Calibration of Eberline HFM-7A Hand and Foot Monitor

Tank Farm Maintenance Procedure

Changes “Other Than Inconsequential” Require These Additional Reviews:

Radiological Controls:
Central Radcon Organization

USQ # GCX-2

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<th>Rev-Mod</th>
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<td>D-0</td>
<td>08/17/2016</td>
<td>Periodic Review</td>
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<td>RadCon Request</td>
<td>Changes to section 4.1 Added use of CI-36 sources</td>
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<td>C-3</td>
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<td>Radcon’s request to address WRPS-PER-2013-1261 Radcon request</td>
<td>Added Step 4.3.2 to check calibration sticker for sources to be used for calibration</td>
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<td>C-1</td>
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<td>DOE Standard</td>
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1.0 PURPOSE AND SCOPE

1.1 Purpose

This procedure provides instructions for calibrating the Eberline Model HFM-7A Hand and Foot Monitor.

1.2 Scope

This procedure involves calibrating Eberline Model HFM-7A Hand and Foot Monitor.

2.0 INFORMATION

2.1 Terms and Definitions

- DPM - Disintegrations Per Minute

3.0 PRECAUTIONS AND LIMITATIONS

3.1 Personnel Safety

WARNING - Failure to comply with DOE–0359, Hanford Site Electrical Safety Program, may cause Electrical Shock or Death by electrocution

3.1.1 IF working around live circuits, extreme caution should be used. Failure to follow electrical safety practices as outlined in DOE–0359 could result in serious injury or death.

3.1.2 If a lock and tag is required during the performance of this procedure, comply in accordance with DOE-0336, Hanford Site Lockout/Tagout Procedure.

3.1.3 Failure to use protective equipment when working on or near energized systems could result in serious injury. Job specific protective equipment requirements should be addressed during the pre-job brief and be in accordance with TFC-ESHQ-S_IS-C-02.

3.2 Equipment Safety

CAUTION - When opening front access door, the base plate must be raised. Use care not to damage exposed detector Mylar and dust covers.

CAUTION - Do not press [ESC] key on laptop computer during calibration. Pressing [ESC] key at any time during calibration with laptop will cause the calibration to abort.
3.3 Radiation and Contamination Control

3.3.1 Radioactive sources must be handled with care. They should be kept covered and protected when not in use. Sources should be handled by the edges and personnel or equipment should not contact the active surface.

3.3.2 Work in radiological areas will be performed using a Radiological Work Permit following review by Radiological Control per the ALARA Work Planning procedure TFC-ESHQ-RP_RWP-C-03.

4.0 PREREQUISITES

4.1 Special Tools, Equipment and Supplies

The following supplies may be needed to perform this procedure:

- Key for instrument upper and lower access doors
- Laptop computer with Eberline HFM7 calibration program installed
- Computer interface cable (Eberline p/n CA-41-80, or equivalent)
- Printer interface cable (Eberline p/n CA-40-80, or equivalent)
- Calculator
- High voltage meter below:
  - Electrostatic voltmeter
  OR
  - DMM (Fluke model 867B or equivalent) with high voltage probe capable of measuring 2500 Vdc, with minimum impedance of 1000 megohms.
- NIST traceable sources with current Pacific Northwest National Labs (PNNL) calibration sticker:
  - Beta/Gamma source, $^{137}\text{Cs}$ or $^{36}\text{Cl}$, > 100,000 DPM, for calibration
  - Alpha source, $^{239}\text{Pu}$, > 20,000 DPM, for calibration.
- NIST traceable sources for alarm verification:
  - Beta/Gamma source, $^{137}\text{Cs}$, 4000 to 6000 DPM or $^{36}\text{Cl}$, 5,000 to 6,500 DPM, for source check
  - Alpha source, $^{239}\text{Pu}$, 400 to 600 DPM, for source check (for units set for alpha-monitoring only).
4.2 Performance Documents

The following documents may be needed to perform this procedure:


4.3 Field Preparation

4.3.1 ENSURE Shift manager has been notified prior to starting test.

4.3.2 CONFIRM all radiation sources to be used for calibration have current Pacific Northwest National Labs (PNNL) calibration stickers.

