


Moisture Guidance From U.S. EPA




Moisture Control
Guidance for Building
Design, Construction
and Maintenance


Indoor Air Quality (IAQ)

Moisture Guidance from U.S. EPA 1


EPA Guidance Documents



Guidance for Homeowners



Remediating Mold




Avoiding Problems In Commercial and Institutional Buildings

Moisture Guidance from U.S. EPA 2

Avoiding moisture and mold problems

Developed: 2004 - 2013 Released: February 2014



Foreword: How to Use this Guidance

Acknowledgements

Chapter 1
Moisture Control in Buildings
Introduction
Health Implications of Dampness in Buildings
Moisture Damage in Buildings
Moisture Problems and Expenses
How Water Causes Problems in Buildings
Moisture Control Principles for Design
Moisture Control Principle #1: Control Liquid Water
Moisture Control Principle #2: Manage Condensation
Moisture Control Principle #3: Use Moisture-Tolerant Materials
The Basics of Water Behavior

Chapter 2
Designing for Moisture Control
Introduction
Designing Effective Moisture Controls
Building Commissioning
Who Should Read this Chapter
Site Drainage
Foundations
Walls
Roof And Ceiling Assemblies
Plumbing Systems
HVAC Systems

Chapter 3
Constructing to Prevent Moisture Problems
Introduction
Pre-Construction Planning
Site Drainage Construction
Foundation Construction
Wall Construction
Roof and Ceiling Assembly Construction
Plumbing System Installation
HVAC System Installation

Chapter 4
Operating and Maintaining Moisture-Controlled Environments
Introduction
Site Drainage Maintenance
Foundation Maintenance
Wall Maintenance
Roof and Ceiling Assembly Maintenance
Plumbing System Operation and Maintenance
HVAC System Operation and Maintenance

Appendix A - The "Pen Test"

Appendix B - Roof Inspection Checklist

Appendix C - Testing Moisture During Construction

Appendix D - Air Pressure Mapping

Appendix E - HVAC Inspection Checklist


Appendix F - Site Drainage Maintenance

Appendix G - Dampness & Mold Evaluation

Glossary

Moisture Guidance from U.S. EPA 3

<http://www.epa.gov/iaq/moisture>



Moisture Control Guidance for Building Design, Construction and Maintenance

This document provides building professionals with practical guidance to control moisture in buildings during design, construction and maintenance. The guidance includes audience specific moisture control guidance related to site drainage, foundations, walls, roof and ceiling assemblies, plumbing systems, and HVAC systems as well as methods for verifying the appropriate implementation of the discussed moisture control recommendations.

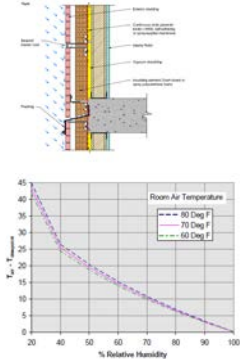
Content Overview

- Chapter 1 - Principles of moisture control**
 - Core Concepts and Relevant Principles
 - Basic health implications
 - How water moves into and within a building and
 - Why the movement of water should be controlled or changed
- Chapter 2 - Designing for Moisture control**
 - Audience: professionals who design buildings and produce drawings, specifications and contracts for construction or renovation
- Chapter 3 - Constructing to Prevent Moisture Problems**
 - Audience: professionals who erect buildings from the construction documents
- Chapter 4 - Operating and Maintaining Moisture-Controlled Environments**
 - Audience: professionals who maintain and/or operate buildings, conduct preventive maintenance, inspect the landscape, building interior and exterior equipment and finishes, and those who perform maintenance and repairs

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Chapter 1 Basics

- **Manage liquid water**
 - Rain and snow
 - Surface and groundwater
 - Plumbing
- **Manage condensation**
 - Within assemblies
 - Inside the building
- **Manage water during construction**
- **Mold resistant materials**



Structured by...

1st
The sequence of building construction decisions

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2nd
The building sub-assembly

For each sub-assembly:

- Issue
- Goals
- Guidance
- Verification (QA)

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Architectural decisions during design

Site + Foundation

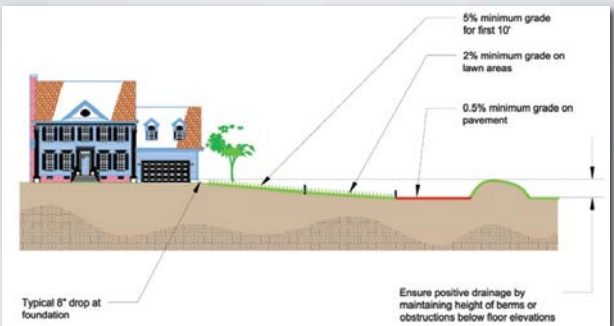
- Site drainage
- Foundation drainage and vapor barrier
- Capillary break in the foundation
- SEALED and DRY crawl spaces

Walls + Roof

- Air gap and drainage plane behind exterior cladding
- Pan flashing under windows and doors
- 6-sided and air and water barrier—sealed along all joints

