INNOVAPANEL®

TECHNICAL DESIGN GUIDE TDG-008

Mechanical Design for High-Performance Structural Insulated Panel Buildings

HVAC • Humidity Control • Ventilation • Indoor Air Quality • Building Science

Purpose

A practical engineering reference for architects, mechanical engineers, HVAC contractors, builders, and owners designing mechanical systems for airtight SIP and MgO SIP buildings, with specific guidance for South Florida, the Gulf Coast, Caribbean, and other hot-humid climates.

Professional Edition | Rev. 1.0 | Prepared for design coordination and project planning

Important Notice and Intended Use

This Technical Design Guide is an educational reference prepared to support better design coordination for high-performance SIP buildings. It does not replace the sealed design of the licensed mechanical engineer of record, the requirements of the Authority Having Jurisdiction, applicable codes, or the installation instructions of HVAC equipment manufacturers.

All ventilation, dehumidification, air distribution, filtration, combustion safety, duct design, electrical design, controls, condensate disposal and commissioning decisions remain the responsibility of the project design professionals, HVAC contractor, building owner and applicable code officials.

InnovaPanel Position

In hot-humid climates, InnovaPanel does not recommend ductless mini-split systems as the sole whole-house HVAC strategy unless they are supplemented by properly designed mechanical ventilation, whole-house dehumidification, return-air pathways and humidity controls.

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1. Executive Summary

Structural Insulated Panel (SIP) buildings change the assumptions normally used for residential and light commercial HVAC design. The envelope is more insulated, more continuous and significantly more airtight than conventional construction. As a result, the sensible cooling load is often reduced while the importance of latent moisture removal, controlled ventilation, and air distribution increases.

In South Florida, the Caribbean, Gulf Coast, Hawaii and other hot-humid locations, a building can be thermally comfortable by temperature while still failing by humidity. A home held at 74°F with 65% relative humidity may feel clammy, support microbial growth and create condensation risk. A home held at 76°F with 45-50% relative humidity can feel more comfortable while using less energy.

- Mini-splits are efficient room cooling devices, but they generally do not provide required whole-house fresh-air ventilation.
- Mini-splits often have limited latent moisture removal compared with properly designed central systems, especially when oversized or operated intermittently.
- Only mini-split systems with a true Dry Mode should be considered in hot-humid SIP applications.
- A properly sized whole-house dehumidifier with fresh-air intake and distribution ducts is required where mini-splits are used as the primary cooling strategy in humid climates.
- For South Florida and similar climates, InnovaPanel recommends a properly sized two-stage or variable-speed central air-conditioning system with humidistat control as the preferred approach, often with supplemental whole-house dehumidification.

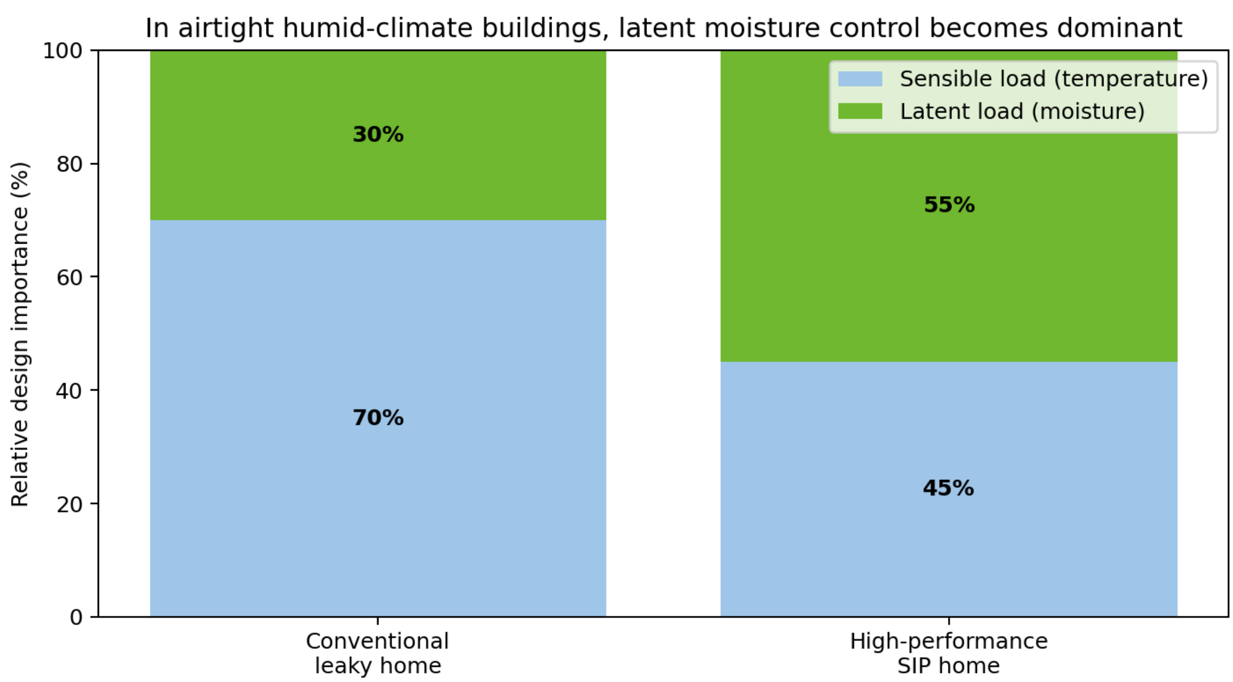

Figure 1. In airtight humid-climate buildings, moisture control becomes a primary design driver.

2. Why High-Performance SIP Buildings Require Different Mechanical Design

A conventional home leaks air through framing joints, top plates, electrical penetrations, attic bypasses, wall cavities and unsealed duct chases. That leakage is undesirable because it wastes energy and brings in dust, allergens, pollutants and moisture. However, it also masks poor mechanical design by unintentionally providing outside air.

A SIP building is different. The closed-cell insulation core, continuous panel geometry and sealed joints significantly reduce uncontrolled infiltration. This creates a better foundation for indoor air quality because the design team can intentionally filter, dehumidify and distribute outdoor air. The same airtightness also removes the accidental drying and accidental ventilation that many conventional homes rely upon.

