# NAB AUDIO

# RECORDING AND REPRODUCING

# STANDARDS

# FOR DISC RECORDING AND REPRODUCING

## including

## A GLOSSARY OF TERMS AND DEFINITIONS

The NAB Recording and Reproducing Standards Committee was originally organized in 1941. Standards proposals issuing from the Committee have been adopted by the Board of Directors in 1942, 1949, 1950, and 1953. The Standards contained herein were adopted by the Board on Feb. 1, 1964.

These standards and recommended good engineering practices are for the guidance of the broadcasting industry, and represent the contributions of many of the nation's authorities on the various phases of recording as used by the industry. The NAB Recording and Reproducing Standards Committee has also benefited by contributions made by several international organizations. The committee was open to participation by any interested individual or organization and consisted of representatives from the manufacturers, broadcasters and producers. Close liaison was maintained with other organizations (as well as foreign countries) to insure the maximum degree of coordinated understanding and recommended standardization, to permit interchangebility and, at the same time, to embrace the latest technological advances of the art.

Nothing in these standards prohibits or discourages continued progress or advancement of the art. On the contrary, the standards are intended to provide stimulus for continued scientific exploration in the field of recording. It is anticipated that when necessary, the NAB Recording and Reproducing Standards Committee will review its work looking toward any needed amendments and additions to keep pace with the art as it affects all forms of broadcasting—AM, FM, and Television.

The following organizations contributed to the formulation of these standards:

American Broadcasting Company, New York City
Audio Devices, Inc., New York City
Collins Radio Company, Cedar Rapids, Iowa
Electronic Applications, Inc., Wilton, Conn.
Gates Radio Company, Quincy, Ill.
Gotham Audio Corporation, New York City
ITA Electronics Corporation, Lansdowne, Penna.
Music Makers, Inc., New York City
National Broadcasting Company, New York City
Pickering and Company, Plainview, L.I., New York
Radio Corporation of America, Camden, N. J.
Radio Station WWDC, Washington, D. C.
RCA Victor Record Division, Indianapolis, Ind.
Reeves Soundcraft, Danbury, Conn.
Shure Brothers, Inc., Evanston, Ill.
V-M Corporation, Benton Harbor, Mich.

# LATERAL MONOPHONIC AND STEREOPHONIC DISC RECORDING AND REPRODUCING STANDARDS[1]

## I. TURNTABLE SPECIFICATIONS

### Turntable Speed (RPM)[2]

**1.05** It shall be standard that the mean speed of the recording turntable be either **33-95** or 45 RPM ±0.1%, and the mean speed of the reproducing turntable be either **33-95** or **45** RPM ± **0.3%**

**1.05.01** This measurement shall be made by means of a stroboscopic disc illuminated by a neon lamp or equivalent operated from a standard frequency source. The stroboscopic disc for 33-⅓ RPM speed measurements shall have **216** spots in **360** degrees and for **45** RPM shall have **160** spots in **360** degrees.

At either 33-⅓ or **45** RPM not more than 7 dots per minute in either direction may pass or drift by a reference point for the recorder and **21** dots per minute in either direction for the reproducer.

### Turntable and Disc Rotation

**1.10** It shall be standard that discs intended for broadcasting application be rotated in a clockwise direction as viewed from the side being reproduced and that the direction of feed shall be outside-in.

### Wow and Flutter Factor (Recording)[3]

**1.15** It shall be standard that the average deviation (measured over the range **0.5-200** cps) from the mean speed of the recording turntable, when making the recording, shall not exceed **0.04%** of the mean speed. The average deviation above shall be measured by a meter the dynamics of which shall be the same as those of the VU meter as specified in ASA Standard C16.5-**1961.**

### Wow and Flutter Factor (Reproducing)[3]

**1.20** It shall be standard that the average deviation from the mean speed of the reproducing turntable when reproducing shall not exceed 0.1% of the mean speed.

### Turntable Starting Time (Reproducing)

**1.25** It shall be standard that the turntable platen shall attain its mean speed as defined in Section **1.05** in not more than **120** degrees rotation.

### Turntable Height (Reproducing)

**1.30** It is considered good practice that the vertical distance between the floor and the top of the platen be **28** inches.

### Turntable Platen (Reproducing)

**1.35** It is considered good practice that the diameter of the reproducing turntable platen be substantially the same as that of the largest diameter disc for which the turntable is intended.

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[1] **The term disc is used throughout these standards to indicate both types of mechanical recording commonly referred to separately as transcriptions and phonograph records.**

[2] **It is recognized that 78.26 RPM discs are still in existence but this speed is no longer considered a standard.**

[3] **The term average as used in this section shall refer to the measurement device characteristic rather than the period of time over which the observation is made.**

1.35.01 Turntables for 45 RPM shall be recessed a minimum of 0.030 inches to a diameter of 3-7/8 inches ±1/32 inches from the center pin.

1.40 It shall be standard that the diameter of the center pin of a turntable be 0.2830 inches + 0.000 inches — 0.0005 inches for 33⅓ RPM discs. The diameter of the center pin for 45 RPM discs shall be 1.500 inches + 0 — 0.002 inches.

## II. DISC SPECIFICATIONS

### Outer Diameters [4]

2.05 It shall be standard that the outer disc diameter fall within the limits specified in the following table:

| Nominal | Finished Discs (Pressings or Instantaneous) |
|---|---|
| 12 inches | 11-7/8 ± 1/32 inches |
| 10 inches | 9-7/8 ± 1/32 inches |
| 7 inches | 6-7/8 ± 1/32 inches |

### Center Hole Diameter

2.10 It shall be standard that the disc center hole diameter be 0.286 inches + 0.001 — 0.002 inches for 33-⅓ RPM discs and 1.504 inches ± 0.002 inches for 45 RPM discs.

