ПРИЛОЖЕНИЕ № 9

към договор за обществена поръчка с реф. № РРС 15-128 и предмет „Подмяна на маслонапълнена кабелна електропроводна линия 110 кV „Захарна фабрика" от линеен ножов разединител 110 кV на ПС „Орион" до линеен ножов разединител 110 кV в ПС „Боримечка", доставка на материали, оборудване и частична реконструкция на разпределителни уредби 110 кV в двете подстанции"

Приложение № 9 съдържа Приложения №№ 13, 14, 15, 16, 17 и 18 към Техническото предложение на изпълнителя.

Приложение № 13 – Заводска декларация за количество комутации на полюс до ревизия при изключване на номиналния ток на к.с 31,5 кА за елегазов прекъсвач 110 kV съгласно таблица 10, точка 18, подточка 18.2;

Приложение № 14 - Заводска декларация за количество комутации на полюс до ревизия при изключване на номиналния ток на к.с 20 кА за елегазов прекъсвач 110 kV съгласно таблица 10, точка 18, подточка 18.4;

Приложение № 15 - Заводска декларация за количество механични цикли на задвижващия механизъм до основен ремонт за всеки тип прекъсвачи съгласно таблица 10, точка 19, подточка 19.8.

Декларацията от АББ АБ е обща за горните приложения.

DECLARATION

To Whom it May Concern,

We, ABB AB, as reputable manufacturer of High Voltage Circuit Breakers having our factory at SE-771 80 Ludvika, Sweden and with regards to the open tender procedure: „REPLACEMENT OF EXISTING OIL-FILLED CABLE LINE 110KV „ZAHARNA FABRICA" FROM LINE DISCONNECTOR 110 KV AT SUBSTATION „ORION" TO LINE DISCONNECTOR 110 KV AT SUBSTATION „BORIMECHCATA", DELIVERY OF MATERIALS, EQUIPMENT AND PARTIAL RECONSTRUCTION OF 110 KV SWITCHYARDS AT THE TWO SUBSTATIONS", РЕФ. № РРС 15 – 128 of "CEZ Razpredelenie Bulgaria" AD, herewith declare that our circuit breaker LTB123D1/B for rated current 2500A, rated short-circuit current 31,5kA/3sec., equipped with operating mechanism MSD, quoted under the above mentioned open tender procedure has the following switching capacity, proven by witnessed type tests according to IEC:

- 20 trippings/switchings with short circuit current of 31,5kArms
- 50 trippings/switchings with short circuit current of 20kArms
- 10 000 mechanical operation cycles (ON and OFF)

Yours faithfully,
28th January 2016

Mikael Sellén
ABB AB
Lyviksvägen 4
77180, Ludvika, SWEDEN

ДЕКЛАРАЦИЯ

До всички заинтересовани,

Ние, АББ АБ, реномиран производител на прекъсвачи за високо напрежение, имащи завод с адрес SE-771 80 гр. Людвика, Швеция и във връзка с открита процедура за възлагане на обществена поръчка с име: „ПОДМЯНА НА МАСЛОНАПЪЛНЕНА КАБЕЛНА ЕЛЕКТРОПРОВОДНА ЛИНИЯ 110 КV „ЗАХАРНА ФАБРИКА" ОТ ЛИНЕЕН НОЖОВ РАЗЕДИНИТЕЛ 110 КV НА ПС „ОРИОН" ДО ЛИНЕЕН НОЖОВ РАЗЕДИНИТЕЛ 110 КV В ПС „БОРИМЕЧКА", ДОСТАВКА НА МАТЕРИАЛИ, ОБОРУДВАНЕ И ЧАСТИЧНА РЕКОНСТРУКЦИЯ НА РАЗПРЕДЕЛИТЕЛНИ УРЕДБИ 110 КV В ДВЕТЕ ПОДСТАНЦИИ" и РЕФ. № РРС 15 – 128 на „ЧЕЗ Разпределение България" АД с настоящото декларираме, че нашият прекъсвач LTB123D1/B за номинален ток 2500А, номинален ток на късо съединение 31,5kA/3sec., окомплектован със задвижващ механизъм тип MSD, предложен по горепосочената открита процедура, доказани с проведени типови изпитани съгласно IEC:

- 20 броя изключвания на номинален изключвателен ток 31,5kArms
- 50 броя изключвания на номинален изключвателен ток 20kArms
- 10 000 броя механични цикли (ВКЛ. и ИЗКЛ.)

Искрено ваш,
28th януари 2016

Микаел Селлен
АББ АБ
Ливикскеген 4
77180, Людвика, Швеция

HIGH VOLTAGE PRODUCTS LUDVIKA, SWEDEN

ЕЛЕКТРИКСИТИ София ООД

Приложение № 16 - Заводска декларация за гаранционен срок за силов сух кабел 110 kV, съгласно таблица 3, позиция „Общи технически характеристики“, точка 21

Estralin PS LLC

111024, Moscow
2-nd Kabelnaya str,2, bld. 24

tel.: +7 495 956 25 25, fax: +7 495 956 26 26

www.estralin.com

ESTRALIN PS

DECLARATION

To Whom it May Concern,

We, Estralin PS LLC, as reputable supplier of HV cables, cable systems, cable joints & terminations, cable accessories, with regards to the open tender procedure: „REPLACEMENT OF EXISTING OIL-FILLED CABLE LINE 110KV „ZAHARNA FABRICA" FROM LINE DISCONNECTOR 110 KV AT SUBSTATION „ORION" TO LINE DISCONNECTOR 110 KV AT SUBSTATION „BORIMECHCATA", DELIVERY OF MATERIALS, EQUIPMENT AND PARTIAL RECONSTRUCTION OF 110 KV SWITCHYARDS AT THE TWO SUBSTATIONS", РЕФ. № РРС 15 – 128 of "CEZ Razpredelenie Bulgaria" AD, herewith declare:

1. our products and systems quoted under the above mentioned open tender procedure do not infringe any patent rights of any third party;
2. our proposal (technical and commercial) is in full compliance with the requirements part of the documentation about the above mentioned open tender procedure;
3. The warranty period secured by us for the 110kV cables, cable joints and terminations, cable accessories part of the scope of supply is 60 months from the date of delivery.

Yours faithfully,
25th January 2016

Pavel Vetkhov
General Manager
Estralin PS LLC
Tel.: +7 (495) 956 25 25
Fax: +7 (495) 956 26 26
111024, Moscow, 2-nd Kabelnaya, Str, 2, bld. 24
www.estralin.com

ДЕКЛАРАЦИЯ

До всички заинтересовани,

Ние, Естралин ПС, реномиран доставчика на високоволтови кабели, кабелни системи, кабелна арматура (глави и муфи) и във връзка с открита процедура за възлагане на обществена поръчка с име: „ПОДМЯНА НА МАСЛОНАПЪЛНЕНА КАБЕЛНА ЕЛЕКТРОПРОВОДНА ЛИНИЯ 110 КV „ЗАХАРНА ФАБРИКА" ОТ ЛИНЕЕН НОЖОВ РАЗЕДИНИТЕЛ 110 КV НА ПС „ОРИОН" ДО ЛИНЕЕН НОЖОВ РАЗЕДИНИТЕЛ 110 КV В ПС „БОРИМЕЧКА", ДОСТАВКА НА МАТЕРИАЛИ, ОБОРУДВАНЕ И ЧАСТИЧНА РЕКОНСТРУКЦИЯ НА РАЗПРЕДЕЛИТЕЛНИ УРЕДБИ 110 КV В ДВЕТЕ ПОДСТАНЦИИ" и РЕФ. № РРС 15 – 128 на „ЧЕЗ Разпределение България" АД с настоящото декларираме:

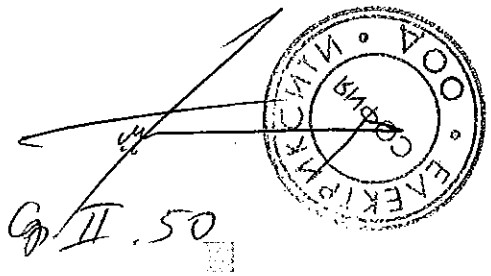
1. Нашите продукти и системи, предложени в гореспоменатата открита процедура за възлагане на обществена поръчка не нарушават патентни права на трети страни;
2. Нашето предложение (техническо и търговско) е в пълно съответствие с изискванията, заложени документацията по гореспоменатата открита процедура за възлагане на обществена поръчка;
3. Предоставеният от нас гаранционен срок за кабели 110kV, кабелна арматура (глави и муфи) и кабелни аксесоари, предмет на доставка е 60 месеца от датата на доставка.

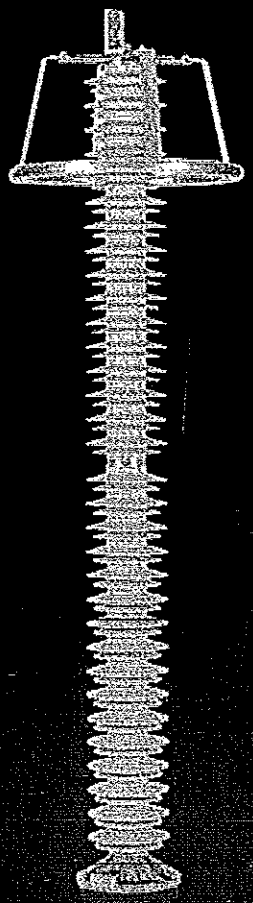
Искрено ваш,
25th януари 2016

Павел Ветхов
Генерален директор
Естралин ПС
Тел.: +7 (495) 956 25 25
Факс: +7 (495) 956 26 26
111024, Москва, ул. 2-ая Кабельная, д. 2, стр. 24
www.estralin.com

II.49

Приложение № 17 – Техническа документация (включително каталози), даваща пълно описание, технически данни и характеристики на предлаганото оборудване по Приложение № 1 – Технически данни за Вентилен отвод за нова КЕЛ 110 kV;





Assembly instruction

Zinc oxide surge arresters PEXLIM R, PEXLIM Q, PEXLIM P and PEXLINK transmission line arrester

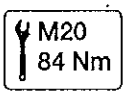
Power and productivity for a better world™

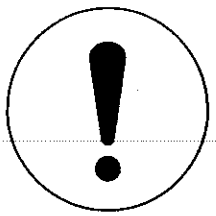
ABB

1. Introduction

Safety information

Key to the signs

	This sign is a visual notice to avoid mistakes which can result in damage of the material and/or no function of the surge arrester. Read the text carefully and if you don't understand do not proceed.
	Serious material damage, severe personal injury and/or death can be the result of not following the information given at this sign. Read the text carefully and if you don't understand do not proceed.
	The bolt of the given size shall be tightened with a torque wrench to the specified value.



Important
The following instruction is valid for PEXLIM R, Q, P-X , P-Y and PEXLINK transmission line arresters including non-catalogue arresters with the following additional suffix letters:

E = Non-standard electrical data

H = Inverted mounting

L = Line surge arrester

Serious material damage, severe personal injury and/or death can be the result of not following this instruction. Therefore, the personnel responsible for the installation of the equipment **shall read and follow the instruction carefully.**

Handling and maintenance of all the surge arresters described in this instruction must be done by personnel trained for this type of work.

WARNING!
All work related to the surge arresters shall be made with disconnected and earthed conductors. Follow all regulations and rules stated by international and national safety regulations.

Normally, surge arresters operate at a high voltage. Therefore, they must be handled and installed by qualified personnel.

Storage

In all cases and with consideration to specific local conditions, appropriate steps must be taken to ensure the equipment and packaging is stored in such a way as to protect it from damage or deterioration.

Table of contents

This manual covers both PEXLIM and PEXLINK surge arresters. An X in the respective column above indicates which section should be followed for each type. An (X) in brackets indicates the section to be followed when an accessory is to be installed.

1.1 Sequence of assembly

The respective procedure in the tables below should be followed for safe and correct installation of the surge arresters.

PEXLIM

Order	Procedure	Section
1	Inspection upon arrival.	1.2
2	Prepare before installation	1.3 - 1.4
3	Lift out the surge arrester from the case.	3
4	Adjust the line terminals.	4
5	Assemble the grading rings.	5.1 - 5.2
6	Assemble the grading ring on the surge arrester. Lift the top unit on the second unit if there is a two-unit surge arrester.	6.1 - 6.3
7	Lift the surge arrester on structure and anchored it. If a insulating base and/or EXCOUNT-II should be assembled see section 7.2 instead.	7.1 (7.2)
8	Connect the line and earth conductors. If a surge counter (EXCOUNT-C or other) should be installed see section 8.5.	8.1 - 8.4 (8.5)

PEXLINK

Order	Procedure	Section
1	Inspection upon arrival.	1.2
2	Prepare before installation	1.3
3	Lift out the surge arrester from the case.	3
5	Assemble the grading rings.	5.1 - 5.2
6	Assemble the grading ring on the PEXLINK surge arrester. Lift the top unit on the second unit if there is a two-unit surge arrester.	6.1 - 6.3
7	Assembly the terminal and links.	9.1
8	Assembly of disconnecting device. If a EXCOUNT-II should be installed see section 9.3 instead.	9.2 (9.3)
9	Install the PEXLINK surge arrester on the transmission line.	-

Multi-unit arresters must be erected with their units in correct order, see section 2.2 on page 6 and 6.1 on page 12.

The instruction must be followed in correct order to prevent problems during assembly. In the case where an arrester is not supplied with an insulating base and/or surge counter, the paragraphs dealing with these accessories may be disregarded.

1.2 Inspection upon arrival

Upon arrival it is important that the cases are inspected and the contents checked against the packing list which is attached to each case. Any shortage or damage should be reported immediately to the insurance and/or ABB representative; latest within 30 days from the arrival of goods at site. ABB cannot take responsibility for shortages or damages not reported within this time period.

If the contents are to be stored for a long period of time prior to installation they must be repacked and preferably stored dry and indoors. However, outdoor storage is acceptable for the arresters themselves.

1.3 Tools for assembly

Special instruments or tools are not required for assembly and erection of the surge arrester. It is recommended to assemble all details of a complete arrester before mounting it on the structure.

1.4 Vertical or inverted installation

Surge arresters have an insulator with an alternating shed profile, see figure 1.4.1. The surge arrester shall be mounted such that the shed form points downwards so that water can easily run off the insulator.

Should the surge arrester be incorrectly mounted upside down, then rainwater will collect in the inverted sheds, leading to a risk for flashover and subsequent short-circuit.

Surge arresters specifically intended for inverted mounting have a "H" at the end of the type designation, see the below example, and must always be inverted mounted, see figure 1.4.4.

PEXLIM Q192-XV245H

Surge arresters without "H" in the type designation must always be upright mounted, see figure 1.4.3.

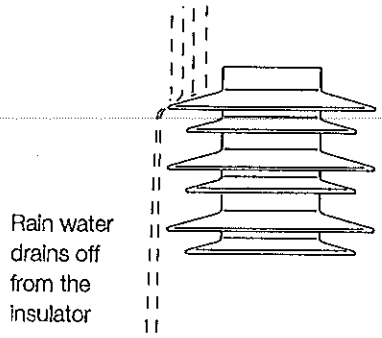


Figure 1.4.1
Ensure that shed profile points downwards to avoid collection of rainwater on the insulator.

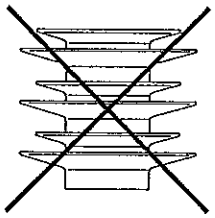


Figure 1.4.2
WARNING!
Incorrect direction of the sheds

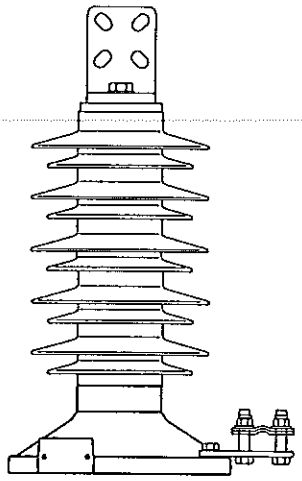


Figure 1.4.3
Surge arrester for upright mounting (note direction of sheds)

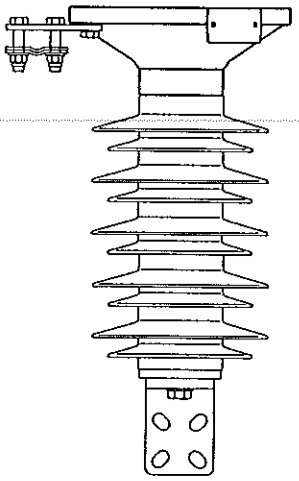


Figure 1.4.4
Surge arrester for inverted mounting (note direction of sheds)

2. Rating plates

2.1 Location of rating plate

See figure 2.1.1 to 2.1.3 for location of the rating plate on respective surge arrester types.

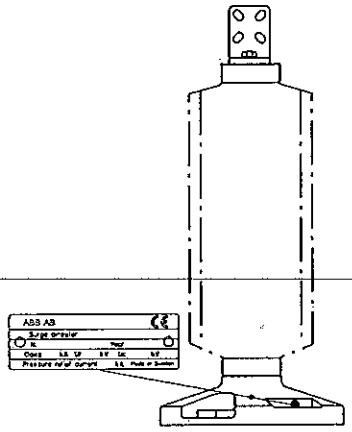


Figure 2.1.1
PEXLIM P-Y and R surge arrester

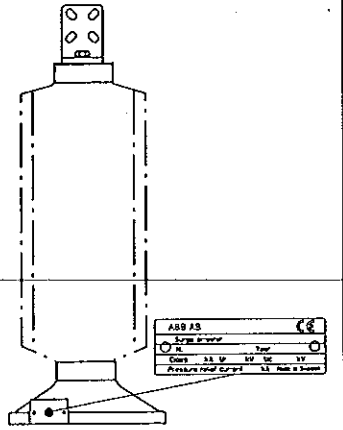


Figure 2.1.2
PEXLIM Q and P-X surge arrester

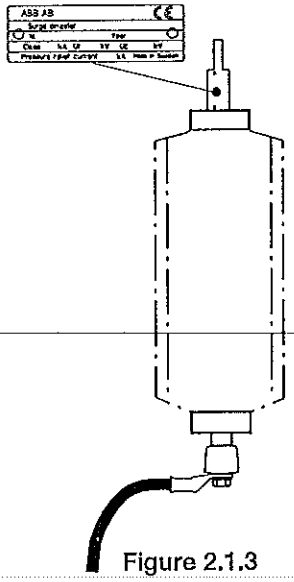


Figure 2.1.3
PEXLINK surge arrester

2.2 Relative position of arrester units

Two-unit arresters must be erected with their units in the correct order.
All units in one arrester have the same serial number with a consecutive suffix number to identify their position, i.e. top unit = N. XXXXXXX/1, bottom unit = N. XXXXXXX/2.

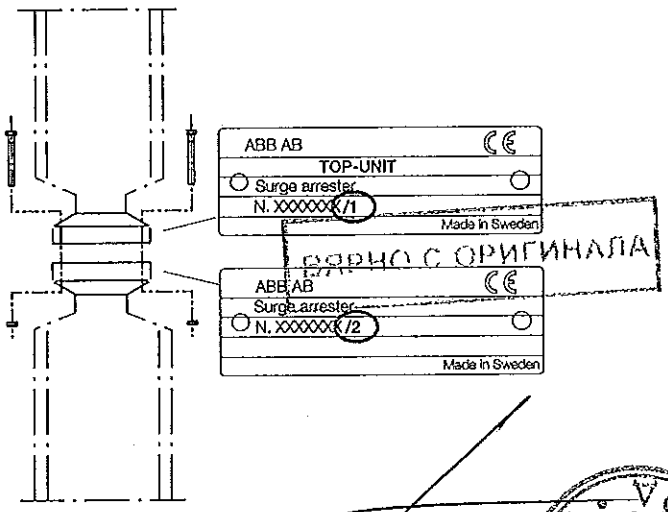


Figure 2.2.1
Plate with serial number on the flanges

3. Lifting

3.1 Lifting the surge arrester

Lift the surge arrester by the line terminal or the flange. Use of shackles or lifting eye bolts is recommended. See figure 3.1 to 3.4 (for PEXLINK see figure 3.5).

Table 3.1

	PEXLIM R	PEXLIM Q-X	PEXLIM Q-Y	PEXLIM P-X	PEXLIM P-Y	PEXLINK
Typical weight of the smallest to the largest surge arrester.	15 to 33 kg	17 to 126 kg	18 to 129 kg	19 to 148 kg	54 to 247 kg	14 to 130 kg

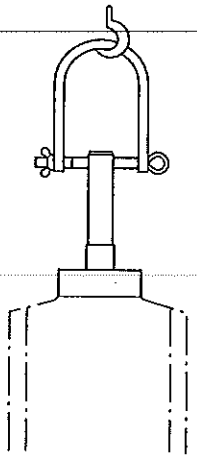


Figure 3.1 Lifting with shackles mounted on the line terminal

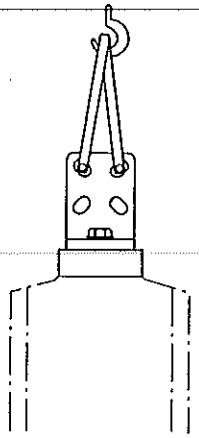


Figure 3.2 Lifting with slings mounted on the line terminal

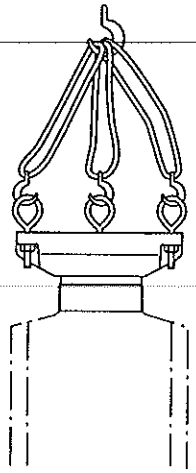


Figure 3.3 Lifting the joint flange with lifting eye bolts and lifting slings

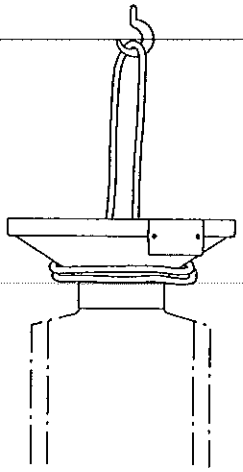


Figure 3.4 Lifting the base with lifting slings (prefered lifting arrangement for inverted mounting)

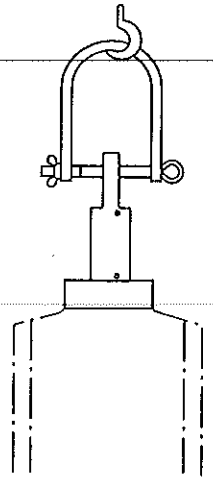


Figure 3.5 Lifting the PEXLINK surge arrester with shackles mounted on the line terminal

Do NOT lift the surge arrester by its insulator!

Be careful so that the arrester units do not hit anything during lifting!

Keep the lifting slings in place until the completely assembled arrester is securely anchored to the structure.

4. Line terminal

4.1 Adjusting the pre-assembled line terminals

Adjust the line terminal to desired position. Recommended tightening torque is: PEXLIM R 100 Nm, PEXLIM Q, P 150 Nm (M20). See figure 4.2.

Ensure that metal contact surfaces on the arrester unit, line terminal and holder for grading ring (when applicable) are free from dirt and grease.

Line terminal with clamp: when the line conductor is to be connected, assemble the clamp according to the assembly instruction delivered with it.

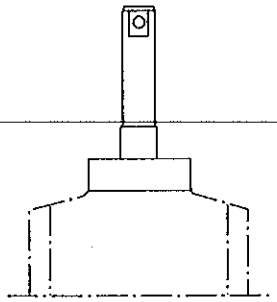


Figure 4.1
Adjustment of
1HSA410 000-N, -P

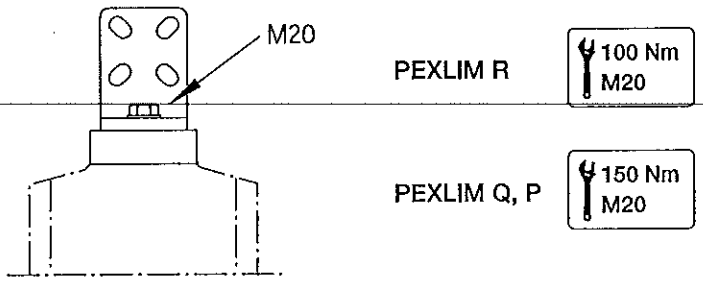


Figure 4.2
Adjustment of
1HSA410 000-L, -M

4.2 Orientation of line terminal

When grading ring A (see page 9 and 10) is used: The orientation of grading ring with its holder in relation to the line terminal shall be in accordance with figure 4.3.

Recommended tightening torque is: PEXLIM R 100 Nm, PEXLIM Q, P 150 Nm (M20).

NOTE: This is not applicable to PEXLINK surge arresters.

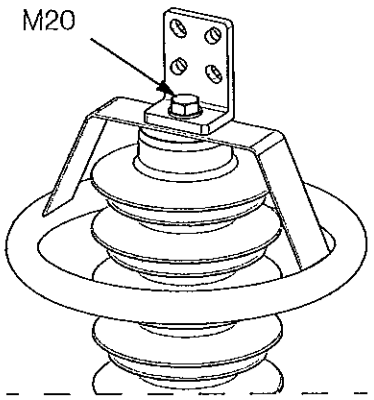


Figure 4.3
Correct orientation
of line terminal and grading ring

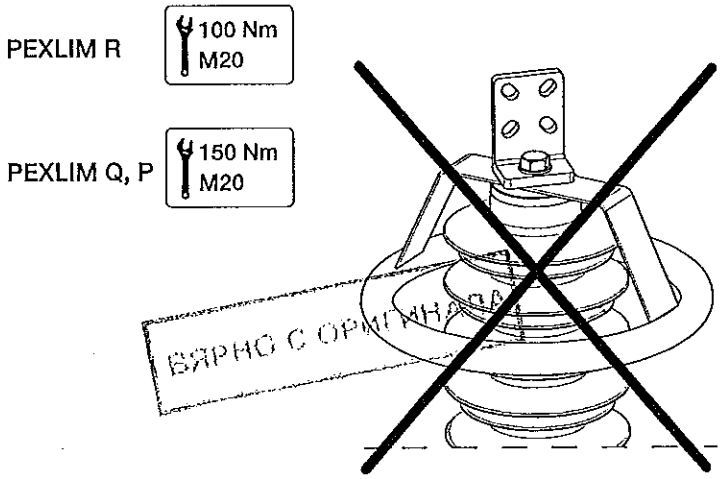


Figure 4.4
WARNING!
Incorrect orientation

5. Grading ring

5.1 Grading ring arrangement

When a grading ring is supplied, it **must** be fitted to the arrester. **Otherwise the correct performance is not guaranteed.** If the surge arrester has a grading ring, assemble the stays with the ring/rings according to the table 5.1.1 and the figures in paragraph 5.2. The recommended tightening torque for M10 screws is 33 Nm.

For inverted installation, the surge arrester has a "H" added to the end of the type designation shown in the table below.

Table 5.1.1 Grading ring arrangement. The letters in the table refer to the figures on the next page. Types where grading rings are included.

