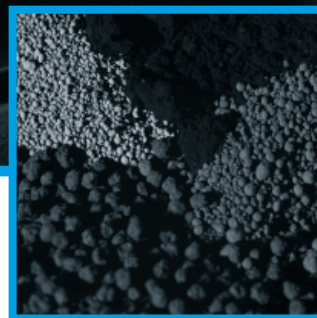
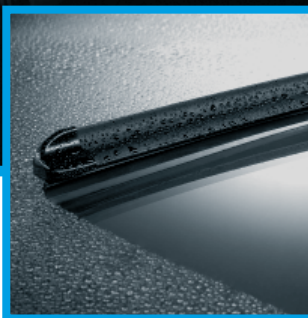
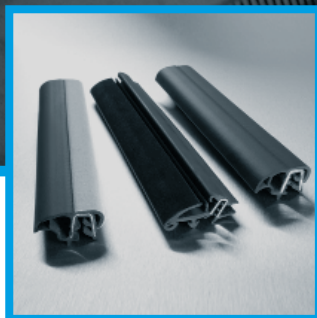


Rubber Blacks

Technical Data Europe - Middle East - Africa



orion ENGINEERED
CARBONS
Focused. Innovative. Responsive.

Table 1**Product range**

ASTM carbon blacks	ECORAX®
CORAX® N115	ECORAX® S 204
CORAX® N121	ECORAX® S 206
CORAX® N134	ECORAX® S 470
CORAX® N220	ECORAX® S 600
CORAX® N234	
CORAX® N326	PUREX® / Clean blacks
CORAX® N330	PUREX® LS 18
CORAX® N339	PUREX® HS 20
CORAX® N347	PUREX® HS 22
CORAX® N375	PUREX® HS 25
CORAX® N550	PUREX® HS 40
CORAX® N660	PUREX® HS 45
CORAX® N683	PUREX® HS 55
CORAX® N772	PRINTEX® MV
CORAX® N774	
	Low PAH grades
	PUREX® LS 30 RP
	PUREX® HS 45 RP
	PUREX® HS 75 RP
	PUREX® HS 95 RP
Thermal black	Lamp blacks
CORAX® N990	DUREX® 0 BEADS
	DUREX® 0 POWDER
HP blacks	Gas black
CORAX® HP 160	CK 3
CORAX® HP 180	
CORAX® HP 130	Acetylene Black
CORAX® HP 1107	Y200 BEADS
	Conductive carbon blacks
	PRINTEX® kappa 70 BEADS
	PRINTEX® XE2 B

