

VersaDamp™ 2000 TPE System simplifies vibration and shock control design



Product Applications

Small electric motor mounts

Fan isolators

Instrument mounts

Electronics snubbers

Energy-absorbing gaskets

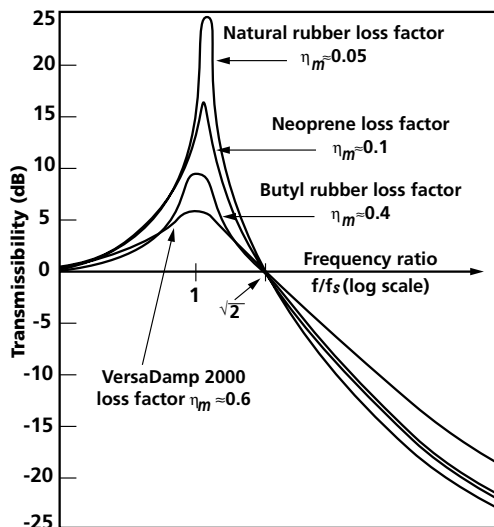
- Adjustable damping—can optimize product performance
- Adjustable durometer—no need to change the design to vary stiffness
- Injection moldable—lower processing costs
- Broad temperature range—materials perform in extreme environments
- Ten standard formulations—design versatility and quick prototypes
- No free sulfur, carbon or plasticizer—materials meet electronics and automotive requirements
- Ideal for shock, vibration and noise control in automotive, portable electronics and appliance applications.

The new VersaDamp 2000 System for formulating damping and isolation thermoplastic elastomer (TPE) materials eliminates the need to make tradeoffs for shock and vibration control in OEM product design. The system allows us to adjust both the materials' damping performance and the durometer—individually and simultaneously.

Multiple motors, fans, microphones, LEDs and other mechanisms packed into today's miniaturized devices can create complex, interrelated noise, vibration and shock problems. Portability adds the problems of shock and unpredictable vibration to the equation as well. The E-A-R VersaDamp system simplifies the problem-solving process by giving product engineers nearly limitless options to deal with limited isolator space, broad operating temperature ranges and multiple vibration sources.

As molded isolators and other equipment components, E-A-R VersaDamp 2000 Series materials provide predictable damping performance throughout a broad range of temperatures. And, because the materials can be formulated at the molding machine, they enable economical small runs of both standard and custom formulations.

E-A-R VersaDamp materials can be formulated with a continuum of durometers, ranging from 40 Shore A to 75 Shore A, and damping performance can be varied as well.



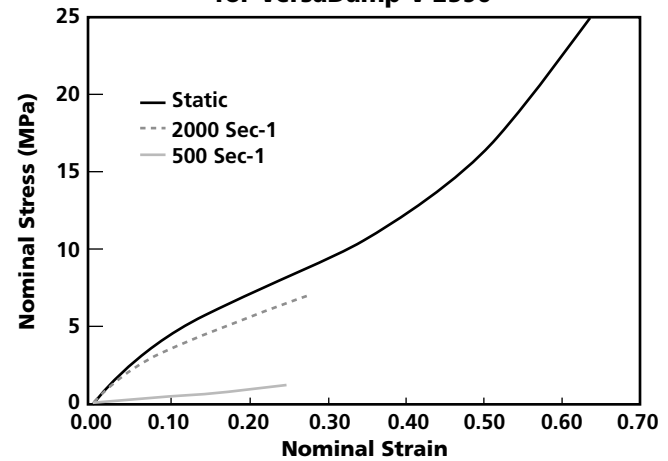
Uncontrolled response of rubber and neoprene isolators can mean damage to sensitive components, as well as audible noise in typical operation environments. E-A-R VersaDamp isolators minimize these effects.

