Dorood Kelid Bargh Company

Composite Insulator

Technical Compliance of Manufactured Insulators with the Standard

IEC 60815

1- About Our Company

Drood Kelied Electric Co. is one of the leaders in producing electrical equipment with more than 30 years of experience. Drood Kelied Electric Co. is now proud to announce the production of composite insulators of up to 400 kV for the first time in Iran. Our belief is to respect the international standards; hence, Drood Kelied Electric Co. has coordinated with various international companies and national experts for over two years in order to optimize the quality of its products. In line with this trend, Drood Kelied Electric Co. has benefited from the latest technologies and innovations of leading research institutions such as NRI, STRI, and EPRI among others.

Our products are standardized, as demonstrated in the insulator's characteristics section. Resistance maximization of the rods, high resistance fittings, reduction in the electrical field, minimized partial discharge are just a few of the characteristics of the insulators that highlight the innovative and cutting-edge technology used in Drood Kelied ElectricCo's product range.

Combining our 30 years of experience with the innovative technology has provided us an exceptional opportunity to produce insulators with unique features, which we strongly believe, will provide us with the opportunity to supply our products globally and play a major role in the international market. Our high quality and low prices will enable us to compete with international companies in the field of electrical equipment production.

Our aim is to gain customer confidence and satisfaction. In order to accomplish our aim, shareholders of Drood Kelied Electric Co. attempt to equip themselves with latest industry knowledge and technology.

2- Scope and object of IEC 60815-3

IEC/TS 60815-3, which is a technical specification, is applicable to the selection of polymer insulators for a.c. systems, and the determination of their relevant dimensions, to be used in high voltage systems with respect to pollution.

This part of IEC/TS 60815 gives specific guidelines and principles to arrive at an informed judgments on the probable behaviour of a given insulator in certain pollution environments.

The contents of this technical specification are based on CIGRE 33.13 TF 01 documents , which form a useful complement to this technical specification for those wishing to study in greater depth the performance of insulators under pollution.

This technical specification does not deal with the effects of snow or ice on polluted insulators. Although this subject is dealt with by CIGRE [3], current knowledge is very limited and practice is too diverse.

The object of this technical specification is to give the user means to :

- determine the reference unified specific creepage distance (USCD) from site pollution severity (SPS) class,
- choose appropriate profiles,
- apply correction factors for altitude, insulator shape, size and position, etc. to the reference USCD.

This report introduces the standard profile parameters of insulators and describes the performance and concept of each of these parameters. This standard values compared to profile parameters of this company products to investigate performance of our composite insulators in polluted areas according to the standards.

3- Site severity determination

For the purposes of standardization, five classes of pollution characterizing the site severity are qualitatively defined in IEC/TS 60815-1, from very light pollution to very heavy pollution, as follows:
a – Very light;
b – Light;
c – Medium;
d – Heavy;
e – Very heavy.
NOTE 1 These letter classes do not correspond directly to the previous number classes of IEC/TR 60815:1986.
The SPS class for the site is determined according to IEC/TS 60815-1, using the standard glass or porcelain reference insulator, and is used to determine the reference USCD for polymeric insulators.
NOTE 2 It is not recommended to use polymeric insulators for site severity determination. As mentioned in Clause 5, polymeric surfaces may have a different pollution collection and self-cleaning behaviour compared to glass or ceramic surfaces. Additionally, some polymer materials may exhibit surface tack or roughness which can further affect short- or long-term pollution collection.

4- Determination of the reference USCD

Figure 1 shows the relation between SPS class and RUSCD for polymer insulators, for normal cases .The bars are preferred values representative of a minimum requirement for each class and are given for use with approach 3 as described in IEC/TS 60815-1. If the estimation of SPS class tends towards the neighboring higher class, then the curve may be followed.
If exact SPS measurements are available (approach 1 or 2), it is recommended to take an RUSCD which corresponds to the position of the SPS measurements within the class by following the curve in Figure 1.
NOTE It is assumed that the final USCD resulting from the application of the corrections given hereafter to the RUSCD will not correspond exactly to a creepage distance available for catalogue insulators. Hence it is preferred to work with exact figures and to round up to an appropriate value at the end of the correction process.

