



# ASHRAE<sup>®</sup> STANDARD

AN AMERICAN NATIONAL STANDARD

## Method of Testing Air-to-Air Heat Exchangers

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**AMERICAN SOCIETY OF HEATING,  
REFRIGERATING AND  
AIR-CONDITIONING ENGINEERS, INC.**

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## CONTENTS

Section	Page
1. Purpose .....	1
2. Scope .....	1
3. Definitions .....	1
4. Basis of Performance Testing .....	1
5. Measurements .....	1
6. Calculations .....	6
7. Test Preparation and Performance .....	8
8. Reporting Results .....	9

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## 1. PURPOSE

1.1 The purpose of this standard is to

- (a) establish a uniform method of testing for obtaining performance data;
- (b) specify data required, calculations to be used, and reporting procedures for testing the performance of an air-to-air heat exchanger;
- (c) specify types of test equipment for performing such tests.

## 2. SCOPE

2.1 This standard prescribes methods for testing the performance of certain air-to-air heat exchangers.

2.2 In this standard, an air-to-air heat exchanger is a device utilized to transfer heat from one airstream to another. The types of air-to-air heat exchangers covered by this standard are

- (a) rotary energy recovery wheels
- (b) heat pipe exchanger
- (c) thermosiphon exchanger
- (d) coil recovery loop exchanger
- (e) fixed plate exchanger
- (f) open spray recovery loop exchanger

2.3 This standard is not intended for testing a packaged system, sometimes called a heat recovery ventilator.

## 3. DEFINITIONS

**accuracy:** the ability of an instrument to indicate or record the true value of a measured quantity. The error of indication, which is the difference between the indicated value and the true value of the measured quantity, expresses the accuracy of an instrument.

**air leakage:** air quantity gain or loss between airstreams in cfm ( $m^3/s$ ).

**coil recovery loop exchanger:** finned-tube water coils with interconnecting piping placed in supply and exhaust airstreams and filled with a circulated liquid heat transfer fluid.

**crossover:** migration between airstreams.

**effectiveness:** actual energy transfer divided by the maximum possible transfer.

**fixed plate exchanger:** multiple alternate channels, separated by a wall of metal or other materials, connected to supply and exhaust airstreams.

**heat pipe exchanger:** a tube, placed in side-by-side supply and exhaust airstreams, fabricated with an internal capillary wick structure and filled with a refrigerant heat transfer fluid.

**open spray recovery loop exchanger:** extended surface contractor towers with interconnecting piping placed in supply and exhaust airstreams. A circulated heat and mass transfer fluid is alternately brought in direct contact with each airstream.

**packaged systems:** heat recovery devices that combine the exchanger with filters, fans, and controls.

**precision:** closeness of agreement among repeated measurements of the same physical quantity by the same method under the same conditions. (An instrument may be precise but inaccurate.)

**rotary energy recovery wheels:** porous discs, fabricated from materials with heat retention capacity, that rotate through internally separate, side-by-side, supply and exhaust airstreams.

**standard air (I-P):** dry air at 70°F and 14.696 psia. Under these conditions, dry air has a mass density of 0.075 lbm/ft<sup>3</sup>.

**standard air (SI):** dry air at 21°C and 101.325 kPa abs. Under these conditions, dry air has a mass density of 1.204 kg/m<sup>3</sup>.

**thermosiphon exchanger:** a tube, or coils with interconnecting piping, placed in supply and exhaust airstreams and filled with a refrigerant heat transfer fluid.

## 4. BASIS OF PERFORMANCE TESTING

### 4.1 Performance Determinations

#### 4.1.1

(a) Determination of the heat transfer effectiveness of the heat exchanger in transferring sensible, latent, and total heat from one airstream to another over the range of the specified operating conditions.

(b) Determination of the air friction pressure drop through the unit for both supply and exhaust airstreams.

(c) Determination of the crossover operating conditions using tracer gas procedures.

(d) Determination of the air leakage rate from one airstream to the other at various manufacturer-recommended operating conditions using airflow measurement procedures.

(e) Tests (a) through (d) should be conducted on the same unit with no adjustment to the unit equipment configuration between tests.

## 5. MEASUREMENTS

### 5.1 Accuracy and Precision (see Table 1)

### 5.2 Instrumentation

Temperature and humidity measurement instruments, unless noted below, shall be in accordance with *ASHRAE Standards 41.1-84 (RA 91)* and *41.6-82*, respectively.

#### 5.2.1 Temperature

Temperature measurement shall be made with one or more of the following instruments:

- (a) Mercury-in-glass thermometers
- (b) Platinum resistance thermometers
- (c) Individually calibrated thermistors
- (d) Individually calibrated thermocouples

#### 5.2.2 Humidity

Humidity measurement shall be made with one or more of the following instruments:

- (a) Aspirated psychrometer