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Technical Memorandum **80599**

GSFC Specification Electronic Data Processing Magnetic Recording Tape

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CONTENTS

CONTENTS (cont)

CONTENTS (cont)

CONTENTS (cont)

ILLUSTRATIONS

ILLUSTRATIONS (cont)

TABLES

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

GODDARD SPACE FLIGHT CENTER

SPECIFICATION FOR TAPE, ELECTRONIC DATA PROCESSING, MAGNETIC OXIDE COATED

This Specification was developed by the Goddard Space Flight Center, Greenbelt, MD 20771, and generally reflects available, state-of-the-art products. Copies may be obtained from GSFC, Code 863.1.

1. SCOPE AND CLASSIFICATION

1.1 Scope. This specification covers the requirements for magnetic oxide-coated, electronic data processing tape, wound on reels, designed for use in digital recording applications. Magnetic recording tape types covered by this specification are intended for use on digital tape transports using the Non-Return-to-Zero-change-on-ones (NRZI) recording method for recording densities up to and including 800 characters per inch (cpi) and the Phase-Encoding (PE) recording method for a recording density of 1600 cpi.

1.2 Classification

1.2.1 General. Each individual tape configuration covered by this specification shall be identified by an item identifying part number consisting of the specification number, with revision indicator (if any), and the indicators compiled from the part number code as follows:

TM80599	-	16	-	24	-	BF	-	SD
Specification number		Application indicator (para 1.2.2.1)		Tape length & reel size indicator (para 1.2.2.2)		Latch leader indicator (para 1.2.2.3)		Tape reel storage & shipping device indicator (para 1.2.2.4)

1.2.2 Part Number Code

1.2.2.1 Application Indicator. The application indicator identifies the recording density (in cpi); track format (in number of tracks); and recording method (in the NRZI method or the PE method) for which the tape is intended. The application shall be indicated as follows:

Indicator Code	Application
16	1600 cpi, 9-track, PE
08-16	Multiple use, 800 cpi, 9-track NRZI 1600 cpi, 9-track PE

1.2.2.2 Tape Length and Reel Size Indicator. The tape length and reel size shall be indicated as follows:

Indicator Code	Tape Length and Reel Size
06	600 feet on 7.0-inch reel
12	1200 feet on 8.5-inch reel
24	2400 feet on 10.5-inch reel

1.2.2.3 Latch Leader Indicator. When tape is supplied with a latch leader, the latch leader shall be indicated as follows:

Indicator Code	Latch Leader Type
BF	Burroughs-compatible, female
BM	Burroughs-compatible, male
UF	Univac-compatible, female
UM	Univac-compatible, male

1.2.2.4 Tape Reel Storage and Shipping Device Indicator. The tape reel storage and shipping device indicator identifies whether the tape is supplied in a disposable shipping device, a wraparound reel band, an autoload cartridge, or a transparent plastic dust-proof canister. The tape reel storage and shipping device shall be indicated as follows:

Indicator Code	Tape Reel Storage and Shipping Device
SD	Disposable shipping device
RB	Wraparound reel band
CA	Transparent plastic dust proof canister
AL2	Autoload cartridge, Type 2

2. APPLICABLE DOCUMENTS

2.1 Specifications and Standards. The following documents, of the issue in effect on date of invitation for bids or request for proposal, form a part of this specification to the extent specified herein:

Federal Specifications:

PPP-B-636 - Boxes, Shipping, Fiberboard.

W-B-001573 - Bands, Wraparound, Tape Reel (For Computer Tape Storage).

Federal Standards:

Fed. Std. No. 123 - Marking for Domestic Shipment (Civil Agencies).

Fed. Test Method Std. No. 406/GEN - Plastics: Methods of Testing.

Fed. Test Method 406/1013 - Tensile Properties of Thin Plastic Sheet and Films.

Fed. Test Method 406/4041 - Electrical Resistance.

Activities outside the Federal Government may obtain copies of Federal Specifications, Standards, and Handbooks as outlined under General Information in the Index of Federal Specifications and Standards and at the prices indicated in the Index. The Index, which includes cumulative monthly supplements as issued, is for sale on a subscription basis by the Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402.

Single copies of Federal Specifications required by activities outside the Federal Government for bidding purposes are available without charge from Business Service Centers at the General Services Administration Regional Offices in Boston, New York, Washington, Atlanta, Chicago, Kansas City, Fort Worth, Denver, San Francisco, Los Angeles, and Seattle.

Federal Government activities may obtain copies of Federal Specifications, Standards, and Handbooks and the Index of Federal Specifications and Standards from established distribution points in their agencies.

Military Standards:

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

MIL-STD-129 - Marking for Shipping and Storage.

MIL-I-631 - Insulation, Electrical, Synthetic Resin Composition, Non Rigid.

Copies of Military Specifications and Standards required by suppliers in connection with specific procurement functions should be obtained from the procuring activity or as directed by the contracting officer.

NASA Goddard Standards:

NHB 5300.4(1C) - NASA Quality Publication - Inspection Provisions for Suppliers of Space Materials, Parts, Components, and Service.

2.2 Other Publications. The following documents form a part of this specification to the extent specified herein. Unless a specific issue is identified, the issue in effect on date of invitation for bids or request for proposal shall apply.

American Society for Testing and Materials (ASTM) Standards:

D 638 - Test for Tensile Properties of Plastics.

Applications for copies should be addressed to the American Society for Testing Materials, 1916 Race Street, Philadelphia, Pennsylvania 19103.

U.S. Dept. of Commerce, National Bureau of Standards (NBS):

NBS Special Publication 260-29 - Calibration of NBS Secondary Standard Magnetic Tape (Computer Amplitude Reference) SRM 3200 Using the Reference Tape Amplitude Measurement "Process A" Model II.

Copies of NBS Special Publication 260-29 may be obtained from the Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402.

3. DEFINITIONS

Where the listed terms are used herein, the following definitions apply unless otherwise stated:

3.1 Certifying Agency. National Aeronautics and Space Administration, Goddard Space Flight Center (NASA-GSFC).

3.2 Dynamic Skew. A time difference between amplitude peaks of 1 bits in the two outside tracks of the same character.

3.3 NRZI Recording Method. The recording method wherein a 1 bit is produced by each reversal of flux polarity. No change in flux polarity produces a 0 bit. Tape is fully saturated in each polarity of flux.

3.4 Pass. The movement of an increment of tape of any length over the magnetic head in the forward direction while reading or writing followed by a reverse or rewind operation over the same increment without reading or writing.

3.5 PE Recording Method. The recording method wherein flux polarity reversals are writtern for 1 bits and 0 bits. A 1 bit is a flux transition to the polarity of the interblock gap when tape moves in the forward direction; a 0 bit is a transition to the polarity opposite to that of the interblock gap. A flux transition (phase flux reversal) may be written at the nominal midpoint between data bit flux transitions to establish the proper polarity for the succeeding bit.

3.6 Permanent Dropout. A reduction in the read back signal amplitude of any bit(s) to less than the threshold values given for three consecutive read trials whether the reduction is caused by tape debris or other deterioration of the tape during a test.

3.7 Primary Reference Tape. An unrecorded length of tape used as a reference to establish the Standard Reference Current (Ir) and the Standard Reference Amplitude for the magnetic measurements and tests specified herein. This reference is maintained at the National Bureau of Standards, Washington, DC 20234.

3.8 Secondary Reference Tape. An unrecorded length of tape, the magnetic characteristics of which have been calibrated against those of the primary reference tape. It is used for the adjustment of the measurement system(s) and for certain magnetic tests specified herein. The secondary reference tape is referred to as "Secondary Standard Magnetic Tape Computer Amplitude Reference" and is designated as the NBS Standard Reference Material 3200 (SRM 3200). It may be ordered from the Office of Standard Reference Materials, National Bureau of Standards, Washington DC 20234.

3.9 Standard Measurement Current. The write current used to determine the Standard Reference Amplitude from the primary reference tape at the recording density under consideration. The relationship between Standard Reference Current (Ir) and Standard Measurement Current (Im) is expressed as the ratio N = Im/Ir and shall be in accordance with the following requirements:

Recording Density (cpi)	Ratio N
800	2.02 to 2.20
1600	1.75 to 1.85

3.10 Standard Recording, 800 cpi. Consists of all 1's recorded at 800 cpi, using the NRZI recording method, with applicable Standard Measurement Current (Im).

3.11 Standard Recording, 1600 cpi. Consists of all 1's reecorded at 1600 cpi (3200 flux changes per inch), using the PE recording method, with applicable Standard Measurement Current (Im).

3.12 Standard Reference Amplitude. The average peak-to-peak output signal level of a signal recorded on the primary reference tape at the specified recording density and with the applicable Im.

3.13 Standard Reference Current. The minimum write current at any specified recording density which will give an output signal amplitude from the primary reference tape equal to 95 percent of its maximum output signal amplitude.

3.14 Temporary Dropout. A reduction in the read back signal amplitude of any bit(s) to less than the threshold values given and of a transient nature; i.e., during three consecutive read trials, the dropout cause is eliminated and the signal amplitude returns to normal.

3.15 TF Value. The radial distance by which magnetic tape reel flanges extend beyond the outermost layer of tape.

4. TEST EQUIPMENT

The qualification tests and acceptance tests specified herein which require recording data on the tape will be performed using the following listed systems and record/read heads:

4.1 Digital Tape Certifiers

4.1.1 General Kinetics Model 97.

4.1.2 Radix II Model MTT-1250 consisting of Pertec Model T-1640 digital transports, control devices, and data printer.

4.1.3 Digital Equipment Corp. Model PDP-11/40 computer system using TU-16 digital transports.

4.1.4 Intermediate Band recorder/reproducer, Bell & Howell VR-3400, Ampex FR600 or equivalent.

4.2 Record/Read Heads. The qualification tests and acceptance tests specified herein will be performed using the following record/read heads:

4.2.1 Digital Heads

Part No.	Description
IBM 2510730	9 track
Pertec 530-6369	9 track
DEC 7412722-1	9 track

4.2.2 Analog Heads

Record Head

Seven tracks on 0.070 ±0.001 inch centers.

Track width: 0.048 ±0.001 inch.

Gap width: 0.0005 inch ±10 percent.

Tape-to-head contact angle: 7 $+2^{0}$ measured from a line normal to the head gap.

Apex radius at gap: 0.1 inch.

Read Head

Track width: 0.030 ±0.001 inch. All other specifications are the same as listed for the record head.

Note

Head surface finish shall be equivalent to heads exposed to a minimum of 50 and a maximum of 800 hours of use.

5. REQUIREMENTS

5.1 General Requirements. The tape and tape reels supplied under this specification shall be new and shall have been tested for conformance to the requirements specified herein. In addition, the supplier must have met the requirements of NASA Quality Publication NHB 5300.4(1C)

5.1.1 Product Qualification. Qualification testing shall be conducted at the Magnetic Tape Certification Facility, Goddard Space Flight Center, Greenbelt, MD 20771 and shall consist of all tests listed in this section. All samples subjected to these tests must also conform to the requirements

listed in this specification, unless otherwise specified. Qualification of a particular tape type of a given base material, thickness, width, oxide, and performance characteristics shall constitute qualification of all tapes of identical characteristics regardless of length.

5.1.1.1 Qualified Products Listing. The tape and tape reels supplied under this specification shall be products which have been tested and have passed the qualification tests specified herein, and that are listed or approved for listing on the applicable Federal Qualified Products List (QPL).

5.1.1.2 Qualification Product Testing. Products may be submitted by prospective suppliers of magnetic tape on dates to be announced by the certifying agency. A prospective supplier may submit only the type of tape requested for testing on these submission dates. Qualifying tapes being submitted must be identified by a manufacturer's designator and the recording density certification. Should the submitted product fail to meet specifications as defined herein, the certifying agency reserves the right to refuse to accept such a product for additional qualification tests until satisfactory data and test results have been submitted indicating correction of product deficiencies. The certifying agency shall accept only one type of tape for qualification testing from each prospective supplier within any eight-month period. Two copies of the manufacturer's printed commercial specifications and technical data shall be submitted with tape samples. The certifying agency reserves the right to levy a charge to cover cost of product qualification testing; however, such charge shall only be made when so specified in the procurement documents.

5.1.1.3 Samples for Qualification. The sample size shall consist of fifteen reels of tape for each particular tape type of a given base material, thickness, oxide, and performance characteristics for which qualification is desired. All tape samples shall be submitted on reels which conform to the requirements of this specification unless otherwise specified. The manufacturer shall also submit test data showing that each tape type for which qualification is desired has successfully met all of the requirements of this specification.

5.1.1.4 Sample Disposition. Samples submitted for qualification shall be retained by the certifying agency.

5.1.1.5 Qualification Withdrawal. A supplier's qualified product listing shall be withdrawn for any of the following reasons: (1) the product offered under contract does not meet the requirements of the specifications, (2) the manufacturer is delivering a product differing in material and/or manufacturing process from the one originally qualified, or (3) other reasons considered to be sufficient by the certifying agency.

5.1.1.6 Requalification. A supplier's product, once withdrawn from the QPL, shall not be accepted for requalification within eight months from date of product listing withdrawal notice and until satisfactory data and test results have been submitted to the certifying agency by the supplier indicating correction of the product fault(s).

5.1.1.7 Process Change. Qualification and certification of a supplier's product under this specification, once established, applies only to those tapes manufactured by the specific process in use at the time of qualification. All process changes shall be reported to the certifying agency indicating the extent and probable effect of such changes on the delivered product. The certifying agency reserves the right to require six weeks notice, and sufficient samples of the new product for quality assurance tests, from the supplier prior to delivery of products manufactured under any such change 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 equal to or better than those products originally submitted for qualification.

5.1.2 Product Acceptance Testing. Acceptance testing shall be conducted at the Magnetic Tape Certification Facility, Goddard Space Flight Center, Greenbelt, Maryland 20771. Normal acceptance testing will be those tests indicated in Test Groups A, B, and C (table I). Groups A, B, C, and D tests shall be required at the time of qualification and as often thereafter as is deemed necessary to ensure continued compliance with the specified requirements. Failure to conform to any of the requirements of Group D tests or inspection shall be cause for rejection of that lot represented by the samples.

5.1.2.1 Samples for Acceptance Testing. Samples shall be drawn from lots delivered to GSFC unless otherwise indicated in the procurement. The number of samples required for acceptance testing is governed by lot size and shall be in accordance with MIL-STD-105D, Normal Inspection, Level 1, Single Sampling Plan, at an AQL of 2.5.

5.1.3 Lot Size and Definition. On orders exceeding 1000 reels of tape, the minimum lot size shall be 1000 and the maximum lot size shall be 3200. For orders of less than 1000 reels of tape, the lot size may be the order size. A lot shall consist of reels of tape, of the same type, that have been manufactured and processed from the same batch or mix of the basic coating materials used in the production of the tape. This batch or mix shall be sufficient to ensure compliance with lot size requirements. In the case of a continuous batching or production process, a lot shall consist of tapes selected from concurrent production runs to meet lot size requirements.

5.1.4 Compatibility with Other Tapes. Tape supplied under this specification shall not act as inhibitor tape. The performance of other tapes shall not be degraded by the use of any other qualified product listed tape when operated on the same transports.