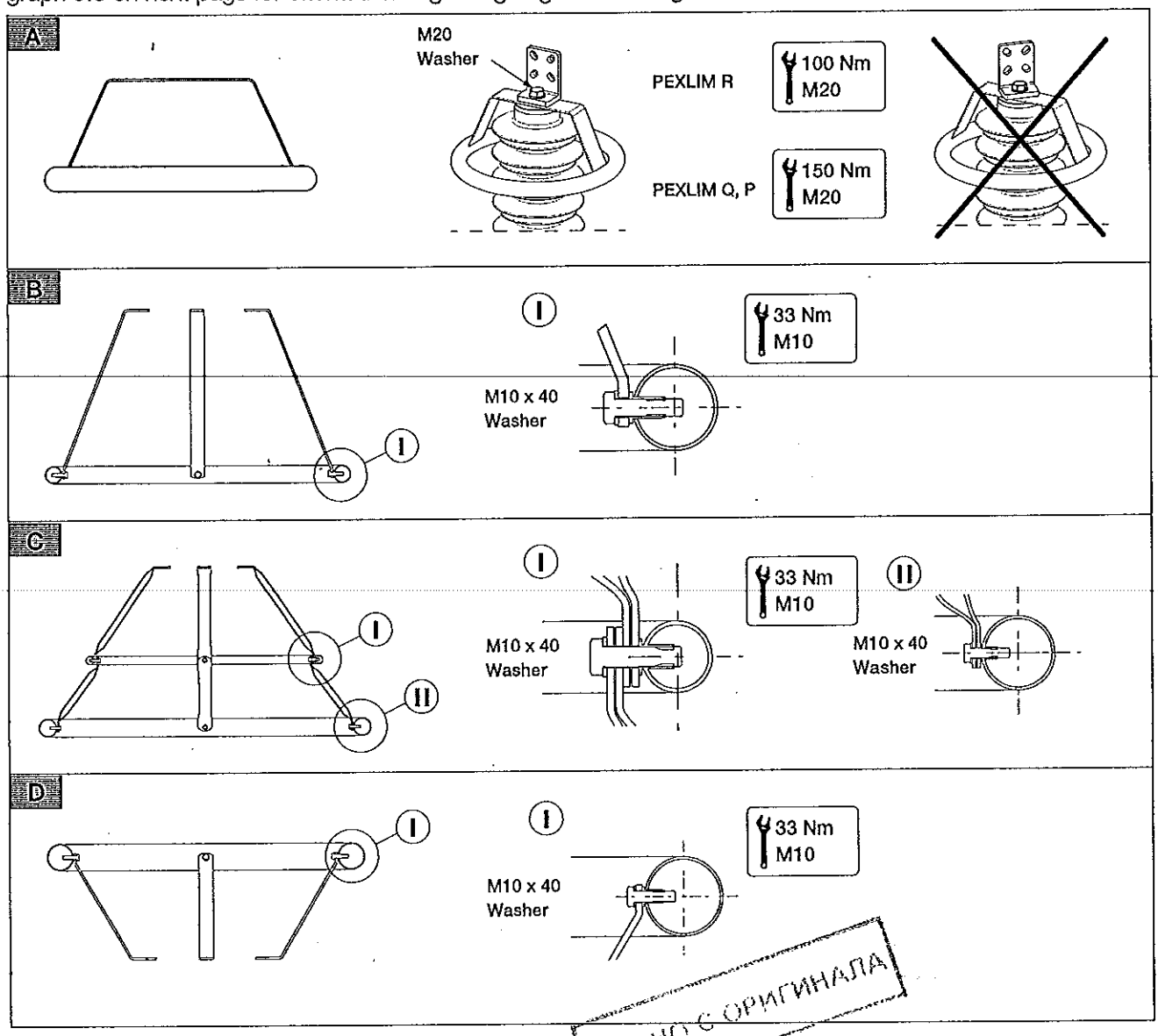
Type designation	See 5.2
PEXLIM R-Y	
R090-YH123	A
R090-YV123 – R096-YV123	A
R108-YH145	A
R108-YV145	A
R132-YH170 – R144-YH170	A
PEXLIM Q-X	
Q132-XH170 – Q150-XH170	A
Q132-XV170 – Q192-XV170	A
Q192-XM245	B
Q180-XH245 – Q228-XH245	B
Q180-XV245 – Q198-XV245	B
Q210-XV245 – Q228-XV245	B
Q216-XH300 – Q276-XH300	B
Q216-XV300 – Q276-XV300	B
Q258-XH362 – Q288-XH362	C
Q258-XV362 – Q288-XV362	C
Q330-XH420 – Q360-XH420	C
PEXLIM Q-Y	
Q180-YH245 – Q228-YH245	A
Q180-YV245 – Q228-YV245	B
Q216-YH300 – Q276-YH300	B
Q216-YV300 – Q240-YV300	C
Q258-YV300 – Q276-YV300	B
Q258-YH362 – Q288-YH362	C
Q258-YV362 – Q288-YV362	C
Q330-YH420 – Q360-YH420	C
Q330-YV420 – Q396-YV420	C
PEXLIM P-X	
P132-XH170 – P150-XH170	A
P132-XV170 – P192-XV170	A
P180-XM245 – P192-XM245	A
P180-XH245 – P228-XH245	A
P180-XV245 – P228-XV245	B
P210-XV245 – P228-XV245	B
P216-XH300 – P276-XH300	B

Type designation	See 5.2
PEXLIM P-X	
P216-XV300 – P276-XV300	B
P258-XH362 – P288-XH362	C
P258-XV362 – P288-XV362	C
P330-XH420 – P360-XH420	C
PEXLIM P-Y	
P228-YH300 – P276-YH300	B
P228-YV300 – P276-YV300	B
P258-YM362 – P276-YM362	C
P258-YH362 – P288-YH362	C
P258-YV362 – P288-YV362	C
P330-YH420 – P396-YH420	C
P330-YV420 – P396-YV420	C
P396-YH550 – P444-YH550	C/D
PEXLINK	
R090-YH123L	A
R108-YH145L	A
R132-YH170L – R144-YH170L	A
R150-YV170L – R192-YV170L	A
R180-YH245L – R216-YH245L	B
R108-ZH145L	A
R108-ZV145L	A
R132-ZH170L – R144-ZH170L	A
R132-ZV170L – R144-ZV170L	B
R150-ZV170L – R192-ZV170L	A
R192-ZM245L	B
R180-ZH245L – R228-ZH245L	B
R180-ZV245L – R228-ZV245L	B
R216-ZH300L	C
R240-ZH300L – R276-ZH300L	B
R216-ZV300L	C
R240-ZV300L – R276-ZV300L	B
R258-ZH362L – R288-ZH362L	C
R330-ZH420L – R342-ZH420L	C
Q132-XH170L – Q150-XH170L	A
Q162-XV170L – Q192-XV170L	A

Type designation	See 5.2
PEXLINK	
Q180-XH245L – Q228-XH245L	B
Q216-XH300L – Q264-XH300L	B
Q258-XH362L – Q288-XH362L	C
Q330-XH420L – Q360-XH420L	C
P180-XH245L – P228-XH245L	A
P216-XH300L – P264-XH300L	B
P258-XH362L – P288-XH362L	C
P330-XH420L – P360-XH420L	C

5.2 Grading ring assembly

Assemble the grading ring according to the applicable arrester type designation in table 5.1.1. See also paragraph 5.3 on next page for orientation of grading ring with drainage holes.



5.3 Grading rings with drainage holes

Assemble the grading ring with drainage holes oriented downwards, see also table 5.3.1

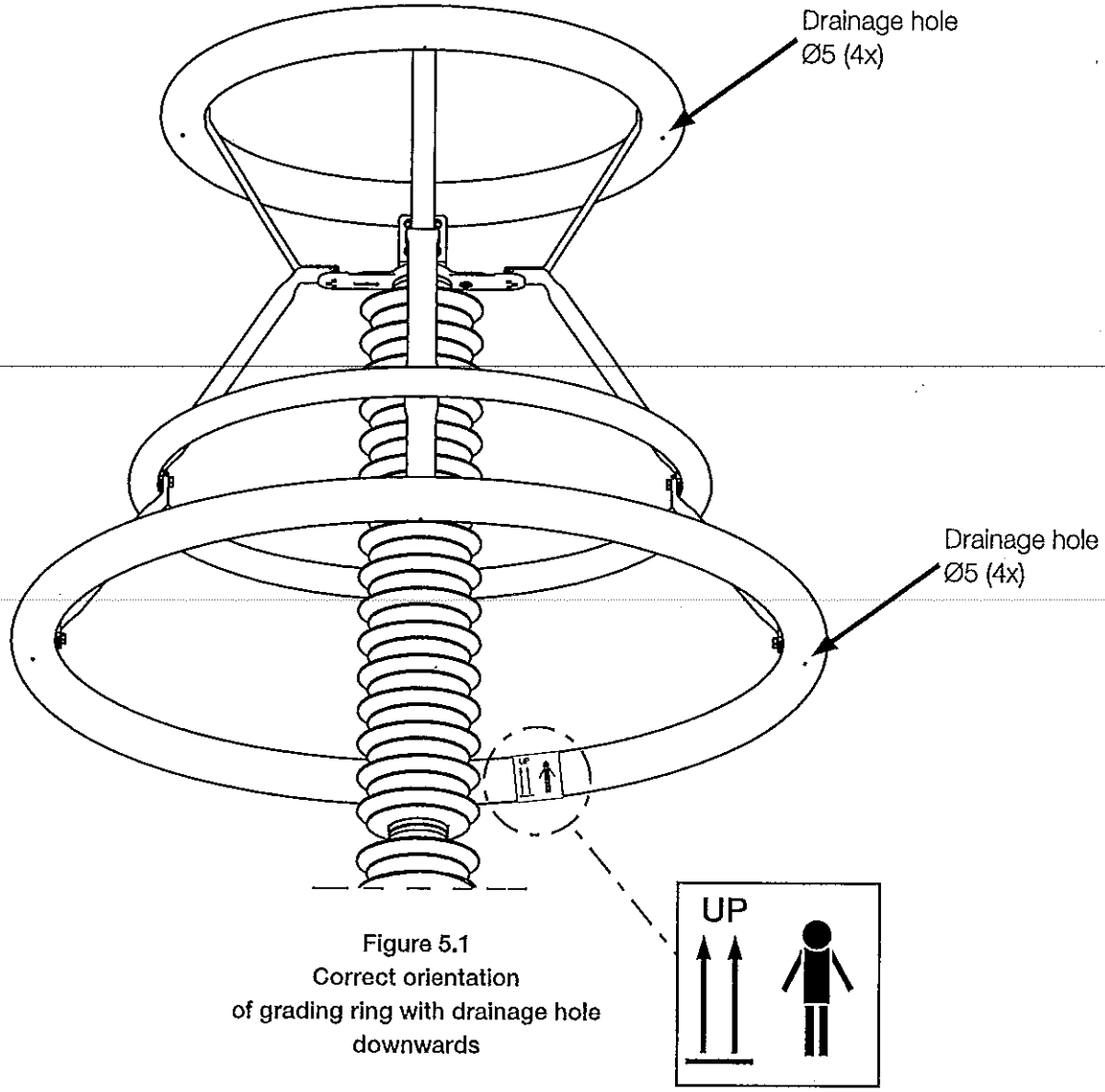


Figure 5.1
Correct orientation
of grading ring with drainage hole
downwards

NOTE! Surge arrester with grading ring arrangement C and D: drainage hole must always be oriented downwards.

Table 5.3.1 The letters refer to the figures on page 10

Grading ring arrangement	View	Drainage hole	View	Drainage hole
C	I	-	II	X
D	I	X	II	-

6. Assembly of units and grading rings

6.1 Find your surge arrester

Standard PEXLIM and PEXLINK surge arresters are built up of either one unit (table 6.1.1) or two units (table 6.1.2). Find your arrester from the respective table below and follow the reference located at the bottom of the table.

For inverted installation the surge arrester has a "H" added to the end of the type designation shown in the tables below.

Table 6.1.1
SINGLE-UNIT SURGE ARRESTERS

PEXLIM R		PEXLIM Q-X		PEXLIM Q-Y		PEXLIM P-X	
Rxxx-YV024	Rxxx-YN123	Qxxx-XV024	Qxxx-XH145	Qxxx-YV024	Qxxx-YV170	Pxxx-XV012	Pxxx-XN123
Rxxx-YV036	Rxxx-YH145	Qxxx-XV036	Qxxx-XV145	Qxxx-YV036	Qxxx-YH245	Pxxx-XV024	Pxxx-XH145
Rxxx-YV052	Rxxx-YV145	Qxxx-XV052	Qxxx-XN145	Qxxx-YV052	Qxxx-YV245	Pxxx-XV036	Pxxx-XV145
Rxxx-YN052	Rxxx-YN145	Qxxx-XN052	Qxxx-XH170	Qxxx-YV072	Q216-YH300	Pxxx-XV052	Pxxx-XN145
Rxxx-YH072	Rxxx-YH170	Qxxx-XV072	Qxxx-XV170	Qxxx-YH100	Q240-YH300	Pxxx-XN052	Pxxx-XH170
Rxxx-YV072	Rxxx-YN170	Qxxx-XN072	Qxxx-XN170	Qxxx-YV100		Pxxx-XV072	Pxxx-XV170
Rxxx-YN072	Rxxx-ZV072	Qxxx-XV100	Qxxx-XM245	Qxxx-YH123		Pxxx-XN072	Pxxx-XN170
Rxxx-YV100	Rxxx-ZV100	Qxxx-XN100	Qxxx-XH245	Qxxx-YV123		Pxxx-XV100	Pxxx-XM245
Rxxx-YN100	Rxxx-ZV123	Qxxx-XH123	Qxxx-XN245	Qxxx-YH145		Pxxx-XN100	Pxxx-XH245
Rxxx-YH123	Rxxx-ZV145	Qxxx-XV123		Qxxx-YV145		Pxxx-XH123	Pxxx-XN245
Rxxx-YV123		Qxxx-XN123		Qxxx-YH170		Pxxx-XV123	

PEXLIM P-Y		PEXLINK			
P228-YH300	P240-YH300	Qxxx-XV072L	Qxxx-YH145L	Rxxx-YH170L	Rxxx-ZM245L
		Qxxx-XH123L	Qxxx-YV170L	Rxxx-YV245L	Rxxx-ZH245L
		Qxxx-XV145L	Pxxx-XH245L	Rxxx-ZH145L	
		Qxxx-XV170L	Rxxx-YV052L	Rxxx-ZV145L	
		Qxxx-YV072L	Rxxx-YV100L	Rxxx-ZH170L	
		Qxxx-YH123L	Rxxx-YH145L	Rxxx-ZV170L	

For assembly of grading rings, please refer to section 6.2 on page 13.

Table 6.1.2
TWO-UNIT SURGE ARRESTERS

PEXLIM R	PEXLIM Q-X	PEXLIM Q-Y	PEXLIM P-X
	Qxxx-XV024	Q258-YH300 - Q276-YH300	Pxxx-XV245
	Qxxx-XV036	Qxxx-YV300	Pxxx-XH300
	Qxxx-XV052	Qxxx-YH362	Pxxx-XV300
	Qxxx-XN052	Qxxx-YV362	Pxxx-XH362
	Qxxx-XV072	Qxxx-YH420	Pxxx-XV362
	Qxxx-XN072	Qxxx-YV420	Pxxx-XH420

PEXLIM P-Y	PEXLINK	
P258-YH300 - P276-YH300	Qxxx-XH300L	Pxxx-XH420
Pxxx-YV300	Qxxx-XH362L	Rxxx-ZV245L
Pxxx-YM362	Qxxx-XH420L	Rxxx-ZH300L
Pxxx-YH362	Qxxx-YH300L	Rxxx-ZV300L
Pxxx-YV362	Qxxx-YH362L	Rxxx-ZH362L
Pxxx-YH420	Qxxx-YH420L	Rxxx-ZH420L
Pxxx-YV420	Pxxx-XH300L	
Pxxx-YH550	Pxxx-XH362L	

For assembly of grading rings and units, please refer to section 6.3 on page 14.

6.2 Assembly of one-unit surge arrester

PEXLIM

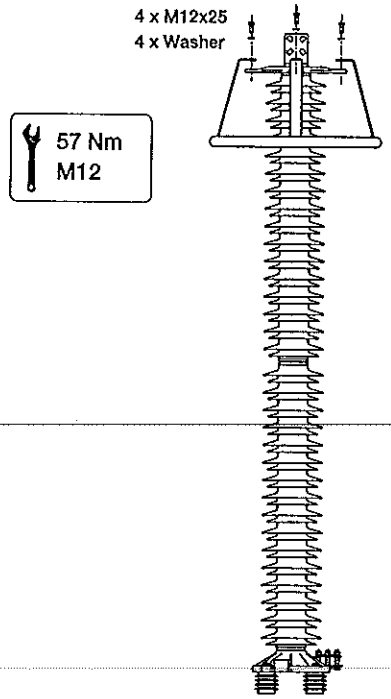


Figure 6.2.1
PEXLIM surge arrester for vertical upright mounting

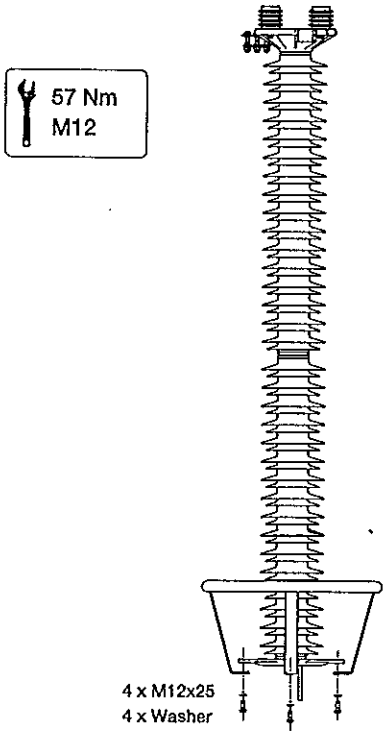


Figure 6.2.2
PEXLIM surge arrester for inverted mounting

PEXLINK

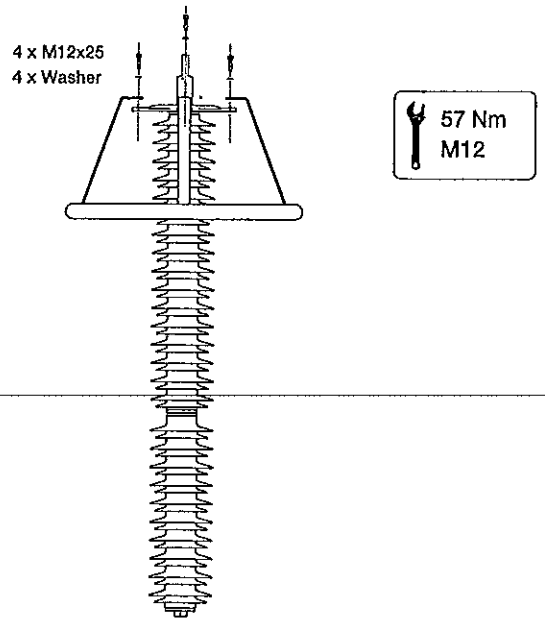


Figure 6.2.3
PEXLINK surge arrester with pre-assembled coupling at bottom

6.3 Assembly of two-unit surge arrester

PEXLIM

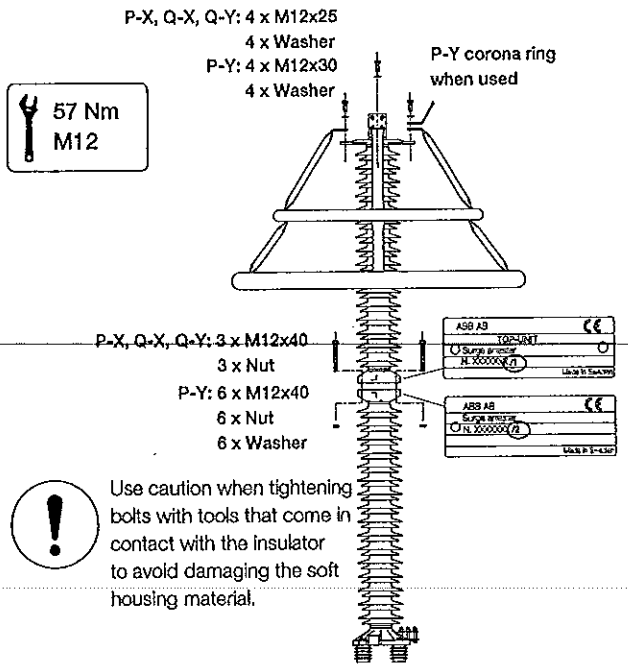


Figure 6.3.1
PEXLIM surge arrester for vertical upright mounting

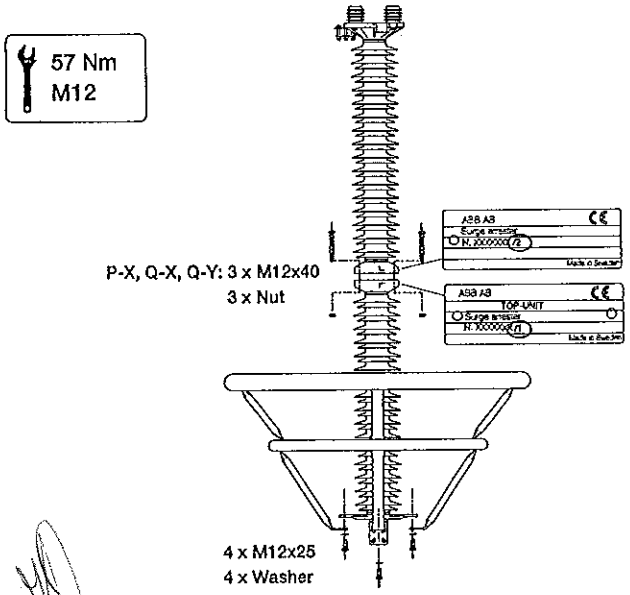


Figure 6.3.2
PEXLIM surge arrester for inverted mounting

PEXLINK

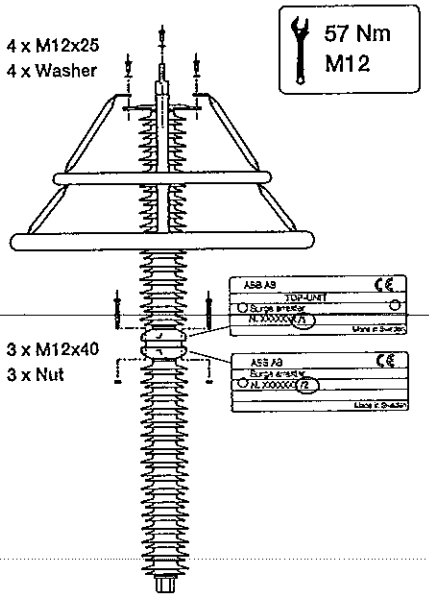


Figure 6.3.3
PEXLINK surge arrester with pre-assembled coupling at bottom

7. Installation on structure

7.1 Installation on structure without insulating base

This section covers installation of PEXLIM surge arrester on a structure without insulating base. For installation on a structure with insulating base see paragraph 7.2.

Ensure that the distances between the drilling holes in the structure are according to the corresponding figure below. PEXLIM R has the possibility to use two different drilling plans; either the drilling plan in figure 7.1.2 or the alternative drilling plan in figure 7.1.1. PEXLIM Q and PEXLIM P-X have only the drilling plan in figure 7.1.1. PEXLIM P-Y has the possiblity to use two different drilling plans, either the drilling plan in figure 7.1.3 or the alternative drilling plan in figure 7.1.4.

Note the lifting instructions in section 3 on page 7 before undertaking installation.
Anchoring bolts and nuts are **not** provided with the arrester.
Ensure that the chosen bolts have sufficient mechanical strength, to handle the loads described in paragraph 8.1 on page 18.

Fit the arrester to the structure and the earth terminal to the flange according to figure 7.1.5

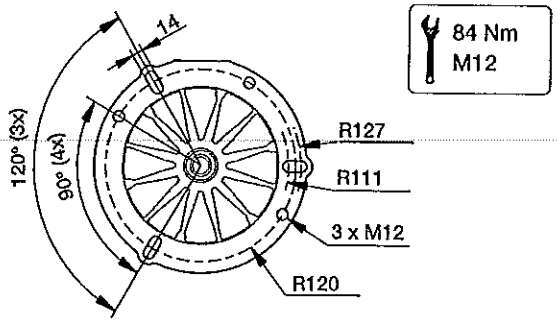


Figure 7.1.1
Drilling plan for PEXLIM Q and P-X
(alternative drilling plan for PEXLIM R)

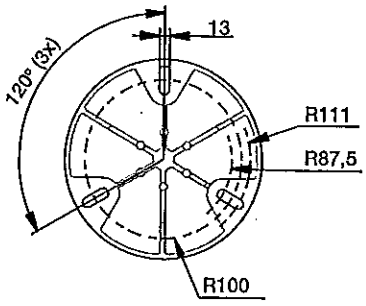


Figure 7.1.2
Drilling plan for PEXLIM R
(alternative drilling plan in figure 7.1.1)

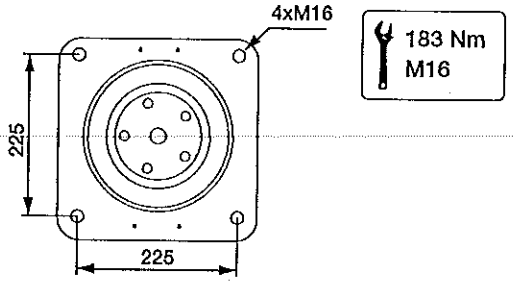


Figure 7.1.3
Drilling plan for PEXLIM P-Y
(alternative drilling plan in figure 7.1.4)

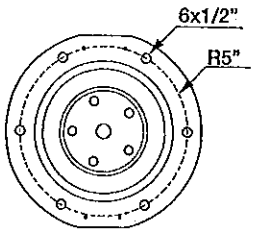


Figure 7.1.4
Drilling plan for PEXLIM P-Y
(alternative drilling plan in figure 7.1.3)

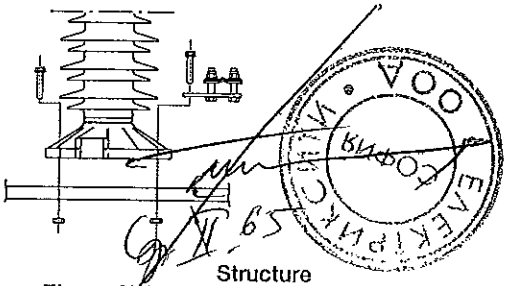


Figure 7.1.5
Assembly of earth terminal and installation on structure

7.2 Installation on structure with insulating base

This instruction covers insulating base 1HSA430 000-A, -B, -C, -D -H and -J. See separate instruction for other types. 1HSA430 000-B is identical to -A and 1HSA430000-D is identical to -C, respectively, except that the bolts used are UNC-type. If you have purchased -B or -D, please use the bolts size indicated in brackets. Insulating base 1HSA430 000-H is for use with the standard PEXLIM R and includes three insulating blocks instead of four.

Insulating base from other manufacturer

In the case where another insulating base is to be fitted, the installation instructions included with the delivery shall be followed.

Drilling plan

Ensure that the distances between the drilling holes in the structure are according the corresponding figure below. PEXLIM R has the possibility to use two different drilling plans; either the drilling plan in figure 7.2.2 or the alternative drilling plan in figure 7.2.1. PEXLIM Q and PEXLIM P-X only have the drilling plan in figure 7.2.1. PEXLIM P-Y has the possibility to use two different drilling plans, either the drilling plan in figure 7.2.3 or the alternative drilling plan in figure 7.2.4

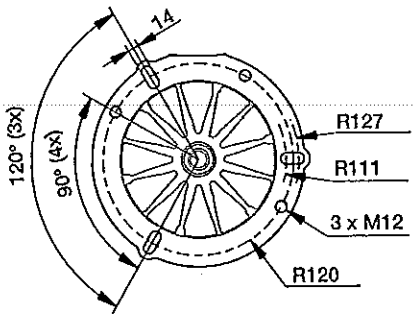


Figure 7.2.1
Drilling plan for
PEXLIM Q and P-X
(alternative drilling plan for PEXLIM R)

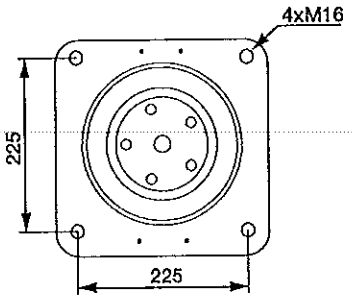


Figure 7.2.3
Drilling plan for PEXLIM P-Y
(alternative drilling plan in figure 7.2.4)

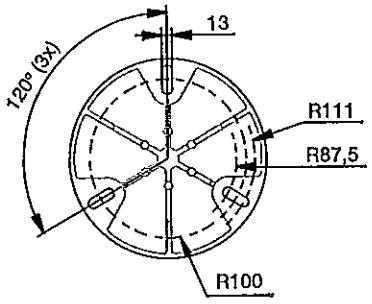


Figure 7.2.2
Drilling plan for PEXLIM R
(alternative drilling plan in figure 7.2.1)

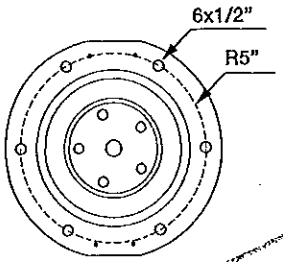


Figure 7.2.4
Drilling plan for PEXLIM P-Y
(alternative drilling plan in figure 7.2.3)

Installation on structure

Earth terminal or EXCOUNT-II

As per the below figures, a longer bolt my be used to fix the earth terminal or mount the surge arrester monitor EXCOUNT-II on the flange. Since the bolt sets are used for different applications sometimes not all bolts are used. Recommended tightening torque is as indicated.

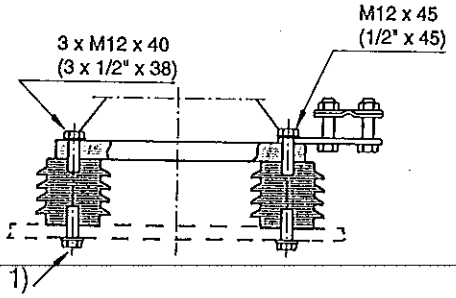


Figure 7.2.5
PEXLIM R, Q and P-X with earth terminal and/or surge counter EXCOUNT-C and EXCOUNT-I

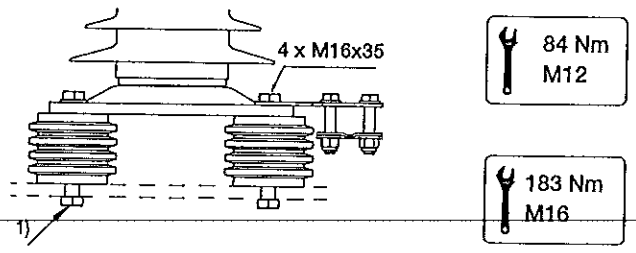


Figure 7.2.7
PEXLIM P-Y with earth terminal and/or surge counter EXCOUNT-C and EXCOUNT-I

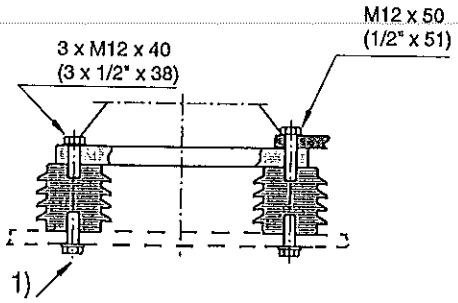


Figure 7.2.6
PEXLIM R, Q and P-X with diagnostic indicator EXCOUNT-II

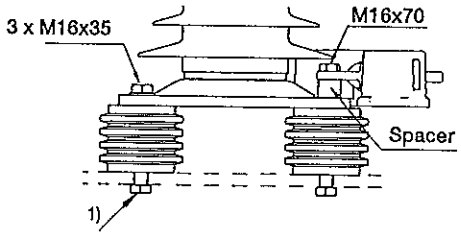


Figure 7.2.8
PEXLIM P-Y with diagnostic indicator EXCOUNT-II

1) Requirements on M16 / M12 (1/2") bolts for installation to structure:
These bolts are not supplied with the arrester.
Recommended tightening torque: Acc. to strength class.
Strength class: 8.8 or higher
Material: Hot dip galvanized steel or waxed stainless steel.
Required threaded grip length: 15 to 20 mm.
A washer shall be placed under the bolts head.

8. Connection of conductors

8.1 Mechanical load of the surge arrester

The bending moment (in Nm) acting at the base of a surge arrester is that resulting from the vector sum of all possible loads (eg. line conductor load, wind load, arrester weight, earthquake, etc) in the direction perpendicular to the arrester axis.

PEXLIM surge arresters are dimensioned to withstand bending moments according to table 8.1.1. To obtain the best protection performance, **the arresters must be connected with as short connectors as possible to both line and earth.** However the mechanical aspects must be taken into consideration. Terminals with clamps accept conductors of diameter in the range 8-34 mm.

The PEXLIM design may present a visible deflection at normal load. It is recommended to connect the line conductor vertically to further reduce the mechanical stresses.

Table 8.1.1

Sevice loading	PEXLIM R-Z	PEXLIM R-Y	PEXLIM Q and PEXLIM P-X	PEXLIM P-Y
Specified long-term load (SLL)	800 Nm	1000 Nm	2500 Nm	6000 Nm
Specified short-term load (SSL)	1300 Nm	1600 Nm	4000 Nm	9000 Nm
Definitions as per IEC 60099-4				

8.2 Connection of the conductor

Connection of the conductor must be done correctly. The conductor must be fixed edge to edge with the clamp, see figure 8.2.1 and 8.2.2 below.

