Conductive Elastomer EMI/EMP Gaskets

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Chomerics has invented and extended virtually every aspect of conductive elastomer materials technology – from the earliest silver and silver/copper based silicones to the latest and more cost effective silver/aluminum composites. Parker Seal has significantly enhanced Chomerics' capabilities, especially in manufacturing technology.

Chomerics' two types of conductive elastomers for EMI shielding are –

CHO-SEAL® – homogeneous structure

CHO-SIL® – reticular structure

Each composite consists of a silicone, fluorosilicone, EPDM or fluorocarbon binder with a filler of either pure silver, silver-plated copper, silver-plated aluminum, silver-plated nickel, silver-plated glass or nickel-coated graphite. They all meet MIL-STD-810 requirements for fungus resistance.

The development of Chomerics' conductive composites is the result of years of research and testing, both in the laboratory and in the field. Our proprietary manufacturing techniques allow the precise dispersion of metal particles in resinous binders to produce materials with stable and consistent

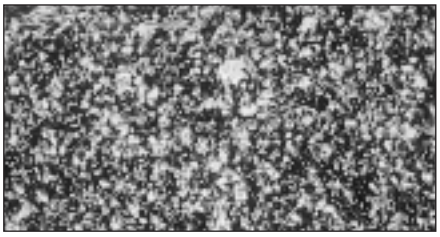

Figure 1 Homogeneous Structure: CHO-SEAL materials

Table 1

CONDUCTIVE ELASTOMER SPECIFICATIONS

			Test Procedure (Type of Test) ¶	CHO-SEAL 1215*	CHO-SEAL 1285	CHO-SEAL 1217	CHO-SEAL 1287	CHO-SEAL 1298	CHO-SEAL 1224	CHO-SEAL 1221	CHO-SEAL 1239 ■	CHO-SEAL 1240 ■
Type (Ref. MIL-G-83528)				Type A	Type B	Type C	Type D	Type D	Type E	Type F	Type G	Type H
Elastomer Binder				Silicone	Silicone	Fluoro-silicone	Fluoro-silicone	Fluoro-silicone	Silicone	Fluoro-silicone	Silicone	Silicone
Conductive Filler				Ag/Cu	Ag/Al	Ag/Cu	Ag/Al	Passivated Ag/Al	Ag	Ag	Ag/Cu	Ag
Volume Resistivity (ohm-cm, max.) as supplied (without pressure-sensitive adhesive)			MIL-G-83528 Para. 4.6.11	0.004	0.008	0.010	0.012	0.012	0.002	0.002	0.007	0.005
Hardness (Shore A ±5)			ASTM D2240 (Q/C)	65	65	75	70	70	65	75	80	80
Specific Gravity (±.25)			ASTM D792 (Q/C)	3.7	1.9	4.1/3.8§	2.0	2.0	3.4	4.0	4.75 ±0.75	4.0
Tensile Strength psi (MPa), min.			ASTM D412 (Q/C)	200 (1.38)	200 (1.38)	180 (1.24)	180 (1.24)	180 (1.24)	300 (2.07)	250 (1.72)	600 (4.14)	400 (2.76)
Elongation, (percent, min.)			ASTM D412 (Q/C)	100	100	100	60	60	200	100	20	90
Tear Strength lb/in. (kN/m), min.			ASTM D624 (Q/C)	40/25§	30 (5.25)	35 (6.13)	35 (6.13)	35 (6.13)	50 (8.75)	40 (7.00)	70 (12.25)	60 (10.50)
Compression Set 70 hrs @ 100°C (percent, max.)§§			ASTM D395 Method B (Q)	32	32	35	30	30	45	60	NA	60
Low Temperature Flex, TR10 (°C, min.)			ASTM D1329 (Q)	–65	–65	–55	–55	–55	–65	–65	NA	–55
Maximum Continuous Use Temperature (°C)**			(Q)	125	160/200	125	160/200	160/200	160/200	160/200	125	160
Shielding Effectiveness (see note below)	200 kHz (H Field)	(dB, min.)	MIL-G-83528 Para. 4.6.12 (Q)	70	60	70	55	55	70	70	70	—
	100 MHz (E Field)			120	115	120	110	110	120	120	110	110
	500 MHz (E Field)			120	110	120	100	100	120	120	110	110
	2 GHz (Plane Wave)			120	105	115	95	95	120	120	110	110
	10 GHz (Plane Wave)			120	100	110	90	90	120	120	110	110
Electrical Stability	Heat Aging	(ohm-cm, max.)	MIL-G-83528 Para. 4.6.15 (Q/C)	0.010	0.010	0.015	0.015	0.015	0.010	0.010	0.010	0.008
	Vibration Resistance – During		MIL-G-83528 (Q) Para. 4.6.13 (Q)	0.006	0.012	0.015	0.015	0.015	0.010	0.010	0.010	0.006
	Vibration Resistance – After			0.004	0.008	0.010	0.012	0.012	0.002	0.002	0.007	0.005
	Post Tensile Set Volume Resistivity		MIL-G-83528 Para. 4.6.9 (Q/C)	0.008	0.015	0.015	0.015	0.015	0.010	0.010	NA	0.006
	EMP Survivability (kA per in. perimeter)		MIL-G-83528 Para. 4.6.16 (Q)	>0.9	>0.9	>0.9	>0.9	>0.9	>0.9	>0.9	>0.9	>0.9

