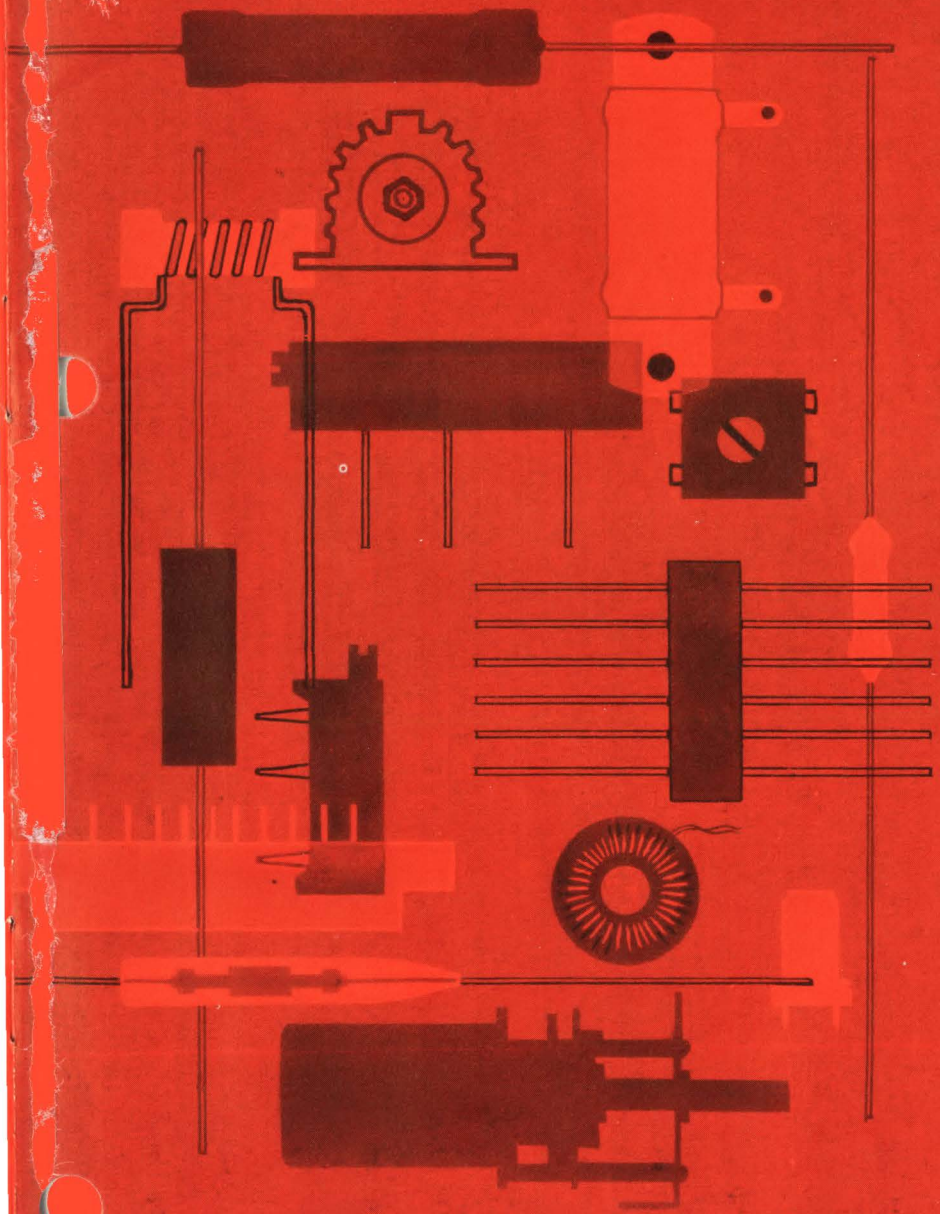
1972

DEPENDABLE DALE

Condensed Full Line Catalog



- Wirewound Resistors
- Film Resistors
- Networks
- Microcircuits
- Trimmers
- Connectors
- Inductors
- Electromechanical Products
- Surge Arresters

Includes complete listing of Dale Representatives and Distributors

DALE ELECTRONICS, INC., GENERAL OFFICES, COLUMBUS, NEB. 68601 U.S.A.
A Subsidiary of The Lionel Corporation

DALE® Ordering Information

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- From DALE ELECTRONICS, INC., Box 609, Columbus, Nebr. 68601
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NOTE: Prices and specifications on all products are subject to change without notice.

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DALE®

WIREWOUND RESISTORS

APPLICABLE MIL. ENVIRONMENTAL SPECIFICATIONS

■ MIL-R-26

TYPES RS, G, RLS & GL

TEST	MIL-R-26E REQUIREMENT	DALE MAXIMUM RS, G, RLS & GL*
Load Life	± (.5%+.05Ω) ΔR	± (.5%+.05Ω) ΔR
Moisture Resistance	± (.2%+.05Ω) ΔR	± (.2%+.05Ω) ΔR
Temp. Coefficient	30-90 PPM/°C Max.	See tables
Thermal Shock	± (.2%+.05Ω) ΔR	± (.2%+.05Ω) ΔR
Short Time Overload	± (.2%+.05Ω) ΔR	± (.2%+.05Ω) ΔR
Dielectric	± (.1%+.05Ω) ΔR	± (.1%+.05Ω) ΔR
Low Temp. Storage	± (.2%+.05Ω) ΔR	± (.2%+.05Ω) ΔR
High Temp. Exposure	± (.5%+.05Ω) ΔR	± (.5%+.05Ω) ΔR
Shock	± (.1%+.05Ω) ΔR	± (.1%+.05Ω) ΔR
Vibration	± (.1%+.05Ω) ΔR	± (.1%+.05Ω) ΔR
Terminal Strength	± (.1%+.05Ω) ΔR	± (.1%+.05Ω) ΔR

All ΔR figures shown are maximum, based on units with an initial tolerance of 1% and maximum operating temperature of 275°C.

*GL & RLS physical configurations are not covered in MIL-R-26. Environmental specifications will be same as for RS & G styles.

TYPES CW, HL, NHL, HLM, HLA, HLT & HLW

TEST	MIL-R-26E REQUIREMENT	DALE TYPICAL* HL Tubular & Flat	DALE TYPICAL CW
Load Life	± (3%+.05Ω) ΔR	± (2%+.05Ω) ΔR	± (0.5%+.05Ω) ΔR
Moisture Resistance	± (2%+.05Ω) ΔR	± (0.5%+.05Ω) ΔR	± (0.5%+.05Ω) ΔR
Temp. Coefficient	260-400 PPM/°C	±50 PPM/°C except on low values	±50 PPM/°C except on low values
Thermal Shock	± (2%+.05Ω) ΔR	± (0.5%+.05Ω) ΔR	± (0.2%+.05Ω) ΔR
Short Time Overload	± (2%+.05Ω) ΔR	± (0.5%+.05Ω) ΔR	± (0.2%+.05Ω) ΔR
Dielectric	± (0.1%+.05Ω)	± (0.1%+.05Ω) ΔR	± (0.1%+.05Ω) ΔR
Low Temp. Storage	± (2%+.05Ω) ΔR	± (0.2%+.05Ω) ΔR	± (0.2%+.05Ω) ΔR
High Temp. Exposure	± (2%+.05Ω) ΔR	± (1%+.05Ω) ΔR	± (1%+.05Ω) ΔR
Shock	± (0.2%+.05Ω) ΔR	N/A	± (0.1%'.05Ω) ΔR
Vibration	± (0.2%+.05Ω) ΔR	N/A	± (0.1%+.05Ω) ΔR
Terminal Strength	± (1%+.05Ω) ΔR	± (0.1%+.05Ω) ΔR	± (0.1%+.05Ω) Δ R

ΔR figures shown are based on units with an initial tolerance of 5% and maximum operating temperature of 350°C.

*NHL, HLM, HLA and HLW physical configurations are not covered in MIL-R-26. However, environmental specifications will be same as for HL tubular and HL flat styles.

■ MIL-R-18546

TYPES RH, HG & PH

TEST	MIL-R-18546	DALE TYPICAL RH, HG & PH*
Load Life	±(1%+.05Ω)ΔR	±(.5%+.05Ω)ΔR
Moisture Resistance	±(1%+.05Ω)ΔR	±(.5%+.05Ω)ΔR
Resistance Temperature Characteristic	±50 PPM to 2000Ω ±30 PPM over 2000Ω	See tables
Thermal Shock	±(.5%+.05Ω)ΔR	±(.25%+.05Ω)ΔR
Momentary Overload	±(.5%+.05Ω)ΔR	±(.25%+.05Ω)ΔR
Dielectric	±(.2%+.05Ω)ΔR	±(.1%+.05Ω)ΔR
High Temp. Storage	±(.5%+.05Ω)ΔR	±(.25%+.05Ω)ΔR
Shock	±(.2%+.05Ω)ΔR	±(.1%+.05Ω)ΔR
Vibration	±(.2%+.05Ω)ΔR	±(.1%+.05Ω)ΔR
Terminal Strength	±(.2%+.05Ω)ΔR	±(.1%+.05Ω)ΔR

All ΔR figures shown are based on units with an initial tolerance of 1% and maximum operating temperatures of 275° C.

*PH physical configuration is not covered in MIL-R-18546. However, environmental specifications will be same as for RH & HG styles.

■ MIL-R-93

TYPES WWA, MWA & WWP

TEST	MIL-R-93 REQUIREMENT	DALE MAXIMUM	DALE TYPICAL
Moisture	±(.1%+.05Ω)	±(.05%+.05Ω)ΔR	±.02%ΔR
T.C. (10 ohms and over)	± 20 ppm/°C	±20 ppm/°C	±15 ppm/°C
Short Time Overload	±(.1%+.05Ω)	±(.05%+.05Ω)ΔR	±.01%ΔR
Dielectric	±(.05%+.05Ω)	±(.02%+.05Ω)ΔR	±.00%ΔR
Low Temp. Storage	±(.2%+.05Ω)	±(.05%+.05Ω)ΔR	±.02%ΔR
High Temp. Exposure	±(.5%+.05Ω)	±(.10%+.05Ω)ΔR	±.04%ΔR
Low Temp. Operation	±(.25%+.05Ω)	±(.05%+.05Ω)ΔR	±.02%ΔR
Temperature Cycling	±(.2%+.05Ω)	±(.15%+.05Ω) ΔR	±.07%ΔR
Terminal Strength	±(.05%+.05Ω)	±(.01%+.05Ω)ΔR	±.00%ΔR
Salt Water	±(.25+.05Ω)	±(.15%+.05Ω) ΔR	±.03%ΔR
Life	±(.5%+.05Ω)	±(.25%+.05Ω)ΔR	±.09%ΔR
Shock	±(.1%+.05Ω)	±(.02%+.05Ω)ΔR	±.00%ΔR
Vibration	±(.1%+.05Ω)	±(.03%+.05Ω)ΔR	±.01%ΔR

All ΔR figures shown are based on units with an initial tolerance of 1% and maximum operating temperature of 145°C.

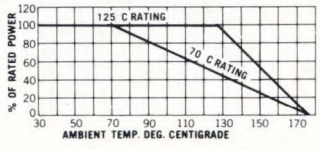
DEPENDABLE DALE® RESISTORS

METAL FILM PRECISION RESISTORS, ESTABLISHED RELIABILITY

■ TYPE EMF

Failure Rate: Verified Failure Rate of .01% per 1000 hours at 60% confidence level. Estimated Failure Rate: .001% per 1000 hours per MIL-R-55182

DERATING
Dale EMF resistors have an operating temperature range of −65° C to +175° C. They must be derated according to the curve at right.



DALE TYPE	MIL. TYPE*	70° C RATING	125° C RATING	MAX. WT. (Grams)	MAX. WORKING VOLTAGE	RESISTANCE RANGE (OHMS) By T.C.**		
						T-1 (K)	T-2 (H)	T-9 (J)
EMF 50	RNR50	1/10 w	1/20 w	.11	200	49.9 to 100K	49.9 to 100K	49.9 to 100K
EMF 55	RNR55	1/8 w	1/10 w	.35	200	30.1 to 301K	49.9 to 200K	49.9 to 200K
EMF 60	RNR60	1/4 w	1/8 w	.45	250	24.9 to 1 Meg.	49.9 to 499K	49.9 to 499K
EMF 65	RNR65	1/2 w	1/4 w	.84	300	24.9 to 2 Meg.	49.9 to 1 Meg.	49.9 to 1 Meg.
EMF 70	RNR70	3/4 w	1/2 w	1.6	350	24.9 to 2.49 Meg.	24.9 to 1 Meg.	24.9 to 1 Meg.
EMF 75	–	–	1 w	4.4	500	24.9 to 4.07 Meg.	49.9 to 2.61 Meg.	49.9 to 2.61 Meg.

Standard Resistance Tolerances: .1% (B), .25%, .5% (D) and 1% (F).
*Available in corresponding RNC & RNN styles.
**Extended resistances above and below this range available as Non-MIL parts.

DIMENSIONS
See section on MF resistors. Dimensions on Types RNR50 thru RNR70 will conform to Types RN-50 thru RN-70.
Note: EMF 75 conforms to RN-75.

POWER RATING
Dale EMF power ratings are based on the following two conditions:
1. 0.5% maximum ΔR in 2000 hours load life.
2. 175° C maximum operating temperature.

WIREWOUND PRECISION RESISTORS, ESTABLISHED RELIABILITY

■ TYPE ARS*

Failure rate .000044% per 1000 hours at 50% rated power, 25°C ambient (60% confidence level). Failure defined as ΔR>0.5%.

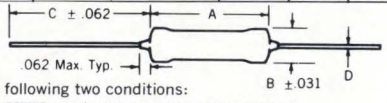
■ TYPE AGS*

Miniature version of ARS Series with BeO core for optimum thermal conductivity, operational stability and increased reliability. Significantly smaller size. Failure rate .000037% per 1000 hours at 50% rated power, 25°C ambient (60% confidence level). Failure defined as ΔR>0.5%.

*Available with solderable and weldable leads.

DALE TYPE	MIL-R-39007B TYPE	POWER RATING (watts)	MIN. RES. (ohms)	MAX. RES. (ohms)	MAX. WORKING VOLTAGE	MAX. WEIGHT (grams)	DIM. A	DIM. B	DIM. C	DIM. D
ARS-2	RWR-71	2	0.1	16.2K	180	1.6	.812±.062	.187	1.5	.032
ARS-5	RWR-74	5	0.1	12K	250	4.75	.875±.062	.312	2.0	.040
ARS-10	RWR-78	10	0.1	40K	650	12.00	1.780±.062	.375	2.0	.040
AGS-1	RWR-81	1	0.5	1.0K	25	.35	.250±.031	.085	1.5	.020
AGS-2	RWR-82	1.5	0.1	1.3K	32	.30	.312±.016	.078	1.5	.020
AGS-3	RWR-80	2.25	0.1	2.67K	52	.375	.406±.031	.094	1.5	.020
AGS-5	RWR-89	4	0.1	4.12K	112	1.25	.560±.062	.187	1.5	.032
AGS-10	RWR-84	7	0.1	12.4K	275	4.25	.875±.062	.312	2.0	.040

Tolerance: All established reliability resistors have a standard resistance tolerance of 1%.

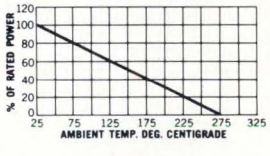


POWER RATING
Dale ARS and AGS power ratings are based on the following two conditions:
1. 0.5% maximum ΔR in 2000 hours load life. 2. 275°C maximum operating temperature.

■ TYPE ARH

Advanced design housed power wirewounds made on the same line and under the same high reliability standards as the ARS and AGS. Failure rate of .01% at 100% rated power.

DERATING
ARS, AGS, ARH
At high ambient temperatures, the derating curve at right applies.



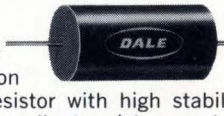
DALE TYPE	MIL-R-39009A TYPE	POWER RATING (watts)		RESISTANCE RANGES (ohms)		MAX. WORKING VOLTAGE	MAX. WT. GRAMS
		MTD.	FREE AIR	MIN.	MAX.		
ARH-5	RER-60	5	3	.1	4.12K	220	3
ARH-10	RER-65	10	6	.1	5.62K	340	8
ARH-25	RER-70	20	8	.1	12.1K	650	15
ARH-50	RER-75	30	10	1.0	39.2K	1400	32

Tolerance: All established reliability resistors have a standard resistance tolerance of 1%. Non-inductive versions also available.

DIMENSIONS: See section on RH resistors. Types ARH-5 thru 50 will correspond with RH-5 thru 50.

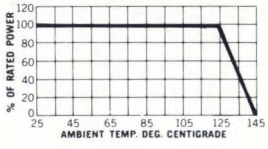
POWER RATING
Dale ARH resistor ratings are based on the following requirements:
1. 275° maximum internal hotspot temperature
2. 1% maximum ΔR in 2000 hour load life
3. Proper heat sink
   4x6x2x.040 aluminum chassis = ARH-5 and ARH-10
   5x7x2x.040 aluminum chassis = ARH-25 and ARH-50

■ TYPE AWA



Established reliability epoxy-molded precision bobbin wirewound resistor with high stability and low T.C.; offers excellent moisture protection and low noise. Quality verified by acceptance testing.

DERATING
Dale AWA resistors have an operating temperature range of −55°C to +145°C. Derating is required for temperatures above 125°C. The curve at right applies.



DALE TYPE	MIL-R-39005B TYPE	POWER RATING (Watts)	MINIMUM RESISTANCE RANGE (Ohms)					MAX. RES. (Ohms) ALL TOL.	MAX. WORKING VOLTAGE	MAX. WT. (Grams)
			.01%	.02%	.05%	.1%	1%			
AWA-55	RBR-55	.15	10	10	10	10	.1	250K	200	1.2
AWA-54	RBR-54	.25	10	10	10	10	.1	450K	300	1.5
AWA-53	RBR-53	.33	10	10	10	10	.1	1.1 Meg.	300	3.1
AWA-52	RBR-52	.50	10	10	10	10	.1	1.21 Meg.	600	3.8

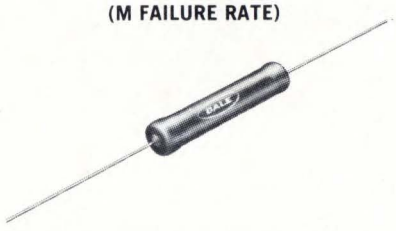
DIMENSIONS:
See section on WWA resistors. Dimensions on Types RBR-52 thru RBR-55 will conform to Types RB-52 thru RB-55.

POWER RATING
Dale AWA power ratings are based on the following two conditions:
1. 1% maximum ΔR in 2000 hours load life.
2. 125°C maximum operating temperature.

DEPENDABLE DALE® RESISTORS

WIREWOUND PRECISION RESISTORS, ESTABLISHED RELIABILITY

(M FAILURE RATE)



■ **TYPE ESS** (Solderable Leads)
■ **TYPE ESW** (Weldable Leads)

■ **TYPE EGS** (Solderable Leads)
■ **TYPE EGW** (Weldable Leads)

These styles meet the requirements of MIL-R-39007 Failure Rate Level M (1%/1000 hours). See ARS and AGS for lower failure rates.

POWER RATING

Power ratings are based on the following two conditions:

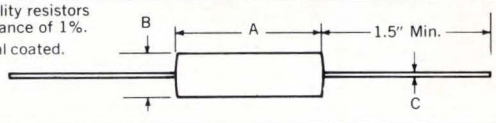
1. .5% maximum ΔR in 2000 hours load life.
2. 275° C maximum operating temperature.

DALE TYPE	MIL-R-39007 TYPE	POWER RATING (Watts)	RESISTANCE RANGE (Ohms) .1%	RESISTANCE RANGE (Ohms) .5% & 1%	MAX. WEIGHT (Grams)	DIMENSIONS A	DIMENSIONS B	DIMENSIONS C
EGS-1*	RWR-81S	1	.499-1000	.1-1000	.21	.250	.075	.020
EGW-1*	RWR-81W	1	.499-1000	.1-1000	.21	.250	.075	.020
EGS-2*	RWR-82S	1.5	.499-1300	.1-1300	.23	.312	.075	.020
EGW-2*	RWR-82W	1.5	.499-1300	.1-1300	.23	.312	.075	.020
EGS-3*	RWR-80S	2	.499-2670	.1-2670	.34	.422	.093	.020
EGW-3*	RWR-80W	2	.499-2670	.1-2670	.34	.422	.093	.020
ESS-2B	RWR-89S	3	.499-4120	.1-4120	.70	.560	.187	.032
ESW-2B	RWR-89W	3	.499-4120	.1-4120	.70	.560	.187	.032
ESS-5	RWR-74S	5	.499-12,100	.1-12,100	4.2	.875	.312	.040
ESW-5	RWR-74W	5	.499-12,100	.1-12,100	4.2	.875	.312	.040
EGS-10	RWR-84S	7	.499-12,400	.1-12,400	3.6	.875	.312	.040
EGW-10	RWR-84W	7	.499-12,400	.1-12,400	3.6	.875	.312	.040
ESS-10	RWR-78S	10	.499-39,200	.1-39,200	9.0	1.780	.375	.040
ESW-10	RWR-78W	10	.499-39,200	.1-39,200	9.0	1.780	.375	.040

Tolerance: All established reliability resistors have a standard resistance tolerance of 1%.

*Molded models. Other conformal coated.

