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ASHRAE Guideline 39-2024
Method of Test for Measuring Fractionated Compositions of Refrigerant Blends

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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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(This foreword is not part of this guideline. It is merely informative and does not contain requirements necessary for conformance to the guideline.)

FOREWORD

This guideline describes a method of test (MOT) for determining the fractionated compositions of refrigerant blends for the purpose of assigning a safety classification under ANSI/ASHRAE Standard 34. It is prescriptive rather than descriptive; the user must be able to reproduce data on the reference blend R-125/600 and may use either the MOT described here or other methods or apparatus to meet the accuracy requirements.

This MOT is intended to give sufficient details to allow someone who does not routinely perform vapor liquid equilibria (VLE) experiments but is skilled in working with liquefied gases and analytical methods to be able to obtain satisfactory results.

1. PURPOSE

The purpose of this guideline is to establish test methods and procedures to obtain accurate experimentally determined fractionation (vapor and liquid) compositions of refrigerant blends under simulated isothermal leak events from containers and equipment in storage, transport, operation, and service. A fractionation analysis is undertaken to determine the worst case of fractionation for flammability (WCFF) of a refrigerant blend in order to assign flammability safety classifications under criteria established in ANSI/ASHRAE Standard 34. The WCFF, with respect to flammability and worst case of formulation (WCF) compositions of a refrigerant blend, are tested for flammability to determine the refrigerant's lower flame limit and burning velocity, which is used, along with the calculated heat of combustion, in assigning a flammability safety classification for a refrigerant blend.

2. SCOPE

This guideline defines a standardized test apparatus and procedure for experimentally conducting fractionation analyses of refrigerant blends to determine the worst case of fractionation for flammability (WCFF) composition of refrigerant blends or to validate computer simulation programs for fractionation analysis.

3. DEFINITIONS

blend: a refrigerant consisting of a mixture of two or more different chemical compounds, often used individually as refrigerants for other applications.

component: a chemical compound that is mixed with others to form a refrigerant blend.

composition: ratio of components in a blend, normally expressed as a mass percent.

equilibrium: the state in which system properties remain constant with time and, if the system is isolated from its surroundings, the properties do not change.

fractionation: a change in composition of a blend by preferential evaporation of the more volatile components or condensation of the less volatile components.

isothermal leak: a leak that occurs at a fixed temperature—i.e., under conditions such that thermal equilibrium is maintained with the surroundings at a specified fixed temperature.

liquid composition: the concentration (mass percent) of components present in the liquid phase of a refrigerant blend that is in equilibrium with its vapor phase.

liquid sample: a sample taken from the liquid phase of a refrigerant blend.

maximum permissible fill (MPF): maximum amount of refrigerant to be packaged in a shipping container for safe transportation as defined by U.S. Department of Transportation.

nominal formulation: the bulk manufactured composition of the refrigerant blend, which includes the gas and liquid phases.

vapor composition: the concentrations (mass percentages) of components present in the vapor phase of a refrigerant blend that is in equilibrium with its liquid phase.

vapor sample: a sample taken from the vapor phase of a refrigerant blend.

worst case of formulation for flammability (WCF): the nominal formulation, including the composition tolerances, that results in the most flammable composition.

worst case of fractionation for flammability (WCFF): the composition produced during fractionation of the worst case of formulation for flammability that results in the highest concentration of flammable components as identified in ANSI/ASHRAE Standard 34 in the vapor or liquid phase.