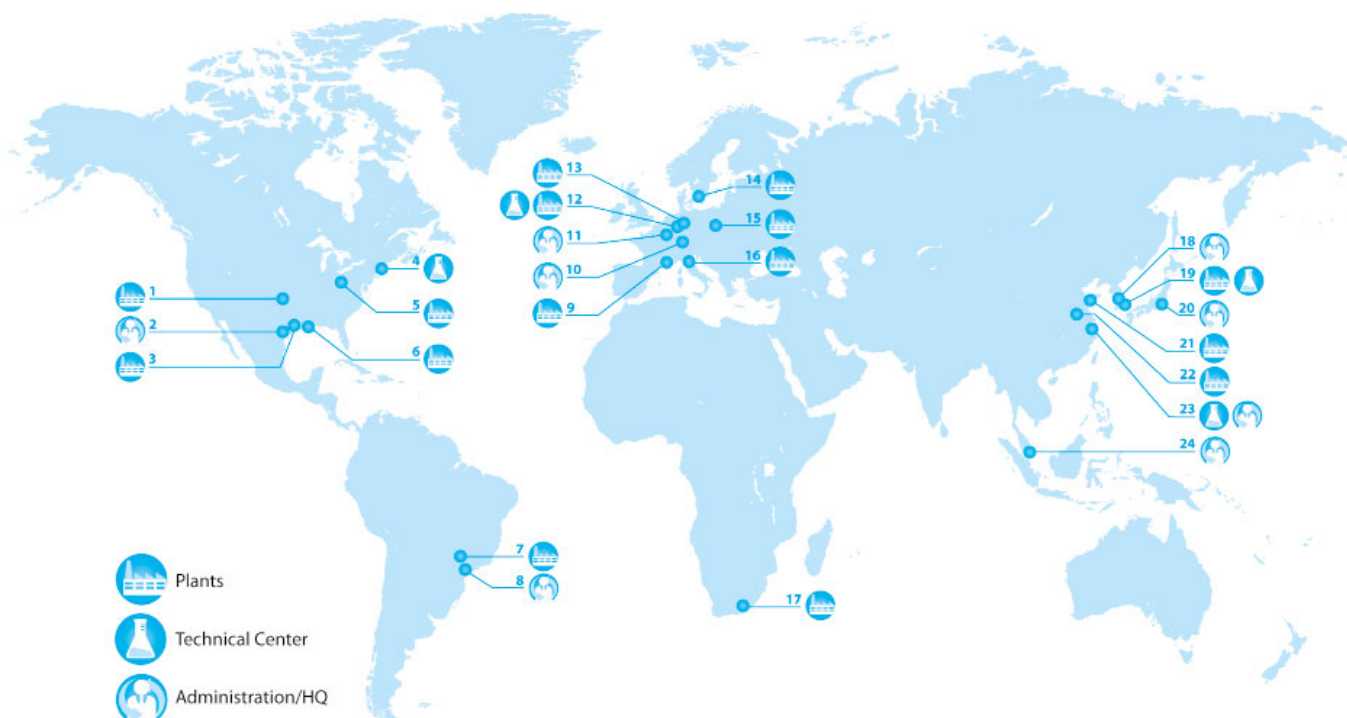
1. About Orion Engineered Carbons

Orion Engineered Carbons is one of the world's leading suppliers of carbon black. We offer standard and high-performance products for rubber, coatings, printing inks, polymers and other applications. Our high-quality gas blacks, furnace blacks and specialty carbon blacks tint, colorize and enhance the performance of tires and rubber goods such as automotive belts and hoses, plastics, paints and coatings, inks and toners, adhesives and sealants.

With approximately 1,425 employees worldwide, Orion Engineered Carbons runs 14 global production sites and 4 applied technology centers, focusing on quality supply and collaborative partnerships with customers. Common shares of Orion Engineered Carbons are traded on the New York Stock Exchange under the symbol OEC.



2. Technical center, administration and production sites



The Americas

- 1 **Borger**, TX, USA
- 2 **Houston**, TX, USA (Principal Executive Office + Regional HQ)
- 3 **Orange**, TX, USA
- 4 **Carlstadt**, NJ, USA
- 5 **Belpre**, OH, USA
- 6 **Ivanhoe** (New Iberia), LA, USA
- 7 **Paulínia** (São Paulo), Brazil
- 8 **São Paulo**, Brazil

Europe/Middle East/Africa

- 9 **Berre l'Étang**, France
- 10 **Luxembourg** (Global Corporate HQ)
- 11 **Frankfurt**, Germany (Global Operational and Administrative HQ)
- 12 **Cologne**, Germany
- 13 **Dortmund**, Germany
- 14 **Malmö**, Sweden
- 15 **Jasło**, Poland
- 16 **Ravenna**, Italy
- 17 **Gqeberha** (Port Elizabeth), South Africa

