



|  |              |                |
|--|--------------|----------------|
| <b>SURFACE VEHICLE<br/>STANDARD</b>  | <b>J2763</b> | <b>FEB2015</b> |
|  | Issued       | 2008-08        |
|  | Reaffirmed   | 2015-02        |
| Superseding J2763 AUG2008  |              |                |
| Test Procedure for Determining Refrigerant Emissions from<br>Mobile Air Conditioning Systems |              |                |

## RATIONALE

J2763 has been reaffirmed to comply with the SAE five-year review policy.

## INTRODUCTION

Vehicle makers and A/C system and component suppliers are continually improving the containment of system refrigerant. For development purposes, a common means of measuring refrigerant emissions was deemed desirable; this standard test method is intended to serve that purpose. For commonality with existing vehicle testing, the testing takes place in a chamber (mini-shed) under a static temperature profile and under the California Air Resources Board's Title 13 ambient profile (CARB Profile).

### 1. SCOPE

This SAE Standard covers the Mini-Shed testing methodology to measure the rate of refrigerant loss from an automotive air conditioning (A/C) system. This SAE procedure encompasses both front and rear air conditioning systems utilizing refrigerants operating under sub-critical conditions.

#### 1.1 Purpose

The purpose of the SAE Mini-Shed Test Refrigerant Emission procedure is to provide a means of measuring refrigerant emissions from properly assembled vehicle air conditioning systems under specific A/C usage conditions (i.e., typical use conditions) and to convert the results to an estimated annual refrigerant emission rate (g/yr). Such conversion from laboratory test results to estimated vehicle emission applies to properly assembled systems and does not account for normal production assembly variations.

SAE Technical Standards Board Rules provide that: "This report is published by SAE to advance the state of technical and engineering sciences. The use of this report is entirely voluntary, and its applicability and suitability for any particular use, including any patent infringement arising therefrom, is the sole responsibility of the user."

SAE reviews each technical report at least every five years at which time it may be revised, reaffirmed, stabilized, or cancelled. SAE invites your written comments and suggestions.

Copyright © 2015 SAE International

All rights reserved. No part of this publication may be reproduced, stored in a retrieval system or transmitted, in any form or by any means, electronic, mechanical, photocopying, recording, or otherwise, without the prior written permission of SAE.

TO PLACE A DOCUMENT ORDER: Tel: 877-606-7323 (inside USA and Canada)  
Tel: +1 724-776-4970 (outside USA)  
Fax: 724-776-0790  
Email: CustomerService@sae.org  
http://www.sae.org

**SAE values your input. To provide feedback  
on this Technical Report, please visit  
[http://www.sae.org/technical/standards/J2763\\_201502](http://www.sae.org/technical/standards/J2763_201502)**

SAE WEB ADDRESS:

## 2. REFERENCES

### 2.1 Applicable Publications

The following publications form a part of this specification to the extent specified herein. Unless otherwise indicated, the latest version of SAE publications shall apply.

#### 2.1.1 SAE Publications

Available from SAE International, 400 Commonwealth Drive, Warrendale, PA 15096-0001, Tel: 877-606-7323 (inside USA and Canada) or 724-776-4970 (outside USA), [www.sae.org](http://www.sae.org).

SAE J2727 HFC-134a Mobile Air Conditioning System Refrigerant Emission Chart

#### 2.1.2 Other Publications

European Emission Regulation Number 706/2007 of 21 June 2007

California Air Resources Board's Title 13 Ambient Profile

Armines, Dr. Denis Clodic, Ecole Des Mines (Paris): "Research Study on the Definition of the Implementation of a Method of Measurement of Annual Leak Flow Rates (LFRs) of MAC Systems"

## 3. TEST PROCEDURE

### 3.1 System Assembly

3.1.1 Starting with components that have never been exposed to refrigerant, assemble the A/C system on the test fixture per system schematic. Do not charge the system with refrigerant.

