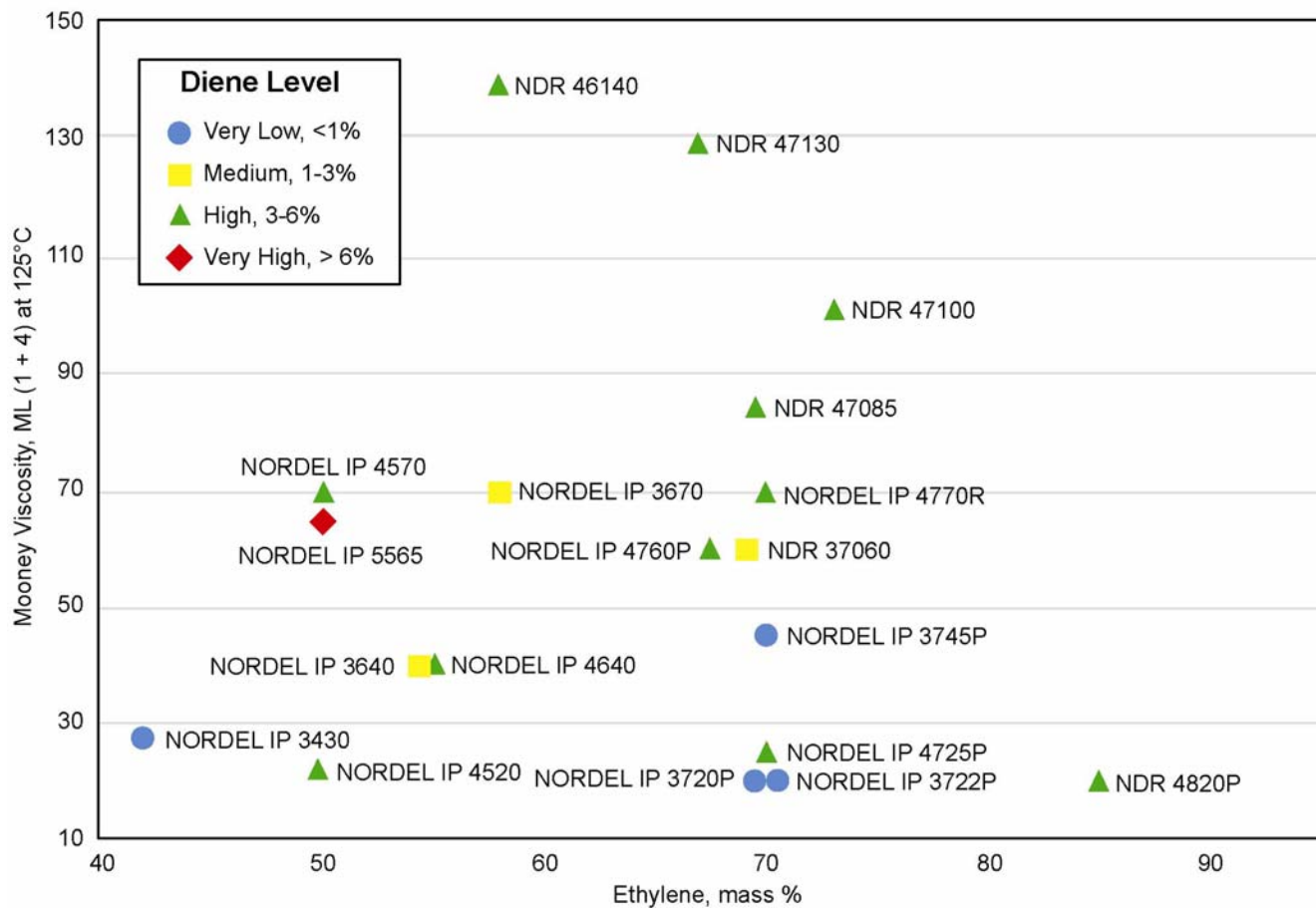




NORDEL™
Hydrocarbon Rubber

NORDEL™ IP and NORDEL™ MG Product Selection Guide

While NORDEL IP provides improved yield, scrap reductions and unparalleled polymer cleanliness, NORDEL MG expands the NORDEL performance arena to cover the broadest range of EPDM applications in the industry.