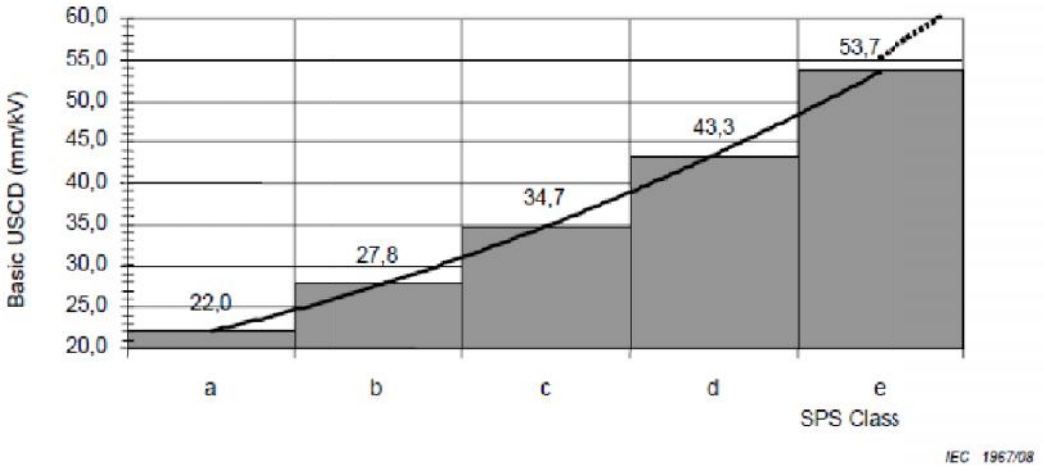


Figure 1 – RUSCD as a function of SPS class

Our Product compliance with standards

Catalog Number	Ur	USCD	SPS CLASS
TS-70-603-CT-28-N	36 kV	**47**	**d**
TS-70-603-CT-32-N	36 kV	**51**	**e**
TS-70-603-SB-32-N	36 kV	**51**	**e**
PT-13.4-355-PTF-22-N	36 kV	**37**	**c**
PT-13.4-420-PTF-28-N	36 kV	**47**	**d**
PT-13.4-450-PTF-29-N	36 kV	**49**	**d**
TS-120-956-SB-33-N	63 kV	**56**	**e**
TS-120-1000-SB-36-N	63 kV	**61**	**e**
TS-120-1095-SB-40-N	63 kV	**68**	**e**
TS-160-1375-SB-25-Z	132 kV	**42**	**d**
TS-160-1655-SB-32-Z	132 kV	**51**	**e**
TS-160-1800-SB-36-Z	132 kV	**61**	**e**
TS-160-2000-SB-41-Z	132 kV	**69**	**e**
TS-210-2100-SB-42-Z	132 kV	**71**	**e**
TS-210-2100-SB-25-Y	230 kV	**42**	**d**
TS-210-2590-SB-32-Y	230 kV	**51**	**e**
TS-210-2800-SB-35-Y	230 kV	**59**	**e**
TS-210-3150-SB-41-Y	230 kV	**69**	**e**
TS-210-3355-SB-44-X	230 kV	**74**	**e**
TS-210-3355-SB-25-X	400 kV	**42**	**d**
TS-210-4200-SB-33-X	400 kV	**56**	**e**
TS-210-4690-SB-37-X	400 kV	**62**	**e**
TS-210-5170-SB-41-X	400 kV	**69**	**e**

