

THE **WELL**

PERFORMANCE VERIFICATION GUIDEBOOK

Applies to WELL v1
Q3 2017



WELL Building Standard™ v1

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TABLE OF CONTENTS

- INTRODUCTION 1
- GENERAL INFO AND SET UP..... 3
- PERFORMANCE TESTING PROTOCOLS..... 4
- VISUAL VERIFICATIONS AND SPOT CHECKS.. 27
- SPECIAL CONSIDERATION FOR MULTIFAMILY RESIDENTIAL..... 28
- APPENDIX A..... 29

INTRODUCTION

The WELL Performance Verification guidebook contains details regarding the Performance Verification stage of WELL Certification and applies to the WELL Building Standard v1. For more information on WELL Certification and the steps involved in scheduling WELL Performance Verification, refer to the complete WELL Certification guidebook.

What is Performance Verification

Achieving WELL Certification involves two processes – Documentation Review, and Performance Verification – which together evaluate adherence to the requirements of the WELL Building Standard™. While building design is verified through the Documentation Review phase, Performance Verification ensures that the building is performing as it was designed to perform.

Performance Verification entails a site visit during which a WELL Assessor completes performance tests and visual assessments to evaluate compliance with the requirements established in the WELL Building Standard. The Performance Verification site visit is an official part of the WELL Certification process and the data collected for each applicable Feature will determine whether that Feature is achieved for the project.

Each Feature is achieved through documentation, Performance Verification, or a combination of both. Appendix D in the WELL Building Standard outlines the required documentation and/or Performance Verification method for each Feature.

Performance Verification consists of three primary verification types:

1. Performance tests: physical measurements of various air quality, water quality, lighting, acoustics, and thermal parameters against the WELL requirement thresholds
2. Visual verification: visual verification of design and operational requirements
3. Spot checks: visual verification of a representative sample of design and operational requirements

Purpose of This Guidebook

This guidebook dictates the performance testing protocol for each of the WELL Features that have performance tests included as a part of their verification method.

WELL Assessors are required to ensure that the Performance Verification activities executed for a given project are conducted in accordance with the instructions and requirements specified in this guidebook. In addition, this guidebook provides information for project teams wishing to engage in their own pre-testing of the WELL requirements prior to Performance Verification by a WELL Assessor. (Note: the results of any independent pre-testing engaged by the project team do not affect the outcome of the official Performance Verification testing executed by the WELL Assessor for the purposes of WELL Certification.)

The information contained in the WELL Performance Verification guidebook is subject to revision as protocols change and updated versions of the WELL Building Standard are released.

Role of the WELL Assessor

A WELL Assessor acts on behalf of the Green Business Certification Inc. (GBCI), the third-party certification entity responsible for assessing/reviewing the project. The WELL Assessor is charged with ensuring that the project complies with the WELL Building Standard requirements, and is responsible for both the Documentation Review

phase of WELL Certification and for Performance Verification activities.

During the Performance Verification site visit, the WELL Assessor will follow the testing protocol contained in this guidebook. The WELL Assessor will ensure that the data collected during Performance Verification accurately represents the environmental and design conditions in the project at that time.

Because the WELL Assessor is a part of the entity providing third-party WELL Certification services to the project, they are not permitted to interfere, manipulate or alter site conditions in any way that might affect the WELL Performance Verification outcome. The data collected while on site must be analyzed before Feature compliance can be determined; therefore, the WELL Assessor also cannot provide information regarding the Performance Verification results while on site.

In certain circumstances the WELL Assessor may choose to contract a pre-approved third-party testing organization to conduct a particular performance test component of WELL Performance Verification. Third-party testing organizations are evaluated and approved by GBCI to ensure that they fully understand the specific aspect of building performance for which they are being contracted to test. In these instances, the WELL Assessor remains primarily responsible for ensuring that performance testing by the third-party meets the guidelines established in this guidebook.

While on site, the WELL Assessor may request assistance from building management staff on accessing certain building areas. For example, the WELL Assessor may need assistance in accessing the mechanical room to verify the installed filtration media.

In some cases, representatives from the International WELL Building Institute (IWBI) may be present with the WELL Assessor during the Performance Verification site visit.

GENERAL INFORMATION AND SET UP

Scope

The below table sets forth the Performance Verification scope and is applicable for each WELL project type. For each project type, all areas described in the table below are subject to performance testing, visual verification, and spot checks, and must be considered by the WELL Assessor when choosing sampling zones and sampling points.

Table 1. Scope of Performance Verification Activities

WELL PROJECT TYPE	PERFORMANCE VERIFICATION SCOPE
New and Existing Buildings New and Existing Interiors	The entire area within the WELL project boundary, including any mechanical spaces and/or water fixtures servicing the project.
Core and Shell	The common areas of the building, including only the spaces directly under the control of the building management team.

Sampling Point Selection

The WELL Assessor will select sample points for each performance test ahead of arriving on site. Upon arriving on site, the WELL Assessor will perform a walk-through of the areas subject to performance verification to familiarize themselves with the building floor plan. In order to ensure access is available to all sampling areas, the WELL Assessor should be guided by an individual from the building management team who is familiar with the space. Afterwards, the WELL Assessor may make adjustments to the selected sampling locations after observing actual site conditions to comply with testing protocol. For example, the WELL Assessor may move a sampling point from an area of low occupancy to an area of typical occupancy.

Equipment and Laboratories

In all cases, the equipment used must be calibrated according to the manufacturer’s specifications. Instructions from the equipment manufacturer must be followed when taking measurements. Any applicable laboratory analyses must be performed in a third-party laboratory that is accredited by an agency recognized by the International Laboratory Accreditation Cooperative (ILAC) that has no financial or other interest in the outcome of WELL Certification or Performance Verification. Laboratory samples must be collected, packaged, and analyzed in accordance with the instructions provided from such third-party laboratory.

Compliance with Instructions and Protocols

WELL Assessors are required to ensure that the Performance Verification activities performed for a given project are conducted in accordance with the instructions and requirements specified in this guidebook. If, due to site conditions or other factors beyond the WELL Assessor’s control, it is necessary for the WELL Assessor to deviate from the protocols described in this guidebook during Performance Verification, the WELL Assessor must make a note of explaining the deviation in the final report.

