Conductive Elastomer Materials

CONDUCTIVE ELASTOMER SELECTION GUIDE

Tables 4-1 and 4-2 provide selection guidelines for Parker Chomerics most general-purpose EMI elastomer materials. With the exception of certain limitations, these materials are electrically stable over time and provide excellent moisture and pressure sealing.

They are all medium-durometer materials and differ mainly in shielding performance and corrosion resistance. (Nickel-plated aluminum materials are significantly more corrosion-resistant than silver-plated copper, silver-plated aluminum and silver-plated nickel filled materials against aluminum.)

- Availability
- Design Flexibility
- Cost Effectiveness
- Proven Performance

…just four of the reasons why conductive elastomer gaskets are so often the right EMI shielding solution!

Once used mainly to shield critical defense and aerospace electronic systems, Parker Chomerics conductive elastomers have become the progressive choice for packaging designers of consumer, telecommunications, business, industrial equipment, automotive, medical devices and much more.

Conductive elastomers are reliable over the life of the equipment. The same gasket is both an EMI shield and an environmental seal. Elastomer gaskets resist compression set, accommodate low closure force, and help control airflow. They're available in corrosion-resistant and flame-resistant grades. Their aesthetic advantages are obvious.

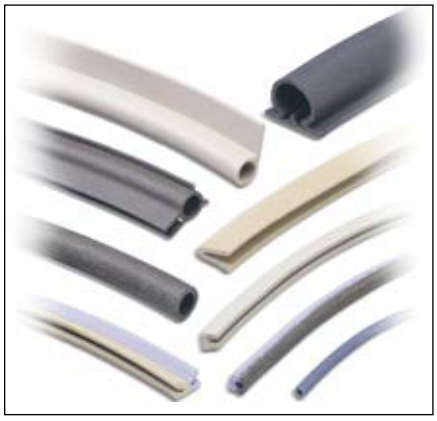
Almost any elastomer profile can be extruded or custom-molded with modest tooling costs and short lead times for either prototypes or large orders. Parker Chomerics can also take a customer-supplied design and deliver finished parts. Parker Chomerics offers hundreds of standard molded and extruded products.

Molded products provide moisture/pressure sealing and EMI/EMP shielding when compressed properly in seals, flanges, bulkheads and other assemblies. Extrusions provide similar benefits and are also readily lathe-cut into washers, spliced, bonded, kiss-cut, or die-cut to reduce installation labor and to conserve material, resulting in a cost-effective alternative to other methods of EMI shielding and environmental sealing.

CHO-SEAL® CONDUCTIVE ELASTOMERS

Over the years, Parker Chomerics has developed and enhanced virtually every aspect of conductive elastomer materials technology, from the earliest silver and silver-plated copper filled silicones, to the latest and more cost-effective nickel-plated aluminum and nickel-plated graphite composites. Today Parker Chomerics offers the most comprehensive selection and highest quality products available.

Each conductive elastomer consists of a silicone, fluorosilicone, EPDM or fluorocarbon-fluorosilicone binder with a filler of pure silver, silver-plated copper, silver-plated aluminum, silver-plated nickel, silver-plated glass, nickel-plated graphite, nickel-plated aluminum or unplated graphite particles. The development of these composites is the result of decades of research and testing, both in the laboratory and in the field. The Parker Chomerics proprietary filler powder technology allows us to carefully control the composition, size and morphology of the conductive particles. Their precise, uniform dispersion within the resinous binders produces materials with stable and consistent electrical and physical properties.



Parker Chomerics conductive elastomers feature excellent resistance to compression set over a wide temperature range, resulting in years of continuous service. In addition to EMI shielding, these materials can provide an environmental or pressure seal if required.

For those materials containing silver, both 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 sulfur-containing materials, such as sulfur-cured neoprene, cardboard, etc. To remove dirt, clean the elastomer with water or alcohol containing mild soap (do not use aromatic or chlorinated solvents).

Shelf life of conductive elastomers without pressure sensitive adhesive (PSA) is indefinite, with PSA it is 12 months from date of manufacture. Refer to Section 1 for detailed applications guidance on PSA systems.

Tables 4-3 and 4-4 outline the properties and specification limits of Parker Chomerics conductive elastomers. These materials are produced in a virtually unlimited variety of molded, die-cut and extruded shapes and sizes. The Applications Engineering Department is very accessible, and ready to assist with material selection and gasket design. We welcome your inquiry.

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MATERIAL SELECTION

The Parker Chomerics array of conductive elastomers offers true flexibility in selecting the appropriate material for a specific application on the basis of cost and level of attenuation required. Price varies directly with shielding performance.

For some military/aerospace applications, users of conductive elastomer gaskets consider specifying materials that meet MIL-DTL-83528 where appropriate but note that newer materials may not yet be included in that specification, e.g., nickel-plated aluminum filled elastomers. To avoid the risk of system EMI or environmental seal failure, any change in conductive elastomer seal supplier (including MIL DTL-83528 QPL suppliers) should be preceded by thorough system qualification testing.

UL 94 V-0 RATED MATERIALS

Parker Chomerics selection of UL 94 V-0 rated gasket materials includes CHO-SEAL 6370, CHO-SEAL 6371, CHO-SEAL 1273, CHO-SEAL S6305 and CHO-SEAL 1310.

CHO-SEAL gasket materials are rated at UL 94 V-0 down to a thickness of 0.013 Inch (0.33 mm). Actual thickness for each certified material, and specific conditions of use can be found in UL File #OCDT2. E140244 under Insulating Devices and Materials – Components. CHO-SEAL materials certified by UL for use in Canada can be found in UL File OCDT8.E140244. For UL Certification files, please visit www.ul.com.

