

# High performance specialty carbon blacks for semi-conductive compounds

Technical Information TI 1387



Global trends of rapid urbanization and increasing energy consumption require innovative energy saving solutions. The wire & cable industry therefore is progressively demanding high voltage (HV) cables as a solution to highly efficient power grids. Essential features of HV cables are low energy loss during long-distance transmission of electricity, excellent durability and service life – the solution to allow energy generation where it is most efficient and bringing it to junction sites all over. Further distribution to end-consumer needs additional cable network. As consequence the market for medium voltage (MV) cables undergoes excellent growth at the same time.

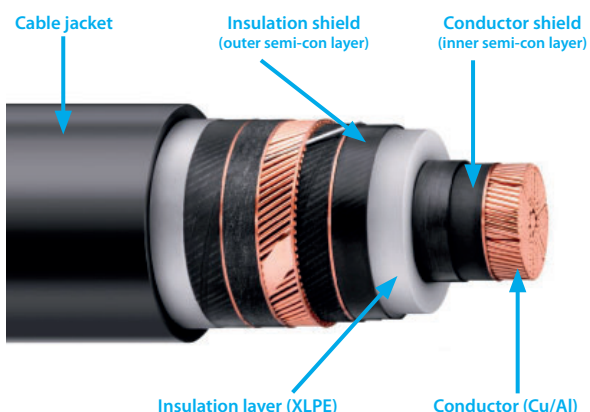
Specialty carbon black is one of the most essential raw materials used in semi-conductive compounds to manufacture HV- and MV-cables for transportation of electric current. Specialty carbon blacks impart electrical conductivity to both conductor shield and insulation shield. The semi-conductive layer in power cables facilitates homogeneous distribution of the electrical field, thus reducing the electrical stresses to the cable's polymer components. This smoothing effect prevents the cable from local failure and guarantees long service life.

### High performance specialty carbon blacks for semi-conductive compounds

Orion Engineered Carbons GmbH, with its strong focus on innovation, has developed a new series of specialty carbon blacks in response to the industry requirement. The specifically designed grades PRINTEX® kappa 10 and PRINTEX® HV with their extraordinary high purity level and superior dispersibility impart excellent surface smoothness and high conductivity to the compound and makes them ideal for use in high voltage cables. PRINTEX®MV completes the needs of the W & C industry and fully meets the requirements for medium voltage solutions.

PRINTEX® brands are preferably supplied in EMEA, whereas HIBLACK® grades are intended for usage in ASIA and AROSPERSE® in AMERICAS region mainly. Hence, from our Korean plant HIBLACK® 420B is equivalent quality for high and medium voltage, HIBLACK®150B for medium voltage respectively. AROSPERSE®5-183A is particularly designed to be used in medium voltage insulation shield. However, on specific request each quality can be made available in any region worldwide.

### Use of specialty carbon blacks in power cables



### PRINTEX® and HIBLACK® and AROSPERSE® - our solutions for high and medium voltage cables

Orion produces specialty carbon black by means of several process technologies: Furnace black process, Degussa gas black process, LAMP BLACK process and thermal black process. With our technical capabilities and expertise, we are able to provide the market with functional specialty carbon blacks having suitable chemical and physical properties. Especially geared towards the stringent needs of the wire & cable industry, Orion with its strong innovative power continuously develops new premium grades. PRINTEX® kappa10 is the latest high quality development completing the range of products for W & C.

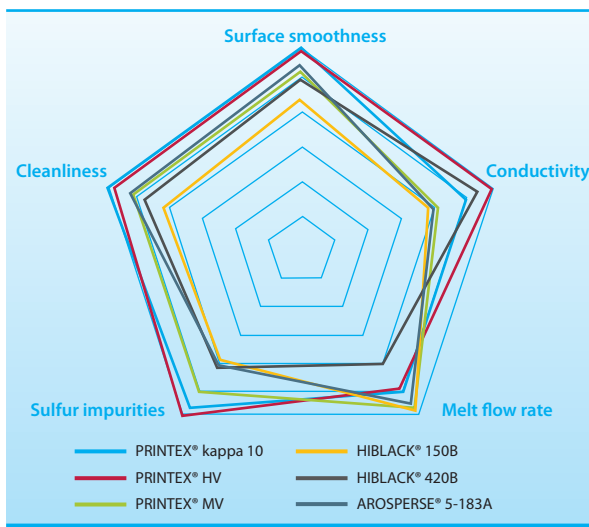
This technical bulletin addresses the key performance and functional attributes of Orion's specialty carbon blacks and their suitability for semi-conductive compounds utilized in HV and MV cables.

