

	SURFACE VEHICLE RECOMMENDED PRACTICE	
	SAE	J1598 MAY2009
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Superseding J1598 DEC1999		
Laboratory Testing of Vehicle and Industrial Heat Exchangers for Durability Under Vibration-Induced Loading		

RATIONALE

This document has been converted to Word format and corrections have been made to spelling, punctuation, and grammar. SAE J2679, Charge Air Cooler Leakage, has been added to the list of applicable publications in section 2.1.1 and it has been specified in section 5.7 as the method of determining leaks in charge air coolers. A suggestion to filter road cycle data has been added to section 5.3.1 to reduce test time.

1. SCOPE

This SAE Recommended Practice is applicable to all liquid-to-gas, liquid-to-liquid, gas-to-gas, and gas-to-liquid heat exchangers used in vehicle and industrial cooling systems. This document outlines the test to determine durability characteristics of the heat exchanger from vibration-induced loading.

1.1 Purpose

This document provides a test guideline for determining the durability of a heat exchanger under specified vibration loading.

2. REFERENCES

2.1 Applicable Publications

The following publications form a part of this specification to the extent specified herein. The latest issue 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.

SAE J1542	Laboratory Testing of Vehicle and Industrial Heat Exchangers for Thermal Cycle Durability
SAE J1597	Laboratory Testing of Vehicle and Industrial Heat Exchangers for Pressure-Cycle Durability
SAE J2679	Charge Air Cooler Leakage

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3. OBJECTIVE

To verify compliance with established criteria that insures durability in a specific application. This document describes a system to induce stresses in a heat exchanger resulting from vibration loading. The process is accomplished by vibrating the unit at specified frequencies, and amplitudes or at specified frequencies and acceleration.

4. FACILITY REQUIREMENT

The facility should provide the following as required:

4.1 Vibration equipment with controls on frequency, amplitude, and acceleration (for 50 Hz and below, electrohydraulic is suggested, higher frequencies may require electrodynamic).

4.2 Test Fixture

4.2.1 Actual Installation

4.2.2 If actual installation is not available, a fixture should support the heat exchanger with orientation as in service or as specified. The fixture must be rigid so as not to induce any additional dynamic inputs.

4.3 Means of checking heat exchanger integrity.

4.4 Equipment to monitor motion of unit during test.

4.5 Source for pressurizing and heating test unit if required.

4.6 Additional equipment may include but not be limited to the following:

- a. Accelerometers
- b. Automatic data logging equipment
- c. Automatic emergency shutdown
- d. Cycle counters
- e. Digital signal analyzer
- f. Function generator (sine wave, random noise, square wave, ramp function, etc.)
- g. Load transducers
- h. Pressure gauges
- i. Pressure regulators
- j. Road data recording equipment
- k. Safety features as specified by regulatory codes and common practices
- l. Strain measurement equipment
- m. Temperature monitoring and control equipment

5. TESTING

5.1 Test heat exchanger for integrity.

5.2 Install test unit on vibration test fixture, fill with specified test fluid, orientation the same as in service or as specified, and to include all mounting hardware: isolators, tie rods, mounting brackets, etc. All heat exchanger mounted masses will affect the response characteristics of the test unit and should be attached. Examples of mounted masses for a radiator are: charge air cooler, condensers, oil cooler, air dryers, shrouds, shutter, etc.

5.3 Set up control system to obtain the specified vibration cycle under one of the following modes:

5.3.1 Road or duty cycle (simulation or replication). It may be desirable to filter road cycle data to remove non damaging portions of the drive event (smooth road for example) to reduce overall test time.

5.3.2 Failure mode simulation.

5.3.3 Sine sweep at specified acceleration or amplitude.

5.3.4 Resonant frequency at specified energy input.

5.3.5 Random noise at specified acceleration levels.

5.3.6 Per established specification.

5.4 Pressurize and heat the test unit if required.

CAUTION: Pressures exceeding specified maximum value can cause significant structural damage which will invalidate the test results. The system shall be capable of maintaining this pressure within 5% absolute pressure unless otherwise specified and should be measured within or as near the test units a possible.

5.5 Run test to specified duration or component failure.

5.6 Remove and test heat exchanger for leaks and structural damage. Methods described in SAE J2679, Charge Air Cooler Leakage, should be used for air-to-air charge air coolers to determine if post test leakage is acceptable.

6. TEST DOCUMENTATION

6.1 During and after test, document leakage rate(s), location(s), and structural failures for comparison to acceptance criteria. Methods described in SAE J2679, Charge Air Cooler Leakage, should be used for air-to-air charge air coolers to determine if post test leakage is acceptable.

6.2 Document the following:

a. Condition of unit prior to test (new or previous history)

b. Unit Orientation (Reference to 5.2)

c. Test Mode (Reference to 5.3)

d. Pressure and Temperature (Reference to 5.4)

e. Duration of Test (Reference to 5.5)

f. Location of leaks and structural damage (Reference to 5.6)

6.3 Testing should be adequately documented to allow test reproduction. Documentation to include a test log of the complete test, recording any changes in the heat exchanger and fixture. Test log to include cycles or hours, time of day for all test starts and stops with reasons for stops.