CONDUCTIVE ELASTOMER APPLICATIONS

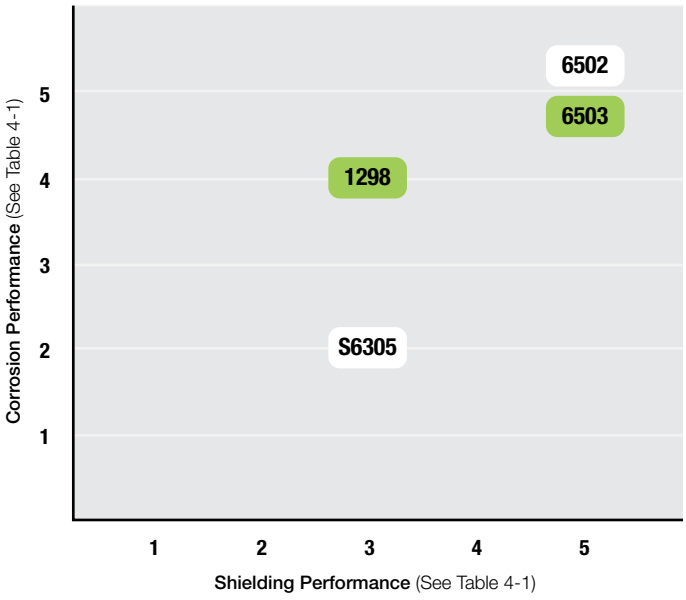
In general, certain types of Parker Chomerics conductive elastomers are specified more often for military/aerospace applications or for commercial applications. However, there is a considerable overlap, and the Applications Engineering department will be pleased to assist you with your product selection.

Elastomer Product Offering

	Material	Binder	Configuration
Common Materials	CHO-SEAL 6502	Silicone	Molded and Extruded
	CHO-SEAL 6503	Fluorosilicone	
	CHO-SEAL 1298	Fluorosilicone	
	CHO-SEAL 1285	Silicone	
	CHO-SEAL 1287	Fluorosilicone	
	CHO-SEAL 1215	Silicone	
	CHO-SEAL 1217	Fluorosilicone	
	CHO-SEAL S6305	Silicone	
	CHO-SEAL 6370	Silicone	Extruded
	CHO-SEAL 6371	Silicone	Molded
	CHO-SEAL 6308	Silicone	Extruded
	CHO-SEAL 6330	Silicone	Sheets Only
	CHO-SEAL L6303	Fluorosilicone	Molded and Extruded
	CHO-SEAL 1350	Silicone	
	CHO-SEAL 1310	Silicone	Molded
	CHO-SEAL 1273	Silicone	Molded and Extruded
	CHO-SEAL 1270	Silicone	Molded
Specialty Materials	CHO-SEAL 1224	Silicone	
	CHO-SEAL 1221	Fluorosilicone	
	CHO-SEAL 1401	Silicone	Molded and Extruded
	CHO-SEAL 1239	Silicone/Cu Mesh	Molded
	CHO-SEAL 1212	Silicone	
	CHO-SEAL 6435	EPDM	
	CHO-SEAL 6307	EPDM	
	CHO-SEAL 6452	EPDM	Extruded
	CHO-SEAL 6460	EPDM	Molded
	CHO-SEAL V6433	Fluoro/Fluorocarbon	
	CHO-SEAL S6600	Silicone	

CHO-SEAL Conductive Elastomer Performance Guide

Most Commonly Selected Materials



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Elastomer Binder Legend

Silicone | Fluorosilicone | EPDM | Fluorocarbon/ Fluorosilicone

Shielding and Corrosion Performance

Fair ● Good ● ● Very Good ● Excellent ●

Table 4-1: Quick Reference Guide for Selecting Conductive Elastomers – Common Materials Typical for Commercial & Military Applications (M) = Molded only, (E) = Extruded only

Material	Filler	Binder	Shielding	Corrosion (on Aluminum)	MIL-DTL-83528
CHO-SEAL 6502	Nickel-Aluminum	Silicone	●●●●●	●●●●●	-----
CHO-SEAL 6503	Nickel-Aluminum	Fluorosilicone	●●●●●	●●●●●	-----
CHO-SEAL 1298	Passivated Silver-Aluminum	Fluorosilicone	●●●●○	●●●●○	Type D
CHO-SEAL S6305	Nickel-Graphite	Silicone	●●●●○	●●○○○	-----
CHO-SEAL 1285	Silver-Aluminum	Silicone	●●●●○	●●●○○	Type B
CHO-SEAL 1287	Silver-Aluminum	Fluorosilicone	●●●●○	●●●○○	Type D
CHO-SEAL 1215	Silver-Copper	Silicone	●●●●●	●○○○○	Type A
CHO-SEAL 1217	Silver-Copper	Fluorosilicone	●●●●●	●○○○○	Type C
CHO-SEAL 6370 (E)	Nickel-Graphite	Silicone	●●●○○	●●○○○	-----
CHO-SEAL 6371 (M)	Nickel-Graphite	Silicone	●●○○○	●●○○○	-----
CHO-SEAL 6308 (E)	Nickel-Graphite	Silicone	●●●●○	●●○○○	-----
CHO-SEAL 6330 (M)	Nickel-Graphite	Silicone	●○○○○	●●○○○	-----
CHO-SEAL L6303	Nickel-Graphite	Fluorosilicone	●●●●○	●●○○○	-----
CHO-SEAL 1350	Silver-Glass	Silicone	●●●●○	●○○○○	Type M*
CHO-SEAL 1310 (M)	Silver-Glass	Silicone	●●●○○	●○○○○	-----
CHO-SEAL 1273	Silver-Copper	Silicone	●●●●○	●○○○○	-----
CHO-SEAL 1270 (M)	Silver-Copper	Silicone	●○○○○	●○○○○	-----

*Molded version of CHO-SEAL 1350 meets Mil-DTL-83528 type M specifications. Extruded version of CHO-SEAL 1350 meets Mil-DTL-83528 type M specifications except elongation (60/260).

