protective equipment (PPE): equipment worn to minimize exposure to a variety of hazards [2]. Examples of PPE include such items as gloves, foot and eye protection, protective hearing devices (earplugs, muffs), hard hats, respirators, face shields, safety shields, and full-body suits.

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 [3].

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

sealed glass tube: a borosilicate glass tube with one end formed into a round bottom. The tube is charged with the refrigerant and lubricant to be tested and then sealed in a rounded tip at the other end [4]. The glass tube must be rated for the maximum pressure anticipated for the test conditions for the refrigerant.

test apparatus: a system of equipment with a specific purpose. Such items include the charging manifold and controlled temperature bath.

test cell: a steel cell containing a charge valve and windows that allow the operator to clearly observe the refrigerant/lubricant mixture for any visual changes. The cell must be rated for the maximum pressure anticipated for the test conditions for the particular refrigerant and possess a pressure relief device.

4. SAFETY

There are inherent hazards when handling pressurized glass tubes or metal vessels. Therefore, the operator shall follow the safety procedures herein and be aware of the possible hazards at every step of the procedure.

Informative Note: See Appendix A for special areas of concern.

5. APPARATUS

This standard shall be conducted by charging lubricant and refrigerant in sealed glass tubes or metal test cells.

5.1 Sealed Glass Tubes. One end is sealed to form a rounded bottom with the open-end fire polished. The preparation of these tubes shall be performed by someone skilled in the art of glass blowing. A skilled glass blower shall take into consideration such factors as

a. proper storage of the glass tubing;
b. proper cleanliness of the tubing;
c. cutting to obtain square ends;
d. the use of a small, sharply pointed oxygen-gas flame and proper glass blower's torch;
e. obtaining a uniform wall thickness throughout; and
f. proper safety precautions (***Informative Note:*** See Appendix A.)

5.2 Metal Test Cell. The metal test cell design shall allow charging of refrigerant and lubricant as well as visualization of the liquid and vapor phases. An example design is shown in Figure 1. The cell is constructed of stainless steel and high-pressure borosilicate sight glass. The metal test cell design shall incorporate a charging port and optional temperature measurement port and pressure relief device.

5.3 Charging Manifold. The charging manifold is illustrated in Figure 2. This apparatus consists of a manifold (metal or