

MIL-I-805B
27 February 1969
~~SUPERSEDED~~
MIL-I-805A
28 November 1951
(See 6.3 and 6.5)

MILITARY SPECIFICATION
INSULATION, ELECTRICAL, PAPER (SLOT-CELL)

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

1. SCOPE

1.1 Scope. This specification covers insulation used primarily in the coils and slots of electrical machinery.

1.2 Classification. Electrical insulation shall be of the following types and forms, as specified (see 6.2):

Type F—Fish paper.

Type R—100-percent rag paper, not chemically treated.

Type FP—One layer of fish paper sandwiched between cover films or synthetic resinous material.

Type RP—One layer of type R paper sandwiched between cover films of synthetic resinous material.

Type FC—One layer of fish paper laminated with one layer of varnished cambric.

Form S—Sheets (except type F in nominal thicknesses less than 0.020 inch).

Form R—Rolls (type F in nominal thicknesses less than 0.020 inch only).

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 the specification to the extent specified herein.

SPECIFICATIONS

FEDERAL

- | | |
|-----------|--|
| PPP-B-576 | - Box, Wood, Cleated, Veneer, Paper Overlaid. |
| PPP-B-585 | - Boxes, Wood, Wirebound. |
| PPP-B-591 | - Boxes, Fiberboard, Wood-Cleated. |
| PPP-B-601 | - Boxes, Wood, Cleated-Plywood. |
| PPP-B-621 | - Boxes, Wood, Nailed and Lock-Corner. |
| PPP-B-636 | - Box, Fiberboard. |
| PPP-B-640 | - Boxes, Fiberboard, Corrugated, Triple-Wall. |
| PPP-C-650 | - Crates, Wood, Open and Covered. |
| PPP-T-60 | - Tape, Pressure-Sensitive Adhesive, Waterproof, for Packaging. |
| PPP-T-76 | - Tape, Pressure-Sensitive Adhesive Paper, (For Carton Sealing). |

MILITARY

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|-------------|--|
| MIL-P-116 | - Preservation, Methods of. |
| MIL-I-631 | - Insulation, Electrical, Synthetic-Resin Composition, Nonrigid. |
| MIL-I-3374 | - Insulation, Cloth and Tape, Electrical, Varnish Cambric. |
| MIL-B-13239 | - Barrier Material, Waterproofed, Flexible All Temperature. |

STANDARDS

MILITARY

- | | |
|-------------|--|
| MIL-STD-105 | - Sampling Procedures and Tables for Inspection by Attributes. |
| MIL-STD-129 | - Marking for Shipment and Storage. |

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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 procuring activity or as directed by the contracting officer.)

1.2 Other publications. The following document forms 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.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

D-669-Standard Method of Test for Internal Tearing Resistance of Paper.

(Application for copies should be addressed to the American Society for Testing and Materials, 1915 Race Street, Philadelphia, Pa. 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.

3.1.1 The insulation shall be uniform in texture, density, and finish, without breaks, cracks, wrinkles, or flaws of any kind. The paper shall be well formed and there shall be no tendency toward splitting or separation of the layers of the paper, or of the laminations in laminated constructions. In laminated constructions the layers shall be cemented together by an insulating compound which is a good flexible binder.

3.1.2 The insulation shall be free from electrically conductive particles, dirt, and other foreign material that may affect the serviceability of the finished product. The percentage of soluble chloride remaining in the paper shall be as small as possible, and shall not exceed 0.10 percent when calculated as chlorine.

3.2 Type F. Fish paper shall be a tough, strong, dense paper made from chemically treated cotton rag stock. The paper shall be thoroughly washed after the chemical treatment to remove all chemicals which may cause deterioration. The paper shall contain no added coloring matter and no sizing or loading material.

3.3 Type R.

3.3.1 The insulation shall be a tough, strong, dense paper made from 100-percent selected cotton rag stock not chemically treated.

3.3.2 The density shall be not less than 1.30 grams per cubic centimeter.

3.4 Type FP. The insulation shall consist of one layer of fish paper, conforming to type F specified in 3.2, sandwiched between two layers of synthetic resinous insulating film conforming to type C, form F of MIL-I-631.

3.5 Type RP. The insulation shall consist of one layer of insulation conforming to type R specified in 3.3, sandwiched between two layers of synthetic resinous insulating film conforming to type C, form F of MIL-I-631.

3.6 Type FC. The insulation shall consist of one layer of varnished cambric in accordance with MIL-I-3374, and one layer of fish paper conforming to type F specified in 3.2.

