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SAE J1597 JUL88

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

SAE Recommended Practice
Issued July 1988

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Submitted for Recognition as
an American National Standard

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LABORATORY TESTING OF VEHICLE AND INDUSTRIAL HEAT EXCHANGERS
FOR PRESSURE CYCLE DURABILITY

1. PURPOSE:

This recommended practice provides a test guideline for determining the durability of a heat exchanger under specified pressure cycle conditions.

2. SCOPE:

This 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.

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 be not limited to the following:

Automatic data logging equipment

Automatic emergency shutdowns

Electrical relays, timers, switches, indicator lights, and related items as required

Flow measuring devices

Fluid filters

Heaters and controls

Leak detector

Pressure cycle counters

Pressure gauges

Pressure regulators for each fluid

Pressure switches

Pumps

Relief and back pressure regulators

Safety features as specified by regulatory codes and common practices

Tanks

Temperature indicators

See Fig. 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 Fig. 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.

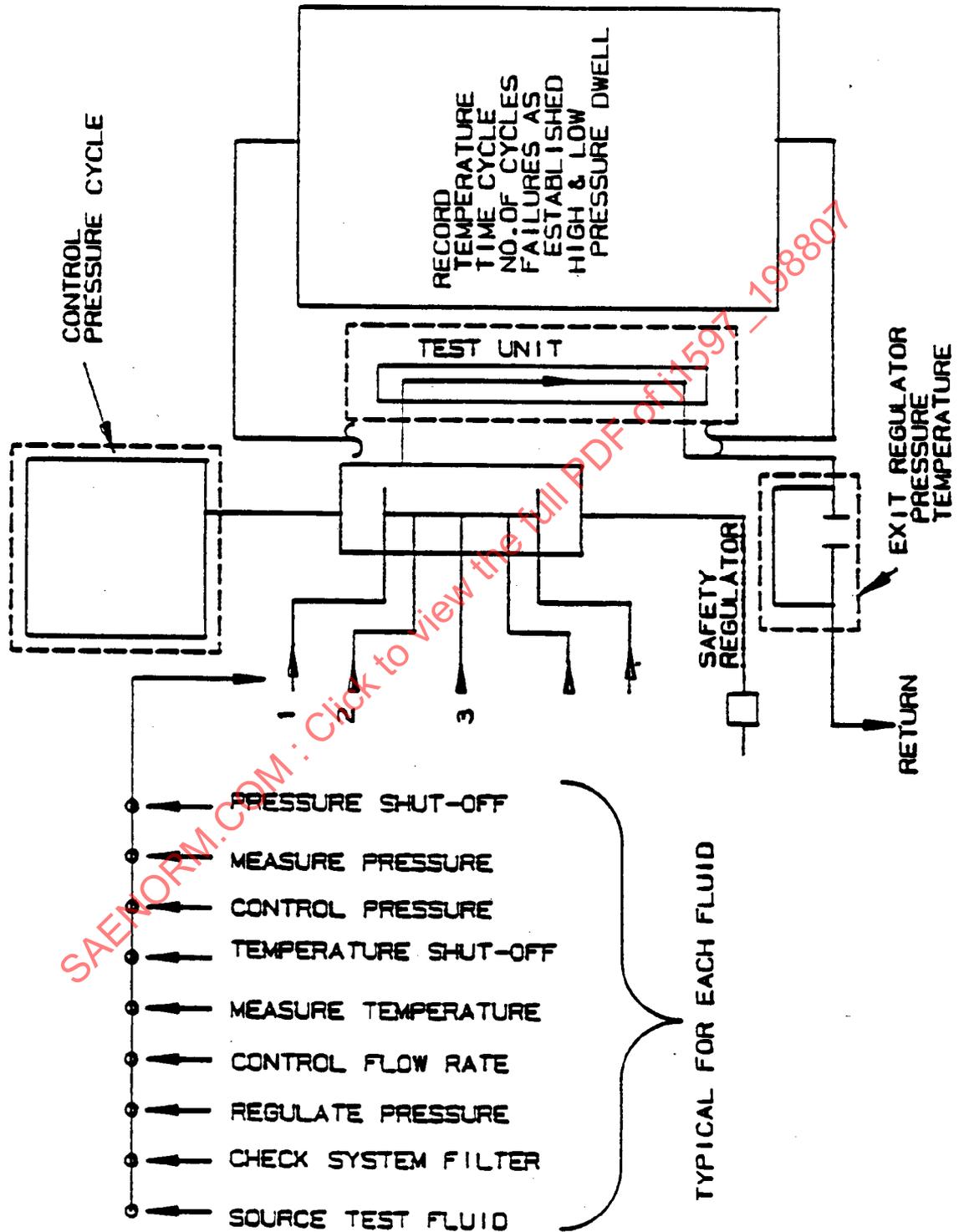


FIGURE 1 - Typical Control System

