

**MIL-W-80C**

1 DECEMBER 1966

SUPERSEDING

MIL-P-80B

18 AUGUST 1952

(SEE 6.4)

**MILITARY SPECIFICATION**

**WINDOW, OBSERVATION, ACRYLIC BASE,  
 ANTIELECTROSTATIC, TRANSPARENT  
 (FOR INDICATING INSTRUMENT)**

*This specification is mandatory for use by all Departments and Agencies of the Department of Defense.*

**1. SCOPE**

1.1 This specification covers one type of transparent heat resistant acrylic resin-based sheet material, which is antielectrostatic.

PPP-B-640 — Boxes, Fiberboard, Corrugated, Triple-Wall.

PPP-T-45 — Tape, Gummed, Paper, Reinforced.

**2. APPLICABLE DOCUMENTS**

2.1 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:

**MILITARY**

MIL-P-5425 — Plastic, Sheet, Acrylic, Heat Resistant.

**STANDARDS****MILITARY**

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

MIL-STD-129 — Marking for Shipment and Storage.

**SPECIFICATIONS****FEDERAL**

CCC-T-191 — Textile Test Methods.

PPP-B-636 — Box, Fiberboard.

FSC 9330
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(Copies of specifications, standards, drawings, and publications required by suppliers in connection with specific procurement functions should be obtained from the procurement activity or as directed by the contracting officer.)

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

**OFFICIAL CLASSIFICATION COMMITTEE****Uniform Freight Classification Rules.**

(Application for copies should be addressed to the Official Classification Committee, 1 Park Avenue at 33rd Street, New York, N.Y. 10016.)

**AMERICAN SOCIETY FOR TESTING  
AND MATERIALS STANDARDS (ASTM)****D 1003 — Method of Test for Haze  
and Luminous Transmittance  
of Transparent Plastics.**

(Application for copies should be addressed to the American Society for Testing and Materials, 1916 Race Street, Philadelphia, Pennsylvania 19103.)

(Technical Society and Technical Association specifications and standards are generally available for reference from libraries. They are also distributed among technical groups and using Federal agencies.)

**3. REQUIREMENTS**

**3.1 Material.** The material shall conform to all of the requirements of MIL-P-5425.

**3.2 Form.** The material shall be in the form of sheets, strips, or windows, cut therefrom, as specified (see 6.2). The surface of the sheets shall conform to finish A of MIL-P-5425.

**3.3 Dimensions and tolerances.****3.3.1 Thickness.**

<i>Nominal thickness (inch)</i>	<i>Tolerance (Plus or minus) (inch)</i>
1/16 and 3/32	0.012
1/8	.015
3/16	.020

**3.3.2 Length and width.**

**3.3.2.1 Strips and sheets.** Strips shall be 4 by 4 inches or 6 by 6 inches. Sheets shall be 12 by 12 inches, or as specified (see 6.2). The tolerance shall be plus or minus 1/16 inch.

**3.3.2.2 Windows.** Dimensions of windows, sheets or strips shall be as specified (see 6.2). The tolerances shall be as follows:

<i>Dimension (inches)</i>	<i>Tolerance (Plus or minus) (inch)</i>
Less than 3	± 1/32
3 to less than 6	± 3/64
6 and over	± 1/16

**3.4 Antielectrostatic treatment of surface.** When treatment or coating is used to make the sheet or strip antielectrostatic, it shall be applied on either one or both surfaces of the sheet or strip at the option of the manufacturer.

**3.5 Antielectrostatic property.** After conditioning by each of the procedures specified in 4.4.4.2 and 4.4.4.3 the sheet, strip, or window shall show no bound electrostatic charge when tested as specified in 4.4.5.4.

**3.6 Optical properties.** The optical properties shall be as specified in table I.

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TABLE I. *Physical requirements*

<i>Property</i>	<i>Requirement</i>	<i>Test reference</i>
Light transmittance, percent, minimum		4.4.6.1
After reference conditioning (see 4.4.4.1)	90	
After humidity cycling (see 4.4.4.3)	88	
After accelerated aging (see 4.4.4.4)	85	
Haze, percent, maximum		4.4.6.1
After reference conditioning (see 4.4.4.1)	2	
After humidity cycling (see 4.4.4.3)	3	
After accelerated aging (see 4.4.4.4)	3	

**3.7 Identification.** Unless otherwise specified, each sheet or window shall be marked within  $\frac{1}{2}$  inch ( $\frac{1}{4}$  inch for windows  $1\frac{1}{2}$  inches or smaller) of the edge, with the supplier's name or trademark, and with "MIL-W-80C". This marking shall be on the untreated surface, if any, (see 3.4) of the sheet or window. If one side of the sheet or window is not antielectrostatic, this surface shall be marked "OUTSIDE" within  $\frac{1}{2}$  inch of the edge. Strips shall be marked as specified (see 6.2).

