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BUILDING MOISTURE INDEX (BMI)

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ENVIRONMENTAL DIAGNOSTIC REPORT

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Building Professional:

Jon Snow

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Company Name:

test server

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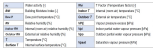
Property Address:

16 Spencer Hill, SW19 4NY

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Date of Inspection:

27 August 2024 12:29:56



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The BMI system produces diagnostic reports on indoor air and surface moisture in buildings by processing environmental data. A protocol to install data loggers (environmental sensors) in properties and a novel method integrated in a computer program enables the system to generate autonomous diagnostic reports.

BUILDING MOISTURE INDEX (BMI)  
DIAGNOSTIC SYSTEM

MONITORING EQUIPMENT

USER MANUAL

Figure 1. Thermal Envelope Performance

Figure 1 is a graph showing the relationship between Temperature ( $T_{\text{Env}} [^{\circ}\text{C}]$ ) on the Y-axis and Water Activity ( $a_w$ ) on the X-axis. The Y-axis ranges from 0.0 to 1.0, and the X-axis ranges from 0.0 to 1.0. The graph is divided into three regions: 'No Mould' (yellow), 'Mould Growth' (orange), and 'Mould Growth' (blue). A blue maple leaf icon is placed in the 'No Mould' region. The graph also shows a grid of temperature and water activity values.

| Temperature ( $T_{\text{Env}} [^{\circ}\text{C}]$ ) \ Water Activity ( $a_w$ ) | 0.0  | 0.2  | 0.4  | 0.6  | 0.8  | 1.0  |
|--|------|------|------|------|------|------|
| 1.0  | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 0.8  | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 0.6  | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 0.4  | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 0.2  | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 0.0  | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |

A user manual is provided for the installation of the data loggers in the property. These sensors gather environmental data every 30 minutes (ambient air-atmospheric relative humidity (RH) and temperature (T), plus surface T) in the identified problem room and area of the property, during a minimum period of two weeks. Raw data collected by the sensors is then processed by establishing links through other computed environmental parameters that relate to the root causal factors leading to surface condensation and mould growth.

The BMI system identifies the severity of the problem based on the objective quantification of atmospheric and surface moisture levels. It analyses the data (critical thresholds and weighted values) to establish the severity and likelihood of moisture imbalance leading to condensation and mould. Provided that the BMI protocol to install the data loggers in the monitored property has been accurately followed, the BMI method provides a quick, accurate and impartial assessment to identify and quantify the root cause of the problem.

Please, note that this report is not a building survey; it complements property inspections. This report is based solely on the data processed from the environmental sensors placed in the dwelling and on the understanding they have not been moved or manipulated.



## 3. PROPERTY AND SURVEYOR: MOISTURE OBSERVATIONS

**Building professional:** Jon Snow  
**Company Name:** test server  
**Date of inspection:** 27 August 2024 12:29:56  
**Property Address:** 16 Spencer Hill, SW19 4NY

**Occupied or empty?:** Empty  
**During all monitoring period?:** No  
**Monitoring period:** 13 days 23 hours 59 minutes  
**If occupied, how many occupants?:** 0

**Monitored Problem room:** kitchen  
**Monitored Problem area:** wall  
**Is there visible mould?:** No

**Comments and additional relevant observations:**  
ebrtbtr

# Building Moisture Index (BMI) Environmental Diagnostic Report

|   |   |   |   |
|---|---|---|---|
| 1 | Water activity [-]                        | 1 | Water vapour pressure [kPa]                 |
| 2 | Building Moisture Index [-]               | 2 | Indoor air temperature [°C]                 |
| 3 | Dew point temperature [°C]                | 3 | External air temperature [°C]               |
| 4 | Relative humidity [%]                     | 4 | Vapour pressure excess [kPa]                |
| 5 | Internal (room air) relative humidity [%] | 5 | Indoor partial water vapour pressure [kPa]  |
| 6 | External air relative humidity [%]        | 6 | Outdoor partial water vapour pressure [kPa] |
| 7 | Temperature [°C]                          | 7 | Saturation vapour pressure [kPa]            |
| 8 | Internal surface temperature [°C]         |   |   |

## Outdoor Image



## Indoor Image 1

|                             |   |                         |   |
|-----------------------------|---|-------------------------|---|
| <b><i>a<sub>w</sub></i></b> | Water activity [-]                        | <b><i>fRsi</i></b>      | T Factor (Temperature factor) [-]           |
| <b><i>BMI</i></b>           | Building Moisture Index [-]               | <b><i>Indoor T</i></b>  | Internal (room air) temperature [°C]        |
| <b><i>Dew P</i></b>         | Dew point temperature [°C]                | <b><i>Outdoor T</i></b> | External air temperature [°C]               |
| <b><i>RH</i></b>            | Relative humidity [%]                     | <b><i>VPE</i></b>       | Vapour pressure excess [kPa]                |
| <b><i>Indoor RH</i></b>     | Internal (room air) relative humidity [%] | <b><i>Vpi</i></b>       | Indoor partial water vapour pressure [kPa]  |
| <b><i>Outdoor RH</i></b>    | External air relative humidity [%]        | <b><i>Vpo</i></b>       | Outdoor partial water vapour pressure [kPa] |
| <b><i>T</i></b>             | Temperature [°C]                          | <b><i>Vpsat</i></b>     | Saturation vapour pressure [kPa]            |
| <b><i>Surface T</i></b>     | Internal surface temperature [°C]         |                         |   |

