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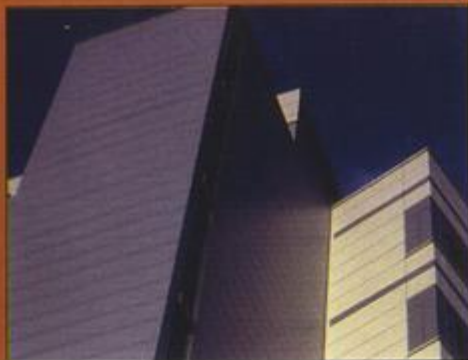
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Exterior Wall Moisture Solutions

Today's building teams face numerous problems in their quest to build new structures that are moisture and thermal resistant—but there are solutions.

BY MARK A. THIMONS

Many of the materials and methods used for wall construction in the past 30 years are resulting in more problems than solutions. Architects, engineers and designers are seeking new construction materials and techniques to meet this new market challenge, and offer innovative exterior wall solutions. Thermal and moisture protection has quickly become one of the hottest industry topics as the architects, designers and contractors who build new structures, and the owners who maintain them, place more and more emphasis on energy efficiency, minimizing moisture entrapment within the wall cavity, and mold prevention.

PROBLEMS

Engineers, continuing to dissect the exterior wall in search of solutions, have identified the following challenges:

- Increasing demands to stop moisture intrusion and entrapment in exterior walls

- The need for better insulation values to reduce energy costs
- Requirements for more durable materials to provide a longer service life.

Problem 1: In the 1970s, industry standards changed in response to the energy crisis. On the inside, buildings became tighter with minimal air infiltration and more insulation. On the outside, thinner curtain walls of glass, brick veneer and metal replaced traditional exteriors of stone and brick. Unfortunately, the newer materials couldn't stand the test of time.

Curtain walls were intended to be watertight. But over time, due to poor construction methods and questionable product quality, sealants failed and moisture seeped through the thin veneers, causing irreversible water damage. Today, buildings with these materials show signs of compromised insulation and deterioration of metal supports, with the potential to become

breeding grounds for damaging and dangerous mold.

Problem 2: When thin veneers replaced thick traditional exterior building materials, lightweight studs became the wall support system of choice for many structures. Builders placed varying amounts of insulation into the cavities between these metal studs. However, recent research published by the American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE) indicates that placing insulation between metal studs greatly reduces the thermal effectiveness of the insulation.

According to ASHRAE 90.1-2001, *Energy-efficient Design of New Buildings Except Low-Rise Residential Buildings*, insulation value reductions of as much as 65 percent can be the result of this type of construction (see table below). The insulation's R-values are not going to deliver according to their specifica-

Effective Insulation/Framing Layer R-Values for Wall Insulation Installed Between Steel Framing

Nominal Depth of Cavity (in.)	Actual Depth of Cavity (in.)	Rated R-Value of Airspace or Insulation	Effective Framing/Cavity R-Value at 16 in. on center	Effective Framing/Cavity R-Value at 24 in. on center
Empty cavity, no insulation				
4	3.5	R-0.91	R-0.79	R-0.91
Insulated Cavity				
4	3.5	R-11	R-5.5	R-6.6
4	3.5	R-13	R-6.0	R-7.2
4	3.5	R-15	R-6.4	R-7.8
6	6.0	R-19	R-7.1	R-8.6
6	6.0	R-21	R-7.4	R-9.0
8	8.0	R-25	R-7.8	R-9.6

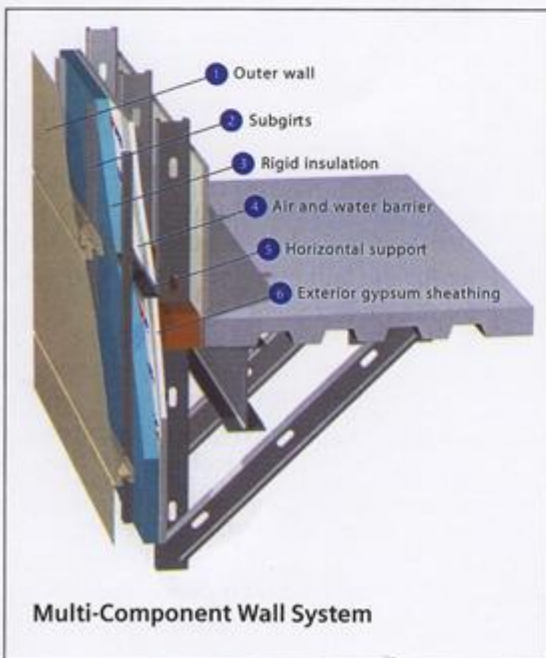
tions, not only because the insulation lacks continuity, but also because the steel studs provide no thermal break within the wall assembly. An R-20 insulation can easily be reduced to an effective R-8 by the through-conductivity of the metal stud frame and the discontinuities in the insulation itself, as indicated by ASHRAE 90.1. Additionally, when the vapor retarder is placed on the inside of the stud line, it is more difficult—if not impossible—to make the barrier continuous, resulting in an increased likelihood of entrapped moisture.

Problem 3: Vapor diffusion causes moisture penetration in many wall assemblies. Methods to prevent vapor diffusion vary across the United States, according to climate. In cold climates, vapor barriers are located on the warm side of the insulation. In warm, humid areas, such as the southeast, vapor barriers are located outside the insulation. In moderate climates, a special vapor barrier with a variable perm rating is used, because it can adjust to varying temperature and humidity conditions.

