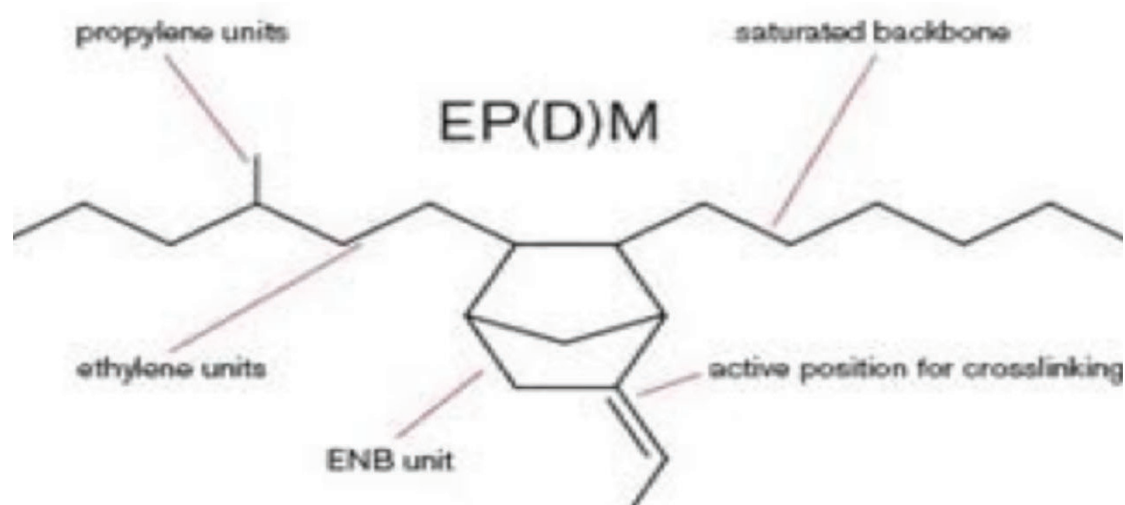


OVERVIEW ON EPDM RUBBER

EPDM RUBBER – Ethylene Propylene Diene Monomer Rubber which comes under M-class (i.e. the backbone chain is having polymethylene chains) as classified by ASTM D 1418 standard.



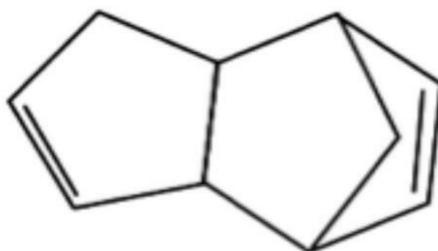
EPDM RUBBER IS DESIGNATED BY THE FOLLOWING LETTERS IN THE SAE J200 / ASTM D 2000 LINE CALL OUT's in the specification as:

EPDM RUBBER	AA , BA, CA, DA
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The properties of the EPDM depends on the composition of ETHYLENE, PROPYLENE percentage in the grade and the cure rate depends on the percentage of the Diene content and as well as the Diene type.

The following dienes are used in the production of the EPDM

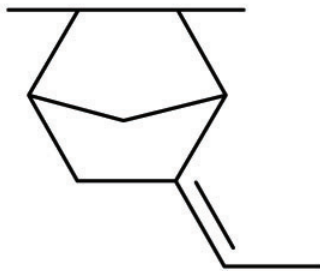
1) DICYCLOPENTADIENE – DCPD



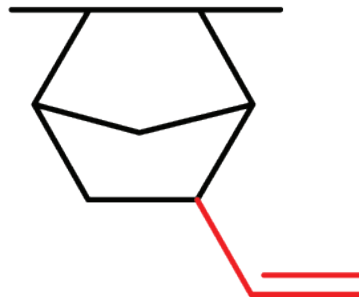
2) 1,4 – HEXADIENE – HD – Now not in commercial production of EPDM grades



3) ETHYLIDENENORBORNENE – ENB



4) VINYL NORBORNENE – VNB



THE GENERAL CHARACTERISTICS OF EPDM RUBBER is as follows:

1. EPDM Rubber is having very good Heat, Weather, Ozone resistance.
2. Good resistance to Steam, Polar substances, Ketones, diluted acids and alkalines
3. Excellent insulation properties for the low/Medium voltage range.
4. THERMAL PROPERTIES OF EPDM

Thermal properties of EPDM	
Property	Value
Coefficient of thermal expansion linear	160 $\mu\text{m}/\text{m}\cdot\text{K}$
Maximum service temperature	150 $^{\circ}\text{C}$
Minimum service temperature	-50 $^{\circ}\text{C}$
Glass transition temperature	-54 $^{\circ}\text{C}$

Limitations of EPDM : It is having poorer resistance to most oils, gasoline, kerosene, aromatic, aliphatic hydrocarbons, halogenated solvents & concentrated acids.