5- Checking of profile parameters

5-1 General remark

Profile parameters are important for avoiding rain bridging, preventing local short-circuiting between sheds, aiding self-cleaning, avoiding pollution "traps" and controlling local electricfield stress. The following profile parameters have a normal (white) range, a grey range wherethey can reduce performance (minor deviation) and a black range where they can have a serious effect on performance under pollution (major deviation). Each parameter shall be calculated and checked according to the following. It is allowed for one parameter to deviate into a grey area, i.e. to have a minor deviation. In the case of a minor deviation, it is recommended that the RUSCD be chosen from Figure 1 towards the upper end of the SPS class or even for the next higher class, unless such a change would further aggravate the deviation, notably by reducing *s/p* or increasing *l/d*. If more than one parameter is in a grey area, or any parameter in a black area, then this is considered as a major deviation and it is recommended to do one of the following:

– consult data from service or test station experience to confirm the performance of the profile;

– find an alternative profile or insulator technology;

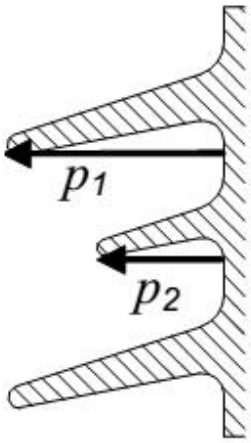
– verify the performance of the profile by testing.

NOTE The figures in the following subclauses are intended solely to illustrate the dimensional parameters used to determine profile parameters. They are not intended to represent optimum shed shapes or shapes that are actually used.

5-2 Alternating sheds and shed overhang

The classification of a profile as being alternating or not is based on difference in shed overhang measured from the insulator trunk to the tips of the largest and smallest sheds.

Shed overhang alone is not an important parameter, as long as the shed angle is not essentially flat (< 5؛), or excessive (> 35؛). The parameter is useful for defining uniform shed diameter profiles compared to alternating shed diameter profiles. However larger values of difference in shed overhang may be beneficial for vertical insulators in ice, snow and heavy rain conditions



	Classification of profile	
	Non-alternating	Alternating
Vertical insulators with overall diameter > 200 mm	$p_1 = p_2$ or $p_1 - p_2 < 15$ mm	$p_1 - p_2 \geq 15$ mm
Other positions and vertical insulators with overall diameter ≤ 200 mm	$p_1 = p_2$ or $p_1 - p_2 < 0{,}18\ p_1$ mm	$p_1 - p_2 \geq 0{,}18\ p_1$ mm