4.3.3 IF HFM-7A is to be out of service, ENSURE Radiological Control Manager has been notified.

4.3.4 ENSURE P-10 gas supply pressure to HFM-7A is 200 psig or greater.

4.3.5 PRIOR to starting, IF more than one P-10 gas supply bottle is being used ENSURE all trouble lights or indications are cleared on HFM-7A.

4.3.6 PRIOR to starting, IF only one P-10 gas supply bottle is being used ENSURE all trouble lights or indications are cleared on HFM-7A except one “BOTTLE EMPTY” indicator light.

4.3.7 PRIOR to start of calibration where potential exists for unit to be radiologically contaminated ENSURE unit has been surveyed by HPT.
5.0 PROCEDURE

NOTE - If performance of any steps in this procedure is not required for procedure completion, steps not performed are to be marked, "N/A" and explained on Data Sheet.

5.1 Operational Check

5.1.1 PRIOR to beginning cleaning and inspection, PERFORM a source check of unit (to verify accuracy is acceptable).

5.1.2 IF unit fails source check, NOTIFY Radiological Engineering and continue.

5.2 General Instructions

5.2.1 RECORD the serial number and location of Hand and Foot Monitor on Data Sheet.

5.2.2 INSPECT instrument for physical damage AND RECORD discrepancies in comment section on Data Sheet.

5.2.3 IF during performance of this procedure power supplies, computer cards, dual detector card or detector assemblies are found to be damaged or out of tolerance, PERFORM the following:

5.2.3.1 REPLACE with shop spares.

5.2.3.2 ENTER replacement information on Data Sheet.

5.2.4 IF at any time during performance of this procedure, a system error, failure or abnormal condition error occurs, PERFORM the following:

5.2.4.1 RESET as necessary.

5.2.4.2 RECORD any corrective action taken on Data Sheet.

5.2.4.3 IF problem cannot be corrected successfully, NOTIFY System Engineer.
5.3 P-10 Gas Checks

5.3.1 PRESS AND RELEASE Gas Manager Control Knob.

5.3.2 ENTER 4-digit password as follows (password permanently set at “1287”):
   5.3.2.1 ROTATE Control Knob until first number “1” appears.
   5.3.2.2 PRESS AND RELEASE Control Knob.

NOTE - If unit is set for alpha-monitoring, the following Source Check shall be performed with both the alpha and the beta source.

5.3.2.3 PRESS [SOURCE CHECK] key on HFM-7A.

NOTE - Default password is “0000”.

5.3.2.4 ENTER password AND

PRESS [ENTER].

5.3.2.5 ENTER remaining digits (i.e., 1, 2, 8, 7).

5.3.3 PERFORM P-10 gas flow and pressure checks AND

RECORD the following data on Data Sheet:
- As-Found gas output pressure (regulator)
- As-Found Gas Manager pressure.

5.3.4 RECORD As-Left gas output pressure regulator and Gas Manager on Data Sheet (same as As-Found if no adjustments made).

5.3.5 IF initially setting up an instrument, ADJUST Gas Manager flow to 200 cc/min for initial purging.

5.3.6 ALLOW detectors to purge at 50 cc/min for at least two hours.

5.3.7 AFTER purge is completed, REDUCE Gas Manager flow to 25 cc/min.
5.4 Source Check

NOTE - If unit is set for alpha-monitoring, the following Source Check shall be performed with both the alpha and the beta source.

5.4.1 PRESS [SOURCE CHECK] key on HFM-7A.

NOTE - Default password is “0000”.

5.4.2 ENTER password AND

PRESS [ENTER].

5.4.3 CENTER check source on detector.

5.4.4 WHEN count time has elapsed, PERFORM the following:

5.4.4.1 VERIFY alarm light illuminates.

5.4.4.2 CONFIRM Silhouette light for detector under test is illuminated.

5.4.5 REMOVE source AND

IF necessary, ACKNOWLEDGE alarm.