Generally EPDM Rubber is manufactured by Zeiglar-Natta catalyst during the polymerisation stage and further new development takes place with Metallocene catalysts and the limitation of these system i.e. the Mooney range of only 20-80 MU units and the ENB of maximum of 7% → is overcome by the new catalyst system of M/s.LANXESS – Advanced Catalyst Elastomer (ACE),

With ACE technology grades the advantage of elimination of Chlorine residues in the polymer which will reflect in better heat ageing properties. It also helps to develop complete range of the polymers with high molecular weight grades, oil extended grades, high ENB grades and continued benefits of CLCB – Controlled Long chain Branching grades – for better combination of properties and processing requirements, along with the possibility of developing High VNB grades as well.

LANXESS EPDM - Keltan® Global Grade Portfolio

New Grade Name	Former Grade Name	Viscosity		Monomer content			Other properties		
		Test conditions	Values MU g/10 min.	Ethylene content wt.%	Third Monomer type	Content wt.%	Oil content PHR	MAH content wt.%	MWD
Keltan® 2070P	Buna® EP G 2070P VP	ML(1+4) 125°C	25	73	-				M
Keltan® 2450	Buna® EP G 3440	ML(1+4) 125°C	28	48	ENB	4.1			N
Keltan® 2450S	Buna® EP G 3440	ML(1+4) 125°C	24	51	ENB	4.3			CLCB
Keltan® 2470	Buna® EP G 2470	ML(1+4) 125°C	24	69	ENB	4.2			N
Keltan® 2470L	Buna® EP G 2470 LM	ML(1+4) 125°C	22	69	ENB	4.2			CLCB
Keltan® 2650	Keltan® 2340A	ML(1+4) 125°C	25	53	ENB	6.0			CLCB
Keltan® 2750	Buna® EP G 3850	ML(1+4) 125°C	28	48	ENB	7.8			N
Keltan® 3050	Keltan® 3200A	ML(1+4) 100°C	51	49	-				N
Keltan® 3250Q		ML(1+4) 125°C	33	55	ENB	2.3			N
Keltan® 3960Q	Buna® EP T 3950	ML(1+8) 100°C	54	56	ENB	11.4			N
Keltan® 3973	Buna® EP G 3963	ML(1+4) 125°C	34	66	ENB	9.0	30		N
Keltan® 4450	Buna® EP G 5450	ML(1+4) 125°C	46	52	ENB	4.3			N
Keltan® 4450S	Buna® EP G 5450	ML(1+4) 125°C	42	52	ENB	4.3			CLCB
Keltan® 4455	Buna® EP G 5455	ML(1+4) 125°C	46	55	ENB	4.3	50		M
Keltan® 4460D	KELTAN 520	ML(1+4) 125°C	46	58	DCPD	4.5			B
Keltan® 4577	Buna® EP G 5567	ML(1+4) 125°C	46	66	ENB	5.1	75		N
Keltan® 4869	Keltan® 4551A	ML(1+4) 125°C	48	64	ENB	8.7	100 *)		M
Keltan® 5170P	Buna® EP G 6170P	ML(1+4) 125°C	59	71	ENB	1.5			N
Keltan® 5260Q	Buna® EP T 6250	ML(1+4) 125°C	55	62	ENB	2.3			N
Keltan® 5465Q	Buna® EP T 6465 CL VP	ML(1+8) 150°C	37	64	ENB	4.0	50 *)		N
Keltan® 5469	Keltan® 5531A	ML(1+4) 125°C	52	63	ENB	4.5	100 *)		N
Keltan® 5469Q	Buna® EP T 5459 CL	ML(1+8) 150°C	38	59	ENB	4.0	100 *)		N
Keltan® 5470	Keltan® 5508	ML(1+4) 125°C	55	70	ENB	4.6			N
Keltan® 5470C	Keltan® 5508	ML(1+4) 125°C	55	66	ENB	4.6			N
Keltan® 5470P	Buna® EP G 6470P	ML(1+4) 125°C	55	70	ENB	4.6			N
Keltan® 5470Q	Buna® EP T 6470	ML(1+4) 125°C	57	68	ENB	4.7			N
Keltan® 6160D	Keltan® 740	ML(1+4) 125°C	63	64	DCPD	1.2			M
Keltan® 6471	Keltan® 6531A	ML(1+4) 125°C	65	67	ENB	4.7	15 *)		N
Keltan® 6750	Buna® EP G 6850	ML(1+4) 125°C	60	51	ENB	7.7			M
Keltan® 6950	Keltan® 4703	ML(1+4) 125°C	65	48	ENB	9.0			M
Keltan® 6950C	Keltan® 4703	ML(1+4) 125°C	65	44	ENB	9			M
Keltan® 6951	Keltan® 6251A	ML(1+4) 125°C	63	48	ENB	9.0	15 *)		CLCB
Keltan® 6951C	Keltan® 6251A	ML(1+4) 125°C	63	44	ENB	9	15*)		CLCB
Keltan® 7450	Buna® EP G 8450	ML(1+4) 125°C	76	53	ENB	4.3			N
Keltan® 7752	Keltan® 7341A	ML(1+8) 150°C	53	53	ENB	7.5	20 *)		CLCB
Keltan® 7752C	Keltan® 7341A	ML(1+8) 150°C	53	45	ENB	7.5	20 *)		CLCB
Keltan® 8550	Keltan® 8340A	ML(1+4) 125°C	80	55	ENB	5.5			CLCB
Keltan® 8550C	Keltan® 8340A	ML(1+4) 125°C	80	48	ENB	5.5			CLCB
Keltan® 8570	Keltan® 8642A	ML(1+4) 125°C	80	70	ENB	5.0			CLCB
Keltan® 8570C	Keltan® 8642A	ML(1+4) 125°C	80	66	ENB	5			CLCB
Keltan® 9650Q	Buna® EP T 9650	ML(1+8) 150°C	60	53	ENB	6.5			N
Keltan® 9650C	Buna® EP T 9650	ML(1+8) 150°C	60	44	ENB	9			M
Keltan® Eco 5470		ML(1+4) 125°C	55	70	ENB	4.6			N
Keltan® 0500R	Keltan® 1200A	MFI 190°C/2.16 kg	11.0	49	-				N
Keltan® 1500R	PA1305	MFI 190°C/2.16 kg	2.6	49	-				N
Keltan® 2708R	Buna® EP XT 2708	MFI 230°C/10 kg	8.0	73	-			0.8	

