



ASHRAE STANDARD

Criteria for Moisture-Control Design Analysis in Buildings

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CONTENTS

ANSI/ASHRAE Standard 160-2009 Criteria for Moisture-Control Design Analysis in Buildings

SECTION	PAGE
Foreword.....	2
1 Purpose	2
2 Scope	2
3 Definitions, Abbreviations, and Symbols	3
4 Criteria for Design Parameters	3
5 Criteria for Selecting Analytical Procedures	7
6 Moisture Performance Evaluation Criteria.....	7
7 Reporting	8
8 References	8
Informative Annex A: Flowcharts	9
Informative Annex B: Commentary on Standard 160	11
Informative Annex C: Bibliography	13

NOTE

When addenda, interpretations, or errata to this standard have been approved, they can be downloaded free of charge from the ASHRAE Web site at www.ashrae.org.

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FOREWORD

Although the majority of new buildings are safe, comfortable, and designed to provide effective protection against moisture-related problems, there are a certain number of buildings built each year that do experience moisture or mold problems. Whether this number is now increasing and whether the increase is due to the greater emphasis on energy-efficiency measures today is a widely debated topic. This purpose of this standard is not to answer either of these questions but rather to provide guidance on how to best design buildings with adequate moisture control features. Given its position as a leader in the proper design of heating, ventilating, and air-conditioning equipment, ASHRAE is uniquely qualified to provide such guidance.

During the last two decades, a number of computer simulation tools have been developed to predict thermal and moisture conditions in buildings and the building envelope. In addition to their use as forensic tools in the investigation of building failures, these computer models are increasingly used to make recommendations for building design in various climates. However, results obtained with these models are extremely sensitive to the assumed moisture boundary conditions. For instance, during winter in cold climates, the moisture conditions in walls depend greatly on the indoor humidity conditions. Thus, a consistent approach to moisture design demands a consistent framework for design assumptions, or assumed "loads." The question whether design features such as vapor retarders or ventilation systems are necessary cannot be answered objectively unless there is a consensus definition of the interior and exterior moisture boundary conditions that the building is expected to be able to sustain without negative consequences to itself or its inhabitants. This standard formulates design assumptions for moisture design analysis and criteria for acceptable performance.

Ideally, a design analysis involves the determination of the probability of failure and treats all design parameters and loads as stochastic variables. However, sufficient data are often not available to make a full statistical treatment practical. Instead, where only limited data exist, a moisture design protocol must be based on a combination of statistical data and professional judgment. Another judgment involves the choice of an acceptable probability of the occurrence of damage. Although it is common to impose very stringent criteria for structural design because of safety concerns, moisture damage usually occurs over a long period of time and usually has less catastrophic, although sometimes costly, consequences. An international consensus has emerged that the analysis should be predicated on loads that will not be exceeded 90% of the time. This standard adopts this approach.

In a moisture analysis for building envelope design, the choice of indoor environmental conditions is extremely important, especially for buildings in cold climates. This standard opts for a design indoor climate definition that is based on engineering principles, is independent of construction, and reflects the influence of ventilation and air-conditioning equipment and controls that may or may not be part of the building design. In buildings where indoor humidity and temperature are explicitly controlled, the building envelope performance should be evaluated with the intended indoor design conditions. In residential buildings, indoor humidity is rarely explicitly controlled, so default design assumptions are needed for these buildings. In general, the standard encourages designers to use their own design parameter values if they are known and part of the design. If they are unknown or not included in the design, the standard provides default values for those loads and parameters.

The standard does not address design details that deal with rainwater intrusion, plumbing leaks, ground water, and water damage caused by natural disasters such as floods and hurricanes. While proper design for these issues is extremely important, and damage from such events involves a large percentage of moisture damage in buildings, they can be more effectively addressed by codes, training of the trades, and specific design guidelines (see Annex B, "Commentary on Standard 160"). This standard assumes that appropriate measures were taken to limit bulk water entry into the building and building envelope. It does not intend to replace the judgment of the design professional. Rather, it provides a framework for the design professional to identify and consider factors that are important to the durability and serviceability of the building. In addition, many items in this standard are based on incomplete information and are, therefore, partially based on the best professional judgment of the standard committee at the time of writing. The development of this standard has pointed to many unanswered questions, questions that hopefully will be addressed and answered by research in the near future.

1. PURPOSE

The purpose of this standard is to specify performance-based design criteria for predicting, mitigating, or reducing moisture damage to the building envelope, materials, components, systems, and furnishings, depending on climate, construction type, and HVAC system operation. These criteria include the following:

- a. Criteria for selecting analytic procedures
- b. Criteria for inputs
- c. Criteria for evaluation and use of outputs

2. SCOPE

2.1 This standard applies to the design of new buildings and to the retrofit and renovation of existing buildings.

2.2 This standard applies to all types of buildings, building components, and materials.