3.7 Dimensions and weight. Electrical insulation shall be of the dimensions and weight, within the tolerances shown in tables I and II as specified (see 6.2).

TABLE I. - Dimensions and weights, types F and R.

| Type | Combined insulation thickness (nominal) | Tolerance (±) combined insulation thickness | Area per 100 pounds (approx.) | Sheets-Form S | | | | Rolls-Form R | | Length of 100-pound rolls 45 inches wide (approx.) | |
|--------|---|---|-------------------------------|---------------|---------|---------|---------|--------------|---------|--|---------|
| | | | | Width | | Length | | Weight | Width | | |
| | | | | Minimum | Maximum | Minimum | Maximum | Per Roll | Minimum | | Maximum |
| Type F | Inch | Inch | Square feet | Inches | | Inches | | Pounds | Inches | | Feet |
| | 0.005 | 0.0010 | ----- | ----- | ----- | ----- | ----- | 100 or 200 | 36 | 60 | 750 |
| | .007 | .0010 | ----- | ----- | ----- | ----- | ----- | 100 or 200 | 36 | 60 | 540 |
| | .010 | .0015 | ----- | ----- | ----- | ----- | ----- | 100 or 200 | 36 | 60 | 375 |
| | .015 | .0015 | ----- | ----- | ----- | ----- | ----- | 100 or 200 | 36 | 60 | 265 |
| | .020 | .0015 | 700 | 36 | 60 | 36 | 88 | ----- | ----- | ----- | ----- |
| | .025 | .0030 | 560 | 36 | 60 | 36 | 88 | ----- | ----- | ----- | ----- |
| .030 | .0030 | 470 | 36 | 60 | 36 | 88 | ----- | ----- | ----- | ----- | |
| Type R | .005 | .0010 | 2,360 | 36 | 60 | 36 | 88 | ----- | ----- | ----- | ----- |
| | .007 | .0010 | 1,890 | 36 | 60 | 36 | 88 | ----- | ----- | ----- | ----- |
| | .010 | .0015 | 1,180 | 36 | 60 | 36 | 88 | ----- | ----- | ----- | ----- |
| | .015 | .0015 | 830 | 36 | 60 | 36 | 88 | ----- | ----- | ----- | ----- |
| | .020 | .0015 | 590 | 36 | 60 | 36 | 88 | ----- | ----- | ----- | ----- |
| | .025 | .0030 | 472 | 36 | 60 | 36 | 88 | ----- | ----- | ----- | ----- |
| | .030 | .0030 | 396 | 36 | 60 | 36 | 88 | ----- | ----- | ----- | ----- |

TABLE II. - Dimensions and weights, types FP, RP, and FC.

| Type | Combined insulation thickness (nominal) | Tolerance (±), combined insulation thickness | Paper thickness (nominal) | Tolerance (±), paper thickness | Synthetic resinous film thickness (nominal) 1 layer | Tolerance (±), synthetic resinous film thickness one layer | Varnished cambric thickness (nominal) | Tolerance (±), varnished cambric thickness | Area per 100 pounds (approx.) | | | | Sheets-Form S | | | |
|-----------------|---|--|---------------------------|--------------------------------|---|--|---------------------------------------|--|-------------------------------|-------|---------|---------|---------------|---------|---------|---------|
| | | | | | | | | | Width | | Length | | Minimum | Maximum | Minimum | Maximum |
| | | | | | | | | | FP | RP | Minimum | Maximum | | | | |
| Types FP and RP | Inch | Inch | Inch | Inch | Inch | Inch | Inch | Inch | Square feet | | Inches | | Inches | | | |
| | 0.007 | 0.0016 | 0.005 | 0.0010 | 0.001 | 0.00025 | ----- | ----- | 1,994 | 1,690 | 36 | 60 | 36 | 88 | | |
| | .008 | .0016 | .005 | .0010 | .0015 | .00025 | ----- | ----- | 1,740 | 1,475 | 36 | 60 | 36 | 88 | | |
| | .009 | .0016 | .007 | .0010 | .001 | .00025 | ----- | ----- | 1,546 | 1,310 | 36 | 60 | 36 | 88 | | |
| | .010 | .0016 | .007 | .0010 | .0015 | .00025 | ----- | ----- | 1,392 | 1,180 | 36 | 60 | 36 | 88 | | |
| | .012 | .0020 | .010 | .0015 | .001 | .00025 | ----- | ----- | 1,160 | 983 | 36 | 60 | 36 | 88 | | |
| | .013 | .0020 | .010 | .0015 | .0015 | .00025 | ----- | ----- | 1,070 | 907 | 36 | 60 | 36 | 88 | | |
| | .017 | .0020 | .015 | .0015 | .001 | .00025 | ----- | ----- | 819 | 694 | 36 | 60 | 36 | 88 | | |
| | .018 | .0020 | .015 | .0015 | .0015 | .00025 | ----- | ----- | 773 | 655 | 36 | 60 | 36 | 88 | | |
| | .022 | .0020 | .020 | .0015 | .001 | .00025 | ----- | ----- | 632 | 536 | 36 | 60 | 36 | 88 | | |
| | .023 | .0020 | .020 | .0015 | .0015 | .00025 | ----- | ----- | 605 | 513 | 36 | 60 | 36 | 88 | | |
| | .027 | .0036 | .025 | .0030 | .001 | .00025 | ----- | ----- | 515 | 437 | 36 | 60 | 36 | 88 | | |
| | .028 | .0036 | .025 | .0030 | .0015 | .00025 | ----- | ----- | 497 | 421 | 36 | 60 | 36 | 88 | | |
| | .032 | .0036 | .030 | .0030 | .001 | .00025 | ----- | ----- | 435 | 369 | 36 | 60 | 36 | 88 | | |
| | .033 | .0036 | .030 | .0030 | .0015 | .00025 | ----- | ----- | 421 | 357 | 36 | 60 | 36 | 88 | | |

