INTERNATIONAL WELL BUILDING INSTITUTE™

WELL FOR RESIDENTIAL PERFORMANCE VERIFICATION GUIDEBOOK

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Introduction

The WELL for residential Performance Verification Guidebook contains details regarding the optional onsite testing of indoor environmental conditions for certain features within the WELL for residential program. The implementation of these features is optional and they include:

- Air
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    - R-A03 Pollution Infiltration Management
    - R-A07 Indoor Air Quality
    - R-A08 Radon Risk Mitigation
- Water
    - R-W02 Water Testing
- Thermal Comfort
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- Sound
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Some of the above features are structured so that there is an onsite testing option and a prescriptive (design) option, while others only include an onsite testing option. Data collected for each performance-based feature is submitted as part of the Documentation Review to determine whether the feature has been achieved.

This guidebook dictates the onsite testing protocol for each feature that has *Onsite Test* included as a part of the verification method type.

Qualified Professionals

Onsite tests must be conducted by the qualified professionals indicated for each parameter. In many features, the relevant qualified professional(s) includes a WELL Performance Testing Agent from IWBI's network of approved WELL Performance Testing Organizations. WELL for residential enrollees select and contract directly with their chosen service provider(s).

Section Organization

The testing protocols are organized by the WELL for residential concepts that contain features verified by onsite tests.

Each concept is further organized by parameter, in the order it appears within the concept. Each parameter contains the following information:

- **Features** – A list of features that reference the parameter.
- **Qualified professionals** – Individuals who maintain the minimum qualifications required to test the parameter.
- **Device requirements** – Specifications used to determine adequate capabilities of device used for testing.
- **Test locations & conditions** – Where measurements must be taken and what parts of dwelling unit construction need to be completed.
- **Test method** – The process to take the measurements (may refer to external standards and guidelines).
- **Test quantity** – The number of tests required per submission, development and dwelling unit.
- **Reporting & compliance** – How the results determine if the feature has been met.

Each concept may also contain General Guidelines that apply to multiple testing parameters within the respective concept.

General Information and Set-Up

Testing must take place after construction and once all relevant systems are installed. Information on what systems are relevant is described for each parameter. Tests may take place when the dwelling unit is occupied or unoccupied, at the project team's discretion.

Dwelling unit conditions during testing must be representative of those normally experienced by residents unless otherwise noted within the guidebook. Also, unless otherwise noted, all tests must have been taken within the 12 months prior to submitting for review.

Dwelling Unit Test Selection

The WELL for residential program utilizes auditing for onsite testing when there is more than one dwelling unit included in a review cycle. This method is intended to provide a more efficient process where a subset of dwelling units is tested to represent the performance of all dwelling units in the review cycle (see the WELL for residential Introduction for a description of the review process). For each feature to be awarded, results from all audited dwelling units tested must comply with feature requirements.

The quantity of dwelling units submitted in a review cycle determines the number of units to be tested. This calculation is described for each parameter. In many instances, it is the square root of the number of units submitted in a review cycle; in these cases, the units selected for testing will be the same units as those randomly selected to submit audited design documentation and photographs. During pre-submission, after the enrollee submits a cover sheet identifying the units included in the review cycle, units will be randomly selected for audit by IWBI and provided to the enrollee.

Dwelling Unit Selection Scenarios

If testing is not possible in a selected unit (e.g., residents have already moved into that unit and it is no longer available for testing), the project team may apply to substitute a similar unit for testing by notifying IWBI. All substitutions must be approved prior to submitting test results. The substitute unit should share as many attributes with the originally selected unit as possible, including size, location in the building or community, location *of* the building or community, level of finish/fit-out and HVAC design.

If a dwelling unit identified for testing is no longer targeting WELL for residential certification in the review cycle (e.g., if plans changed and it was not built), no testing is required for that selected unit. No substitute testing is required (i.e., one fewer test location is allowed), unless that unit represents the *only* location that was identified for testing; in that case, the project team must identify a substitute unit for testing to take place.

If a dwelling unit identified for testing is still targeting WELL for residential certification but is no longer targeting the feature being tested, then the enrollee must identify a substitute unit to test. Under a subscription, note that a review cycle may contain no more than five sets of features; when withdrawing a subset of dwelling units from a feature, they must be assigned to a different set of features (see the WELL for residential Introduction for more information about sets of features).

The number of sampling locations indicated per feature represents a minimum; additional sampling points may be included at the discretion of the qualified professional performing the tests.

Reporting Expectations

Results are submitted as part of a Documentation Review. Only passing results should be submitted; if a test results in measurements that do not meet the feature requirements, it is the responsibility of the project team to remediate the conditions to bring the dwelling unit(s) into compliance. The qualified professional will then retest the selected unit(s). Remediation and retesting should be performed until a test results in measurements that meet the feature requirements. If the original unit is no longer available for testing, the team may apply to substitute a similar unit (see requirements above under Dwelling Unit Selection).

Devices and Laboratories

In all cases, the device used must be maintained and calibrated according to the manufacturer's specifications and instructions from the manufacturer must be followed when taking measurements. Any applicable laboratory analyses must be performed in a third-party laboratory that has no financial or other interest in the outcome of WELL Residence certification. The applicable laboratory must be accredited by an agency recognized by the International Laboratory Accreditation Cooperative (ILAC) or be accredited to meet ISO 17025-2017 by an accreditation body authorized by the local government.

