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DAQ-13-002.1 Standard Operating Procedure (SOP)  
for the DryWell 3101 Temperature Generator  
ECB RESPONSIBILITIES

Revision 0

## 1.0 Approval Sign Off-Sheet

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I certify that I have read and approve of the contents of the DAQ-13-002.1 Standard Operating Procedure with an effective date of May 5, 2021.

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Signature:  Date: 5/6/2021

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Disclaimer: This document, and any revision hereto, is intended solely as a reference guide to assist individuals in the operation of the instrument, related to the North Carolina Division of Air Quality's Ambient Monitoring Program.

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## 2.0 SCOPE AND PURPOSE

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This document is designed for the Electronics and Calibration Branch (ECB) Technicians operating the ThermoWorks Drywell 3101 or other 3100 series as a temperature generator/calibrator for temperature probes and thermometers associated with the ambient monitoring network. This document shall provide procedures used to achieve uniformity and ensure highly accurate temperature measurements.

The Drywell 3101 dry-block heating and cooling sources allow users to check the accuracy of thermometers and sensors as a system, on site or in the lab. The Drywell 3101 dry-blocks are controlled by a closed loop microprocessor based digital PID (Proportional Integral Derivative) temperature controller system incorporating a combination heater/cooler and a precision platinum RTD (Resistance Temperature Detector) sensor housed in the aluminum block. Fan cooling allows rapid changes in block temperature upon demand.



Drywell 3101 Temperature Generator

### 3.0 EQUIPMENT CHECKS AND MATERIALS

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This section describes the equipment and materials that are required to complete the steps described in this document. Additional subsection(s) or SOPs will also describe the equipment and materials as needed.

#### 3.1 Equipment and Material List

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- Drywell 3101 Temperature Generator
- Acceptance Testing E-log

#### 3.2 Chemical and Material Checks

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This section is reserved. No chemicals or material is needed for this type of instrument.

#### 3.3 Support Equipment Checks

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No support equipment is needed as the Drywell 3100 is considered support instrumentation for the ambient monitoring network.

#### 3.4 Initial Acceptance Testing

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Upon acceptance of a newly purchased or calibrated Drywell 3101, a designated ECB Technician will perform the following test procedures prior to putting the device into use:

- Open the boxed Drywell 3101 and check for any damage during shipping. If damage is observed, contact the vendor and the shipping company to fill out the appropriate claims forms.
- Review the packing slip to verify the correct unit was sent from the manufacturer. If there is an issue, contact the vendor and reconcile these matters before moving forward.
- Find the certificate of calibration, review and record the following: certification number, certification date, Instrument specifications, calibration data as found, calibration data as left and any notes from the certifying lab. Note: If any anomalies are found, contact the appropriate parties involved and

rectify the issue of concern. Scan and file the certification of calibration (See Section 7.0 File Management) to the P: Drive at P:\Ambient\ECB\NIST Certification Devices.

- Setup the Drywell 3101 (See 5.1 Dry-Block Set-up) and allow the unit warm up for 20 minutes.
- Adjust the temperature settings (See 5.2 Temperature Setting) on the Drywell 3101 to 0 degrees Celsius (°C) and insert a National Institute of Standards and Technology (NIST) traceable lab standard probe (See 5.3 Probe Testing) into the top dry-block hole (well 1) of the Drywell 3101. Allow the readings to stabilize and record in the designated section of the e-log. Do the same procedure for the bottom dry-block hole (well 2). Repeat the procedure above except using 50°C and 100°C temperature setting or whatever temperatures are used on the certification of calibration. When the test procedure is complete, review the data and save the e-log as AcceptanceTestingDrywell\_mmdyyy at P:\Ambient\ECB\NIST Certification Devices\ Acceptance Testing E-log). As noted before

#### 4.0 SITE CHECKS

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This section is reserved. Site checks do not apply to this type of instrument.

#### 5.0 DETAILED PROCEDURES

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##### IMPORTANT SAFETY INSTRUCTIONS-READ PRIOR TO USE:

Operate the Drywell 3101 in an ambient temperature between +50 degree Fahrenheit (°F) and 86°F (+10 and +30°C) (+15 to +25°C for optimum accuracy) and humidity between 5 to 95% (non- condensing). Note: High humidity will cause icing of the well when operated below zero. The fan runs continuously to moderate the internal unit temperature. Always ensure the air vents and fan aperture are clear and have at least 6 inches (150 millimeters [mm]) of space between them and any obstructions.

- Never cover the unit while in operation or operate if the fan stops.
- The Drywell 3101 can operate at high and low temperatures. Precautions must be taken to prevent personal injury or damage to surrounding objects. Probes may be hot or cold when removed from the unit and should be placed on a heat resistant surface and handled with care. The unit may remain hot for several minutes after switching off. Do not switch off at temperatures above +212°F (+100°C). Allow to cool before storage.
- The Drywell 3101 is designed to be rugged and durable but contains electronics. Do not operate in dirty, dusty or very damp environments or near liquids, such as water, that could present a hazard from electric shock.
- Connect input power lead to only a 110-115 voltage (V) or 230V, 50-60 Hertz (model dependent) grounded alternating current (AC) power supply. The unit requires up to 200 watts of power.
- The Drywell 3101 dry-block heat sources are programmed and calibrated at the factory for optimum performance and should not need adjusting. If the unit is out of calibration or is in need of repair, please return to the supplier. The dry-block unit is equipped with an internal electrical fuse. If a fuse blows, return to the supplier for inspection and repair. THERE ARE NO USER SERVICEABLE PARTS INSIDE.
- Because of the design of temperature probes, care should be taken when handling the probes to avoid injury.