TABLE II - Dimensions and weights, types FP, RP, and FC—continued

| Type | Combined insulation thickness (nominal) | Tolerance (+), combined insulation thickness | Paper thickness (nominal) | Tolerance (+), paper thickness | Synthetic resinous film thickness (nominal) 1 layer | Tolerance (+), synthetic resinous film thickness one layer | Varnished cambric thickness (nominal) | Tolerance (+), varnished cambric thickness | Area per 100 pounds (approx.) | Sheets—Form S | | | |
|---------|---|--|---------------------------|--------------------------------|---|--|---------------------------------------|--|-------------------------------|---------------|---------|---------|---------|
| | | | | | | | | | | Width | | Length | |
| | | | | | | | | | | Minimum | Maximum | Minimum | Maximum |
| Inch | Inch | Inch | Inch | Inch | Inch | Inch | Inch | Square Feet | Inches | | Inches | | |
| Type FC | .011 | .0018 | .005 | .0010 | ----- | ----- | .005 | .0008 | 1450 | 36 | 80 | 36 | 88 |
| | .012 | .0016 | .007 | .0010 | ----- | ----- | .005 | .0006 | 1050 | 36 | 60 | 36 | 88 |
| | .015 | .0020 | .007 | .0010 | ----- | ----- | .007 | .0010 | 900 | 36 | 60 | 36 | 88 |
| | .018 | .0025 | .010 | .0015 | ----- | ----- | .007 | .0010 | 750 | 36 | 60 | 36 | 88 |
| | .023 | .0025 | .015 | .0015 | ----- | ----- | .007 | .0010 | 600 | 36 | 60 | 36 | 88 |
| | .028 | .0025 | .020 | .0015 | ----- | ----- | .007 | .0010 | 500 | --- | --- | --- | --- |

3.8 Flexibility. The insulation shall not show any signs of cracking or breaking when tested as specified in 4.4.3. In the case of types R and RP insulation, surface crazing will be permitted, provided at least 75 percent of the original dielectric strength is retained. This shall be determined by conducting the dielectric strength test as specified in 4.4.7.8.2.

3.9 Aging factor. The aging factor shall be not less than 8 hours when determined as specified in 4.4.4. In the case of types R and RP insulation, surface crazing will be permitted, provided no deterioration of mechanical or electrical properties results. This shall be determined by conducting the dielectric strength test as specified in 4.4.7.8.2.

3.10 Characteristics. The tearing, tensile, and dielectric strength shall conform to tables III, IV, and V.

TABLE III Characteristics, Types F and R.

