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NARTB RECORDING AND REPRODUCING STANDARDS

(June, 1953)

INSTRUCTIONS FOR FILING

To open binder, pull up on the ring and slide the cover of the binder upwards. Lift up on the metal bar, and the posts are open for insertion of the punched Supplement.

After Page	*Remove Old Pages*	*Insert New Pages*
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NARTB
RECORDING AND REPRODUCING
STANDARDS

FOR MECHANICAL, MAGNETIC AND OPTICAL RECORDING AND REPRODUCING
including
A GLOSSARY OF TERMS AND DEFINITIONS

The NARTB 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, and 1950. Standards as contained herein were adopted by the Board on June 19, 1953.

These standards and recommended good engineering practices are for the benefit and welfare of the broadcasting industry, and represent the contributions of more than 100 of the nation's authorities on the various phases of recording as used by the industry. The NARTB Recording and Reproducing Standards Committee has also benefitted by contributions made by the administrations belonging to the International Radio Consultative Committee (Study Group X). The approach taken to many of the problems in the development of these standards was suggested by the work of CCIR Study Group X, particularly in the case of the methods of measuring the magnetization of a tape. The committee is open to participation by any interested individual or organization and consists of representatives from the manufacturers, broadcasters and producers. Close liaison has been maintained with other organizations (as well as foreign countries) to insure the maximum degree of coordinated understanding and recommended standardization, to permit interchangeability 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 so molded as to provide a stimulus for continued scientific exploration in the field of recording. It is anticipated that when necessary the NARTB Recording and Reproducing Standards Committee will review its work of the past decade, 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 NARTB Recording and Reproducing Standards Committee

Neal McNaughten, *Chairman*

K. R. Smith, Mechanical Disk Subcommittee

W. Earl Stewart, Magnetic Tape Subcommittee

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June 1953

1-3-01

Section 1

MECHANICAL RECORDING AND REPRODUCING STANDARDS*

Turntable Speed (RPM)

1.05 It shall be standard that the average speed of the turntable be either 33-1/3, 45 or 78.26 RPM ± 0.3%.

1.05.01 Method of Measurement: This measurement shall be made by means of a stroboscopic disk illumined by a neon lamp or equivalent operated from the same power source as the turntable. The stroboscopic disk for 33-1/3 RPM speed measurement shall have 216 spots in 360°; for 45 RPM speed it shall have 160 spots in 360°; and for 78.26 RPM speed it shall have 92 spots in 360°.

At either 33-1/3, 45 or 78.26 RPM, not more than 21 dots per minute in either direction may pass or "drift" by a reference point.

Turntable and Disk Rotation

1.06 It shall be standard that disk records intended for broadcasting application be rotated in a clockwise direction as viewed from the side being reproduced.

WOW Factor (Recording)

1.10 It shall be standard that the instantaneous peak deviation from the mean speed of the recording turntable, when making the recording, shall not exceed +0.1% of the mean speed.

WOW Factor (Reproducing)

1.11 It shall be standard that the instantaneous peak deviation from the mean speed of the reproducing turntable when reproducing shall not exceed ±0.2% of the mean speed.

Disk Reproducing System Rumble

1.12 It shall be a good engineering practice that the low frequency noise output of a turntable, its associated pickup and equalizer, when playing an essentially rumble-free silent groove, shall be more than 35 db below a reference level of 1.4 centimeters per second peak velocity at 100 cycles per second.

A record shall be considered rumble free if its rumble content is at least 8 db below that of the system being measured. The response of the pickup and equalizer shall conform to the NARTB standard reproducing curve; the amplifier and indicating meter shall have uniform response, within ±1 db, between 10 and 250 cycles per second, with 500 cycle response 3 db below the 100 cycle response, an attenuation at the rate of at least 12 db per octave at frequencies above 500 cycles. Amplifier and indicating meter response shall decrease at the rate of at least 6 db per octave below 10 cycles per second. The meter used shall have the same ballistic characteristics as the standard VU meter. If the meter reading fluctuates, both average and maximum values shall conform to this requirement.

1.12.01 This measurement is intented 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 and pickup 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 will create severe intermodulation distortion in an audio system, and that in modern systems with extended low frequency response, this is more serious than the audibility of the low frequency.

The reference level of 1.4 centimeters per second at 100 cps corresponds in amplitude to 7 centimeters per second at 500 cps, since we are then operating on the constant amplitude portion of the recording characteristic. It is suggested that such noise data be

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*For clarification in the use of these standards, the term "transcription" is deemed to mean those disk recordings made primarily for broadcast transmissions; the term "record" is deemed to mean those disk recordings which by virtue of their size, electrical and mechanical characteristics may be used for broadcast transmissions, but may not primarily be manufactured for this purpose.

Note:

For the purpose of distinguishing between those recordings using a 2 mil or larger reproducing stylus and those requiring a 1 mil or smaller reproducing stylus, all Standards specifically relating to those recordings requiring the smaller stylus will use the term "fine groove."

taken periodically for each turntable in a broadcast system, with a change in the indication reflecting a a need for maintenance work.

Turntable Recovery Time (Reproducing)

1.15 It shall be standard that the maximum turntable recovery time be 0.3 seconds.

1.15.01 Recovery time shall be defined as the time required after release of a record which has been restrained from rotation until the wows have fallen to 120% of the permissible steady state level.

Turntable Height (Reproducing)

1.20 It shall be good engineering practice that the height of the turntable be 28 inches.

1.20.01 The height of a turntable of the console type is defined as "the vertical distance from the surface on which the turntable rests to the top of the platen."

Turntable Platen (Reproducing)

1.21 It shall be good engineering practice that the diameter of the transcription reproducing turntable platen be substantially the same as that of the largest diameter records for which the turntable is intended.

1.21.01 Turntables for 45 RPM shall be recessed a minimum of 0.030" to a diameter of 3-7/8 ±1/32".

Turntable Center Pin Diameter

1.25 It shall be standard that the diameter of the center pin of a transcription turntable be 0.2835" ±0.0005" for 33-1/3 and 78.26 RPM transcriptions. The diameter of the center pin for 45 RPM records shall be 1.500 +0 -0.002".

Outer Record Diameters

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

Nominal	Finished Records (Pressings or Instantaneous)	
16"	15-15/16"	±3/32"
12"	11-7/8"	±1/32"
10"	9-7/8"	±1/32"
7"	6-7/8"	±1/32"

Record Center Hole Diameter

1.35 It shall be standard that the record center hole diameter be 0.286" ±0.001" for 33-1/3 and 78.26 RPM records and transcriptions, and 1.504" ±0.002" for 45 RPM records.

Concentricity of Center Hole

1.36 It shall be good engineering practice that the record center hole be concentric with the recorded groove spiral within 0.002 inches.

Record Warp

1.40 It shall be standard that the maximum departure of the surface of a record from a true plane because of warping shall not be in excess of 1/16".

Frequency Characteristics for Vertical Recordings[1]

1.50 It shall be standard that the recorded frequency characteristics on vertically recorded records be as shown in attached Figure 1.

Frequency Characteristics for Lateral Recordings[2]

1.55 It shall be standard that the recorded frequency characteristics on laterally recorded records be as shown in attached Figure 2.

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[1] The recording characteristics for vertical transcriptions remain as specified in the standards adopted in March 1942, except that in place of "stylus velocity" the words "recorded velocity" should be substituted.

[2] This curve is defined as the algebraic sum of the ordinates of three individual curves which conform to the admittances of the following three networks expressed in db:

a) A parallel L/R network having a time constant of 3180 microseconds.
b) A series RC network having a time constant of 318 microseconds.
c) A parallel RC network having a time constant of 75 microseconds.

Record Groove Shape[3]

1.60 Lateral: It shall be standard that the groove shape for finished lateral records and transcriptions shall have an included angle of 88° ±5°, and a top width of not less than 4.0 mils for records to be reproduced with a 2.3 mil stylus and not less than 2.0 mils for records to be reproduced with a 1.0 mil stylus.

1.60.01 It shall be good engineering practice on records and transcriptions with less than 136 lines per inch that the groove have a bottom radius of 1.5 mils; for records and transcriptions having more than 136 lines per inch, the groove shall have a bottom radius not less than 0.25 mils.

1.65 Vertical: It shall be standard that the groove shape for finished vertical records shall have an included angle of 88° ±5°; a radius of 2.0 to 2.3 mils; and a top width of not less than 4.0 mils.

Reproducer Stylus Contour

1.70 33-1/3 and 78.26 RPM lateral or vertical transcriptions (other than fine groove): It shall be the primary standard that the stylus for reproducing lateral or vertical transcriptions shall have an included angle of 40° to 55° and a bottom radius of 2.3 ±0.2 mils.

1.70.01 45 RPM records and fine groove records and transcriptions: It shall be the primary standard that the stylus have an included angle of 40° to 55° and a bottom radius of $1.0\ ^{+0.1}_{-0.2}$ mils.

1.75 Lateral 78 RPM phonograph records and transcriptions: It shall be the secondary standard that the stylus for reproducing lateral 78 RPM phonograph records and transcriptions shall have an included angle of 40° to 55° and a bottom radius of 2.5 ±0.1 mils.

Recorded Level (Lateral and Vertical)[4]

1.80 It shall be standard that the recorded program level shall produce the same reference deflection on a standard volume indicator (ASA Standard C16.5-1942) as that produced by a 1,000-cycle tone recorded at a peak velocity of 7 cm. per second.

Signal to Noise Ratio[5]

1.85 It shall be standard that the noise level measured with a standard volume indicator (ASA Standard C16.5-1942) when reproducing a record on a flat velocity basis over a frequency range between 500 and 10,000 cycles per second shall be at least 40 db below the level obtained under the same conditions of reproduction using a tone record of 1,000 cycles per second having a peak velocity of 7 centimeters per second. Response of the system at 500 cycles per second shall be 3 db below the response at 1,000 cycles per second, and the response shall fall at the rate of at least 12 db per octave below 500 cycles per second. Response of the system at 10,000 cycles per second shall be 3 db below the response at 1,000 cycles per second, and the response shall fall at the rate of at least 12 db per octave above 10,000 cycles per second.

Outermost Groove Diameter

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

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[3] It has been concluded that groove shape standards should apply to the finished record rather than to the recording stylus. It is recognized that in some cases record 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 record.

[4] 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 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 33-1/3 rpm disk. This has also been substantiated by practical experience. This standard of course applies to both lateral and vertical recording.

[5] 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 disks. It does not, however, take into account the program level which may happen to be recorded on a particular disk nor the dynamic range of the program material. NARTB preemphasis will improve the signal to noise ratio by approximately 8 db, thus resulting in an effective signal to noise ratio under minimum conditions of 48 db. It should be remembered that the peak signal to noise ratio will be at least 10 db better than the figure given above when NARTB standard of recorded level is used, with normal program material.

16" -- outside start --	15-1/2"	±1/16"
16" -- inside start --	15-9/16"	maximum
12" -- outside start --	11-1/2"	±0.020"
10" -- outside start --	9-1/2"	±0.020"
7" -- outside start --	6-5/8"	+0 -5/64"

Number of Blank Grooves

1.100 It shall be standard for transcriptions that the number of blank grooves, before and after modulation occurs, shall be not less than two complete revolutions.

Stopping Groove

1.110 For transcriptions, it shall be standard that at the termination of the recording groove spiral a locked concentric stopping groove shall be provided.

Innermost Groove Diameter

1.115 It shall be standard that the diameter of the innermost groove shall be not less than 7-1/2" in the case of 33-1/3 RPM transcriptions recorded to be reproduced with a 2.3 mils radius stylus, and not less than 4-3/4" for recordings to be reproduced with a 1 mil stylus. It shall be standard that the diameter be not less than 3-3/4" for 78.26 RPM recordings and not less than 4-1/4" for 45 RPM recordings.

