



SETTING NEW STANDARDS IN RELIABILITY

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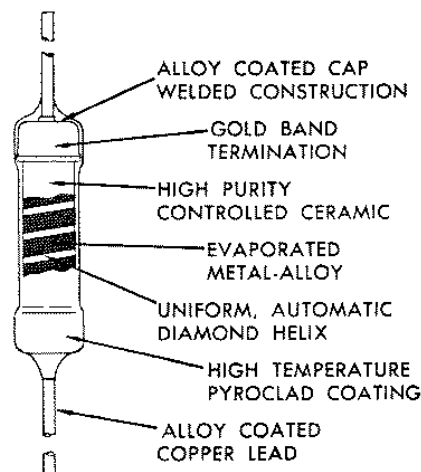
CONFORMAL COATED

**KDI PYROFILM
CORPORATION**

METAL FILM RESISTORS

FEATURES

- Low temperature coefficients — as low as $0 \pm 10 \text{ ppm}/^\circ\text{C}$
- High resistance values — up to 100 times MIL resistance range
- Rugged end cap construction
- Reliable — surpasses MIL-R-10509 and MIL-R-55182 Requirements
- Custom testing available — temperature cycling, burn-in, moisture, etc.
- Low noise
- Superior stability and reliability at reasonable cost.



Pyrofilm's metal film PME series is the solution to the circuit engineers' requirement for a stable, rugged and reliable resistor with a low temperature coefficient for values ranging from below MIL range to as high as 100 times MIL range. The small size and big performance of Pyrofilm's PME resistors makes them particularly ideal for precision miniaturized equipment using either conventional wiring or printed circuit boards.

Pyrofilm has established a separate manufacturing facility specifically designed for the production of metal film resistors. Advanced manufacturing techniques make available a wide variety of metal film resistors unmatched in stability and reliability.

The manufacturing process for these resistors begins with the application of gold terminal bands integrally bonded to pure, inert specially selected ceramics by high temperature firing that insures chemically clean ceramics. An automatically programmed vacuum evaporator applies the metal film with accurately controlled thickness and

composition. Welded cap and lead assemblies are press fitted on the resistive cores and special Pyrofilm developed lathes spiral the resistors to value. Proprietary coating machines then apply a Pyroclad Polymer protective coating which provides excellent protection for the most stringent moisture requirements.

However, good manufacturing design is not enough. Product homogeneity, a key to reliability, is insured by lot control and traceability from raw materials, to the evaporator, through the finished product. Although this procedure is common for many high rel programs, Pyrofilm provides this for standard commercial resistors as well as high rel. Complete MIL approved, in-plant testing facilities are available (See Page 4).

Quality procedures per MIL-Q-9858A, NPC 200-3 and MIL-I-45208A are the rule rather than the exception at Pyrofilm where reliability is designed in rather than inspected in. Where quality long term stability and reliability is required — make no mistake — specify Pyrofilm.