| Combined insulation thickness (nominal) | Tearing strength (see 4.4.5) | | | | Tensile strength (see 4.4.6) | | | | Dielectric strength (see 4.4.7) | | | |
|---|------------------------------|-------|-----------------|-------|------------------------------|-----------------------|-----------------------|-----------------------|---|-------|---|-------|
| | Lengthwise direction | | Cross direction | | Lengthwise direction | | Cross direction | | After 48 hours at 50 percent relative humidity and 25° C. | | After 48 hours at 96 percent relative humidity and 25° C. | |
| | F | R | F | R | F | R | F | R | F | R | F | R |
| Types F and R | Grams | Grams | Grams | Grams | Pounds per inch width | Pounds per inch width | Pounds per inch width | Pounds per inch width | Volts | Volts | Volts | Volts |
| Inch | | | | | | | | | | | | |
| 0.005 | 100 | 175 | 120 | 200 | ----- | ----- | ----- | ----- | 875 | 1,350 | 220 | 425 |
| .007 | 190 | 275 | 220 | 400 | ----- | ----- | ----- | ----- | 1,400 | 1,750 | 300 | 600 |
| .010 | 250 | 400 | 300 | 625 | ----- | ----- | ----- | ----- | 3,000 | 3,000 | 500 | 875 |
| .015 | 375 | 700 | 450 | 1,200 | ----- | ----- | ----- | ----- | 4,500 | 4,500 | 650 | 1,300 |
| .020 | ----- | ----- | ----- | ----- | 200 | 270 | 120 | 80 | 5,000 | 6,000 | 900 | 1,750 |
| .025 | ----- | ----- | ----- | ----- | 250 | 330 | 150 | 100 | 6,000 | 7,500 | 1,200 | 2,200 |
| .030 | ----- | ----- | ----- | ----- | 300 | 400 | 180 | 120 | 6,000 | 9,000 | 1,200 | 2,625 |

TABLE IV. -- Characteristics, types FP and RP.

| Combined insulation thickness (nominal) | Tearing strength (see 4.4.5) | | | | Tensile strength (see 4.4.6) | | | | Dielectric strength (see 4.4.7) | | | |
|---|------------------------------|-------|-----------------|-------|------------------------------|-----------------------|-----------------------|-----------------------|---|--------|---|-------|
| | Lengthwise direction | | Cross direction | | Lengthwise direction | | Cross direction | | After 48 hours at 50 percent relative humidity and 25° C. | | After 48 hours at 96 percent relative humidity and 25° C. | |
| | Types FP and RP | FP | RP | FP | RP | FP | RP | FP | RP | FP | RP | FP |
| Inch | Grams | Grams | Grams | Grams | Pounds per inch width | Pounds per inch width | Pounds per inch width | Pounds per inch width | Volts | Volts | Volts | Volts |
| 0.007 | 120 | 200 | 180 | 250 | ----- | ----- | ----- | ----- | 3,875 | 4,750 | 1,940 | 2,375 |
| .008 | 135 | 225 | 180 | 275 | ----- | ----- | ----- | ----- | 5,875 | 6,750 | 2,940 | 3,375 |
| .009 | 225 | 325 | 250 | 425 | ----- | ----- | ----- | ----- | 4,400 | 5,450 | 2,200 | 2,725 |
| .010 | 240 | 400 | 300 | 450 | ----- | ----- | ----- | ----- | 6,400 | 7,450 | 3,200 | 3,725 |
| .012 | 350 | 425 | 420 | 550 | ----- | ----- | ----- | ----- | 6,000 | 6,500 | 3,000 | 3,250 |
| .013 | 370 | 450 | 450 | 700 | ----- | ----- | ----- | ----- | 8,000 | 8,500 | 4,000 | 4,250 |
| .017 | 500 | 700 | 550 | 950 | ----- | ----- | ----- | ----- | 7,500 | 8,250 | 3,750 | 4,125 |
| .018 | 525 | 750 | 700 | 1,200 | ----- | ----- | ----- | ----- | 9,500 | 10,250 | 4,750 | 5,125 |
| .022 | ----- | ----- | ----- | ----- | 200 | 250 | 125 | 100 | 8,000 | 10,000 | 4,000 | 5,000 |
| .023 | ----- | ----- | ----- | ----- | 200 | 250 | 125 | 100 | 10,000 | 12,000 | 5,000 | 6,000 |
| .027 | ----- | ----- | ----- | ----- | 250 | 310 | 150 | 125 | 9,000 | 11,750 | 4,500 | 5,875 |
| .028 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 11,000 | 13,750 | 5,500 | 6,875 |
| .032 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 9,000 | 13,500 | 4,500 | 6,750 |
| .033 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 11,000 | 15,500 | 5,500 | 7,750 |

TABLE V. -- Characteristics, type FC.

| Combined insulation thickness (nominal) | Dielectric strength (see 4.4.7) |
|---|---|
| | After 48 hours at 50 percent relative humidity and 25° C. |
| Inch | Volts |
| 0.011----- | 5,375 |
| .013----- | 5,900 |
| .015----- | 7,000 |
| .018----- | 8,600 |
| .023----- | 10,100 |
| .028----- | 10,600 |

3.11 Workmanship. The workmanship shall be first class in every respect.

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 as specified herein. Except as otherwise specified in the contract or order, the supplier may use his own or any other facilities suitable for the performance of the inspection requirements specified herein, unless disapproved by 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 service conform to prescribed requirements.