The results presented here have been obtained under the recorded external weather and indoor environmental conditions. The causal factors of moisture imbalance (poor envelope performance, inadequate heating, insufficient ventilation) are dynamic and interrelated. Any significant changes in the living conditions (e.g. increasing moisture production, reducing heating, not opening windows or using extraction fans, increasing occupancy, changing building usage, etc.) can upset the balance increasing the BMI score to higher levels. This could increase surface condensation or mould risk on thermal bridges.

The table below shows the moisture imbalance, risk of surface condensation and mould growth, causes and recommendations on remediation actions for each monitored room.

| Possible causes and recommendations for rectification measures |  |
|--|--|
| C1   | The temperature factor results indicate that the building envelope performance in the measured area is poor. An investigation of the thermal performance of the walls in this area and surroundings is strongly recommended. |

It must be fully appreciated that the areas examined may not fully reflect other areas in the property that were not measured. To confirm the 'whole-house' performance of the thermal envelope, ventilation and heating systems, further inspections would be required.

Useful tips to reduce condensation and mould risk may involve simple lifestyle changes like modification of the occupants' activities. Some examples for this could be cooking with pan lids on, opening windows and closing bathroom doors, for drying laundry, or during and after showers, until surfaces get dry, using warm heating sources, allowing space for the air to circulate in and around furniture, etc. Information, education, and long-term collaboration may also prove beneficial.



## 6. SYMBOLS AND DEFINITIONS

The following symbols correspond to the environmental parameters used in this report:

|                         |   |                          |   |
|-------------------------|---|--------------------------|---|
| <b><math>a_w</math></b> | Water activity [-]                        | <b><math>fRsi</math></b> | T Factor (Temperature factor) [-]           |
| <b>BMI</b>              | Building Moisture Index [-]               | <b>Indoor T</b>          | Internal (room air) temperature [°C]        |
| <b>Dew P</b>            | Dew point temperature [°C]                | <b>Outdoor T</b>         | External air temperature [°C]               |
| <b>RH</b>               | Relative humidity [%]                     | <b>VPE</b>               | Vapour pressure excess [kPa]                |
| <b>Indoor RH</b>        | Internal (room air) relative humidity [%] | <b>Vpi</b>               | Indoor partial water vapour pressure [kPa]  |
| <b>Outdoor RH</b>       | External air relative humidity [%]        | <b>Vpo</b>               | Outdoor partial water vapour pressure [kPa] |
| <b>T</b>                | Temperature [°C]                          | <b>Vpsat</b>             | Saturation vapour pressure [kPa]            |
| <b>Surface T</b>        | Internal surface temperature [°C]         |                          |   |

### 6.1. Raw data gathered by the sensors (data loggers):

**Air temperature (T):** ambient measure of how hot or cold the air is (degrees Celsius)

**Air relative humidity (RH):** water vapour proportion in air relative to 100% saturation at the same T

|                               |                                    |
|-------------------------------|------------------------------------|
| <b>Indoor T and Indoor RH</b> | 18-24 °C and 45-60 %: Comfort zone |
|-------------------------------|------------------------------------|

**Surface Temperature:** surface measure of how hot or cold the surface is (degrees Celsius)

**Dew point:** temperature at which air vapour needs to be cooled to reach 100% RH (condensation)

|   |   |
|---|---|
| <b>Surface T – Dew P (differential)</b> | Surface T > Dew P: No condensation<br>(larger the difference, lower the risk)<br>Surface T ≤ Dew P: Condensation occurs |
|---|---|

### 6.2. Calculated parameters assessed by BMI:

**Water activity ( $a_w$ ):** relative humidity (RH) at the surface in steady state conditions (surface humidity)

|   |   |
|---|---|
| $a_w = V_{pi} / V_{psat} = RH \text{ (surface)} / 100 \%$ | < 0.6: Mould growth unlikely<br>> 0.7: Risk of mould growth<br>0.8-0.9: High risk of mould growth |
|---|---|

**Temperature factor ( $fRsi$ ):** total thermal envelope resistance regarding Indoor & Outdoor T

|   |  |
|---|--|
| <b>T Factor=</b> (Surface T – Outdoor T) / (Indoor T – Outdoor T) | 1.0: Well insulated structure (e.g. passive house)<br>< 0.75: Risk of surface condensation<br>≤ 0.5: High risk (e.g. severe thermal bridges) |
|---|--|

**Vapour Pressure Excess (VPE):** differential vapour pressure (Vp) regarding Indoor & Outdoor Vp

|  |  |
|--|--|
| <b>VPE =</b> Indoor Vp – Outdoor Vp (differential) | > 0.6 kPa: Wet air environment from accumulation of moisture production<br>0.5 kPa: Moderate wet air environment<br>< 0.4 kPa: No trapped air moisture |
|--|--|