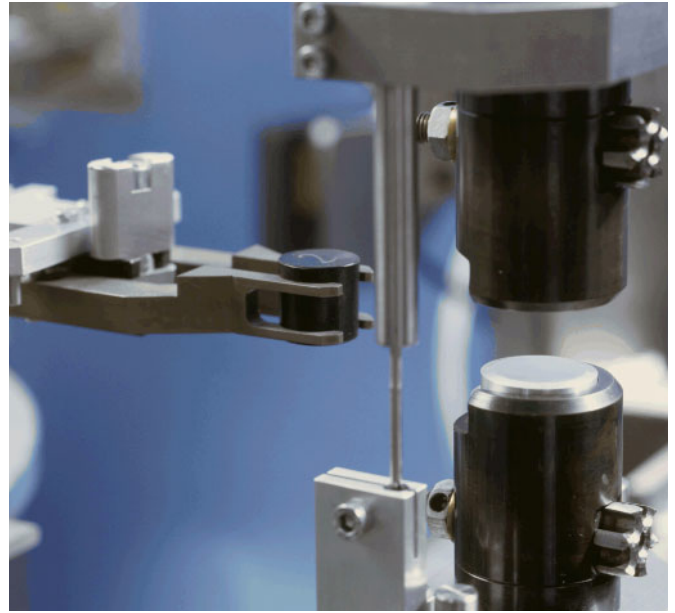
Asia Pacific

- 18 **Seoul**, South Korea
- 19 **Yeosu**, South Korea
- 20 **Tokyo**, Japan
- 21 **Qingdao**, China
- 22 **Huaibei**, China
- 23 **Shanghai**, China (Regional HQ)
- 24 **Singapore**, Singapore

3. Technical Service for our customers

Besides a worldwide network of production sites Orion Engineered Carbons maintains research & development centers for rubber reinforcement. The main technical center is located in Kalscheuren (Germany), where physicists, chemists and engineers investigate the mechanism of rubber reinforcement and develop new products to meet future requirements of the rubber industry. A modern and well-equipped laboratory is available for research work, for application studies and for centralized test programs to monitor the in-rubber performance of our products. Orion Engineered Carbons continuously works on improvements of test methods and is actively involved in standardization associations.

Technical market managers offer technical support in all questions related to our product range, quality features and to the most beneficial application of our products. Additional service units are at our customers' disposal when it comes to specific questions regarding product safety, product handling, logistics or packaging. Beyond this, the central laboratories of Orion Engineered Carbons may be consulted for sophisticated analytical tests.



4. Rubber black

Carbon black has been produced by Orion's predecessors since 1862. It plays a crucial role in the rubber industry: When used in car tires it ensures a high resistance to abrasion, good road handling and ageing resistance. Furthermore, carbon black is an important ingredient in the production of a multiplicity of rubber goods, like for example sealings, hoses and anti-vibration systems.

The reinforcing properties of carbon black strongly depend on its morphology, i.e. specific surface area and structure (see table next page). Another important parameter is the amount of carbon black used in a rubber formulation (see graph next page).

Carbon black consists of carbon. Today the most common method for producing carbon black is the furnace black process. A liquid hydrocarbon feedstock is injected into a flame, which is generated by the combustion of a gaseous or liquid fuel in combination with preheated air. Under these conditions the feedstock decomposes and carbon black particles are formed. After separation of the process gas / carbon black mixture in filter systems the carbon black powder is pelletized in order to improve the handling properties. Alternative production processes with a similar principle are the lamp black and Degussa gas black process, whereas the thermal black and acetylene black process are based on thermal decomposition of natural gas or acetylene, respectively.

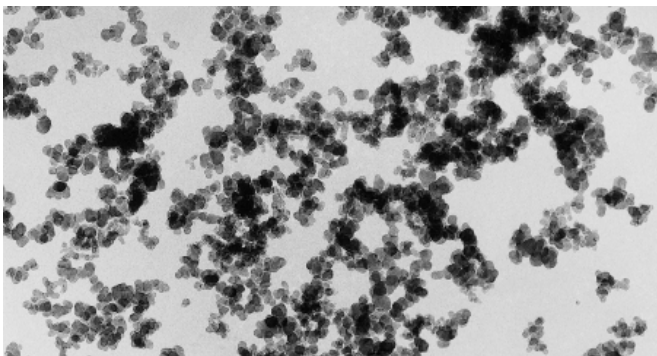


Figure 2:

TEM picture of fine furnace black with average primary particle size of approx. 14 nm

They all provide carbon blacks with a unique combination of properties. Under the brand CORAX®, Orion Engineered Carbons produces a comprehensive range of standard grades of furnace blacks in accordance with the requirements of ASTM D 1765.