Most commonly selected materials

Table 4-2: Quick Reference Guide for Selecting Conductive Elastomers - Specialty Elastomers (M) = Molded only, (E) = Extruded only

Material	Filler	Binder	Shielding	Corrosion (on Aluminum)	MIL-DTL-83528
CHO-SEAL 1224 (M)	Silver	Silicone	●●●●●	●○○○○	Type E
CHO-SEAL 1221 (M)	Silver	Fluorosilicone	●●●●●	●○○○○	Type F
CHO-SEAL 1401	Silver	Silicone	●●●○○	●○○○○	Type J
CHO-SEAL 1239 (M)	Silver-Copper	Silicone/Cu Mesh	●●●●○	●○○○○	Type G
CHO-SEAL 1212 (M)	Silver-Copper	Silicone	●●●●●	●○○○○	Type K
CHO-SEAL 6435 (M)	Silver-Nickel	EPDM	●●○○○	●●○○○	-----
CHO-SEAL 6307 (M)	Nickel-Graphite	EPDM	●●○○○	●●●○○	-----
CHO-SEAL 6452 (E)	Nickel-Graphite	EPDM	●●○○○	●●●●○	-----
CHO-SEAL 6460 (M)	Nickel-Aluminum	EPDM	●●●●○	●●●●●	-----
CHO-SEAL V6433 (M)	Silver-Nickel	Fluoro/Fluorocarbon	●●●○○	●○○○○	-----
CHO-SEAL S6600 (M)	Carbon	Silicone	●○○○○	●○○○○	-----

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Elastomer Binder Legend

Silicone | Fluorosilicone | EPDM | Fluorocarbon/ Fluorosilicone

Elastomer Filler Legend

Corrosion Resistant on Aluminum

Table 4-3: Material Guidelines - Military and Commercial

			Test Procedure (Type of Test)	CHO-SEAL 6502	CHO-SEAL 6503	CHO-SEAL 1298	CHO-SEAL 1285	CHO-SEAL 1287	CHO-SEAL 1215
Physical	Molded (M) or Extruded (E)		--	M/E	M/E	M/E	M/E	M/E	M/E
	Conductive Filler		--	Ni/Al	Ni/Al	Passivated Ag/Al	Ag/Al	Ag/Al	Ag/Cu
	Elastomer Binder		--	Silicone	Fluorosilicone	Fluorosilicone	Silicone	Fluorosilicone	Silicone
	Type (Ref. MIL-DTL-83528)		--	Not Applicable	Not Applicable	Type D	Type B	Type D	Type A
	Volume Resistivity, ohm-cm, max., as supplied without pressure sensitive adhesive		CEPS-0002[C] (Q/C)	0.150	0.250	Not Applicable	Not Applicable	Not Applicable	Not Applicable
			MIL-DTL-83528 (Q/C)	Not Applicable	Not Applicable	0.012	0.008	0.012	0.004
	Hardness, Shore A		ASTM D2240 (Q/C)	68 ±10	72 ±10	70 ±7	65 ±7	70 ±7	65 ±7
	Specific Gravity		ASTM D792 (Q/C)	1.85 ±0.25	2.05 ±0.25	2.00 ±0.25	2.00 ±0.25	2.00 ±0.25	3.50 ±0.45
	Tensile Strength, psi (MPa), min.		ASTM D412 (Q/C)	150 (1.03)	150 (1.03)	180 (1.24)	200 (1.38)	180 (1.24)	200 (1.38)
	Elongation, % min. or % min./max.		ASTM D412 (Q/C)	100 min	50 min	60/260	100/300	60/260	100/300
	Tear Strength, lb/in. (kN/m), min.		ASTM D624 (Q)	40 (7.00)	35 (6.13)	35 (6.13)	30 (5.25)	35 (6.13)	40 (7.00)/25 (4.38)
	Compression Set, 70 hrs at 100°C, % max.[A]		ASTM D395, Method B (Q)	30	30	30	32	30	32
Thermal	Low Temperature Flex TR10, °C, min.		ASTM D1329 (Q)	-55	-55	-55	-65	-55	-65
	Maximum Continuous Use Temperature, °C[B]		--	125	125	160/200	160/200	160/200	125
	Thermal Conductivity, W/m-K (Typical) 300 psi (2.07 MPa)		ASTM D5470	1.0	0.9	1.2	2.2	Not Tested	2.1
Electrical	Shielding Effectiveness, dB, min.[F]		Method 1: CHO-TP08[C] (Q)	Method 2	Method 2	Method 2	Method 2	Method 2	Method 2
	200 kHz (H Field)			Not Tested	Not Tested	55	60	55	70
	100 MHz (E Field)		Method 2: MIL-DTL-83528 Para. 4.5.12 (Q)	127	127	110	115	110	120
	500 MHz (E Field)			115	117	100	110	100	120
	2 GHz (Plane Wave)			116	116	95	105	95	120
	10 GHz (Plane Wave)		Method 3: CHO-TP09[C] (Q)	127	127	90	100	90	120
	40 GHz (Plane Wave)			Not Tested		75	Not Tested	75	90
	Electrical Stability, ohm-cm, max.	Heat Aging	CEPS-0002[C] (Q)	0.200 [H]	0.250 [H]	Not Applicable	Not Applicable	Not Applicable	Not Applicable
			MIL-DTL-83528 Para. 4.5.15 (Q/C)	Not Applicable	Not Applicable	0.015	0.010	0.015	0.010
		Resistance During Vibration	MIL-DTL-83528 Para. 4.5.13 (Q)	Not Applicable	Not Applicable	0.015	0.012	0.015	0.004
		Resistance After Vibration	MIL-DTL-83528 Para. 4.5.13 (Q)	Not Applicable	Not Applicable	0.012	0.008	0.012	0.008
		Post Tensile Set Volume Resistivity	MIL-DTL-83528 Para. 4.5.9 (Q/C)	Not Applicable	Not Applicable	0.015	0.015	0.015	0.008
Regulatory	EMP Survivability, kA per in. perimeter		MIL-DTL-83528 Para. 4.5.16 (Q)	>0.9	>0.9	>0.9	>0.9	>0.9	>0.9
	RoHS Compliant		--	Yes	Yes	Yes	Yes	Yes	Yes
	UL 94 Flammability Rating		UL 94	Not Tested	Not Tested	Not Tested	Not Tested	Not Tested	Not Tested