4.2 Sampling.

4.2.1 Lot.

4.2.1.1 Rolls. For the purpose of sampling, a lot shall consist of all electrical insulation of one type and thickness offered for delivery at one time.

4.2.1.2 Sheets. For the purpose of sampling, a lot shall consist of all electrical insulation of one type and thickness offered for delivery at one time. A unit of sheets shall consist of not more than 100 pounds of electrical insulation contained in one lot.

4.2.2 Sampling procedure.

4.2.2.1 Sampling of rolls for visual and dimensional examination. Samples shall be selected as specified in table VI in accordance with MIL-STD-105. The outer layer of each roll to be sampled shall be discarded and the next 2 linear yards shall be taken as the sample. The remainder of each roll from which a sample is taken shall be returned to the lot.

4.2.2.2 Sampling of sheets for visual and dimensional examination. Samples shall be selected as specified in table VI in accordance with MIL-STD-105. A sample shall consist of one sheet if 2,090 square inches or more in area. Otherwise, a sample shall consist of two sheets. Each sample shall be taken from a different unit of the lot (see 4.2.1.2).

TABLE VI. --Sampling for visual and dimensional inspection AQL (approx.) = 1.5 percent defective.

| Number of rolls or units in inspection lot | Number of rolls or units in sample | Acceptance number (defectives) | Rejection number (defectives) |
|--|------------------------------------|--------------------------------|-------------------------------|
| 40 and under -- | 15 | 0 | 1 |
| 41 to 110----- | 25 | 1 | 2 |
| 111 to 300 ----- | 35 | 1 | 2 |
| 301 to 500----- | 50 | 2 | 3 |
| 501 and over --- | 75 | 3 | 4 |

4.2.2.3 Sampling of rolls and sheets for tests. From the sample of rolls specified in 4.2.2.1 or sheets specified in 4.2.2.2 a sample of five rolls or five units of sheets shall be selected for the tests specified in 4.4.

4.3 Quality conformance examination.

4.3.1 Visual and dimensional examination. Each sample selected in accordance with 4.2.2 shall be examined to determine compliance to this specification as to texture, presence of foreign matter, and measurement of dimensions. Any roll or unit in the sample having one or more visual or dimensional defects shall be rejected and if the number of defective rolls or units of sheets exceeds the acceptance number specified in table VI, this shall be cause for rejection of the lot represented by the sample.

4.4 Test procedures.

4.4.1 Conditioning. The specimens of insulation to be used in the tests for flexibility, tearing strength, tensile strength, and dielectric strength shall be conditioned for 48 hours at 50 ± 2 percent relative humidity and $77 \pm 2^\circ\text{F}$. ($25 \pm 1^\circ\text{C}$.). Specimens shall also be tested for dielectric strength after conditioning for 48 hours at 96 ± 2 percent relative humidity and $77 \pm 2^\circ\text{F}$. ($25 \pm 1^\circ\text{C}$.).

4.4.2 Dimensions and density. A suitable method shall be used to determine the thickness of the insulation (and of the component insulations) to the nearest 0.0001 inch. The density shall be measured by using a suitable balance (see tables I and II, and 3.3.2).

4.4.3 Flexibility (see 3.8).

4.4.3.1 In the case of insulation having a thickness up to and including 0.010 inch, a corner forming a triangle approximately 4 inches on each side shall be doubled back upon the remaining insulation.

4.4.3.2 In the case of insulation having a thickness greater than 0.010 inch, strips shall be cut in the crosswise direction and bent 120 degrees around a mandrel whose diameter is equal to approximately three times the thickness of the insulation.

4.4.4 Aging factor. The specimens shall consist of strips approximately 3 inches wide and 4 inches long. Ten specimens shall be cut from the lengthwise direction of the sheet or roll, and ten specimens from the crosswise direction. The specimens shall be placed in a uniformly heated oven in which the temperature is maintained at $121^{\circ} \pm 5^{\circ}$ C. ($250^{\circ} \pm 9^{\circ}$ F.) for 8 hours. The specimens shall be withdrawn from the oven in pairs (one from the lengthwise and one from the crosswise direction); one pair at the end of the fourth hour and one pair at the end of each 30-minute period thereafter. After cooling to normal room temperature (20° to 30° C. (68° to 86° F.)), the specimens shall be separately bent around a mandrel having a diameter of 15 times insulation thickness for 0.005-inch paper, and 25 times insulation thickness for thicker insulation. The length of time that the sample is in the oven before it cracks or splits shall be defined as the aging factor of the insulation (see 3.9).