Typical Properties

Property	V-2525	V-2550	V-2575	V-2590
Loss Factor (DMA) ASTM D2240 @ 10Hz Glass Transition (C) Max Loss Factor Loss Factor at 20C	-64 0.48 0.12	-64 0.64 0.16	-61 0.67 0.21	-58 0.75 0.36
Electrical Resistance Volume Resistivity ASTM D257 (ohms cm)				5.3 x 10 ¹⁵
Abrasion Resistance Taber ASTM D3389 Wear Factor (1000mg H22 wheel)		393		
Ozone Resistance ASTM D1149-91	No Cracking	No Cracking	No Cracking	No Cracking
UV Resistance Change (%) ASTM G53 2 weeks Exposure Durometer Tensile Strength Elongation (%)			-2.9 1.3 5.0	
Plasticizer Migration ASTM 1203 Method A % @ 70C 24hr activated charcoal		0.24		0.23
Bacterial Resistance ASTM G21	Meets	Meets	Meets	Meets
Fungal Resistance ASTM G22	Meets	Meets	Meets	Meets
Chemical Resistance Weight Change (%) ASTM D543 7 days immersion				
Glycerol	0.0			0.0
Sea Water	0.3			0.2
Motor Oil				14.4
Hydraulic Fluid	-6.2			0.0
Diesel Fuel				125.0
Deionized Water	4.8			0.3
95% Ethanol	-4.8			0.0
Antifreeze	7.0			0.0
Hexane				84.0
ASTM #3 Oil				163.0
Gasoline				125.0
50% NaOH	0.1			0.3
10% HCl	0.4			0.2
Heat Aging 100C				
Change in Hardness				
1 Day	0.0	(1.0)	(1.5)	
7 Days	1.1	(0.2)	(0.4)	
30 Days	(3.2)	(2.3)	(2.1)	
Change in Tensile Strength				
1 Day	3.6	6.0	4.4	
7 Days	3.6	5.0	0.1	
30 Days	5.1	4.3	2.2	
Change in Elongation (%)				
1 Day	1.3	4.8	10.8	
7 Days	3.0	5.1	4.7	
30 Days	5.7	11.0	21.7	
Heat Aging 125C				
Change in Hardness				
1 Day	(1.1)	(1.9)	(2.9)	
7 Days	(0.7)	(1.6)	(3.9)	
30 Days	(0.4)	(3.4)	(4.6)	
Change in Tensile Strength				
1 Day	1.2	(0.8)	(4.9)	
7 Days	7.4	(0.4)	(4.9)	
30 Days	3.9	(9.3)	(25.6)	
Change in Elongation (%)				
1 Day	(0.9)	1.0	10.8	
7 Days	6.1	8.1	23.8	
30 Days	1.2	2.6	(5.6)	

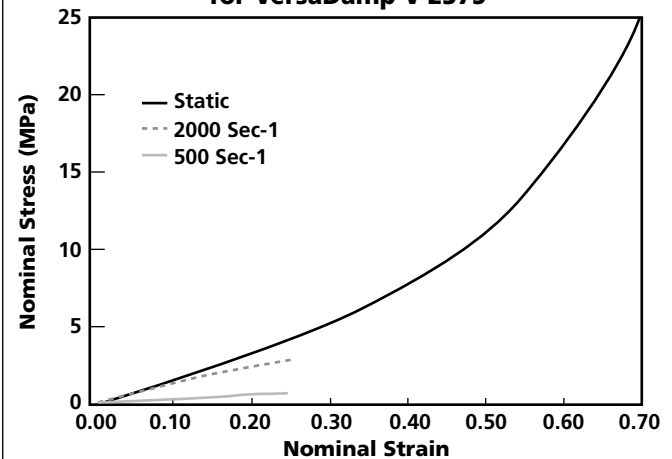
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Dynamic Stress vs. Strain for VersaDamp V-2590