5.4.6 REPEAT Steps 5.4.3 through 5.4.5 for each detector.

5.4.7 PRESS [MENU] to exit Source Check mode.
5.5 High Voltage Calibration

5.5.1 PRESS [MENU] to enter Test Mode menu on HFM-7A.

5.5.2 TYPE in password (default password is “0000”).

5.5.3 PRESS [ENTER].

NOTE - Scrolling or sequencing through menus will be performed by using [+ ] or [- ] keys.

5.5.4 SCROLL to “HIGH VOLTAGE ADJUST”

5.5.5 PRESS [ENTER] AND

CONFIRM display reads ‘LH Back Beta’ detector.

5.5.6 PRESS [ENTER].

5.5.7 RECORD displayed high voltage setpoint on the Data Sheet.

---

**WARNING**

Failure to comply with DOE–0359, Hanford Site Electrical Safety Program, may cause Electrical Shock or Death by electrocution.

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**CAUTION**

When opening front access door, the base plate must be raised. Use care not to damage exposed detector Mylar and dust covers.

5.5.8 CONNECT high voltage probe and voltmeter (or electrostatic voltmeter) to unused MHV connector on right hand side of card cage.

5.5.8.1 RECORD measured As-Found voltage on the Data Sheet.
5.5 High Voltage Calibration (Cont.)

5.5.9 IF measured high voltage is within ±20 Vdc of displayed setpoint, **PERFORM** the following:

5.5.9.1 **DISCONNECT** M&TE.

5.5.9.2 **PRESS** [MENU] to return to Test Mode menu.

5.5.9.3 **RECORD** As-Found value in As-Left column on Data Sheet.

5.5.9.4 **PROCEED** to Section 5.6.

5.5.10 IF high voltage is not within tolerance provided, **PERFORM** high voltage calibration as follows:

5.5.10.1 **PRESS** [MENU] to return to Test Mode menu.

5.5.10.2 **SCROLL** to SYSTEM PARAMETERS AND **PRESS** [ENTER].

5.5.10.3 **SCROLL** to HIGH VOLTAGE.

5.5.10.4 **PRESS** [EDIT].

   a. **SET** high voltage to 1250 Vdc.

   b. **WAIT** for high voltage to stabilize.

5.5.10.5 **REMOVE** card cage cover (4 screws).

   NOTE - HV adjust potentiometer R18 is on the edge of the HV card, facing outward, to the left of toggle switch SW10 (HV ON / HV OFF).

5.5.10.6 **ADJUST** R18 until voltmeter reads 1250 Vdc (±5 Vdc).

5.5.10.7 **USING** keypad, **RESET** high voltage to value recorded in Step 5.5.7.

5.5.10.8 **RECORD** measured As-Left voltage on the Data Sheet.

5.5.10.9 **CONFIRM** As-Left voltage is within ±20 Vdc of displayed setpoint.
5.5 High Voltage Calibration (Cont.)

5.5.10.10 IF As-Left voltage is not within ± 20 Vdc of displayed setpoint, NOTIFY System Engineer AND PROCEED as directed.

5.5.10.11 RE-INSTALL card cage cover plate.

5.5.10.12 DISCONNECT M&TE.

5.5.10.13 CLOSE access doors.

5.5.10.14 PRESS [MENU] to return to Test Mode menu.
5.6 **System Status Checks**

5.6.1 SCROLL to “System Poll”.

5.6.2 PRESS [ENTER].

5.6.3 SEQUENCE through boards using [-] or [+ ] keys AND CONFIRM each board, when polled, indicates “OK”.

5.6.4 RETURN to “System Poll” after all boards are polled.

5.6.5 SCROLL to “System Status”.

5.6.6 PRESS [ENTER] AND PERFORM the following:

5.6.6.1 ENSURE display reads “READY TO MEASURE”.

5.6.6.2 PRESS [MENU] to return to Test Mode menu.

5.6.7 SCROLL to “Channel Status”.

5.6.8 PRESS [ENTER].

5.6.9 SEQUENCE through detectors using [-] or [+ ] keys AND CONFIRM the following detectors, when polled, indicates “NORMAL”:

