

Specification for IBM/IBM Compatible 3480 Tape Cartridge

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NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

GODDARD SPACE FLIGHT CENTER

SPECIFICATION FOR IBM/IBM COMPATIBLE

3480 TAPE CARTRIDGE

This specification was developed by the Goddard Space Flight Center's Magnetic Tape Certification Facility (MTCF), Greenbelt, MD 20771, and generally reflects available state-of-the art products. Copies may be obtained from GSFC, Code 562.2.

1. SCOPE AND CLASSIFICATION

1.1 Scope. This specification covers the requirements for magnetic oxide-coated IBM/IBM compatible 3480 cartridges designed for use in digital recording applications. The 3480 cartridges covered by this specification are intended for use on 3480 compatible transports using the Group Coded Recording method for recording maximum densities of 37,871 Characters Per Inch (CPI).

1.2 CLASSIFICATION

1.2.1 General. Each individual 3480 cartridge 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:

<u>TM-100702</u>	34	54	TC
Specification Number	Application Indicator	Tape Length Indicator	Tape Container

1.2.2 Part Number Code

Part Number	Indicator
34	3480 Recording
54	540 feet minimum
TC	Cartridge (3480)

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.

Federal Standards:

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

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

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

Fed. Test Method 406/4041 - Electrical Resistance.

Organizations 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, D. C. 20402.

Single copies of Federal Specifications required by organizations 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 organizations 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.

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

NASA 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 the date of invitation for bids or request for proposal shall apply.

American National Standard Institute (ANSI):

X3B5/86-001 - American National Standard for Unrecorded Magnetic Tape and Cartridge for Information Interchange.

American Society for Testing and Materials (ASTM) Standards:

D 638 - Test for Tensile Properties of Plastics.

3. DEFINITIONS

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

3.1 Acceptable Quality Level (AQL). The maximum percent defective (or the maximum number of defects per hundred units) that, for purposes of sampling inspection, can be considered satisfactory.

3.2 Azimuth. The angular deviation, in minutes of arc, of the mean flux transition line from the line normal to the tape reference edge.

3.3 Beginning of Tape (BOT). Indicated by the start of the density-identification mark.

3.4 Bit. A single digit in the binary number system.

3.5 Bit-Cell. A distance along the track between the initial flux transition of adjacent bits.

3.6 Block. A group of contiguous recorded bytes considered and transported as a unit. Blocks are separated by an interblock gap.

3.7 Byte. A group of eight data bits (nine encoded bits) operated on as a unit.

3.8 Cartridge. A container holding a supply reel of 12.65mm (1/2 in) wide magnetic tape with an attached leader block at the BOT end.

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

3.10 Character. One or more bytes acted on as a unit.

3.11 Coincident Dropout. A coincident dropout is a simultaneous dropout condition on two or more tracks of a 9-track group.

3.12 Data Density. The number of single-byte characters stored per unit length of tape, usually expressed in characters per millimeter (cpmm) or characters per inch (cpi).

3.13 Dropout. A dropout is a loss of read-back amplitude. A dropout exists when the read-back signal amplitude is 25% or less of the average read-back signal amplitude.

3.14 End of Tape (EOT). The last point of the tape for any recording.

3.15 Group Code Recording (GCR). A data-encoding method where an 8-bit recording group of bits (one byte) is encoded into a 9-bit group for recording on magnetic tape.

3.16 Interblock Gap. A recorded interval between adjacent recorded blocks or other special marks.

3.17 Physical Recording Density. The number of recorded flux transitions per unit length of track, usually expressed in flux transitions per millimeter (ftpm) or flux transitions per inch (ftpi).

3.18 Skew. The deviation of bits within a frame from a line perpendicular to the tape reference edge.

3.19 Track. A longitudinal area on the tape along which a series of magnetic signals can be recorded.

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:

TestMaster Model CTC-100 3480 Cartridge Certifier

IBM Personal System II/Model 30 Host Computer

IBM magneto-resistive thin-film 18-track write/read heads

IBM 3480 Tape Drives

5. REQUIREMENTS

5.1 General Requirements. The IBM/IBM Compatible 3480 cartridges 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 (MTCF), 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 IBM/IBM Compatible 3480 cartridges 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 IBM/IBM Compatible 3480 cartridges on dates to be announced by the certifying agency. A prospective supplier may submit only the type of cartridge requested for testing on these submission dates. Qualifying cartridges being submitted must be identified by a manufacturer's designator. 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 cartridge for qualification testing from each prospective supplier within any one-year period. Two copies of the manufacturer's printed commercial specifications and technical data shall be submitted with the cartridge samples. The certifying agency reserves the right to levy a charge to cover cost of product qualification testing; however, such charges shall only be made when so specified in the procurement documents.

5.1.1.3 Samples for Qualification. The sample size shall consist of thirty (30) cartridges for each particular type of a given base material, thickness, oxide and performance characteristics for which qualification is desired. All samples shall be submitted on cartridges which conform to the requirements of this specification unless otherwise specified. The manufacturer shall also submit test data showing that each cartridge 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 specification; (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 one year from the 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's 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 cartridges 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 week 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 1). 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 the MTCF 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 cartridges, the minimum lot size shall be 1000 and the maximum shall be 3200. For orders of less than 1000 cartridges, the lot size may be the order size. A lot shall consist of cartridges 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 cartridge. 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

cartridges selected from concurrent production runs to meet lot size requirements.

5.1.4 Compatibility with Other Cartridges. Cartridges supplied under this specification shall not act as an inhibitor. The performance of other cartridges shall not be degraded by the use of any other QPL cartridge when operated on the same tape drives.

5.1.5 Materials

5.1.5.1 Tape. The magnetic tape shall consist of a backing or base of polyethylene terephthalate film (or its equivalent) coated on one side with a layer of ferromagnetic material suspended in a suitable binder. The back surface of the tape may also be coated.

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

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

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

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

5.1.8 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 specification.

5.1.9 Workmanship and General Examination

5.1.9.1 Workmanship. The magnetic tapes and cartridges 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 edges, dust, flakes, powder, holes, scratches, creases, or any other defects which would render the tape unsuitable for its intended use.

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

5.1.10 Physical Damage. All cartridges and tapes 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 cartridges 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 cartridge 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 cartridges, 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 cartridge will be required prior to qualification testing, unless otherwise specified, to relieve stresses and establish uniformity. The cartridges shall be conditioned at 125 +/- 5 degrees F (52 +/- 3 degrees C), 80 to 90 percent relative humidity for 3 hours. The cartridges 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 24 hours. After the last cycle, the cartridges shall then be held in a room conditioned at the Standard Temperature and 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.

5.4 Product Physical Requirements

5.4.1 General. The tape cartridge consists of a cartridge case, magnetic tape, brake mechanism, file-protect assembly, and leader block. When fabricated, the final assembly must meet the mechanical specifications given. Particular attention should be given to the design of the reel and flange assembly to minimize tape offset. Figure 1 shows the critical mechanical requirements that must be met to ensure compatibility with magnetic-tape-drive assemblies. All dimensions have a tolerance of ± 25 mm (0.01 in) unless otherwise specified.

5.4.2 Tape-Reel Hub Requirements.

Straightness: 0.04 mm (0.0016 in)

Perpendicularity to datum B: 0.07 mm (0.0028 in)

Cylindricity: 0.05 mm (0.002 in)

Rate-of Change (across the width): 0.025 mm per mm
(0.025 in per in)

Full indicator movement to datum B: 0.2 mm (0.008 in) FIM

NOTE: Datum B is a plane defined by the pitch line of the hub teeth at the 41 mm (1.614 in) diameter (Figure 1 part 5 of 13).

5.4.3 File-Protect Assembly. The file-protect assembly must rotate when a force between 2.02 foot-pounds and 0.45 foot-pound is applied at a tangent to the surface of the thumbwheel. When the assembly has been rotated so that the white spot is visible and centrally placed, writing is inhibited.

