

**National Library Service
for the Blind and
Physically Handicapped**

The Library of Congress

Approved by Director, NLS/BPH

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Date 12/13/90

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BACKGROUND

The National Library Service for the Blind and Physically Handicapped (NLS) of the Library of Congress administers a free library service to eligible residents of the United States and citizens living abroad who cannot hold, handle, or read traditional print media because of visual or physical handicaps.

Using federal funds, NLS annually publishes approximately 2,000 books and 70 magazines on cassettes, on discs, and in braille. Titles are selected to appeal to a wide variety of interests, and copyright permission is obtained from authors and publishers. Books and magazines are narrated and duplicated at a high-quality professional standard. The quantity produced of any title is dependent on anticipated reader demand.

Playback machines and their accessories are designed to facilitate convenient use by handicapped people and to provide maximum reliability under environmental conditions that are sometimes harsh and handling that may be technically unsophisticated or inadvertently abusive. The equipment plays program materials at noncommercial speeds: 8-1/3 rpm for discs and 15/16 ips, 4-track for cassettes. All materials and equipment in the program can be sent to users and returned to libraries postage free.

A cooperating network of 56 regional libraries and more than 100 subregional libraries circulates recorded and braille books to some 700,000 adults and children out of a potential three million eligible population. Magazine subscriptions are provided on a direct-mail basis from the manufacturers. Users must generally deal with service centers in distant cities with communication by mail or phone and little or no personal contact. Everything comes and goes through a mail-order system. Fifty percent of the users are over sixty-four years old, and many depend on the NLS program for their major source of entertainment and connection with the world; 95 percent read recorded materials, 5 percent read braille.

Users are informed about new books, magazines, and services through bimonthly publications, annual catalogs, and subject bibliographies produced by NLS, and through various publications produced and circulated by the regional and subregional libraries.

USER MATERIALS

Contractors who consider submission of a bid to produce books, equipment, or other program products should be cognizant of the consumer-responsive nature of the program, and that the specifications for these products have been developed to meet the special reader needs in the program. Materials are produced with those reader needs foremost in mind, and improved through constant monitoring and consumer input. Contractors are expected to familiarize themselves with the equipment-handling practices of blind and physically handicapped clientele and ensure that the equipment they produce will stand up under this type of use. A high degree of quality workmanship and product reliability is mandated by the product specification.

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1. SCOPE

This specification defines the requirements for C-90 spoken word, twin-hub, coplanar tape cassettes, duplicated for 15/16 ips play back, in a four-track monaural mode, and suitable for use in the Library of Congress, National Library Service for the Blind and Physically Handicapped (NLS), talking-book program.

2. APPLICABLE DOCUMENTS

The following documents and publications, of the issue in effect on the date of the invitation for bids, form a part of this specification. In the event of conflict between the documents and publications referenced herein and the content of this specification, the content of this specification shall be considered a superseding requirement.

Specifications

NLS

#203 - Open Reel Intermaster

#300 - Specification for the Recording of Books

#403 - Labeling and Packaging - Cassette Books

Standards

MIL-STD 105D - Sampling Procedures and Tables for Inspection by Attributes

International Electrotechnical Commission (IEC) Recommendations: IEC 94 Amendment #1 and #2: Magnetic Tape Recording and Reproducing Systems: Dimensions and Characteristics

IEC 94A - Supplement to Publication 94, Amendment #1: Cassette for Commercial Tape Records and Domestic Use, Dimensions and Characteristics

(Copies may be obtained from the American National Standards Institute, 1430 Broadway, New York, New York 10018.)

Electronic Industries Association (EIA) Standards: RS-362-Tensile Properties of Magnetic Tape - Recommended Test Method RS-399A - Dimensional Standard Coplanar Magnetic Tape Cartridge Type CP II.

(Copies may be obtained from the Electronic Industries Association, Engineering Department,

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2001 Eye Street, N.W., Washington, D.C. 20006.)

3. REQUIREMENTS

3.1 General

The magnetic tape and the cassettes furnished under this specification shall be new and shall have been designed in accordance with the requirements given in IEC 94A, the dimensional measurements given in EIA RS-399A, and as specified herein.

3.1.1 Component Parts

One complete cassette shall consist of a length of magnetic oxide-coated tape, with tape leaders, contained within a cassette housing as specified herein, and packaged in accordance with Section 5.

3.2 Qualification

The items furnished under this specification shall be products that have been tested and passed the qualification tests specified herein. Items that pass the qualification tests shall be considered qualified by NLS for the remainder of the Library of Congress contracting period.

3.2.1 Process Change

Qualification, once established, applies only to those cassettes manufactured by the same process used to make the cassettes that passed the qualification tests. All proposed process or materials changes shall be reported to the NLS contracting officer in writing, with a statement by the supplier as to the nature of the changes and the extent of such changes on the delivered product. NLS reserves the right to require six (6) weeks notice and sufficient samples of the new product for quality assurance tests prior to delivery of products manufactured under any such changes in process. The foregoing requirement does not in any way relieve the manufacturer of delivery requirements, quality control, and testing necessary to ensure that all products delivered under this specification are identical to those products originally submitted for qualification.

3.3 Materials

3.3.1 Tape

The tape shall consist of a layer of magnetic material on a backing of mylar plastic or

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equivalent, subject to the approval of NLS, and shall have the physical, magnetic, and other characteristics specified herein.

3.3.2 Cassettes

The cassettes shall be constructed of non-magnetic materials suitable for the intended use and shall conform to the physical, dimensional, and other requirements specified herein.

3.3.3 Flammable Materials

Tape or cassette components which ignite from a match flame, and when so ignited continue to burn in a still carbon dioxide atmosphere, shall not be used.

3.3.4 Toxicity

Tape or cassette components which may cause bodily harm by contact, inhalation or ingestion shall not be used.

3.4 Cassette Dimensional Measurements

The cassette dimensions shall conform to the measurements given in EIA RS-399A.

3.5 Cassette Physical Requirements

3.5.1 Cassette Assembly

Cassette halves shall be bound together with five screws. The finish of the cassette halves shall be smooth and clean. There shall be no flash, cracks, gaps, bumps, lips, or teats, on the front of the cassette housing, where the two cassette halves come together or on any parting line. The contractor shall specify the screws so that the cassette shell may be assembled and disassembled three times without screw hole thread degradation. The cassettes shall be supplied with their record-protect tabs removed.

3.5.1.1 Drop Resistance

The cassette shall remain bound together with no dislocation of parts within the overall tolerances given in EIA RS-399A, and must perform satisfactorily in the standard reproducer after being subjected to the drop

test of 4.6.8.4.

3.5.2 Corner Tape Guides

Rotating idler roller corner tape guides shall be provided. The corner idler roller tape guides shall be flanged and shall have a minimum hub diameter of 7.11 mm (0.280 in). These idler rollers shall be secured to the cassette shell using an inserted stainless steel pin or a molded plastic support post.

3.5.3 Windows

Each side of the cassette shall be provided with a window. Minimum viewable dimensional measurements shall be 6.35 mm (0.25 in) wide and 19.05 mm (0.75 in) long. The windows shall be constructed of a material suitable for the intended use. Each window shall be capable of withstanding a force of 1.59kg (3.5 lbs) without loosening from the cassette or cracking. There shall be no excess adhesive around the window edges.

3.5.4 Friction Liners

Cassettes shall be provided with anti-friction liners. Liner configuration, material, coating and impregnation are subject to the approval of NLS. Liners shall be evenly coated or impregnated with solid lubricant and shall be of uniform workmanship free from manufacturing defects, shall not fray, tear, or wrinkle, and shall exhibit no shredding or shedding of debris. The tape contact surface of the liner shall be electrically conductive to reduce build up of static charges to the tape.

3.5.5 Hubs

The hub mold-injection-point shall not be on any part of the hub where it can be in contact with the tape and friction liners. The hub shall be constructed in such a way that no bulging or depression of the tape occurs when the tape is wound around the hub or dislodging of the hub occurs under normal conditions of cassette operation. Hubs shall be of the design configuration shown in IEC 94A.

3.5.6 Pressure Pad Assembly

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The pressure pad assembly shall consist of a device to apply pressure between the tape and record/reproduce head and shall meet the requirement of 3.8.3.

3.5.7 Magnetic Shield

Each cassette shall be provided with a hum reducing shield positioned directly behind the pressure pad, in accordance with EIA Standard RS-399A. (See Section 2, Applicable Documents.)

3.5.8 Label Area

Each cassette shall be provided with two label areas in conformance with those given in EIA RS-399A.

3.6 Tape Dimensional Measurements

3.6.1 Length

The length of tape contained within the cassette shall be in accordance with Table I, except for titles designated "For grades K-3" or "Preschool-2" in the annotation. Tape length for these titles shall be the actual length of the sound track supplied.