Typical Properties and Applications of NORDEL™ Hydrocarbon Rubber

NORDEL Grade	Mooney Viscosity ML 1+4 at 125°C ASTM D 1646 MG calculated	Ethylene, Mass % ASTM D 3900	ENB, Mass % ASTM D 6047	Typical Molecular Weight, Mw GPC ⁽¹⁾ Dow Test Method	MWD Characteristics Dow Test Method	Carbon Black Content, phr Dow Test Method
NDR 37060.02 ⁽²⁾	60	68	2.2	176,000	Medium-narrow	28
NDR 46140.01 ⁽²⁾	140	58	4.9	327,000	Medium-narrow	28
NDR 47085.03 ⁽²⁾	85	69.5	4.5	184,000	Medium-narrow	28
NDR 47100.00 ⁽²⁾	100	73	4.9	214,000	Medium-narrow	28
NDR 47130.01 ⁽²⁾	130	67	4.9	308,000	Medium-narrow	28
NORDEL IP 3430	27	42	0.7	135,000	Narrow	
NORDEL IP 3640	40	55	1.8	160,000	Medium	
NORDEL IP 3670	70	58	1.8	210,000	Medium	
NORDEL IP 3720P	20	70	0.6	130,000	Broad	
NORDEL IP 3722P	18	71	0.5	100,000	Medium	
NORDEL IP 3745P	45	70	0.5	150,000	Narrow	
NORDEL IP 4520	20	50	4.9	115,000	Medium	
NORDEL IP 4570	70	50	4.9	210,000	Medium	
NORDEL IP 4640	40	55	4.9	160,000	Medium	
NORDEL IP 4725P	25	70	4.9	135,000	Broad	
NORDEL IP 4760P	60	67	4.9	170,000	Medium	
NORDEL IP 4770R	70	70	4.9	200,000	Medium	
NORDEL IP 4770P	70	70	4.9	200,000	Medium	
NDR 4820P ⁽²⁾	–	85	4.9	100,000	Narrow	
NORDEL IP 5565	65	50	7.5	200,000	Medium	

(1) GPC data is specific to the test method, and dependent on column and equipment.

(2) NDR denotes Development Product.

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Continued — Typical Properties and Applications of NORDEL™ Hydrocarbon Rubber

