



**Decarbonizing Panama's Commercial Sector with
Precision Moisture Control**

Technical / Engineering Brief (PIM)

Independent Dehumidification for High-Humidity Commercial Environments

System Overview

This approach is based on independent, custom-designed dehumidification systems that remove latent moisture load directly, allowing HVAC systems to operate as intended—focused on sensible cooling.

By decoupling humidity control from temperature control, the system improves overall building performance, energy efficiency, and environmental stability in tropical commercial applications.

The Engineering Problem: Latent Load Mismanagement

In tropical climates such as Panama's Climate Zone 1A, latent moisture load represents a significant portion of total cooling demand.

Conventional HVAC systems are not designed to manage sustained latent loads efficiently, leading to:

- Overcooling to control humidity
- Increased compressor runtime and energy consumption
- Inconsistent indoor conditions
- Reduced equipment lifespan

This results in systems that are operating outside of their intended design parameters.

Independent Dehumidification Approach

Custom-designed independent systems:

- Remove moisture at the source
- Operate independently of HVAC cycles
- Maintain stable indoor humidity levels regardless of cooling demand
- Reduce latent load before it impacts system performance

This allows HVAC systems to:

- Run more efficiently
- Maintain proper temperature setpoints
- Avoid unnecessary cycling and overcooling

System Architecture & Integration

Systems are designed based on building use, load conditions, and air distribution requirements.

Typical configurations include:

- Ducted, independently controlled dehumidification systems
- Integration with existing air distribution (without relying on HVAC runtime)
- Placement optimized for moisture-heavy zones (atria, kitchens, high-traffic areas)
- Scalable configurations using multiple units for large commercial spaces

This approach supports:

- Retrofit applications
- New construction integration
- Minimal disruption to existing HVAC infrastructure

Performance & Energy Efficiency

High-efficiency independent dehumidification systems operate with:

- Low electrical demand relative to moisture removal capacity
- High moisture removal efficiency (L/kWh)
- Reduced total system energy consumption by lowering latent load on HVAC

Typical benefits include:

- Reduced compressor load
- Shorter HVAC runtime
- Stabilized indoor conditions
- Elimination of overcooling strategies

Comparison to Conventional Approaches

HVAC-Integrated Dehumidification

- Dependent on cooling cycles
- Limited latent removal capacity
- Leads to overcooling in humid conditions

Heat-Driven / Desiccant Systems

- Require continuous energy input for regeneration
- Higher operational energy demand
- More complex system design and maintenance

Independent Dehumidification (This Approach)

- Removes moisture directly with low electrical demand
- Operates independently of HVAC cycles
- Reduces total system energy consumption
- Simplifies integration and long-term operation

Measured Results & Case-Based Performance

This methodology is supported by over 20 years of operational experience in high-humidity coastal environments, along with documented case studies demonstrating measurable results across commercial applications.

Observed outcomes include:

- Significant reduction in indoor relative humidity
- Stabilized temperature setpoints without overcooling
- Improved occupant comfort and indoor air quality
- Reduction in maintenance issues related to moisture (condensation, mold, corrosion)

Performance data from U.S. Gulf Coast (Climate Zone 2A) applications translates directly to Panama's more demanding Climate Zone 1A conditions.

Application-Specific Performance

This approach is particularly effective in:

- Hospitality & Hotels
Common areas, gyms, pools, meeting spaces
- Condominiums & HOAs
Atria, corridors, enclosed shared spaces
- Convenience Stores & Food Service
Kitchens, refrigeration-heavy environments, high moisture generation
- Municipal & Institutional Buildings
Libraries, recreation centers, administrative buildings

Implementation Model

System design and engineering are led by a U.S.-based moisture control firm with extensive experience in coastal high-humidity environments.

A local Panama-based team supports:

- Installation
- System commissioning
- Ongoing service and maintenance

This ensures both technical accuracy and long-term operational reliability.

Engineering Value

This approach provides:

- A practical method for latent load management in tropical climates
- Improved HVAC performance without full system replacement
- A scalable solution for both retrofit and new construction
- Measurable performance outcomes supported by real-world applications

Next Steps

Engineering teams, consultants, and project stakeholders are invited to:

- Evaluate project-specific humidity load conditions
- Identify candidate buildings for pilot implementation
- Integrate independent dehumidification into system design strategies



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