4.4.5 Tearing strength. Ten measurements shall be made in each principal direction of the sample in accordance with ASTM D889, except that conditioning shall be in accordance with 4.4.1 and readings obtained from tears which deviate more than 1/2 inch from the vertical shall be disregarded and a new specimen tested.

4.4.6 Tensile strength (see tables III and IV).

4.4.6.1 Specimen. The test specimen shall conform to the dimensions shown on figure 1. The surface of the specimen shall be smooth and free from scratches. Five specimens cut lengthwise and five cut crosswise of the sheet shall be used.

4.4.6.2 Apparatus. Any standard type of testing machine shall be used. It shall be accurate to within 1 percent on the lowest load for which it is used. Jaws which tighten under load, such as wedge-grip jaws, shall be used with the specimen properly aligned.

4.4.6.3 Procedure. The tests shall be made with the specimen at room temperature. The crosshead speed of the testing machine shall be such that the beam of the machine can be kept balanced, but shall not exceed 0.50 inch per minute when the machine is running idle.

4.4.7 Dielectric strength (see tables III, IV, and V).

4.4.7.1 Specimens. The test specimens shall be of any convenient size, but the total areas of the specimens of one sample of insulation shall be sufficient to permit making at least 10 satisfactory tests for each conditioning procedure. The specimens shall be representative of the material to be tested, care being taken to select insulation free from abnormal defects such as blisters, wrinkles, cracks, etc.

4.4.7.2 Apparatus. A suitable transformer having as nearly a true sine wave as possible, shall be used. The transformer and source of supply of energy shall be not less than 2 kilovolt-ampere (kv.-a) for voltages of 50,000 volts or less, and not less than 5 kv.-a. voltages above 50,000 volts. The frequency shall not exceed 100 cycles per second.

4.4.7.3 Regulation. The regulation shall be so controlled that the testing voltage taken from the secondary of the testing transformer can be raised gradually from any point, and in no case more than 500 volts at a step. Any method of regulating the voltage is satisfactory which does not introduce a deviation factor greater than 10 percent.

4.4.7.4 Voltage measurement. The voltage shall be measured by any standard method which gives root-mean-square values, preferably by means of a voltmeter connected to a special voltmeter coil in the high-voltage winding of the testing transformer, or to a separate step-down instrument potential transformer. A voltmeter on the low-voltage side of the transformer is satisfactory if the ratio of transformation does not change under any test condition. An electrostatic voltmeter properly calibrated in the high-voltage circuit also is satisfactory. A spark gap may be used to check the readings at very high potentials.

4.4.7.5 Electrodes. The electrodes shall be brass or copper cylinders with flat, polished contact surfaces. The cylinders shall be 2 inches in diameter and 1 inch in length, with the edges rounded to a 1/4 inch radius.

4.4.7.6 Procedure.

4.4.7.6.1 The test shall be made in air with the specimen at room temperature. The testing electrodes shall be kept clean and polished. The electrodes shall be self-aligning, and shall be placed exactly opposite one another with the specimens in a horizontal plane between them. Starting at zero, the voltage shall be increased uniformly to breakdown, at a rate such that the breakdown will not occur in less than 40 nor more than 60 seconds. If the material fails at less than 5 kilovolts, the minimum time shall be reduced from 40 to 30 seconds.

4.4.7.6.2 Effect of surface crating (see 3.8 and 3.9). The tests shall be made as specified in 4.4.7.6.1, except that the specimens shall be bent as specified in 4.4.3.1 and 4.4.3.2, reopened and re-acted between the electrodes so that the bend forms the diameter of the electrodes.

4.4.8 Soluble chloride determination (see 3.1.2).

4.4.8.1 Specimen. This test is conducted only on specimens of types F and R. The test specimen shall consist of 5 grams of finely divided particles of the insulation.

