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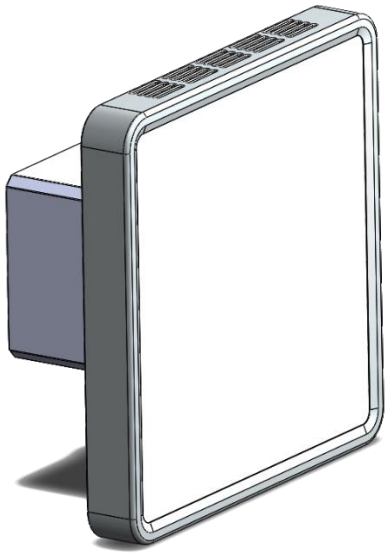


E5000 IAQ probe compliance to existing green buildings certifications

Ver	Date	Update
V1	25/10/2019	Initial version
V2	05/02/2021	Well V2 requirements update
V3	04/12/2021	Update
V4	12/02/2023	Well V2 VOCT library released by Renesas

Reminder of certifications

Green color indicates compliance of EP5000 NanoSense probe.

Well V2 requirements

A05 Enhanced air quality

https://v2.wellcertified.com/wellv2/en/air/feature/5

This WELL feature requires projects to go beyond current guidelines to provide enhanced air quality levels that have been linked to improved human health and performance.

Part 1

Meet Enhanced Thresholds for Particulate Matter (Max: **2 points**)

For All Spaces

The following requirement is met:

a. Projects comply with the thresholds specified in the table below:

Particulate Matter Thresholds	**Points**
$PM_{2.5}$: 12 µg/m³ or lower. PM_{10}: 30 µg/m³ or lower.	1
$PM_{2.5}$: 10 µg/m³ or lower. PM_{10}: 20 µg/m³ or lower.	2

Comment:
Met, thanks to DCV on PM.

Part 2

Meet Enhanced Thresholds for Organic Gases (**1 point**)

The following thresholds are met in occupable spaces:

1. Acetaldehyde: 140 µg/m³ or lower.
2. One of the following:
    1. Acrylonitrile: 5 µg/m³ or lower.
    2. Caprolactam: 2.2 µg/m³ or lower.
3. Benzene: 3 µg/m³ or lower.
4. Formaldehyde: 9 µg/m³ or lower.
5. Naphthalene: 9 µg/m³ or lower.
6. Toluene: 300 µg/m³ or lower.

Comment:
Can be met thanks to DCV on TVOC if low VOC emission materials are used.

Part 3

Meet Enhanced Thresholds for Inorganic Gases (**1 point**)

For All Spaces

The following thresholds are met:

a. Carbon monoxide less than 6 ppm.
b. Ozone less than 25 ppb.
c. Nitrogen dioxide less than 21 ppb

Comment:
Met thanks to DCV on NOx and O3.

A06 Enhanced Ventilation

https://v2.wellcertified.com/wellv2/en/air/feature/6

Part 1

Increased Outdoor Air Supply (max 3 point)

Option 1: Increased air supply.

For mechanically ventilated projects, the following requirement is met in all occupable spaces:

a. Exceed outdoor air supply rates described in one of the ventilation guidelines listed in Feature A03 Part 1 by the percentages shown in the table below:

Thresholds	Points
30%	1
60%	2

Comment:
Ventilation system dependent

Option 2: Implement Demand control ventilation

For mechanically ventilated projects, the following requirements are met in at least 90% of regularly occupied spaces:

a. A Demand-Controlled Ventilation (DCV) system regulates the outdoor air ventilation rate to keep CO_2 levels less than the thresholds specified in the table below, at the maximum intended occupancy:

Threshold		Points
900 ppm	Or 500ppm above outdoor level	1
750 ppm	Or 350ppm above outdoor level	2

Comment:
Can be set as low as 500ppm

b. Carbon dioxide is measured at the return air diffusers or in the breathing zone at least 3.3 ft away from doors, windows, air supply diffusers or occupants. At least one sensor is used for each occupancy zone (or per air handling unit, if a single zone is served by multiple air handling units). If the occupancy density/pattern/usage is substantially different in two adjacent areas, each area must be considered a separate zone.

