

# OPERATIONAL CHECK

Operational Check Accessory for the RAD7  
User Manual

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# 1 INTRODUCTION

The Operational Check is essentially an uncalibrated sister product to the Natural Rock Sample. Whilst the Natural Rock Sample provides reproducible, 'rock steady' radon and thoron activity concentrations under conditions of secular equilibrium, the Operational Check is instead intended to be used to make a quick check that your RAD7 is seeing and correctly identifying counts from radon and thoron. With careful record-keeping, it can also be used to check for leaks in the RAD7's internal sample path.

The Operational Check is a 21oz (600g) sample of granite gravel, enclosed in a container that may be sealed using a pair of ball valves and end caps. Granite generally contains trace amounts of both uranium and thorium that has been in the rock since it was formed, millions if not billions of years ago. Therefore all the progeny of both the uranium and thorium decay chains are fully supported and in full equilibrium down to 226-Ra and 224-Ra.

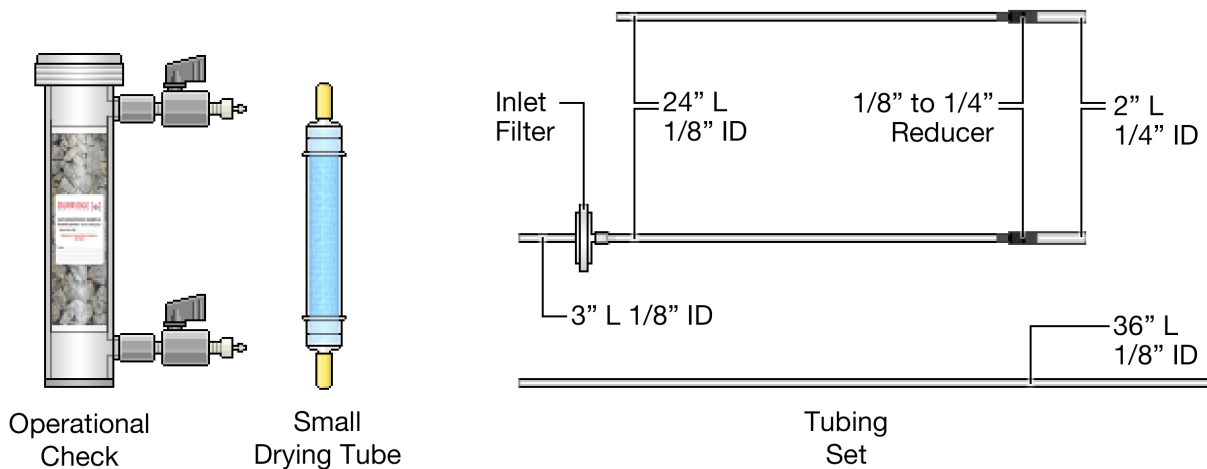


Figure 1 Operational Check Components

## 2 OPERATIONAL CHECK

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After sitting sealed on a shelf for one month, the radon in the Operational Check container will have reached within 1% of a steady value, in which the rate of emission of radon into the container is equal to the rate of loss by decay and leakage.