Design Principle

Build tight, ventilate right. Airtight construction is an advantage only when paired with deliberate ventilation, humidity control and air distribution.

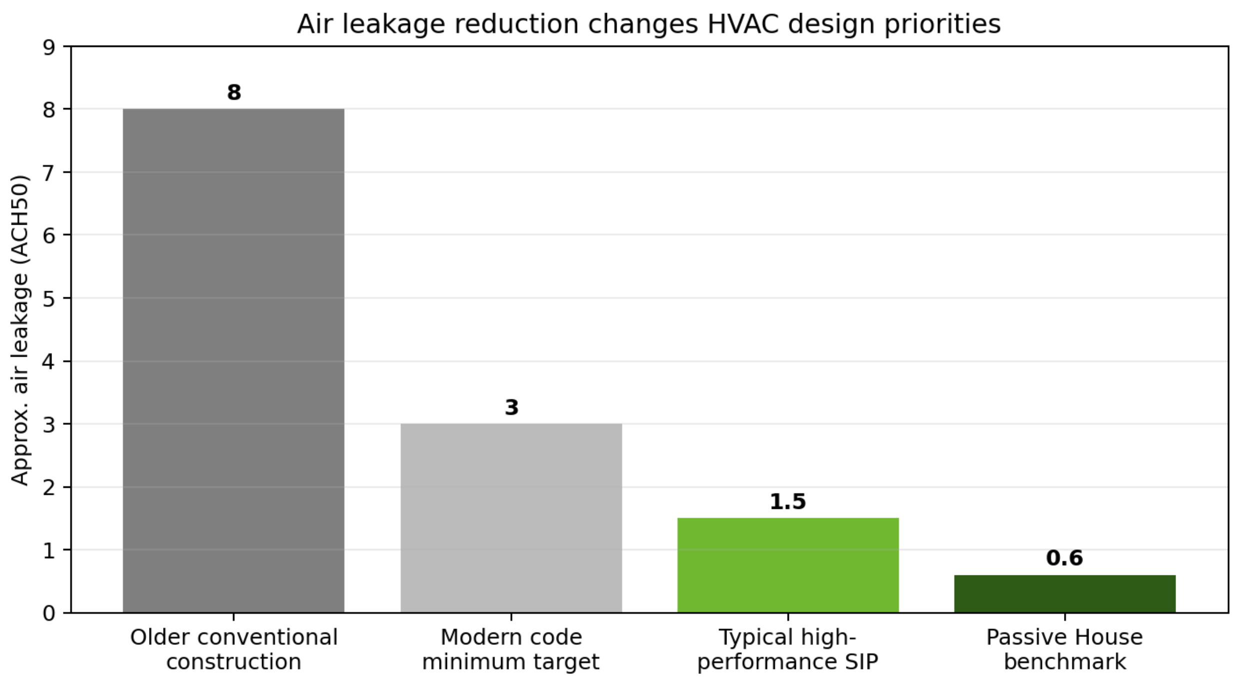

Figure 2. Air leakage reduction requires deliberate mechanical ventilation and humidity design.

InnovaPanel project documents already notify purchasers that SIP buildings are highly insulated, near airtight structures and that care must be used in mechanical design to ensure sufficient ventilation, especially in humid environments.

3. Building Science Fundamentals

Mechanical design for SIP buildings requires coordination of heat, air and moisture. These three factors are inseparable in humid climates.

Term	Meaning for SIP HVAC Design
Sensible heat	Temperature load measured by dry-bulb temperature. Reduced in SIP buildings because insulation and air sealing lower heat gain.
Latent heat	Moisture load. In hot-humid climates this can dominate comfort and durability.
Relative humidity	Percent saturation at a given temperature. RH rises when air is cooled without removing enough moisture.
Dew point	Temperature at which air reaches saturation and condensation can occur.
Vapor drive	Movement of water vapor from high vapor pressure to lower vapor pressure, often from outdoors to indoors in South Florida.
Air leakage	Uncontrolled air movement through the envelope; carries far more moisture than vapor diffusion.
Thermal bridge	Conductive path that bypasses insulation and may create a cold/warm surface where condensation occurs.

Because SIPs reduce uncontrolled air leakage, designers must not assume that infiltration will provide dilution ventilation. Mechanical ventilation must be selected, ducted, balanced and commissioned.

4. Psychrometrics for Humid-Climate SIP Design

Psychrometrics is the study of moist air. It explains why temperature alone does not define comfort or durability. A thermostat only responds to dry-bulb temperature; it does not necessarily respond to moisture content. In a humid climate, indoor air may reach thermostat setpoint before the cooling system removes enough moisture.