### Concentricity of Center Hole

2.15 It shall be standard that the disc center hole be concentric with the recorded groove spiral within 0.005 inches.

### Disc Warp

2.20 It shall be standard that the variation of the total indicator reading (TIR) of the surface of the disc because of warping shall not be in excess of 1/16 inches and that within any 45° segment the total indicator reading (TIR) shall not exceed 1/32 inches.

### Outer Modulated Groove Diameter

2.25 It shall be standard that the diameter of the outermost modulated groove be within the limits specified in the following table:

12 inches — outside start — 11-7/16 inches Maximum

10 inches — outside start — 9-7/16 inches Maximum

7 inches — outside start — 6-9/16 inches Maximum

### Innermost Groove Diameter

2.30 It shall be standard that the diameter of the innermost modulated groove shall be not less than 4¾ inches in the case of 33⅓ RPM discs, and not less than 4¼ inches for 45 RPM discs.

### Number of Blank Grooves

2.35 It shall be standard that there shall be at least one unmodulated groove at recording pitch before and after modulation.

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[4] It is recognized that 16 inch transcriptions are still in limited use but this size disc is no longer considered a standard.

Stopping Groove

2.40 It shall be standard that following the termination of the innermost recording groove, a leadout spiral and a locked concentric stopping groove shall be provided.

Minimum Label Information

2.45 It shall be standard that the label of a disc contain at least the following technical information:

a. Monophonic or Stereophonic

b. Speed—(45 or 33⅓ RPM)

c. Recommended playback characteristic

d. Recommended type of playback stylus

Groove Shape—Monophonic[5]

2.50 It shall be standard that the groove shape for finished monophonic discs shall have an included angle of 90° ± 5°; a top width of not less than 0.0022 inches, and a bottom radius not greater than 0.00025 inches. (It is recommended that discs with these groove shape characteristics be reproduced with a stylus having a tip radius of 0.001 inches + 0.0001 inches —0.0002 inches and an included angle of 40-55°).

Groove Shape—Stereophonic [5]

2.55 It shall be standard that the groove shape for finished stereophonic discs shall have an included angle of 90° ± 2°, a top width of not less than 0.001 inches and a bottom radius of not greater than 0.0002 inches. (It is recommended that discs with these groove shape characteristics be reproduced with a stylus having a tip radius of 0.0005 to 0.0007 inches and an included angle of 40-55°).

## III. ELECTRICAL SPECIFICATIONS

Frequency Characteristics for Monophonic and Stereophonic Discs [6]

3.05 It shall be standard that the reproduce system frequency response characteristic for monophonic and stereophonic discs shall be as shown in Figure 1 and Table 1.

Reproducing characteristic — with constant velocity of the reproducing stylus tip the curve of voltage output of the reproducing system versus frequency shall be that which results from the combination of three curves as follows:

one falling with increasing frequency in conformity with the impedance of a parallel combination of a capacitance and a resistance having a time constant of $t_1$; (75 $\mu$sec.)

[5] It has been concluded that groove shaped standards should apply to the finished disc rather than to the recording stylus. It is recognized that in some cases disc groove dimensions depart slightly from those of the recording stylus, but such deviations should be anticipated in the recording operation and controlled in the processing plant. In actual practice, standards covering reproducer stylus contour have no significance unless the groove standards refer to the finished disc. In the event that it is necessary to play both monophonic and stereophonic discs with the same reproducer, the use of a 0.0007 inch stylus is recommended.

[6] In disc recording, it is the generally accepted practice to evaluate sound quality and musical balance of a disc on a reproducer which has a specified response—frequency characteristic. This characteristic, which has become an international standard, is essentially the inverse of the NAB recording characteristic originally introduced in the NARTB Recording and Reproducing Standards (June 1953). It is considered appropriate, therefore, that NAB specify the reproducing characteristic rather than the recording characteristic in its disc standards. It should be recognized, however, that in so doing, the basic disc recording characteristic is implied and defined.

one falling with increasing frequency in conformity with the impedance of a series combination of a capacitance and a resistance having a time constant of $t_2$; (318 $\mu$sec.)

one rising with increasing frequency in conformity with the admittance of a series combination of a capacitance and a resistance having a constant of $t_3$; (3180 $\mu$sec.)

The combined curve is defined by:

$$N\ (db) = 10 \log \left(1 + \frac{1}{4\pi^2 f^2 t_2^2}\right) - 10 \log \left(1 + 4\pi^2 f^2 t_1^2\right) - 10 \log \left(1 + \frac{1}{4\pi^2 f^2 t^2}\right)$$

f = frequency in cps.

It is recommended that the system response below 30 cps and above 15,000 cps be attenuated at least 6 db per octave with the 3 db points at 20 cps and 16 kc.

Reference Recorded Program Level—Monophonic[7]

3.10 It shall be standard that the reference recorded program level shall produce the same reference deflection on a standard volume indicator (**ASA** Standard C16.5—1961) as that produced by a 1000 cps tone recorded at a peak velocity of 7 centimeters per second.

Reference Recorded Program Level—Stereophonic[7]

3.15 'It shall be standard that the reference recorded program level for each channel in its plane of modulation shall produce the same reference deflection on a standard volume indicator (**ASA** Standard C16.5—1961) as that produced by a 1000 cps tone recorded at a peak velocity of 5.0 centimeters per second. (Approximately 3 db below the monophonic Reference Recorded Program Level.)