Minimum Label Information

1.120 It shall be standard for the label of a recording to contain at least the following technical information:

a. Type of recording -- vertical or lateral
b. Speed -- 78.26, 45, or 33-1/3 RPM
c. Direction of feed (start) -- outside-in or inside-out
d. Recording frequency characteristic (Example: NARTB 1953 Standard.)
e. Recommended type of playback stylus

Section 2

MAGNETIC RECORDING AND REPRODUCING STANDARDS

Magnetic Tape Dimensions

2.05 Thickness: It shall be standard that the thickness of magnetic tape shall not exceed 0.0022 inches.

2.10 Width: It shall be standard that the width of magnetic tape shall not exceed 0.250 inches nor shall it be less than 0.244 inches.

Magnetic Tape Speed

Definition: Magnetic tape speed for recording and reproducing is the velocity of the magnetic tape recording medium with respect to the recording or reproducing device.

2.15 Primary standard: It shall be standard that the primary standard magnetic tape speed shall be 15 inches per second.

2.20 Secondary standard: It shall be standard that the secondary magnetic tape speed shall be 7.5 inches per second.

2.25 Supplementary standard: It shall be standard that the supplementary magnetic tape speed shall be 30 inches per second.

Frequency Response Limits

2.30 Primary Frequency Response Limits: It shall be standard that the primary frequency response shall lie between two limits. (See Figure 3-A). The upper of these limits shall be uniform from 50 to 15,000 cps. The lower shall be uniform from 100 to 7500 cps and 2 db below the upper limit. In addition, the lower limit shall be an additional amount down at 50 and 15,000 cps determined by decrease at a uniform rate of 3 db per octave below 100 cps and above 7500 cps.

2.35 Secondary Frequency Response Limits: (For applications where a restricted frequency response may be tolerated). It shall be standard that the secondary frequency response shall lie between two limits. (See Figure 3-B). The upper of these limits shall be uniform from 50 to 7500 cps. The lower shall be uniform from 100 to 5000 cps and 2 db below the upper limit. In addition, the lower limit shall be an additional amount down at 50 and 7500 cps determined by a uniform 3 db decrease from 100 to 50 cycles and from 5000 to 7500 cycles.

Flutter and Wow

2.40 It shall be standard that the instantaneous peak flutter and wow shall not exceed 0.2% (peak to peak 0.4%) when recording and reproducing on the same equipment.

Magnetic Tape Reel

2.45 It shall be standard that the hub carrying magnetic tape shall be in accordance with Figure 4.

Tape Wind

2.46 It shall be standard that magnetic tape, when supplied on reels ready for use, shall be wound with the active magnetic surface on each layer facing toward the center of the reels.

2.50 Primary Standard: It shall be standard where flanges are used that the primary standard flange shall be in accordance with Figure 5.

2.50.01 The primary standard flange provides for the accommodation of sufficient magnetic tape of standard thickness for a nominal 30 minutes of recording.

Erasing Function

2.55 It shall be standard that the erasing function shall be applied to the entire width of the tape.

Magnetic Tape Length

2.60 Length - Primary Standard: It shall be standard that the primary standard length of magnetic tape shall be 2,400 feet, +50 feet -0 feet.

2.60.01 The primary standard length of magnetic tape provides the nominal amount of maximum thickness magnetic tape for the primary standard flange as well as a nominal recording time of 30 minutes (plus a starting and stopping margin) when recording with the primary standard magnetic tape speed.

2.65 Length - Secondary Standard: It shall be standard that the secondary standard length of magnetic tape shall be 1,200 feet, +25 feet -0 feet.

2.65.01 The secondary standard length of magnetic tape provides a nominal recording time of 30 minutes (plus a starting and stopping margin) when recording with the secondary standard magnetic tape speed.

Magnetic Sound Track Position

2.75 It shall be standard that the magnetic sound track shall be symmetrically located with respect to the center line of the tape.

Standard Reproducing Characteristic

2.80 It shall be standard that a Standard Reproducing System is one having an "ideal" reproducing head,[1] the EMF of which is amplified in an amplifier with a response curve having the following characteristic:

At a tape speed of 15"/second: The response curve shall be that which results from the superposition of three curves; one that falls with increase of frequency at the rate of 6 db per octave; this curve to be modified at low audio frequencies by a curve that falls with decrease of frequency in conformity with the admittance of a series combination of a capacity and a resistance having a time constant of 3180 microseconds; and this same curve to be modified at high audio frequencies by a curve that rises with increase of frequency in conformity with the admittance of a parallel combination of a capacitance and a resistance having a time constant of 50 microseconds. The combined curve is shown in Figure 6.

Methods of Establishing the Standard Reproducing System

2.85 The relative surface inductions at different frequencies on a tape can be measured by at least three methods that are described in the attached Annex. From such measurements the departure of the response of a reproducing head from the "ideal" can be deduced and consequently a Standard Reproducing System can be established as a primary standard. Test tapes can then be made which can serve as secondary standards for use in normal operation.

Signal-to-Noise Ratio

2.90 It shall be standard that the signal-to-noise ratio of a recording system shall be at least 55 db referred to the Standard Reference Level. All frequencies between 50 and 15,000 cycles are to be included in the measurement of the noise. (The standard reference level for signal-to-noise measurements shall be the output level obtained by reproducing tape, produced by a recording system operating under

[1] An "ideal" reproducing head is defined as a reproducing head the losses of which are negligible. With a normal ferromagnetic head this means that the gap is short and the arc of contact with the tape is long compared to the relevant wavelengths, and the losses in the material of the head are small. With the reproducing heads used in practice, an equalization to compensate for the head losses must be added to the replay amplifier.

normal conditions, at which two percent total harmonic distortion of the recorded 400 cycle tone occurs using tape that is normally available.)

ANNEX

Methods of Measuring the Magnetization of a Tape[2]

There are two general ways in which the surface induction[3] vs. frequency characteristic of a tape may be determined:

1. By means which do not affect the surface induction. This implies the use of a non-magnetic reproducing device. For example, reproduction by means of a simple non-magnetic conductor placed in the field at the surface of the moving tape appears to be practicable as a laboratory method and might therefore be used to establish a primary standard which could be used to determine the relative change of surface induction with wavelength created by the presence of a magnetic head.

2. By means of a magnetic reproducing device, which necessarily affects the surface induction of the tape in a manner dependent on recorded wavelength. In this category there are two ways in which conventional magnetic heads have been used, one method involving heads with a short gap, the other involving heads with a long gap. In both cases the gap in the reproducing head must be sufficiently accurate, magnetically, to give well-defined minima of reproduced level, one in the short gap method or several in the long gap method.

(a) **The "Short Gap" Head Method**

The longest wavelength at which a minimum of reproduced level occurs is the effective gap length (d). The necessary correction for the gap length is calculated on the assumption that output is proportional to

$$\frac{\sin \frac{\pi d}{\lambda}}{\frac{\pi d}{\lambda}}$$

This correction must not exceed 5 db at the shortest wavelength considered. Any necessary correction for eddy current losses must also be determined, for example, by comparing output at various tape speeds or by the use of an inducing loop.

It appears that if the correction for gap length does not exceed 5 db, then the surface induction is altered, due to the presence of the head, by an approximately constant factor over the whole range of wavelengths and may therefore be neglected.

Once these corrections are known and applied, the head may be used as an "ideal" head to measure relative surface inductions on the tape over the wavelength range considered.

(b) **The "Long Gap" Method**

In this method a head is used with a gap some 50 times as long as that of the normal reproducing head. In practice an erase head can usually be adapted for the purpose. The response of such a head should show a series of well defined maxima and minima as shown in Figure 7.

A curve through the successive maxima is a measure of the surface induction on the tape when the necessary corrections for eddy current losses of the head have been made. This curve rises at 1 to 2 db/octave compared with the curve of surface induction vs. frequency in air as determined by a non-magnetic reproducing device, or by a "short-gap" head. This correction must be explored further before this method can be applied.

Note 1. The "Long Gap" method is included here because of its use in other countries and its possible future use in the U.S.A. The uncertainty of the correction factor makes it unusable as a standard method of measurement at present.

The precise steps by which the procedures of (2) (a) and (b) may be applied in practice are outlined in the following.

Standardization by the "Short Gap" Magnetic Head

Using the "Short Gap" Method a recording equipment is set to the standard condition in the following way:

[2] These methods resulted from experiments undertaken by members of the NARTB Recording and Reproducing Standards Committee following the original work in CCIR Study Group X on the subject.

[3] In general terms, surface induction is the flux density (B) at right angles to the surface of the tape. It depends not only on the magnetization of the tape but also on the properties of the reproducing device. In the following, surface induction means the surface induction of the tape in space and not in contact with a reproducing device.

1. A "gliding tone" is recorded on a tape and reproduced by means of the head to be used for the measurements. The longest wavelength at which the output disappears is noted. This wavelength will be equal to the effective gap length, from which the necessary gap correction may be deduced. If this correction exceeds 5 db, the head is unsuitable for this measurement.

   Since the measurement must take place at a very short recorded wavelength, a high coercivity tape should be used, and a certain amount of pre-emphasis will be found useful. In order to avoid making the measurements at an unnecessarily high frequency, the lowest tape speed available should be used.

2. The tape with the gliding tone is reproduced at two different speeds and the output curves compared. If the curve can be brought to coincidence by displacing one frequency scale so that equal wavelengths coincide it may be assumed that frequency-dependent losses are negligible. If not, these losses may be deduced from the two curves mentioned or, alternatively, from a measurement with an inducing loop.

3. The frequency response of the reproducing amplifier is now adjusted to consist of the sum of the following:

   (a) Compensation for the gap loss noted in (1) above.

   (b) Any compensation for the frequency-dependent losses noted in (2) that may be required.

   (c) The response curve specified for a Standard Reproducing System with an "ideal" reproducing head and shown in Figure 6.

4. The recording equalization is then adjusted so that a flat overall response is obtained.

Standardization by the "Long Gap" Magnetic Head

Using the "Long Gap" Method a recording equipment is set to the standard condition in the following way:

1. The reproducing head used has a well defined gap long enough to give successive maxima of response at intervals of 1 kc/s or less in the audio frequency range. (With a tape speed of 30 in/sec the gap length required would be about 800 microns.) If the successive minima in the response curve are not equally well defined, the head is not suitable for this measurement.

   A short preliminary experiment is carried out to determine the exact frequencies at which the successive maxima occur at the standard tape speed.