Table I. Test and Examination Acceptance Criteria

Normal Inspection Level 1, A.Q.L. 2.5	
Group A	Requirement Paragraph
Wind	5.1.6
Workmanship and general examination	5.1.10
Length	5.4.2.1.1
Thickness	5.4.2.1.3
"TF" Value	5.4.2.1.4
Signal output amplitude	5.5.1.1
Dropouts	5.5.1.3
Special Inspection Level S-1, A.Q.L. 4.0	
Group B	Requirement Paragraph
Width	5.4.2.1.2
Latch leaders	5.4.2.2
Slitting	5.4.2.4
Modulus of flexibility	5.4.2.8
Magnetic coating electrical resistance	5.4.2.11
Back coating electrical resistance	5.4.2.12
Layer-to-layer adhesion	5.4.2.13
Signal output amplitude uniformity	5.5.1.2
Dynamic skew	5.5.1.4

Table I. Test and Examination Acceptance Criteria (cont)

Normal Inspection Level 1, A.Q.L. 0.40	
Group C	Requirement Paragraph
Splices	5.1.7
Reels	5.4.1
Coating to base material anchorage	5.5.1.6
Physical damage	5.1.11

Other Tests and Examinations	
Group D	Requirement Paragraph
Toxic compounds	5.1.5.2
Flammable materials	5.1.5.3
Moment of inertia	5.4.1.6
Photoreflective markers	5.4.2.3
Magnetic properties	5.4.2.5
Tensile strength	5.4.2.6
Shock tensile strength	5.4.2.7
Elongation under stress	5.4.2.9
Longitudinal curvature	5.4.2.10
Humidity stability (cupping)	5.4.2.14
Abrasivity	5.4.2.15
Surface finish (magnetic and back coatings)	5.4.2.16
Surface finish (uncoated backing)	5.4.2.17
Dynamic frictional characteristics	5.4.2.18
Fungus resistance	5.4.2.19
Ease of erasure	5.5.1.5

Table I. Test and Examination Acceptance Criteria (cont)

Other Tests and Examinations (cont)	
Group D	Requirement Paragraph
Start time	5.5.1.7
Ten-foot wear	5.5.1.8
Compatibility	5.5.1.9
Layer-to-layer signal transfer	5.5.1.10

5.1.5 Materials

5.1.5.1 Tape. The magnetic tape shall consist of a backing or base of polyethylene terephthalate, polyester film, or equivalent, coated on one side with a layer of ferromagnetic material suspended in a suitable binder, and when applicable, coated on the other (back) surface with a conductive coating.

5.1.5.2 Toxic Compounds. Materials which may cause bodily harm through contact, inhalation, or ingestion during normal use of the tape, reels, and reel containers, shall not be used.

5.1.5.3 Flammable Materials. Materials which will ignite from a match flame and when so ignited will continue to burn in a still carbon dioxide atmosphere shall not be used.

5.1.5.4 Reels. The tape reels shall be constructed of nonmagnetic material(s) suitable for the intended use, capable of long-term storage at ambients of up to 120 degrees F (49 degrees C) and 80 percent relative humidity without affecting serviceability, and shall conform to the pshysical, dimensional, and other requirements specified herein.

5.1.6 Wind. Tape shall be wound, oxide surface toward the reel hub, in a clockwise direction; i.e., when the reel is viewed from the front, the loose end of the tape hangs from the right side of the reel. Tape delivered under this specification shall be furnished wound with a tension of 8 $\pm$2 ounces.

5.1.7 Splices. All tape lengths supplied under this specification shall be continuous and splice free.

5.1.8 Operating Environment. Operating temperatures range from 50 to 90 degrees F (10 to 32 degrees C) and relative humidity from 20 to 80 percent.

5.1.9 Storage Environment. After storage for one year from date of delivery at 40 to 120 degrees F (5 to 49 degrees C) and 20 to 80 percent relative humidity, no deterioration of magnetic oxide, binder, or base shall take place which will prevent the magnetic tape from meeting the specifications herein.

5.1.10 Workmanship and General Examination

5.1.10.1 Workmanship. The magnetic tape, reels, and containers shall be manufactured and processed in a careful and workmanlike manner in accordance with good practice. All surfaces of the tape shall be free from raised areas, dust, flakes, powder, holes, scratches, creases, or any other defects which would render the tape unsuitable for its intended use.

5.1.10.2 General Examination. The tape as initially received from the supplier shall be examined to determine that the reels and tape are free from the defects listed in table II.

5.1.11 Physical Damage. All tape shall be free from physical damage. Any tape that is found to be physically damaged during any quality assurance testing shall be considered a failure.

5.2 Inspection

5.2.1 Responsibility for Inspection. Unless otherwise specified in the contract or purchase order, the supplier is responsible for the performance of all inspection requirements as specified herein. Except as otherwise specified, the supplier may utilize his own facilities or any other commercial laboratory acceptable to the government. The government reserves the right to perform any of the inspections set forth in the specification where such inspections are deemed necessary to ensure that supplies and services conform to prescribed requirements.

5.2.2 Quality Conformance Inspection. The supplier shall be responsible for the performance of quality conformance inspections. The contractor shall select a sample number of reels from each lot offered for delivery and shall subject the samples to the examinations and tests necessary to ensure compliance with the specification requirements. Furthermore, every reel of tape in any lot offered for delivery shall be 100 percent dropout tested to ensure compliance with the requirements of this specification.

5.2.3 Reporting of Quality Conformance Inspection. Unless otherwise directed by the contracting officer, the supplier shall maintain a complete record of all production test results for the duration of the contract. The production test records shall be available to the government at all reasonable times. The records shall include the information necessary to identify the lot, the reels of tape, the testing equipment, the inspection, and the date of the test.

5.3 Test Sample Environmental Conditioning

5.3.1 Standard Temperature and Humidity. The standard temperature and humidity is 75 ±5 degrees F (24 ±3 degrees C) 50 ±3 percent relative humidity. This is the temperature and humidity used for conditioning and/or making tests and measurements unless otherwise specified.

5.3.2 Qualification Sample Preliminary Conditioning. Preliminary conditioning of each reel or hub of tape will be required prior to qualification testing, unless otherwise specified, to relieve stresses and establish uniformity. Reels or hubs of tape shall be rewound under a tension of 8 ±2 ounces per one-half inch tape width. The reels or hubs of tape shall then be conditioned at 125 ±5 degrees F (52 ±3 degrees C) 80 to 90 percent relative humidity for 3 hours. The tape shall then be conditioned at 70 ±5 degrees F (21 ±3 degrees C) 50 ±5 percent relative humidity for a minimum of 3 hours. This temperature-humidity cycle shall be repeated with the transition times between temperature extremes not to exceed 60 minutes, until the tape has been subjected to a total conditioning time, including transitions, of 20 hours. Upon removal after the last cycle, the tape shall immediately be rewound a minimum of three times, at a tension of 8 ±2 ounces per one-half inch tape width. The tape shall then be held in a room conditioned at 70 ±5 degrees F (21 ±3 degrees C) 50 ±5 percent relative humidity for a minimum of 24 hours before any tests are made. Preliminary conditioning shall not be required for supplier quality conformance or acceptance testing.

Table II. General Examination Defects

Examine	Defects
Reels:	
Appearance	Voids, nicks, and other surface imperfections which do not fall within an area of a circle 0.0625 inch in diameter; scratches which exceed 0.5 inch in length.
Identification and labeling	Not as specified.
Reel color	Not as specified.
Write enable ring	Missing; improper fit.
Tape:	
Wind	Not as specified.
Wound pile envelope	Tape pile not smoothly wound; loose, with visible folds, buckling, cinching, spoking, or gaps between the tape layers. Protruding tape edges, tape layers, or groups of layers. Plane of the tape pile not perpendicular to the reel axis.
Appearance	Tape surfaces not clean; presence of dirt, dust, lint, fuzz, or other foreign matter. Presence of blemishes, holes, tears, creases, or wrinkles; split or ragged edges. Presence of adhesive substance.
Construction	Tape does not unroll evenly and uniformly; tape sticks.
Reflective markers	Missing; incorrect placement; wrinkled; improper method of application.
Reel containers	Not as specified.
Condition as received	Improper packaging. Improper marking. Damaged contents.

5.4 Product Physical Requirements

5.4.1 Reels

5.4.1.1 Dimensions. Tape reel dimensions shall be in accordance with those given in figure 1 and table III.

5.4.1.2 Color. The rear flange shall be white and the front flange shall be transparent. The front flange may be frosted; however, the tape pack must be fully visible through the front flange.

5.4.1.3 Flange Label Area. The front flange of the reel shall be free of decorative designs, ribs, bosses, etc., over either two sectors of not less than 120 degrees or three sectors of not less than 100 degrees. The minimum radius difference (R_1 minus R_2 of any sector shall be as in the following listing. The roughness of the surface described by this sector shall not exceed 60 microinches (arithmetic average) when using a profile measuring instrument having a 0.0001-inch stylus and cutoff wavelength of 0.030 inch. R_1 is the larger radius of the label end and R_2 is the smaller radius of the label area.

Reel Flange Area (inches)	Radius Difference (inches)
7.0	0.8
8.5	1.5
10.5	2.3

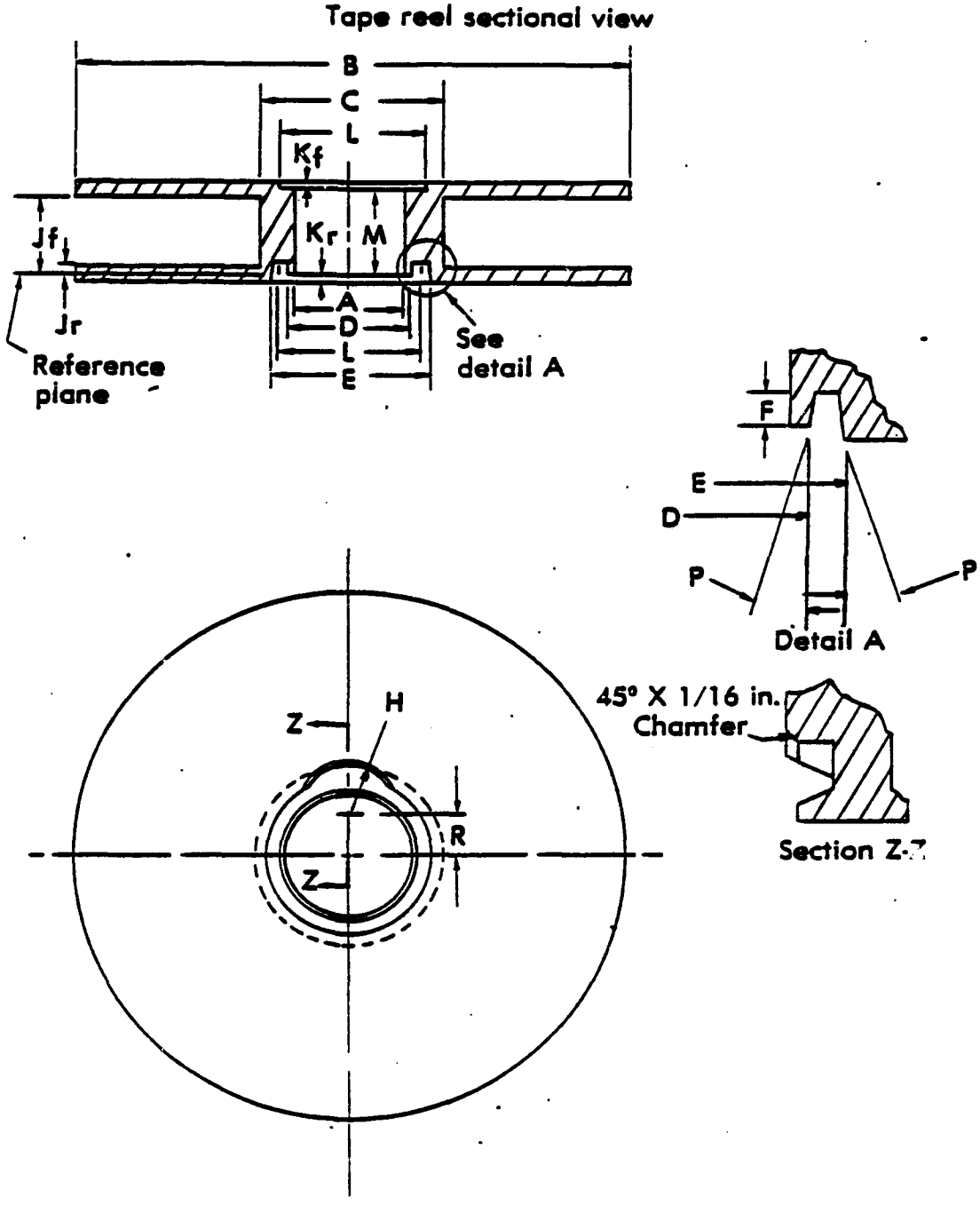


Figure 1. Tape Reel

Table III. Reel Measurements (Note 1)

Dimension	Measurement
A	3.688 + 0.005 - 0.003
B (Note 2)	Table IV
C	4.125 ± 0.005
D	3.875 ± 0.005
E	4.388 ± 0.005
F	0.250 + 0.010 - 0.000
H	0.750 ± 0.015
J_f	9.622 + 0.025 - 0.005
J_r	0.097 + 0.005 - 0.025
K_f	0.125 (maximum)
K_r	0.080 (maximum)
L	4.125 (minimum)
M	0.718 ± 0.005
P	4 degrees ± 0.25 degree
R	1.677 ± 0.010

Table III. Reel Measurements (cont)

NOTES:

1. All measurements (except dimension P) are in inches.
2. There shall be a minimum radius of 0.035 inch on the inside edge and 0.015 inch on the outside edge of the outer extremity of the flanges.
3. The hub surface shall be perpendicular to the reference plane within 0.0026 inch.
4. The reel mounting surface extends out to dimension L.
5. A finger guide shall be provided; size, shape, and location is optional.
6. Bosses, ribs, or raised designs are permitted on the outside surfaces of the flanges, provided they do not extend beyond the cross-hatched envelope of figure 1.
7. Flange holes are optional, as are their number, size, and shape when provided.
8. At no point shall the minimum flange spacing fall below 0.515 inch.
9. The outside cylinder surface of the hub shall be concentric with the centerline of the hub hole within 0.010 inch.
10. Each flange rim shall be concentric with the centerline of the hub hole within 0.020 inch.
11. K_r and K_f shall be 0.030 inch maximum within 0.030 inch of the flange outside diameter (Dimension B).
12. Dimension L defines the minimum diameter of the reel mounting surface. The ring-groove relief is not required so long as the ring does not protrude beyond the reel mounting surface.

Table IV. Flange Measurements

Reel Size	B dimension (inches)
7.0	7.000 ± 0.020
8.5	8.500 ± 0.020
10.5	$10.500 \begin{smallmatrix} + 0.010 \\ - 0.030 \end{smallmatrix}$

5.4.1.4 Color Coding Ring. When specified in the contract or purchase order, one color coding ring, of the color specified in the contract or purchase order, shall be provided for each reel of tape in the contract or purchase order. When color coding rings are required, they shall be provided as a separate item of the order and shall not be affixed to the tape reels. Color coding rings shall be constructed of thin plastic (polystyrene or equivalent) with the color on one side and a pressure-sensitive adhesive coating on the reverse side. Color coding rings shall meet the dimensional measurements as given in figure 2 and shall be available in the following listed colors:

Color Coding Ring Colors

Black	Green	Tan
Blue	Orange	Yellow
Gray	Red	White

5.4.1.5 Write Enable Ring. Each reel shall be furnished with a write enable ring installed. The write enable ring shall be in accordance with requirements given in figure 3. The color of the write enable ring shall be other than white.

