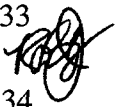


New Folder Name Vibration and Acoustic
Requirements for the Laser and Vacuum
Equipment Area (LVEA) and Vacuum

CALIFORNIA INSTITUTE OF TECHNOLOGY
Laser Interferometer Gravitational Wave Observatory (LIGO) Project

To/Mail Code: A. Lazzarini/ 51-33
From/Mail Code: R. Savage/ 51-33 
Phone/FAX: 395-2122/304-9834
Refer to: LIGO-T950113-05-O
Date: 12/18/95

Subject: Vibration and Acoustic Requirements for the Laser and Vacuum Equipment Area (LVEA) and Vacuum Equipment Areas (VEA) of the LIGO Facilities

A. Broadband Vibration Requirements for the LVEA and VEA Slabs

A1. Definition of the LIGO Standard Power Spectral Density (LSPSD)

$$1 \times 10^{-18} \left[\frac{f}{\text{Hz}} \right]^{-6} \frac{\text{m}^2}{\text{Hz}}; \quad 0.1 \text{ Hz} \leq f \leq 1 \text{ Hz}$$

$$1 \times 10^{-18} \frac{\text{m}^2}{\text{Hz}}; \quad 1 \text{ Hz} \leq f \leq 10 \text{ Hz}$$

$$1 \times 10^{-14} \left[\frac{f}{\text{Hz}} \right]^{-4} \frac{\text{m}^2}{\text{Hz}}; \quad f \geq 10 \text{ Hz}$$

A2. Ground-excited vibrations due to ambient, facility-transmitted noise (background seismic, wind, etc.)

Less than four times the LSPSD

B. Narrowband Vibration Requirements for the LVEA and VEA Slabs (vibrations produced by "powered" facility equipment: motors, pumps, transformers, etc.)

B1. 0.1 Hz < f < 1 Hz

The rms acceleration (RSS of three axes, measured along the vertical and two orthogonal horizontal axes) resulting from each narrowband excitation in the frequency band from 0.1 Hz to 1 Hz must be less than 2.4×10^{-7} m/sec².

B2. 1 Hz < f < 50 Hz

The rms acceleration (RSS of three axes, measured along the vertical and two orthogonal horizontal axes) resulting from each narrowband excitation in the frequency band from 1 Hz to 50 Hz

must be less than 5×10^{-4} m/sec².

B3. $f > 50$ Hz

The rms displacement (RSS of three axes, measured along the vertical and two orthogonal horizontal axes) resulting from each narrowband excitation at frequencies above 50 Hz must be less than 3×10^{-9} m.

C. Acoustic Requirements Ten Feet Above the LVEA and VEA Slabs

Mean Frequency	Sound Pressure Level* (0dB ref: 2×10^{-4} dyne/cm ²)
$f > 63$ Hz	< PNC-50
$f=63$ Hz	< 66 dB
$f=31.5$ Hz	< 64 dB
$f=16$ Hz	< 61 dB
$f=8$ Hz	< 57 dB
$f=4$ Hz	< 55 dB

*The sound pressure levels are expressed in dB in an octave band around a mean frequency.

D. Environmental Effects

At least 95 percent of the time, the vibration and acoustic levels must not exceed the limits specified in sections A, B, and C above. This includes the influences of wind, rain, and other local environmental effects.

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