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BROOKHAVEN NATIONAL LABORATORY Safety & Health Services Division	NUMBER IH96600
	REVISION SHSD FINAL rev1 RCD Review draft
INDUSTRIAL HYGIENE GROUP Standard Operating Procedure: Field Procedure	DATE 06-08-01
SUBJECT: INSTRUMENT OPERATION: Quest M-27 Noise Dosimeter	PAGE 1 OF 12

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1.0 Purpose/Scope

This procedure provides a standardized method for the operation of the Quest M-27 Personnel Noise Dosimeter. It should be used in conjunction with the ES&H Standard 2.4.0 and IH SOP IH96300: *Noise Measurement Principles: Noise Dosimetry*.

Employee exposure assessments for regulatory compliance should be made with a noise dosimeter, such as the M-27. Employees wear dosimeters as they move through the work area. The dosimeter logs a close representation to the actual noise exposure of the ear as the distance from the source changes with employee movements. The logged exposure data is compared to occupational exposure limits to determine compliance with hearing conservation regulations.

The Quest M-27 Noise Logging Dosimeter is a microcomputer-based sound analyzing instrument for accumulating, displaying, and sending data to serial or parallel printers or computers. The M-27 can function as a personal noise dosimeter, an area monitor or a survey event monitor. While the M-27 can be used as a survey meter, other SPL meters designed as precision area survey meters offer more features (such as impact/ impulse capturing) and should be used for area surveys.

2.0 Responsibilities

- 2.1 Use of the M-27 shall be limited to persons who act under the direction of a competent

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hazard assessment person and have demonstrated the competency to satisfactorily use the meter, as evidenced by experience and training, to the satisfaction of their supervision or existing qualification criteria set by their organization.

- 2.2 Personnel that perform exposure monitoring with this instrument are responsible to follow all steps in this procedure.
- 2.3 The data collected using this meter must have an appropriate evaluation of the hazard and risk by a knowledgeable Industrial Hygiene professional.

3.0 **Definitions**

- 3.1 *Decibel (dB)*: A non-dimensional unit used to express sound pressure levels. It is the log of the ratio of the measured sound pressure level to a reference level.
- 3.2 *dBA*: A sound pressure level in decibels made on the A-scale of a sound level meter. This unit of measure approximates the response of the human ear.
- 3.3 *dBC*: Sound pressure based on a nearly flat, non-weighted scale.
- 3.4 *HTL*: High Threshold Level
- 3.5 *LTL*: Low Threshold Level
- 3.6 *Occupational Exposure Limit*: The maximum time weighted average (TWA) exposure permitted for employee exposure, based on the less of the OSHA Permissible Exposure Limits (PEL) or ACGIH Threshold Limit Value (TLV). See IH96300.

4.0 **Prerequisites**

4.1 **Training prior to using this meter:**

- 4.1.1 Demonstration of proper operation of this instrument to the satisfaction of the employee's supervision.
- 4.1.2 Other appropriate training for the area to be entered (check with ESH coordinator or FR Representative for the facility).
- 4.1.3 Noise and Hearing Conservation Training and a Baseline audiogram may be needed if the duration of exposure to the person performing the survey will be in excess of the OSHA Permissible Exposure Limits (PEL) or ACGIH Threshold Limit Value (TLV) (which ever is less). See IH96300.

4.2 **Area Access:**

- 4.2.1 Contact the appropriate Facility Support Representative or Technician to obtain approval to enter radiological areas.

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- 4.2.2 Verify with the appropriate Facility Support Representative or Technician if a Work Permit or Radiological Permit is needed or is in effect. If so, review and sign the permit.
- 4.2.3 Use appropriate PPE for area.

5.0 Precautions

5.1 Hazard Determination:

- 5.1.1 The operation of this meter does not cause exposure to any chemical, physical, or radiological hazards. The meter design does not cause significant ergonomic concerns in routine use. The meter does not generate Hazardous Waste.
- 5.1.2 By its very nature, noise dosimeters may be used in areas where excessive noise levels exist or are suspected to be present. Exposures to noise levels above the PEL and/or TLV may cause temporary or permanent hearing loss.