Note A: Compression set is expressed as a percentage of deflection per ASTM D395 Method B, at 25% deflection. To determine percent recovery, subtract 0.25 of the stated compression set value from 100%. For example, in the case of 30% compression set, recovery is 92.5%.

Note B: Where two values are shown, the first represents maximum operating temperature for conformance to MIL-DTL-83528 (which requires Group A life testing at 1.25 times maximum operating temperature) and the second value represents the practical limit for exposure up to 1000 hrs. (compressed between flanges 7-10%). Single values conform to both definitions.

Note C: Copies of CEPS-0002, CHO-TP08 and CHO-TP09 are available from Parker Chomerics. Contact Applications Engineering.

Note D: Heat aging condition: 100°C for 48 hrs.

Note E: Heat aging condition: 150°C for 48 hrs.

Note F: It may not be inferred that the same level of shielding effectiveness provided by a gasket material tested in the fixture per MIL-DTL-83528 Para. 4.5.12 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-DTL-83528, but which is useful for making comparisons between different gasket materials. The 40 GHz test data for all materials uses TP08 test method.

Note G: Heat aging condition: 200°C for 48 hours

Note H: Heat aging condition: 125°C for 1000 hours

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Elastomer Binder Legend

Silicone | Fluorosilicone | EPDM | Fluorocarbon/ Fluorosilicone

Elastomer Filler Legend

Corrosion Resistant on Aluminum

Table 4-3: Material Guidelines - Military and Commercial - continued

			Test Procedure (Type of Test)	CHO-SEAL 1217	CHO-SEAL S6305	CHO-SEAL 6370	CHO-SEAL 6371	CHO-SEAL 6308
Physical	Molded (M) or Extruded (E)		--	M/E	M/E	E	M	E
	Conductive Filler		--	Ag/Cu	Ni/C	Ni/C	Ni/C	Ni/C
	Elastomer Binder		--	Fluorosilicone	Silicone	Silicone	Silicone	Silicone
	Type (Ref. MIL-DTL-83528)		--	Type C	Not Applicable	Not Applicable	Not Applicable	Not Applicable
	Volume Resistivity, ohm-cm, max., as supplied without pressure sensitive adhesive		CEPS-0002[C] (Q/C)	Not Applicable	0.100	0.100	0.100	0.100
			MIL-DTL-83528 (Q/C)	0.010	Not Applicable	Not Applicable	Not Applicable	Not Applicable
	Hardness, Shore A		ASTM D2240 (Q/C)	75 ±7	65 ±10	60 ±10	65 ±10	65 ±10
	Specific Gravity		ASTM D792 (Q/C)	4.00 ±0.50	2.00 ±0.25	2.10 ±0.25	2.00 ±0.25	2.00 ±0.25
	Tensile Strength, psi (MPa), min.		ASTM D412 (Q/C)	180 (1.24)	200 (1.38)	150 (1.03)	150 (1.03)	200 (1.38)
	Elongation, % min. or % min./max.		ASTM D412 (Q/C)	100/300	100	100	100	75
	Tear Strength, lb/in. (kN/m), min.		ASTM D624 (Q)	35 (6.13)	50 (8.75)	35 (6.13)	Not Tested	40 (7.00)
	Compression Set, 70 hrs at 100°C, % max.[A]		ASTM D395, Method B (Q)	35	30	40	40	30
Thermal	Low Temperature Flex TR10, °C, min.		ASTM D1329 (Q)	-55	-45	-45	-40	-60
	Maximum Continuous Use Temperature, °C[B]		--	125	150	150	150	150
	Thermal Conductivity, W/m-K (Typical) 300 psi (2.07 MPa)		ASTM D5470	Not Tested	0.8	0.9	1.1	Not Tested
Electrical	Shielding Effectiveness, dB, min.[F]		Method 1: CHO-TP08[C] (Q)	Method 2	Method 1	Method 1	Method 1	Method 1
	200 kHz (H Field)			Not Tested	Not Tested	Not Tested	Not Tested	Not Tested
	100 MHz (E Field)		Method 2: MIL-DTL-83528 Para. 4.5.12 (Q)	120	100	100	100	100
	500 MHz (E Field)			120	100	100	100	100
	2 GHz (Plane Wave)			115	100	95	80	100
	10 GHz (Plane Wave)		Method 3: CHO-TP09[C] (Q)	110	100	95	80	100
	40 GHz (Plane Wave)			Not Tested	75	Not Tested	Not Tested	Not Tested
	Electrical Stability, ohm-cm, max.	Heat Aging	CEPS-0002[C] (Q)	Not Applicable	0.250[E]	0.250[E]	0.250[E]	0.250[E]
			MIL-DTL-83528 Para. 4.5.15 (Q/C)	0.015	Not Applicable	Not Applicable	Not Applicable	Not Applicable
		Resistance During Vibration	MIL-DTL-83528 Para. 4.5.13 (Q)	0.010	Not Applicable	Not Applicable	Not Applicable	Not Applicable
		Resistance After Vibration	MIL-DTL-83528 Para. 4.5.13 (Q)	0.015	Not Applicable	Not Applicable	Not Applicable	Not Applicable
		Post Tensile Set Volume Resistivity	MIL-DTL-83528 Para. 4.5.9 (Q/C)	0.015	Not Applicable	Not Applicable	Not Applicable	Not Applicable
Regulatory	EMP Survivability, kA per in. perimeter		MIL-DTL-83528 Para. 4.5.16 (Q)	>0.9	Not Applicable	Not Applicable	Not Applicable	Not Applicable
	RoHS Compliant		--	Yes	Yes	Yes	Yes	Yes
	UL 94 Flammability Rating		UL 94	Not Tested	V-0	V-0	V-0	Not Tested