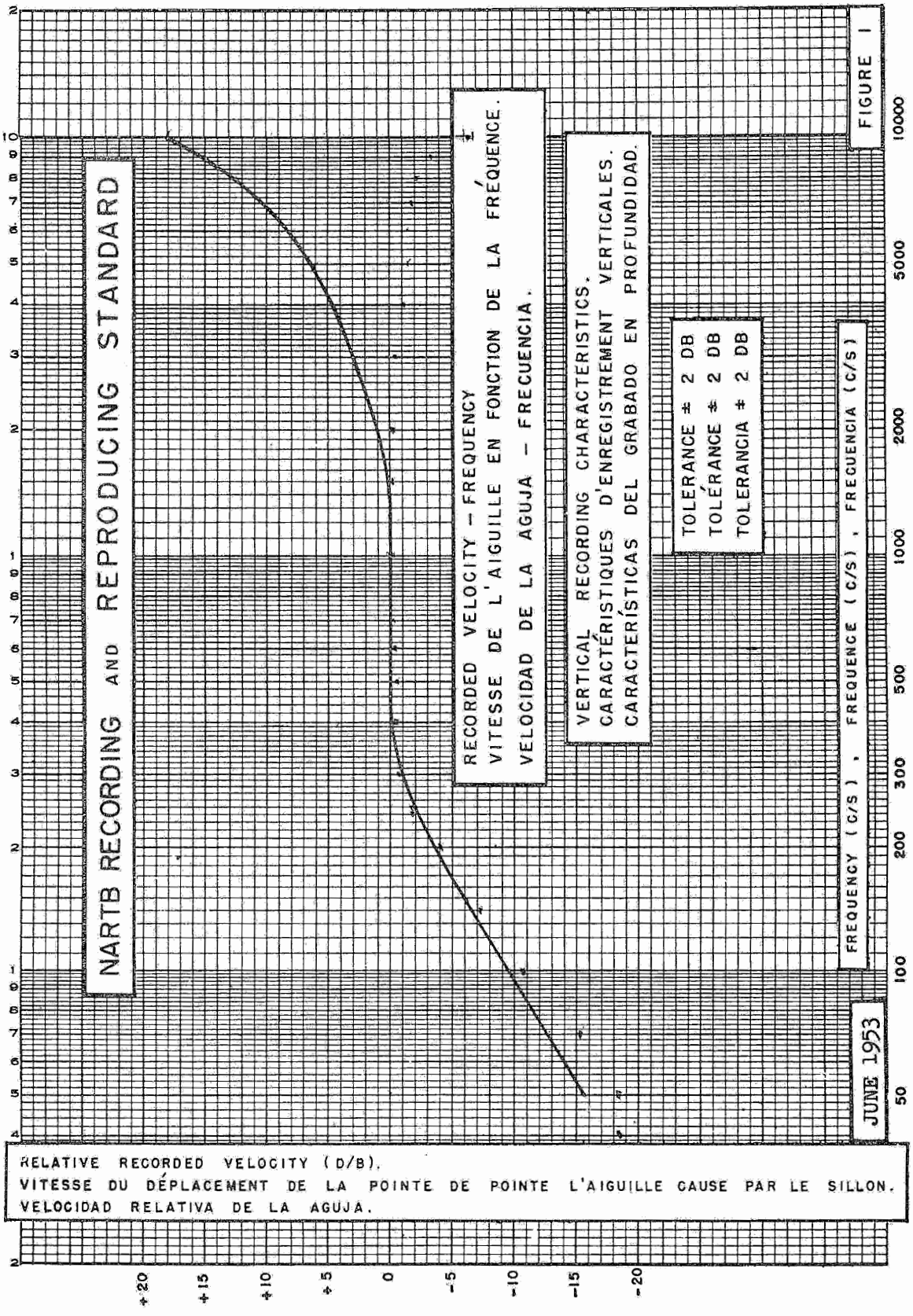
2. A "gliding tone" test tape of the audio frequencies of maximum level is then recorded with constant voltage input to the recording chain and the tape is reproduced using the long gap head. The open circuit voltage of the head around these frequencies is then plotted against frequency, and a smooth curve is drawn through the successive maxima.

3. The tape with the gliding tone is reproduced at two different speeds using the long gap head and the output curves compared. If the curves can be brought to coincide by displacing one frequency scale so that equal wavelengths coincide it may be assumed that frequency-dependent losses are negligible. If not, these losses may be deduced from the two curves mentioned or, alternatively, from a measurement with an inducing loop.

4. When the curve drawn in (2) has been corrected by a 6 db/octave rise with increase in frequency, together with the compensation for frequency-dependent losses and a correction of 1 to 2 db/octave falling with increase of frequency, the result defines the surface induction of the tape.

5. The equalization of the recording amplifier is now altered to obtain a characteristic of surface induction vs. frequency that is the inverse of the equalization specified for the reproducing system (without allowance for the reproducing head losses).

6. The reproducing amplifier equalization is then adjusted so that a flat overall response is obtained when using a normal reproducing head.


NARTB RECORDING AND REPRODUCING STANDARD
RECORDED VELOCITY – FREQUENCY
VITESSE DE L'AIGUILLE EN FONCTION DE LA FRÉQUENCE.
VELOCIDAD DE LA AGUJA – FRECUENCIA.
VERTICAL RECORDING CHARACTERISTICS.
CARACTÉRISTIQUES D'ENREGISTREMENT VERTICALES.
CARACTERÍSTICAS DEL GRABADO EN PROFUNDIDAD.
TOLÉRANCE ± 2 DB
TOLÉRANCE ± 2 DB
TOLERANCIA ± 2 DB
FIGURE 1
FREQUENCY (C/S), FREQUENCE (C/S), FRECUENCIA (C/S)
JUNE 1953
RELATIVE RECORDED VELOCITY (D/B).
VITESSE DU DÉPLACEMENT DE LA POINTE DE POINTE L'AIGUILLE CAUSE PAR LE SILLON.
VELOCIDAD RELATIVA DE LA AGUJA.
+20
+15
+10
+5
0
-5
-10
-15
-20
10000
5000
2000
1000
500
300
200
100
50

1-3-10

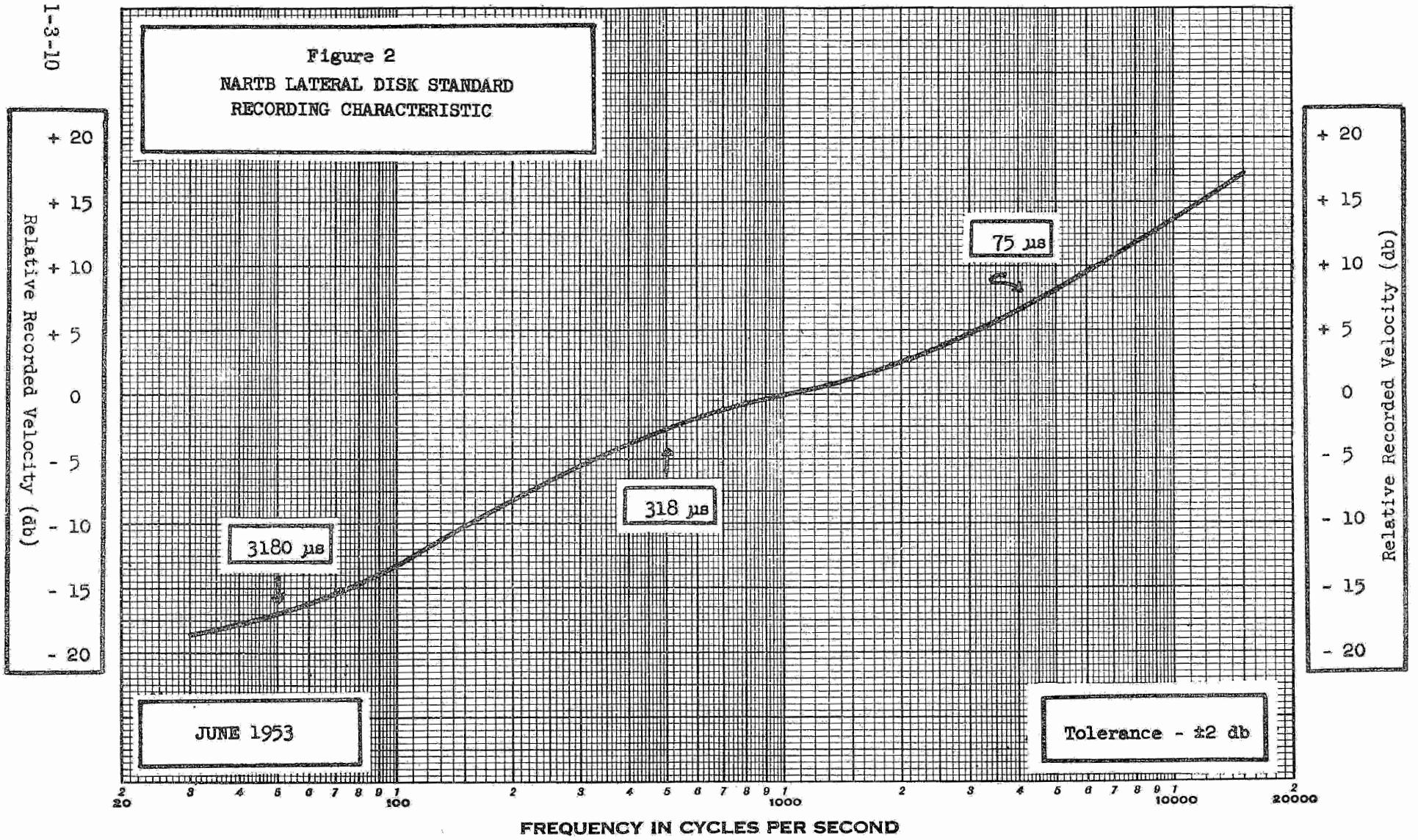
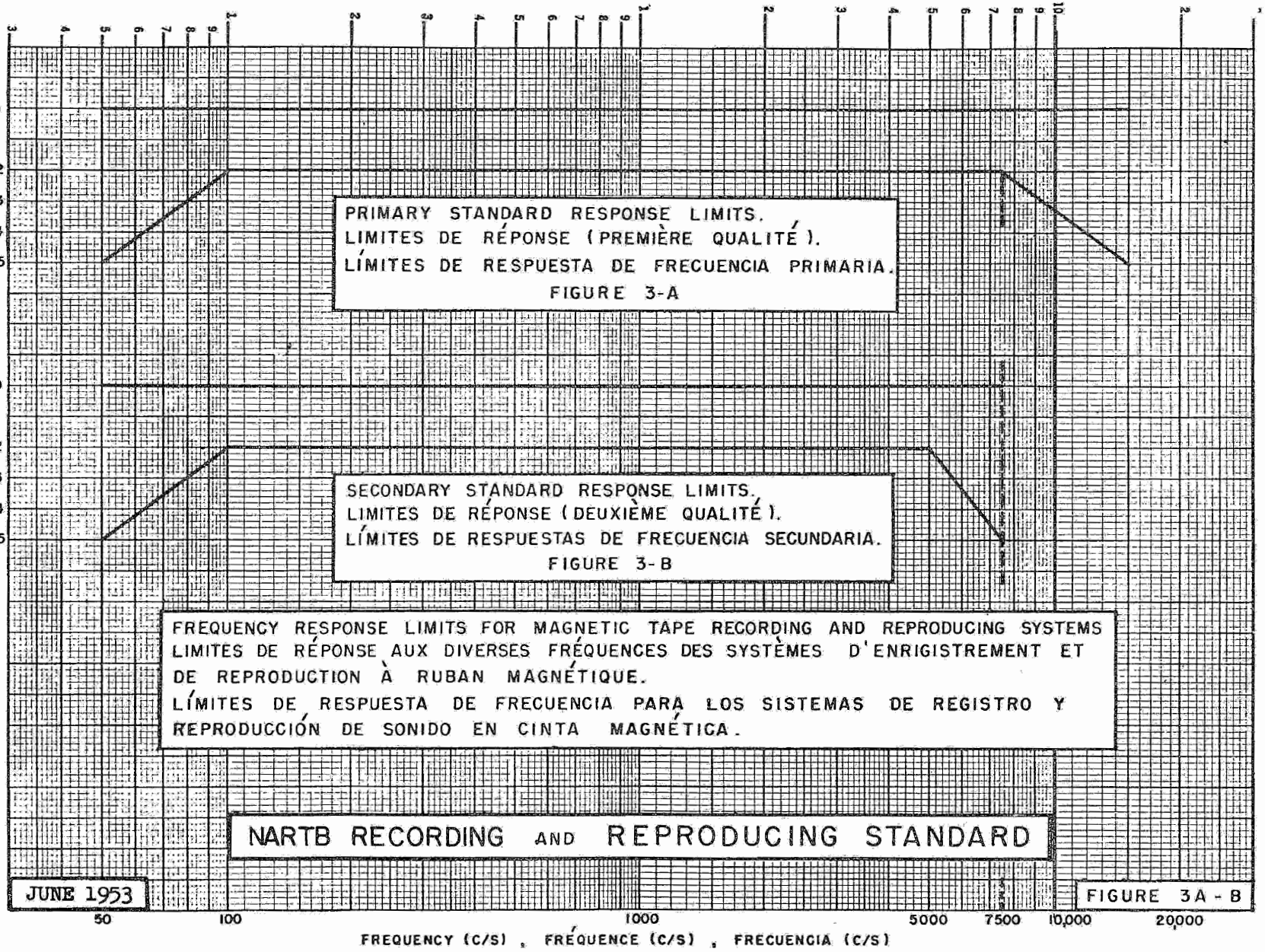
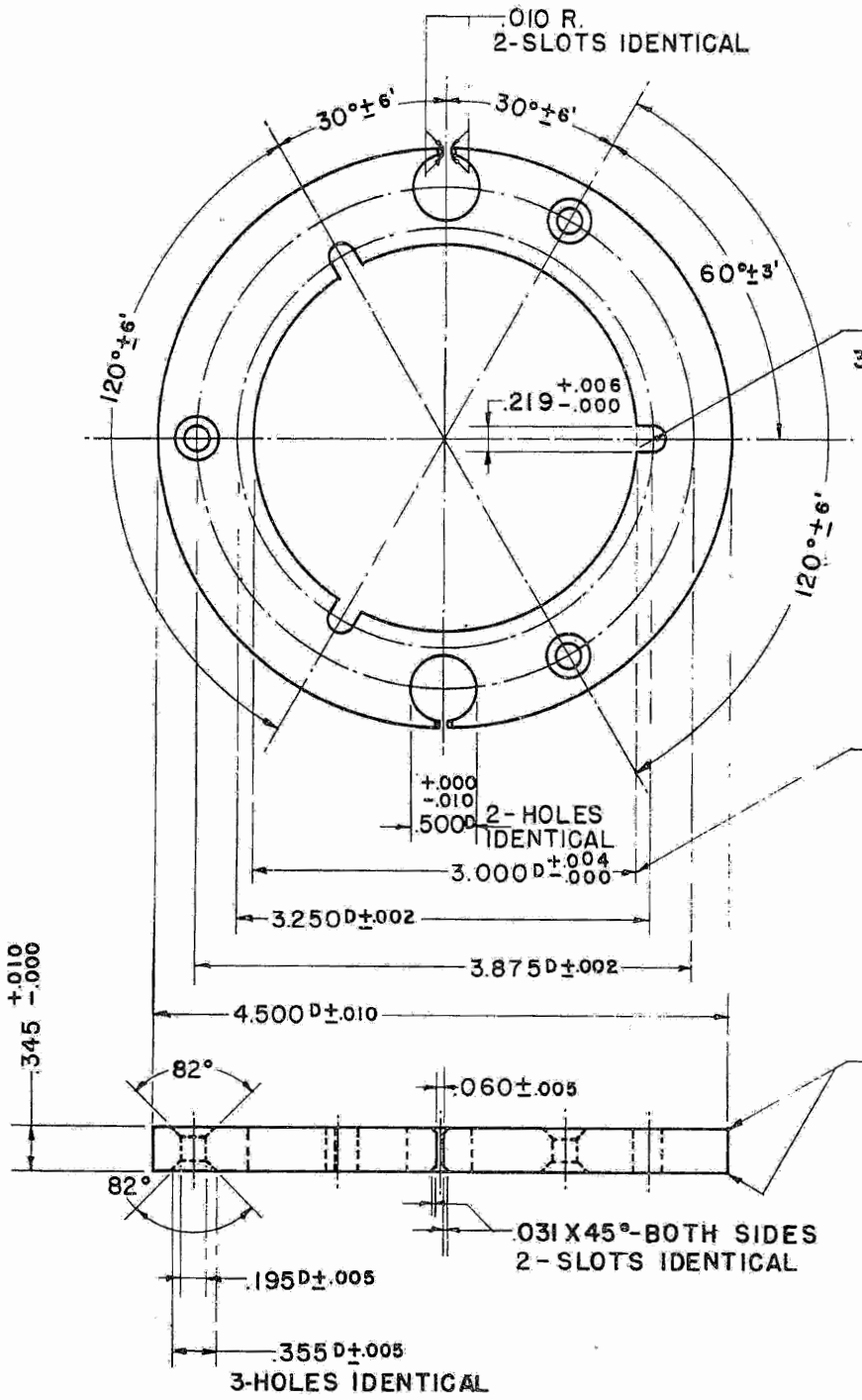


