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Flexible Composites

# Glass and Polyester Mat/ Polyester Film Composites

**Description**
Polyester Mat/Polyester Film Composites consist of the short fiber polyester mat laminated to polyester film with a heat resistant adhesive system.

The film provides the dielectric barrier while the mat gives the construction good mechanical properties. These are designated DM 70 or Pyrolam 70.

Excellent heat resistance is obtained by bonding the composites with thermosetting adhesives which enclose and protect the film at elevated temperatures. Increases in cut-through temperature and improvements in physical properties can be obtained by 100% saturating the mat with suitable resins. These composites are known as Pyrolam 100 or MEMCO 100. MEMCO 100 is approved for hermetic applications.

**Pyrolam Composites**
The thermal stability of Class F Pyrolam polyester mat/polyester film combinations is demonstrated by the data summarized below.

The thermal tests were run according to ASTM D1830, commonly called a curved electrode test. Essentially, the test measures flexibility retention versus heat aging using dielectric strength as the failure criterion. Current standards set the failure point at 50% loss in dielectric strength.

As can be seen from the data, we have yet to find a temperature or aging time at which the Pyrolam system will fail. The initial tests were run at 200C and 220C which are the standard test temperatures for establishing the slope of a Class F curve. However, when the Pyrolam system showed no signs of deterioration at triple the aging times reported by the industry for similar materials, further tests were run at 240C. But even at 240C, a failure point could not be reached after over 10 times the projected life of other Class F polyester mat/film composites.

**DM70 or Pyrolam 70**

| Product | Composite thickness ASTM D374 (Inches) | Yield Sq. Yds./Lb. | Dielectric Strength ASTM D149 (2 In. Dia. Electrodes) (Volts) | Volume Resistivity① ASTM D257 (ohm/cms) | Tensile Strength ASTM D828 M.D. Lbs./In. of Width | C.M.D. | Tear Strength Graves M.D. (Lbs.) | C.M.D. |
|---|---|---|---|---|---|---|---|---|
| **DM70-222** | 0.006 | 3.57 | 6,500 | $10^{15}$ | 85 | 70 | 6 | 4 |
| **DM70-313** | 0.007 | 3.13 | 5,300 | $10^{15}$ | 85 | 40 | 9 | 8 |
| **DM70-323** | 0.008 | 2.56 | 6,700 | $10^{15}$ | 100 | 75 | 16 | 6 |
| **DM70-333** | 0.009 | 2.17 | 9,000 | $10^{15}$ | 110 | 80 | 13 | 8 |
| **DM70-353** | 0.011 | 1.69 | 11,900 | $10^{15}$ | 130 | 127 | 19 | 13 |
| **DM70-3-7.5-3** | 0.013 | 1.35 | 16,600 | $10^{15}$ | 206 | 222 | 20 | 16 |
| **DM70-3103** | 0.016 | 1.13 | 19,000 | $10^{15}$ | 215 | 220 | 30 | 24 |
| **DM70-555** | 0.015 | 1.49 | 11,000 | $10^{15}$ | 131 | 140 | 21 | 14 |

① Values Obtained Were Greater Than Values Shown.