PERFORMANCE TESTING PROTOCOL

The following protocol describes the performance testing requirements for each applicable parameter in the WELL Building Standard – those marked as Performance Test or Spot Measurement in Appendix D of the standard. Parts marked as Performance Test are validated solely through the on-site verification process, while those labeled Spot Check are sampled on-site while also previously attested to by the project team during the document submission process.

Performance testing protocol is outlined by Feature and Part. In cases where testing protocol is identical, Features and Parts have been grouped.

Table 2. Testing Protocol Table of Contents

CONTENTS	PAGE
Outdoor Air Quality Measurements	5
Feature 1: Air Quality Standards, Part 1 Standards for Volatile Substances	7
Feature 1: Air Quality Standards, Part 2 Standards for Particulate Matter and Inorganic Gases	8
Feature 1: Air Quality Standards, Part 3 Radon	10
Feature 30: Fundamental Water Quality, Part 1 Sediment	11
Feature 30: Fundamental Water Quality, Part 2 Microorganisms	12
Feature 31: Inorganic Contaminants, Part 1 Dissolved Metals Feature 32: Organic Contaminants, Part 1 Organic Pollutants Feature 33: Agricultural Contaminants, Part 1 Herbicides and Pesticides, Part 2 Fertilizers Feature 34: Public Water Additives, Part 2 Disinfectant Byproducts, Part 3 Fluoride Feature 37: Drinking Water Promotion, Part 1 Drinking Water Taste Properties	13
Feature 34: Public Water Additives, Part 1 Disinfectants	15
Feature 53: Visual Lighting Design, Part 1 Visual Acuity For Focus	17
Feature 54: Circadian Lighting Design, Part 1a Melanopic Light Intensity for Work Areas 250 equivalent melanopic lux with daylight (spot measurement)	18
Feature 54: Circadian Lighting Design, Part 1b Melanopic Light Intensity for Work Areas IES-ANSI RP-1-12 method with electric lights only (spot measurement)	19
Feature 74: Exterior Noise Intrusion, Part 1 Sound Pressure Level	20
Feature 75: Internally Generated Noise, Part 2 Mechanical Equipment Sound Levels	22
Feature 16: Humidity Control, Part 1 Relative Humidity (spot measurement) Feature 76: Thermal Comfort, Part 1 Ventilated Thermal Environment, and Part 2 Natural Thermal Adaption (spot measurement)	23
Feature 78: Reverberation Time, Part 1 Reverberation Time	25
Feature 79: Sound Masking, Part 2 Sound Masking Limits	26

Outdoor Air Quality Measurements

In addition to indoor samples, the WELL Assessor must collect data on the outside air quality conditions.

Parameters Measured

- Carbon monoxide (CO)
- PM_{2.5}
- PM₁₀
- Ozone (O₃)

Method of Measurement

- All parameters: direct reading instrument

Equipment and Materials

- Direct reading instruments must be used to measure the parameters listed above.
- For carbon monoxide and ozone, the direct reading instruments must function within the limits of the performance specifications in Table 3 below and operated in accordance with the operation manual.

Table 3. Instrument Requirements for CO and O₃ Direct Read Instrumentsⁱ

PARAMETER	CARBON MONOXIDE	OZONE
Measurement range	0 to 50 ppm	0 to 0.5 ppm
Resolution	1 ppm	1 ppb
Noise	0.5 ppm	0.005 ppm
Lower detectable limit	1.0 ppm	0.01 ppm
Interference equivalent <ul style="list-style-type: none"> • Each Interferant • Total Interferant 	± 1.0 ppm 1.5 ppm	± 0.02 ppm 0.06 ppm
Zero drift, 14 and 24 hour	± 1.0 ppm	± 0.02 ppm
Span drift, 24 hour <ul style="list-style-type: none"> • 20% of upper range limit • 80% of upper range limit 	±10.0% ± 2.5%	± 20% ± 5.0%
Lag Time	10 minutes	20 minutes
Rise Time	5 minutes	15 minutes
Fall Time	5 minutes	15 minutes
Precision <ul style="list-style-type: none"> • 20% of upper range limit • 80% of upper range limit 	0.5 ppm 0.5 ppm	0.01 ppm 0.015 ppm

- For $PM_{2.5}$ and PM_{10} , the sum of
 - a) the lower end of the measurement ranges of the instrument and
 - b) 3 times the on-screen resolution
 must be less than the WELL Building Standard threshold for the parameter being measured.

Example 1:

WELL Building Standard threshold for $PM_{2.5}$: $15 \mu\text{g}/\text{m}^3$

Lower end of the measurement range of the instrument: $10 \mu\text{g}/\text{m}^3$

On-screen resolution on the device: $2 \mu\text{g}/\text{m}^3$

The sum of the lower end of the measurement range of the device and 3 times the on-screen resolution is 16. This value exceeds the WELL Building Standard threshold for $PM_{2.5}$. Therefore, the instrument does not qualify for measuring $PM_{2.5}$.

Example 2:

WELL Building Standard threshold for $PM_{2.5}$: $15 \mu\text{g}/\text{m}^3$

Lower end of the measurement range of the instrument: $10 \mu\text{g}/\text{m}^3$

On-screen resolution on the device: $1 \mu\text{g}/\text{m}^3$

The sum of the lower end of the measurement range of the device and 3 times the on-screen resolution is 13. This value is below the WELL Building Standard threshold for $PM_{2.5}$. Therefore, the instrument qualifies for measuring $PM_{2.5}$.

Sampling Points

- Measurements will be recorded at a representative outside air intake that supplies air to the project space.
- When access to an outside air intake serving the project space is not available, the measurements must be recorded outside of the main entrance to the building containing the WELL project. Sampling points outside the building entrance shall be within 25 feet of a major entrance and within the breathing zone (3 to 6 feet above the ground).

Duration of Measurement

- 15 minutes (5 minutes of acclimation time followed by 10 minutes of measurement time)

Additional WELL Methodology Requirements

- A total of three outdoor air measurements are required throughout the day:
 - Morning (between 7 AM and 9 AM)
 - Midday (between 11 AM and 3 PM)
 - Evening (between 5 PM and 8 PM)
- At least three hours must separate each outdoor measurement.
- The WELL Assessor must also note any environmental conditions that could affect outdoor air quality measurements (e.g., high traffic).