Apart from ASTM carbon blacks, considerable emphasis is placed on the development of new products, also manufactured by the furnace process. With these products Orion Engineered Carbons responds to the fast growing demand for specialities for high- and ultra-high-performance car tires and fuel-efficient truck tires. ECORAX® blacks used in tire treads and bodies provide a significant reduction in rolling resistance and consequently in fuel consumption.

Clean carbon black grades (PUREX®) are of particular value in the manufacturing of mechanical rubber goods like extruded profiles and seals. PUREX® grades show a good processability and contribute to a smooth surface of the final product.

Carbon black produced by the lamp black process, DUREX® 0, is a special type of carbon black. It is mainly used for technical rubber goods, where it leads to excellent extrusion properties, a very smooth surface finish and some unique in-rubber properties. Another application field for DUREX® 0 are rubber products in contact with food or drinking water.

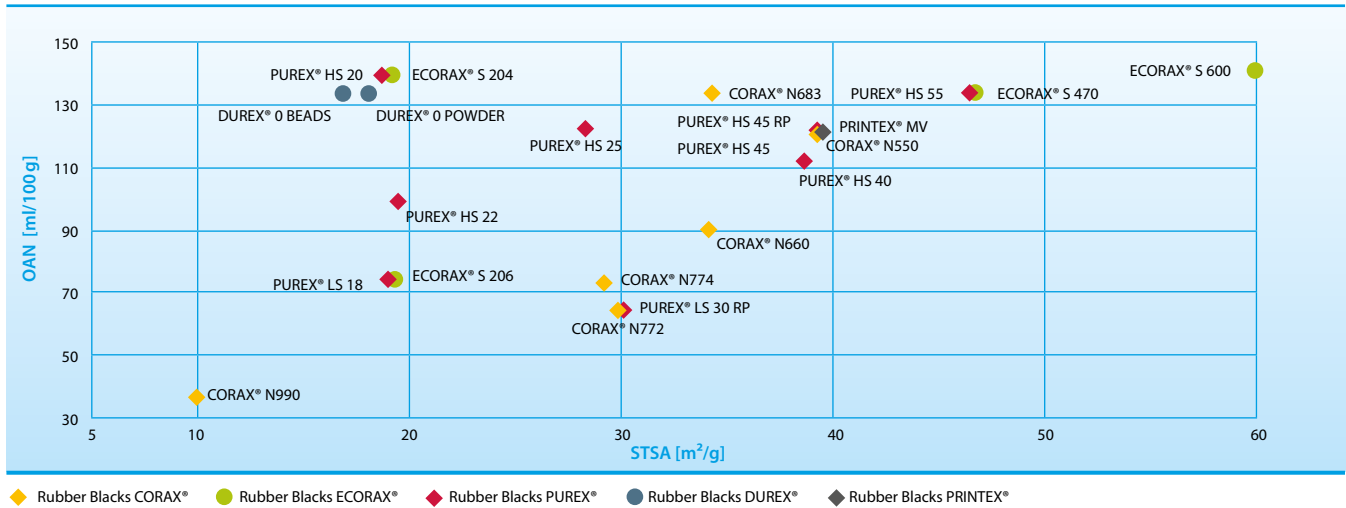
For special applications thermal black CORAX® N990 is used. Because of its low reinforcement degree this grade allows particularly high loadings and has excellent processing properties.

The product portfolio comprises a variety of products for applications requiring low level of PAH (Polycyclic Aromatic Hydrocarbons).