Note A: Compression set is expressed as a percentage of deflection per ASTM D395 Method B, at 25% deflection. To determine percent recovery, subtract 0.25 of the stated compression set value from 100%. For example, in the case of 30% compression set, recovery is 92.5%.

Note B: Where two values are shown, the first represents maximum operating temperature for conformance to MIL-DTL-83528 (which requires Group A life testing at 1.25 times maximum operating temperature) and the second value represents the practical limit for exposure up to 1000 hrs. (compressed between flanges 7-10%). Single values conform to both definitions.

Note C: Copies of CEPS-0002, CHO-TP08 and CHO-TP09 are available from Parker Chomerics. Contact Applications Engineering.

Note D: Heat aging condition: 100°C for 48 hrs.

Note E: Heat aging condition: 150°C for 48 hrs.

Note F: It may not be inferred that the same level of shielding effectiveness provided by a gasket material tested in the fixture per MIL-DTL-83528 Para. 4.5.12 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-DTL-83528, but which is useful for making comparisons between different gasket materials. The 40 GHz test data for all materials uses TP08 test method.

Note G: Heat aging condition: 200°C for 48 hours

Note H: Heat aging condition: 125°C for 1000 hours

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Elastomer Binder Legend

Silicone | Fluorosilicone | EPDM | Fluorocarbon/ Fluorosilicone

Elastomer Filler Legend

Corrosion Resistant on Aluminum

Table 4-3: Material Guidelines - Military and Commercial - continued

			Test Procedure (Type of Test)	CHO-SEAL 6330	CHO-SEAL L6303	CHO-SEAL 1350	CHO-SEAL 1310	CHO-SEAL 1273	CHO-SEAL 1270
Physical	Molded (M) or Extruded (E)		--	M	M/E	M/E [J]	M	M/E	M
	Conductive Filler		--	Ni/C	Ni/C	Ag/Glass	Ag/Glass	Ag/Cu	Ag/Cu
	Elastomer Binder		--	Silicone	Fluorosilicone	Silicone	Silicone	Silicone	Silicone
	Type (Ref. MIL-DTL-83528)		--	Not Applicable	Not Applicable	Type M[J]	Not Applicable	Not Applicable	Not Applicable
	Volume Resistivity, ohm-cm, max., as supplied without pressure sensitive adhesive		CEPS-0002[C] (Q/C)	0.250	0.100	Not Applicable	0.010	0.004	0.050
			MIL-DTL-83528 (Q/C)	Not Applicable	Not Applicable	0.006	Not Applicable	Not Applicable	Not Applicable
	Hardness, Shore A		ASTM D2240 (Q/C)	40 ±7	65 ±10	65 ±7	70 ±10	65 ±8	40 ±7
	Specific Gravity		ASTM D792 (Q/C)	1.70 ±0.25	2.20 ±0.25	1.90 ±0.25	1.80 ±0.25	3.70 ±0.25	2.90 ±0.25
	Tensile Strength, psi (MPa), min.		ASTM D412 (Q/C)	120 (0.83)	150 (1.03)	200 (1.38)	200 (1.38)	175 (1.21)	80 (0.55)
	Elongation, % min. or % min./max.		ASTM D412 (Q/C)	75	60	100/300	100	75	75
	Tear Strength, lb/in. (kN/m), min.		ASTM D624 (Q)	Not Tested	35 (6.13)	30 (5.25)	Not Tested	Not Tested	Not Tested
	Compression Set, 70 hrs at 100°C, % max.[A]		ASTM D395, Method B (Q)	25	25	30	35	32	30
Thermal	Low Temperature Flex TR10, °C, min.		ASTM D1329 (Q)	-40	-45	-55	-40	-65	-60
	Maximum Continuous Use Temperature, °C[B]		--	150	150	160	160	125	125
	Thermal Conductivity, W/m-K (Typical) 300 psi (2.07 MPa)		ASTM D5470	0.6	0.8	1.2	Not Tested	Not Tested	0.8
Electrical	Shielding Effectiveness, dB, min.[F]		Method 1: CHO-TP08[C] (Q)	Method 3	Method 1	Method 2	Method 1	Method 1	Method 3
	200 kHz (H Field)			Not Tested	Not Tested	50	Not Tested	Not Tested	Not Tested
	100 MHz (E Field)		Method 2: MIL-DTL-83528 Para. 4.5.12 (Q)	75	100	125	100	100	80
	500 MHz (E Field)			75	100	114	100	100	80
	2 GHz (Plane Wave)			70	100	116	90	100	70
	10 GHz (Plane Wave)		Method 3: CHO-TP09[C] (Q)	70	100	124	80	100	70
	40 GHz (Plane Wave)			Not Tested	Not Tested	Not Tested	Not Tested	Not Tested	Not Tested
	Electrical Stability, ohm-cm, max.	Heat Aging	CEPS-0002[C] (Q)	0.250[E]	0.250[E]	Not Applicable	0.010	0.010	0.100[E]
			MIL-DTL-83528 Para. 4.5.15 (Q/C)	Not Applicable	Not Applicable	0.015	Not Applicable	Not Applicable	Not Applicable
		Resistance During Vibration	MIL-DTL-83528 Para. 4.5.13 (Q)	Not Applicable	Not Applicable	0.009	Not Applicable	Not Applicable	Not Applicable
		Resistance After Vibration	MIL-DTL-83528 Para. 4.5.13 (Q)	Not Applicable	Not Applicable	0.006	Not Applicable	Not Applicable	Not Applicable
		Post Tensile Set Volume Resistivity	MIL-DTL-83528 Para. 4.5.9 (Q/C)	Not Applicable	Not Applicable	0.009	Not Applicable	Not Applicable	Not Applicable
Regulatory	EMP Survivability, kA per in. perimeter		MIL-DTL-83528 Para. 4.5.16 (Q)	Not Applicable	Not Applicable	>0.9	Not Applicable	Not Applicable	Not Applicable
	RoHS Compliant		--	Yes	Yes	Yes	Yes	Yes	Yes
	UL 94 Flammability Rating		UL 94	Not Tested	Not Tested	Not Tested	V-0	V-0	Not Tested

