MIL-STD 740 Measurements

Using Tescia

Agenda

1. Current Standards and their scope
2. Goals and Purpose
3. MIL-STD-740-2:
    1. Structureborne Vibratory Acceleration Measurements
    2. Background and Considerations
    3. Measurement Procedures
    4. Criteria
4. MIL-STD-1474E
    1. Steady-State Noise measurement requirements
    2. Microphone selection, placement and orientation
5. Measurements using Tescia
    1. Simple operation
    2. Measurement results
    3. Report generation
    4. Configuration/Display Layout

Current Standards

MIL-STD 740-2 (1986)

- For Structureborne Vibratory Acceleration Measurements

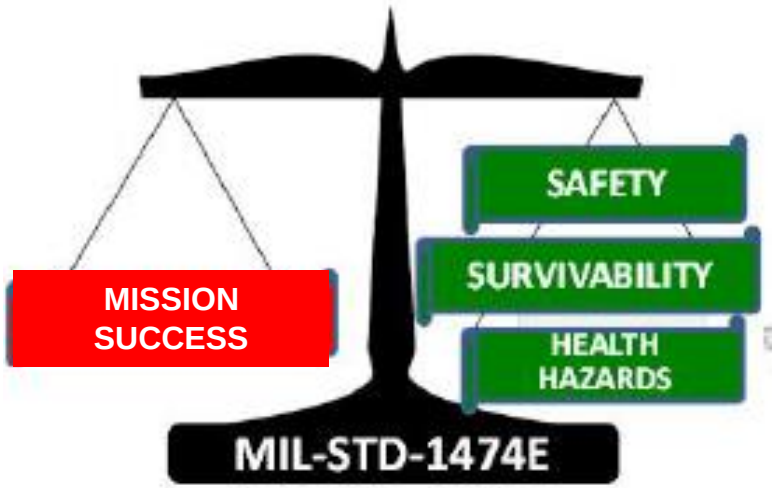
MIL-STD-1474E (2015)

- Supersedes 1474D and 740-1
- For Airborne Noise measurements
- Includes:
  - **Steady-state noise requirements for personnel-occupied areas**
  - Impulsive noise requirements for personnel-occupied areas
  - Speech Intelligibility
  - Aural non-detectability requirements
  - Aircraft noise requirements
  - Shipboard equipment noise requirements
  - Shipboard compartment noise requirements

MIL-STD-1474E

Goal

Provide design guidance, test and measurement techniques, and methods necessary to produce and deploy military systems (…), while minimizing hearing damage caused by noises produced by military sources.



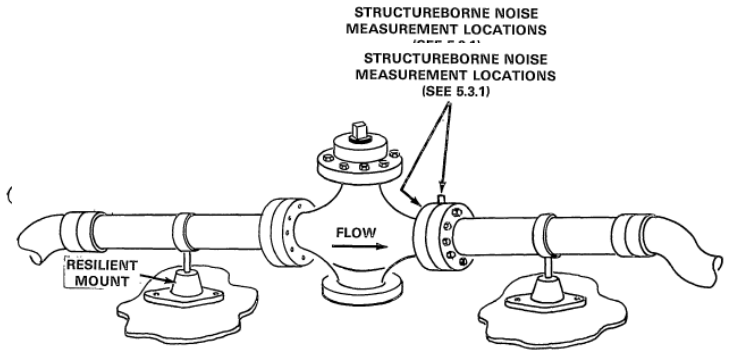
Why is it needed?

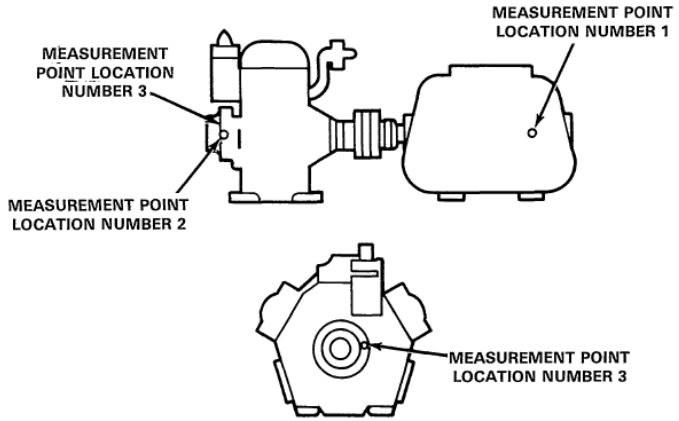
Noise associated with military operational conditions is unique and differs considerably from that found in civilian occupational environments