3.1.2 Tighten each fitting to its specified minimum torque.

3.1.3 Make all electrical connections and pressure connections.

3.1.4 Place test fixture in the Emission Test Chamber (Volume of ~1 cubic meter).

3.1.5 The Emission Test Chamber (Mini-Shed) should be equipped with an expansion bag to assure isobaric conditions throughout the test. Changes in temperature cause corresponding changes in pressure (which can cause leakage from the chamber), or in volume (which slightly affect ppm/vol readings). Slight variations in volume are preferred over mass loss from the chamber during testing. Readings taken at calibration temperature should not be affected.

3.1.6 Larger chambers may be required for large A/C systems and will require proportionately larger volumetric injections of refrigerant during the calibration procedure (below).

### 3.2 Chamber Calibration

3.2.1 Refrigerant vapor injected in this procedure is to be accomplished at known and recorded atmospheric pressure and temperature for subsequent conversion to mass injected.

3.2.1.1 Record atmospheric pressure.

3.2.2 Refrigerant concentration measurements (ppm by volume readings) should be taken every 2 minutes. If the equipment has a longer response time, measurements should be taken at the shortest measurement interval possible.

- 3.2.3 To verify chamber integrity, inject 100 cc of refrigerant per cubic meter chamber volume and record ppm measurement for 24 hr. Readings shall vary no more than 5% after initial stabilization.
- 3.2.4 The following procedure is intended to enable construction of a calibration curve covering the full range of expected refrigerant emission to be measured.
- 3.2.5 Purge the chamber with fans. Flush the gas analyzer lines with dry nitrogen to remove any residual water vapor and refrigerant from the line sets.
- 3.2.6 Close the chamber and record refrigerant ppm. If above 5 ppm of refrigerant, open chamber, start fans to purge chamber. Close chamber and re-measure ppm. Repeat as necessary until the level drops below 5 ppm.
- 3.2.7 Stabilize the system at  $20\text{ }^{\circ}\text{C} \pm 2\text{ }^{\circ}\text{C}$  chamber temperature for 1 hr, recording emissions. Record initial chamber concentration (ppm) for 10 minutes. ppm readings should vary less than 10%. If greater, check for refrigerant intrusion from outside the chamber or equipment malfunction.
- 3.2.8 Record initial chamber ppm and then, with a gas-tight syringe, inject 5.0 cc of pure refrigerant vapor into chamber and record refrigerant concentration for at least 10 minutes. Last 2 readings must be within 10% of each other. If greater, check for refrigerant intrusion from outside the chamber or equipment malfunction. Open chamber, start fans to purge chamber. Close chamber and re-measure ppm. Repeat as necessary until the level drops below 5 ppm.
- 3.2.9 Repeat 3.2.8, injecting 10.0 cc of pure refrigerant vapor.
- 3.2.10 Repeat 3.2.8, injecting 20.0 cc of pure refrigerant vapor.
- 3.2.11 Repeat 3.2.8, injecting 30.0 cc of pure refrigerant vapor.
- 3.2.12 Repeat 3.2.8, injecting 40.0 cc of pure refrigerant vapor.
- 3.2.13 Continue additions as necessary to construct calibration curves covering the expected range of test chamber concentrations.

### 3.3 Calibration Curves

- 3.3.1 Calculate the net change in refrigerant emission concentration (c) for each injection.

$$c = \text{final concentration} - \text{initial concentration} \quad (\text{Eq. 1})$$

- 3.3.2 From the volumes of refrigerant added in 3.2.8 to 3.2.13 and their corresponding net changes in measured concentration (c), construct a calibration curve of ppm vs.  $V_{\text{ref}}$  as shown in Figure 1.
- 3.3.3 Multiply the refrigerant vapor density (at measured and recorded injection conditions of atmospheric pressure and temperature) by each volume of refrigerant added to construct a calibration curve of ppm vs. refrigerant mass emitted as shown in Figure 2. Record the atmospheric pressure to which this calibration curve corresponds for subsequent atmospheric pressure corrections of test data.