Note A: Compression set is expressed as a percentage of deflection per ASTM D395 Method B, at 25% deflection. To determine percent recovery, subtract 0.25 of the stated compression set value from 100%. For example, in the case of 30% compression set, recovery is 92.5%.

Note B: Where two values are shown, the first represents maximum operating temperature for conformance to MIL-DTL-83528 (which requires Group A life testing at 1.25 times maximum operating temperature) and the second value represents the practical limit for exposure up to 1000 hrs. (compressed between flanges 7-10%). Single values conform to both definitions.

Note C: Copies of CEPS-0002, CHO-TP08 and CHO-TP09 are available from Parker Chomerics. Contact Applications Engineering.

Note D: Heat aging condition: 100°C for 48 hrs.

Note E: Heat aging condition: 150°C for 48 hrs.

Note F: It may not be inferred that the same level of shielding effectiveness provided by a gasket material tested in the fixture per MIL-DTL-83528 Para. 4.5.12 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-DTL-83528, but which is useful for making comparisons between different gasket materials. The 40 GHz test data for all materials uses TP08 test method.

Note G: Heat aging condition: 200°C for 48 hours

Note H: Heat aging condition: 125°C for 1000 hours

Note J: Molded version of CHO-SEAL 1350 meets Mil-DTL-83528 type M specifications. Extruded version of CHO-SEAL 1350 meets Mil-DTL-83528 type M specifications except elongation (60/260).

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Elastomer Binder Legend

Silicone | Fluorosilicone | EPDM | Fluorocarbon/ Fluorosilicone

Elastomer Filler Legend

Corrosion Resistant on Aluminum

Table 4-4: Material Guidelines - Specialty Products

			Test Procedure (Type of Test)	CHO-SEAL 1224	CHO-SEAL 1221	CHO-SEAL 1401	CHO-SEAL 1239	CHO-SEAL 1212
Physical	Molded (M) or Extruded (E)		--	M	M	M/E	M	M
	Conductive Filler		--	Ag	Ag	Ag	Ag/Cu	Ag/Cu
	Elastomer Binder		--	Silicone	Fluorosilicone	Silicone	Silicone & Expanded Cu Foil	Silicone
	Type (Ref. MIL-DTL-83528)		--	Type E	Type F	Type J	Type G	Type K
	Volume Resistivity, ohm-cm, max., as supplied without pressure sensitive adhesive		CEPS-0002[C] (Q/C)	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable
			MIL-DTL-83528 (Q/C)	0.002	0.002	0.010	0.007	0.005
	Hardness, Shore A		ASTM D2240 (Q/C)	65 ±7	75 ±7	45 ±5	80 ±7	85 ±7
	Specific Gravity		ASTM D792 (Q/C)	3.50 ±0.45	4.00 ±0.50	1.60 ±0.25	4.75 ±0.75	3.50 ±0.45
	Tensile Strength, psi (MPa), min.		ASTM D412 (Q/C)	300 (2.07)	250 (1.72)	200 (1.38)	600 (4.14)	400 (2.76)
	Elongation, % min. or % min./max.		ASTM D412 (Q/C)	200/500	100/300	75	20	100/300
	Tear Strength, lb/in. (kN/m), min.		ASTM D624 (Q)	50 (8.75)	40 (7.00)	20 (3.50)	70 (12.25)	40 (7.00)
	Compression Set, 70 hrs at 100°C, % max.[A]		ASTM D395, Method B (Q)	45	60	35	Not Tested	35
Thermal	Low Temperature Flex TR10, °C, min.		ASTM D1329 (Q)	-65	-65	-55	Not Tested	-45
	Maximum Continuous Use Temperature, °C[B]		--	160/200	160/200	160/200	125	125
	Thermal Conductivity, W/m-K (Typical) 300 psi (2.07 MPa)		ASTM D5470	2.8	Not Tested	0.9	1.9	1.8
Electrical	Shielding Effectiveness, dB, min.[F]		Method 1: CHO-TP08[C] (Q)	Method 2	Method 2	Method 2	Method 2	Method 2
	200 kHz (H Field)			70	70	60	70	70
	100 MHz (E Field)		Method 2: MIL-DTL-83528 Para. 4.5.12 (Q)	120	120	100	110	120
	500 MHz (E Field)			120	120	100	110	120
	2 GHz (Plane Wave)			120	120	90	110	120
	10 GHz (Plane Wave)		Method 3: CHO-TP09[C] (Q)	120	120	80	110	120
	40 GHz (Plane Wave)			Not Tested	Not Tested	Not Tested	Not Tested	Not Tested
	Electrical Stability, ohm-cm, max.	Heat Aging	CEPS-0002[C] (Q)	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable
			MIL-DTL-83528 Para. 4.5.15 (Q/C)	0.010	0.010	0.015	0.010	0.010
		Resistance During Vibration	MIL-DTL-83528 Para. 4.5.13 (Q)	0.010	0.010	0.015	0.007	0.010
		Resistance After Vibration	MIL-DTL-83528 Para. 4.5.13 (Q)	0.002	0.002	0.010	Not Applicable	0.005
		Post Tensile Set Volume Resistivity	MIL-DTL-83528 Para. 4.5.9 (Q/C)	0.010	0.010	0.020	Not Applicable	0.010
Regulatory	EMP Survivability, kA per in. perimeter		MIL-DTL-83528 Para. 4.5.16 (Q)	>0.9	>0.9	>0.9	>0.9	>0.9
	RoHS Compliant		--	Yes	Yes	Yes	Yes	Yes
	UL 94 Flammability Rating		UL 94	Not Tested	Not Tested	Not Tested	Not Tested	Not Tested