DIMENSIONS



■ **TYPE ERH** (Inductive Winding)
■ **TYPE ENH** (Non-inductive Winding)

Meet the requirements of MIL-R-39009 Failure Rate Level M (1%/1000 hours). See ARH for lower failure rates.

POWER RATING

Dale ERH and ENH resistor ratings are based on the following requirements:

1. 275° C maximum internal hotspot temperature
2. 1% maximum ΔR in 2000 hour load life
3. Proper heat sink
   4x6x2x.040 aluminum chassis = ERH-5 & ERH-10
   5x7x2x.040 aluminum chassis = ERH-25 & ERH-50

DALE TYPE	MIL-R-39009 TYPE	POWER RATING (Watts) DALE*	POWER RATING (Watts) MIL	RESISTANCE RANGE (Ohms) 1%	MAX. WORKING VOLTAGE	MAX. WEIGHT (Grams)	STANDARD TEMPERATURE COEFFICIENT VALUE RANGES (Ohms) ±50PPM	±30PPM	±20PPM
ENH-5	RER-40	7.5 (5)	5	1 to 1.65K	110	3.3	1 to 9.9	10 to 25	26 to 1.65K
ENH-10	RER-45	12.5 (10)	10	1 to 2.8K	190	8.8	1 to 9.9	10 to 40	41 to 2.8K
ENH-25	RER-50	25	15	1 to 6.04K	390	16.5	1 to 9.9	10 to 85	86 to 6.04K
ENH-50	RER-55	50	30	1 to 19.6K	890	35.0	1 to 9.9	10 to 235	236 to 19.6K
ERH-5	RER-60	7.5 (5)	5	0.10 to 3.32K	160	3	1 to 9.9	10 to 49	50 to 3.32K
ERH-10	RER-65	12.5 (10)	10	0.10 to 5.62K	265	6	1 to 9.9	10 to 79	80 to 5.62K
ERH-25	RER-70	25	15	0.10 to 12.1K	550	13	1 to 9.9	10 to 169	170 to 12.1K
ERH-50	RER-75	50	30	0.10 to 39.2K	1250	28	1 to 9.9	10 to 469	470 to 39.2K

Tolerance: All established reliability resistors have a standard resistance tolerance of 1%. Non-inductive versions also available.

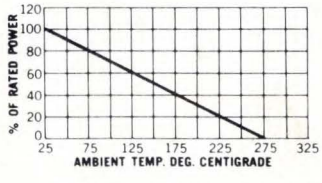
*Figures in parentheses indicate wattage printed on these resistors. They can be rated at 7.5 and 12 watts respectively, but will be printed with these higher ratings only upon request.

DIMENSIONS

See section on RH resistors. Types ENH and ERH-5 thru 50 will correspond with RH-5 thru 50.

DERATING
ESS, ESW, EGS, EGW, ERH, ENH

At high ambient temperatures, the derating curve at right applies.



DOCUMENTATION

Qualification, acceptance and failure-rate maintenance test data is retained by Dale and is available upon request. Lot traceability and identification data is maintained by Dale for 5 years.

RELIABILITY PROGRAMS

The established reliability series are the result of an extensive reliability program at Dale Electronics which includes basic design and materials improvement, special production and test facilities, and trained, reliability-oriented personnel. A separate program group has been set up to provide customer service on established reliability programs, and the facilities and know-how of the Dale established reliability organization can be directed toward the development of reliability programs for specific user requirements. Inquiries may be directed to your local Dale representative or to the factory.

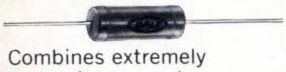
WIREWOUND PRECISION RESISTORS, SILICONE COATED OR MOLDED

(Available with Weldable Leads)

■ TYPE RS

Meets applicable requirements of MIL-R-26E, MIL-R-26C and MIL-R-23379. Non-inductive (NS) styles available.

■ TYPE LVR



Combines extremely low resistance values with high power and low T.C. Molded body, axial leads.

■ TYPE RLS

Radial leads for printed circuit board mounting. Meets applicable requirements of MIL-R-26E. Non-inductive (NS) styles available.

DALE TYPE	MIL-R-26E TYPE*	DALE RATING U .05% thru 5%	DALE RATING V 3% & 5%	RESISTANCE RANGES (OHMS) .05%** .1%, .25%	RESISTANCE RANGES (OHMS) .5%, 1% 3%, 5%	MAX.*** WORKING VOLTAGE U	MAX.*** WORKING VOLTAGE V	MAX. WT. GRAMS	STANDARD TEMPERATURE COEFFICIENT VALUE RANGES (OHMS)† ± 90 PPM	± 50 PPM	± 30 PPM	± 20 PPM
RS-⅛	–	.25 W	–	–	1 to 950	8.5	–	.15	–	1 to 6.9	–	7 to 950
RS-¼	–	.4 W	–	10 to 950	1 to 3.4K	20	–	.21	Below 1 Ω	1 to 6.9	–	7 to 3.4K
RS-½	–	.75W	–	10 to 1.3K	1 to 4.9K	29	–	.23	Below 1 Ω	1 to 9.9	–	10 to 4.9K
RS-1A	RW-70	1.0 W	–	.1 to 2.7K	.1 to 10.4K	52	–	.34	Below 1 Ω	1 to 9.9	10 to 19	20 to 10.4K
RS-1B	–	1.1 W	–	1 to 4.0K	.1 to 15K	62	–	.40	Below 1 Ω	1 to 9.9	10 to 29	30 to 15K
RS-2	–	4.0 W	5.5 W	1 to 12.7K	.1 to 47.1K	210	250	2.1	Below 1 Ω	1 to 9.9	10 to 79	80 to 47.1K
RS-2A	–	3.25 W	4.75 W	1 to 11.4K	.1 to 42.1K	185	220	.90	Below 1 Ω	1 to 9.9	10 to 79	80 to 42.1K
RS-2B	RW-79	3.0 W	3.75 W	.1 to 6.5K	.1 to 24.5K	140	157	.70	Below 1 Ω	1 to 9.9	10 to 49	50 to 24.5K
RS-2C	–	2.5 W	3.25 W	1 to 8.6K	.1 to 32.3K	138	157	1.6	Below 1 Ω	1 to 9.9	10 to 59	60 to 32.3K
RS-2C-23	RW-69	2.5 W	3.25 W	.1 to 8.6K	.1 to 32.3K	138	157	1.6	Below 1 Ω	1 to 9.9	10 to 59	60 to 32.3K
RS-5	–	5.0 W	6.5 W	.1 to 25.7K	.1 to 95.2K	360	410	4.2	Below 1 Ω	1 to 9.9	10 to 169	170 to 95.2K
RS-5-69	RW-74	5.0 W	6.5 W	.1 to 24.5K	.1 to 91.0K	350	400	4.2	Below 1 Ω	1 to 9.9	10 to 169	170 to 91.0K
RS-5-70	RW-67	5.0 W	6.5 W	.5 to 25.7K	.1 to 95.2K	360	410	4.2	Below 1 Ω	1 to 9.9	10 to 169	170 to 95.2K
RS-7	–	7.0 W	9.0 W	.5 to 41.4K	.1 to 154K	504	576	4.7	Below 1 Ω	1 to 9.9	10 to 269	270 to 154K
RS-10	–	10 W	13 W	.5 to 73.4K	.1 to 273K	858	978	9.0	Below 1 Ω	1 to 9.9	10 to 469	470 to 273K
RS-10-38	RW-78	10 W	13 W	.1 to 71.5K	.1 to 265K	846	966	9.0	Below 1 Ω	1 to 9.9	10 to 469	470 to 265K
RS-10-39	RW-68	10 W	13 W	.1 to 73.4K	.1 to 273K	858	978	9.0	Below 1 Ω	1 to 9.9	10 to 469	470 to 273K

**RS-⅛ not available in .05% tolerance.
***Max. working voltage determined at .0008 dia. wire resistance values.

†Consult factory for special T.C. requirements.

*MIL-R-26C, MIL-R-23379 TYPES

DALE TYPE	MIL-R-26C (G & V)	MIL-R-23379
RS-1A	–	RWP-18
RS-2C	RW-69	–
RS-2C-23	–	RWP-20
RS-5	RW-67	RWP-21
RS-10	RW-68	RWP-23

TYPE LVR STANDARD ELECTRICAL SPECIFICATIONS

DALE TYPE	POWER RATING	RESISTANCE RANGE (Ohms) 1%, 3%, 5%, 10%	TEMPERATURE COEFFICIENT ALL MODELS
LVR-2	2 W	.008 to .332	± 150 PPM/°C from +25°C to −55°C
LVR-5	5 W	.010 to .659	± 60 PPM/°C from +25°C to +125°C
LVR-10	10 W	.010 to .800	± 30 PPM/°C from +125°C to +275°C

POWER RATINGS RS, RLS, G SERIES

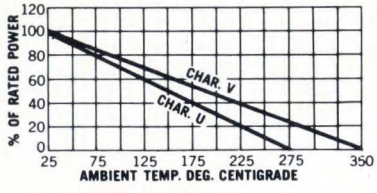
These Series have two power ratings, depending on operating temperature and stability requirements.

CHARACTERISTIC U: **1.** 275°C maximum hotspot temperature
2. .5% maximum ΔR in 2000 hour load life

CHARACTERISTIC V: **1.** 350°C maximum hotspot temperature
2. 3% maximum ΔR in 2000 hour load life

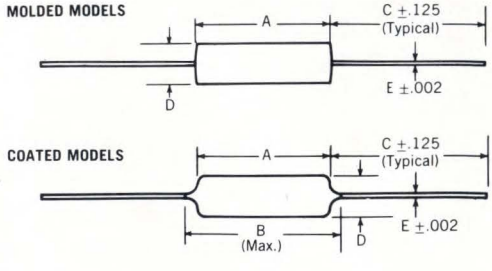
DERATING RS, RLS, G, LVR

RS, RLS and G coated resistors have an operating temperature range of −55°C to +350°C. Dale RS and LVR molded resistors have an operating temperature range of −55°C to +275°C. They must be derated at high ambient temperatures according to the curves below.



DIMENSIONS (Consult factory for RLS Types)

	TYPE	DIM. A	DIM. B	DIM. C	DIM. D	DIM. E
MOLDED MODELS	RS-⅛	.155±.015	–	1.500	.065±.015	.016
	RS-¼	.250±.015	–	1.500	.078±.015	.020
	RS-½	.312±.015	–	1.500	.078±.015	.020
	RS-1A	.422±.015	–	1.500	.093±.032	.020
	RS-1B	.575±.015	–	1.500	.093±.032	.020
	LVR-2	.675±.010	–	2.00	.250±.010	.040
	LVR-5	.927±.010	–	2.00	.343±.010	.040
	LVR-10	1.828±.010	–	2.00	.392±.010	.040
COATED MODELS	RS-2	.625±.062	.765	2.000	.250±.032	.040
	RS-2A	.812±.062	.890	1.500	.188±.032	.032
	RS-2B	.560±.062	.622	1.500	.187±.031	.032
	RS-2C	.500±.062	.593	1.500	.218±.032	.040
	RS-2C-23	.500±.062	.593	1.500	.218±.032	.032
	RS-5	.875±.062	1.000	2.000	.312±.032	.040
	RS-5-69	.875±.062	.937	2.000	.312±.031	.040
	RS-5-70	.875±.062	1.000	1.500	.312±.031	.032
	RS-7	1.218±.062	1.281	2.000	.312±.032	.040
	RS-10	1.780±.062	1.875	2.000	.375±.032	.040
	RS-10-38	1.780±.062	1.842	2.000	.375±.031	.040
	RS-10-39	1.780±.062	1.875	1.500	.375±.031	.032



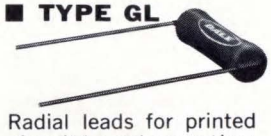
DEPENDABLE DALE® RESISTORS

WIREWOUND PRECISION RESISTORS, SILICONE COATED *(Available with Weldable Leads)*

■ TYPE G

Beryllium oxide core for decreased size, increased stability. Meets applicable specifications of MIL-R-26 and MIL-R-23379. Non-inductive styles available.

■ TYPE GL



Radial leads for printed circuit board mounting. Meets applicable requirements of MIL-R-26E.

DALE TYPE	MIL-R-26E TYPE*	DALE RATING U .05% thru 5%	DALE RATING V 3% & 5%	RESISTANCE RANGES (OHMS) .05% .1%, 25%	RESISTANCE RANGES (OHMS) .5%, 1%, 3%, 5%	MAX.** WORKING VOLTAGE U	MAX.** WORKING VOLTAGE V	MAX. WT. GRAMS	STANDARD TEMPERATURE COEFFICIENT VALUE RANGES (OHMS)† ± 90 PPM	± 50 PPM	± 30 PPM	± 20 PPM
G-1	RW-81	1.0 W	—	.1 to 950	1 to 3.4K	33	—	.20	Below 1 Ω	1 to 6.9	—	7 to 3.4K
G-2	—	1.5 W	—	10 to 1.3K	1 to 4.9K	42	—	.21	Below 1 Ω	1 to 9.9	—	10 to 4.9K
G-3	RW-80	2.25 W	—	.1 to 2.7K	.1 to 10.4K	80	—	.34	Below 1 Ω	1 to 9.9	10 to 19	20 to 10.4K
G-5	—	4.0 W	5 W	1 to 6.5K	.1 to 24.5K	162	184	.80	Below 1 Ω	1 to 9.9	10 to 49	50 to 24.5K
G-5A	—	4.5 W	6.5 W	1 to 11.4K	.1 to 42.1K	214	257	.95	Below 1 Ω	1 to 9.9	10 to 79	80 to 42.1K
G-5C	—	5 W	7 W	1 to 8.6K	.1 to 32.3K	194	230	1.2	Below 1 Ω	1 to 9.9	10 to 59	60 to 32.3K
G-6	—	6 W	8 W	1 to 12.7K	.1 to 47.1K	258	298	2.0	Below 1 Ω	1 to 9.9	10 to 79	80 to 47.1K
G-10	—	7 W	10 W	.5 to 25.7K	.1 to 95.2K	425	508	3.6	Below 1 Ω	1 to 9.9	10 to 169	170 to 95.2K
G-12	—	10 W	12 W	.5 to 41.4K	.1 to 154K	607	665	4.2	Below 1 Ω	1 to 9.9	10 to 269	270 to 154K
G-15	—	15 W	18 W	.5 to 73.4K	.1 to 273K	1050	1150	7.6	Below 1 Ω	1 to 9.9	10 to 469	470 to 273K

**Maximum Working Voltage determined at .0008 dia. wire resistance values. †Consult factory for special T.C. requirements.

*MIL-R-26C, MIL-R-23379 TYPES

	MIL-R-26C	MIL-R-23379
G-1	—	RWP-17
G-3	—	RWP-19
G-5C	RW-69	—
G-5C-2	—	RWP-20
G-10	RW-67	RWP-21
G-15	RW-68	RWP-23

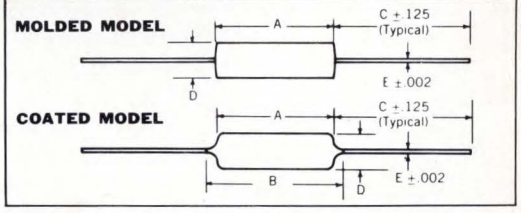
POWER RATING
Power ratings of Dale G resistors are 1.4 to 4 times higher than those of conventional wirewound resistors of equivalent size.

Stability When Dale G resistors are operated at the same ratings (Char. U) as conventional Dale RS resistors of equivalent size, the shift in resistance is 50% or less than that of the RS.

For additional power and derating information, see section on RS resistors.

DIMENSIONS

	TYPE	DIM. A	DIM. B	DIM. C	DIM. D	DIM. E
MOLDED MODELS	G-1	.250±.015	—	1.500	.078±.015	.020
	G-2	.312±.015	—	1.500	.078±.015	.020
	G-3	.422±.015	—	1.500	.093±.032	.020
COATED MODELS	G-5	.562±.062	.640	1.500	.188±.032	.032
	G-5A	.812±.062	.890	1.500	.188±.032	.032
	G-5C	.500±.062	.593	1.500	.218±.032	.040
	G-6	.625±.062	.765	2.000	.250±.032	.040
	G-10	.875±.062	1.000	2.000	.312±.032	.040
	G-12	1.218±.062	1.281	2.000	.312±.032	.040
	G-15	1.780±.062	1.875	2.000	.375±.032	.040

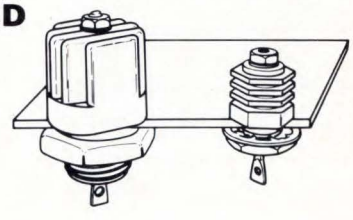


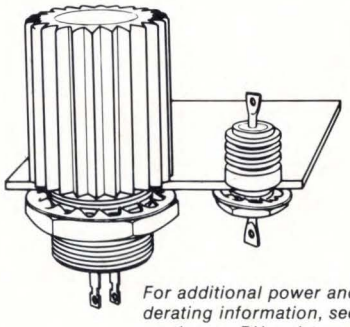
WIREWOUND POWER RESISTORS, HEAT SINK ENCASED

■ TYPE PH

TWO TERMINAL CONFIGURATIONS (PH-10-1, PH-25, PH-50 and PH-100).
Thru chassis mounting—two connections required on one or both sides of panel. Meet electrical and environmental requirements of MIL-R-18546.

SINGLE TERMINATION, CHASSIS GROUND (PH-10-5 and PH-25-8).
Speeds assembly time as only one connection is required. Often utilized as a drive line resistor in a high speed core memory system using a series termination technique. Non-inductive windings have low reactance properties giving exceptionally fast cycle time.





For additional power and derating information, see section on RH resistors

DALE TYPE	DALE RATING (WATTS)	RESISTANCE RANGES (OHMS) .05%, .1%, .25%	RESISTANCE RANGES (OHMS) .5%, 1%, 3%	MAX. WORKING VOLTAGE	MAX.* WT. (GRAMS)	STANDARD TEMPERATURE COEFFICIENT VALUE RANGES (OHMS)† ±50 PPM	±30 PPM	±20 PPM
PH-10A	10	1 to 12.7K	.1 to 47.1K	240	6	1 to 9.9	10 to 79	80 to 47.1K
PH-10-1	10	1 to 12.7K	.1 to 47.1K	240	6	1 to 9.9	10 to 79	80 to 47.1K
PH-10-5	10	.5 to 6.3K	.1 to 23.5K	170	6	1 to 9.9	10 to 79	80 to 23.5K
PH-25	25	.5 to 25.7K	.1 to 95.2K	425	22	1 to 9.9	10 to 169	170 to 95.2K
PH-25-8	25	.25 to 12.8K	.1 to 47.7K	300	22	1 to 9.9	10 to 169	170 to 47.7K
PH-50	50	3 to 52K	.1 to 75K	1500	80	1 to 99	100 to 999	1K to 75K
PH-100	100	5 to 35K	.1 to 50K	1700	186	1 to 99	100 to 999	1K to 50K

*A weight increase of 10% should be allowed for non-inductive types. †Consult factory for values below 1Ω and for special T.C. requirements.

WIREWOUND POWER RESISTORS, HEAT SINK ENCASED

Patented design. Mount to the chassis. Provide high power and precision tolerance in a variety of sizes, mounting and terminal configurations. RH and HG types exceed MIL-R-18546. Non-inductive NH styles available.

■ TYPE RH

5 through 250 watts. Bonus power dissipation ability within MIL-R-18546 size.

■ TYPE HG

Beryllium oxide core for optimum heat dissipation. Doubles Mil. Spec. power at no increase in size. Exceptional stability at mil. levels.

DALE TYPE	MIL-R-18546 TYPE	POWER RATING* (WATTS)		RESISTANCE RANGES (OHMS)		MAX. WORKING VOLTAGE	MAX.† WT. GRAMS	STANDARD TEMPERATURE COEFFICIENT VALUE RANGES (OHMS)††		
		DALE**	MIL	.05%, .1%, .25%	.5%, 1%, 3%			±50 PPM	±30 PPM	±20 PPM
RH-5	RE-60	7.5 (5)	5	1 to 6.5K	.1 to 24.5K	160	3	1 to 9.9	10 to 49	50 to 24.5K
RH-10	RE-65	12.5 (10)	10	1 to 12.7K	.008 to 47.1K	265	6	1 to 9.9	10 to 79	80 to 47.1K
RH-25	RE-70	25	20	.5 to 25.7K	.01 to 95.2K	550	13	1 to 9.9	10 to 169	170 to 95.2K
RH-50	RE-75	50	30	.5 to 73.4K	.01 to 273K	1250	28	1 to 9.9	10 to 469	470 to 273K
RH-100	RE-77	100	75	.3 to 50K	.1 to 50K	1900	400	1 to 99	100 to 949	950 to 50K
RH-250	RE-80	250	120	.3 to 75K	.1 to 75K	2300	800	1 to 99	100 to 999	1K to 75K
HG-5	RE-60	15	5	1 to 6.5K	.1 to 24.5K	220	3	1 to 9.9	10 to 49	50 to 24.5K
HG-10	RE-65	20	10	1 to 12.7K	.1 to 47.1K	340	6	1 to 9.9	10 to 79	80 to 47.1K
HG-25	RE-70	35	20	.5 to 25.7K	.1 to 95.2K	650	13	1 to 9.9	10 to 169	170 to 95.2K
HG-50	RE-75	50	30	.5 to 73.4K	.1 to 273K	1400	28	1 to 9.9	10 to 469	470 to 273K

*Rating is based on chassis mounting area and stability.