5.4.1.6 Moment of Inertia

5.4.1.6.1 Requirement. The moment of inertia for a reel of tape shall not exceed 0.091 in.-lb-sec ^{2}.

5.4.1.6.2 Test Equipment. A rigid fixture with a horizontally positioned level knife edge upon which to rest the inner cylindrical hub surface of the reel under test.

5.4.1.6.3 Sample Preparation. Standard.

5.4.1.6.4 Test Procedure. Weigh the reel with write enable ring installed, then place the reel under test squarely on the knife-edge positioned to make contact with the inner cylindrical hub surface parallel to and at a distance equal to the hub hole radius from the reel's normal axis of rotation. The reel of tape shall then be started into motion to swing as a pendulum; pivoting a maximum of 10 degrees from its resting point. One hundred complete oscillations (forward and back) shall be timed. This procedure shall be repeated three times for each reel tested and the average time for one oscillation calculated to determine value T (Total time 100). The moment of inertia shall be calculated using the following formula:

$$I = AW (T^2 - B)$$

where: I = moment of inertia

A = 0.0467 inch

W = weight in pounds

T = period in seconds, one complete oscillation

B = 0.1885 sec.^{2}

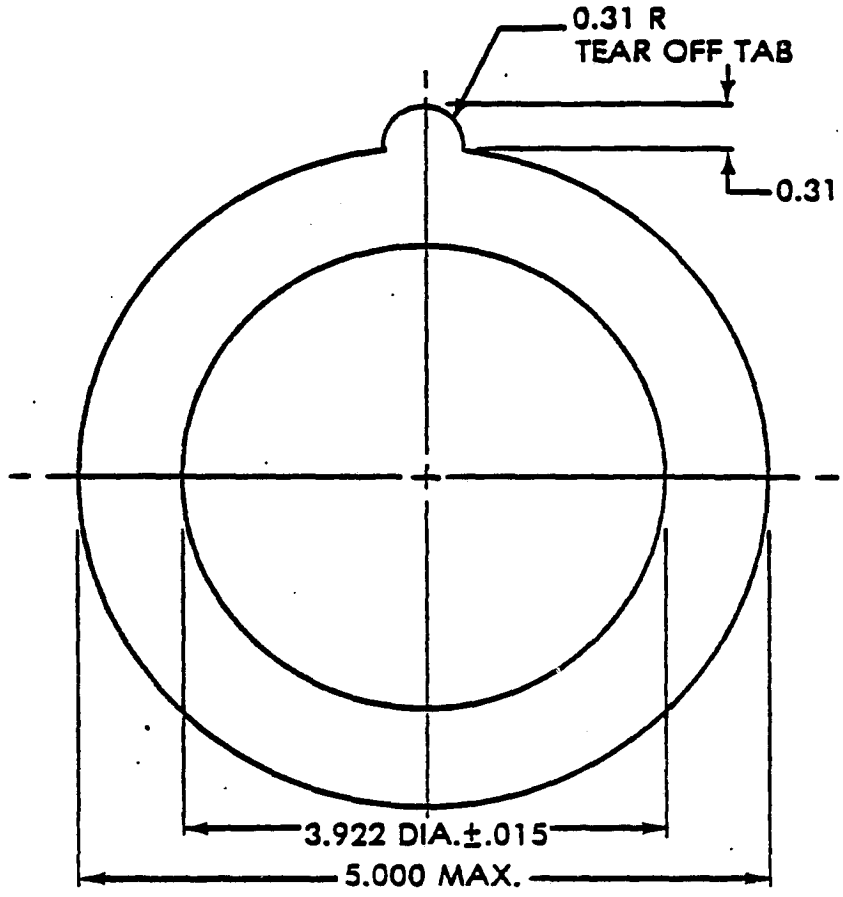


Figure 2. Color Coding Ring

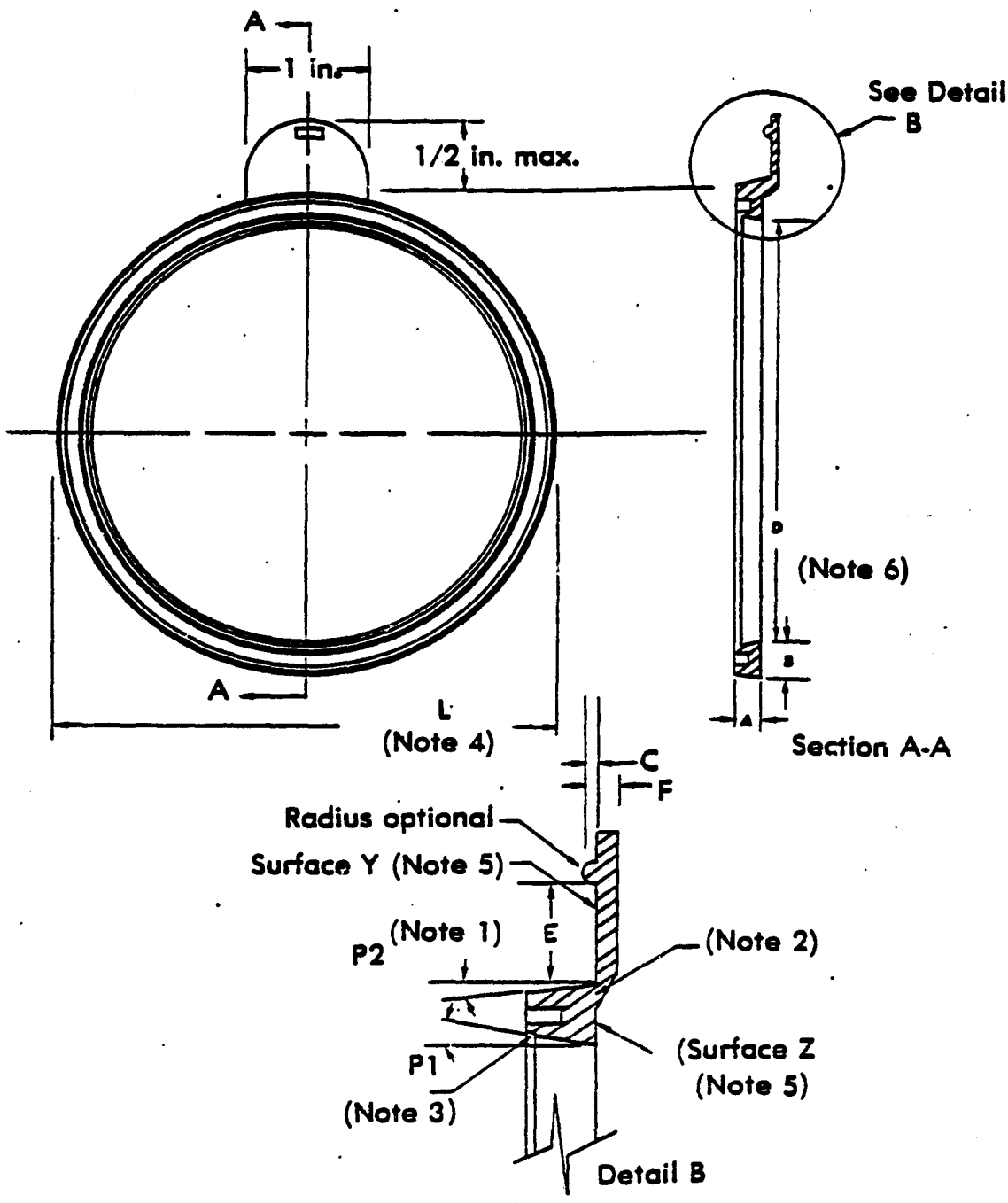


Figure 3. Write Enable Ring

Legend

Dimension	Measurement
A	0.235 + 0.010 - 0.020
B	0.230 ± 0.010
C	0.040 max
E	0.300 min
F	0.060 max
L	4.383 max
P_1	$4^o \pm 1^o$
P_2	3^o min

Unless other specified, all measurements are in inches.

NOTES:

1. Angle must be such that the outside diameter (OD) of ring does not interfere with ring groove when ring is installed.
2. Cross section optional within dimensions specified.
3. Edge relief optional: 0.03125 inch x 45 degrees chamfer, or 0.0625 inch R.
4. L dimension is measured with ring installed in a standard reel.
5. Surface Y must not be recessed below the plane of surface Z.
6. The D dimension, cross section, and material used must be such that the ring may be installed and removed with reasonable effort and remain seated during normal use.
7. When installed on a standard reel, the top surface of the write enable ring must be such that it does not protrude above the lateral mounting surface as defined by dimension L in figure 1.
8. All rings must have a tab to facilitate removal from the groove. The shape and size of the tab are optional within the limits specified.

Figure 3. Write Enable Ring (Cont)

5.4.2 Tape

5.4.2.1 Dimensions

5.4.2.1.1 Length. Tape shall be supplied in lengths in accordance with table V on reels as described in table III. The length given in table V is for the overall length of the tape measured under a tape tension of 8 ounces ±2 ounces. Length shall be checked during operational tests on MTT-1250.

Table V. Tape Lengths

Tape Length (feet)	Reel Size (inches)
600 +50 -00	7.0
1200 +50 -00	8.5
2400 +50 -00	10.5

5.4.2.1.2 Width. The tape width shall be 0.498 inch ±0.002 inch. This measurement shall be made using a tool makers microscope or equivalent.

5.4.2.1.3 Thickness. The thickness of the base material shall be 0.00142 inch nominal and the overall thickness (base material and coating) shall be 0.0019 inch ±0.0003 inch. This measurement shall be made using a Brown & Sharpe Model 962/975 Electronic Comparator or equivalent.

5.4.2.1.4 TF Value. The radial distance by which the reel flanges extend beyond the outermost layer of tape, wound at a tension of 8 ±2 ounces shall be 0.125 inch minimum for 7-inch and 8.5-inch reels of tape, and 0.25 to 0.625 inch for 10.5-inch reels of tape.

5.4.2.2 Latch Leaders. Latch leaders may be an integral part of the tape or may be of the self-adhesive type applied during manufacture of the tape. Self-adhesive latch leaders shall be in accordance with figures 4, 5, 6, or 7 as applicable. Integral latch leaders shall be designed to operate exactly the same as self-adhesive latch leaders described herein.

5.4.2.2.1 Requirement. The adhesive used to affix the latch leader shall be self-bonding and of a non-oozing type. The latch leader shall be able to withstand a constant pulling force of 4 pounds for 10 minutes without coming loose or deforming.

5.4.2.2.2 Test Equipment. A rigid fixture capable of clamping a 10-inch sample of tape at one end and supporting the tape with a 4-pound weight affixed at the other end.

5.4.2.2.3 Sample Preparation. Q.P.L.

5.4.2.2.4 Test Procedure. Cut samples approximately 12 inches long, with latch leaders attached, from reels of tape to be tested. Clamp cut end of tape in fixture. Hang four-pound weight on latch leader and allow to hang for 10 minutes. Examine latch leader for any signs of adhesive failure or deforming of latch leader.

5.4.2.3 Photoreflective Markers. Each reel of tape shall be furnished with two reflective markers, consisting of (or equivalent to) a transparent plastic base with a vaporized aluminum coating sandwiched between the base and a thin layer of low-cold-flow adhesive. Photoreflective markers shall not protrude beyond the edge of the tape and shall be free of wrinkles and excessive adhesive. Dimensions and placement of the reflective markers shall be as shown in figure 8.

5.4.2.3.1 Requirement. The photoreflective markers, when compared to a standard reflective reference, shall be no less than 90 percent as reflective as the reference.

5.4.2.3.2 Test Equipment. A fixture containing a light source, calibrated photo-diode, and calibrated meter. The reflectivity reference shall be a flat plate made of 6061-T6 aluminum approximately 1.5 inches square and 0.125 inch thick polished to a surface finish between 0.3 and 0.6 microinch Center Line Average (CLA). The standard reference shall be refinished periodically to maintain its reflectivity.

5.4.2.3.3 Sample Preparation. Standard.

5.4.2.3.4 Test Procedure. Marker reflectivity shall be determined by measuring the reflectivity of the reflective marker and comparing this measurement to the reflectivity of a reference standard; where the reflectivity of both the marker and the reference standard is measured over an angle of incidence of light of 60 degrees.

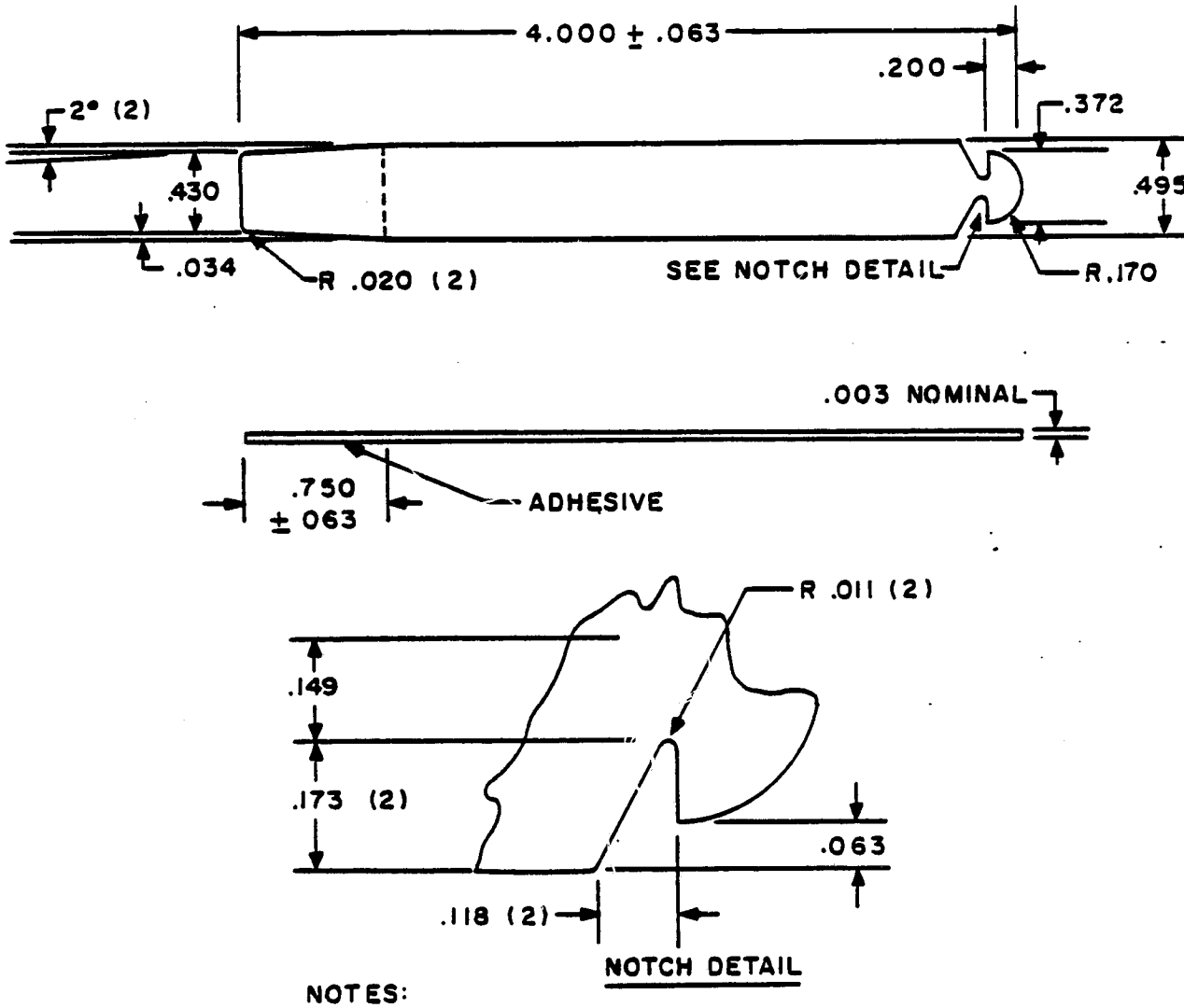
5.4.2.4 Slitting

5.4.2.4.1 Requirement. Tape edges shall be cut clean with no ragged coating or backing. No torn particles shall be clinging to the edges of the tape. The coating shall not be mashed or fractured along the edges.