- LH Back
- LH Palm
- RH Back
- RH Palm
- Left Foot
- Right Foot.
5.7 Verification of Active Inputs

5.7.1 SCROLL to “Input Check” AND
PRESS [ENTER].

5.7.2 ACTIVATE each of the following inputs one at a time AND
CONFIRM display indicates input as “Active”:
- Left Hand switch
- Right Hand switch
- Left Foot switch
- Right Foot switch
- Each keypad key, [MENU] key last.
5.8 Verification of Outputs

5.8.1 SCROLL through Main Menu to “Output Check”.

5.8.2 PRESS [ENTER] and “STATUS LIGHTS” will be displayed.

5.8.2.1 CONFIRM the following Status Lights illuminate on front panel:
- Ready
- Counting
- Alarm
- Out of Service.

5.8.3 PRESS (-) key to scroll to “SILHOUETTE LIGHTS”.

5.8.3.1 CONFIRM the following six lights on hand and foot alarm illuminate:
- LH Back & Palm
- RH Back & Palm
- LF & RF.

5.8.4 PRESS (-) key to scroll to “BOTTLE EMPTY LIGHTS” AND
CONFIRM both bottle empty lights illuminate on right hand side.

5.8.5 PRESS (-) key to scroll to “CHIME” AND
CONFIRM the OK chime sounds.

5.8.6 PRESS (-) key to scroll to “HORN” AND
CONFIRM Alarm horn sounds.

NOTE - Remaining output options are not installed.

5.8.7 PRESS [MENU] to return to Test Mode menu.
5.9 Calibration with Laptop Computer

NOTE - Unless otherwise specified, keypad entries are for the laptop computer.

5.9.1 RETURN to Operational Mode on HFM-7A.

5.9.1.1 ENSURE HFM-7A has no failed conditions (the “Ready to Measure” message is posted).

5.9.2 CONNECT laptop to HFM-7A “laptop J4” serial communications port.

NOTE - Pressing HFM-7A [MENU] key at any time during Remote Calibration will cause calibration to abort and return instrument control to the HFM-7A.

5.9.3 PERFORM the following on HFM-7A:

5.9.3.1 PRESS [MENU] to access Test Mode menu.

5.9.3.2 TYPE in password.

5.9.3.3 PRESS [ENTER].

5.9.3.4 SCROLL to “REMOTE CALIBRATION”.

5.9.3.5 PRESS [ENTER] to select.

5.9.4 START “HFM7” program on laptop.

5.9.4.1 ENTER the following requested information:

- HFM-7A serial number
- User ID (payroll #).
5.9 Calibration with Laptop Computer (Cont.)

NOTE - Program retrieves “Instrument Configuration” files (instrument and detector parameter files). If a file cannot be retrieved, a message will display “Not Retrieved” next to the configuration item.

- Due to Instrument Configuration, the following files will not be retrieved: Option Beta; Option Alpha; Frisk Beta; and Frisk Alpha.

5.9.4.2 IF files, other than those noted above, cannot be retrieved, PERFORM the following:

a. STOP AND NOTIFY System Engineer.

b. DOCUMENT discrepancy on Data Sheet.

c. CORRECT problem prior to proceeding.

5.9.4.3 PRESS [ENTER].

5.9.5 SELECT “Password” on toolbar.

5.9.6 PRESS [ENTER].

5.9.7 TYPE in password (default is “Eberline”).

5.9.8 PRESS [ENTER] AND CONFIRM text box displays “password OK, connection OK.”

NOTE - Laptop calibration values are not downloaded to HFM-7A until completion of calibration. During calibration, values are temporarily downloaded, but original values are automatically reloaded by the program at the end of each step.