KDI PYROFILM CORPORATION

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PME 8/82

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FIGURE 1

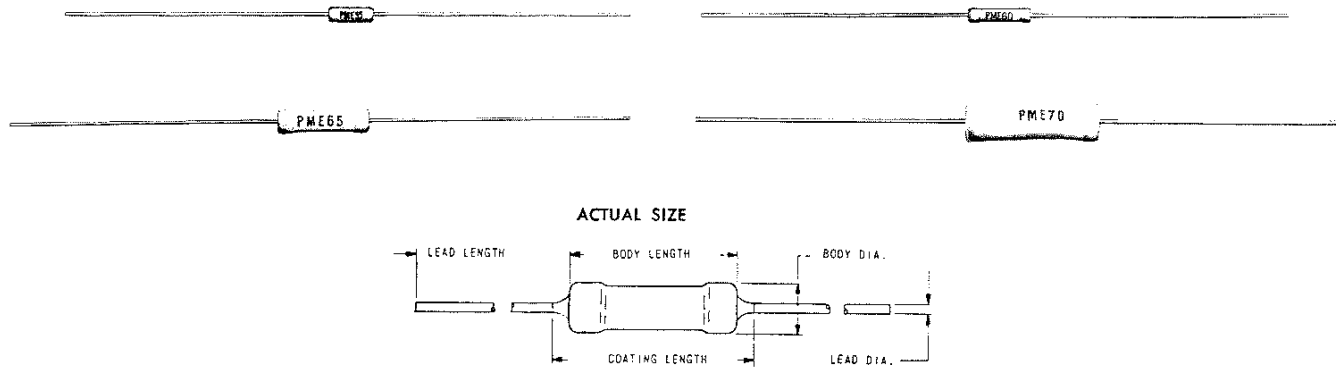
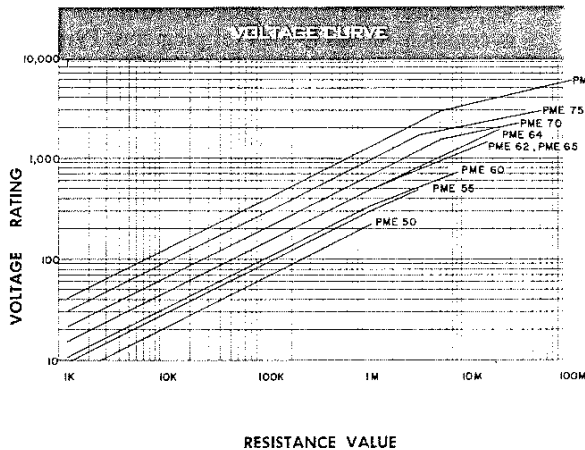
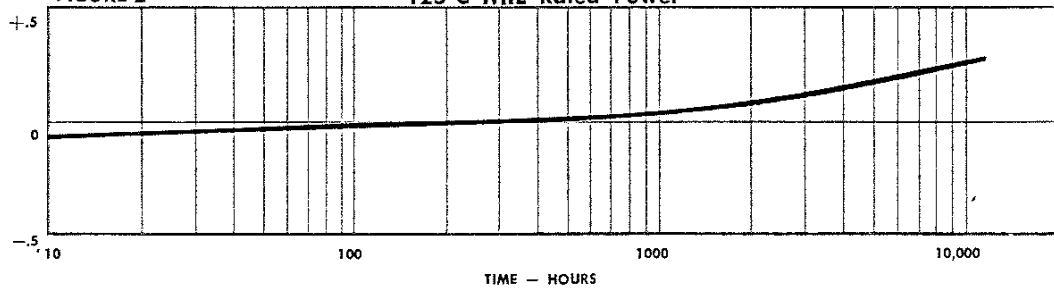


TABLE 1

PHYSICAL AND ELECTRICAL CHARACTERISTICS												MAXIMUM COATING LENGTH Inches	
PYRO-FILM	MIL-R-10509	RATING Watts		RESISTANCE RANGE		VOLT-AGE	BODY DIMENSIONS Inches		LEAD DIMENSIONS Inches				
		MIL	Com.	Min.	Max.		Diameter	Length	Dia.	Length	AWG	Standard	Special
PME50	RN50	1/20	1/8	10Ω	1M	200	.060 + .015 - .010	.150 ± .020	.016	1±1/8	#26	.200	.172
PME55	RN55	1/10	1/8	10Ω	4M	250	.095 ± .015	.250 ± .031	.025	1½±1/8	#22	.360	.281
PME60	RN60	1/8	1/4	49Ω	10M	300	.105 ± .015	.390 ± .031	.025	1½±1/8	#22	.475	.406
PME62	—	—	1/4	500Ω	20M	1,500	.105 ± .015	0.510 ± .031	.025	1½±1/8	#22	.600	.530
PME64	—	—	1/4	500Ω	30M	2,500	.105 ± .015	0.970 ± .031	.025	1½±1/8	#22	1.070	.985
PME65	RN65	1/4	1/2	49Ω	20M	400	.156 ± .015	.580 ± .031	.025	1½±1/8	#22	.650	.600
PME70	RN70	1/2	1	24Ω	40M	700	.230 ± .015	.730 ± .031	.032	1½±1/8	#20	.830	.730
PME75	RN75	1	2	49Ω	50M	1,000	.365 ± .015	1.050 ± .031	.032	1½±1/8	#20	1.165	—
PME80	RN80	2	2	100Ω	70M	5,000	.365 ± .015	2.175 ± .031	.032	1½±1/8	#20	2.290	2.206

MIL-R-10509 Designations for reference only.