3.6.2 Width

The tape width shall be $3.81 + 0.00$ mm [$0.150 + 0.000$ in] - 0.05 mm [- 0.002 in]

3.6.3 Thickness

The overall thickness of the tape (base and coating) contained within the cassette shall be in accordance with Table I.

TABLE I. TAPE LENGTH AND THICKNESS

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Time Indicator	Tape Length		Tape Thickness Nominal	
	Meters	Feet	mm	in
C-90	128.60 min. - 133.20 max.	422 min. - 437 max.	0.015	0.0006

3.7 Tape Leader

The magnetic tape shall be provided with a polyester or equivalent leader attached to both ends of the tape. Tape leader width shall be in accordance with the tape width requirement of 3.6.2.

3.7.1 Leader Length

Each leader shall be 33.02 cm (13 inches) minimum, 38.10 cm (15 inches) maximum in length, with a thickness of 0.0508 mm (0.0020 inches) maximum.

3.7.2 Leader-to-Hub and Tape-to-Hub Connections

Leader-to-hub and tape-to-hub connections shall be capable of withstanding a minimum force of 1 kilogram (2.2 pounds) for 10 seconds.

3.7.3 Leader Splices

Tape-to-leader splices shall be capable of withstanding a force of 326 gram (11.5 oz) at 118 degrees +0 -5 degrees F for 60 minutes, without an increase of the gap between tape and leader or separation of the splice. No overlap is permitted.

3.7.3.1 Splicing Tape Width

The splicing tape shall not protrude beyond the edges of the magnetic tape and tape leader.

3.7.3.2 Splicing Tape Adhesive

The splicing tape adhesive shall not ooze after the complete cassette has been

subjected to any one of the temperature and humidity conditions given in 3.13 or the conditions given in 3.7.3.

3.8 Mechanical Requirement

3.8.1 Maximum Friction Torque of Both Hubs

The friction torque of both hubs, measured in the cassette itself at the nearly full hub, shall not exceed 0.0027 Nm (0.38 oz.in), when measured in accordance with 4.6.6.1.

3.8.2 Maximum Friction Torque of Both Hubs With Hold Back Torque

With a hold back torque of 0.0008 Nm (0.085 oz.in) applied to the nearly empty hub, the required torque to be applied to the nearly full hub, when moving tape, shall not exceed 0.0055 Nm (0.74 oz. in), when measured in accordance with 4.6.6.1.

3.8.3 Pressure-Pad Pressure

When the magnetic head is engaged into the cassette, in accordance with the maximum dimension given in EIA RS-399A, the pressure of the pad on the magnetic head over the head to pad contact area shall be 0.005 to 0.015 N/mm² (0.73 to 2.18 psi).

3.9 Tape Physical Requirements

3.9.1 Yield Strength

The 1% offset yield point; the force corresponding to 3% elongation; and the tensile force at break for the tape, when measured in accordance with 4.6.13.1, shall equal or exceed the value specified in Table II, in accordance with EIA Standard RS-362. (See Applicable Documents, Section 2.)

3.9.2 Elongation Under Stress

The elongation of the tape for a particular type cassette, when measured in accordance with 4.6.13.2, shall not exceed the value specified in Table II.

TABLE II. MAGNETIC TAPE PHYSICAL REQUIREMENTS

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<u>Characteristic</u>	<u>Requirement</u> (3.81 mm [0.150 in.] tape width)
Yield strength	C-90
Elongation under stress	0.363 kg (0.8 lbs.) 0.5%

3.9.3 Anchorage

The magnetic layer of the tape shall show no visible evidence of anchorage failure after completion of all tests. Anchorage failure is manifested as a separation of the magnetic coating from the base material of the tape, or internal failure of the coating layer itself.

3.9.4 Splices

All magnetic tape lengths shall be continuous and splice free.

3.9.5 Layer-to-Layer Adhesion

The adhesion characteristics of the tape shall be such that the frictional torque shall not exceed the value given in 3.8.2, after the complete cassette has been subjected to any one of the temperature and humidity conditions given in 3.13.

3.9.6 Mechanical Operation

When tested in accordance with 4.6.9.1, the cassettes shall be free from obvious noises, such as, squeals, clicks, thumps, chatter, and rattles. Cassettes shall not jam or spill tape into the machine.

3.10 Magnetic Tape Performance Requirements - 1-7/8 ips

3.10.1 Maximum Recording Level

The maximum recording level, when measured in accordance with 4.6.7.4.1, shall not fall below the reference recording level (see 4.6.7.1.4) by more than the applicable value specified in Table III.

3.10.2 Maximum Output Level

The maximum output level, when measured in accordance with 4.6.7.4.1, shall not fall below the reference output level (see 4.6.7.1.5) by more than the applicable value specified in Table III.

3.10.3 Sensitivity

The output voltage level of a 315 Hz signal, recorded at standard record level (see 4.6.7.1.6) with operating bias current (see 4.6.7.1.3), at any point on the tape, when measured in accordance with 4.6.7.4.3, relative to the reference output level (see 4.6.7.1.5), shall fall within the applicable values specified in Table III.

3.10.4 Harmonic Distortion

The harmonic distortion at reference recording level (see 4.6.7.1.4) and at standard recording level (see 4.6.7.1.6), when measured in accordance with 4.6.7.4.2, and 4.6.7.4.3, respectively, shall not exceed the applicable value specified in Table III.

3.10.5 Frequency Response

The output voltage levels, at frequencies of 6,000 Hz, 8,000 Hz, and 10,000 Hz, when measured in accordance with 4.6.7.4.4, and when normalized to the output voltage level at 315 Hz and compared with the response of the "Reference Medium" tape (see 4.6.7.1.1), shall fall within the applicable limits specified in Table III.

3.10.6 Uniformity

The uniformity of the output signal level at the test frequencies of 315 Hz and 8,000 Hz, when measured in accordance with 4.6.7.4.5, shall be such that the maximum deviation from the maximum peak output shall not exceed the applicable value in Table III.

3.10.7 Reference Level to Direct Current (dc) Noise Ratio

The reference level to dc noise ratio, when measured in accordance with 4.6.7.4.6, shall equal or exceed the applicable value specified in Table III.

3.10.8 Ease of Erasure

A 60 Hz ac 1,000 Oersteds (peak value) erase field shall cause a reduction in signal of not

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less than the applicable value specified in Table III, when measured in accordance with 4.6.7.4.7.

TABLE III. MAGNETIC TAPE PERFORMANCE REQUIREMENTS
Measured at 1-7/8 ips

C-90 Characteristic	Measurement Oxide Characteristic	Units
Maximum recording level	-3.5	Decibels
Maximum output level	-3.5	Decibels
Sensitivity	-8, -13	Decibels
Harmonic distortion (max.):		
@Reference recording level (Third Harmonic distortion)	3	Percent
@ Standard recording level (Total Harmonic distortion)	1	Percent
Frequency response:		
@ 6000 Hz	-2 maximum	Decibels
@ 8000 Hz	-4 maximum	Decibels
@ 10000 Hz	-6 maximum	Decibels
Uniformity:		
@ 315 Hz	20	Percent
@ 8000 Hz	30	Percent
Reference level to dc noise ratio	47	Decibels

3.11 Duplicated Cassette Performance Requirements - 15/16 ips

3.11.1 Duplicated Speed

The duplication system shall be capable of producing cassette copies at a speed of 15/16 ips. (4.76 cm/s) ($\pm 2\%$).

3.11.2 Duplication Equalization

The duplication system shall be adjusted to provide 15/16 ips equalization equivalent to that of a duplicated cassette at 1-7/8 ips, except that the upper limit or frequency response shall be considered as 5000 Hz. Naturalness of reproduction when compared to the master tape shall be the subjective basis for judging acceptability of the system. Over or under accentuation of bass, treble, and/or high frequency response of duplicated cassettes shall not be permitted.

3.11.3 Level of Duplication

Cassettes shall be produced at an average duplication system level of -7 VU. Peaks of the voice shall not exceed 0 VU. (0 VU reference is defined in paragraph 4.6.7.1.4., Standard Recording Level is defined in paragraph 4.6.7.1.6.)

3.11.4 Duplication Signal-to-Noise

The unweighted signal-to-noise ratio of a duplicated tape shall not be less than 40 dB down from maximum record level.

3.11.5 On-Tape Crosstalk

There shall be no discernible interchannel crosstalk between any tracks on the duplicated cassette. As a periodic test the contractor will be required to duplicate the NLS crosstalk tape on all of the duplication equipment used for production of materials for NLS. At 1 kHz, crosstalk shall not be less than 50 dB down from the reference record level using the NLS crosstalk test tape and procedure outlined in Section 4.6.7.4.8. this test is intended

to provide a comprehensive overview of the entire production system but meeting the 50 dB crosstalk level does not eliminate the requirement for meeting the listening test, i.e., no discernible crosstalk between any tracks for recorded speech. The duplicators (slaves) will be tested for crosstalk on a periodic basis. Each supplier will receive a test tape from NLS which must be copied by all slave units. Two samples from each slave will be submitted to NLS Quality Assurance for evaluation. Any slave that does not meet the 50 dB requirement (para. 4.6.7.4.8) shall not be used for NLS products (frequencies on the test tape other than 1 kHz are for general reference only).

