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Millathane® E34 Flame Retardant Compounds

ZH (Zero Halogen) and Halogenated, Peroxide Cured

	6104-A1	6104-B1	6104-C1	6104-D1	6104-E1
Millathane® E34	100	100	100	100	100
Stearic Acid	0.3	0.3	0.3	0.3	0.3
Ultrasil VN3	20	20	20	20	20
Silquest A-172	0.4	0.4	0.4	0.4	0.4
Tricresyl Phosphate (TCP)		5	5	15	5
SR 350 (TMPTMA)	1	1	1	1	1
Aluminum Trihydrate, ATH (DH-35[1])		100	150	150	50
Struktol WB222	1	1	1	1	1
Antimony Trioxide[2]					10
Firemaster 2100[3]					30
TP-95 (DBEEA)	5				
Dicup 40C	2	2	2	2	2
Total	129.7	229.7	279.7	289.7	219.7

[1] DH35 is a 3.5 micron ground Aluminum Tri-Hydrate produced by Franklin Industrial Minerals, Dalton, GA
[2] TMS®-HP / Timonox Blue Star is a high purity antimony trioxide produced by Chemtura Corp., Middlebury, CT.
[3] Decabromodiphenylethane produced by Chemtura Corp., Middlebury, CT.

Mooney Viscosity, ML(1+4)/100ºC	50	93	119	86	76
MDR, 20'/160ºC					
ML, lb-in	0.9	1.9	2.7	1.8	1.6
dNm	1.0	2.2	3.1	2.0	1.8
MH, lb-in	15.9	24.2	27.2	23.0	19.7
dNm	17.9	27.3	30.7	26.0	22.2
ts1, minutes	0.6	0.5	0.9	0.7	0.6
t50, minutes	2.5	2.1	2.6	2.4	2.1
t90, minutes	8.8	7.4	8.0	7.6	7.7
Physical Properties, Press Cure, tc90 at 160°C					
Hardness, Shore A	61	75	80	78	72
TSE-100*, psi	275	440	465	455	400
MPa	1.9	3.0	3.2	3.1	2.8
TSE-300, psi	1320	700	655	630	840
MPa	9.1	4.8	4.5	4.3	5.8
Tensile Strength, psi	1770	1740	1380	1380	1900
MPa	12.2	12.0	9.5	9.5	13.1
Elongation, %	350	490	460	485	465
Tear, Die C, lb/in	105	112	108	104	108
kN/m	18.4	19.6	18.9	18.2	18.9
Tear, Die B, lb/in	137	194	190	187	178
kN/m	24.0	34.0	33.3	32.7	31.2

*TSE-xxx=Tensile Stress at xxx% Elongation

Millathane® E34 Compounds: Flame Retardant, Peroxide Cured (continued)

Compound Description	6104-A1 Control No FR	6104-B1 100 ATH 5 TCP	6104-C1 150 ATH 5 TCP	6104-D1 150 ATH 15 TCP	6104-E1 Antimony Oxide/Br
Bashore Resilience, %	55	47	42	42	48
DIN Abrasion, mm³ loss	78	261	277	273	248
Compression Set, 22 hr/70°C, %	11	18	22	21	17

Vertical Burn Test, Propane torch flame applied for 10s, reapplied for 10s if flame goes out

Rating	**Poor**	**Fair**	**Very Good**	**Excellent**	**Excellent**
Description	Sample burned very readily, with burning rubber drops	Sample burned, self-extinguished (SE) after ~10s. After second flame application, sample burned completely	1st app SE after several seconds. 2nd app SE after several seconds	1st app SE immediately. 2nd app SE immediately	1st app SE immediately, 2nd app SE immediately

Observations:

1. To obtain good flame retardant properties in this Millathane E34 compound, you need about 150 parts of aluminum trihydrate (ATH) with 5 parts of TCP.

2. Increasing the TCP to 15 parts made the flame resistance “Excellent”.

3. The halogen-containing compound (E1), also containing 50 parts of ATH and 5 parts of TCP, also had “Excellent” FR properties and better strength properties than the non-halogenated compounds.

Comment:

The FR ingredients in this study could similarly be used in sulfur-cured Millathane E34 compounds, and physical properties would be improved because of the sulfur curing system.

Note: The flame resistance/flame retardance ratings, above, are not intended to reflect hazards presented by this or any other materials under actual fire conditions.