FIGURE 2
TYPICAL — PME55 LOAD LIFE
125°C MIL Rated Power



*Figure 3 shows the maximum voltage rating of Pyrofilm's high value metal film resistors according to resistance value. The test data for these curves were taken at 70°C ambient temperature and 1000 hours duration. The voltage ratings for lower values are as indicated in Table 1 Page 2, or by the formula $E = \sqrt{PR}$.

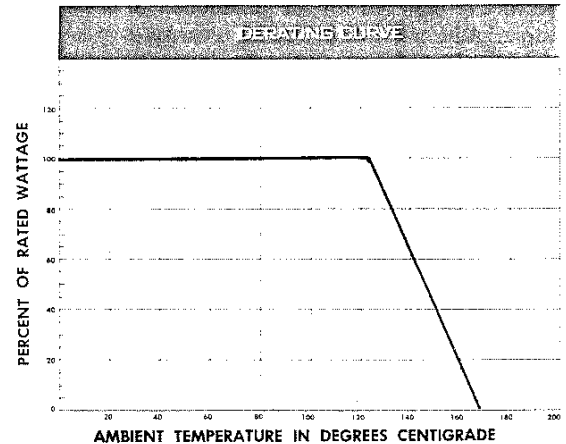


FIGURE 4

SPECIFICATIONS

VOLTAGE RATING

Resistors shall have a rated d.c. continuous working voltage rating as determined by $E = \sqrt{PR}$.

To determine voltage ratings for resistors above 1 Meg, see curve on Page 2, Figure 3. Pyrofilm's PVC resistors are recommended for high voltage series resistors.

RESISTANCE ELEMENT

A metal film, evaporated from specially formulated metal alloys on to high quality ceramic substances assures stable, firmly bonded films with low temperature coefficients.

TERMINATION

Electrical contact between the metal film and external leads is provided by a gold band termination which is bonded to the ceramic by high temperature firing.

END CAPS

Positive electrical and mechanical connection is assured by specially designed end cap construction.

TEMPERATURE COEFFICIENT

Standard temperature coefficients include ± 10 ppm, ± 25 ppm, ± 50 ppm and ± 100 ppm/ $^{\circ}\text{C}$. Special temperature coefficients are available by contacting the factory or our local sales engineer.

VOLTAGE COEFFICIENT

When measured between one-tenth and full rated voltage, high resistance values are below 1 ppm/volt. For low and medium value resistance, the voltage coefficient is essentially zero.

NOISE

Metal Film Resistors exhibit better noise characteristics than carbon film resistors. These metal film resistors have inherently low noise levels depending upon resistance and are test on Quan. Tech Model 375 noise meter.

INSULATION

The terminated element is coated with a special PyroClad-Polymer which protects the metal film from abrasive damage and is extremely impervious to moisture.

TOLERANCE

Available in standard tolerances of $\pm 1.0\%$, $\pm 0.5\%$, $\pm 0.25\%$ and $\pm 0.1\%$ depending upon value.

LEADS

Standard lead material is copper solder coated; nickel "A" is available for welding programs. Gold plated nickel 0.016 is available as an option.

MARKING

Standard marking consists of manufacturing symbol, type, value, tolerance, and T.C. symbol, wherever space permits.

SHELF LIFE

Mil Range Resistors stored at room temperature without power, will change less than .02%/year.

MATCHING

Matched sets are available on request. Temperature coefficients can be matched within 1 ppm/ $^{\circ}\text{C}$. Ratio matching is available to .010%. For special applications, consult factory application engineering.

LOAD LIFE

When operated under specified power and voltage ratings at ambient temperatures of 125°C for 50,000 hours, the typical change is less than 0.4% for the PME 55.

SHUNT CAPACITANCE

The shunt capacitance is less than 0.3 pf.

CLEANING

Heated chlorinated solvents are not recommended for the cleaning of this product.