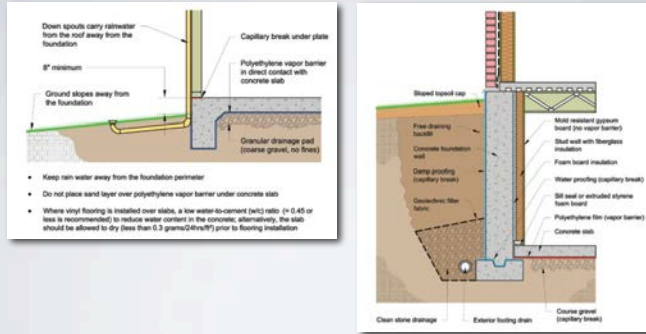
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Site drainage



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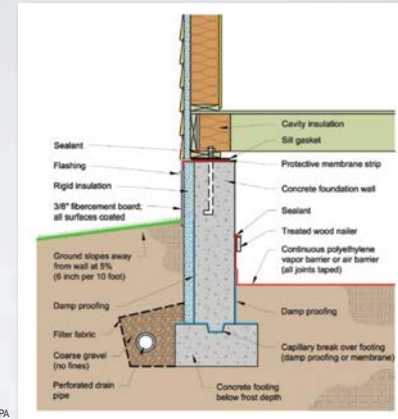
Foundation drainage + Capillary break



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9

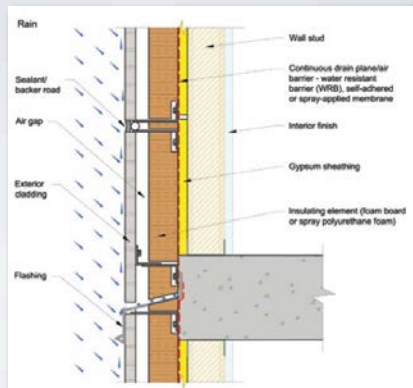
Sealed and dry crawl spaces



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10

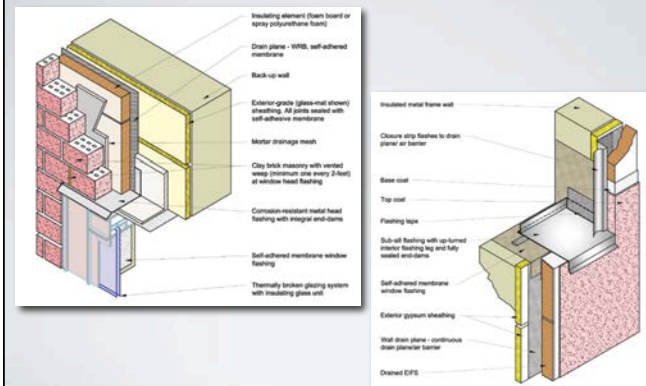
Walls: Cladding, flashing, air gap and drainage plane



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11

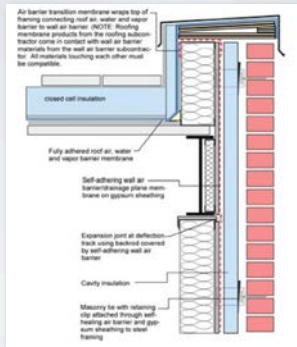
Windows and doors: Head, jamb and pan flashing



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12

6-sided air and water barrier SEALED at long joints
Roof-wall, wall-wall and wall-foundation



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HVAC Design

Equipment Design

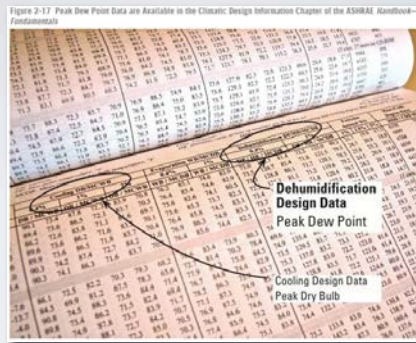
- 55°F indoor dew point
- Use ASHRAE peak outdoor dew point for humidity control design (not peak temperature)
- Don't oversize cooling—it leads to major problems

Air-side Design

- Exhaust humid air and provide DRY makeup air
- Avoid plenums—Use sealed duct work instead
- Seal ALL duct connections, using mastic

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ASHRAE peak dew point design data



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Chapter 3 Constructing

- To prevent moisture problems during construction contractors need a plan:
 - Keeping moisture sensitive stuff dry
 - Responding to accidental water problems when they happen
- Contractors must effectively implement the moisture control elements in the construction documents

Moisture Control Principles For **Construction**

1. Things get wet during construction - That's life. But the building **must dry out**.
2. Understand the **purpose** of moisture-related design details. If the design has problems RFI, substitution, proposed alternates, Vulcan mind-meld
3. **Installation** is often more important than design.
4. The **sequence of installation** matters—a lot