**NOTE: Figures in parentheses on RH-5 and RH-10 indicate wattage printed on these resistors. New construction allows them to be rated at 7.5 and 12.5 watts—but they will be printed with these higher ratings only upon customer request.

†A weight increase of 10% should be allowed for non-inductive styles.

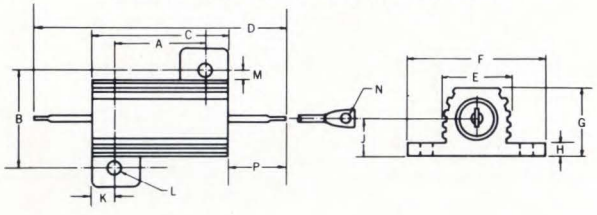
††Consult factory for values below 1 ohm and for special T.C. requirements.

POWER RATING RH, HG, PH TYPES

Dale housed resistor ratings are based on the following requirements:

1. 275°C maximum internal hotspot temperature
2. 1% maximum ΔR in 1000 hour load life for RH-5, 10, 25, 50; PH-10, 25, 50. 3% maximum ΔR in 1000 hour load life for RH-100, 250; PH-100.
3. Proper heat sink.
   4x6x2x.040 aluminum chassis = RH-5, 10; HG-5, 10; PH-10
   5x7x2x.040 aluminum chassis = RH-25; HG-25, 50; PH-25
   12x12x.059 aluminum panel = RH-50
   12x12x.125 aluminum panel = RH-100, 250; PH-50, 100

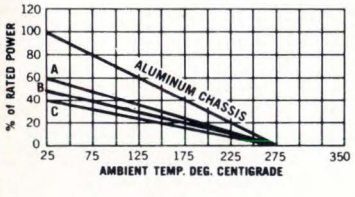
5 THRU 50 WATT MODELS, ARH, RH & HG



DERATING

Dale housed resistors have an operating temperature range of −55°C to +275°C. Derating is required for reduced chassis mounting area and for high ambient temperatures. The following curves apply to operation of unmounted resistors:

A = RH-5, 10
B = RH-25; PH-10, 25
C = RH-50, 100, 250; PH-50, 100; HG-5, 10, 25, 50

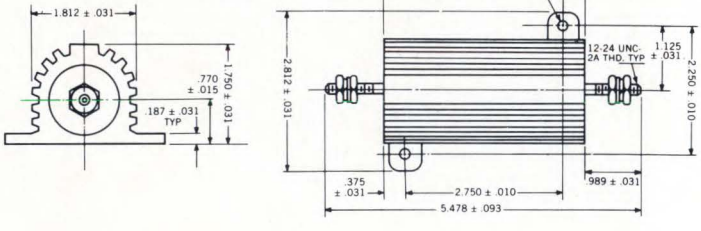


DIMENSIONS—5 thru 50 WATT MODELS—ARH, RH & HG

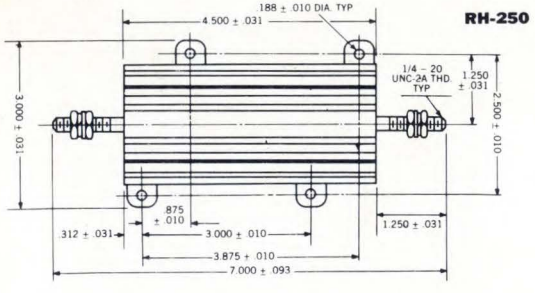
TYPE*	A	B	C	D	E	F	G	H	J	K	L	M	N	P
RH-5, HG-5	±.444 .005	±.490 .005	±.600 .031	±1.125 .062	±.334 .015	±.646 .015	±.320 .015	±.065 .010	±.133 .010	±.078 .010	±.093 .005	±.078 .015	±.050 .005	±.262 .062
RH-10, HG-10	±.562 .005	±.625 .005	±.750 .031	±1.375 .062	±.420 .015	±.800 .015	±.390 .015	±.075 .010	±.165 .010	±.093 .010	±.093 .005	±.102 .015	±.086 .005	±.312 .062
RH-25, HG-25	±.719 .005	±.781 .005	±1.062 .031	±1.938 .062	±.550 .015	±1.080 .015	±.546 .015	±.088 .010	±.231 .010	±.172 .010	±.125 .005	±.115 .015	±.086 .005	±.438 .062
RH-50, HG-50	±1.563 .005	±.844 .005	±1.968 .031	±2.781 .062	±.630 .015	±1.140 .015	±.610 .015	±.088 .010	±.260 .010	±.196 .010	±.125 .005	±.107 .015	±.086 .005	±.406 .062

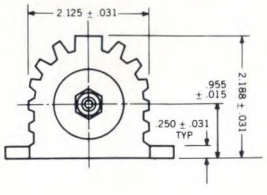
*Types ARH, ERH, ENH 5 thru 50 correspond with RH-5 thru 50.

RH-100



RH-250



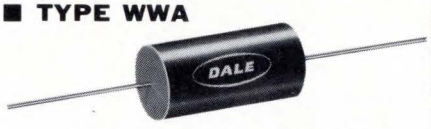


DEPENDABLE DALE® RESISTORS

WIREWOUND PRECISION RESISTORS, BOBBIN TYPE *(Available with Weldable Leads)*

Non-inductive precision resistors. Epoxy molded for high dielectric strength and complete environmental protection. Meet applicable requirements of MIL-R-93D.

■ TYPE WWA



Patented design insures high stability. Special tolerances and matching available.

■ TYPE MWA

Subminiature size retains Dale's unique bobbin-type design and high protection molding coating.

DALE TYPE	MIL-R-93 TYPE	POWER RATING (WATTS)	MINIMUM RESISTANCE RANGE (OHMS)* .05%	.1%	.25%	.5%	1%	MAXIMUM RESISTANCE (OHMS) ALL TOLERANCES	MAXIMUM WORKING VOLTAGE	MAXIMUM WEIGHT (GRAMS)
MWA-8	–	.1	50	10	5	2	1	100K	27	.21
MWA-10	–	.125	50	10	5	2	1	160K	37	.23
WWA-13	–	.125	50	10	5	2	1	311K	50	.35
WWA-22	–	.15	130	20	5	.2	.1	600K	100	.9
WWA-23	RB-56	.15	105	12	5	.2	.1	650K	150	1.0
WWA-24	RB-55	.20	40	12	6	.2	.1	900K	200	1.2
WWA-26	RB-54	.25	20	10	5	.2	.1	1.72 Meg.	300	1.5
WWA-36	RB-53	.33	15	4	1	.2	.1	4 Meg.	300	3.1
WWA-38	RB-52	.50	10	3	1	.2	.1	5.4 Meg	600	3.8
WWA-44	†	.5	15	4	1	.2	.1	5.75 Meg.	500	3.4
WWA-45	†	.5	10	3	1	.2	.1	7.5 Meg.	550	5.4
WWA-48	RB-57	.75	10	3	1	.2	.1	11.5 Meg.	850	6.5
WWA-412	RB-58	.875	10	3	1	.2	.1	17.5 Meg.	1050	8.4
WWA-416	RB-59	1	10	3	1	.2	.1	23 Meg.	1400	15.5

*Consult factory for tolerances below .05%.

†Although there is no direct mil. model of the same physical size, the Dale type will meet the electrical and environmental requirements of MIL-R-93.

SPECIAL MODIFICATIONS

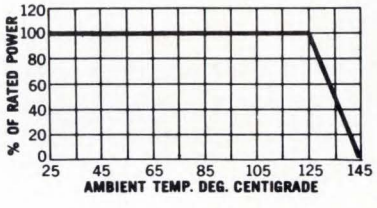
- Special tolerances are available to as low as .005%.
- Resistors can be matched to a tolerance of .001%.
- Special T.C.'s are available to ±2 ppm/° C over a limited temperature range.
- T.C.'s can be matched to an accuracy of 1 ppm/° C.

POWER RATING

MWA, WWA and WWP power ratings correspond to MIL-R-93 ratings and are based on .5% maximum ΔR in 1500 hours load life. For commercial applications, power ratings may be doubled.

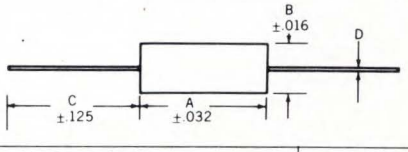
DERATING

Dale MWA, WWA and WWP resistors have an operating temperature range of −55° C to +145° C. Derating is required for temperatures above 125° C. The curve at right applies.



DIMENSIONS

TYPE	DIM. A	DIM. B	DIM. C	DIM. D
MWA-8	.250	.078	1.500	.020
MWA-10	.312	.078	1.500	.020
WWA-13	.375	.125	2.000	.020
WWA-22	.250	.250	2.000	.032
WWA-23	.375	.250	2.000	.032
WWA-24	.500	.250	2.000	.032
WWA-26	.750	.250	2.000	.032
WWA-36	.750	.375	2.000	.032
WWA-38	1.000	.375	2.000	.032
WWA-44	.500	.500	2.00	.032
WWA-45	.625	.500	2.00	.032
WWA-48	1.00	.500	2.00	.032
WWA-412	1.500	.500	2.00	.032
WWA-416	2.00	.500	2.00	.032

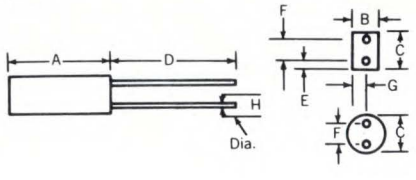


■ TYPE WWP

Rectangular or round printed circuit construction. High resistance per unit volume. Meets applicable requirements of MIL-R-93.

DALE TYPE	MIL-R-93D TYPE	POWER RATING (WATTS)	MINIMUM RESISTANCE RANGE (OHMS) .02%	.05%	.1%	.25%	.5%	1%	MAXIMUM RESISTANCE (OHMS) ALL TOLERANCES	MAXIMUM WORKING VOLTAGE	MAXIMUM WEIGHT (GRAMS)
WWP-18	–	⅛ W	1.5K	600	150	50	25	10	1 Megohm	150 V	1.0
WWP-14	–	¼ W	1K	400	150	50	25	10	1.5 Megohms	300 V	1.5
WWP-225	RB-71	⅛ W	–	105	12	5	.2	.1	515K	150 V	1.0

For additional Power Rating and Derating Information, see section on MWA and WWA styles.



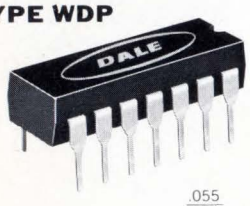
DIMENSIONS

TYPE	A (±.020)	B (±.020)	C (±.020)	D (Min.)	E (±.010)	F (±.010)	G (±.010)	H
WWP-18	.300	.125	.250	1	.062	.125	.062	.032
WWP-14	.600	.125	.250	1	.062	.125	.062	.032
WWP-225	.312	–	.250	1	.025	.200	–	.025

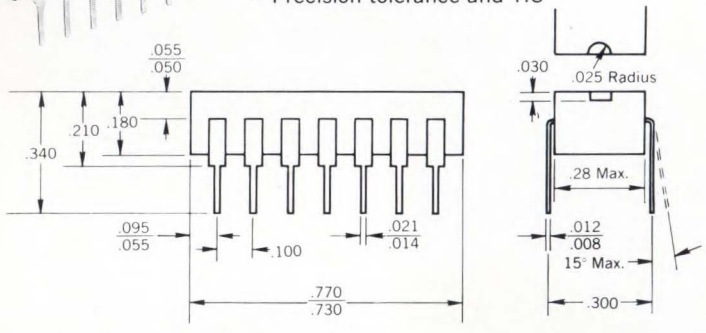
DEPENDABLE DALE® RESISTORS

WIREWOUND DUAL-IN-LINE PACKAGE

■ TYPE WDP



- Designed for automatic insertion
- Up to 7 resistors in a 14-pin package
- Optimum heat dissipation in small package
- High temperature stability
- Precision tolerance and T.C



SPECIFICATIONS

Electrical

Power Rating: 3.5 watts (up to .5 watts/resistor)

Resistance Range: 1Ω to 800Ω per resistor

Tolerance: ±0.1% to ±5.0%

Temperature Coefficient: ±20 PPM/° C (7Ω to 800Ω)
±50 PPM/° C (1Ω to 6.9Ω)

Tolerance Match: .05%

Temperature Coefficient Match: To 5 PPM/° C, depending on resistance values

Operating Temperature: −65° C to +275° C

Dielectric Strength: 500 VAC

Insulation Resistance: 1000 Megohms minimum dry, 100 Megohms minimum after moisture test.

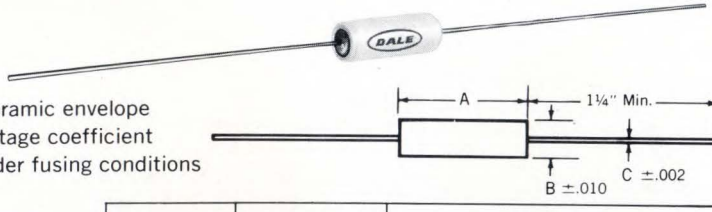
Material

Package: Silicone molded

Leads: KOVAR

CUSTOM FUSE RESISTORS

■ TYPE CFR



- Performs function of resistor and series fuse
- Completely welded construction hermetically sealed in ceramic envelope
- Low temperature coefficient with negligible noise and voltage coefficient
- Predictable fusing times with no flaming or distortion under fusing conditions
- Commercial type fuse resistors also available

CONTINUOUS POWER RATING	VALUE RANGE	DIMENSIONS		
		"A" Length	"B" Dia.	"C" Lead Dia.
1/4 W	0.1Ω to 1.2KΩ	.437 ± .020	.155	.020
1/2 W	0.1Ω to 1.6KΩ	.437 ± .020	.155	.020
3/4 W	0.2Ω to 2.5KΩ	.437 ± .020	.155	.020
1-1/2 W	0.3Ω to 5.3KΩ	.640 ± .031	.243	.032
2-1/2 W	0.45Ω to 7.4KΩ	.750 ± .031	.250	.032

SPECIFICATIONS

Electrical

Tolerance: 3%, 5% and 10% standard. 1% available for some applications

Dielectric Strength: 750 VAC 1/4 watt thru 3/4 watt; 1000 VAC all others

Insulation Resistance: 10,000 Megohms minimum dry

Temperature Coefficient: ±90 PPM/° C below 1 ohm; ±50 PPM/° C 1 ohm thru 9.9 ohms; ±30 PPM/° C 10 ohms and up

Operating Temperature: −55° C to +275° C

Fusing Times: 1 millisecond to 1 second

Minimum Fusing Current: 3 to 4 times continuous operating current depending upon stability requirements.

Mechanical

Terminal Strength: 5 lb. pull test = 1/4 watt thru 3/4 watt; 10 lb. pull test = all others

Solderability: Continuous satisfactory coverage when tested in accordance with MIL-R-26E

ORDERING INFORMATION *Please include the following information:*

1. Operating wattage or current, ambient temperature and required resistance stability, (% ΔR/1000 hours).
2. Fusing wattage or current and maximum "blow" time. Also minimum "blow" time, if applicable.
3. Nominal resistance and maximum allowable resistance tolerance, (5% to 10% preferred).
4. Maximum allowable physical size.
5. Voltage to be interrupted.
6. Frequency of power source, wave form, and a brief description of your application.

NON-STANDARD RESISTORS TO YOUR SPECIFICATION

Dale is the industry's acknowledged leader in designing and supplying non-standard resistors. From the thousands of designs in our engineering files, we can select proven methods of solving your specific requirements...faster and at a lower cost. Our capabilities include:

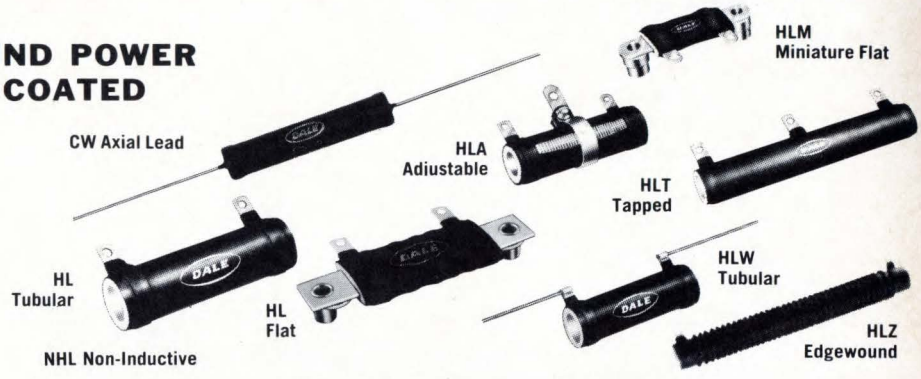
- ■ Extended resistance ranges
- ■ Low reactance
- ■ Very high or very low T.C.
- ■ Special tolerances
- ■ Low noise
- ■ Match of T.C., tolerance, resistance ratio
- ■ Special packaging

For assistance in obtaining non-standard resistors, call:

402—564-3131 • Columbus, Nebraska • DALE WIREWOUND RESISTORS
402—371-0080 • Norfolk, Nebraska • DALE METAL FILM RESISTORS

INDUSTRIAL WIREWOUND POWER RESISTORS, SILICONE COATED

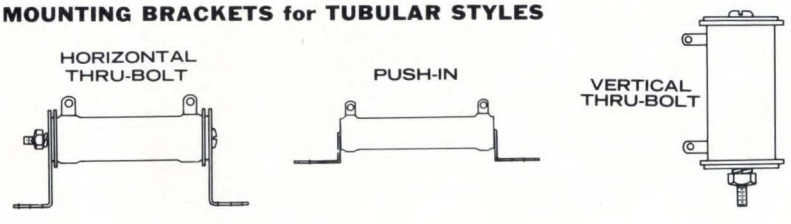
Dale's silicone-coated industrial wirewound resistors assure maintenance of tolerance and T.C. without compromise in mechanical and chemical protection.



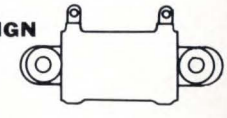
CONTACT DISTRIBUTOR FOR PRICES.

TYPE	APPLICATION	APPLICABLE MIL SPEC AND TYPES	WATTAGE RATING	RESISTANCE RANGE	CORE SIZES	TERMINALS	MOUNTINGS	TOLERANCE
CW Axial Lead	Axial leads. For applications requiring high performance at low cost	MIL-R-26 RW-67, 68, 69	2.5-13 watts	.1 ohm to 100K ohms	Body Dia. .188 to .375" Body Length .500 to 1.781" Leads 1.5 to 2"	Leads	Terminals	±5% (10% below 1 ohm)
HL Tubular	General purpose wirewound resistors with a broad power range.	MIL-R-26 RW-29, 30, 31, 32, 33, 35, 36, 37, 38, 47	5-225 watts	.1 ohm to 1.3 Megohms	O.D. 1/4 to 1-1/8" Length 1-10½"	Lugs	Push-in bracket or thru-bolt	±5% (10% below 1 ohm)
NHL Non-Inductive	High frequency circuits and applications requiring low inductive effect and minimum distributed capacity	None	5-225 watts	1 ohm to 90K ohms	O.D. 1/4 to 1-1/8" Length 1-10½"	Lugs or Leads	Push-in bracket or thru-bolt	±5%
HL Flat	For limited space requiring high power-to-size ratio. Vertical or horizontal stacking.	MIL-R-26 RW-20 thru RW-24	30-95 watts	.1 ohm to 150K ohms	Length 1¼ to 6"	Lugs	Thru mount with spacers	±5% (10% below 1 ohm)
HLM Miniature Flat	For limited space, high power-to-size requirements particularly in high vibration areas.	None	10-20 watts	.1 ohm to 51K ohms	Length 3/4 to 2-1/16"	Lugs	Thru mount with spacers	±5% (10% below 1 ohm)
HLA Adjustable	For resistance or voltage adjustment	MIL-R-19365C RX-29, 32, 33, 35, 36 37, 38, 47	12-225 watts	1 ohm to 100K ohms	O.D. 5/16 to 1-1/8" Length 1½ to 10½"	Lugs	Push-in bracket or thru-bolt	±5%
HLT Tapped	For voltage divider networks	MIL-R-26 RW-22, 23, 24, 33, 35, 36, 37, 38, 47	11-225 watts	.1 ohm to 1.1 Megohms	O.D. 5/16 to 1-1/8" Length 1½ to 10½"	Lugs	Push-in bracket or thru-bolt	±10% each section (±10% total)
HLW Tubular	General application where terminal wires are required for direct electrical connection	None	3-20 watts	.1 ohm to 80K ohms	O.D. 13/64 to 7/16" Length 7/16" to 2"	Lugs with terminal wires	Terminals, thru-bolt or push-in bracket	±5% (10% below 1ohm)
HLZ Edge-wound	For heavy duty requirements where space is at a premium. High thermal capacity.	None	35-375 watts	.05 ohm to 32 ohms	O.D. 9/16 to 1-1/8" Length 2 to 10-1/2"	Lugs	Push-in bracket or thru-bolt	±10%

MOUNTING BRACKETS for TUBULAR STYLES



EXCLUSIVE BRACKET DESIGN FOR MINIATURE FLAT STYLE



Mounting strap fits snugly through core and is bound tightly against unit by two eccentric spacers. Eliminates expensive cements and improves heat transfer and power handling capabilities.

DEPENDABLE DALE® RESISTORS

■ TYPE CP

- Fireproof inorganic construction
- Special inorganic potting compound provides high thermal conductivity.
- Superior moisture resistance

Construction: Resistance wire is high quality, premium grade wound onto a woven fiberglass core. Terminals are tinned copper or copperweld crimped to the wound core with a special brass alloy.