5.4.2.4.2 Test Equipment. A microscope with 100X magnification.

5.4.2.4.3 Sample Preparation. Standard.

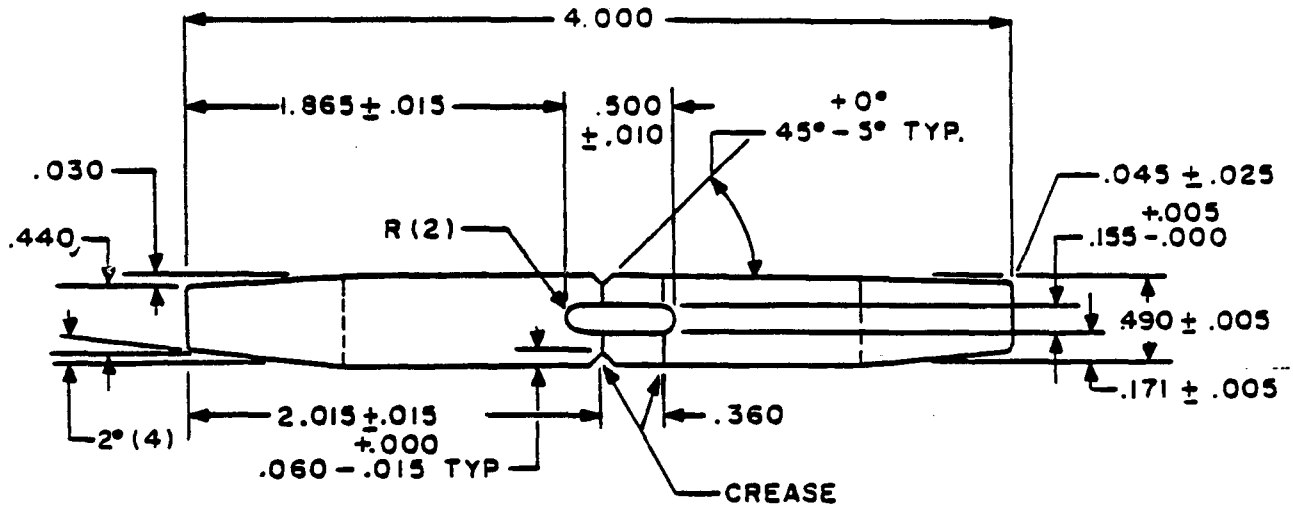
5.4.2.4.4 Test Procedure. A minimum length of five feet of tape at the beginning, middle, and end of the reel shall be inspected on both edges for evidence of poor slitting. The tape shall be examined for compliance with this specification.

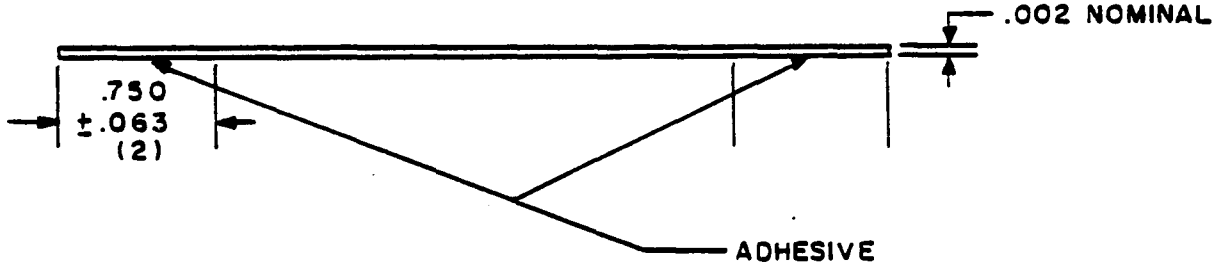


NOTES:

1. ALL DIMENSIONS ARE IN INCHES.
2. TOLERANCES; (UNLESS OTHERWISE SPECIFIED) .005 INCHES.
3. MATERIAL; MATTE POLYESTER.
4. ADHESIVE TO BE SELF-BONDING NON-OOZING TYPE, CAPABLE OF WITHSTANDING 4 LBS. OF FORCE FOR 10 MINUTES.

Figure 4. Latch Leader, Univac Compatible, Male





NOTES:

1. ALL DIMENSIONS ARE IN INCHES.
2. TOLERANCES; (UNLESS OTHERWISE SPECIFIED) .020 INCH.
3. MATERIAL; MATTE POLYESTER
4. ADHESIVE TO BE SELF-BONDING, NON-OOZING TYPE, CAPABLE OF WITHSTANDING 4 LBS. OF FORCE FOR 10 MINUTES.

Figure 5. Latch Leader, Univac Compatible, Female

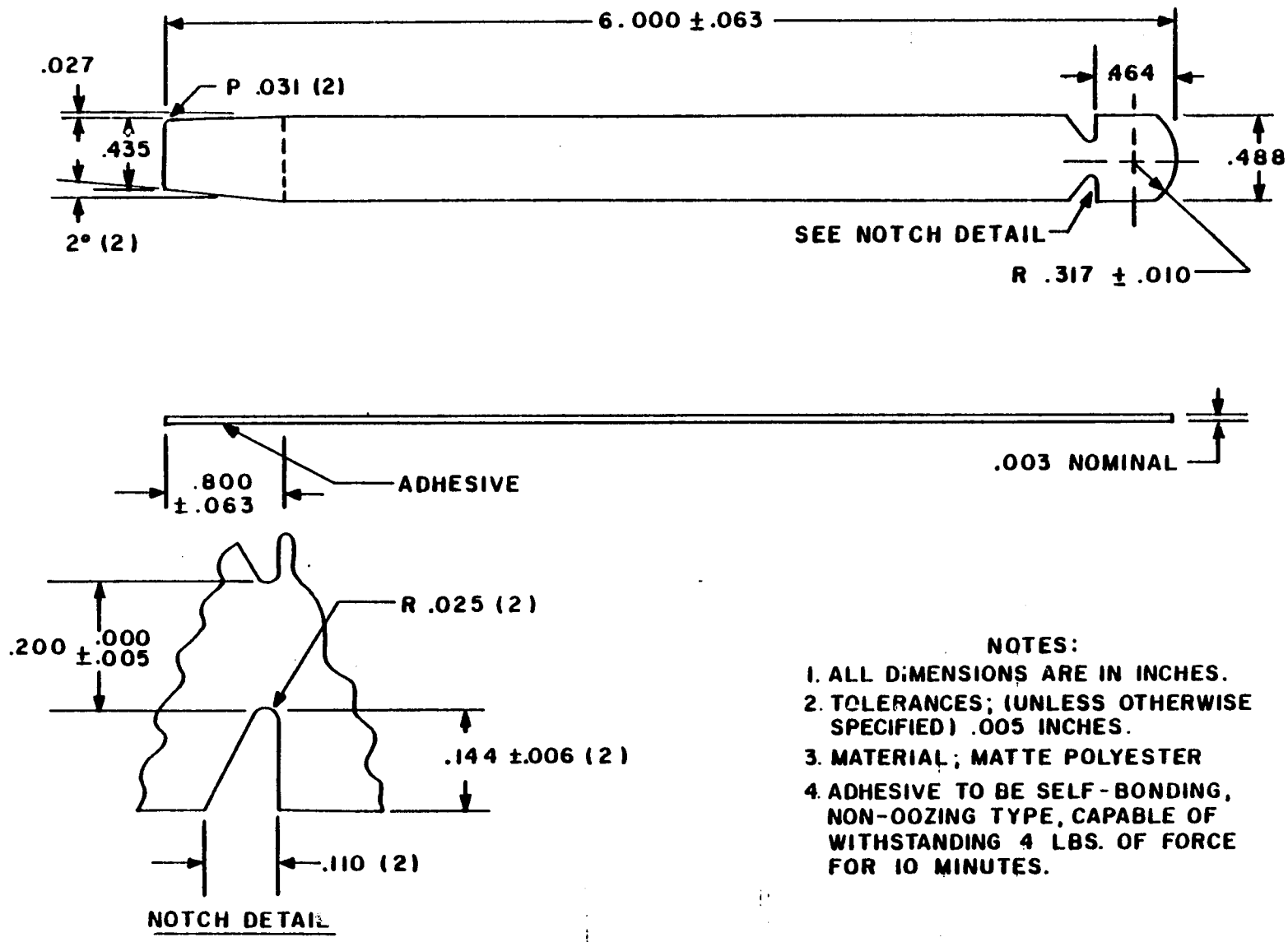
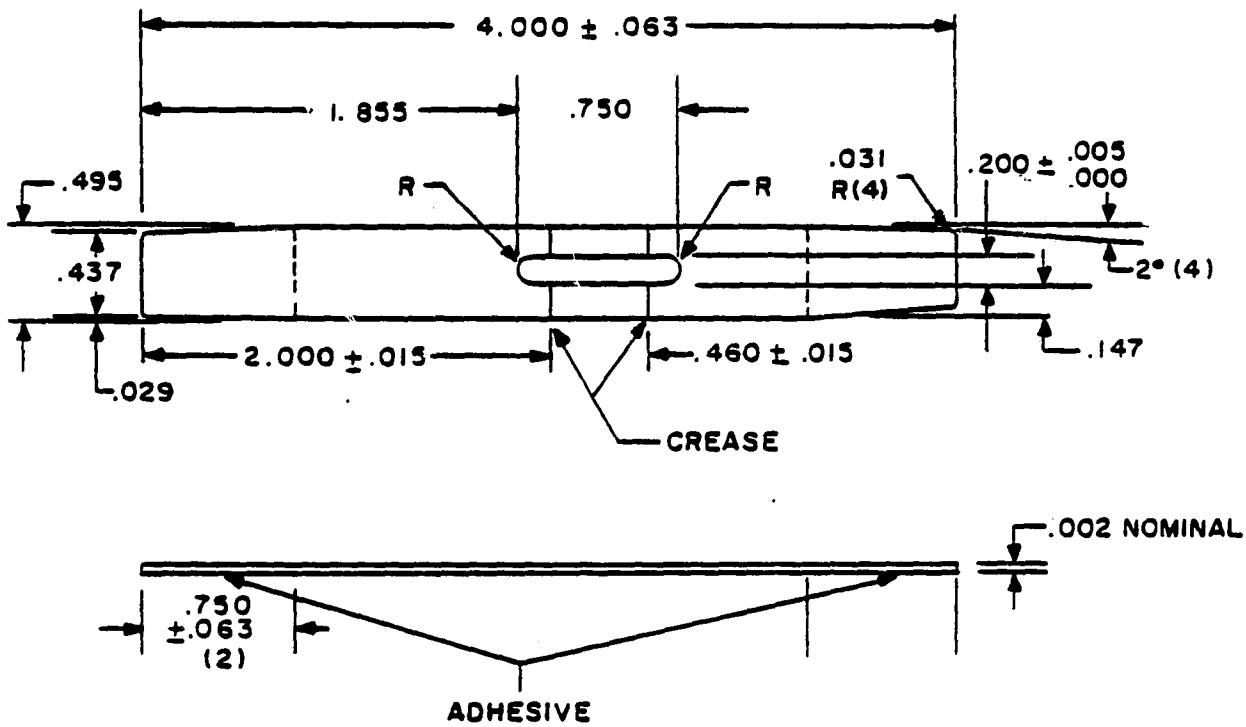


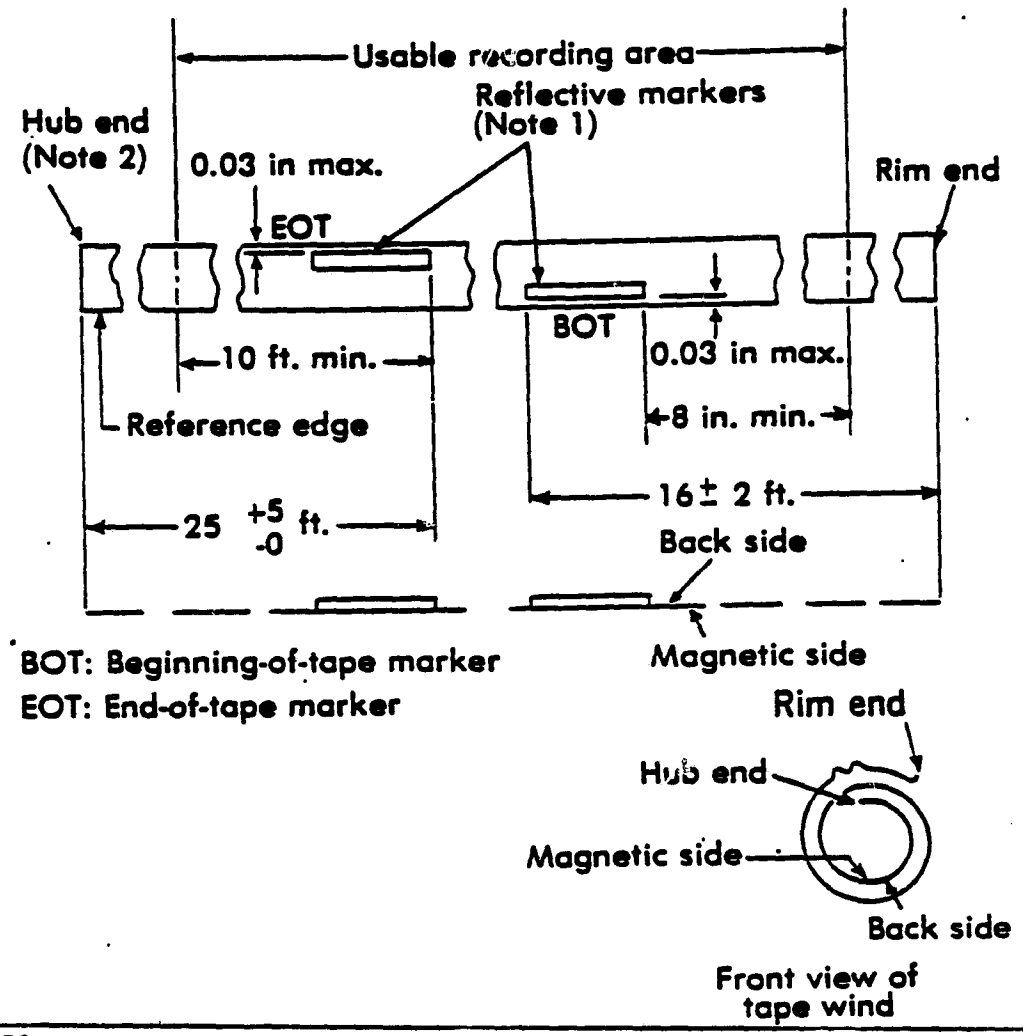
Figure 6. Latch Leader, Burroughs Compatible, Male



NOTES

1. ALL DIMENSIONS ARE IN INCHES.
2. TOLERANCES; (UNLESS OTHERWISE SPECIFIED) .005 INCHES.
3. MATERIAL; MATTE POLYESTER
4. ADHESIVE TO BE SELF-BONDING NON-OOZING TYPE, CAPABLE OF WITHSTANDING 4 LBS. OF FORCE FOR 10 MINUTES.

