USAF BIOENVIRONMENTAL NOISE DATA HANDBOOK

Volume 116

AF/M24T-2 Tester, Pressurized Cabin Leakage, Aircraft

DECEMBER 1976

Approved for public release; distribution unlimited.

AEROSPACE MEDICAL RESEARCH LABORATORY
AEROSPACE MEDICAL DIVISION
AIR FORCE SYSTEMS COMMAND
WRIGHT-PATTERSON AIR FORCE BASE, OHIO 45433
The AF/M24T-2 Tester is an electric motor-driven cabin leakage tester designed to furnish pressurized air to the aircraft at controlled pressures and temperatures during ground pressurization of aircraft cockpits and pressurized compartments. This report provides measured data defining the bioacoustic environments produced by this unit operating inside a large aircraft hangar at normal rated/loaded conditions. Near-field data are reported for 37 locations in a wide variety of physical and psychoacoustic measures: overall and band.
sound pressure levels, C-weighted and A-weighted sound levels, preferred speech interference level, perceived noise level, and limiting times for total daily exposure of personnel with and without standard Air Force ear protectors. Refer to Volume 1 of this handbook, "USAF Bioenvironmental Noise Data Handbook, Vol. 1: Organization, Content and Application", AMRL-TR-75-50(1) 1975, for discussion of the objective and design of the handbook, the types of data presented, measurement procedures, instrumentation, data processing, definitions of quantities, symbols, equations, applications, limitations, etc.
PREFACE

This report was prepared by the Biodynamic Environment Branch, Aerospace Medical Research Laboratory, under Project/Task 723104, Measurement and Prediction of Noise Environments of Air Force Operations.

The author acknowledges the efforts of Mr. L. K. Kettler of the University of Dayton and Messers Robert G. Powell and Robert A. Lee was assisted in conducting the field measurements, and Mr. John N. Cole who established the data analysis requirements and assisted in the preparation of this report. Mr. Henry Mohlman and Mr. David Eilerman of the University of Dayton assisted in the mechanics of data processing, and Mrs. Norma Peachey typed and prepared the graphics.
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INTRODUCTION

The AF/M24T-2 Tester is an electric motor-driven cabin leakage tester designed to furnish pressurized air to the aircraft at controlled pressures and temperatures during ground pressurization of aircraft cockpits and pressurized compartments.

This volume provides measured data defining the bioacoustic environments produced by this unit. Such data are essential to evaluate ear protection requirements, limiting personnel exposure times, voice communication capabilities, and annoyance problems associated with operations of the AF/M24T-2 tester.

This volume is one of a series published by the Aerospace Medical Research Laboratory (AMRL) under the same report number (AMRL-TR-75-50) as a multi-volume handbook that quantifies the noise environments produced at flight/ground crew locations and in surrounding communities by operations of Air Force aircraft and ground support equipment. The far-field, community-type, noise data in the handbook describe the noise produced during ground operations of aircraft, ground support equipment, and other ground-based equipment or facilities.

Volume 1 of this handbook discusses the objectives and design of the handbook, the types of data presented, measurement procedures, instrumentation, data processing, definitions of quantities, symbols, equations, applications, limitations, etc. Volume 2 provides a method and data for adjusting the handbook’s far-field noise data, which are for standard meteorological conditions (15C temperature, 70% rel humidity, 0.760 meters Hg barometric pressure) to derive comparable data for other meteorological conditions. Refer to Volumes 1 and 2 (references 1 and 2) for such information because it is not repeated in other handbook volumes.

A cumulative index lists those aerospace systems contained in the handbook, and identifies the specific volumes containing each type of environmental noise data available (i.e., inflight/flight crew and passenger noise, near-field/ground crew noise, far-field/community noise). Volume numbers are assigned sequentially as individual volumes are published. This index is periodically updated as individual volumes are published, and is available upon request from AMRL/BBE, Wright-Patterson AFB, OH 45433. Organizations on the distribution list for the handbook will automatically receive a copy of the updated index as it is generated.