5.9.9 SELECT 'Inst Config' from the 'Edit' main menu item.

5.9.9.1 SELECT 'No' to 'Edit Disk File Only'.

5.9.9.2 ENSURE 'Units of Activity' set to 'dpm'.

5.9.9.3 PRESS [ESCAPE] to return to main menu.
5.9 Calibration with Laptop Computer (Cont.)

5.9.10 SET UP Source List as follows:

5.9.10.1 From “Edit” drop-down menu, SELECT “souRce list”.

5.9.10.2 PRESS [ENTER].

5.9.10.3 CONFIRM sources listed in Section 4.1 are in Source List.

a. ENSURE Activity (dpm) displayed for each source corresponds to actual source Activity (dpm) as recorded in Section 4.1.

5.9.10.4 PRESS [ESC].

5.9.10.5 IF values were edited, SELECT “Save & Exit”.

---

CAUTION

Do Not press [ESC] key on laptop computer during calibration. Pressing [ESC] key at any time during calibration with laptop will cause the calibration to abort.

5.9.11 SELECT “Calibrate” from the ‘Calibrate’ main menu.

5.9.12 PRESS [ENTER] AND

CONFIRM prompt reads ‘Ready to calibrate beta threshold’.

5.9.13 SELECT ‘Use optimum (default) value’.

5.9.14 PRESS [ENTER] AND

CONFIRM prompt reads ‘Ready to calibrate alpha threshold’.

5.9.15 SELECT ‘Use optimum (default) value’.

5.9.16 PRESS [ENTER] AND

CONFIRM prompt reads ‘Ready to run a high voltage plateau on the master detector’.

5.9.17 PRESS [ENTER].
5.9 Calibration with Laptop Computer (Cont.)

5.9.18 FOLLOW program instructions AND

CONFIRM computer sounds a tone when plateau has been completed.

5.9.19 PRESS [ENTER] AND

CONFIRM computer displays instructions on obtaining the plateau graph so that a high voltage point can be chosen and will display options for the type of graph to display.

5.9.20 SELECT 'Count Rate'.

5.9.21 PRESS [ENTER].

5.9.22 WHEN the graph is displayed, USE the arrow keys to move the graphics pointer along the graph curve to the top of the 'hump'.

NOTE - The plateau high voltage must be 1550-1750 Volts. If it is not, the detector may be defective, the detector may not be purged, or there may be an electronic hardware failure. The problem must be corrected, and calibration re-started.

5.9.23 PRESS [ENTER] AND

CONFIRM the program pauses while data is saved to disk and when the graph data has been saved to disk, the plateau data will again be displayed.

5.9.24 PRESS [ENTER] AND

CONFIRM the prompt reads 'The plateau data will be saved in the calibration report. Press Esc to abort, any other key to save and continue.'

5.9.25 CONFIRM the prompt reads 'Ready to balance beta threshold voltages. Press Esc to abort, any other key to continue.'

5.9.26 IF beta threshold data already exists PRESS “N” AND

GO TO Step 5.9.30.
5.9 Calibration with Laptop Computer (Cont.)

5.9.27 IF beta threshold is needed PRESS “Y”.

5.9.28 PRESS [ENTER] AND

CONFIRM the computer displays 'election box' (this selection box will have the title: 'Ready to calibrate non-master channel beta thresholds') listing a choice of options on how to proceed.

5.9.29 SELECT 'Use master channel pick value'.

5.9.30 PRESS [ENTER] AND

CONFIRM the prompt reads “Ready to establish beta efficiencies. Press Esc to abort, any other key to save and continue.”

5.9.31 IF efficiencies already exist PRESS “Y” to display or “N” to continue.

5.9.32 CONFIRM the prompt reads 'Ready to perform background count on all detectors. Remove all sources. Press any key to continue.'

5.9.33 CONFIRM the computer instructs the HFM to perform a background count.

NOTE - Data will be updated on the screen as the background count proceeds. When the background count has complete, the computer will instruct the operator to select a source from the displayed list of sources.