Feature 1: Air Quality Standards, Part 1 Standards for Volatile Substances

Parameters Measured

- Formaldehyde
- Total volatile organic compounds (TVOCs)

Method of Measurement

- Formaldehyde: chromatographic analysis of air collected onto a substrate (either diffusive or active collection) in accordance with ISO 16000-3-2011, or formaldehyde samplers in accordance with ISO 16000-4-2011, or methods in accordance with NIOSH 2016M, NIOSH 2017, NIOSH 3500, EPA TO-11, ASTM D5197 or EPA Compendium Method IP-6.
- Total VOCs: chromatographic analysis of air collected onto a substrate (either diffusive or active collection) in accordance with ISO 16000-6, EPA TO-1, TO-17, EPA Compendium Method IP-1, NIOSH 2549, EPA TO-15, or OSHA Validation Guidelines for Air Sampling Methods Utilizing Chromatographic Analysis.

Equipment and Materials

- Laboratory materials and/or samplers must be prepared according to the referenced testing methodology and meet the referenced testing methodology requirements.
- Air sampling pumps utilized in active collection measurements must be capable of meeting the air flow rates prescribed by the referenced testing methodology, if applicable.

Sampling Points

- One sampling point in each major sampling zone (see Appendix A for details on major sampling zone selection)
- Sampling points must be representative of typical occupied areas within the sampling zone
- Sampling points must be within the breathing zone (3 to 6 feet above the finished floor)

Duration of Measurement

- Active collection: Minimum of 2 continuous hours OR the duration of sampling volume prescribed by the referenced testing methodology (120 min)
- Diffusive collection: duration of a typical workday (8 hours. / 480 min.) OR duration specified by sampling kit manufacturer

Additional WELL Methodology Requirements

- Total VOCs: a minimum of one exposure field blank sample per day of sampling must be prepared and analyzed.
- Formaldehyde: a minimum of one exposure field blank sample must be prepared and analyzed per day of sampling.
- Testing should be done under regular project conditions. For naturally ventilated spaces, if the windows are required to be opened to meet Feature 3 outside air requirements, then the windows should be open during testing.

Feature 1: Air Quality Standards, Part 2 Standards for Particulate Matter and Inorganic Gases

Parameters Measured

- Carbon monoxide (CO)
- PM_{2.5}
- PM₁₀
- Ozone (O₃)

Method of Measurement

- All parameters: direct reading instrument

Equipment and Materials

- Direct reading instruments must be used to measure the parameters listed above.
- For carbon monoxide and ozone, the direct reading instruments must function within the limits of the performance specifications in the table below when operated in accordance with the operation manual.

Table 4. Requirements for CO and O₃ Direct Reading Instrumentsⁱⁱ

PARAMETER	CARBON MONOXIDE	OZONE
Measurement range	0 to 50 ppm	0 to 0.5 ppm
Resolution	1 ppm	1 ppb
Noise	0.5 ppm	0.005 ppm
Lower detectable limit	1.0 ppm	0.01 ppm
Interference equivalent <ul style="list-style-type: none"> • Each Interferant • Total Interferant 	± 1.0 ppm 1.5 ppm	± 0.02 ppm 0.06 ppm
Zero drift, 14 and 24 hour	± 1.0 ppm	± 0.02 ppm
Span drift, 24 hour <ul style="list-style-type: none"> • 20% of upper range limit • 80% of upper range limit 	±10.0% ± 2.5%	± 20% ± 5.0%
Lag Time	10 minutes	20 minutes
Rise Time	5 minutes	15 minutes
Fall Time	5 minutes	15 minutes
Precision <ul style="list-style-type: none"> • 20% of upper range limit • 80% of upper range limit 	0.5 ppm 0.5 ppm	0.01 ppm 0.015 ppm

- For $PM_{2.5}$ and PM_{10} , the sum of
 - a) the lower end of the measurement ranges of the instrument and
 - b) 3 times the on-screen resolutionmust be less than the WELL Building Standard threshold for the parameter being measured.

Example 1:

WELL Building Standard threshold for $PM_{2.5}$: $15 \mu\text{g}/\text{m}^3$

Lower end of the measurement range of the instrument: $10 \mu\text{g}/\text{m}^3$

On-screen resolution on the device: $2 \mu\text{g}/\text{m}^3$

The sum of the lower end of the measurement range of the device and 3 times the on-screen resolution is 16. This value exceeds the WELL Building Standard threshold for $PM_{2.5}$. Therefore, the instrument does not qualify for measuring $PM_{2.5}$.

Example 2:

WELL Building Standard threshold for $PM_{2.5}$: $15 \mu\text{g}/\text{m}^3$

Lower end of the measurement range of the instrument: $10 \mu\text{g}/\text{m}^3$

On-screen resolution on the device: $1 \mu\text{g}/\text{m}^3$

The sum of the lower end of the measurement range of the device and 3 times the on-screen resolution is 13. This value is below the WELL Building Standard threshold for $PM_{2.5}$. Therefore, the instrument qualifies for measuring $PM_{2.5}$.

Sampling Points

- At least one sampling point in each major AND each minor sampling zone (refer to Appendix A for details on major and minor sampling zone selection)
- Sampling points must be representative of typical occupied areas within the sampling zone
- Sampling points must be within the breathing zone (3 to 6 feet above the finished floor)

Duration of Measurement

- Major sampling points: 2 hours total (10 minutes of acclimation time followed by 1 hour and 50 minutes of measurement time), with measurements recorded at least once every 5 minutes
- Minor sampling points: 30 minutes total (10 minutes of acclimation time followed by 20 minutes of measurement time), with measurements recorded at least once every 5 minutes

Additional WELL Methodology Requirements

- The WELL Assessor should note whether the HVAC system (or any air treatment systems) turn on or off during the data collection period

Reporting Notes

- The 50th percentile value collected during the measurement time at each sampling point is reported and used to determine compliance with the WELL Building Standard requirements.

Feature 1: Air Quality Standards, Part 3 Radon

Parameters Measured

- Radon

Method of Measurement

- Passive Radon sampler

Equipment and Materials

- For charcoal sample kits, short-term radon test kits are permitted. Professional Note: Long-term test kits are preferred if the building can be accessed outside of Performance Verification for placement or retrieval.