Note A: Compression set is expressed as a percentage of deflection per ASTM D395 Method B, at 25% deflection. To determine percent recovery, subtract 0.25 of the stated compression set value from 100%. For example, in the case of 30% compression set, recovery is 92.5%.

Note B: Where two values are shown, the first represents maximum operating temperature for conformance to MIL-DTL-83528 (which requires Group A life testing at 1.25 times maximum operating temperature) and the second value represents the practical limit for exposure up to 1000 hrs. (compressed between flanges 7-10%). Single values conform to both definitions.

Note C: Copies of CEPS-0002, CHO-TP08 and CHO-TP09 are available from Parker Chomerics. Contact Applications Engineering.

Note D: Heat aging condition: 100°C for 48 hrs.

Note E: Heat aging condition: 150°C for 48 hrs.

Note F: It may not be inferred that the same level of shielding effectiveness provided by a gasket material tested in the fixture per MIL-DTL-83528 Para. 4.5.12 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-DTL-83528, but which is useful for making comparisons between different gasket materials. The 40 GHz test data for all materials uses TP08 test method.

Note G: Heat aging condition: 200°C for 48 hours

Note H: Heat aging condition: 125°C for 1000 hours

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Elastomer Binder Legend

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Corrosion Resistant on Aluminum

Table 4-4: Material Guidelines - Specialty Products - continued

			Test Procedure (Type of Test)	CHO-SEAL 6435	CHO-SEAL 6307	CHO-SEAL 6452	CHO-SEAL 6460
Physical	Molded (M) or Extruded (E)		--	M	M	E	M
	Conductive Filler		--	Ag/Ni	Ni/C	Ni/C	Ni/Al+Ni/C
	Elastomer Binder		--	EPDM	EPDM	EPDM	EPDM
	Type (Ref. MIL-DTL-83528)		--	Not Applicable	Not Applicable	Not Applicable	Not Applicable
	Volume Resistivity, ohm-cm, max., as supplied without pressure sensitive adhesive		CEPS-0002[C] (Q/C)	0.006	5.000	Not Applicable	Not Applicable
			MIL-DTL-83528 (Q/C)	Not Applicable	Not Applicable	0.500	0.600
	Hardness, Shore A		ASTM D2240 (Q/C)	80 ±7	75 ±7	70 ±10	65 ±7
	Specific Gravity		ASTM D792 (Q/C)	3.70 ±0.25	1.90 ±0.25	1.95 ±0.25	1.80 ±0.25
	Tensile Strength, psi (MPa), min.		ASTM D412 (Q/C)	200 (1.38)	200 (1.38)	200 (1.38)	200 (1.38)
	Elongation, % min. or % min./max.		ASTM D412 (Q/C)	200	75	200	200
	Tear Strength, lb/in. (kN/m), min.		ASTM D624 (Q)	75 (13.13)	60 (10.51)	55 (9.63)	50 (8.75)
	Compression Set, 70 hrs at 100°C, % max.[A]		ASTM D395, Method B (Q)	40	40	35	30
Thermal	Low Temperature Flex TR10, °C, min.		ASTM D1329 (Q)	-40	-45	-50	-50
	Maximum Continuous Use Temperature, °C[B]		--	100	100	100	100
	Thermal Conductivity, W/m-K (Typical) 300 psi (2.07 MPa)		ASTM D5470	1.8	0.6	Not Tested	Not Tested
Electrical	Shielding Effectiveness, dB, min.[F]		Method 1: CHO-TP08[C] (Q)	Method 2	Method 2	Method 3	Method 2
	200 kHz (H Field)			Not Tested	Not Tested	Not Tested	Not Tested
	100 MHz (E Field)		Method 2: MIL-DTL-83528 Para. 4.5.12 (Q)	105	95	75	110
	500 MHz (E Field)			100	90	100	120
	2 GHz (Plane Wave)			85	85	105	105
	10 GHz (Plane Wave)		Method 3: CHO-TP09[C] (Q)	85	85	85	100
	40 GHz (Plane Wave)			Not Tested	Not Tested	Not Tested	Not Tested
	Electrical Stability, ohm-cm, max.	Heat Aging	CEPS-0002[C] (Q)	0.0125[D]	10[D]	Not Applicable	Not Applicable
			MIL-DTL-83528 Para. 4.5.15 (Q/C)	Not Applicable	Not Applicable	0.350	2.500[D]
		Resistance During Vibration	MIL-DTL-83528 Para. 4.5.13 (Q)	Not Applicable	Not Applicable	Not Applicable	Not Applicable
		Resistance After Vibration	MIL-DTL-83528 Para. 4.5.13 (Q)	Not Applicable	Not Applicable	Not Applicable	Not Applicable
		Post Tensile Set Volume Resistivity	MIL-DTL-83528 Para. 4.5.9 (Q/C)	Not Applicable	Not Applicable	Not Applicable	Not Applicable
Regulatory	EMP Survivability, kA per in. perimeter		MIL-DTL-83528 Para. 4.5.16 (Q)	Not Applicable	Not Applicable	Not Applicable	Not Applicable
	RoHS Compliant		--	Yes	Yes	Yes	Yes
	UL 94 Flammability Rating		UL 94	Not Tested	Not Tested	Not Tested	Not Tested

Note A: Compression set is expressed as a percentage of deflection per ASTM D395 Method B, at 25% deflection. To determine percent recovery, subtract 0.25 of the stated compression set value from 100%. For example, in the case of 30% compression set, recovery is 92.5%.