TYPICAL PERFORMANCE

TABLE 2

Metal Film — MIL Series

Test	Pyrofilm $\Delta R \%$	MIL-R-10509		MIL-R-55182	
		$\Delta R \%$	Para.	$\Delta R \%$	Para.
Load Life	.10	.50	3.18	.5	3.23
Thermal Shock	.05	.25	3.9	.25	3.7
Low Temperature Operation	.05	.25	3.10	.25	3.15
Short Time Overload	.10	.25	3.11	.25	3.8
Moisture Resistance	.07	.50	3.16	.4	3.20
Terminal Strength	.05	.1	3.12	.20	3.16
Resistance to Soldering Heat	.05	.2	3.15	.10	3.19

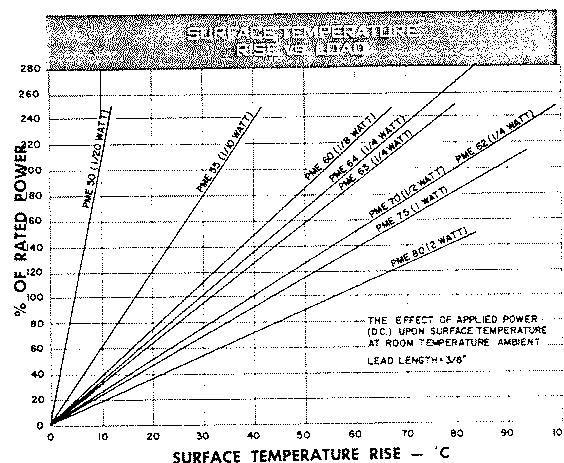


Figure 5 shows the surface temperature rise of Pyrofilm metal film resistors under varying load conditions. This curve is for units mounted in free air. The curve for resistors mounted on a printed circuit board is available from the factory.



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QUALITY ASSURANCE

Pyrofilm Corporation, maintains an engineering laboratory to assure top quality in all Pyrofilm resistors. Environmental tests are run systematically to various applicable military specifications. Typical tests include: power rating, thermal shock, temperature coefficient, dielectric strength, insulation resistance, moisture resistance, load life, and continuation of acceptance performance under Group A, B and C of MIL-R-10509.

Pyrofilm Corporation, maintains a quality control system which meets MIL-Q-9858A and can provide traceability when required. All production must undergo in-process inspection as well as final inspection. Production is controlled by travelers, inspected at critical points and final inspected. All records and tests are filed as a permanent record of each customer order. All production is checked 100% for resistance tolerance, and every lot is sample checked to insure compliance to applicable specs. Lot checks consist of determination of size, mechanical strength, workmanship and tolerance.

IN PLANT TESTING FACILITIES

Load Life — Short Time Overload — Moisture — Temperature Coefficient — Dielectric Withstanding Voltage — Resistance to Soldering Heat — Vibration Medium Frequency — Insulation Resistance — Solderability.

Screen tests — upon request the following screening tests are available:

- Short time overload — 5 seconds at 6.25 full rated power.
- Overload — 1 hour per MIL-R-55182C
- Stabilization — load life for 100 hours at rated load and temperature.
- Custom — Designed to customer specifications

ORDERING INFORMATION

When ordering Pyrofilm metal film resistors, the following information is requested:

- Type Designation
- Temperature Coefficient
- Resistance Value
- Resistance Tolerance

EXAMPLE: To order a 1 watt, T-2 100 K, $\pm 1\%$ resistor, MIL part number:

MIL Type	Temp. Coef.	Resistance Value	Tolerance
RN75	C	1003	F

To order a 1 watt, T-2, 100 K, $\pm 1\%$ resistor, commercial part number:

Pyrofilm P/N	Temp. Coef.	Resistance Value	Tolerance
PME75	T-2	100 K	$\pm 1\%$

TABLE 3

TEMPERATURE COEFFICIENT

CLASS	CHAR.	PPM/°C	%/°C	TEMP. RANGE
T-0, T-1	D, G	± 100	.01	-55 to +165°C
T-2	C	± 50	.005	-55 to +175°C
T-9	E	± 25	.0025	-55 to +175°C
T-B	—	± 10	.0010	25°C to +125°C

For specials other than listed, consult factory.

RESISTANCE

The first three digits are significant figures. The fourth digit denotes the number of zeros following the significant figures.

Description	Resistance in ohms
10R0 to 97R6	10.0 to 97.6
1000 to 9760	100 to 976
1001 to 9761	1,000 to 9,760
1002 to 9762	10,000 to 97,600
1003 to 9763	100,000 to 976,000
1004 to 9764	1,000,000 to 9,760,000
1005 to —	10,000,000 to —

(R denotes decimal point)

RESISTANCE TOLERANCE

MIL Designation	Tolerance
F	$\pm 1\%$
D	$\pm 0.5\%$
C	$\pm 0.25\%$
B	$\pm 0.10\%$
—	$\pm 0.05\%$

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