STANDARD

ANSI/ASHRAE Standard 172-2017

Method of Test for Insoluble Materials in Synthetic Lubricants and HFC Refrigerant Systems

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NOTE

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FOREWORD

Partially soluble substances in the refrigerant/lubricant mixture that are soluble under one set of temperatures and pressures in the refrigeration system but precipitate under other conditions or in select components or locations of the system can adversely impact the operation and reliability of refrigeration and HVAC equipment. Such substances can be transported within the system to select components where they can form permanent deposits. The process of selective precipitation and deposit formation not only may remove a critical component of the refrigerant/lubricant mixture from locations in the system where it is needed but also form undesirable insulating films or constrictions to flow. The impact can be most damaging to fixed-orifice, thermally controlled or electronically controlled expansion devices, where even small deposit formation can dramatically alter the diameter or completely block the orifice. Such changes can dramatically decrease the efficiency of the refrigeration equipment and/or lead to complete failure of the equipment.

1. PURPOSE

The purpose of this standard is to define a test method to determine the formation of insoluble materials in synthetic lubricants and hydrofluorocarbon (HFC) systems.

2. SCOPE

The test will determine the presence of materials that separate from refrigerant and lubricant mixtures over a range of temperatures and concentrations. The test is based on the precipitation of insoluble material in a lubricant/refrigerant combination. The results can be used to compare lubricants and refrigerants.

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].

metal 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.

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.

precipitation temperature: the highest temperature at which the working fluid forms a precipitate that is visible to the naked eye.

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: borosilicate glass tube 9 mm (0.35 in.) OD × 7 mm (0.27 in.) ID × approximately 180 mm (7.1 in.) long with one end formed into a round bottom. The above are the finished dimensions. The tube is charged with the refrigerant and materials to be tested and then sealed in a rounded tip at the other end [4].

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

4. SAFETY

4.1 Introduction. There are inherent hazards when handling sealed glass or metal vessels and the materials being tested. At times, the absolute pressure inside the tube is in excess of 6000 kPa (870 psia). It is not unusual for a sealed glass tube to rupture. Therefore, it is mandatory that the operator follow the safety procedures herein and be aware of the possible hazards at every step of the procedure.

4.2 Safety Shield. The operator shall stand behind a large safety shield made of safety glass or plastic whenever examining a vessel that may be under pressure. This safety shield shall protect the operator's head, face, and body.

4.3 Personal Protective Equipment. Personal protective equipment (PPE) shall include a face shield, heavy cloth lab coat, and heavy gloves (see Figure 1). A neck protector is optionally added to the mandatory PPE. The face shield shall extend down to protect the neck and upper chest. The lab coat must be of suitable construction to protect the arms and body in the event that a tube under pressure ruptures. The heavy gloves must be insulated to protect the hands from hot temperatures and cold temperatures incurred when handling glass