Laboratory accreditation must be valid for the test methods used to evaluate the parameters listed in WELL for residential feature(s). Laboratory samples must be collected, packaged and analyzed in accordance with instructions provided by the third-party laboratory.

Compliance with Instructions and Protocols

Qualified professionals must ensure that onsite testing is conducted in accordance with the instructions and requirements specified in this guidebook. If, due to site conditions or other factors beyond the qualified professional's control, it is necessary to deviate from the protocols described in this guidebook during testing, the qualified professional must note and provide an explanation for the deviation in test method when submitting data. Depending on the amount of deviation, it is possible that the test results will not be accepted.

The qualified professional is not permitted to interfere, manipulate or alter site conditions in any way that might affect feature compliance. Data collected onsite by the qualified professional must be analyzed and the results must be reviewed by the WELL Reviewer before feature compliance can be determined.

Documentation Package

As part of the documentation package submitted for third-party review, qualified professionals must provide the following:

- The completed PIP tool, including all relevant data entries and field notes.
- A list of the devices used and manufacturer specifications, confirming that all devices meet the requirements described in this Guidebook.
- For the laboratories used to analyze samples:
    - Laboratory accreditations for the relevant test methods and parameters
    - Test methodologies utilized by the laboratory to analyze the related parameters
    - Chain of custody for the parameters analyzed
- Calibration certificates for the devices used confirming that all devices are maintained in accordance with requirements described in this Guidebook.
- Annotated floor plans showing the final sample locations along with the date and time that each sample was collected.
- A minimum of one photograph of each unique equipment setup for each parameter tested at the project site. Photographs demonstrating typical set-up used across projects are not acceptable.

- Raw data collected for each sample location:
    - Acceptable file types include .xlsx; .csv; .doc; .pdf; .txt
    - Note that proprietary files such as .svl are not acceptable
- If the measurement device does not log data, provide a photograph of the result displayed on the device for each measurement at each sample location.
- Analysis of raw data including calculations used to determine compliance with the feature part(s).
- Evidence that they meet/hold the necessary professional qualifications (e.g., copy of certificate, resume, C.V.).
- WELL for residential Onsite Testing Training Module certificate of completion.

The documentation package above must be in English or translated into English and shared with the project team.

Measurement Tolerance

Several onsite performance testing parameters include a tolerance that is added to the requirement's threshold. For example, for $PM_{2.5}$, compliance is based on the feature requirement plus a tolerance of 20%. Thus, since the threshold is a maximum of 15 µg/m^3, the acceptable threshold for $PM_{2.5}$ is 18 µg/m^3 (or lower).

Onsite Testing Protocols

Air and Thermal Comfort

General Guidelines

Unless otherwise noted, these rules apply to all parameters within the WELL for residential Air and Thermal Comfort concepts.

Qualified Professionals

At least one of the following:

- Certified Industrial Hygienist (CIH) credential
- Certified Indoor Environmentalist (CIE) credential
- Council-certified Indoor Environmental Consultant (CIEC) credential
- Indoor air/environmental quality professional with three years of directly-related work experience
- WELL Performance Testing Agent

Device Requirements

For laboratory analysis test methods:

- Laboratory materials and/or samplers must be prepared according to the referenced test method and meet the referenced test method requirements.
- Single tube sampling at each test location is acceptable as an alternative to distributed volume pair sampling. The qualified professional must take responsibility for any compromise to data quality (e.g., insufficient sample volume, breakthrough).
- Air sampling pumps utilized in active collection measurements must be capable of meeting the airflow rates prescribed by the referenced test method, if applicable.

Test Locations & Conditions

- Testing must be conducted under the following conditions:
    - Construction must be substantially complete with all finishes installed.
    - For mechanically ventilated spaces, ventilation systems must be operating, including exhausts in kitchens and bathrooms. (If multiple speeds are available, use the minimum setting.)
    - Windows must be closed during and at least 1 hour prior to testing. The qualified professional must note whether the HVAC system (or

any ventilation or air treatment method) is on or off during the data collection period.
- Sampling points must be at a height of 1.1-1.7 m [3.6-5.6 ft] above the finished floor.
- Sampling points must be at least 1 m [3.3 ft] away from walls, doors, windows, air supply/exhaust outlets and any occupant present during testing.
- Sampling points must be located in the primary/master bedroom and/or the primary living room.

Test Quantity

- Provide tests for the square root of the number of dwelling units, rounded down to the nearest integer. IWBI will identify the dwelling units to be tested.
- Perform one test per dwelling unit selected for audit.
    - If only one dwelling unit is subject to testing, the qualified professional must test in either the primary/master bedroom or the primary living room, at their discretion.
    - If more than one dwelling unit is subject to testing, the test locations must be equally distributed between the primary/master bedroom and primary living room.

Reporting & Compliance

- For laboratory analysis test methods, the reporting value is the measured concentration on the laboratory report.
    - If the result in the sample is below the limit of detection, the limit of detection is used as the result.
    - It is the responsibility of the qualified professional to gather a volume of air sufficient to determine a compliant concentration.
- For direct reading devices, the reporting value is the median value collected during the measurement time.
- For each parameter to be met, the reporting value must meet the feature requirements, plus the tolerance described for the parameter.