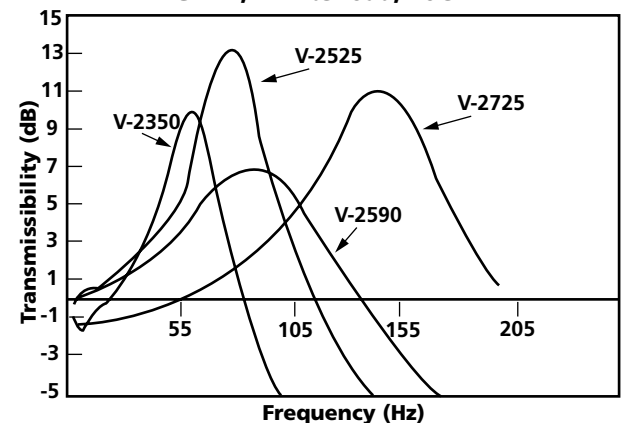
Damped materials exhibit strain rate-sensitive modulus behavior. This means that as they are deformed or deflected at a faster rate, they react with a higher stiffness. These curves show how E-A-R VersaDamp V-2590 (above) and V-2375 materials react to different rates of deformation (strain rates). They can be used to correctly describe a viscoelastic material within an FEA model that is being used for non-linear, dynamic, transient analysis.

Dynamic Stress vs. Strain for VersaDamp V-2375



Variation of Isolator Response with Material Change

E-A-R VersaDamp V-2000 G-411, 1.2 lbs load, 20C

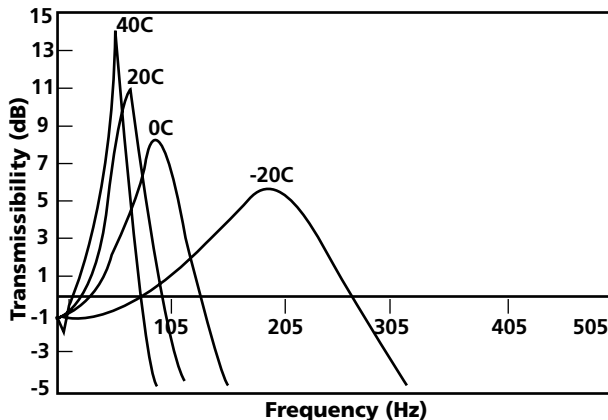


The response of VersaDamp isolators can be tuned to a system without expensive tooling modifications. By controlling both the stiffness, which affects natural frequency, and the damping, which affects peak transmissibility, it is possible to balance both isolation and stability.

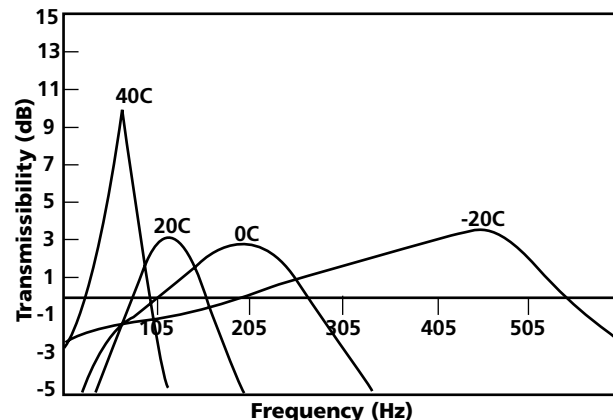
E-A-R VersaDamp V-2000 TPE System—Typical Properties