Note B: Where two values are shown, the first represents maximum operating temperature for conformance to MIL-DTL-83528 (which requires Group A life testing at 1.25 times maximum operating temperature) and the second value represents the practical limit for exposure up to 1000 hrs. (compressed between flanges 7-10%). Single values conform to both definitions.

Note C: Copies of CEPS-0002, CHO-TP08 and CHO-TP09 are available from Parker Chomerics. Contact Applications Engineering.

Note D: Heat aging condition: 100°C for 48 hrs.

Note E: Heat aging condition: 150°C for 48 hrs.

Note F: It may not be inferred that the same level of shielding effectiveness provided by a gasket material tested in the fixture per MIL-DTL-83528 Para. 4.5.12 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-DTL-83528, but which is useful for making comparisons between different gasket materials. The 40 GHz test data for all materials uses TP08 test method.

Note G: Heat aging condition: 200°C for 48 hours

Note H: Heat aging condition: 125°C for 1000 hours

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Corrosion Resistant on Aluminum

Table 4-4: Material Guidelines - Specialty Products - continued

			Test Procedure (Type of Test)	CHO-SEAL V6433	CHO-SEAL S6600
Physical	Molded (M) or Extruded (E)		--	M	M
	Conductive Filler		--	Ag/Ni	Carbon
	Elastomer Binder		--	Fluorocarbon/Fluorosilicone	Silicone
	Type (Ref. MIL-DTL-83528)		--	Not Applicable	Not Applicable
	Volume Resistivity, ohm-cm, max., as supplied without pressure sensitive adhesive		CEPS-0002[C] (Q/C)	Not Applicable	7
			MIL-DTL-83528 (Q/C)	0.006	Not Applicable
	Hardness, Shore A		ASTM D2240 (Q/C)	85 ±7	75 ±7
	Specific Gravity		ASTM D792 (Q/C)	4.80 ±0.25	1.20 ±0.25
	Tensile Strength, psi (MPa), min.		ASTM D412 (Q/C)	400 (2.76)	650 (4.48)
	Elongation, % min. or % min./max.		ASTM D412 (Q/C)	50	70
	Tear Strength, lb/in. (kN/m), min.		ASTM D624 (Q)	70 (12.25)	Not Tested
	Compression Set, 70 hrs at 100°C, % max.[A]		ASTM D395, Method B (Q)	45	45
Thermal	Low Temperature Flex TR10, °C, min.		ASTM D1329 (Q)	-25	-45
	Maximum Continuous Use Temperature, °C [B]		--	200	200
	Thermal Conductivity, W/m-K (Typical) 300 psi (2.07 MPa)		ASTM D5470	2.1	0.6
Electrical	Shielding Effectiveness, dB, min.[F]		Method 1: CHO-TP08[C] (Q)	Method 2	Method 1
	200 kHz (H Field)			Not Tested	Not Tested
	100 MHz (E Field)		Method 2: MIL-DTL-83528 Para. 4.5.12 (Q)	105	80
	500 MHz (E Field)			100	80
	2 GHz (Plane Wave)			90	60
	10 GHz (Plane Wave)		Method 3: CHO-TP09[C] (Q)	90	50
	40 GHz (Plane Wave)			Not Tested	Not Tested
	Electrical Stability, ohm-cm, max.	Heat Aging	CEPS-0002[C] (Q)	0.008[G]	7[E]
			MIL-DTL-83528 Para. 4.5.15 (Q/C)	Not Applicable	Not Applicable
		Resistance During Vibration	MIL-DTL-83528 Para. 4.5.13 (Q)	Not Applicable	Not Applicable
		Resistance After Vibration	MIL-DTL-83528 Para. 4.5.13 (Q)	Not Applicable	Not Applicable
		Post Tensile Set Volume Resistivity	MIL-DTL-83528 Para. 4.5.9 (Q/C)	Not Applicable	Not Applicable
Regulatory	EMP Survivability, kA per in. perimeter		MIL-DTL-83528 Para. 4.5.16 (Q)	Not Applicable	Not Applicable
	RoHS Compliant		--	Yes	Yes
	UL 94 Flammability Rating		UL 94	Not Tested	Not Tested

Note A: Compression set is expressed as a percentage of deflection per ASTM D395 Method B, at 25% deflection. To determine percent recovery, subtract 0.25 of the stated compression set value from 100%. For example, in the case of 30% compression set, recovery is 92.5%.

Note B: Where two values are shown, the first represents maximum operating temperature for conformance to MIL-DTL-83528 (which requires Group A life testing at 1.25 times maximum operating temperature) and the second value represents the practical limit for exposure up to 1000 hrs. (compressed between flanges 7-10%). Single values conform to both definitions.

Note C: Copies of CEPS-0002, CHO-TP08 and CHO-TP09 are available from Parker Chomerics. Contact Applications Engineering.

Note D: Heat aging condition: 100°C for 48 hrs.

Note E: Heat aging condition: 150°C for 48 hrs.

Note F: It may not be inferred that the same level of shielding effectiveness provided by a gasket material tested in the fixture per MIL-DTL-83528 Para. 4.5.12 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-DTL-83528, but which is useful for making comparisons between different gasket materials. The 40 GHz test data for all materials uses TP08 test method.

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