Ventilation

Features

- R-A01 Ventilation Design, Part 3 Validate Ventilation

Qualified Professionals

- Current credential related to HVAC commissioning from an accrediting body or government agency

Device Requirements

- In accordance with ASHRAE 152-2014, ASTM E1554-07 or ASTM/RESNET/ICC 380-2019

Test Locations & Conditions

- Test according to ASHRAE 152-2014, ASTM E1554-07 or ASTM/RESNET/ICC 380-2019

Test Method

- Test according to ASHRAE 152-2014, ASTM E1554-07 or ASTM/RESNET/ICC 380-2019

Test Quantity

- See *General Guidelines*.

Reporting & Compliance

- The reporting value is the leakage rate of dwelling unit ducts.
- For this parameter to be met, the reported leakage rates must meet the threshold listed feature requirements (based on the number of air returns).

Envelope Commissioning

Features

- R-A03 Pollution Infiltration Management, Part 3 Minimize Envelope Air Leakage

Qualified Professionals

- Current credential related to envelope commissioning from an accrediting body or government agency

Device Requirements

- In accordance with ASTM E779-19, ASTM E1827-22 or ASTM/RESNET/ICC 380-2019.

Test Locations & Conditions

- Test according to ASTM E779-19, ASTM E1827-22 or ASTM/RESNET/ICC 380-2019.

Test Method

- Test according to ASTM E779-19, ASTM E1827-22 or ASTM/RESNET/ICC 380-2019.

Test Quantity

- See *General Guidelines*.

Reporting & Compliance

- The reporting value is the measured leakage rate.
- For this parameter to be met, the reporting value must meet the threshold listed feature requirements appropriate for the dwelling unit's IECC climate zone.

$PM_{2.5}$ and PM_{10}

Features

- R-A07 Indoor Air Quality Testing, Part 1 Meet Indoor Particulate Matter Thresholds

Qualified Professionals

- See *General Guidelines*.

Device Requirements

- Method of measurement: direct reading device (light-scattering airborne particle counter)
- Measurement range: 1-1,000 $\mu g/m^3$
- Device accuracy (at the size specified by the manufacturer): ≤ 15%
- Resolution: 1 $\mu g/m^3$
- Lower detectable limit: 1 $\mu g/m^3$
- Reporting interval: one-minute maximum
- Calibration: the device must be calibrated within the manufacturer's specification (maximum interval: one year) and the calibration record (i.e., the measurement result obtained during calibration) must be traceable to a National Metrological Institute, such as NIST, NPL or PTB.

Test Locations & Conditions

- See *General Guidelines*.

Test Method

- Duration of measurement: minimum of one continuous hour (10 minutes of acclimation time followed by 50 minutes of measurement time), with measurements recorded at least once every minute.

Test Quantity

- See *General Guidelines*.

Reporting & Compliance

- See *General Guidelines*.
- Use a tolerance of 20%.

Formaldehyde and Acetaldehyde

Features

- R-A07 Indoor Air Quality Testing, Part 2 Meet Indoor VOC Thresholds

Qualified Professionals

- See *General Guidelines*.

Device Requirements

- See *General Guidelines* for laboratory analysis test methods.

Test Locations & Conditions

- See *General Guidelines*.

Test Method

- Take samples through active collection in accordance with ISO 16000-3, ASTM D5197, NIOSH 2016, EPA TO-11 (or 11A) or EPA Compendium Method IP-6 (or 6A).
- Test for a minimum of one continuous hour OR the duration of sampling volume prescribed by the referenced test method.
- Prepare and analyze at least one exposure field blank sample per day of sampling.

Test Quantity

- See *General Guidelines*.

Reporting & Compliance

- See *General Guidelines* for laboratory analysis test methods.
- Use a tolerance of 20%.

Acrylonitrile, Benzene, Caprolactam, Toluene & Naphthalene

Features

- R-A07 Indoor Air Quality Testing, Part 2 Meet Indoor VOC Thresholds

Qualified Professionals

- See *General Guidelines*.

Device Requirements

- See *General Guidelines* for laboratory analysis test methods.

Test Locations & Conditions

- See *General Guidelines*.

Test Method

- Take samples through active collection in accordance with ISO 16000-6, ASTM D5197, EPA TO-15 or EPA TO-17.
- The following methods are acceptable alternatives for speciating individual VOCs:
    - Acrylonitrile: NIOSH 1604 (modified methodology acceptable to reach ppb concentrations)
    - Caprolactam: OSHA PV2012 (modified methodology acceptable to reach ppb concentrations)
- Prepare and analyze at least one exposure field blank sample per day of sampling.

Test Quantity

- See *General Guidelines*.

Reporting & Compliance

- See *General Guidelines* for laboratory analysis test methods.
- Use a tolerance of 5%.

Carbon Monoxide

Features

- R-A07 Indoor Air Quality Testing, Part 3 Meet Indoor Inorganic Gas Thresholds

Qualified Professionals

- See *General Guidelines*.

Device Requirements

- Method of measurement: direct reading device
- Lower detectable limit: 0.1 ppm
- Upper detectable limit: 25 ppm
- Resolution: 0.1 ppm
- Maintain device calibration in accordance with the manufacturer's instructions.