**3.8 Workmanship.** Sheets, strips, and windows shall be uniform in quality and shall be free from surface and internal imperfections and roughness of cut edges. Subsequent fabrication shall continue to meet the antielectrostatic requirements of this specification.

#### 4. QUALITY ASSURANCE PROVISIONS

**4.1 Responsibility for inspection.** Unless otherwise specified in the contract or purchase order, the supplier is responsible for the performance of all inspection requirements specified herein. Except as otherwise specified, the supplier may utilize his own facilities or any 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 assure supplies and services conform to prescribed requirements.

**4.1.1 Inspection of materials and components.** The supplier is responsible for insuring that materials and components used were manufactured, tested, and examined in accordance with the requirements of referenced subsidiary specifications and standards to the extent specified, or, if none, in accordance with this specification. In the event of conflict, this specification shall govern.

#### 4.2 Sampling.

**4.2.1 Lot.** A lot shall consist of not more than one thousand pieces of the same thickness, prepared from the same material under essentially identical conditions and offered for delivery at one time.

**4.2.2 Sampling for inspection.** Sampling for inspection shall be performed in accordance with the provisions set forth in MIL-STD-105, except where otherwise indicated.

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### 4.2.3 Quality conformance inspection.

**4.2.3.1 Examination.** Examination shall be made in accordance with the classification of defects, inspection levels, and acceptable quality levels (AQLs) set forth below. The lot size, for purpose of determining the sample size in accordance with MIL-STD-105, shall be expressed in units of sheets, strips, or windows, as required (see 6.2) for examination in 4.2.3.1.1, 4.2.3.1.2 and in units of shipping containers for examination in 4.2.3.1.3.

**4.2.3.1.1 Examination for defects in appearance and workmanship.** The sample unit for this examination shall be one sheet, strip, or window.

<i>Examine</i>	<i>Defect</i>
Appearance and workmanship	Bubbles, striae, chipped, scratches.  Waves, distortion, irregularities, or other defects which would render the material unfit for the purpose of viewing objects through it.  Surfaces not made to a smooth finish.  Imbedded particles, such as grit or other foreign matter.  Ragged or rough edges or sides.

**4.2.3.1.2 Examination for defects in dimensions.** The sample unit for this examination shall be one plastic sheet, strip, or window.

<i>Examine</i>	<i>Defect</i>
Length and width of sheet or strip	Varies by more than plus or minus 1/16 inch from length or width specified.
Length of window	Varies by more than specified in 3.3.2.2.
Thickness	Varies by more than $\pm$ the applicable tolerance specified in 3.3.1.

**4.2.3.1.3 Examination for defects in preparation for delivery.** Examination shall be made to determine that the packaging, packing, and marking comply with the requirements of Section 5 of this specification. The sample unit for this examination shall be one shipping container, fully packed, selected just prior to the closing operation. Shipping containers fully prepared for delivery shall be examined for closure defects.

<i>Examine</i>	<i>Defects</i>
Packaging	Individual sheets or strips not wrapped or packaged as specified.  Packaging material not as specified.
Packing	Not in accordance with contract requirements.  Container not as specified, closures not accomplished by specified or required methods or materials.  Inadequate application of components; such as incomplete closures of case liners, container flaps, loose or inadequate strappings, bulged or distorted containers.
Count	Case liners missing or not as specified when required. Less than specified or indicated quantity.
Weight	Gross weight exceeds specified requirements.
Markings	Interior or exterior markings omitted, illegible, incorrect, incomplete, or not in accordance with contract requirements.

**4.2.3.1.4 Inspection levels and acceptable quality levels (AQLs) for examinations.** The inspection levels for determining the sample size, and the acceptable quality levels (AQLs) expressed in defects per 100 units, shall be as follows:

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<i>Examination paragraph</i>	<i>Inspection level</i>	<i>AQL</i>
4.2.3.1.1	I	1.5
4.2.3.1.2	S-3	2.5
4.2.3.1.3	S-2	4.0

**4.2.4 Sampling for tests.** Representative samples shall be taken at random from each lot that passes the examination specified in 4.3.1 in sufficient quantity to conduct the production check tests or the quality conformance tests specified in 4.3.3 and 4.3.4, as applicable. If the items are of such size or shape that test specimens cannot be prepared from them, a substitute sample shall be provided in the form of a piece or pieces of plastic sheet or strips having dimensions appropriate for the tests required. The substitute samples shall be certified to be of the same material and properties as that in the lot of finished material offered for delivery.

