© ASHRAE. Per international copyright law, additional reproduction, distribution, or transmission in either print or digital form is not permitted without ASHRAE's prior written permission.

CONTENTS
ANSI/ASHRAE Standard 84-2024
Method of Testing Air-to-Air Heat/Energy Exchangers

SECTION **PAGE**

Foreword 2
1 Purpose 2
2 Scope 2
3 Definitions 3
4 Requirements for Performance Testing 4
5 Test Parameters 7
6 Operating Conditions, Inequality Checks, and Conditions for Rejection of Test Data 8
7 Pre- and Post-Test Uncertainty Analysis 10
8 Instruments and Methods of Measurement 10
9 Calculations 16
10 Reporting Results 17
11 Nomenclature 18
12 Normative References 19
Informative Appendix A: Laboratory Test Configurations 21
Informative Appendix B: Transient Testing of Energy Exchangers Using a Bag Sampling Method 26
Informative Appendix C: An Explanation for the Use of Effectivenesses to Characterize Air-to-Air Heat/Energy Exchangers 27
Informative Appendix D: Selection of Test Conditions 33
Informative Appendix E: Field Testing 36
Informative Appendix F: Extrapolation of Test Performance Data 40
Informative Appendix G: Informative References and Bibliography 41

NOTE

Approved addenda, errata, or interpretations for this standard can be downloaded free of charge from the ASHRAE website at www.ashrae.org/technology.

© 2024 ASHRAE

180 Technology Parkway · Peachtree Corners, GA 30092 · www.ashrae.org · All rights reserved.

ASHRAE is a registered trademark of the American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc.
ANSI is a registered trademark of the American National Standards Institute.

Preview

© ASHRAE. Per international copyright law, additional reproduction, distribution, or transmission in either print or digital form is not permitted without ASHRAE's prior written permission.

(This foreword is not part of this standard. It is merely informative and does not contain requirements necessary for conformance to the standard. It has not been processed according to the ANSI requirements for a standard and may contain material that has not been subject to public review or a consensus process. Unresolved objectors on informative material are not offered the right to appeal at ASHRAE or ANSI.)

FOREWORD

ASHRAE Standard 84 provides rules for the measurement and expression of values characterizing the energy-related performance of air-to-air heat/energy exchangers.

Application of the standard is determined by reviewing introductory Sections 1 through 3, which provide the scope and purpose of the standard and defines its terms. Section 4 presents the metrics that express performance of a heat/energy exchanger, the measurements that must be taken, and the equations used to calculate the metrics. This section also identifies the essential required instrumentation and requires pretest uncertainty analysis and appropriate instrument calibrations. Section 5 outlines the basic test procedures. The quality of test data is discussed in Section 6, which outlines the use of measurement inequalities to detect and reject invalid tests. Section 7 sets out the uncertainty levels that a performance test must satisfy to be acceptable. (Informative Appendix D shows how test conditions can be selected to meet specified uncertainty limits.) Section 8 describes acceptable instruments and measurement methods and the ASHRAE standards prescribing relevant measurement methods. The specialized measurement methods required for testing of fixed-bed regenerators, in which steady-state outlet conditions are not achieved, are introduced here for the first time. (Informative Appendix B provides examples from peer-reviewed literature of these measurement methods and testing of fixed-bed regenerators.) Performance calculations and test result reporting are presented in Sections 9 and 10, respectively. In an effort to both provide more flexibility in the design of test labs and to provide additional guidance, all discussion of test system layout has been moved from the normative body of the standard to Informative Appendix A. The special challenges in field testing of air-to-air heat/energy exchangers are discussed in Informative Appendix E. The extrapolation of test performance data is discussed in Informative Appendix F.

The 2024 edition of Standard 84 updates references. This standard was prepared under the auspices of ASHRAE. It may be used, in whole or in part, by an association or government agency with due credit to ASHRAE. Adherence is strictly on a voluntary basis and merely in the interests of obtaining uniform standards throughout the industry.

1. PURPOSE

The purpose of this standard is to

a. establish a uniform method of test for obtaining the effectiveness of air-to-air heat/energy exchangers;
b. specify the test conditions, data required, uncertainty analysis to be performed, calculations to be used, and reporting procedures for testing the performance of an air-to-air heat/energy exchanger; and
c. specify the types of test equipment for performing such tests.

2. SCOPE

2.1 This standard prescribes the laboratory methods for testing the performance of air-to-air heat and energy exchangers. In this standard, an air-to-air heat/energy exchanger is a device to transfer heat, or heat and water vapor, from one airstream to another. The types of air-to-air heat/energy exchangers covered by this standard are as follows.

2.1.1 Regenerators:

a. Rotary regenerators (including heat wheels and total energy wheels)
b. Fixed-bed regenerators, including double-core regenerators, but excluding indoor fixed-bed regenerators that require connecting ductwork at Station 1 and 4 in which reversing airflows will occur in the field, and single-core fixed-bed regenerators

2.1.2 Exchangers with intermediate energy transfer medium arranged in a closed-loop circuit:

a. Heat pipe exchangers
b. Thermosiphon exchangers
c. Recovery loop exchangers (run-around loops)

2.1.3 Recuperators:

a. Fixed-plate exchangers (including sensible-only and enthalpic plates)