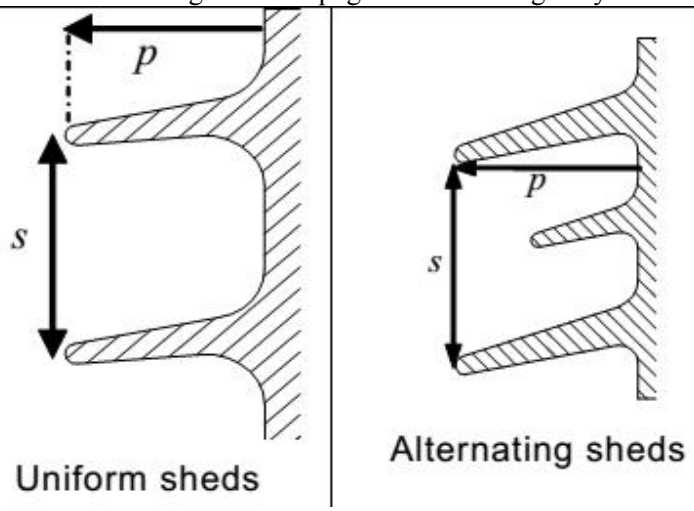
Our Product compliance with standards

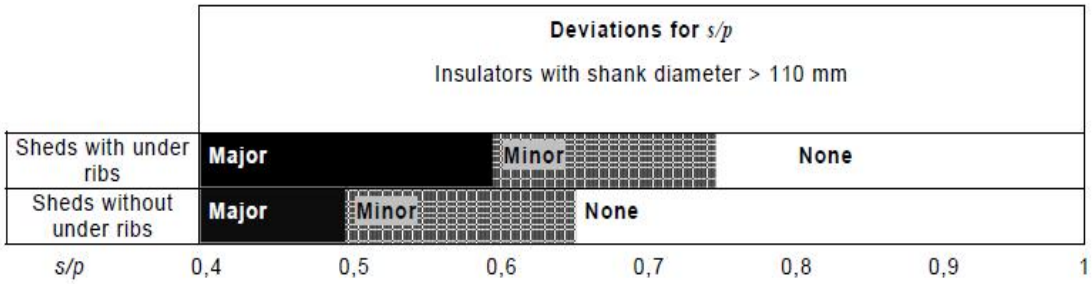
Catalog Number	Ur	Result
TS-70-603-CT-28-N	36 kV	Ok
TS-70-603-CT-32-N	36 kV	Ok
TS-70-603-SB-32-N	36 kV	Ok
PT-13.4-355-PTF-22-N	36 kV	Ok
PT-13.4-420-PTF-28-N	36 kV	Ok
PT-13.4-450-PTF-29-N	36 kV	Ok
TS-120-956-SB-33-N	63 kV	Ok
TS-120-1000-SB-36-N	63 kV	Ok
TS-120-1095-SB-40-N	63 kV	Ok
TS-160-1375-SB-25-Z	132 kV	Ok
TS-160-1655-SB-32-Z	132 kV	Ok
TS-160-1800-SB-36-Z	132 kV	Ok
TS-160-2000-SB-41-Z	132 kV	Ok
TS-210-2100-SB-42-Z	132 kV	Ok
TS-210-2100-SB-25-Y	230 kV	Ok
TS-210-2590-SB-32-Y	230 kV	Ok
TS-210-2800-SB-35-Y	230 kV	Ok
TS-210-3150-SB-41-Y	230 kV	Ok
TS-210-3355-SB-44-X	230 kV	Ok
TS-210-3355-SB-25-X	400 kV	Ok
TS-210-4200-SB-33-X	400 kV	Ok
TS-210-4690-SB-37-X	400 kV	Ok
TS-210-5170-SB-41-X	400 kV	Ok

5-3 Spacing versus shed overhang

Spacing versus shed overhang is the ratio of the vertical distance between two similar points of successive sheds of the same diameter (spacing) and the maximum shed overhang.

This parameter, as well as those described in 9.4, 9.5 and 9.6, involve shed-to-shed spacing and are important for the avoidance of "shorting out" creepage distance bridged by a shed-*to-shed arc*





Our Product compliance with standards

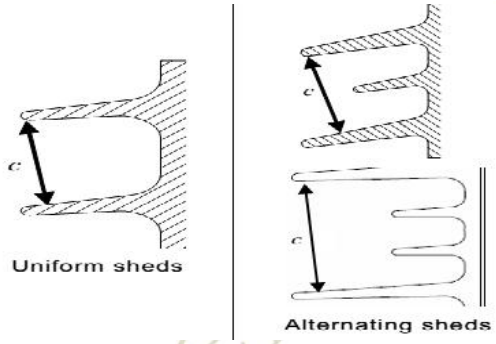
Catalog Number	Ur	S/P	Result
TS-70-603-CT-28-N	36 kV	1.7	Ok
TS-70-603-CT-32-N	36 kV	1.7	Ok
TS-70-603-SB-32-N	36 kV	1.7	Ok
PT-13.4-355-PTF-22-N	36 kV	1.7	Ok
PT-13.4-420-PTF-28-N	36 kV	1.7	Ok
PT-13.4-450-PTF-29-N	36 kV	1.7	Ok
TS-120-956-SB-33-N	63 kV	1.16	Ok
TS-120-1000-SB-36-N	63 kV	1.16	Ok
TS-120-1095-SB-40-N	63 kV	1.16	Ok
TS-160-1375-SB-25-Z	132 kV	1.16	Ok
TS-160-1655-SB-32-Z	132 kV	1.16	Ok
TS-160-1800-SB-36-Z	132 kV	1.16	Ok
TS-160-2000-SB-41-Z	132 kV	1.16	Ok
TS-210-2100-SB-42-Z	132 kV	1.16	Ok
TS-210-2100-SB-25-Y	230 kV	1.16	Ok
TS-210-2590-SB-32-Y	230 kV	1.16	Ok