Reproducing System Noise—Monophonic

**3.20** ***Low Frequency Noise (Rumble):*** It shall be standard that for a monophonic disc reproducing system the low frequency noise voltage generated by the turntable, its associated pickup and equalizer or equalized preamplifier when playing an essentially rumble-free silent groove, shall be at least 40 db below a reference level of 1.4 centimeters per second peak velocity at 100 cps.

The response of the pickup and equalizer or equalized preamplifier shall conform to the NAB standard reproducing curve; the amplifier and indicating meter shall have uniform response, within ± 1 db, between 10 and 250 cps with 500 cycle response 3 db below the 100 cycle response, and an attenuation at the rate of at Ieast 12 db per octave at frequencies above 500 cycles. The amplifier and indicating meter response shall decrease at the rate of at least 6 db per octave below 10 cps. The meter used shall have the same dynamic characteristics as the standard VU meter (**ASA** Standard C16.5—1961). If the meter reading fluctuates, maximum values shall conform to this requirement. It should be recognized that in making these measurements, the arm resonance should fall outside of the prescribed pass-band or be sufficiently damped so as to not affect the results.

This measurement is intended to give a measure of the electrical effect of the low-frequency noise output of a turntable pickup combination. Since the result depends on the equalizer, pickup and arm characteristics as much as on the turntable itself, it is not feasible to standardize the turntable alone.

The measurement reflects the electrical effect, not the aural annoyance value, of low-fre-

**[7] It is well established that at least a 10 db margin is required between the sine wave load handling capacity of a system and the level of program material measured by a standard volume indicator. This standard would then contemplate program peaks running as high as a velocity of approximately 21 centimeters per second. This is believed to be approximately the maximum velocity which can be traced without excessive distortion at groove speeds encountered at the inner radius of a 33⅓ RPM disc. This has also been substantiated by practical experience.**

quency noise. It has been found that strong low-frequency noise at a frequency and intensity below audibility may create severe intermodulation distortion in an audio system, and that in modern systems with extended low frequency response, this may be more serious than the audibility of the low frequency.

The reference level of 1.4 centimeters per second peak velocity approximates the expected program level at 100 cps and corresponds in amplitude to 7 centimeters per second peak velocity at 500 cps.

*3.25 High Frequency Noise:* [8] It shall be standard that the noise level measured with a standard volume indicator (ASA Standard C16.5—1961) when reproducing a disc on a flat velocity basis over a frequency range between 500 and 15,000 cps shall be at least 55 db below the level obtained under the same conditions of reproduction using a 1,000 cps tone recorded at a peak velocity of 7 centimeters per second. Response of the system at 500 cps shall be 3 db below the response at 1,000 cps, and the response shall fall at the rate of at least 12 db per octave below 500 cps. Response of the system at 15,000 cps shall be 3 db below the response at 1,000 cps, and the response shall fall at the rate of at least 12 db per octave above 15,000 cps.

Reproducing System Noise—Stereophonic

*3.30 Low Frequency Noise (Rumble).* It shall be standard that for a stereophonic reproducing system, the low frequency noise voltage in each channel generated by the turntable, its associated pickup and equalizer, or equalized preamplifier when playing an essentially rumble-free silent groove shall be at least 35 db below a reference level of 1 centimeter per second peak velocity at 100 cps in the plane of modulation.[9]

The response of the pickup, and equalizer or equalized preamplifier shall conform to the NAB standard reproducing curve; the amplifier and indicating meter shall have uniform response, within + 1 db, between 10 and 250 cps, with 500 cycle response 3 db below the 100 cycle response, and an attenuation at the rate of at least 12 db per octave at frequencies above 500 cycles. The amplifier and indicating meter response shall decrease at the rate of at least 6 db per octave below 10 cps. The meter used shall have the same dynamic characteristics as the standard VU meter (ASA Standard C16.5—1961). If the meter reading fluctuates, maximum values shall conform to this requirement. It should be recognized that in making these measurements, the arm resonance should fall outside of the prescribed pass-band or be sufficiently damped so as to not affect the results.

This measurement is intended to give a measure of the electrical effect of the low-frequency noise output of the turntable-pickup combination. Since the result depends on the equalizer, pickup, and arm characteristics as much as on the turntable itself, it is not feasible to standardize the turntable alone.

The measurement reflects the electrical effect, not the aural annoyance value, of low frequency noise. It has been found that strong low-frequency noise at a frequency and intensity below audibility may create severe intermodulation distortion in an audio system, and that in modern systems with extended low frequency response, this may be more serious than the audibility of the low frequency.

The reference level of 1 centimeter per second peak velocity at 100 cps corresponds in amplitude to 5 centimeters per second peak velocity at 500 eps since we are then operating on the constant amplitude portion of the recording characteristic.

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**[8] This measurement is intended to give a measure of noise in terms of a fixed reference. In this way, it becomes a true figure of merit for comparisons of variations in surface noise of discs. It does not, however, take into account the program level which may happen to be recorded on a particular disc nor the dynamic range of the program material. NAB pre-emphasis will improve the signal-to-noise ratio by approximately 8 db, thus resulting in an effective signal-to-noise ratio under minimum conditions of 63 db.**

**[9] A 100 cps 1.4 centimeters per second peak reference'lateral signal may also be used for this measurement.**

3.35 High Frequency Noise [10]: It shall be standard that the noise level in each channel measured with a standard volume meter (ASA Standard C16.5—1961) when reproducing a disc on a flat velocity basis over a frequency range between 500 and 15,000 cps shall be at least 50 db below the level obtained under the same conditions of reproduction using a 1,000 cps tone recorded at a peak velocity of 5 centimeters per second. Response of the system at 500 cps shall be 3 db below the response at 1,000 cps, and the response shall fall at the rate of at least 12 db per octave below 500 cps. Response of the system at 15,000 cps shall be 3 db below the response at 1,000 cps, and the response shall fall at the rate of at least 12 db per octave above 15,000 cps.