5.4.4 Leader-Block Pull-Out and Insertion Forces. The pull-out force is the amount of force required to pull the leader-block and attached tape out of the cartridge. Insertion force is the amount of force required to push the leader-block into its latched position in the cartridge. The leader-block pull-out force shall be a minimum of 0.67 foot-pound and the insertion force shall be a maximum of 2.7 foot-pounds when measured at an angle of 48 degrees ± 1 degree (Figure 1 Part 1 of 13).

5.4.5 Bond Strength between the Leader-Block and Tape. The bond strength between the leader-block and tape is the amount of force required to pull the leader-block free from the tape. The leader-block shall remain attached to the tape when a force of 2.25 foot-pounds is applied to the leader block at an angle of 38 degrees ± 2 degrees (Figure 1 part 8 of 13).

5.4.6 Tape Winding. Tape shall be wound in a counterclockwise direction, with the recording surface toward the hub, when the cartridge is viewed from the top.

5.4.7 Winding Tension. Tape shall be wound with a tension of 0.5 foot-pound $\pm$ 0.075 foot-pound.

5.4.8 Brake-Button Material. The brake-button material shall be nylon 6/6 with 2% $\pm$ 1% molybdenum disulfide or equivalent.

5.5 Tape

5.5.1 Dimensions

5.5.1.1 Length. The total length of cartridge tape from leader-block to the end of the tape should be a minimum of 541 feet.

5.5.1.2 Width. The width of the tape shall be 12.650 mm $\pm$ 0.025mm (0.498 in $\pm$ 0.001 in). The width shall be measured across the tape from edge to edge when the tape is under a tension of less than 0.063 foot-pound. This measurement shall be made using a tool maker's microscope or equivalent.

5.5.1.3 Thickness. The total thickness of the tape at any point shall be between 1020 micro-inches and 1330 micro-inches.

5.6 BOT/EOT

5.6.1 BOT. The BOT should begin not further than 52.76 inches or 4.39 feet from the leader-block.

5.6.2 EOT. The EOT should not be less than 169.3 inches or 14.1 feet from the tape-to-hub junction.

5.6.3 BOT to EOT. The distance from the Beginning of Tape to the End of Tape should be a minimum of 523 feet.

5.7 Slitting

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

5.7.2 Test Equipment. A microscope with 100x magnification.

5.7.3 Sample Preparation. Standard.

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

5.8 Magnetic Properties

5.8.1 Requirement. The intrinsic coercive force of the recording surface shall be 520 Oersteds $\pm$ 30 Oersteds when measured in the longitudinal direction.

5.8.2 Test Equipment. Scientific Atlanta Model 651B BH Meter.

5.8.3 Sample Preparation. Standard.

5.8.4 Test Procedure. The BH Meter shall be calibrated using the manufacturer's procedures. Test samples shall then be cut and measured. The results will then be logged.

5.9 Tensile Strength

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

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

5.9.3 Sample Preparation. QPL. Lengths of sample tapes sufficient for this test shall be unwound from the cartridges and placed in a 70 $\pm$ 5 degrees F (21 $\pm$ 3 degrees C), 50 $\pm$ 5 percent relative humidity environment for at least 24 hours prior to testing. The tape shall be free of bends and kinks.

5.9.4 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 and logged.

5.10 Shock Tensile Strength

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

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

5.10.3 Sample Preparation. QPL. Lengths of sample tapes sufficient for this test shall be unwound from the cartridges and placed in an environment of 70 $\pm$ 5 degrees F (21 $\pm$ 3 degrees C), 50 $\pm$ 5 percent relative

humidity for at least 24 hours before the test. The tape samples shall be free of bends and kinks.

5.10.4 Test Procedure. The tape shall be looped through the clamps, magnetic side inward, and securely clamped. The pendulum 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.

5.11 Modulus of Flexibility

5.11.1 Requirement. The minimum angle of deflection shall be greater than 35 degrees.

5.11.2 Test Equipment. Test fixture as shown in figure 2.

5.11.3 Sample Preparation. Standard.

5.11.4 Test Procedure. The sample shall be clamped in the test fixture in a horizontal plane with 3 inches of 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 axis to the free end of the sample. The angle shall be measured in degrees from the horizontal axis.

5.12 Elongation Under Stress

5.12.1 Requirement. The elongation shall not exceed 0.30 percent.

5.12.2 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.

5.12.3 Sample Preparation. QPL. 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.

5.12.4 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 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 $\pm$ 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.

5.13 Longitudinal Curvature

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

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

5.13.3 Sample Preparation. QPL.

5.13.4 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.

5.14 Magnetic Coating Electrical Resistance

5.14.1 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 megohms/square and a maximum of 500 megohms/square.

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

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

5.14.4 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 Federal 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 $\pm$ 10 volts dc.

5.15 Back Coating Electrical Resistance

5.15.1 Requirement. The electrical resistance of the back coating (when applicable) shall not be greater than 1.0 megohm/square.

5.15.2 Test Equipment. (Same as stated in paragraph 5.14.2)

5.15.3 Sample Preparation. (Same as stated in paragraph 5.14.3)

5.15.4 Test Procedure (Backing). (Same as stated in paragraph 5.14.4)

5.16 Layer-to-Layer Adhesion

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

5.16.2 Test Equipment. The test equipment shall consist of: 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 2000-gram weights. 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.

5.16.3 Sample Preparation. QPL or Standard.

5.16.4 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 hours shall be at 130 degrees F (53 degrees C), 85 +/- 5 percent relative humidity, and 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), 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.

5.17 Humidity Stability (Cupping)

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

5.17.2 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 magnification of from 5X to 25X, having at least one cross-hair which can be referred to a clinometer or goniometer so as to measure the angle between the cross-hair 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.

5.17.3 Sample Preparation. QPL.

5.17.4 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 cross-hair 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 of 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 specimen 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 cross-hair 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.

5.18 Abrasivity

5.18.1 Requirement. The abrasivity of the magnetic surface of the tape shall be measured using the procedures indicated. When tested as specified herein the abrasivity of the tape should not exceed 80 units.

5.18.2 Test Equipment. The equipment required for this test shall consist of a Bell & Howell 3400C intermediate band recorder/reproducer (or equivalent); A Fulmer Thin Film Sensor consisting of a resistive film deposited onto a ceramic cylinder; and a Fulmer Abrasivity Meter.

5.18.3 Sample Preparation. QPL.

5.18.4 Test Procedure

A reference tape with proven low abrasivity shall be passed over the sensor in alternate forward and reverse directions of 100ft lengths. The abrasiveness shall be measured for each pass. Consecutive forward and reverse passes shall be made until consistent values are achieved in both directions. The sensor shall then be suitable for abrasivity measurement tests.

The sample tape shall be installed on the transport and five (5) passes in both the forward direction and reverse direction shall be made. Each pass shall consist of 100ft lengths, and the abrasiveness value for each pass shall be recorded.

The sample tape shall then be wound onto a new length, and one forward and one reverse pass shall be made. The abrasiveness value for each pass shall then be recorded.

The sensors and guides shall be re-cleaned and the reference tape re-installed. Two (2) forward and two reverse passes shall be made and the abrasivity values recorded for each pass. The results from the reference tape shall be used to produce a normalizing factor. The normalizing factor is calculated by dividing the known average abrasiveness of the reference tape by the average value obtained from the last four passes.

Once the normalizing factor has been established, each abrasivity value of the tape under test shall be multiplied by this factor. The results from the final pass shall be recorded as the abrasivity of the tape.

5.19 Dynamic Frictional Characteristics

5.19.1 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.

5.19.2 Test Equipment. The test equipment shall consist of: a fixture consisting of a motor drive; driven mandrel; a polished brass or chrome cylindrical bar that is one inch in diameter, surface finished to 5 to 10 microinches peak-to-peak Center-Line-Average; a grams torque gauge; and a 65-gram weight.