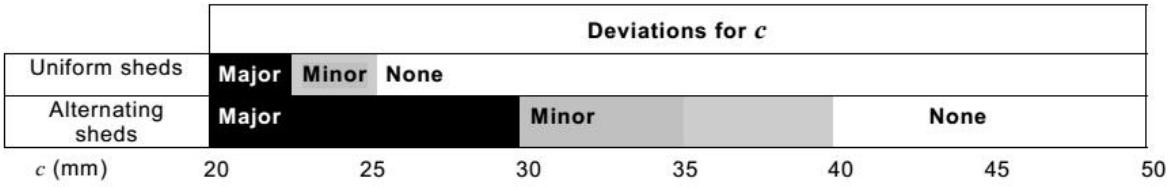
TS-210-2800-SB-35-Y	230 kV	1.16	Ok
TS-210-3150-SB-41-Y	230 kV	1.16	Ok
TS-210-3355-SB-44-X	230 kV	1.16	Ok
TS-210-3355-SB-25-X	400 kV	1.16	Ok
TS-210-4200-SB-33-X	400 kV	1.16	Ok
TS-210-4690-SB-37-X	400 kV	1.16	Ok
TS-210-5170-SB-41-X	400 kV	1.16	Ok

5-4 Minimum distance between sheds

Not applicable to cap and pin insulators or pin insulators. *c* is the minimum distance between adjacent sheds of the same diameter, measured by drawing a perpendicular from the lowest point of rim of the upper shed to the next shed below of the same diameter.

Minimum distance between sheds is one of the more important characteristics for insulator profile evaluation. Shed-to-shed arcing for small shed spacing can negate any effort to improve performance by adding creepage distance





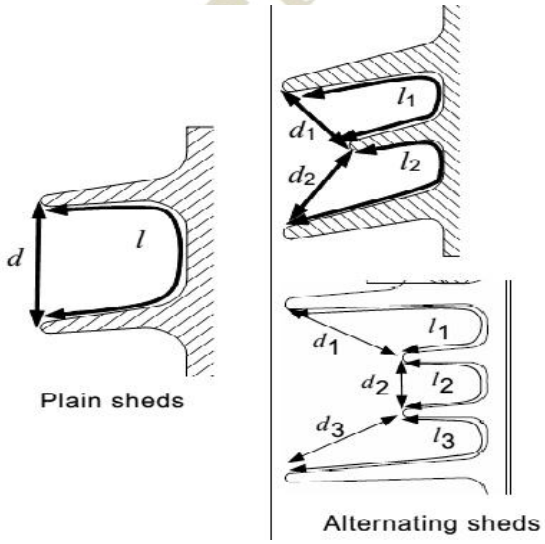
Our Product compliance with standards

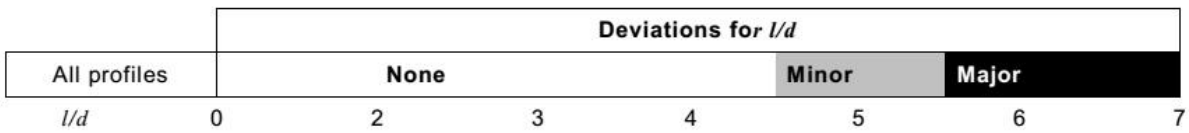
Catalog Number	Ur	Result
TS-70-603-CT-28-N	36 kV	Ok
TS-70-603-CT-32-N	36 kV	Ok
TS-70-603-SB-32-N	36 kV	Ok
PT-13.4-355-PTF-22-N	36 kV	Ok
PT-13.4-420-PTF-28-N	36 kV	Ok
PT-13.4-450-PTF-29-N	36 kV	Ok
TS-120-956-SB-33-N	63 kV	Ok
TS-120-1000-SB-36-N	63 kV	Ok
TS-120-1095-SB-40-N	63 kV	Ok
TS-160-1375-SB-25-Z	132 kV	Ok