Direct any questions concerning the technical data in this report and other handbook volumes to: AMRL/BBE, Wright-Patterson AFB, OH 45433; Autovon 78-53675 or 78-53664; Commercial (513) 255-3675 or (513) 255-3664.


NEAR-FIELD NOISE

MEASUREMENTS

A standard AF/M24T-2 Tester was operated inside, and approximately in the center of a large aircraft hanger (190.5 m long × 95.1 m wide × 18.3 m high) with doors closed on a concrete floor at a normal rated condition of loaded (5 PSI). The hanger walls and ceiling were not acoustically treated. No aircraft were in the vicinity of the unit while being measured. On the other hand, no far-field acoustic data were acquired because of the relatively close proximity of the hanger walls.

Figure 1 identifies 36 noise measurement locations at a height of 1.5 meters above the concrete apron (nominal ear level of ground crew). The 0 degree reference direction passes through the tow bar. These locations are in the acoustic near-field of the source where the sound wave fronts generally do not spherically diverge and the source appears to be spatially distributed (i.e., not a point source). Consequently, these near-field data cannot be extrapolated to longer distances but do properly define the levels at locations close to the unit.

Near-field measurements were also made at ear level at the operator control panel. Table 1 lists the numeric/alphabetic designators used on the data pages in this report to identify the operator measurement location and test conditions. The designator 1/A means operator location 1 and test condition A. Such a descriptor is essential in many handbook volumes that involve multiple combinations of locations/conditions. It is used in this report to maintain format consistency.

RESULTS

The measured data presented in Table 2 define the sound pressure levels (SPL) produced by the AF/M24T-2 unit at the 37 specified, near-field locations. This table includes the overall, 1/3 octave band, and octave band levels. From these data one can calculate the variety of measures in Table 3 which are widely used to assess the effects of noise on personnel and their performance.

For data at other intermediate near-field locations (i.e., for radial distances less than 4 meters) you can interpolate between the 36 measured data points.

TABLE 1

MEASUREMENT LOCATION AND TEST CONDITION
FOR OPERATOR NOISE MEASUREMENTS

AF/M24T-2 Tester, Pressurized Cabin Leakage, Aircraft
Edwards AFB, 9 Jun 1976
FSN 4920-601-6923, Mfr. Part #76150

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Figure 1. Measurement Locations

• MEASUREMENT LOCATION, MIC. HEIGHT, 1.5 METERS

2 METERS (RADIUS)

4 METERS (RADIUS)

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### HAZARD/PROTECTION

- C-WEIGHTED OVERALL SOUND LEVEL (OASLC IN DB) AT EAR
- A-WEIGHTED OVERALL SOUND LEVEL (OASLA IN DB) AT EAR
- MAXIMUM PERMISSIBLE TIME (T IN MINUTES) FOR ONE EXPOSURE PER DAY (AFR 161-35, JULY 73)

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#### MINIMUM QPL EAR MUFFS

- OASLA* |
- T |
- AMERICAN OPTICAL 1700 EAR MUFFS
- OASLA* |
- T |
- V-51R EAR PLUGS
- OASLA* |
- T |
- AMERICAN OPTICAL 1700 EAR MUFFS PLUS V-51R EAR PLUGS
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- H-133 GROUND COMMUNICATION UNIT
- OASLA* |
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### ANNOYANCE

- PERCEIVED NOISE LEVEL, TONE CORRECTED (PNLT IN PNDB)
- TONE CORRECTION (C IN DB)
- PNLT |
- C |

* BASED ON CALCULATED SPL SPECTRUM UNDER PROTECTIVE DEVICE.
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| DISTANCE (M) | 4 | 4 | 4 | 4 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| ANGLE (DEG) | 260 | 280 | 300 | 320 | 340 | 0 | 20 | 40 | 60 | 80 | 100 |
| CONDITION | A | A | A | A | A | A | A | A | A | A | A |