NORDEL Grade	Product Density, g/cc ASTM D 297	Crystallinity, Mass % DSC, 10°C/min Dow Test Method	T _c , °C PQ-E-005 Dow Test Method	Form	Applications
NDR 37060.02 ⁽¹⁾	0.98 ⁽²⁾	6	18	Granular	Roofing membranes, hoses, belts, peroxide cure profiles, and inner tubes
NDR 46140.01 ⁽¹⁾	0.97 ⁽²⁾	<1	—	Granular	Extruded profiles, hose, seals and production of TPV compounds
NDR 47085.03 ⁽¹⁾	0.98 ⁽²⁾	10	17	Granular	Extruded profiles, hose and sheeting
NDR 47100.00 ⁽¹⁾	0.99 ⁽²⁾	—	40	Granular	Industrial hoses and extruded profiles
NDR 47130.01 ⁽¹⁾	0.97 ⁽²⁾	9	8	Granular	Extruded profiles, hose and sheeting, and production of TPV compounds
NORDEL IP 3430	0.86	<1	—	Bales	Thermoplastic modifications; brake parts, molded gaskets, molded electrical parts, oil modification (peroxide cured)
NORDEL IP 3640	0.86	4	-10	Bales	Blends with butyl rubber in inner tubes, peroxide cured belts
NORDEL IP 3670	0.86	6	-2	Bales	Roofing, liners, insulation, peroxide cured hose
NORDEL IP 3720P	0.88	14	43	Pellets	Thermoplastic modification, electrical insulation, molded connectors, belts, rolls (peroxide cured)
NORDEL IP 3722P	0.88	15	46	Pellets	Thermoplastic modification, electrical insulation, molded connectors (peroxide cured)
NORDEL IP 3745P	0.88	12	34	Pellets	Thermoplastic modifications, cable bedding, sound insulation
NORDEL IP 4520	0.86	<1	—	Bales	Molded seals, brake diaphragms, gaskets, sealants, weather-strip corner molding
NORDEL IP 4570	0.86	<1	—	Bales	Extrusions, automotive and general purpose hose, profile gaskets and weather-stripping
NORDEL IP 4640	0.86	4	-10	Bales	Molded automotive and industrial parts, hose, and tubing, weather-strip, belts
NORDEL IP 4725P	0.88	12	36	Pellets	Rolls, high hardness compounds, gaskets, extruded profiles
NORDEL IP 4760P	0.88	10	35	Pellets	Extrusions, automotive and general purpose hose, profile gaskets and weather-stripping
NORDEL IP 4770R	0.88	13	34	Rods	Automotive and general purpose hose, wire and cable
NORDEL IP 4770P	0.88	13	34	Pellets	Automotive and general purpose hose, extruded profiles, glass run channel, low voltage wire and cable
NDR 4820P ⁽¹⁾	0.91	28	79	Pellets	Property modification of thermoplastic polyolefin and thermoset rubber formulations — high hardness, weather-strip and molded goods
NORDEL IP 5565	0.86	<1	—	Bales	Weather-stripping, cellular profiles

(1)NDR denotes Development Product.

(2)Polymer+Carbon Black



Comparison of NORDEL™ Hydrocarbon Rubber Grades in Peroxide Cure Test Recipe

Polymer	NORDEL IP Resins								
	3430	3640	3670	3720P	3722P	3745P	4520	4570	4640
Mooney Viscosity, ML 1 + 4, 100°C	44	50	76	25	27	59	32	72	50
Mooney Scorch at 125°C Minutes to 5 pt. rise	>30	>30	20	>30	>30	>30	>30	13	20
MDR at 175°C, 0.5° Arc, 30 min cht									
M _L , dN.m	1.1	1.4	2.0	0.8	0.8	1.5	1.0	1.9	1.3
M _H , dN.m	7.3	8.5	14.0	7.5	8.1	11.3	10.4	17.9	15.4
t _{S1} , min	0.61	0.6	0.43	0.6	0.58	0.51	0.82	0.38	0.41
t _{C90} , min	4.7	6.0	5.1	7.0	7.5	5.8	7.6	6.8	7.2
Vulcanizate Properties Physical Properties at R.T. Press Cured: t _{C95} +3 min at 175°C									
Tensile Strength, MPa	6.0	8.1	11.6	8.0	8.1	12.2	8.5	12.5	11.1
Elongation, %	386	300	321	324	275	307	253	245	230
Modulus at 100% Elongation, MPa	1.5	1.9	2.3	3.0	3.3	3.4	2.7	3.0	3.4
Modulus at 200% Elongation, MPa	3.2	5.1	7.1	5.6	6.3	8.7	6.6	9.1	8.9
Hardness, Shore A	54	53	57	72	71	67	58	57	61
Compression Set, Method B Pellets Cured MDR t _{C95} +15 min									
22 hr at -10°C	53	66	66	91	93	98	40	28	42
22 hr at 70°C	27	17	12	30	29	21	9	8	8
22 hr at 100°C	23	12	12	20	20	19	9	7	8
70 hr at 150°C	32	21	20	30	29	27	18	16	17
Temperature Retraction, °C									
TR-10	-47	-39	-39	-14	-13	-18	-43	-45	-30
TR-20	-39	-31	-32	-1	1	-6	-36	-38	-20
TR-50	-24	-17	-20	14	15	9	-24	-29	23
Change in Properties Aged in air 70 hr at 150°C									
Tensile Strength, MPa	5.5	7.9	10.7	7.7	8.1	11.4	8.3	11.0	11.9
Elongation, %	398	292	323	314	301	341	250	237	244
Elongation Change, %	3.3	-2.9	0.7	-2.9	9.3	11.3	-1.3	-3.2	6.3
Modulus at 100% Elongation, MPa	1.4	2.2	2.6	3.3	3.4	3.4	2.6	3.4	3.3
Modulus Change, %	-3.4	16.1	11.1	10.1	4.9	1.5	-0.8	11.7	-1.5
Hardness, Shore A	58	59	61	75	75	70	60	64	64
Hardness Change, pts	4	6	4	3	4	3	2	7	3