5.19.3 Sample Preparation. QPL.

5.19.4 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.

5.20. Fungus Resistance

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

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

5.20.3 Sample Preparation. QPL.

5.20.4 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 specimen are rated 0 or 1.

5.21 Product Performance

5.21.1 Dropouts

5.21.1.1 Definition.

A dropout is a loss of read-back signal amplitude. A dropout exists when the read-back signal amplitude is 25% or less of the average read-back signal amplitude. The average read-back signal amplitude is the average measured over the previous 25.4 mm (1 inch) of track length, exclusive of

dropouts. When a dropout is detected, a second dropout should not be counted until 64 consecutive dropout-free flux transitions are recorded. If a dropout persists for a distance of 1mm (0.039 inches) another dropout is counted.

5.21.1.2 Requirements

5.21.1.2.1 Single-Track Dropouts. When tested as specified, the total number of single-track dropouts shall not exceed 50.

5.21.1.2.2 Coincident Dropouts. A coincident dropout is a simultaneous dropout condition on two or more tracks of a 9-track group. A coincident dropout is counted as a single event regardless of length. There are two 9-track groups in the 18-track format. One group comprises the odd-numbered tracks, and the other group comprises the even-numbered tracks.

When tested as specified there shall be no coincident dropouts detected.

5.21.2 Test Equipment. The test equipment shall consist of a TestMaster Model CTC-100 3480 Cartridge Certifier with an IBM Personal System II Model 30 Host Computer.

5.21.3 Sample Preparation. QPL or Standard.

5.21.4 Test Procedures. The TestMaster CTC-100 detects and counts dropouts by the continuous writing and reading of a predefined data pattern and the monitoring of the read data analog outputs from the drives. The tape is written with an "all ones" bit pattern with no inter-record gaps. At the start of each test pass, the CTC-100 initiates a functional loopback test that ensures the integrity of the entire certifier-to-tape-transport interface. This functional loopback test is entirely automatic and cannot in any way be disabled or overridden. No tape will be tested unless the entire system successfully passes the functional loopback test. Single-track dropouts and coincident dropouts will be detected, counted and printed on an Error Report Summary.

5.22 Coating to Base Material Anchorage.

5.22.1 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 magnetic coating from the base material of the tape or failure of the coating layer itself.

5.22.2 Test Equipment. The test equipment shall consist of a TestMaster Model CTC-100 3480 Cartridge Certifier with an IBM Personal System II Model 30 Host Computer.

5.22.3 Sample Preparation. QPL or Standard.

5.22.4 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.

5.23 Durability

5.23.1 Requirement. The tape shall be put through 100 full length wear passes. There shall be no increase in the number of allowable coincident errors, and the single-track errors shall not exceed 75. The tape under wear pass 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 QPL.

5.23.2 Test Equipment. The test equipment shall consist of a TestMaster Model CTC-100 Cartridge Certifier with an IBM Personal System II Model 30 Host Computer (or equivalent).

5.23.3 Sample Preparation. QPL.

5.23.4 Test Procedure. An initial write/read dropout pass shall be performed on a virgin reel of tape. The tape shall then be subjected to 100 wear passes on the appropriate transport. A wear pass shall consist of a normal record/reproduce pass and a high-speed rewind pass over the tape heads for the entire tape length. After completion of the last wear pass, a dropout count shall be conducted to determine compliance with paragraph 5.21.1.

6. PREPARATION FOR DELIVERY

Unless otherwise specified in the contract or purchase order, cartridges supplied under this specification shall be packaged and packed in accordance with the requirements of paragraphs 6.1 through 6.3.

6.1 Packaging. Ten (10) cartridges shall be packaged in a heat-sealed, airtight, plastic bag of sufficient gauge to ensure the cartridges' integrity until received by the users. The packaged cartridges shall be sealed in a manner to prevent any shifting during transportation.

6.2 Packing. The sealed cartridges shall be packed in a closefitting fiberboard box conforming to the requirements of PPP-B-636, type CF, class domestic, grade 275. The number of cartridges in a box may range from ten (10) to thirty (30).

6.3 Marking. Each box shall be marked with the following information:

- a. Manufacturer's type number
- b. Number of cartridges in box
- c. Manufacturer's lot number
- d. Date of manufacture (month and year)

- e. Contract number
- f. NASA purchase order number
- g. NASA Federal Stock Number.

7.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-100702 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 organization responsible for the Qualified Products List is the Goddard Space Flight Center, Magnetic Tape Certification Facility (MTCF), Code 562.2, Greenbelt, MD. 20771. Information pertaining to product qualification can be obtained from this organization.

TABLE I. Test and Examination Acceptance Criteria

Normal Inspection Level 1 AQL 2.5	
Group A	Requirement Paragraph
Workmanship and General Examination	5.1.9
Tape Winding	5.4.6
Length	5.5.1.1
Thickness	5.5.1.3
Dropouts	5.21.1
Special Inspection Level S-1 AQL 4.0	
Group B	
Product Physical Requirements	5.4
Width	5.5.1.2
Slitting	5.7
Modulus of Flexibility	5.11
Magnetic Coating Electrical Resistance	5.14
Back Coating Electrical Resistance	5.15
Layer-to-Layer Adhesion	5.16
Normal Inspection Level 1 AQL 0.40	
Group C	
Splices	5.1.6
Physical Damage	5.1.10
Coating to Base Anchorage	5.22
Other Tests and Examinations Special Inspection Level S-1 AQL 4.0	
Group D	
Toxic Compounds	5.1.5.2
Flammable Materials	5.1.5.3
Magnetic Properties	5.8
Tensile Strength	5.9
Shock Tensile Strength	5.10
Elongation Under Stress	5.12
Longitudinal Curvature	5.13

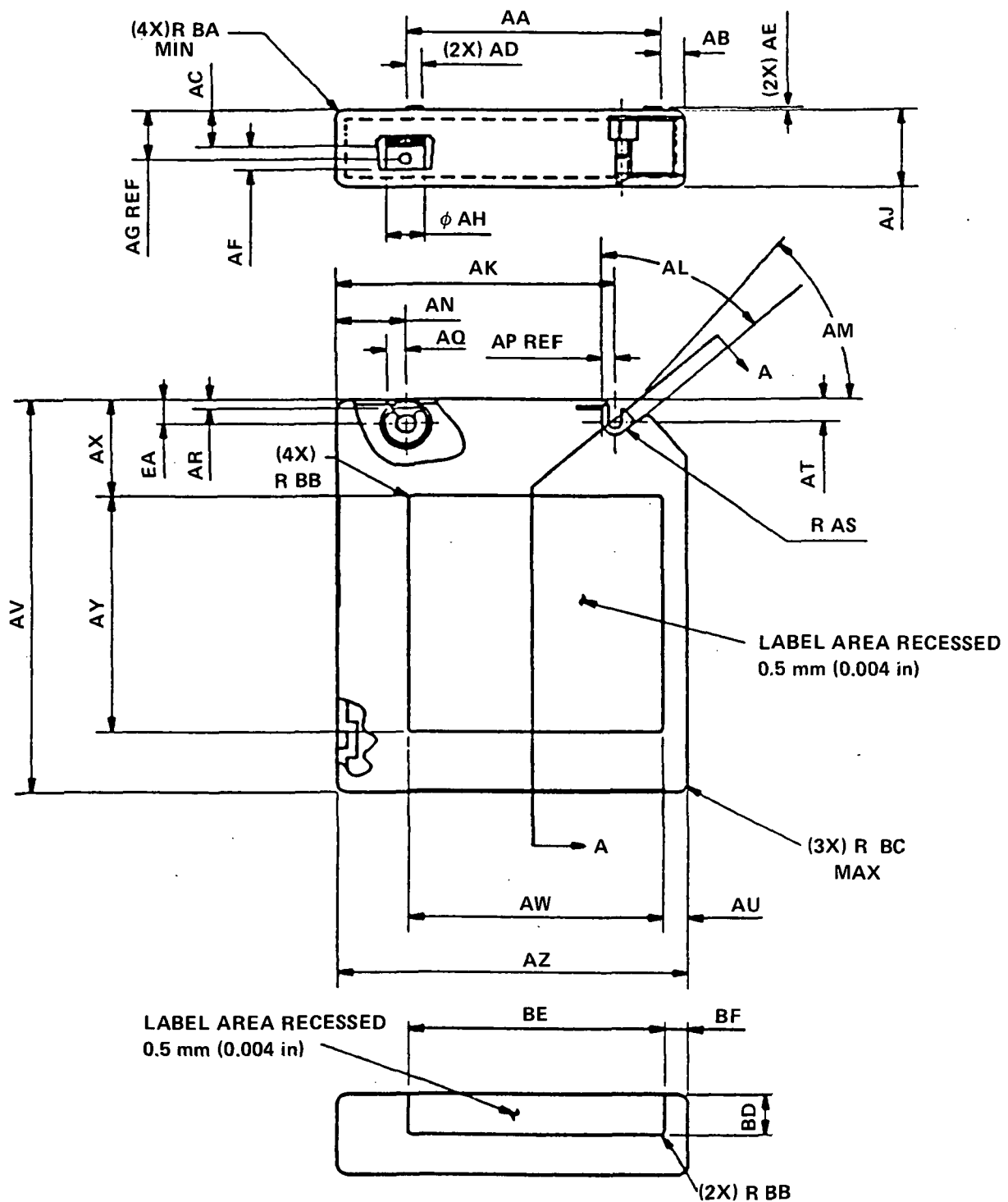
TABLE I (continued)