### 4.3 Quality conformance examination and tests.

**4.3.1 Examination.** Each of the sample plastic pieces selected in accordance with 4.2.2 shall be examined visually for form, dimensions and tolerances, identification, and workmanship.

**4.3.2 Rejection.** If the number of defects exceed the applicable acceptance number, this shall be cause for rejection of the entire lot represented by the sample.

**4.3.3 Production check tests.** Production check tests shall be conducted on samples from (or representing) one out of every 5 lots. All the tests specified in 4.4 shall be conducted, using three specimens for each test. The results of each test shall be averaged.

**4.3.4 Quality conformance tests.** Quality conformance tests shall be conducted on samples from (or representing) all lots on which

production check tests were not conducted. The test specified in 4.4.5 (see 3.5), after conditioning at low humidity (see 4.4.4.2) only, shall be performed. Three specimens shall be tested.

**4.3.5 Action in case of nonconformance.** If any sample in the production check tests or quality conformance tests is found not to be in conformance with the requirements of this specification, this shall be cause for rejection of the lot which it represents. Furthermore, additional samples shall be taken or provided from each subsequent lot and shall be subjected to the test or tests wherein the failure occurred. Each lot shall then be accepted only after satisfactory results are obtained on the test or tests by all the samples taken or provided to represent the lot. This additional testing shall be discontinued after four successive lots have passed the test or tests.

### 4.4 Methods of tests.

**4.4.1 Standard atmospheres.** Unless otherwise specified herein, conditioning and testing shall be conducted at  $73.5^{\circ} \pm 2^{\circ}\text{F}$ . ( $23.1^{\circ} \pm 1.1^{\circ}\text{C}$ .) and 50 plus or minus 4 percent relative humidity.

**4.4.2 Specimen preparation and positioning for testing.** Unless otherwise specified herein, specimens shall be machined from sheets, strips, or windows to length and width tolerances of plus or minus 5 percent. Before testing specimens shall be wiped with a clean, dry cloth; subsequent contamination of the surface by dust or fingerprints shall be avoided. Specimens shall be tested with the untreated surface, if any, facing the testing action.

#### 4.4.4 Conditioning.

**4.4.4.1 Reference.** Specimens shall be exposed for not less than 48 hours to the conditions specified in 4.4.1.

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4.4.4.2 *Low humidity.* Specimens shall be exposed for not less than 48 hours to a temperature of  $73.5^{\circ} \pm 2^{\circ}\text{F}$ . ( $23.1^{\circ} \pm 1.1^{\circ}\text{C}$ .) and a relative humidity of 10 plus or minus 2 percent. The measurement of electrostatic dispersion (4.4.5.4) shall be conducted at these conditions.

4.4.4.3 *Humidity cycling.* Specimens shall be kept for 6 hours at a temperature of  $149.0^{\circ} \pm 2^{\circ}\text{F}$ . ( $45.0^{\circ} \pm 1.1^{\circ}\text{C}$ .) and a relative humidity of 95 plus or minus 2 percent. The heat and humidity controls shall then be turned off and the specimens permitted to cool for 18 hours. This procedure shall be repeated three times, whereupon the specimens shall be removed. Care shall be taken to avoid damage to the antielectrostatic treatment, if present. The specimens shall be gently blotted with a clean damp cloth or sponge. They shall then be conditioned as specified in 4.4.1 for at least one hour before optical testing and for at least 24 hours before testing for electrostatic dispersion.

4.4.4.4 *Accelerated aging.* The applicable provisions of method 5660 of CCC-T-191 shall be used.<sup>1</sup> Exposure time shall correspond to 75 standard fading hours. Before further testing, the specimens shall be wiped with a clean cloth.

### 4.4.5 *Electrostatic dispersion.*

4.4.5.1 *Specimens.* The specimens shall be four-inch squares, or, if smaller, the actual window size.