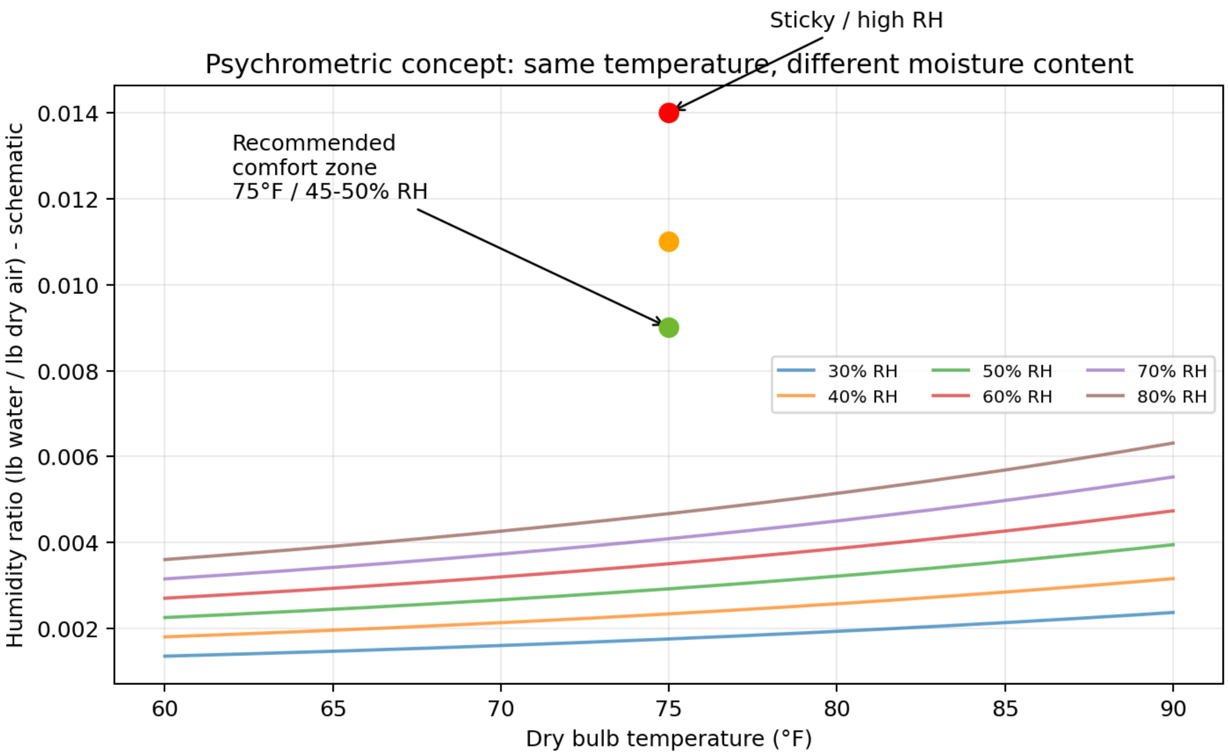

Figure 3. Simplified psychrometric concept: the same dry-bulb temperature can represent very different humidity conditions.

For design purposes, the mechanical engineer should evaluate both sensible and latent loads. The Sensible Heat Ratio (SHR) of selected equipment must match the project load profile. A high SHR unit that removes temperature rapidly but removes little moisture can perform poorly in a SIP home in South Florida.

Psychrometric Variable	Design Use
Dry-bulb temperature	Controls sensible cooling load and thermostat response.
Wet-bulb temperature	Indicates combined heat and moisture condition.
Humidity ratio	Actual mass of water vapor in the air; useful for moisture removal analysis.
Dew point	Critical for condensation risk assessment.
Relative humidity	Occupant comfort and microbial risk indicator.
Enthalpy	Total heat content; useful for ventilation and outdoor air calculations.

5. Air Leakage, ACH50 and Mechanical Ventilation

ACH50 is the air changes per hour measured at 50 pascals during blower-door testing. It is not the same as natural ventilation, but it is a useful indicator of envelope tightness. As air leakage decreases, the need for intentional ventilation increases.

Industry SIP guidance states that high-performance structures designed and built extremely airtight must have make-up air, and recommends involvement of a design professional experienced in tight envelopes. SIP industry guidance also notes that mechanical ventilation is generally recommended for homes tighter than 3 ACH50.

Envelope Type	Typical Design Implication
Leaky conventional building	Accidental infiltration may dilute pollutants but wastes energy, and moisture control is uncontrolled.
Modern code building	Ventilation and air sealing must be coordinated.
SIP building	Mechanical ventilation should be treated as a required design element.
Very airtight / Passive House-level building	Balanced ventilation, filtration, humidity management, and commissioning are mandatory design priorities.

ASHRAE Reference

ASHRAE Standards 62.1 and 62.2 are recognized ventilation and acceptable indoor air quality standards. Designers should use the currently adopted edition required by the project jurisdiction and should not rely on natural leakage in airtight SIP buildings.

6. Humidity Control and Condensation Risk

Moisture is generated every day by occupants, cooking, bathing, laundry, cleaning, pets, and outside air. In a SIP home, that moisture does not easily escape through random leakage. This is good when the mechanical system is properly designed, but problematic when ventilation and humidity control are neglected.

Moisture Source	Design Response
Showers and bathrooms	Exhaust fans controlled by timer or humidistat; verify makeup air.
Cooking	Kitchen exhaust; avoid excessive negative pressure.
Laundry	Dryers exhausted outdoors; laundry room exhaust recommended.
Occupants and pets	Whole-house ventilation and dehumidification.
Outdoor air	Filter and dehumidify introduced fresh air before distribution.
Garage and storage areas	Ventilate separately; avoid pulling garage air into conditioned space.

In humid environments, InnovaPanel recommends maintaining indoor relative humidity generally below 50% where practical. Many comfort complaints blamed on temperature are actually humidity complaints. Proper humidity control can allow higher thermostat settings while improving comfort.

Condensation Warning

If an oversized cooling system short cycles, it may cool surfaces without removing adequate moisture from the air. This can create cold, clammy spaces, elevated RH, and condensation risk on cooler surfaces.

7. Mini-Split Systems: Benefits, Limitations and Required Supplements

Ductless mini-splits can be excellent equipment in the right application. They are efficient, quiet, and flexible. However, they are not automatically complete HVAC systems for airtight SIP buildings in humid climates.

Mini-Split Benefit	Engineering Limitation in Airtight SIP Homes
High efficiency	Efficiency does not equal ventilation or humidity control.
Room-by-room zoning	Rooms without heads may have poor air mixing and elevated humidity.
Simple installation	Lack of ductwork can mean lack of whole-house filtration and distribution.
Dry Mode availability	Dry Mode can help, but is not a substitute for dedicated dehumidification.
Low sensible cooling capacity	Can still short cycle if oversized relative to the SIP envelope load.

