White Paper: Ozone-Free Bipolar Ionisation vs Hydroxyl Technology in Social Housing

Prepared for Social Housing Providers | Breathe Pure

Executive Summary

Social housing providers are prioritising solutions that reduce damp and mould risks, protect residents' health, and meet legal duties. While air-cleaning technologies such as hydroxyl generators and bipolar ionisation (BPI) can reduce airborne contaminants, only active humidity control prevents condensation and sustained high relative humidity (RH), the core drivers of damp and mould. The IW25-5 On Wall Dehumidifier uniquely combines ozone-free BPI with continuous, tankless dehumidification, maintaining RH within recommended ranges and preventing condensation even when heating is off due to fuel poverty.

Policy & Health Context

Damp and mould are a public health risk. UK government guidance emphasises urgent landlord action, focusing on moisture control as the key to prevention [UK Government, 2024]. ASHRAE's position documents highlight that humidity control is essential to limit indoor dampness and mould [ASHRAE, 2024]. The WHO guidelines likewise prioritise prevention of persistent dampness and microbial growth [WHO, 2009].

Technologies at a Glance

• Ozone-Free Bipolar Ionisation (BPI): generates balanced positive and negative ions that agglomerate particulates and interact with airborne microbes and some VOCs. Best practice is to select systems validated to UL 2998 for zero ozone emissions [US EPA, 2025], such as the IW25-5.

• Hydroxyl Technology: uses UV light and a catalyst (often TiO_2) to form hydroxyl radicals/advanced oxidation products (AOPs) that oxidise VOCs and neutralise microbes [Axis Portable Air, 2024; Ask Jon Eakes, 2023]. Both improve air quality, but neither alone addresses condensation or high RH.

Why Active Humidity Control Is Non-Negotiable

RH above ~60% increases condensation risk and supports mould growth. In cold homes (e.g., heating off due to fuel poverty), surfaces drop below the dew point, condensation forms, and mould can flourish [US EPA Mold Course; Schöck Ltd]. Only dehumidification actively removes water vapour, lowering RH and dew point to safe ranges [ASHRAE, 2024].

IW25-5: Combined Air Cleaning + Active Dehumidification

The IW25-5 On-/Wall Dehumidifier integrates ozone-free BPI with a tankless dehumidifier. UK model performance: up to 33 litres/day at 30°C/80%RH, quiet operation (~47 dBA), integral humidistat with a gravity drain or optional pump. By removing moisture and reducing airborne contaminants, the IW25-5 addresses both causes and consequences of damp and mould.

How Hydroxyl/BPI-Only Devices Fall Short

Hydroxyl systems and BPI-only purifiers can reduce microbes and odours, but they do not remove water vapour. Without active humidity control, RH may remain above mould-supporting thresholds, especially in cold homes, so condensation and damp persist [US EPA; ASHRAE].

Comparative Analysis: IW25-5 vs Hydroxyl Air Cleaner

Criterion	**IW25-5 On-Wall Dehumidifier**	**Hydroxyl Air Cleaner**
Primary Function	Active dehumidification + ozone-free BPI	Air cleaning only (hydroxyl + BPI + HEPA)
Moisture Removal	Up to 33 L/day (UK model)	None
Condensation Prevention	Yes (lowers RH & dew point)	No
Ozone Safety	Ozone-free; specify UL 2998	Marketed for occupied use; focusses on AOPs
Fuel Poverty Suitability	Prevents damp even when heating is off	Cannot control RH

Technical Breakdown: Ozone-Free Bipolar Ionisation (BPI)

1) Ion Generation Methods

Most BPI systems use needlepoint/brush corona discharge or non-thermal plasma to create balanced streams of positive and negative ions. Electrodes apply high voltage at very low current to ionise ambient air and water vapour, producing ions such as H^+ and O_2^-.
Well-designed systems minimise by-products (e.g., ozone) and are validated to UL 2998 (Zero Ozone Emissions)** [US EPA, 2025]. ASHRAE's primer describes the physics of electron collisions and ion formation in HVAC contexts [ASHRAE Journal, 2021].

2) Reactive Pathways & What They Do

Agglomeration (physical): Charged ions attach to fine particles (PM), causing them to cluster and become easier to filter or settle, documented reductions up to ~80% for $PM_{2.5}$/PM_{10} in controlled testing [Gupta et al., 2023].
Surface chemistry (chemical): Ions and short-lived reactive species can oxidise certain VOCs and disrupt microbial structures (e.g., hydrogen abstraction from proteins/lipids), reducing viability. Some BPI designs may yield limited hydroxyl radical formation via interactions with water

vapour, but this is **not equivalent** to dedicated hydroxyl generators and is highly design-dependent [ASHRAE; EPA].

3) Safety & Standards

The US EPA notes BPI is an emerging technology whose effectiveness can vary by design and installation; it advises selecting devices validated to UL 2998 to ensure zero ozone emissions** [US EPA, 2025]. ASHRAE and CDC resources emphasise that air cleaning should complement, not replace, ventilation and humidity control [ASHRAE; CDC].

4) Performance Considerations

Ions disperse with airflow and can reach areas beyond the device, but performance depends on airflow patterns, distance, and room geometry. Effectiveness improves when combined with filtration and source control; however, none of this address the moisture burden, which is why pairing BPI with active dehumidification is critical.

5) Integration with IW25-5 Dehumidification

In the IW25-5, the integral humidistat monitors RH and energises dehumidification automatically when RH rises above the setpoint. Air is drawn across a cold evaporator coil where moisture condenses and drains away; the air is then gently reheated and returned to the room. Simultaneously, the ozone-free BPI module disperses ions into the space, reducing particulates and microbial load. The result is dry air + clean air preventing condensation and mould while improving overall IAQ.

Implementation Guidance for Social Landlords

1) Specify humidity control first. Target RH ~40–60% to avoid condensation and mould [ASHRAE; EPA].
2) Combine with safe air cleaning. Use ozone-free BPI to reduce particulates/microbes and support odour/VOC reduction [EPA].
3) Place strategically. Install in rooms with persistent condensation risk (bedrooms, living rooms, kitchens).
4) Monitor & maintain. Verify drainage, clean filters, and log RH trends to demonstrate proactive compliance.

References

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- Axis Portable Air (2024) & Ask Jon Eakes (2023). Hydroxyl generator mechanisms & use in occupied spaces.