4.4.8.2 Procedure. The test specimen shall be dried for 2 hours at 105° to 110° C. The dried specimen shall be placed in a Soxhlet, Wiley-Richardson or similar type of extractor, and extracted with distilled water for 3 hours. The rate of extraction with the Wiley-Richardson size of extractor shall be sufficient to cause the tube containing the sample to be filled by condensation and emptied by the siphon at least six times per hour. When the Soxhlet or similar size extractor is used, the tube shall be filled and emptied at a rate of at least 3 cycles per hour. After this extract has cooled, 0.5 milliliter (mL) of potassium-chromate solution (10 percent) shall be added and the extract titrated with standard silver-nitrate solution. The end point will be indicated by the appearance of a permanent red color. A blank test shall be made on an equal volume of distilled water and potassium-chromate solution, and the result shall be subtracted from that of the specimen to obtain the net result. The net result shall be calculated in terms of chlorine.

4.4.9 Inspection of packaging, packing, and marking for shipment and storage. Packaging, packing, and marking for shipment and storage shall be examined to determine conformance with the documents referenced in section 5.

5. PREPARATION FOR DELIVERY

(The preparation for delivery requirements specified herein apply only for direct Government procurements. For the extent of applicability of the preparation for delivery requirements of referenced documents listed in section 2, see 6.4.)

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

5.1.1 Level A.

5.1.1.1 Cleaning. Insulation electrical paper shall be cleaned in accordance with MIL-P-116, procedure C-1.

5.1.1.2 Drying. The procedure used shall not be injurious to the item.

5.1.1.3 Preservation application. None required.

5.1.1.4 Unit packaging.

5.1.1.4.1 Type F insulation in thicknesses of less than 0.020 inches shall be furnished in rolls and packaged method IC-3 in accordance with MIL-P-116 as follows: The insulation shall be wound tight on a heavy chipboard or fiber tube designed to accommodate the weight and size of the insulation and shall be rolled straight so that the edges will form even at each end. Overwrap each roll containing the insulation with barrier material, type CW-2, class heat sealable, grade heavy duty conforming to MIL-B-13239. Heat seal closure. Fold the excess barrier material and secure the fold with pressure sensitive tape conforming to PPP-T-76.

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5.1.1.4.2 Sheets. Types R, FP, RP, and FC insulation and type F insulation in thicknesses of 0.020 inches and over shall be furnished in sheets and packaged method III in accordance with MIL-P-116 as follows: Insert a quantity of insulation sheets not to exceed 50 within a close fitting container, conforming to PPP-B-636, full telescope design box, type SF, class weather resistant. Closure and waterproofing shall be in accordance with the requirements of the appendix to PPP-B-636.

5.1.2 Level C. Insulation paper shall be preserved and packaged in a manner that will afford adequate protection against corrosion, deterioration, and physical damage during shipment from the supply source to the first receiving activity for immediate use.

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

5.2.1 Level A. The insulation rolls packaged as specified in 5.1.1.4.1 shall be packed in the overseas style or type containers conforming to any of the following specifications at the option of the supplier.

| <u>Specifications</u> | <u>Class, style, or type</u> |
|-----------------------|--|
| PPP-B-576 | Class 2 |
| PPP-B-585 | Class 2 or 3 |
| PPP-B-591 | Style A or B |
| PPP-B-601 | Style A or B |
| PPP-B-621 | Class 2 |
| PPP-B-636 | Type CF, weather resistant, Special requirements |
| PPP-B-640 | Class 2, Grade A, Style E. |

Box closure and strapping shall be as specified in the applicable box specification or appendix thereto. Banding (reinforcement requirements) excluding metal, is required for fiberboard containers and will be applied in accordance with the provisions outlined in the appendix to the box specification. Case liners shall be omitted in lieu of the closure requirements in the appendix of PPP-B-636, closure shall be accomplished by sealing the center seams, ends, edges and manufacturer's joints with waterproof tape conforming to PPP-T-60 or PPP-T-76. The gross weight of boxes shall not exceed 250 pounds. Fiberboard boxes shall not exceed the limitations of the box specification.

5.2.1.1 Level A or B. The insulation sheets packaged as specified in 5.1.1.4.2 shall be packed in crates conforming to PPP-C-650, style B, type II. Closure shall be accomplished in accordance with the appendix of the box specification except that shrouds shall not be used.

5.2.2 Level B. The insulation rolls shall be packed in accordance with 5.2.1 except that containers shall be constructed for domestic requirements. Closure shall be accomplished in accordance with appendix of the applicable box specification.

5.2.3 Level C. The packaged item(s) shall be packed in a manner that will afford adequate protection against damage during direct shipment from the supply source to the first receiving activity for immediate use. This pack shall conform to the applicable carrier rules and regulations.

5.3 General exterior container shall be of a minimum tare and cube consistent with the protection required and shall contain quantities of identical stock numbered items to the greatest extent possible.

