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Introduction | Definition of Drying Engine

Drying has long been interpreted as a result produced by various devices, such as dehumidifiers, heating systems, or airflow systems.

These approaches describe the form of drying, but do not define the physical conditions required for drying to occur.

Traditionally, drying is described using environmental parameters such as temperature, humidity, and airflow.

These parameters represent system states, not controllable system behaviors.

From an engineering perspective, drying should not be defined by

devices, but by whether required conditions are satisfied.

Required Conditions of a Drying Engine

A Drying Engine is defined as a system that establishes and maintains the following three conditions simultaneously:

Heat Input × Humidity Control × Forced Ventilation = Drying Engine

These three conditions are mandatory and non-substitutable.

If any one of these conditions is absent, the system does not qualify as a Drying Engine.

Engineering Interpretation of Drying

Drying is not a function of a single device.

It is a system state formed by the satisfaction of required conditions.

When all three conditions are present:

- Heat Input — provides energy required for moisture evaporation
- Humidity Control — maintains low humidity conditions
- Forced Ventilation — removes moisture from the system

These conditions form a continuous drying mechanism.

01 | HumiDry® Drying Engine Core Module

HumiDry® is not defined as a drying device.

It is defined as a core module that enables drying to be designed, controlled, and integrated as an engineering function.

Conventional drying systems are developed based on application scenarios, including:

- Residential and commercial systems
- Storage and protection systems
- Industrial and process systems
- Building and environmental control systems

These systems are scenario-driven and focus on outcomes rather than controlling the required physical conditions.

As a result, system integration and modularization are limited.

HumiDry® defines drying as a controllable system function.

02 | Engineering Foundation: Three Elements and Efficiency Layer

Drying is governed by three fundamental elements:

1. Heat Input

Provides thermal energy required for moisture evaporation.

2. Humidity Control

Drying efficiency is determined by absolute humidity.

Lower humidity increases moisture transfer rate.

3. Forced Ventilation

Performs the following functions:

- Removes moisture from material surfaces
- Maintains circulation of dry air
- Exhausts humid air from the system

Efficiency Layer | Moisture Ventilation

Moisture ventilation is not an independent function.

It is an efficiency layer within airflow control that enables continuous moisture removal.

03 | Why a Drying Engine Did Not Previously Exist

Traditional systems are designed to produce drying results within specific scenarios.

They do not define or control required physical conditions as a unified system.

Therefore, drying has not been treated as an independent engineering module.

04 | Core Architecture

4.1 Zeolite Rotor

- Adsorbs moisture continuously
- Maintains stable dehumidification under low temperature conditions
- Operates without refrigerant or compressor

4.2 Regeneration Airflow

- Removes moisture from the desiccant material
- Required for continuous operation

4.3 PTC Heating Module

- Provides controlled heat input
- Ensures stable temperature behavior

4.4 Forward-Curved Centrifugal Fan

- Generates continuous airflow
- Maintains system airflow conditions

4.5 Electronic Damper

Controls system behavior:

- Enables or restricts moisture exhaust
- Regulates exhaust ratio
- Switches operation modes

Without the electronic damper, Drying Engine behavior cannot be controlled.

4.6 Dual Airflow Architecture

- Primary airflow: drying circulation
- Secondary airflow: regeneration and exhaust

Defines airflow pathways within the system.

05 | Drying Behavior Modules

HumiDry® defines six drying behavior modules.

Each module represents a controlled combination of the required conditions: Heat Input, Humidity Control, and Forced Ventilation.

All drying behaviors are derived from these conditions.

Cool Air Drying Mode

Humidity Control + Forced Ventilation

Removes moisture continuously without additional heat input.

Warm Air Drying Mode

Moderate Heat Input + Humidity Control + Forced Ventilation

Increases evaporation rate under controlled conditions.

Hot Air Drying Mode

High Heat Input + Humidity Control + Forced Ventilation

Maximizes evaporation and enables rapid moisture removal.

Constant-Temperature Heating Mode

Controlled Heat Input

Maintains a defined temperature condition over time.

Forced Ventilation Mode

Forced Ventilation

Removes humid air and enables air exchange within the system.

Air Circulation Mode

Controlled Airflow

Maintains uniform distribution of temperature and humidity.

06 | Automatic Drying Logic (Reference)

The system supports basic control logic:

- Humidity-triggered activation
- Condition-based stop
- Time limit protection

- Restart upon humidity increase

This logic serves as a reference, not a fixed control strategy.

07 | Control Interface: RS-485

Provides:

- Behavior module control
- System status feedback
- Basic parameter configuration

RS-485 defines the control layer, not the drying strategy.

08 | Application Domains

Applicable to:

- Residential and commercial systems
- Storage and protection systems
- Industrial and process drying systems
- Building and environmental control systems

Conclusion | What HumiDry® Represents

HumiDry® does not replace existing systems.

It defines drying as:

- Designable
- Controllable
- Integrable

Drying is no longer a result.

It is an engineering function.

Signature and Attribution

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