Group D

Humidity Stability (Cupping)	5.17
Abrasivity	5.18
Dynamic Frictional Characteristics	5.19
Fungus Resistance	5.20
Durability	5.23

TABLE II. General Examination Defects

Examine	Defects
Cartridges:	
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.
Packaging	Not as specified.
Packing	Not as specified.
Tape:	
Wind	Not as specified.
Appearance	Tape surface 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.
Condition as Received:	Improper marking. Damaged contents.



TAPE CARTRIDGE TOP AND ENDS

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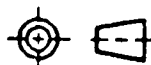
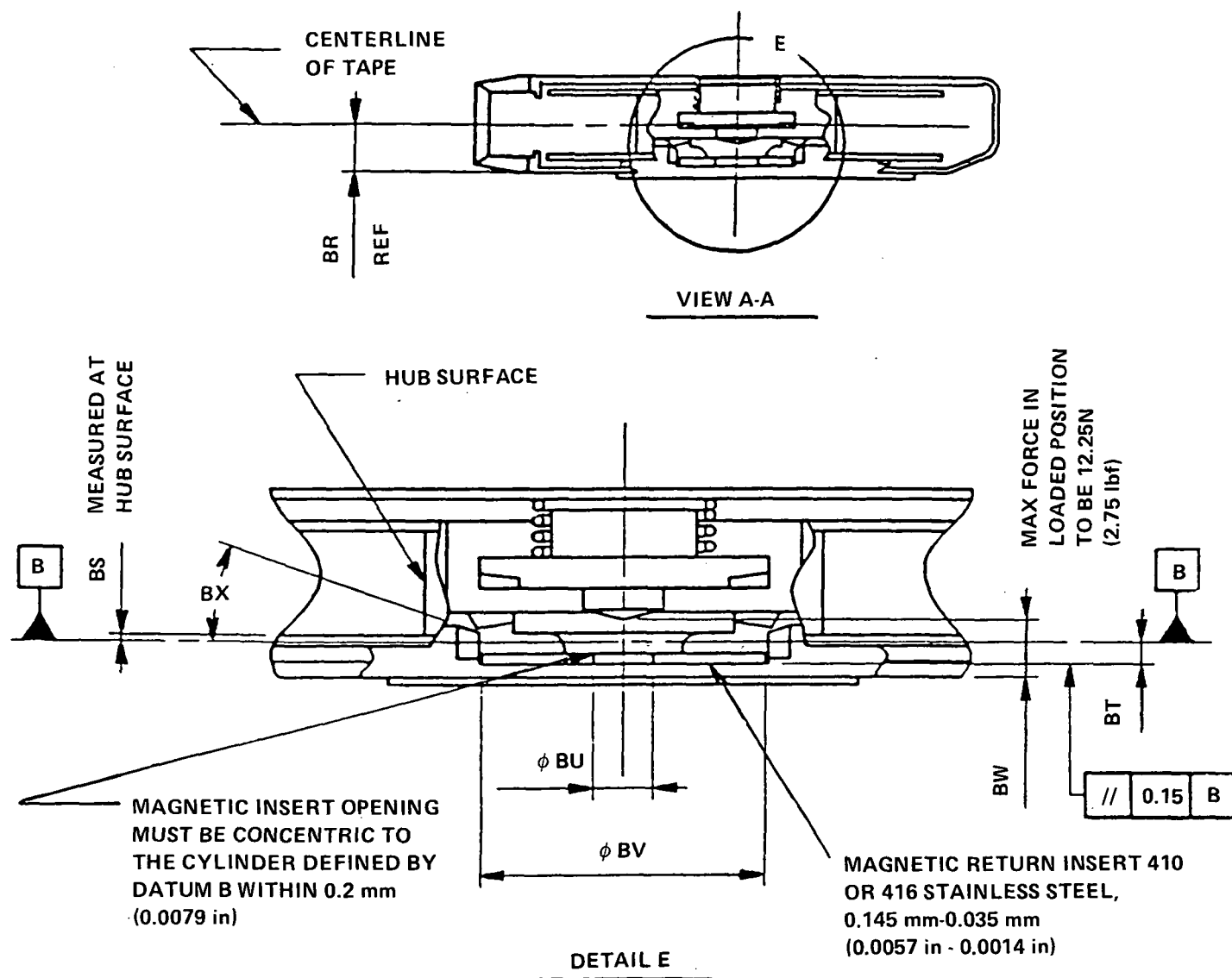