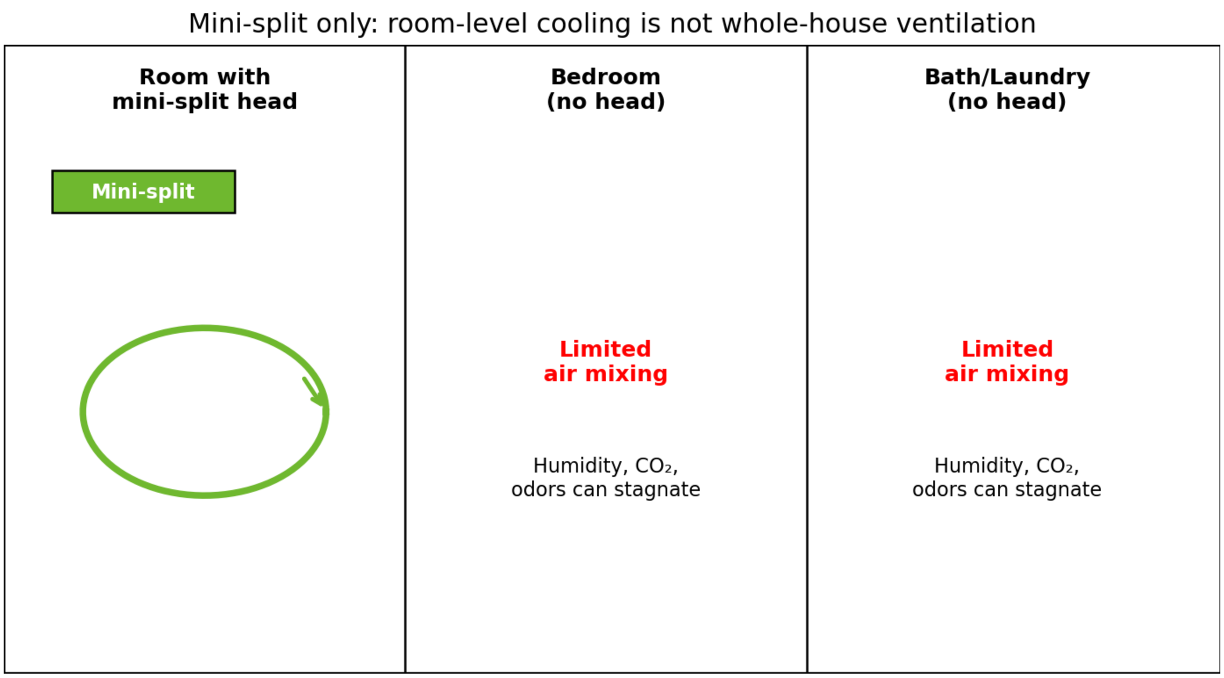

Figure 4. Mini-split only systems condition the room with the head but do not inherently ventilate or circulate the entire home.

InnovaPanel Requirement for Humid Climates

If mini-splits are used in South Florida or similar hot-humid climates, only units with Dry Mode should be considered, and the design should include a whole-house dehumidifier, fresh-air intake, return-air pathways, and air distribution to rooms without mini-split heads.

8. Preferred Central HVAC Systems for South Florida and Similar Climates

For South Florida and similar climates, InnovaPanel recommends properly sized central air-conditioning systems as the preferred mechanical approach for whole-house comfort, air distribution, filtration and humidity control. Two-stage and variable-speed systems are preferred because they provide longer run times, better part-load operation and improved latent moisture removal compared with oversized single-stage equipment.

System Type	Use in Hot-Humid SIP Buildings	Comment
Variable-speed central system with humidistat	Preferred	Best ability to match reduced loads and operate longer at low speed.
Two-stage central system with humidistat	Recommended	Good balance of cost, runtime and dehumidification.
Single-stage central system	Use with caution	Must be accurately sized; may need dedicated dehumidification.
Ducted mini-split / small ducted inverter	Project-specific	Can be effective if designed as a ducted ventilation and distribution system.
Ductless mini-split only	Not recommended as sole system	No whole-house ventilation; limited room-to-room mixing and dehumidification.

A humidistat or integrated humidity control is strongly recommended. The control sequence should prioritize humidity control when RH rises above the design threshold, rather than relying solely on dry-bulb temperature.

9. Whole-House Dehumidification and Fresh-Air Integration

A whole-house dehumidifier is often the missing component in high-performance buildings in humid climates. The dehumidifier should be selected based on expected latent load, outdoor air quantity, occupancy, and internal moisture generation. It should be ducted to provide meaningful distribution, not simply located in a closet.

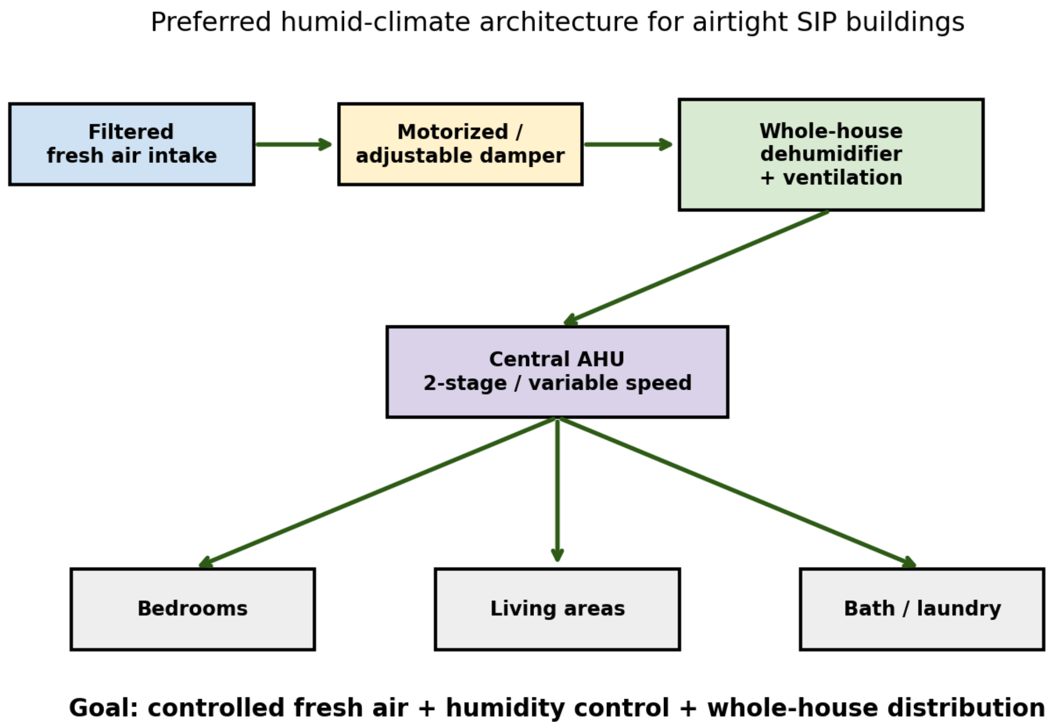

Figure 5. Preferred strategy: controlled fresh air, dehumidification and distribution to rooms throughout the structure.