Test Locations & Conditions

- Testing must be conducted under the following conditions:
    - Installation of all appliances must be complete.
    - For mechanically ventilated spaces, ventilation systems must be operating, including exhausts in kitchens and bathrooms. (If multiple speeds are available, use the minimum setting.)
    - Windows must be closed during and at least 1 hour prior to testing. The qualified professional must note whether the HVAC system (or any ventilation or air treatment method) is on or off during the data collection period.
- Sampling points must be at a height of 1.1-1.7 m [3.6-5.6 ft] above the finished floor.
- This parameter is tested at 0.5 m [1.5 ft] from one source of combustion within the dwelling unit. The test location is selected based on the following priority of sources within the unit:
    1. Gas range or oven
    2. Gas or wood fireplace or stove
    3. Gas water heater
    4. Gas furnace or boiler
- The tested source of combustion is turned on at the beginning of the device acclimation period (e.g., turn on range/thermostat/fireplace, run hot water).

- If the dwelling unit has no source of combustion, the parameter is tested in the primary/master bedroom.

Test Method

- Test for a minimum of one continuous hour (10 minutes of acclimation time followed by 50 minutes of measurement time) and record measurements at least once every minute.

Test Quantity

- Provide tests for the square root of the number of dwelling units, rounded down to the nearest integer. IWBI will identify the dwelling units to be tested.
- Perform one test per dwelling unit selected for audit.

Reporting & Compliance

- See *General Guidelines* for direct reading devices.
- No tolerance is applied.

Ozone

Features

- R-A07 Indoor Air Quality Testing, Part 3 Meet Indoor Inorganic Gas Thresholds

Qualified Professionals

- See *General Guidelines*.

Test Locations & Conditions

- See *General Guidelines*.

Test Method

- Test for a minimum of one continuous hour (10 minutes of acclimation time followed by 50 minutes of measurement time) and record measurements at least once every minute.

Device Requirements

- Method of measurement: direct reading device
- Lower detectable limit: 20 ppb
- Upper detectable limit: 500 ppb
- Resolution: 1 ppb

- Maintain device calibration in accordance with the manufacturer's instructions.

Test Quantity

- See *General Guidelines*.

Reporting & Compliance

- See *General Guidelines* for direct reading devices.
- Use a tolerance of 5%.

Nitrogen Dioxide

Features

- R-A07 Indoor Air Quality Testing, Part 3 Meet Indoor Inorganic Gas Thresholds

Qualified Professionals

- See *General Guidelines*.

Device Requirements

One of the following methods of measurement:

- Direct reading device:
    - Lower detectable limit: 10 ppb
    - Upper detectable limit: 500 ppb
    - Resolution: 1 ppb
    - Maintain device calibration in accordance with the manufacturer's instructions.
- Laboratory analysis that meets the following:
    - See *General Guidelines* for laboratory analysis test methods.

Test Locations & Conditions

- See *General Guidelines*.

Test Method

One of the following, depending on testing devices/materials used:

- Direct reading device:
    - Test for a minimum of one continuous hour (10 minutes of acclimation time followed by 50 minutes of measurement time) and record measurements at least once every minute.
- Laboratory analysis:

- Take samples through active collection in accordance with NIOSH 6014-1 or OSHA ID-182 (modified methodology acceptable to obtain accurate detection limits sufficient for the concentration threshold).
- Test for a minimum of one continuous hour OR the duration of sampling volume prescribed in the above referenced standard(s).
- Prepare and analyze at least one exposure field blank sample per day of sampling.

Test Quantity

- See *General Guidelines*.

Reporting & Compliance

- See *General Guidelines* for direct reading devices or for laboratory analysis test methods, depending on testing devices/materials used.
- Use a tolerance of 20%.

Sulfur Dioxide

Features

- R-A07 Indoor Air Quality Testing, Part 1 Meet Indoor Air Quality Thresholds

Qualified Professionals

- See *General Guidelines*.

Device Requirements

- See *General Guidelines* for laboratory analysis test methods.

Test Locations & Conditions

- See *General Guidelines*.

Test Method

- Take samples through active collection in accordance with ASTM D2915-15 or NIOSH 6004 (modified methodology acceptable to reach ppb concentrations).
- Prepare and analyze at least one exposure field blank sample per day of sampling.

Test Quantity

- See *General Guidelines*.

Reporting & Compliance

- See *General Guidelines* for laboratory analysis test methods
- Use a tolerance of 20%

Radon

Features

- R-A08 Radon Risk Mitigation, Part 2 Meet Radon Thresholds

Qualified Professionals

At least one of the following:

- Current certification or license related to radon testing from an accrediting body or government agency
- Minimum two years of experience performing radon tests in a residential setting

Device Requirements

- According to ANSI/AARST MAH, ANSI/AARST MA-MFLB, ANSI/AARST MS-PC, ANSI/AARST MS-QA, GB/T 18883 or a method approved by a local government for residential radon sampling
- Passive radon samplers must provide a time-weighted average.

Test Locations & Conditions

- Test according to ANSI/AARST MAH, ANSI/AARST MA-MFLB, GB/T 18883 or a method approved by a local government for residential radon sampling.

Test Method

- Test according to ANSI/AARST MAH, ANSI/AARST MA-MFLB, GB/T 18883 or a method approved by a local government for residential radon sampling.
- Tests must have been taken within the five years prior to submitting for review.

Test Quantity

- For detached dwelling units: one radon test is required in the lowest occupiable floor of every dwelling unit pursuing the feature within the review cycle.