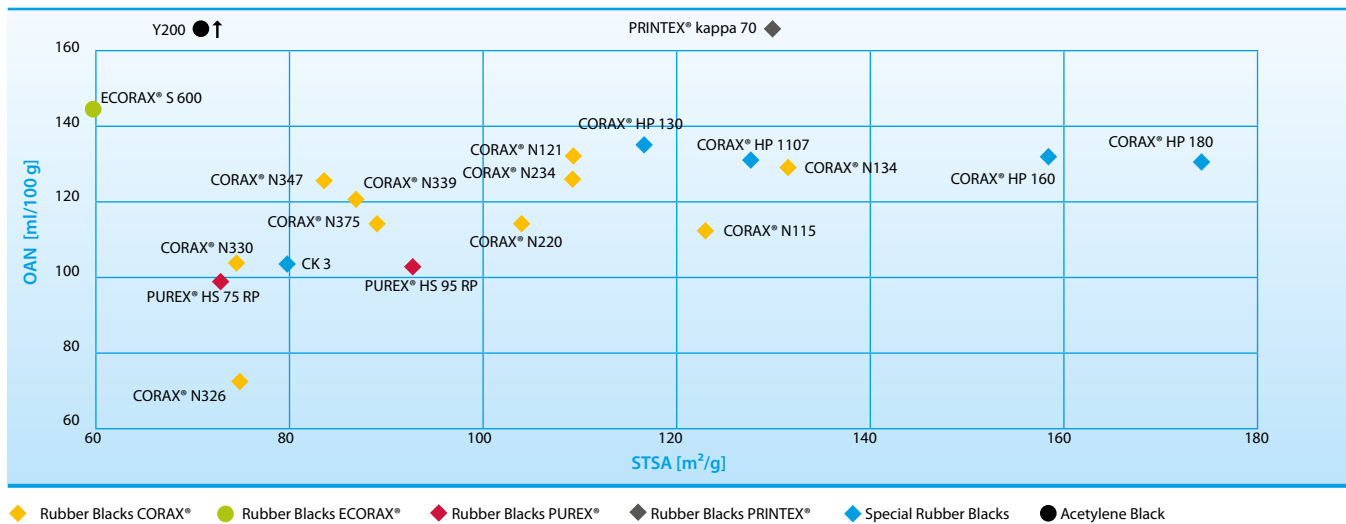
Special conductive carbon blacks are offered under the PRINTEX® brand. In addition to electrical conductivity, acetylene black also provides outstanding thermal conductivity.

5. Orion rubber blacks at a glance

Soft blacks



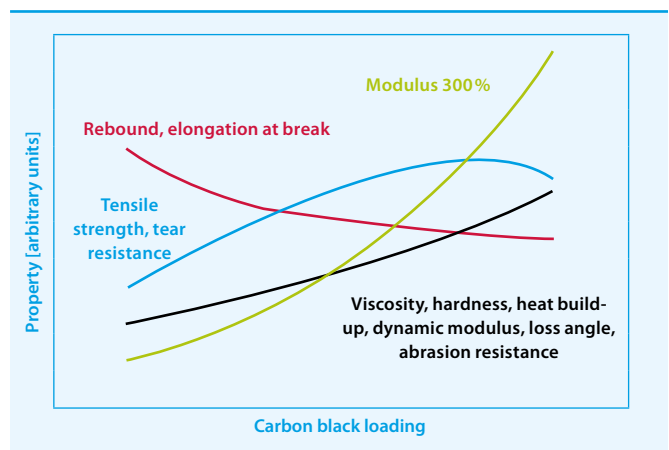
Hard blacks



Influence of specific surface area an structure on rubber properties
(constant carbon black loading and constant crosslink density)

	Spec. surface area		Structure		
	low	>> high	low	>> high	high
Dispersibility		▼		▲	
Mooney-viscosity		▲		▲	
Die swell		▽		▼	
Modulus 300 %		≈		▲	
Tensile strength		▲		▽	
Elongation at break		≈		▼	
Shore hardness		▲		▲	
Rebound 23 °C		▼		≈	
Compression set		≈		≈	
Abrasion resistance		▲		△	
Tear resistance		▲		▽	
Heat build-up		▲		≈	
Dynamic modulus E*		▲		▲	
Loss angle tan delta 60 °C		▲		≈	
Conductivity		▲		△	