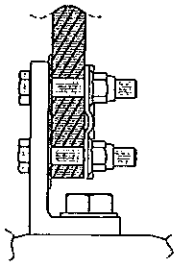


Figure 8.2.1
Correct
installation

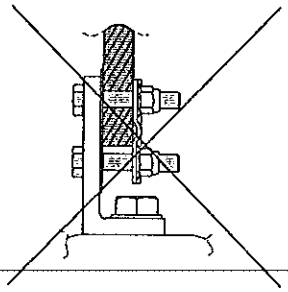


Figure 8.2.2
Warning!
Faulty connection

Compatible conductor material

All earth terminals are compatible with both copper and aluminium conductors.

Line terminal 1HSA410 000-P is manufactured from stainless steel and 1HSA410 000-M is aluminium together with a stainless steel clamp and spacer. These terminals are thus suitable for use with both aluminium and copper conductors.

Line terminals 1HSA410 000-L and -N are manufactured of aluminium. In the case where these are used together with copper conductors, preventative measures must be taken to avoid direct contact between aluminium and copper which could lead to bi-metallic corrosion.

8.3 Connection of the conductor to the line terminal

Connect the line conductor to the line terminal in such way that the permissible static loading together with steady wind load does not exceed the maximum value according to table 8.1.1 on page 18.

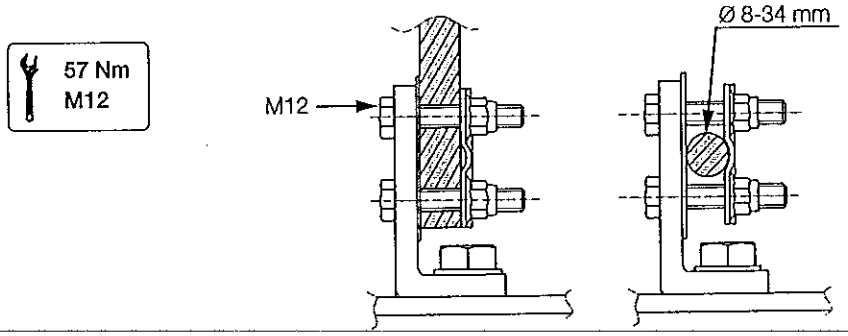


Figure 8.3.1
Connection of single line conductor
can be done from top or side.

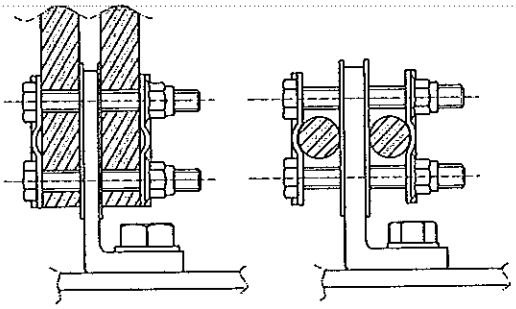


Figure 8.3.2
Connection of double line conductor
can be done from top or side.

8.4 Connection of the conductor to the earth terminal

For installation of surge counter in series with the earth conductor, please see paragraph 8.5 on page 22.

The earth conductor cross section shall be chosen in accordance with local regulations and earth fault current requirements. For assembly of earth terminal to flange, see figure 7.1.5 on page 15. For assembly of clamp see figure 8.4.1.

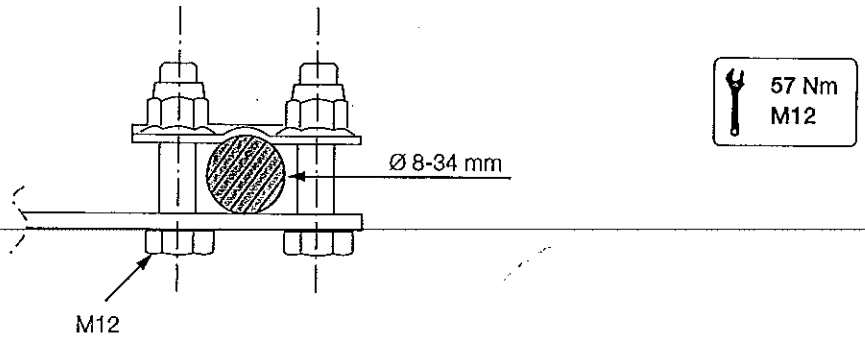


Figure 8.4.1
Earth terminal

8.5 Installation of surge counter

For installation of surge arrester monitor EXCOUNT-II, see section 7.2 on pages 16/17 together with the separate assembly instruction included with the delivery.

For installation of a surge counter EXCOUNT-C, EXCOUNT-I or surge counter from another manufacturer, ensure that:

- The arrester is insulated from the structure by an insulating base with a LIWL of at least 15 kV or equal to that of the conductor between the surge arrester and the surge counter (see below), whichever is the greater.

- The length of the conductor between the arrester and the surge counter is to be minimum 0,5 m when a clip-on CT is to be used for control measurements of leakage current. The maximum lenght shall not exceed 3 m in the case of the insulating base and conductor having a LIWV of 15 kV. Longer lenghts up to 10 m could be used with an insulating base having suitably higher LIWV. The insulated base and conductor shall then be insulated for 5xL kV (LIWV), where L is the conductor lenght in meters as shown in figure 8.5.1. Note that connection leads should always be kept as short as possible as longer leads result in a disadvantage from a protection point of view since inductance is added in series with the arrester.

- The conductor from the earth terminal of the counter to connection with the grounded support stand (point A in figure 8.5.1) on to which the counter is attached (or similar support) shall not exceed 0,5 m. For example, lenght B as shown in figure 8.5.1. The earth conductor may be extended from the connection point at the support to any "earth point" if the support itself, due to local requirements, is not considered as sufficiently grounded. However a flashover of the arrester base may occur if the lenght (L+B in figure 8.5.1) results in the LIWV as described above being exceeded and the counter may be damaged if the lenght B exceeds 0.5 m.

- The surge counter is to be installed according to the included assembly instruction.

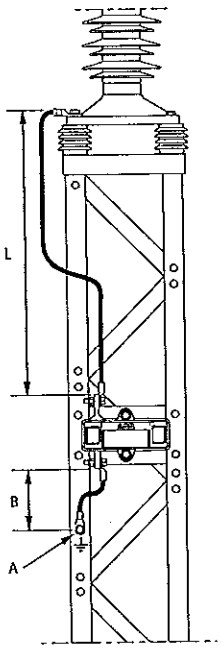


Figure 8.5.1

Standard ABB insulated base	Maximum lenght L*)
1HSA430 000-A, -B	10 m
1HSA430 000-C, -D	10 m
1HSA430 000-H, -J	10 m
1HSA430 000-P	3 m

*) On the condition the connecting conductor has at least LIWV = 5xL kV

9. Assembly of PEXLINK

9.1 Assembly of terminal and links

The following details for assembly of PEXLINK applies to the common installation alternatives and is included here for information only unless otherwise stated. In the event that a separate installation instruction is supplied with the actual delivery, this shall always take precedence.

The terminal is pre-assembled from the factory. Fit the suspension clamp and the clevis link together with the terminal, see figure 9.1.1. If a shunt should also be installed, follow figure 9.1.2 instead.

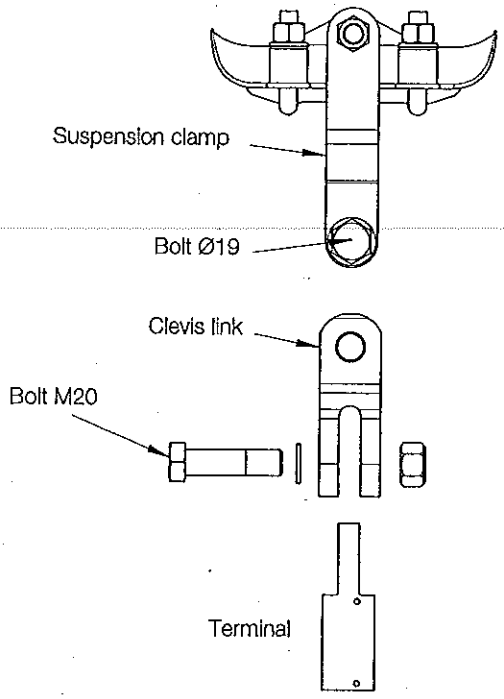


Figure 9.1.1
Terminal link without shunt

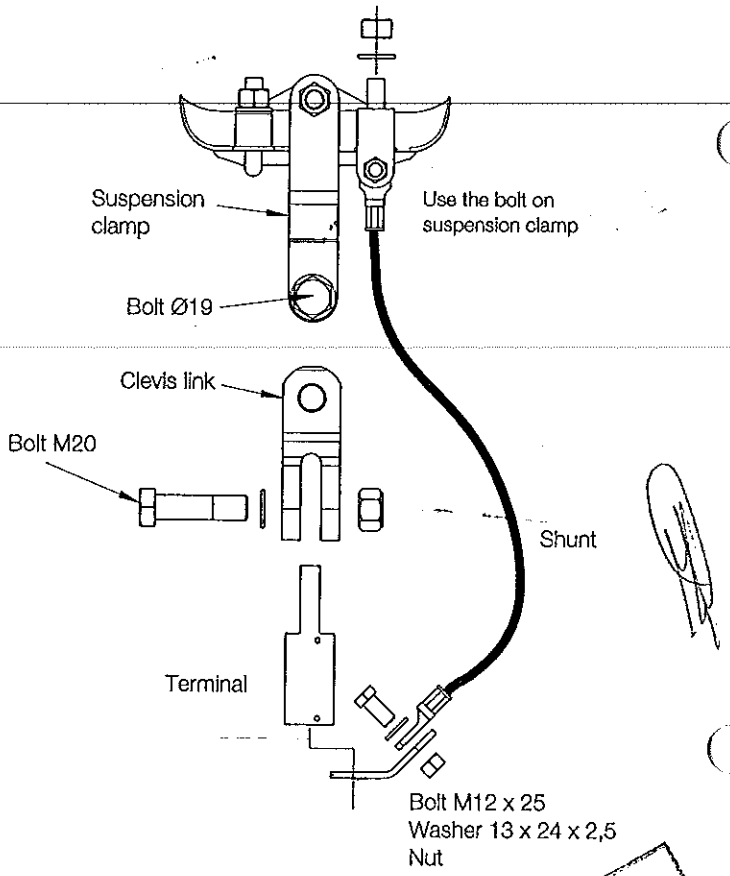


Figure 9.1.2
Terminal link with shunt

When tightening the bolt in clevis link the following conditions shall be met:

Bolt and nut M20 in clevis link shall be firmly fastened in clevis link, but shall allow the clevis link to rotate in the line terminal.

9.2 Assembly of disconnecting device

If the PEXLINK transmission line arrester should be installed with EXCOUNT-II, please also refer to the instructions according to section 9.3 on the next page.

Assemble the disconnecting device to the pre-assembled coupling, figure 9.2.1, or figure 9.2.2, as appropriate to the type of PEXLINK transmission line arrester. For details of assembly for the disconnecting device, see figure 9.2.3. Maximum load of the disconnecting device is given in the table 9.2.1.
The dimension of the earth cable is recommended to be at least 70 mm² (flexible copper).

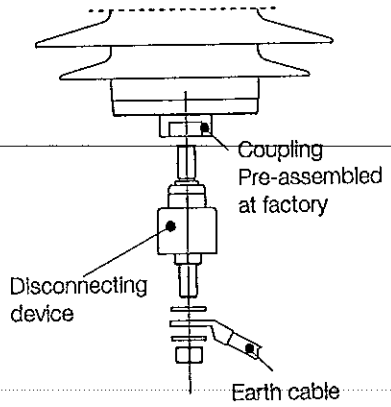


Figure 9.2.1
Assembly of disconnecting device and earth cable to coupling

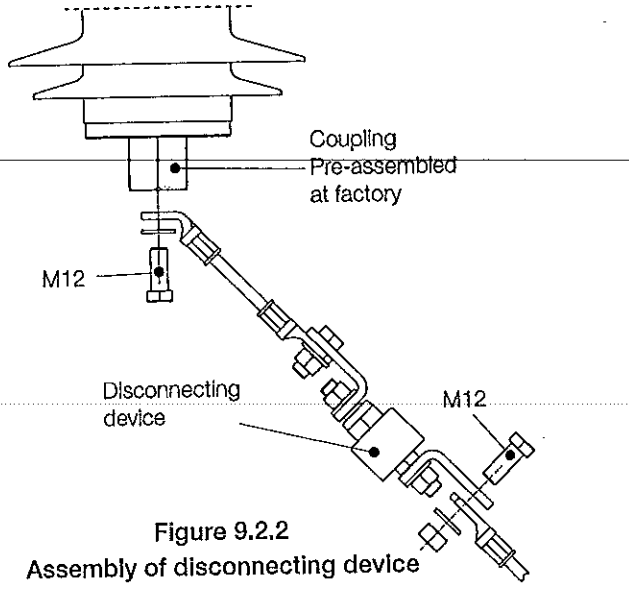


Figure 9.2.2
Assembly of disconnecting device and earth cable to coupling

Table 9.2.1

Maximum load allowed for disconnecting device:	
Max. bending force:	1000 N
Max. tensile force:	2400 N

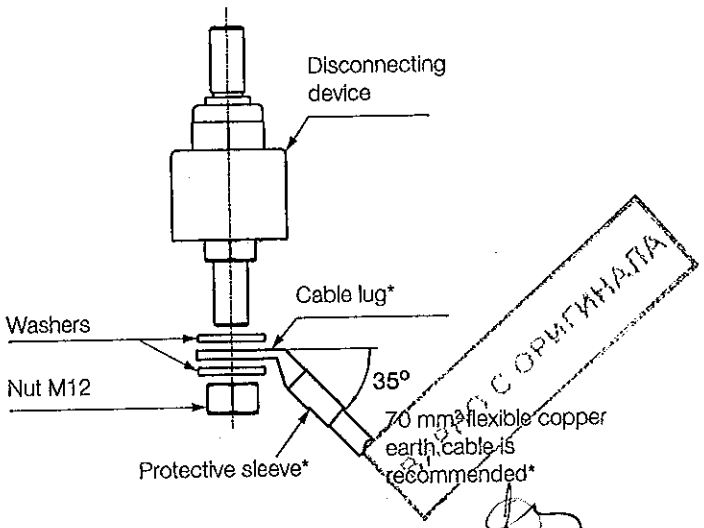


Figure 9.2.3
Detail of disconnecting device
* Items not supplied unless specifically stated at order

9.3 Assembly of EXCOUNT-II

Assemble the EXCOUNT-II sensor to the pre-assembled coupling, figure 9.3.1 or figure 9.3.2, as appropriate to the type of PEXLINK transmission line arrester. For more information about assembly of the disconnecting device, please also refer to the instructions according to section 9.2 on the previous page.

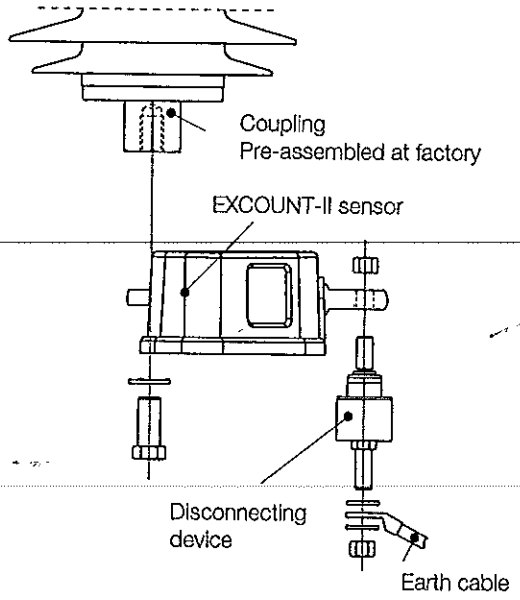


Figure 9.3.1
Assembly of EXCOUNT-II on PEXLINK with coupling

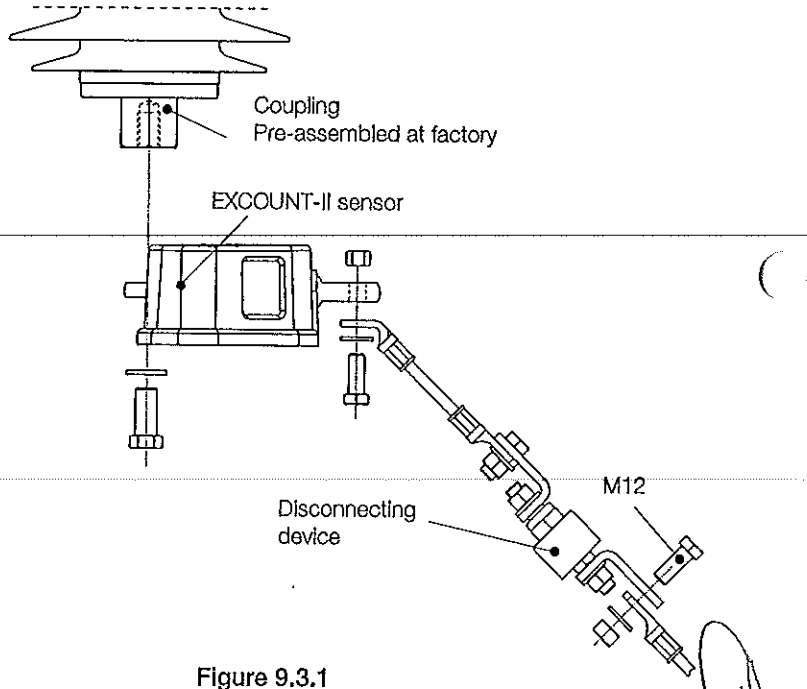


Figure 9.3.1
Assembly of EXCOUNT-II on PEXLINK with coupling

10. Maintenance

10.1 Maintenance and checking

A properly chosen and installed PEXLIM surge arrester is maintenance free during its lifetime, when operating under normal operating conditions. However, the tightening torques on terminals shall be checked and, if necessary, adjusted to the correct value at inspections of the plant. A properly chosen arrester means that both its electrical capability as well as its mechanical design correspond to the service conditions of the actual network.

Cleaning

PEXLIM arresters do not require any cleaning of the external surfaces for their lifetime. The surface may appear to be dirty, but this is of no significance.

Should, for any reason, the arresters be subjected to live washing observe the following in addition to normal precautions for live washing:

- Arrester insulators usually have shorter flashover distances than other insulators for the same system voltage, which means higher risk for external flashover during washing.
- Arresters must be spray-washed evenly in order to avoid overheating.
- Do not use water under high pressure, otherwise the soft silicone housing may be damaged.

General

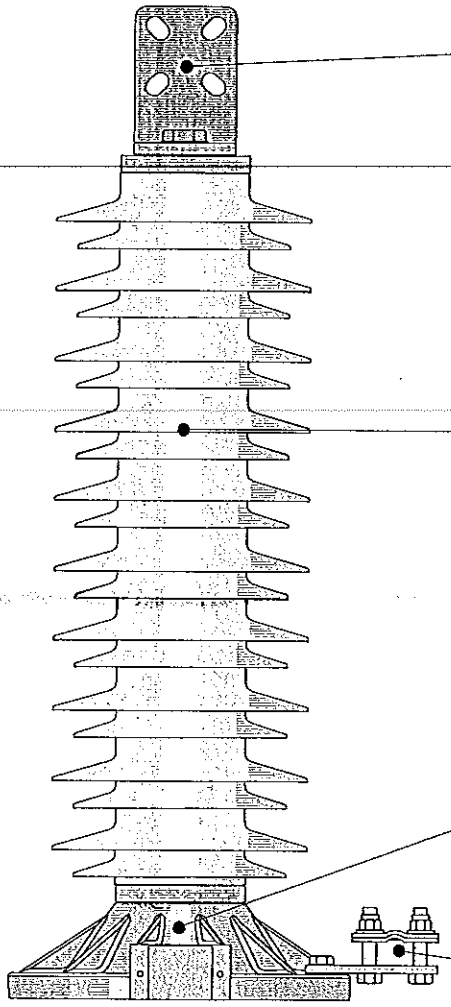
Should a routine check be desired, the only reliable method is to periodically measure the resistive component of the leakage current. For this purpose, use of Leakage Current Monitor, LCM, or ABB surge arrester monitor, EXCOUNT-II is recommended. For description of the LCM/EXCOUNT-II and measurement procedures, please refer to the relevant catalogues.

ВЯРНО С ОРИГИНАЛА

11. Disposal

11.1 Disposal of the surge arrester

When the surge arrester is taken out of service due to age or in case of an arrester overload, its components shall be disposed of according to local regulations. Each surge arrester module is moulded in a silicone housing which is completely bonded to the internal components. This makes full disassembly difficult for separate disposal. The composition of the arrester is shown in the figure below.



Line terminal:
Aluminium and stainless steel

Surge arrester module:
In non-halogenated silicone housing.
Internal components:
Aluminium, stainless steel, glass fibre, aramide fibre and metal-oxide varistors.

Foot and joint flange:
Aluminium
Fitted to surge arrester module with a screw (stainless steel) and fixed with thread-lock.
R, Q, P-X: Aluminium
P-Y: Hot-dip galvanized steel, fitted with 5 extra screws

Earth terminal:
Stainless steel

Contact us

ABB AB
High Voltage Products
Surge Arresters
S-771 80 LUDVIKA, SWEDEN

Phone: +46 (0)240 78 20 00
Telefax: +46 (0)240 179 83

E-mail: arresters.div@se.abb.com
Internet: http://www.abb.com/arrestersonline

NOTE! ABB AB is working continuously to improve the products. We therefore reserve the right to change designs, dimensions and data without prior notice.

Document ID 1HSA 801 080-05en, Assembly instruction PEXLIM R, PEXLIM Q, PEXLIM P and PEXLINK transmission line arrester Edition 4, 2015-03

ВЯРНО С ОРИГИНАЛА

Power and productivity
for a better world™

High Voltage Surge Arresters
Buyer's Guide — Section PEXLIM P-X

Power and productivity
for a better world™

ABB

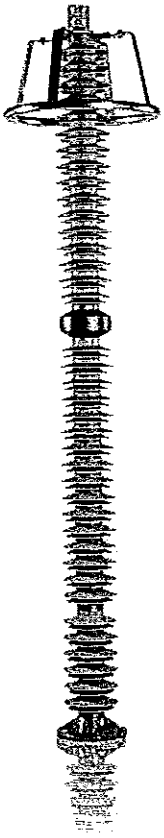
Zinc Oxide Surge Arrester PEXLIM P-X

Protection of switchgear, transformers and other equipment in high voltage systems against atmospheric and switching overvoltages.
- in areas with very high lightning intensity
- where grounding or shielding conditions are poor or incomplete
- for important installations
- where energy requirements are very high (e.g. very long lines, capacitor protection).

Superior where low weight, reduced clearances, flexible mounting, non-fragility and additional personnel safety is required.

Major component in PEXLINK™ concept for transmission line protection.

Other data can be ordered on request. Please contact your local sales representative.



Brief performance data

System voltages (U_m)	52 - 420 kV
Rated voltages (U_r)	42 - 360 kV
Nominal discharge current (IEC)	20 kA_{peak}
Classifying current (ANSI/IEEE)	15 kA_{peak}
Discharge current withstand strength:	
High current 4/10 µs	100 kA_{peak}
Low current 2000 µs	1500 A_{peak}
Energy capability:	
Line discharge class (IEC)	Class 4
[2 impulses, (IEC Cl. 8.5.5)	12.0 kJ/kV (U_r)]
Fulfils/exceeds requirements of ANSI transmission-line discharge test for 362 kV systems.	
Short-circuit/Pressure relief capability	65 kA_{sym}
External insulation	Fulfils/exceeds standards
Mechanical strength:	
Specified long-term load (SLL)	2500 Nm
Specified short-term load (SSL)	4000 Nm
Service conditions:	
Ambient temperature	-50 °C to +45 °C
Design altitude	max. 1000 m
Frequency	15 - 62 Hz

PEXLIM P-X
Guaranteed protective data 24 - 145 kV

Max. system voltage	Rated voltage	Max. continuous operating voltage [1]		TOV capability [2]		Max. residual voltage with current wave						
		as per IEC	as per ANSI/IEEE			30/60 µs			8/20 µs			
U_m	U_r	U_c	MCOV	1 s	10 s	1 kA	2 kA	3 kA	5 kA	10 kA	20 kA	40 kA
kV_{rms}	kV_{rms}	kV_{rms}	kV_{rms}	kV_{rms}	kV_{rms}	kV_{peak}	kV_{peak}	kV_{peak}	kV_{peak}	kV_{peak}	kV_{peak}	kV_{peak}
24[3]	24	19.2	19.5	27.8	26.4	46.8	48.5	49.7	51.9	54.6	59.8	65.6
36[3]	30	24.0	24.4	34.8	33.0	58.5	60.7	62.2	64.9	68.3	74.8	81.9
	33	26.4	26.7	38.2	36.3	64.4	66.7	68.4	71.4	75.1	82.3	90.1
	36	28.8	29.0	41.7	39.6	70.2	72.8	74.6	77.9	81.9	89.7	98.3
	39	31.2	31.5	45.2	42.9	76.1	78.8	80.8	84.3	88.8	97.2	107
52	42	34	34.0	48.7	46.2	81.9	84.9	87.0	90.8	95.6	105	115
	48	38	39.0	55.6	52.8	93.6	97.0	99.4	104	110	120	132
	51	41	41.3	59.1	56.1	99.5	104	106	111	117	128	140
72	54	43	43.0	62.6	59.4	106	110	112	117	123	135	148
	60	48	48.0	69.6	66.0	117	122	125	130	137	150	164
	63	50	51.0	73.0	69.3	123	128	131	137	144	157	172
	66	53	53.4	76.5	72.6	129	134	137	143	151	165	181
	72	58	58.0	83.5	79.2	141	146	150	156	164	180	197
100	72	58	58.0	83.5	79.2	141	146	150	156	164	180	197
	75	60	60.7	87.0	82.5	147	152	156	163	171	187	205
	78	62	63.1	90.4	85.8	153	158	162	169	178	195	213
	81	65	65.6	93.9	89.1	158	164	168	176	185	202	222
	84	67	68.0	97.4	92.4	164	170	174	182	192	210	230
123	90	72	72.0	104	99.0	176	182	187	195	205	225	246
	96	77	77.0	111	105	188	194	199	208	219	240	263
	102	78	82.6	118	112	199	207	212	221	233	255	279
	108	78	84.0	125	118	211	219	224	234	246	270	295
	114	78	92.3	132	125	223	231	237	247	260	284	312
	120	78	98.0	139	132	234	243	249	260	273	299	328
	129	78	104	149	141	252	261	268	279	294	322	353
	132	78	106	153	145	258	267	274	286	301	329	361
	138	78	111	160	151	270	279	286	299	314	344	377
	144	78	115	167	158	281	291	299	312	328	359	394
	150	78	121	174	165	293	304	311	325	342	374	410
145	108	86	86.0	125	118	211	219	224	234	246	270	295
	120	92	98.0	139	132	234	243	249	260	273	299	328
	132	92	106	153	145	258	267	274	286	301	329	361
	138	92	111	160	151	270	279	286	299	314	344	377

1) The continuous operating voltages U_c (as per IEC) and MCOV (as per ANSI) differ only due to deviations in type test procedures.
U_c has to be considered only when the actual system voltage is higher than the tabulated.
Any arrester with U_c higher than or equal to the actual system voltage divided by √3 can be selected.

2) With prior duty equal to the maximum single-impulse energy stress (7.0 kJ/kV (U_r)).

3) Arresters for system voltages 36 kV or below can be supplied, on request, when the order also includes arresters for higher system voltages.

Arresters with lower or higher rated voltages may be available on request for special applications.

PEXLIM P-X
Guaranteed protective data 145 - 420 kV

Max. system voltage	Rated voltage	Max. continuous operating voltage [1]		TOV capability [2]		Max. residual voltage with current wave						
						30/60 µs			8/20 µs			
		as per IEC	as per ANSI/IEEE									
U_m	U_r	U_c	MCOV	1 s	10 s	1 kA	2 kA	3 kA	5 kA	10 kA	20 kA	40 kA
kV_{rms}	kV_{rms}	kV_{rms}	kV_{rms}	kV_{rms}	kV_{rms}	kV_{peak}	kV_{peak}	kV_{peak}	kV_{peak}	kV_{peak}	kV_{peak}	kV_{peak}
145	144	92	115	167	158	281	291	299	312	328	359	394
	150	92	121	174	165	293	304	311	325	342	374	410
	162	92	131	187	178	316	328	336	351	369	404	443
	168	92	131	194	184	328	340	348	364	383	419	459
170	132	106	106	153	145	258	267	274	286	301	329	361
	144	108	115	167	158	281	291	299	312	328	359	394
	150	108	121	174	165	293	304	311	325	342	374	410
	162	108	131	187	178	316	328	336	351	369	404	443
	168	108	131	194	184	328	340	348	364	383	419	459
	180	108	144	208	198	351	364	373	390	410	449	492
	192	108	152	222	211	375	388	398	415	437	479	525
245	180	144	144	208	198	351	364	373	390	410	449	492
	192	154	154	222	211	375	388	398	415	437	479	525
	198	156	160	229	217	387	400	410	428	451	494	541
	210	156	170	243	231	410	425	435	454	478	524	574
	214	156	173	248	235	419	434	445	464	488	535	586
	216	156	175	250	237	422	437	448	467	492	539	590
	219	156	177	254	240	427	443	454	474	499	546	598
	222	156	179	257	244	433	449	460	480	506	554	607
	228	156	180	264	250	445	461	473	493	519	568	623
300	216	173	175	250	237	422	437	448	467	492	539	590
	228	182	182	264	250	445	461	473	493	519	568	623
	240	191	191	278	264	468	485	497	519	546	598	656
	258	191	209	299	283	504	522	535	558	587	643	705
	264	191	212	306	290	515	534	547	571	601	658	721
	276	191	220	320	303	539	558	572	597	628	688	754
362	258	206	209	299	283	504	522	535	558	587	643	705
	264	211	212	306	290	515	534	547	571	601	658	721
	276	221	221	320	303	539	558	572	597	628	688	754
	288	230	230	334	316	562	582	597	623	656	718	787
420	330	264	267	382	363	644	667	684	714	751	823	901
	336	267	272	389	369	656	679	696	727	765	838	918
	342	267	277	396	376	667	691	709	740	779	852	934
	360	267	291	417	396	702	728	746	779	819	897	983

1) The continuous operating voltages U_c (as per IEC) and MCOV (as per ANSI) differ only due to deviations in type test procedures.
U_c has to be considered only when the actual system voltage is higher than the tabulated.
Any arrester with U_c higher than or equal to the actual system voltage divided by √3 can be selected.

