

Submitted for recognition as an American National Standard

**Laboratory Testing of Vehicle and Industrial Heat Exchangers
for Pressure-Cycle Durability**

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 tests to determine durability characteristics of the heat exchanger under pressure cycling.
- 1.1 **Purpose**—This document provides a test guideline for determining the durability of a heat exchanger under specified pressure-cycle conditions.
2. **References**
- 2.1 **Applicable Publications**—The following publications form a part of this specification to the extent specified herein. Unless otherwise specified, the latest issue of SAE publications shall apply.
 - 2.1.1 SAE PUBLICATIONS—Available from SAE, 400 Commonwealth Drive, Warrendale, PA 15096-0001.

SAE J1542—Laboratory Testing of Vehicle and Industrial Heat Exchangers for Thermal Cycle Durability
SAE J1598—Laboratory Testing of Vehicle and Industrial Heat Exchangers for Durability Under Vibration Induced Loading
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 specified pressure variations. The process is accomplished by varying the pressure in the unit at a specified frequency and temperature.
4. **Facility Requirement**—The facility should provide the following as required:
 - 4.1 Source of pressurized fluid at specified temperature and pressure range.
 - 4.2 Means of moving these fluids to and from the test unit in a specified manner.
 - 4.3 Means of checking heat exchange integrity.

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4.4 A system adequate to control the pressure cycle as specified. It may include but not be limited to the following:

- a. Automatic data logging equipment
- b. Automatic emergency shutdowns
- c. Electrical relays, timers, switches, indicator lights, and related items as required
- d. Flow measuring devices
- e. Fluid filters
- f. Heaters and controls
- g. Leak detector
- h. Pressure cycle counters
- i. Pressure gauges
- j. Pressure regulators for each fluid
- k. Pressure switches
- l. Pumps
- m. Relief and back pressure regulators
- n. Safety features as specified by regulatory codes and common practices
- o. Tanks
- p. Temperature indicators

See Figure 1 for typical control system as reference.

5. Testing

5.1 Test heat exchanger for integrity.

5.2 Install test unit as specified (orientation as in service) in a safe manner.

5.3 Set up control system to obtain the specified pressure cycle (see Figure 2 for typical pressure cycle).

5.3.1 High pressure and pressure range to be specified based on specific application. High pressure and pressure range to be at least equal to or greater than normal operating conditions.

CAUTION—Pressures exceeding specified 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 unit as possible.

5.3.2 High- and low-pressure dwell, and rate of pressure change, are to be as specified.

5.3.3 Fluid temperature to be as specified and controlled within 1% absolute temperature unless otherwise specified. The specified temperature should be near the maximum value expected in service.