Figure 7. Latch Leader, Burroughs Compatible, Female



NOTES:

1. Photoreflective markers shall not protrude beyond the edge of the tape and shall be free of wrinkles and excessive adhesive. Marker dimensions: length, 1.1 inch ±0.2 inch; width, 0.19 inch ±0.02; thickness, 0.0008 inch maximum.

2. Tape shall not be attached to the hub.

Figure 8. Marker Dimensions and Placement

5.4.2.5 Magnetic Properties

5.4.2.5.1 Requirement. The remanent magnetic flux shall be 1.45 ±0.2 Maxwells. The intrinsic coercive force shall be 255 ±5 percent Oersteds. The 90-percent value of magnetization saturation shall be less than 900 Oersteds.

5.4.2.5.2 Test Equipment. Scientific Atlanta, Model 6518 BH Meter.

5.4.2.5.3 Sample Preparation. Standard.

5.4.2.5.4 Test Procedure. The BH meter shall be calibrated using the manufacturer's procedures. Samples shall then be cut and measured and results logged.

5.4.2.6 Tensile Strength

5.4.2.6.1 Requirement. The minimum tensile strength shall be 11.0 pounds per one-half inch of tape width.

5.4.2.6.2 Test Equipment. The Amthor Testing Instrument Company, Inc., Vertical Tensile Tester Type 272 or equivalent shall be used for this test.

5.4.2.6.3 Sample Preparation. Q.P.L. Lengths of sample tape sufficient for this test shall be unwound from the reels and placed in a 70 ±5 degrees F (21 ±3 degrees C) 50 ±5 percent relative humidity environment for at least 24 hours prior to testing. The tape shall be free of bends and kinks.

5.4.2.6.4 Test Procedure. A strip of tape not less than 7 inches in length shall be clamped in the grips set for an initial separation of 4 inches. The test specimen shall be clamped in the testing machine taking care to align the long axis of the specimen with an imaginary line joining the points of attachment of the grips to the machine. The grips shall be tightened evenly and firmly to the degree necessary to prevent slipping of the specimen during the test. The rate of grip separation shall be 12 inches per minute. The point of yield shall be noted.

5.4.2.7 Shock Tensile Strength

5.4.2.7.1 Requirement. The minimum energy absorption shall not be less than 1.16 foot-pounds per one-half inch of tape width.

5.4.2.7.2 Test Equipment. The equipment for the test shall be a pendulum-type slipperiness tester, as specified in Bureau of Standards Research Paper RP1879 Volume 40 of May 1948, or equivalent such as that made by Wiedmann Baldwin, King of Prussia, PA.

5.4.2.7.3 Sample Preparation. Q.P.L. Lengths of sample tape sufficient for this test shall be unwound from the reels and placed in a 70 ±5 degrees F (21 ±3 degrees C) 50 ±5 percent relative humidity environment for at least 24 hours before the test. The tape samples shall be free of bends and kinks.

5.4.2.7.4 Test Procedure. The tape shall be looped through the clamps, magnetic side inward and securely clamped. The pendulum arm shall be raised until it makes an angle with the vertical corresponding to a potential energy of 1.16 foot-pounds. The pendulum shall then be released smoothly and shall be allowed to strike the free loop of the tape. The tape shall not break.

5.4.2.8 Modulus of Flexibility

5.4.2.8.1 Re-uirement. The minimum angle of deflection shall be greater than:

Nominal Width (inches)	Base Thickness (mil)	Deflection (degrees)
0.5	1.5	35

5.4.2.8.2 Test Equipment. Test fixture as shown in figure 9.

5.4.2.8.3 Sample Preparation. Standard.

5.4.2.8.4 Test Procedure. The sample shall be clamped in the test fixture in a horizontal plane with 3 inches of the magnetic tape extended beyond the point of clamping, free to assume a natural curvature which will be a function of its flexibility. The sample shall be clamped with the oxide coating facing the direction of curvature. The angle of curvature (deflection from the horizontal) shall be measured from the horizontal axis to the free end of the sample. The angle shall be measured in degrees from the horizontal axis.

5.4.2.9 Elongation Under Stress

5.4.2.9.1 Requirement. The elongation shall not exceed 0.30 percent.

5.4.2.9.2 Test Equipment. A suitable fixture from which to hang the tape sample, with positive nonslipping tape clamps, a standard scale for measuring length, a scribe with which to mark the tape, a 7X magnifier through which to measure results, a 30-gram weight, and a 5-pound weight.

5.4.2.9.3 Sample Preparation. Q.P.L. Samples at least 24 inches long shall be clamped so as to hang in the test area at 70 +5 degrees F (21 +3 degrees C) 50 +5 percent relative humidity for at least 24 hours under no externally applied stress before tests are started.

5.4.2.9.4 Test Procedure. The tape sample shall be clamped in the fixture and the 30-gram weight attached to the free end. A reference mark shall be scribed on the tape approximately 20 inches from the point of clamping. The mark will be used as a reference to measure elongation and recovery of the sample. The distance between the mark and clamping point shall be measured accurately to the nearest 0.01 inch. This distance shall be taken as the base distance for calculation of residual elongation. When the measurement of the base distance has been made, the test shall begin. A weight of 5 pounds for all polyester film base shall be attached to the tape below the

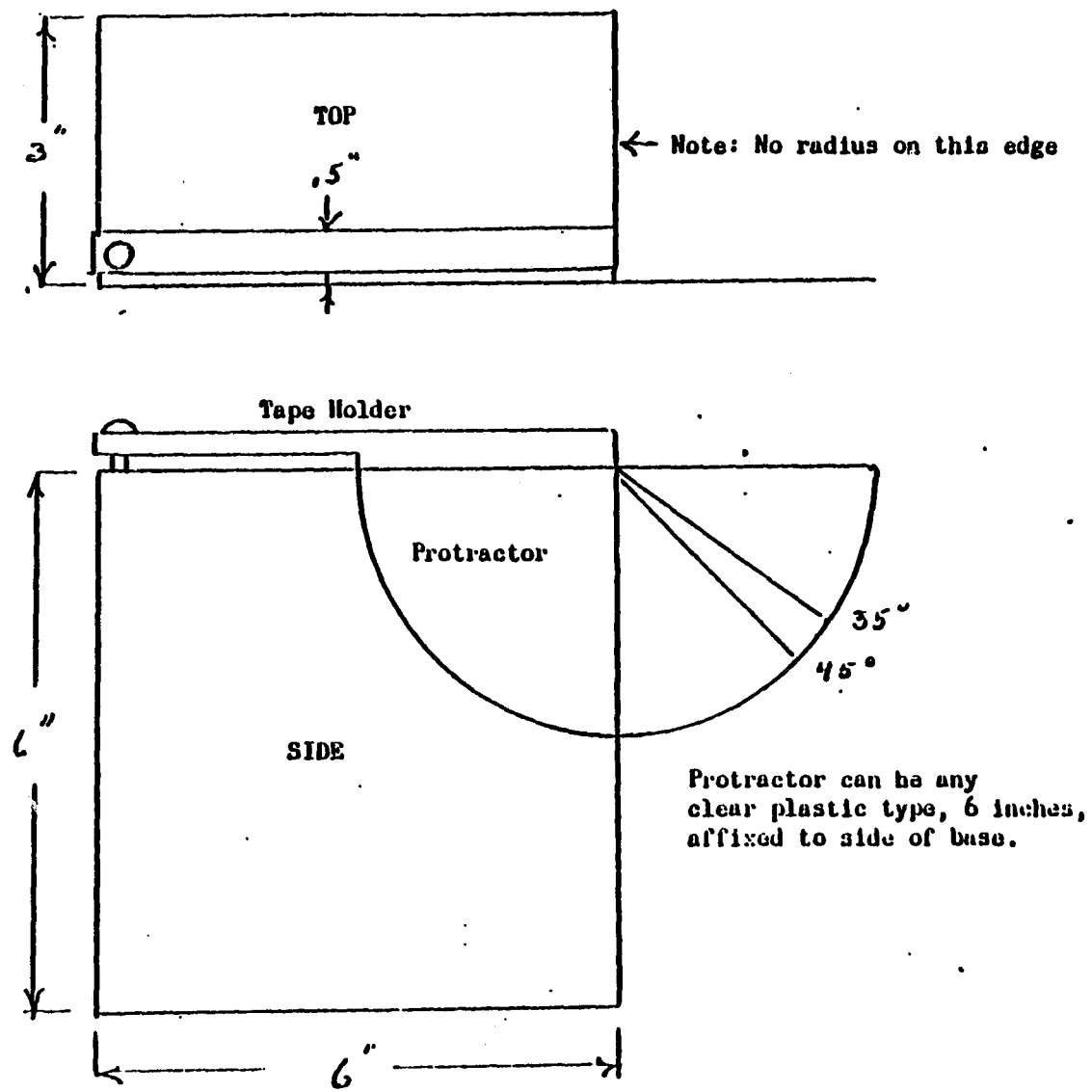


Figure 9. Modulus of Flexibility Test Fixture

mark at zero time, and allowed to hang undisturbed for 180 minutes ±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 ±30 seconds. The 30-gram weight shall then be attached to the free end of the tape. The distance between the mark and the point of clamping shall then be measured to the nearest 0.01 inch. The difference between the base distance and the final distance shall be expressed as a percent of the base distance to determine compliance with this specification.

5.4.2.10 Longitudinal Curvature

5.4.2.10.1 Requirement. The deviation of each tape edge from a straight line shall not exceed 0.125 inch per 36-inch length of tape.

5.4.2.10.2 Test Equipment. No special apparatus other than a 48-inch straight-edge is required.

5.4.2.10.3 Sample Preparation. Q.P.L.

5.4.2.10.4 Test Procedure. A 36-inch length of tape shall be made to lie flat on a horizontal surface. The tape shall be under no tension and free from bends, kinks, or other visible distortions. The straight-edge shall be placed along either edge of the tape and any deviation from a straight line shall be measured.

5.4.2.11 Magnetic Coating Electrical Resistance

5.4.2.11.1 Requirement. The magnetic coating shall have the ability to dissipate a static charge. The electrical resistance of the magnetic coating shall have a minimum resistivity of 0.5 megohm/square and a maximum of 50 megohms/square.

5.4.2.11.2 Test Equipment. The apparatus for this test shall consist of that required by Method 4041, Insulation Resistance for Flexible Tapes, of Fed. Test Method Std. No. 406; and a Freed Transformer Co. Model 1620 megohmeter.

5.4.2.11.3 Sample Preparation. Q.P.L. or Standard. Lengths of tape sufficient for this test shall be unwound from the reels and placed in a 70 ±5 degrees F (21 ±3 degrees C) 50 ±5 percent relative humidity atmosphere without kinks or bends and allowed to remain for at least 24 hours before test.

5.4.2.11.4 Test Procedure (Oxide Surface). The surface electrical resistance of the oxide construction shall be determined in accordance with Method 4041, Insulation Resistance for Flexible Tapes, of Fed. Test Method Std. No. 406 to determine conformance with this specification. Two layers of the sample tape shall be placed in the strip electrodes, backing material to backing material, so that only the oxide surfaces of the tape are in contact with the electrodes. The method of clamping shall be similar to that specified. The measurement potential shall be 500 ±10 volts dc.

5.4.2.12 Back Coating Electrical Resistance

5.4.2.12.1 Requirement. The electrical resistance of the back coating shall not be greater than 1.0 megohm/square.

5.4.2.12.2 Test Equipment. The apparatus for this test shall consist of that required by Method 4041, Insulation Resistance for Flexible Tapes, of Fed. Test Method Std. No. 406; and a Freed Transformer Co. Model 1620 megohmeter.

5.4.2.12.3 Sample Preparation. Q.P.L. or Standard. Lengths of tape sufficient for this test shall be unwound from the reels and placed in a 70 ±5 degrees F (21 ±3 degrees C) 50 ±5 percent relative humidity atmosphere without kinks or bends and allowed to remain for at least 24 hours before test.

5.4.2.12.4 Test Procedure. The surface electrical resistance of the back coating shall be determined in accordance with Method 4041, Insulation Resistance for Flexible Tapes, of Fed. Test Method Std. No. 406 to determine conformance with this specification. Two layers of the sample tape shall be placed in the strip electrodes, oxide to oxide, so that only the back coating surfaces of the tape are in contact with the electrodes. The method of clamping shall be similar to that specified. The measurement potential shall be 500 ±10 volts dc.

5.4.2.13 Layer-to-layer Adhesion

5.4.2.13.1 Requirement. The tape shall show no sticking or layer-to-layer adhesion when tested as specified.

5.4.2.13.2 Test Equipment. A temperature and humidity controlled chamber in which to process the prepared samples, a special winding apparatus, hollow metal tubes on which tape samples are wound, and a 2000-gram weight. The tube shall be made of nonoxidizing metal such as brass or corrosion resisting steel 0.5 inch in diameter and 4 inches in length, and shall weigh no less than 15 grams nor more than 30 grams. The tube shall be capable of being mounted in bearings so that it may be rotated freely around its central axis and easily removed from the bearings.

5.4.2.13.3 Sample Preparation. Standard.

5.4.2.13.4 Test Procedure

A 3-foot sample length of tape shall be fastened at one end, magnetic side down, to the 0.5-inch diameter hollow tube with a nonflowing adhesive material. The tube shall then be mounted in the bearings so that the tape hangs free below the tube.

Attached to the free end of the tape shall be the 2000-gram weight. A small strip of double-coated adhesive tape shall be affixed to the magnetic side of the tape 1 inch above the weight. The tube shall then be slowly and uniformly rotated so that the tape, held in tension by the weight, winds uniformly around the tube into a compact and even roll. The double-coated tape when wound into the test roll acts to secure the roll and prevent its unwinding when the weight is removed.

The tube supporting the rolled tape shall be removed from the winding setup and subjected to a heat and humidity cycle in which the first 16 to 18 hours shall be at 130 degrees F (53 degrees C) and 85 ±5 percent relative humidity while the final 4 hours shall be at 130 degrees F dry heat (less than 5 percent relative humidity). During the humidification and dry heat cycle, the air

surrounding the tube shall be constantly circulated to ensure uniformity of conditions throughout the test area. At the end of the dry heat cycle, the rod shall be removed from the conditioned area and allowed to come to equilibrium with room conditions, approximately 70 degrees F (31 degrees C) at 50 percent relative humidity.