Sampling Points

- Measurements are only required in the lowest occupied level of the project site. If the project does not contain the ground floor of the building (defined as the first aboveground floor), or any below-grade floors, radon testing is not required.
- One radon sampler is required for every 2,000 square feet of floor plate on the lowest occupied level
- Radon samplers must be located:
 - 0.91 m (3 ft.) from windows and exterior doors
 - 20.3 cm 12 inches from exterior walls
 - 50.8 cm (20 inches) above the finished floor

Duration of Measurement

- Minimum of 48 hours, or the entire length of the performance verification, whichever is longer.

Feature 30: Fundamental Water Quality, Part 1 Sediment

Parameters Measured

- Turbidity

Method of Measurement

- Water samples are evaluated with a turbidimeter

Equipment and Materials

- The turbidimeter must function within the limits of the performance specifications in the below table when operated in accordance with the operation manual.

Table 5. Turbidimeter Range Requirements

PARAMETER	MEASUREMENT RANGE	RESOLUTION
Turbidity	0.00 to 9.99; 10.0 to 99.9 and 100 to 1000 NTU	±2% of reading plus 0.02 NTU

- The turbidimeter must meet the criteria specified by the EPA Method 180.1

Sampling Points

- 10% of the total number of drinking water fixtures (at least one), 3 samples at each chosen fixture
- 10% of the total number of hand washing fixtures (at least one), 3 samples at each chosen fixture
- 10% of the total number of shower and bath fixtures (at least one if present), 3 samples at each chosen fixture

Additional WELL Methodology Requirements

- Each water sample must be collected from the cold water faucet. When fixtures providing mixed temperature water are sampled, turn off the hot water supply. If conditions exist preventing adjustment of the water temperature, perform the testing at the temperature of the water provided.
- Water samples must be taken in the following order:
 - Run the faucet for 30 seconds
 - Feature 31 Part 1, Feature 32 Part 2, Feature 33 Parts 1 and 2, Feature 34 Part 2, Feature 34 Part 3, and Feature 37 Part 1
 - Feature 30, Part 2
 - Feature 34, Part 1
 - Feature 30, Part 1

Reporting Notes

- The average of the results for the 3 samples collected at each chosen fixture is used to determine compliance with the WELL Building Standard requirements
- When conditions exist preventing adjustment of the water temperature, perform the testing at the temperature of the water provided and accompany the recorded testing data with an explanatory note indicating that the temperature could not be adjusted and whether the water temperature was mild, warm, or hot.

Feature 30: Fundamental Water Quality, Part 2 Microorganisms

Parameters Measured

- Total coliforms (including E. coli)

Method of Measurement

- Water samples are evaluated by a third party laboratory in accordance with EPA 1604, ISO 9308-1:2001.

Equipment and Materials

- Appropriate sampling vials must be obtained from a third party laboratory prior to Performance Verification.

Sampling Points

- 10% of the total number of drinking water fixtures (at least one), 1 sample at each chosen fixture
 - NOTE: If there is no designated drinking water fixture, then water from the kitchen faucet or next most likely source is used in its place.
- 10% of the total number of hand washing fixtures (at least one), 1 sample at each chosen fixture
- 10% of the total number of shower and bath fixtures (at least one if present), 1 sample at each chosen fixture

Additional WELL Methodology Requirements

- Each water sample must be collected from the cold water faucet. When fixtures providing mixed temperature water are sampled, turn off the hot water supply. If conditions exist preventing adjustment of the water temperature, perform the testing at the temperature of the water provided.
- Water samples must be taken in the following order:
 - Run the faucet for 30 seconds
 - Feature 31 Part 1, Feature 32 Part 2, Feature 33 Parts 1 and 2, Feature 34 Part 2, Feature 34 Part 3, and Feature 37 Part 1
 - Feature 30, Part 2
 - Feature 34, Part 1
 - Feature 30, Part 1
- Follow all laboratory procedures for collecting and packaging the sample.
- Package and ship sample to third party testing laboratory per the laboratory's instructions. Total coliforms sampling analysis is time sensitive and the samples should be shipped to the laboratory overnight the same day that they are collected, or couriered or driven to the laboratory on the same day that they are collected. Sample design must take into account the fact that samples are not permitted to be shipped on a Friday, due to the risk of delays in custody transfer and degradation of samples in storage.

Reporting Notes

- When conditions exist preventing adjustment of the water temperature, perform the testing at the temperature of the water provided but accompany the recorded testing data with an explanatory note indicating that the temperature could not be adjusted and whether the water temperature was mild, warm, or hot.

Feature 31: Inorganic Contaminants, Part 1 Dissolved Metals
Feature 32: Organic Contaminants, Part 1 Organic Pollutants
Feature 33: Agricultural Contaminants, Part 1 Herbicides and Pesticides
Feature 33: Agricultural Contaminants, Part 2 Fertilizers
Feature 34: Public Water Additives, Part 2 Disinfectant Byproducts
Feature 34: Public Water Additives, Part 3 Fluoride
Feature 37: Drinking Water Promotion, Part 1 Drinking Water Taste Properties

Parameters Measured

- Feature 31
 - Lead
 - Arsenic
 - Antimony
 - Mercury
 - Nickel
 - Copper

- Feature 32, Part 1
 - Styrene
 - Benzene
 - Ethyl benzene
 - Polychlorinated biphenyls
 - Vinyl chloride
 - Toluene
 - Xylenes (total: m, p, and o)
 - Tetrachloroethylene

- Feature 33, Part 1
 - Atrazine
 - Simazine
 - Glyphosate
 - 2,4-dichlorophenoxyacetic acid

- Feature 33, Part 2
 - Nitrate (as nitrogen)

- Feature 34, Part 2
 - Total trihalomethanes
 - Total halo acetic acids

- Feature 34, Part 3
 - Fluoride

- Feature 37, Part 1
 - Aluminum
 - Chloride
 - Manganese
 - Sodium
 - Sulfate
 - Iron
 - Zinc
 - Total dissolved solids

Method of Measurement

- Water samples are evaluated by a third party laboratory.