Property	Compound									
	V-2300 Series			V-2500 Series				V-2700 Series		
	V-2325	V-2350	V-2375	V-2525	V-2550	V-2575	V-2590	V-2725	V-2750	V-2775
Relative Peak Transmissibility (dB) G-411 Grommet 1.2lb load @ 20C (68F)	12.7	10.2	6.8	13.3	11.1	7.9	7.1	11.2	9.7	7.3
Hardness Shore A Durometer ASTM D2240 at 5 seconds	40	47	50	56	57	57	57	74	70	64
Resilience Bashore Rebound (%) ASTM D2632 22C (72 F) 70C (158 F)	40 53	30 51	19 46	36 51	26 48	17 44	12 37	35 50	27 49	16 43
Tensile Properties ASTM D412 Strength MPa (psi) Elongation (%) Modulus MPa (psi)	2.62 (380) 278 1.34 (195)	3.16 (459) 294 1.50 (217)	4.29(622) 378 1.50 (217)	4.90 (710) 305 2.48 (360)	4.32 (627) 310 2.17 (315)	4.43 (643) 328 2.00 (290)	4.50 (653) 344 1.83 (265)	6.73 (976) 381 3.79 (549)	6.23 (903) 343 3.29 (477)	6.10 (885) 359 2.66 (386)
Tear Strength kN/m (lbF/in) ASTM D624	10.2 (58)	12.6 (72)	15.9 (91)	21.2 (121)	21.7 (124)	22.2 (127)	23.1 (132)	24.9 (142)	22.8 (130)	22.1 (126)
Compression Set (% set) ASTM D395B 1/2 hr @ 20C (68F) 24 hr @ 20C (68F)	9.9 5.0	9.1 6.0	10.5 3.9	13.4 8.1	13.8 4.9	14.5 5.1	14.9 7.0	20.1 14.5	20.5 14.9	17.1 10.5
15% Compressive Modulus MPa (psi) ASTM D575	2.2 (319)	2.5 (361)	2.9 (416)	4.3 (617)	4.0 (583)	3.9 (572)	4.0 (575)	7.6 (1098)	5.8 (848)	4.4 (631)
Compression Load Deflection MPa (psi) ASTM D575 5% 10% 15% 20% 25%	0.10 (14) 0.21 (30) 0.32 (46) 0.45 (65) 0.62 (90)	0.09 (13) 0.22 (32) 0.35 (51) 0.50 (72) 0.70 (102)	0.09 (13) 0.24 (35) 0.39 (57) 0.57 (83) 0.82 (119)	0.14 (20) 0.37 (54) 0.59 (86) 0.85 (124) 1.21 (176)	0.15 (22) 0.37 (53) 0.57 (82) 0.81 (117) 1.14 (165)	0.14 (20) 0.35 (51) 0.54 (79) 0.77 (112) 1.09 (158)	0.17 (24) 0.37 (54) 0.56 (81) 0.79 (115) 1.12 (162)	0.39 (57) 0.77 (111) 1.17 (169) 1.66 (241) 2.33 (338)	0.34 (50) 0.65 (94) 0.95 (138) 1.35 (196) 1.85 (268)	0.26 (37) 0.48 (69) 0.70 (102) 0.99 (143) 1.38 (200)
Flammability MVSS 302 UL94	Passes Meets HBF	Passes Meets HBF	Passes Meets HBF	Passes Meets HBF	Passes Meets HBF	Passes Meets HBF	Passes Meets HBF	Passes Meets HBF	Passes Meets HBF	Passes Meets HBF
Brittleness Temperature C(F) ASTM D2137	<-40 (-40)	<-40 (-40)	<-40 (-40)	-66 (-87)	-54 (-65)	-46 (-51)	-40(-40)	<-40 (-40)	<-40 (-40)	<-40 (-40)
Recommended Use Temperature C(F) Continuous Intermittent	100 (212) 125 (257)	100 (212) 125 (257)	100 (212) 125 (257)	100 (212) 125 (257)	100 (212) 125 (257)	100 (212) 125 (257)	100 (212) 125 (257)	100 (212) 125 (257)	100 (212) 125 (257)	100 (212) 125 (257)

Variation of Response with Temperature
E-A-R VersaDamp V-2525
G-411, 1.2 lbs load

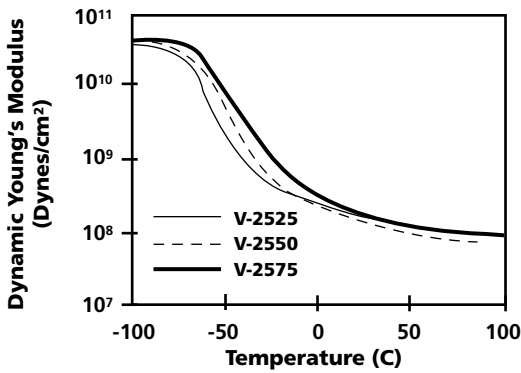


Variation of Response with Temperature
E-A-R VersaDamp V-2590
G-411, 1.2 lbs load