5.9.34 SELECT the desired source.

5.9.35 PRESS [ENTER].

5.9.36 FOLLOW the instructions given by the computer AND

CONFIRM the computer beeps and a message is displayed on the screen saying 'Ready to continue...' when an efficiency reading has been completed for each detector.

5.9.37 AFTER all efficiency readings have been completed PRESS any key except “ESC or R”
5.9 Calibration with Laptop Computer (Cont.)

5.9.38 CONFIRM computer shows efficiencies AND REMOVE source.

5.9.39 PRESS [ENTER] AND CONFIRM the prompt reads 'The displayed values will be saved in the calibration report. Press Esc to abort, any other key to continue...'

5.9.40 CONFIRM the prompt reads 'Ready to balance alpha threshold voltages. Press Esc to abort, any other key to continue.'

5.9.41 CONFIRM the computer displays a 'selection box' listing a choice of options on how to proceed (selection box will have the title: “Ready to calibrate non-master channel alpha thresholds”).

5.9.42 SELECT 'Use master channel pick values'.

5.9.43 PRESS [ENTER] AND CONFIRM the prompt reads 'The threshold values will be saved in the calibration report. Press Esc to abort, any other key to save and continue.'

5.9.44 CONFIRM the prompt reads 'Ready to establish alpha efficiencies. Press Esc to abort, any other key to continue.'

5.9.45 IF alpha efficiency data already exist, PRESS “Y” to display or “N” to continue.

5.9.46 PRESS [ENTER] AND CONFIRM the prompt reads 'Ready to perform background count on all detectors. Remove all sources. Press any key to continue.'

5.9.47 REMOVE all sources.

5.9.48 CONFIRM the computer instructs the HFM to perform a background count.
5.9 Calibration with Laptop Computer (Cont.)

NOTE - Data will be updated on the screen as the background count proceeds. When the background count has complete, the computer will instruct the operator to select a source from the displayed list of sources.

5.9.49 SELECT the desired source.

5.9.50 PRESS [ENTER].

5.9.51 FOLLOW the instructions given by the computer AND CONFIRM the computer beeps and a message is displayed on the screen saying 'Ready to continue...' when an efficiency reading has been completed for each detector.

5.9.52 AFTER all efficiency readings have been completed PRESS any key except “ESC or R”

5.9.53 CONFIRM computer shows efficiencies AND REMOVE source.

5.9.54 PRESS [ENTER] AND CONFIRM the prompt reads 'The displayed values will be saved in the calibration report. Press Esc to abort, any other key to continue...'

5.9.55 CONFIRM the prompt reads 'Ready to re-check beta efficiencies (Alpha thresholds will be set.) Press Esc to abort, any other key to continue...'

5.9.56 PRESS [ENTER] AND CONFIRM the computer instructs the HFM to perform a background count.

NOTE - Data will be updated on the screen as the background count proceeds. When the background count has complete, the computer will instruct the operator to select a source from the displayed list of sources.

5.9.57 SELECT the desired source.

5.9.58 PRESS [ENTER].
5.9 Calibration with Laptop Computer (Cont.)

5.9.59 FOLLOW the instructions given by the computer AND CONFIRM the computer beeps and a message displayed at the bottom of the screen saying 'Ready to continue...' when an efficiency reading has been completed for each detector.

5.9.60 AFTER all efficiency readings have been completed, PRESS any key except “ESC or R”

5.9.61 CONFIRM computer shows efficiencies AND REMOVE source.

5.9.62 PRESS [ENTER] AND CONFIRM the computer displays the beta efficiency re-check data.

5.9.63 PRESS [ENTER], CONFIRM the prompt reads 'The displayed values will be saved in the calibration report. Press Esc to abort, any other key to continue...'

5.9.64 CONFIRM the prompt reads 'Ready to establish shield factors. Press Esc to abort, any other key to continue...'.

5.9.65 CONFIRM the computer instructs the HFM to perform a background count.

NOTE - Data will be updated on the screen as the background count proceeds. When the background count has completed, the computer will give the user the following instructions 'Step into the instrument, the program will continue when all hand and foot sense switches are closed.'