Tolerance: ±10% standard. ±5% also available.

Operating Temperature: –55° C to +275° C.

Terminal Strength: 5 lbs.

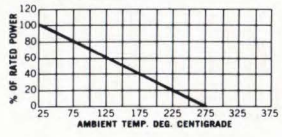
Ordering Information:

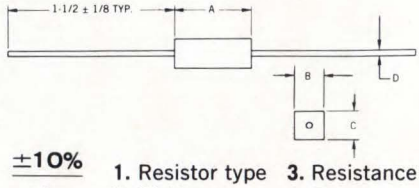
When ordering, please specify Dale type, wattage, resistance value and tolerance.

Example: A 2-watt CP resistor with resistance at 1000 ohms and tolerance of ±10% is designated as shown.

DALE TYPE	WATTAGE RATING	EIA STANDARD RS-344 TYPE	RESISTANCE	MAX. WORKING VOLTAGE	DIMENSIONS A±1/32	B±1/32	C±1/32	D±.001
CP-2	2	CRU2A	.1 to 2.4K	65	11/16	1/4	1/4	.032
CP-3	3	CRU3	.1 to 7.5K	150	7/8	5/16	5/16	.036
CP-5	5	CRU5	.1 to 8.5K	200	7/8	3/8	11/32	.036
CP-7	7	CRU7	.12 to 18K	350	1-25/64	3/8	11/32	.036
CP-10	10	CRU10	.18 to 30K	540	1-7/8	3/8	11/32	.036

DERATING



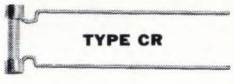


CP	2	1K	±10%
1	2	3	4

1. Resistor type
2. Wattage
3. Resistance
4. Tolerance

■ TYPES CA and CR

TYPE CA



TYPE CR

Construction:

Dale CA and CR Series have a high quality, premium resistance wire wound on woven fiberglass core impregnated and coated with a special grade silicone. Available with special smokeproof coating.

Resistance Range: .1 ohm minimum to 7K, dependent on resistor core length.

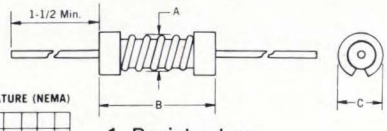
Tolerance: ±10% standard, ±5% also available.

Leads: Standard lead diameter is .036" (#19 AWG). Standard minimum lead length is 1½". Standard lead material is tinned copper or copperweld. Axial lead pull strength on CA Series is 4 lbs.

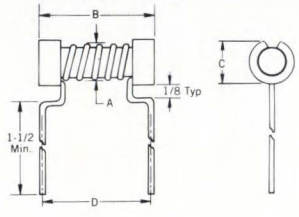
DIMENSIONAL AND POWER SPECIFICATIONS

DALE TYPE	DIM. A	DIM. B MIN.	DIM. B MAX.	DIM. C	DIM. D ±1/16	WATTAGE RATING PER INCH
CA-4000	.110	.5"	2.0"	.150	NA	4
CR-4000	.110	.4"	2.0"	.150	(B-.062")	4

CA-4000 SERIES



CR-4000 SERIES

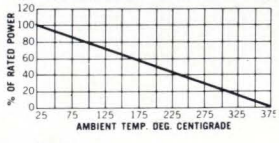


POWER RATINGS

4000 Series = 4 watts per inch

DERATING

FOR HIGH AMBIENT TEMPERATURE (NEMA)



Ordering Information:

When ordering, please specify resistor body length, watts/inch, resistance and tolerance.

1. Resistor type
2. Core diameter designation
3. Overall resistor body length
4. Resistance
5. Tolerance

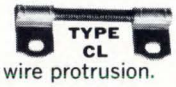
Example: A 1½" unit, 4 watts per inch; 350 ohms, ±10% radial lead unit is designated as shown.

CR	4	150	350Ω	±10%
1	2	3	4	5

■ TYPE RF FUSE RESISTOR

Dale RF resistors can reliably function as a fuse and as a wirewound resistor. RF resistors are similar in appearance to Type CA, CP or CR models, but are wound with special wire conforming to performance required. Contact factory for design assistance.

■ TYPES CL and CLC



TYPE CL

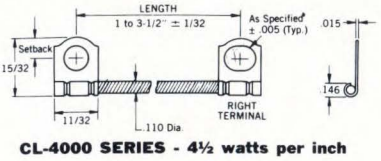
TYPE CLC

- Recessed core prevents resistance wire protrusion.
- Lugs are double-crimped for positive electrical contact and high terminal pull strength.
- Any variation of mounting hole and slot available. Construction, Resistance Range, Tolerance and Derating same as CA.

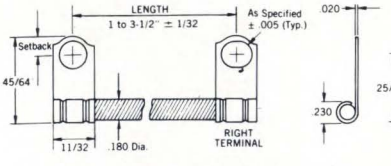
Resistance Identification: Resistance is always stamped on the left terminal tab.

Terminals: (CL Series) Mounting holes as shown are Dale standard. Any variation of hole and slot is available, also tabs with no holes are available. Standard terminal material is tin plated steel. Special tinned brass is available on request.

Ordering Information: Same as CA except (3)
3. Mounting length between centers.



CL-4000 SERIES - 4½ watts per inch

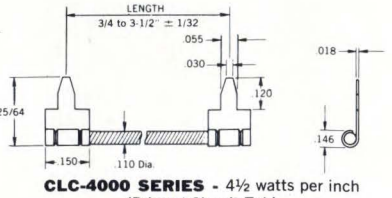


CL-6000 SERIES - 6 watts per inch

DIMENSIONS

	CL-4000	CL-6000
Setback	.145"	.135"
Left Terminal	.133" dia.	.215" dia.
Right Terminal	133" x .153" slot	.215" dia.

Other terminal dimensional variations available on request.



CLC-4000 SERIES - 4½ watts per inch
(Printed Circuit Tab)

METAL and CARBON FILM RESISTORS

APPLICABLE MIL. ENVIRONMENTAL SPECIFICATIONS MIL-R-10509

TYPES MF & MFF

These environmental performance figures are typical for MFF conformally coated resistors. However, this style is dimensionally smaller than the RN types per MIL-R-10509.

REQUIREMENT	CHAR. B		CHAR. D		CHAR. C		CHAR. E		CHAR. F	
Mil. Temp. Coefficient	± 500 PPM		+200 −500 PPM		±50 PPM		±25 PPM		±50 PPM	
Applicable Dale T.C. Code	T-00 (200 PPM)		T-1 (100 PPM) T-0 (150 PPM)		T-2 (50 PPM)		T-9 (25 PPM)		T-2 (50 PPM)	
POWER RATING	at 70°C		at 70°C		at 125°C		at 125°C		at 125°C	
ENVIRONMENTAL TEST	MIL. MAX.	DALE TYP.	MIL. MAX.	DALE TYP.	MIL. MAX.	DALE TYP.	MIL. MAX.	DALE TYP.	MIL. MAX.	DALE TYP.
Temperature Cycling	±0.5%ΔR	±0.10%	±0.5%ΔR	±0.10%	±0.25%ΔR	±0.10%	±0.25%ΔR	±0.10%	±0.25%ΔR	±0.10%
Low Temp. Operation	±0.5%ΔR	±0.05%	±0.5%ΔR	±0.05%	±0.25%ΔR	±0.05%	±0.25%ΔR	±0.05%	±0.25%ΔR	±0.05%
Short Time Overload	±0.5%ΔR	±0.02%	±0.5%ΔR	±0.02%	±0.25%ΔR	±0.02%	±0.25%ΔR	±0.02%	±0.25%ΔR	±0.02%
Dielectric Withstanding Voltage	±0.5%ΔR	±0.01%	±0.5%ΔR	±0.01%	±0.25%ΔR	±0.01%	±0.25%ΔR	±0.01%	±0.25%ΔR	±0.01%
Effect of Soldering	±0.5%ΔR	±0.02%	±0.5%ΔR	±0.02%	±0.1% ΔR	±0.02%	±0.1% ΔR	±0.02%	±0.1% ΔR	±0.02%
Moisture Resistance	±1.5%ΔR	±0.05%	±1.5%ΔR	±0.05%	±0.5% ΔR	±0.05%	±0.5% ΔR	±0.05%	±0.5% ΔR	±0.05%
Load Life	±1.0%ΔR	±0.05%	±1.0%ΔR	±0.05%	±0.5% ΔR	±0.15%	±0.5% ΔR	±0.15%	±0.5% ΔR	±0.15%
Shock	±0.5%ΔR	±0.01%	±0.5%ΔR	±0.01%	±0.25%ΔR	±0.01%	±0.25%ΔR	±0.01%	±0.25%ΔR	±0.01%
Vibration	±0.5%ΔR	±0.01%	±0.5%ΔR	±0.01%	±0.25%ΔR	±0.01%	±0.25%ΔR	±0.01%	±0.25%ΔR	±0.01%

All ΔR figures shown are based on units with an initial tolerance of 1%.

TYPES MC & DC

TYPE D This physical configuration is not covered in MIL-R-10509.

REQUIREMENT	CHAR. B		CHAR. D		CHAR. D		CHAR. C		CHAR. E	
Power Rating Temp.	70° C		70° C							
Temperature Coefficient	±500 PPM/° C		+200 − 500 PPM/° C							
ENVIRONMENTAL TESTS	MIL. MAX	DALE TYP.	MIL. MAX.	DALE TYP.	MIL. MAX	DALE TYP.	MIL. MAX.	DALE TYP.	MIL. MAX.	DALE TYP.
Temperature Cycling	± 0.5% ΔR	± 0.25% ΔR	± 0.5% ΔR	± 0.25% ΔR	± 0.5% ΔR	± 0.10%	± 0.25% ΔR	± 0.1%	± 0.25% ΔR	± 0.10%
Low Temp. Operation	± 0.5% ΔR	± 0.05% ΔR	± 0.5% ΔR	± 0.05% ΔR	± 0.5% ΔR	± 0.05%	± 0.25% ΔR	± 0.05%	± 0.25% ΔR	± 0.05%
Short Time Overload	± 0.5% ΔR	± 0.05% ΔR	± 0.5% ΔR	± 0.05% ΔR	± 0.5% ΔR	± 0.10%	± 0.25% ΔR	± 0.10%	± 0.25% ΔR	± 0.10%
Dielectric Withstanding Voltage	± 0.5% ΔR	± 0.01% ΔR	± 0.5% ΔR	± 0.01% ΔR	± 0.5% ΔR	± 0.01%	± 0.25% ΔR	± 0.01%	± 0.25% ΔR	± 0.01%
Effect of Soldering	± 0.5% ΔR	± 0.01% ΔR	± 0.5% ΔR	± 0.01% ΔR	± 0.5% ΔR	± 0.05%	± 0.1% ΔR	± 0.05%	± 0.1% ΔR	± 0.05%
Moisture Resistance	± 1.5% ΔR	± 0.25% ΔR	± 1.5% ΔR	± 0.25% ΔR	± 1.5% ΔR	± 0.25%	± 0.5% ΔR	± 0.25%	± 0.5% ΔR	± 0.25%
Load Life	± 1.0% ΔR	± 0.10% ΔR	± 1.0% ΔR	± 0.20% ΔR	± 1.0% ΔR	± 0.5%	± 0.5% ΔR	± 0.5%	± 0.5% ΔR	± 0.5%
Shock	± 0.5% ΔR	± 0.10% ΔR	± 0.5% ΔR	± 0.10% ΔR	± 0.5% ΔR	± 0.01%	± 0.25% ΔR	± 0.01%	± 0.25% ΔR	± 0.01%
Vibration	± 0.5% ΔR	± 0.10% ΔR	± 0.5% ΔR	± 0.10% ΔR	± 0.5% ΔR	± 0.01%	± 0.25% ΔR	± 0.01%	± 0.25% ΔR	± 0.01%

DEPOSITED CARBON RESISTORS *(Available with Weldable Leads)*

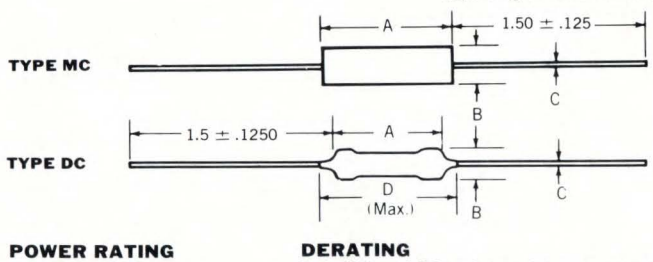
Made of pure crystalline carbon film bonded to selected ceramic cores. Excellent high frequency characteristics. Types MC and DC meet functional requirements of MIL-R-10509F.

■ TYPE MC Epoxy Molded

■ TYPE DC
Epoxy Conformal Coated

DALE TYPE	MIL. TYPE		POWER RATING (WATTS)		MINIMUM RESISTANCE (OHMS)	MAXIMUM 1% RESISTANCE (OHMS)	MAXIMUM 2% RESISTANCE (OHMS)	MAX. WT. (GRAMS)		MAXIMUM WORKING VOLTAGE
	MC	DC	B	D*				MC	DC	
MC-1/10, DC-1/10	RN-55	–	1/10	1/8	2	400K	400K	.35	.20	200
MC-1/8, DC-1/8	RN-60	–	1/8	1/4	1	3 Megohms	5 Megohms	.45	.30	300
MC-1/4, DC-1/4	RN-65	RN-10	1/4	1/2	2	5 Megohms	6 Megohms	.85	.35	350
MCS-1/2, DCS-1/2	RN-70	RN-20	1/2	3/4	1	10 Megohms	15 Megohms	1.50	.80	500
MC-1, DC-1	RN-75	RN-25	1	–	1	15 Megohms	30 Megohms	4.50	2.8	500
MC-2, DC-2	RN-80	RN-30	2	–	2	100 Megohms	125 Megohms	8.25	5.5	750
– DC-5	–	–	–	5	5	150 Megohms	300 Megohms	–	21.9	14,000

*Applies to MC only. **Tolerance:** .5%, 1%, 2%.
Temperature Coefficient: −200 PPM to −500 PPM, depending on value within normal resistance range.



DIMENSIONS

DALE TYPE	A	B	C	D
MC-1/10	.260±.010	.095±.005	.025 Dia.	–
MC-1/8	.406±.015	.135±.010	.025 Dia.	–
MC-1/4	.593±.015	.203±.015	.025 Dia.	–
MCS-1/2	.730±.020	.250±.015	.032 Dia.	–
MC-1	1.093±.020	.375±.015	.032 Dia.	–
MC-2	2.188±.020	.375±.015	.032 Dia.	–
DC-1/10	.249±.031	.090±.015	.025 Dia.	.381
DC-1/8	.343±.031	.109±.031	.025 Dia.	.453
DC-1/4	.468±.031	.125±.031	.025 Dia.	.578
DCS-1/2	.562±.062	.187±.031	.032 Dia.	.734
DC-1	.937±.062	.296±.031	.032 Dia.	1.187
DC-2	2.062±.062	.296±.031	.032 Dia.	2.312
DC-5	4.000±.125	.438±.031	.040 Dia.	4.300

POWER RATING
Dale MC and DC power ratings are based on 1% maximum ΔR in 1000 hours load life at 70° C.

DERATING
Dale MC and DC resistors have an operating temperature range of −55° C to +165° C. They must be derated at high ambient temperatures from 100% power at 70° C to 0% power at +165° C.

DEPENDABLE DALE® RESISTORS

PRECISION METAL FILM RESISTORS *(Available with Weldable Leads)*

Vacuum-deposited metal film resistors. Good R.F. characteristics. Low noise level. Wide choice of tolerances, T.C.'s and resistance.

■ TYPE MF, LMF, HMF

Epoxy molded. Meets MIL-R-10509.

■ TYPE MFF, CMF

Epoxy conformal coated.
Type MFF meets electrical and environmental characteristics of MIL-R-10509F, but is dimensionally smaller. Type CMF meets functional requirements of MIL-R-22684.

■ TYPE D

Molded in aluminum housing to utilize heat sink effect of chassis. Resistance ranges from 24.9Ω to 2.6 Meg., with power ratings of 4, 8 and 12 watts.

DALE TYPE	MIL-R-10509 TYPE	125° C RATING (Char. C & E)	70° C RATING (Char. D)	MIL-R-22684 Type	MIL-R-22684 Rating	MAX. WT. (Grams)	MAX. WORKING VOLTAGE	DIMENSIONS (See Drawing on opposite page) A	B	C	D
MF50, HMF50	RN-50	1/20 w	–	–	–	.11	200	.150 ± .020	.065 ± .015	.016 Dia.	–
MF-1/10, LMF-1/10, HMF-1/10	RN-55	1/10 w	1/8 w	–	–	.35	200	.260 ± .010	.095 ± .005	.025 Dia.	–
MF-1/8, LMF-1/8, HMF-1/8	RN-60	1/8 w	1/4 w	–	–	.45	300	.406 ± .015	.135 ± .010	.025 Dia.	–
MF-1/4, LMF-1/4, HMF-1/4	RN-65	1/4 w	1/2 w	–	–	.84	350	.593 ± .015	.203 ± .015	.025 Dia.	–
MFS-1/2, LMF-1/2, HMF-1/2	RN-70	1/2 w	3/4 w	–	–	1.6	500	.730 ± .020	.250 ± .015	.032 Dia.	–
MF-3/4, HMF-3/4	RN-70F	3/4 w*	–	–	–	1.9	500	.790 ± .020	.260 ± .015	.032 Dia.	–
MF-1, HMF-1	RN-75	–	1 w**	–	–	4.4	500	1.093 ± .020	.375 ± .015	.032 Dia.	–
MF-2	RN-80	–	2 w**	–	–	7.9	750	2.188 ± .020	.375 ± .015	.032 Dia.	–
CMF-1/10	–	1/10 w	1/4 w	RL-07	1/4 w	.25	200	.249 ± .031	.090 ± .008	.025 Dia.	.381
CMF-1/8	–	1/8 w	1/2 w	RL-20***	1/2 w	.50	300	.385 ± .031	.145 ± .015	.025 Dia.	.484
CMF-1/4	–	1/4 w	1 w	RL-32***	1 w	.80	500	.562 ± .031	.190 ± .015	.025 Dia.	.750
MFF-1/8	–	1/8 w	–	–	–	.40	300	.343 ± .031	.098 ± .015	.025 Dia.	.453
MFF-1/4	–	1/4 w	–	–	–	.65	350	.468 ± .031	.125 ± .015	.025 Dia.	.578
MFF-1/2	–	1/2 w	–	–	–	.95	500	.562 ± .031	.187 ± .031	.032 Dia.	.734
MFF-1	–	–	1 w**	–	–	2.7	500	.937 ± .062	.296 ± .031	.032 Dia.	1.187
MFF-2	–	–	2 w**	–	–	4.7	750	2.062 ± .062	.296 ± .031	.032 Dia.	2.312

*Characteristic F **Characteristic B ***MIL-R-22684. Lead diameters available.

Tolerance MIL-R-10509 ±1%, ±.5%, ±0.25%, ±0.10% standard, MIL-R-22684 ±2%, ±5%. LMF and HMF ±1% standard. Special tolerances and matching on request.

STANDARD T.C. RESISTANCE RANGE (OHMS)*

TYPE	T-0 150 PPM	T-1 100 PPM	T-2 50 PPM	T-9 25 PPM
MF50	24.9-100K	49.9-100K	100-100K	100-100K
HMF50	100K-700K	100K-700K	100K-500K	100K-200K
LMF-1/10	1-9.9	5-30	10-30	15-30
MF-1/10, CMF-1/10	10-499K	30.1-499K	30.1-301K	30.1-301K
HMF-1/10	500K-2.5M	500K-2.5M	301K-2M	301K-500K
LMF-1/8	1-9.9	5-24	10-30	15-30
MF-1/8, MFF-1/8	10-1M	24.9-1M	30.1-499K	30.1-499K
CMF-1/8	10-1M	24.9-1M	30.1-499K	30.1-499K
HMF-1/8	1M-5M	1M-5M	499K-3M	499K-1M
LMF-1/4	1-9.9	5-24	10-30	15-30
MF-1/4, MFF-1/4	10-2M	24.9-2M	30.1-1M	30.1-1M
CMF-1/4	10-2M	24.9-2M	30.1-1M	30.1-1M
HMF-1/4	2M-15M	2M-15M	1M-10M	1M-2M
LMF-1/2	1-9.9	5-24	10-24	15-24
MFS-1/2, MFF-1/2	10-2.49M	24.9-2.49M	24.9-1M	24.9-1M
HMF-1/2	2.49M-30M	2.49M-30M	1M-20M	1M-3M
MF-3/4	10-2.49M	24.9-2.49M	100-1M	100-1M
HMF-3/4	2.49M-30M	2.49M-30M	1M-20M	1M-3M
MF-1, MFF-1	10-5.11M	24.9-4.02M	49.9-2.61M	49.9-2.61M
HMF-1	5.11M-50M	4.02M-50M	2.61M-30M	2.61M-5M
MF-2, MFF-2	30.1-10M	100-8M	100-6M	200-5.11M

*On Mil types, T-0 and T-1 = Char. D, T-2 = Char. C and T-9 = Char. E.
T-0 and T-1 are available in tolerance of ±.25% and greater only.
11 standard T.C.'s available in −55° C to +175° C range.