3.12 General Requirements

3.12.1 Program Material

The sides shall be assigned as follows: (See Figure 3.)

Side I	Corresponds to Track 1
Side II	Corresponds to Track 4
Side III	Corresponds to Track 3
Side IV	Corresponds to Track 2

Duplicated program material shall be placed on the tape so that:

- (a) The end of side 1 and the beginning of side 2 physically coincide;
- (b) The end of side 2 and the beginning of side 3 physically coincide;
- (c) The end of side 3 and the beginning of side 4 physically coincide.
- (d) The track layout of subsequent cassettes shall follow the same format.

Information shall be as close as possible to the beginning of the tape.

3.12.2 Timing

The recorded time for all tracks shall be 88 minutes, +0 -1 minute, except for the last track. All cassettes, regardless of track length, shall be C-90 load, except for titles designated "For grades K-3" or "Preschool-2" in the annotation. Tape length for these titles shall be the actual length of the sound track supplied.

3.12.3 Indexing Signals

Master tapes may include a 50 Hz sub-audible tone recorded at -12 to -18 VU for

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purposes of locating chapter headings, subject areas, etc. They may also include voice-indexing information over a band of frequencies extending down to 4 Hz, at recording levels between -20 and -5 VU. (See Specification #300, Applicable Documents.)

3.12.4 Masters

Masters supplied by NLS for duplication shall follow the formats listed in 3.12.1 and 3.12.2, except that the program material may be in either quarter track, 2 or 4 channel, or half track, 2 channel format. The tape speed of the master is 3-3/4 ips.

3.13 Environmental Extremes

When tested in accordance with 4.6.8, cassettes shall not warp and shall conform to mechanical requirements in 3.8.2, and the tape magnetic performance requirements in 3.10.3, 3.10.5, 3.10.6, and 3.10.8, after being subjected to the following: 60 degrees C +0, -5 degrees C (140 degrees F +0, -9 degrees F) at 0 to 30% relative humidity for 24 hours; -30 degrees C +5, -0 degrees C (-22 degrees F +9, -0 degrees F) for 24 hours; and 45 degrees C \pm 5 degrees C (113 degrees F \pm 9 degrees F) at a relative humidity of 90% \pm 5% for 24 hours.

3.14 Short-Term Operation

When tested in accordance with 4.6.9.1 and 4.6.9.3, the cassettes shall perform satisfactorily in the standard recorder/reproducer and the spill test machine and shall conform to the requirements of 3.8.1, 3.8.2, and 3.9.6.

3.15 Operational Life

After the cassette has been subjected to the operational life test of 4.6.9.2, the cassette shall perform satisfactorily in the standard recorder/reproducer, and shall conform to the mechanical requirement of 3.8.2, and the average output level of 315 Hz signal, recorded at standard recording level (see 4.6.7.1.6), shall not decrease by more than 2 dB.

3.16 Workmanship and General Examination

The tape and tape cassette shall be manufactured and processed in a careful and workmanlike manner in accordance with good practice. Both the magnetic oxide surfaces and base of the tape shall be free from any raised areas, dust, flakes, or powder, which would render the tape unsuitable for its intended use. The condition of tape slitting and the cassette shall be examined for

workmanship and cleanliness.

4. QUALITY ASSURANCE PROVISIONS

4.1 Responsibility for Inspection

The supplier is responsible for the performance of all inspection requirements specified herein. The supplier may utilize his own facilities or any reputable commercial laboratory acceptable to the Government. The Government reserves the right to perform any of the inspections set forth in this specification where such inspections are deemed necessary to assure that supplies and services conform to the prescribed requirements.

4.2 Classification of Inspections

4.2.1

Sampling for all inspections shall be in accordance with MIL-STD 105D.

4.2.2

The inspections herein specified are classified as follows:

- a. Qualification Inspections 4.3.1
- b. Incoming Materials Inspections 4.3.2
- c. Quality Conformance Inspections 4.3.3
- d. Acceptance Inspections 4.3.4

4.3 Order of Inspections

4.3.1 Qualification Inspections

Qualification inspection shall consist of each of the examinations, measurements, and tests listed in Table IV, and shall be performed in the order given in 4.6.1, and Figure 1. Copies of the record of the examinations, measurements, and tests listed in Table IV and Figure 1; the test samples themselves; and certification of production compliance with the requirements under qualification inspections shall accompany the supplier's bid.

4.3.1.1 Qualification Sample Size

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The qualification sample shall consist of eight (8) C-90 cassettes. Tested samples shall be retained by NLS.

TABLE IV. EXAMINATIONS, MEASUREMENTS, AND TESTS
QUALIFICATION INSPECTIONS

Examinations, Measurements, and Tests	Requirement Paragraph Paragraph	Test Method
<u>GROUP A</u>		
General examination	3.5.1, 3.5.3, 3.5.6, 3.5.7, 3.5.8, 3.11.1, 3.11.5, 3.12.1, 3.12.2, 3.16	4.6.4
Cassette outside dimensions measurements	3.4	4.6.5
<u>GROUP B</u>		
Short-term operation	3.9.6 and 3.14	4.6.9.1 & 4.6.9.3
Frictional torque	3.8.1 and 3.8.2	4.6.6.1
<u>GROUP C</u>		
Sensitivity	3.10.3	4.6.7.4.3
Frequency response	3.10.5	4.6.7.4.4
Uniformity	3.10.6	4.6.7.4.5
Reference level to dc noise ration	3.10.7	4.6.7.4.6
Duplication equalization	3.11.2	4.6.4
Level of duplication	3.11.3	4.6.7.4.1
Duplication signal-to-noise	3.11.4	4.6.7.4.6
Crosstalk	3.11.5	4.6.4. & 4.6.7.4.8

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Duplicated speed 3.11.1 4.6.7.4.9

TABLE IV. EXAMINATIONS, MEASUREMENTS, AND TESTS
QUALIFICATION INSPECTIONS
(Continued)

Examinations, Measurements and Tests	Requirement Paragraph Paragraph	Test Method
<u>GROUP D</u>		
Pressure-pad pressure	3.8.3	4.6.6.2
Anchorage	3.9.3	4.6.14
Magnetic tape length	3.6.1 & 3.9.4	4.6.12.1
Magnetic tape width	3.6.2	4.6.12.1
Magnetic tape thickness	3.6.3	4.6.12.1
Leader length	3.7.1	4.6.12.3
<u>GROUP E</u>		
Maximum recording level	3.10.1	4.6.7.4.1
Maximum output level	3.10.2	4.6.7.4.1
Harmonic distortion	3.10.4	4.6.7.4.2
Ease of erasure	3.10.8	4.6.7.4.7
Splice gap	3.7.3	4.6.12.4
Splice strength	3.7.3	4.6.12.4

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Splice tape width	3.7.3.1	4.6.12.4
Leader-to-hub or tape-to-hub strength	3.7.2	4.6.13.3

TABLE IV. EXAMINATIONS, MEASUREMENTS, AND TESTS
QUALIFICATION INSPECTIONS
(*Continued*)

Examinations, Measurements and Tests	Requirement Paragraph Paragraph	Test Method
Cassette physical examination and measurement	3.5.4, 3.5.5, 3.5.2, 3.5.3, and 3.5.8	4.6.10 & 4.6.11
Magnetic tape yield strength	3.9.1	4.6.13.1
Magnetic tape elongation under stress	3.9.2	4.6.13.2
Environmental conditions	3.13	4.6.8.1, 4.6.8.2, 4.6.8.3
Drop test	3.5.1.1	4.6.8.4
<u>GROUP F</u>		
Operational life	3.15	4.6.9.2

4.3.2 Incoming Materials Inspections

Incoming materials inspections shall consist of each of the examinations, measurements, and tests listed in Table V. The contractor shall select the appropriate number of samples from incoming lots or batches. All samples subjected to the examinations, measurements, and tests supplied in Table V must conform to the appropriate requirements specified in Section 3.

4.3.2.1 Incoming Materials Sampling

Sampling for incoming materials inspections shall be in accordance with MIL-STD 105D and as specified in 4.3.2.2, 4.3.2.3, 4.3.2.4, and 4.3.2.5.

4.3.2.2 Sampling for Table V Group A Examinations, Measurements, and Tests

Sampling for Group A examinations, measurements, and tests shall be in accordance with MIL-STD 105D, General Inspection Level II, at an acceptable quality level (AQL) of .65 defects per hundred units.