To evaluate the tape for layer-to-layer adhesion, the end of the roll on the rod shall be carefully opened and the double-coated tape removed. The rod shall then be held between the thumb and fingers and the untabbed tape shall be observed to note if the first two or three layers loosen up of their own accord; if this occurs, there is obviously no adhesion and the tape has passed the test. If no loosening or very little loosening of the outermost layers is observed, the free end of the tape shall be unwound slowly until 9 inches has been unwound. The free end shall then be allowed to hang and the tape shall be observed to see if it will loosen by itself. If it will not unwind unaided, the rod, with the tape hanging freely, shall be slowly rotated in the direction of tape unwind. If the tape adheres to itself and refuses to begin to unwind after the rod has been rotated through one-fourth revolution or 90 degrees, it shall be considered to have failed the test. After the rotation test has been made, the free end of the tape shall be held and the rod allowed to fall, thereby unwinding the tape. The unwound tape shall be checked for evidence of coating delamination and in this way the severity of adhesion is established. Any tape which will not self-unwind after rotating the rod through 90 degrees or which shows any delamination except in the 2 inches nearest the rod, shall be considered as having failed this test.

5.4.2.14 Humidity Stability (Cupping)

5.4.2.14.1 Requirement. The tape shall show no cupping in excess of 10 degrees for polyester film when tested as specified.

5.4.2.14.2 Test Equipment. The apparatus for this test shall consist of the following:

Chamber. The humidity chamber shall be of materials which are nonreactive to water vapor and potassium chloride solution and shall be constructed so that all joints are sealed tight when the chamber is closed. It shall consist of two separate compartments each approximately 11 by 13 by 7 inches. The front and back sides of the compartments shall be of a transparent material such as glass. The trays used to hold the chemicals inside the chamber shall measure approximately 10 by 10 by 4 inches and shall be made from aluminum, glass, or any nonreactive material. The trays shall be provided with removable perforated aluminum cover plates to permit placing tape holders above the conditioning chemicals with minimum interference with free air circulation. Means shall be provided for circulation of air within each compartment with a velocity of at least 20 feet per minute across both the conditioning chemicals and the tape holders.

Tape Holders. Each tape holder shall clamp the tape along its longitudinal axis and shall prevent any movement of the longitudinal axis of the tape by positively contacting it beginning at the end where the cupping is to be measured and continuing at least 1 inch along the tape length. The holder shall raise the tape at least 0.125 inch above the holder base plate and shall be separated from the adjacent tape holder by at least 0.625 inch,

thus ensuring that there will be no interference to cupping in either direction. For example, this may be accomplished by constructing the holder from two pieces of straight, corrosion-resistant wire, the bottom piece being 0.125 inch in diameter and the top piece being 0.0625 inch in diameter, 1.5 inches in length, which are soldered or brazed together at the front tips, and then brazed onto a base plate of noncorrosive material. When the tape holders are in place in the chamber compartment with tapes inserted for measurement, the longitudinal axis of the tapes shall be substantially horizontal.

Measuring Instrument and Illumination. The measuring device shall be any optical system with a magification of from 5 to 25, having at least one crosshair which can be referred to a clinometer or goniometer so as to measure the angle between the crosshair and a reference line and having a focal length such that it can be focused on the near end of a tape when the tape is mounted in the chamber and the measuring device is placed in front of the chamber. A source of light shall be placed behind the chamber during measurement to outline the tapes when viewed through the measuring instrument.

5.4.2.14.3 Sample Preparation. Standard.

5.4.2.14.4 Test Procedure

Prior to conditioning the samples, the initial tape cupping shall be measured on each test specimen. The measurement on each specimen is performed by viewing the ends of the specimen through the measuring instrument so as to measure the angle formed by the conjunction of lines constructed perpendicular to the edges of the viewed tape end. Local irregularities shall be averaged when setting the crosshair for these measurements.

When using a two-compartment chamber for conditioning the samples, one chamber shall be desiccant and one shall be humidifying. The desiccant chamber shall contain a desiccant anhydrous calcium chloride with indicating "Drierite" in the ratio 3 to 1. The humidified chamber shall have a saturated solution (plus an excess) of potassium chloride in distilled water as the humidifying agent. The chambers containing the conditioning media shall be closed and the air circulated for at least 12 hours immediately preceding the insertion of the tapes to ensure equilibrium. The test shall be run at a temperature of 90 ±5 degrees F (32 ±3 degrees C) in both cabinets. The humidity conditions shall be 90 ±5 percent in the wet chamber and 15 ±5 percent in the dry chamber. If a two-compartment chamber is used, a 6-inch length of tape shall be selected and cut into two 3-inch pieces with scissors (not a razor blade). These shall be mounted as specified with the backing side down on two separate holders, one to be placed in the desiccant chamber and the other in the humidifying chamber, so that the measured ends are those made by the scissors cut in each case. The tape holders containing the tape specimens shall be placed in their respective sections. The compartments shall be closed, and the air shall be made to circulate for at least 16 hours before the measurements are made. At the end of conditioning, the differential cupping, the arithmetical difference in degrees between the angle measured on the desiccated tape, and the angle measured in the same manner on the humidified tape, will be the criteria for acceptance or rejection of the samples. Since this test is designed to measure the effect of differential cupping, local irregularities shall be averaged when setting the crosshair for these measurements.

Neither the initial cupping, differential cupping, nor the cupping under any one condition (wet or dry chamber) shall fail to meet the requirements specified.

5.4.2.15 Abrasivity

5.4.2.15.1 Requirement. The abrasivity of the magnetic surface of the tape shall be measured using the procedures indicated. Under the operating conditions indicated and using the magnetic record head(s) specified, the wear rate shall be such as to guarantee that the manufacturer's normal head warranty of 1000 hours shall not be degraded. Head failures due to causes other than gap wear are excluded from this requirement. The wear rate per hour value to be used for abrasivity test evaluation shall be provided by the magnetic tape supplier along with the tapes to be qualified. This value shall be based upon the usable gap depth as defined by the head manufacturer.

5.4.2.15.2 Test Equipment. The equipment required for this test shall consist of an intermediate band recorder/reproducer with new-unused record heads installed and a profilometer with at least a 2 microinch resolution such as Brown & Sharpe Model 962/975. The heads to be used for the tape test shall be either Spin Physics, Inc. part number 200602, 0.5 inch or Bell and Howell, Inc. part number 13-421-5, 0.5 inch.

5.4.2.15.3 Sample Preparation. Standard.

5.4.2.15.4 Test Procedure

A new half-inch head shall be mounted in the recorder. Wear passes shall be made in both forward and reverse reproduce modes at a speed of 120 inches per second. Tape tension shall be 8 ±2 ounces. Tests shall be conducted in a standard environment of 70 ±5 degrees F (21 ±3 degrees C), 50 ±5 percent relative humidity.

Two virgin reels of tape 0.5 inch by 2400 feet shall be put through full forward-reverse cycles for a total of 4 hours running time. The head shall then be removed from the recorder and the surface wear measured using the profilometer. Test results shall be as specified.

Note

At the end of the first 30 minutes running time, the head should be removed and its surface measured to establish a point of reference. The head should then be reinstalled and the balance of the test performed.

5.4.2.16 Surface Finish Magnetic Coating and Back Coating

5.4.2.16.1 Requirement. The average peak-to-peak surface irregularity shall be in the range of 1 to 5 microinches Center Line Average (CLA) in both the longitudinal and transverse directions using a cut-off wave length of 0.010 inch.

5.4.2.16.2 Test Equipment. Brush Surfindicator System, vibration-free surface block, and calibration gauge block.

5.4.2.16.3 Sample Preparation. Q.P.L.

5.4.2.16.4 Test Procedure. Set up and calibrate the test equipment using manufacturer's procedures. Cut 6-inch samples from the tape to be tested. Make a surface finish measurement test on each sample and record the results.

5.4.2.17 Surface Finish Uncoated Backing

5.4.2.17.1 Requirement. The average peak-to-peak backing surface irregularity shall be in the range of 0.5 to 6.0 microinches CLA in both the longitudinal and transverse directions using a cut-off wave length of 0.010 inch.

5.4.2.17.2 Test Equipment. Brush Surfindicator System, vibration-free surface block, and calibration gauge.

5.4.2.17.3 Sample Preparation. Q.P.L.

5.4.2.17.4 Test Procedure. Set up and calibrate the test equipment using manufacturer's procedures. Cut 6-inch samples from the tape to be tested. Make a surface finish measurement test on each sample and record the results.

5.4.2.18 Dynamic Frictional Characteristics

5.4.2.18.1 Requirement. The dynamic frictional drag of the magnetic coating over brass or chrome shall be no greater than 130 grams. The dynamic frictional drag of the back coating or backing material over brass or chrome shall be no less than 80 grams.

5.4.2.18.2 Test Equipment. A fixture consisting of a motor drive; driven mandrel; a polished brass or chrome cylindrical bar, one inch in diameter, surface finished to 5 to 10 microinches peak-to-peak CLA; a grams torque gauge; and a 65-gram weight.

5.4.2.18.3 Sample Preparation. Q.P.L.

5.4.2.18.4 Test Procedure. Depending upon the dimensions of the fixture used, cut the tape to be tested to a proper length. Attach one end of the tape sample to the mandrel and loop the tape over the brass bar a full 90-degree wrap, oxide surface against the bar. Attach the 65-gram weight to the free end. Turn on the motor driven mandrel and pull the tape over the brass rod at 2 inches per minute. Read the drag directly from the torque gauge. Repeat this procedure, using the same samples, with the back coating or backing surface against the brass rod. Read the drag directly from the torque gauge.

5.4.2.19 Fungus Resistance

5.4.2.19.1 Requirement. The tape shall not support the growth of fungus when tested as specified.

5.4.2.19.2 Test Equipment. Temperature-controlled environmental chamber and other items as required in MIL-I-631.

5.4.2.19.3 Sample Preparation. Q.P.L.

5.4.2.19.4 Test Procedure. Resistance to fungus shall be determined in accordance with the method specified in MIL-I-631, except that a 2-inch diameter roll of tape shall be tested. The entire sample shall be tested in the rolled condition. Tapes shall be considered fungus resistant if at least two of three specimens are rated 0 or 1.

5.5 Product Performance

5.5.1 Magnetic Tape

5.5.1.1 Signal Output Amplitude

5.5.1.1.1 Requirement. The output amplitude is defined as the average peak value of the read voltage over at least 10,000 consecutive flux changes. The output amplitude shall be within ±10 percent of the standard output at 800 cpi and within +25 percent and -15 percent at 1600 cpi.

5.5.1.1.2 Test Equipment. An intermediate band magnetic tape recorder and special electronics as recommended in NBS Special Publication 260-29 or equivalent systems.

5.5.1.1.3 Sample Preparation. Q.P.L.

5.5.1.1.4 Test Procedure. The output signal level measurement shall be performed using a test system in accordance with the Signal Amplitude Measuring System described in the NBS Special Publication 260-29. All tape under test shall be bulk ac erased prior to performing output signal level measurements. Output signal levels from tape under test shall be measured from tracks 2, 4, and 6 on the first read/write pass. Measurement procedures shall be as follows:

The procedures given in the NBS Special Publication 260-29 shall be used to calibrate the test system to the primary reference tape and to establish the output signal levels from the primary reference tape at the recording density under test.

The output signal levels from the tape under test shall be determined using the same procedures and conditions used to establish the output signal level from the primary reference tape in the previous step.

The output signal levels from the tape under test shall be compared with the output signal levels from the primary reference tape to determine conformance to this specification.

5.5.1.2 Signal Output Amplitude Uniformity

5.5.1.2.1 Requirement. The average peak output amplitude of the tape under test shall not vary more than ±5 percent from beginning to end of tape.

5.5.1.2.2 Test Equipment. An intermediate band magnetic tape recorder with at least three tracks of direct record/reproduce electronics, stripchart recorder with a minimum of 200 Hz response, and an ac-to-dc converter/chart recorder driver model JF IV with three-channel input.

5.5.1.2.3 Sample Preparation. Q.P.L.

5.5.1.2.4 Test Procedure. The tape recorder shall be set up and calibrated to the manufacturer's recommendations using an intermediate band tape selected from current qualified products. The two edge tracks and the center track reproduce amplifiers shall be connected to the ac-to-dc signal converter/chart recorder driver. The tape to be tested shall be bulk degaussed and mounted on the recorder. A 200-kHz sine wave signal shall be simultaneously recorded/-reproduced at a standard record level on the two edge tracks and the center track at a tape speed of 120 in./sec. The signal output amplitude from the three tracks shall be monitored and recorded to determine compliance with the requirement.

5.5.1.3 Dropouts

5.5.1.3.1 Requirement

800 cpi. When tested at 800 cpi (50-percent threshold) the number of temporary dropouts shall not exceed an average of five per reel, and the number of permanent dropouts shall not exceed an average of one per reel. There shall be no more than five permanent dropouts in any one reel and the maximum dropout length shall not exceed 320 characters. This test applies to 2400-foot lengths of tape.

1600 cpi. When tested at 1600 cpi (35-percent threshold) the number of temporary dropouts shall not exceed an average of five per reel, and the number of permanent dropouts shall not exceed an average of one per reel. There shall be no more than five permanent dropouts in any one reel, and the maximum dropout length shall not exceed 640 characters. This test applies to 2400-foot length of tape.

5.5.1.3.2 Test Equipment. A model MTT-1250 and/or a model 97 certifier/tester.

5.5.1.3.3 Sample Preparation. Q.P.L. or Standard.

5.5.1.3.4 Test Procedure. The standard 800-cpi or 1600-cpi recording shall consist of all ones written from the BOT marker to 10 feet past the EOT marker on all nine tracks. The dropout selector threshold shall be set to 50 percent for 800 cpi or 35 percent for 1600 cpi. The tape shall be written and read on the first pass and every 9-bit character checked for an error. The tape shall be checked for temporary and permanent dropouts during the same pass. Any character with one or more bits missing shall be counted as a dropout.

5.5.1.4 Dynamic Skew

5.5.1.4.1 Requirement. The total number of dynamic skew errors shall not exceed one skew error per reel of tape regardless of length. A time difference in excess of 2.0 μsec between the outside bits in any character shall constitute a skew error.

5.5.1.4.2 Test Equipment. A model MTT-1250 and/or model 97 certifier/tester.

5.5.1.4.3 Sample Preparation. Q.P.L. or Standard.

5.5.1.4.4 Test Procedure. The tape under test shall be recorded on all tracks at 1600 cpi, all 1's, from the BOT marker to 10 feet past the EOT

marker. During readback, the time difference between amplitude peaks of the outside bits in each character shall be measured to determine compliance with the requirement.

Note

This test may be performed simultaneously with the dropout test (paragraph 5.5.1.3).

5.5.1.5 Ease of Erasure

5.5.1.5.1 Requirement. The residual signal after dc erasure (1000-oersted field of a standard 1600-cpi recording shall be below the output signal level of the standard 1600-cpi recording by not less than 50 dB.

5.5.1.5.2 Test Equipment. A model MTT-1250 and/or a model 97 certifer/tester and an HP model 310 wave analyzer.

5.5.1.5.3 Sample Preparation. Q.P.L.

5.5.1.5.4 Test Procedure. The standard recording of 1600 cpi shall be continuously recorded on the tape under test, after which the tape shall be read back and the output signal level from each track measured and noted. The recorded tape shall then be dc erased (standard recording of all zeros), after which the erased tape shall be read back and the output level of the residual signal from each track measured and noted. The output levels of the recorded signals shall be compared with the output levels of the residual signals to determine conformance to this specification. The residual signal is measured independently of test system noise.