Equipment and Materials

- Appropriate sampling vials must be obtained from a third party laboratory prior to Performance Verification.

Sampling Points

- 10% of the total number of drinking water fixtures (at least one), 1 sample at each chosen fixture

Additional WELL Methodology Requirements

- Each water sample must be collected from the cold water faucet. When fixtures providing mixed temperature water are sampled, turn off the hot water supply. If conditions exist preventing adjustment of the water temperature, perform the testing at the temperature of the water provided.
- Water samples must be taken in the following order:
 - Run the faucet for 30 seconds
 - Feature 31 Part 1, Feature 32 Part 2, Feature 33 Parts 1 and 2, Feature 34 Part 2, Feature 34 Part 3, and Feature 37 Part 1
 - Feature 30, Part 2
 - Feature 34, Part 1
 - Feature 30, Part 1
- Follow all laboratory procedures for collecting and packaging the sample.
- Package and ship sample to third party testing laboratory per the laboratory's instructions.

Reporting Notes

- When conditions exist preventing adjustment of the water temperature, perform the testing at the temperature of the water provided but accompany the recorded testing data with an explanatory note indicating that the temperature could not be adjusted and whether the water temperature was mild, warm, or hot.

Feature 34: Public Water Additives, Part 1 Disinfectants

Parameters Measured

- Residual chlorine (free chlorine)
- Residual chloramine (total chlorine minus free chlorine)

Method of Measurement

- Water samples are evaluated by a third party laboratory.

Equipment and Materials

- The chlorine meter must function within the limits of the performance specifications in the below table when operated in accordance with the operation manual.

Table 6. Chlorine Meter Parameters

PARAMETER	MEASUREMENT RANGE	ACCURACY	RESOLUTION
Residual chlorine (free chlorine)	0-5 mg/L	±0.02 mg/L @ 1.00 mg/L	0.01 ppm
Total chlorine	0-5 mg/L	±0.02 mg/L @ 1.00 mg/L	0.01 ppm

- The appropriate reagents as specified by the chlorine meter manufacturer must be obtained to perform the total and free chlorine tests.

Sampling Points

- 10% of the total number of drinking water fixtures (at least one), 6 samples at each chosen fixture (3 free chlorine samples and 3 total chlorine samples)
- 10% of the total number of shower and bath fixtures (at least one, if present), 6 samples at each chosen fixture (3 free chlorine samples and 3 total chlorine samples)

Additional WELL Methodology Requirements

- Each water sample must be collected from the cold water faucet. When fixtures providing mixed temperature water are sampled, turn off the hot water supply. If conditions exist preventing adjustment of the water temperature, perform the testing at the temperature of the water provided.
- Water samples must be taken in the following order:
 - o Run the faucet for 30 seconds
 - o Feature 31 Part 1, Feature 32 Part 2, Feature 33 Parts 1 and 2, Feature 34 Part 2, Feature 34 Part 3, and Feature 37 Part 1
 - o Feature 30, Part 2
 - o Feature 34, Part 1
 - o Feature 30, Part 1

Reporting Notes

- To calculate residual chloramines, subtract the free chlorine value from the total chlorine value.
- The average of the results for the 3 samples collected at each chosen fixture is used to determine compliance with the WELL Building Standard requirements.
- When conditions exist preventing adjustment of the water temperature, perform the testing at the temperature of the water provided but accompany the recorded testing data with an explanatory note indicating that the temperature could not be adjusted and whether the water temperature was mild, warm, or hot.

Feature 53: Visual Lighting Design, Part 1 Visual Acuity for Focus

Parameters Measured

- Ambient lighting illuminance

Measured Method of Measurement

- Lux meter

Equipment and Materials

- The lux meter must function within the limits of the performance specifications in the below table when operated in accordance with the operation manual:

Table 7. Lux Meter Parameters

PARAMETER	MEASUREMENT RANGE	ACCURACY	RESOLUTION
Illuminance	5-50,000 lux	±5%	0.1 lux

Sampling Points

- Measurements must be recorded at workstations and desks.
- The number of sampling points must provide 90% confidence that the mean of the measured illumination values falls within a confidence interval of $\pm 10\%$. (See appendix A on calculating the number of sampling points.)
- A proportionate number of each type of workstation/desk must be measured.

Duration of Measurement

- Instantaneous at each sampling point

Additional WELL Methodology Requirements

- The lighting measurements must be recorded on the horizontal plane of the area of the workstation/desk where the occupant will typically be working or be situated.
- The lux meter must be placed on the surface of the workstation or desk.
- The lighting measurements must be recorded independent of sunlight (electric lighting only, no daylighting).

Feature 54: Circadian Lighting Design, Part 1a Melanopic Light Intensity for Work Areas (250 equivalent melanopic lux with daylight)

Parameters Measured

- Equivalent melanopic lux

Measured Method of Measurement

- Optical spectrometer

Equipment and Materials

- The optical spectrometer must function within the limits of the performance specifications in the below table when operated in accordance with the operation manual.

Table 8. Optical Spectrometer Parameters

PARAMETER	WAVELENGTH RANGE	ACCURACY	OPTICAL RESOLUTION
Spectral Power	380-780 nm	±5%	10 nm or less

Sampling Points

- Measurements must be recorded at workstations.
- The number of sampling points must provide 90% confidence that the mean of the measured illumination values falls within a confidence interval of $\pm 10\%$. (See appendix A on calculating the number of sampling points.)
- A proportionate number of each type of workstation/desk must be measured.

Duration of Measurement

- Instantaneous at each sampling point

Additional WELL Methodology Requirements

- Measurements must be recorded in the presence of both electric light and natural light.
- Measurements must be recorded at each workstation at a minimum of 1.2 m (48 inches) above the finished floor on a vertical plane (perpendicular to the floor) facing in the direction of the workstation.
- The WELL Assessor will record the spectral power at each of the wavelengths specified in the WELL Building Standard Table L2.
- The methodology described in Table L2 in the WELL Building Standard will be used to calculate the equivalent melanopic lux using the recorded spectral power values.

Reporting Notes

- A statistical analysis will be run on the total measurements recorded to determine whether with 75% of workstations/desks have an equivalent melanopic lux level above 250.