**CAUTIONS:**

- **Do not** use fluid to clean inside the drywell. It is important to keep the well of the calibrator clean and clear of any foreign matter.
- Avoid operating the instrument in an oily, wet, or dirty environment.
- Operating the instrument in a draft-free environment improves performance of the instrument.

## 5.1 Dry-Block Set-Up

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1. Place the dry-block unit on a flat level surface with at least 6 inches (150mm) of space in front and behind. The stand may be swung out to lift the front of the unit.
2. Plug the power cord into a suitable grounded AC power outlet socket. Check for and remove any foreign objects prior to switching on.
3. Turn the instrument on using the switch located on the rear panel, below the power cord. The fan will start immediately and the controller display will illuminate after approximately three seconds.

## 5.2 Temperature Setting

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The dry-block may be set to any temperature between -14°F and 230°F (-10 to +110°C) in 0.1° increments. In normal operating mode the numeric light emitting diode (LED) display shows the actual block temperature. To set the temperature, follow these steps:

1. Check the top left corner of the display; a control indicator light will show when the heater is active. The dry-block temperature is displayed in operation.
2. To show the set point temperature in the display press and release either the up or down arrow button.
3. Press and hold either the up or down arrow button to change the set-point value.
4. To reach a higher set point temperature than the current dry-block temperature, wait at least 10 minutes for the dry-block to reach the desired temperature. A small overshoot and undershoot will occur when the block reaches the set point temperature.
5. To reach a lower set point temperature than the current dry-block temperature, wait at least 10 minutes for the dry-block to reach the desired temperature. A small overshoot and undershoot will occur when the block reaches the set point temperature.
6. Once the set point temperature is reached a further 10 minutes should be allowed for stability to be achieved. For optimum accuracy and stability allow the unit to warm up for 30 minutes after power up.
7. The displayed block temperature should stay within  $\pm 0.9^\circ\text{F}$  ( $\pm 0.5^\circ\text{C}$ ) of the set point temperature.
8. All other functions of the controller have been factory set and locked to maintain accuracy and repeatability.

## 5.3 Probe Testing

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The aluminum temperature well is accessible from the front panel. The dry-well model 3101 is designed to accept five different probe sizes: 1/8-inch (3.3-mm), 5/32-inch (4.1-mm), 3/16-inch (4.8-mm), ¼-inch (6.4-mm), and 3/8-inch (9.6-mm). Two inserts are included with each unit: 1/8-inch (3.3-mm) and 3/16-inch (4.8-mm). These inserts can be carefully removed and additional sizes may be purchased.

In order to test a probe, please follow these instructions:

1. Insert the probe to be tested into one of the holes in the dry-block. The probe should be a snug fit for good heat transfer but should not be so tight that it cannot be removed easily. Best results will be

obtained when the probe is inserted to the full depth of the dry-block hole of closest size to the probe diameter.

2. Allow the reading from the probe to stabilize and then compare the reading with either the temperature controller display or an external reference thermometer.
3. For optimum accuracy use a high precision reference thermometer and probe. If probes with a large mass are inserted into the dry-block holes the unit will require up to 10 to 15 minutes to re-stabilize.

#### 5.4 Maintenance Procedures

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The Drywell 3101 requires very little maintenance.

- Avoid operation in dusty, dirty, oily or wet environments.
- If the case becomes dirty it may be cleaned using a damp cloth and mild detergent.
- Do not allow moisture to enter the case.
- It is important to check for and remove any foreign objects in the dry-block holes.
- **WARNING:** Never introduce any fluids or other foreign material into the dry-block. This will damage the dry-block and could cause probes to become stuck. It could also cause a potential electric shock.
- In the event that the heat/cool source should require service or repair, please contact the manufacturer for assistance.
- There are no user serviceable parts inside and any attempted repair will void any warranty.

#### 6.0 DATA REVIEW

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Review certificates of calibration and the acceptance testing e-logs.

#### 7.0 FILE MANAGEMENT

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The primary types of files to manage with the Drywell 3100 include but are not limited to: certificates of calibration, acceptance testing e-logs and procurement documentation. They are maintained on the P: Drive at P:\Ambient\ECB\

##### 7.1 Certificates of Calibration

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The original certificate of calibration that comes with the units are kept on file at ECB. Scanned copies of these certificates are saved on the P drive at P:\Ambient\ECB\NIST Certification Devices for the appropriate current year.

#### 8.0 FILE QUALITY ASSURANCE AND DATA HANDLING

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The primary types of files to manage with the Drywell 3100 include but are not limited to: certificates of calibration and acceptance testing e-logs. They are maintained on the P: Drive at P:\Ambient\ECB\

#### 9.0 TROUBLESHOOTING AND CORRECTIVE ACTIONS

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In the event the unit malfunctions contact the manufacturer for assistance; any attempted repair will void any warranty.

## 10.0 REVISION HISTORY

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1. Revision 0.0 – [5/5/2021] – Original Publication

## 11.0 REFERENCES

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1. ThermoWorks 3101 DRY-BLOCK HEAT/COOL SOURCE USER MANUAL
2. DAQ-14-001 Standard Operating Procedure (SOP) for Preparing SOPs for the NCDAQ
3. Quality Assurance Handbook for Air Pollution Measurement Systems Volume II Ambient Air Quality Monitoring Program January 2017