

HVAC FOR HIGH-HUMIDITY FOOD PROCESSING ENVIRONMENTS

5 INNOVATIVE SOLUTIONS

- HVAC (Heating, Ventilation, and Air Conditioning) systems are essential for dehumidification to prevent moisture accumulation, reduce microbial growth, and preserve quality
- Proper designing and optimization of HVAC is necessary to achieve a comfortable working environment while ensuring integrity and safety of food products
- Correct sizing, dedicated dehumidification units and proper airflow management of HVAC systems are the crucial parameters to consider while designing an HVAC system



HVAC (High Ventilation, and Air Conditioning) System



1) Desiccant Dehumidification Systems

- Utilize moisture-absorbing materials like silica gel or lithium chloride to extract humidity from the air
- Ideal for environments with frequent washdowns and high moisture loads

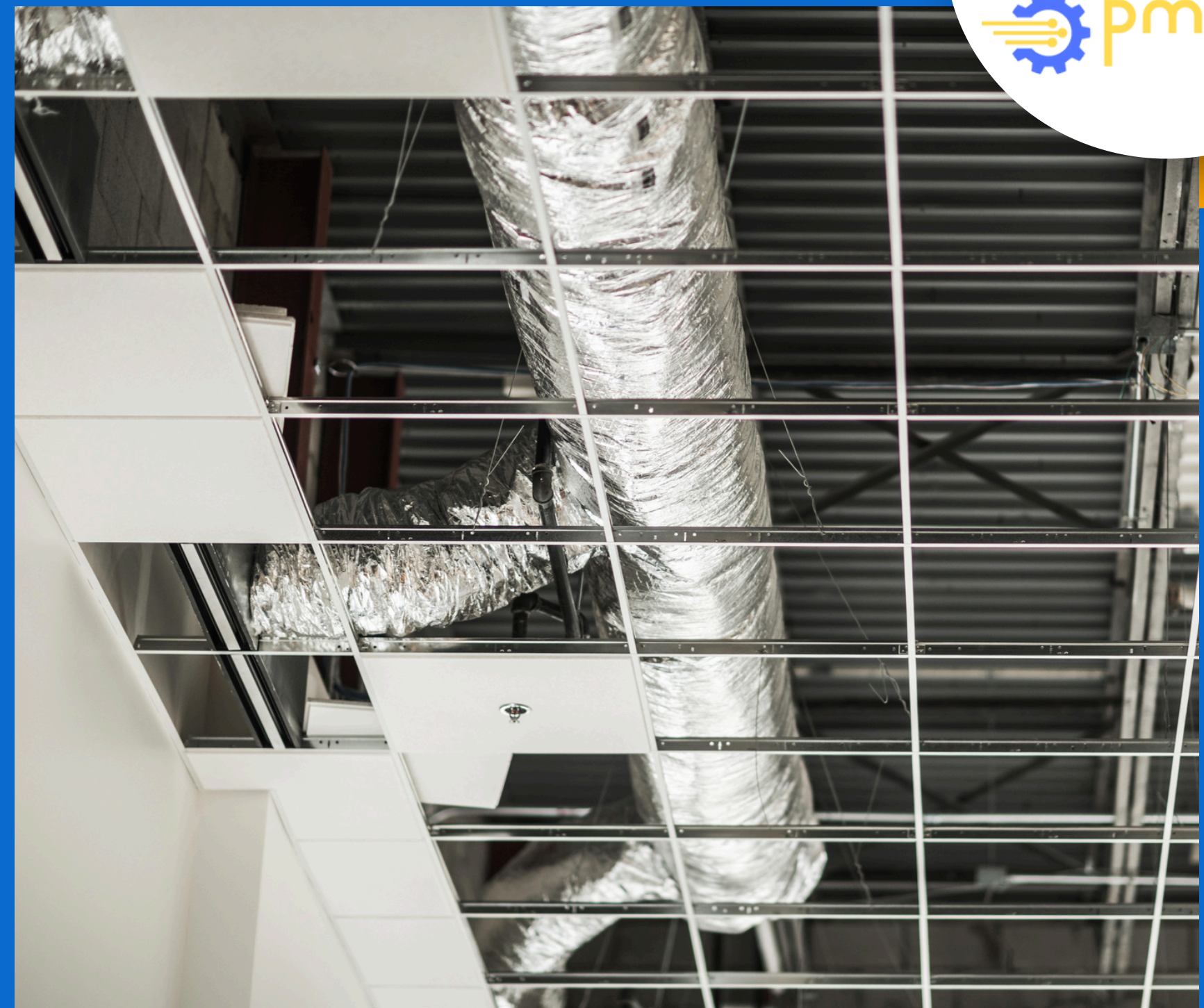
WORKING:

- The humid air pass through desiccant wheel, which soaks up moisture directly from the air leaving dry air that is circulated back into the facility
- A separate heated air stream (around 120°C) removes and evaporates the collected moisture from the desiccant
- The wheel continuously rotates, ensuring constant moisture removal and system efficiency

- Supplies filtered, low-velocity air at floor level and removes contaminants at ceiling level
- Reduces airborne moisture accumulation and prevents condensation on cold surfaces and equipment.

Working

- Filtered, cool air is introduced at floor level at a low velocity
- Air moves upward as it absorbs heat and moisture, carrying contaminants with it
- Exhaust vents at the ceiling remove humid, warm, and contaminated air, preventing recirculation
- A stratified airflow effect is maintained, ensuring minimal turbulence and efficient humidity control



2) Low-Velocity Displacement Ventilation (LVDV)



3) Variable Refrigerant Flow (VRF) Systems

- Provide precise temperature and humidity control in high-humidity food processing facilities
- Allows for simultaneous cooling, heating, and dehumidification across multiple zones

WORKING:

- Humidity-laden air enters the system and passes through the evaporator coil
- Moisture condenses as the air cools, reducing relative humidity (RH)
- Hot gas reheat coil activates, reheating the dehumidified air without adding extra moisture
- Conditioned air is distributed to maintain optimal temperature and humidity