Figure 1 (Part 1 of 13) Mechanical Requirements of the Tape Cartridge



CUTAWAY VIEW OF CARTRIDGE IN MACHINE
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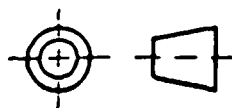
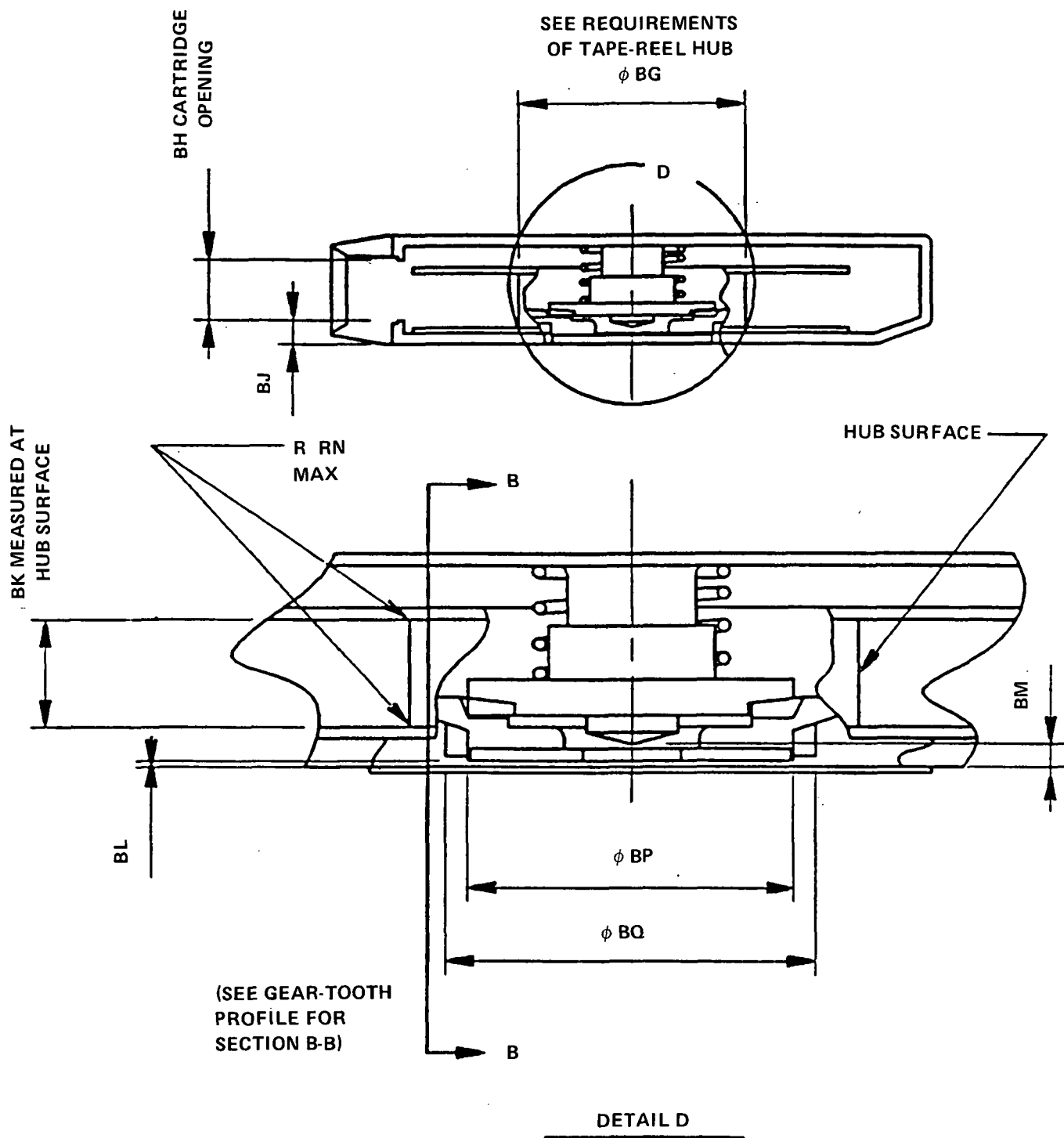


Figure 1 (Part 2 of 13) Mechanical Requirements of the Tape Cartridge



CUTAWAY VIEW OF CARTRIDGE IN HAND
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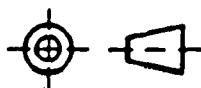
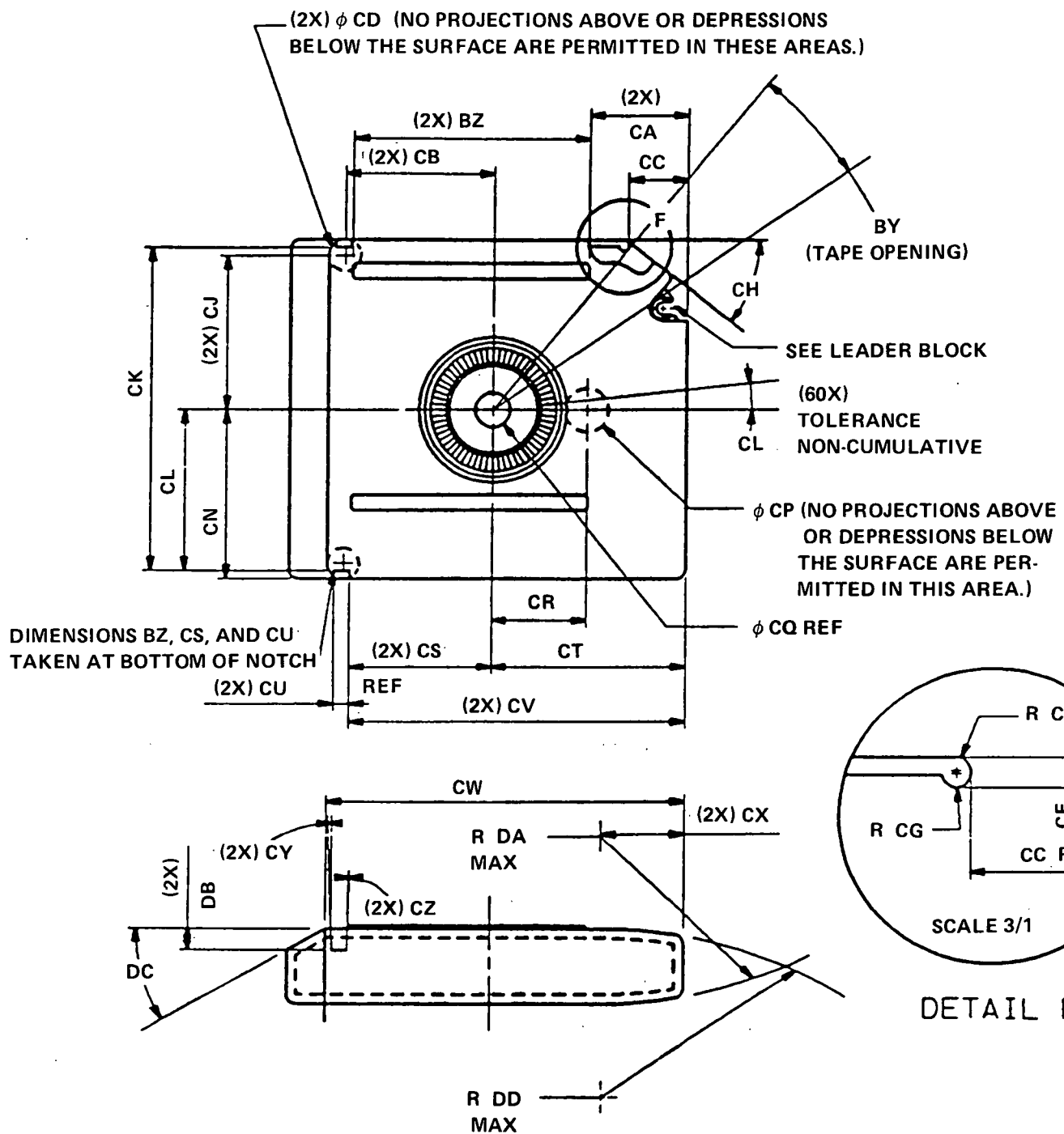


Figure 1. (Part 3 of 13) Mechanical Requirements of the Tape Cartridge



TAPE CARTRIDGE BOTTOM AND SIDE
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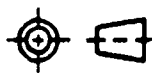