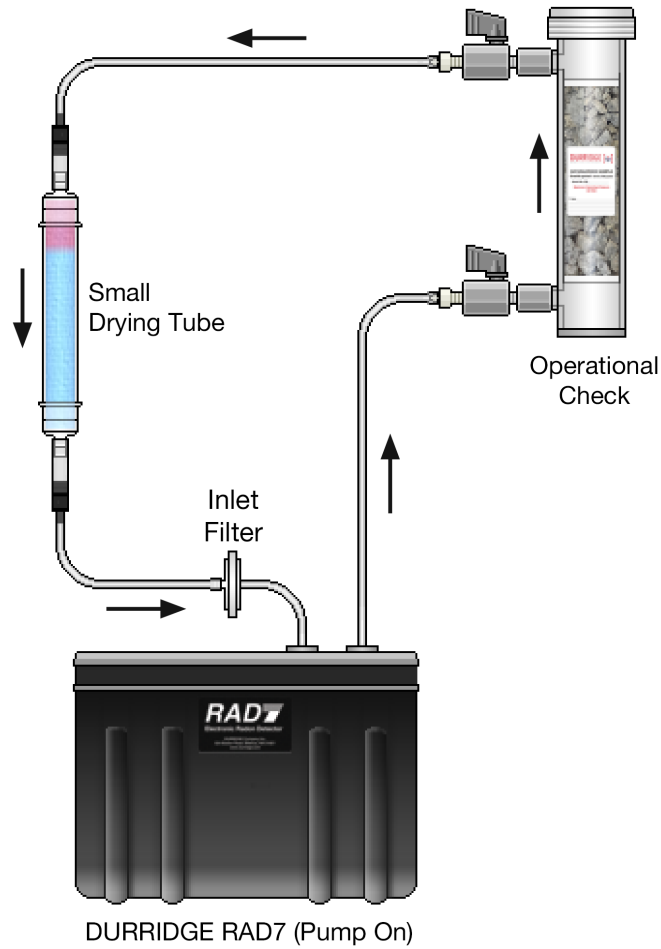


Figure 2 Operational Check Setup

## 2.1 Purge the RAD7

First, purge the RAD7 with dry air in an open loop for at least 5 minutes, then switch to 1-day protocol: select Setup, Protocol, 1-day, and push [ENTER]. Start a reading, still sampling fresh air through a drying unit. Go to the third status window (push the [Menu] key, then push [ENTER], [ENTER], Rt Arrow, Rt Arrow, and observe the relative humidity in the top right corner. Keep the reading going until the RH is below 9%, then switch off the RAD7.

## 2.2 Hook up to the Operational Check

Hook the RAD7 up to the Operational Check in a closed loop, using the tubing and Small Drying Tube provided with the device. Use the configuration shown in Figure 2, with the Small Drying Tube upstream of the RAD7, and the Operational Check connection upstream of the Small Drying Tube. If one end of the Small Drying Tube has started to turn pink, indicating that it is wet, that end should be positioned closest to the RAD7 outlet.

## 2.3 3-Hour Test

Switch on the RAD7 and press the menu key. Select 1-day protocol (Setup, Protocol, 1-day, [ENTER]). Change the Recycle number to 6 (Setup, Protocol, Recycle, 06, [ENTER]), and the Format to Long (Setup, Format, Long, [ENTER]). Put the RAD7's infrared printer in place and switch off the RAD7.

Switch on the RAD7 printer. Switch on the RAD7 and let it print out the header, including a review of the settings. Check the printed review to make sure the Cycle time is 00:30 (30 minutes), the Recycle number is 06, and Format is set to Long (which ensures that a spectrum is printed at the end of each Cycle). Open the ball valves on the Operational Check container and start a test (Test, Start, [ENTER]).

Keep the measurement going until all six cycles are complete and the summary, including the cumulative spectrum, is printed out (3 hours). When the test is complete, ensure that the RAD7's pump is idle, then close the inlet and outlet valves on the Operational Check before disconnecting the tubing. Once sealed, the Operational Check will begin to build up radon again, and will be ready for another check in a few weeks' time.