2) With prior duty equal to the maximum single-impulse energy stress (7.0 kJ/kV (U_r)).

Arresters with lower or higher rated voltages may be available on request for special applications.

PEXLIM P-X
Technical data for housings

Max. system voltage	Rated voltage	Housing	Creepage distance	External insulation *)				Dimensions					
U_m	U_r			1.2/50 µs dry	50 Hz wet (60s)	60 Hz wet (10s)	250/2500 µs wet	Mass	A_{max}	B	C	D	Fig.
kV_{rms}	kV_{rms}		mm	kV_{peak}	kV_{rms}	kV_{rms}	kV_{peak}	kg	mm	mm	mm	mm	
24	24	XV024	1363	283	126	126	242	19	481	-	-	-	1
36	30-36	XV036	1363	283	126	126	242	19	481	-	-	-	1
	39	XV036	2270	400	187	187	330	30	736	-	-	-	1
52	42-72	XV052	2270	400	187	187	330	30	736	-	-	-	1
72	54-72	XV072	2270	400	187	187	330	29	736	-	-	-	1
	75-84	XV072	3625	578	293	293	462	44	1080	-	-	-	1
100	75-96	XV100	3625	578	293	293	462	44	1080	-	-	-	1
123	90-120	XH123	3625	578	293	293	462	43	1080	-	-	-	1
	90-144	XV123	4540	800	374	374	660	54	1397	-	-	-	2
	150	XV123	4988	861	419	419	704	55	1486	-	-	-	2
145	108-120	XH145	3625	578	293	293	462	42	1080	-	-	-	1
	108-144	XV145	4540	800	374	374	660	53	1397	-	-	-	2
	150	XV145	4988	861	419	419	704	55	1486	-	-	-	2
	162-168	XV145	5895	978	480	480	792	66	1741	-	-	-	2
170	132-144	XH170	4540	800	374	374	660	53	1400	400	-	160	3
	150	XV170	4988	861	419	419	704	57	1489	400	-	160	3
	132-192	XV170	5895	978	480	480	792	70	1744	400	-	160	3
245	180-192	XM245	5895	978	480	480	792	66	1744	400	-	160	3
	180-228	XH245	7250	1156	586	586	924	83	2088	400	-	160	3
	180-198	XV245	8613	1439	712	712	1166	101	2647	800	-	500	4
	210-228	XV245	8613	1439	712	712	1166	98	2617	600	-	300	4
300	216-276	XH300	8613	1439	712	712	1166	101	2617	800	-	500	4
	216-276	XV300	9520	1556	773	773	1254	110	2872	800	-	500	4
362	258-288	XH362	9520	1556	773	773	1254	118	2872	1200	1000	600	5
	258-288	XV362	11790	1956	960	960	1584	148	3533	1400	1000	700	6
420	330-360	XH420	10875	1734	879	879	1386	131	3216	1400	1000	700	5
Neutral-ground arresters													
52	30-36	XN052	1363	283	126	126	242	19	481	-	-	-	1
72	42-54	XN072	2270	400	187	187	330	29	736	-	-	-	1
100	60	XN100	2270	400	187	187	330	30	736	-	-	-	1
123	72	XN123	2270	400	187	187	330	28	736	-	-	-	1
	75-120	XN123	3625	578	293	293	462	43	1080	-	-	-	1
145	84-120	XN145	3625	578	293	293	462	42	1080	-	-	-	1
170	96-120	XN170	3625	578	293	293	462	42	1080	-	-	-	1
245	108	XN245	3625	578	293	293	462	41	1080	-	-	-	1
	132-144	XN245	4540	800	374	374	660	50	1397	-	-	-	2

*) Sum of withstand voltages for empty units of arrester.

PEXLIM P-X
Technical data for housings

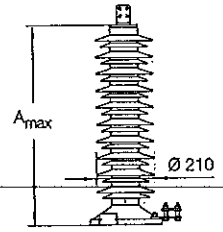


Figure 1

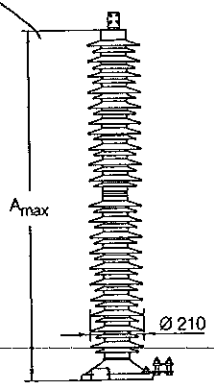


Figure 2

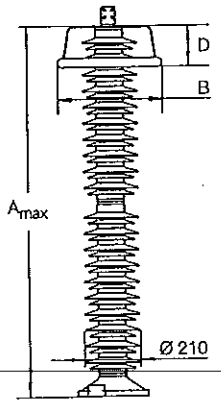


Figure 3

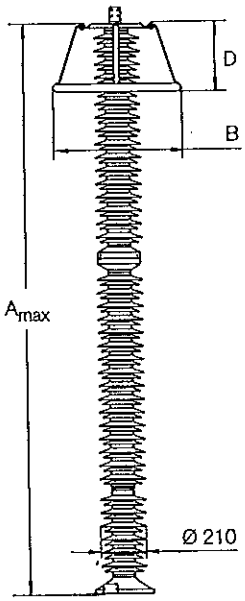


Figure 4

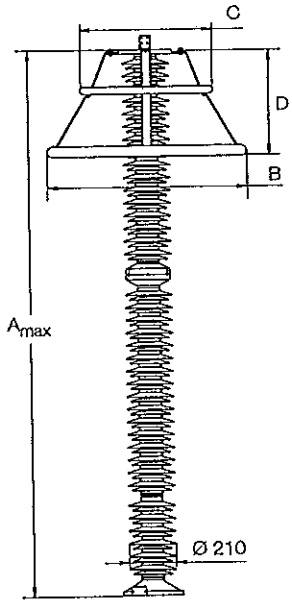


Figure 5

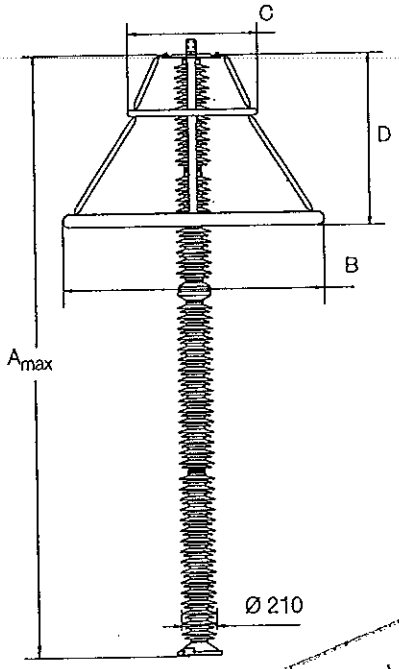
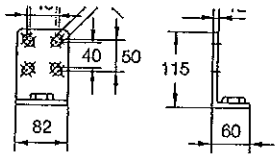


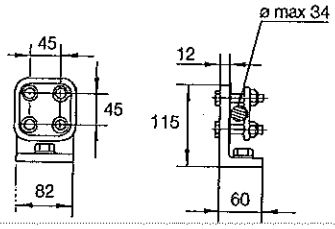
Figure 6

PEXLIM P-X
Accessories

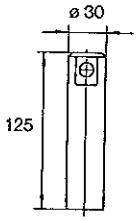
Line terminals



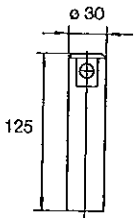
1HSA410 000-L
Aluminium



1HSA410 000-M
Aluminium flag with other items in stainless steel

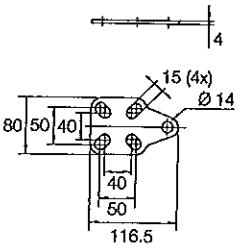


1HSA410 000-N
Aluminium

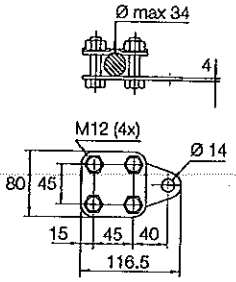


1HSA410 000-P
Stainless steel

Earth terminals

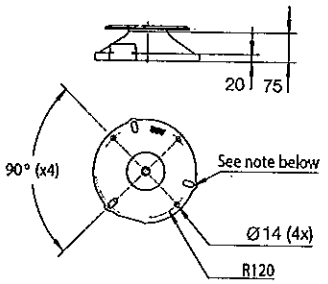


1HSA420 000-A
Stainless steel



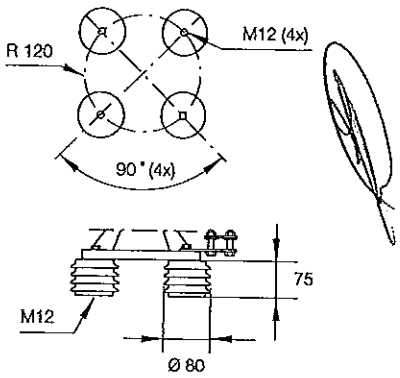
1HSA420 000-B
Stainless steel

Drilling plans



NOTE! Alternative drilling plan
3 slotted holes (120 °), n14 at R111-127

Without insulating base
Aluminium



Insulating base
1HSA430 000-A
Epoxy resin

M12 bolts for connection to structure are not supplied by ABB. Required threaded grip length is 15-20 mm.

PEXLIM P-X
Shipping data

Rated voltage U_r kV$_{rms}$	Housing	Number of arresters per crate One Volume m³	Gross kg	Three Volume m³	Gross kg	Six Volume m³	Gross kg
24	XV024	0.1	42	0.5	86	0.9	152
30-36	XV036	0.1	42	0.5	86	0.9	152
39	XV036	0.5	52	0.5	116	0.9	212
42-72	XV052	0.5	52	0.5	116	0.9	212
54-72	XV072	0.5	52	0.5	116	0.9	212
75-84	XV072	0.7	71	0.7	163	1.2	301
75-96	XV100	0.7	71	0.7	163	1.2	301
90-120	XH123	0.7	71	0.7	163	1.2	301
90-144	XV123	0.9	87	0.9	201	1.5	372
150	XV123	0.9	87	0.9	201	1.5	372
108-120	XH145	0.7	68	0.7	154	1.2	283
108-144	XV145	0.9	87	0.9	201	1.5	372
150	XV145	0.9	87	0.9	201	1.5	372
162-168	XV145	1.1	98	1.1	239	1.9	443
132-144	XH170	0.9	89	0.9	207	1.5	384
150	XH170	0.9	89	0.9	207	1.5	384
132-192	XV170	1.1	102	1.1	251	1.9	443
192	XM245	1.1	98	1.1	239	1.9	443
180-228	XH245	1.1	115	1.1	290	1.9	545
180-198	XV245	0.9	133	1.5	339	-	-
210-228	XV245	0.9	133	1.5	339	-	-
216-264	XH300	1.0	155	1.7	358	-	-
276	XH300	1.0	155	1.7	358	-	-
216-276	XV300	1.0	163	1.7	382	-	-
258-288	XH362	1.6	207	2.3	435	-	-
258	XV362	2.1	242	2.9	497	-	-
264-288	XV362	2.1	258	2.3	545	-	-
330-360	XH420	2.1	242	2.3	497	-	-
Neutral-ground arresters							
30-36	XN052	0.1	42	0.5	86	0.9	152
42-54	XN072	0.5	52	0.5	116	0.9	212
60	XN100	0.5	52	0.5	116	0.9	212
72	XN123	0.5	52	0.5	116	0.9	212
75-120	XN123	0.7	71	0.7	163	1.2	301
84-120	XN145	0.7	71	0.7	163	1.2	301
96-120	XN170	0.7	71	0.7	163	1.2	301
108-120	XN245	0.7	71	0.7	163	1.2	301
132-144	XN245	0.9	87	0.9	201	1.5	372

Each crate contains a certain number of arrester units and accessories for assembly and erection. A packing list is attached externally on each crate.

Each separate crate is numbered and the numbers of all crates and their contents are listed in the shipping specification. ABB reserves the right to pack arresters in the most effective/economic combination. Alternate or non-standard crates may involve additional charges.

The table above is to be seen as an approximation and specific data for deliveries may differ from the values given.

For more information please contact:

ABB AB
High Voltage Products
Surge Arresters
SE-771 80 Ludvika, Sweden
Phone: +46 (0)240 78 20 00
Fax: +46 (0)240 179 83
E-Mail: arresters.div@se.abb.com

www.abb.com/arrestersonline

Section of 1HSM 9543 12-00en High Voltage Surge Arresters Buyer's Guide, Edition 11, 2014-05

Power and productivity
for a better world™

Data Schedule

Tender ID: 16Q2863109 Pos: 90

ABB High Voltage Products

Data schedule: Surge Arresters

DIMENSION DRAWING: 1HSA134-8664

		PEXLIM P-X P096-XH123
1 General data		
Design		ZnO, Gapless
Manufacturer, country		ABB
Applied standards		IEC
Catalogue		1HSM 9543 12-00en
Maximum system voltage (Us)	kVrms	123
Arrester classification as per IEC 60099-4 Ed 3.0		Station; SH
Nominal discharge current	kApeak	20
Rated voltage (Ur)	kVrms	96
Maximum continuous operating voltage (Uc)	kVrms	77
Frequency	Hz	15-62
TOV capability (after thermal energy rating, Wth)		
1 s	kVrms	106
10 s	kVrms	100
2 Charge, energy and current withstand data		
Repetitive charge transfer rating, Qrs	C	3.2
Thermal energy rating, Wth	kJ/kV (Ur)	11
Discharge current withstand strength		
High current, 4/10 µs	kApeak	100
Low current, 2000 µs	Apeak	1600
Single-impulse withstand rating (IEEE), Repetitive charge transfer test value (IEC) - sample tests on all manufactured block batches	C	4
Energy data as per previous IEC standard IEC 60099-4, Ed 2.2		
Line discharge class	Class	4
Energy capability - thermal energy capability (as per IEC 60099-4 Ed 2.2, clause 8.5.5)	kJ/kV (Ur)	11
3 Guaranteed max. protective data		
Maximum residual/discharge voltage		
with current wave 30/60 µs (slow-front/switching)		
0.5 kA	kVpeak	182
1.0 kA	kVpeak	188
2.0 kA	kVpeak	194
with current wave 8/20 µs (fast-front/lightning)		
5.0 kA	kVpeak	208
10 kA	kVpeak	219
20 kA	kVpeak	240
with current wave 1/(2-20) µs (FOW as per IEEE, steep front as per IEC)		
External inductive effects neglected.		
10 kA	kVpeak	233
4 Technical data for housing		
Short-circuit capability		
High current, 0.2 s	kArms	65
Low current	Arms	600
External insulation		
Requirements as per IEC 60099-4		
LIWL, 1.2/50 µs	kVpeak	312
50 Hz, wet (60 s)	kVrms	146
SIWL, wet (250/2500 µs)	kVpeak	243
Tested values on empty units/modules housings		
LIWL, 1.2/50 µs	kVpeak	578
50 Hz, wet (60 s)	kVrms	293
SIWL, wet (250/2500 µs)	kVpeak	462
Creepage distance (nominal)	mm	3625
	mm/kV (Us)	29.5
Specified long-term load (SLL)	Nm	2500
Specified short-term load (SSL)	Nm	4000
Insulator colour / material		Grey Silicone

Release 6.3/4/7/2015 1

ВЯРНО С ОРИГИНАЛА

ООД ЕЛЕКТРИК СИТИ СОФИЯ

SUMMARY OF CUSTOMER WITNESS TESTS

Routine test requirements

The minimum requirements for routine tests on surge arresters are specified by IEC and IEEE. The tests performed by ABB fulfils or exceeds the requirements according to IEC 60099-4 or IEEE C62.11, as applicable for a specific order.

The routine tests performed by ABB comprise the following, as applicable:

- Residual voltage (Discharge voltage) at 10 kA (8/20µs) is individually measured on each MO resistor. The residual voltage of the complete arrester is taken as the sum of the residual voltages of the MO resistors in series.
- Tightness (Seal) check on arresters with hollow insulators having enclosed gas volume and separate sealing system is made on each unit in a pass/no-pass test. Maximum permissible seal leak rate is 0.0001 mbarl/sec at a pressure difference of 0.1 MPa.
- Reference voltage (Power frequency resistive current) is measured on each unit.
- After the application of at least rated voltage on each unit for a minimum of 10 seconds, the test voltage is decreased to 0.9 times rated voltage of the unit (being a higher voltage stress than required by IEC or IEEE) . At this voltage each unit is checked to have a steady partial discharge level less than 5pC.
- Power losses are measured at continuous operating voltage on each unit.
- Grading current is measured at continuous operating voltage on each unit.

Witnessing of routine tests

ABB accepts inspection and witnessing of these routine tests by Final Customer, Consultant or Purchaser, provided this is undertaken at the time of production and in accordance with our planned schedule. However, unless an extended visit is planned, not all tests can usually be witnessed for practical reasons. For example, the Residual Voltage (Discharge Voltage) test is performed during daily production of the MO resistors, which can occur a significant time before their assembly into the arresters.

If no Inspector is available at the time for the tests, we reserve the right to perform the tests according to our planned schedule and present the test report to the Inspector.

Acceptance tests are not considered necessary nor value-adding to secure the performance of ABB surge arresters due to the extensive testing program already undertaken by ABB (type, routine and sample). Consequently, acceptance tests are not performed unless specifically agreed upon in advance. Unless otherwise agreed, **customer witness of tests** on surge arresters from a specific order are hence limited to the following repeated electrical tests from the above list, performed on an agreed number (maximum 10%) of samples from the actual order, with all testing made on individual units of the arrester:

- Reference voltage
- Partial discharge
- Power losses
- Grading current

During customer visits, we welcome the opportunity to provide a tour of our facilities and, if possible, show the production of similar equipment from other customer orders.

ABB AB
High Voltage Products
James Taylor
Technology Support Manager
Principal Specialist / Surge Arresters

ABB AB High Voltage Products QA QUALITY

ВЯРНО С ОРИГИНАЛА

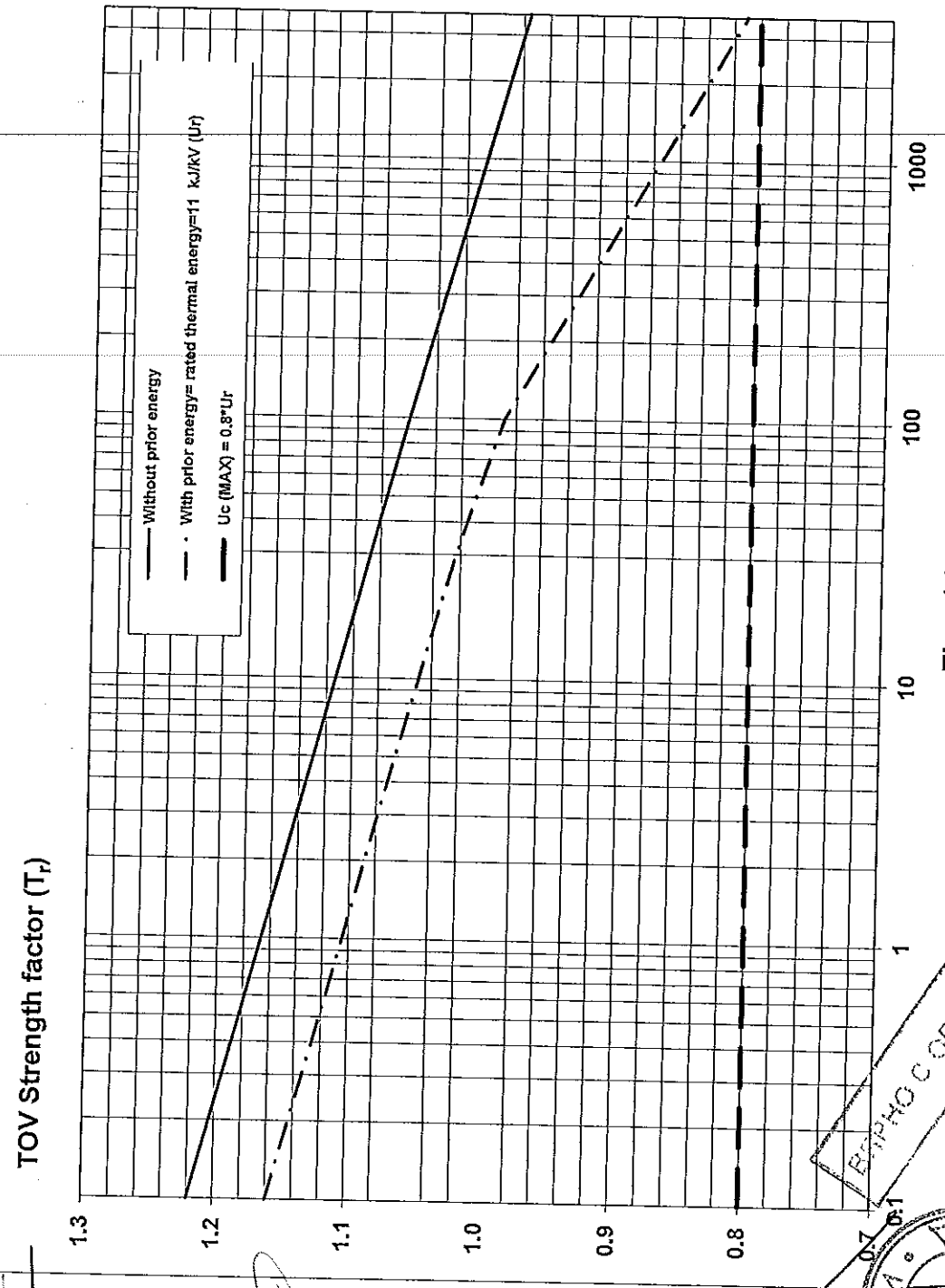
ABB

ABB Ludvika, Sweden

LAK 7992
PPHC/AKB 2014-10-06

TOV CAPABILITY FOR ARRESTERS TYPE PEXLIM P-X and PEXLIM P-Y

Expressed in multiples of the rated voltage U_r, (T_r)



ВЕРНО С ОРИГИНАЛА

ООО "ЭЛЕКТРИКО СОФИЯ"

Summary of type tests and documentation for arrester type PEXLIM P-X

Zinc oxide surge arrester with HTV silicone rubber housing.

LAK 5873 Rev 8
PPHC/AKB

Type tests performed	Standard	Report No.	Issued	Note/verification
Electrical tests				
Insulation withstand tests	IEC 60099-4,Ed 3.0 cl.10.8.2	Q 12-120	2013-02-28	All module sizes (36, 72 and 120kV)
		HVP/AK 13-21	2013-04-09	Validation of test samples
Residual voltage tests	IEC 60099-4,Ed 3.0 cl.10.8.3	HVP/AK 13-70	2013-12-06	The protection levels
Test to verify the long term stability against continuous operating voltage	IEC 60099-4,Ed 3.0 cl.10.8.4	HVP/AK 10-22	2010-04-29	The long term stability at highest voltage stress (0.98*Uref)
Test to verify the repetitive charge transfer rating	IEC 60099-4,Ed 3.0 cl.10.8.5	HVP/AK 13-28	2013-06-26	Charge rating, Qrs, of 3.2 C
Heat dissipation behaviour of test sample	IEC 60099-4,Ed 3.0 cl.10.8.6	HVP/AK 13-69	2013-12-04	
Operating duty test	IEC 60099-4,Ed 3.0 cl.10.8.7	HVP/AK 14-41	2014-07-01	Thermal energy rating of 11 kJ/kV rated voltage
Power-frequency voltage-versus-time test	IEC 60099-4,Ed 3.0 cl.10.8.8	HVP/AK 14-74	2014-10-20	
Lightning impulse discharge capability test	IEC 60099-4,Ed 3.0 Annex H	HVP/AK 08-06	2008-06-02	Impulse strength for lightning surges
Short-circuit tests	IEC 60099-4, Ed 2.2 cl.10.8.7 Same requirements as in new revision IEC 60099-4 Ed 3.0 cl.10.8.10	HVP/AK 07-45	2007-10-05	All current levels for a rated short-circuit current of 63 kA. (Actual high-current 65 kA)
Mechanical tests				
Bending strength test Bending fatigue test	IEC 60099-4, IEC 37/345/CDV Same requirements as in new revision IEC 60099-4 Ed 3.0 cl.10.8.11	HVP/AK 08-01	2008-06-17	Verifies a specified long-term load, SLL, of 2500 Nm and a specified short-term load, SSL, of 4000 Nm.
Verification of low temperature performance		HVP/AK 02-01	2002-01-07	Test on 120 kV module at 2500 Nm -50°C
Environmental ageing tests				
Weather ageing test (1000 h salt fog)	IEC 60099-4,Ed 3.0 cl.10.8.17	No. 333a E (TUD)	2013-02-15	Test on 120 kV module
Data sheets		**Document No.**	**Issued**	
Protective characteristics		LAK 5882rev 3	2013-11-14	
Temporary overvoltage (TOV) characteristics		LAK 7992	2014-10-06	With and without previous thermal energy of 11 kJ/kV rated voltage

ABB AB

2002-01-25
Rev 8 (Revision date 2015-04-14)

We hereby certify that the tests listed above verify guaranteed data for PEXLIM P-X arresters

Ludvika 2015-04-14
ABB AB

High Voltage Products/Surge Arresters
Quality Department

Kurt Jansson

ABB AB High Voltage Products QA QUALITY

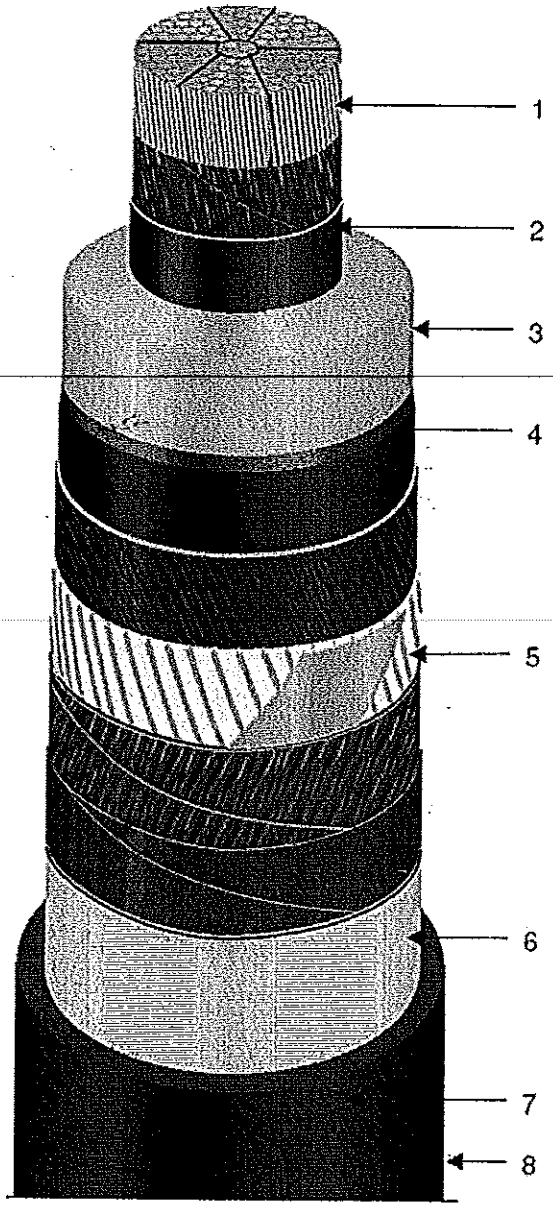
ABB

Приложение № 17 – Техническа документация (включително каталози), даваща пълно описание, технически данни и характеристики на предлаганото оборудване към Приложение № 3 - Технически данни за сух силов кабел 110 kV – техническо описание, Протоколи от типови изпитвания TIC 3181-13; Сертификат/акредитация на независимата изпитвателна лаборатория, провела типовите изпитвания; Инструкция за полагане/изтегляне и монтиране на кабела, Изисквания за съхранение и транспортиране, Кратко описание на системата за управление на качеството на производството с приложен сертификат за внедрена система за управление на качеството по ISO 9001:2008 или БДС EN ISO 9001:2008

Сф. II. 93

Техническо описание на кабел 110 kV:

A2XS (FL)2Y 1x1600RMS/110 – 64/110 kV



Стандарт на който отговаря: IEC 60840

1. Токопроводящо жило

Материал	: Алуминий (Al)
Напречно сечение	: 1600 mm^2
Диаметър на токопроводящо жило	: 49,6 mm
Тип токопроводящо жило	: кръгъл, секторен-многожичен
Надлъжна водонепропускливост	: водоблокираща лента

2. Токопроводящ екран (проводим слой)

Материал	: проводим PE
Дебелина на стената	: прибл. 1,5 mm
Тип на проводимия слой	: екструдиран PE

3. Изолация

Материал	:XLPE
Номинална дебелина на стената	:18,0 mm
Ниво на напрежение Uo/Un/Um	: 64 / 110 / 126 kV

4. Изолационен екран (проводим слой)

Материал	: проводим PE
Тип на проводимия слой	: екструдиран PE

5. Екран/метална обвивка

Материал	: Медно жило и медна лента
Напречно сечение	: 110 mm^2
Надлъжна водонепропускливост	: полупроводима водоблокираща лента

6. Радиална водна преграда

Материал	: Алуминий (Al)
Дебелина на стената	: 0,2 mm

7. Външна обвивка

Материал	: HDPE
Номинална дебелина	: 0,6 mm
Общ диаметър	: прибл. 108,0 mm

8. Специални компоненти

Тегло	: прибл. 11,88 kg/m
Мин. радиус на огъване	: 1,6 m
Макс. теглеща сила	: 48 kN