5.4 Run test to specified cycle duration or heat exchanger failure.

5.5 Remove and test heat exchanger for leaks and structural damage.

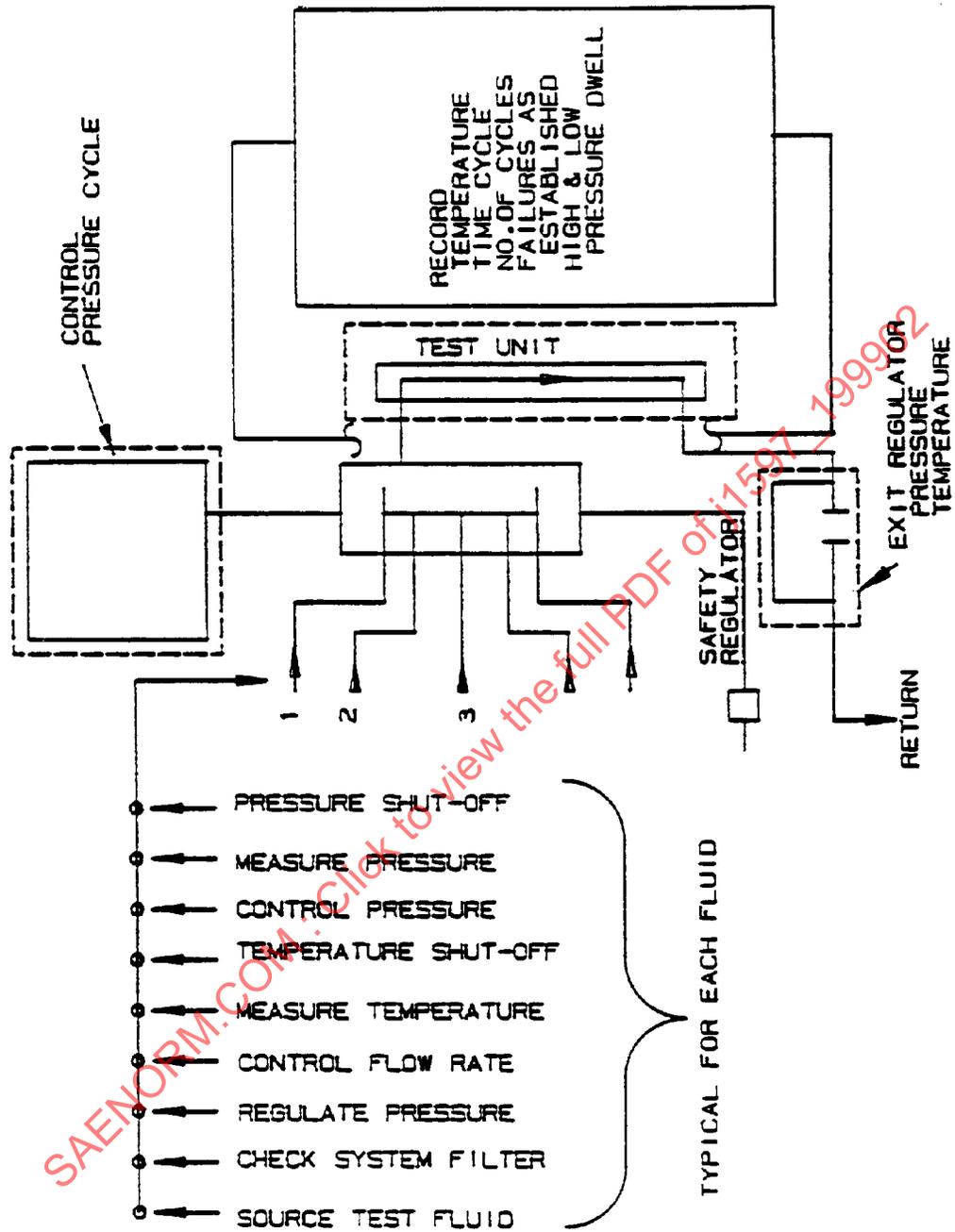


FIGURE 1—TYPICAL CONTROL SYSTEM

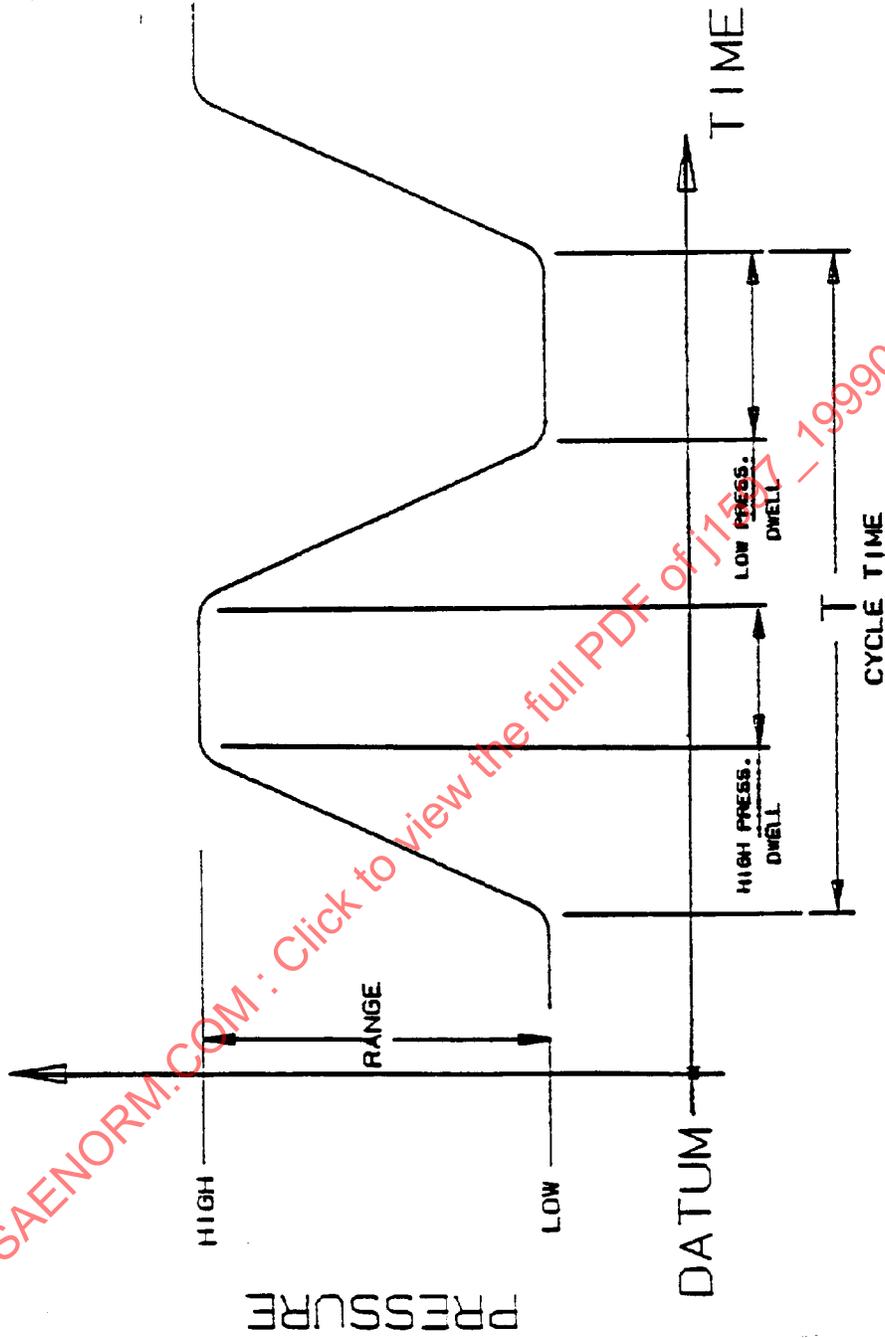


FIGURE 2—TYPICAL PRESSURE CYCLE