Figure 2
NARTB LATERAL DISK STANDARD
RECORDING CHARACTERISTIC
Relative Recorded Velocity (db)
+ 20
+ 15
+ 10
+ 5
0
- 5
- 10
- 15
- 20
3180 µs
318 µs
75 µs
JUNE 1953
Tolerance - ±2 db
20
100
1000
10000
20000
FREQUENCY IN CYCLES PER SECOND


PRIMARY STANDARD RESPONSE LIMITS.
LIMITES DE RÉPONSE (PREMIÈRE QUALITÉ).
LÍMITES DE RESPUESTA DE FRECUENCIA PRIMARIA.
FIGURE 3-A
SECONDARY STANDARD RESPONSE LIMITS.
LIMITES DE RÉPONSE (DEUXIÈME QUALITÉ).
LÍMITES DE RESPUESTAS DE FRECUENCIA SECUNDARIA.
FIGURE 3-B
FREQUENCY RESPONSE LIMITS FOR MAGNETIC TAPE RECORDING AND REPRODUCING SYSTEMS
LIMITES DE RÉPONSE AUX DIVERSES FRÉQUENCES DES SYSTÈMES D'ENRIGISTREMENT ET DE REPRODUCTION À RUBAN MAGNÉTIQUE.
LÍMITES DE RESPUESTA DE FRECUENCIA PARA LOS SISTEMAS DE REGISTRO Y REPRODUCCIÓN DE SONIDO EN CINTA MAGNÉTICA.
NARTB RECORDING AND REPRODUCING STANDARD
JUNE 1953
FIGURE 3A - B
RELATIVE LEVEL (DB), NIVEAU RELATIF (DB), NIVEL RELATIVO (DB)
0
-1
-2
-3
-4
-5
50
100
1000
5000
7500
10,000
20000
FREQUENCY (C/S), FRÉQUENCE (C/S), FRECUENCIA (C/S)

NARTB STANDARD
HUB FOR MAGNETIC TAPE REEL



NOTE: ALUMINUM OR AN EQUIVALENT WEIGHT MATERIAL SHALL BE USED.

NOTE: THE 3.875, 3.250, & 3.000 DIAMETERS TO BE CONCENTRIC WITHIN .005 TOTAL INDICATOR READING.

NOTE: THIS DIAMETER SHALL NOT CHANGE MORE THAN .004 WHEN BARE HUB IS WOUND WITH 2400 FEET OF .250 X .0022 TAPE AT CONSTANT TENSION OF 5.5 OZ.

NOTE: DIAMETERS MEASURED AT THESE TWO EDGES SHALL NOT DIFFER BY MORE THAN .002.

NOTE: EXCEPT AS OTHERWISE NOTED, ALL DIMENSIONS ARE IN INCHES.

EXCEPT AS NOTED; BREAK SHARP EDGES .004 R.

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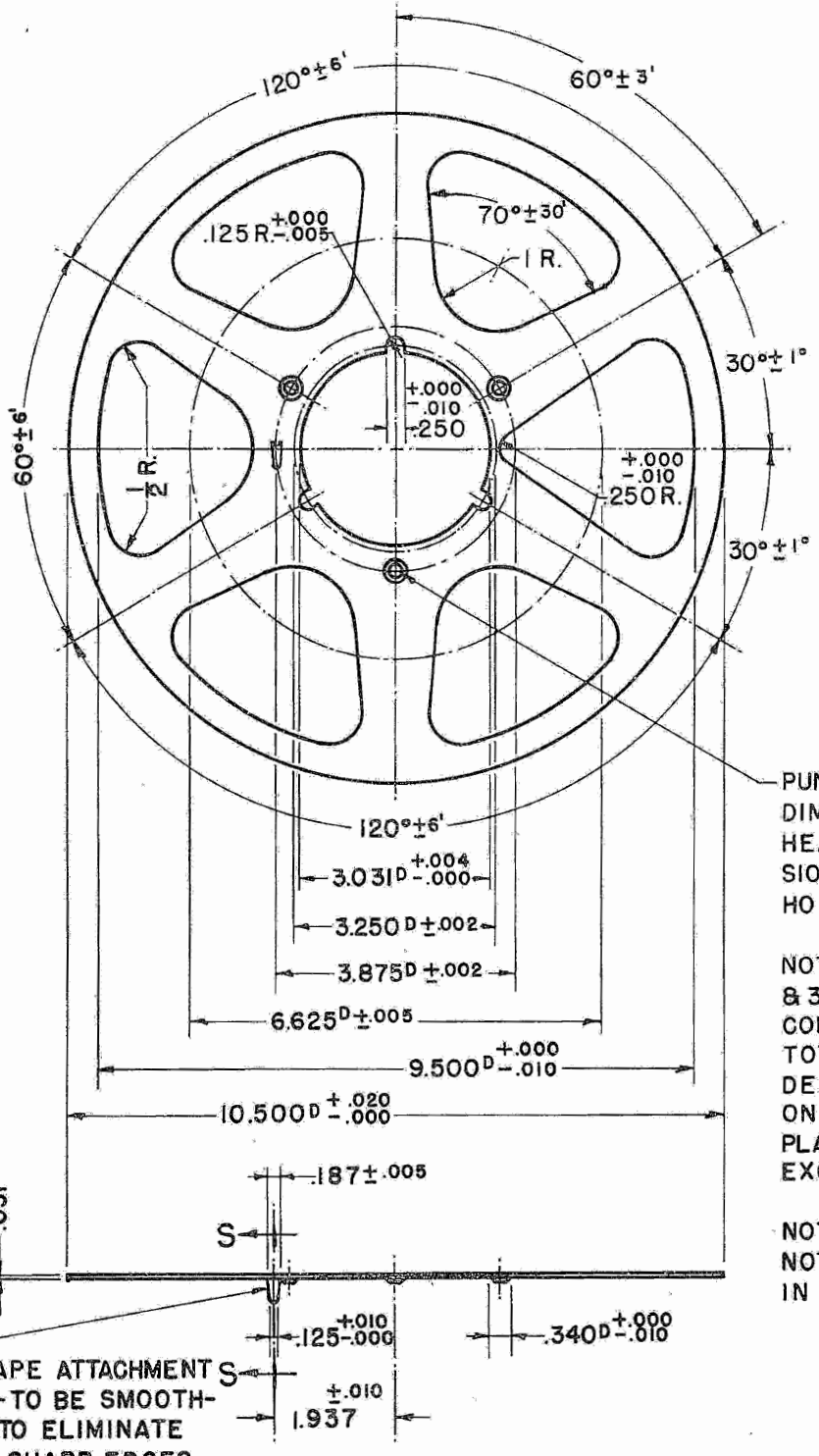
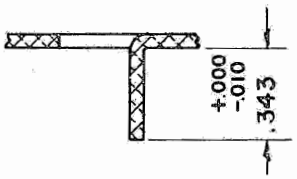
FIGURE 4

1-3-12

NARTB STANDARD
FLANGE FOR MAGNETIC TAPE REEL





SECTION S-S
ENLARGED

PUNCH (.190) DIAM. HOLE & DIMPLE FOR NO. 6-32 FLAT HEAD SCREW, SEE DIMENSION IN OTHER VIEW — 3 HOLES.

NOTE: THE 10.500, 3.875, 3250, & 3.031 DIAMETERS TO BE CONCENTRIC WITHIN ± .005 TOTAL INDICATOR READING. DEPARTURE OF ANY POINT ON FLANGE FROM AVERAGE PLANE OF FLANGE NOT TO EXCEED ± .010 .

NOTE: EXCEPT AS OTHERWISE NOTED, ALL DIMENSIONS ARE IN INCHES.