- Provide a dedicated outdoor air duct with an adjustable or motorized damper.
- Filter outdoor air before it enters the dehumidifier or air handler.
- Distribute dehumidified air to bedrooms, bathrooms, laundry rooms and other rooms without mini-split heads.
- Provide return-air pathways from closed rooms using transfer grilles, jump ducts or ducted returns.
- Drain condensate with proper trap, cleanout and secondary overflow protection.
- Commission airflow and verify RH under occupied conditions.

10. ERV/HRV, DOAS and Ventilation Options

Ventilation systems introduce outdoor air and remove stale air. In humid climates, ventilation must be coordinated with moisture removal. ERVs can reduce the moisture burden compared with unconditioned outdoor air, but they are not dehumidifiers. HRVs recover heat but are generally less suited to hot-humid cooling-dominated climates than ERVs.

Ventilation Option	Advantages	Cautions
ERV	Balanced ventilation with energy recovery	Does not replace dehumidification in South Florida.
HRV	Balanced ventilation; useful in cold climates	Can introduce too much moisture in humid climates without supplemental dehumidification.
Dedicated outdoor air to dehumidifier	Strong humid-climate approach	Requires proper design, filtration, damper control and duct distribution.
Exhaust-only ventilation	Simple and inexpensive	Can depressurize building and pull humid air through leaks; not preferred for SIP envelopes.
Supply-only ventilation	Can positively pressurize	Must be filtered, dehumidified and controlled.

The selected system should comply with applicable ASHRAE 62.2 residential ventilation requirements or ASHRAE 62.1 for nonresidential occupancies, as adopted by the jurisdiction.

11. Air Distribution, Return Pathways and Room-to-Room Mixing

Airtight homes need deliberate air distribution. Closed bedroom doors, isolated bathrooms, small closets, laundry rooms and rooms without ducted supply or return can become humidity and odor pockets. Mini-split heads installed in only some rooms make this problem more likely.

- Provide a supply and return strategy for every regularly occupied room.
- Use transfer grilles or jump ducts where direct returns are not practical.
- Avoid excessive room pressure imbalances when doors are closed.
- Do not rely on ceiling fans for ventilation; fans move air but do not provide fresh air or moisture removal.
- Coordinate bath exhaust, kitchen exhaust and dryer exhaust with makeup air strategy.
- Provide separate garage ventilation where applicable; do not use garage air as return air.

Design Note

Air distribution is not only about temperature. It is also about humidity, odor dilution, filtration, CO_2 control and pressure balance.

12. Equipment Sizing: Manual J, Manual S and Manual D

HVAC equipment for SIP buildings should be sized using project-specific calculations. Rules of thumb based on conventional construction are likely to oversize equipment because SIP buildings have lower infiltration, reduced thermal bridging and higher whole-wall performance.

Design Manual	Purpose
ACCA Manual J	Room-by-room heating and cooling load calculation.
ACCA Manual S	Equipment selection based on calculated loads and manufacturer performance data.
ACCA Manual D	Duct design and airflow distribution based on calculated room loads.
ASHRAE 62.2 / 62.1	Ventilation rate and indoor air quality design framework.
ASHRAE 55	Thermal comfort design considerations.

The mechanical engineer should model the actual InnovaPanel wall and roof assembly performance, window performance, shading, orientation, occupancy, ventilation load, and latent load. Remember these are highly insulated structures with performance R-values of R-38 for walls and R-50 and greater for roofs. Basically, structures built with SIPs are insulated to the levels of walk-in coolers. Oversizing the cooling system should be avoided because it reduces runtime and latent removal. An informal rule of thumb for humid climates is that the air-handling unit should run at least 15 minutes each time it starts. If the unit(s) are running for 5 -7 minutes and shutting off, they are short cycling and will not provide proper sufficient dehumidification.

Runtime Rule of Thumb

In humid climates, if the system regularly satisfies the thermostat in only a few minutes, it is likely short cycling and may not be removing adequate moisture. Longer lower-capacity operation is generally better for humidity control. Target indoor humidity levels 45 – 50%.

13. South Florida, Gulf Coast and Caribbean Design Recommendations

Hot-humid design should prioritize humidity control as a co-equal design objective with cooling. The following recommendations are intended as InnovaPanel best-practice guidance for design coordination.

Design Item	InnovaPanel Recommendation
Primary HVAC	Two-stage or variable-speed central air-conditioning preferred.
Controls	Humidistat or integrated humidity control required/recommended.
Indoor RH target	Generally maintain 45-50% RH; avoid sustained levels above 55-60%.
Mini-splits	Use only with Dry Mode and supplemental dehumidification/ventilation.
Fresh air	Provide filtered, controlled outdoor air through engineered ventilation system.
Dehumidification	Dedicated whole-house dehumidifier strongly recommended; mandatory when mini-splits are primary in humid climates.
Filtration	MERV-rated filtration appropriate for equipment static pressure; MERV 13 where feasible.
Bathrooms/laundry	Humidistat or timer controls for exhaust; dryer exhausted outdoors.
Garages/unconditioned areas	Ventilate separately; do not communicate return air with living space.

14. Design Examples and System Selection Matrix

The following examples are schematic only. Final sizing must be performed by the project mechanical engineer using actual project data.

Example Building	Envelope	Recommended Strategy
1,200 sf ADU, South Florida	4-6 in SIP walls, SIP roof, low glazing	Small variable-speed central system or ducted mini-split; whole-house dehumidifier with fresh air.
2,000 sf residence, coastal Florida	6 in SIP walls, 8 in SIP roof, impact windows	Two-stage or variable-speed central system, humidistat, fresh-air dehumidifier, ducted returns.
Luxury custom home	High ceilings, large glazing, multiple zones	Variable-speed zoned central systems with dedicated outdoor air/dehumidification and commissioning.
Mini-split retrofit / addition	Limited duct access	Mini-splits with Dry Mode plus dedicated dehumidifier and transfer/return air plan.
Commercial SIP structure	Higher occupancy and ventilation load	Mechanical engineer to design per ASHRAE 62.1 with DOAS or ERV + dehumidification.