- For buildings with more than one dwelling unit: one radon test is required in every dwelling unit in the lowest occupiable floor of the building.

Reporting & Compliance

- The reporting value is calculated through one of the following:
    - Direct reading device: the median value collected during the measurement time.
    - Laboratory analysis: the measured concentration on the laboratory report.
- For this parameter to be met, the reporting value must meet the feature requirements.

Relative Humidity

Features

- R-T04 Humidity Control, Part 3 Meet Relative Humidity Thresholds

Qualified Professionals

- See *General Guidelines*.

Device Requirements

- Method of measurements: direct reading device
- Lower detectable limit: 10% or lower
- Upper detectable limit: 90% or higher
- Resolution: 1%
- Device accuracy: ± 3% from 10-90% relative humidity
- Maintain device calibration in accordance with the manufacturer's instructions.

Test Locations & Conditions

- See *General Guidelines*.

Test Method

- Test for a total of 10 minutes and record measurements at least once every minute.

Test Quantity

- See *General Guidelines*.

Reporting & Compliance

- See *General Guidelines* for direct reading devices.
- Use a tolerance of 3 percentage points.

Water

General Guidelines

Unless otherwise noted, these rules apply to all parameters within the WELL for residential Water concept.

Qualified Professionals

At least one of the following:

- Plumbing professional with at least two years of directly-related work experience
- Professional with associate or college degree in science, environmental science, geology, civil engineering or chemical engineering
- HERS H2O Rater
- WaterSense Home Verifier
- WELL Performance Testing Agent

Test Quantity

- Provide tests for the square root of the number of dwelling units, rounded down to the nearest integer. IWBI will identify the dwelling units to be tested.

Hot Water Rise-Time and Maximum Temperature

Features

- R-W02 Water Testing, Part 1 Meet Water Performance Parameters

Qualified Professionals

- See *General Guidelines*.

Device Requirements

- Stopwatch with ability to display seconds
- Thermocouple thermometer with probe:
    - Range: 0-100 °C [32-212 °F]
    - Accuracy: ± 1 °C [2 °F] at 0-100 °C [32-212 °F]
    - Resolution: 0.1 °C [0.2 °F] at 0-100 °C [32-212 °F]
    - Maintain device calibration in accordance with the manufacturer's instructions.

Test Locations & Conditions

- Testing must be conducted after all plumbing-related construction is complete.

- This parameter is tested at two faucets that provide hot water, in separate rooms within each audited dwelling unit.
    - If a dwelling unit has more than one floor, at least one sample must be from a fixture on the highest floor.
    - If the dwelling unit has a shower, one of the tests must be from the shower. If there are multiple showers, test the shower on the highest floor.
- The hot water faucet must not have been used for at least 30 minutes before the test.

Test Method

- If the faucet has a mixing valve, run the water at its coldest setting for at least two minutes.
- Remove any aerators, point-of-use filters and/or showerheads present.
- At the same time (or as near as possible):
    - Turn on the hot water faucet OR, if this is a mixing valve, turn on the water to its hottest setting.
    - Start the stopwatch.
    - Immerse the tip of the thermometer probe into the water flow as near to the faucet as possible.
- Record temperature every 10 seconds.
- Stop the measurement when the water temperature reaches the target temperature or after two minutes, whichever occurs first.

Test Quantity

- See *General Guidelines*.
- Two tests per dwelling unit.

Reporting & Compliance

- Report the time of the first measurement to be within 3 °C [5 °F] of the target temperature as the rise-time for hot water.
- Report the maximum hot water temperature.
- For this parameter to be met:
    - The reported rise time must meet the target provided in the feature.
    - The reported temperature must meet the target by the project team (or 49 °C [120 °F] if none is provided).

Cold Water Pressure

Features

- R-W02 Water Testing, Part 1 Meet Water Performance Parameters

Qualified Professionals

- See *General Guidelines*.

Device Requirements

- Pressure gauge:
    - Maximum pressure: 100 psi or above
    - Materials in contact with water: the gauge is approved for drinking water use by a local government authority or by a government-authorized certification body or is certified as ANSI/NSF 61-compliant.

Test Locations & Conditions

- Testing must be conducted after all plumbing-related construction is complete.
- This parameter is tested at the primary kitchen faucet. If the kitchen faucet is not available (e.g., it has no screw thread), test at any cold water faucet.

Test Method

- Unscrew any aerators, point-of use filters or attachments from the faucet.
- If the faucet is a mixing valve, set it to the lowest (i.e., coldest) temperature control.
- Install the pressure gauge.
- Turn the water on to full flow.
- Record the pressure from the gauge once the pressure stabilizes.

Test Quantity

- See *General Guidelines*.
- One test per dwelling unit

Reporting & Compliance

- The reporting value is the pressure reading once the pressure stabilizes.
- For this parameter to be met, the reporting value must meet the feature requirements.

Turbidity

Features

- R-W02 Water Testing, Part 2 Test Kitchen Water Quality Parameters

Qualified Professionals

- See *General Guidelines*.

Device Requirements

- Turbidimeter must either:
    - Meet or exceed requirements of EPA Method 180.1
    - Have an upper detectable limit of 5 NTU or greater and reporting resolution of 0.02 NTU or finer
- Accuracy: ± 2% of reading
- Lowest detectable limit: 0.05 NTU or lower
- Maintain device calibration in accordance with the manufacturer's instructions.