.051 STANDARD MILL FINISH ALUMINUM

FIGURE 5

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1-3-13

1-3-14

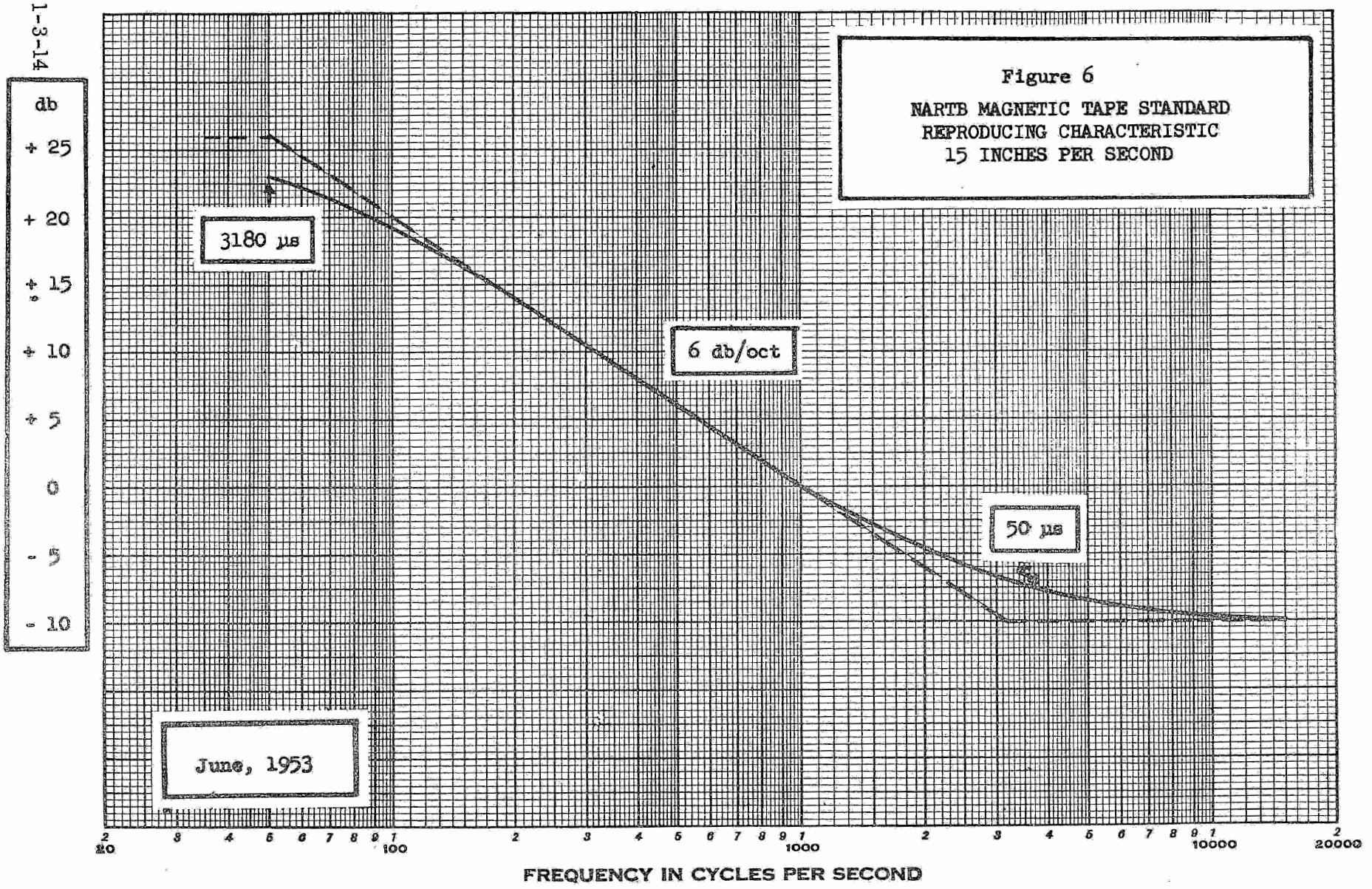
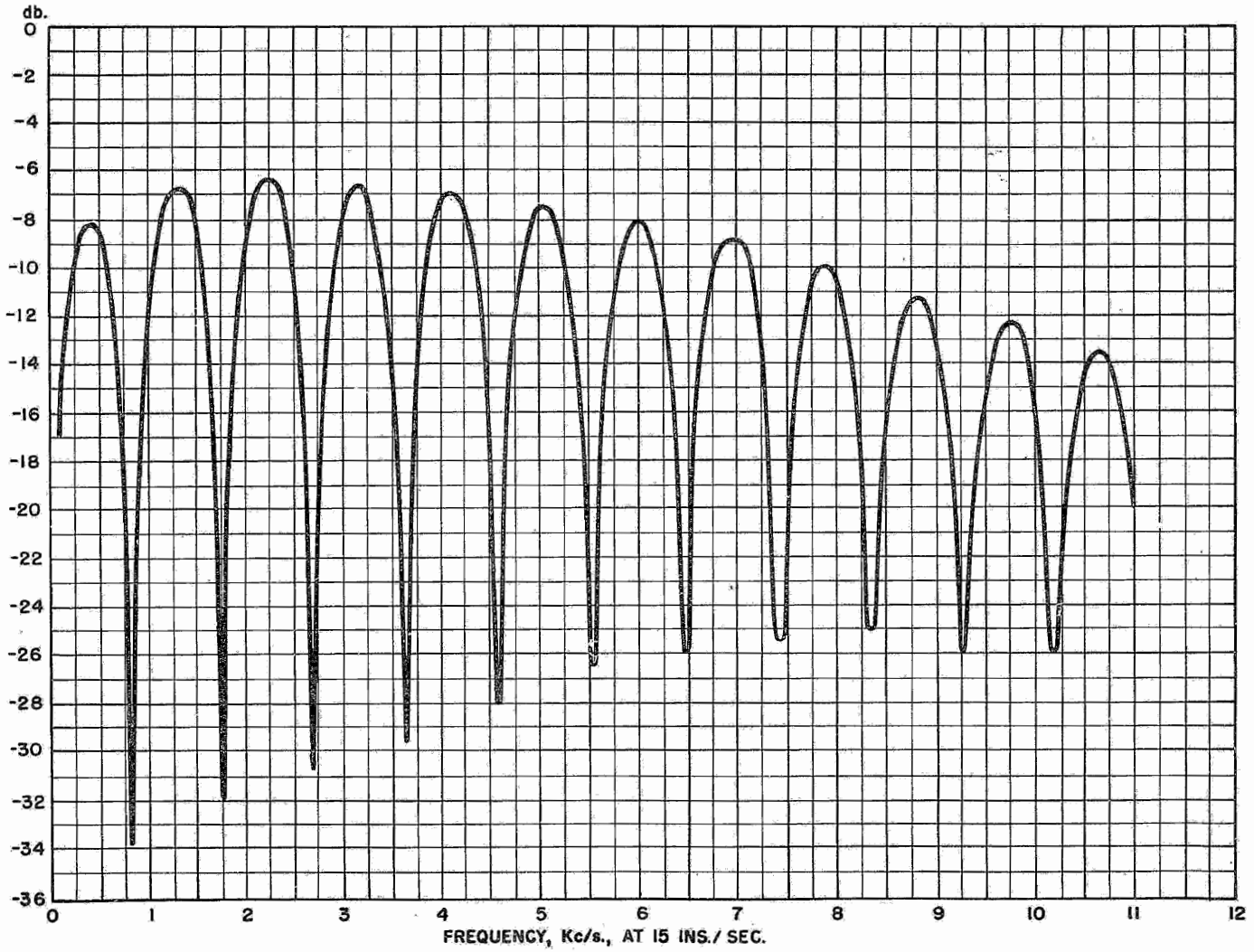


Figure 6

NARTB MAGNETIC TAPE STANDARD
REPRODUCING CHARACTERISTIC
15 INCHES PER SECOND

Figure 7

FREQUENCY CHARACTERISTIC STANDARDIZATION IN MAGNETIC RECORDING



Section 4

GLOSSARY OF MECHANICAL, MAGNETIC AND OPTICAL TERMS AND DEFINITIONS

4.005 Acetate Disks. Acetate disks are mechanical recording disks, either solid or laminated which are made mostly from cellulose nitrate lacquer plus a lubricant.

4.010 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 disk surface.

4.015 Aeolight. An aeolight is a glow lamp employing a cold cathode and a mixture of permanent gases in which the intensity of illumination varies with the applied signal voltage.

4.020 Background Noise. Background noise is the total system noise independent of whether or not a signal is present. The signal is not to be included as part of the noise.

4.025 Bilateral-Area Track. A bilateral-area track is a sound track having the two edges of the central area modulated according to the signal.

4.030 Binder. A binder is a resinous material which causes the various materials of a record compound to adhere to one another.

(Biscuit) -- See Preform (Biscuit)

4.035 Burnishing Surface. A burnishing surface, in mechanical recording, is the portion of the cutting stylus directly behind the cutting edge which smooths the groove.

(Cathode Sputtering) -- See Sputtering

(Cellulose Nitrate Disks) -- See Lacquer Disks

4.040 Chip. The chip, in mechanical recording, is the material removed from the recording medium by the recording stylus while cutting the groove.

(Christmas Tree Pattern) -- See Optical Pattern

(Coated Tape) -- See Magnetic Powder-Coated Tape

(Concentric Groove) -- See Groove, Locked

4.041 Compression Molding. Compression molding is molding a record or transcription by means of compressing a preform of plastic.

4.042 Cold Cutting Stylus. A cold cutting stylus is a stylus having its cutting edge burnished at a plane substantially different from the cutting face for the purpose of cutting and polishing the groove in an acetate disk at normal room temperature.

4.045 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.

4.050 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 the frequency.

4.052 Constant Velocity Recorder or Reproducer. Consists of a recording or reproducing machine designed so that the turntable rotates in such a manner that constant velocity is effected at the recording stylus or reproducer stylus irrespective of diameter.

4.055 Control Track. A control track is a supplementary sound track, usually placed on the same film with the sound track carrying the program material. Its purpose is to control, in some respect, the reproduction of the sound track. Ordinarily, it contains one or more tones, each of which may be modulated either as to amplitude or frequency.

4.060 Core. A core, in mechanical recording, is the center layer or basic support of certain types of laminated media.

(Crossover Frequency) -- See Transition Frequency

(Crosstalk) -- See Magnetic Printing

4.065 Crystal Cutter. A crystal cutter is a cutter in which the mechanical displacements of the recording stylus are derived from the deformations of a crystal having piezoelectric properties.

4.070 Cutter (Mechanical Recording Head). A cutter is an electromechanical transducer which transforms an electric input into a mechanical output, typified by mechanical motions which may be inscribed into a recording medium by a cutting stylus.

(De-Emphasis) -- See Postemphasis

4.075 Densitometer. A densitometer is an instrument for the measurement of optical density (photographic transmission, photographic reflection, visual transmission, etc.) of a material.

4.080 Disk Recorder. A disk recorder is a mechanical recorder in which the recording medium has the geometry of a disk.

(Drift) -- See Flutter

4.085 Drive Pin. A drive pin, in disk recording, is a pin similar to the center pin, but located to one side thereof, which is used to prevent a disk record from slipping on the turntable.

4.090 Drive-Pin Hole. A drive-pin hole, in disk recording, is a hole in a disk recording which accommodates the turntable drive pin.

4.095 Dubbing. Dubbing is a term used to describe the combining of two or more sources of sound into a complete recording, at least one of the sources being a recording. (See Re-Recording)

(Dynamic Reproducer) -- See Pickup, Moving Coil

(Eccentric Circle) -- See Groove, Eccentric

4.100 Eccentricity. Eccentricity, in disk recording, is the displacement of the center of the recording groove spiral, with respect to the record center hole.

4.105 Equalization (Corrective Equalization). Equalization is the effect of all corrective means employed in the recording and reproducing process to obtain a desired over-all frequency response.

4.106 Equalization (Diameter). Diameter equalization is the increasing of the high frequency response with respect to decreasing diameter of the recording.