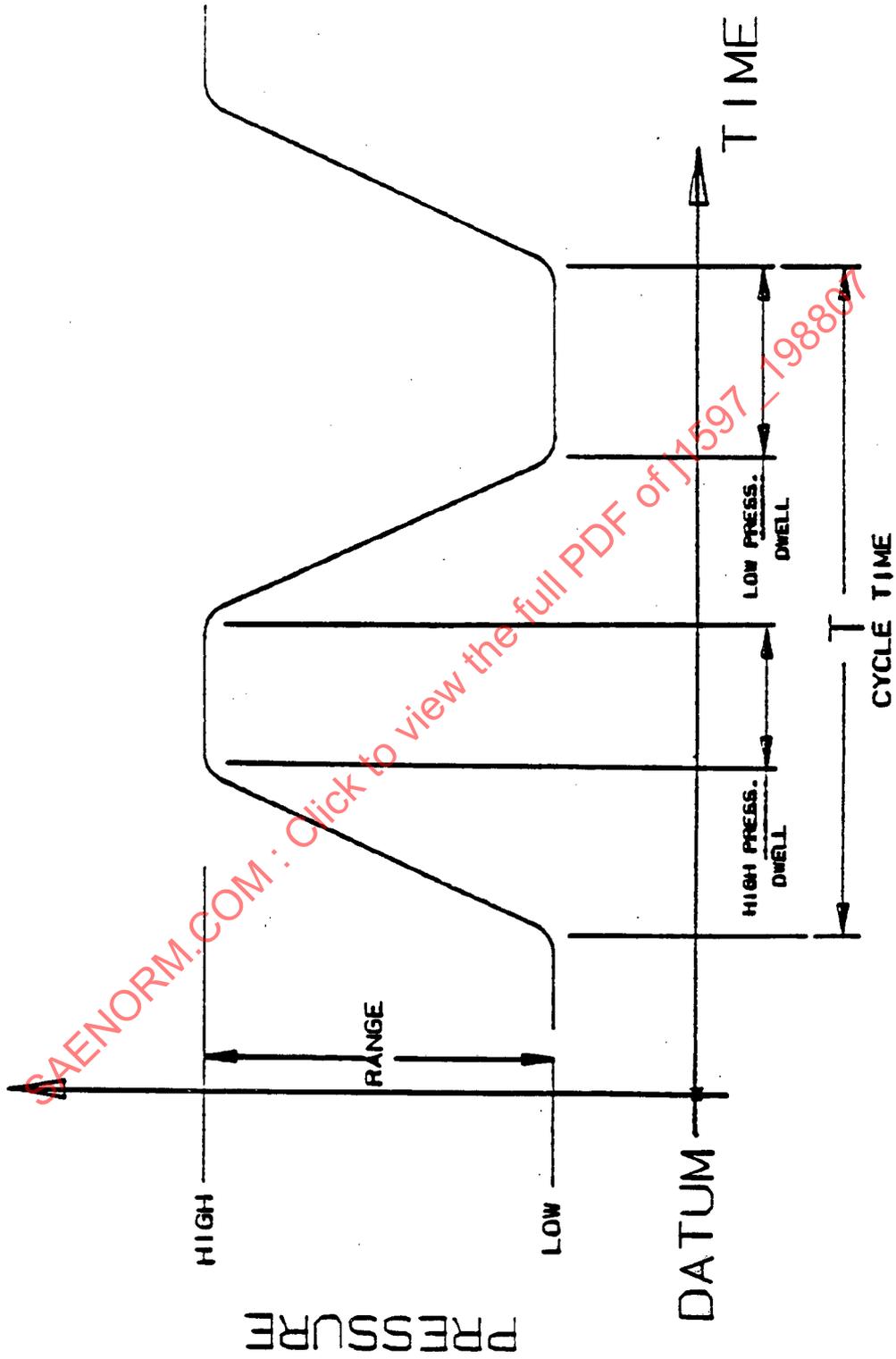


FIGURE 2 - Typical Pressure Cycle

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.

6. TEST DOCUMENTATION:

6.1 During and after the test, document leakage rate and location(s) at specified pressure (gauge or absolute) and compare to acceptance criteria.

6.2 Document the following:

- . Condition of unit prior to test (new or previous history)
- . Unit Orientation (Ref. 5.2)
- . Pressure Range (Ref. 5.3.1)
- . High Pressure (Ref. 5.3.1)
- . Frequency, Pressure Dwell, High & Low, Rate of Pressure Change (Ref. 5.3.2)
- . Fluid Temperature (Ref. 5.3.3)
- . Number of Cycles to Completion (Ref. 5.4)
- . Location of Leaks and Structural Damage (Ref. 5.5)
- . If testing is continuous, or in block units

7. This recommended practice is valid for durability comparison of pressure cycle conditions only. Correlation to field results must be developed on an individual basis. Other tests affecting heat exchanger durability are SAE J1542 (Thermal Cycle) and SAE J1598 (Vibration). These tests can be run in combination as well as independently.

NOTE: Combination testing may make it difficult to determine cause of failure.

RATIONALE:

Not applicable.

RELATIONSHIP OF SAE STANDARD TO ISO STANDARD:

Not applicable.

REFERENCE SECTION

SAE J1542

SAE J1598

APPLICATION:

This 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.

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