Figure 1 (Part 4 of 13) Mechanical Requirements of the Tape Cartridge

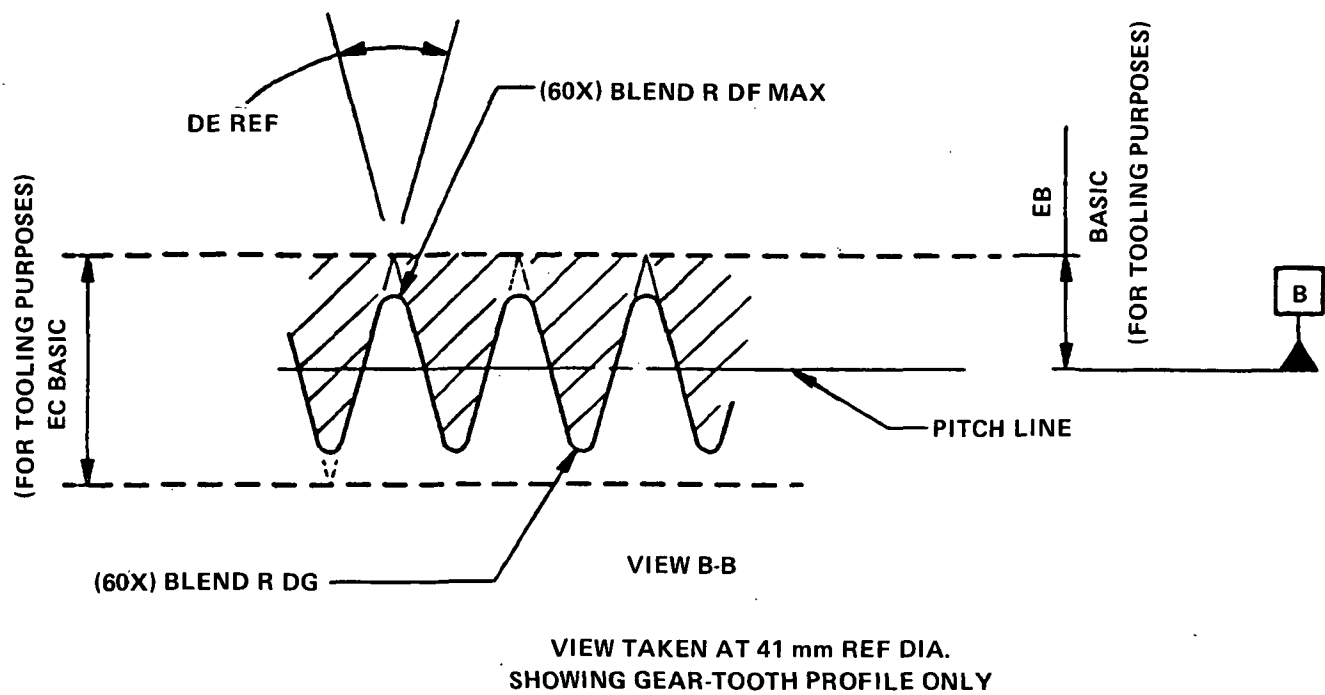
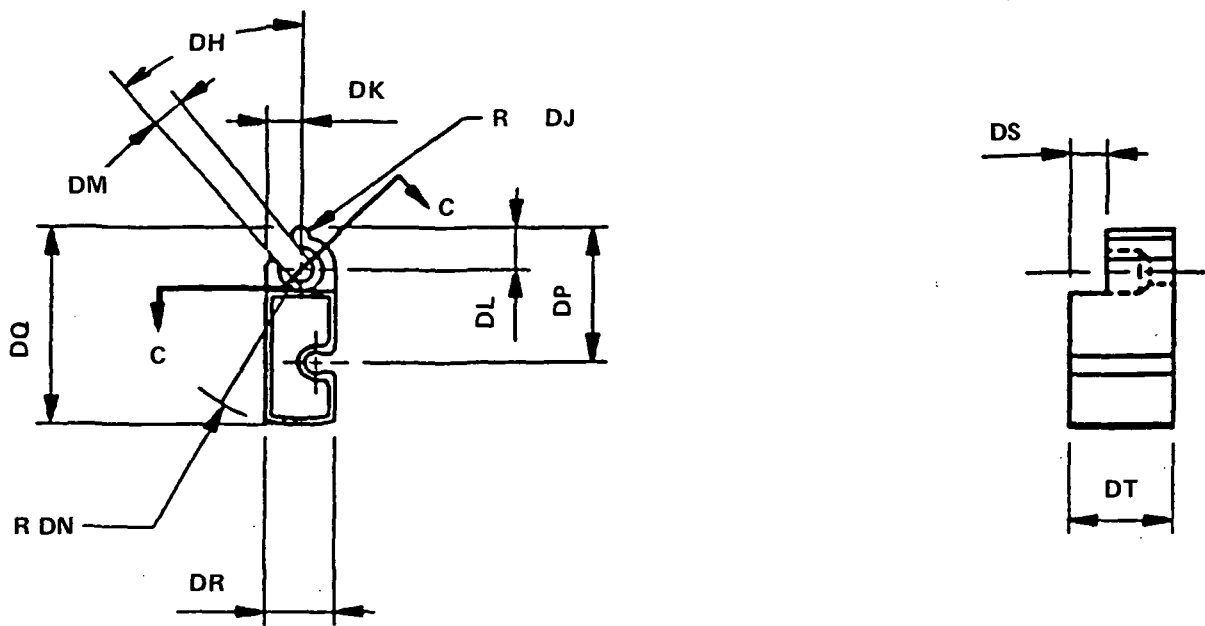
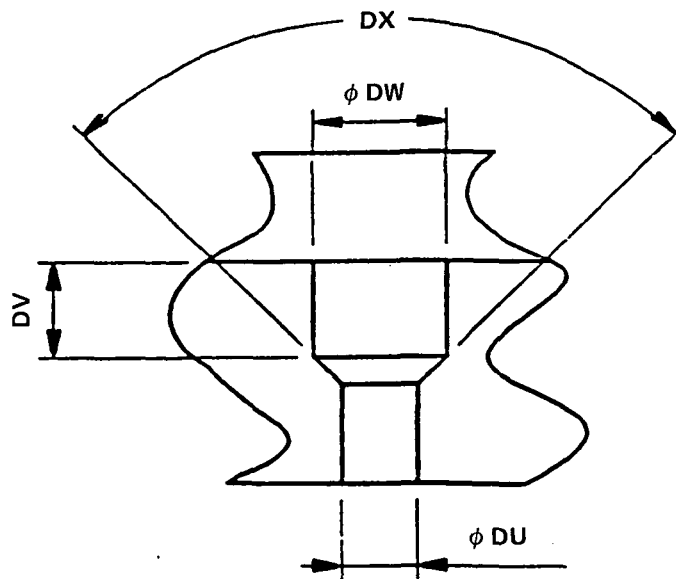


Figure 1 (PART 5 of 13) Mechanical Requirements of the Tape Cartridge



LEADER BLOCK



VIEW C-C

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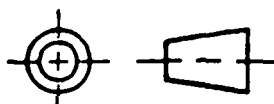
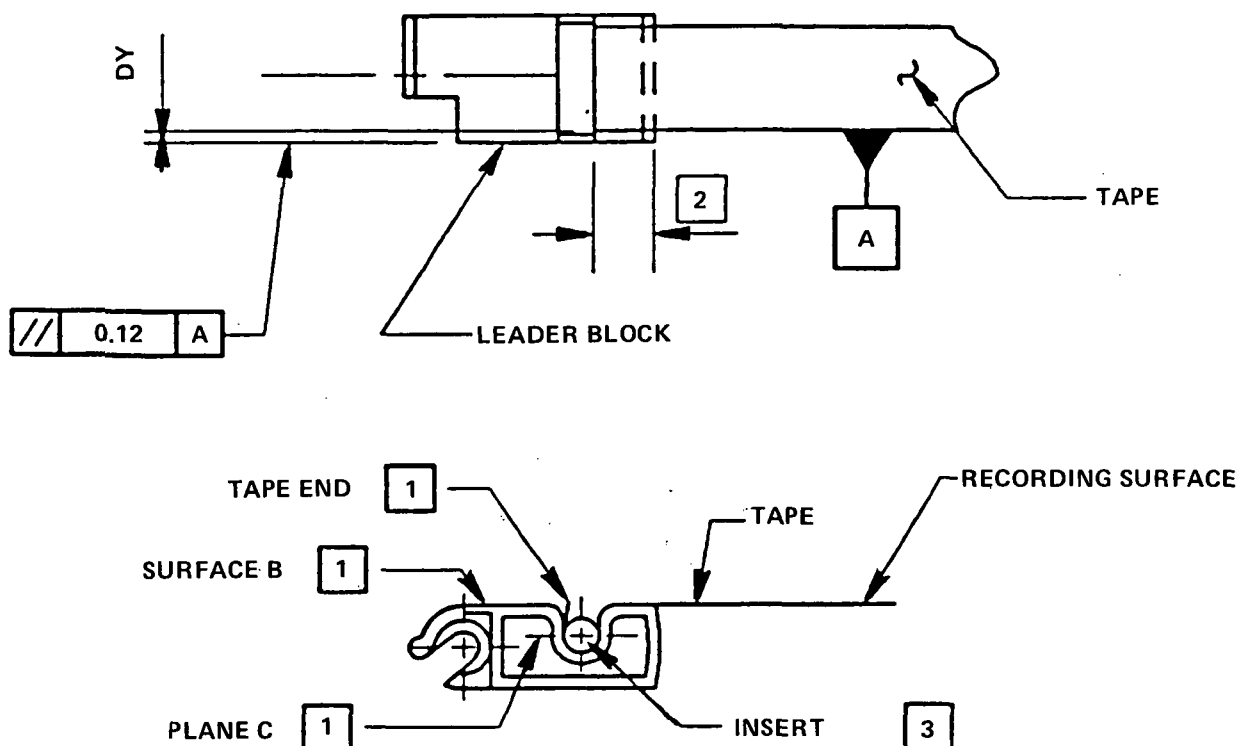