4.110 Erasing Head. An erasing head is a device for obliterating any previous recordings. It may be used for preconditioning the magnetic media for recording purposes.

4.115 Erasing Head, A-C. An a-c erasing head is a magnetic head which uses alternating current to produce the magnetic field necessary for erasing.

NOTE: A-c erasing is achieved by subjecting the medium to a number of cycles of a magnetic field of a decreasing magnitude. The medium is, therefore, essentially magnetically neutralized.

4.120 Erasing Head, D-C. A d-c erasing head is a magnetic head which utilizes direct current to produce the magnetic field necessary for erasing.

NOTE: D-c erasing is achieved by subjecting the medium to a unidirectional field. Such a medium is, therefore, in a different magnetic state than one erased by a-c.

4.125 Erasing Head, P-M. A p-m erasing head uses the fields of one or more permanent magnets for erasing.

4.130 Fast Groove (Fast Spiral). A fast groove, in disk recording, is an unmodulated spiral groove having a pitch that is much greater than that of the recorded grooves.

4.132 Feed Back Cutter. A feed back cutter is an electromechanical transducer which performs the same as a "cutter" except that it is equipped with an auxiliary feed back coil in the magnetic field. Signals exciting the "cutter" are induced into the feed back coil which in turn is fed back to the input of the cutter amplifier resulting in a substantially uniform frequency response.

4.135 Filler. Filler, in mechanical recording, is the insert material of a record compound as distinguished from the binder.

4.140 Film Reproducer. A film reproducer is an instrument in which film is the medium from which a recording is reproduced.

NOTE: In many cases, the term "film reproducer" is erroneously used synonymously with optical sound reproducer.

4.145 Film Sound Recorder. A film sound recorder is equipment which uses film as the recording medium.

NOTE: In many cases, the term "film sound recorder" is erroneously used synonymously with optical sound recorder.

4.147 Flash. Flash is the excess material generated at the edge of a record or transcription after the molding is completed.

4.150 Flutter (WOW) (Drift). In recording and reproducing, flutter is the deviation of frequency which results in general from irregular motion during recording, duplication, or reproduction.

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 phonograph turntable. The term "drift" usually refers to a random rate close to zero cycles per second.

4.155 Flutter Rate. Flutter rate is the number of cyclical variations per second of the flutter.

(Frequency -- Crossover-Transition-Turnover) -- See Transition, Frequency

4.157 Forty-five Record. A "45 RPM" record is a record recorded and reproduced at 45 revolutions per minute having a center hole of 1.5 inches.

4.160 Frequency Record. A frequency record is a recording of various known frequencies at known amplitudes, usually for the purposes of testing or measuring.

4.165 Galvanometer Recorder (For Photographic Recording). A galvanometer recorder for photographic recording is a combination of mirror and coil suspended in a magnetic field. The application of a signal voltage to the coil causes a reflected light beam from the mirror to pass across a slit in front of a moving photographic film, thus providing a photographic record of the signal.

4.170 Gamma. The gamma of a photographic material is the slope of the straight line portion of the H and D curve. It represents the rate of change of photographic density with the logarithm of exposure. Gamma is a measure of the contrast properties of the film. Both gamma and density specifications are commonly used as controls in the processing of photographic film.

4.175 Gap Length. In longitudinal magnetic recording, the gap length is the physical distance between adjacent surfaces of the poles of a magnetic head. (See Magnetic Head)

NOTE: The effective gap length is usually greater than the physical length and can be experimentally determined in some cases.

4.180 Grain. A grain of photographic material is a small particle of metallic silver remaining in a photographic emulsion after development and fixing. In the agglomerate, these grains form the dark area of a photographic image.

4.185 Graininess. Graininess of a photographic material is the visible coarseness under specified conditions due to silver grains in a developed photographic film.

4.190 Groove. A groove, in mechanical recording, is the track inscribed in the record by the cutting or embossing stylus, including undulations or modulations caused by the vibration of the stylus.

4.195 Groove Angle. Groove angle, in disk recording, is the angle between the two walls of an unmodulated groove in a radial plane perpendicular to the surface of the recording medium.

4.200 Groove, Eccentric (Eccentric Circle). An eccentric groove, in disk recording, is an unmodulated locked groove whose center is other than that of the disk record (generally used in connection with mechanical control of phonographs).

4.205 Groove, Fast (Fast Spiral). A fast groove, in disk recording, is an unmodulated spiral groove having a pitch that is much greater than that of the recorded grooves.

4.210 Groove, Lead-In (Lead-In Spiral). A lead-in groove, in disk recording, is a blank spiral groove at the beginning of a record generally having a pitch that is much greater than that of the recorded grooves.

4.215 Groove, Lead-Over (Crossover Spiral). A lead-over groove, in disk recording, is a groove cut between recordings of small durations which enables the pickup stylus to travel from one cut to the next.

4.220 Groove, Lead-Out (Throw-Out Spiral). A lead-out groove, in disk recording, is a blank spiral groove at the end of a recording generally of a pitch that is much greater than that of the recorded grooves and which is connected to either the locked or eccentric groove.

4.225 Groove, Locked (Concentric Groove). A locked groove, in disk recording, is a blank and continuous groove at the end of modulated grooves whose function is to prevent further travel of the pickup.

4.230 Groove Shape. Groove shape, in disk recording, is the contour of the groove in a radial plane perpendicular to the surface of the recording medium.

4.235 Groove Speed. Groove speed, in disk recording, is the linear speed of the groove with respect to the stylus.

4.240 Groove, Unmodulated. An unmodulated groove, in mechanical recording, is a groove made in the medium with no signal applied to the cutter.

4.245 Ground Noise. Ground noise is the residual system noise in the absence of the signal. It is usually caused by inhomogeneity in the recording and reproducing media, but may also include amplifier noise such as tube noise or noise generated in resistive elements in the input of the reproducer amplifier system.

4.250 Grouping. Grouping is nonuniform spacing between the grooves of a disk recording.

4.255 Guard Circle. A guard circle is an inner concentric groove inscribed, on disk records, to prevent the pickup from being damaged by being thrown to the center of the record.

4.260 H and D Curve (Hurter and Driffield Curve). An H and D Curve is a characteristic curve of a photographic emulsion which is a plot of density against the logarithm of exposure. It is used for the control of photographic processing, and for defining the response characteristics to light of photographic emulsions.

(Impregnated Tape) -- See Magnetic Powder-Impregnated Tape.

4.262 Injection Molding. Injection molding is the process of molding a record or transcription by means of injecting into a die cavity a plastic liquified by heat.

4.265 Instantaneous Recording. An instantaneous recording is a recording which is intended for direct reproduction without further processing.

4.270 Lacquer Disks (Cellulose Nitrate Disks). Lacquer disks are mechanical recording disks usually made of metal, glass, or paper, and coated with a lacquer compound (often containing cellulose nitrate).

4.275 Lacquer Original (Lacquer Master*). A lacquer original is an original recording on a lacquer surface for the purpose of making a master.

4.280 Lacquer Recording. A lacquer recording is any recording made on a lacquer recording medium.

4.285 Laminated Record. A laminated record is a mechanical recording medium composed of several layers of material. Normally, it is made with a thin face of surface material on each side of a core.

4.290 Land. The land is the record surface between two adjacent grooves of a mechanical recording.

4.295 Lateral Recording. A lateral recording is a mechanical recording in which the groove modulation is perpendicular to the motion of the recording medium and parallel to the surface of the recording medium.

4.300 Light Modulator. A light modulator is the combination of a source of light, an appropriate optical system, and a means for varying the resulting light beam, so that a sound track may be produced (such as a galvanometer or light valve).

4.305 Light Valve. A light valve is a device in which the light passes through one or more slits, the width of which changes in accordance with the signal supplied.

4.307 Long-playing. Long-playing refers to a transcription or record having substantially longer playing time by reason of more lines per inch.

4.310 Magnetic Biasing. Magnetic biasing is the simultaneous conditioning of the magnetic recording medium during recording by superposing an additional magnetic field upon the signal magnetic field.

NOTE: In general, magnetic biasing is used to obtain a substantially linear relationship between the amplitude of the signal and the remanent flux density in the recording medium.

4.315 Magnetic Biasing, A-C. A-c magnetic biasing is magnetic biasing accomplished by the use of an alternating current, usually well above the signal frequency range.

4.320 Magnetic Biasing, D-C. D-c magnetic biasing is magnetic biasing accomplished by the use of direct current.

4.325 Magnetic Cutter. A magnetic cutter is a cutter in which the mechanical displacements of the recording stylus are produced by the action of magnetic fields.

4.330 Magnetic Head. In magnetic recording, a magnetic head is a transducer for converting electric variations into magnetic variations for storage on magnetic media, for reconverting energy so stored into electric energy, or for erasing such stored energy.

* Deprecated.

4.335 Magnetic Head, Double Pole-Piece. A double pole-piece magnetic head is a magnetic head having two separate pole pieces in which pole faces of opposite polarity contact the medium on opposite sides. Either both or only one of these pole pieces may be provided with an energizing winding.

4.340 Magnetic Head, Single Pole-Piece. A single pole-piece magnetic head is a magnetic head having a single pole piece which contacts the recording medium on one side.

4.345 Magnetic Plated Wire. Magnetic plated wire is a magnetic wire having a core of nonmagnetic material and a plated surface of ferromagnetic material.

4.350 Magnetic Powder-Coated Tape (Coated Tape). Magnetic powder-coated tape is a tape consisting of a coating of uniformly dispersed, powdered ferromagnetic material on a nonmagnetic base.

4.355 Magnetic Powder-Impregnated Tape (Impregnated Tape) (Dispersed Magnetic Powder Tape). Magnetic powder-impregnated tape is a magnetic tape which consists of magnetic particles uniformly dispersed in a nonmagnetic material.

4.360 Magnetic Printing (Crosstalk*). Magnetic printing is the permanent transfer of a recorded signal from a section of a magnetic recording medium to another section of the same or a different medium when these sections are brought in proximity.

4.365 Magnetic Recorder. A magnetic recorder is equipment incorporating an electromagnetic transducer and means for moving a ferromagnetic recording medium relative to the transducer for recording electric signals as magnetic variations in the medium.

NOTE: The generic term "magnetic recorder" can also be applied to an instrument which has not only facilities for recording electric signals as magnetic variations, but also for converting such magnetic variations back into electric variations.

4.370 Magnetic Recording Head. In magnetic recording, a magnetic recording head is a magnetic head for transforming electric variations into magnetic variations for storage on magnetic media.

4.375 Magnetic Recording Medium. A magnetic recording medium is a magnetizable material used in a magnetic recorder for retaining the magnetic variations imparted during the recording process. It may have the form of a wire, tape, cylinder, disk, etc.

4.380 Magnetic Recording Reproducer. A magnetic recording reproducer is equipment for converting magnetic variations on magnetic recording media into electric variations.

4.385 Magnetic Reproducing Head. In magnetic recording, a magnetic reproducing head is a magnetic head for converting magnetic variations on magnetic media into electric variations.

4.390 Magnetic Tape. Magnetic tape is a magnetic recording medium having a width greater than approximately 10 times the thickness. This tape may be homogeneous or coated.

4.395 Magnetic Wire. Magnetic wire is a magnetic recording medium, approximately circular in cross section.

4.400 Magnetization, Longitudinal. Longitudinal magnetization in magnetic recording is magnetization of the recording medium in a direction essentially parallel to the line of travel.

4.405 Magnetization, Perpendicular. Perpendicular magnetization in magnetic recording is magnetization of the recording medium in a direction perpendicular to the line of travel, and parallel to the smallest cross-sectional dimension of the medium.

NOTE: In this type of magnetization, either single pole-piece or double pole-piece magnetic heads may be used.

4.410 Magnetization, Transverse. Transverse magnetization in magnetic recording is magnetization of the recording medium in a direction perpendicular to the line of travel and parallel to the greatest cross-sectional dimension.