System	Cooling	Humidity	Ventilation	Distribution	Recommended Use
Mini-split only	Good	Weak to moderate	None	Room only	Not recommended for whole-house humid-climate SIP use.
Mini-split + dehumidifier	Good	Good	Good if ducted	Moderate	Acceptable if engineered and balanced.
Two-stage central	Very good	Very good	Good when integrated	Very good	Recommended.
Variable-speed central + dehumidifier	Excellent	Excellent	Excellent	Excellent	Preferred / best practice.

15. Architect and Mechanical Engineer Checklists

Use the following as a design coordination checklist. It is not a substitute for a project-specific mechanical design.

Architect Checklist	Complete
Provide mechanical room space for air handler, dehumidifier, filters, and service access	☐
Coordinate fresh-air intake location away from contaminants	☐
Provide duct chases or soffits for supply/return pathways	☐
Coordinate condensate drains and overflow protection	☐
Avoid isolated rooms without transfer air strategy	☐
Coordinate kitchen, bath, laundry and garage exhaust	☐

Mechanical Engineer Checklist	Complete
Manual J room-by-room load calculation using SIP envelope values	☐
Manual S equipment selection using manufacturer data at design conditions	☐
Manual D duct design and static pressure verification	☐
ASHRAE 62.2/62.1 ventilation calculation	☐
Latent load and dehumidification capacity calculation	☐
Humidity control sequence specified	☐
Return-air and pressure balancing plan	☐
Commissioning requirements included in specifications	☐

16. Builder and Installer Coordination

Mechanical performance begins with the building envelope. HVAC penetrations through SIP walls or roofs must be sealed to preserve the intended airtightness. SIP industry guidance emphasizes sealing openings, penetrations, SIP joints, and connections to minimize air leakage and maximize energy performance.

- Coordinate HVAC penetrations with shop drawings before cutting panels.
- Seal all duct, refrigerant line, condensate and electrical penetrations through the SIP envelope.
- Do not leave unsealed chases, sleeves or holes that can move humid air into the assembly.
- Protect partially completed SIP work from rain and moisture.
- Provide installer documentation and photographs for critical air-sealing details.
- Avoid installing saturated lumber or wet materials into SIP assemblies.

17. Commissioning, Testing and Balancing

Commissioning verifies that the design was installed and operates as intended. High-performance buildings deserve more commissioning than conventional homes because small mechanical errors are more noticeable in airtight structures.

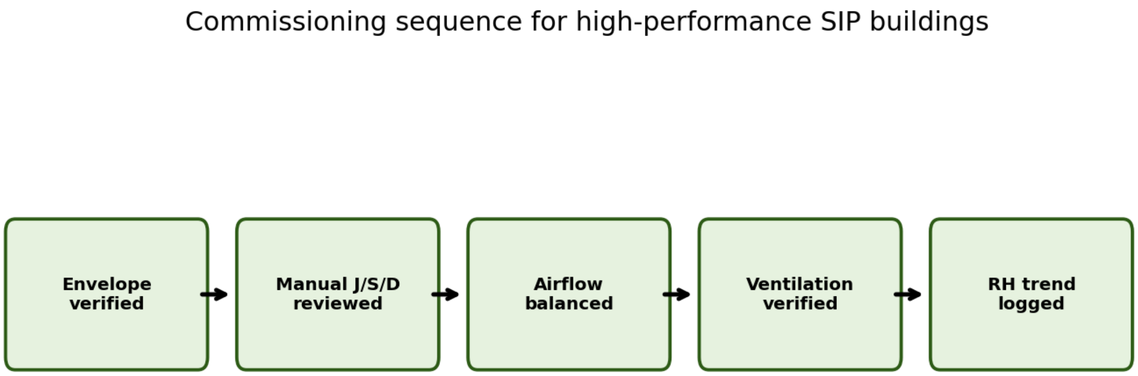

Figure 6. Recommended commissioning workflow.

Test / Verification	Purpose
Blower door test	Confirm envelope airtightness and identify uncontrolled leakage.
Duct leakage test	Confirm duct integrity and avoid energy/humidity loss.
Airflow measurement	Verify supply, return and outdoor air quantities.
Ventilation verification	Confirm ASHRAE design airflow is delivered.
Static pressure test	Confirm equipment can move required airflow.
Condensate test	Verify drainage and overflow safety.
RH trend logging	Confirm humidity control under occupied conditions.
Owner orientation	Teach filter changes, humidity settings and ventilation operation.

18. Specification Language and Owner Notice

The following language may be adapted by the design professional for project specifications and owner notices.

Sample Owner Notice

This building uses a high-performance SIP envelope that is highly insulated and near airtight. Proper HVAC sizing, ventilation, humidity control, and dehumidification are required. Mini-split systems alone do not provide whole-house fresh air ventilation and may not provide adequate dehumidification in hot-humid climates.

Sample Mechanical Specification

The mechanical contractor shall provide a project-specific Manual J load calculation, Manual S equipment selection, and Manual D duct design. The system shall include humidity control, outdoor air ventilation sized per the applicable ASHRAE ventilation standard, and commissioning documentation verifying airflow, ventilation, and dehumidification performance.

Mini-Split Specification Limitation

Ductless mini-split systems shall not be used as the sole whole-house mechanical system in hot-humid SIP buildings unless supplemented by a dedicated whole-house dehumidification and ventilation system with distribution to rooms not served by mini-split heads.

19. Troubleshooting Guide

Symptom	Likely Cause	Corrective Direction
Home is cool but feels clammy	High indoor RH; oversized or short-cycling system	Verify RH, runtime, latent capacity and dehumidifier operation.
Musty odors	Insufficient ventilation or stagnant rooms	Verify fresh-air flow, exhaust, return pathways and filtration.
Bedroom humidity high when door closed	No return or transfer pathway	Add transfer grille, jump duct or ducted return.
Condensation on surfaces	Surface below dew point or high indoor RH	Lower RH, improve air distribution, check thermal bridges.
Mini-split room comfortable, other rooms not	Room-only distribution	Add ducted dehumidified air and return pathways.
High electric bill despite SIP envelope	Oversized cycling, poor controls, duct leakage	Commission equipment, ducts, controls, and ventilation.
Bathroom / Laundry moisture lingers	Insufficient exhaust or no humidistat/timer	Upgrade exhaust and controls; verify makeup air.