## 2.4 Cumulative Spectrum

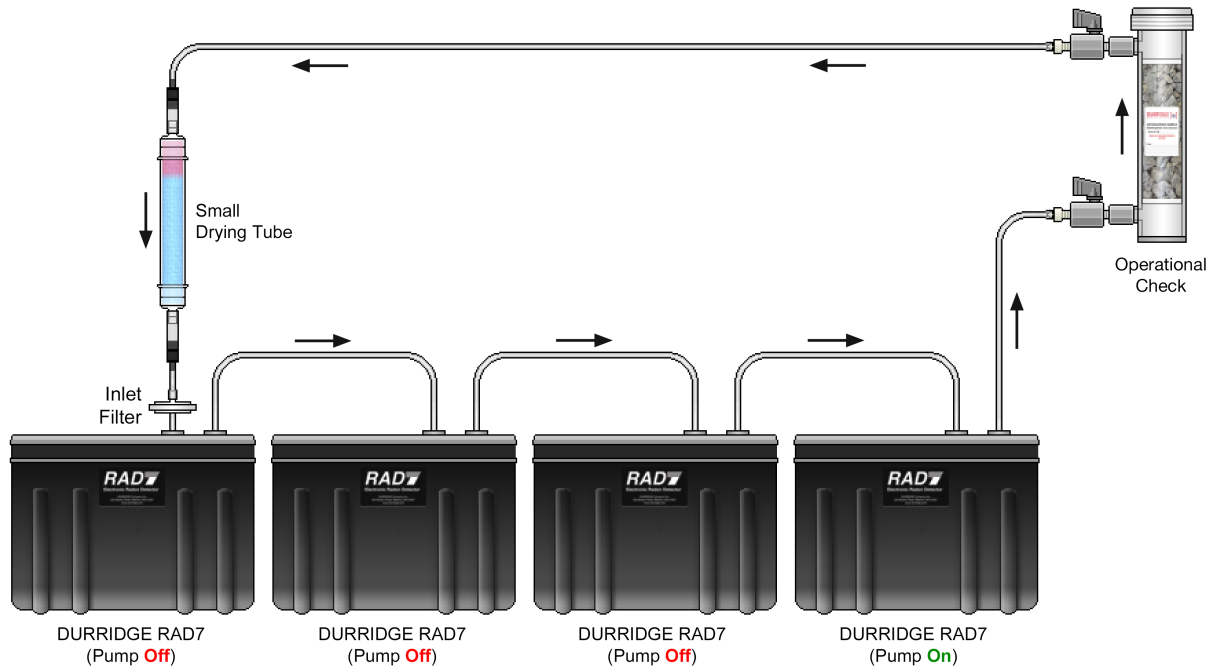
The cumulative spectrum (based on counts from multiple cycles) gives excellent diagnostic information on the health of the instrument. With the Recycle set to 6 cycles, as indicated above, at the end of the sixth cycle the RAD7 will automatically finish the run and print out a run summary. This consists of some data, a bar chart of the six readings and then the cumulative spectrum. That spectrum should show a sharp peak in the A window, about midway between the boundaries. There may also be peaks in the other three (B, C, D) windows and at 5.3 MeV (210-Po) just to the left of the A window. Please see the RAD7 manual for a description and image of some possible pathological spectra to watch out for.

## 2.5 Leak Check

If the RAD7 had developed a leak, the radon concentration in the loop would fall rapidly. Thus for each month, a record of the slope should also be maintained, as the radon concentration falls off over time from decay and any leakage. If during one month the slope is steeper than usual, that would be an indication of a leak in the loop somewhere.

## 2.6 Multiple RAD7s

Before using the Operational Check to check a RAD7, the Operational Check must be left sealed for a month, in order for the radon inside the container to reach equilibrium. That means a RAD7 can have its operation checked each month on a regular basis. However, there is nothing to stop us hooking up multiple RAD7s in series in the loop connected to the Operational Check. This increases the volume of the loop and hence decreases the radon concentration in the loop. This method is recommended for checking up to six RAD7s on a monthly basis.



**Figure 3 Multiple RAD7 Sensitivity Check Configuration**

Each month, all four RAD7s can be connected in series with one another and thoroughly purged and dried out, before being connected to the Operational Check to check that the instruments are counting and obtain spectra. During the measurement all the RAD7 pumps, except one, should be set to OFF (Setup, Pump, Off, [ENTER].)

**DURRIDGE Company Inc.**  
900 Technology Park Drive  
Billerica, MA 01821

Telephone: (+1) 978-667-9556  
Fax: (+1) 978-667-9557  
Web: [www.durridge.com](http://www.durridge.com)  
Email: [service@durridge.com](mailto:service@durridge.com)

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