4.3.2.3 Sampling for Table V Group C Examinations, Measurements, and Tests

Sampling for Group C examinations, measurements, and tests shall be in accordance with MIL-STD 105D, General Inspection Level II, at an acceptable quality level (AQL) of .65 defects per hundred units.

4.3.2.4 Sampling for Table V Group D Examinations, Measurements, and Tests

Sampling for Group D examinations, measurements, and tests shall be in accordance with MIL-STD 105D, General Inspection Level II, at an acceptable quality level (AQL) of 1.5 defects per hundred units.

4.3.2.5 Sampling for Table V Group E Examinations, Measurements, and Tests

Sampling of Group E examinations, measurements, and tests shall be in accordance with MIL-STD 105D, General Inspection Level II, at an acceptable quality level (AQL) of 1.5 defects per hundred units.

TABLE V. EXAMINATIONS, MEASUREMENTS, AND TESTS

INCOMING MATERIALS INSPECTIONS

Examinations, Measurements, and Tests	Requirement Paragraph Paragraph	Test Method
<u>GROUP A</u>		
General examination	3.5.1, 3.5.1.1, 3.5.2, 3.5.3, 3.5.4, 3.5.5, 3.5.6, 3.5.7 and 3.5.8	4.6.4 4.6.8.4 4.6.10 4.6.11
Cassette outside dimensions measurements	3.4	4.6.5
<u>GROUP C</u>		
Sensitivity	3.10.3	4.6.7.4.3
Frequency response	3.10.5	4.6.7.4.4
Uniformity	3.10.6	4.6.7.4.5
Reference level to dc noise ratio	3.10.7	4.6.7.4.6
<u>GROUP D</u>		
Pressure-pad pressure	3.8.3	4.6.6.2
Anchorage	3.9.3	4.6.14
Magnetic tape width	3.6.2	4.6.12.1
Leader length	3.7.1	4.6.12.3

TABLE V. EXAMINATIONS, MEASUREMENTS, AND TESTS

INCOMING MATERIALS INSPECTIONS

(*Continued*)

Examinations, Measurements, and Tests	Requirement Paragraph Paragraph	Test Method
<u>GROUP E</u>		
Maximum recording level	3.10.1	4.6.7.4.1
Maximum output level	3.10.2	4.6.7.4.1
Harmonic distortion	3.10.4	4.6.7.4.2
Ease of erasure	3.10.8	4.6.7.4.7
Leader-to-hub or tape-to-hub strength	3.7.2	4.6.13.3
Magnetic tape yield strength	3.9.1	4.6.13.1
Magnetic tape elongation under stress	3.9.2	4.6.13.2

4.3.3 Quality Conformance Inspections

Quality conformance inspections shall consist of each of the examinations, measurements, and tests listed in Table VI. The contractor shall select the appropriate number of samples from each lot produced. All samples subjected to the examinations, measurements, and tests specified in Table VI must conform to the appropriate requirements specified in

Section 3.

4.3.3.1 Quality Conformance Sampling

Sampling for quality conformance inspections shall be in accordance with MIL-STD 105D and as specified in 4.3.3.2, 4.3.3.3, and 4.3.3.4.

4.3.3.2 Sampling for Table VI Group B Examinations, Measurements, and Tests

Sampling for Group B examinations, measurements, and tests shall be in accordance with MIL-STD 105D, General Inspection Level II, at an acceptable quality level (AQL) of .65 defects per hundred units.

4.3.3.3 Sampling for Table VI Group C Examinations, Measurements, and Tests

Sampling for Group C examinations, measurements, and tests shall be in accordance with MIL-STD 105D, General Inspection Level II, at an acceptable quality level (AQL) of .65 defects per hundred units.

4.3.3.4 Sampling for Table VI Group D Examinations, Measurements, and Tests

Sampling for Group D examinations, measurements, and tests shall be in accordance with MIL-STD 105D, General Inspection Level II, at an acceptable quality level (AQL) of 1.5 defects per hundred units.

4.3.3.5 Lot

A lot shall consist of any and all cassettes manufactured for any one given cassette book title.

TABLE VI. EXAMINATIONS, MEASUREMENTS, AND TESTS
QUALITY CONFORMANCE INSPECTIONS

Examinations, Measurements, and Tests	Requirement Paragraph Paragraph	T e s t Method
<u>GROUP B</u>		
Frictional torque	3.8.1 and 3.8.2	4.6.6.1
Program material	3.12.1	4.6.4
<u>GROUP C</u>		
Duplication equalization	3.11.2	4.6.4
Level of duplication	3.11.3	4.6.7.4.1
Crosstalk	3.11.5	4.6.4
<u>GROUP D</u>		
Magnetic tape length	3.6.1 & 3.9.4	4.6.12.1

4.3.4 Lot Acceptance Inspections (See 4.3.4.4 & 4.3.5)

(This inspection is performed on completed lots only.)

Acceptance inspections shall consist of each of the examinations, measurements, and tests listed in Table VII. The contractor shall select the appropriate number of samples produced. All samples subjected to the examinations, measurements, and tests specified

in Table VII must conform to the appropriate requirements specified in Section 3.

4.3.4.1 Acceptance Sampling

Sampling for acceptance inspections shall be in accordance with MIL-STD 105D, and as specified in 4.3.4.2, 4.3.4.3 and 4.3.4.4.

4.3.4.2 Sampling for Table VII Group B Examinations, Measurements, and Tests

Sampling for Group B examinations, measurements, and tests shall be in accordance with MIL-STD 105D, General Inspection Level II, at an acceptable quality level (AQL) of .65 defects per hundred units.

4.3.4.3 Sampling for Table VII Group E Examinations, Measurements, and Test

Sampling for Group E examinations, measurements, and tests shall be in accordance with MIL-STD 105D, General Inspection Level II, at an acceptable quality level (AQL) of .65 defects per hundred units.

4.3.4.4 Sampling for Table VII Group F Examinations, Measurements, and Tests

Sampling for Group F examinations, measurements, and tests shall be in accordance with MIL-STD 105D, General Inspection Level II, at an acceptable quality level (AQL) of .65 defects per hundred units.

4.3.4.5 Lot

A lot shall consist of any and all cassettes manufactured for any one given cassette book title. Lot inspection reports are to be forwarded to NLS Quality Assurance Section on a weekly basis.

TABLE VII. EXAMINATIONS, MEASUREMENTS, AND TESTS

ACCEPTANCE INSPECTION

Examinations, Measurements, and Tests	Requirement Paragraph Paragraph	Test Method
<u>GROUP B</u>		
Short-term operation	3.9.6	4.6.9.1
<u>GROUP E</u>		
Splice gap	3.7.3	4.6.12.4
<u>GROUP F</u>		
Playback Level	3.11.3	4.6.7.1.7
Subjective Listening	3.11.2	4.6.4

4.3.5 Certified Lot Acceptance Sample

A certified acceptance sample of each lot produced (see Section 4.3.4) shall be forwarded to NLS for production approval. This sample shall be considered representative of any and all cassettes produced in that lot and shall be retained by NLS as a production control copy. The certified lot acceptance sample (production control copy) shall be marked with the slave number from which it came. As production of books progresses, subsequent acceptance samples shall be taken from different slaves and marked with that slave number. Rotation of samples/slaves shall be on a sequential basis.

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4.4 Reporting of Test Results

4.4.1

The contractor shall maintain a complete record of all test results for the duration of the contract. The test records shall be available to the Government at all reasonable times. The records shall include the information necessary to identify the lot, the lot sample, the testing equipment, the inspector, and the date of the test.

4.4.2

The contractor is required to provide written documentation showing that his methods of quality control incorporate those established by this specification, under Section 4.

4.4.3

Should NLS determine that a significant fault or faults be found in production units, then correction of the fault or faults in previously produced units, and production inspections or controls for prevention shall be instituted without additional charge to NLS.

4.5 Warranty

The contractor shall agree to unconditionally warrant each book he produces for this program for a period of one year. Books that are found to be not in conformance with this specification shall be returned to the contractor. Defective books shall be replaced and returned within two (2) working days. A monthly report on warranty returns shall be forwarded to the NLS Quality Assurance Section. The monthly report document shall be submitted for approval as part of the written documentation described in paragraph 4.4.2.

4.5.1

Books produced for the talking-book program are subject to recall and reduplication, based on the criteria under the Quality Assurance Section. It shall be the prerogative of the contracting officer to institute a recall at his discretion,

4.5.2

The right is reserved by the National Library Service for the Blind and Physically Handicapped, Library of Congress, to inspect any process or tests being performed. The Library representative shall have the authority, without advance notice, to select at random a sample of the books at any time during the course of the contract for testing to the specified requirements. The right is reserved by the National Library Service for the Blind and Physically Handicapped, Library of Congress, to reject any production lot represented by a tested sample which has been rejected.

4.5.3

The right is reserved by the National Library Service for the Blind and Physically Handicapped, Library of Congress, to inspect plant facilities or manufacturing processes at any reasonable time.