Feature 54: Circadian Lighting Design, Part 1b Melanopic Light Intensity for Work Areas (IES-ANSI RP-1-12 method with electric lights only)

Parameters Measured

- Equivalent melanopic lux

Measured Method of Measurement

- Optical spectrometer

Equipment and Materials

- The optical spectrometer must function within the limits of the performance specifications in the below table when operated in accordance with the operation manual.

Table 8. Optical Spectrometer Parameters

PARAMETER	WAVELENGTH RANGE	ACCURACY	OPTICAL RESOLUTION
Spectral Power	380-780 nm	±5%	10 nm or less

Sampling Points

- Measurements must be recorded at frequently occupied space (e.g., desk, seat, work station).
- The number of sampling points must provide 90% confidence that the mean of the measured illumination values falls within a confidence interval of $\pm 5\%$. (See Appendix A on calculating the number of sampling points).
- A proportionate number of each type of frequently occupied space must be measured.

Duration of Measurement

- Instantaneous at each sampling point

Additional WELL Methodology Requirements

- Measurements must be recorded in the presence of electric light only. This can be done by either a) taking measurements at night with electric lights on OR by b) taking two measurements, one in the presence of natural light and electric light (total light), and one with natural light only. The natural light may then be subtracted from the total light measurements to obtain the measurements with only electric light.
- Measurements must be recorded at each frequently occupied space at a minimum of 1.2 m (48 inches) above the finished floor on a vertical plane (perpendicular to the floor) facing in the direction of the workstation.
- The WELL Assessor must note the type of work performed at each frequently occupied space.
- The WELL Assessor will record the spectral power at each of the wavelengths specified in the WELL Building Standard Table L2.
- The methodology described in Table L2 in the WELL Building Standard will be used to calculate the equivalent melanopic lux using the recorded spectral power values

Reporting Notes

- The calculated equivalent melanopic lux values for each sampling point will be compared against the Vertical (Ev) targets for the 25-65 category in Table B1 of IES-ANSI RP-1-12 to determine compliance.

Feature 74: Exterior Noise Intrusion, Part 1 Sound Pressure Level

Parameters Measured

- Time-averaged, A-weighted, sound pressure level from outside noise intrusion (dBA)

Measured Method of Measurement

- Sound level meter

Equipment and Materials

- The sound level meter must function within the limits of the performance specifications in the below table when operated in accordance with the operation manual.

Table 9. Sound Level Meter Parameters

PARAMETER	BANDWIDTH	ACCURACY	RESOLUTION
Sound Level	20 Hz to 20 kHz	±0.5% at 1 kHz	0.1 dB

Sampling Points

- Measurements are recorded in 10% of the total number of each regularly occupied room type in the project (at least one of each room type).
- The number of sampling points per each chosen room is dependent on the total square footage of that room (see table below). One measurement is recorded per sampling point.

Table 10. Number of Sampling Points Required Based on Square Footage

TOTAL ROOM SQUARE FOOTAGE	NUMBER OF SAMPLING POINTS
<1,000	1
≥1,000 and < 5,000	2
≥5,000 and <10,000	3
≥10,000 and <15,000	4
≥15,000 and <20,000	5

Duration of Measurement

- 30 seconds at each sampling point

Additional WELL Methodology Requirements

- The measurements must be performed when the space is unoccupied (e.g., prior to opening, lunch hour, or after hours.)
- Avoid transient sounds (people talking, door closing, etc.) during the measurement periods.
- The HVAC system must be off during the measurement periods.
- Sound masking systems (if present) must be off for the duration of the measurement period.
- The sample points must be located at the location where an occupant would typically be situated within the space.

- As much as possible, the sample points must be located 1 m (39 inches) from the window wall while still located where an occupant would typically be situated.
- As much as possible, the sample points should be located farthest from sources of mechanical noise including HVAC system ducts and elevators while still located where an occupant would typically be situated.
- The sample points must be located at least 1.2 m (48 inches) above the finished floor.
- The distance between any two points of measurement must be at least 3 m (118 inches).
- If the windows are normally closed, the sound level measurements must occur with the windows closed. If the windows are normally open, the sound level measurements must occur with the windows open.

Reporting Notes

- The time-averaged, A-weighted, sound pressure level recorded during the measurement period will be used to determine compliance with the WELL Building Standard threshold.

Feature 75: Internally Generated Noise, Part 2 Mechanical Equipment Sound Levels

Parameters Measured

- Noise criterion

Measured Method of Measurement

- Sound level meter

Equipment and Materials

- The sound level meter must function within the limits of the performance specifications in the below table when operated in accordance with the operation manual.

Table 11. Sound Level Meter Parameters

PARAMETER	BANDWIDTH	ACCURACY	RESOLUTION
Sound Level	20 Hz to 20 kHz	±0.5% at 1 kHz	0.1 dB

- The sound level meter must be capable of measuring the sound pressure level at each of the following distinct octave band frequencies: 63 Hz, 125 Hz, 250 Hz, 500 Hz, 1000 Hz, 2000 Hz, 4000 Hz, 8000 Hz

Sampling Points

- 10% of the total number of each type of space specifically described in the WELL Building Standard, Feature 75, that are present in the project (e.g., conference room) with at least one of each room type

Duration of Measurement

- 30 seconds at each sampling point

Additional WELL Methodology Requirements

- The measurements must be performed when the space is unoccupied (e.g., prior to opening, lunch hour, or after hours.)
- Avoid transient sounds (people talking, door closing, etc.) during the measurement.
- The HVAC system must be on during the measurement periods.
- Sound masking systems (if present) must be off during the measurement period.
- The sampling points must be located where an occupant would typically be situated within the space.
- As much as possible, sampling points should be located near sources of mechanical noise including HVAC system ducts and elevators.
- As much as possible, sampling points should be located away from walls containing windows. The sampling points must be located a minimum of 1.2 m (48 inches) above the finished floor.
- The distance between any two points of measurement must be at least 3 m (118 inches).
- Windows and doors in the sampling zone must be closed.
- If the conditions specified above are violated during the measurement, the measurement must be halted, data discarded, and restarted.

