OJSC “ESRE”

- **Efrolen (Polyisobutylene/PIB)**

High Molecular Weight: P-230, P-225, P-220, P-155, P-118, P-100, P-85, P-80, P-50

Low Molecular Weight: P-30

REACH (RN): 01-2119471988-16-0045
FDA(GR): 21 CFR 177.1420

The product is used in oil and gas industries, in wide range of applications including automotive, construction: insulating glass sealants and roofing membranes, packaging, electronic, food industries, medicine, adhesives, sealants, coatings, as compounds with waxes, bitumen and asphalts

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- Location – town of Efremov, Tula Region, about 300 km south of Moscow
- Enterprise was founded in 1933, and since then remained the biggest manufacturer of Polybutadiene Rubber and Low and High Molecular Weight Polyisobutylene in Russia. In April 2016 according to the shareholder’s decision the production of PB rubber was stopped for renovation of equipment and facilities to improve the properties of the product and for production volume to meet the market requirements.
- Current main production lines:
  - Production unit of High Molecular Weight Polyisobutylene – 3 lines, 2 more lines planned to be built to increase capacity
  - Production unit of Low Molecular Weight Polyisobutylene
  - Production unit of Low Molecular Weight Polybutadiene
  - Production unit of Low Molecular Weight Polyisoprene

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- Current manufacturing capacity of HMW PIB is 5,500 metric tons per annum
- From the PIB total production, almost 90% is exported
- Production unit of HMW PIB is undergoing expansion currently (does not affect ongoing production of PIB), which will increase capacity to 8,000 metric tons per annum. We aim to complete expansion by the end of 2021.

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Technical characteristics of Efrolen (HMW/LMW Polyisobutylene)

Type	Properties									
EFROLEN	Appearance	Mol.Mass acc.to Staudinger* 10^3	Viscosity of solution(Isooctan 20°C)			Relative molecular mass				
			Concentration	Uncorrected passing time Ubbelode capillare №1*, sec	Staudinger Index(lo)* cm^3/g	Average Molecular Mass** (Mn) 10^3	Average viscosityMolecular Mass**(Mv) 10^3	Ash-content max %	Stabilizer max %	Volatile Matter (105°C) max %
P-30	rubber-like	26-40	0.002		56-113	47-100	200	0.04	0.04	0.3
P-50	rubber-like	47-64	0.002		120-160	105-144	338-526	0.04	0.04	0.5
P-80	rubber-like	71-94	0.002	102-123	178-236	161-217	619-956	0.04	0.04	0.5
P-85	rubber-like	59-104	0.002	102-123	150-260	134-241	476-1110	0.04	0.04	0.5
P-100	rubber-like	104-131	0.002	113-137	260-325	192-305	900-1564	0.04	0.04	0.5
P-118	rubber-like	106-159	0.002	125-155	265-395	246-376	1143-2112	0.04	0.04	0.5
P-155	rubber-like	153-206	0.001	109-122	380-510	361-493	1989-3128	0.04	0.04	0.5
P-220	rubber-like	170-243	0.001	113-132	420-600	401-586	2321-4017	0.04	0.04	0.5
P-225	rubber-like	221-260	0.001		550-640	535-628	3512-4435	0.04	0.04	0.5
P-230***	rubber-like	261-340	0.001		710-820	701-817	5200-6500	0.04	0.01	0.3

* one of the following value may be indicated in Certificate of Analysis on customer request:

Molecular Mass acc. to Staudinger;

Staudinger Index Mass (lo);

Average viscosity Molecular Mass (Mv);

Uncorrected passing time Ubbelode capillare №1.

** for information only

*** the grade is testing for approval of properties

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Technical characteristics of Low Molecular Weight Polybutadiene

Type	Properties									
Synthetic Rubber	Appearance	Transperency Cm^3 min	Viscosity at 50°C, Pas	Conventional Viscosity, In limits	Ash mass content %, max	Antioxidant mass content, %	Volatile matter content, %, max	Acid number, Mg KOH per 1 g, max	Iodometric scale color, mg of iodine, max	1,2-links content, %, min
SKDSN	From light to dark brown		30.0-80.0		0.3	02.-0.6	0.7			40
SKDN-N	non									
Grade 1		175		170-215	0.1	05.-0.9	0.2	0.3	5	
Grade 2		100		170-300	0.1	0.5-0.9	0.5	0.5	5	

- **Application:** Because of its great properties Low Molecular Weigh Polybutadiene is used in wide range of industries.
- Rubber **SKDSN** is successfully used in electrical, engineering, rubber processing and constructing industries as a base for corrosion resistant sealants, bitumen polymeric insulators, vanishes coating and plasticizers production. Depressors' compounds DP 300-399, KD-133 are produced on base of rubber **SKDSN**. Depressors' compounds are used for making changes in rheological data and cooling temperature reduction in petroleum, gas condensators, and distillation fractions of petroleum oil, fuel oils. They are also used to prevent waxes residue formation.
- Low molecular weight rubber **SKDN-N** takes an extraordinary place among liquid rubbers, because it can excellently replace vegetable oils. The rubber's good ability to be oxidized find wide application of **SKDN-N** in color and vanishes industries for vanishes, colors, corrosion resistant compounds fabrication and electrophoresis materials production, for example, primers for cars.
- **Packaging:** Rubbers **SKDSN** and **SKDN-N** are available in aluminum drums BA 1(P)275 or special metal package.
- **Shelf Life:** Guaranteed period for **SKDSN** is one year minimum. Guaranteed period for **SKDN-N** grade 1 is three years, for **SKDN-N** grade 2 is one year minimum.