4.6 Examinations, Measurements, and Tests

4.6.1 Order of Qualification Inspection

Qualification inspection shall be performed in the following order, in accordance with Figure 1.

- (a) All cassettes under test shall be subjected to the examinations, measurements, and tests for general examination, outside dimensions, frictional torque, short-term operation, pressure-pad pressure, maximum recording level, maximum output level, harmonic distortion, sensitivity, frequency response, reference level to dc noise ratio, duplicated speed, duplication equalization, level of duplication, duplication signal-to-noise, crosstalk, program material and timing, listed in Table IV.
- (b) The cassettes shall then be divided into four groups. Cassettes in groups 1, 2, and 3 shall be subjected to the environmental conditions of 4.6.8.1, 4.6.8.2, and 4.6.8.3, respectively. Cassettes in group 1 shall be recorded with the test signal given in 4.6.7.4.7, prior to being subjected to the conditions of 4.6.8.1. Cassettes in group 4 shall be subjected to the drop test of 4.6.8.4. All cassettes, groups 1 through 4, shall then be subjected to the mechanical measurement of 4.6.6.1 for conformance to the frictional torque requirement of 3.8.2. Cassettes in group 1

shall then be subjected to the magnetic tape measurement for ease of erasure listed in Table IV. Cassettes in groups 1, 2, and 3 shall be examined for warpage, loose or curled labels, and printing ink that will smear or come off the labels.

- (c) One cassette from each group shall then be subjected to the operational life test of 4.6.9.2. Measurement for conformance to the frictional torque requirement shall be for the requirement of 3.8.2 only.
- (d) One cassette from each group shall then be subjected to the examinations, measurements, and tests for physical examination and measurements, anchorage, tape length, tape width, tape thickness, leader length, splice gap, splicing tape width, splicing tape adhesive, leader-to-hub or tape-to-hub strength, splice strength, layer-to-layer adhesion, magnetic tape yield strength, and magnetic tape elongation under stress listed in Table IV.

4.6.2 Preliminary Conditioning

Test units shall be subjected to the test environment of 4.6.3 for a period of not less than 24 hours prior to performance of any measurement or test specified herein.

4.6.3 Test Environment

Except as otherwise specified herein, all measurements and tests shall be performed at an ambient temperature of 21 degrees C \pm 2.8 degrees C (70 degrees F \pm 5 degrees F) and a relative humidity of between 45 and 55%.

4.6.4 General Examination

Test units shall be visually and aurally examined for conformance to the applicable requirement of 3.5.1, 3.5.3, 3.5.6, 3.5.7, 3.5.8, 3.11.1, 3.11.2, 3.11.5, 3.12.1, 3.12.2, 3.16, and 5.1.

4.6.5 Cassette Outside Dimensions Measurements

The following listed critical dimensions shall be measured for conformance to the measurements given in EIA RS-399A. Appropriate "GO" "NO-GO" gauges may be used to determine conformance to outside dimensional requirements.

Outside dimensions to be measured

- (a) Length
- (b) Width
- (c) Thickness
- (d) Capstan holes; size and location
- (e) Locating holes; size and location
- (f) Erase head opening; height and width
- (g) Record/reproduce head opening; height and width
- (h) Extreme ends of head openings
- (i) Hub spindle holes; size and location
- (j) Hub spoke inside diameter
- (k) Hub spoke; size, number, and location
- (l) Support planes flatness and parallelism

4.6.6 Cassette Mechanical Measurements

4.6.6.1 Frictional Torque

With no holdback torque applied to the supply reel and with the nearly full reel on the take-up side, note the average torque reading for conformance to requirement 3.8.1. Repeat the foregoing test with a holdback torque of 0.0008 Nm (8 gm.cm.). Note the average torque reading for conformance to the requirements of 3.8.2. Wind the tape on the opposite hub and repeat the foregoing test.

4.6.6.2 Pressure-pad Pressure

The pressure-pad pressure shall be measured for conformance to the requirement of 3.8.3.

4.6.7 Magnetic Tape Performance Measurements

4.6.7.1 Definitions

4.6.7.1.1 Reference and Calibration Tapes

The reference medium cassette shall consist of an unrecorded length of magnetic tape which defines the magnetic characteristics for IEC type I

recording tape contained in a cassette shell conforming to IEC 94A, BASF part number 52015. The calibration cassette shall be BASF part number 54407: reference level, azimuth alignment and frequency response; 120/3180 micro second equalization.

4.6.7.1.2 Secondary Reference Tape

The secondary reference tape is an unrecorded length of tape, the characteristics of which have been calibrated against those of the "Reference Level" section of the reference tape. The secondary reference tape is used for preliminary adjustments of the reference test recorder/reproducer and shall be a representative sample of the tape used in duplication.

4.6.7.1.3 Operating Bias Current

Operating bias current is that bias current through the recording head which will give a 2.5 dB fall off (over bias peak) of the peak output from the secondary reference tape (see 4.6.7.1.2) when a 6.3 kHz signal is recorded at standard recording level (see 4.6.7.1.6).

4.6.7.1.4 Reference Recording Level

The reference recording level is that voltage level of 315 Hz input signal which, in conjunction with operating bias current (see 4.6.7.1.3), will produce a permanent induction in the "Reference Medium" section of the reference tape (see 4.6.7.1.1), or (BASF IEC-1 Type 52105) such that upon playback the output signal level conforms to the reference output level. This reference level shall be +3 VU. 0 VU shall be 3 dB below reference recording level. See Table VIII.

TABLE VIII

	Reference Record Level	Reference Output Level	Standard Record Level
BASF DIN 4513/6			
IEC-1 Type 54407	+3 VU	+3 VU	-7 VU
RCA 107	-1 VU	-1 VU	-7 VU

4.6.7.1.5 Reference Output Level

The reference output level is the output level that is obtained by reproducing the "Reference Level" section of the DIN Calibration Tape (see 4.6.7.1.1).

4.6.7.1.6 Standard Recording Level

Standard recording level is 10 dB below the reference recording level, i.e., -7 VU.

4.6.7.1.7 Standard Output Level

Standard output level is that reproduce output voltage measured on playback of 315 Hz signal that has been recorded on the secondary reference tape (see 4.6.7.1.2) at standard recording level (see 4.6.7.1.6) with operating bias current (see 4.6.7.1.3).

4.6.7.2 Reference Test Recorder/Reproducer

For the measurements specified in 4.6.7.4, a reference test recorder/reproducer in proper adjustment shall be used. The reference test recorder/reproducer shall have the following minimum features.

- (a) The recorder/reproducer shall be a stereophonic cassette type and except as otherwise specified herein shall be in accordance with the applicable requirements of IEC 94A.
- (b) The tape speed shall be 4.76 cm/s (1-7/8 in/s) \pm 0.2%.

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- (c) The playback frequency response and the overall record/playback frequency response shall be flat to within the limits given in Figure 2 at the tape speed of 4.76 cm/s (1-7/8 in/s) using the "Calibration" and "Reference Medium" cassettes (see 4.6.7.1.1).
- (d) The harmonic distortion introduced by the record/reproduce amplifiers and the record/reproduce head shall not exceed 0.5% at all levels and frequencies used in the magnetic tape performance measurements.
- (e) The overall signal-to-noise ratio shall be 52 dB or higher. The overall signal-to-noise ratio is defined as the ratio of the reference output level to the total unweighted playback noise after erasure of a signal recorded at reference recording level and in the absence of a new signal. Thus, bias and erase noises are included as well as the playback and record amplifier noises. All frequencies between 40 Hz and 12 kHz shall be measured.
- (f) The flutter shall be less than 0.15% r.m.s. at a tape speed of 4.76 cm/s (1-7/8 in/s). (The weighing mode complying with DIN 45507, IEC 386, IEEE 193).
- (g) The record/reproduce head shall be a two-channel quarter track head.
- (h) The erase signal frequency shall be 80 kHz or higher. The signal strength shall be such as to reduce the level of a signal recorded at reference recording level on the "Reference Medium" tape by at least 60 dB.
- (i) The bias frequency shall be 80 kHz or higher and adjustable in amplitude. The even order harmonic distortion of the bias current waveform shall be less than 0.1%.
- (j) The reproducing characteristic shall be that which gives a flat response, in accordance with the requirement of (c) when

reproducing a track record with the recorded tape flux characteristics stated in Clause 7 of IEC 94 (see Publication 94, Amendment 1) for a tape speed of 4.76 cm/s (1-7/8 in/s).

- (k) The recording characteristic shall be such that the overall record/reproduce frequency response is in accordance with the requirements of (c) over the frequency range given.
- (l) Any commercial recorder which conforms to the requirements specified herein may be used for the applicable tests and measurements specified herein.