EP5000 installation manual compliant

Option 3: Enhanced natural ventilation

a. For naturally ventilated buildings, the following requirement is met:

Implement an engineered natural ventilation system that is sufficient to keep CO2 levels in the breathing zone of all regularly occupied spaces below the specified thresholds at the maximum intended occupancies:

Threshold		Points
900 ppm	Or 500ppm above outdoor level	1
750 ppm	Or 350ppm above outdoor level	2

EP5000 control natural ventilation too.

A07 Operable Windows (2 point)

https://v2.wellcertified.com/wellv2/en/air/feature/7

This WELL feature requires buildings with operable windows to increase the supply of high-quality outdoor air and promote a connection to the outdoor environment by encouraging building users to open windows when outdoor air quality is acceptable.

Part 1 Provide operable Windows (1 point)

Project meets one of the below:

1. At least 75% of the regularly occupied spaces have operable windows that provide access to outdoor air.
2. For each floor, the openable window area is at least 4% the area of the occupable space.

Part 2 Manage Window use (1 point)

Projects may only achieve this part if Part 1 is also achieved.

Outdoor air measurement

The following requirement is met:

a. Outdoor levels of $PM_{2.5}$, temperature and humidity are monitored at intervals of at least once per hour, based on a data-gathering station located within 2.5 mi of the building. This monitoring system may be operated by the project or by another entity (e.g., a government).

Comment:
Use of NanoSense OAQ probe on each façade.

AND

Window operation

Indicator lights and/or digital displays at windows (at least one per room with windows) cue occupants when conditions outside are suitable for opening windows:

a. $PM_{2.5}$: 15 µg/m³ or lower
b. Dry-bulb temperature: within 15°C of indoor air temperature setpoint.
c. Relative humidity: 65% or lower

2 indicators (one per façade) settable on Well V2 or NanoSense physio effects comparison between IAQ and OAQ

A08 Air Quality Monitoring and Awareness

https://v2.wellcertified.com/wellv2/en/air/feature/8

This WELL feature requires the ongoing measurement of contaminant data to educate and empower occupants about their environmental quality.

Part 1: Install indoor air monitor (1 point)

For All Spaces but dwelling units

1: Sensor requirements

The project deploys monitors with sensors that measure at least three of the following parameters in occupable spaces in compliance with the requirements outlined in the Continuous Monitoring Protocols of the Performance Verification Guidebook:

1. $PM_{2.5}$ or PM_{10}.

2. Carbon dioxide.
3. Carbon monoxide.
4. Ozone.
5. Nitrogen dioxide.
6. Total VOCs.
7. Formaldehyde

Comment:
O3 is optional on EP5000. There is a growth potential for NOx by software update via OTC.

AND

2: Reporting & maintenance

The following requirements are met:

a) Data are submitted annually through the WELL digital platform.
b) Proof of calibration or replacement is submitted annually in accordance with the requirements of the WELL Performance Verification Guidebook.

Part 2: Promote air quality awareness (1 point)

For All Spaces but dwelling units

Note: Projects may only receive points for this part, if Part 1 is also achieved.

Information about the air quality measured in Part 1 of this feature is made available to occupants as follows:

1. Data are presented through one of the following:

    a) Display screens prominently positioned at a height of 3.6–5.6 ft with at least one display per 5400 ft^2 of regularly occupied space.
    b) Hosted on a website or phone application accessible to occupants. Signs are present indicating where the data may be accessed at a density of at least one sign per 5400 ft^2 of regularly occupied space.

Comment:
Data transmitted to various supervision platforms.