LOW T.C. RESISTANCE VALUE RANGES*

TYPE	L-1 (20 PPM)	L-2 (15 PPM)	L-3 (10 PPM)
CMF-1/10 MFF-1/8 MF-1/8	30.1Ω to 300KΩ	49.9Ω to 200KΩ	100Ω to 100KΩ
CMF-1/8 MFF-1/4 MF-1/4	30.1Ω to 499KΩ	49.9Ω to 300KΩ	100Ω to 200KΩ
MFF-1/2 MFS-1/2	30.1Ω to 750KΩ	49.9Ω to 500KΩ	100Ω to 400KΩ

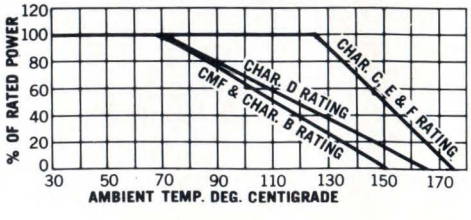
*Over temperature range from 0 to +80° C

POWER RATING

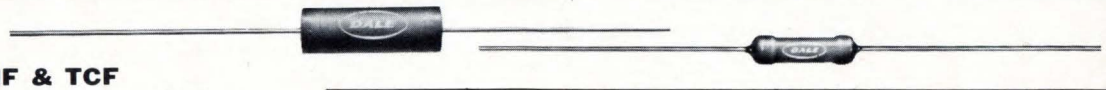
Dale metal film resistors have power ratings depending on operating temperatures of 70° C and 125° C as indicated above. All are based on a maximum ΔR of .5% in 1000 hour load life.

DERATING

Dale metal film resistors have an operating temperature range beginning at −65° C. They must be derated according to the curves at right.



DEPENDABLE DALE® RESISTORS



■ TYPE TMF & TCF

Dale technology allows deposit of high resistivity film on conventional cores resulting in higher values than before available.

DALE TYPE	70°C RATING	MAX. WEIGHT (Grams) TMF	MAX. WEIGHT (Grams) TCF	MAX. WORKING VOLTAGE	RESISTANCE RANGE by T.C. (PPM/°C) *(Ohms) 0 ± 250	RESISTANCE RANGE by T.C. (PPM/°C) *(Ohms) 0 ± 1000
TMF-1, TCF-1	.25 W	.35	.30	300 V	10K-39M	40M-80M
TMF-2, TCF-2	.3 W	.45	.40	600 V	10K-84M	85M-175M
TMF-3, TCF-3	.625 W	.84	.65	1 KV	10K-159M	160M-320M
TMF-4, TCF-4	1.25 W	1.6	.95	2 KV	10K-299M	300M-600M
TMF-5, TCF-5	2.5 W	4.4	2.7	5 KV	10K-399M	400M-800M
TMF-6, TCF-6	5 W	7.9	4.7	10 KV	20K-699M	700M-1800M

***Standard Tolerance:** For 250 PPM values, 1%, 2%, 3%, 5% and 10%. For 1000 PPM values, 2%, 3%, 5% and 10%.

DIMENSIONS (See drawings below)

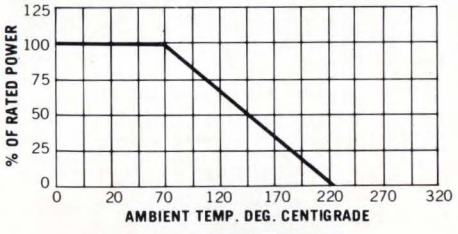
TYPE	DIM. A	DIM. B	DIM. C	DIM. D
TMF-1	.260±.010	.095±.005	.025	–
TMF-2	.406±.015	.135±.010	.025	–
TMF-3	.593±.015	.203±.015	.025	–
TMF-4	.730±.020	.250±.015	.032	–
TMF-5	1.093±.020	.375±.015	.032	–
TMF-6	2.188±.020	.375±.015	.032	–
TCF-1	.264±.031	.090±.008	.025	.381
TCF-2	.343±.031	.098±.015	.025	.453
TCF-3	.468±.031	.125±.015	.025	.578
TCF-4	.562±.031	.187±.031	.032	.734
TCF-5	.937±.062	.296±.031	.032	1.187
TCF-6	2.062±.062	.296±.031	.032	2.312

POWER RATING

Dale TMF and TCF power ratings are based on 1% maximum ΔR in 1000 hours load life at 70°C.

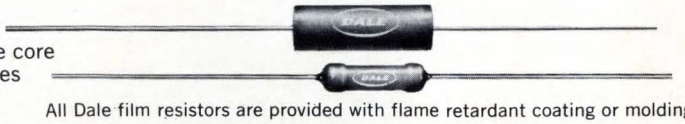
DERATING

Operating temperature range is −55°C to +220°C. They must be derated at high ambient temperatures according to the curve below.



■ TYPE MFB & CFB

Vacuum-deposited metal film on high thermal conductive core allows greater wattage rating and or lower resistor changes over long use (R) at conventional wattage ratings. This allows higher wattage rating at smaller sizes. Controlled T.C. Good high frequency characteristics.



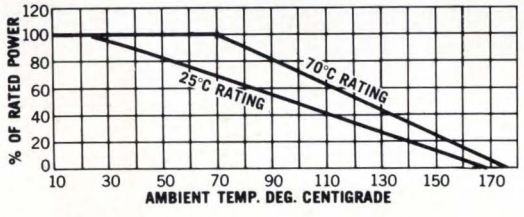
All Dale film resistors are provided with flame retardant coating or molding.

POWER RATING

Dale MFB and CFB resistors have two power ratings, depending on operating temperature of 25°C and 70°C and are based on maximum ΔR of .5% in 1000 hour load life.

DERATING

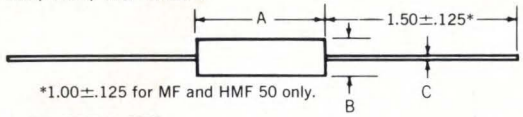
Operating temperature range is −65°C to +175°C. They must be derated according to the curves at right.



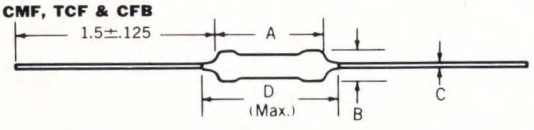
TYPE	MAX. WEIGHT (Grams)	MAX. WORKING VOLTAGE	25°C RATING	70°C RATING	RESISTANCE RANGE (Ohms)
MFB-1/2 CFB-1/2	1.6 .95	700V	3 W	1 W	100-2.49M
MFB-3/4 CFB-3/4	1.9 1.3	800V	4 W	2 W	10-2.49M
MFB-1 CFB-1	4.4 2.7	950V	7 W	3 W	10-5.11M
MFB-2 CFB-2	7.9 4.7	1200V	10 W	5 W	30.1-10M

Standard Tolerance: 10%, 5%, 2%. (±1% available on request.)
Standard Temperature Coefficient: T-00 (0±200 PPM/°C).

TYPE MF, LMF, HMF, TMF & MFB



TYPE MFF, CMF, TCF & CFB



DIMENSIONS

TYPE	A	B	C	D
MFB-1/2	.730±.020	.250±.015	.032	–
MFB-3/4	.790±.020	.260±.015	.032	–
MFB-1	1.093±.020	.375±.015	.032	–
MFB-2	2.188±.020	.375±.015	.032	–
CFB-1/2	.562±.031	.187±.031	.040	.734
CFB-3/4	.665±.062	.235±.031	.040	.852
CFB-1	.937±.062	.296±.031	.040	1.187
CFB-2	2.062±.062	.296±.031	.040	2.312

For complete information, write or phone:

DALE ELECTRONICS, INC.

P. O. Box 609 • COLUMBUS, NEBRASKA 68601

PHONE: 402-564-3131 • TWX: 910-626-8314 • TELEX: 048-6434

A subsidiary of The Lionel Corporation

DEPENDABLE DALE® RESISTORS

from Dale's Welwyn Group

PRECISION METAL FILM TO 100 MEG.

Metal Film Resistors manufactured by Dale's Welwyn Group provide a unique combination of precision performance, high reliability, low temperature coefficient and high resistance values at economical prices.

High Values up to 300 Meg. available on special order.

TYPE NO.	WATTAGE RATING 70°C	WATTAGE RATING 125°C	MAX. Cont. VOLTAGE	SURF. TEMP. RISE °C	DIMENSIONS LENGTH	DIMENSIONS DIAMETER	LEADS	T.C. IN PPM	RESISTANCE RANGE
M20D	.25	.125	250	30	.375" ± .025" (Molded construction)	.145" ± .010"	.032" ± .002"	100	10Ω to 1 Meg.
M20H								150	High Value 1.01 Meg. to 1.5 Meg.
M11D	.375	.187	300	30	.470" ± .025"	.145" ± .010"	.025" ± .002"	100	10Ω to 1.5 Meg.
M11H								150	High Value 1.51 Meg. to 3.0 Meg.
M22D	0.5	0.25	350	35	.575" ± .015"	.205" ± .010"	.032" ± .002"	100	10Ω to 2.5 Meg.
M22H								150	High Value 2.51 Meg. to 10 Meg.
M13D	1.0	–	500	50	.840" ± .025"	.285" ± .010"	.032" ± .002"	100	10Ω to 10 Meg.
M13H								150	High Value 10.1 Meg. to 30 Meg.
M14D	2.0	–	1600	60	2.000" ± .060"	.285" ± .010"	.032" ± .002"	100	10Ω to 20 Meg.
M14H								150	High Value 20.1 Meg. to 100 Meg.

MINIATURE OXIDES TO MIL-R-22684B (Molded)

Metal oxide resistors manufactured by Dale's Welwyn Group are superior for any requirement involving load life with extremely high reliability and stability – up to 100,000 hours or more. They have conclusively outperformed other resistor types under environmental conditions of varying humidities and temperatures or where prolonged operation in a high dissipation and/or ambient temperature is necessary. Their ability to withstand extreme overloads make them ideal for pulse applications where extremely high peak voltages are involved.

TYPE	RATING WATTS	MIL TYPE	RATED VOLTAGE	DIELECTRIC STRENGTH	RESISTANCE RANGE MIN.	RESISTANCE RANGE MAX.	DIMENSIONS LENGTH	DIMENSIONS DIAMETER	DIMENSIONS LEADS
F07	1/4	RL-07	250	1000 V	47Ω	150K	.250" ± .031"	.090" ± .008"	.025"
F20	1/2	RL-20	350	1000 V	10Ω	470K	.375" ± .025"	.145" ± .005"	.032"

TEST CHARACTERISTICS	MAXIMUM CHANGES PER MIL-R-22684	WELWYN PERFORMANCE DATA – TYPICAL CHANGE F STYLE RESISTORS
Resistance/Temperature Characteristic	200 PPM	200 PPM
Dielectric Withstanding Voltage	±0.5%	±0.1%
Low Temp. Operation	±0.5%	±0.25%
Temperature Cycling	±1%	±0.5%
Moisture Resistance	±1.5%	±0.5%
Short Time Overload	±0.5%	±0.25%
Load Life	±2%	±1%
Terminal Strength	±0.5%	±0.1%
Soldering	±0.5%	±0.25%
Shock	±0.5%	±0.1%
Vibration	±0.5%	±0.1%

POWER OXIDES – 3 to 10 WATTS (Flameproof)

Medium power components specifically designed for applications where a highly reliable resistor (even under abnormal stress conditions) is required. A specially developed coating material provides high flame-retardant characteristics as well as excellent thermal conductivity.

TYPE	RATING WATTS	MAX. LENGTH	MAX. DIAMETER	RESISTANCE RANGE MIN.	RESISTANCE RANGE MAX.
FP32	3-4	29/32"	11/32"	100Ω	39K
FP33	5-6	1-5/16"	11/32"	100Ω	47K
FP34	7-8	1-23/32"	11/32"	100Ω	56K
FP35	10	2-3/32"	11/32"	100Ω	68K

ULTRA LOW VALUES – 0.27Ω TO 10Ω

Ultra low value resistors produced by an exclusive process in which passive conductive metal film is diffused in a new arrangement of materials upon the surface of a special ceramic substrate.

TYPE	LENGTH	DIAMETER	LEADS	WATTS	RESISTANCE RANGE
A20	.400" ± .010"	.145" ± .005"	.032" ± .002"	1/2	0.27Ω-10Ω
A31	11/16" ± 1/32"	13/64" ± 1/64"	.032" ± .002"	1-1/2	0.27Ω-27Ω
A32	57/64" ± 1/32"	21/64" ± 1/64"	.032" ± .002"	3	0.27Ω-27Ω

HIGH FREQUENCY LOAD RESISTORS (Tubes)

Carbon film resistors with inherent stability and excellent high frequency characteristics for applications involving high power, high accuracy RF measurements. Ideally suited as non-reactive radio frequency terminations for many applications.

Specifications show only a few standard types available. We invite your inquiries regarding special applications.

TYPE	LENGTH	O. D.	TERMINAL	I. D.	WATTAGE IN FREE AIR (25°C)
I-273	18" ± 1/16"	1.750" ± .010"	3/4"	1.250" ± .010"	120
I-270	12" ± 1/16"	.875" ± .010"	3/4"	.625" ± .010"	40
I-272	5" ± 1/32"	.562" ± .006"	1/2"	.375" ± .010"	10
I-240	Max. 2.000" Min. 1.937"	.252" .240"	1/4"	Solid Rod	2

ATTENUATOR PADS Write for Bulletin AP13 covering our extensive line of pads.

For information on resistors produced by Dale Welwyn Group, contact:

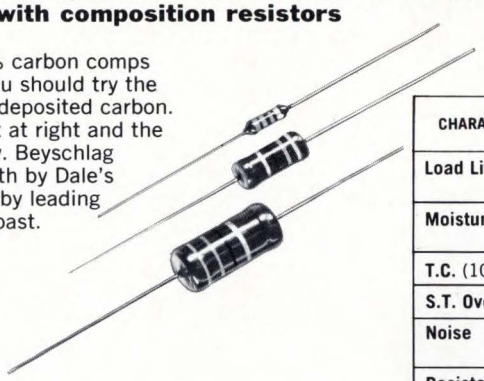
COLUMBUS, NEBRASKA – Box 609 – Phone 402-564-3131 • WESTLAKE, OHIO – Box G – Phone 216-871-8900

DEPENDABLE DALE® RESISTORS

from Dale's Welwyn Group

BEYSCHLAG SUPERIOR QUALITY 5% DEPOSITED CARBON RESISTORS priced competitively with composition resistors

If you are using the best 5% carbon comps made in North America...you should try the world's best semi-precision deposited carbon. Check the comparison chart at right and the general specifications below. Beyschlag resistors are stocked in depth by Dale's Welwyn Group and handled by leading distributors from coast to coast.



CHARACTERISTIC	CARBON COMP per MIL-R-11 limits	BEYSCHLAG
Load Life	Avge. Allowable ±6.0% Max. Allowable ±10.0%	Less than 1.0%
Moisture Resistance	Avge. Allowable ±10.0% Max. Allowable ±15.0%	Less than 1.5%
T.C. (10Ω to 1 Meg.)	600 to ±1800 PPM*	−250 to −500 PPM
S.T. Overload	±2.5%	Less than 0.5%
Noise	Not applicable in Mil. specifications	0.3 microvolt/v**
Resistance to Soldering Heat	±3.0%	Less than 0.2%

*Depending on value and temperature. **Depending upon type and value.

GENERAL SPECIFICATIONS

Load Life ΔR/R 1000 hours: Less than 2.0%. Continuous operation @ 40°C results in maximum 1.0% change

Shelf Life ΔR/R: < 0.5% after 12 months

Moisture Resistance ΔR/R: < 1.0%

Solderability ΔR/R: < 0.5% ±0.1Ω

Voltage Coefficient: < 5 PPM per Volt

Short Time Overload ΔR/R: < 1.0%

Shock ΔR/R: < 0.5% ± 0.1Ω

Insulation Resistance: < 10^{10} Ω

H.F. Vibration ΔR/R: < 0.5% ± 0.1Ω

Terminal Strength ΔR/R: < 0.2% ± 0.1Ω

Low Temp. Operation ΔR/R: < 0.2% ± 0.1Ω

TYPE	WATTS @ 70°C	MAX. BODY LENGTH (Inches)	DIA. (Inches)	LEAD DIA. (Inches)	MAX. WORKING VOLTAGE	DIEL. VOLTAGE DC	RESISTANCE RANGE TOL.	MIN.	MAX.
SBA	1/8	0.160	0.063	0.016	150	300V	±5%	10Ω	220K
SBB	1/4	0.250	0.098	0.024	250	500V	±5% ±2%	1Ω 10Ω	1M 1M
SBC	1/2	0.350	0.114	0.028	350	700V	±5% ±2%	1Ω 1Ω	1M 1M
SBE	3/4	0.470	0.157	0.032	500	1000V	±5% ±2%	1Ω 1Ω	10M 5.1M
SBF	1	0.554	0.236	0.032	630	1000V	±5% ±2%	4.7Ω 4.7Ω	22M 5.1M
SBH	2	0.810	0.354	0.032	750	1000V	±5% ±2%	10Ω 10Ω	22M 5.1M

HIGH VOLTAGE OXIDE RESISTORS FROM 2 MEG TO 150,000 MEG.

High Voltage oxide resistors with stability and reliability in high voltage and pulse applications far exceeding that obtained from components previously available. Continuous voltage stress up to 8,000 volts per inch can be applied. In addition, voltage pulses up to 3-1/2 times the magnitude of the continuous rating may be applied without deterioration of the element.

TYPE	WATTS @ 40°C	TERMINATION	DIMENSIONS L	D	WORKING VOLTAGE	PULSE VOLTAGE	TEMP. RISE	RESISTANCE RANGE TOL.	MIN.	MAX.
F43D	1/2	Standard Wire Leads	1.094"	0.312"	4KV	15KV	26°C	±2%	2M	3,000M
F43KU	1/2	Comb. Lead/Threaded Cap	1.188"	0.312"	4KV	15KV	26°C	±5%	2M	100,000M
***F43TU**	1/2	Threaded Cap, Both Ends	1.280"	0.312"	4KV	15KV	26°C	±10%		
F44D	1	Standard Wire Leads	2.000"	0.312"	14KV	50KV	36°C	±2%	2M	10,000M
F44KU	1	Comb. Lead/Threaded Cap	2.094"	0.312"	14KV	50KV	36°C	±5%	2M	150,000M
***F44TU**	1	Threaded Cap, Both Ends	2.187"	0.312"	14KV	50KV	36°C	±10%		

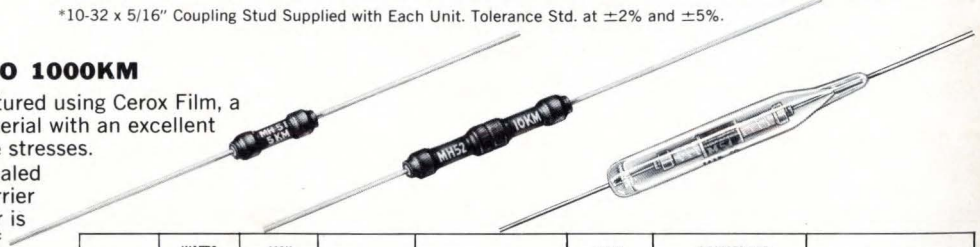
*10-32 x 5/16" Coupling Stud Supplied with Each Unit. Tolerance Std. at ±2% and ±5%.

ULTRA HIGH VALUES–TO 1000KM

High Value resistors are manufactured using Cerox Film, a highly stable thick resistance material with an excellent voltage coefficient at high voltage stresses.

Type M51 resistors are vacuum sealed in a glass envelope to which a barrier coating of special silicone lacquer is applied to minimize the effects of surface moisture or contamination.

Types MH51 and MH52 are encapsulated in a sleeve of irradiated polyolefin heat shrunk for intimate contact with the capped body.



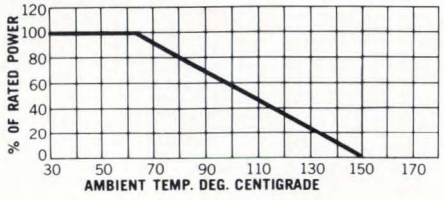
TYPE	WATTS @ 40°C	MAX. VOLT	LENGTH	DIAMETER	LEAD DIA.	RESISTANCE RANGE	TOLERANCE
MH51	1/4	1500	.50"	.140" ± .010"	.028"	30M- 5KM	10%, 20%
MH52	1/2	3000	.88"	.140" ± .020"	.028"	60M-10KM	1%, 2%, 5%
M51	1/2	500	1.88"	.216" ± .006"	.020"	10M-1000KM	1%, 2%, 5%, 10%

THICK FILM NETWORKS

- Made for use with automatic insertion and testing equipment.
- Complex circuits in small space.
- Flame retardant coated package.
- Coated model available double width with up to 24 leads on CDP style.
- Custom circuits and packages available.
- Laser trimmed for high quality and stability.

DERATING

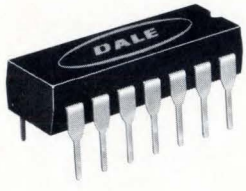
Dale resistor networks have an operating temperature range of –65°C to +150°C. They must be derated at high ambient temperatures according to the curve at right.