4.4.5.2 *Apparatus.* The apparatus shall consist of a motor which imparts a 2 inch forward and backward stroke at 100 cycles per minute to a connecting link and of an assembly for generating and measuring electrostatic charges, shown diagrammatically in figure 1. The component parts shall be as follows:

(a) *Rubbing pad.* The rubbing pad shall be  $1\frac{1}{2}$  by  $2\frac{3}{4}$  inches and of such height as to weigh 2 pounds. It shall be pivoted at the shorter sides and connected by another pivot joint to the connecting link in such a manner that it can be lifted away from the specimen, when desired. The pad shall be grooved on all sides to hold the rubbing cloth by means of a rubber band. The cloth shall be made of cotton.

(b) *Specimen mounting stand.* The stand shall consist of a square frame of  $5\frac{1}{2}$  inches outside and  $3\frac{1}{2}$  inches inside length. It shall be constructed of metal, preferably brass. The position of the stand and its height, in relation to the connecting link, shall be such that the rubbing pad is centrally located on the specimen at the midpoint of the stroke, and makes full contact with the specimen during the entire stroke. For specimens smaller than 4 by 4 inches, metal strips, less than  $1/16$ -inch thick, shall be installed on the frame to fix the position of the specimen symmetrically over the frame opening. The specimen shall be attached to the frame by means of commercial type spring clips.

(c) *Electrostatic receiving plate.* The plate shall be  $3\frac{1}{4}$  inches square and shall be constructed of thin but rigid metal. The plate shall be electrically isolated from all parts of the stand (see 4.4.5.2 (b)) and shall be mounted at its center by means of a counter-sunk screw to an insulator (see 4.4.5.2(d)) parallel to and at a

<sup>1</sup>Type FDA-R Fade-Ometer, manufactured by Atlas Electrical Devices Company, Chicago, Illinois, or equivalent, is suitable.

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distance of 1/16 to 3/16 inch between its top side and the bottom surface of the specimen.

- (d) *Insulator.* The insulator shall be the stand-off type, made of glazed porcelain. It shall be mounted on the baseboard and its height adjusted by interposed washers so that the specified distance between the top side of the receiving plate and the bottom side of the specimen is attained.
- (e) *Electrostatic voltmeter.* The electrostatic voltmeter shall have a measuring range of 300 volts.
- (f) *Electrical connections.* A rigid conductor shall be soldered to the underside of the electrostatic receiving plate and shall be connected to the high voltage terminal of the voltmeter. Connections between the low voltage terminal, the specimen mounting stand, and the ground shall complete the electrical circuit of the electrostatic voltmeter.

**4.4.5.3** *Checking of apparatus before operation.* A 4 by 4 inch specimen which is not antielectrostatic shall be subjected to rubbing for one minute with cotton cloth mounted on the rubbing pad assembly. The rubbing arms shall be lifted from the specimen immediately upon cessation of the rubbing action, and a reading on the voltmeter taken ten seconds thereafter. Readings shall continue to be taken at one minute intervals for the next ten minutes. If the voltage exceeds the range of the voltmeter, readings shall begin as soon as the voltage has dropped to within reading range. In any of the one minute intervals, the voltage drop shall not exceed five volts. An appreciably higher rate indicates a defect in the apparatus (see 6.3).

**4.4.5.4** *Procedure.* After the satisfactory operation of the electrostatic dispersion appa-

ratus has been determined (see 4.4.5.3) the specimen used for checking shall be replaced by the specimen to be tested. If the specimen is antielectrostatic on one side only the other side shall face the rubbing pad. The specimen shall be subjected to the rubbing action specified in 4.4.5.3. The rubbing arm shall then be lifted immediately away from the specimen and ten seconds thereafter a reading shall be taken on the voltmeter. Presence of a charge shall constitute failure of the sample represented by the specimen to meet the antielectrostatic property requirement (see 3.5).

#### **4.4.6** *Optical properties.*

**4.4.6.1** *Total light transmittance and haze.* ASTM method D1003, or any other method having an accuracy not less than specified therein, shall be used. Only one measurement of transmittance and haze shall be made on each specimen.

**4.5** *Examination of preparation for delivery.* The preservation, packaging, packing, and marking shall be examined to determine compliance with the requirements of Section 5 of this specification.

## **5. PREPARATION FOR DELIVERY**

**5.1** *Packaging.* Packaging shall be Level A or C, as specified (see 6.2).

### **5.1.1** *Level A.*

**5.1.1.1** Antielectrostatic plastic sheets, strips, or windows shall be protected by a complete wrap of polyethylene of 0.0015 inch minimum thickness in sheet, ribbon, or bag form, depending upon the shape or size of the material being packaged. No paper shall be used in direct contact with the plastic sheet or windows; however, after wrapping with polyethylene, additional wraps of soft, nonabrasive paper may be utilized for physical protection or cushioning purposes if required.