2. Data presented include one of the following:

    a) Concentrations of the parameters measured.
    b) Qualitative results of air quality (e.g., colored-coded levels).

Comment:
Data in Cloud via a gateway for website supervision.

Sensor Technical Specification Requirement

Parameter	Unit	Sensor type	Range	Accuracy	Resolution	Specific Requirement
$PM_{2.5}$	$\mu g/m^3$	Light scattering	1-1000	±5 + 20% between 1 and 100 $\mu g/m^3$	1	Adjustable particle density (K-factor) to accommodate project/region specific particulate profile
PM_{10}	$\mu g/m^3$					
TVOC	$\mu g/m^3$	MOX	1-2000	±20 $\mu g/m^3$ + 15% between 1 and 500 $\mu g/m^3$	1	Calibration gas: ethanol Target gas profile (ppb=µg/m 3 conversion factor under STP): 22 VOC mixed per Molhav et al.* (1 ppb = 4.57 $\mu g/m^3$) OR to project-specific VOC profile.
CO	ppm	MOX	0.1-25	1 ppm between 0 and 10 ppm	0.1	
O3	ppb	Electrochemical *	10-500	±10 ppb between 0 and 100	5	
Radon	Bq/m^3	Photodiode				
CO2	ppm	NDIR	400-5000	±50 ppm + 5% between 400 and 2000 ppm	1	
Formaldehyde	ppb	MOX	20-1000	±20 ppb between 0 and 100 ppb	1	
NO2	ppb	MOX	5-500	±20 ppb between 0 and 100	1	
Temperature	°C	Semiconductor	10-40	±0.5°C	0.5	
Relative humidity	%	Semiconductor	5-95	±5%	1	

*O3 being measured with a MOX sensor, Alternative Adherence Path that includes 1) technical specifications listed in Table 4 and 2) evidence indicating the alternative sensor technology provides performance that is similar or exceeds approved sensor technologies to be submitted.

RESET requirements

2.6.1 Introduction to Monitor Grades and Types

RESET™ Air Accredited Monitors are defined and categorized by both Grade and Type. Monitor Grade defines the performance, accuracy and data reporting proficiency of a monitoring device. Monitor Type defines the "fit for purpose" scenarios applicable to each Grade and serves to define appropriate deployment of monitoring devices.

The RESET™ Air Accredited Monitor Grades include:

- Grade A
- Grade B
- Grade C

Grade A: Calibration Grade monitors. Monitors that are used for the calibration of Grade B and C monitors. Grade A monitors are typically (but not exclusively) handheld and are primarily utilized for project commissioning, site audits, and pollutant source detection.

Grade B: Commercial Grade monitors. Grade B monitors provide actionable, indoor air quality data at scale within buildings, balancing performance and cost while reliably enabling building automation and providing occupants with high-quality data.

Grade C: Consumer Grade monitors. Grade C monitors are affordable to the average user or "citizen scientist". Primarily utilized for personal data gathering or non-scientific purposes.

The RESET™ Air Accredited Monitor Types include:

- Interior
- In-duct
- Outdoor

Interior monitors are devices that monitor and report air quality within the built environment. Interior monitors are intended to be used for RESET™ Air for Commercial Interiors projects. Interior monitors must comply with the requirements as outlined in the RESET™ Air Standard for Accredited Monitors.

In-duct monitors are devices that monitor and report air quality in a project's mechanical system (ie ductwork/air ducts). In-duct monitors are intended to be used for RESET™ Air for Core & Shell projects. In-duct monitors must comply with the requirements as outlined in the RESET™ Air Standard for Accredited Monitors and must have mechanisms integrated into the design of the device to account for the variable air velocity inherent to mechanical systems.

Outdoor monitors are devices that monitor and report outdoor air quality. Outdoor monitors are intended to be used for RESET™ Air for Core & Shell projects. Outdoor monitors are designed to withstand outdoor weather conditions, including, but not limited to, extreme temperatures and humidity, while maintaining data quality and accuracy. The In-duct monitor and Outdoor monitor performance tests include environmental simulation exercises in order to evaluate a device's performance capabilities.