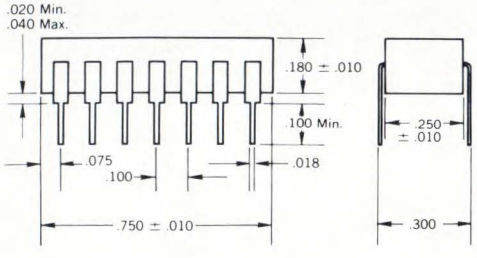


SPECIFICATIONS

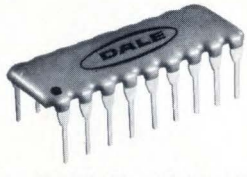
Resistance Range: 10Ω to 1 Megohm
Power Rating: At 70°C, ⅛ watt maximum/resistor – package rating; MDP-14=1 watt, MDP-16=1¼ watts, CDP-16=1⅛ watts, CDP-18=1¼ watts, CSP-6=1½ watts, CSP-8=2 watts, CSP-10=2½ watts.
Tolerance: ±1%, ±2%, ±5%, ±10%
Temperature Coefficient: ±50-250 PPM/°C (200 PPM/°C standard)
Ratio Match: ±0.1%
Operating Voltage: 75 VDC typical (2 volts max. per 0.001" of resistor length)
T.C. Tracking: 25 PPM/°C (in resistors of similar geometry and similar value)
Voltage Coefficient: As low as ±15 PPM/V, depending on value and geometry
Noise: Depends on value and geometry
Stability: ±1%/year
Operating Temperature Range: –55°C to +150°C

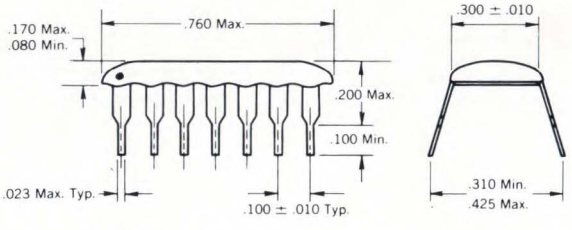
■ TYPE MDP 14 & 16 (Molded)





■ TYPE CDP 14, 16 & 18 (Coated)

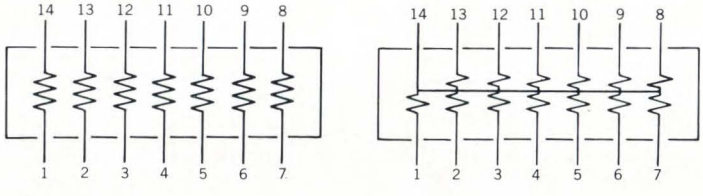




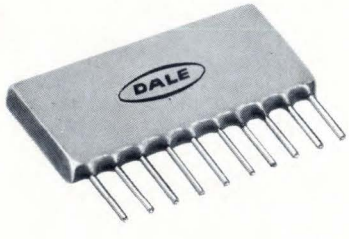
Pin #1 is identified by a dot or notch.

MDP 16 identical to MDP 14 package except that it has 16 pins and is .850 long ± .010.

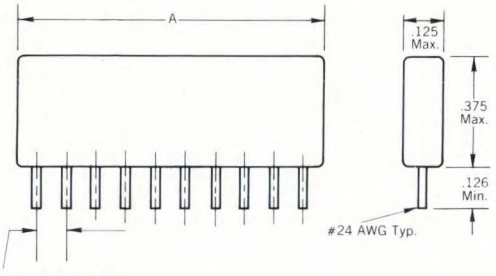
CDP 16 & 18 identical to CDP 14 package except that they have 16 and 18 pins and are .860 and .960 max. long.



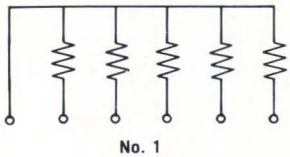
■ TYPE CSP6, 8 & 10 (Coated)



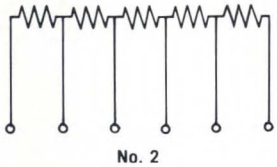
LENGTH "A"
CSP10 = 1.000
CSP8 = .975
CSP6 = .725



PIN SPACING
CSP10 = .100 ± .010
CSP8 = .125 ± .010
CSP6 = .125 ± .010



No. 1



No. 2

DEPENDABLE DALE® MICROCIRCUITS

THICK FILM MICROCIRCUITS

FEATURES

- Custom design allows you to specify design tolerance, packaging, environmental requirements.
- Engineering assistance for production design.
- Specialists in design of networks for high power dissipation.
- Standard dual in-line packaging or modular packaging with screened silicone coating and choice of lead types.
- Wide choice of pre-conditioning options.

ELECTRICAL CAPABILITIES*

Resistors

Tolerance: To 1% standard. Specials available.
Matching Resistance Ratio: ±0.2%
Temperature Coefficient: ±100-250 PPM/° C
T.C. Tracking: Down to 25 PPM
Resistivity: 10 ohms to 100KΩ/sq.
Resistance: 1 ohm to 1 Meg.
Stability: 1%/yr.
Power Dissipation: Depending on design and package requirements

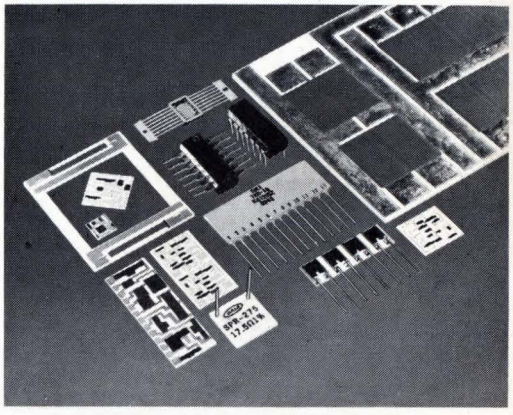
Capacitors

Tolerance: ±10% standard. **Voltage:** 50-100 VDC **Capacitance:** 10 pf-.1 mfd

PHYSICAL

Capacitors: Tantalum, Ceramic (W or NPO characteristic)
Substrates: Alumina, Beryllia
Terminations: Wire Leads, Ribbon Leads or Solder Pads
Conductors and Land Areas: Platinum Gold, Palladium Gold, Gold, Palladium Silver
Crossovers: As required
Packaging: Dual in-line, single in-line, custom
Coating: Screened Silicone, epoxy, custom

*For tighter parameters, contact Microcircuit Department.



PRECONDITIONING OPTIONS

- Power Aging
- Temperature Cycling
- Temperature & Power
- Temperature Aging
- Short Time Overload
- Thermal Shock
- X-Ray

To obtain prototypes for your circuit...

contact your Dale representative or phone or write Dale at the address below. Dale's Microcircuit Department is geared to assist you with every phase of design – providing the shortest possible leadtime between concept and production ready component.

THICK FILM CHIP RESISTOR

Resistance Range: 100Ω to 300K. 10Ω to 5 Meg. by special order
Tolerance: ±20%, ±10%, ±5%, ±2%, ±1%
Temp. Coefficient: ±200 PPM (−55° C to +150° C) +25° C Reference
Load Life: 1% ΔR, 1000 hours at 80° C
Humidity: 1% ΔR per MIL-STD-202C
Temp. Cycling: −55° C to +150° C, ±0.5% ΔR
Operating Voltage: 100 VDC maximum

PHYSICAL	SIZE CODE	POWER RATING
.050 x .050	550	75mw
.050 x .075	575	100mw
.050 x .100	5100	150mw
.050 x .150	5150	300mw

WIREWOUND and FILM PACKAGED NETWORKS

FEATURES

- Choice of linear wirewound, bobbin wirewound, metal film, carbon film or cermet elements
- Less components to stock or handle
- Reduced inspection time
- Ease of assembly
- Matched resistors cannot be mixed or lost
- Complete environmental protection
- Dale networks meet or exceed requirements of MIL-R-26, MIL-R-93 or MIL-R-10509, depending on type of element used
- Packaged to meet your requirements

GENERAL RESISTOR ELECTRICAL CAPABILITIES

	WIREWOUND	FILM (Carbon & Metal)
Power Rating	.1 to 10 W	.02 to .5 W
Resistance Range	1 ohm to 1.5 Meg.	5 ohms to 5 Meg.
Tolerance	.02% to 1%	.1% to 1%
Tolerance Match	.005%	.05%
Temp. Coefficient	5 PPM/°C from 0° C to +75° C	25 PPM/° C
Temp. Coefficient Match	2 PPM/° C from 0° C to +75° C	7 PPM/° C
Resistance Stability	.005%/yr.	.03%/yr.
Operating Temp.	−65° C to +145° C	−55° C to +175° C

LADDER NETWORKS

- **Output Accuracy:** ± .05% full scale accuracy or ± 1/2 least significant bit, whichever is less.
- **Output Variation with Temp.:** ± .1% full scale accuracy or ± 1 least significant bit, whichever is less.
- **Operating Temp. Range** (For Accuracies Specified Above): −55° C to +70° C (Film Type) −55° C to +125° C (Wirewound Type).
- **Input Resistance** (All inputs connected): 1KΩ to 500KΩ
- **Output Resistance** (All inputs grounded): 250Ω to 125KΩ
- **Insulation Resistance:** 100 Megohms minimum.
- **Terminals:** Solderable or weldable wire leads.
- **Packaging:** Epoxy or Silicone resin potting. Transfer molded, Can be encapsulated. Other types of special packaging available to meet your requirements.

BINARY DIGITAL-TO-ANALOG LADDER NETWORKS

Resistor Parameters for meeting 4 and 8 bit dimensional requirements

	WIREWOUND	FILM
Power Rating	1/8 watt from −55° C to +125° C, derated linearly to 0 at +145° C	1/2 watt from −55° C to +70° C, derated linearly to 0 at +145° C.
Temp. Coefficient	0 ±20 PPM/° C from −55° C to +125° C. Lower T.C.'s available upon request	400 PPM/° C max. T. C.'s available down to 25 PPM/° C
Heat Rise	20° C max. at rated power	60° C max. at rated power

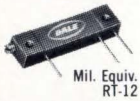
DALE ELECTRONICS, INC., P.O. Box 609 • COLUMBUS, NEBRASKA 68601 • PHONE: 402-564-3131 • TWX: 910-626-8314

DEPENDABLE DALE® TRIMMERS

TRIMMER QUICK REFERENCE GUIDE

■ Fastpack DIP models for automatic and hand insertion ■ Mil-style construction methods used throughout
■ Expanded low-priced Econo-Trim series with sealability for pennies more ■ Panel mount models available in most series

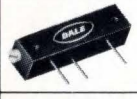
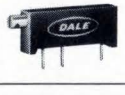
MILITARY GRADE TRIMMER POTENTIOMETERS (High Temperature, Precision)

SERIES	ILLUSTRATION	MODEL	SEAL† TYPE	CONFIGURATION	STANDARD RESISTANCE & TOLERANCE	POWER RATING	OPERATING TEMP. RANGE	ADJUSTMENT TURNS	HEIGHT	WIDTH	LENGTH
600	 Mil. Equiv. RT-10	691 680 697* 692*	1 1 2 2	• Alternate position Printed Circuit Pins 22 AWG • Printed Circuit Pins 22 AWG • 28 AWG Stranded Teflon Leads • 26 AWG Solid Leads	10 ohms to 100K ohms ±5%	1 watt at 70° C, derated to 0 at 175° C	−65° C to 175° C	15±2	.18	.32	1.00
1200	 Mil. Equiv. RT-11	1287 1288* 1299*	1 2 1	• Printed Circuit Pins 21 AWG • Stranded Teflon Leads 28 AWG • Spade Type Solder Lug	10 ohms to 100K ohms ±5%	1 watt at 70° C, derated to 0 at 175° C	−65° C to 175° C	25±2	.28	.31	1.25
1600	 Mil. Equiv. RT-12	1680 1697* 1692* 1690*	1 2 2 2	• Printed Circuit Pins 21 AWG • Stranded Teflon Leads 28 AWG • 22 AWG Solid Wire • Solder Lug	10 ohms to 100K ohms ±5%	1 watt at 70° C, derated to 0 at 175° C	−65° C to 175° C	22±3	.19	.32	1.25
1800	 Mil. Equiv. RTR-12	1880 1897	3 3	• Printed Circuit Pins, Gold Plated Nickel • 28 AWG Stranded Teflon Insulated Leads	10 ohms to 20K ohms ±5%	.75 watt at 85° C, derated to 0 at 150° C	−65° C to 150° C	22±3	.19	.32	1.25
5000	 Mil. Equiv. RT-22	5050 5080 5091 5087	2 1 1 1	• Stranded Teflon Leads 30 AWG • Printed Circuit Pins 21 AWG, Edge Mount • Printed Circuit Pins 21 AWG • Printed Circuit Pins 21 AWG, Side Adjust	10 ohms to 50K ohms ±5%	1 watt at 70° C, derated to 0 at 175° C	−65° C to 175° C	25±2	.19 .22 .22 .22	.50 .50 .50 .50	.50 .50 .50 .50
5800	 Mil. Equiv. RT-24	5850 5891 5880 5887	2 1 1 1	• Stranded Teflon Leads 30 AWG • Printed Circuit Pins 22 AWG, Base Mount • Printed Circuit Pins 22 AWG, Edge Mount • Printed Circuit Pins 22 AWG, Side Adjust	10 ohms to 50K ohms ±5%	1 watt at 70° C, derated to 0 at 175° C	−65° C to 175° C	25±3	.145 .150 .145 .150	.375 .375 .375 .375	.375 .375 .375 .375

*Indicates model is also available in Panel Mount version.

COMMERCIAL/INDUSTRIAL GRADE POTENTIOMETERS

WIREWOUND ELEMENT

SERIES	ILLUSTRATION	MODEL	SEAL† TYPE	CONFIGURATION	STANDARD RESISTANCE & TOLERANCE	POWER RATING	OPERATING TEMP. RANGE	ADJUSTMENT TURNS	HEIGHT	WIDTH	LENGTH
2100		2187 2188* 2199*	4 4 4	• Printed Circuit Pins 21 AWG • Stranded Vinyl Leads 28 AWG • Spade Type Solder Lug	10 ohms to 100K ohms ±10%	1 watt at 70° C, derated to 0 at 125° C	−65° C to 125° C	25±2	.28	.31	1.25
2300		2317 2319	5 5	Printed Circuit Terminals, Gold Plated Hook-type Solder Lugs, Gold Plated	10 ohms to 50K ohms ±10%	0.5 watt at 25° C, derated to 0 at 105° C	−55° C to 105° C	15 turns nominal	.36	.28	1.00
2400		2487 2417	4 5	Printed Circuit Terminals, Gold Plated	10 ohms to 50K ohms ±10%	1 watt at 40° C, derated to 0 at 125° C	−55° C to 125° C	20 turns nominal	.31	.16	.75
2600		2619 2617	5 5	Printed Circuit Terminals, Gold plated, machine insertable Printed Circuit Terminals, Gold plated, hand insertable	10 ohms to 50K ohms ±10%	1 watt at 70° C, derated to 0 at 150° C	−65° C to 150° C	20 turns nominal	.19	.25	.75
2700		2721 2723 2724	5 5 5	Printed Circuit Terminals, Gold Plated	10 ohms to 50K ohms ±10%	1.0 watt at 70°C, derated to 0 at 150°C	−65° C to 150° C	20 turns nominal	.25	.165	.75

*Indicates model is also available in Panel Mount version.

DEPENDABLE DALE® TRIMMERS

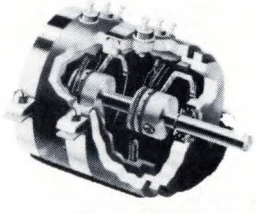
COMMERCIAL/INDUSTRIAL GRADE POTENTIOMETERS

CERMET ELEMENT

SERIES	ILLUSTRATION	MODEL	SEAL† TYPE	CONFIGURATION	STANDARD RESISTANCE & TOLERANCE	POWER RATING	OPERATING TEMP. RANGE	ADJUSTMENT TURNS	HEIGHT	WIDTH	LENGTH
8400		8487 8417	4 5	Printed Circuit Terminals, Gold Plated	10 ohms to 2 Megohms ±10% 100Ω thru 500K ±20% all other values	.75 watt at 25° C, derated to 0 at 125° C	−55° C to 125° C	20 turns nominal	.31	.16	.75
8600		8619 8617	5 5	Printed Circuit Terminals, Gold plated, machine insertable Printed Circuit Terminals, Gold plated, hand insertable	10 ohms to 2 Megohms ±10% 100Ω thru 500K ±20% all other values	.75 watt at 25° C, derated to 0 at 125° C	−55° C to 125° C	20 turns nominal	.19	.25	.75
8700		8781 8783 8784	5 5 5	Printed Circuit Terminals, Gold Plated	10 ohms to 2 Megohms ±10% 100Ω thru 500K ±20% all other values	1.0 watt at 70° C, derated to 0 to 125° C	−55°C to 125°C	20 turns nominal	.25	.165	.75
800		887 817	4 6	Printed Circuit Pins 26 AWG	10 ohms to 2 Megohms ±10% 100Ω thru 500K ±20% all other values	.3 watt at 85° C, derated to 0 at 150° C	−65° C to 150° C	10 turns nominal	.15	.10	.50
85		85 85A	5 5	• Printed Circuit Terminals, Gold Plated, machine insertable • Printed Circuit Terminals, Gold Plated, hand insertable	10 ohms to 1 Megohm ±20%	.5 watt at 25° C, derated to 0 at 125° C	−55° C to 125° C	12 turns nominal	.19	.265	.28
87		87 87A	5 5	• Printed Circuit Terminals, Gold Plated, machine insertable • Printed Circuit Terminals, Gold Plated, hand insertable	10 ohms to 1 Megohm ±20%	.5 watt at 25°C, derated to 0 at 125° C	−55° C to 125° C	Single turn	.19	.265	.28

†SEAL TYPE IDENTIFICATION

1. Immersion proof per MIL-R-27208
2. Humidity proof per MIL-STD-202, Method 106
3. Sealed per MIL-R-39015
4. Humidity proof per MIL-STD-202, Method 103, Condition B
5. Immersion proof – sealed for board washing, leak tested in 70°C water
6. Immersion proof per MIL-R-22097



PRECISION POTENTIOMETERS – SINGLE TURN *(Write for Catalog B)*

• Precision machined anodized aluminum cups • Molded Diallyl Phthalate liners • Welded tap and terminal construction • Precious metal wipers and slip rings • Flush clamp bands • Gold-plated terminals • Precision sleeve or ball bearings • Centerless ground stainless steel shafts • Single or ganged units.

SPECIFICATIONS:

- Meet requirements of MIL-R-12934 and NAS-710
- Eight physical sizes, 3/4" to 3" diameter
- Electrical angles and functions to specification
- Special mechanical configurations available

ORDERING INFORMATION

WHERE TO ORDER:
From your Authorized Dale Distributor, your Dale Representative, or Dale Electronics, Inc., Box 609, Columbus, Nebraska 68601 – PHONE 564-3131 AREA CODE 402 TWX 910-626-8314

TERMS: 1% 10 – Net 30 **F.O.B. POINT:** Columbus, Nebraska

SPECIAL CHARGES:
Minimum Order Charge..... $35.00
Minimum Item Charge..... $15.00

DALE ELECTRONICS, INC.
P. O. Box 609, Columbus, Nebraska 68601
A subsidiary of The Lionel Corporation

DEPENDABLE DALE® CONNECTORS

SERIES EBT 156

PHYSICAL and ELECTRICAL

Number of Contacts: 8, 10, 12, 15, 18 or 22
Contact Spacing: .156″
Board Thickness: .054″ to .070″
Board Slot Depth: .330″ **Current Rating:** 5 amps
Test Voltage between Contacts: At Sea Level: 1800 VRMS
At 70,000 feet: 450 VRMS
Insulation Resistance: 5000 meg. min.
Contact Resistance: 30 millivolts max. at rated current

COMPONENT MATERIAL

Body: Glass-filled phenolic per MIL-M-14, Type MFH, black
Contacts: Nickel silver per QQ-C-585, alloy 770, spring temper. Gold flash optional.
Polarizing Key: Glass-filled nylon
Optional Threaded Mounting Insert: Nickel plated brass. (Type Y)
Optional Floating Mounting Bushing: Cadmium plated brass. (Type Z)

APPLICATION For use with 1/16″ printed circuit boards requiring an edgeboard type connector on .156″ centers.

SERIES EBTL 050

PHYSICAL and ELECTRICAL

Number of Contacts: 8, 16, 20, 25, 32, 50 or 64 per side
Contact Spacing: .050″
Board Thickness: Size 1 = .027″-.035″
Size 2 = .056″-.068″
Board Slot Depth: .200″ **Current Rating:** 0.5 amp
Test Voltage between Contacts: At Sea Level: 1200 VRMS
At 50,000 feet: 675 VRMS
Insulation Resistance: 5000 meg. min.
Contact Resistance: 10 millivolts max. at rated current

COMPONENT MATERIAL

Body: Glass-filled phenolic per MIL-M-14, Type MFH, black
Contact Backer Strips: Epoxy glass laminate per MIL-P-18177, Type GEE, black
Contacts: Beryllium copper per QQ-C-533, alloy 172. Gold plate per MIL-G-45204.
Polarizing Key: Polycarbonate

APPLICATION For use with 1/32″ and 1/16″ printed circuit boards in integrated thin film, and semiconductor circuitry with .050″ contact spacing.