5.5.1.6 Coating to Base Material Anchorage

5.5.1.6.1 Requirement. The magnetic layer of the tape shall show no visible evidence of anchorage failure when tested as specified. Anchorage failure may be manifested as a separation of the ferromagnetic coating from the base material of the tape or failure of the coating layer itself.

5.5.1.6.2 Test Equipment. A model MTT-1250 and/or model 97 certifier/tester.

5.5.1.6.3 Sample Preparation. Q.P.L. or Standard.

5.5.1.6.4 Test Procedure. A visual examination shall be made of the tape, tape transport, tape path, and heads after the completion of all dynamic tests to determine compliance with this specification.

5.5.1.7 Start Time

5.5.1.7.1 Requirement. The initial start time shall be measured from 10 percent to 90 percent of final tape speed and noted. After 5000 ten-foot wear passes (paragraph 5.5.1.8) the start time shall not increase by more than 10 percent of its initial value due to tape wear characteristics.

5.5.1.7.2 Test Equipment. Digital Equipment Corp. model PDP11/40 computer and card TU16 transports.

5.5.1.7.3 Sample Preparation. Q.P.L.

5.5.1.7.4 Test Procedure. This test may be run in conjunction with the ten-foot wear test (paragraph 5.5.1.8). The initial start time shall be measured at the beginning of the ten-foot wear test procedure. After the specified 5000 passes have been completed, the tape shall be rewound and the transport stopped for 30 seconds. The transport shall then be restarted and the start time measured. The start time shall be measured 10 times and the average value calculated to determine specification conformance.

5.5.1.8 Ten-foot Wear

5.5.1.8.1 Requirement. The tape shall be put through 5000 wear passes. No permanent read error shall occur due to the wear test procedure.

5.5.1.8.2 Test Equipment. Digital Equipment Corp. Model PDP 11/40 computer and TU16 transports.

5.5.1.8.3 Sample Preparation. Q.P.L.

5.5.1.8.4 Test Procedure. The tape under test shall be written with twenty-two 4000-character records at 800 cpi or twenty-two 8000-character records at 1600 cpi. The interrecord gap shall be 0.6 inch. The applicable standard recording shall be used. The approximately 10-foot length of tape, recorded as indicated, shall be run on the TU16 transport in a start/stop mode, stopping at the end of each record and restarting to read the next record. After all records have been read, the tape shall be rewound without stopping and the cycle repeated. This process shall continue until the tape fails or completes 5000 passes. If the tape fails prior to the completion of 5000 passes, the fact shall be noted and the tape allowed to continue running until 5000 passes are completed. This is necessary so that the start time requirements of paragraph 5.5.1.7 can be verified.

5.5.1.9 Compatibility

5.5.1.9.1 Requirement. The tape under test shall not act as an inhibitor tape; i.e., the characteristics of the test tape shall not be such as to degrade transport performance, causing the failure of other tapes supplied against the current Q.P.L.

5.5.1.9.2 Test Equipment. Digital Equipment Corp. model PDP-11/40 computer and TU16 transports.

5.5.1.9.3 Sample Preparation. Q.P.L.

5.5.1.9.4 Test Procedure. This test will require preselected 2400-foot control tapes that have been selected from current qualified products and have known performance characteristics and failure rates. Upon completion of the ten-foot wear test and the start time test, the test tape shall be removed from the transport and the control tape mounted without any cleaning or maintenance being performed on the transport. The control tape shall be tested in a read-after-write mode, without stopping, using the same format as that used in the ten-foot wear test. The full length of the tape from BOT to EOT shall be tested. Should the control tape develop errors due to

contaminants, chemical reaction, or transport degradation as a result of having run the test tapes, the test tape shall be designated as having failed this test.

5.5.1.10 Layer-to-layer Signal Transfer

5.5.1.10.1 Requirement. No transfer of signal between adjacent layers of tape shall take place greater than 1 percent of average peak output.

5.5.1.10.1 Test Equipment. General Kinetics model 97 certifier/tester and test chamber.

5.5.1.10.3 Sample Preparation. Q.P.L.

5.5.1.10.4 Test Procedure. Two reels of tape shall be ac erased and then written as specified for the standard recording of 800 cpi with a 3000-character record followed by an equivalent space of unrecorded tape. Three such records shall be written resulting in six sections of alternately written sections and blank sections. The tape shall then be placed in the test chamber and held at 150 ±5 degrees F (66 ±3 degrees C), 50 ±10 percent relative humidity for 8 hours. After this conditioning, the tape shall be rerun on the transport and the levels of the recorded signal and of the signal resulting from signal transfer shall be measured. The percentage of signal transfer shall be calculated.

6. PREPARATION FOR DELIVERY

Unless otherwise specified in the contract or purchase order, tape supplied under this specification shall be packaged and packed in accordance with the requirements of paragraphs 6.1 through 6.4. The packaging and packing methods specified in 6.1 and 6.2 are intended to provide for tape shipments in bulk form. The specific method required shall be specified in the contract or purchase order. Table VI delineates quality defects in preparation for delivery of tapes supplied under this specification.

6.1 Packaging

6.1.1 Method I (Packaging in Disposable Containers)

6.1.1.1 Option A. Each reel of tape shall contain a disposable device inserted at the outer reel periphery to ensure maintenance of flange spacing. This device may be one complete polyethylene or equivalent type disposable band (see figure 10) located around the reel periphery. In any case, the material and method used shall be suitable to prevent pinching of the reel flange during packing and unpacking and shall be designed such that spacers will not become detached from the reel flange during normal shipment and handling. Each reel of tape, with spacer in place, shall then be packaged in a heat-sealable plastic bag of a minimum thickness of 2 mils nominal to form an airtight package. The 8.5-inch and 10.5-inch reels of tape shall then be packaged in a corrugated fiberboard box conforming to PPP-B-636, type CF, B flute, class domestic, grade 200, style optional. The top panel shall be provided with a die-cut finger access hole and one panel of the box shall be provided with a centered hub constructed from a material adequate to provide support of the tape reel by the hub and in such a manner as to suspend the reel in the box to prevent resting on the flanges or movement

Table VI. Preparation for Delivery Defects

Item	Defect
Interior packaging	Use of improper or defective materials.
	Unit container not as specified.
	Quantity in shipping container not as specified.
	Incorrect packaging method employed.
	Cushioning or padding omitted.
	Cushioning inadequate for the physical protection of the item.
	Unsealed, punctured, or improperly sealed bag, wrap, or envelope.
	Damaged or otherwise defective reels.
Exterior packaging	Use of improper or defective materials.
	Type, grade, class, and style of shipping container not as specified.
	Inadequate application of components such as: incomplete closure of case liners; loose container flaps; or inadequate sealing, strapping, or stapling.
	Bulged or distorted container.
Marking (exterior or interior)	Marking incorrect; incomplete; illegible; omitted; or of improper size, location, sequence, or method of application.

within the closed box. An example of an acceptable package is shown in figure 11. The 7-inch reels of tape shall then be packaged in a box of the type normally used for the product.

6.1.1.2 Option B. Each reel of tape shall contain a disposable device inserted at the outer reel periphery to ensure maintenance of flange spacing. This device may be one complete polyethylene or equivalent type disposable band (see figure 10) located around the reel periphery. The material and method used shall be suitable to prevent pinching of the reel flange during normal shipment and handling. Each reel of tape, with spacer in place, shall then be placed in an expanded polystyrene single-unit container designed in such a manner that support by the hub is provided and the flanges are free; i.e., suspended by the hub to prevent resting on the flanges. An example of an acceptable single-unit container is shown in figure 12. The reel with disposable flange spacer shall be packaged in a heat-sealed, airtight, plastic bag of sufficient gauge to ensure the integrity of the bag until received by the user.

6.1.2 Method II (Packaging in Wraparound Reel Bands or Self-loading Cartridge)

6.1.2.1 Option A. In accordance with paragraph 6.1.1.1, except that the disposable flange spacer(s) shall be replaced with a wraparound reel band conforming to W-B-001573 or self-loading cartridge as specified. The reel and band shall then be packaged in a heat-sealed, airtight, plastic bag of sufficient gauge to ensure its integrity until received by the user. The sealed unit shall then be packaged in a close-fitting, two-piece, die-cut, sleeve-type mailing carton (NASA PAC) conforming to PPP-B-636, type CF, C flute, class domestic, grade 200.

6.1.2.2 Option B. In accordance with paragraph 6.1.1.2, except that the disposable flange spacer shall be replaced with a wraparound reel band conforming to W-B-001573 or self-load cartridge, as specified. The reel and band shall then be packaged in a heat-sealed, airtight, plastic bag of sufficient gauge to ensure its integrity until received by the user. The sealed unit shall be placed in a suitable container, supported at the hub, as defined in paragraph 6.1.1.2.

6.1.2.3 Option C. In accordance with paragraph 6.1.1.2, except that the disposable flange spacer shall be replaced with a wraparound reel band conforming to W-B-001573 or self-load cartridge, as specified. The reel with band or cartridge installed shall then be packaged in a heat-sealed, airtight, plastic bag of sufficient gauge to ensure its integrity until received by the user.

6.1.3 Method III (Packaging in Plastic Dust-proof Storage Containers). Plastic containers for 8.5-inch and 10.5-inch reels of tape shall contain a locking device which will provide secure closure and firm seating of the top cover on the gasket material of the bottom section. Reel movement within the case shall be prevented by firm support at the reel hub only. Plastic containers for 7-inch reels of tape shall be constructed to provide secure closure and to ensure a dust-proof seal of the bottom section by the top cover. The reel shall be centered within the case and shall be supported by the hub only.

6.1.3.1 Option A. In accordance with paragraph 6.1.3, except that each reel of tape, in plastic container, shall be packaged in a heat-sealed, air-tight, plastic bag of sufficient gauge to maintain its integrity until received by the user. The sealed unit shall then be packaged in a closefitting, two-piece, die-cut, sleeve-type mailing carton (NASA PAC) conforming to PPP-B-636 type CF, C flute, class domestic, grade 200.

6.1.3.2 Option B. In accordance with paragraph 6.1.3, except that each reel of tape, in plastic container, shall be packaged in a heat-sealed, air-tight, plastic bag of sufficient gauge to ensure its integrity until received by the user.

6.2 Packing

6.2.1 Method I. Ten reels of tape, packaged as specified in paragraph 6.1 shall be packed in a closefitting fiberboard box conforming to PPP-B-636, type CF, class domestic, grade 275. Closure shall be in accordance with method I of the appendix to PPP-B-636.

6.2.2 Method II. Ten reels of tape, packaged as specified in paragraph 6.1 shall be packed in an expanded polystyrene container, not less than 1.5 pounds per cubic foot density. The container shall consist of two identical sections designed to hold each reel separately and securely. The two sections shall have tongue and groove configurations to permit a locking closure when positioned together. The polystyrene container, with the reels in place and the two sections locked together, shall be strapped together using two bands of plastic strapping material.

6.2.3 Method III. Ten reels of tape, packaged as specified in paragraph 6.1 shall be packed in a closefitting fiberboard box conforming to PPP-B-636, type CF, class domestic, grade 275. Each reel of tape shall be supported at the hub by an appropriate fiberboard spacer (see figure 13). Box closure shall be in accordance with method I of the appendix to PPP-B-636.

6.3 Special Marking. In addition to the marking required by Fed. Std. No. 123, the reels and shipping containers shall contain the following identification:

6.3.1 Reel. Unique identification of tapes supplied under this specification shall be provided by assigning a manufacturer's type number, packing density, serial number, date of manufacture (month and year), and a lot number to the outer reel flange on a removable gummed label.

6.3.2 NASA PAC Mailing Label. A label as shown in figure 14 shall be affixed to each NASA PAC carton.

6.3.3 Master Carton. Each master carton shall be marked in the upper left corner of the small end as follows:

a. Tape, magnetic oxide coated for computer use.

b. Manufacturer's type number and packaging density.

c. Number of reels in each lot.