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**5.1.1.2 Unit containers.** Plastic sheets, strips, or windows, in the quantity specified (see 6.2), shall be further packaged in a fiberboard box conforming to PPP-B-636. Closure and sealing shall be in accordance with the applicable container specification.

**5.1.2 Level C.** Packaging shall be sufficient to afford adequate protection against deterioration and physical damage during shipment from the supply source to the first receiving activity for immediate use or for controlled humidity storage. This level may conform to the supplier's commercial practice when such meets the requirements of this level.

**5.2 Packing.** Packing shall be level A, B, or C, as specified (see 6.2).

**5.2.1 Level A.** Antielectrostatic plastic sheets, strips or windows, packaged as specified in 5.1.1, shall be packed in fiberboard boxes conforming to any one of the following specifications at the option of the supplier:

<i>Specification</i>	<i>Class</i>
PPP-B-636	Weather-resistant class
PPP-B-640	Class 2

**5.2.1.1** All center and edge seams and manufacturer's joint of fiberboard boxes shall be sealed and waterproofed with pressure sensitive tape in accordance with the applicable fiberboard box specification. Shipping containers shall be closed and banded (reinforced with pressure-sensitive tape) in accordance with the applicable box specification or appendix thereto. The gross weight of shipping containers shall not exceed the weight limitations of the applicable box specification. When specified (see 6.2), unit fiberboard containers conforming to weather resistant class of PPP-B-636 closed, sealed and banded as specified herein may be used as the shipping container and need not be overpacked.

**5.2.2 Level B.** Antielectrostatic plastic sheets, strips or windows, packaged as specified in 5.1, shall be packed in fiberboard boxes conforming to any one of the following specifications at the option of the supplier:

<i>Specification</i>	<i>Class</i>
PPP-B-636	Domestic class
PPP-B-640	Class 1

**5.2.2.1** Shipping containers shall be closed and banded in accordance with the applicable container specification or appendix thereto. Fiberboard containers may be sealed with PPP-T-45 tape. The gross weight of shipping containers shall not exceed the weight limitations of the applicable box specification. Unit fiberboard containers conforming to PPP-B-636, closed and banded as specified herein, may be used as the shipping container and need not be overpacked.

**5.2.3 Level C.** Antielectrostatic sheets, strips, or windows, packaged as specified in 5.1.2, shall be packed to insure acceptance by common carrier at the lowest rate and will afford protection against physical and mechanical damage during direct shipment from the supply source to the first receiving activity for immediate use. The shipping containers or the method of packing shall conform to the Uniform Freight Classification Rules and Regulations as applicable to the mode of transportation and may be the supplier's commercial practice when such meets the requirements of this level.

**5.3 Marking.** In addition to any special marking required (see 6.2), interior packages and exterior shipping containers shall be marked in accordance with MIL-STD-129.

**6. NOTES**

**6.1 Intended use.** The materials covered by this specification are intended for use as



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windows or protective shields for instruments, gages, and other measuring devices, where observation under adverse conditions of heat, relative humidity, electrostatic charge development, and intense illumination must not be obscured.

**6.2 Ordering data.** Procurement documents should specify the following:

- (a) Title, number, and date of this specification.
- (b) Quantity, form and dimensions required (see 3.2 and 3.3).
- (c) If identification markings on sheets or windows shall be omitted (see 3.7).
- (d) Identification marking on strips required (see 3.7).
- (e) Applicable levels of packaging and packing (see 5.1 and 5.2).

- (f) Special markings, if required (see 5.3).

**6.3 Repair of defects in electrostatic dispersion test apparatus.** Improper functioning of the equipment may be caused by excessive insulator leakage. This may be overcome by coating the porcelain surface with a thin film of a dimethylsilicone liquid, such as Dow Corning DC200, or equivalent. Manufacturers instructions for application should be followed. Malfunctions of the test equipment may also be caused by accidental grounding of the electrical connection between the static receiving plate and the voltmeter. If elimination of these defects does not result in proper operation of the test equipment, the electrostatic voltmeter should be checked or returned to the manufacturer for repairs or replacement.