2.6.2 Basic Requirements

RESET™ Air Accredited Monitors are designed for continuous monitoring, thus there are basic connectivity and continuous monitoring requirements for all RESET™ Air Accredited Monitors.

Only Grade A and B monitors are permitted for use in RESET™ Air Projects.

For RESET™ Air Accredited Monitors, accreditation will be assigned for each of the air parameters individually.

An air quality monitor is awarded RESET™ Air Accreditation for a single air quality parameter or for multiple air quality parameters as defined in the RESET™ Air Standards, provided that the monitor fulfills the basic requirements as outlined herein.

All RESET™ Air Accredited Monitors must fulfill the following Basic Requirements as outlined below:

			Grade A	Grade B	Grade C
a	Interfaces with RESET™ Assessment Cloud		Required	Required	N/A
b	Data Output Interval	min	1	5	10
c	Data Loss	%	1	10	N/A
d	Operating Range for Temperature	℃	0 - 50	0 - 40	0 - 40
e	Operating Range for Relative Humidity	%RH	5 - 95 non-condensing	10 - 85 non-condensing	5 - 50 non-condensing
f	Installation Options		Permanent Option	Permanent Option	N/A
g	Calibration Report		Required	Required	Required

Note on Calibration Report:
Monitors must be accompanied with documentation from the original manufacturer attesting that the monitor was appropriately calibrated and confirmed functional without defect prior to shipping. Explanation of the methodology for calibration must be provided to RESET™.

Comment: Calibration certificate is optional.

2.6.3 Particulate Matter 2.5 (PM2.5) Sensor Requirements

RESET™ does not specify PM2.5 sensor type, but the sensor technology utilized must be reported.

The default unit for PM2.5 is µg/m^3.

The following section specifies PM2.5 sensor requirements

			Grade A	Grade B	Grade C
a	Sampling Type		Active Airflow	Active Airflow	N/A
b	Sensor Output Resolution	µg/m^3	1	1	5
c	Measuring Range	µg/m^3	0 - 1000	0 - 500	0 - 300
d	Accuracy	±%	**0 - 150**: ±2 & 10% **150 - 300**: ±5 & 15% **300 - 500**:15%	**0 - 150**: ±5 & 15% **150 - 500** : ±5 & 20%	**0 - 300**: ±5 && 30%

			500 - 1000: 20%		
e	Performance Check and Re-calibration		Required	Required	N/A

Note: Performance Check and Re-calibration
An annual performance check of all monitors is compulsory as per RESET™ Air Building Certification.
The PM2.5 sensor must demonstrate the ability to be re-calibrated or be removed and exchanged for a new or newly calibrated sensor.

Comment:
PM sensor is plug and play. Calibration is possible but require a large calibration Chamber.

2.6.4 Total Volatiles Organic Compounds (TVOC) Sensor Requirements

RESET™ does not specify TVOC sensor type, but the sensor technology utilized must be reported.
TVOC allows for two units: µg/m3 and ppb. The conversion between the two units uses isobutylene's molecular weight of 56.106 g/mol at 25°C and 1 atm: X ppb = (Y µg/m^3) (24.45)/(molecular weight). Isobutylene's molecular weight is used is because it is often used for TVOC calibration and it is a good middle ground between formaldehyde (30.031 g/mol), toluene (92.14 g/mol), benzene (78.11 g/mol), and ethanol (46.07 g/mol). TVOC is used as a reference and does not serve to replace laboratory testing methodologies for air sampling and/or speciation.
The following section specifies TVOC sensor requirements for RESET™ Air Accredited Monitors.