**MEMCO 100 or Pyrolam 100**

| Product | Composite thickness ASTM D374 (Inches) | Yield Sq. Yds./Lb. | Lbs./ Sq. Yd. | Dielectric Strength ASTM D149 (2 In. Dia. Electrodes) (Volts) | Volume Resistivity① ASTM D257 (ohm/cms) | Surface Resistivity① ASTM D257 (ohms) | Tensile Strength ASTM D828 M.D. Lbs./In. of Width | C.M.D. | Tear Strength Graves M.D. (Lbs.) | C.M.D. |
|---|---|---|---|---|---|---|---|---|---|---|
| **MEMCO-222** | 0.006 | 3.45 | 0.29 | 9,000 | $10^{15}$ | $10^{13}$ | 79 | 51 | 8 | 5 |
| **MEMCO-232** | 0.007 | 2.94 | 0.34 | 8,000 | $10^{15}$ | $10^{13}$ | 90 | 95 | 8 | 7 |
| **MEMCO-2-7.5-2** | 0.0118 | 1.56 | 0.64 | 16,800 | $10^{15}$ | $10^{13}$ | 190 | 190 | 17 | 17 |
| **MEMCO-333** | 0.009 | 1.96 | 0.51 | 8,900 | $10^{15}$ | $10^{13}$ | 125 | 94 | 12 | 9 |
| **MEMCO-353** | 0.011 | 1.65 | 0.61 | 12,000 | $10^{15}$ | $10^{13}$ | 155 | 130 | 18 | 13 |
| **MEMCO-3753** | 0.014 | 1.23 | 0.81 | 15,000 | $10^{15}$ | $10^{13}$ | 210 | 195 | 25 | 20 |
| **MEMCO-3103** | 0.016 | 1.04 | 0.96 | 19,800 | $10^{15}$ | $10^{13}$ | 250 | 250 | 25 | 24 |
| **MEMCO-3143** | 0.020 | 0.82 | 1.22 | 22,000 | $10^{15}$ | $10^{13}$ | 277 | 289 | 39 | 33 |
| **MEMCO-535** | 0.014 | 1.69 | 0.59 | 9,300 | $10^{15}$ | $10^{13}$ | 185 | 115 | 17 | 11 |
| **MEMCO-555** | 0.0154 | 1.39 | 0.72 | 14,000 | $10^{15}$ | $10^{13}$ | 203 | 148 | 22 | 15 |
| **MEMCO-5105** | 0.020 | 0.96 | 1.04 | 17,600 | $10^{15}$ | $10^{13}$ | 270 | 220 | 34 | 26 |
| **MEMCO-5145** | 0.025 | 0.76 | 1.31 | 25,500 | $10^{15}$ | $10^{13}$ | 290 | 270 | 39 | 37 |

① Values Obtained Were Greater Than Values Shown.

**Thermal Aging of Pyrolam Polyester Mat/Polyester Film Composite.**

Test Results on "Pyrolam" 70 313 Per ASTM D1830

| Aging Temp. | Hours Req'd for Class F | Hours Aging on Pyrolam | % Retention of Dielectric Strength |
|---|---|---|---|
| 240C | 40 | 510 | 85 |
| 220C | 100 | 380 | 109 |
| 200C | 500 | 1512 | 109 |
| 180C | 5000 | 5000 | 103 |

**Military Specifications**
All Westinghouse Polyester Mat/Polyester Film composites are manufactured to conform to MIL-I-22834 and MIL-E-917D (Navy) and are approved for Class F (155C).

**Description**
Pyroglass (ET 2018) composites consist of a polyester-glass non-woven mat laminated to polyester film with a heat resistant adhesive system.

First introduced in 1977, pyroglass is designed to offer the design engineer a wider choice of products for applications up to 180°C.

**Advantages:**
**Tear Resistance** – Greater than previously available non-woven glass composites, equally oriented cross-machine and machine direction.

**Scuff Resistance** – Very tough; will not abrade.

**High Temperature** – The glass component of this laminated provides a positive space factor.

**Hot Cut Through Resistance** – Excellent.

**Value** – Excellent, low cost alternative for aramid papers in 180°C applications.

**Experience** – Service proven in original equipment and repair applications.

**Applications:**
**Motors** – Slot and phase insulation.

**Transformers** – Layer and ground insulation.

**Pyroglass ET2018**

| Composition (mils) | | | | | | | Tensile Strength ASTM D828 Lbs./In. of Width | | Tear Strength Graves ASTM D1004 | |
|---|---|---|---|---|---|---|---|---|---|---|
| Mat | Polyester Film | Mat | Nominal Thickness (Inches) | Yield Sq. Yds./Lb. | Dielectric Strength ASTM D149 (Volts) | Volume Resistivity ASTM D257 (ohm/cms) | M.D. | C.M.D. | M.D. | C.M.D. |
| 4 | 1 | 4 | .010 | 2.94 | 4,500 | $10^{13}$ | 48 | 49 | 10 | 9 |
| 4 | 2 | 4 | .011 | 2.50 | 6,000 | $10^{13}$ | 62 | 64 | 13 | 12 |
| 4 | 3 | 4 | .0115 | 2.13 | 8,000 | $10^{13}$ | 82 | 91 | 17 | 15 |
| 4 | 5 | 4 | .0135 | 1.70 | 14,000 | $10^{13}$ | 115 | 145 | 22 | 20 |
| 4 | 7.5 | 4 | .0155 | 1.32 | 17,000 | $10^{13}$ | 158 | 204 | 31 | 31 |
| 4 | 10 | 4 | .018 | 1.09 | 23,000 | $10^{13}$ | 208 | 221 | 42 | 42 |
| 4 | 14 | 4 | .022 | .83 | 26,500 | $10^{13}$ | 305 | 312 | 59 | 57 |

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