Moisture can also be transported through airflow. The volume of moisture transported through airflow can be 50 to 200 times greater than that transported through vapor diffusion. Any small penetration in the vapor barrier allows moisture-laden air to travel into the wall cavity. Moisture-laden air moving across the building envelope condenses instantly upon any surface cooled to its dew point temperature, depositing liquid water that may lead to wall system deterioration.

Air and water barriers, either permeable or impermeable as dictated by the local climate, must be continuous to perform effectively. Even properly installed membranes can be damaged by penetration and weather-induced deterioration. Unfortunately, penetration is unavoidable. Even the fasteners used to affix the vapor barrier are examples of intentional penetrations that can create system failures even before construction is complete.

Problem 4: One of today's trends is to layer exterior gypsum applied to the outside of metal stud wall supports, with an air and water barrier, rigid insulation and an exterior wall material. This multi-layered construction requires a high degree of trade coordination among multiple subcontractors. Therefore, no one person is responsible for the total wall performance. To make matters worse, numerous penetrations are required to attach the air and water barrier membrane, rigid insulation or subgirts, which may result in leaks or entrapped moisture.



SOLUTIONS

Recent research into thermal and moisture management issues in exterior walls has resulted in the development of new wall design concepts. These solutions help simplify exterior wall construction and installation processes, providing superior performance.

Solution 1—Single-Component Wall System Construction: With single component wall system construction, air-, water- and vapor barriers, exte-

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rior sheathing and insulation are combined to form an integrated system. The ideal single component wall system is a dry-sealed, metal, factory-foamed, insulated composite sandwich panel with proven rain screen and pressure equalized joinery that prevents moisture penetration.

This creates a rigid air and water barrier for improved pressure equalization, ultimate continuity of vapor barrier, superior insulation value and without mold food sources such as batt insulation and paper-faced exterior sheathing. The exterior aesthetic wall surface works as a primary rain screen with pressure-equalized joinery. This panel, placed outboard of the metal stud supports, eliminates through-conductance and maintains optimum thermal performance. Single-component rain screen construction provides a single source for all wall cavity components, eliminates trade jurisdiction problems and creates a solution for all climates.

Solution 2—Insulated Composite Back-up Panel (ICBP): An insulated composite back-up panel can be placed behind other single skin metal and composite wall panels or other wall materials. A properly constructed wall



The new Sheridan Elementary School in Sheridan, AR, now features a modern metal facade with CENTRIA's Formawall Dimension Series metal wall panels.

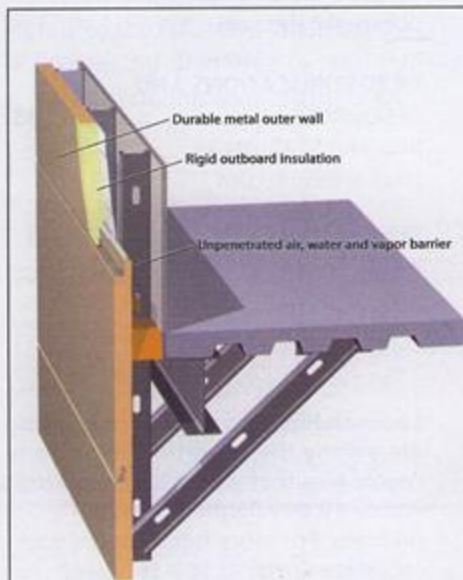
with an insulated composite back-up panel maintains the positive attributes of the single component wall system (described in Solution 1), and provides a vent and drain space for the cavity between the exterior metal wall panel and the ICBP.

THE BENEFITS OF INTEGRATED SYSTEMS

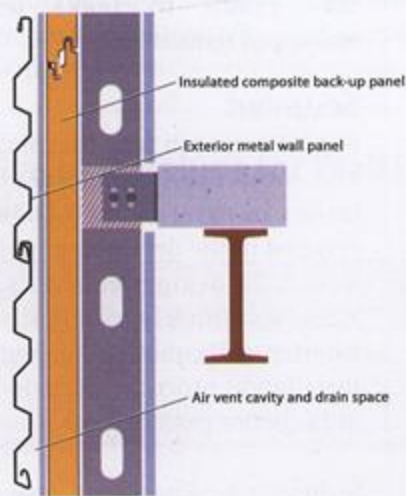
Moisture can lead to damaged insulation and reduced thermal values, the weakening of building supports due to corrosion, and potentially-harmful mold growth. These potential moisture problems, coupled with thermally inefficiency, can be disastrous for any type of building. But the solution is simple: Specify an integrated system that allows for continuous air and water barriers, insulates properly, eliminates mold food sources and minimizes trade jurisdiction problems. Metal and other non-porous materials should be specified for the exterior wall component because they will not absorb moisture.

Single-component wall system construction and insulated composite back-up panels provide viable solutions to today's moisture management issues. These solutions can be specified for new construction, as well as renovation of existing buildings. In addition to the thermal and moisture benefits, these systems are lighter in weight and require fewer materials. By focusing on these integrated wall systems, designers can create long-life buildings that are not only thermally efficient and cost effective, but are also healthier for the building's occupants and safer for the environment. ■

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Single-Component Wall System



Insulated Composite Back-Up Panel