Stereophonic Groove Characteristics — (45°—45° system)

3.40 Planes of Modulation — It shall be standard that in a 45°—45° stereophonic disc the groove shall have orthogonal modulation planes inclined at 45° to a radial line on the surface of the disc and the intersection of the modulation planes shall be normal to said radial lines.

3.45 Channel Orientation—It shall be standard that the outer groove wall of the disc shall contain the right-hand channel information and the inner wall shall contain the left-hand channel information.

3.50 Phase — It shall be standard that the phase relationship between channels shall be such as to result in lateral groove displacement when the stereo recording system is driven with equal amplitude and in-phase signals and the groove displacement shall be vertical when the stereophonic recording system is driven by equal amplitude signals in anti-phase (180").

Channel Separation — Stereophonic [11]

3.55 It shall be standard that the separation between recorded and unrecorded channels measured at the output of the pickup and equalizer or equalized preamplifier shall be at least 26 db over the range between 100—7,500 cps and above 7,500 cps separation shall not degenerate at a rate greater than 6 db per octave.

Channel Balance Stereophonic [12]

3.60 It shall be standard that with equal groove modulations and with the outputs of the two complete channels adjusted to be equal within ¼ db at 1000 cps the frequency characteristic of each channel shall agree with the standard reproduce curve of Figure 1 within ± 1 db between 100 and 7,500 cps and within ± 2 db above and below these frequencies.

Channel **Phasing—Stereophonic**

**3.65** Recording: It shall be standard that equal in-phase signals applied to the left and right channel inputs of a stereo disc recorder result in lateral modulation of the stereo groove. Conversely, equal anti-phase signals produce vertical modulation.

3.70 Reproducing: It shall be standard that lateral modulation of a disc groove will produce equal in-phase voltages at the output of the turntable and conversely that vertical modulation will produce equal anti-phase voltages.

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**[10] This measurement is intended to give a measure of noise in terms of a fixed reference. In this way, it becomes a true figure of merit for comparisons of variations in surface noise of discs. It does not, however, take into account the program level which may happen to be recorded on a particular disc nor the dynamic range of the program material. NAB pre-emphasis will improve the signal-to-noise ratio by approximately 8 db, thus resulting in an effective signal-to-noise ratio under minimum conditions of 58 db.**

**[11] It is recognized that the values specified herein are of a magnitude that may in certain cases be subject to noise influences. The measurement of separation is best accomplished by the use of tuned voltmeter.**

**[12] For measurement purposes it may be assumed that equal modulations are obtained by reproducing a lateral monophonic test record.**

## IV. TEST RECORD SPECIFICATIONS

The NAB Test Record shall consist of a 12-inch double-face disc, side A of which is Monophonic and side B Stereophonic, recorded at a speed of 33⅓ RPM, with a fast spiral between bands of radial distance 3/32 inches and containing the following information.[13]

4.05 Side *A*, Monophonic:

Band I—Level Check: A 1000 cps tone of 20 seconds duration recorded at the NAB Standard Reference Level of 7 centimeters per second peak velocity.

Band 2—Wow and Flutter: A 3000 cps tone recorded at 7 centimeters per second peak velocity for a duration of 2 minutes.

Band 3—Frequency Response:

1) Frequency run containing frequencies as tabulated in Table 1 of the Standards with the duration of each tone being 10 seconds except for 100, 1000, 10,000 cps which shall be 15 seconds.
2) The recorded characteristic shall be the inverse of the NAB curve at 14 db below the reference level of 7 centimeters per second peak velocity at 1000 cps.
3) Between tones there shall be a fast spiral of radial distance 1/32 inch, except between 100, 1000 and 10,000 cps where the radial distance shall be 1/16 inch.

Band 4—Rumble Reference Level: A 100 cps tone recorded at 1.4 centimeters per second peak velocity for a duration of 20 seconds.

**4.10** Side B, Stereophonic:

Band 1—Phase and Balance Test:

1) 1 kc lateral recording at 7 centimeters per second peak velocity for 20 seconds duration.
2) Fast spiral 1/16 inch radial distance.
3) 1 kc right channel recorded at 5 centimeters per second peak velocity for 10 seconds duration.
4) Fast spiral 1/16 inch radial distance.
5) 1 kc left channel recorded at 5 centimeters per second peak velocity for 10 seconds duration.
6) Fast spiral 1/16 inch radial distance.
7) 1 kc vertical recording at 7 centimeters per second peak velocity for 20 seconds duration.

Band 2—Spot Frequency Test: A series of 3 second tones as follows: Lateral recording of 100 cps, 1 kc, 10 kc, 1 kc, 100 cps, 1 kc, 10 kc, 1 kc etc., with a total duration of 60 seconds with no interval between tones, and with levels adjusted for constant output on a reproducing system using the NAB Standard.

Band 3—Separation Test:

1) 10 kc right channel recorded at 5 centimeters per second peak velocity for 10 seconds duration.
2) Fast spiral of 1/32 inch radial distance.
3) 10 kc left channel recorded at 5 centimeters per second peak velocity for 10 seconds duration.
4) Fast spiral of 1/16 inch radial distance.
5) Repeat 1 through 4 at 7.5 kc, 3 kc, 1 kc, 100 and 50 cps.