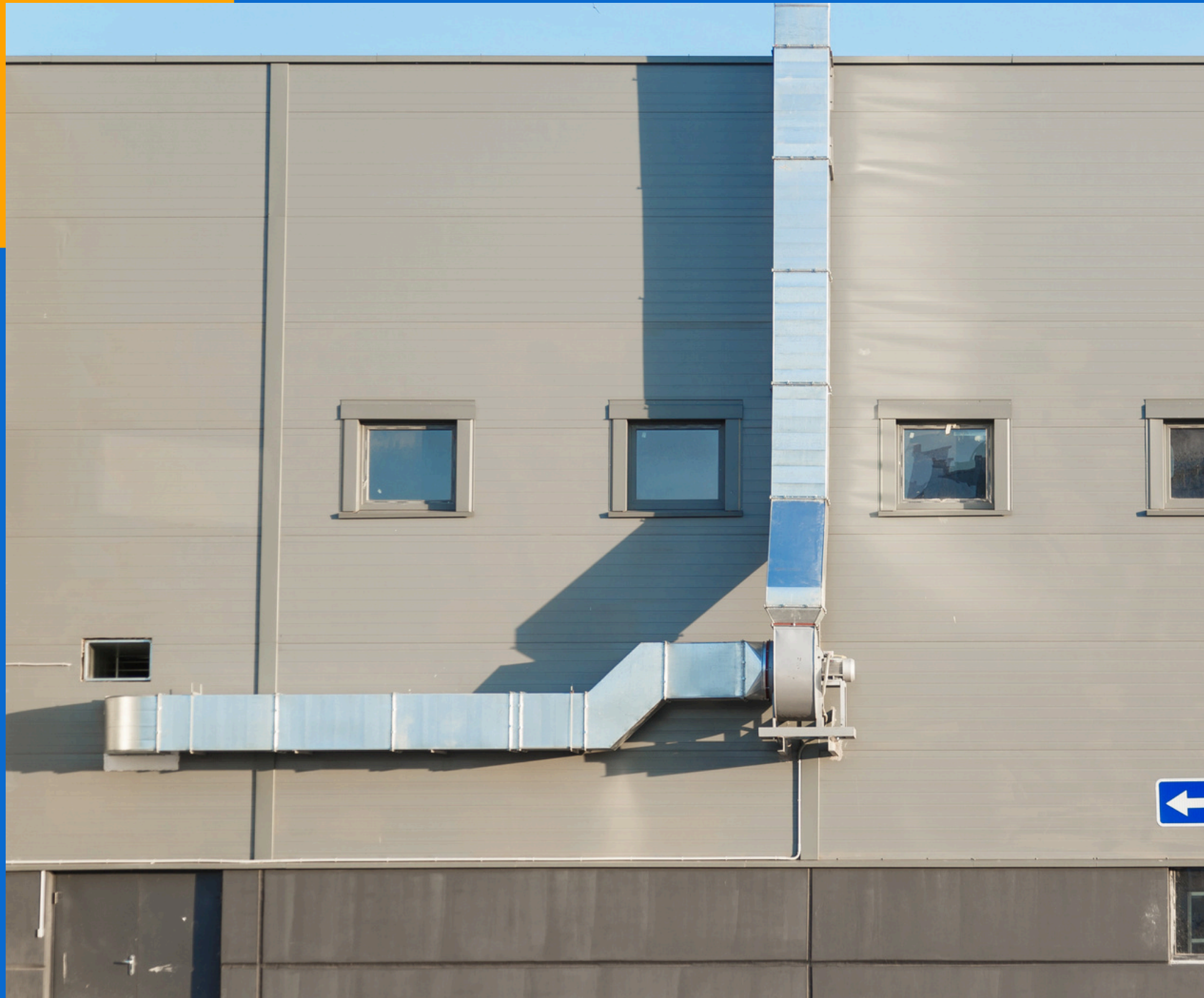
- Uses a secondary air stream for cooling without adding moisture to the processing area
- Heat recovery wheels transfer waste heat to pre-condition incoming air

WORKING:

- Hot process air passes through the heat exchanger without direct contact with water
- A separate secondary air stream is cooled via evaporative cooling (water absorbs heat and evaporates)
- Heat is transferred from the primary air to the secondary air, cooling the primary air without adding moisture
- The cooled, dry air is then supplied to the food processing area, maintaining temperature and humidity control
- Waste heat from refrigeration units or exhaust air is recovered and used for pre-conditioning fresh intake air



4) Indirect Evaporative Cooling (IEC) with Heat Recovery



5) Air Handling Units (AHUs) with HEPA Filtration

- AHUs with High-Efficiency Particulate Air (HEPA) filtration are critical to control humidity
- These filter airborne contaminants, regulate temperature and humidity in Ready-To-Eat (RTE) food production

WORKING:

- Ambient air enters the AHU and passes through pre-filters to remove large contaminants
- Air is cooled or dehumidified using refrigeration or desiccant-based moisture control
- HEPA filtration captures airborne microorganisms, mold, and fine particles before air distribution
- Clean, conditioned air is distributed into the food processing area, maintaining hygiene and temperature control



OUR EXPERTISE

- PMG Engineering delivers end-to-end engineering design and project management services for the food manufacturing facilities globally
- We provide HVAC design inputs and ensure that the HVAC design inputs are effectively incorporated, communicated, and adhered to during the detailed engineering phase
- We facilitate coordination, manage risks, maintain quality control, and promote effective communication between stakeholders, ultimately enhancing the overall quality assurance of the HVAC system design

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PMG ENGINEERING PRIVATE LIMITED



1504, Office Tower, Logix City Center, Sector 32,
Noida U.P. 201301



www.pmg.engineering

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