5.2 Personal Protective Equipment:

- 5.2.1 In areas where noise levels exceed the *Occupational Exposure Limit (OEL)*, hearing protection should be worn. The hearing protection should be able to reduce the noise levels below the OEL. See IH96300 for guidance on PPE selection.
- 5.2.2 Additional PPE: Other appropriate PPE for the area being entered. Check with your ES&H representative.

- 5.3 **Dosimeter Calibration:** Failure to calibrate the Quest M-27 prior to use may result in an increased margin of error in the results. All field testers must verify a valid calibration status.

6.0 Procedure

6.1 **Equipment:** (Pictured in Appendix 8.1)

- 6.1.1 Meter Body
- 6.1.2 Microphone protective cap (white plastic cap)
- 6.1.3 Microphone windscreen (foam ball)
- 6.1.4 Calibrator (Model CA-128)

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6.2 **Operation of the M-27** (picture of meter and description of controls and displays is contained in Appendix 8.1.)

6.2.1 **Turning the meter on:** Press *<ON/OFF>*.

6.2.2 **Battery Check**

6.2.2.1 Press any key. If the battery is low *LOBAT* will be displayed and if so, replace the batteries.

6.2.3 **Warm-up:** A warm-up is not required for this meter.

6.2.4 **Calibration:**

6.2.4.1 Slide the calibrator *Power Switch* to *ON*. Check the battery indicator (green region) and replace batteries if necessary. Listen to see if Calibrator is producing a tone.

6.2.4.2 Remove the windscreen from the microphone. Inset the dosimeter microphone into the calibrator adaptor.

6.2.4.3 Press *<Code/HIL3>* until *Cal* is displayed. Press *<Sound Level>*.

6.2.4.3.1 If the level is between 109.0 and 111.0, press *<Pause/Reset>* until *CAL* is displayed.

6.2.4.3.2 If the reading is off slightly, insert a small screwdriver in the hole above *CAL* and adjust with screwdriver until display reads *110.0*. Press *<Pause/Reset>* until *CAL* is displayed.



6.2.5 **Meter Operation:**

6.2.5.1 If the dosimeter is to be used outdoors, install the windscreen (foam ball) over the microphone.

6.2.5.2 Attach the microphone to the workers collar near the ear. Clip meter to belt. Note: Unit should be OFF (or on Pause).

6.2.5.3 Press *<ON/OFF>* to turn unit on.

6.2.5.4 If *LOBAT* is displayed, replace the battery and continue.



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6.2.5.5 Clear the M-27 memory by pressing and holding down the *<Pause/Reset>* key until it counts down from *P-5* to *P-0* and - - -. (Note: Memory does not erase simply by tuning the meter off).

6.2.5.6 When work is ready to begin logging press *<RUN>*. You can separate the logging into “events” by doing the following:

- To Enter the Event mode, press *<Event>*.
- To accumulate data, press *<RUN>*.
- To stop, press *<Pause/Reset>*
- To accumulate data on another event, Press *<RUN>*.
- At end of Work: Press *<ON/OFF>* to exit events.

6.2.5.7 Post calibrate meter as per step 6.2.4. Record on sample form.

6.2.6 **Printing of Logged Data:** The printout can include a heading, a summary of the data, event data, 1 to 3 histograms, 1 or 2 percent time statistical distributions, and 1 or 2 percent DOSE statistical distributions. The histograms can be one of 1,3, 5 or 10- minute duration. The histograms and statistical distributions can be text, graphical or both. The printout can be changed and edited before or during printing to print only desired data. Data is not lost during printout.

6.2.6.1 Connect the dosimeter directly to the serial printer via the multi-pin cable.

6.2.6.2 **Printing a hardcopy report:** Press *<Print>* to print all the standard headings, summary, events, and desired histograms and distributions.