 ENB = Ethylidene norbornene DCPD = Dicyclopentadiene
 CLCB = Controlled Long Chain Branching

*) Clear / colourless oil

MWD = Molecular Weight Distribution M = Medium

N = Narrow

MAH = maleic anhydride grafted

Some of the high mooney CLCB grades help the compounders in developing the compound with higher yield without compromising the required quality of the end products, i.e. the compound design flexibility as well as the possibility of the economical compound is possible as per the following illustrations, in which the formulation is compound even upto 600 /700 phr as well.

RAW MATERIALS	400 PHR	500 PHR	600PHR	700PHR
KELTAN 8570	100	100	100	100
ZNO ACTIVE	5	5	5	5
S.A.	1.5	1.5	1.5	1.5
PEG	4	4	4	4
CAO	6	6	6	6
N-550	165	205	240	265
WHITING	20	40	80	120
PARAFFINIC OIL	95	130	165	195
MB TOTAL	396.5	491.5	601.5	696.5
CURING PACKAGE	8.45	8.45	8.45	8.45
TYPICAL PHYSICAL PROPERTIES				
HARDNESS	70	70	69	68
TENSILE ST., MPa	12.1	9.7	7.8	6.6
E.B.%	438%	406%	366%	371%
COMPRESSION SET				
@ 70 °C,for 22 hrs.	15	17	21	25
@100°C, for 22 hrs.	50	52	59	68

General Guideline for the PEROXIDE curing of the EPDM Rubber:

- The choice of the grade for the peroxide curing application with better Heat ageing property could have lesser polypropylene percentage, as there is a possibility of chain scission in the Polypropylene, which might reduces the physical properties.
- Also the type of the third monomer (Diene) and its percentage, as the allylic hydrogen (that is adjacent to double bond of the diene) is easily abstracted to create a radical that is used to create the crosslink and also acts as the co-agent. Kindly note DCPD type contains 3 allylic hydrogen, whereas ENB contains upto 6 allylic hydrogen.
- The proper choice of the EPDM grade is high molecular weight with Narrow distribution to have good physical properties and the choice of the proper Coagents will also give good physicals – Here the CLCB grades can be useful in balancing the processing and physicals.
- Choice of the oil should be Paraffinic type (In Naphthenic, the oil will interfere with the peroxide as the aromatic content is higher).
- When acidic fillers (including kaolin clay, calcined clay, ppt. Silica) are used, PEG or TEA or Silanes needs to be used for better cross-link density.
- On the usage of Antioxidants TQ or ODPA with MBI can be used for those requirements.

SOME OF THE APPLICATIONS OF EPDM RUBBER:

SEALS – Door, Window, Trunk, Hood (ALSO FACE SEALS OF INDUSTRIAL RESPIRATORS), O-RINGS, WASHERS, ELECTRICAL INSULATION VIBRATORS, PROFILES, GLASS-RUN CHANNELS, RADIATOR HOSES, COOLANT HOSE, GARDEN HOSE/TUBE, POND LINERS, ROOFING MEMBRANES, ELECTRICAL CABLE JOINTING(FOR LOW/MEDIUM VOLTAGE APPLICATIONS), CONVEYOR BELTS, V-BELTS, GEOMEMBRANES, Moulded Mechanical goods, Mountings, Tank/valve lining, Rubber Rollers, Tyre Flap, Automotive Butyl tube blends, Sponges / sponge profiles, in Plastics modifications.....

Please Note : The grades of Keltan are manufactured by M/S.LANXESS.