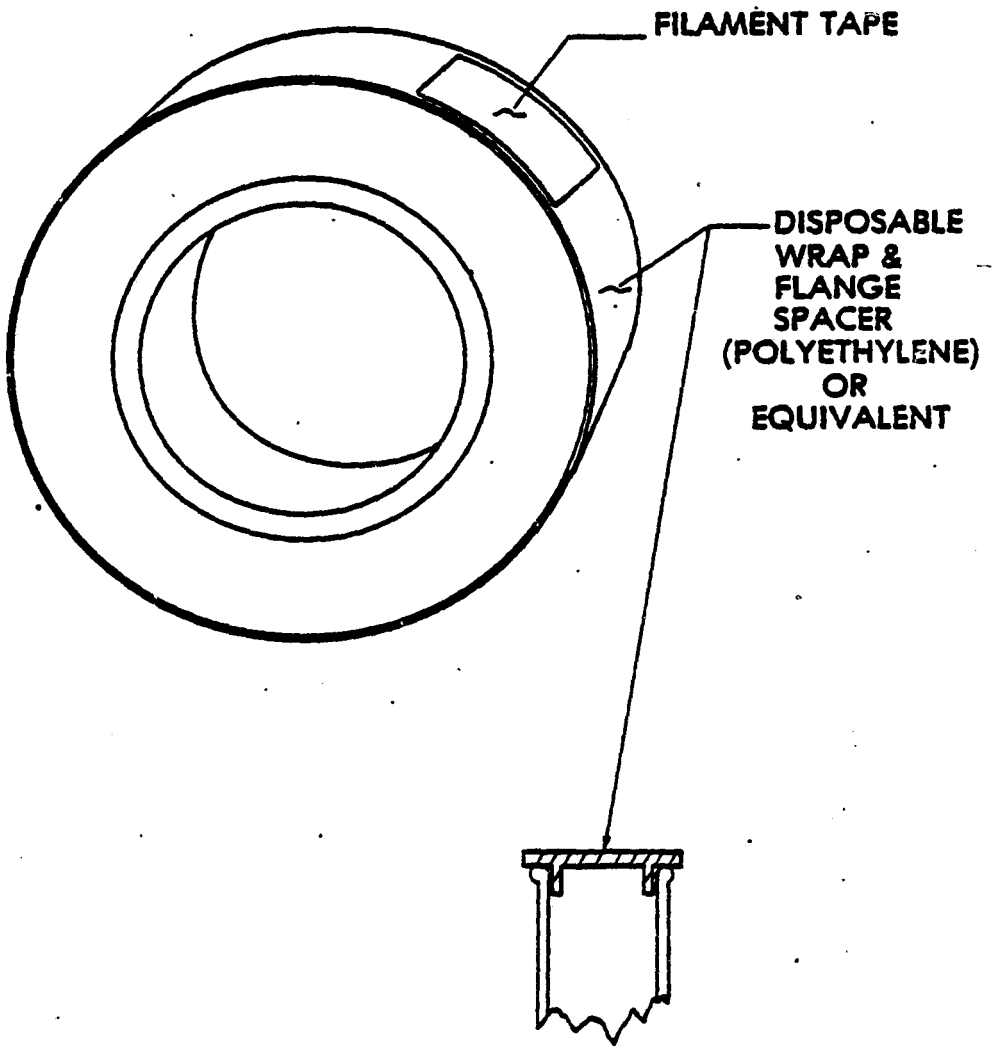
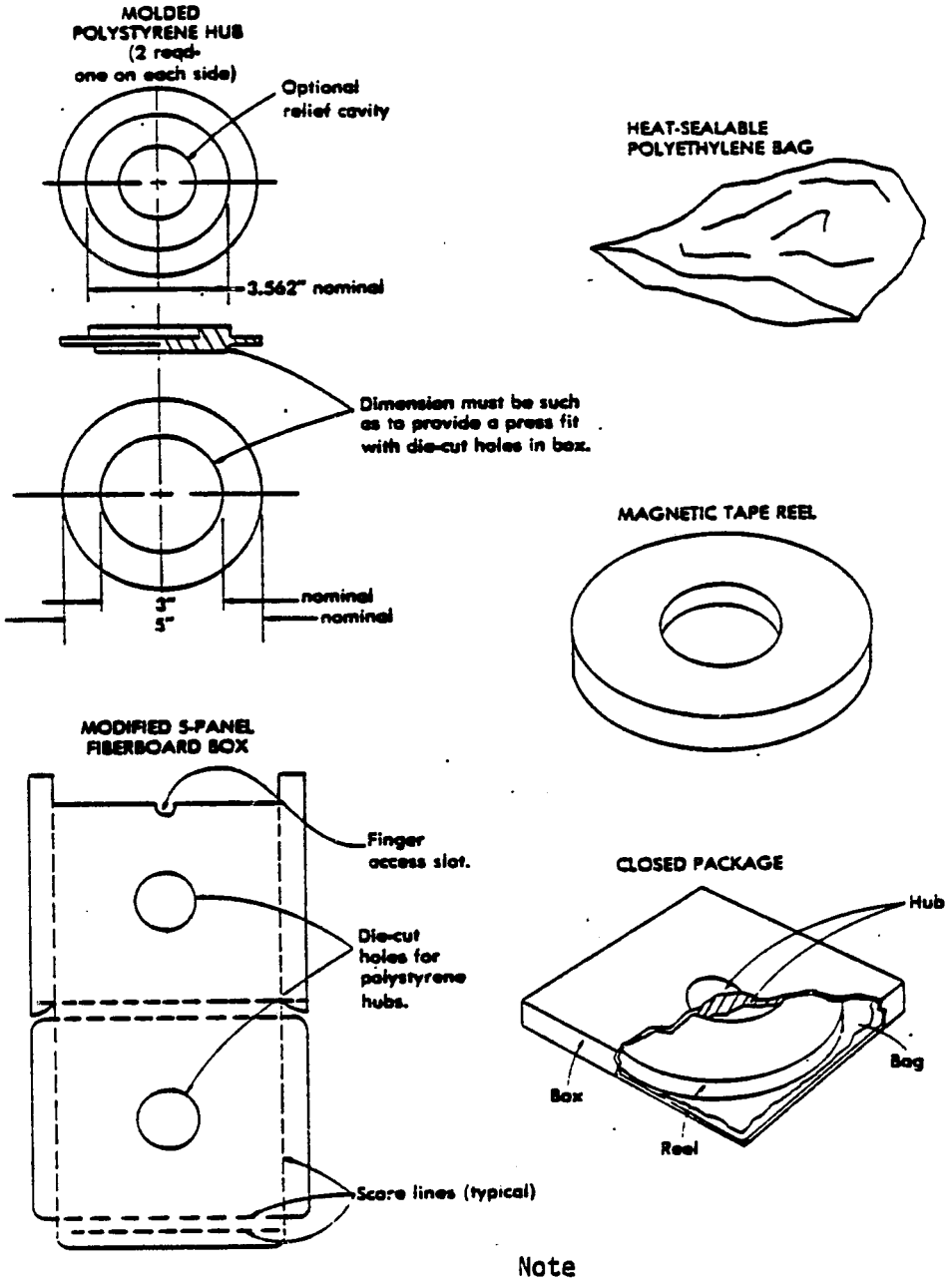


Figure 10. Tape Reel Disposable Band Spacer



Note

The specific design of the box need not be as shown, but should provide the same function and result; i.e., a rigid protective shipper providing support of the tape reel by the hub so that the flanges do not support the weight of the tape and reel.

Figure 11. Tape Reel Packaging

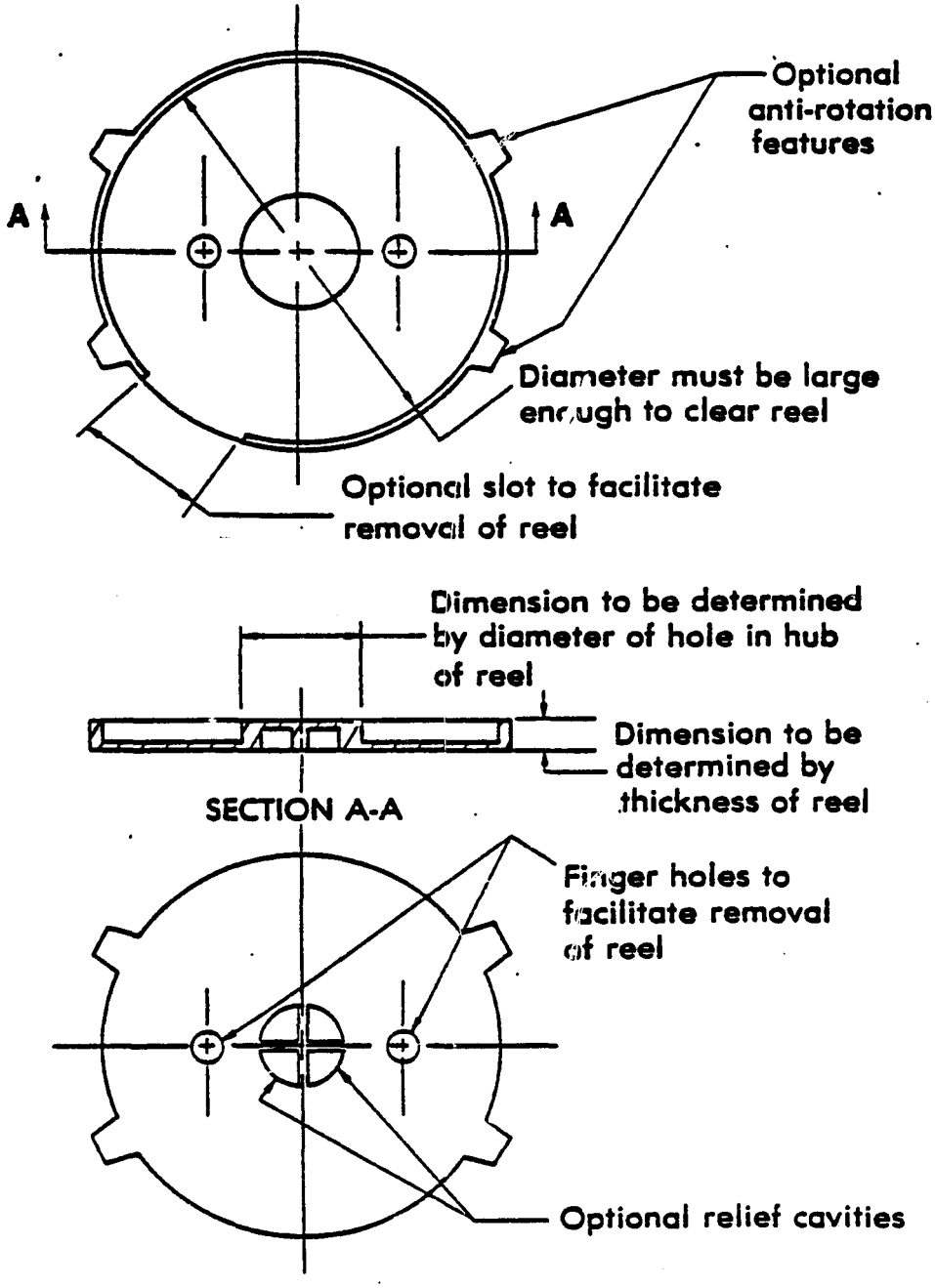


Figure 12. Tape Reel Single-unit Container

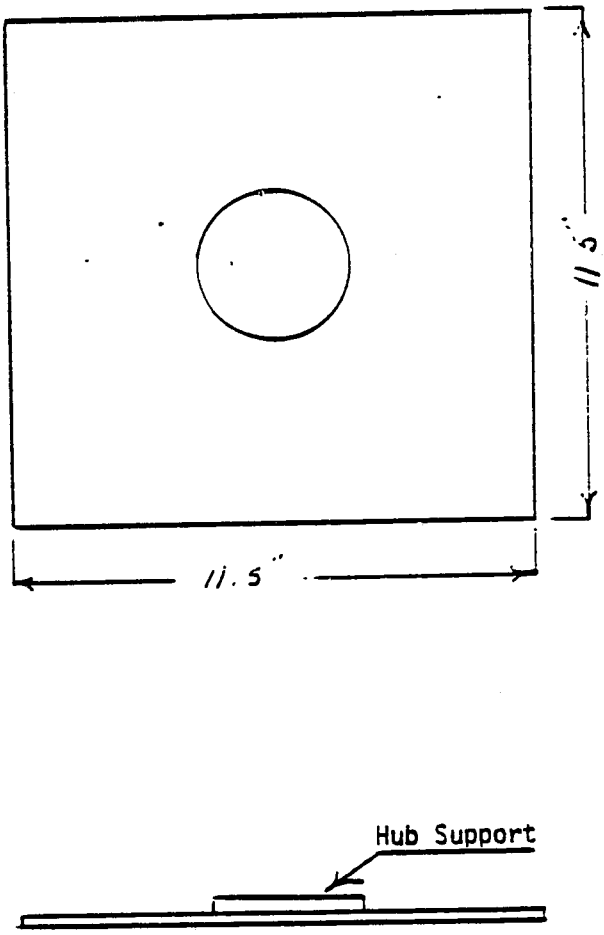


Figure 13. Fiberboard Spacer

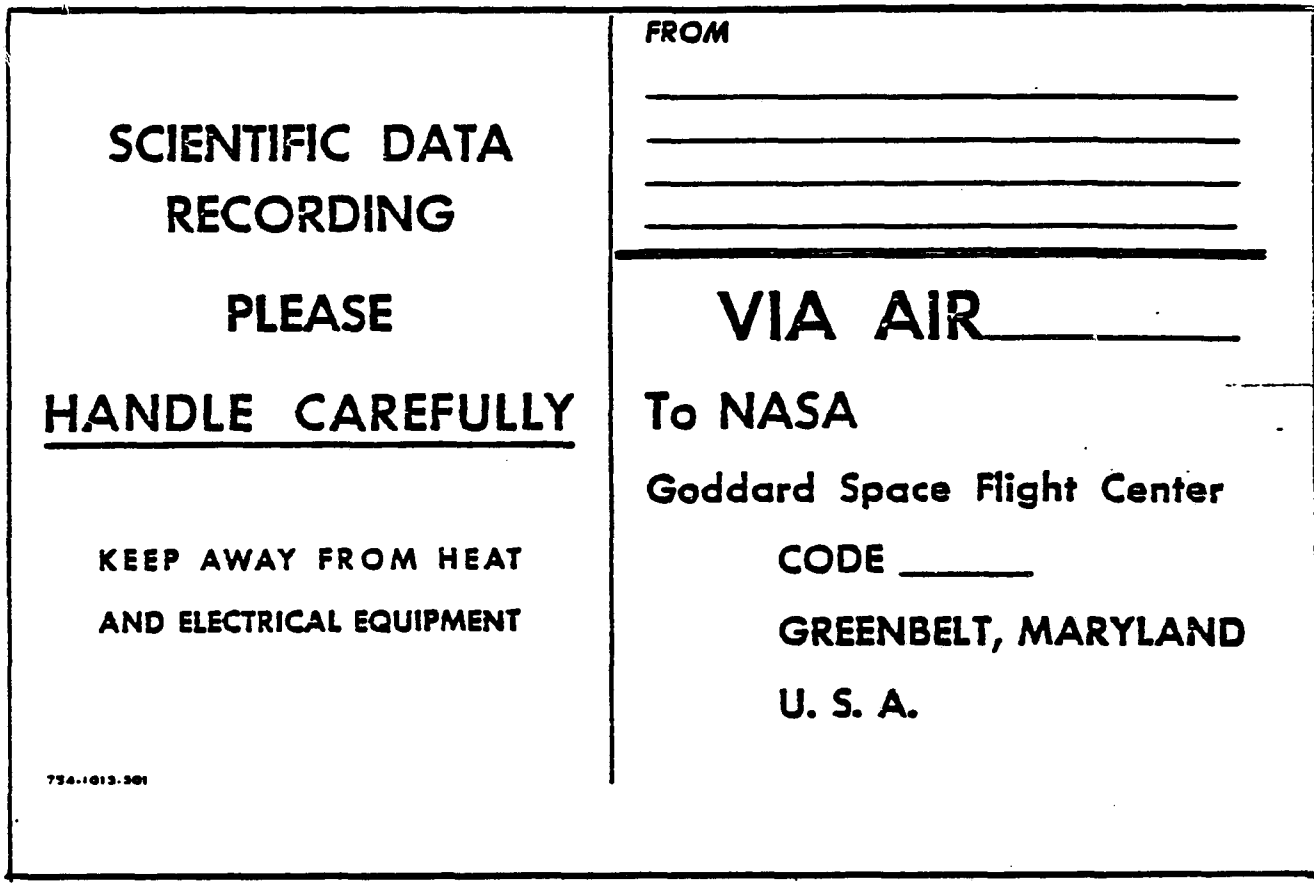


Figure 14. NASA PAC Mailing Label

d. Manufacturer's lot number.

e. Date of manufacture (month and year).

f. Contract number.

g. NASA order number.

h. NASA Federal Stock Number.

6.4 Palletizing. All master cartons shall be palletized for shipment. The cartons must be securely banded to the pallets. No more than 500 reels may be shipped on any one pallet. The pallets are to be 42 by 48 inches, 0.75-inch boards on top and bottom, chambered on outer edges with three each 2 by 4 stringers, one in the middle. The boards shall be securely banded to the pallet.

7. ADDITIONAL INFORMATION

7.1 Ordering Data. Purchasers should select the preferred options permitted herein and include the following information in procurement documents:

a. Title, symbol, and date of this specification.

b. Quantity of tape required.

c. Recording density, track format, recording method, tape reel size.

d. Specify when special latch leaders are to be supplied, also specify type of latch leader required, (see figures 4 through 7).

e. Specify when color coding rings are to be supplied; also specify color required (this is an ordering option).

f. Specify when a dust-proof canister other than specified herein is required.

g. Purchasers should specify that the tape-end retaining sponge rubber block shall not be supplied, when the tape ordered is to be used with autoload cartridges.

h. Purchasers should specify when nonperforated tape serial numbers are required.

i. Inspection responsibility if other than specified.

j. Specify when packaging and packing other than specified herein is required.

k. Specify reel container and method of packaging required.

l. Specify special marking if required.

7.2 Contract Awards. With respect to products requiring qualification, awards will be made only for such products as have, prior to the time set

for opening of bids, been tested and approved for inclusion in the Qualified Products List NASA/GSFC QPL-TM-80599 whether or not such products have actually been so listed by that date. The attention of suppliers is called to this requirement and manufacturers are urged to arrange to have the products they propose to offer to the government tested for qualification in order that they may be eligible to be awarded contracts or orders for the products covered by this specification. The activity responsible for the Qualified Products List is the Goddard Space Flight Center, Greenbelt, Md. 20771. Information pertaining to product qualification can be obtained from this activity.