SERIES EB 7

PHYSICAL and ELECTRICAL (Featuring Bifurcated Bellow Contacts)

Number of Contacts:
Single Row (Single Readout) – 6, 10, 15, 18 and 22
Double Row (Double Readout) – 12, 20, 30, 36 and 44
Contact Spacing: .156″ **Board Thickness:** .054″ to .070″
Board Insertion Depth:
Single Readout Contact – .300″
Double Readout Contact – .260″

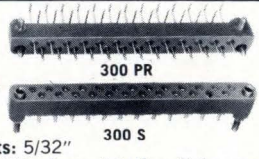
Current Rating: 5 amps
Test Voltage between Contacts: At Sea Level: 1800 VRMS
At 70,000 feet: 450 VRMS
Insulation Resistance: 5000 meg. min.
Contact Resistance: 30 millivolts max. at rated current

COMPONENT MATERIAL

Body: Glass-filled diallyl phthalate per MIL-P-19833, Type GDI-30F, green
Contacts: Phosphor Bronze per QQ-B-750 with .000030 min. gold plated
Polarizing Key: Nylon
Optional Threaded Mounting Insert: Brass, nickel plated
Optional Floating Mounting Bushing: Brass, cadmium plated

APPLICATION For use with 1/16″ printed circuit boards requiring an edgeboard type connector on .156″ centers.

SERIES 300



PHYSICAL and ELECTRICAL

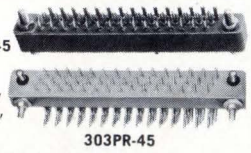
Number of Contacts: 7, 15, 19 and 25
Contact Spacing: 0.250″, staggered rows provide a .125″ grid.
Contact Gauge: #20 AWG
Minimum Creepage Path between Contacts: 5/32″
Minimum Air Space between Contacts: 7/64″ **Current Rating:** 7.5 amps
Breakdown Voltage: At Sea Level: 3600 VRMS
At 70,000 feet: 975 VRMS

COMPONENT MATERIAL

Contact Pin: Phosphor Bronze
Contact Socket: Phosphor Bronze
Contact Plating: Gold Plated
Guide Pins: Stainless steel, passivated
Standard Body: Glass-filled diallyl phthalate per MIL-P-19833, Type GDI-30F green. Other body material supplied upon request.

APPLICATION Where permanent mounting of male connector to printed circuit board is required with mating female connector available.

SERIES 303



PHYSICAL and ELECTRICAL

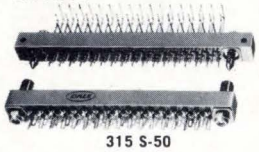
Number of Contacts: 45
Contact Gauge: #22 AWG
Minimum Creepage between Contacts: 1/16″
Minimum Air Space between Contacts: 1/64″
Contacts, Center to Center: .050″
Voltage Breakdown, Contact to Contact and Contact to Ground:
At Sea Level: 1200 VRMS • At 70,000 feet: 325 VRMS
Current Rating: 3 amps

COMPONENT MATERIAL

Contact: Phosphor Bronze, Gold Plated
Contact Plating: Gold Plated
Studs, Pilot Pins, Washers, Nuts: Corrosion-resistant steel, passivated
Standard Body: Glass-filled diallyl phthalate per MIL-M-19833, Type GDI-30F, green

APPLICATION For use in equipment requiring printed circuit connectors of the dip solder type with mating female connector.

SERIES 315



PHYSICAL and ELECTRICAL

Number of Contacts: 50
Contact Termination: Male contacts available in right angle dip solder or solder cup termination
Contact Spacing: 0.200″, staggered rows provide a 0.100″ grid
Contact Gauge: #20 AWG
Minimum Creepage Path between Contacts: 7/64″
Minimum Air Space between Contacts: 1/16″
Current Rating: 7.5 amps
Breakdown Voltage, Contact to Contact: At Sea Level: 2500 VRMS
At 70,000 feet: 600 VRMS

COMPONENT MATERIAL

Contact Pin: Phosphor Bronze, Gold Plated
Contact (closed entry) Socket: Phosphor Bronze, Gold Plated
Guides and Hardware: Stainless steel, passivated
Body: Glass-filled diallyl phthalate per MIL-P-19833, Type GDI-30F, green

APPLICATION Designed for dip solder printed circuit applications requiring 50 contacts. Also available with solder cup termination for rack and panel applications.

SERIES 330

PHYSICAL and ELECTRICAL

Number of Contacts: 12
Contact Spring: .150″
Contact Size: .040″ dia.
Minimum Creepage Path between Contacts: 7/64″
Minimum Air Space between Contacts: 7/64″
Current Rating: 7.5 amps
Breakdown Voltage: At Sea Level: 2500 VRMS
At 70,000 feet: 600 VRMS

COMPONENT MATERIAL

Contact Pin: Phosphor Bronze, Gold Plated
Contact Socket: Phosphor Bronze, Gold Plated
Eyelets: Brass, Cadmium Plated
Body: Phenolic, CFG (black)

APPLICATION Where permanent mounting of male connector to a printed circuit board is required with mating female connector available. Polarization available.

SERIES M20

PHYSICAL and ELECTRICAL

Number of Contacts: 7, 9, 14, 18, 20, 26, 34, 41, 50, 75
Contact Spacing: 0.150″
Contact Gauge: #20 AWG
Minimum Creepage Path between Contacts: 1/8″
Minimum Air Space between Contacts: 3/32″
Current Rating: 7.5 amps
Breakdown Voltage: At Sea Level: 3000 VRMS
At 70,000 feet: 675 VRMS

COMPONENT MATERIAL

Contact Pin: Brass
Contact Socket: Phosphor Bronze (beryllium copper also available).
Contact Plating: Gold Plated
Screwlocks: Stainless steel
Standard Body: Glass-filled diallyl phthalate per MIL-P-19833, Type GDI-30F, green. Other materials available on request.
Guides: Stainless steel

APPLICATIONS For use in instrumentation, avionics, communications, missiles, guidance systems, computers, portable equipment and test equipment.

DEPENDABLE DALE® CONNECTORS

SERIES SM20

PHYSICAL and ELECTRICAL

Number of Contacts: 5, 7, 11, 14, 20, 26, 34, 42, 50, 75
Contact Spacing: 0.125″
Contact Gauge: #20 AWG
Minimum Creepage Path between Contacts: 5/64″
Minimum Air Space between Contacts: 3/64″
Current Rating: 7.5 amps
Breakdown Voltage: At Sea Level: 2000 VRMS
At 70,000 feet: 500 VRMS

COMPONENT MATERIAL

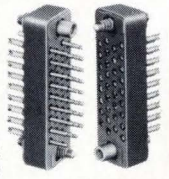
Contact Pin: Brass
Contact Socket: Phosphor Bronze. Beryllium copper also available.
Contact Plating: Gold Plated
Guides: Stainless steel, passivated
Screwlocks: Stainless steel, passivated
Standard Body: Glass-filled diallyl phthalate per MIL-P-19833, Type GDI-30F, green. Other body material supplied upon request.

APPLICATIONS For use wherever space is at a premium and a high quality connector is required in avionics, automation, communications, controls, instrumentation, missiles, computers and guidance systems.

SERIES MM22 and MM24

PHYSICAL and ELECTRICAL

Number of Contacts: 5, 7, 9, 11, 14, 20, 26, 29, 34 and 44
Contact Spacing: 3/32″
Contact Gauge: MM22 Series = 22 gauge. • MM24 = 24 gauge
Minimum Creepage Path between contacts: 5/64″
Minimum Air Space between contacts: 3/64″
Current Rating: MM22 Series = 5 amps
MM24 Series = 3 amps
Breakdown Voltage: At Sea Level: 2000 VRMS
At 70,000 feet: 500 VRMS



COMPONENT MATERIAL

Contact Pin: Phosphor Bronze
Contact Socket: Phosphor Bronze
Contact Plating: Gold Plated
Screwlocks: Stainless steel, passivated
Guides: Brass, gold plated

Standard Body: Glass-filled diallyl phthalate per MIL-P-19833, Type GDI-30F, green. Other body material supplied upon request.

APPLICATIONS Especially suited for use in airborne, instrumentation and portable equipment applications or wherever the following requirements must be met: Minimum space and weight without sacrifice of performance, high quality materials, long service life, high vibration and shock resistance, and positive locking.

SERIES PJ

PHYSICAL and ELECTRICAL

Current Rating: 7.5 amps
Socket Contact Engages: 0.080″ dia. probe

COMPONENT MATERIAL

Standard Body: Glass-filled diallyl phthalate per MIL-M-19833, Type GDI-30F, green.
Pin Contacts: Brass
Socket Contacts: Phosphor Bronze
Contact Plating: Gold Plated

APPLICATION Printed circuit checkout and testing.

MODEL 500 SR5

PHYSICAL and ELECTRICAL

Number of Contacts: 5
Contact Spacing: 0.150″
Contact: Accepts .080″ dia. probe
Current Rating: 5 amps
Breakdown Voltage: At Sea Level: 3000 VRMS
At 70,000 feet: 676 VRMS

COMPONENT MATERIAL

Contact Socket: Phosphor Bronze
Contact Plating: Gold Plated
Standard Body: Glass-filled diallyl phthalate per MIL-P-19833, Type GDI-30F, green. Other materials available upon request.

APPLICATION Permanent or semi-permanent test points for checkout and testing of printed circuits.

For complete information, write or phone:

DALE ELECTRONICS, INC.

P. O. Box 180 • YANKTON, SOUTH DAKOTA 57078
PHONE: 605-665-9301

SERIES QX32

PHYSICAL and ELECTRICAL

Minimum Creepage between Contacts: 9/64″
Minimum Air Space between Contacts: 7/64″
All male contacts are .093″ in diameter. Current ratings vary only because some solder cups are made for #12 AWG and others for #16 AWG.

Voltage Breakdown Contact to Contact (#12 AWG solder cup): At Sea Level: 3300 VRMS
At 70,000 feet: 712 VRMS
Current Rating: 23 amps #12 AWG • 13 amps #16 AWG
Voltage Breakdown Contact to Contact (#16 AWG solder cup): At Sea Level: 3600 VRMS • At 70,000 feet: 750 VRMS

COMPONENT MATERIAL

Closed Entry Socket Contacts: Phosphor Bronze*, Gold Plated
Inserts and Hardware: Stainless steel, passivated*
"O" Ring: Synthetic rubber **Boot:** Neoprene
Body Material: Glass-filled diallyl phthalate per MIL-M-19833, Type GDI-30F, green. Consult factory for other materials.
For use with QX32S, a shorting plug to ground static electricity is available. Contact factory for details.
*Contact factory. Beryllium copper can be specified to ordinance drawing 10182288.

APPLICATION Used in the firing system of missiles.

SERIES 400 and 401

PHYSICAL and ELECTRICAL

Voltage Breakdown, contact to contact:
At Sea Level: 2000 VRMS
At 70,000 feet: 500 VRMS
Minimum Creepage Path between Contacts: 5/64″
Minimum Air Space between Contacts: 3/32″
Contacts, center to center: .150″

COMPONENT MATERIAL

Molded Body: Glass-filled diallyl phthalate per MIL-M-19833, Type GDI-30F, green. For other materials, contact factory.
Hood: Aluminum, anodized (on 401PF)
Shells, Mounting Nut and Coupling Nut: Aluminum, clear anodized.
Contact Pins: Brass, Gold Plated
Contact Socket: Phosphor Bronze, Gold Plated
Lock Ring: Brass, cadmium plated
Retaining Ring: Stainless steel **Protective Cap:** Polyvinyl

APPLICATION Series 400: For use in equipment requiring a 41, 51 or 55 pin sealed connector, with a mating non-sealed female connector. **Series 401:** For identical applications where hood is required. Mates with Series 400RM connectors.

SERIES S20

COMPONENT MATERIAL

Molded Body: Orlon-filled diallyl phthalate per MIL-M-14F, Type SDI-5 (blue), furnished as standard.
Contact Pin: Brass, Gold Plated
Contact Socket: 4 tine beryllium copper, gold plated
Coaxial Insulator: Teflon
Coaxial Socket Body: Brass, silver plating standard. Gold also available.
Coaxial Socket Contact: Beryllium copper, gold plated
Shell and Retaining Plate: Aluminum, cadmium plated and gold iridited

Coaxial Contacts are for use with Adapter No. 2710-10 by Cannon or No. 5988 by Greymar and fit RG 188/U cable.

S20P-41 and S20S-41

PHYSICAL and ELECTRICAL

Minimum Creepage Path between Contacts: 1/8″
Minimum Air Space between Contacts: 1/16″
Contacts, center to center: 3/32″
Ambient Temperature Range: −67° F to +250° F
Approximate Weight: S20S-41 = 1.5 oz.
S20P-41 = 1.0 oz.

Voltage Breakdown, contact to contact: At Sea Level: 2500 VRMS
At 70,000 feet: 600 VRMS
Current Rating: 10 amps

S20P-13-4R and S20S-13-4R

PHYSICAL CHARACTERISTICS

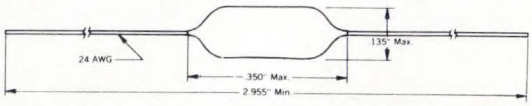
Minimum Creepage Path between Contacts: 7/64″
Minimum Air Space between Contacts: 1/16″
Contacts, center to center: .150″
Ambient Temperature Range: −67° F to +250° F
Approximate Weight: S20P-13-4R = 1.8 oz.
S20S-13-4R = 1.3 oz.

DEPENDABLE DALE® INDUCTORS

TYPE IR-2 EPOXY CONFORMAL COATED INDUCTORS

■ Designed primarily for commercial applications
■ Combines durability and low cost ■ Flame retardant coating

Standard tolerance: ±10%. **Inductance range:** .10 μh to 1000 μh. 49 standard values. Q, self-resonant frequency, DC resistance, rated current and core material as specified in MS-75083, 75084 and 75085.

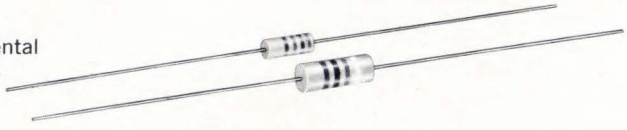


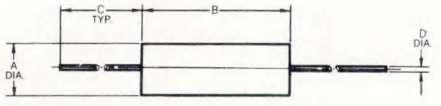
Dimensions: Body .350" L x .135" W, minimum length with leads 2.955".

TYPE IM-2 and IM-4 MOLDED INDUCTORS

■ Designed to meet electrical, material, mechanical and environmental requirements of MIL-C-15305D ■ Features precision performance, reliability ■ Wide range of inductance values in a small package
■ Flame retardant molded coating

Standard values IM-2 (49) and IM-4 (47). Tolerance, Q, test frequency L & Q, self-resonant frequency, DC resistance, DC current rating and core material per standards shown in the Inductance Range and MIL Standard Chart below.





INDUCTANCE RANGE

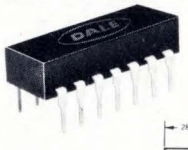
MODEL NO.	INDUCTANCE RANGE FROM	INDUCTANCE RANGE TO	CLASSIFICATION GRADE	CLASSIFICATION CLASS	MILITARY STANDARD
IM-2	.10 μh	1.00 μh	1	B	MS-75083
	1.2 μh	27. μh	1	A	MS-75084
	33. μh	1000. μh	1	A	MS-75085
IM-4	.15 μh	33. μh	1	B	MS-18130
	36. μh	240. μh	1	A	MS-90538

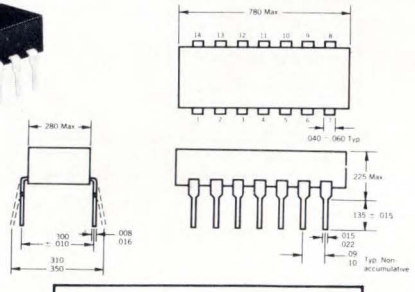
DIMENSIONS

MODEL NO.		A	B	C	D
IM-2	MAX.	.105	.260	1.626	.0215
	MIN.	.085	.240	1.250	.0185
IM-4	MAX.	.165	.385	1.626	.027
	MIN.	.145	.365	1.250	.023

TYPE PT 14 and PT 16 DIP PULSE TRANSFORMERS

■ Machine or hand insertable package designed to contain 3 pulse transformers (14 pin size) and 4 pulse transformers (16 pin size)
■ Fully sealed to permit cleaning in common solvents ■ Suitable for production soldering ■ Pulse transformers within the package designed with controlled precision characteristics to your requirements.





TRANSFORMER SPECIFICATIONS

Electrical

Inductance Range: 1 μh to 2.0 mh
Temperature Range: −55°C to +125°C
Temperature Stability: ±10% standard, lower available
Tolerance: ±20% standard, lower available
Leakage Inductance: As low as 0.2% of inductance
Interwinding Capacitance: As low as 3 pf

.300 between rows, pins on .100 centers.

ET Product: Up to 10 volt-microseconds
Dielectric Strength: 100 VRMS at 60 hz, winding to winding

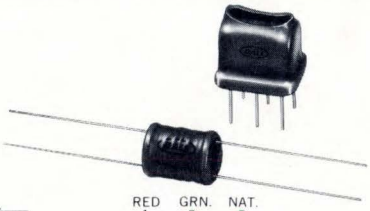
Material

Body: Molded plastic
Standard Terminals: Phosphor bronze, tin plated
Weight: Approximately 1 gram

NOTE
There is an inherent compromise between parameters which sometimes makes certain exact combinations unattainable.

TYPE PT10 and PT20 PULSE TRANSFORMERS – TRIGGER TYPE

■ Designed for low cost trigger source isolation in half and full wave SCR power control circuits including motor speed controls, heater controls and incandescent lighting controls ■ Choice of printed circuit or bobbin-type configurations
■ Designed to transfer high amplitude or long duration pulses without saturation.



TRANSFORMER SPECIFICATIONS

Electrical

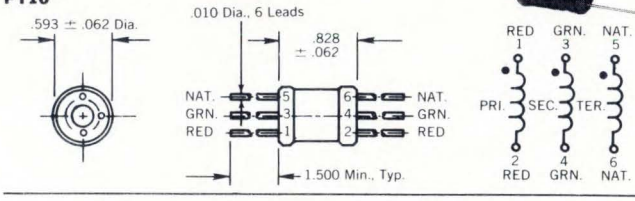
Primary Inductance Values: 200μh to 5000μh
Turns Ratio: 1:1, 1:1:1, 2:1, 2:1:1 and 5:1
Temperature Range: −10°C to +70°C
Dielectric Test @ 60 Hz: 1600 Volts RMS
AC Line Voltage @ 60 Hz: 240 Volts RMS Max.

Material

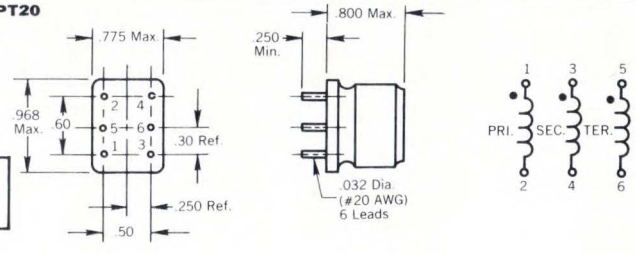
Bobbin: Nylon
Leads: Tinned, solderable. PT10 = Polyurethane insulated magnet wire for clip or bracket mounting. PT20 = Tinned copper #20 AWG for printed circuit mounting.
Covering: Thermoplastic **Header:** Thermoset Plastic

Also available in standard models with 4 pins or leads for applications where only primary and secondary windings are required.

PT10

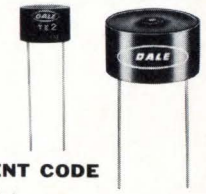


PT20



DEPENDABLE DALE® INDUCTORS

TYPE TE-2, TE-3, TE-4 and TE-5 ENCAPSULATED TOROIDAL INDUCTORS



Epoxy encapsulated precision toroids designed to meet MIL-T-27C, Type TF5SX20ZZ for outstanding stability and performance under severe environmental conditions. Offers high Q and wide selection of Q vs frequency ranges, plus a large number of inductance values.

SPECIFICATIONS

DALE TYPE	INDUCTANCE	STANDARD TOLERANCE	TERMINAL SPACING	O.D.	HEIGHT	CENTER HOLE DIA.
TE-2Q0 TE-2Q3 TE-2Q4	50.0 μh to 10.0 mh 470 μh to 120 mh 1.00 mh to 250 mh	±1% > 2 mh ±2% 0.05 mh to 2.0 mh	.300″	.437″	.270″	–
TE-3Q0 TE-3Q3 TE-3Q4	50.0 μh to 15 mh 500 μh to 1 h 1 mh to 4 h	±1% > 2 mh ±2% 154 μh to 2 mh ±5% < 150 μh	.500″	.685″	.385″	.093″
TE-4Q0 TE-4Q3 TE-4Q4	150 μh to 20 mh 1 mh to 2 h 2 mh to 7.5 h	±1% > 2 mh ±2% < 2 mh	.900″	1.062″	.500″	.120″
TE-5Q0 TE-5Q3 TE-5Q4	1 mh to 100 mh 5 mh to 2 h 10 mh to 20 h	±1% > 2 mh ±2% < 2 mh	1.00″	1.320″	.725″	.144″

Within the inductance ranges shown above, Dale offers a wide choice of standard values each of which is within one percent of the preceding and succeeding values.