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Technical characteristics of Low Molecular Polyisoprene

Type	Properties					
	Appearance	Dynamic viscosity, 38 °C, Pa·s	Number-average molecular mass, Mn $\cdot 10^{-3}$	Ash mass content, %	Antioxidant mass content, %	Volatile matter content (at 105 °C), %
NMPI-40	clear viscous liquid that does not contain sediment and visible inclusions	35 - 45	26-34	≤0.5	01.-0.5	≤0.7
NMPI-70		65 - 75	26-34	≤0.5	01.-0.5	≤0.7
NMPI-400		385-415	50-60	≤0.3	01.-0.5	≤0.7
NMPI-500		485 - 515	50-60	≤0.3	01.-0.5	≤0.7

- **Application:** - reactive plasticizer for nitrile, isoprene, styrene butadiene, butadiene and isoprene-isobutylene rubbers;
  - tires, conveyor belts, seals and other rubber products: it is recommended to use in metal cord tires to solve the problem of low adhesion;
  - for compounding such products as pressure-sensitive adhesives (PSA), UV-curable polymer systems, and S-I-S & S-B-S block copolymers;
  - automotive sealants, coatings and adhesives;

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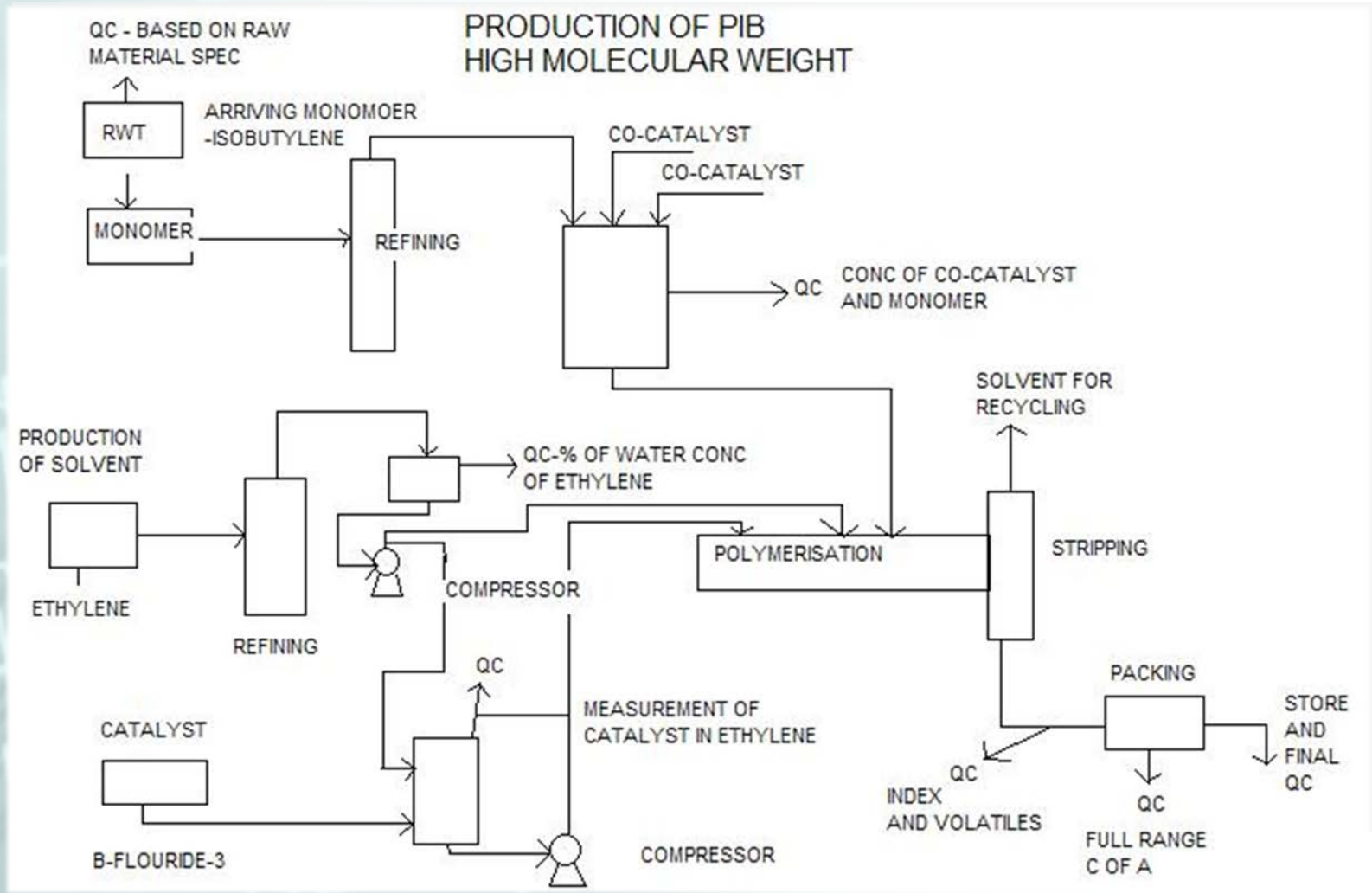
PIB Production



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PACKAGING IMAGES

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BALE IMAGES

Siliconized polyethylene film

High Molecular Weight Polyisobutylene P-50

High Molecular Weight Polyisobutylene P-50

High Molecular Weight PIB wrapped in siliconized PE film

High Molecular Weight PIB wrapped in PE film

Low Molecular Weight Polyisobutylene P-30