Figure 1 (Part 6 of 13) Mechanical Requirements of the Tape Cartridge



NOTES:

- 1 TAPE END TO TERMINATE BETWEEN PLANE C AND A SURFACE 2.5 mm ABOVE SURFACE B.
- 2 PARALLEL IN THIS AREA ONLY AND MEASURED WHILE TAPE IS UNDER TENSION.
- 3 INSERT MUST COVER FULL WIDTH OF TAPE AND NOT PROTRUDE BEYOND SURFACE OF LEADER BLOCK.

LEADER BLOCK TAPE ATTACHMENT

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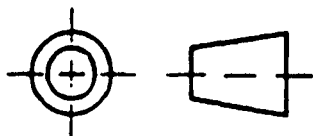
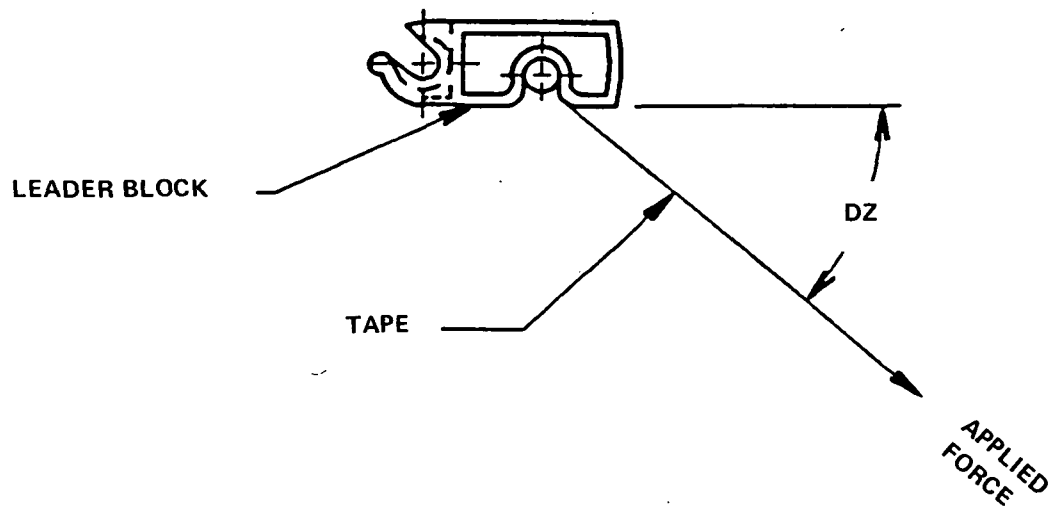


Figure 1 (Part 7 of 13) Mechanical Requirements of the Tape Cartridge



BOND STRENGTH BETWEEN LEADER BLOCK AND TAPE

Figure 1 (Part 8 of 13) Mechanical Requirements of the Tape Cartridge

Symbol	Dimension			Tolerance		
	mm	in	deg/min	mm	in	deg/min
AA	79.5	3.130				
AB	7.5	0.296		±0.32	±0.013	
AC	11.8	0.465				
AD	5	0.197				
AE	1	0.0394		±0.16	±0.0063	
AF	7.4	0.291				
AG	15.3	0.603				
AH	∅12	∅0.473				
AJ	24.5	0.965		+0.50 -0.32	+0.019 -0.013	
AK	87.1	3.429				
AL			50°			±1°
AM			48°			±1°
AN	21.6	0.851				
AP	4	0.158				
AQ	6	0.236				
AR	2.8	0.110				
AS	4R	0.158R				
AT	7.5	0.295				
AU	7	0.276				
AV	125	4.921		±0.32	±0.013	
AW	80	3.150		+0.3 -0.16	+0.0118 -0.0063	
AX	31	1.221				
AY	75	2.953		+0.30 -0.16	+0.0118 -0.0063	
AZ	109	4.291		±0.32	±0.013	

∅ - Diameter dimension
R - Radius dimension

Tolerance is ±0.25 mm (0.010 in)
unless otherwise noted

Figure 1 (Part 9 of 13) Mechanical Requirements of the Tape Cartridge

Symbol	Dimension			Tolerance		
	mm	in	deg/min	mm	in	deg/min
BA	3R	0.118R		min	min	
BB	1R	0.0394R		max	max	
BC	3R	0.118R		max	max	
BD	12.3	0.484				
BE	80	3.150				
BF	7	0.276				
BG	Ø50	Ø1.9685		-0.2	-0.0079	
BH	14.9	0.587		±0.32	±0.013	
BJ	4.7	0.185				
BK	13.05	0.5138		+0.2 -0.1	+0.0079 -0.0040	
BL	0.4	0.0157		+1.0 -0.5	+0.0394 -0.0197	
BM	1.9	0.075		+1.4 -0.9	+0.055 -0.036	
BN	0.08R	0.0031R		max	max	
BP	Ø36	Ø1.418		+0.5	+0.020	
BQ	Ø41	Ø1.614				
BR	12.25	0.482				
BS	0.65	0.0256		±0.09	±0.0036	
BT	2.27	0.0894		±0.12	±0.0048	
BU	Ø11.15	Ø0.43898		±0.02	±0.00079	
BV	Ø35	Ø1.378		+0.2 -1.2	+0.008 -0.047	
BW	8.1	0.3189		±0.08	±0.0032	
BX			11°3'			±0°5'
BY			16°			±0°30'
BZ	74.5	2.933				

Ø - Diameter dimension
R - Radius dimension

Tolerance is ±0.25 mm (0.010 in)
unless otherwise noted

Figure 1 (Part 10 of 13) Mechanical Requirements of the Tape Cartridge

Symbol	Dimension			Tolerance		
	mm	in	deg/min	mm	in	deg/min
CA	31	1.221				
CB	47.5	1.870				
CC	18.4	0.725				
CD	Ø10	Ø0.394				
CE	1.5R	0.059R				
CF	3.3	0.130				
CG	1.5	0.059				
CH			40°			±0°30'
CJ	51	2.008				
CK	104	4.095				
CL			6°			±0°5'
CM	52	2.047				
CN	54.5	2.146				
CP	Ø14	Ø0.551				
CQ	Ø11.15	Ø0.439		ref	ref	
CR	29.75	1.171				
CS	45	1.772				
CT	61	2.402				
CU	5	0.197				
CV	106	4.173				
CW	113.2	4.457		±0.3	±0.012	
CX	26	1.024				
CY			2°			±0°30'
CZ			1°30'			±0°30'