Hold *<CODE HIL3>* down to print only TL, LTL, or 3 dB histograms and statistical distributions. To print all 3, hold key down until all 3 are displayed. Customized reports can be made by following the following

- **HIST1:** Press *<HIST1>* to print 1-minute histograms or 5 minutes per line. If HTL, LTL, and 3 dB are displayed all 3 will be printed.
- **HIST 3:** Press *<HIST3>* to print 3-minute Histograms or 15 minutes per line.
- **HIST 5:** Press *<HIST5>* to print 5-minute Histograms or 30 minutes per line.
- **HIST 10:** Press *<HIST10>* to print 10 minute Histograms or 1 hour per line.
- **STAT:** Press *<STAT>* to print a % time and a % Dose statistical distribution.

6.2.6.3 **Pausing printing:** Press *<Pause/Reset>* to pause the printer to edit printout or adjust printer. The display shows *PSE*. To continue printing, press *<Pause/Reset>* again. Other print keys will alter the printout. To conserve power do not leave *PSE* on display.

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6.2.6.4 **Stopping printing:** Press <On/Off> to Stop Printout. If the printer buffer contains data the printer may run for several seconds after 0-5 is displayed; however, the printout has stopped.

6.2.7 **Dumping Raw data to a computer:** The data stored in the unit may be transferred to a computer for reprocessing but is useful only with additional computer programs.

6.2.7.1 **CODE HL3:** Press <Code HIL3> until CPU is displayed.

6.2.7.2 **PRINT:** Press <Print> to send raw data to computer.

6.2.7.3 **On Off:** Press <On/Off> to stop printout.

6.2.8 **Documenting Sampling Data and Work Conditions readings:**

6.2.8.1 Use the BNL Noise Dosimeter Form to record readings (Attachment 8.4).

6.2.8.2 Return meter and original sampling form to the SHSD IH Laboratory daily or at the end of each project as agreed to by the IH Laboratory Technician.

6.2.8.3 Send a copy of any hazard evaluation report written on the survey to the IH Laboratory and the Occupational Medicine Clinic.

6.2.9 **Results interpretation:**

6.2.9.1 A competent person should write a hazard evaluation report that evaluates the survey data and summarizes the potential for occupational exposure and compliance with OSHA and ACGIH Occupational Exposure Limits.

6.2.9.2 Ensure that a copy of the hazard evaluation report is sent to the IH Laboratory and is included in the ESHQ Directorate Recordkeeping system.

6.2.9.3 Ensure that a copy the written hazard evaluation report is sent to the Occupational Medicine Clinic with the worker(s) BNL Life Number(s) noted.

6.2.9.4 The hazard evaluation report and/or an *Employee Notification Form* (IH75140 Attachment 8.3) must be used to inform all monitored employees of the results of the air sampling and the implication to compliance with OELs. Reporting to employees must be within the 15 days (BNL policy in lieu of limits established by regulatory drivers).

6.2.9.5 Complete an *IH Database Entry* form (Attachment 8.5) and return to the IH Laboratory.

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7.0 References

- 7.1 Quest M-27 Instruction Manual 59-253 12/86.
- 7.2 BNL ES&H Standard 2.4.0.
- 7.3 OSHA Noise/Hearing Conservation 29CFR1910.95.
- 7.4 NIOSH Criteria for a Recommended Standard-Occupational Noise Exposure, 1998.
- 7.5 ACGIH American Conference of Governmental Industrial Hygienists Threshold Limit Values for Chemical Substances and Physical Agents and Biological Exposure Indices.