Test Locations & Conditions

- Testing must be conducted after all plumbing-related construction is complete.
- This parameter is tested at the kitchen faucet at the coldest setting. If a kitchen is equipped with a secondary faucet used for drinking water, samples may be taken from this drinking water faucet and the primary kitchen faucet can be excluded from testing. Exception: In kitchens where the only cold water source includes a point-of-use filter, this parameter may be tested from another cold water source within the dwelling unit (e.g., bathroom faucet).

Test Method

- Run the water for at least 30 seconds before gathering a water sample (unless the sample is drawn immediately following a previous sample).
- Mix the sample to thoroughly disperse the solids. Wait until air bubbles disappear, then pour the sample into the turbidimeter tube.
- Take a total of three samples.

Test Quantity

- See *General Guidelines*.
- One test per dwelling unit

Reporting & Compliance

- The reporting value for each dwelling unit is the average of the three measurements, rounded to the nearest tenth of NTU.
- For this parameter to be met, the reporting value must meet the feature requirements.

Disinfectants

Features

- R-W02 Water Testing, Part 2 Test Kitchen Water Quality Parameters

Qualified Professionals

- See *General Guidelines*.

Device Requirements

- Method of measurement: any methods listed by the US EPA 'Analytical Methods Approved for Drinking Water Compliance Monitoring under the Disinfection Byproduct Rules' for total and free (residual) chlorine, or a method approved by a local government to test these parameters in drinking water.
- Lower detectable limit: 0.1 mg/L or lower
- Upper detectable limit: 5 mg/L or higher
- Reporting resolution: 0.01 mg/L or finer
- Accuracy: ±0.05 mg/L at 1.00 mg/L

Test Locations & Conditions

- Testing must be conducted after all plumbing-related construction is complete.
- This parameter is tested at the kitchen faucet at the coldest setting. If a kitchen is equipped with a secondary faucet used for drinking water, samples may be taken from this drinking water fixture and the primary kitchen faucet can be excluded from testing. Exception: In kitchens where the only cold water source includes a point-of-use filter, this parameter may be tested from another cold water source within the dwelling unit (e.g., bathroom faucet).

Test Method

- Run the water for at least 30 seconds before gathering a water sample (unless the sample is drawn immediately following a previous sample).

- Take measurements of the total and residual (free) chlorine in water samples by adding the appropriate reagents as specified by the chlorine meter manufacturer.
- Take a total of three samples.

Test Quantity

- See *General Guidelines*.
- One test per dwelling unit

Reporting & Compliance

- The reporting value for each dwelling unit is the average of the three measurements.
- For this parameter to be met, the reporting value must meet the feature requirements.

Lead & Copper

Features

- R-W02 Water Testing, Part 2 Test Kitchen Water Quality Parameters

Qualified Professionals

- See *General Guidelines*.

Device Requirements

- Appropriate sampling vials obtained from the laboratory prior to testing.

Test Locations & Conditions

- Testing must be conducted after all plumbing-related construction is complete.
- Obtain the appropriate sampling vials from the laboratory prior to testing.
- This parameter is tested at the kitchen faucet at the coldest setting. If a kitchen is equipped with a secondary faucet used for drinking water, samples may be taken from this drinking water fixture and the primary kitchen faucet can be excluded from testing. Exception: In kitchens where the only cold water source includes a point-of-use filter, this parameter may be tested from another cold water source within the dwelling unit (e.g., bathroom faucet).

Test Method

- Run the water for at least 30 seconds before gathering a water sample (unless the sample is drawn immediately following a previous sample).
- Follow all laboratory procedures for collecting, packaging and shipping the sample.

Test Quantity

- See *General Guidelines*.
- One test per dwelling unit

Reporting & Compliance

- The reporting value for each dwelling unit is the result provided by the laboratory analysis.
- For this parameter to be met, the reporting value must meet the feature requirements.

Sound

General Guidelines

Unless otherwise noted, these rules apply to all parameters within the WELL for residential Sound concept.

Qualified Professionals

At least one of the following:

- Board Certification by the Institute of Noise Control Engineering (INCE)
- Minimum three years of experience with onsite acoustics and noise control testing

Device Requirements

- Type/Class 1 sound level meter with whole and ⅓-octave measuring capabilities
- Sound level meter is annually calibrated in accordance with ANSI/ASA S1.4-2014, IEC 61672-1:2013 or regionally equivalent standard.
- Sound level meter must be capable of reporting parametric results as L_{eq}, L_{Max}, L_{90}, L_{10} using slow weightings.
- Measurement device parameters:
    - Bandwidth: At least 20 Hz to 20 kHz
    - On-screen resolution: 0.1 dB

Test Locations & Conditions

- Construction must be substantially complete with all finishes installed.
- The measurements must be taken at a minimum height of 1.2 m [4 ft] above the finished floor.
- The measurements must be taken at least 1.5 m [5 ft] away from noise sources, fenestration or other exterior penetration (e.g., piping or externally ducted HVAC device) and at least 1 m [3.3 ft] away from any reflective surfaces such as walls, columns and furniture.
- Windows must be closed.

Test Method

- Avoid transient interior sounds (e.g., people talking, doors closing) during the measurement periods. If there are internal noises (other than the HVAC system or building services such as escalators or elevators) lasting longer than 10 seconds, the measurement must be deleted and restarted.
- Testing must occur when the space is unoccupied or when the fewest number of residents/staff are onsite or nearby.