Reporting Notes

- The time-averaged sound pressure level measured at each of the following octave band frequencies is plotted against noise criteria curves to determine the noise criterion: 63 Hz, 125 Hz, 250 Hz, 500 Hz, 1000 Hz, 2000 Hz, 4000 Hz, and 8000 Hz.
- Note any existing intruding sounds that may interfere with an accurate measurement of noise criterion (e.g., traffic noise intrusion).

Feature 16: Humidity Control, Part 1 Relative Humidity

Feature 76: Thermal Comfort, Part 1 Ventilated Thermal Environment

Feature 76: Thermal Comfort, Part 2 Natural Thermal Adaption

Parameters Measured

- Operative temperature
- Relative humidity

Measured Method of Measurement

- Direct reading instrument

Equipment and Materials

- The direct reading instrument must function within the limits of the performance specifications in the below table when operated in accordance with the operation manual.

Table 12. Temperature and Relative Humidity Meter Parameters

PARAMETER	MEASUREMENT RANGE	RESOLUTION	ACCURACY
Temperature	-40° to 100°C (-40° to 212°F)	0.03°C	±0.25°C from 0°C to 50°C
Relative Humidity	5% - 90%	0.03%	±2.5% from 10% to 85%

- The direct reading instrument must be capable of continuous measurement with a frequency of at least 1 measurement per minute.

Sampling Points

- Measurements are recorded in 10% of the total number of each regularly occupied room type in the project (at least one of each room type).

Duration of Measurement

- 5 minutes at each sampling point

Additional WELL Methodology Requirements

- Measurements must occur during occupied hours, and the HVAC system must be operating according to the typical operating schedule during occupied periods.
- Within each space, place the temperature and relative humidity sensor(s) as close to actual locations where occupants would reside in the space.
- As much as possible, the sensor should not be placed in direct sunlight or close to heat emitting appliances such as printers or lights.
- As much as possible, the sensor should not be placed in the airflow path of supply air diffusers, return air diffusers, or near doors to adjacent spaces.
- Individual comfort devices (such as space heaters or fans) must not be in operation in the immediate vicinity of the sampling point. The temperature sensor must be placed between 0.6 m (24 inches) and 1.1 m (43 inches) above the finished floor.
- Testing will only occur in common spaces within 1 m [3.2 ft] of the exterior wall.

- The temperature sensor must be placed at least 1 m (39 inches) from walls, windows, and partitions.
- The distance between any two points of measurement must be at least 7.62 m (300 inches).
- If thermal comfort testing is interrupted during the sampling period, either by sensor disruption, irregular gaps in normal occupancy, or modification to the HVAC operation, the measurements will be repeated the following day provided conditions have normalized.

Reporting Notes

- The average space temperature or relative humidity collected at each measurement point will be used to determine whether that sampling location complies with the requirements.

Feature 78: Reverberation Time, Part 1 Reverberation Time

Parameters Measured

- Reverberation time (RT 60)

Measured Method of Measurement

- Impulse response measured by a sound level meter

Equipment and Materials

- The sound level meter must function within the limits of the performance specifications in the below table when operated in accordance with the operation manual.

Table 13. Sound Level Meter Reverberation Measurement Requirements

PARAMETER	MEASUREMENT RANGE	RESOLUTION
Reverberation time (RT 60)	10 ms to 14 seconds	1/1 octave band results from 63 Hz to 8 kHz

- RT60 results may be calculated based on RT20 and RT30 measurements.

Sampling Points

- 10% of the total number of conference rooms (at least one), 3 samples per sample point
- 10% of the total number of open office spaces (at least one) in the project, 3 samples per sample point

Additional WELL Methodology Requirements

- The measurements must be performed when the space is unoccupied (e.g., prior to opening, lunch hour, or after hours). Avoid transient sounds (people talking, door closing, etc.) during the measurement.
- The HVAC system must be off during the measurement periods.
- Sound masking systems (if present) must be off during the measurements.
- The sampling points must be located a minimum of 1.2 m (48 inches) above the finished floor.
- The sampling points should be located at least 1 m (39 inches) from any sound-reflecting surfaces.
- The impulse sound source must be at least 1 m (39 inches) from both the sound measuring device and sound reflecting surfaces.
- If the conditions specified above are violated during the measurement, the measurement must be halted, data discarded, and restarted.

Reporting Notes

- The average RT60 value at 500 Hz of the 3 samples recorded at each sampling point will be used to determine compliance with the WELL Building Standard threshold.

Feature 79: Sound Masking, Part 2 Sound Masking Limits

Parameters Measured

- A-weighted time-averaged sound pressure level (dBA)

Measured Method of Measurement

- Sound level meter

Equipment and Materials

- The sound level meter must function within the limits of the performance specifications in the below table when operated in accordance with the operation manual.

Table 14. Sound Level Meter Bandwidth Requirements

PARAMETER	BANDWIDTH	ACCURACY	RESOLUTION
Sound Level	20 Hz to 20 kHz	±0.5% at 1 kHz	0.1 dB

- The sound level meter must be capable of measuring the RT60 value at each of the following distinct octave band frequencies: 63 Hz, 125 Hz, 250 Hz, 500 Hz, 1 kHz, 2 kHz, 4 kHz, and 8 kHz.

Sampling Points

- 10% of the total number of open occupied spaces (at least one), 1 sample per sample point
- 10% of the total number of enclosed occupied spaces (at least one) in the project, 1 sample per sample point

Duration of Measurement

- 30 seconds at each sampling point

Additional WELL Methodology Requirements

- The measurements must be performed when the space is unoccupied (e.g., prior to opening, lunch hour, or after hours).
- The HVAC system must be on during the measurement periods.
- Sound masking systems (if present) must be on during the measurements.
- The sample points must be located where an occupant would typically be situated.
- The sample points must be located a minimum of 1.2 m (48 inches) above the finished floor.
- If the conditions specified above are violated during the measurement, the measurement must be halted, data discarded, and restarted.

Reporting Notes

- The time-averaged, A-weighted, sound pressure level recorded during the measurement period will be used to determine compliance with the WELL Building Standard threshold.

VISUAL VERIFICATIONS AND SPOT CHECKS

The WELL Building Standard Appendix D Feature Types and Verification Methods indicates which Features and Parts require visual verifications and spot checks. In addition, all Features, regardless of Appendix D, are potentially subject to verification on-site: if a Feature's documentation was approved in Documentation Review and Appendix D does not list any on-site checks for the Feature, the WELL Assessor may still mark the Feature as pending clarifications in the Performance Verification report if he/she identifies evidence while on-site that the building may not be in compliance with the requirements of that Feature.

