

**DEFINITIONS AND PROCEDURES FOR COMPUTING THE PERCEIVED
NOISE LEVEL OF AIRCRAFT NOISE**

1. **INTRODUCTION:** The perceived noise level is a single number rating of aircraft noise, based upon objective acoustic measurements, which is related to the relative subjective response to aircraft noise. The perceived noise level, as defined in this standard, is based only on the noise spectra measured in the eight octave or 24 one-third octave frequency bands within the nominal range of 50 to 10,000 Hz. As such, it is considered an accurate method for rating the noisiness of broadband jet aircraft type sounds of similar time duration which do not contain strong discrete frequency components.

For rating the loudness of certain classes of noise (i.e., steady state), another procedure, defined in Ref. 1, and not unlike that specified herein, is also available. However, the measure, perceived noisiness, has become generally accepted for defining the noisiness of jet aircraft.

When the additional effects of duration of the time-varying aircraft noise signal and the presence of discrete frequency components are to be taken into account, the effective perceived noise level (EPNL), as defined in Refs. 2, 3, and 4, is the preferred measure.

2. **CALCULATION OF PERCEIVED NOISE LEVEL IN DECIBELS FROM MEASURED NOISE LEVELS:**

2.1 **Explanation of Terms:**

*This revision consists solely of editorial changes, deletion of obsolete material, or correction of minor errors in terminology. No changes have been made in the computation procedures contained in the revision, ARP 865A, dated 8-15-69.

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- 2.1.1 Perceived Noise Level in Decibels: Perceived noise level in decibels of a given sound is calculated as specified in paragraph 2.2.

NOTE: This procedure gives an approximation of the perceived noise level as determined by subjective experiment on a fundamental psychoacoustical basis: namely, that perceived noise level of a given sound is numerically equal to the sound pressure level of a reference sound that is judged by listeners to have the same perceived noisiness as the given sound, the reference sound being a band of random noise one octave in width centered on 1000 Hz.

- 2.1.2 Noy: A unit of perceived noisiness. The numerical value of the perceived noisiness of a sound within a given frequency band, in noys, is related to the band sound pressure level. This relationship is given in Table I. An alternative means of calculating the appropriate perceived noisiness is provided by the equations in Section 2.2 (Step 1). (These equations, in conjunction with Table II, may be the preferred method for computer computation of perceived noisiness values.)

NOTE 1: In order to avoid confusion, attention is drawn to the fact that values of perceived noisiness given herein are the same as given in Ref. 5 but differ from those given in Refs. 6, 7, 8, and 9. The differences between the values given here and those of Refs. 6 and 7 result from minor changes made to facilitate computer computations; the changes are not based on new psychoacoustic test data and are generally not large enough to necessitate re-calculation of perceived noise levels previously calculated by the tables given in Refs. 6 and 7.

NOTE 2: The data in Tables I and II may be used for calculating perceived noisiness for either octave or one-third octave bands. The difference in octave or one-third octave band computation arises in the summation described in Step 2 of Section 2.2.

NOTE 3: Tables I and II present information at one-third octave frequencies (Ref. 10).

2.2 Calculation Procedure: Perceived noise level (PNL) in decibels is calculated according to the following procedure:

Step 1 - The sound pressure level in each one-third octave frequency band (or full octave frequency band) is converted to a value of perceived noisiness, in noys, by reference to Table I, entering the Table at the appropriate band center frequency or by use of the following equations, and associated constants given in Table II, at the appropriate band center frequency.

The value of perceived noisiness (n) in noys, given in Table I for a particular frequency band, is related to the band sound pressure level, L , by the general basic equation:

$$n = A 10^{M_j (L - L_k)} \quad \text{for} \\ n \leq 0.1 \text{ and } L \leq 150$$

where M_j , L_k , and A depend upon the band center frequency and the magnitude of L . The values of M_j and L_k are tabulated in Table II.

For $L_1 \leq L \leq L_2$

$$n = 0.1 10^{M_1 (L - L_1)}; \quad 0.1 \leq n \leq 0.3$$

For $L_2 \leq L \leq L_3$

$$n = 10^{M_2 (L - L_3)}; \quad 0.3 \leq n \leq 1.0$$

For $L_3 \leq L \leq L_C$

$$n = 10^{M_3 (L - L_3)}; \quad 1.0 \leq n, L \leq 150$$

For $L_C \leq L \leq 150$

$$n = 10^{M_4 (L - L_4)}$$

Note that for frequency bands having center frequencies from 400 to 6300 Hz inclusive, $L_3 = L_4$ and $M_3 = M_4$ (i.e., one set of values of L_k and M_j suffice to define values of perceived noisiness for $n \geq 1$ and $L \leq 150$).