TS-160-1655-SB-32-Z	132 kV	Ok
TS-160-1800-SB-36-Z	132 kV	Ok
TS-160-2000-SB-41-Z	132 kV	Ok
TS-210-2100-SB-42-Z	132 kV	Ok
TS-210-2100-SB-25-Y	230 kV	Ok
TS-210-2590-SB-32-Y	230 kV	Ok
TS-210-2800-SB-35-Y	230 kV	Ok
TS-210-3150-SB-41-Y	230 kV	Ok
TS-210-3355-SB-44-X	230 kV	Ok
TS-210-3355-SB-25-X	400 kV	Ok
TS-210-4200-SB-33-X	400 kV	Ok
TS-210-4690-SB-37-X	400 kV	Ok
TS-210-5170-SB-41-X	400 kV	Ok

5-5 Creepage distance versus clearance

d is the straight air distance between two points on the insulating part or between a point on the insulating part and another on a metal part.
l is the part of the creepage distance measured between the above two points.
l/d is the highest ratio found on any section.
Creepage distance versus clearance is a more localized check of the risk of bridging by arcs when dry bands or uneven hydrophobicity occur. It is also important in avoiding localized pollution build-up in deep and narrow sections of the profile



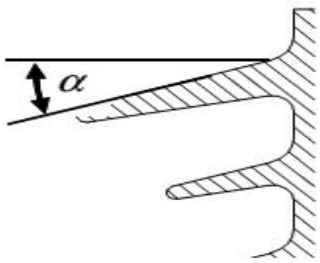


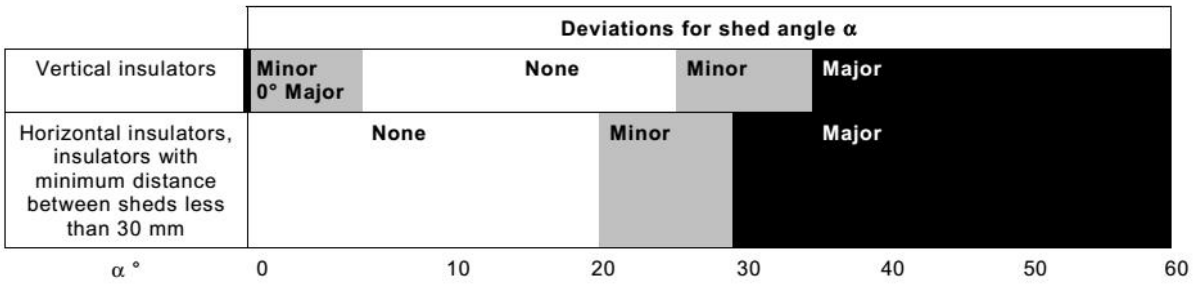
Our Product compliance with standards

Catalog Number	Ur	l/d	Result
TS-70-603-CT-28-N	36 kV	3.5	Ok
TS-70-603-CT-32-N	36 kV	3.5	Ok
TS-70-603-SB-32-N	36 kV	3.5	Ok
PT-13.4-355-PTF-22-N	36 kV	3.5	Ok
PT-13.4-420-PTF-28-N	36 kV	3.5	Ok
PT-13.4-450-PTF-29-N	36 kV	3.5	Ok
TS-120-956-SB-33-N	63 kV	3.5	Ok
TS-120-1000-SB-36-N	63 kV	3.5	Ok
TS-120-1095-SB-40-N	63 kV	3.5	Ok
TS-160-1375-SB-25-Z	132 kV	3.5	Ok
TS-160-1655-SB-32-Z	132 kV	3.5	Ok
TS-160-1800-SB-36-Z	132 kV	3.5	Ok
TS-160-2000-SB-41-Z	132 kV	3.5	Ok
TS-210-2100-SB-42-Z	132 kV	3.5	Ok
TS-210-2100-SB-25-Y	230 kV	3.5	Ok
TS-210-2590-SB-32-Y	230 kV	3.5	Ok
TS-210-2800-SB-35-Y	230 kV	3.5	Ok
TS-210-3150-SB-41-Y	230 kV	3.5	Ok
TS-210-3355-SB-44-X	230 kV	3.5	Ok
TS-210-3355-SB-25-X	400 kV	3.5	Ok
TS-210-4200-SB-33-X	400 kV	3.5	Ok
TS-210-4690-SB-37-X	400 kV	3.5	Ok
TS-210-5170-SB-41-X	400 kV	3.5	Ok