TVOC sensor specification requirements in ug/m^3, according to Grade, are outlined below:

			Grade A	Grade B	Grade C
a	Sensor Output Resolution	µg/m^3	1	10	100
b	Measuring Range	µg/m^3	10 - 5000	150 - 2000	150 - 1000
c	Accuracy	±%	**10 - 1000**: ±10 & 10% **1000 - 5000**: ±10 &15%	**150 - 600**: ±20 & 15% **600 - 2000**: ±20 & 20%	**150 - 1000**: ±100 &25%
d	Performance Check and Re-calibration		Required	Required	N/A

Comment:
Absolute TVOC Well library allows recalibration as specified.

TVOC sensor specification requirements in ppb, according to Grade, are outlined below:

			Grade A	Grade B	Grade C
a	Sensor Output Resolution	ppb	0.44	4.4	44
b	Measuring Range	ppb	4.4 - 2180	65 - 870	65 - 440
c	Accuracy	±%	**4.4 - 440**: ±4.4 & 10% **440 - 2180**: ±4.4 & 15%	**65 - 260**: ±8.7 & 15% **260 - 870**: ±8.7 & 20%	**65 - 440** : ±0.044 & 25%
d	Performance Check and Re-calibration		Required	Required	N/A

2.6.5 Carbon Dioxide (CO2) Sensor Requirements

RESET™ does not specify CO2 sensor type, but the sensor technology utilized must be reported.
The default unit for CO2 is ppm.
The following section specifies CO2 sensor requirements for RESET™ Air Accredited Monitors.

RESET™ Air Accredited Monitor CO2 sensor specification requirements, according to Grade, are outlined below:

			Grade A	Grade B	Grade C
a	Sensor Output Resolution	ppm	1	5	10
b	Measuring Range	ppm	200 - 5000	400 - 5000	400 - 2000
c	Accuracy	±%	**0 - 2000**: ±40 & 3% **2000 - 5000**: ±50 & 3%	**400 - 2000**: ±50 & 3% **2000 - 5000**: ±50 & 5%	**400 - 2000**: ±50 & 3% **2000 - 5000**: ±50 & 5%
d	Performance Check and Re-calibration		Required	Required	N/A

Comment:
Baseline recalibration with smartphone App.

2.6.6 Temperature Sensor Requirements

RESET™ does not specify temperature sensor type, but the sensor technology utilized must be reported.
The default unit for temperature can be either ℃ or ℉ as the default unit for temperature because an exact conversion factor between the two is available.

			Grade A	Grade B	Grade C
a	Sensor Output Resolution	°C	0.1	0.1	1
b	Measuring Range	°C	0-50	0-40	0-40
c	Accuracy	±°C	0.5	1	1
d	Performance Check and Re-calibration		Required	Required	N/A

Comment:
Offset recalibration with smartphone App.

2.6.7 Humidity Sensor Requirements

RESET™ does not specify humidity sensor type, but the sensor technology utilized must be reported.
The default unit for humidity is % RH (relative humidity).

			Grade A	Grade B	Grade C
a	Sensor Output Resolution	%RH	0.1	1	1
b	Measuring Range	%RH	5-95	10-80	20-80
c	Accuracy	±°%RH	3	8	10
d	Performance Check and Re-calibration		Required	Required	N/A

Comment:
Offset recalibration with smartphone App.

Compliance

EP5000

Basic Requirements			Feature	Well Compliance	RESET Grade B compliance
a	Interfaces with RESET™ Assessment Cloud		Via gateway	NA	✓
b	Data Output Interval	min	5s Modbus 30s EnOcean 10Min LoRa	✓	✓
c	Data Loss	%	< 5% in LoRa	NA	✓
d	Operating Range for Temperature	℃	0-50	✓	✓
e	Operating Range for Relative Humidity	% RH	10-85	✓	✓
f	Installation Options		Permanent	NA	✓
g	Calibration Report		Provided on request	✓	✓