5.9.66 STEP onto the HFM as if using the instrument in a measurement cycle.
5.9 Calibration with Laptop Computer (Cont.)

NOTE - When all switches have closed the program will automatically begin taking a background count from the instrument.

-- When the background count has completed the computer will beep and the shield factor data will be displayed and the prompt will read 'Ready to continue...'

5.9.67 PRESS [ENTER] AND

CONFIRM the prompt reads 'The displayed values will be saved in the calibration report. Press Esc to abort, any other key to continue.

NOTE - This shows the values which have been determined by the calibration program.

5.9.68 CONFIRM the 'Calibration Summary' is displayed.

5.9.69 DOWNLOAD calibration values to HFM-7A as follows:

NOTE - No calibration values are downloaded to the HFM-7A until this step is performed. During calibration, values are temporarily downloaded, but original values are reloaded at end of each step.

- If any values are out of tolerance or have not been calibrated, the computer will beep and display a message indicating values are out of tolerance. No calibration values will be downloaded to the instrument if any one value is out of tolerance. However a report will be generated.

- If all calibration values are in tolerance, then all system and detector parameter files will be downloaded to the instrument with the newly calibrated values, and a report will be generated.

5.9.69.1 PRESS [ENTER] AND

HIGHLIGHT “Calibration download/print”.

5.9.69.2 PRESS [ENTER] to download calibration values to the detector files and system file AND PRINT.

5.9.70 ATTACH printout to work package.
5.10 Restoration

5.10.1 HIGHLIGHT AND SELECT “Utils” On toolbar.

5.10.2 SELECT “Disconnect” On the Utilities drop-down menu.

5.10.3 PRESS [ENTER] AND CONFIRM instrument control is returned to HFM-7A microprocessor.

5.10.4 EXIT HFM-7 A program AND SHUTDOWN computer.

5.10.5 DISCONNECT interface cable.

5.10.6 ENSURE all test equipment has been disconnected and removed.

5.10.7 CLOSE UP HFM-7A.

5.10.8 PRESS [MENU].

5.10.9 CONFIRM all HFM-7A alarms are cleared.

5.10.10 CONFIRM HFM-7A is in Operational Mode with display “Ready to Measure”.

5.10.11 REQUEST HPT to perform source check of unit.

5.10.11.1 PRESS [SOURCE CHECK] key on HFM-7A,

5.10.11.2 ENTER password AND PRESS [ENTER].

5.10.11.3 CENTER check source on LH Back detector.

5.10.11.4 WHEN count time has elapsed, PERFORM the following:

   a. CONFIRM Alarm light illuminates

   b. CONFIRM Silhouette light for detector under test is illuminated.
5.10 Restoration (Cont.)

5.10.11.5 **REMOVE** source **AND**

**ACKNOWLEDGE** alarm.

5.10.11.6 **REPEAT** Steps 5.10.11.3 through 5.10.11.5 for each of the following detectors:

- LH Back
- LH Palm
- RH Back
- RH Palm
- Left Foot
- Right Foot.

**NOTE** - If unit is set for alpha-monitoring, Source Check shall be performed with both the alpha and the beta source.

5.10.11.7 **RETURN** source to storage container.

5.10.11.8 **PRESS** [MENU] to exit Source Check mode.

5.10.11.9 **HPT VERIFY** Source Check Satisfactory **AND**

**RECORD** on the Data Sheet.

5.10.12 **CONFIRM** System Status Checks as follows:

5.10.12.1 **SCROLL** to “System Poll” **AND**

**PRESS** [ENTER].

a. **SEQUENCE** through boards using [-] or [+]{w} keys **AND**

**CONFIRM** each board, when polled, indicates “OK”.

b. **RETURN** to “System Poll” after all boards are polled.

