

TECHNICAL BULLETIN

EPDM Tire Flaps

Thermax® N990 medium thermal carbon black is manufactured by the thermal decomposition of natural gas. The thermal process provides a unique carbon black characterized by a large particle size and low structure. Thermax® N990 is widely used in applications which require excellent dynamic properties. The large particle size (low surface area) and low structure allow for low compression set, high rebound and low hysteresis, thereby maintaining the inherent elastomeric properties of the rubber compound. As a non-reinforcing filler, Thermax® N990 is often blended with furnace carbon blacks and/or mineral fillers to achieve cost reduction and specific physical properties in the rubber compound.

This technical bulletin provides the results of Cancarb’s tests of Thermax® N990 in various loadings in EPDM tire flaps. Performance benefits from Thermax® N990 in this application include:

- High loadability in tire flaps, compared to using only furnace grades
- Reduction of compound cost due to high black loading
- Maintenance of low hardness, preventing edge tear in tubes
- Excellent rebound, low compression set, low heat build-up

The following data demonstrates the application of Thermax® N990 as a filler in EPDM tire flaps compounds. The filler loading is maximized to reduce compound cost.

Bayer Formulations

	Flap 1	Flap 2	Flap 3	Flap 4
Bayer 5459	160.0	160.0	160.0	160.0
Bayer 345	20.0	20.0	20.0	20.0
N660 Carbon Black	180.0	180.0	150.0	125.0
Thermax® N990	150.0	200.0	150.0	150.0
Sunpar 2280	90.0	90.0	75.0	75.0
Zinc Oxide	5.0	5.0	5.0	5.0
Stearic Acid	1.0	1.0	1.0	1.0
Thiuram M	0.75	0.75	0.75	0.6
Butyl Zimate	0.75	0.75	0.75	2.0
MBT	0.75	0.75	0.75	-
Sulfasan R	-	-	-	1.0
Thiuram E	0.75	0.75	0.75	0.6
Sulphur	1.0	1.0	1.0	0.5
TOTAL	610.0	660.0	565.0	540.7

Compound Properties

	Flap 1	Flap 2	Flap 3	Flap 4
Oscillating Disk Rheometer, ASTM D2084-95, 160°C				
Minimum (dNm)	10.8	10.5	8.1	6.0
Maximum (dNm)	29.7	29.1	28.5	23.7
t _s 2 (dNm)	13.3	13.1	10.4	8.4
t _c 90 (min)	13.88	14.63	14.30	14.31
t _c 95 (min)	17.41	18.51	18.06	17.45
Cure Rate Index	9.22	8.52	8.84	9.95

Stress-Strain, ASTM D412-92, RT, Cure Conditions T95 x 160°C				
Shore A Hardness	66	68	65	56
Elongation (%)	257	231	403	644
Tensile (MPa)	7.8	7.6	8.1	7.4
100% Modulus (MPa)	3.5	3.7	2.8	1.7
200% Modulus (MPa)	6.7	6.8	5.7	3.7
400% Modulus (MPa)	-	-	8.2	5.6

Stress-Strain, Aged 24 hours @ 121°C, ASTM D412-95, Cure Conditions T95 x 160°C				
Shore A Hardness	71	72	70	60
Elongation (%)	200	165	276	450
Tensile (MPa)	8.7	8.1	9.0	8.1
100% Modulus (MPa)	4.8	5.3	4.1	2.4
200% Modulus (MPa)	8.7	-	7.5	5.1
400% Modulus (MPa)	-	-	-	7.7

Nordel Formulations

	Flap 5	Flap 6
Nordel 1660	100.0	100.0
N774 Carbon Black	200.0	-
N660 Carbon Black	-	180.0
Thermax® N990	100.0	150.0
Sunpar 2280	150.0	150.0
Zinc Oxide	5.0	5.0
Stearic Acid	1.0	1.0
Thiuram M	0.6	0.6
Butyl Zimate	2.0	2.0
Sulfasan R	1.0	1.0
Sulphur	0.5	0.5
Thiuram E	0.6	0.6
TOTAL	560.7	590.7



Compound Properties

Flap 5

Flap 6

Oscillating Disk Rheometer, ASTM D2084-95, 160°C

Minimum (dNm)	4.4	5.2
Maximum (dNm)	16.4	20.1
t _{s2} (dNm)	6.9	7.6
t _{c90} (min)	12.72	16.76
t _{c95} (min)	14.89	19.54
Cure Rate Index	13.26	8.64

Stress-Strain, ASTM D412-92, RT, Cure Conditions T95 x 160°C

Shore A Hardness	57	61
Elongation (%)	575	474
Tensile (MPa)	4.65	6.0
100% Modulus (MPa)	1.1	1.5
200% Modulus (MPa)	2.2	3.5
300% Modulus (MPa)	3.36	4.9
400% Modulus (MPa)	4.03	5.7

Stress-Strain, Aged 24 hours @ 121°C, ASTM D412-95, Cure Conditions T95 x 160°C

Shore A Hardness	66	69
Elongation (%)	392	255
Tensile (MPa)	6.3	7.6
100% Modulus (MPa)	1.7	3.1
200% Modulus (MPa)	4.0	6.6
300% Modulus (MPa)	5.7	-
400% Modulus (MPa)	6.3	-



For reference, the following Nordel formulation and data from DuPont Dow Elastomers are provided.

Nordel 1660	100.0
SRF Black	250.0
Thermax® N990	100.0
Sunpar 2280	150.0
Whiting	100.0
Zinc Oxide	5.0
Stearic Acid	1.0
Thiuram M	0.6
Butyl Zimate	2.0
Sulfasan R	1.0
Sulphur	0.5
Thiuram E	0.6
TOTAL	710.7

Physical Properties - Originals

Cure 15 minutes @ 160°C	
Tensile Strength (psi)	925
Elongation (%)	260
Hardness	78