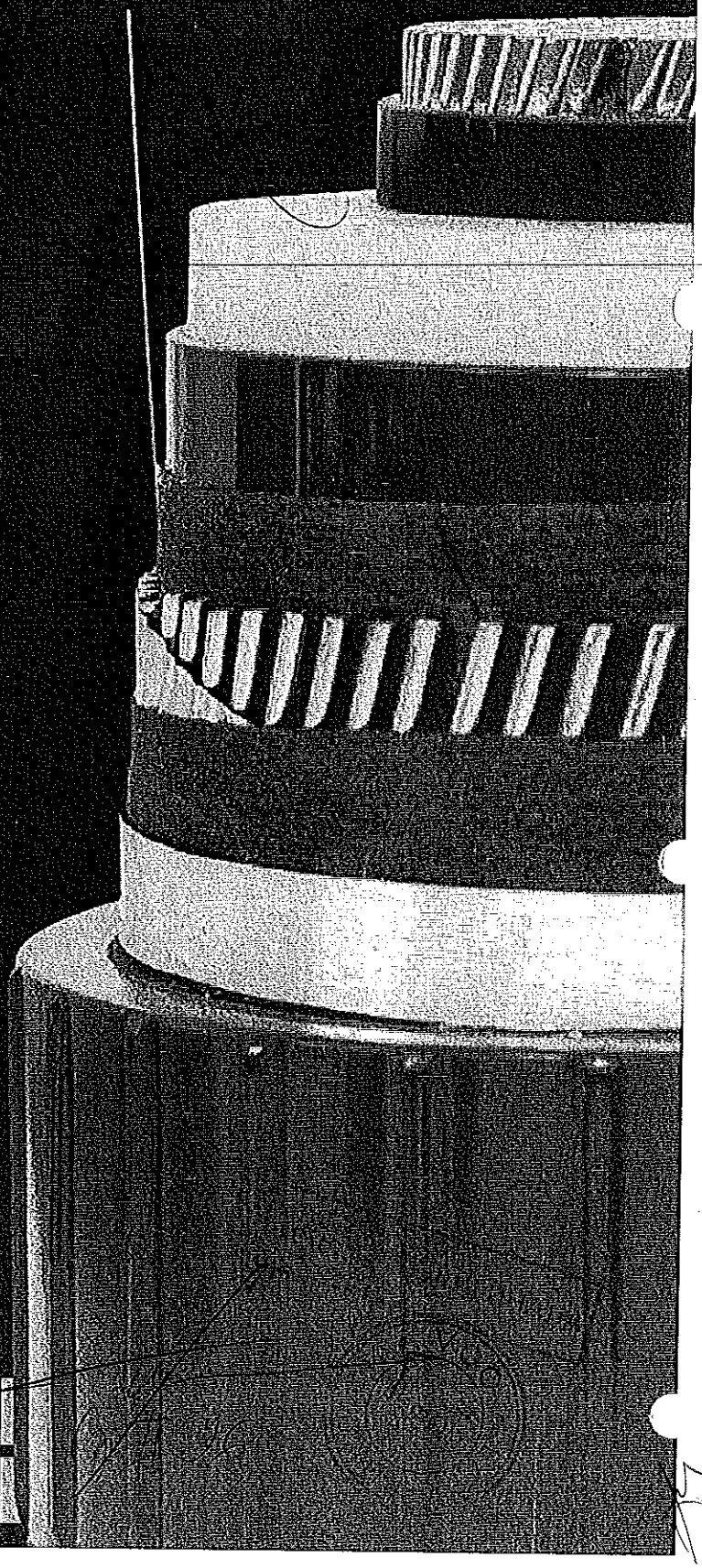
Механични характеристики	
Тегло на кабела, прибл., kg/m	11,88
Външен диаметър, mm	108,0
Максимална теглеща сила, kN	48,0
Минимален радиус на огъване, m	1,6
Електрически параметри	
DC съпротивление на токопроводящото жило при 20°C, Ohm / km	0,0186
AC съпротивление на токопроводящото жило при 90°C, Ohm / km	0,025
Капацитивно съпротивление на фаза, uF/km	0,31
Индуктивност между токопроводящото жило и екрана, mH/km	0,12
Капацитивен ток на зареждане, A/km	6,16
Ток на късо съединение през токопроводящото жило за една секунда, kA	152,3
Ток на късо съединение през екрана за една секунда, kA	21,0

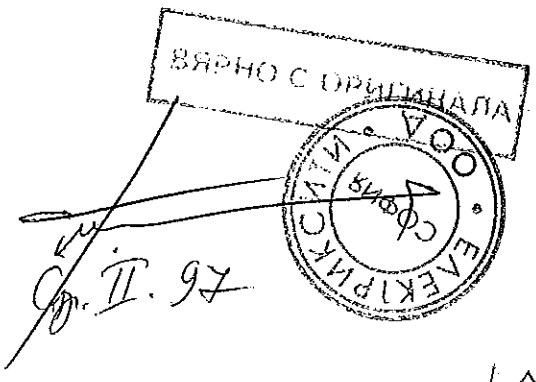
Сер. II. 95

ESTRALIN HVC

POWER CABLES
AND CABLE SYSTEMS
6-220 KV

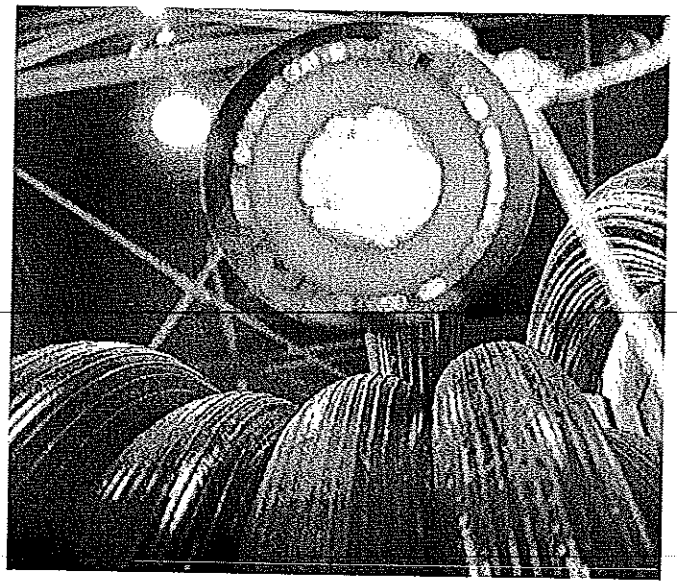
MODERN SOLUTIONS
FOR POWER CABLES

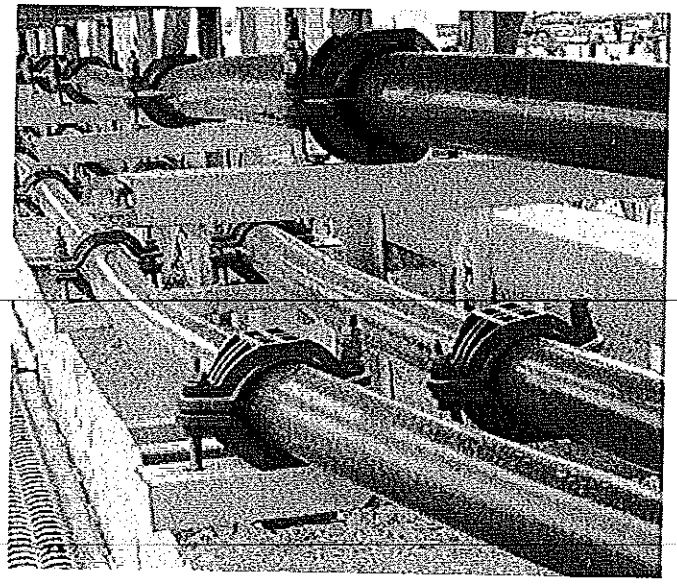




XLPE power cables

ESTRALIN HVC





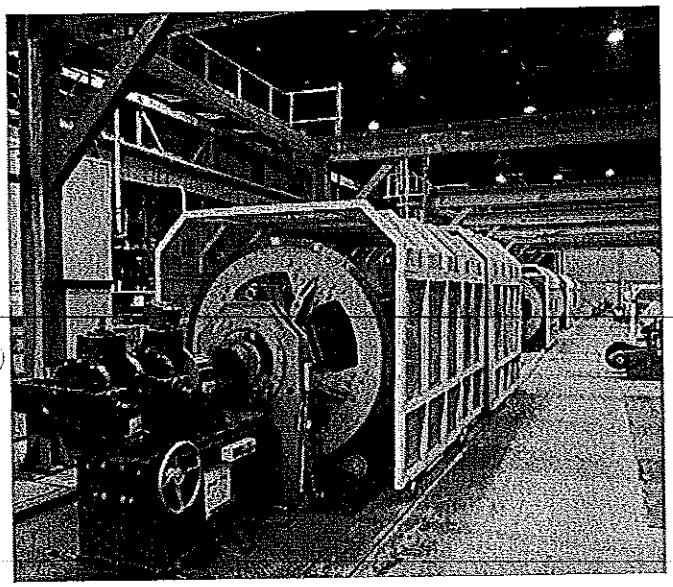
Cables 6-35 kV and 110-220 kV are widely used for electric energy transmission and distribution especially in large cities and at production plants, where electric energy consumption and load density levels are particularly high. Although basic requirements to cables (i.e. reliability, functionality, low costs of maintenance) are obvious they should be thoroughly met because their violation can cause considerable financial losses.

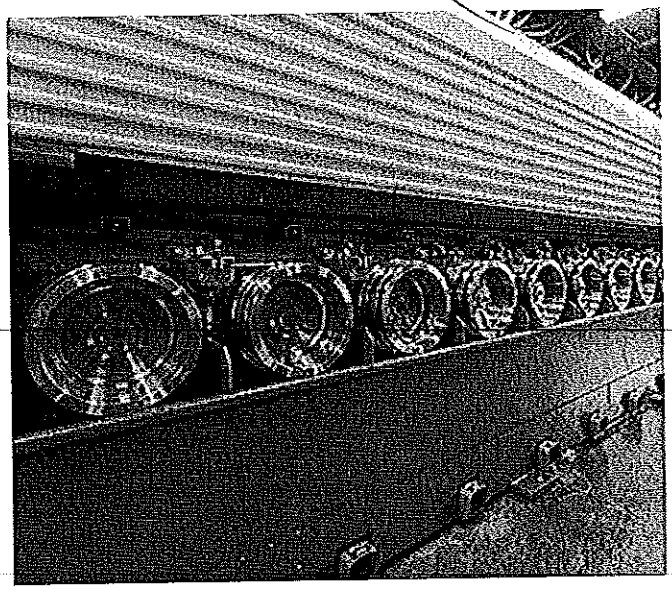
Cable's service life should be long; their function is to provide continuously the consumer with sufficient amount of electric power. Unlike cables with paper-filled or oil-filled insulation that find limited use from year to year, cables with cross-linked polyethylene insulation (Russian designation is – СПЭ, English – XLPE, German-VDE, and Swedish - PEX) meet that requirement in full.

Medium and high voltage XLPE cables due to the design, modern production technology and perfect materials have better electric and mechanical properties and the longest service life among other types of cables of mass production.

XLPE cables transfer capability is substantially higher than that of cables with paper or oil-filled insulation. According to international standards procedure, the cable is designed for continuous service with conductor temperature of 90°C and it is still active under emergency conditions even at higher temperatures, while oil-filled with paper insulation cables can withstand heating only to 70°C.

Сорт. II. 98





Advantage of XLPE cable is its environmental safety. Absence of liquid inclusions ensures maintaining clean environment, which permits its laying at any projects and service-free maintenance of cable lines.

Due to its single core design, cable laying is easier, as well as the installation accessories, even in the most extreme conditions. Cable laying is still possible at temperatures up to -20°C with polyethylene cable sheath.

XLPE cable production technology was first introduced in the 70s of XX century. The cross-links are a space lattice constructed using formation of longitudinal and transversal ties between macromolecules of polymer. With its physical and electrical properties, cross-linked polymer suits ideally for insulation of medium, high and extra-high voltage cables.

During production of XLPE cable a special attention is paid on the purity and quality of insulating materials, as any inclusions released to the insulation reduces the life of the cable. It is for this reason, the concept of clean rooms, excluding ingress of foreign particles, as well as interaction with reliable suppliers of high quality raw materials, are one of the foundations of the production of reliable cable with a long trouble-free operation time.

It should be stressed that insulation and electrically conducting screens are applied in the process of triple extrusion followed with the simultaneous cross-linking of all three layers. Such a technology ensures high adhesion between the screens and insulation.

Advantages of the enhanced design and modern production technology of XLPE cables have determined their universal application in developed countries and notable decrease in the use of other type cables.

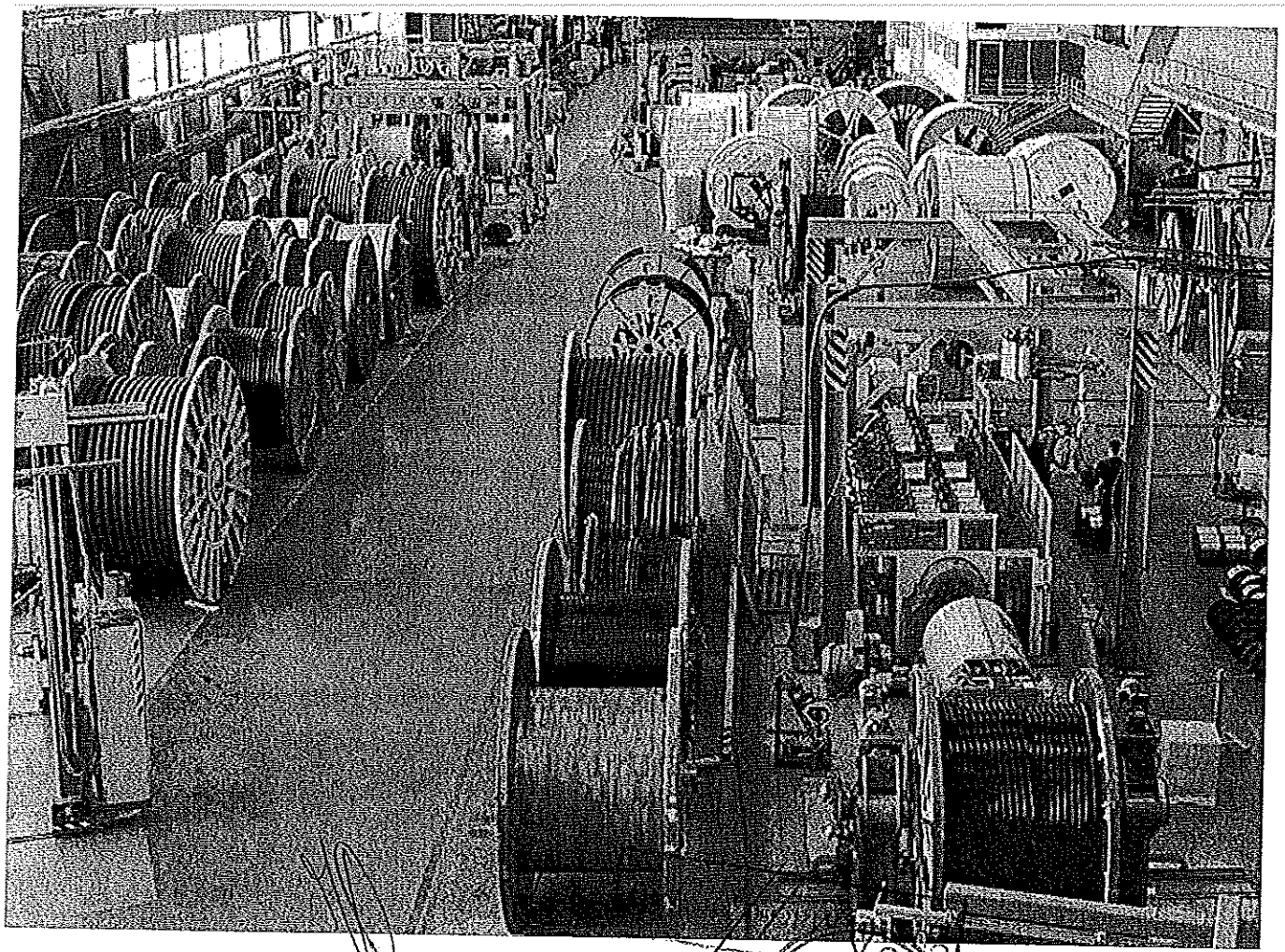
Estralin HVC – a pioneer in Russia's XLPE cable production

The aim of the plant "Estralin High Voltage Cables" (Estralin HVC) is introduction of innovative technologies in the field of power cable production. Providing high-quality production and services, we are helping our customers to raise their competitiveness and reduce the adverse impact upon environment.

Estralin HVC pays attention to technologies development and advancement that provide high quality of manufactured products. Only best materials of leading world manufacturers are used for cable insulation. These are peroxide-cross-linked polyethylenes, triingostable (TSPE) and copolymer (CCPE) polyethylenes. High skilled personnel and the use of high-quality basic materials are the key to perfect production that complies the requirements of advanced Russian and international standards and equals its West-European counterparts.

Continuous control over all phases of the process, starting with the choice of cable and accessories at the design stage and up to commissioning of completed cable line, permits the Company fully satisfy customer's requirements to modern cable lines. A systematic approach of complying international quality standards has been introduced at the factory.

High emphasis is placed upon environmental aspects of the production. Estralin HVC's successes in development and introduction of quality assurance systems and environmental management have been recognized by the largest independent European certification Company, TUV CERT: the Plant was awarded certificates of conformity with regulatory requirements ISO 9001 : 2008.



Main types of products and services

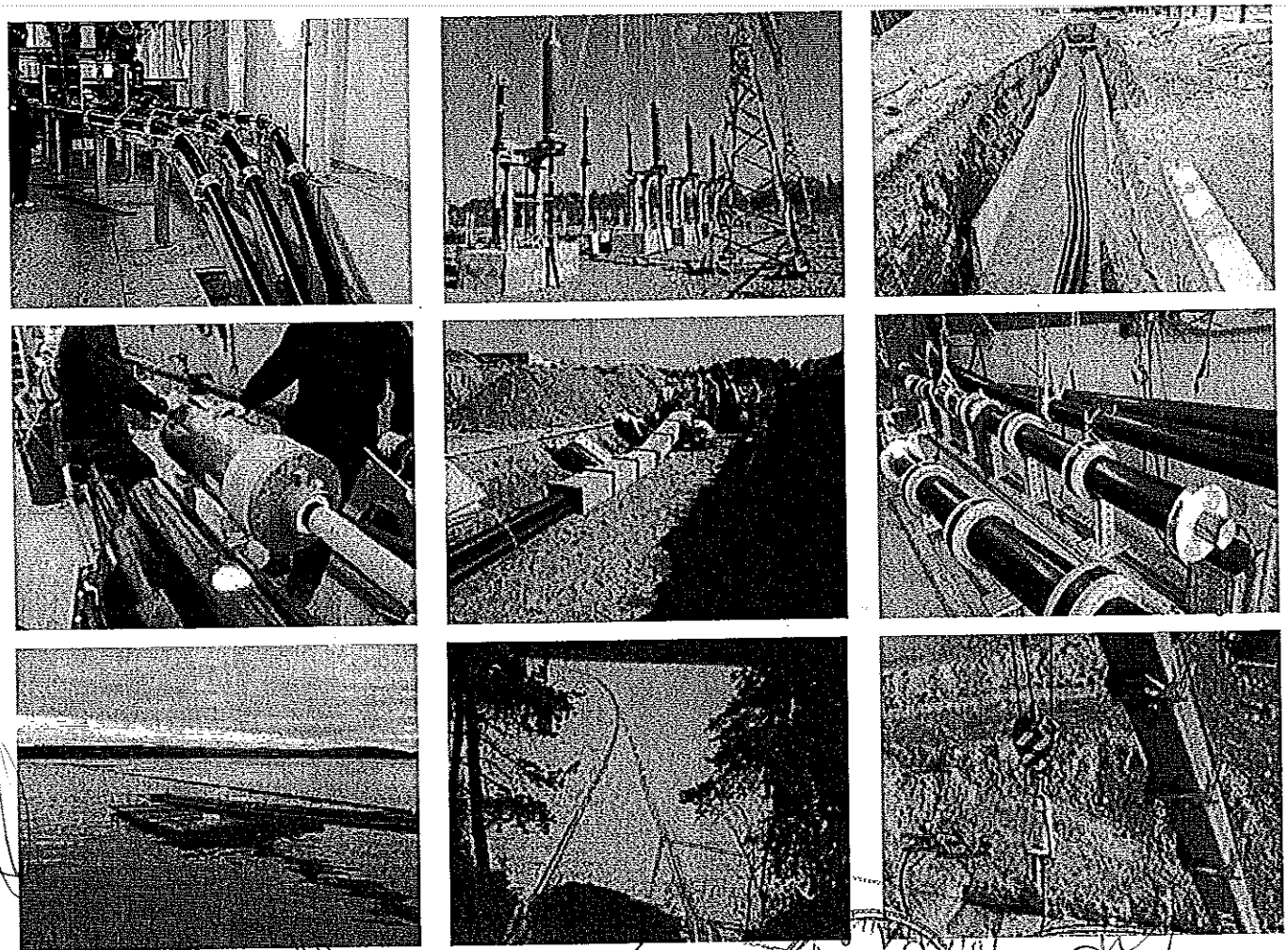
A main activity of Estralin HVC is XLPE cable 6-220 kV production, which use in insulated or earthed networks.

All cables, by their design, technological data and service characteristics comply the international standard requirements: IEC 60502-2 (6-35 kV cables), IEC 60840 (110 kV cables), and IEC 62067 (220 kV cables), as well as with the GOST R certification, including those with regard to fire safety.

Our company offers:

– medium and high voltage cable accessories;

– technical support at all stages of cooperation.



Markings

Conductor material	**Without designation**	Copper conductor
	A	Aluminum conductor
	RMS	Segmented conductor
Insulation material	Y	PVC insulation
	2XS	XLPE insulation
Screen	S	Copper wire and copper tape screen
	SE	Copper wire and copper tape screen around each cable conductor
	(F)	Watertight screen from swelling tape which provides longitudinal water sealing
	(FL)	Watertight screen from swelling tape which provides longitudinal water sealing and laminated polymer
Armouring	F	Wires armouring from galvanized steel
	G	Armouring: tape from galvanized steel winding with 2 spirals in the opposite directions
	B	Armouring from double steel tape
	R	Armouring from galvanized steel wire of coaxial shape
Sheath	K	Lead sheath
	Y	PVC sheath
	2Y	XLPE sheath
	H	Halogen free flame retardant sheath
	LWL (following screen designation)	Optic fibers in steel tubing inserted into copper

ВЯРНО С ОРИГИНАЛА

ООД Кабел Електрик

Гр. II. 102

Comparative characteristics	6-35 kV XLPE-cables	Paper-insulated cables	
		10 kV	20-35 kV
Continuous permissible temperature, °C	90	70	65
Permissible heating in emergency, °C	130	90	65
Maximum permissible temperature under short-circuit current flow, °C	250	200	130
Minimum cable laying temperature without pre-heating, °C	-20	0	0
Relative permittivity ε at 20°C	2,4	4,0	4,0
Dielectric loss ratio tg δ at 20°C	0,001	0,008	0,008
Level differential at cable laying operation, m	not limited	15	15

Main advantages of XLPE-cables are:

- big cable transmission capability due to increased conductor permissible temperature (permissible load currents are 15-30% higher than those of paper-insulated cables, depending on cable laying conditions);
- high-current thermal stability at short circuit that is of a special importance when a cross-section has been chosen on the basis of short-circuit nominal current only;
- light-weight, smaller diameter and bending radius, which facilitates cable laying in both cable structures and underground along complicated routes;
- feasibility of cable laying at temperatures up to - 20°C without preheating due to the use of polymer materials in insulation and screening;
- low specific damageability (practice of XLPE-cables employment demonstrates that their damage resistance at least is 1-2 orders lower than that of paper-insulated and cables);
- absence of any liquid components (oils), and therefore, time and cost of cable laying and installation is reduced;
- single-core design permits cable to produce with a conductor with cross-section up to 1000 mm2 that is optimal for a large-power transmission;
- large lengths for construction: up to 2000-4000 m.

Take into account that the main type of single core cable faults are single-phase short circuit; it is possible to confirm that repair costs are drastically cut.

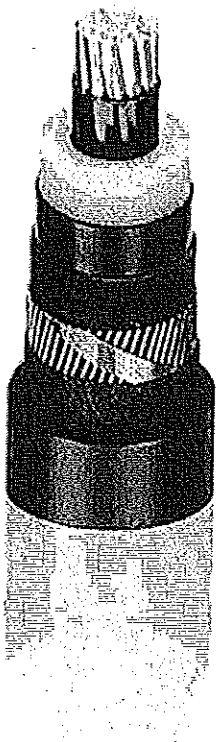
Strong insulation provides enormous advantages at the cable laying over a sloping, hilly or rough terrain, i.e. along the routes with considerable level difference, in vertical and inclined collectors.

Design

6, 10, 20 and 35 kV XLPE cable consists of a round copper or aluminum stranded conductor, a semiconductive layer over the conductor, a cross-linked polyethylene insulation, a conductive layer on the insulation, a conductive tape, a screen of cooper wires and a copper band, a separating layer, a high-density polyethylene sheathing, and a PVC plasticate sheathing or PVC plasticate sheath of reduced combustibility with reduced smoke and gas emission, or a sheath of halogen-free polyethylene composite.

In order to ensure the screen longitudinal sealing, a water-blocking conductive tape can be used in place of a conductive tape, and a water-blocking conductive tape layer can replace a separation layer.

Cables indexed «FL» are provided with an alumo-polymer tape sheath welded to the polyethylene or PVC sheath apart from having longitudinal sealing. Such a design creates an effective diffusion barrier stopping penetration of water vapors; and an outside sheath of black polyethylene provides protection against mechanical damage.



Field of application

2XS2Y, A2XS2Y, cables are used for underground lines for complicated sections of the routes, as well as for overhead lines providing proper fire protection. Cables with longitudinal sealing could be used for underground lines in humid soils and in damp, partially flooded premises.

2XSY, A2XSY, 2XS(FL)Y, and A2XS(FL)Y cables are used for cable structures and industrial premises (2XS(Fl)Y and A2XS(Fl)Y – in batch laying), and also underground in dry soils.

2XS(FL)Y-LS and A2XS(FL)Y-LS cables are intended for stationary overhead batch lines, in cable structures and premises that have specified limitation on smoke consistency in fire situations.

2XS(Fl)Y-HF and A2XS(Fl)Y-HF are used for stationary electrical installations inside public and industrial buildings limited by requirements restricting impact of corrosive gases.

6-10 kV[1] XLPE cable specifications

Nominal cross-section	mm²	50	70	95	120	150	185	240	300	400	500	630	800	1000	1200
Screen cross-section[2]	mm²	16	16	16	16	25	25	25	25	35	35	35	35	35	50
Insulation thickness	mm	3,4	3,4	3,4	3,4	3,4	3,4	3,4	3,4	3,4	3,4	3,4	3,4	3,4	3,4
Sheath thickness	mm	2,5	2,5	2,5	2,5	2,5	2,5	2,5	2,5	2,5	2,5	2,7	2,7	2,9	2,9
D outside[3]	mm	27,4	29,1	30,8	32,3	33,5	35,4	37,6	39,9	42,9	45,9	49,8	54	58,2	63,4
Weight approx.[3]															
Al conductor	kg/km	689	784	891	994	1189	1329	1529	1746	2173	2512	2981	3543	4210	5152
Cu conductor	kg/km	999	1217	1479	1737	2117	2473	3014	3602	4647	5606	6894	8492	10397	12781
Min. bending radius	cm	42	44	47	49	51	53	57	60	65	69	75	81	87	95
Permissible pulling force															
Al conductor	kN	1,5	2,1	2,85	3,60	4,50	5,55	7,20	9,00	12,0	15,0	18,9	24,0	30,0	36,0
Cu conductor	kN	2,5	3,5	4,75	6,00	7,50	9,25	12,0	15,0	20,0	25,0	31,5	40,0	50,0	60,0
Max. single length supply[4]	m	11760	10380	9150	8550	7810	7090	6410	5810	5270	4760	4290	3790	3410	3050
Continuous permis. earth current[3]															
Cu	A	223	273	326	370	414	467	540	607	683	768	858	947	1026	1060
Al	A	173	212	253	288	322	365	423	477	543	618	702	788	871	920
Continuous permis. earth current[3]															
Cu	A	231	282	336	379	421	472	542	606	662	736	814	889	957	945
Al	A	180	220	262	296	331	373	431	484	540	609	683	759	833	846
Continuous permis. air current[3]															
Cu	A	259	322	391	450	509	581	683	782	899	1030	1175	1327	1452	1541
Al	A	201	250	304	350	396	454	535	614	715	829	959	1102	1230	1334
Continuous permis. air current[3]															
Cu	A	301	374	454	522	582	662	771	875	969	1090	1222	1355	1497	1501
Al	A	234	292	355	409	458	525	615	702	796	909	1036	1170	1308	1351

1 All data in Table 1 apply for categories A and B networks (acc. to IEC 60183).

2 Cross-section of the screen shown in the Table is minimal. Cross-section of the screen is chosen under condition of short-circuit current .

3 Weight, outside diameter and continuous permissible cable currents are for cable types 2XS2Y i A2XS2Y with minimal cross-section of the screen. If a larger screen cross-section is desired, continuous permissible cable currents get lower because of increased losses in the screen.

4 Deviation from the nominal construction length is ± 1%.

20 kV XLPE cable specifications

Nominal cross-section	mm²	50	70	95	120	150	185	240	300	400	500	630	800	1000	1200
Screen cross-section[1]	mm²	16	16	16	16	25	25	25	25	35	35	35	35	35	50
Insulation thickness	mm	5,5	5,5	5,5	5,5	5,5	5,5	5,5	5,5	5,5	5,5	5,5	5,5	5,5	5,5
Sheath thickness	mm	2,5	2,5	2,5	2,5	2,5	2,5	2,5	2,5	2,5	2,7	2,7	2,9	2,9	2,9
D outside[2]	mm	31,6	33,3	34,9	36,4	37,7	39,6	41,8	44,1	47,5	50,5	54,0	58,6	62,4	67,6
Weight approx.[2]															
Al conductor	kg/km	849	953	1073	1185	1386	1537	1751	1981	2455	2815	3277	3899	4557	5568
Cu conductor		1158	1386	1660	1927	2314	2681	3236	3838	4930	5908	7192	8848	10744	13197
Min. bending radius	cm	48	50	52	55	57	60	63	66	72	76	si	88	94	101
Permissible pulling force															
Al conductor	kN	1,5	2,1	2,85	3,60	4,50	5,55	7,20	9,00	12,0	15,0	18,9	24,0	30,0	36,0
Cu conductor		2,5	3,5	4,75	6,00	7,50	9,25	12,0	15,0	20,0	25,0	31,5	40,0	50,0	60,0
Max. single length supply[3]	m	8380	7500	6670	6250	5770	5260	4790	4370	3990	3620	3260	2910	2640	2370
Continuous permis. earth current[2]															
Cu	A	224	274	327	371	416	469	542	610	687	774	869	961	1040	1073
Al		174	213	254	289	323	366	424	479	545	621	706	794	879	928
Continuous permis. earth current[2]															
Cu	A	231	282	337	382	423	474	545	609	667	742	823	900	966	953
Al		180	220	262	298	332	374	432	485	543	612	688	765	839	852
Continuous permis. air current[2]															
Cu	A	261	325	394	453	512	585	687	786	903	1036	1182	1336	1468	1555
Al		203	252	306	352	398	457	537	616	717	830	960	1104	1236	1340
Continuous permis. air current[2]															
Cu	A	298	371	450	517	577	657	764	868	965	1088	1221	1359	1500	1509
Al		232	289	351	404	454	519	608	694	788	902	1028	1165	1304	1352

[1] Cross-section of the screen shown in the Table is minimal. Cross-section of the screen is chosen under condition of short-circuit current.