Product	Performance attributes			Load of the cable (kV)			Technical attributes	
	Dispersibility	High cleanliness	Low Sulfur	Low < 5	Medium 5 – 46	High 60 – 150	Conductivity	Surface smoothness
PRINTEX® kappa 10	●	●	●	●●●	●●●	●●●	●●●	●●●
PRINTEX® HV	●	●	●	●●●	●●●	●●	●●	●●
HIBLACK® 420B	●			●●●	●●		●●	●●
PRINTEX® MV	●			●●●	●		●	●
HIBLACK® 150B	●●			●●●	●●		●	●
AROSPERSE® 5-183A	●●●	●		●●●	●●●		●●	●●●

Parameter	Method	Unit	PRINTEX® kappa 10	PRINTEX® HV	PRINTEX® MV	HIBLACK® 420B	HIBLACK® 150B	AROSPERSE® 5-183A
BET	ASTM D 6556	m <sup>2</sup> /g	74	125	41	80	40	40
Iodine absorption number	ASTM D 1510	mg/g	85	150	43	88	41	43
OAN	ASTM D 2414	ml/100g	145	125	121	153	122	124
Ash content	ASTM D 1506	%	<0.05	<0.10	<0.10	<0.50	<0.50	<0,10
Sieve residue 325mesh	ASTM D 1514	ppm	<25	<25	<20	<50	<50	<15
Sulfur content	ASTM D 1619	%	<0.10	<0.10	n.a.	n.a.	n.a.	<0.70

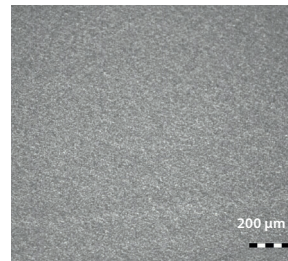
### Special attributes

The following chart illustrates the relative merits of the recommended specialty carbon blacks measured at same loading level in high voltage cables.

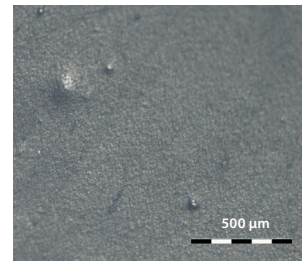


- Good surface smoothness of extruded tapes made with the semi-conductive compounds is indicative of low electrical stresses and water tree failures in power transmission cables.
- Conductivity measured by volume resistivity of the semi-conductive compounds at various specified temperatures and at equal specialty carbon black loading indicates efficiency.
- Higher melt flow rate translates into lower compound viscosity and easier processing.
- Cleanliness is defined as low ionic and any types of particulate impurities in specialty carbon blacks. Low level of such contaminants prolongs the service life of cables and minimizes potential for failures in the field.
- Low sulfur impurities prolong the service life and performance of power transmission cables.

### Orion high performance specialty carbon blacks provide excellent surface smoothness and thus prevent power cables from premature failure



Excellent surface smoothness of semi-conductive tape

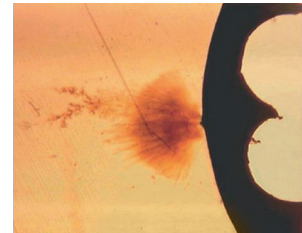


Poor surface smoothness of semi-conductive tape

Surface smoothness of tapes made with semi-conductive compounds directly influences the service life of power cables.



No trees



Water & electrical treeing

Electrical & water trees lead to insulation breakdown and failure of the power transmission cable resulting in sudden interruption of power transmission.

### Regulatory compliance

Specialty carbon blacks from Orion Engineered Carbons comply with most global regulatory requirements including CONEG, REACH, etc. Rigorous quality standards are followed during the production, handling and storage of these grades. The products are supported by an extensive and competent sales, technical and customer support staff around the world. For additional details and to verify compliance with specific regulations, please contact us.

### Quality standards

Orion Engineered Carbons follows rigorous quality procedures and standards during production, handling and storage of specialty carbon blacks to ensure that the product consistently meets the requirements for these applications.



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