Band 4—Level Check: 1 kc lateral recording at 7 centimeters per second peak velocity ending at 5¼ inches.

[13] A 4-inch label shall be used which contains a 33⅓ and 45 RPM strobe.

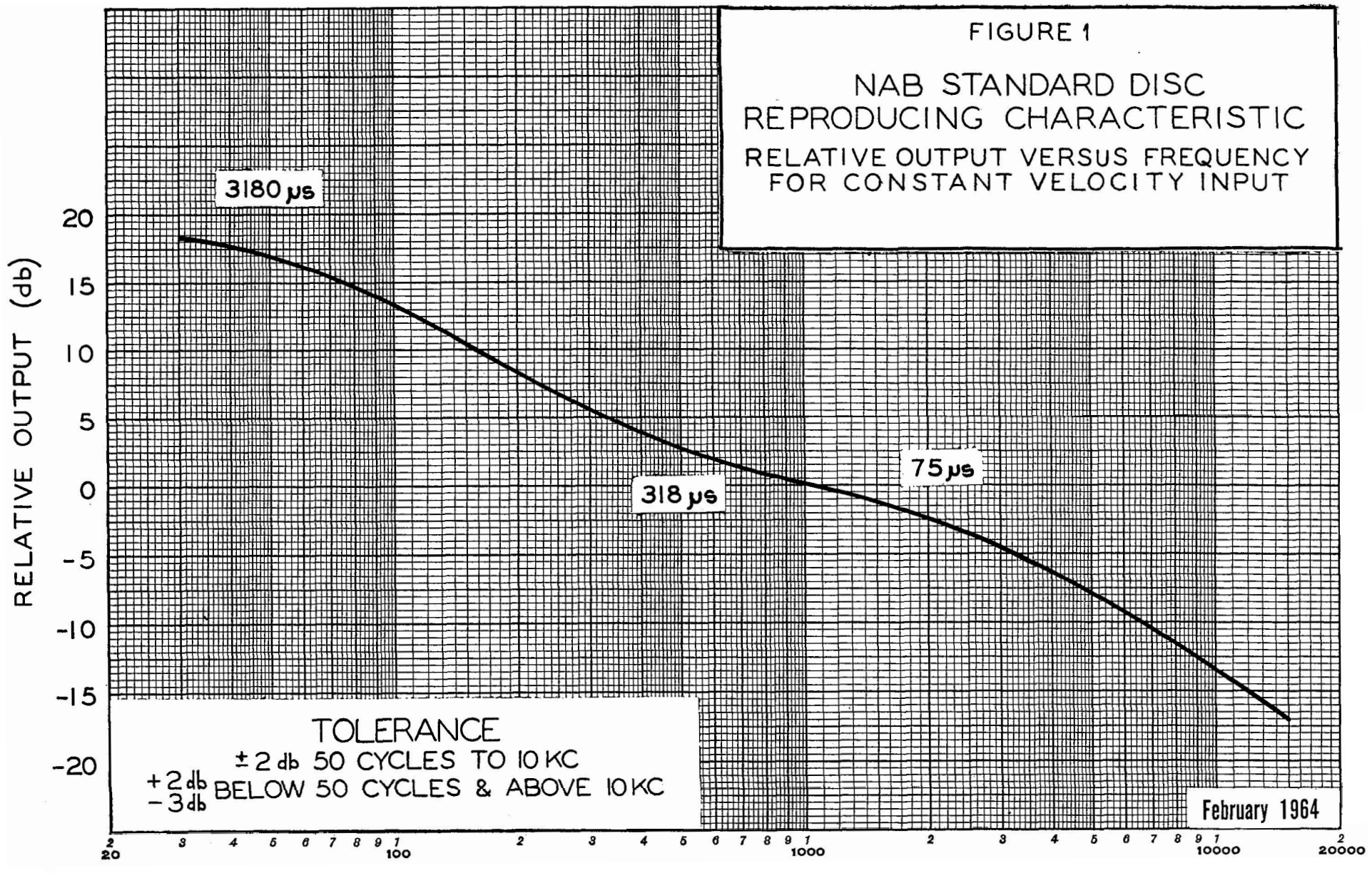
FIGURE 1
NAB STANDARD DISC
REPRODUCING CHARACTERISTIC
RELATIVE OUTPUT VERSUS FREQUENCY
FOR CONSTANT VELOCITY INPUT
3180 μs
318 μs
75 μs
RELATIVE OUTPUT (db)
20
15
10
5
0
-5
-10
-15
-20
TOLERANCE
± 2 db 50 CYCLES TO 10 KC
+2 db
-3 db BELOW 50 CYCLES & ABOVE 10 KC
February 1964
2
20
3
4
5
6
7
8
9
1
100
2
3
4
5
6
7
8
9
1
1000
2
3
4
5
6
7
8
9
1
10000
2
20000
FREQUENCY IN CYCLES PER SECOND

# TABLE 1

## FREQUENCY

vs.