HAZARD/PROTECTION

C-WEIGHTED OVERALL SOUND LEVEL (OASLC IN DBC) AT EAR
A-WEIGHTED OVERALL SOUND LEVEL (OASLA IN DBA) AT EAR
MAXIMUM PERMISSIBLE TIME (T IN MINUTES) FOR ONE EXPOSURE PER DAY (AFR 161-35, JULY 73)

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T MINIMUM QPL EAR MUFFS

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AMERICAN OPTICAL 1700 EAR MUFFS

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V-51R EAR PLUGS

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AMERICAN OPTICAL 1700 EAR MUFFS PLUS V-51R EAR PLUGS

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H-133 GROUND COMMUNICATION UNIT

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COMMUNICATION

PREFERRED SPEECH INTERFERENCE LEVEL (PSIL IN DB)

| PSIL | 83 | 85 | 85 | 83 | 79 | 82 | 81 | 84 | 86 | 85 | 86 | 87 | 88 |

ANNOYANCE

PERCEIVED NOISE LEVEL, TONE CORRECTED (PHLT IN PNDB)

<table>
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* BASED ON CALCULATED SPL SPECTRUM UNDER PROTECTIVE DEVICE.
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<tr>
<td>ANGLE (DEG)</td>
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<tr>
<td>CONDITION</td>
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HAZARD/PROTECTION

C-WEIGHTED OVERALL SOUND LEVEL (OASLC IN DB) AT EAR
A-WEIGHTED OVERALL SOUND LEVEL (OASLA IN DB) AT EAR
MAXIMUM PERMISSIBLE TIME (T IN MINUTES) FOR ONE EXPOSURE PER DAY (AFR 161-35, JULY 73)

<table>
<thead>
<tr>
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</thead>
<tbody>
<tr>
<td>OASLC</td>
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<tr>
<td>T</td>
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</tbody>
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MINIMUM QPL EAR MUFFS

| OASLA* | 70 | 68 | 68 | 71 | 74 | 73 | 73 | 74 | 72 | 68 | 79 |
| T | 960 | 960 | 960 | 960 | 960 | 960 | 960 | 960 | 960 | 960 | 960 |

AMERICAN OPTICAL 1700 EAR MUFFS.

| OASLA* | 64 | 62 | 63 | 66 | 69 | 68 | 68 | 69 | 67 | 63 | 74 |
| T | 960 | 960 | 960 | 960 | 960 | 960 | 960 | 960 | 960 | 960 | 960 |

V-51R EAR PLUGS

| OASLA* | 67 | 65 | 65 | 69 | 72 | 71 | 71 | 71 | 70 | 65 | 77 |
| T | 960 | 960 | 960 | 960 | 960 | 960 | 960 | 960 | 960 | 960 | 960 |

AMERICAN OPTICAL 1700 EAR MUFFS PLUS V-51R EAR PLUGS

| OASLA* | 53 | 52 | 51 | 53 | 56 | 55 | 55 | 55 | 55 | 51 | 60 |
| T | 960 | 960 | 960 | 960 | 960 | 960 | 960 | 960 | 960 | 960 | 960 |

H-133 GROUND COMMUNICATION UNIT

| OASLA* | 64 | 63 | 63 | 64 | 67 | 67 | 67 | 67 | 68 | 63 | 72 |
| T | 960 | 960 | 960 | 960 | 960 | 960 | 960 | 960 | 960 | 960 | 960 |

COMMUNICATION

| PREFERRED SPEECH INTERFERENCE LEVEL (PSIL IN DB) |
| PSIL | 87 | 84 | 85 | 87 | 90 | 89 | 89 | 89 | 89 | 85 | 95 |

ANNOYANCE

| PERCEIVED NOISE LEVEL, TONE CORRECTED (PNLT IN PND) |
| TONE CORRECTION (TC IN DB) |
| PNLT | 110 | 100 | 106 | 109 | 112 | 111 | 111 | 112 | 112 | 105 | 114 |
| TC | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 2 | 2 |

* BASED ON CALCULATED SPL SPECTRUM UNDER PROTECTIVE DEVICE.