8.0 Attachments

- 8.1 **Photo of meter and parts**
- 8.2 **Control Keys**
- 8.3 **Short List of Operating Instructions**
- 8.4 **Noise Dosimeter Form- (IH96250 with entry for Quest M-27 data)**

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9.0 Documentation

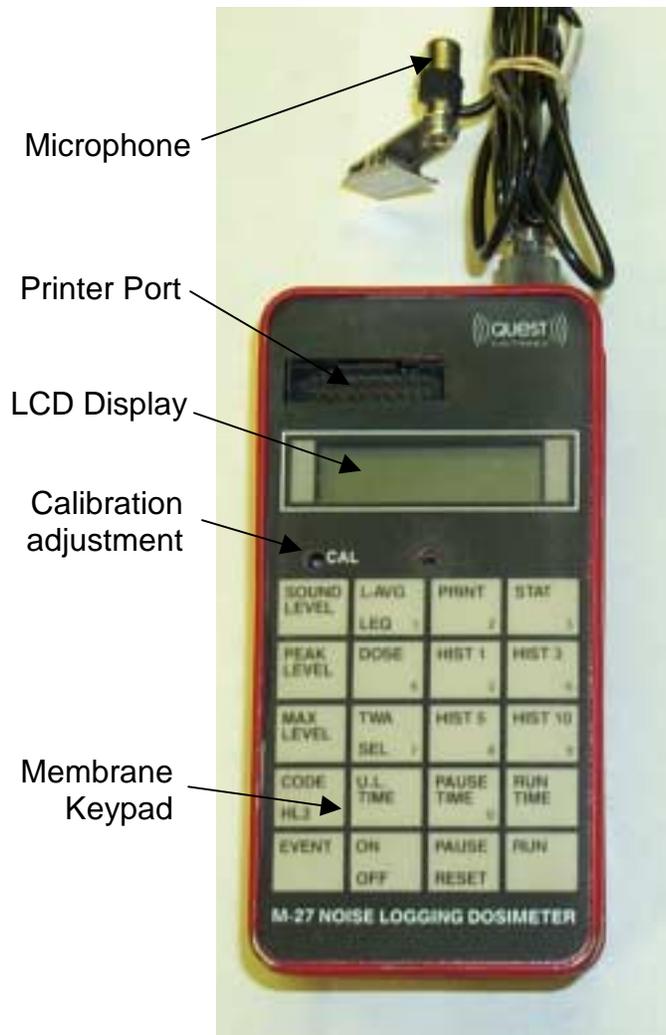
Document Review Tracking Sheet		
PREPARED BY: H. Jeanty 07/06/00 <i>(Signature and date on file)</i> R. Selvey 03/13/01	REVIEWED BY: <i>(Signature and date on file)</i> R. Wilson SHSD IH Group Date 03/16/01	APPROVED BY: <i>(Signature and date on file)</i> R. Selvey SHSD IH Group Leader Date 03/19/01
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Periodic Review Record		
Date of Review	Reviewer Signature and Date	Comments Attached
06/08/01	<i>(Signature and date on file)</i> R. Selvey	Added wording on post calibration to reinforce IH51660.

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Attachment 8.1 Photo of the Meter and Parts



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Attachment 8.2 Control Keys

Control Keys	
RUN	Starts or continues accumulating data. Display shows run time. Also used to start Events.
Pause/RESET	Stops accumulation of data. Display counts down from P-5 to P-1. If key is not released in 5 seconds, unit will reset and old data will be lost. Key is also used to reset Clock, Calibrator, Events, and pause the printout.
ON	If OFF, press to turn on. If on, Hold key down; display counts down from 0-5 to 0-1 and then blank. When off, data is retained. Key also turns off print and Events.
CODE	Cycles through 7 steps. Press the key for each step.
HL3	Allows the M-27 to display and print data 7 ways. Also displays a code of internal switch settings.
Sound Level Meter Keys	
Sound Level	Sound level in decibels. Will repeat each sound until another key is pressed. To conserve power; press RUN, Pause or any other key to exit sound level when it is not needed
PEAK Level	The Highest unweighted peak level in decibels during run time or an Event.
Max Level	The Maximum level in decibels after the filter and slow fast time constant circuit.
Dosimeter Keys:	
L-avg LEQ:	The average integrated sound level in decibels for the HTL (High Threshold Level), LTL (Low threshold Level), or the equivalent Level for 3 dB. It is the accumulated sound averaged during the run time.
DOSE	The accumulated dose in percent for HTL,LTL, or 3 dB.
TWA	Time weighted average in decibels for TL and LTL.
SEL	It is the accumulated sound averaged over 8 hours. For 3dB it is the Sound exposure Level of the accumulated sound averaged over 1 second.
Time Keys	
RUN Time	The total time the unit was running and accumulating data. If the total time is less than 30 minutes, the colon will blink if the key is held down and the time shown is in minutes and seconds. If the colon stays on, the time shown is in hours and minutes.
Pause Time	The time the unit was on but not accumulating data. The colon blinks as in Run Time.
UL Time	The time exposure was above the Upper Limit. The colon blinks as in Run time.
Event Keys	
Event	Enters Events and cycles through the Events with data. The display shows the event number, a "CE" if it is the Current Event or else an "-E" for a previous Event. (As an example: 12CE means 12 is the current Event, 3-E means 3 was a previous event. Only previous events with data will be displayed.
RUN	Starts accumulating data for the Current Event.
Pause Reset	Stops accumulating data and cycles to the next Event.
On/Off	Exits the Event Mode.