Influence of carbon black loading



▲	effect increases strongly
△	effect increases slightly
▼	effect decreases strongly
▽	effect decreases slightly
≈	no clear influence

	Property* Unit Test Method	Iodine mg/g ASTM D 1510	STSA m ² /g ASTM D 6556	OAN ml/100 g ASTM D 2414	COAN ml/100 g ASTM D 3493	Tint – ASTM D 3265	Sieve residue ppm ASTM D 1514
ASTM carbon blacks	CORAX® N115	160	124	113	97	123	≤ 500
	CORAX® N121	121	114	132	111	119	≤ 500
	CORAX® N134	142	131	127	102	131	≤ 500
	CORAX® N220	121	106	114	98	116	≤ 500
	CORAX® N234	120	113	125	100	124	≤ 500
	CORAX® N326	82	77	72	69	111	≤ 500
	CORAX® N330	82	76	102	88	103	≤ 500
	CORAX® N339	90	88	120	99	110	≤ 500
	CORAX® N347	90	83	124	99	105	≤ 500
	CORAX® N375	90	90	114	96	114	≤ 500
	CORAX® N550	43	39	121	85	–	≤ 300
	CORAX® N660	36	34	90	74	–	≤ 300
	CORAX® N683	35	34	133	87	–	≤ 300
	CORAX® N772	30	30	65	59	–	≤ 300
	CORAX® N774	29	29	72	63	–	≤ 300
HP blacks	CORAX® HP 160	202	160	132	96	144	≤ 500
	CORAX® HP 180	205	175	130	103	–	≤ 500
	CORAX® HP 130	115	118	135	107	–	≤ 500
	CORAX® HP 1107	140	130	130	104	–	≤ 500
ECORAX®	ECORAX® S 204	19	19	138	76	–	≤ 300
	ECORAX® S 206	19	19	75	60	–	≤ 300
	ECORAX® S 470	54	47	133	86	–	≤ 300
	ECORAX® S 600	60	60	144	–	–	≤ 300
PUREX® / clean blacks	PUREX® LS 18	19	19	73	60	–	≤ 50
	PUREX® HS 20	19	19	138	76	–	≤ 50
	PUREX® HS 22	21	20	102	75	–	≤ 50
	PUREX® HS 25	28	28	123	83	–	≤ 50
	PUREX® HS 40	43	38	111	82	–	≤ 50
	PUREX® HS 45	43	39	121	85	–	≤ 50
	PUREX® HS 55	54	47	133	86	–	≤ 50
	PRINTEX® MV	43	39	121	–	–	≤ 20
Low PAH grades	PUREX® LS 30 RP	30	30	65	59	–	≤ 50
	PUREX® HS 45 RP	43	39	121	85	–	≤ 50
	PUREX® HS 75 RP	90	74	99	–	–	≤ 50
	PUREX® HS 95 RP	127	94	102	90	–	≤ 50
Lamp blacks	DUREX® 0 BEADS	30	17	–	–	–	≤ 50
	DUREX® 0 POWDER	35	18	–	–	–	≤ 50
Gas black	CK 3	–	80	104	–	–	≤ 100
Thermal black	CORAX® N990	10	10	38	–	–	≤ 30
Acetylene black	Y200 BEADS	–	61 (BET)	265	–	–	≤ 25
Conductive blacks	PRINTEX® kappa 70 BEADS	–	130	165	–	–	≤ 25
	PRINTEX® XE2 B	1125	–	420	–	–	≤ 50