20. Glossary and References

Term	Definition
ACH50	Air changes per hour at 50 pascals measured by blower door test.
Dry bulb temperature	Air temperature measured by a standard thermometer.
Latent load	Moisture removal load.
Sensible load	Temperature change load.
Relative humidity	Actual moisture in air relative to saturation at the same temperature.
Dew point	Temperature at which condensation begins.
ERV	Energy recovery ventilator.
HRV	Heat recovery ventilator.
DOAS	Dedicated outdoor air system.
Manual J	ACCA residential load calculation method.
Manual S	ACCA equipment selection procedure.
Manual D	ACCA residential duct design procedure.

Selected References

- ASHRAE Standard 62.2: Ventilation and Acceptable Indoor Air Quality in Residential Buildings. Use the currently adopted edition required by the jurisdiction.
- ASHRAE Standard 62.1: Ventilation for Acceptable Indoor Air Quality for nonresidential occupancies.
- ASHRAE Standard 55: Thermal Environmental Conditions for Human Occupancy.
- ASHRAE Handbook - Fundamentals, chapters related to psychrometrics, heat transfer, moisture and load calculations.
- ACCA Manual J: Residential Load Calculation.
- ACCA Manual S: Residential Equipment Selection.
- ACCA Manual D: Residential Duct Systems.
- Structural Insulated Panel Association, Design Best Practices: HVAC Systems with SIPs.
- InnovaPanel internal articles and contract/warranty notices regarding humid-climate SIP ventilation, whole-house dehumidification, humidistats and mechanical design responsibilities.

Appendix A. Mini-Split Evaluation Checklist

Question	Required Answer
Does each mini-split have true Dry Mode?	Yes
Was Manual J/S performed using SIP envelope values?	Yes
Is a whole-house dehumidifier included?	Yes in humid climates
Is filtered fresh air provided?	Yes
Is dehumidified air distributed to rooms without heads?	Yes
Are return-air pathways provided from closed rooms?	Yes
Is there a RH control strategy independent of temperature?	Yes
Will the system be commissioned and balanced?	Yes

Appendix B. Recommended Owner Operating Targets

Parameter	Recommended Target
Cooling setpoint	Often 74-78°F depending on comfort and RH
Relative humidity	45-50% preferred in hot-humid climates; avoid sustained >55-60%
Ventilation	Operate continuously or per engineered control sequence
Dehumidifier	Set to maintain design RH, typically below 50%
Filters	Replace per manufacturer schedule or more often during construction/dust events
Bathroom exhaust	Use humidistat/timer controls; verify operation

Appendix C. Final InnovaPanel Recommendations

21. In South Florida and similar humid climates, use properly sized two-stage or variable-speed central air-conditioning as the preferred system for whole-house applications.
22. Use humidistat or integrated humidity controls; do not rely on dry-bulb thermostat control alone.
23. Do not oversize cooling equipment. Oversizing causes short cycling and inadequate dehumidification.
24. Use whole-house dehumidification where required by climate, occupancy, ventilation load or system type.
25. If mini-splits are used, select only units with Dry Mode and provide supplemental whole-house ventilation, dehumidification and air distribution.
26. Provide filtered fresh air through a controlled intake and adjustable or motorized damper.
27. Distribute dehumidified ventilation air to rooms not served by mini-split heads.
28. Provide return-air pathways and pressure balancing for closed rooms.
29. Commission airflow, ventilation and humidity control before occupancy.
30. Provide owner training and written operating instructions.

Appendix D. Psychrometric Design Notes for Hot-Humid SIP Buildings

Psychrometric design for a high-performance SIP structure should start with the recognition that the building envelope reduces sensible heat gain, while outdoor air, occupants and daily activities can still produce substantial latent moisture loads. The design professional should evaluate outdoor design conditions, indoor design targets, ventilation air, infiltration assumptions, occupancy, and internal moisture generation.

When an HVAC system is selected solely to meet sensible temperature load, humidity can remain uncontrolled. This is why equipment selection should be reviewed at part-load operation and at the expected indoor humidity target, not simply at peak sensible capacity.

Design Item	Recommended Engineering Review
Indoor design point	Evaluate both temperature and RH, commonly 75°F with 45-50% RH in hot-humid residential applications.
Outdoor ventilation air	Calculate moisture load of outdoor air introduced for ASHRAE ventilation compliance.
Apparatus dew point/coil performance	Confirm equipment can remove moisture, not simply meet dry-bulb cooling.
Part-load operation	Review how the system performs during shoulder seasons and nighttime humid conditions.
Controls	Confirm humidity control can call for dehumidification even when sensible cooling demand is low.

Design Reminder

The most difficult condition may not be the hottest afternoon. It may be a mild, rainy, humid day when the sensible load is low, but the latent load remains high.

Appendix E. Recommended Control Strategies

Controls should be selected to manage temperature, relative humidity, and ventilation. A thermostat-only strategy is often inadequate for high-performance buildings in humid climates. Humidity control should be integrated with the air-conditioning system, whole-house dehumidifier and ventilation damper.

Control Function	Recommended Sequence
Normal cooling	Variable-speed or two-stage cooling operates to maintain temperature with longer lower-capacity cycles.
Humidity override	If indoor RH rises above setpoint, system prioritizes dehumidification through lower airflow, dehumidifier operation or extended runtime.
Ventilation air	Outdoor air damper operates per ASHRAE ventilation design, preferably through dehumidifier or conditioned air path.
Bath/laundry exhaust	Exhaust operates by timer, occupancy, or humidistat and is coordinated with makeup air.
Unoccupied mode	Maintain humidity control even when temperature setpoint is relaxed.
Alarm condition	Notify owner if RH remains above target for an extended period or condensate drain safety switch trips.