4.415 Master. A master is a metal part, normally derived from a disk recording by electroforming, which is a negative of the recording, i.e., a master which has ridges instead of grooves and thus cannot be played with a pointed stylus.

(Master, Lacquer) -- See Lacquer Original

(Master, Metal) -- See Master, Original

4.420 Master No. 2, No. 3, Etc. A No. 2, No. 3 master, etc. is a master produced by electroforming from a No. 1, No. 2, etc. mold.

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* Deprecated.

4.425 Master, Original (Metal Master) (Metal Negative) (No. 1 Master). An original master, in disk recording, is the master produced by electroforming from the face of a wax or lacquer recording.

4.430 Mechanical Recorder. A mechanical recorder is an equipment for transforming electric or acoustical signals into mechanical motion of approximately like form and inscribing such motion in an appropriate medium by cutting or embossing.

(Mechanical Recording Head) -- See Cutter

(Mechanical Reproducer) -- See Pickup

(Metal Master) (Metal Negative) -- See Master, Original

(Metal Positive) -- See Mold, No. 1.

4.432 Micro-groove. Micro-groove refers to a transcription or record having substantially longer playing time by reason of more lines per inch.

4.433 Mini-groove. Mini-groove is a recording having more lines per inch than the average 78 RPM phonograph record and yet not enough lines per inch to be called "Extended play," "Long playing" or "Micro-groove."

4.435 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.

NOTE: The term is also sometimes applied to the operator of the above device.

4.440 Modulation Noise. (Noise Behind the Signal). The modulation noise is the noise caused by the signal. The signal is not to be included as part of the noise.

NOTE: The term is used where the noise level is a function of the strength of the signal.

4.445 Mold. In disk recording, a mold is a metal part derived from a master by electroforming which is a positive of the recording, i.e., it has grooves similar to a recording and thus can be played in a manner similar to a record.

4.450 Mold, No. 1 (Mother) (Metal Positive). A No. 1 mold is a mold derived by electroforming from the original master.

4.455 Mold, No. 2, No. 3, Etc. A No. 2, No. 3, etc. mold is a mold derived by electroforming from a No. 2, No. 3, etc. master.

(Mother) -- See Mold, No. 1

4.460 Multitrack Magnetic Recording System. A multitrack magnetic recording system is a recording system which provides, on a medium such as magnetic tape, two or more recording paths which are parallel to each other, and which may carry either related or unrelated program material in common time relationship.

(Needle Drag) -- See Stylus Drag

(Needle Force) -- See Stylus Force

(Noise Behind the Signal) -- See Modulation Noise

4.465 Noise Reduction. Noise reduction is a process whereby the average transmission of the sound track of the print (averaged across the track) is decreased for signals of low level and increased for signals of high level.

NOTE: Since the background noise introduced by the sound track is less at low transmission, this process reduces film noise during soft passages. The effect is normally accomplished automatically.

4.470 Offset Angle. In lateral disk recording reproduction, the offset angle is the smaller of the two angles between the projections into the plane of the disk of the vibration axis of the pickup stylus and the line connecting the vertical pivot (assuming a horizontal disk) of the pickup arm with the stylus point.

4.475 Opacity. Opacity of an optical path is the reciprocal of transmission. (See Transmission)

(Optical Density) -- See Transmission Density

4.480 Optical Pattern (Christmas Tree Pattern). In mechanical recording, an optical pattern is a pattern which is observed when the surface of a record is illuminated by a light beam.

4.485 Optical Sound Recorder (Photographic Sound Recorder). An optical sound recorder is equipment incorporating a light modulator and means for moving a light-sensitive medium relative to the modulator for recording electric signals derived from sound signals.

4.490 Optical Sound Reproducer. An optical sound reproducer is a combination of light source, optical

system, photoelectrical cell, and a mechanism for moving a photoelectric medium (usually film), by means of which recorded variations on a sound track may be converted into electric signals of approximately like form.

4.495 Overcutting. In disk recording, overcutting is the effect of excessive level characterized by one groove cutting through into an adjacent one.

4.500 Photographic Emulsion. Photographic emulsion is the light-sensitive coating on photographic film consisting usually of a gelatine containing silver halide.

4.505 Pickup, Acoustical. An acoustical pickup is a device which transforms groove modulations directly into acoustical radiation.

4.510 Pickup Arm (Tone Arm). A pickup arm is a pivoted arm arranged to hold a pickup.

4.515 Pickup, Capacitor. A capacitor pickup is a reproducer which depends for its operation upon the variation of its electrical capacitance.

4.520 Pickup Cartridge. A pickup cartridge is the removable portion of a pickup containing the electromechanical translating elements and the reproducing stylus.

4.525 Pickup, Crystal. A crystal pickup is a reproducer which depends for its operation on the piezoelectric effect of crystals.

4.530 Pickup, Light-Beam. A light-beam pickup is a reproducer in which a light beam is a coupling element of the transducer.

4.535 Pickup, Magnetic (Variable-Reluctance Pickup). A magnetic pickup is a reproducer which depends for its operation on the variations in the reluctance of a magnetic circuit.

4.540 Pickup (Mechanical Reproducer). A pickup is a mechanoelectrical transducer which is actuated by modulations present in the groove of the recording medium and which transforms this mechanical input into an electric output.

4.545 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.

4.550 Pickup, Variable-Inductance. A variable-inductance pickup is a reproducer which depends for its operation on the variation of its inductance.

4.555 Pickup, Variable-Resistance. A variable-resistance pickup is a reproducer which depends for its operation upon the variation of a resistance.

4.560 Pinch Effect. In disk 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 of the groove angle cut by the recording stylus when it is moving across the record as it swings from a negative to a positive peak.

4.565 Playback. A playback is an expression used to denote reproduction of a recording.

(Playback Loss) -- See Translation Loss

4.570 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.

4.575 Post-emphasis (De-emphasis) (Post Equalization). Post-emphasis is usually a form of equalization complementary to pre-emphasis.

4.580 Pre-emphasis (Pre-equalization). In recording, pre-emphasis is an arbitrary change in the frequency response of a recording system from its basic response (such as constant velocity or amplitude) for the purpose of improvement in signal-to-noise ratio, or the reduction of distortion.

4.585 Preform (Biscuit*). In disk recording, a preform is a small slab of record stock material as it is prepared for use in the record presses.

4.590 Pressing. In disk recording, a pressing is a record produced in a record-molding press from a master or stamper.

4.595 Recording Channel. The term "recording channel" refers to one of a number of independent recorders in a recording system or to independent recording tracks on a recording medium.

NOTE: One or more channels may be used at the same time for covering different ranges of the transmitted frequency band, for multichannel recording, or for control purposes.

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* Deprecated.

4.600 Recording Loss. Recording loss, mechanical recording, is the loss in recording level whereby the amplitude of the wave in the recorded medium differs from the amplitude executed by the recording stylus.

4.605 Re-recording. Re-recording is the process of making a recording by reproducing a recorded sound source and recording this reproduction. (See Dubbing)

4.610 Re-recording System. A re-recording system is an association of reproducers, mixers, amplifiers, and recorders capable of being used for combining or modifying various sound recordings to provide a final sound record. Recording of speech, music, and sound effects may be so combined.

4.615 Ring Head. A ring head is a magnetic head in which the magnetic material forms an enclosure with one or more air gaps. The magnetic recording medium bridges one of these gaps and is contacted by the pole pieces on one side only.

4.620 Rumble (Turntable Rumble). Rumble is low-frequency vibration mechanically transmitted to the recording or reproducing turntable and super-imposed on the reproduction.

4.625 Scoring System. A scoring system for motion picture production is a recording system used for recording music to be reproduced in timed relationship with a motion picture.

4.630 Sensitometry. Sensitometry is the measurement of the light response characteristics of photographic film under specified conditions of exposure and development.

4.635 Shaving. In mechanical recording, shaving is the process of removing material from the surface of a recording medium for the purpose of obtaining a new recording surface.

4.640 Side Thrust. Side thrust, in disk recording, is the radial component of force on a pickup arm caused by the stylus drag.

4.645 Single Track (Standard Track). A single track is a variable-density or variable-area sound track in which both positive and negative halves of the signal are linearly recorded.

4.650 Sound Recording System. A sound recording system is a combination of transducing devices and associated equipment suitable for storing sound in a form capable of subsequent reproduction.

4.655 Sound Reproducing System. A sound reproducing system is a combination of transducing devices and associated equipment for reproducing recorded sound.

4.660 Sound Track. A sound track is a narrow band, usually along the margin of a sound film, which carries the sound record. In some cases, a plurality of such bands may be used.

4.665 Sound Track, Multiple. A multiple sound track consists of a group of sound tracks, printed adjacently on a common base, independent in character but in a common time relationship, e.g., two or more have been used for stereophonic sound recording.

4.670 Sound Track, Push-Pull, Class A. A class-A push-pull sound track consists of two single tracks, side by side, the transmission of one being 180 degrees out of phase with the transmission of the other. Both positive and negative halves of the sound wave are linearly recorded on each of the two tracks.

4.675 Sound Track, Push-Pull, Class-B. A class-B push-pull sound track consists of two tracks, side by side, one of which carries the positive half of the signal only, and the other the negative half. During the inoperative half-cycle each track transmits little or no light.

(Spiral, Crossover) -- See Groove, Leadover

(Spiral, Fast) -- See Groove, Fast

(Spiral, Lead-In) -- See Groove, Lead-In

(Spiral, Throw-Out) -- See Groove, Throw-Out

4.677 Silvering. Silvering is a process wherein the surface of the original recorded master is metallized by precipitating on to this surface, the metallic silver in ammoniated silver nitrate.

4.678 Silver Spraying. Silver spraying is metallizing the surface of the original recorded master using a dual spray nozzle wherein the ammoniated silver nitrate and reducer are combined in anatomized spray to precipitate the metallic silver.

4.680 Sputtering (Cathode Sputtering). Sputtering is a process sometimes used in the production of the metal master wherein the original is coated with an electric conducting layer by means of an electric discharge in a vacuum.

NOTE: This is done prior to electroplating a heavier deposit.

4.685 Squeeze Track. A squeeze track is a variable-density sound track wherein, by means of adjustable masking, the width is varied by the recording operator, thus providing an overriding control on the amplitude of the reproduced signal.

4.690 Stamper. A stamper is a negative (generally made of metal by electro-forming) from which finished pressings are molded.

4.695 Stamper, Backed. A backed stamper is a thin metal stamper which is attached to a backing material, generally a metal disk of desired thickness.

(Standard Track) – See Single Track

4.700 Stylus, Cutting. A cutting stylus is a recording stylus with a sharpened tip which, by removing material, cuts a groove into the recording medium.

4.705 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.

4.710 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.

4.715 Stylus Force (Static Stylus Force) (Vertical Stylus Force) (Needle Force) (Stylus Pressure*). The stylus force is the vertical force exerted on a stationary recording medium by the stylus when in its operating position.

4.720 Stylus, Recording. A recording stylus is a tool which inscribes the grooves into the recording medium. There is the unmounted type used by cementing to the mounting; mounted, affixed to a metal shank and held in place by a set screw; morse taper which is held in place by friction. The latter two methods are necessary for "hot stylus" technique.

4.725 Stylus, Reproducing. A reproducing stylus is a mechanical element adapted to following the modulations of a record groove and transmitting the mechanical motion thus derived to the pickup mechanism.

NOTE: Stylus is a term defining a pickup needle or a holder furnished with a jewel or other abrasive-resistant tip. A stylus may or may not be arranged for convenient replacement.

4.730 Surface Noise. In mechanical recording surface noise is the noise component in the electric output of a pickup due to irregularities in the contact surface of groove. (See Ground Noise)

(Throw-Out Spiral) – See Groove, Lead-Out

4.735 Toe and Shoulder (of an H and D Curve). Toe and shoulder are the terms applied to the nonlinear portions of the H and D curve which lie respectively below and above the straight portion of this curve.