IPH avg. g ASTM D	Heating loss % ASTM D 1509	Fines % ASTM D 1508	Pour density g/dm ³ ASTM D 1513	NDM ppm ASTM D 7724	Property* Unit Test Method
≤ 45	≤ 1.0	≤ 7.0	345	–	CORAX® N115
≤ 45	≤ 1.0	≤ 7.0	320	–	CORAX® N121
≤ 45	≤ 1.0	≤ 7.0	320	–	CORAX® N134
≤ 45	≤ 1.0	≤ 7.0	350	–	CORAX® N220
≤ 45	≤ 1.0	≤ 7.0	325	–	CORAX® N234
≤ 45	≤ 1.0	≤ 7.0	455	–	CORAX® N326
≤ 45	≤ 1.0	≤ 7.0	370	–	CORAX® N330
≤ 45	≤ 1.0	≤ 7.0	340	–	CORAX® N339
≤ 45	≤ 1.0	≤ 7.0	330	–	CORAX® N347
≤ 45	≤ 1.0	≤ 7.0	345	–	CORAX® N375
≤ 45	≤ 1.0	≤ 7.0	365	–	CORAX® N550
≤ 45	≤ 1.0	≤ 7.0	440	–	CORAX® N660
≤ 45	≤ 1.0	≤ 7.0	350	–	CORAX® N683
≤ 45	≤ 1.0	≤ 7.0	530	–	CORAX® N772
≤ 45	≤ 1.0	≤ 7.0	495	–	CORAX® N774
≤ 45	≤ 2.5	–	300	–	CORAX® HP 160
≤ 45	≤ 2.5	≤ 7.0	300	–	CORAX® HP 180
≤ 40	≤ 1.2	≤ 10.0	300	–	CORAX® HP 130
≤ 40	≤ 1.2	≤ 10.0	310	–	CORAX® HP 1107
≤ 45	≤ 1.0	≤ 10.0	345	–	ECORAX® S 204
≤ 45	≤ 1.0	≤ 7.0	520	–	ECORAX® S 206
≤ 30	≤ 1.0	≤ 10.0	335	–	ECORAX® S 470
≤ 45	≤ 1.0	≤ 7.0	300	–	ECORAX® S 600
≤ 40	≤ 0.50	≤ 7.0	520	≤ 80	PUREX® LS 18
≤ 40	≤ 0.50	≤ 7.0	345	≤ 80	PUREX® HS 20
≤ 40	≤ 0.50	≤ 7.0	430	≤ 80	PUREX® HS 22
≤ 40	≤ 0.50	≤ 7.0	375	≤ 80	PUREX® HS 25
≤ 40	≤ 0.50	≤ 7.0	400	≤ 80	PUREX® HS 40
≤ 40	≤ 0.50	≤ 7.0	365	≤ 80	PUREX® HS 45
≤ 40	≤ 1.0	≤ 10.0	335	≤ 80	PUREX® HS 55
≤ 25	≤ 0.50	≤ 9.0	365	–	PRINTEX® MV
≤ 40	≤ 0.50	≤ 7.0	530	≤ 80	PUREX® LS 30 RP
≤ 40	≤ 0.50	≤ 7.0	365	≤ 80	PUREX® HS 45 RP
≤ 40	≤ 1.0	≤ 7.0	405	≤ 80	PUREX® HS 75 RP
≤ 40	≤ 1.0	≤ 7.0	370	≤ 80	PUREX® HS 95 RP
≤ 40	≤ 0.75	≤ 7.0	375	≤ 80	DUREX® 0 BEADS
–	≤ 0.75	–	150	≤ 80	DUREX® 0 POWDER
≤ 40	≤ 4.0	≤ 7.0	380	–	CK 3
–	≤ 0.20	≤ 8.0	640	–	CORAX® N990
–	–	≤ 5.0	–	–	Y200 BEADS
≤ 20	≤ 2.0	≤ 12.0	300	–	PRINTEX® kappa 70 BEADS
≤ 20	≤ 2.0	≤ 7.0	–	–	PRINTEX® XE2 B

Table 2
Typical physico-chemical
properties**



* Detailed designations:
Iodine: Iodine adsorption number
STSA: Statistical thickness surface area
OAN: Oil absorption number
COAN: Oil absorption number of
compressed sample
IPH avg.: Individual pellet hardness,
average 1.4 – 1.7 mm

** Further grades from other regions avail-
able upon request



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