5.4 Marking. In addition to any special marking required by the contract or order, each unit package, intermediate and exterior containers shall be marked in accordance with MIL-STD-129.

6. NOTES

6.1 Intended use. Types F and R materials are class O insulation with continuous operating temperature limit of 90° C. Types FP, RP, and FC are class A insulation with continuous operating temperature limit of 105° C.

3.2 Ordering data. Procurement documents should specify the following:

- (a) Title, number, and date of this specification.
- (b) Type and form required (see 1.2).
- (c) Dimensions and weights required (see 3.7).
- (d) Applicable level of packaging and packing required (see 5.1 and 5.2).
- (e) Additional marking, if required (see 5.4).
- (f) When ordered in rolls, the weight should be specified in units of 100 or 200 pound rolls. When ordered in sheets, the number of pounds should be specified.

3.3 International standardization. Certain provisions of this specification are the subject of international standardization agreement ABC-NAVY-STD-17C. When amendment, revision, or cancellation of this specification is proposed which will effect or violate the international agreement concerned, the preparing activity will take appropriate reconciliation action through international standardization channels including departmental standardization offices, if required.

3.4 Sub-contracted material and parts. The preparation of delivery requirements of referenced documents listed in Section 2 do not apply when material and parts are procured by the supplier for incorporation into the equipment and lose their separate identity when the equipment is shipped.

6.5 CHANGES FROM PREVIOUS ISSUE. THE OUTSIDE MARGINS OF THE DOCUMENT HAVE BEEN MARKED "X" TO INDICATE WHERE CHANGES (DELETIONS, ADDITIONS, ETC.) FROM THE PREVIOUS ISSUE HAVE BEEN MADE. THIS HAS BEEN DONE AS A CONVENIENCE ONLY AND THE GOVERNMENT ASSUMES NO LIABILITY WHATSOEVER FOR ANY INACCURACIES IN THESE NOTATIONS. BIDDERS AND CONTRACTORS ARE CAUTIONED TO EVALUATE THE REQUIREMENTS OF THIS DOCUMENT BASED ON THE ENTIRE CONTENT AS WRITTEN IRRESPECTIVE OF THE MARGINAL NOTATIONS AND RELATIONSHIP TO THE LAST PREVIOUS ISSUE.

Custodians:
 Army - EL
 Navy - SH
 Air Force - 85

Preparing activity:
 Navy - SH
 (Project 5970-0236)

Review activities:
 Army - EL, MU
 Navy - SH, OS
 Air Force - 85

User activities:
 Navy - EC, MC

International interest (see section 6)

FOLD

DEPARTMENT OF THE NAVY
NAVAL SHIP ENGINEERING CENTER
CENTER BUILDING
PRINCE GEORGE'S CENTER
HYATTSVILLE, MARYLAND 20782

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SPECIFICATION ANALYSIS SHEET

Form 13000
Subject: Ships, Boats, and Barges

This sheet is to be filled out by personnel either Government or Contractor, involved in the use of the specification in procurement of products for ultimate use by the Department of Defense. This sheet is provided for obtaining information on the use of this specification which will insure that suitable products can be procured with a minimum amount of delay and at the least cost. Comments and the return of this form will be appreciated. Fold on lines on reverse side, staple in corner, and send to preparing activity (as indicated on reverse hereof).

| | | |
|--|----------------------------|---------------------|
| SPECIFICATION | | |
| ORGANIZATION (of submitter) | | CITY AND STATE |
| CONTRACT NO. | QUANTITY OF ITEMS PROCURED | DOLLAR AMOUNT \$ |
| MATERIAL PROCURED UNDER A <input type="checkbox"/> DIRECT GOVERNMENT CONTRACT <input type="checkbox"/> SUBCONTRACT | | |
| 1. HAS ANY PART OF THE SPECIFICATION CREATED PROBLEMS OR REQUIRED INTERPRETATION IN PROCUREMENT USE? A. GIVE PARAGRAPH NUMBER AND DESCRIPTION. B. RECOMMENDATIONS FOR CORRECTING THE DEFICIENCIES. | | |
| 2. COMMENTS ON ANY SPECIFICATION REQUIREMENT CONSIDERED TOO RIGID | | |
| 3. IS THE SPECIFICATION RESTRICTIVE? <input type="checkbox"/> YES <input type="checkbox"/> NO IF "YES", IN WHAT WAY? | | |
| 4. REMARKS (Attach any pertinent data which may be of use in improving this specification. If there are additional papers, attach to form and place both in an envelope addressed to preparing activity) | | |
| SUBMITTED BY (Printed or typed name and activity) | | DATE |