5.10.12.2 **SCROLL** to “System Status” **AND**

**PRESS** [ENTER].

a. **CONFIRM** display reads “READY TO MEASURE”.
5.10 Restoration (Cont.)

5.10.12.3 PRESS [MENU] to return to Test Mode menu.

5.10.12.4 SCROLL to “Channel Status” AND

PRESS [ENTER].

5.10.12.5 CONFIRM each of the following detectors, when polled, indicates “NORMAL”:
- LH Back
- LH Palm
- RH Back
- RH Palm
- Left Foot
- Right Foot.

5.10.13 PRESS [MENU] to return to Operate Mode.

5.10.14 PLACE calibration sticker on unit.

5.10.15 IF any problems were encountered with calibration, INFORM FWS.

5.10.16 ENSURE Test Equipment has been disconnected and removed.

5.10.17 ENSURE Test Equipment information and calibration status are recorded on Data Sheet.

5.10.18 IF any problems were encountered with calibration, INFORM FWS.

5.10.19 ENSURE Test Equipment has been disconnected and removed.

5.10.20 ENSURE Test Equipment information and calibration status are recorded on Data Sheet.

5.10.21 ENSURE equipment system restoration by observing indications are consistent with expected conditions.

5.10.22 NOTIFY Operations that testing is complete and system may be returned to desired configuration.
5.11 Acceptance Criteria

Acceptance Criteria has been met when Steps in this procedure have been satisfactorily performed and As-Left values meet the specifications and tolerances per the Data Sheet.

5.12 Review

5.12.1 INFORM FWS calibration is complete.

5.12.2 RECORD in COMMENTS/REMARKS section of Data Sheet the Work Request Number(s) of any work documents generated as a result of this procedure, if applicable.

5.12.3 RETURN Work Package to FWS.

5.12.4 FWS REVIEW AND ENSURE that the completed Data Sheets meet the acceptance criteria and the comments sections are filled out appropriately.

5.12.4.1 ENSURE that any work requests needed as a result of this procedure are identified and generated.

5.12.4.2 IF the As-Found efficiency is outside of the specified tolerance for any detector, NOTIFY Radiological Engineering.

5.13 Records

The performance of this procedure generates no records. However, PM Data Sheets associated with the procedure, are records and are maintained in the work package as record material.

The record custodian identified in the Company-level Records Inventory and Disposition Schedule (RIDS) is responsible for record retention in accordance with TFC-BSM-IRM_DC-C-02.
Calibration of Eberline HFM-7A Hand and Foot Monitor

Attachment 1 – System Parameters

<table>
<thead>
<tr>
<th>System Parameters</th>
<th>Default Value</th>
<th>SST Retrievals</th>
</tr>
</thead>
<tbody>
<tr>
<td>High Voltage</td>
<td>1601 Vdc</td>
<td>TBD</td>
</tr>
<tr>
<td>Base Units</td>
<td>CPS</td>
<td>CPS</td>
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<tr>
<td>Activity Units</td>
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<tr>
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<tr>
<td>RDA Confidence</td>
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<tr>
<td>Max Count Time</td>
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<td>30 sec</td>
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<tr>
<td>Alarm Hold Time</td>
<td>2 sec</td>
<td>3 sec</td>
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<tr>
<td>Test Count Time</td>
<td>30 sec</td>
<td>30 sec</td>
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<tr>
<td>Alpha RDA *</td>
<td>5 Bq</td>
<td>15,000 dpm 500 dpm</td>
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<tr>
<td>Beta RDA</td>
<td>83 Bq</td>
<td>5,000 dpm</td>
</tr>
<tr>
<td>Alpha Low Fail Background</td>
<td>0.001 cps</td>
<td>0.001 cps</td>
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* Alpha RDA is set to 500 dpm when the Facility Radcon Organization requires alpha-monitoring.
## Attachment 2 – Channel Parameters

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<tr>
<td>RDA</td>
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<tr>
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<tr>
<td>Threshold</td>
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<td>Shield Factor</td>
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<table>
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<tr>
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<td>RDA *</td>
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