Ø - Diameter dimension
R - Radius dimension

Tolerance is ±0.25 mm (0.010 in)
unless otherwise noted

Figure 1 (Part 11 of 13) Mechanical Requirements of the Tape Cartridge

Symbol	Dimension			Tolerance		
	mm	in	deg/min	mm	in	deg/min
DA	145.5R	5.729R				
DB	7	0.276				
DC			30°			±0°30'
DD	145.5R	5.729R				
DE			30°			
DF	0.25R	0.010R		max	max	
DG	0.2R	0.0079R		+0.1	+0.004	
DH			44°			-3°
DJ	1.4R	0.0551R		±0.2	±0.0079	
DK	5.46	0.2150		±0.10	±0.0040	
DL	6.8	0.2678		±0.1	±0.004	
DM			8°			-3°
DN	25R	0.984R				
DP	21.8	0.8583		±0.2	±0.0079	
DQ	31.8	1.2520		±0.04	±0.0016	
DR	10.93	0.4303		+0.06 -0.08	+0.0024 -0.0031	
DS	6	0.236				
DT	16.5	0.6496		-0.2	-0.0079	
DU	Ø4	Ø0.1575		±0.2	±0.0079	
DV	5.2	0.2048		±0.2	±0.0079	
DW	Ø7	Ø0.2756		±0.2	±0.0079	
DX			90°			±2°
DY	1.9	0.075		±0.26	±0.010	
DZ			38°			±2°

Ø - Diameter dimension
R - Radius dimension

Tolerance is ±0.25 mm (0.010 in)
unless otherwise noted

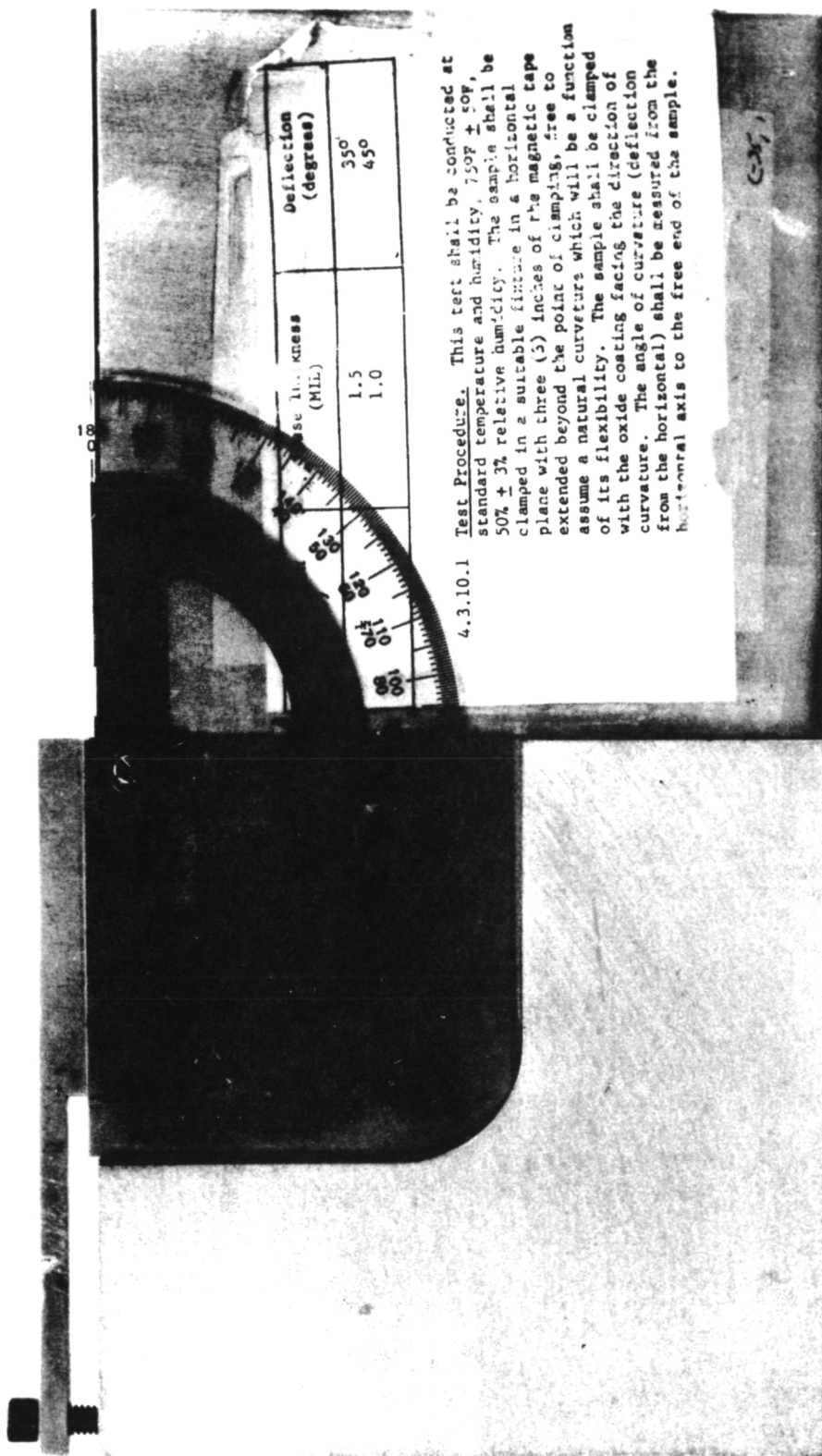
Figure 1 (Part 12 of 13) Mechanical Requirements of the Tape Cartridge

Symbol	Dimension			Tolerance		
	mm	in	deg/min	mm	in	deg/min
EA	8	0.3150				
EB	2	0.07874		basic	basic	
EC	4	0.15748		basic	basic	

Ø - Diameter dimension
 R - Radius dimension

Tolerance is ± 0.25 mm (0.010 in)
 unless otherwise noted

Figure 1 (Part 13 of 13) Mechanical Requirements of the Tape Cartridge



Test Procedure. This test shall be conducted at standard temperature and humidity, $75^{\circ}\text{F} \pm 5^{\circ}\text{F}$, $50\% \pm 3\%$ relative humidity. The sample shall be clamped in a suitable fixture in a horizontal plane with three (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.

NOTE

1. ALL DIMENSIONS ARE IN INCHES.
2. NO RADIUS ON THIS EDGE.
3. PROTRACTOR CAN BE OF ANY CLEAR PLASTIC TYPE, 6 INCHES, AFFIXED TO SIDE OF BASE.

Figure 2. Modulus of Flexibility Test Fixture

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Report Documentation Page

1. Report No. NASA TM-100702		2. Government Accession No.		3. Recipient's Catalog No.	
4. Title and Subtitle Specification for IBM/IBM Compatible 3480 Tape Cartridge				5. Report Date May 1988	
				6. Performing Organization Code 562.2	
7. Author(s) Jimmy L. Perry				8. Performing Organization Report No. 88B0181	
				10. Work Unit No.	
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16. Abstract This document establishes the same kinds of standards and controls that are currently in use for the procurement of new analog and digital magnetic tapes. The Magnetic Tape Certification Facility (MTCF) currently maintains a Quality Products List (QPL) for all new analog and digital magnetic tapes purchased by NASA-GSFC. Extensive tests are conducted in the MTCF on an annual basis to determine the manufacturers' tape ttypes to be added to or deleted from the current QPL. The MTCF currently maintains two specifications for magnetic tapes. NASA TM-79724 is used for the QPL and acceptance testing of new analog tapes, and NASA TM-80599 is used for the QPL and acceptance testing of new digital tapes. This specification will be used for the QPL and acceptance testing of new 3480 cartridges. The magnetic tapes used by GSFC, LaRC, LeRC, ARC/Dryden, WFF, and the Network Tracking Stations are covered by the NASA-GSFC specifications. The 3480 cartridge was introduced approximately 3-1/2 years ago and is becoming an increasingly attractive alternative to digital magnetic tapes. Many users have already converted to the 3480 system and have more tape drives on order.					
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