LUDLUM MEASUREMENTS, INC
501 OAK STREET, P.O. BOX 810
SWEETWATER, TEXAS 79556
325-235-5494, FAX: 325-235-4672

Calibration and Testing Procedure

Model: 54 and 54-1 **Dial: none**

Revision 0

Written by: Tim Monday **Date:** 01/18/2012

Approved by: Randal Stevens **Date:** 18 JAN 12

Q/A Approval: Larry Hillis **Date:** 19 JAN'12

Table of Contents

1. Gather sources and Model 54(-1) calibration/testing source fixture

a. Model 54 Calibration/Testing Source fixture
   i. Part Number = 4540-352

b. Desired Calibration Source
   i. A source of the desired isotope in the desired range of 2X – 10X background

2. Perform HV calibration using FOM HV Calibration Tool

a. Use the source(s) to perform an HV calibration
b. Navigate to the HV – FOM window
c. Setup the FOM determination parameters as follows

   i. Background Count Time = 60 seconds
   ii. Source Count Time = 60 seconds
   iii. All detectors selected
   iv. Enter the appropriate source size in DPM
   v. HV Start = 650
   vi. HV End = 950
   vii. HV Increment = 25

   NOTE: The above numbers are guidelines that may be adjusted

d. Ensure all sources and other items that may cause background fluctuation are clear of the area
e. Place the calibration fixture inside the Model 54
f. Start the HV – FOM determination
g. When background counting is complete, place source in Model 54 as prompted and continue
h. Once complete, set the HV for each detector at the recommended HV value
   NOTE: High Voltage may be set at a value other than the recommended HV value presented by the FOM HV tool. The value presented is a guideline, not a requirement.
i. Save the associated report

3. Determine Efficiency

a. Use the source(s) to perform an efficiency determination
b. Navigate to the Efficiencies window
c. Set up the Efficiencies Calibration with the below parameters

   i. Background Count Time = 60 seconds
   ii. Source Count Time = 60 seconds
   iii. All detectors selected (including Sum Channel)

   NOTE: The above numbers are guidelines that may be adjusted

d. On the Sources tab enter the source(s) data as one of the available sources and save
e. On the Efficiencies tab select the newly saved source and the Free Air configuration
f. Ensure all sources and other items that may cause background fluctuation are clear of the area
g. Place the calibration fixture inside the Model 54
h. Start the efficiency test
i. When background counting is complete, place source in Model 54 as prompted and continue

4. Save Efficiency Report

a. Once all sources' efficiency calibrations are complete, save the associated report

5. Set Isotope Mix to 100% of the first source

6. Note Sum Channel Efficiency [E]

a. Found under the Efficiencies tab on the Efficiencies window
b. Also found under the Calculations tab on the Radiological setup window

7. Acquire Background Count

a. Press the Update button on the Setup Menu

8. Acquire Activity Estimate

a. Acquire activity estimate from scaler window using the first source

9. Fill out Model 54(-1) Activity Estimate Worksheet

a. It is recommended that a laptop or tablet be taken to the instrument being calibrated to allow for easy data entry
b. The worksheet is located at http://www.ludlums.com/images/stories/Calibration-Worksheets/M54-1_Calibration_Testing_Worksheet_for_Customers.xlsx
c. Calculations are preformed automatically

i. Determine source activity in decays per second (also becquerels) [S]
ii. Note Activity Estimate value in dps [A_E]
iii. Determine Activity Error in dps [$S - A_E = A_X$]
iv. Determine Gross Activity in dps [$G_C / E = G_A$]
v. Determine error as a percentage of total counts/decays [$A_X / G_A * 100\% = R$]
vi. Acceptable Error Range is ±5%

10. Acquire Background Count

a. Press the Update button on the Setup Menu

11. Perform Source Check using the first source

12. Set Isotope Mix to 100%

13. Repeat the process for all sources

14. Save and Print Worksheets

a. Once all sources' Activity Estimate and Source Check Worksheets are completed, save a copy of the Excel file and print a copy if desired

15. Set the Isotope Mix to the desired operating mix

16. Perform six normal operating count checks

a. Perform three counts with a desired test source
b. Perform three empty chamber counts
c. Ensure all counts and associated contamination checks give appropriate results (alarm when source in chamber, clean otherwise)

17. Save Reports

a. If all tests are passed, save the System Setup and Calibration reports

18. Collect Saved Model 54(-1) Unit Data

a. Collect saved data as desired

19. Complete Calibration Paperwork

a. Complete any desired additional calibration paperwork

20. Save Calibration and Checkout Data to Network

a. Save data according to company requirements