## NAB MONOPHONIC AND STEREOPHONIC REPRODUCING CHARACTERISTIC

| *Frequency* | *Reproducing Characteristic* |
|---|---|
| 15,000 cps | — 17.17 db |
| 14,000 " | — 16.64 " |
| 13,000 " | — 15.95 " |
| 12,000 " | — 15.28 " |
| 11,000 " | — 14.55 " |
| 10,000 " | — 13.75 " |
| 9,000 " | — 12.88 " |
| 8,000 " | — 11.91 " |
| 7,000 " | — 10.85 " |
| 6,000 " | — 9.62 " |
| 5,000 " | — 8.23 " |
| 4,000 " | — 6.64 " |
| 3,000 " | — 4.76 " |
| 2,000 " | — 2.61 " |
| 1,000 " | 0 |
| 700 " | + 1.23 " |
| 400 " | + 3.81 " |
| 300 " | + 5.53 " |
| 200 " | + 8.22 " |
| 100 " | + 13.11 " |
| 70 " | + 15.31 " |
| 50 " | + 16.96 " |
| 30 " | + 18.61 " |

# GLOSSARY OF DISC RECORDING AND REPRODUCING TERMS AND DEFINITIONS

ACETATE DISC—An acetate disc is a recording disc consisting of a solid substrate coated with a plasticized cellulose nitrate lacquer.

ADVANCE BALL—An advance ball is a rounded support (often sapphire) attached to a cutter which rides on the surface of the recording medium so as to maintain a uniform mean depth of cut and correct for small irregularities of the disc surface.

BACKGROUND NOISE—Background noise is the total system noise output of a reproducer in the absence of signal when the system is in normal operation.

BINDER—A binder is a resinous material which causes the various materials of a disc compound to adhere.

BISCUIT—A biscuit is a small slab of plastic material as it is prepared for use in the presses.

BURNISHING FACET (SURFACE)—A burnishing facet in disc recording is the portion of the cutting stylus directly behind the cutting edge and which smooths the groove.

CHIP—The chip, in disc recording, is the material removed from the recording medium by the recording stylus while cutting the groove.

COMPRESSION MOLDING—Compression molding is the process of forming a disc by means of compressing a charge of suitable plastic in a cavity.

CONSTANT-AMPLITUDE RECORDING—Constant-amplitude recording indicates a mechanical recording characteristic wherein, for a fixed amplitude of a sinusoidal signal, the resulting recorded amplitude is independent of frequency.

CONSTANT-VELOCITY RECORDING—Constant-velocity recording indicates a mechanical recording characteristic wherein, for a fixed amplitude of a sinusoidal signal, the resulting recorded amplitude is inversely proportional to frequency.

CRYSTAL CUTTER—A crystal cutter is a cutter in which the mechanical displacements of the recording stylus are derived from the deformations of a piezoelectric material.

CUTTER (MECHANICAL RECORDING HEAD)—A cutter is an electromechanical transducer which transforms an electric input into mechanical motions of a cutting stylus.

CUTTING STYLUS—A cutting stylus is a stylus having its cutting edge at a plane substantially different from the cutting facet for the purpose of cutting and polishing the groove in an acetate disc.

DISC RECORDER—A disc recorder is a mechanical device consisting of a record head with cutting stylus and a properly driven turntable to inscribe a signal on a recording disc.

DRIVE PIN—A drive pin is a pin similar to the center pin, but located to one side thereof, which is used to prevent a disc from slipping on the recording turntable.

ECCENTRICITY—Eccentricity is the displacement of the center of the recording groove spiral, with respect to the disc center hole.

EQUALIZATION (CORRECTIVE EQUALIZATION)—Equalization is the effect of intentionally introduced electrical correction employed in the recording and reproducing process to obtain a desired over-all response.

EQUALIZATION (DIAMETER)—Diameter equalization is the increasing of the high frequency record level with respect to the decreasing groove speed (velocity) in recording to compensate for reproducing losses (see translation loss).

FAST SPIRAL--A fast spiral is an unmodulated groove on a disc having a spacing that is much greater than that of the modulated grooves.

FEEDBACK CUTTER—A feedback cutter is an electro-mechanical transducer which performs the same function as a "cutter". It is equipped with an auxiliary coil mechanically coupled to the

driver coil in the magnetic field, Signals exciting the "cutter" are induced into the feedback coil and in turn are fed back to the input circuit of the cutter amplifier resulting in reduced distortion and substantially constant velocity response.

FLASH—Flash is the excess compound generated at the edge of a disc during the compression molding operation.

FLUTTER (WOW)—In recording or reproducing, flutter is the deviation in frequency or pitch which results from minor periodic or random changes in the motion of the medium. *(Note:* The term "flutter" usually refers to cyclic deviations occurring at a relatively high rate, as, for example, 10 cycles per second. The term "wow" usually refers to cyclic deviations occurring at a relatively low rate as, for example, a once-per-revolution speed variation of a turntable. The term "drift" usually refers to a random rate close to zero cycles per second.)

FLUTTER RATE—Flutter rate is the number of cyclical variations per second of the flutter.

FORTY-FIVE DISC—A "45" disc is one recorded for reproduction at 45 revolutions per minute. It is normally a seven-inch disc with a raised label area and a center hole 1.5 inches in diameter.

FREQUENCY RECORD—A frequency record is a disc containing various sine-wave frequencies recorded at known amplitudes, for the purpose of measuring reproducing system frequency response characteristics.

GROOVE—A groove is the track inscribed in a disc by a cutting or embossing stylus including modulations caused by the vibrations of the stylus.

GROOVE ANGLE—Groove angle is the angle between the two side walls of a groove measured in a radial plane perpendicular to the disc surface.

GROOVE, CONCENTRIC OR STOPPING—A concentric groove is a locked circular groove the center of which is coincident with the center of the recording spiral.

GROOVE DEPTH—Groove depth is the vertical distance from the plane at the surface of the disc to the bottom of the groove.

GROOVE DEPTH, VARIABLE—Variable groove depth is the technique of varying the average groove depth in relation to the vertical modulation displacement.