[2] Weight, outside diameter and continuous permissible cable currents are for cable types 2XS2Y, 1-RA2XS2Y with minimal cross-section of the screen. If a larger screen cross-section is desired, continuous permissible cable currents get lower because of increased losses in the screen.

[3] Deviation from the nominal construction length is ± 1%.

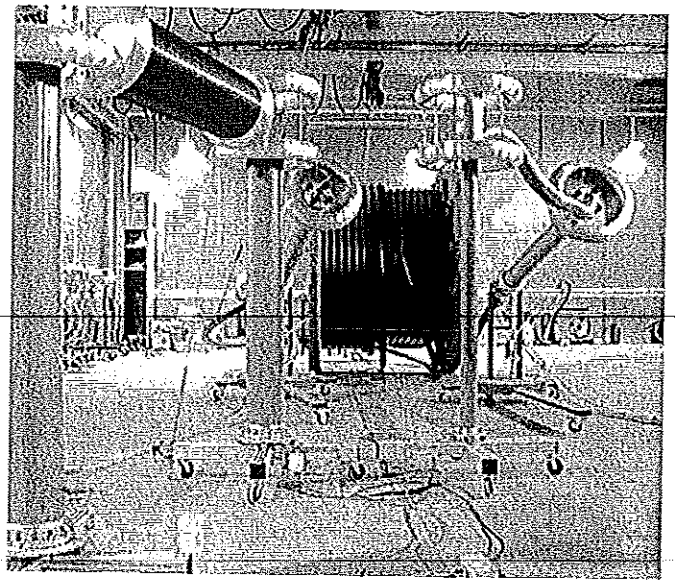
35 kV XLPE cable specifications

Nominal cross-section	mm²	50	70	95	120	150	185	240	300	400	500	630	800	1000	1200
Screen cross-section[1]	mm²	16	16	16	16	25	25	25	25	35	35	35	35	35	50
Insulation thickness	mm	9,0	9,0	9,0	9,0	19,0	2,5	9,0	9,0	9,0	9,0	9,0	9,0	9,0	9,0
Sheath thickness	mm	2,5	2,5	2,5	2,5	2,5	2,5	2,5	2,7	2,7	2,9	2,9	2,9	2,9	2,9
D outside[2]	mm	38,2	39,9	41,6	43,1	44,7	46,7	49,3	51,6	55,0	58,0	61,4	65,6	69,4	74,6
Weight approx.[2] Al conductor	kg/km	1171	1293	1428	1556	1770	1948	2214	2470	2980	3371	3863	4495	5162	6324
Cu conductor	kg/km	1480	1726	2016	2298	2698	3093	3699	4326	5455	6465	7781	9445	11379	13953
Min. bending radius	cm	57	59	63	65	67	70	74	78	83	87	92	99	104	112
Permissible pulling force Al conductor	kN	1,5	2,1	2,85	3,60	4,50	5,55	7,20	9,0	12,0	15,0	18,9	24,0	30,0	36,0
Cu conductor	kN	2,5	3,5	4,75	6,0	7,50	9,25	12,0	15,0	20,0	25,0	31,5	40,0	50,0	60,0
Max. single length supply[3]	m	7690	6990	6290	5950	520	5100	4670	4350	3950	3610	3280	2510	2700	2430
Continuous permis. earth current[2]  Cu	A	224	274	327	371	1416	469	542	610	687	774	869	961	1040	1091
Al	A	174	213	254	289	1323	366	424	479	545	621	706	794	879	939
Continuous permis. earth current[2]  Cu	A	231	282	337	382	1423	474	545	609	667	742	823	900	966	965
Al	A	180	220	262	298	1332	374	432	485	543	612	688	765	839	861
Continuous permis. air current[2]  Cu	A	261	325	394	453	512	585	687	786	903	1036	1182	1336	1468	1572
Al	A	203	252	306	352	398	457	537	616	717	830	960	1104	1236	1346
Continuous permis. air current[2]  Cu	A	298	371	450	517	577	657	764	868	965	1088	1221	1359	1500	1520
Al	A	232	289	351	404	454	519	608	694	788	902	1028	1165	1304	1352

1 Cross-section of the screen shown in the Table is minimal. Cross-section of the screen is chosen under condition of short-circuit current.

2 Weight, outside diameter and continuous permissible cable currents are for cable types 2XS2Y и A2XS2Y with minimal cross-section of the screen. If a larger screen cross-section is desired, continuous permissible cable currents get lower because of increased losses in the screen.

3 Deviation from the nominal construction length is ± 1%.



Medium voltage cables load capacity is calculated for the following conditions:

Laid in ground:

load factor	1,0
depth of cable laying	0,7 m
soil thermal resistance	1,2 K•m/W
ambient temperature, t°	15°C
conductor temperature, t°	90°C

Laid in air

load factor	1,0
ambient temperature, t°	25°C
conductor temperature, t°	90°C

Continuous permissible currents are fixed for each cable line under service conditions with regard to specific requirements. At different design ambient temperatures, it is advised to use corrective ratios, given in the following Table.

When single-core cables are fixed in triangle formation they are laid immediately adjacent. When single core cables are laid in flat formation, clear distance between them is one cable diameter.

Correction factors for ambient temperatutre												
Temperatutre	-5	0	5	10	15	20	25	30	35	40	45	50
in ground	1,13	1,10	1,06	1,03	1,00	0,97	0,93	0,89	0,86	0,82	0,77	0,73
in air	1,21	1,18	1,14	1,11	1,07	1,04	1,00	0,96	0,92	0,88	0,83	0,78

Correction factors for specific soil resistance						
Soil specific thermal resistance, K·m/W	0.8	1,0	1.2	1.5	2.0	2.5
Correction factor	1,13	1,05	1,00	0,93	0,85	0,8

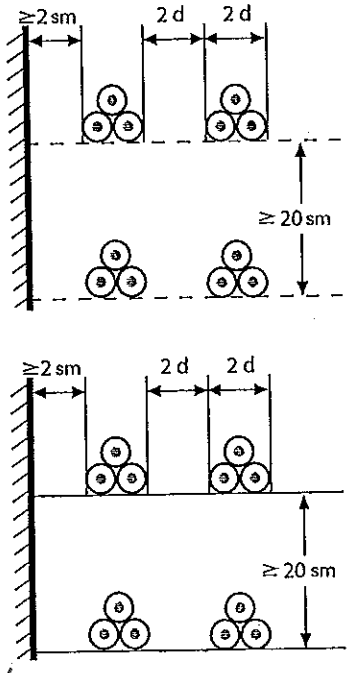
Correction factors for the laying depth						
Depth of cable laying, m	0,50	0,70	0,90	1,00	1,20	1,50
Correction factor	1,05	1,00	0,96	0,95	0,93	0,9

Correction factors on number of working cables arranged in plane side by side underground in pipes or without pipes, are used, when a section of a cable line between the earthing points is partially laid in pipes, under following conditions:

- cable are laid in a triangle formation over a substantial part of the line section;
- pipes are laid in flat formation;
- length of piping composes less than 10% of the section between the earthing points;
- each cable is laid in a separate pipe;
- pipe diameter is twice cable diameter.

Correction factors for side by side laying of the 6,10,15, 20 and 35 kV cables	
Cables partially laid in separate pipes	0,94
Cables in separate pipes on a plane	0,90
Single-conductor cables laid in triangle formation in a common pipe	0,90

Correction factors for group of cables in the ground					
Clear distance between groups, mm	Number of groups				
	2	3	4	5	6
100	0,76	0,67	0,59	0,55	0,51
200	0,81	0,71	0,65	0,61	0,49
400	0,85	0,77	0,72	0,69	0,66



Correction factors for group of cables in air arranged in a triangle			
Number of cables/systems on a rack			
Number of racks	1	2	3
1	1,00	0,98	0,96
2	1,00	0,95	0,93
3	1,00	0,94	0,92
4-6	1,00	0,93	0,90
1	0,95	0,90	0,88
2	0,90	0,85	0,83
3	0,88	0,83	0,81
4-6	0,86	0,81	0,79

Short-circuit currents

Short-circuit current for all types of cables and cross-sections are calculated on the basis of the following conditions:

Conductor temperature		Screen temperature	
before short-circuit	90°C	before short-circuit	70°C
after short-circuit	250°C	after short-circuit	350°C

Permissible conductor one-second short-circuit current														
Conductor cross-section mm²	50	70	95	120	150	185	240	300	400	500	630	800	1000	1200
Copper conductor	7,15	1,00	13,6	17,2	21,5	26,5	34,3	42,9	57,2	71,5	90,1	114,4	143,0	172,8
Aluminum conductor	4,7	6,6	8,9	11,3	14,2	17,5	22,7	28,2	37,6	47,0	59,2	75,2	93,9	114,3

Permissible screen one-second short-circuit current					
Screen [1] cross-section mm²	16	25	35	50	70
1-sec. screen short-circuit current, KA	3,3	5,1	7,1	10,2	14,2

If short-circuit duration differs from 1 sec., short-circuit values shown in the Tables are multiplied by correction coefficient:

$K = 1/\sqrt{t}$, where t — short-circuit duration, sec

[1] Values of permissible short-circuit currents for different cross-sections of the screen are calculated on request.

Electrical specification

Conductor's DC resistance at 20°C, Ω/km, not less		
Nominal cross-section of conductor, mm²	Copper conductor	Aluminum conductor
50	0,3870	0,6410
70	0,2680	0,4430
95	0,1930	0,3200
120	0,1530	0,2530
150	0,1240	0,2060
185	0,0991	0,1640
240	0,0754	0,1250
300	0,0601	0,1000
400	0,0470	0,0778
500	0,0366	0,0605
630	0,0280	0,0464
800	0,0221	0,0367
1000	0,0176	0,0291
1200	0,0151	0,0247

Conductor resistance at temperatures, different from 20°C, is calculated with the formula:

for copper conductor:
$R_\tau = R_{20} \cdot (234,5+\tau)/254,5$

for aluminum conductor:
$R_\tau = R_{20} \cdot (228+\tau)/254,5$

where:
τ — conductor's temperature, (°C),

R_{20} — conductor resistance at 20°C, (Ω/km),

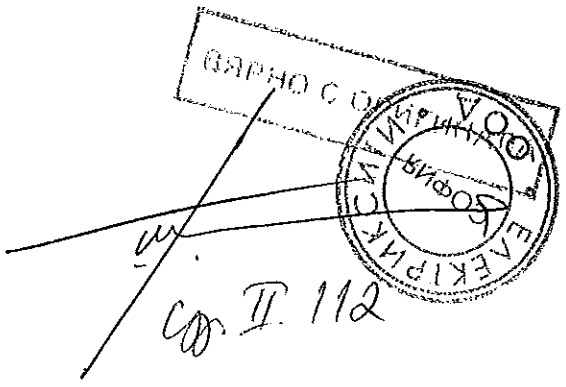
R_τ — conductor resistance at d°C, (Ω/km)

Cable capacitance for various voltage levels, μF/km														
Voltage, kV	Conductor cross-section, mm²													
	50	70	95	120	150	185	240	300	400	500	630	800	1000	1200
6	0,300	0,340	0,390	0,420	0,450	0,500	0,560	0,610	0,620	0,670	0,750	0,840	0,930	1,040
6/10	0,255	0,2891	0,328	0,351	0,384	0,423	0,468	0,516	0,569	0,630	0,700	0,792	0,880	0,983
10/10	0,226	0,254	0,288	0,307	0,336	0,370	0,410	0,450	0,493	0,550	0,610	0,680	0,757	0,845
15	0,207	0,230	0,262	0,280	0,305	0,325	0,369	0,405	0,445	0,492	0,548	0,615	0,680	0,759
20	0,179	0,200	0,225	0,240	0,260	0,285	0,313	0,343	0,376	0,414	0,460	0,515	0,568	0,633
35	0,130	0,143	0,159	0,168	0,181	0,196	0,214	0,230	0,253	0,277	0,305	0,399	0,371	0,411

Charging current for various voltage levels , A/km														
Voltage, kV	Conductor cross-section, mm²													
	50	70	95	120	150	185	240	300	400	500	630	800	1000	1200
6	0,305	0,348	0,381	0,414	0,446	0,490	0,555	0,599	0,609	0,675	0,773	0,871	0,969	1,068
10	0,435	0,490	0,544	0,580	0,635	0,689	0,780	0,852	0,961	1,070	1,215	1,378	1,524	1,780
15	0,560	0,630	0,710	0,780	0,830	0,910	1,010	1,100	1,230	1,360	1,490	1,670	1,850	2,060
20	0,617	0,689	0,762	0,834	0,943	0,979	1,052	1,161	1,270	1,415	1,560	1,778	1,959	2,290
35	0,889	1,016	1,143	1,206	1,270	1,397	1,524	1,651	1,841	2,031	2,222	2,539	2,857	2,610

Conductor inductive reactance at frequency of 50 Hz1, Ω/km						
Nominal conductor cross section,, mm²	6/10² kV		20²kV		35² KV	
	⊙⊙⊙	⊙⊙⊙	⊙⊙⊙	⊙⊙⊙	⊙⊙⊙	⊙⊙⊙
50	0,204	0,127	0,219	0,143	0,231	0,156
70	0,196	0,119	0,210	0,134	0,222	0,146
95	0,189	0,112	0,203	0,127	0,214	0,139
120	0,184	0,108	0,198	0,122	0,209	0,133
150	0,179	0,103	0,192	0,116	0,203	0,127
185	0,175	0,099	0,188	0,112	0,198	0,122
240	0,170	0,094	0,183	0,107	0,193	0,117
300	0,167	0,091	0,179	0,103	0,189	0,113
400	0,165	0,088	0,173	0,097	0,182	0,106
500	0,161	0,085	0,169	0,093	0,178	0,102
630	0,159	0,083	0,166	0,090	0,174	0,098
800	0,157	0,081	0,163	0,087	0,170	0,094
1000	0,154	0,079	0,159	0,083	0,166	0,090
1200	0,152	0,076	0,156	0,080	0,162	0,087

Calculation of inductive reactances are carried out with cables arranged in a triangle immediately adjacent, and in flat formation with clear distance between the cables equal to cable diameter.



[1] Inductive values are calculated with regard to the screen earthing from both sides.

[2] Inductive reactance values for other classes of voltage and another arrangement of cables are calculated on request.

Cable laying conditions and testing after medium voltage cable laying accessories installation

Bending radius of XLPE cable during cable laying and accessories installation laying procedure shall be at least 15xD, where D — outside cable diameter. When cable accessories installation is carried out with the use of a special template minimal bending radius is permitted to be reduced down to template 7,5xD.

When installing with the use of a cable sleeve or taking by the conductor, pulling tension shall not exceed the following figures:

F=Sx50 N/ mm² — for copper conductor,
F=Sx30 N/ mm² — for aluminum conductor,
where S — conductor area of the cross-section, mm².

Cable temperature during installation shall be not lower than:

-15°C – for cables with PVC- plasticate sheath;
-20°C – for cables with polyethylene sheath.

This is achieved when keeping the cable in warm (about 20°C) premises during 48 hours or with the use of special equipment.

After cable laying and accessories installation it is recommended to conduct testing with the following AC voltage, frequency 0,1 Hz during 15 minutes:

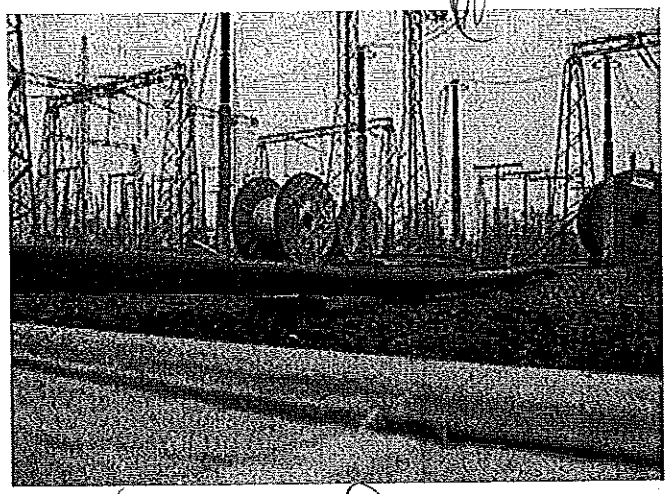
10 kV cable with 18 kV,
15 kV cable with 45 kV,
20 kV cable with 60 kV,
35 kV cable with 105 kV voltage.

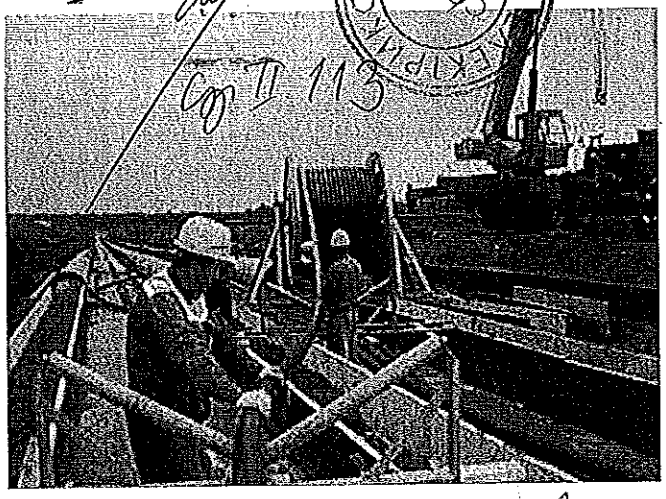
It is permissible to test with AC voltage of industrial frequency during 24 hours:

10 kV cable with 6 kV,
15 kV cable with 8,7 kV,
20 kV cable with 12 kV,
35 kV cable with 20 kV voltage.

On completing the installation and in coordination with cable manufacturing plant, cable testing is permitted with DC voltage of $4U_0$ during 15 minutes.

Cable sheath shall be tested with DC voltage of 10 kV, applied between the metallic screen and earthing device during at least 1 minute.





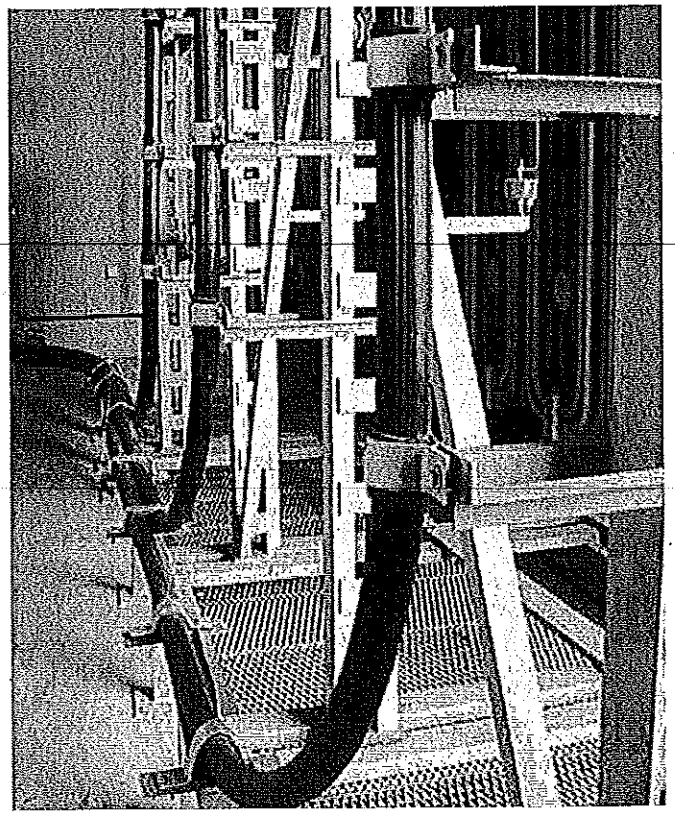
Capacity of cable drums

XLPE cable delivery length, m			
Cable outside diameter, mm	Construction length of cable, m		
	22D	24D	25D
26	2405	4566	6593
27	2230	4234	6113
28	2073	3937	5685
29	1933	3670	5299
30	1806	3430	4952
31	1692	3212	4638
32	1587	3014	4352
33	1493	2835	4092
34	1406	2670	3855
35	1327	2520	3638
36	1254	2382	3439
37	1187	2255	3255
38	1126	2138	3086
39	1069	2029	2930
40	1016	1929	2785
41	967	1836	2651
42	922	1750	2526
43	879	1669	2410
44	840	1594	2302
45	803	1524	2201
46	768	1459	2106
47	736	1397	2018
48	706	1340	1934

XLPE cable delivery length, m			
Cable outside diameter, mm	Construction length of cable, m		
	22D	24D	25D
49	677	1286	1856
50	650	1235	1783
51	625	1187	1713
52	601	1142	1648
53	579	1099	1587
54	557	1059	1528
55	537	1020	1473
56	518	984	1421
57	500	950	1372
58	483	918	1325
59	467	887	1280
60	452	857	1238
61	437	830	1198
62	423	803	1159
63	410	778	1123
64	397	754	1088
65	385	731	1055
66	373	709	1023
67	362	688	993
68	352	668	964
69	341	648	936
70	332	630	910

6, 10, 20 and 35 kV XLPE cable construction lengths are presented in the Table, they can be accommodated in standard wooden cable drums.

Construction lengths can be increased in coordination with customer using drums of greater capacity. In this way a special cable-carrying trucks; can be used in addition, one should be aware of oversized cargo transportation rules.

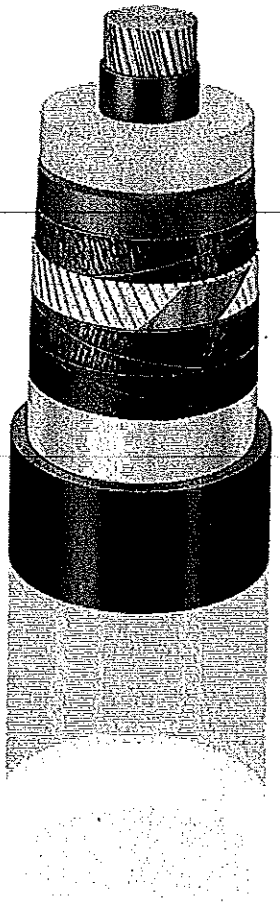


Comparative characteristics	XLPE cable	High pressure oil-filled cable
Continuous permissible temperature, °C	90	85
Permissible heating in emergency, °C	105	90
Ultimate permissible temperature under short-circuit current flow, °C	250	200
Density of 1-sec. short-circuit current, A/mm²		
— copper conductor	144	101
— aluminum conductor	93	67
Relative permittivity ε at 20°C	2,5	3,3
Dielectric loss ratio, tg δ at 20°C	0,001	0,004

Main advantages of XLPE cables are the following:

- high cable transmission capability due to increased conductor permissible temperature;
- high-current thermal stability at short-circuit that is of a special importance when a cross-section has been chosen on the basis of short-circuit nominal current only;
- light-weight, smaller diameter and bending radius, which facilitates laying in both cable structures and underground along complicated routes;
- strong insulation provides enormous advantages at the laying over a sloping, hilly or rough terrain, i.e. along the routes with considerable level difference due to absence of mass dulling effect;
- absence of liquids (oils) under pressure, and consequently, no need for costly refilling equipment, that results in considerable saving in operational costs, simplification of installation equipment, cutting time and cost of cable laying, as well as installation;
- feasibility of prompt repair in case of fault;
- absence of leakages and, therefore, no risks of environmental pollution in case of damage.

Design



110-220 kV XLPE cable consists of a round copper or aluminum stranded conductor, a semiconductive layer over the conductor, a cross-linked polyethylene insulation, a semiconductive layer on the insulation, a semiconductive tape, a screen of cooper wires and a copper band, a semiconductive tape, a polyethylene sheathing, or PVC plasticate sheathing.

The conductor is covered with an extrudable screen of semiconducting material, insulation and a semiconducting screen over the insulation binded together. Insulation thickness depends upon the conductor diameter.

Metallic screen consists of copper wires and a spirally applied over them a copper band. Screen cross-section is chosen on the basis of short-circuit current flow.

In order to provide longitudinal sealing in cables indexed «F», a layer of water-swellable material is used. Contacting with water it swells thus forming a longitudinal barrier, preventing in this way moisture propagation, should damage of outside sheathing occur.

Cables indexed «FL» are provided with an alumo-polymer tape sheath welded to the polyethylene or PVC sheath apart from having longitudinal sealing. Such a design creates an effective diffusion barrier stopping ingress of water vapors; and an outside sheath of black polyethylene provides protection against mechanical damage.

Reinforced polyethylene stiffened sheath.

Cables have a sheath of black polyethylene. Cables indexed «2Y» are provided with reinforced polyethylene longitudinally stiffened sheath that is designed for preventing the sheath damage while cabling at complicated sections of cable routes.

On request of customer 110-220 kV cables can be produced with optic fiber inserted for temperature measurements along the entire length of the cable and for transmitting any signals.

110 kV XLPE cable specification

Nominal cross-section	mm²	185	240	300	350	400	500	630	800	1000	1200	1400	1600	2000
Screen cross-section[1]	mm²	35	35	35	35	35	35	35	35	35	50	50	50	50
Insulation thickness	mm	16,0	16,0	16,0	16,0	15,0	15,0	15,0	15,0	15,0	15,0	15,0	15,0	15,0
Sheath thickness	mm	3,0	3,0	3,2	3,4	3,4	3,4	3,6	3,6	3,8	4,0	4,0	4,0	4,0
D outside	mm	64	66	69	70	70	73	77	81	85	91	95,8	98,1	104,6
Weight approx.[2]														
Al conductor	kg/km	3400	3700	4000	4230	4290	4830	5410	6140	7316	8422	8900	9600	11100
Cu conductor	kg/km	4560	5180	5870	6390	6760	7930	9310	11090	13699	16081	17600	19600	23600
Min. bending ra-dius	cm	95	99	104	105	105	109	116	122	128	137	144	148	157
Permissible pull-ing force														
Al conductor	kN	5,55	7,20	9,00	10,5	12,0	15,0	18,9	24,0	30,0	36,0	42,0	48,0	60,0
Cu conductor	kN	9,25	12,00	15,00	17,5	20,00	25,0	31,5	40,0	50,0	60,0	70,0	80,0	100,0
DC resistance														
Cu conductor	Ω/km	0,0991	0,0754	0,0601	0,0543	0,0470	0,0366	0,0280	0,0221	0,0176	0,0151	0,0129	0,0113	0,0090
Al conductor	Ω/km	0,1640	0,1250	0,1000	0,0890	0,0778	0,0605	0,0460	0,0367	0,0291	0,0247	0,0212	0,0186	0,0149
Inductance[3]	mH/km	0,4627	0,4439	0,4289	0,4209	0,4057	0,39	0,3781	0,363	0,351	0,339	0,334	0,330	0,317
Capacitance	µF/km	0,1364	0,1468	0,1575	0,1639	0,179	0,1936	0,209	0,2296	0,25	0,27	0,29	0,30	0,33
Continuous permis. earth current[4]														
Cu	A	500	575	650	715	755	840	935	1030	1121	1184	1248	1298	1364
Al	A	395	455	515	560	600	675	760	850	935	1009	1059	1114	1204
Continuous permis. earth current														
Cu	A	451	507	556	581	611	667	724	777	869	927	960	982	1014
Al	A	366	416	461	486	514	572	631	690	782	838	877	906	951
Continuous permis. air current[5]														
Cu	A	600	690	755	835	895	995	1115	1245	1452	1494	1598	1666	1796
Al	A	480	555	630	680	735	825	948	1060	1253	1317	1408	1483	1629
Continuous permis. air current[6]														
Cu	A	624	725	820	871	938	1065	1204	1352	1485	1533	1629	1692	1814
Al	A	494	576	656	702	758	872	999	1139	1276	1344	1446	1516	1655

1 Screen cross-section is calculated on the basis of the short-circuit current and thus can be increased..

2 Weight is shown for cables having a polyethylene sheath and basic cross-section of the screen.

3 Calculation was performed in cabling with cables in triangle formation with immediate adjacency and earthing from both sides.

4 Currents are calculated to be buried at the depth of 1,5 m with soil specific thermal resistance of 1,20 K•m/W, and load coefficient, $K_H = 0,8$

5 Currents are calculated for installation in air with cables in triangle formation, clear interphase distance shall be equal to cable diameter, no solar radiation, and earthing from both sides.

6 Currents are calculated for installation in air with cables in flat formation, clear interphase distance shall be equal to cable diameter, no solar radiation, and earthing from both sides.

