

INNOVAPANEL® TECHNICAL BULLETIN TB-009

Mini-Split HVAC Systems in High-Performance SIP Structures

Design Recommendations for Humid Climates

Architects • Engineers • Builders • HVAC Contractors • Homeowners

“Cooling Is Not Ventilation.”

PURPOSE

This Technical Bulletin provides design recommendations for the use of ductless mini-split air-conditioning systems in InnovaPanel® Structural Insulated Panel (SIP) buildings located in hot-humid and tropical climates.

Because SIP structures are highly insulated and extremely airtight, traditional HVAC design assumptions often do not apply. Improperly designed mini-split systems may result in elevated indoor humidity levels, poor air circulation, condensation issues, and reduced indoor air quality.

This bulletin is intended to assist architects, engineers, builders, and homeowners in developing HVAC systems that support healthy indoor environments while protecting the long-term performance of the building.

COOLING IS NOT VENTILATION

Mini-split air conditioning systems have become increasingly popular due to their energy efficiency, zoning capabilities, quiet operation, and ease of installation. However, mini-split systems alone do not provide the ventilation, humidity control, and whole-house air circulation required for optimal performance in highly insulated SIP structures located in hot-humid climates.

UNDERSTANDING SIP BUILDINGS

InnovaPanel® SIP structures routinely achieve airtightness levels far exceeding those of conventional construction.

Benefits include:

- ✓ Lower energy consumption
- ✓ Reduced utility costs
- ✓ Improved occupant comfort
- ✓ Better indoor air quality control
- ✓ Reduced outdoor contaminant infiltration

However, tighter buildings require carefully designed ventilation and humidity control systems.

Unlike conventional leaky structures, high-performance SIP homes cannot rely on accidental air leakage to remove moisture generated by daily living activities.

Moisture generated from:

- Showers
- Cooking
- Laundry
- Occupants
- Pets

must be intentionally removed through mechanical ventilation and dehumidification systems.

MINI-SPLIT SYSTEMS – BENEFITS AND LIMITATIONS

Mini-split systems provide several advantages:

- ✓ High efficiency
- ✓ Variable-speed operation
- ✓ Zone control
- ✓ Reduced electrical consumption
- ✓ Quiet operation

However, mini-splits have important limitations.

Most ductless mini-split systems:

- ✗ Do not provide fresh air ventilation
- ✗ Do not provide whole-house air circulation
- ✗ Do not exchange stale indoor air
- ✗ Only condition the room where the indoor head is installed
- ✗ May provide inadequate dehumidification in humid climates

A mini-split system should never be considered a complete ventilation strategy for a high-performance SIP structure.

THE HUMIDITY PROBLEM

Florida, the Caribbean, Hawaii, Coastal Texas, Louisiana, Mississippi, Alabama, and similar regions experience extremely high outdoor humidity levels.

In these climates:

The primary HVAC challenge is often humidity control rather than temperature control.

Because SIP structures are highly insulated and energy efficient:

- Cooling loads are significantly reduced.
- HVAC systems are frequently oversized.
- Oversized systems short cycle.
- Short cycling reduces moisture removal.

When humidity is not properly controlled, the result can include:

- Condensation
 - Surface moisture
 - Mold growth
 - Reduced occupant comfort
 - Indoor air quality concerns
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INNOVAPANEL® DESIGN RECOMMENDATIONS

Recommendation #1

Use High-Efficiency Inverter Systems

Only high-efficiency inverter-driven mini-split systems should be considered.

Variable-speed compressors provide:

- ✓ Longer run times
 - ✓ Improved moisture removal
 - ✓ Better comfort
 - ✓ Lower operating costs
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Recommendation #2

Use Dry Mode Capability

Mini-split systems should include a dedicated Dry Mode or Dehumidification Mode.

Dry Mode improves moisture removal during periods when sensible cooling demand is low.

However:

Dry Mode alone should not be relied upon as the sole dehumidification strategy in hot-humid climates.

Recommendation #3

Do Not Oversize Equipment

Oversized HVAC systems are one of the most common causes of humidity problems in SIP structures.

HVAC sizing should be based on:

- ACCA Manual J
- ACCA Manual S
- SIP-specific load calculations

Traditional sizing rules of thumb should not be used.

Oversized systems frequently short cycle and fail to remove sufficient moisture from indoor air.

Recommendation #4

Whole-House Dehumidification Is Strongly Recommended

For hot-humid climates, InnovaPanel® strongly recommends the installation of a dedicated whole-house dehumidification system.

Benefits include:

- ✓ Independent humidity control
- ✓ Improved indoor comfort
- ✓ Reduced condensation risk
- ✓ Enhanced indoor air quality
- ✓ Reduced mold potential

Humidity should generally be maintained between 45% and 55% relative humidity.

RECOMMENDED VENTILATION STRATEGY

A dedicated ventilation system should be incorporated into the building design.

The preferred approach includes:

Fresh Air Intake

Provide a dedicated outdoor air intake with:

- Adjustable balancing damper
 - Filtered intake air
 - Proper sizing by the mechanical engineer
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Whole-House Dehumidifier

Fresh outdoor air should be introduced through a properly sized whole-house dehumidification system whenever possible.

Benefits:

- ✓ Fresh air
 - ✓ Moisture removal
 - ✓ Improved air quality
 - ✓ Controlled ventilation
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Air Distribution

The dehumidifier should distribute conditioned air to:

- Bedrooms
- Hallways
- Bathrooms
- Laundry rooms
- Other areas without mini-split heads

This creates whole-house air circulation and reduces stagnant air pockets.

Return Air Pathways

Return air should be provided from rooms not directly served by mini-split units.

This allows:

- ✓ Air movement throughout the structure
 - ✓ Improved ventilation effectiveness
 - ✓ More uniform humidity control
 - ✓ Better indoor comfort
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ENGINEER OF RECORD NOTES

The HVAC design professional shall evaluate:

- Occupancy loads

- Internal moisture generation
- Local climate conditions
- Fresh air requirements
- Ventilation rates
- Equipment sizing
- Air distribution requirements
- Dehumidification loads

Ventilation systems should be designed in accordance with applicable building codes and accepted engineering practices.

IMPORTANT NOTICE

InnovaPanel® manufactures high-performance structural insulated panel systems.

The design, sizing, selection, balancing, commissioning, and performance of HVAC, ventilation, dehumidification, and indoor air quality systems remain the responsibility of the project design professionals, mechanical engineer, HVAC contractor, and building owner.

Failure to properly size and design ventilation and dehumidification systems may result in elevated humidity levels, condensation, occupant discomfort, mold growth, and indoor air quality issues.

The use of ductless mini-split systems without supplemental ventilation and humidity control may not be appropriate for hot-humid climates.

InnovaPanel® strongly recommends that all SIP structures be evaluated by qualified HVAC professionals experienced in the design of high-performance, airtight building envelopes.

KEY TAKEAWAY

Mini-split systems can be an excellent cooling solution for InnovaPanel® SIP structures; however, cooling is not ventilation.

In hot-humid climates, proper fresh-air ventilation, humidity control, air circulation, and whole-house dehumidification are critical components of a healthy, durable, and comfortable high-performance SIP building.