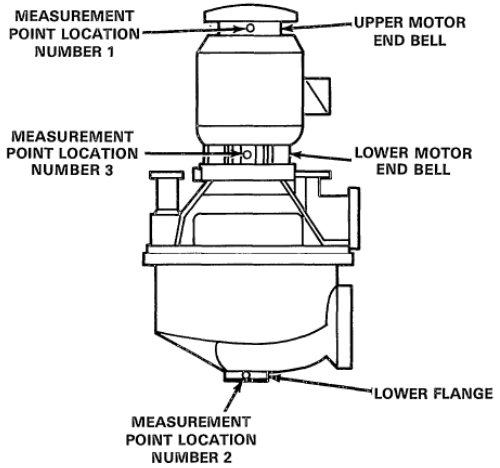
«Military standard 1474E: Design criteria for noise limits vs. operational effectiveness»; Bruce E. Amrein, 2015

MIL-STD-740-2: Structureborne Vibratory Acceleration Measurements

- Establishes measurement locations, accel. attachment, directions, etc.
  - Feet of equipment, above mounts and isolators;
  - Valves: at outlet flanges or nozzles
  - Use mounting blocks, measure three axes







MIL-STD-740-2: Structureborne Vibratory Acceleration Measurements

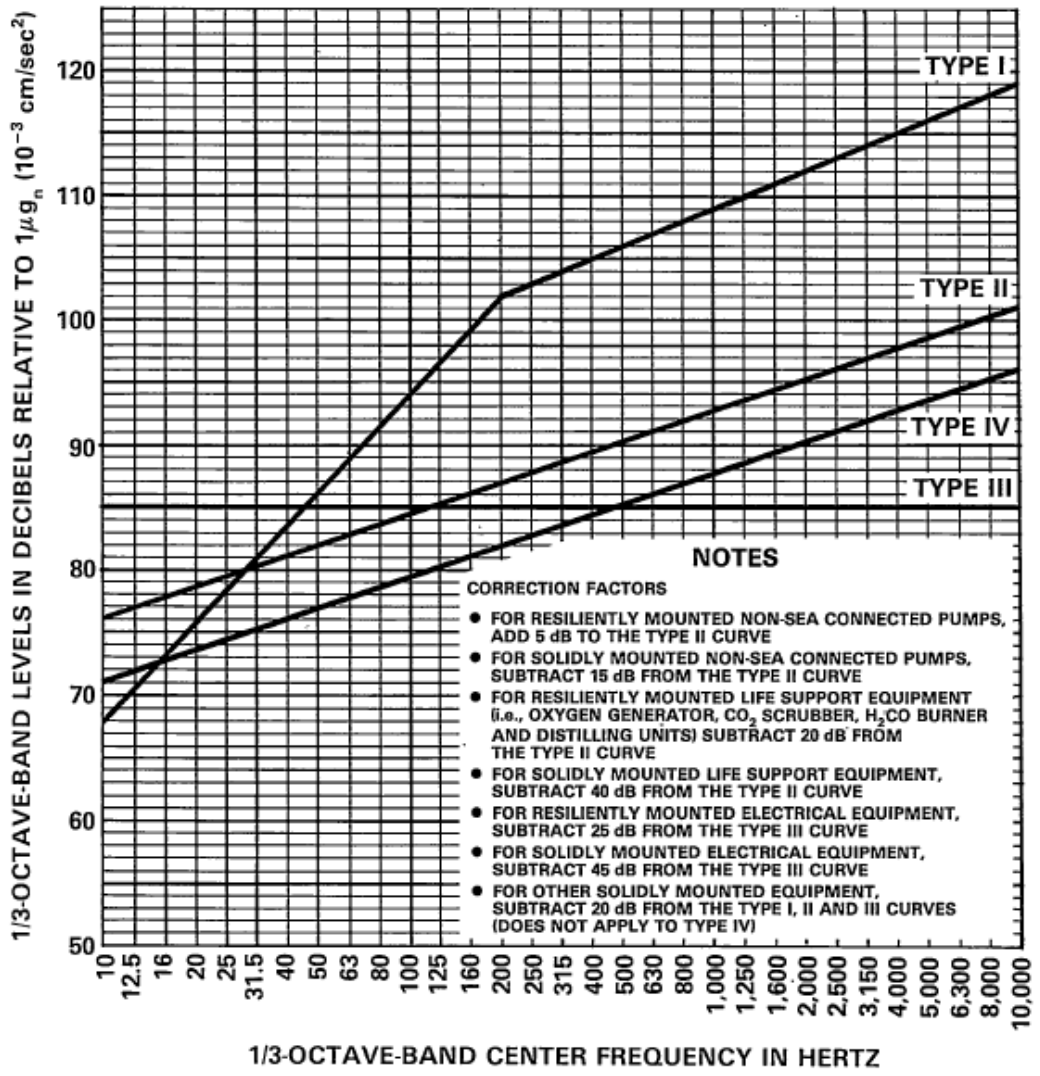
Structureborne vibratory acceleration level (L_a)