Moisture Control Principles For **Operation and Maintenance**

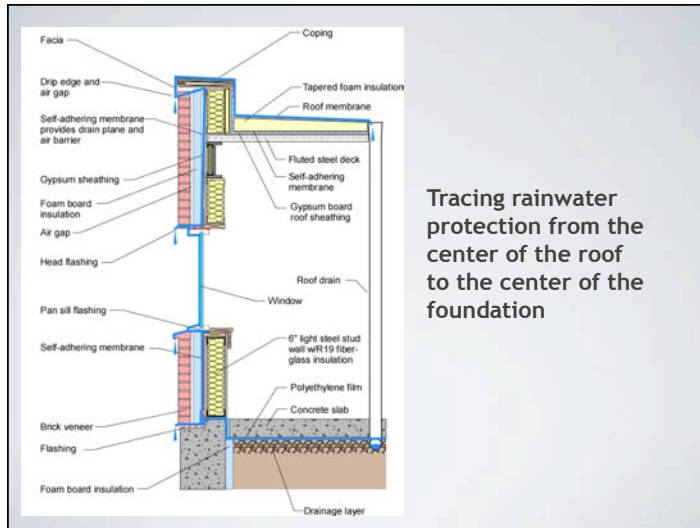
1. Principles are less useful for maintenance personnel than component-specific **checklists**. Generate checklists and use them:
 - a. Site and foundation **drainage**
 - Walls and roof **leaks**
 - Plumbing **leaks** and HVAC **filters**

Troubleshooting checklist

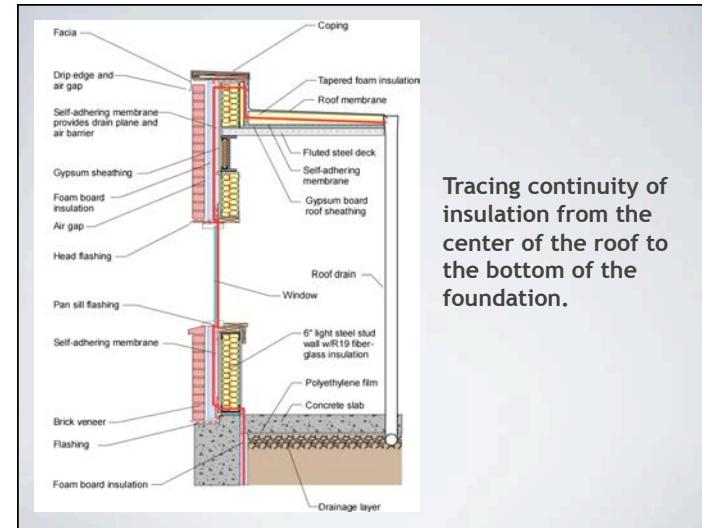
Table 4-1 Troubleshooting Common Indoor Water Problems

SYMPTOMS	MOISTURE PROBLEM	POTENTIAL CAUSES		
		DESIGN	CONSTRUCTION	USE
Mold growth Insufficient dehumidification by HVAC system? Condensation on dirty surface water HVAC systems Wet materials installed in building assemblies	Leaks in the building envelope due to problems with rain and groundwater control	Missing or poorly designed details	Missing flashing or building error	Failure to identify and repair potential gaps near foundation
		Insufficient air conditioning equipment	Incorrect sloping	Missing sifflings
		Improper installation during construction	Incorrect sub-grade drainage	Failed or missing air barrier
		Improper operation and maintenance practices	Improperly installed air barrier	Improperly installed air barrier
Flashing leaks and spills Water stains to materials that contact building envelope	Leaks in the building envelope due to problems with rain and groundwater control	Improper design	Flashing installed in a space that reaches heating temperatures	Failure to seal penetrations during maintenance, repair or installation of new equipment
		Improper installation during construction	Flashing installed in a space that reaches heating temperatures	Failure to seal penetrations during maintenance, repair or installation of new equipment
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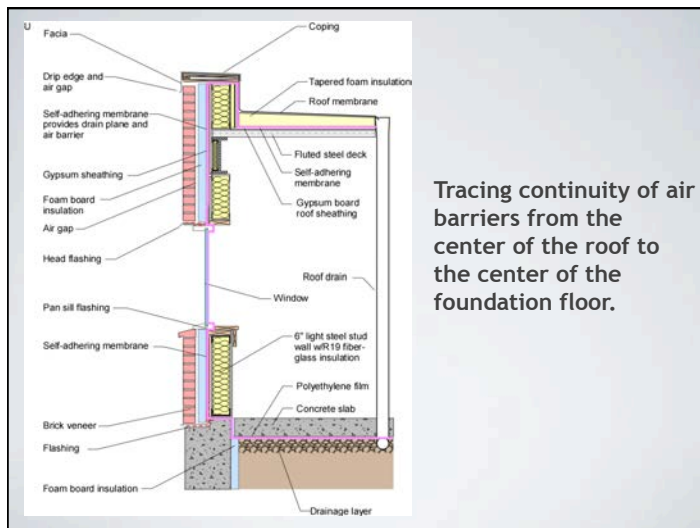
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Tracing rainwater protection from the center of the roof to the center of the foundation



Tracing continuity of insulation from the center of the roof to the bottom of the foundation.



Tracing continuity of air barriers from the center of the roof to the center of the foundation floor.