4.6.7.3 Preliminary Test Recorder/Reproducer Adjustment and Determination of Reference Signal Levels

Before commencing the magnetic tape performance measurements, the reference test recorder/reproducer shall be set up and adjusted, and operating bias current and reference signal levels determined in accordance with the following, for both channel 1 and channel 2:

- (a) For all measurements, the reference test recorder/reproducer shall be terminated with its proper load impedance.
- (b) All test signals shall be sine wave signal.
- (c) The recorder/reproducer shall be thoroughly cleaned and the record/reproduce head demagnetized.
- (d) The record/reproduce head shall be adjusted for correct azimuthal orientation.
- (e) Determine the reference output level using the "Reference Level" section of the calibration tape (see 4.6.7.1.1).
- (f) Determine the reference recording level, the operating bias current, the standard recording level, and the standard output level using the "Reference Medium" tape.

- (g) Determine that the overall frequency response is flat, within the limits given in Figure 2, using the "Frequency Response" section of the calibration tape.
- (h) Determine that the overall frequency response is flat, within the limits given in Figure 2, using the "Reference Medium" tape and recording at 25 dB below reference recording level with operating bias current.

4.6.7.4 Test Procedures

The following magnetic tape performance measurements are applicable to all tracks.

4.6.7.4.1 Maximum Recording Level Measurement

A 315 Hz signal shall be recorded onto the cassette tape to be tested, at that voltage level which, in conjunction with operating bias current (see 4.6.7.1.3), will produce a permanent induction in the tape such that upon playback the output signal will have 3% total harmonic distortion (THD). The input and output voltages, at maximum recording level, shall be measured and noted. The input voltage level, at maximum recording level, shall be compared with the reference recording level (see 4.6.7.1.4) to determine conformance to 3.10.1. The output voltage level, at maximum recording level, shall be compared with the reference output level (see 4.6.7.1.5) to determine conformance to 3.10.2.

Duplicated cassette levels shall be measured using a standard VU meter (ASA Standard C16/5-1961) to conform to the requirement specified in 3.11.3.

4.6.7.4.2 Harmonic Distortion At Reference Recording Level Measurement

A 315 Hz signal shall be recorded onto the cassette tape to be tested at reference recording level (see 4.6.7.1.4) with operating bias current (see 4.6.7.1.3). The recorded signal shall then be played back and the third harmonic distortion in the output shall

be measured to determine conformance to 3.10.4.

4.6.7.4.3 Sensitivity Measurement

A 315 Hz signal shall be recorded onto the cassette tape to be tested at standard recording level (see 4.6.7.1.6) with operating bias current (see 4.6.7.1.3). The recorded signal shall then be played back and the output voltage measured and noted. Correction shall be made for the response of the reference recorder/reproducer with a secondary reference tape at operating bias current, when a secondary reference tape is used. The output voltage level from the tape under test, at standard recording level, shall be compared with the reference output level (see 4.6.7.1.5) to determine conformance to 3.10.3. Total harmonic distortion in the output shall be measured to determine conformance to 3.10.4.

4.6.7.4.4 Frequency Response Measurements

Signals of 315 Hz, 6000 Hz, 8000 Hz, and 10,000 Hz shall be recorded onto both the cassette tape to be tested and the "Reference Medium" tape (see 4.6.7.1.1) at 25 dB below reference recording level (4.6.7.1.4) with operating bias current (see 4.6.7.1.3). The reference tape shall be played back and the output voltage at each frequency measured and noted. Correction shall be made for the response of the reference recorder/reproducer with a secondary reference tape at operating bias current, when a secondary reference tape is used. The outputs at the reference tape, at 6000 Hz, 8000 Hz, and 10,000 Hz, shall be normalized to the output of the reference tape at 315 Hz and expressed in dB as the response of the reference tape. The tape under test shall be played back and the output voltage at each frequency measured and noted. The outputs of the tape under test, at 6000 Hz, 8000 Hz, and 10,000 Hz, shall be expressed in dB as the response of the tape under test. The response of the tape under test shall be compared to the response of the reference tape to determine conformance to 3.10.5.

4.6.7.4.5 Uniformity Measurement

Two 3 minute (minimum) segments, consisting of one 315 Hz segment and one 8000 Hz segment, shall be recorded onto the cassette tape to be tested at 10 dB below reference recording level (see 4.6.7.1.4) with operating bias current (see 4.6.7.1.3). The recorded signals shall then be played back and the output voltage variations measured by means of a graphic level recorder. The tape uniformity shall be measured by determining the peak variations in output as a percentage of maximum peak output for conformance to 3.10.6. All non-recurring pips shall be disregarded.

4.6.7.4.6 Reference Level to Direct Current (dc) Noise Ratio

The cassette tape to be tested shall be externally erased. The tape to be tested shall be recorded with a direct current supplied to the record head that is equal to the r.m.s. value of the audio current at reference recording level (see 4.6.7.1.4), and with operating bias current (4.6.7.1.3). This segment shall be played back and the output voltage measured (in dB) at one output of a 250 Hz high-pass filter (which provides no more than a 3 dB attenuation of the cutoff frequency and has an 18 dB per octave roll off characteristic. This value shall be taken as the dc noise level. Determine the reference level to dc noise ratio at the value (in dB) of the reference recording level (determined in 4.6.7.3) minus the value of the dc noise level for conformance to 3.10.7.

4.6.7.4.7 Ease of Erasure

The cassette tape to be tested shall be externally erased. A 315 Hz signal shall then be recorded at reference recording level (see 4.6.7.1.6) with operating bias current (see 4.6.7.1.3). The cassette tape shall then be subjected to the temperature and humidity conditions of 4.6.8.1. The recorded tape shall then be played back and the output voltage measured at the output of a 315 Hz band-pass filter having a 30 Hz pass band. The recorded signal shall then be erased using a 60 Hz ac field of 1000

Oersteds (peak value). The erased tape shall then be played back and the level of the residual signal measured at the output of the band-pass filter. The difference between the recorded signal level and the residual signal level is the effective reduction in signal, or ease of erasure, and shall conform to 3.10.8.

4.6.7.4.8 Crosstalk

Terminate playback machine with proper impedance. Set output level using reference tape (1 kHz) to 500 mv r.m.s. Set band pass filter frequencies to 900 Hz and 1100 Hz. Measure interchannel track crosstalk between all tracks using above reference level.

Equipment used:

1. R.M.S. voltmeter HP 3400A or equivalent.
2. Universal filter, General Radio #1952 or equivalent.

4.6.7.4.9 Duplicated Speed

- a. Measure and record frequency of open reel NLS crosstalk tape. (1 kHz tone section, 3-3/4 ips).
- b. Measure and record frequency of duplicated cassette (1 kHz tone section, 15/16 ips), from NLS open reel crosstalk tape. Frequency measured should be within \pm 2% of Section a.

Equipment Used:

1. Frequency Counter: Fluke 1920A or equivalent.

4.6.8 Environmental Tests

Cassettes selected in accordance with 4.6.1 (b) shall be subjected to the high temperature, low temperature, and humidity condition of 4.6.8.1, 4.6.8.2, and 4.6.8.3, and shall then

be retested for conformance to mechanical requirements of 3.8.2. Cassettes subjected to the conditions of 4.6.8.1 shall then be tested for conformance to the requirements of 3.10.8. All cassettes shall then be tested to the requirements of 3.10.3, 3.10.5, 3.10.6, 3.9.5, and 3.7.3.2.

4.6.8.1 High Temperature

The cassettes under test shall be subjected to 70 degrees +0 degrees, -5 degrees C (158 degrees +0 degrees, -9 degrees F) and a relative humidity of between 0-30% for a period of 24 hours. The cassettes shall be brought back to "test environment" (see 4.6.3) at a temperature gradient of no greater than 25 degrees C (45 degrees F) per hour and shall remain at "test environment" at least 2 hours before further tests.

4.6.8.2 Low Temperature

The cassettes under test shall be subjected to -30 degrees +5 degrees, -0 degrees C (-22 degrees +9 degrees, -0 degrees F) for a period of 24 hours. The cassettes shall be brought back to "test environment" (see 4.6.3) at a temperature gradient of no greater than 25.0 degrees C (45 degrees F) per hour and shall remain at "test environment" at least 2 hours before further tests.

4.6.8.3 Humidity

The cassettes under test shall be subjected to 45 degrees +5 degrees C (113 degrees \pm 9 degrees F) and a relative humidity of 90 + 5% for a period of 24 hours. The cassette temperature to stabilize to the "test environment" (see 4.6.3) by opening the test chamber door and allowing the cassette temperature to stabilize to the "test environment" for at least 2 hours before further test.

4.6.8.4 Drop Test

The drop test shall consist of four drops of C-90 loaded cassettes from a height of 30 inches onto a concrete floor covered with asphalt or tile. The first two drops shall be on alternate ends and the second two drops shall be on alternate faces. Upon completion of the drops, inspect the cassette and hubs for breakage or

cracks and for conformance to the requirement of 3.8.2. Hub dislocation shall not be considered a failure provided that the hub can easily be repositioned.