$$L_a \text{ in dB} = 20 \log_{10}\left(\frac{\text{measured acceleration in } \mu m/s^2 \text{ (rms)}}{10\ \mu m/s^2 \text{ (rms)}}\right)$$

Measurement Procedures

- Measure one-third octave bands
- 10 Hz* - 10,000 Hz (*10 Hz or fundamental forcing frequency; whichever is lower)
- Measure ambient and operation under various conditions (specified in section 5.8)
- Minimum measurement duration T is determined by B*T ≥ 25. For 10-10k Hz it is 11s
  - B is bandwidth (~23% of center frequency)
  - Lowest bandwidth is ~2.3 Hz (at 10 Hz band), so
  - minimum measurement time is ~11s

Vibratory Acceleration Acceptance Criteria



MIL-STD-1474E: Airborne steady-state noise measurements

- Microphone placement (4.7.3.2.2.1). Noise measurements shall be made at the following locations:
  - a. Each operator or crew position,
  - b. Representative positions, under worst-case operating conditions, where one or more individuals (e.g., passengers) will be located,
  - c. Occasionally occupied positions during typical operation or maintenance of the item/system (e.g., the space in and around a generator set, pump, or arc welder), and
  - d. During testing, the operator(s) shall not occupy that location where the noise is being measured unless required to operate the equipment.
- Pressure/Diffuse field microphone (±1 dB) at grazing incidence (90°)
- Octave band sound pressure level measurement ranges:
  - at least the octave bands with band-centers from 31.5 to 8,000 Hz.
- L_{Aeq} and L_{Ceq} (L_{eq} both A and C weighted)

MIL-STD-1474E Testing Conditions

- For Steady-State Noise Tests, Ambient noise level:
  - at least 5 dB below the acceptance criterion,
  - at least 15 dB below the noise being measured, in each frequency band of interest.

Difference (dB) Between Measured Sound Pressure Level and Ambient Alone	Correction (dB) to be Subtracted From Measured Sound Pressure Level to Estimate Level of Source Alone
5	1.2
6	1.0
7	0.8
8	0.6
9	0.5
10	0.4
11	0.3
12	0.3
13	0.2
14	0.2
15	0.1

MIL-STD-1474E Appendix A: Steady State Noise Requirements

- Establishes Steady-state noise categories and noise limits (dBA) for personnel-occupied areas.

Category	A-Weighted Limit (dBA)	Communications Requirements
A	SPL ≥ 100	No direct person-to-person voice communication required.
B3	SPL < 100	Electrically-aided communication via attenuating helmet or headset required.
C	SPL < 90	No frequent direct person-to-person voice communication required. Occasional shouted communication may be possible at a distance of 30 cm (12 in).
D	SPL < 85	No frequent direct person-to-person voice communication required. Occasional shouted communication may be possible at a distance of 60 cm (24 in).
E	SPL < 75	Occasional telephone or radio use or occasional communication at distances up to 1.50 m (5.0 ft) required. (Equivalent to NC-70).
F	SPL < 65	Frequent telephone or radio use or frequent communication at distances up to 1.50 m (5.0 ft) required. (Equivalent to NC-60).

Measurements of MIL-STD-740E using Tescia

Thank you, for your attention!