* Extruded version of 1215 formerly designated 1250; extruded version of 1401 formerly designated 1405.

** Where two values are shown. First represents max. operating temp. for conformance to MIL-G-83528 (which requires Group A life testing at 1.25 times max. operating temp.) Second value represents practical limit for exposure up to 1000 hours (compressed between flanges 7-10%). Single value conforms to both definitions.

§ Second value applies to extruded forms only. ■ Not available in extruded form.

§§ Compression set is expressed as a percentage of deflection per ASTM D395 Method B., at 25% deflection. To determine percent recovery, subtract 1/4 of stated compression set value from 100%. For example, in the case of 30% compression set, recovery is 92.5%.

¶ Q = Qualification C = QC Conformance NA = Not Applicable

Note: **It may not be inferred that the same level of shielding effectiveness provided by a gasket material tested in the fixture per MIL-G-83528 Para. 4.6.12 would be provided in an actual equipment flange, since many mechanical factors of the flange design (tolerances, stiffness, fastener location, and size, etc.) could lower or enhance shielding effectiveness. This procedure provides data applicable only to the test fixture design of MIL-G-83528, but which is useful for making comparisons between different gasket materials.**

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electrical and physical properties. *Chomerics controls all aspects of the manufacturing process, including powder plating.*

The performance of these superior elastomers depends on many carefully engineered factors, including the size and shape of the filler particles and their composition. For most applications, CHO-SEAL materials are preferred over CHO-SIL materials, owing to their superior physical properties and excellent shielding performance.

Table 1 outlines the properties and specification limits of Chomerics' conductive elastomers. Refer also to our *"EMI Shielding Theory and Design Guide"* in this handbook for further assistance in material selection.

We recommend that users of conductive elastomer gaskets specify that materials meet the requirements of MIL-G-83528 and be procured from MIL-G-83528 QPL sources. To avoid the risk of system EMI or environmental seal failure, any change in conductive elastomer seal supplier (including MIL-G-83528 QPL suppliers) should be preceded by thorough system qualification testing.

Since these materials contain silver, packaging and storage conditions should be similar to those for other silver-containing components, such as relays or switches. They should be stored in sheet plastic, such as polyester or polyethylene and kept away from sulphur-containing materials such as sulphur-cured neoprene, cardboard, etc. To remove dirt, clean with water or alcohol containing mild soap (do not use aromatic or chlorinated solvents).

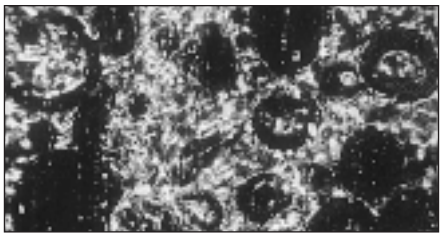

Figure 2 Reticulate Structure: CHO-SIL materials

Chomerics also manufactures commercial grade conductive elastomer gaskets. Contact Chomerics for additional information.