220 kV XLPE cable specification

Nominal cross-section	mm²	400	500	630	800	1000	1200	1400	1600	2000	2500
Screen cross-section[1]	mm²	265	265	265	265	265	265	265	265	265	265
Insulation thickness	mm	24,0	24,0	24,0	24,0	22,0	22,0	22,0	22,0	22,0	22,0
Sheath thickness	mm	4,0	4,0	4,0	4,0	4,0	4,0	4,0	4,0	4,0	4,0
D outside	mm	92,3	95,3	98,9	105,4	106,1	108,9	110,6	119,7	122,7	126,2
Weight approx.[2]											
Al conductor	kg/km	9158	9739	10463	11630	11999	12834	13000	14960	16352	33000
Cu conductor		11685	12899	14445	16670	18269	20934	21800	25074	28899	33000
Min. bending radius	cm	138	142	148	158	159	163	166	179	184	190
Permissible pulling force											
Al conductor	kN	12,0	15,0	18,9	24,0	30,0	36,0	42,0	48,0	60,0	75,0
Cu conductor		20,0	25,0	31,5	40,0	50,0	60,0	70,0	80,0	100,0	125,0
DC resistance											
Cu conductor	Ω/km	0,047	0,0366	0,028	0,0221	0,0176	0,0151	0,0129	0,0113	0,009	0,0072
Al conductor		0,0778	0,0605	0,464	0,0367	0,0291	0,0247	0,0212	0,0186	0,0149	0,0119
Inductance[3]	mH/km	0,254	0,236	0,219	0,203	0,18	0,167	0,155	0,152	0,139	0,126
Capacitance	µF/km	0,133	0,143	0,154	0,174	0,119	0,220	0,220	0,240	0,230	0,270
Continuous permis. earth current[4]	A										
Cu		638	711	785	868	938	986	1038	1072	1133	1149
Al		519	585	657	731	803	858	914	948	1018	1068
Continuous permis. earth current	A										
Cu		620	670	725	774	812	862	892	910	940	960
Al		521	572	631	686	734	782	816	841	883	915
Continuous permis. air current[5]	A										
Cu		800	908	1031	1160	1281	1380	1471	1547	1669	1720
Al		641	734	841	955	1071	1174	1260	1339	1464	1550
Continuous permis. air current[6]	A										
Cu		796	884	977	1063	1136	1232	1297	1327	1393	1481
Al		658	743	836	927	1013	1101	1166	1211	1295	1395

1 Screen cross-section is calculated on the basis of the short-circuit current and thus can be increased. .

2 Weight is shown for cables having a polyethylene sheath and basic cross-section of the screen.

3 Calculation was performed in cabling with cables in triangle formation with immediate adjacency and earthing from both sides.

4 Currents are calculated to be buried at the depth of 1,5 m with soil specific thermal resistance of 1,20 K•m/W, and load coefficient, $K_H = 0,8$

5 Currents are calculated for installation in air with cables in triangle formation, clear interphase distance shall be equal to cable diameter, no solar radiation, and earthing from both sides.

6 Currents are calculated for installation in air with cables in flat formation, clear interphase distance shall be equal to cable diameter, no solar radiation, and earthing from both sides.

Load capacity

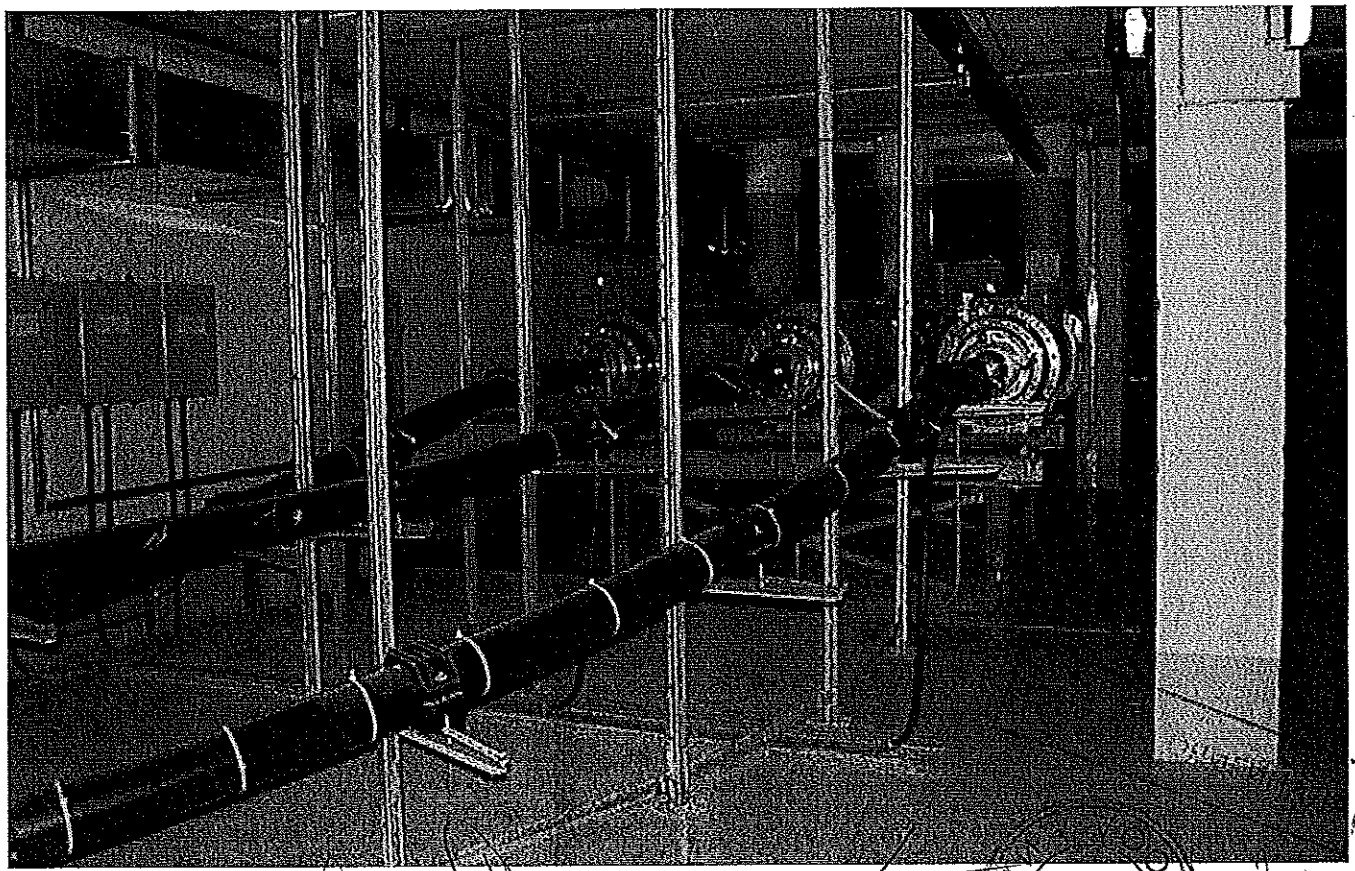
Load capacity of high voltage cables is calculated under the following conditions.

Laid in ground:		Laid in air:	
load factor	0,8	load factor	1,0
depth of cable laying	1,5 m	ambient temperature, t°	25°C
soil thermal resistance	1,2 K•m/W	conductor temperature, t°	90°C
ambient temperature, t°	15°C	screen earthing	from both sides
conductor temperature, t°	90°C		

For underground installation and with triangle arrangement, cables shall be positioned in immediate adjacency. For overhead lines and triangle arrangement of cables the clear distance between cables is recommended be equal to 25 sm. With flat arrangement of cables, recommended clear distance between cables shall be cable diameter.

Correction factor on laying depth

Laying depth, m	0,8	1,0	1,2	1,4	1,6	1,8	2,0	2,2	2,4
Correction factor	1,08	1,05	1,03	1,01	1,0	0,98	0,97	0,96	0,94



Стр. II.119

Short-circuit currents

Short-circuit current for all types of cables are calculated on the basis of the following preconditions:

Conductor temperature		Screen temperature	
before short-circuit	90°C	before short-circuit	70°C
after short-circuit	250°C	after short-circuit	350°C

XLPE cable can be subjected to overloads with temperatures above 90°C. In this regard, emergency overloads do not considerably affect cable service life.

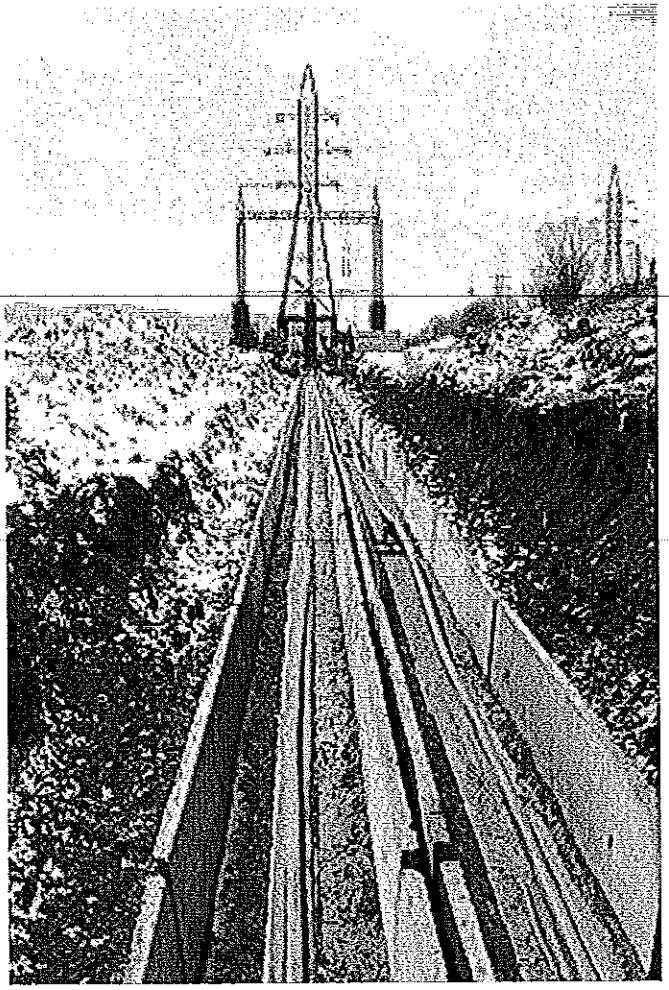
One-second long permissible short-circuit currents along the conductor and through the screen shall not exceed the figures presented in the Tables.

1 sec. permissible short-circuit current in the conductor												
Conductor cross-section, mm²	185	240	300	350	400	500	630	800	1000	1200	1600	2000
copper conductor	26,5	34,3	42,9	50,1	57,2	71,5	90,1	114,4	14	172,8	230	288
aluminum conductor	17,5	22,7	28,2	33,1	37,6	47	59,2	75,2	93, 1	14,3	152	190

1 sec. permissible short-circuit current the screen										
Screen cross-section, mm²	35	50	70	95	120	150	185	210	240	265
Screen 1-sec. short-circuit current, KA	7,1	10,15	14,21	19,29	24,36	30,45	37,56	42,63	48,72	53,8

In the case of short-circuit, apart from the heating, the dynamic forces originated between cable phases shall be also taken into consideration; their values can be significant. They shall be taken into account while choosing design of cable fixing means.

Cable laying conditions and testing after high voltage cable laying



During XLPE 110-220 kV cable laying the bending radius shall be at least 15xD, where D — outside cable diameter. When cables accessories installation is carried out with the use of a special template and with preheating, minimal bending radius shall also be at least 15xD.

When installing with the use of a cable sleeve or taking by the conductor, pulling force shall not exceed the following figures

$F=Sx50$ N/ mm² — for copper conductor,
$F=Sx30$ N/ mm² — for aluminum conductor

where S — conductor area of the cross section, mm².

Ambient temperature during laying shall not be lower than -5°C. With preheating, cable laying can be carried out at the following temperatures:

-15°C – for cables with PVC-plasticate sheath;
-20°C – for cables with polyethylene sheath.

Following cable installation, testing of completed cable line together with all the cable accessories shall be conducted.

Having completed a cable line and prior to its commissioning, each phase of the cable and its accessories shall be tested by increased AC voltage of 128 kV during one hour with frequency of 20 to 300 Hz. As agreed between manufacturing company and customer, it is permitted to conduct testing by nominal working AC voltage of 64 kV during 24 hours at no load, instead of the test by increased AC voltage. The test by increased DC is feasible, but not recommended, and only as agreed between manufacturing company and customer.

Cable sheath shall be tested by DC of 10 kV, applied between a metallic screen and earthing for one minute.

During Estralin HVC cable laying the requirements of "Maintenance of XLPE cable laying 110-500 kV, №ТИ/01-12" should be met.

Estralin
High Voltage Cables Plant

111024, Moscow
Box office a/я 130
2nd Kabelnaya Str., bld 2

Tel.: +7 (495) 956 66 99
Fax: :+7 (495) 234 32 94

e-mail: info@estralin.com
web-site: www.estralin.com

Information:

We reserve the right to introduce to the present catalogue technical alterations or corrections without notice. When ordering equipment, only mutually agreed data shall be valid.

Estralin HVC shall not be responsible for any potential misprints of losses of information in the catalogue.

ВЕРНО С ОРИГИНАЛА

Стр II. 122

ESTRALIN
HIGH VOLTAGE CABLES PLANT

111024, Moscow
Box office a/я 130
2nd Kabelnaya Str., bld 2

tel.: +7 (495) 956 66 99
fax: +7 (495) 234 32 94
e-mail: info@estralin.com

www.estralin.com

ООО «Эстралин ЗВК»

111024, г. Москва,
ул. 2-ая Кабельная, д. 2, стр. 24

тел: +7 495 956 66 99, факс: +7 495 234 32 94

www.estralin.com

ESTRALIN HVC

Tests	Frequency of tests
routine tests	
Measurement of elongation and resistance of wire	one length from each batch (manufacturing series)
Conductor examination, measurement of electrical resistance of conductor	one length from each batch (manufacturing series)
Measurement of geometric parameters of cable core	from both ends of each production length
Hot-set test for XLPE insulations	from one end of each production length
Check for inclusions or contaminants in the insulation	from one end of each production length
acceptance tests	
Electrical test on over sheath of the cable	each cable length
Check of outer sheath marking	each cable length
Measurement of adhesion of metal foil	one length from each batch (manufacturing series)
Measurement of attenuation of FIMT	each cable length
Measurement of capacitance	each cable length
Measurement of electrical resistance of conductor	each cable length
Partial discharge test	each cable length
Voltage test	each cable length
Check of cable construction	from both ends of each cable length

ВЯРНО С ОРИГИНАЛА

ООО «ЕЛЕКТРИКСЕВ»

Сф. II. 124

RAAD VOOR ACCREDITATIE

Dutch Accreditation Council RvA
PO Box 2768 NL-3500 GT Utrecht

The Dutch Accreditation Council RvA, by law appointed as the national accreditation body for The Netherlands, hereby declares that accreditation has been granted to:

KEMA Nederland B.V.
Inspection Services
Arnhem

The organisation has demonstrated to be able to perform inspections, as type **A** inspection body, in a competent, consistent and independent way.

This accreditation is based on an assessment against the requirements as laid down in ISO/IEC 17020:1998

The accreditation covers the activities as specified in the authorized annex bearing the registration number.

The accreditation is valid provided that the organisation continues to meet the requirements.

The accreditation with registration number:

I 049

is granted on 26 March 2014

This declaration is valid until
1 April 2018

The accreditation has been granted for the first time on
17 November 1994

ВЯРНО С ОРИГИНАЛА

The Chief Executive

Ir. J.C. van der Poel

Annex to ISO/IEC 17020:1998 declaration of accreditation for registration number: **I 049, type A**

RAAD VOOR ACCREDITATIE

of **KEMA Nederland B.V.**
Inspection Services
Arnhem

This annex is valid from: **26-03-2014** to **01-04-2018**

Replaces annex dated: **26-10-2012**

No.	Field of inspection	Type and Range of Inspection	Methods and Procedures[1]
	Rotating electrical machines, Transformers, Capacitors, Reactors		
1	Rotating electrical machines	- examine manufacturers' quality registrations - monitor factory inspections - evaluate the results obtained by these examinations	IEC 60034
2	Power transformers		IEC 60076 – 1,2,3,4,5,7,8,10,11,13, 15 NEMA 107 CISPR 16 EN 60076-11
3	Current transformers		IEC 60044 – 1,3,6,8
4	Voltage transformers		IEC 60044 – 2,3,7
5	Capacitors		IEC 60358 IEC 60831-1/-2 IEC 60871-1/-2
6	Reactors		IEC 60076-6

ВЯРНО С ОРИГИНАЛА

Стр. II. 126

This annex has been approved by:

Ir. J.C. van der Poel
Chief Executive

Annex to ISO/IEC 17020:1998 declaration of accreditation for registration number: **I 049, type A**

RAAD VOOR ACCREDITATIE

of **KEMA Nederland B.V.**
Inspection Services
Arnhem

This annex is valid from: **26-03-2014** to **01-04-2018** Replaces annex dated: **26-10-2012**

No.	Field of inspection	Type and Range of Inspection	Methods and Procedures[1]
		Switchgear	
7	Metal-enclosed AC switchgear 1-52 kV resp. ≥ 52 kV	- examine manufacturers' quality registrations - monitor factory inspections - evaluate the results obtained by these examinations	IEC 62271-200 IEC 62271-1 IEC 60265 –1 IEC 62271-104 IEC 62271-105
8	Insulation-enclosed AC switchgear		IEC 62271-201
9	Gas insulated metal-enclosed AC switchgear (GIS)		IEC 62271-203 IEC 62271-1
10	High Voltage AC circuit breakers		IEC 62271-100
11	High-voltage AC disconnectors and earthing switches		IEC 62271-102
		Insulators, Arresters	
12	Insulators and insulated bushings	- examine manufacturers' quality registrations - monitor factory inspections - evaluate the results obtained by these examinations	IEC 60137 IEC 60168 IEC 60383 –1,2 IEC 60507 IEC 60660 IEC 61109 IEC 60815 ANSI C29 CAN/CSA C411.1-M89
13	Surge arresters		IEC 60099 –1,3,4,5,6,7 IEEE Std C62.11

ВЯРНО С ОРИГИНАЛА

Сер. II. 127

Annex to ISO/IEC 17020:1998 declaration of accreditation for registration number: **I 049, type A**

RAAD VOOR ACCREDITATIE

of **KEMA Nederland B.V.**
Inspection Services
Arnhem

This annex is valid from: **26-03-2014** to **01-04-2018**

Replaces annex dated: **26-10-2012**

No.	Field of Inspection	Type and Range of Inspection	Methods and Procedures[1]
		Cables	
14	Cables	- examine manufacturers' quality registrations - monitor factory inspections - evaluate the results obtained by these examinations	IEC 60055 –1,2 IEC 60141-1 IEC 60502 –1,2,4 IEC 60840 NEN 3620 NEN 3172 BS 6622 HD 620 S2 NEN 3616 NEN 3619 NEN 3630 IEC 62067 CSA C49 NF C34-125 IEC 61089
15	Cable accessories		IEC 60055 –1,2 IEC 60502 –1,2,4 VDE 278 IEEE Std 404 IEEE Std 48 IEC 62271-209
		Electrical Energy Meters	
16	Electricity metering equipment (a.c.)	European directive 2004/22/EC: - Annex B: EC type examination - Annex F: Product verification Taking into account the requirements of EA-2/17	Directive 2004/22/EC: Annex I, B, F; MI-003

ВЯРНО С ОРИГИНАЛА

RAAD VOOR ACCREDITATIE

Dutch Accreditation Council RvA
PO Box 2768 NL-3500 GT Utrecht

The Dutch Accreditation Council RvA, by law appointed as the national accreditation body for The Netherlands, hereby declares that accreditation has been granted to:

KEMA Nederland B.V.
High-Power Laboratory
Arnhem

The organisation has demonstrated to be able to generate technical valid results in a competent way and work according to a management system,

This accreditation is based on an assessment against the requirements as laid down in ISO/IEC 17025:2005.

The accreditation covers the activities as specified in the authorized annex bearing the registration number.

The accreditation is valid provided that the organisation continues to meet the requirements.

The accreditation with registration number:

L 020

is granted on 26 March 2014

This declaration is valid until

1 April 2018

The accreditation has been granted for the first time on

30 October 1990

The Chief Executive

Ir. J.C. van der Poel

Annex to ISO/IEC 17025:2005 declaration of accreditation
for registration number: **L 020**

RAAD VOOR ACCREDITATIE

of **KEMA Nederland B.V.**
High-Power Laboratory
Arnhem

This annex is valid from: **26-03-2014** to **01-04-2018**

Replaces annex dated: **26-10-2012**

No.	Material or product	Type of activity	Internal reference number
		Transformers, Reactors, Line traps	
1	Power transformers	Short-circuit tests	IEC 60076-5 IEC 60076-11 STL Guide to IEC 60076 EN 60076-5 EN 50464-1 NEN-EN 50541-1 IEEE Std C57.12.90
2	Current transformers	Short-time current tests Transient Instantaneous error measurement	IEC 60044-1 IEC 60044 -6 STL Guide to IEC 60044-1 STL Guide to IEC 60044-6 IEEE Std C57.13
3	Reactors	Short-time current tests	IEC 60076-6 IEEE Std C57.21
4	Line traps for A.C. power systems	Short-time current tests	IEC 60353
		Switchgear	
5	Metal-enclosed A.C. switchgear 1 - 52 kV resp. > 1 kV and prefabricated substations	Short-time current tests Verification of making and breaking capacities Mechanical operation tests Arcing due to internal fault	IEC 62271-200 IEC 62271-202 STL Guide to IEC 62271-200 IEEE Std C37.20.2 IEEE C37.21 ANSI C37.54 ANSI C37.55
6	Metal-enclosed A.C. switchgear ≥ 72,5 kV resp. ≥ 52 kV	Short-time current tests Verification of making and breaking capacities Mechanical operation tests Arcing due to internal fault	IEC 62271-203 STL Guide to IEC 60517 IEEE Std C37.122

This annex has been approved by:

Ir. J.C. van der Roel
Chief Executive

Annex to ISO/IEC 17025:2005 declaration of accreditation
for registration number: **L 020**

RAAD VOOR ACCREDITATIE

of **KEMA Nederland B.V.**
High-Power Laboratory
Arnhem

This annex is valid from: **26-03-2014** to **01-04-2018** Replaces annex dated: **26-10-2012**

No.	Material or product	Type of activity	Internal reference number
7	Low-voltage A.C. switchgear and control gear assemblies	Short-time current tests	IEC 61439-1 IEC 61439-2 IEC 60439-2 EN 61439-1 EN 61439-2 EN 60439-2 ANSI C37.20.2
8	Insulation-enclosed A.C. switchgear 1 - 52 kV	Short-time current tests Verification of making and breaking capacities Mechanical operation test Arcing due to internal fault	IEC 62271-201
9	High-voltage AC circuit breakers	Short-time current tests Making and breaking tests Switching tests Mechanical and environmental tests	NEN-EN-IEC 62271-100 IEC 62271-110 IEC 62271-101 STL Gulde to IEC 62271-100 STL Gulde to IEC 62271-101 ANSI/IEEE C37.09 ANSI/IEEE C37.081 IEEE Std C37.013 NEN-EN 50152-1
10	High-voltage A.C. switches	Short-time current tests Making and breaking tests Mechanical endurance tests Operation under severe ice conditions	NEN-EN-IEC 62271-103 IEC 62271-104 STL Gulde to IEC 60265-1 IEEE Std C37.74
11	High-voltage A.C. disconnectors and earthing switches	Short-time current tests Switching tests Short-circuit making performance Operating and mechanical endurance tests Operation under severe ice conditions Operation at the temperature limits Contact zone tests	IEC 62271-102 STL Gulde to IEC 62271-102 IEEE Std C37.34 IEEE Std C37.41
12	High-voltage A.C. contactors and motor starters	Making and breaking capacities Coordination with short-circuit protective device	NEN-EN-IEC 62271-106
13	Automatic circuit reclosers and fault interrupters	Interruption tests Operating duty tests	IEC 62271-111 / IEEE Std C37.60

Annex to ISO/IEC 17025:2005 declaration of accreditation
for registration number: **L 020**

RAAD VOOR ACCREDITATIE

of **KEMA Nederland B.V.**
High-Power Laboratory
Arnhem

This annex is valid from: **26-03-2014** to **01-04-2018** Replaces annex dated: **26-10-2012**

No.	Material or product	Type of activity	Internal reference number
		Arresters	
14	Surge arresters	Pressure-relief tests	IEC 60099-1 IEC 60099-4 IEEE Std C62.11
		Fuses	
15	High-voltage A.C. switch-fuse combinations	Making and breaking tests Tests on the mechanism	IEC 62271-105 IEEE Std C37.41 IEEE Std C37.74
16	High-voltage A.C. fuses	Breaking tests	NEN-EN-IEC 60282-1 IEC 60282-2 IEC 60549 NEN-EN-IEC 60644 STL Guide to IEC 60282-1 STL Guide to IEC 60282-2 IEEE Std C37.41 ANSI C37.44
		Cables/Networks	
17	Equipment for networks for transmission and distribution of electrical power	Test as mentioned above (1-16)	In accordance with or equivalent to the reference methods as mentioned above (1-16).

ВЯРНО С ОРИГИНАЛА

стр. II/32

RAAD VOOR ACCREDITATIE

Dutch Accreditation Council RvA
PO Box 2768 NL-3500 GT Utrecht

The Dutch Accreditation Council RvA, by law appointed as the national accreditation body for The Netherlands, hereby declares that accreditation has been granted to:

KEMA Nederland B.V.
High-Voltage Laboratory
Arnhem

The organisation has demonstrated to be able to generate technical valid results in a competent way and work according to a management system.

This accreditation is based on an assessment against the requirements as laid down in ISO/IEC 17025:2005.

The accreditation covers the activities as specified in the authorized annex bearing the registration number.

The accreditation is valid provided that the organisation continues to meet the requirements.

The accreditation with registration number:

L 218

is granted on 26 March 2014

This declaration is valid until

1 April 2018

The accreditation has been granted for the first time on

17 November 1994

ВЯРНО С ОРИГИНАЛА

The Chief Executive

Ir. J.C. van der Poel

Сер. II. 133

RAAD

Холандски Акредитационен Съвет, П.К 2768, НЛ-3500, ЖТ Утрехт

Холандски Акредитационния съвет RVA B, по закон назначен за национален орган по акредитация за Холандия, декларираме, че акредитацията е предоставена на:

KEMA Холандия B.V.

Инспекция на услугите Arnhem

Посочената Организация е демонстрирала че може да извършва изпитания от клас А Инспекционно тяло, в един компетентен, последователен и независим начин.

Тази акредитация е базирана на оценяване съгласно изискванията на и описани в ISO/IEC 17020:1998

Акредитацията покрива всички дейности специфицирани в оторизиран анекс носещ регистрационния номер .

The accreditation is valid provided that the organisation continues to meet the requirements.

Акредитацията е с регистрационен номер

I 049

Даден на 26 Март 2014

Тази декларация е валидна до

1 Април 2018

Тази акредитация е дадена за първи път на

17 Ноември 1994

The Chief Executive

Ir. J.C. vander Poel Изпълнителен директор – Ир Ж.С Ван дер Поел

Сдп. II. 134

Annex to ISO/IEC 17025:2005 declaration of accreditation for registration number: **L 218**

RAAD VOOR ACCREDITATIE

of **KEMA Nederland B.V.**
High-Voltage Laboratory
Arnhem

This annex is valid from: **26-03-2014** to **01-04-2018**

Replaces annex dated: **26-10-2011**

No.	Material or product	Type of activity	Internal reference number
1	Coils and/or windings of rotating electrical machines	AC voltage test Lightning impulse voltage test	IEC 60034
2	Power transformers	AC voltage test Lightning impulse voltage test Temperature-rise test Capacitance and tan δ measurement Power measurement DC resistance measurement Temperature measurement Sound level measurement R.I.V. measurement Partial discharge measurement SFRA measurement Verification of voltage ratio and phase displacement Low ambient test on dry-type transformer Thermal shock test on dry type transformer Condensation test on dry-type transformer Humidity penetration test on dry-type transformer Inspection of the active part	IEC 60076-1, -2, -3, -10, -11, -13, -15, -16, -18 CISPR 16 STL Guide to IEC 60076 NEN-EN 50464-1 NEN-EN 50541-1 IEEE Std. C57.12.00 IEEE Std. C57.12.90 IEEE Std. C57.12.91
3	AC Metal-enclosed switchgear and controlgear above 1 kV and ≤ 52 kV and prefabricated substations	AC voltage test Lightning impulse voltage test Partial discharge measurement Temperature-rise test Temperature measurement DC resistance measurement Verification of degree of protection R.I.V. measurement	IEC 62271-200 STL Guide to IEC 62271-200 IEC 62271-202 STL Guide to IEC 62271-202 IEEE C37.20.2 IEEE C37.21 ANSI C37.54 ANSI C37.55 IEC 60529

This annex has been approved by:

Ir. J.C. van der Poel
Chief Executive

Annex to ISO/IEC 17025:2005 declaration of accreditation for registration number: **L 218**

RAAD VOOR ACCREDITATIE

of **KEMA Nederland B.V.**
High-Voltage Laboratory
Arnhem

This annex is valid from: **26-03-2014** to **01-04-2018** Replaces annex dated: **26-10-2011**

No.	Material or product	Type of activity	Internal reference number
4	AC Insulation-enclosed switchgear and controlgear above 1 kV and ≤ 52 kV	AC voltage test Lightning impulse voltage test Partial discharge measurement Temperature-rise test Temperature measurement DC resistance measurement Verification of degree of protection R.I.V. measurement	IEC 62271-201 IEC 60529
5	Gas-insulated metal-enclosed switchgear for rated voltages above 52 kV	AC voltage test Lightning impulse voltage test Switching impulse voltage test Partial discharge measurement Temperature-rise test Temperature measurement DC resistance measurement R.I.V. measurement	IEC 62271-203 STL Guide to IEC 60517 IEEE Std C37.122
6	High-voltage AC circuit breakers	AC voltage test Lightning impulse voltage test Switching impulse voltage test Partial discharge measurement Temperature-rise test Temperature measurement DC resistance measurement R.I.V. measurement Test under wet conditions	NEN-EN-IEC 62271-100 STL Guide to IEC 62271-100 IEEE Std C37.09 IEEE Std C37.013 NEN-EN 50152-1
7	High-voltage AC disconnectors and earthing switches	AC voltage test Lightning impulse voltage test Switching impulse voltage test Temperature-rise test Partial discharge measurement DC resistance measurement R.I.V. measurement Test under wet conditions Temperature measurement	IEC 62271-102 STL Guide to IEC 62271-102 IEEE Std C37.34 IEEE Std C37.41
8	High-voltage AC switches	AC voltage test Lightning impulse voltage test Partial discharge measurement Temperature-rise test Temperature measurement DC resistance measurement Verification of degree of protection	NEN-EN-IEC 62271-103 STL Guide to IEC 60265-1 NEN-EN-IEC 62271-104 IEEE Std C37.74 Стр. II. 136

Annex to ISO/IEC 17025:2005 declaration of accreditation for registration number: **L 218**

RAAD VOOR ACCREDITATIE

of **KEMA Nederland B.V.**
High-Voltage Laboratory
Arnhem

This annex is valid from: **26-03-2014** to **01-04-2018** Replaces annex dated: **26-10-2011**