Test Recipe: Polymer—100 phr, N-650 Black—115 phr, Paraffinic Oil—70 phr, DCP-40%—8 phr, TMQ—1 phr, HVA #2—1 phr. All components tested per standard ASTM Method.

Test recipe not optimized for high molecular weight NDR 47130 and NDR 46140 grades.

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Continued — Comparison of NORDEL™ Hydrocarbon Rubber Grades in Peroxide Cure Test Recipe

Polymer	NORDEL IP Resins					NORDEL MG Resins		
	4725P	4760P	4770R	NDR 4820P	5565	NDR 37060	NDR 47085	NDR 47100
Mooney Viscosity, ML 1 + 4, 100°C	31	65	72	22	67	70	82	83
Mooney Scorch at 125°C Minutes to 5 pt. rise	26	14	11	29	10	19	11	12
MDR at 175°C, 0.5° Arc, 30 min cht								
M _L , dN.m	0.9	1.6	2.2	0.3	2.0	1.6	2.0	2.1
M _H , dN.m	12.8	18.2	19.6	18.9	16.4	15.8	19.1	20.1
t _{s1} , min	0.48	0.38	0.36	0.39	0.4	0.4	0.35	0.36
t _{c90} , min	8.2	6.7	6.6	9.0	7.1	6.0	6.3	6.5
Vulcanizate Properties								
Physical Properties at R.T. Press Cured: t _{c95} +3 min at 175°C								
Tensile Strength, MPa	12.7	15.0	16.6	17.1	13.3	14.1	15.9	19.2
Elongation, %	247	254	238	184	214	315	245	263
Modulus at 100% Elongation, MPa	4.1	4.2	5.2	9.3	4.2	3.0	3.9	5.2
Modulus at 200% Elongation, MPa	9.6	11.0	13.8	—	12.7	8.8	12.5	15.0
Hardness, Shore A	72	67	71	90	59	60	59	74
Compression Set, Method B Pellets Cured MDR t _{c95} +15 min								
22 hr at -10°C	99	80	83	99	21	92	89	87
22 hr at 70°C	15	9	8	77	6	13	8	6
22 hr at 100°C	11	8	6	8	5	13	6	6
70 hr at 150°C	21	16	15	16	15	19	14	13
Temperature Retraction, °C								
TR-10	-20	-12	-4		-42	-24	-22	
TR-20	-7	2	9		-38	-10	-11	
TR-50	10	23	23		-28	7	3	
Change in Properties								
Aged in air 70 hr at 150°C								
Tensile Strength, MPa	12.3	15.5	16.6	16.5	12.9	13.3	15.5	18.8
Elongation, %	247	254	235	181	211	312	246	246
Elongation Change, %	0.0	-0.1	-1.3	-1.4	-1.3	-0.9	0.2	-6.4
Modulus at 100% Elongation, MPa	4.5	4.3	5.2	10.2	4.0	3.3	4.1	5.7
Modulus Change, %	8.7	2.6	1.2	9.9	-4.5	11.3	4.6	9.5
Hardness, Shore A	74	69	72	93	62	63	63	76
Hardness Change, pts	2	2	1	3	3	3	4	2

Test Recipe: Polymer—100 phr, N-650 Black—115 phr, Paraffinic Oil—70 phr, DCP-40%—8 phr, TMQ—1 phr, HVA #2—1 phr.
Test recipe not optimized for high molecular weight NORDEL MG grades NDR 47130 and NDR 46140.