(Tone Arm) – See Pickup Arm

4.740 Tracing Distortion. Tracing distortion is the nonlinear distortion introduced in the reproduction of mechanical recording because the curve traced by the motion of the reproducing stylus is not an exact replica of the modulated groove. 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.

4.745 Tracking Error. Tracking error, in lateral mechanical recording, is the angle between the vibration axis of the mechanical system of the pickup and a plane containing the tangent to the unmodulated record groove and being perpendicular to the surface of the recording medium at the point of needle contact.

4.750 Transition Frequency (Crossover Frequency) (Turnover Frequency). The transition frequency, of a disk recording system, is the frequency corresponding to the point of intersection of the asymptotes to the constant amplitude and the constant velocity portions of its frequency response curve. This curve is plotted with output voltage ratio in decibels as the ordinate and the logarithm of the frequency as the abscissa.

4.755 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.

4.760 Transmission. Transmission, as applied to optical recording, is the ratio of the light flux transmitted by a medium to the light flux incident upon it. Transmission may be either diffuse or specular.

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* Deprecated.

4.765 Transmission Density, Diffuse.* Diffuse transmission density is the value of the photographic transmission density obtained when the light flux impinges normally on the sample and all the transmitted flux is collected and measured.

4.770 Transmission Density, Photographic* (Optical Density). Photographic transmission density is the common logarithm of opacity. Hence, film transmitting 100 percent of the light has a density of zero; transmitting 10 percent a density of 1, etc. Density may be diffused, specular, or intermediate. Conditions must be specified.

4.775 Transmission Density, Specular. Specular transmission density is the value of the photographic density obtained when the light flux impinges normally on the sample and only the normal component of the transmitted flux is collected and measured.

(Turnover Frequency) – See Transition Frequency

4.780 Unilateral-Area Track. A unilateral-area track is a sound track in which one edge only of the opaque area is modulated in accordance with the recorded signal. There may, however, be a second edge modulated by a noise reduction device.

4.782 Vacuum Chuck. A vacuum chuck is a chuck constructed with vacuum seals in such a manner that stampers may be held by vacuum for the purpose of machining.

* For details of measurement and specifications see American Standard Diffuse Transmission Density, Z38.2.5 – 1946, or the latest edition thereof approved by the American Standards Association.

4.785 Variable-Area Track. A variable-area track is a sound track divided laterally into opaque and transparent areas, a sharp line of demarcation between these areas forming an oscillographic trace of the wave shape of the recorded signal.

4.790 Variable-Density Track. A variable-density track is a sound track of constant width and of uniform light transmission on any instantaneous transverse axis and of which the average light transmission varies along the longitudinal axis in proportion to some characteristic of the applied signal.

4.795 Vertical Recording (Hill and Dale Recording). A vertical recording is a mechanical recording in which the groove modulation is in a direction perpendicular to the surface of the recording medium.

4.800 Wax. In mechanical recording, wax refers to a blend of waxes with metallic soaps. (See also Wax, Cake).

4.805 Wax, Cake. Cake wax is a thick disk of wax upon which an original mechanical disk recording may be inscribed.

4.810 Wax, Flowed. Flowed wax is a mechanical recording medium, in disk form, prepared by melting and flowing wax onto a metal base.

4.815 Wax Original (Wax Master*). A wax original is an original recording on a wax surface for the purpose of making a master.

(Wow) – See Flutter

* Deprecated.

American Recommended
Practice For

VOLUME MEASUREMENTS OF ELECTRICAL SPEECH AND PROGRAM WAVES*

(American Standards Association Approved November 6, 1942)

Sponsor Institute of Radio Engineers, Inc.

C16.5-1942

INTRODUCTION

Radio broadcasting, with its primary requirement of transmitting speech and program material over both wire and radio systems, has faced the problem of measuring these waves. Measurements made by different organizations with variously designed equipments have shown substantial discrepancies.

The instrument described in this recommended practice was developed specifically for broadcasting and the telephone plant which provides the interconnecting service among broadcast stations. It gives satisfactory correlation of measurements under normal conditions of operation and offers a ballistic performance which permits more rapid and accurate reading of deflection than was the case with previous types. The indicating instrument and the method of using it are covered in this document.

1. SECTIONAL COMMITTEE ON RADIO

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2. GENERAL

These standards apply to the methods of and a device for measuring the strength of audio-frequency electrical waves such as speech and program waves.

The measurement of the complex and non-periodic waves encountered in electrical communication cannot be expressed in simple fashion in the ordinary electrical terms of current, voltage, or power. The concept of "volume" furnishes a practical method of great utility to the communications engineer for assigning a numerical value to the strength of electrical speech and program waves.

Volumes are read by noting the more extreme deflections of a device known as a volume indicator. Since the response of such an instrument to the rapidly varying waves is greatly dependent upon the speed of its movement, its damping, and other characteristics, an effective standard for volume measurements must include a specification of these characteristics.

It has been the custom to express the readings of volume in terms of decibels above or below some one of a number of various arbitrary reference levels. This standard uses a new term "vu" to express volume in terms of decibels above or below a particular reference level which is a part of the standard.

3. DEFINITIONS

The definitions herein cover the use of the following terms as they apply specifically to the quantities and instruments used in this field.

3.1 VOLUME

This term applies to the strength of speech and program waves. It is the indication of a device known as a volume indicator, defined in 3.2, which has specific dynamic and other characteristics and which is calibrated and read in a prescribed manner.

3.2 VOLUME INDICATOR

This is the device used for the indication of volume. A standard volume indicator must have the characteristics described in Section 4.

3.3 VU (pronounced "vee-you" and customarily written with lower-case letters).

This word is used for the numerical expression of volume. The volume in vu is numerically equal to the relative strength of the waves in question in decibels above or below "reference volume" as defined in 3.4.

The term vu should not be used to express results of measurements of complex waves made with devices having characteristics differing from those of the standard volume indicator.

3.4 REFERENCE VOLUME

This is the base of the system of measurement of volume. Reference volume is that strength of electrical speech or program waves which gives a reading of 0 vu on a volume indicator whose characteristics and methods of reading are described herein, and which is calibrated to read 0 vu on a steady 1000-cycle-per-second wave whose power is I milliwatt in 600 ohms.

3.5 REFERENCE DEFLECTION

This is the deflection to the scale point at or near which the instrument is intended normally to be read.

4. VOLUME INDICATOR

Volume is measured by means of a volume indicator. This device must conform to the following specifications and must be used in the manner described below.

4.1 COMPONENT PARTS

A volume indicator consists of at least two parts:

(a) An indicating instrument
(b) An attenuator

4.2 DYNAMIC CHARACTERISTICS

If a single-frequency sinusoidal voltage between 35 and 10,000 cycles per second, of such amplitude as to give reference deflection under steady-state conditions is suddenly applied, the instrument pointer shall reach 99 per cent of reference deflection in 0.3 second, $\pm$ 10 per cent, and shall then overswing reference deflection by at least 1.0 per cent and not more than 1.5 per cent. The time required for the instrument pointer to reach its position of rest on the removal of the sinusoidal voltage shall not be greatly different from the time of response.

4.3 RESPONSE-VERSUS-FREQUENCY CHARACTERISTIC

The sensitivity of the volume indicator shall not depart from that at 1000 cycles per second by more than 0.2 decibel between 35 and 10,000 cycles per second nor more than 0.5 decibel between 25 and 16,000 cycles per second.

4.4 RESPONSE TO COMPLEX WAVES

The response to complex waves of such amplitude as to give reference deflection when read, as described in 4.9, shall be that equivalent to the response with a direct-current instrument and a rectifier, the exponent of whose characteristic is 1.2 ± 0.2.

4.5 REVERSIBILITY

The indication must be independent of the poling of the volume indicator when measuring unsymmetrical waves. Such characteristics can be obtained by the use of a direct-current instrument in conjunction with a full-wave rectifier.

4.6 GRADUATION OF INSTRUMENT SCALE

The point of reference deflection shall be definitely indicated in some suitable manner. The remainder of the scale shall be graduated in vu above and below reference deflection. (See also 5.4.)

4.7 ATTENUATOR

The attenuator normally is of an adjustable type and shall be marked in vu.

4.8 CALIBRATION

A correctly calibrated volume indicator with its attenuator set at zero vu will give reference deflection when connected to a source of single-frequency sinusoidal voltage adjusted to develop I milliwatt in a resistance of 600 ohms, or with the attenuator set at n when the calibrating power is n decibels above I milliwatt.

4.9 METHOD OF READING VOLUME INDICATOR

The reading is determined by the greatest deflections occurring in a period of about a minute for program waves, or a shorter period (e.g., 5 to 10 seconds) for message telephone speech waves, excluding not more than one or two occasional deflections of unusual amplitude.

The volume indicator is usually connected across the circuit at a point where the impedance is 600 ohms and the attenuator is adjusted until the deflections, read as described above, just reach the scale point corresponding to reference deflection. The volume in vu is determined by the markings on the attenuator at the setting thus obtained. If for any reason the deflections reach some other scale point than that corresponding to reference deflection, the volume is given by the algebraic addition of the attenuator

setting and the actual deflection as read on the instrument scale.

When the impedance of the circuit at the point where the instrument is connected differs from 600 ohms the volume indicated must be corrected to correspond to this difference by the following relation:

Correction (to be added) in vu =

$$10 \log_{10} \frac{600}{Z}$$ where Z = actual impedance.

5. GOOD ENGINEERING PRACTICE

The following items are not fundamental to this standard but are matters of good engineering practice.

5.1 IMPEDANCE

The volume indicator is normally used as a bridging instrument and when so used its impedance must be sufficiently high so as not to influence unduly the waves in the circuit with which it is used. It is good practice to make the value of impedance not less than 7500 ohms, for use on a 600-ohm circuit.

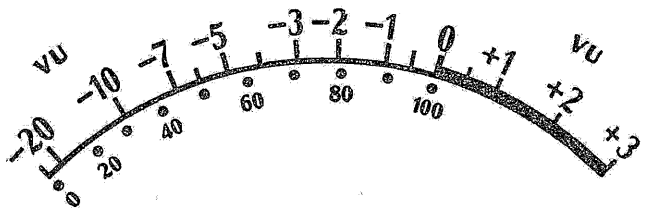

Fig. 1--This scale emphasizes the vu calibration.

5.2 HARMONIC DISTORTION

When the volume indicator is connected to a simple resistive circuit through which a sinusoidal wave, between 25 and 8000 cycles per second, is being transmitted, the root-mean-square sum of the harmonics produced should not exceed 0.2 per cent.

5.3 ABILITY TO WITHSTAND OVERLOAD

Because of the great variation in amplitude which this indicator may encounter, it should possess greater ability to stand overloads than that required for average instruments. A frequently used specification calls for an ability to withstand without injury or effect on calibration a momentary overload of ten times the voltage corresponding to reference deflection and a continuous overload of five times that voltage.

5.4 SCALE

The point of reference deflection should be located within a sector between 2/3 and 3/4 of full scale. In addition to the vu scale, it is good practice also to provide a 0-to-100 scale proportional to voltage with the 100 point coinciding with the point of reference deflection. Samples of the two types of scales in general use are shown in Figs. 1 and 2.

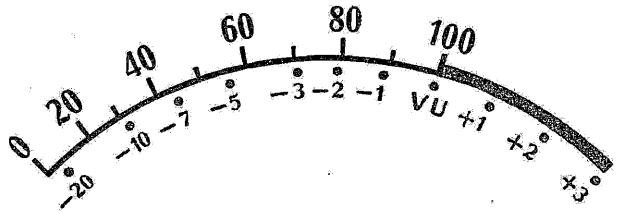

Fig. 2--This scale emphasizes the 0-100 graduations and is useful to indicate percentage utilization of facilities. It is used generally by the principal broadcast organizations.