

Technical Information for Performance Solutions

Special points of interest:

- Tensile Strength
- Heat Aging
- Compression Set
- Oil Resistance
- Abrasion Resistance
- Further Information

SUMMARY

Millathane[®] 5004 can be blended with HNBR polymers to get more cost-effective compounds with usually minor differences from the 100% HNBR compounds.

Millathane[®] 5004 Blends with HNBR

HNBR (hydrogenated nitrile rubber) is a rubber noted for its excellent heat and oil resistance. Millable polyurethanes can generally be blended with HNBR (and NBR) to get properties intermediate between the two polymers. HNBR is one of the more expensive polymers available, so blending a less expensive polymer would be desirable if adequate properties could be maintained. These blends may be useful for applications such as seals, rolls, and conveyor belting.

Millathane 5004, a polyester millable urethane, has very good oil and heat resistance, and was blended with several grades of HNBR at polymer ratios of 70/30, 50/50, and 30/70. The HNBRs used in the study were:

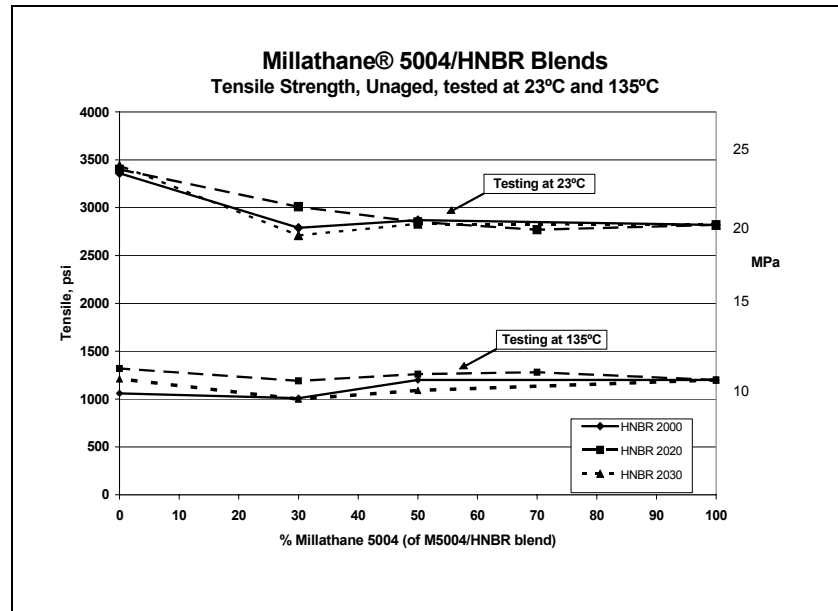
- ⇒ Zetpol* 2000L – 36% ACN HNBR with >99.5% hydrogenation
- ⇒ Zetpol* 2020L – 36% ACN HNBR with 91% hydrogenation
- ⇒ Zetpol* 2030L – 36% ACN HNBR with 85% hydrogenation

*Zetpol is a registered trademark of Zeon Chemicals L.P.



Tensile Strength

The 100% HNBR compounds had slightly higher tensile strength than Millathane 5004 when tested at room temperature (23°C), but when tested at 135°C the tensile values were similar for all polymers and blends.



MILLATHANE®

FACTOID:

Did you know that from 50–70 A, the tear and compression set properties of Millathane millable urethanes can be superior to cast urethane?

Heat Aging

After oven agings at 135°C and 150°C, Millathane 5004 had better heat resistance than Zetpol 2030L and slightly deficient heat resistance vs. Zetpol 2020L and Zetpol 2000L. Replacement of 30% of the three HNBRs with Millathane 5004 gave similar physical property changes compared to the 100% HNBR compounds, as seen below:

Zetpol 2000L	100	70				
Zetpol 2020L			100	70		
Zetpol 2030L					100	70
Millathane® 5004		30		30		100

Oven Aging, 168 hr/135°C

Hardness Change	7	6	7	8	8	8	5
Tensile Strength, % Change	2	14	0	-1	-20	4	15
Elongation, % Change	0	-9	-7	-24	-45	-31	-31

Oven Aging, 70 hr/150°C

Hardness Change	9	9	6	9	10	11	5
Tensile Strength, % Change	1	10	-2	6	-42	-8	17
Elongation, % Change	-13	-19	-19	-24	-64	-54	-35

TIPS

Compression Set

HNBRs are excellent for high temperature compression set, especially at 135°C and beyond. Although Millathane 5004 is deficient in this property, blends of 70% HNBR with 30% Millathane 5004 show them to have only slightly higher set than the 100% HNBR compounds.

Zetpol 2000L	100	70				
Zetpol 2020L			100	70		
Zetpol 2030L					100	70
Millathane® 5004		30		30	30	100

Compression Set

22 hr/135°C	21	28	20	28	21	26	84
22 hr/150°C	24	29	26	29	24	26	98

MILLATHANE®

FACTOID:

Did you know that Millathane CM offers outstanding low temperature properties? With a brittle point as low as -90°F (-68°C), Millathane CM is ideal for applications that demand superior low temperature performance.

Oil Resistance

Millathane 5004 has excellent resistance to oil, similar to that of HNBR and NBR polymers. The data below show the 100% Millathane 5004 compound to have similar property and volume changes after ASTM 903 oil immersion at 135°C. The 70/30 HNBR/Millathane 5004 blends were slightly poorer than the neat polymers, with higher tensile loss. The slight volume loss with the Millathane 5004 compound is probably due to the plasticizer used (TP-95) being more extractable than the plasticizer used in the HNBR compounds (TOTM).

Zetpol 2000L	100	70				
Zetpol 2020L			100	70		
Zetpol 2030L					100	70
Millathane® 5004		30		30	30	100

Oven Aging, 70 hr/100°C ASTM 903 Oil

Hardness Change	-4	1	-5	1	2	2	6
Tensile Strength, % Change	-4	5	-1	-3	-7	-7	-2
Elongation, % Change	5	3	4	-3	-3	-4	-4
Volume Change, %	8	5	8	2	6	2	-5

Oven Aging, 70 hr/135°C ASTM 903 Oil

Hardness Change	-3	0	-5	1	-3	2	6
Tensile Strength, % Change	-6	-22	-6	-22	-10	-25	-8
Elongation, % Change	0	-6	4	-7	0	-12	-2
Volume Change, %	9	3	8	2	8	2	-4

Abrasion Resistance

Millathane 5004 has excellent abrasion resistance, even better than HNBR which has very good abrasion resistance. The data below illustrate that fact, with lower abrasive loss in the DIN Abrasion test. The 70/30 HNBR/Millathane 5004 blends showed them to have comparable abrasion resistance to 100% HNBR when Zetpol 2030L was used, and slightly poorer abrasion resistance when Zetpol 2000L and 2020L were used.

Zetpol 2000L	100	70				
Zetpol 2020L			100	70		
Zetpol 2030L					100	70
Millathane® 5004		30		30	30	100

DIN Abrasion (ASTM D5963)

mm³ lost	76	84	79	90	81	82	61
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**For Further Information**

For the full report, including formulations used and other test data, contact Tom Jablonowski (contact info above).