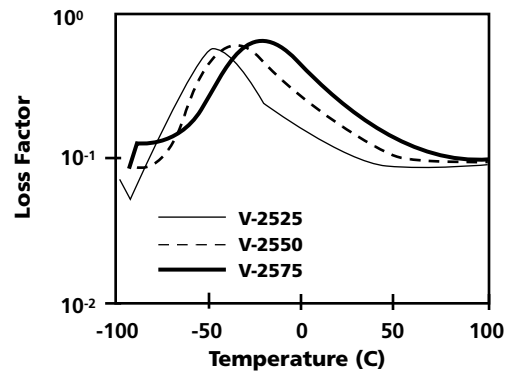


When the amount of damping in a material increases, material response becomes more temperature-dependent. These graphs illustrate the difference in temperature dependence of E-A-R VersaDamp V-2525 (left) and V-2590 (right). Although both materials will operate over the same temperature range, the higher damping of the V-2590 causes the performance characteristics to vary with temperature more than the V-2525.

Dynamic Young's Modulus vs. Temperature at 10Hz



Loss Factor vs. Temperature at 10Hz



These dynamic material analysis graphs for V-2525, V-2550 and V-2575 provide material loss factor and dynamic Young's modulus as a function of both frequency and temperature to aid in the prediction of system damping when an E-A-R VersaDamp material is incorporated.

Comparison Charts

As these charts demonstrate, E-A-R's proprietary elastomers combine the strength and environmental resistance properties expected from thermoset rubbers with high damping and the processing efficiency of thermoplastics. Moreover, typical of the E-A-R VersaDamp V-2000 Series of TPEs, V-2590 material

compares favorably with common thermoset rubbers in terms of mechanical strength and environmental resistance, and outperforms them in terms of maximum amplifications at resonance (Tmax) and rebound percentage.

E-A-R VersaDamp V-2590 vs. Other E-A-R Elastomers

Material	VersaDamp V-2590	ISODAMP C-1002	ISOLOSS HD	ISOLOSS VL
Typical Process Method	Injection Mold	Injection Mold	Transfer Compression Mold	Transfer Compression Mold
Damping Tmax	7	3	3	6
Bashore Resilience 1st Rebound (%)	12.0	4.8	4.5	23.0
Tensile Strength (psi)	653	1574	1300	256
Elongation (%)	344	459	424	900
Recovery Post Compression (%)	85.1	86.0	95.5	95.5
Resistance to:				
Ozone	Good	Good	Good	Good
Water	Good	Good	Good	Good
UV	Good	Good	Good	Good
Kerosene	Poor	Fair	Fair	Poor

E-A-R VersaDamp V-2590 vs. Other Common Elastomers

Material	VersaDamp V-2590	Neoprene Rubber Compound	Natural Rubber Compound	Nitrile Rubber Compound	Butyl Rubber Compound	Proprietary Urethane Compound	Other TPR
Typical Process Method	Injection Mold	Compression Mold	Compression Mold	Compression Mold	Compression Mold	Reaction Mold or Cast	Injection Mold
Damping Tmax	7	18	23	18	9	15	21.0
Bashore Resilience 1st Rebound (%)	12.0	23.8	68.2	28.4	15.6	13.2	49.0
Tensile Strength (psi)	653	584	1741	1103	786	144	600
Elongation (%)	344	675	776	669	335	304	700
Recovery Post Compression (%)	85.1	94.4	94.8	100.0	100.0	96.1	85.0
Resistance to:							
Ozone	Good	Good	Poor	Fair	Good	Poor	Good
Water	Good	Fair	Good	Good	Good	Fair	Good
UV	Good	Fair	Poor	Poor	Good	Fair	Good
Kerosene	Poor	Fair	Poor	Good	Fair	Fair	Poor

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