- The qualified professional must note sources of noise that may impact the results of sampling for the benefit of potential remediation upon non-compliance with feature requirements. Examples include, but are not limited to, exterior noise intrusion from industrial, pedestrian, traffic, mechanical or weather-related sources and interior noise from mechanical, occupant, construction or other building services.

Sound Insulation (NIC or D_{nTw})

Features

- R-S01 Sound Barriers, Part 1 Install High-Performing Wall Assemblies
- R-S01 Sound Barriers, Part 2 Install Airborne Sound Reducing Floor/Ceiling Assemblies

Qualified Professionals

At least one of the following:

- See *General Guidelines*.
- WELL Performance Testing Agent

Device Requirements

- Sound level meter:
    - See *General Guidelines*.
- Loudspeaker:
    - If using a two-way loudspeaker:
        - For testing walls: minimum 25 cm [10 in] diameter
        - For testing floor/ceiling assemblies: minimum 38 cm [15 in] diameter
    - If not using a two-way loudspeaker: omnidirectional loudspeaker and amplifier compliant with ISO 16283-1 sound source requirements
    - Frequency response range of at least 100 Hz – 4 kHz
    - Output of at least 100 dB
    - Noise generator capable of producing white/pink noise of equal sound energy across 100 Hz - 4 kHz

Test Locations & Conditions

- See *General Guidelines*.
- In each dwelling unit, test (as applicable):
    - For walls (Part 1):

        - A wall that separates a bedroom from another occupiable space within the dwelling units (e.g., bathroom, kitchen)
        - A wall that separates a bedroom from an adjacent attached common space, in the following priority: fitness room, media room, mechanical room, elevator, laundry room, stairs, hallway, any other common space
        - A wall that separates a bedroom from an adjacent attached dwelling unit
    - For floor/ceiling assemblies (Part 2):
        - The floor/ceiling above a bedroom that separates it from another occupiable space in the same dwelling unit
        - The floor/ceiling above a bedroom that separates it from an occupiable space in a different dwelling unit
        - The floor/ceiling above a regularly occupied space in the dwelling unit that separates it from a loud common space.
            - Use the following priority for selecting a loud common space: fitness room, media room, mechanical room, laundry room, rooftop terrace, any other common amenity space.
            - Then use the following priority for selecting a space within the dwelling unit: bedroom, living room, kitchen, other regularly occupied space
        - The floor/ceiling above a dwelling unit that separates it from a hallway/corridor, in the following priority: bedroom, living room, kitchen, other regularly occupied space, bathroom, other occupiable space.
- The HVAC system and building services are set to design duty during the measurement periods.
- The measurements must be taken from a location where a resident would typically be situated within the space.
- Windows and doors in both the source and receiver locations must be closed.

Test Method

- See *General Guidelines* for placement of sound level meter.
- The source room is defined as the room in which the sound is being produced. Receiving room is defined as the room in which the second measurement is taken.
- Place loudspeaker in the source room:

    - For measurements of sound insulation in walls, the loudspeaker must be placed near the wall at the opposite side of the room from the wall that is being tested. If a non-omnidirectional speaker is used, it must be aimed into a trihedral corner along this wall (i.e., where two walls join at right angles with the floor).
    - For measurements of sound insulation in floor/ceiling assemblies, the loudspeaker must be placed in the center of the room that is being tested.
- Set the loudspeaker to at least 90 dB. The loudspeaker must operate such that it is audible in the receiving room.
    - Measure L10 in the source room (the "source level").
    - Measure L90 in the receiving room (the "receiving level").
      Note: For floor/ceiling assemblies, the measurements in the source room and the receiving room must be simultaneous.
- Turn off the loudspeaker and measure L90 in the receiving room (the "receiving ambient").
- Each measurement must last at least 30 seconds.
- It is highly recommended that the qualified professional utilizes hearing protection when operating loudspeakers.

Test Quantity

- IWBI will identify the dwelling units to be audited in a quantity equal to the square root of the total number of dwelling units, rounded down to the nearest integer. Of these, the qualified professional must select half (rounded up) for testing. (Note that for attached/semi-detached dwelling units, the qualified professional will need access to the units above/below and/or adjacent, as applicable.)
- Perform up to four tests per dwelling unit selected for audit (see *Test Locations & Conditions*).

Reporting & Compliance

- The reporting value is the Noise Isolation Class, calculated by comparing the difference between the source level and the receiving level against the STC contour.
    - In addition, provide the measurement data for source level, the receiving level, and the receiving ambient. L_{10} and L_{90} measurements for all ⅓ octave bands from 125 Hz to 4 kHz.
- For this parameter to be met, the reporting value must meet the feature requirements for all relevant space type pairs present.

Impact Noise Sound Pressure Level ($L_{nT,w}$,$L_{n,w}$ + $C_{I,50–2500}$)

Features

- R-S01 Sound Barriers, Part 3 Install Impact Noise Reducing Floor/Ceiling Assemblies

Qualified Professionals

- See *General Guidelines*

Device Requirements

- According to ISO 717-2

Test Locations & Conditions

- Test according to ISO 717-2

Test Method

- Test according to ISO 717-2

Test Quantity

- IWBI will identify the dwelling units to be audited in a quantity equal to the square root of the total number of dwelling units, rounded down to the nearest integer. Of these, the qualified professional must select half (rounded up) for testing. (Note that for attached/semi-detached dwelling units, the qualified professional will need access to the units above and below the units selected for audit.)