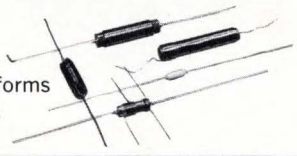
TEMPERATURE COEFFICIENT CODE (APPLIES TO CORE ONLY)

T.C. CODE	TEMPERATURE COEFFICIENT	TEMPERATURE RANGE	TYPE	T.C. AVAILABILITY Q0	Q3	Q4
TA	0±1%	–55°C to +125°C	All		X	X
TB	0±0.1%	+13°C to +35°C	TE-4 & 5		X	X
TD	0±0.1%	0°C to +55°C	All		X	X
TE	0±0.15%	0°C to +55°C	TE-4 & 5			X
TL*	+40 to +110 PPM/°C +85 to +185 PPM/°C	–55°C to +25°C +25°C to +85°C	TE-3, 4 and 5			X
TM	0±0.25%	–65°C to +125°C	All		X	X
TR	50 PPM/°C (Typical)	–65°C to +125°C	All	X		
TW	0±0.25%	–55°C to +85°C	All		X	X

*Inverse of typical temperature coefficient of polystyrene capacitor.

CUSTOM CHOKES

- Axial lead models
- Transformers on choke forms
- Universal wound models

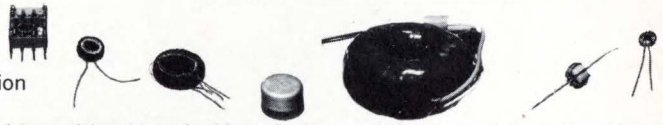


CUSTOM BOBBIN COILS

- Statistical control on high volume production items
- Low initial tooling cost

CUSTOM TOROIDS

- Potted with case sizes to fit your specific designs
- Open wound using Dale-formulated coatings for extra protection
- Hermetically-sealed cans
- Pulse transformers, inverters, RF inductors and transformers with or without terminal boards. Unusual shapes and sizes a specialty.



RF TRANSFORMERS & INDUCTORS

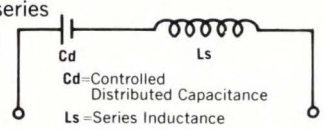
- Powdered iron bobbins
- Molded solenoids
- Ceramic form types
- P.C. cans & transformers

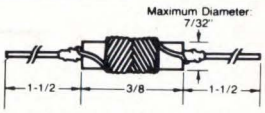
VARIABLE PITCH INDUCTORS

- Extensive design background in all sizes
- Complete engineering assistance

SERIES RESONANT TRAP

- Combines the electrical characteristics of an inductor and a capacitor in series
- Provides controlled self-resonance in a miniaturized circuit
- Saves space, reduces inventory
- Speeds assembly





BASIC SPECIFICATIONS

- Can be designed for any resonant frequency from .4 Mhz to 50 Mhz
- Impedance at design frequency: 15 ohms or less
- Impedance at ±50% of design frequency: 1500 ohms minimum
- Frequencies readily available: 10.7, 12, 14, 18 Mhz

TOUGH COIL JOBS? *Whether you need a hundred pieces or a million, we offer:*

- Broad selection from standard lines, backed by men who believe in and give excellent customer service.
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- Development engineering to provide the electrical function you require.
- Design engineering to transform your basic idea into parts.
- Close production coordination including cost-saving statistical control on high volume items.
- Fulltime quality control personnel enable fast action in establishing military test procedures and in meeting other government requirements – including MIL-Q-9858.

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PHONE 605–665-9301 *A subsidiary of The Lionel Corporation*

DEPENDABLE DALE® ELECTROMECHANICAL PRODUCTS

REVERSIBLE AC MOTOR DRIVEN POTENTIOMETERS

FOR USE IN ■ Home Entertainment Appliances ■ Instrumentation ■ Controls

FEATURES

■ Available with all standard potentiometers: Single, ganged or with power switch—dimensions change accordingly.

■ Magnetic clutch eliminates coasting and allows manual control independent of gear motor inertial load.

■ Long life expectancy ■ No lubrication in normal use ■ Operates in any position ■ Special terminal configurations available

SPECIFICATIONS

Operating Voltage: 6, 12, 24, 117 V.A.C., or any specified

Power Input: 5.5 Volt Amperes

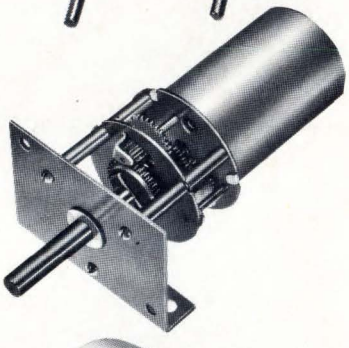
Output: Approximately 5.6 R.P.M.

Torque at Potentiometer Shaft: 10 in./oz. minimum (with decoupler); 21 in./oz. minimum (without decoupler).

Reversing: Accomplished by switching capacitor as shown in hysteresis motor circuit diagram below.

Dimensions: Length: 3.275″ (not including shaft) Diameter: 1.531

REVERSIBLE AC GEARHEAD MOTORS



FOR USE WITH ■ Switches ■ Potentiometers ■ Projectors ■ Turret Drives ■ Ribbon Drives ■ Chart Drives ■ Turntable Drives ■ Business Machines ■ Displays ■ Light industrial and consumer product controls

SPECIFICATIONS

MECHANICAL

Overall Dimensions: Length: 3.275″ (not including shaft) Diameter: 1.531″

Shipping Weight: .32 lbs.

Will meet normal industrial environmental requirements.

Mounting: Horizontal standard, vertical optional; bracket provided for chassis mounting and mounting control.

Output Torque: 14 in./oz. at 5.3 R.P.M.

ELECTRICAL

Operating Voltage: 117 volts AC, 60 cycles standard. Available from 6 to 117 volts AC, 60 cycles.

Capacitor size: Dependent on input voltage. (Capacitor not supplied.)

REVERSIBLE AC HYSTERESIS SYNCHRONOUS MOTORS

FOR USE IN ■ Low Power Driving Mechanisms ■ Control Circuits ■ Timers ■ Fans ■ Entertainment Appliances ■ Scanning Devices ■ Stirring Devices ■ Cassette Drives

FEATURES

■ Output shaft configuration can be specified. Standard units provided with gear.

■ Mounting arrangement can be varied to meet customer requirements.

■ Self-lubricating bearings.

■ Aluminum housing.

■ Long life expectancy.

■ Reversing accomplished by switching external capacitor as shown in circuit diagram.

SPECIFICATIONS

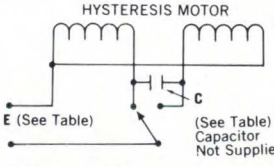
Operating Voltage: 6, 12, 117 V.A.C., or any specified.

Power Input: 5.5 Volt Amperes

Output: Approximately 1800 & 3600 R.P.M.

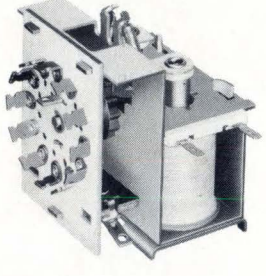
Torque: 0.1 in./oz. min.

CIRCUIT DIAGRAM



E VOLTAGE	C CAPACITANCE	C VOLTAGE
6	170 MFD	20
12	50 MFD	25
24	16 MFD	50
117	.47 MFD	300

AC & DC STEPPING RELAYS



FOR USE IN ■ Control Circuits ■ Television Controls ■ Hi-Fi, Stereo & Radio ■ Appliances ■ Telephone Devices ■ Coin Machines ■ Car Washes ■ Crystal Switching ■ Copy Machines ■ Medical Electronics ■ Computers ■ Coin-operated Laundry Equipment ■ Programmers

FOUR TYPES AVAILABLE ■ Uni-Directional A.C. & D.C. ■ Bi-Directional A.C. and D.C.

SPECIFICATIONS

ELECTRICAL

Operating Voltage: 6 V, 12 V, 24 V, 117 V (AC or DC)

Power Required: 2.5 watts with Plate Sequence Switch (Fig. A); 4.5 watts with Wafer Sequence Switch (Fig. B).

Contact Arrangement: Single Pole 4, 6, 10, 12 or 13 throw sequence. Auxiliary power switch operates at predetermined position of sequence.

Contact Rating: From Dry Circuit to 1 amp at 24 V.A.C. on Sequence Switch. Optional power switch 5 amps at 117 V.A.C.

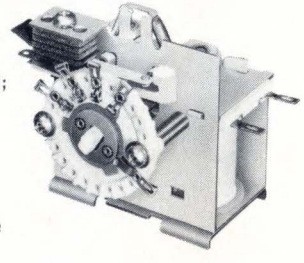
MECHANICAL

Overall Dimensions: Height: 2.200″ Width: 2.190″ Depth: 2.005″

Shipping Weight: 0.27 lbs. Uni-Directional; 0.40 lbs. Bi-Directional

Will meet normal commercial environmental requirements. Standard auxiliary power switch may be omitted.

Mounting: Vertical or horizontal using one screw and two locating tabs.

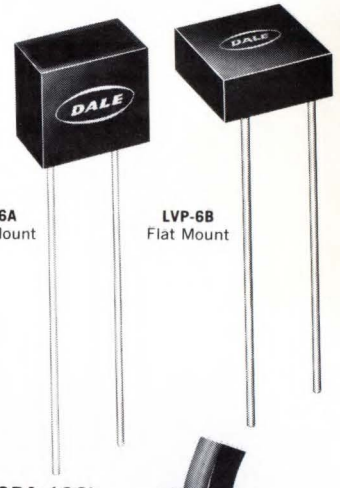


DALE ELECTRONICS, INC., Box 180, Yankton, South Dakota 57078 • Phone: 605—665-9301

DEPENDABLE DALE® SURGE ARRESTERS

SERIES LVP-6 *Low Voltage Protector*

Designed to mount on printed circuit boards to protect solid state circuitry from transients appearing on low voltage DC circuits. Nanosecond response. Automatically restores circuit to normal when transient has passed. Transients substantially above rated surge current would cause failure of the LVP-6 in a shorted condition—still safeguarding the valuable circuit components.



LVP-6A
Edge Mount

LVP-6B
Flat Mount

PROTECTIVE CAPABILITIES

Clamping Voltage: 6.2, 6.8, 7.5, 8.2, 9.1, 10, 11, 12, 13, 15 volts.
Shunt Capacity: 15 μf.
Operating Temperature: −55° C to 85° C
Storage Temperature: −55° C to 125° C

PHYSICAL SPECIFICATIONS

Designed for edge or base mounting. Body Dimensions = .500" L x .500" W x .312 H. Lead Dimensions = 1" ± 1/32" L x .032" dia.

SERIES SPA *Secondary Power Arrester—UL Listed* (Model SPA-100)

Designed for fuse or junction box mounting to protect against direct or indirect lightning and other transient voltages. Unit has hermetically sealed pre-ionized spark gap for increased sensitivity and stable breakdown voltage level. Exceeds all applicable NEMA, USAS, and IEEE standards. Conforms to lightning protection requirements of **Occupational Health and Safety Act.**

PROTECTIVE CAPABILITIES

DC Arc-Over Voltage: SPA-100 (120 VAC) 500-700 volts; SPA-200 (277 VAC) 600-900 volts. **Fast Rise Arc-Over Characteristics:** Typically 1500 volts with 10KV/μsec. pulse applied; **Bypass Capability:** Will withstand repeated 10KA (10x20 μsec.) current surges. Power follow current extinguished in 1/2 cycle or less. Voltage between terminals less than 2000 volts when conducting 10,000 amps of surge current. **Insulation Resistance:** Greater than 100 megohms. **Shunt Capacity:** Less than 25 pf.

PHYSICAL SPECIFICATIONS

Spark gap hermetically sealed with soft solder. Overall dimensions: 1-3/4"Dx3"L. Two 18" leads provided for circuit connection. Has 1/2"-14 NPSL conduit fitting with nut for mounting in any position indoors or outdoors.

SERIES LA *Miniature Size—Maximum Circuit Protection*

Patented design insures much greater reliability and repeatability than standard spark gap designs. Widely used to protect communications equipment from lightning and to guard industrial controls and radios from heavy transient spikes.

PROTECTIVE CAPABILITIES

Spark-Gap Arc-Over Voltage: LA20 = Factory adjustable from 500 to 6000 VDC ± 20% or 10%; LA9 = Factory adjustable from 500 to 5000 VDC ± 20% (10% available). **Bypass Capability:** LA20 = 50 current surges of 2000 amps peak 1x2 millisecond wave shape (2 coulombs), greater than 40 joules/stroke. Derate to 50% below 250 V. LA9 = 100 current surges of 300 amps peak 2x4 millisecond wave shape. Derate to 10% when set below 750 V. Both types will perform as stated without damage to arrester or equipment attached and with less than 20% change in original DC breakdown voltage. **Insulation Resistance:** Greater than 1000 megohms initially and greater than 10 megohms after rated current surges. **Shunt Capacity:** LA20 = 8 mmfd, LA9 = 3.5 mmfd.

PHYSICAL SPECIFICATIONS

LA20 = 3-3/8" outside length. Body 2-1/16" L x 1-1/4" D. Weight: 5 oz. LA9 = 1-5/8" outside length. Body: 1" L x 3/4" D. Weight: 2 oz. **Mounting:** Clip, stud or flange. **Terminal:** LA20=6-32, 8-32, 10-32 stud or wire; LA9=4-40 stud or wire. **Seal:** LA20 and LA9 hermetic.

ADDITIONAL MODELS

- Aircraft lightning arresters of all types
- Arresters for high voltage circuits
- Miniature transient suppressors for circuit board mounting.

Submit your specifications to

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Los Angeles 90064
Tel: (213) 478-0613

Frank Shelley Electronics, Inc.
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San Diego 92121
Tel: (714) 459-3701

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Tel: (415) 961-7000

Hamilton/Avnet Electronics
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Tel: (714) 279-1550

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San Diego 92101
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Denver 80222
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Waco Electronics
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Denver 80216
Tel: (303) 322-7708

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Industrial Electronics Assoc., Inc.
P. O. Box 12444
Palm Beach Gardens 33403
Tel: (305) 622-2626

GEORGIA

Jackson Electronics
1135 Chattahoochee Ave., N.W.
Atlanta 30318
Tel: (404) 355-2223

ILLINOIS

Allied Radio Corp.
2400 W. Lake St.
Chicago 60612
Tel: (312) 421-2400

Ohm Electronics
649 Vermont Avenue
Palatine 60067
Tel: (312) 359-5500

GBL Electronics
75 Gaylord Street
Elk Grove Village 60007
Tel: (312) 593-3220

Hamilton/Avnet Electronics
3901 Pace Court
Schiller Park 60176
Tel: (312) 678-6310

Merquip Electronics, Inc.
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Skokie 60076
Tel: (312) 965-7500

Newark Electronics
500 North Pulaski Road
Chicago 60624
Tel: (312) 638-4411

INDIANA

Ft. Wayne Electronics
3606 Maumee Ave.
Ft. Wayne 46801
Tel: (219) 742-4346

Graham Electric Supply, Inc.
133 South Pennsylvania Street
Indianapolis 46204
Tel: (317) 634-8202

Ohio Valley Sound Inc.
20 East Sycamore Street
Evansville 47713
Tel: (812) 425-6173

Radio Distributing Company
1212 High Street
South Bend 46624
Tel: (219) 287-2911

KANSAS

Hamilton/Avnet
7301 Mission Road
Prairie Village 66208
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Radio Supply Company
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Wichita 67211
Tel: (316) 267-5216

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Lexington 40508
Tel: (606) 255-6661

LOUISIANA

Southern Radio Supply Co.
1909 Tulane Ave.
New Orleans 70112
Tel: (504) 524-2343

MARYLAND

Radio Electric Service Co.
1026 Cromwell Bridge Road
Baltimore 21204
Tel: (301) 823-0070

MASSACHUSETTS

A. W. Mayer Co.
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West Newton 02165
Tel: (617) 965-1111

Sterling Electronics
51 Spring Street
Watertown 02159
Tel: (617) 926-9720

MICHIGAN

Newark Industrial Electric Corp.
2114 South Division
Grand Rapids 49507
Tel: (616) 452-1411

Newark-Detroit Electric, Inc.
20700 Hubbell Ave.
Oak Park 48237
Tel: (313) 548-0250

Wedemeyer Electronic Supply Co.
2280 S. Industrial Highway
Ann Arbor 48107
Tel: (313) 665-8611

MINNESOTA

Electronic Center, Inc.
107 Third Avenue North
Minneapolis 55401
Tel: (612) 338-5881

Gopher Electronics Co.
2520 West Larpenteur Ave.
St. Paul 55113
Tel: (612) 645-0889

Northwest Radio
123 E. First Street
Duluth 55802
Tel: (218) 727-1565

MISSOURI

Burstein-Applebee Co.
3199 Mercier Street
Kansas City 64111
Tel: (816) 931-5863

Lectronix, Inc.
214 North 2nd Street
St. Charles 63301
Tel: (314) 946-6424

Radiolab, Inc.
3814 Main Street
Kansas City 64111
Tel: (816) 561-9935

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Allen & Hurley
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Trenton 08608
Tel: (609) 393-3300

Eastern Radio
312 Clifton Ave.
Clifton 07015
Tel: (201) 471-6600

Federated Purchaser
155 U.S. Route 22
Springfield 07081
Tel: (201) 376-8900

Newark Electronics Center
303 Monroe Avenue
Kenilworth 07033
Tel: (201) 272-8410

Route Electronics
Echo Plaza
U.S. Route 22
Springfield 07081
Tel: (201) 379-7710

NEW MEXICO

Kieruiff Electronics Co.
2524 Baylor Drive S.E.
Albuquerque 37116
Tel: (505) 247-1058

NEW YORK

Arrow Electronics, Inc.
900 Broad Hollow Road
Route 110
Farmingdale, L.I. 11735
Tel: (516) 694-6800

Fairmont Electronics
140 Smith Street
Farmingdale, L.I. 11735
Tel: (516) 694-8200

Harrison Radio Corp.
20 Smith Street
East Farmingdale, L.I. 11735
Tel: (516) 293-7990

Higgins & Sheer
123 Dutchess Turnpike
Poughkeepsie 12603
Tel: (914) 471-3510

Midway Industrial Electronics
38 East 29th Street
New York 10016
Tel: (212) 889-0370

Milo Electronics Corp.
170 Eileen Way
Syosset 11791
Tel: (516) 364-1111

Radio Equipment Corporation
196 Vulcan Street
Buffalo 14207
Tel: (716) 874-2690

Rome Electronics
108-110 Spring Street
Rome 13440
Tel: (315) 337-5400

Simcona Electronics Corp.
275 Mt. Read Blvd.
Rochester 14611
Tel: (716) 328-3230

Stack Industrial Electronics
45 Washington Avenue
Binghamton 13901
Tel: (607) 723-6326

Summit Dist. Inc.
916 Main Street
Buffalo 14203
Tel: (716) 884-3450

Terminal-Hudson Electronics, Inc.
236 West 17th Street
New York 10011
Tel: (212) 243-5200

Valley Industrial Electronics Inc.
Commercial Drive
Yorkville 13495
Tel: (315) 736-3393

NORTH CAROLINA

Electro-Tech, Inc.
5141 Belhaven Blvd.
Charlotte 28214
Tel: (704) 394-4341

Kirkman Electronics, Inc.
901 W. Second Street
Winston-Salem 27102
Tel: (919) 724-0541

OHIO

Hughes-Peters, Inc.
4865 Duck Creek Road
Cincinnati 45227
Tel: (513) 351-2000

Hughes-Peters, Inc.
481 East 11th Avenue
Columbus 43211
Tel: (614) 294-5351

Lima Radio
150 W. Grand Ave.
Lima 45802
Tel: (419) 228-1220

Pattison Supply Company
4550 Willow Parkway
Cleveland 44125
Tel: (216) 441-3000

Pioneer/Dayton
1900 Troy Street
Dayton 45404
Tel: (513) 236-9900

Pioneer Standard Electronics, Inc.
4800 East 131st Street
Cleveland 44105
Tel: (216) 587-3600

Plaintronics Co.
P.O. Box 2265
3100 Plainfield Road
Kettering 45429
Tel: (513) 253-9176

Winteradio Electronics Supply Corp.
1468 West 25th Street
Cleveland 44113
Tel: (216) 621-9383

OKLAHOMA

Oil Capitol Electric
708 South Sheridan
Tulsa 74112
Tel: (918) 836-2541

PENNSYLVANIA

Cameradio Company
2801 Liberty Ave.
Pittsburgh 15222
Tel: (412) 391-7400

Herbach & Rademan, Inc.
401 E. Erie Avenue
Philadelphia 19134
Tel: (215) 426-1700

RPC Electronics
620 Alpha Drive
Pittsburgh 15238
Tel: (412) 782-3770

RHODE ISLAND

William Dandreta & Co.
26 Wolcott Street
Providence 02908
Tel: (401) 861-2800

TENNESSEE

Electra Distributing
1914 West End Avenue
Nashville 37203
Tel: (615) 329-3971

TEXAS

Lenert Company
Box 2184
1420 Hutchins
Houston 77001
Tel: (713) 225-1465

McNichol, Inc.
3012 East Yandell Drive
El Paso 79903
Tel: (915) 566-2936

Newark-Dallas Electronics
707 Easy Street
Garland 75040
Tel: (214) 271-2511

Sterling Electronics, Inc.
P.O. Box 20129
2875 Merrell Road
Dallas 75220
Tel: (214) 357-9131

WASHINGTON

Hamilton/Avnet Electronics
2320 6th Avenue
Seattle 98121
Tel: (206) 624-5930

WEST VIRGINIA

Charleston Electric Supply Co.
312 MacCorkle Ave., S.E., Box 2473
Charleston 25329
Tel: (304) 348-5211

For additional information, phone 402—564-3131 or write Dept. 860, Dale Electronics, Inc., Box 609, Columbus, Nebr. 68601.