No.	Material or product	Type of activity	Internal reference number
9	High-voltage AC contactors	AC voltage test Lightning impulse voltage test Partial discharge measurement Temperature-rise test Temperature measurement DC resistance measurement Verification of degree of protection	NEN-EN-IEC 62271-106
10	Automatic circuit reclosers and fault interrupters	AC voltage test Lightning impulse voltage test Partial discharge measurement Temperature-rise test Temperature measurement DC resistance measurement Verification of degree of protection	IEC 62271-111/ IEEE Std C37.60
11	Busducts	AC voltage test Lightning impulse voltage test Partial discharge measurement Temperature-rise test Temperature measurement DC resistance measurement Verification of degree of protection	IEEE Std C37.23
12	High-voltage AC switch-fuse combinations and high-voltage AC fuses	AC voltage test Lightning impulse voltage test Partial discharge measurement Temperature-rise test Temperature measurement DC resistance measurement Verification of degree of protection	IEC 62271-105 IEEE Std C37.41 IEEE Std C37.74 NEN-EN-IEC 60282-1 IEC 60282-2 STL Guide to IEC 60282-1 STL Guide to IEC 60282-2

Annex to ISO/IEC 17025:2005 declaration of accreditation for registration number: **L 218**

RAAD VOOR ACCREDITATIE

of **KEMA Nederland B.V.**
High-Voltage Laboratory
Arnhem

This annex is valid from: **26-03-2014** to **01-04-2018** Replaces annex dated: **26-10-2011**

No.	Material or product	Type of activity	Internal reference number
13	Insulators and insulated bushings	AC voltage test	IEC 60137
		Lightning impulse voltage test	IEEE Std C57.19.00
		Partial discharge measurement	IEEE Std C57.19.01
		Test under wet conditions	IEC 60168
		Thermal-mechanical performance test	IEC 60383
		Electro-mechanical failing load test	IEC 60507
		R.I.V. measurement	IEC 60660
		Pollution tests	IEC 61109
		Temperature measurement	IEC 62217
		Visible corona test	ANSI C29.1, -2, -6, -7, -12, -13
		Steep front wave flashover test	
		Porosity test	CAN/CSA C411.1
		Visual and dimensional test	
		Galvanizing test	
		Thermal shock test	
		Thermal cycle test	
		Water absorption test	
		Impact test	
		Test of housing: tracking and erosion tests	
14	Cables	AC voltage test	IEC 60055
		DC voltage test	IEC 60141
		Lightning impulse test	IEC 60502
		Heat cycle voltage test	IEC 60840
		Capacitance and tan δ measurement	IEC 62067
		Partial discharge measurement	NEN-HD 620
		Insulation resistance measurement	NEN-HD 632
		DC resistance measurement	NEN 3619
		Temperature measurement	BS 6622
		Condition test of XLPE cable	BS 7835
		Water penetration test	BS 7870
		Bending test	BS 7912
			BS 7970
15	Cable accessories	AC voltage test	IEC 60502-4
		DC voltage test	IEC 60055
		Lightning impulse voltage test	IEC 60840
		Heat cycle voltage test	IEC 62067
		Temperature measurement	HD 629-1
		Partial discharge measurement	HD 629-2
		Insulation resistance measurement	NEN-HD 632
		Test under wet conditions	IEEE Std 48
		Pollution tests	IEEE Std 404
		R.I.V. measurement	
		Water penetration test	
		Impact test	

ВЕРНО С ОРИГИНАЛА

СД. II. 138

Annex to ISO/IEC 17025:2005 declaration of accreditation for registration number: **L 218**

RAAD VOOR ACCREDITATIE

of **KEMA Nederland B.V.**
High-Voltage Laboratory
Arnhem

This annex is valid from: **26-03-2014** to **01-04-2018** Replaces annex dated: **26-10-2011**

No.	Material or product	Type of activity	Internal reference number
16	Current transformers	AC voltage test Lightning impulse voltage test Switching impulse voltage test Temperature-rise test Capacitance and tan δ measurement Partial discharge measurement Accuracy test Test under wet conditions Temperature measurement Inspection of active part	NEN-EN-IEC 60044-1 NEN-EN-IEC 60044-6 IEC 60044-8
17	Voltage transformers	AC voltage test Lightning impulse voltage test Switching impulse voltage test Temperature-rise test Capacitance and tan δ measurement Partial discharge measurement Temperature measurement Accuracy test Test under wet conditions Leakage test Inspection of active part	IEC 61869-1 IEC 61869-3 IEC 61869-5 IEC 60044-7
18	Capacitors	AC voltage test Lightning impulse voltage test Capacitance and tan δ measurement Temperature measurement Test under wet conditions Thermal stability test Short-circuit discharge test Endurance test Sealing test Self-healing test Destruction test Ageing test	IEC 60358 IEC 60831 IEC 60871
19	Surge arresters	AC voltage test Lightning impulse voltage test Switching impulse voltage test Current impulse test Pollution tests Partial discharge measurement Temperature measurement Ageing test R.I.V. measurement	IEC 60099-4 IEEE Std.C62.11A

Cor II.139

Annex to ISO/IEC 17025:2005 declaration of accreditation for registration number: **L 218**

RAAD VOOR ACCREDITATIE

of **KEMA Nederland B.V.**
High-Voltage Laboratory
Arnhem

This annex is valid from: **26-03-2014** to **01-04-2018** Replaces annex dated: **26-10-2011**

No.	Material or product	Type of activity	Internal reference number
20	Reactors	AC voltage test Lightning impulse voltage test Switching impulse voltage test Temperature-rise test Impedance measurement AC resistance measurement Power measurement DC resistance measurement Temperature measurement Acoustic sound level measurement Verification of voltage ratio and phase displacement check	IEC 60076-6 IEEE Std C57.21
21	Compression and mechanical connectors	Temperature-rise test Temperature measurement DC resistance measurement Mechanical tests	IEC 61238-1
22	Protection relays & substation automation equipment	Functional requirements	IEC 60255-1 IEC 60255-8 IEC 60255-12 IEC 60255-13 IEC 60255-16 IEC 60255-127 IEC 60255-151 IEEE C37.112
		Product safety requirements	IEC 60255-1 IEC 60255-27
		EMC requirements	IEC 60255-1 IEC 60255-26 IEC 60255-22 series IEC 60255-11 IEC 61000-4-2 IEC 61000-4-3 IEC 61000-4-4 IEC 61000-4-5 IEC 61000-4-6 IEC 61000-4-8 IEC 61000-4-9 IEC 61000-4-10 IEC 61000-4-11 IEC 61000-4-16 (only 50 Hz) IEC 61000-4-17 IEC 61000-4-18 IEC 61000-4-29 IEEE C37.90 IEEE C37.90.1 IEEE C37.90.2 IEEE C37.90.3

ВЯРНО С ОРИГИНАЛА

Annex to ISO/IEC 17025:2005 declaration of accreditation for registration number: **L 218**

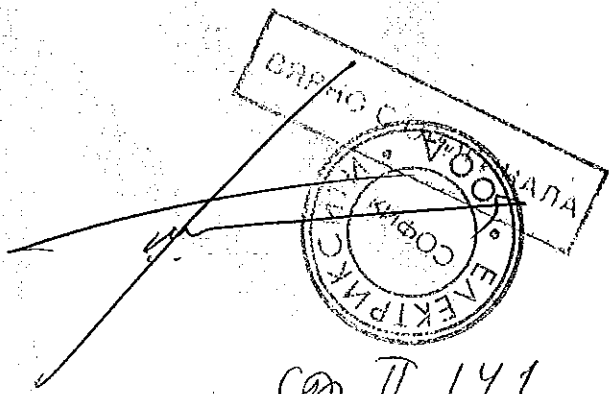
RAAD VOOR ACCREDITATIE

of **KEMA Nederland B.V.**
High-Voltage Laboratory
Arnhem

This annex is valid from: **26-03-2014** to **01-04-2018** Replaces annex dated: **26-10-2011**

No.	Material or product	Type of activity	Internal reference number
	Protection relays & substation automation equipment	Energizing quantities	IEC 60255-1
		Climatic environmental tests	IEC 60255-1 IEC 60068-2-2 tests Bd, Bb IEC 60068-2-1 tests Ad, Ab IEC 60068-2-14 test Nb IEC 60068-2-78 test Cab IEC 60068-2-30 test Db
		Mechanical environmental tests	IEC 60255-1 IEC 60255-21 series
23	Electrical Energy Meters	Tests of - insulation properties, - accuracy requirements, - disturbances of long duration, - electrical requirements, - electromagnetic compatibility, - the effect of climatic environments, - mechanical requirements,	IEC 62052-11 and IEC 62053-11/21/22/23 EN 50470-1/2/3 - Directive 2004/22/EC, annex I, B, F and MI-003

Remark
"in accordance with" is applicable for all standards.



Ср II. 141

KEMA

Report
Отчет

TIC 3181-13

Типови изпитания на 64/110 (123) kV кабелна система

Производител на кабела Estralin HVC LLC, Moscow, Russia

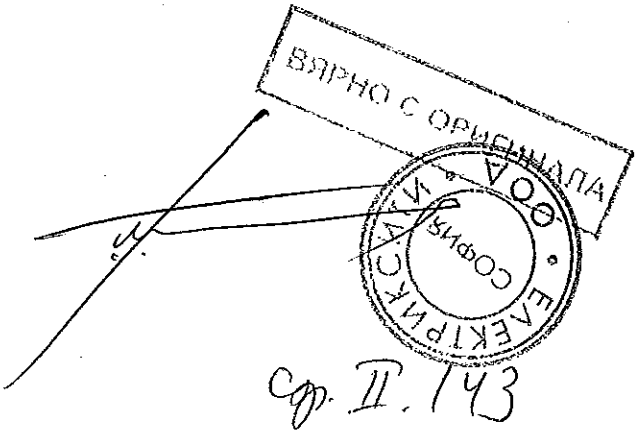
Производител на Аксесоарите ARKASIL SK LLC, Moscow, Russia

ВЯРНО С ОРИГИНАЛА

ООД "ЕЛЕКТРИК СОФИЯ"

Сф. II. 142

Архем, 19 Декември 2013



сф. II. 143

Отчет инспекционен

TIC 3181-13

Списък на типовите изпитания

1. Електрически изпитвания на типа на пълна кабелна система

1.1 Частичен тест разряд при стайна температура

1.2 Tan δ измерване тест

1.3 Частичен тест разряд при стайна температура

1.4 Частичен тест разряд при висока температура

1.5 Тест импулсно напрежение

1.6 Тест при напрежение с промишлена честота

1.7 Тест на кабел с дължина с прилагана метална лента или фолио свързани към обвивката

1.8 Тест на съпротивление на полупроводникови екрани

2.0 Неелектрични типови изпитания за пълна кабелна система и прилежащи компоненти

2.1 Проверка на кабелната констукция

2.2 Тестове за определяне на механичните свойства на изолацията преди и след стареене

2.3 Тестове за определяне на механичните свойства на екранировката преди и след стареене

2.4 Тестове за стареене върху части от цял кабел, за да се провери съвместимостта на материалите тест

2.5 Тест за налягане при висока температура на Обвивката

2.6 Комплексен тест по нагряване на XLPE изолацията

2.7 Измерване на сажди съдържанието на сажди във външната PE обвивка

2.8 Тест за водонепропускливост.

ВЯРНО С ОРИГИНАЛА

ООД • ИНЖ. ЕЛЕКТРИК СОФИЯ

KEMA Nederland B.V.

S.A.M. Verhoeven
Director Testing, Inspections &
Certification The Netherlands
Arnhem, 19 December 2013

KEMA

O: 72130463

1
pn:
s
er

KEMA

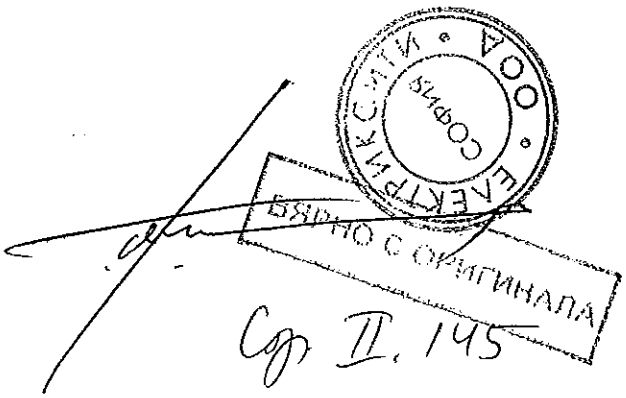
Report

TIC 3181-13

Type tests on a 64/110 (123) kV cable system

Manufacturer cable
Estralin HVC LLC,
Moscow, Russia

Manufacturer accessories
ARKASIL SK LLC,
Moscow, Russia



Arnhem, 19 December 2013

S: EL

KEMA

INSPECTION REPORT

TIC 3181-13

OBJECT	Power cable system consisting of 1-core power cable, 2 terminations, and 1 joint 64/110 (123) kV – 1x2000 mm^2 – Cu – XLPE	
CLIENT	OMACS LLC, Moscow, Russia	
MANUFACTURERS	Cable	Estralin HVC LLC, Moscow, Russia
	Accessory 1	ARKASIL SK LLC, Moscow, Russia
	Accessory 2	ARKASIL SK LLC, Moscow, Russia
	Accessories	See section 1.1.3 Characteristics of the accessories
REFERENCE	72130463	
INSPECTED BY	KEMA Nederland B.V., Arnhem, The Netherlands	
TEST LOCATION	OMACS LLC, Moscow, Russia	
DATE(S) OF TESTS	1 March untill 30 September 2013	
TEST SPECIFICATION	The tests have been carried out based on IEC 60840 (2011).	
SUMMARY AND CONCLUSION	The cable system passed the tests.	

ВЯРНО С ОРИГИНАЛА

PL ■ GC ■ MT ■

This report applies only to the object tested. The responsibility for conformity of any object having the same type references as that tested rests with the manufacturer.

This report consists of 61 pages in total.

KEMA Nederland B.V.

S.A.M. Verhoeven
Director Testing, Inspections & Certification The Netherlands

Arnhem, 19 December 2013

O: 72130463

CONTENTS

Page

1 IDENTIFICATION OF THE OBJECT TESTED

1.1 Ratings/characteristics of the object tested

1.1.1 Characteristics of the cable system

Rated voltage, U_0/U (U_m)	64/110 (123) kV
Rated maximum conductor temperature	90 °C
Rated conductor cross-section	2000 mm^2
Composition of the cable system:	
– Cable	2XS(FL)2Y 1x2000RMS/185-64/110 kV
– Accessory 1	MKB 126
– Accessory 2	MCB 126 X

The test voltages and calculated nominal field stresses were based on U_0 test = 64 kV.

1.1.2 Characteristics of the cable

Standard	IEC 60840, Clause 6
Manufacturer	Estralin HVC LLC, Moscow, Russia
Type	U_0 = 64 kV 1x2000 mm^2 XLPE CABLE
Manufacturing date	2013
Sampling procedure	by the manufacturer
Rated voltage, U_0/U (U_m)	64/110 (123) kV
No. of cores (core identification)	1
Overall diameter (D)	100,7 mm
Calculated nominal electrical stress at conductor screen at U_0 = 64 kV (E_i)	7,09 kV/mm
Calculated nominal electrical stress at insulation screen at U_0 = 64 kV (E_o)	5,28 kV/mm
Nominal capacitance between conductor and metal screen	0,44 µF/km
Embossing on the oversheath	ЭСТРАЛИН ЗВК ПвП2г - 1×2000сгж/185-64/110кВ 2012г + length marking
Construction	see List of drawings

Естралин Високоволтови кабели	
Кратко описание на системата за управление на качеството на Естралин	
Сертификат регистрация №. 44 100 127473	Одит отчет No. 3516 7827 16.10.2015

1. Целта: описание на системата за управление на качеството на Estralin HVC съгласно ISO 9001: 2008 изисквания.
2. Информация за дейността на дружеството:
2.1 Estralin HVC образувана с високо квалифициран екип с дългогодишен опит в кабелната индустрия, което позволи да се създаде широка гама от продукти.
2.2 Основната Company бизнеса е проектирането и производството на кабели за високо напрежение, средно напрежение кабели и проводници.
2.3 Информация за системата за управление на качеството
В обхвата на системата за управление на качеството на Estralin HVC: проектиране и производство на кабели за високо напрежение, средно напрежение кабели и проводници.
Системата за управление на качеството е сертифицирана от 2012 година.
3. Система за управление на качеството
3.1 Обща
Дружеството има разработена, внедрена и поддържа система за управление на качеството, за удължаване за проектиране и производство на кабели за високо напрежение, средно напрежение кабели и проводници, съгласно ISO 9001: 2008 изисквания. Компанията идентифицира 5 процеси на системата за управление на качеството, определя последователността и взаимодействието на тези процеси, критериите за оценка. Схемата на процеса е показана в приложение 1.
3.2 Документация Изисквания
3.2.1 Обща
Документация на системата за управление на качеството включва:
– документирана политика за качество и цели на Дружеството 1;
– документирани цели на отдели в областта на качеството в 2015-2016;
– Ръководство на качеството;
– задължителни документирани процедури:
• ОК-ПР-13-001 "Управление на документация";
• ОК-ПР-13-002 "Процедурата на вътрешни одити";
• ОК-ПР-14-005 "Управление на несъответстващ продукт";
– документира компанията се нуждае от ефективно планиране, процесите на изпълнение и управление;
– записи, изисквани от ISO 9001: 2008.
Обхватът на документацията на системата за управление на качеството отговаря на изискванията на ISO 9001: 2008.
3.2.2 Наръчник по качеството
Компанията разработи и поддържа наръчник по качеството, съдържа:
– обхвата на системата за управление на качеството;
– позоваване на задължителните документирани процедури, установени за системата за управление на качеството;
– обработва схема взаимодействие на системата за управление на качеството.
управление 3.2.3 Документация
Документацията на системата за управление на качеството се управлява в съответствие с процедурата Не ОК-ПР-13-001, в съответствие с изискванията 4.2.3 от ISO 9001: 2008.
управление 3.2.4 Records
Записи за представяне на доказателства за съответствие и на ефективното функциониране на системата за

7

ВЯРНО С ОРИГИНАЛА

Сл. П. 150

управление на качеството се контролират в съответствие с процедурата Не ОК-ПР-13-001, в съответствие с точка 4.2.4 от ISO 9001: 2008.

Сф. II. 151

1. The purpose: description of quality management system of Estralin HVC according to ISO 9001:2008 requirements.

2. Information about the Company:

2.1Estralin HVC formed a highly qualified team with great experience in cable industry, which allowed to create a wide range of products.

2.2The main Company business is the design and manufacturing of high voltage cables, medium voltage cables and wires.

2.3Information about the quality management system

The scope of the quality management system of Estralin HVC: design and manufacturing of high voltage cables, medium voltage cables and wires.

The quality management system is certified since 2012.

3. Quality Management System

3.1 General

The Company developed, implemented and maintains a quality management system, extending to design and manufacture of high voltage cables, medium voltage cables and wires according to ISO 9001:2008 requirements. The company identified 5 processes of the quality management system, determined the sequence and interaction of these processes, the criteria for evaluation. The scheme of process is shown in Annex 1.

3.2 Documentation Requirements

3.2.1 General

Documentation of quality management system includes:

- documented quality policy and objectives of the Company 1;
- documented objectives of departments in the field of quality in the 2015-2016;
- Quality Manual;
- obligatory documented procedures:
  - OK-ПР-13-001 "Documentation management";
  - OK-ПР-13-002 "The procedure of internal audits";
  - OK-ПР-14-005 "Management of nonconforming product";
- documents the company needs for effective planning, implementation and management processes;
- records required by ISO 9001: 2008.

The scope of the quality management system documentation corresponds the requirements of ISO 9001: 2008.

3.2.2 Quality manual .

The Company developed and maintains a quality manual, contains:

- the scope of the quality management system;
- reference to the obligatory documented procedures established for the quality management system;
- processes interaction scheme of the quality management system.

3.2.3 Documentation management

The documentation of quality management system is controlled according to the procedure No OK-ПР-13-001 in accordance with the requirements 4.2.3 of ISO 9001:2008.

3.2.4 Records management

Records for the submission of evidence of compliance and the effective operation of the quality management system are controlled according to the procedure No OK-ПР-13-001 in accordance with 4.2.4 of ISO 9001: 2008.

4. Management responsibility

4.1 Management Commitment

Со-П.152

Top management has committed itself to the development and implementation of quality management system and continually improve its effectiveness. Evidence of acceptance of such liabilities in the clause 5.1 of ISO 9001: 2008.

4.2 Customer focus

Top management provides the definition and implementation of customers' requirements to increase their satisfaction.

4.3 Quality Policy

Quality Policy adopted by the top management of the Company corresponds 5.3 of ISO 9001: 2008.

4.4 Planning

4.4.1 Quality objectives

The company developed the overall quality objectives and targets for departments for 2015-2016.

4.4.2 The planning of the QMS

The development of the QMS is planned in the analysis of the QMS. The Company develops measures to achieve the objectives in the field of quality departments.

4.5 Responsibility, authority and communication

4.5.1 Responsibility and authority

Responsibility and authority of employees established in job descriptions.

4.5.2 Management representative

The Quality manager of the Company is quality management representative and he has responsibility in accordance with the requirements 5.5.2 ISO 9001:2008.

4.5.3 Internal communication

There are established communication processes in the Company, including information relating to the quality management system, through meetings, the Council technical meetings.

4.6 Management review

4.6.1 General

General Manager of the Company reviews quality management system once a year in order to ensure continuing suitability, adequacy and effectiveness according to the procedure No ОК-ПР-13-004.

The analysis results are issued in the report.

4.6.2 Input data for analysis

Inputs to the management review are issued in the form of a report and corresponds the requirements 5.6.2 of ISO 9001: 2008.

4.6.3 Output Analysis

The output from the management review corresponds the requirements 5.6.3 of ISO 9001: 2008.

5. Resources management

5.1 Provision of resources

The Company defined the resources for maintenance of the quality management system and continually improve effectiveness and to increase customer satisfaction through the requirements implementation.

5.2 Human resources

The Company has established requirements for the qualification of staff in job descriptions.
Competence and training of the staff performing work which affects the compliance with the quality of products corresponds the requirements.

Сд-П.153

Responsibility for education records maintaining, training, skills and experience of staff transferred to a third party and controlled in conditions of the contract.

5.3 Infrastructure

The Company has manufacturing and storage facilities, industrial equipment, transport necessary to ensure conformity to product requirements.

The lessor under the terms of the lease agreement provides maintaining the placements in good condition.

Chief mechanic is responsible for maintenance of the equipment.

5.4 Work environment

There are the requirements to the production environment in the Company.

Requirements for production environment are established by internal standards for purity in the production of insulating parts.

The requirements for high-voltage tests corresponds the requirements of the IEC for the high-voltage testing.

6. Product realization

6.1 Planning of product realization

In processes planning according to the procedure No ПР-ПР-16-005 on the stage of approval of the customer application with the Planning engineer is determined the term of the order.

Overall responsibility for production planning responsible Production Director.

6.2 Customer-related processes

6.2.1 Determination of requirements related to the product

The Company defines customer requirements at the stage of application acceptance in accordance with the requirements of the internal procedure ПР-ПР-16-004.

6.2.2 Review of requirements related to the product

The Company reviews the requirements related to the product before the company commitment to supply a product to the customer.

Analysis of customer requirements for products and assessment of their implementation is made by Manager of technology group, Quality Director, Production Director according to the requirements of the procedure No ПР-ПР-16-004.

6.2.3 Customer communication

According to the requirements of the procedure No ОК-ПР-14-005, planning engineers responsible for informing the consumer of all issues during the execution of the order, the analysis of customer feedback, including complaints.

6.3 Design and development

6.3.1 Design and development planning

The Company plans the design and development as a pilot production according to the requirements of the procedure No ТХ-ПР-15-004. The plan of the design and development is approved as the plan for pilot production.

The employee appointed in accordance with the procedure ТХ-ПР-15-004 is responsible for the design and development process.

For the each new project a document «Plan for pilot production» is developed. It contains of the objectives of the project, the technical solution, test plans and certification, project costs and project schedule.

6.3.2 Design and development inputs

Design and development inputs are the description of pilot production that corresponds to the requirements 7.3.2 ISO 9001: 2008.

Ср. II. 154

6.3.3 Design and development outputs

Design and development outputs are report as the results of pilot production appointed in accordance with the procedure ТХ-ПР-15-004.

6.3.4 Design and development review

At suitable stages, the Company performs systematic reviews of design and development to evaluate the ability of the results of design and development to correspond the requirements identify any problems and propose necessary action. After each of stage of the project, the report stage is issuing.

6.3.5 Design and development verification

The Company performs the verification to ensure that the design and development outputs have corresponded the design and development inputs requirements. The Company tests prototypes for compliance to confirm the development of new products are tested with international and national standards. Records of verification results are made in the production report.

6.3.6 Design and development validation

The Company carries out the validation of the project during the prototype testing to ensure that the resulting product corresponds to requirements for the specified application use. As a result of the prototype validation the test report is issuing.

6.3.7 Control of design and development changes

Design and development changes are included in the document "Plan for pilot production". The Company reviews the impact of changes to develop and product already delivered.

6.4 Purchasing

6.4.1 Purchasing process

Procurement and logistics General manager is responsible for the purchasing process.

The procedure of purchasing is described in internal procedure No СЛ-ПР-14-001.

The Company evaluates and selects suppliers according to the requirements of the procedure No СЛ-ПР-14-001.

The Company adopted a list of approved suppliers.

6.4.2 Purchasing information

Purchasing information including the requirements for approval of product, qualification of personnel, quality management system is established in the contract for the purchase or in the specifications to the framework agreement.

6.4.3 Verification of purchased product

The Company carries out the incoming control of the purchased products in accordance with the requirements No ОК-ПР-13-008. Quality department is responsible for input control.

6.5 Production and service provision

6.5.1 Control of production and service provision

Technological guidance and instructions developed for making manufacture products, execution of works on equipment and quality control of products.

The Company plans and produces products under controlled conditions, are achieved by:

- high-qualified staff;
- technical requirements and instructions for products;
- technological and working instructions;
- safety working instructions;
- the necessary equipment and tools for production;
- a positive working environment and microclimate;
- control and measuring tools.

6.5.2 Validation of processes for production and service provision

In the cable manufacture there is carried out the process of extruded insulation. The certification process of extruded insulation according to the requirements of the procedure No ОК-ПР-14-011.

6.5.3 Identification and traceability

The Company identifies products by applying indelible unique identification number for finished products.

During production, the Company provides identification of product status with respect to monitoring and measurement requirements, as evidenced by entries in a route map according to the requirements of the procedure No ПР-ПР-14-002.

The Company provides traceability at all stages of production and post-delivery by means of record keeping in the "Work Journal" in the production process.

6.5.4 Customer property

Cable products owned by the Consumer can be delivered to the Company, for example, for re-testing. To the property of the Consumer can relate, including, containers, tools, materials, equipment, etc.

The consumer property is marked with a special yellow tag with the inscription "the Property of the consumer".

Storage owned by the Consumer shall be in accordance with the internal regulations of the Company. Storage conditions of products shall be determined in accordance with its type.

6.5.5 Preservation of product

For safety of the products during the production process the Company has developed requirements for packaging, handling, transporting and storage.

6.6 Control of monitoring and measuring equipment

The Company provides control of monitoring and measuring equipment with compliance the requirements of procedure ОК-ПР-13-006.

Quality Department is responsible for metrological provision of measuring equipment.

Heads of departments are responsible for the proper use of measurement equipment.

Monitoring and measuring equipment is accounted and periodically calibrated according to the register of measuring equipment. Test equipment is certificated.

Calibration and certification of equipment are provided by accredited organizations.

7. Measurement, analysis and improvement
7.1 General

The Company plans and implements the monitoring, measurement, analysis and improvement processes needed to:

- demonstrate conformity to product requirements;
- ensure conformity of the quality management system;
- continuous improve the effectiveness of the quality management system.

7.2 Monitoring and measurement

7.2.1 Customer satisfaction

The Company carries out monitoring of customer satisfaction by review customer feedback, verbal communication, complaints.

7.2.2 Internal audits

The Company regularly conducts internal audits to determine whether a quality management system:
- conforms to the planned arrangements, to the requirements of ISO 9001: 2008 and the requirements of internal documents;
- effectively implemented and maintained.

Сл. II. 156

The Company conducts internal audits in accordance with the procedure No ОК-ПР-13-002.

The Company develops an annual schedule of internal audits.

Records of the audits carried out in the form of reports.

Heads of departments are responsible for the development and implementation of corrective actions.

7.2.3 Monitoring and measurement of processes

The Company uses the methods of monitoring and measuring quality management system processes to demonstrate the ability of processes to achieve planned results.

The quality manual sets indicators and criterions for each process. Heads of departments carry out continuous monitoring of process indicators, annual results of functioning processes are evaluated in the process of review the quality management system.

7.2.4 Monitoring and measurement of product

The Company monitors and measures the characteristics of the product to verify compliance with the requirements for the product.

Monitoring and measurement of product in the production process is carried out in accordance with instruction No ОК-И-13-003. Operators and Quality department are responsible for monitoring and measurement of product during production.

Routine testing of products are carried out in accordance with the procedure No ОК-ПР-13-012. Quality department is responsible for routine testing.

The results of monitoring and measurement of product during production are recorded in accordance with instruction No ОК-И-13-003.

The results of the routine tests are recorded in the test reports and routing test register.

7.3 Control of nonconforming product

The Company ensures the identification of nonconforming product and its management through the implementation of the procedure requirements No ОК-ПР-14-005.

Records of the nonconformities and subsequent actions are made in the Acts of the nonconformity.

7.4 Analysis of Data

The Company determines, collects and analyzes appropriate data to demonstrate the suitability and effectiveness of the quality management system, as well as the evaluation of areas to improve performance.

The Company analyzes information related to:

- customer satisfaction;
- conformity to product requirements;
- characteristics and trends of processes and products including opportunities for preventive action;
- suppliers.

7.5 Improvement

7.5.1 Continual improvement

The Company demonstrates continuous improvement of the quality management system with policy and quality objectives, audit results, data analysis, corrective and preventive actions and management review.

7.5.2 Corrective actions

The Company takes corrective action to eliminate the causes of nonconformities in order to prevent recurrence in accordance with the procedure No ОК-ПР-14-005.

7.5.3 Preventive action

The Company takes preventive actions to eliminate the causes of potential nonconformities in order to prevent their occurrence in accordance with the procedure No ОК-ПР-14-005.

Con. II. 157

Annex 1 Process scheme