Table 1 *continued*

CONDUCTIVE ELASTOMER SPECIFICATIONS											
CHO-SEAL 1212■	**CHO-SEAL 1278■**	**CHO-SIL 1401***	**CHO-SEAL 1350**	**CHO-SEAL 1501■**	**CHO-SIL 1485**	**CHO-SEAL L6303**	**CHO-SEAL S6304**	**CHO-SEAL S6305**	**CHO-SEAL E6306■**	**CHO-SEAL V6433■**	**CHO-SEAL E6434■**
Type K	Type L	—	—	—	—	—	—	—	—	—	—
Silicone	Silicone	Silicone	Silicone	Silicone	Silicone	Fluoro-silicone	Silicone	Silicone	EPDM	Fluoro-carbon	EPDM
Ag/Cu	Ag/Ni	Ag	Ag/Glass	Ag	Ag/Al	Ni/C	Ni/C	Ni/C	Ni/C	Ag/Ni	Ag/Ni
0.005	0.005	0.010	0.01	0.03	0.02	0.1	0.1	0.1	5	0.006	0.006
80	75	45	65	35 (±7)	60	65 (±10)	55 (±10)	65 (±10)	75 (±7)	85 (±7)	75 (±7)
3.5	4.0	1.6	1.8	2.7 (typ.)	1.7	2.3	1.9	2	1.9	4.8	3.9
400 (2.76)	200 (1.38)	200 (1.38)	150 (1.03)	80 (0.55)	180 (1.24)	150 (1.30)	150 (1.03)	200 (1.38)	200 (1.38)	400 (2.76)	200 (1.38)
100	100/300	75	75	NA	100	200	100	100	75	100	200
40 (7.00)	30 (5.34)	20 (3.50)	25 (4.375)	20 (3.50)	30 (5.25)	35 (6.13)	35 (6.13)	50 (8.75)	70 (12.25)	70 (12.25)	75 (13.125)
35	32	30	30	80	30	25	30	30	40	45	40
–45	–55	–55	–55	NA	–40	–45	–45	–45	–45	–25	–45
125	125	160/200**	160	160/200**	85	150	150	150	125	200	125
70 120 120 120 120	70 120 120 115 110	60 100 100 90 80	50 100 100 90 80	60 100 100 90 80	50 100 100 90 80	NA 100 100 100 100	NA 100 100 100 100	NA 100 100 100 100	— 95 90 85 85	— 105 100 90 90	— 105 100 85 85
0.010	0.010	0.15	0.01	NA	0.06	0.25†	0.25†	0.25†	10††	0.008†††	0.0125††
0.010	0.010	0.015	NA	NA	0.06	0.1	NS	0.1	NA	NA	NA
0.005	0.005	0.01	NA	0.03	0.02	0.1	NS	0.1	NA	NA	NA
0.010	0.010	0.02	0.01	NA	NA	—	—	—	NA	—	—
>0.9	>0.9	***	NS	>0.3	>0.3	0.1	0.1	0.1	NA	NA	NA

*** CHO-SIL 1401 degrades electrically after simulated EMP current levels less than 0.9kA per in. NA = Not Applicable NS = Not Survivable ■ Not available in extruded form.

† Heat aging condition: 150°C/48 hrs. †† Heat aging condition: 125°C/48 hrs. ††† Heat aging condition: 200°C/48 hrs.

Note: **It may not be inferred that the same level of shielding effectiveness provided by a gasket material tested in the fixture per MIL-G-83528 Para. 4.6.12 would be provided in an actual equipment flange, since many mechanical factors of the flange design (tolerances, stiffness, fastener location, and size, etc.) could lower or enhance shielding effectiveness. This procedure provides data applicable only to the test fixture design of MIL-G-83528, but which is useful for making comparisons between different gasket materials.**