Reporting & Compliance

- Report the impact sound as the weighted standardized impact sound pressure level ($L_{nT,w}$) or the normalized weighted impact sound index ($L_{n,w}$ + $C_{I,50–2500}$).
- For this parameter to be met, the reporting value must meet the feature requirements.

Background Noise Level (dBA Leq, NC, tonality)

Features

- R-S03 HVAC and Building Service Noise Levels, Part 2 Achieve Indoor Noise Level Thresholds

Qualified Professionals

- See *General Guidelines*.
- WELL Performance Testing Agent

Device Requirements

- See *General Guidelines*.

Test Locations & Conditions

- See *General Guidelines*.
- The HVAC system and building services are set to design duty during the measurement periods.
- This parameter is measured once in a bedroom and once in a living room. In the case of a studio apartment, it is tested once in the main room.

Test Method

- Measure L_{eq} (i.e., the time-averaged sound level using slow-weighting) over a period of at least 30 seconds at each test location.

Test Quantity

- Provide tests for the square root of the number of dwelling units, rounded down to the nearest integer. IWBI will identify the dwelling units to be tested.
- Perform up to two tests per dwelling unit selected for audit (see *Test Locations & Conditions*).
- If common fitness rooms or shared workspaces are present, test once in each of these rooms as well.

Reporting & Compliance

- Reporting values are as follows:
    - For sound level, report LA_{eq} (i.e., the L_{eq} with A-weighting applied).
    - For tonality, report the difference in sound levels for each ⅓ octave band 20 Hz to 20,000 Hz, rounded to the nearest integer.
    - Determine the reported Noise Criterion (NC) by plotting the unweighted (dBZ) sound level against the NC curves and selecting the lowest NC that is not exceeded by the measured sound at any frequency.
- For this parameter to be met, then either:
    - Option 1

        - The reported LA_{eq} must meet the feature requirements plus a tolerance of 4 dBA, AND
        - The sound level of adjacent ⅓ octave bands must meet the feature requirements.
    - Option 2
        - The Noise Criterion values meet the feature requirements.

Outdoor Sound Pressure Level

Features

- R-S04 Environmental Noise Levels, Part 1 Limit Daytime Community Noise Levels

Qualified Professionals

- See *General Guidelines*.

Device Requirements

- See *General Guidelines*.
- Sound level meter must be equipped with a windscreen approved by the manufacturer.

Test Locations & Conditions

- All framing and cladding must be complete.
- Measurements cannot be taken during periods of precipitation or when wind speeds exceed 2 m/s [4.5 mph].
- This parameter is tested at up to two locations:
    - Outdoors at ground level, at least 1 m [3.3 ft] from the main building entrance and, to the extent possible, within the project boundary at least 1 m [3.3 ft] from the property line.
    - Outdoors at a terrace, balcony or outdoor amenity, if present.

Test Method

- Measure L90 with A-weighting (i.e., the dBA value that is exceeded during 90% of the measurement time) using slow weighting over a period of at least 2 hours between 7:00 a.m. and 10:00 p.m. on a weekday.

Test Quantity

- Under a subscription, provide one set of two measurements for each building or community included in the review cycle (as applicable).

- Test at the location that is nearest known sources of exterior noise (e.g., road traffic, rooftop mechanical equipment, garage doors). Provide justification when reporting results.
- If extension cables (e.g., XLR cables) are needed to extend the sound level meter microphone, maintain device calibration in accordance with the manufacturer's instructions.

Reporting & Compliance

- The reporting value for each measurement location is the A-weighted L90 Sound Level.
- For this parameter to be met, the reporting value must meet the feature requirements plus a tolerance of 4 dBA for both measurement locations. If the parameter is met, all dwelling units in the same building or community are considered to have met the threshold.

Exterior Noise Intrusion (dBA L_{eq}, LAS_{max})

Features

- R-S04 Environmental Noise Levels, Part 2 Limit Nighttime Exterior Noise Intrusion

Qualified Professionals

- See *General Guidelines*.
- WELL Performance Testing Agent

Device Requirements

- See *General Guidelines*.

Test Locations & Conditions

- See *General Guidelines*.
- Test in the bedroom closest to the loudest known exterior noise source.
- The HVAC system and building services are turned off during the measurement periods.

Test Method

- See *General Guidelines*.
- Measure LA_{eq} and LAS_{max} (i.e., the time-averaged and maximum sound levels, both using A-weighting and slow-weighting) over a period of at least 12 hours which includes the hours of 10:00 p.m. to 7:00 a.m.

Test Quantity

- Under a subscription, provide one test for each building or community included in the review cycle (as applicable).
- Test at the dwelling unit that is located nearest known sources of exterior noise (e.g., road traffic, rooftop mechanical equipment, garage doors). Provide justification for the dwelling unit selection when reporting results.

Reporting & Compliance

- The reporting values for each measurement location are the LA_{eq} and LAS_{max}.
- For this parameter to be met, the reporting values must meet the feature requirements plus a tolerance of 4 dBA LA_{eq} and a tolerance of 9 dBA for LAS_{max} for both measurement locations. If the parameter is met, all dwelling units in the same building or community are considered to have met the threshold.