5-6 Shed angle

For rounded sheds, α is measured at the mid-point.
Open profiles allow for more efficient natural washing of insulator surfaces, provided the shed angle is not so low as to impede excess water run-off





Our Product compliance with standards

Catalog Number	Ur	α	Result
TS-70-603-CT-28-N	36 kV	7	Ok
TS-70-603-CT-32-N	36 kV	7	Ok
TS-70-603-SB-32-N	36 kV	7	Ok
PT-13.4-355-PTF-22-N	36 kV	7	Ok
PT-13.4-420-PTF-28-N	36 kV	7	Ok
PT-13.4-450-PTF-29-N	36 kV	7	Ok
TS-120-956-SB-33-N	63 kV	8	Ok
TS-120-1000-SB-36-N	63 kV	8	Ok
TS-120-1095-SB-40-N	63 kV	8	Ok
TS-160-1375-SB-25-Z	132 kV	8	Ok
TS-160-1655-SB-32-Z	132 kV	8	Ok
TS-160-1800-SB-36-Z	132 kV	8	Ok
TS-160-2000-SB-41-Z	132 kV	8	Ok
TS-210-2100-SB-42-Z	132 kV	8	Ok
TS-210-2100-SB-25-Y	230 kV	8	Ok
TS-210-2590-SB-32-Y	230 kV	8	Ok
TS-210-2800-SB-35-Y	230 kV	8	Ok
TS-210-3150-SB-41-Y	230 kV	8	Ok
TS-210-3355-SB-44-X	230 kV	8	Ok
TS-210-3355-SB-25-X	400 kV	8	Ok
TS-210-4200-SB-33-X	400 kV	8	Ok
TS-210-4690-SB-37-X	400 kV	8	Ok
TS-210-5170-SB-41-X	400 kV	8	Ok

6- Calculation

This Studies show that profile parameters of our companies insulators (DK electric) in accordance with the international standards and able to comply with all of the standardized indices Which indicates a very good performance of our insulators in various weather conditions and all types of environmental pollution. The company relies on 14 years of experience in domestic and foreign markets, and the use of sophisticated experts and advanced machinery Able to take steps to protect their clients' rights by compliance with the latest international standards.

7- References

[1] CIGRE Taskforce 33.04.01 – *Polluted insulators: A review of current knowledge*, CIGRE brochure N° 158-2000
[2] CIGRE WG C4.303 – *Outdoor insulation in polluted conditions: Guidelines for selection and dimensioning* Part 1: *General principles and the a.c. case*, CIGRE Technical Brochure N° 361-2008
[3] IEC 60050-604, *International Electrotechnical Vocabulary – Part 604: Generation, transmission and distribution of electricity – Operation*
[4] CIGRE Taskforce 33.13.07 – *Influence of ice and snow on the flashover performance of outdoor insulators* – Part 1: *Effects of ice*, ELECTRA No. 187 December 1999, and Part 2: *Effects of Snow*, ELECTRA No. 188 February 2000
[5] CIGRE Report 142, Natural *and artificial ageing and pollution testing of polymeric insulators*, WG33-04-07 June 1999
[6] IEC 60507, *Artificial pollution tests on high-voltage insulators to be used on a.c. systems*
[7] IEC/TR 62039, *Selection guide for polymeric materials for outdoor use under HV stress*