For luxury and commercial projects, controls should be capable of trend logging temperature, RH, ventilation operation, dehumidifier runtime, and system alarms. Trend data allows the design team to diagnose issues before finishes or materials are affected.

Appendix F. Mini-Split Design and Owner Notice Template

The following notice can be incorporated into project documentation where mini-split systems are proposed. It is intended to prevent the common misunderstanding that room cooling is equivalent to ventilation and whole-house dehumidification.

Mini-Split Owner Notice

Ductless mini-split systems provide cooling and air movement primarily within the rooms where indoor heads are installed. They do not, by themselves, provide whole-house fresh-air ventilation, balanced air distribution, filtration of outdoor air, or reliable whole-house dehumidification in hot-humid climates. In a high-performance SIP structure, mini-splits must be supplemented with properly designed ventilation, whole-house dehumidification, air distribution, and return-air pathways.

Required Item for Mini-Split Use	Reason
Dry Mode	Improves latent moisture removal when sensible load is low.
Accurate sizing	Prevents short cycling and poor dehumidification.
Whole-house dehumidifier	Provides independent humidity control.
Fresh-air intake with damper	Provides controlled ventilation instead of accidental leakage.
Distribution ducts	Delivers dehumidified air to rooms without mini-split heads.
Transfer/return air pathways	Prevents stagnant rooms and pressure imbalance.
Commissioning	Verifies that the system actually performs as designed.

Appendix G. Commercial, Institutional and Multifamily Considerations

Commercial and institutional SIP buildings may have higher occupant density, larger ventilation loads, more equipment heat, larger exhaust systems, and more complex schedules than single-family homes. The design approach should be based on ASHRAE 62.1 where applicable and should include project-specific analysis by qualified mechanical engineers.

Project Type	Mechanical Design Considerations
Schools/classrooms	CO2 control, ventilation verification, filtration, acoustics and occupancy scheduling.
Hospitality	Guest room humidity control during unoccupied periods; corridor pressurization and ventilation balance.
Multifamily	Compartmentalization, kitchen/bath exhaust, makeup air, dryer exhaust and corridor ventilation.
Offices	Ventilation reset, filtration, occupancy schedules and humidity control during partial occupancy.
Mechanical/equipment buildings	Heat rejection, equipment moisture sensitivity, ventilation and corrosion control.

Commercial Design Note

SIP airtightness can improve energy efficiency and indoor environmental control, but it does not reduce the need for code-required ventilation. Ventilation must be measured, balanced and documented.

Appendix H. Owner Maintenance and Operating Guide

High-performance mechanical systems require routine maintenance. Owners should receive written operating instructions at turnover. The system should not be disabled because the home feels cool; humidity control and ventilation may still be required.

Owner Task	Recommended Frequency
Check indoor RH display	Weekly during first cooling season; monthly thereafter.
Replace or clean filters	Per manufacturer instructions; more often during high dust or construction periods.
Inspect condensate drain/pan	Quarterly or as recommended.
Confirm dehumidifier operation	Monthly during humid season.
Confirm bathroom exhaust operation	Monthly.
Keep supply and return grilles unobstructed	Continuous.
Call HVAC contractor if RH remains high	If sustained RH exceeds target for more than 24-48 hours under normal operation.

Owner Warning

Do not turn off ventilation or dehumidification for extended periods in a closed SIP home in hot-humid climates. A cool but unventilated home can still accumulate moisture.

Appendix I. Sample Sequence of Operations

The following simplified sequence can be adapted by the mechanical engineer for residential SIP structures in hot-humid climates.

Mode	Sequence
Occupied cooling	Maintain temperature setpoint using first-stage or variable-speed operation whenever possible.
Dehumidification demand	When RH exceeds setpoint, enable dehumidifier and/or system dehumidification mode regardless of minor sensible cooling demand.
Ventilation	Open outdoor air damper per scheduled or continuous ventilation requirement; route air through dehumidification path.
Bath/laundry moisture event	Run local exhaust and verify makeup air path; continue until RH drops below threshold or timer expires.
Unoccupied humidity protection	Allow temperature setpoint to float within limit but maintain RH below maximum threshold.
Fault/alarm	Disable equipment as required by safety controls and notify owner/service provider.

Final control logic must be coordinated with the selected equipment and manufacturer requirements. The intent is to avoid thermostat-only operation that ignores indoor humidity.

Appendix J. Design Responsibility and Warranty Coordination

InnovaPanel manufactures high-performance structural insulated panel systems. HVAC, ventilation, dehumidification and indoor air quality systems are separate engineered systems. The mechanical engineer and HVAC contractor must design and install those systems based on the actual building configuration, climate, occupancy, code requirements, and equipment selected.

Responsibility Notice

Moisture damage, condensation, microbial growth, occupant discomfort or indoor air quality concerns caused by inadequate ventilation, improper HVAC sizing, lack of dehumidification, disabled controls, unbalanced air distribution or failure to maintain mechanical systems are not manufacturing defects in the SIP panels.

Project documentation should clearly identify the adopted ventilation standard, design humidity target, equipment selection basis, controls sequence and commissioning requirements. Where InnovaPanel warranty language requires ventilation in accordance with ASHRAE 62.2 or other adopted standards, the project team should retain design calculations and commissioning records.

Appendix K. One-Page Quick Reference

Issue	Quick Recommendation
Preferred South Florida system	Two-stage or variable-speed central A/C with humidistat and whole-house dehumidification.
Mini-splits	Do not use as sole whole-house strategy in humid SIP homes unless supplemented by dehumidification and ventilation.
Dry Mode	Required feature for mini-splits considered in hot-humid climates.
Humidity target	Generally 45-50% RH; avoid sustained levels above 55-60%.
Ventilation	Design per applicable ASHRAE 62.2/62.1 standard; do not rely on leakage.
Fresh air	Filter, control and dehumidify before distribution.
Sizing	Use Manual J/S/D with actual SIP assembly performance.
Commissioning	Verify airflow, ventilation, RH control, pressure balance and condensate management.
Owner education	Provide written instructions and explain why ventilation/dehumidification must remain active.