4.6.9 Operational Tests

4.6.9.1 Short-Term Operation Test

The cassette to be tested shall be subjected to one fast cycle to determine conformance to 3.9.6. A fast cycle shall consist of fast rewinding the tape from end-to-end in one direction then turning the cassette over and fast rewinding the tape from end-to-end in the other direction. Upon completion of the fast cycle the cassette shall be tested for conformance to 3.8.1 and 3.8.2.

4.6.9.2 Operational Life Test

A 315 Hz signal shall be recorded onto tracks 1 and 2 of the cassette tape to be tested at standard recording level (see 4.6.7.1.6) with operating bias current (see 4.6.7.1.3). The recorded signals shall be played back and the average output voltage for each track measured and noted as the initial output level for that track. The test cassettes shall then be life tested by repetitive cycling until it has reached 40 cycles or fails, whichever comes first. One cycle shall consist of playing the cassette from end-to-end in one direction, then turning the cassette over and repeating the same procedure. Upon completion of the 40 cycles the cassettes shall be retested for conformance to the mechanical requirements of 3.8.2 and the previously recorded signals shall be played back and the average output voltage for each track measured (in dB) and noted as the final output level for that track. Compare the initial output voltage level for each track with the final output voltage level for each track for conformance to 3.15.

4.6.9.3 Spill Test

1. Set the cassette machine variable speed control to the "Hi" position.
2. Set the speed to 1-7/8 ips.

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3. Insert the cassette into the machine; the cassette should be fully rewound.
4. Put the tape in motion by pressing the fast-forward lever.
5. Allow the machine to run in fast-forward for at least 5 seconds.
6. Switch the machine directly to play. Do not press the stop lever.
7. Allow the machine to run for approximately 1/2 second. Several trials may have to be made to achieve the proper timing.
8. Switch the machine to stop.
9. Check the cassette for capstan wrap around, take up pack wrap around or tape spillage from the cassette.

4.6.10 Corner Tape Guides, Window Dimensions, and Label Writing Space Measurements

The cassette corner tape guide hub diameter, the window dimensions, and the label writing space shall be measured for conformance to the applicable requirements in 3.5.2, 3.5.3, and 3.5.8.

4.6.11 Cassette Physical Examination

The cassette shall be visually examined for conformance to the applicable requirements in 3.5.4 and 3.5.5.

4.6.12 Magnetic Tape and Leader Dimensions Measurements

4.6.12.1 Tape Length, Width, Thickness

The tape shall be measured for conformance to the requirements of 3.6.1, 3.6.2, 3.6.3 respectively.

4.6.12.2 Leader Length

The tape leader length shall be measured for conformance to the requirement of 3.7.1.

4.6.12.3 Splice Gap and Splicing Tape Width

The splice gap shall be measured for conformance to the requirement of 3.7.3. The splicing tape width shall be visually examined for conformance to the requirement of 3.7.3.1.

4.6.13 Magnetic Tape and Leader Physical Measurements

4.6.13.1 Tape Tensile Properties

The tape tensile properties test shall be performed in accordance with EIA RS-362. The 1% offset yield point, the force corresponding to 3% elongation, and the tensile force at break shall equal or exceed the value specified in 3.9.1.

4.6.13.2 Tape Elongation Under Stress

Test samples shall be at least 610 mm (24 in) in length. The test samples shall be clamped so as to hang in the test area for at least 24 hours under no externally applied stress before tests are begun. Before any weight is hung on the test samples, a mark shall be made approximately 508 mm (20 in) from the point of clamping to measure the elongation and recovery of the sample. The distance between the mark and clamping point shall be measured accurately to the nearest 0.254 mm (0.01 in) with an applied tension of approximately 25 grams. This distance shall be taken as the base distance for calculation of elongation. When the measurement of the base distance has been made, the test shall begin. A test weight of 185 grams for tape from C-90 cassettes shall be attached to the tape below the mark at zero time and allowed to hang undisturbed for 180 minutes \pm 30 seconds, at which time the weight shall be removed from the tape. The tape shall be allowed to hang under its own weight for an additional 180 minutes \pm 30 seconds. The distance between the mark and the point of clamping shall then be measured to the nearest 0.254 mm (0.01 in) with an applied tension of approximately 25 grams. The difference between the base distance and the final distance shall be expressed as a percent of the base distance to determine

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compliance with 3.9.2.

4.6.13.3 Leader-to-Hub or Tape-to-Hub Strength

The leader-to-hub or tape-to-hub strength shall be measured for conformance to the requirement of 3.7.2.

4.6.13.4 Splice Strength

The splice strength shall be measured for conformance to the requirement of 3.7.3.

4.6.14 Anchorage

A visual examination shall be made of the tape after completion of all tests to determine conformance to 3.9.3.

5. PREPARATION FOR DELIVERY

5.1 Specific Requirements

The specific requirements for materials to be used in labeling, packaging, and packing cassette books shall be covered in NLS Specification #403. (See Section 2, Applicable Documents.)

6. NOTES

6.1 Reference Cassettes

The DIN Calibration and Reference Cassettes may be obtained from Order Department, BASF Systems, Crosby Drive, Bedford, Massachusetts 01730.

- a. Calibration Cassette Part Number 54407
- b. Reference Medium Part Number 52015.

6.2 Crosstalk Test Tape

Available from NLS on a loan basis. Contact Contracting Officer listed.