GROOVE, FAST (FAST SPIRAL)—A fast groove is an unmodulated spiral groove with groove spacing much greater than normally used for modulated grooves.

GROOVE, LEAD-IN (LEAD-IN SPIRAL)—A Lead-in groove is an unmodulated fast spiral groove from the edge of the disc to the start of the modulated groove area.

GROOVE, LEAD-OVER (CROSSOVER SPIRAL)—A lead-over groove is a fast groove connecting two modulated sections or bands on a disc.

GROOVE, LEAD-OUT—A lead-out groove is an unmodulated spiral groove at the end of a recording connecting the last groove at normal modulated groove pitch to a locked concentric or eccentric stopping groove.

GROOVE, LOCKED (CONCENTRIC GROOVE)—A locked groove is a circular continuous groove following a modulated groove section for the purpose of preventing further inward or outward travel of the pickup.

GROOVE PITCH, VARIABLE—Variable groove pitch is the technique of varying the groove spacing in relation to the lateral modulation displacement of the cutting stylus.

GROOVE SHAPE—Groove shape is the contour of a disc groove in a radial plane perpendicular to the disc surface, usually specified in terms of top width, included angle, and bottom radius.

GROOVE SPEED (LINEAR VELOCITY)—Groove speed is the linear speed of a disc groove with respect to a fixed point such as a stylus tip.

GROOVE, UNMODULATED—An unmodulated groove is a groove in a disc which has been recorded with no signal applied to the cutter.

GROOVE WIDTH — Groove width is the radial distance between the intersections of the groove side walls and the surface plane of the disc.

GROUPING — Grouping is nonuniformity in spacing between grooves of a disc caused by irregular motion on the recording lathe feed screw.

INJECTION MOLDING — Injection molding is the process of forming a disc by injecting a liquefied plastic material into a die cavity.

INSTANTANEOUS RECORDING — An instantaneous recording is a disc which is intended for direct playback without further processing.

LACQUER DISC — A lacquer disc is a recording disc consisting of plasticized cellulose nitrate lacquer coated on a rigid substrate such as aluminum or glass.

LACQUER ORIGINAL (LACQUER MASTER) — A lacquer original is an instantaneous recording on a lacquer disc made for the purpose of generating an original master by an electroforming process.

LAND — Land is the flat surface of a disc between adjacent grooves.

LATERAL RECORDING (MONOPHONIC) — A lateral recording is a disc containing groove modulation caused by radial recorder stylus motion in the plane of the disc surface.

LONG PLAYING — Long playing refers to a disc having a playing time substantially greater than 5 minutes. This normally refers to a 10 or 12 inch 33⅓ RPM disc recorded with approximately 150 to 300 grooves per inch.

MASTER (MASTER ORIGINAL) (MASTER NEGATIVE) — A Master in disc recording is a metal part generated from a Lacquer Original. It may be used to generate metal molds by electroforming or to press discs.

MASTER NO. 2, NO. 3, etc. — A No. 2 master in disc recording is a metal part generated from a No. 1 mold by electroforming; a No. 3 master is a similar part generated from a No. 2 mold, etc.

MICRO-GROOVE — Micro-groove is a disc groove having a nominal top width of 3 mils suitable for reproducing with a ½ to 1 mil stylus.

MIXER — A mixer, in a sound recording or reproducing system, is a device having two or more inputs, usually adjustable, and a common output, which operates to combine linearly the separate input signals to produce an output signal.

MODULATION NOISE — Modulation noise is that component of noise which exists only in the presence of a recorded signal.

MOLD (MOTHER) (METAL POSITIVE) — A mold in disc recording is a metal part derived from a master by electroforming. It has grooves similar to those on a disc and thus may be played as a disc.

MOLD NO. 1 — A No. 1 mold in disc recording is a metal disc derived from a No. 1 Master by electroforming. It may be used to generate a No. 2 master or stampers for pressing discs.

OFFSET ANGLE — In lateral disc reproduction, the offset angle is the smaller of the two angles between the projections into the plane of the disc of the vibration axis of the pickup stylus and the line connecting the vertical pivot (assuming a horizontal disc) of the pickup arm with the stylus point.

OPTICAL PATTERN (LIGHT PATTERN) — An optical pattern is a light pattern which can be observed when the surface of a recorded disc is illuminated radially by a collimated beam of light. The outline of the envelope or pattern is the function of the maximum modulation slope or recorded stylus velocity inscribed in the groove wall.

OVERCUTTING — In disc recording, overcutting is the effect of excessive level characterized by one groove cutting into an adjacent one.

PICKUP — A pickup is an electromechanical transducer which is actuated by modulations present in the groove of the recording medium and which transforms this mechanical input into an electric output.

PICKUP ARM (TONE ARM) — A pickup arm is a pivoted arm arranged to hold a pickup.

PICKUP, CAPACITOR — A capacitor pickup is a reproducer which depends for its operation upon the variation of its electrical capacitance.

PICKUP CARTRIDGE — A pickup cartridge is the removable portion of a pickup containing the electromechanical translating elements and the reproducing stylus.

PICKUP, CRYSTAL — A crystal pickup is a reproducer which depends for its operation on the piezoelectric effect of crystals.

PICKUP (VARIABLE-RELUCTANCE MAGNETIC PICKUP) — A variable reluctance magnetic pickup is a reproducer which depends for its operation on the variations in the reluctance of a magnetic circuit.

PICKUP, MOVING COIL (DYNAMIC REPRODUCER) — A moving-coil pickup is a reproducer, the electric output of which results from the motion of a coil in a magnetic field.