**6.4 CHANGES FROM PREVIOUS ISSUE. THE EXTENT OF CHANGES (DELETIONS, ADDITIONS, ETC.) PRECLUDE THE ANNOTATION OF THE INDIVIDUAL CHANGES FROM THE PREVIOUS ISSUE OF THIS DOCUMENT.**

**Custodians:**

Army—MR

Navy—SH

Air Force—11

**Preparing activity:**

Navy—SH

(Project No. 9330-0203)

Code "C"

**Review activities:**

Army—MR, MI, MU, EL

Navy—SH

Air Force—11

**User activities:**

Army—ME

Navy—YD, AS, OS

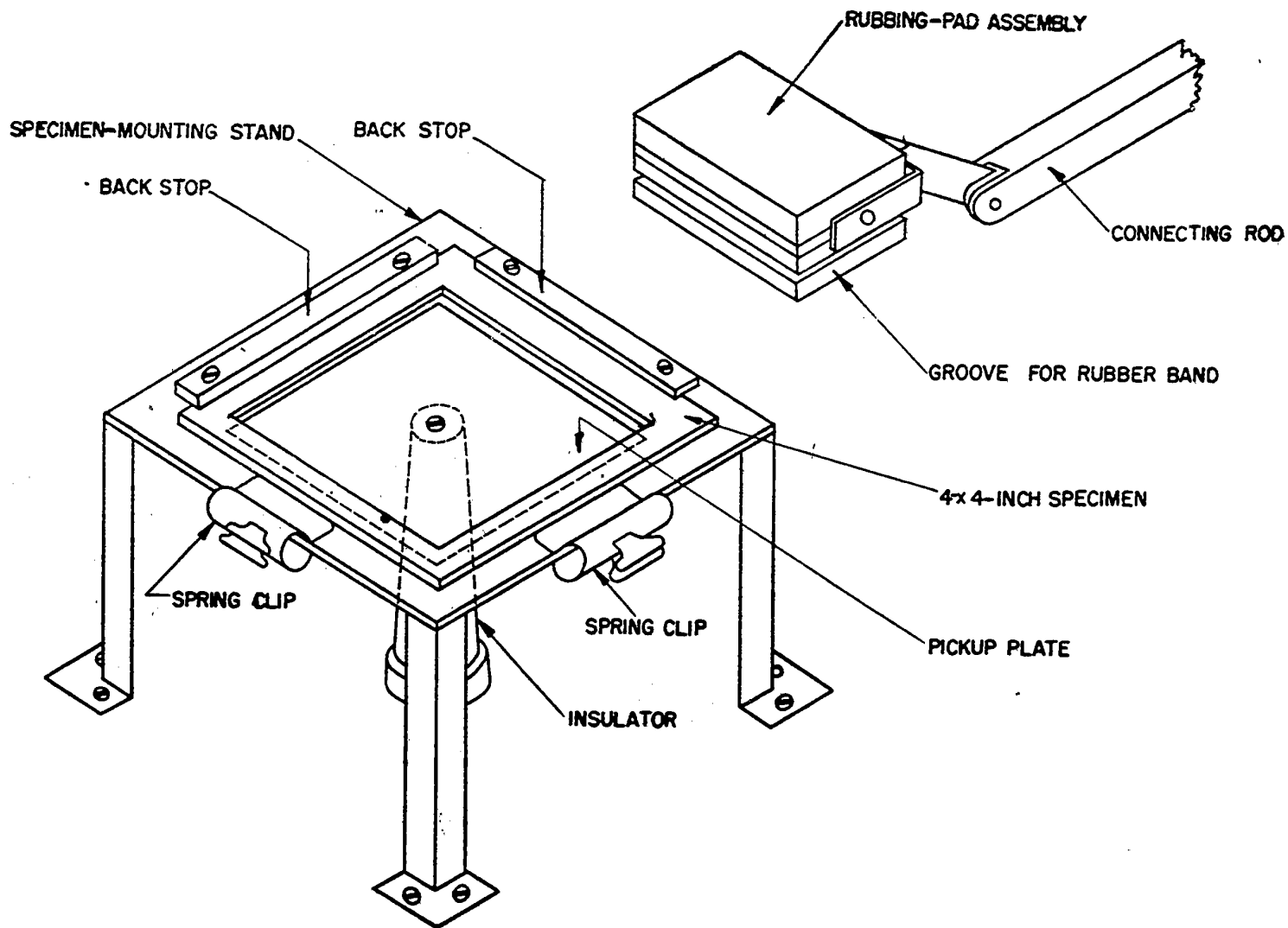


FIGURE 1. Pickup assembly for electrostatic-dispersion measurements.