Visual Inspections

For Features and Parts that require visual verification, the requirements will be visually verified by the WELL Assessor while on-site in all spaces/locations of the project where the Requirements are applicable.

For example, for Feature 8 Healthy Entrance Part 1 Permanent Entryway Walk-Off Systems, the WELL Assessor will verify the requirements at all applicable project entrances.

Spot Checks

The WELL Building Standard Appendix D Feature Types and Verification Methods indicates which Features and Parts require spot checks. For Features and Parts that require spot checks, the requirements will be verified by the WELL Assessor while on-site in at least one part/location of the project where the requirements are applicable.

For example, for Feature 57 Low-Glare Workstation Design, Part 2 Daylight Management, the WELL Assessor will verify the requirements at a sample of workstations/computer screens included in the project.

Special Consideration for Multifamily Residential

Tentative testing locations are typically selected by the WELL Assessor prior to arrival on site. However, these tentative testing locations are subject to change once the WELL Assessor arrives on site, based on the observed conditions. Whenever a calculation results in a fractional sampling point, round up to the next whole number. Additionally, please note that the number of sampling locations represents a minimum. The WELL Assessor may include additional sampling points.

Project team need to determine how many different unit types there are based on the following criteria:

- Be under the same ownership and management
- Be part of the same construction contract
- Use the same heating and ventilation methods
- Use the same building materials, finishes, and furnishings throughout
- May differ in layout and size (e.g. number of bedrooms, window placements, ceiling heights, difference in area)

Feature 01:

- Projects with 10 units or fewer: Two of each unit type
- Projects with more than 10 units: Three of each unit type with a minimum of 5% of units and a maximum of 40 units
- At least two of each unit type or a minimum of 25% of each unit type must be 'major' sampling zones

Features 30/31/32/33/37:

- Projects with 20 units or fewer: One unit
- Projects with 21-100 units: 5% of units
- Projects with more than 100 units: Case by case basis

Features 53/54/74/75:

Sampling should be distributed between different unit types. At least one of each type of room described in the feature in each unit is evaluated.

- Projects with 15 units or fewer: Four units
- Projects with more than 16-50 units: 25% of the units
- Projects with more than 51-100 units: 15% of the units
- Projects with more than 100 units: Case by case basis

Feature 54:

Take four samples at orthogonal directions and use the highest value for certification purposes. Note that compliance for both Part 1a and Part 1b will require testing with two brightness settings in the lighting system, or by using two independently controllable fixtures.

For multifamily residential buildings, initial Performance Verification will involve sampling from randomly determined locations in the entire building. However, the scope of Performance Verification during the recertification process will be limited to components of the common areas only (the interiors of occupied living spaces will not be subject to on-site sampling).

APPENDIX A

i. Sampling Zone Selection

Feature 1: Air Quality Standards

Sampling Zone Selection

Sampling zones are areas of the project site selected for assessment by the WELL Assessor for performance testing required in Feature 1 Air Quality Standards. Sampling zones are representative of the project site, and include all categories of room types within the WELL project. Note that visual inspections and spot-checks and measurements are not limited to specific sampling zones, and instead occur throughout the WELL project within the scope defined in section II of this guidebook.

Sampling zones are defined as an entire floor or an area of a floor space measuring up to 25,000 square feet, whichever area is smaller. A single sampling zone will never be larger than 25,000 square feet. Sampling zones are contiguous and remain on one floor. Floors (if large enough) may contain more than one sampling zone but sampling zones should not overlap. Sampling zones may contain multiple rooms and/or room types. The minimum number of sampling zones required for any project is two.

If a floor plate has space in excess of 25,000 square feet, the additional space will be added as a sampling zone and all zones on that floor plate will be designated in a way that results in similarly-sized sampling zones. For example, a 63,000 square foot floor plate would include three sampling zones, each of approximately 21,000 square feet.

When delineating sampling zones, the WELL Assessor should use professional judgment (based on knowledge of the space gained through prior review of floor plans and observations made during an initial walk-through) to draw a zone that encompasses the centers of activity of the space.

Determining the Number of Sampling Zones

The number of sampling zones is dependent on the total number of floors and total square footage of the project site. Within the project site, every 25,000 square feet or entire floor plate, whichever floor space is smaller, qualifies as a sampling zone.

Selection of Major and Minor Sampling Zones

At least 25% of all sampling zones within a project must be selected as major sampling zones and each project must have at least two major sampling zones. The remaining 75% of zones are minor zones. The distribution of major zones should be representative of the project as a whole.

APPENDIX A

ii. Number of Sample Points Collection

- Feature 53: Visual Lighting Design Part 1 Visual Acuity for Focus**
- Feature 54: Circadian Lighting Design Part 1 Melanopic Light Intensity for Work Areas**
- Feature 16: Humidity Control Part 1 Relative Humidity**
- Feature 76: Thermal Comfort Part 1 Ventilated Thermal Environment**
- Feature 76: Thermal Comfort, Part 2 Natural Thermal Adaptation**

Assume a hypergeometric distribution of measurements.

E = Confidence Interval (Margin of error) = $\pm 10\%$

Confidence Level = 90%

Z = Z Score corresponding to 90% confidence level = 1.65

P = proportion of events in population = assume 0.5

Q = proportion of non-events in population = assume 0.5

N = total population size

$$\text{Number of required sample points} = \frac{Nz^2pq}{E^2(N-1)+z^2pq} = \frac{272N}{(N+271)}$$

i. U.S. Environmental Protection Agency. Quality Assurance Handbook for Air Pollution Measurement Systems. <http://www3.epa.gov/ttnamti1/files/ambient/pm25/qa/QA-Handbook-Vol-II.pdf>. Published May 2013. Accessed October 20, 2015.

ii. U.S. Environmental Protection Agency. Quality Assurance Handbook for Air Pollution Measurement Systems. <http://www3.epa.gov/ttnamti1/files/ambient/pm25/qa/QA-Handbook-Vol-II.pdf>. Published May 2013. Accessed October 20, 2015.



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