Qualification Inspection Flow Chart

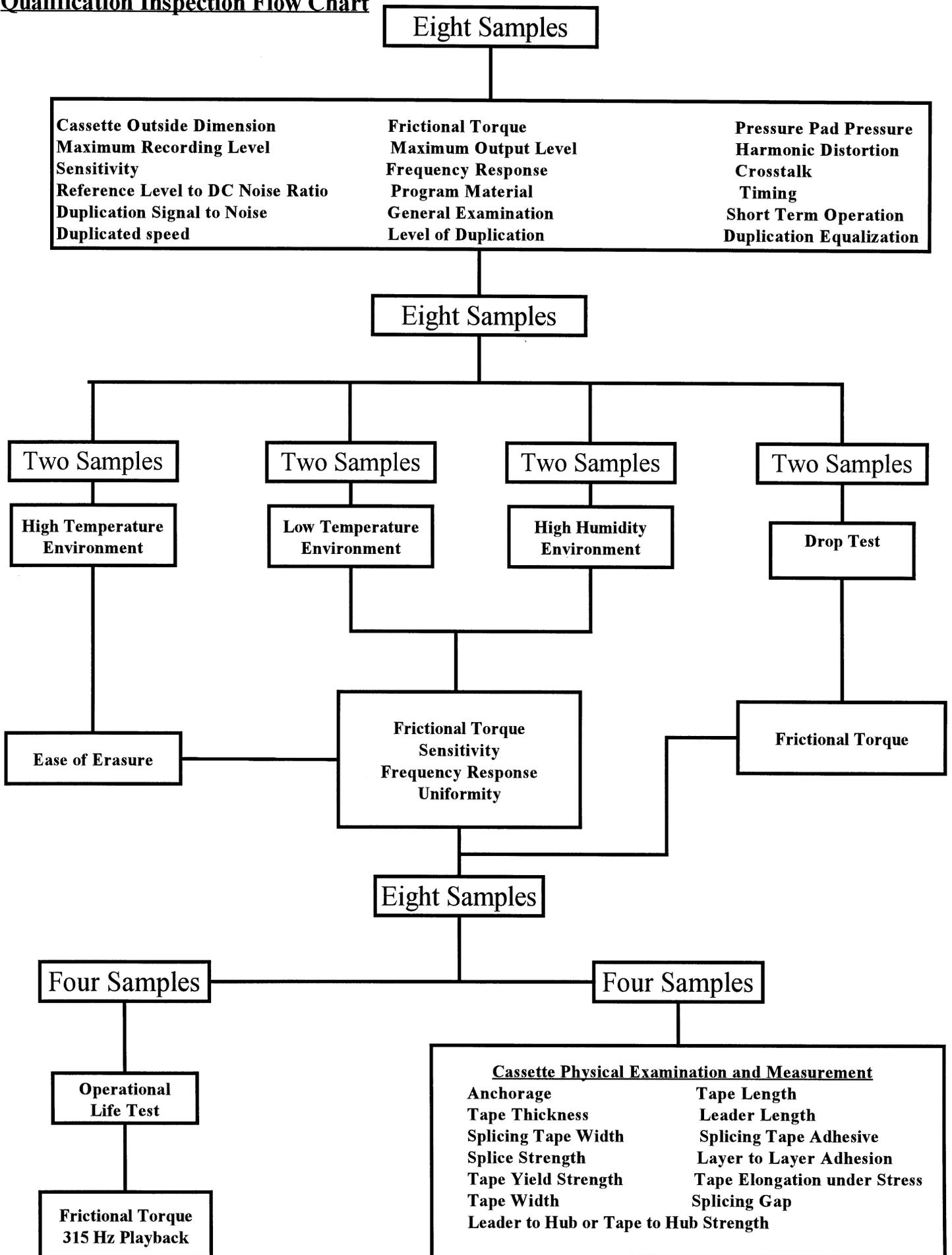


Figure 1

RECORDER/REPRODUCER FREQUENCY RESPONSE LIMITS

K·E SEMI-LOGARITHMIC 359-72
KEUFFEL & ESSER CO. MADE IN U.S.A.
3 CYCLES X 84 DIVISIONS

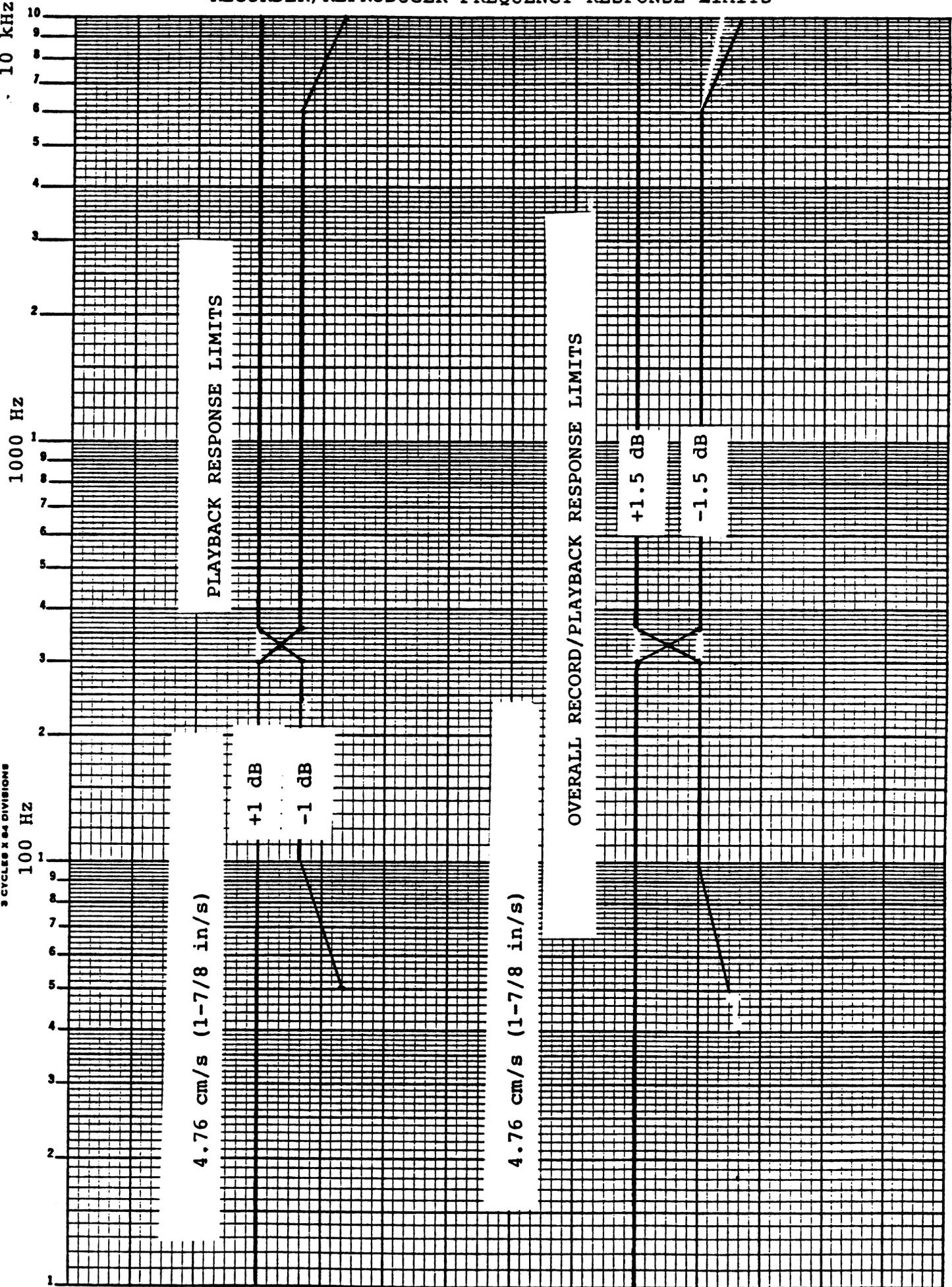
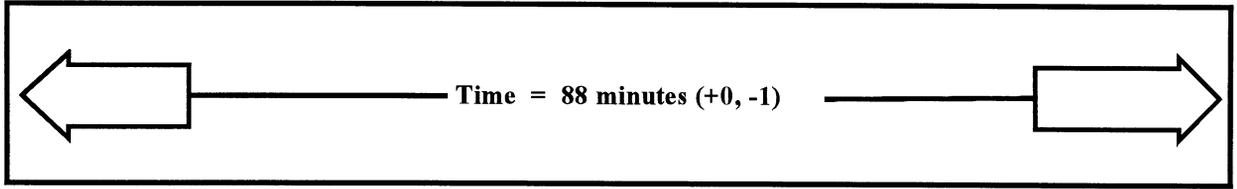
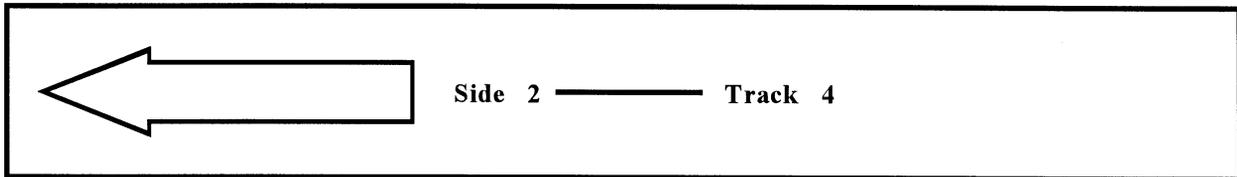


FIGURE 2



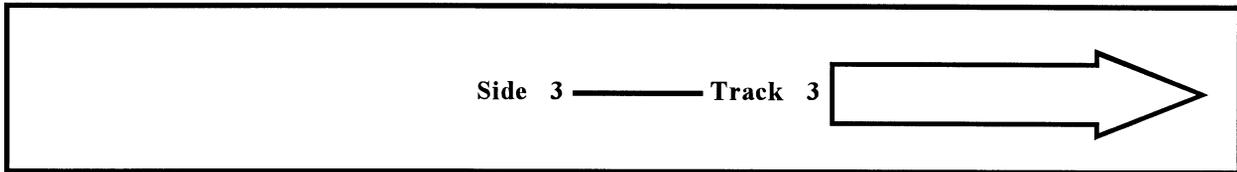
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Finish



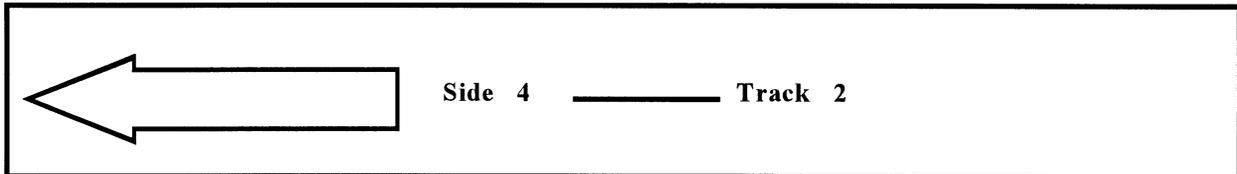
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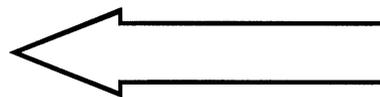
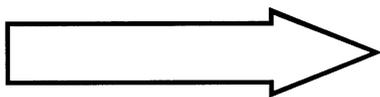
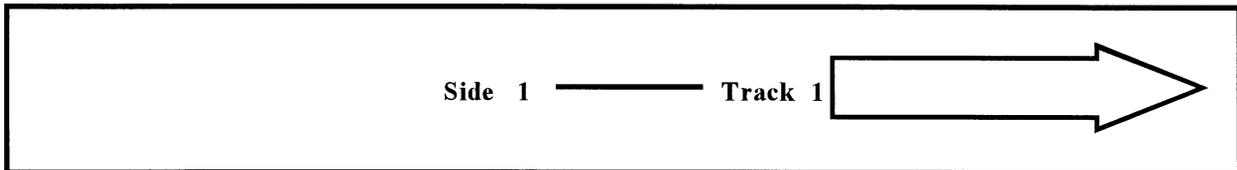
Start

Finish



Start

Finish



Denotes direction of tape travel