PM2.5			Feature	Well Compliance	RESET Grade B compliance
a	Sampling Type		Fan	NA	✓
b	Sensor Output Resolution	µg/m³	1	✓	✓
c	Measuring Range	µg/m³	0-1000	✓	✓
d	Accuracy	±%	< 50µg/m³: ± 10µg/m³ 50~100µg/m³ : ± 15µg/m³ > 100µg/m3: ± 15%	✓ **0 - 100**: ±5 µg/m³ + 20%	✓ **0 - 150**: ±5 & 15% = @ 50 = ±12.5 & @150=±27.5
e	Performance Check and Re-calibration		Compliant	✓	✓

TVOC			Performance	Well Compliance	RESET Grade B compliance
a	Sensor Output Resolution	µg/m³	10		✓
b	Measuring Range	µg/m³	250 000	✓	✓
c	Accuracy	±%	Absolute measurement with WELL V2 recalibration feature	✓ **1 – 500** ±20µg/m³**:** + 15%	✓ **150 - 600**: ±20 & 15% **600 - 2000**: ±20 & 20%
d	Performance Check and Re-calibration		Compliant	✓	✓

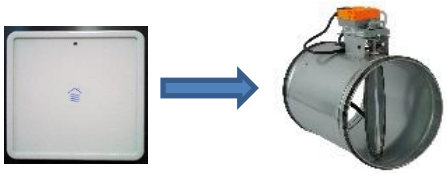
CO2			Performance	Well Compliance	RESET Grade B compliance
a	Sensor Output Resolution	ppm	19ppm in EnOcean and LoRaWAN 1ppm in Modbus, KNX	✓ But LoRa & EnOcean	✓

			ZigBee, BLE		Depend of communication protocol
b	Measuring Range	ppm	400 - 5000	✓	✓
c	Accuracy	±%	Single band ±50ppm+3% Dual band ±50ppm+3%	✓	✓
d	Performance Check and Re-calibration		Compliant	✓	✓

Temperature			Performance	Well Compliance	RESET Grade B compliance
a	Sensor Output Resolution	°C	0.1	✓	✓
b	Measuring Range	°C	0-50	✓	✓
c	Accuracy	±°C	0.3	✓	✓
d	Performance Check and Re-calibration		Compliant	✓	✓

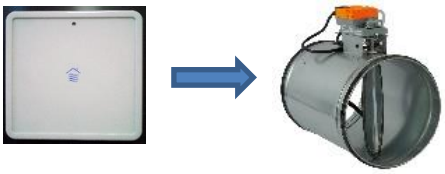
Humidity			Performance	Well Compliance	RESET Grade B compliance
a	Sensor Output Resolution	%RH	1	✓	✓
b	Measuring Range	%RH	10-90	✓	✓
c	Accuracy	±°%RH	5	✓	✓
d	Performance Check and Re-calibration		Compliant	✓	✓

Points Well V2



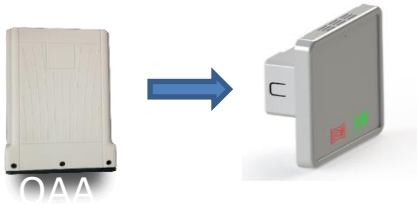
A05 : Amélioration QAI

- PM : 2 points
- VOC : 1 point
- Inorganiques (O3, NOx) : 1 point



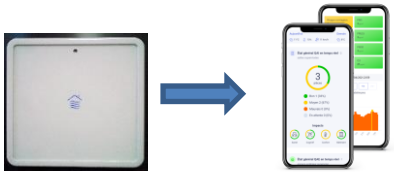
A06 : Amélioration ventilation

- Débit air neuf : 1 ou 2 points
- Control ventilation : 1 à 2 points



A07 : Fenêtres opérables

- Indications pour ouverture : 1 point



A08 : Supervision QAI

- Sonde QAI multi capteurs : 1 point
- Affichage temps réel : 1 point