ENGINEERING MATERIAL SPECIFICATION

Material Name
CHEMICAL INK, RESISTOR (THICK FILM RESISTOR PASTE)

Specification Number
ESF-M99B154-A thru V
ESF-M99B154-W1 thru W6

1. SCOPE

The materials defined by this specification are resistor inks.

2. APPLICATION

This specification was released originally to define materials used as resistors in thick film circuits in the ignition control module.

3. REQUIREMENTS

3.1 STATISTICAL PROCESS

Suppliers must conform to the requirements of Ford Quality System Standard Q-101. A mutually acceptable Control Plan as described therein is required for material/source approval. Appropriate statistical tools must be used to analyze process/product data so that variation in the final product is continuously reduced.

3.2 CONDITIONING AND TEST CONDITIONS

All test values indicated herein are based on material conditioned in a controlled atmosphere of 23 +/- 2 C and 50 +/- 5 % relative humidity for not less than 24 h prior to testing and tested under the same conditions unless otherwise specified.

3.3 VISCOSITY, Pa.s
(ASTM D 2393)

A (1)	B (2)	C (3)	D (2)	E (3)	F (3)	G (3)
125+/-25	350+/-30	160+/-40	350+/-30	290+/-30	290+/-30	290+/-30
H (3)	**J (3)**	**K (3)**	**L (2)**	**M (2)**	**N (2)**	**P (2)**
290+/-30	320+/-30	320+/-30	250+/-50	160+/-40	200+/-30	160+/-40
R (4)	**S (4)**	**T (4)**	**U (4)**	**V (4)**	**W1 (3)**	**W2 (3)**
150+/-25	150+/-25	150+/-25	150+/-25	190+/-40	178+/-33	178+/-33
W3 (3)	**W4 (3)**	**W5 (3)**	**W6 (3)**			
178+/-33	178+/-33	178+/-33	178+/-33			

(1) Brookfield HAT UC and S at 10 rpm
(2) Brookfiekd HBF #6 at 10 rpm
(3) Brookfield HBT #6 at 10 rpm
(4) Brookfield HAT #6 at 10 rpm

Date	Release No.	Release/Revision
9/10 92	FDOE00107002080	Revised 3.6 for W1 thru W6 L. Rumao
1991 07 02	DF00E00107002045	Released Suffixes W1-W6, Updated L. Rumao
1980 12 02	CF4KRD576983-14	Released (Was XF-M99BX13)

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3.4 SOLIDS, %
(20 mm at 750 C)

A	B	C	D	E	F
77+/-1.0	74+/-1.5	68.5+/-1.0	74.5+/-1.5	73+/-1.5	71.5+/-1.5

G	H	J	K	L	M
69.5+/-1.5	69+/-1.5	84.5+/-1.0	80.9+/-1.0	73.5+/-1.5	77+/-1.0

N	P	R	S	T	U
74+/-1.5	68.5+/-1.0	74.75+/-1.25	73+/-1.5	71.5+/-1.5	68+/-1.5

V	W1	W2	W3	W4	W5
73.5+/-1.5	76.5+/-1.5	76.5+/-1.5	70.5+/-1.5	68.5+/-1.5	68.5+/-1.5

W6
73.5+/-1.5

3.5 GRIND GAUGE, micrometre (ASTM D 1210, 4th scratch, 50 % point)

A - M, P, V, W1-6	N, R - U
≤ 20/12	≤ 18/8

3.6 RESISTIVITY, Ohms per unit area*
(DuPont Test Pattern 69-1004-C1)

A	B	C	D	E	F	G
10+/-10%	25+/-10%	100+/-10%	100+/-10%	950+/-5.3%	1E4+/-10%	1E5+/-10%

H	J	K	L	M	N	P
1E6+/-10%	1.5+/-10%	3.0+/-10%	1E3+/-10%	10+/-10%	25+/-10%	100+/-10%

R	S	T	U	V	W1
100+/-10%	1E3+/-10%	1E3+/-10%	1E4+/-10%	1E3+/-10%	10+/-5%

W2	W3	W4	W5	W6
100+/-5%	1E3+/-5%	1E4+/-5%	1E5+/-5%	1E6+/-5%

*Note: Ohms per unit area refers to a square area of resistor ink spread in a dry thickness of 25 micrometres.

3.7 HOT TEMPERATURE COEFFICIENT OF RESISTANCE — Resistance will vary by 0.01 % per C

3.8 COLD TEMPERATURE COEFFICIENT OF RESISTANCE

A - W5 — Resistance will vary by 0.01 % per C

W6 — Resistance will vary by 0.015 % per C

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