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ISO

INTERNATIONAL ORGANIZATION FOR STANDARDIZATION

ISO RECOMMENDATION

R 454

RELATION BETWEEN SOUND PRESSURE LEVELS OF NARROW BANDS OF NOISE IN A DIFFUSE FIELD AND IN A FRONTALLY-INCIDENT FREE FIELD FOR EQUAL LOUDNESS

1st EDITION

November 1965

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BRIEF HISTORY

The ISO Recommendation R 454, *Relation Between Sound Pressure Levels of Narrow Bands of Noise in a Diffuse Field and in a Frontally-Incident Free Field for Equal Loudness*, was drawn up by Technical Committee ISO/TC 43, *Acoustics*, the Secretariat of which is held by the British Standards Institution (BSI).

This ISO Recommendation R 454 is a SUPPLEMENT to ISO Recommendation R 226, *Normal Equal-Loudness Contours for Pure Tones and Normal Threshold of Hearing under Free-Field Listening Conditions*, 1st Edition—1961.

Work on this question by the Technical Committee began in 1960 and led, in 1963, to the adoption of a Draft ISO Recommendation.

In December 1963, this Draft ISO Recommendation (No. 699) was circulated to all the ISO Member Bodies for enquiry. It was approved by the following Member Bodies:

Australia	Finland	Netherlands
Austria	France	New Zealand
Belgium	Germany	Sweden
Brazil	Greece	Switzerland
Canada	Hungary	United Kingdom
Chile	India	U.S.A.
Colombia	Italy	U.S.S.R.
Czechoslovakia	Japan	Yugoslavia
Denmark	Korea, Rep. of	

No Member Body opposed the approval of the Draft.

The Draft ISO Recommendation was then submitted by correspondence to the ISO Council, which decided, in November 1965, to accept it as an ISO RECOMMENDATION.

ISO Recommendation R 454 November 1965

RELATION BETWEEN SOUND PRESSURE LEVELS OF NARROW BANDS OF NOISE IN A DIFFUSE FIELD AND IN A FRONTALLY-INCIDENT FREE FIELD FOR EQUAL LOUDNESS

Supplement to ISO Recommendation R 226

NORMAL EQUAL-LOUDNESS CONTOURS FOR PURE TONES AND NORMAL THRESHOLD OF HEARING UNDER FREE-FIELD LISTENING CONDITIONS

FOREWORD

Curves defining relations between frequencies characterizing sound and their sound pressure levels for the condition of constant loudness, i.e. equal-loudness contours, are involved in many aspects of subjective acoustics. They are fundamental to a proper understanding of the functioning of the human ear in the perception of loudness. They also have important practical applications, for example, in the development of methods of computing loudness from the physical properties of sounds.

Types of sounds and the manner in which they arrive at a listener may be varied. In addition to the basic equal-loudness contours for pure tones, as specified in ISO Recommendation R 226,* it is desirable to establish equal-loudness contours for bands of noise in the conditions of free-field and random incidence.

This ISO Recommendation specifies the relationship between the sound pressure levels of narrow bands of noise in diffuse and frontally-incident free fields respectively, for equal loudness.

1. SCOPE

This ISO Recommendation specifies, for the frequency range 50 to 10,000 Hz (c/s), the difference (in decibels) between sound pressure levels for equal loudness of narrow bands of noise in diffuse and frontally-incident free-field conditions respectively.

Conditions of applicability

(*a*) The sound pressure level is measured in the absence of the listener.

(*b*) The listening is binaural.

(*c*) The listeners are otologically normal persons in the age group from 18 to 25 years.

NOTE. — An "otologically normal subject" is understood to be a person in a normal state of health who is free from all signs or symptoms of ear disease and from wax in the ear canal.

(*d*) The sound is a narrow band of noise of less than critical bandwidth.

NOTE. — For bands of noise not exceeding critical bandwidth, the equal-loudness contours for free-field conditions are approximately the same as those for pure tones, given in ISO Recommendation R 226.* In practice, the use of one-third octave bands in place of critical bands (see Bibliography, item 5, page 4) does not introduce deviations of more than 1 dB.

2. EXPLANATION OF TERMS

For the purposes of this ISO Recommendation, the following terms are employed:

2.1 Frontally-incident free field

Sound field in which the listener directly faces the single source of a free progressive wave.

2.2 Diffuse field

Sound field of uniform energy density for which the directions of propagation at the position occupied by the listener are wholly random in distribution.

* ISO Recommendation R 226, *Normal Equal-Loudness Contours for Pure Tones and Normal Threshold of Hearing under Free-Field Listening Conditions.*