Summary of FDA Compliance by Grade ⁽¹⁾

NORDEL Grade	21 CFR 177.2600	21 CFR 177.1520⁽³⁾	21 CFR 175.105⁽⁴⁾	21 CFR 177.1210
NDR 37060.02 ⁽²⁾	TBD	No	No	No
NDR 46140.01 ⁽²⁾	Yes ⁽⁵⁾	No	No	No
NDR 47085.03 ⁽²⁾	Yes ⁽⁵⁾	No	No	No
NDR 47100.00 ⁽²⁾	TBD	No	No	No
NDR 47130.01 ⁽²⁾	TBD	No	No	No
NORDEL IP 3430	Yes	Yes	Yes	Yes
NORDEL IP 3640	Yes	Yes	Yes	Yes
NORDEL IP 3670	Yes	Yes	Yes	Yes
NORDEL IP 3720P	Yes	No	Yes	No
NORDEL IP 3722P	Yes	No	Yes	No
NORDEL IP 3745P	Yes	Yes	Yes	Yes
NORDEL IP 4520	Yes	No	Yes	No
NORDEL IP 4570	Yes	Yes	Yes	Yes
NORDEL IP 4640	Yes	Yes	Yes	Yes
NORDEL IP 4725P	Yes	No	Yes	No
NORDEL IP 4760P	Yes	Yes	Yes	Yes
NORDEL IP 4770R	Yes	Yes	Yes	Yes
NORDEL IP 4770P	Yes	Yes	Yes	Yes
NDR 4820P ⁽²⁾	Yes	Yes ⁽⁶⁾	Yes	No
NORDEL IP 5565	No	No	Yes	No

(1)Review current code of Federal Regulations for specific details pertaining to food contact requirements.

(2)NDR denotes Developmental Product.

(3)Can be used in contact with all foods except water in oil emulsions, high or low fat, and low moisture fats and oil.

(4)Adhesives only

(5)Polymer as sold excludes use in contact with milk or edible oil. Finished goods made with NDR 47085.03 or NDR 46140.01 may be formulated to comply with use in contact with milk or edible oil, provided they meet the conditions outlined in 21CFR177.2600.

(6)Compliant as a blend component in compliant polymers at levels up to 25% for conditions of use E through G.



NORDEL™ Package Type

NORDEL Grade	Inclusion Bags				Box		Supersack	
NDR 37060 ⁽¹⁾		X						
NDR 46140 ⁽¹⁾		X						
NDR 47085 ⁽¹⁾		X						
NDR 47100 ⁽¹⁾		X						
NDR 47130 ⁽¹⁾		X						
NORDEL IP 3430			X					
NORDEL IP 3640	X							
NORDEL IP 3670			X					
NORDEL IP 3720P				X		X		
NORDEL IP 3722P				X		X		
NORDEL IP 3745P				X		X		
NORDEL IP 4520	X							
NORDEL IP 4570	X							
NORDEL IP 4640	X							
NORDEL IP 4725P			X					
NORDEL IP 4760P			X					X
NORDEL IP 4770R	X				X			
NORDEL IP 4770P	X							X
NDR 4820P ⁽¹⁾			X			X		
NORDEL IP 5565	X							
Bag Melting Point, °C	87	87	95	110	—	—	—	—
Bag Material	EVA/PE	EVA	EVA	PE	—	—	—	—
Unit Weight, kg	25	25	25	25	385	408	800	1,000

(1)NDR denotes Developmental Product.

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