PINCH EFFECT — In disc recording, the pinch effect is a pinching of the reproducing stylus tip twice each cycle in the reproduction of lateral recordings, due to a decrease in angle measured in a plane perpendicular to the modulation slope at any given instant.

PITCH — Pitch is commonly used to express the number of grooves per inch.

PLAYBACK — Playback is an expression used to denote reproduction of a disc.

PLASTIC — plastic is a resin or polymer suitable for molding discs by the application of heat and pressure in a mold (die) cavity.

POID — A poid is the curve traced by the center of a sphere when it rolls or slides over a surface having a sinusoidal profile.

POST EMPHASIS (DE-EMPHASIS) (PLAYBACK EQUALIZATION) — Post emphasis is the reproducing system equalization conforming to a standard response curve. (See NAB Reproducing System Characteristics.)

PRE-EMPHASIS (PRE-EQUALIZATION) (RECORD EQUALIZATION) — Pre-Emphasis in recording is the pre-equalization of a recording system where the system response is the reciprocal of a standard reproduce characteristic.

PRESSING — A pressing is a disc produced in a molding press from a master or stamper.

RECORDING LOSS — Recording loss, is the loss in level whereby the amplitude of the wave in the medium differs from the amplitude executed by the stylus.

RE-RECORDING — Re-recording is the process of reproducing a recorded sound source and recording this reproduction.

RUMBLE (TURNTABLE RUMBLE) — Rumble is low-frequency vibration mechanically transmitted to the recording or reproducing turntable and superimposed on the reproduction.

SEPARATION — Separation is the ratio of signal in the recorded channel to the signal in the unrecorded channel of a stereophonic disc groove.

SIDE THRUST — Side thrust in disc reproduction is the radial component of force on a pickup arm caused by the stylus drag.

SILVERING — Silvering is a process wherein the lacquer original is metalized by precipitating on to this surface the metallic silver in ammoniated silver nitrate.

SILVER SPRAYING — Silver spraying is metalizing the Lacquer Original using a dual spray nozzle wherein the ammoniated silver nitrate and reducer are combined in an atomized spray to precipitate the metallic silver.

SPUTTERING (CATHODE SPUTTERING) — Sputtering is a process sometimes used in the pro-

duction of the metal master wherein the original is coated with an electric conducting layer by means of an electric discharge in a vacuum. *Note:* Obsolete.

STAMPER — A stamper is a metal negative made by electro-forming from which finished pressings are molded.

STEREOPHONIC RECORDING — Stereophonic recording in discs is a system where two channels are recorded in a single groove.

STYLUS DRAG (NEEDLE DRAG) — Stylus drag is an expression used to denote the force resulting from friction between the surface of the recording medium and the reproducing stylus.

STYLUS, EMBOSSING — An embossing stylus is a recording stylus with a rounded tip which displaces the material in the recording medium to form a groove.

STYLUS FORCE (STATIC STYLUS FORCE) (VERTICAL STYLUS FORCE) (NEEDLE FORCE) — The stylus force is the vertical force exerted by the stylus on the groove. *Note:* For convenience of measurement the stylus force may he considered equivalent to the vertical force required to just lift the stylus clear of the groove.

STYLUS, RECORDING — A recording stylus is the tool which inscribes the grooves into the disc medium. Tips may be designed for either cutting or embossing the groove.

STYLUS, REPRODUCING — A reproducing stylus is a mechanical transmission element consisting of a suitable tip to follow the modulation of a recorded groove and a means for transferring the resultant vibration to the transducer element of the pickup. *Note:* In many modern pickups the term "stylus" may refer to a subassembly comprising the entire moving system of the pickup cartridge.

SURFACE NOISE — Surface noise is the noise component in the electric output of a pickup due to irregularities in the surfaces of the groove walls at or close to the points of stylus contact.

TRACING DISTORTION — Tracing distortion is the non-linear distortion introduced in the reproduction of discs, because the curve traced by the motion of the spherical tip stylus is limited to a function of the tip radius and its instantaneous acceleration in the groove. *Note:* For example, in the case of a sine-wave modulation in vertical recording the curve traced by the center of the tip of a stylus is *a* poid.

TRACKING ANGLE ERROR (LATERAL) — Lateral tracking angle error is the angle, projected to the plane of the disc, between the vibration axis of the mechanical system of the pickup and a tangent to an unmodulated groove at the point of stylus contact.

TRACKING ANGLE ERROR (VERTICAL) — Vertical tracking angle error is the angle between the mechanical axis of the pickup, projected on a plane perpendicular to the disc surface and containing the tangent to the groove at the point of contact, and the effective axis of the vertical modulation of the groove.

TRANSLATION LOSS (PLAYBACK LOSS) — Translation loss is the loss in the reproduction of a mechanical recording whereby the amplitude of motion of the reproducing stylus differs from the recorded amplitude in the medium.

VERTICAL RECORDING (HILL AND DALE RECORDING) — A vertical recording is a mechanical recording in which the groove modulation is in a direction essentially perpendicular to the surface of the recording medium. *Note:* Obsolete.

WAX — In mechanical recording, wax refers to a blend of waxes with metallic soaps. *Note:* Obsolete.

WAX, CAKE — Cake wax is a thick disc of wax upon which an original mechanical disc recording may be inscribed. *Note:* Obsolete.

WAX, FLOWED — Flowed wax is a mechanical recording medium, in disc form, prepared by melting and flowing wax onto a metal base. *Note:* Obsolete.

WAX ORIGINAL (WAX MASTER) — A wax original is an original recording on a wax surface for the purpose of making a master. *Note:* Obsolete.

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E-417