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Attachment 8.3 Short Operating Instructions

	Step	User Action	Meter Display
1	Power On	Press <ON/OFF>.	--- HTL
2	Battery Check	Press any key. Observe screen for warning LoBAT .	If LoBAT , do not use.
3	Warm-Up	A warm-up is not required for this meter.	
4	Pre- Calibration	Press <Code/HL3> until <i>Cal</i> is displayed. Press <Sound Level>. If the level is between 109.0 and 111.0, press <Pause/Reset> until <i>CAL</i> is displayed. To correct: insert a small screwdriver in the hole above <i>CAL</i> and adjust with screwdriver until display reads <i>110.0</i> . Press <Pause/Reset> until <i>CAL</i> is displayed. THEN Turn dosimeter off.	Cal
5	Dosimeter Set-up	Attach the microphone to the workers collar near the ear. Clip meter to belt. (Note: Unit should be OFF).	
6	Operation	Press <ON/OFF> to turn unit on.	--- HTL
		Clear memory by pressing and holding down the <Pause/Reset> key until it.	Counts down from P-5 to P-0 then reads ---
		Accumulate event Data: press <Event>, then <RUN>.	Run
		If need to pause or mark event: To stop, press <Pause/Reset>, then <RUN>.	
7	Stop Logging	Press <ON/OFF> to exit events.	--- HTL
8	Download Data	Return to IH Lab.	
9	Post-Calibration	Repeat Step 3.	
10	Documentation	Record data on Noise Dosimeter form. Return meter and form to IH Lab. Download logged data at IH Lab.	

DATE: _____ SURVEYOR(S): _____

I. AREA INFORMATION

DEPT: _____ BLDG: _____ ROOM: _____
 SOURCE: _____
 ENGINEERING CONTROLS: _____

II. EMPLOYEE INFORMATION

FIRST NAME: _____ LAST NAME: _____ BNL #: _____
 DEPT: _____ BLDG: _____ JOB TITLE: _____
 EXPOSURE DURATION (HRS): _____ EXPOSURE (TIMES PER DAY): _____ EXPOSURE (DAYS PER YR): _____
 JOB PERFORMED: _____
 PPE USED: _____

III. SURVEY INSTRUMENT INFORMATION

INSTRUMENT: QUEST ELECTRONICS	MODEL: M-27 LOGGING DOSIMETER	SERIAL#:
FACTORY CALIBRATION DATE:	PRE-CAL: BY:	POST CAL: BY:
BATTERY CHECK (Y/N):	125 250 500 1000 2000	125 250 500 1000 2000
CALIBRATOR SERIAL #:	dBA	dBA
CALIB. (1000 Hz 110 dB):	dBC	dBC

IV. SAMPLING INFORMATION & RESULTS _____ Record Below or _____ See Printed Data Log Report

SAMPLE TIME		COMMENTS
ON	OFF	

TOTAL TIME (hh.mm)	DOSE %	L AVG	L MAX	OVER-EXPOSURE
				Y / N
				Y / N

V. CONCLUSIONS & RECOMMENDATIONS

