поставя се в комплекта на техническото предложение
ОБРАЗЕЦ

П Р Е Д Л О Ж Е Н И Е

за участие в „открита" по вид процедура за сключване на рамково споразумение с предмет: **„Доставка на вентилни отводи средно напрежение (СрН)", реф. № PPD17-158**

ДО: „ЧЕЗ РАЗПРЕДЕЛЕНИЕ БЪЛГАРИЯ" АД,

ОТ: "ВАК-02" ООД

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УВАЖАЕМИ ГОСПОЖИ И ГОСПОДА,

Предоставяме на Вашето внимание предложението ни за изпълнение на обществена поръчка с реф. **PPD17-158** и предмет:**„Доставка на вентилни отводи средно напрежение (СрН)",**

1. Запознат съм и приемам изискванията на Възложителя, като представям техническите спецификации от раздел II на документацията за участие с попълнени всички изисквани стойности за всички позиции от предмета на поръчката и изискванията, описани в рамковото споразумение и приложенията към него.
2. Представям всички изисквани данни и документи, посочени в Приложение 2 от настоящото техническо предложение. Запознат съм с изискването, че представените документи трябва да бъдат на български език или с превод на български език, придружени с оригиналните документи, с изключение на протоколите от типовите изпитвания, които могат да се представят и само на английски език.
3. Запознат съм, че представените от нас технически документи (протоколи от изпитания, каталози и др.) са доказателство за декларираните от мен технически данни и параметри в техническите спецификации на стоката.
4. Потвърждавам, че представяните от нас стоки, описани в Техническото ни предложение, ще отговарят на посочените от Възложителя стандарти или на еквивалентни. В случай, че даден материал отговаря на стандарт, еквивалентен на посочения, се задължаваме да го отразим в отделен документ и да представим доказателства за еквивалентността на двата стандарта.
5. Всички стойности, попълнени в колона **„Гарантирано предложение"** на приложените таблици от Технически спецификации от раздел II от документацията за участие, са точни и истински.
6. Предлагам следният гаранционен срок за предлаганите стоки – 24 месеца / *не по-малко от 24 месеца* /, от датата на приемо - предавателен протокол за получаване на стоката от Възложителя.
7. Запознат съм, че видовете стоки и прогнозните количества за доставка ще бъдат посочени от Възложителя при провеждане на вътрешен конкурентен избор.

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8. Приемам количества със срокове за доставка на стоката, съгласно Приложение 3 към настоящото Техническо предложение.
9. Приемам, че в срок до _____ *(не повече от 14 дни)* от датата на подписване на рамково споразумение с Възложителя, ще сключа договор с посоченият/те в офертата подизпълнител/и (*попълва се, ако участникът е декларирал, че ще използва подизпълнител/и*).
10. Запознат съм, че при последваща обществена поръчка чрез вътрешен конкурентен избор за сключване на конкретен договор, изборът на изпълнител при определяне на икономически най-изгодната оферта ще бъде направен по критерий „най-ниска цена".
11. Запознат съм, че максималният срок за изпълнение на конкретен договор ще бъде определен от Възложителя в поканата за участие при последващата обществена поръчка чрез вътрешен конкурентен избор.

Приложения към настоящото техническо предложение:

1. *Технически изисквания и спецификации за изпълнение на поръчката – раздел IV от документацията за участие – попълнени на съответните места;*
2. *Изисквани документи от Технически изисквания и спецификации;*
3. *Срокове за доставка.*

Дата 02.04.2018 г.

ПОДПИС и ПЕЧАТ:

на основание чл. 2 от ЗЗЛД

Ивайло Конярски
Управител

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II. ТЕХНИЧЕСКИ СПЕЦИФИКАЦИИ И ИЗИСКВАНИЯ НА ВЪЗЛОЖИТЕЛЯ ЗА ИЗПЪЛНЕНИЕ НА ПОРЪЧКАТА

Наименование на материала: Вентилен отвод метало-оксиден тип без искрови разрядници, 10 kV, 10 kA, клас 2

Съкратено наименование на материала (40 знака): Вентилен отвод ZnO, 10 kV / 10 кА / клас 2

Област: В – Въздушни електропроводни линии СрН
Н – Трансформаторни постове

Категория: 20 – Защита от пренапрежения

Мерна единица: Брой

Аварийни запаси: Да

Характеристика на материала:

Метало-оксиден (ZnO) вентилен отвод без искрови разрядници, за монтиране на закрито и открито, с трайно работно напрежение min 10,8 kV, с номинален разряден ток 10 kA, с разряден клас на линията 2, с полимерна изолационната обвивка, с принадлежности (аксесоари) за свързване между тоководещи части и земя. Конфигурацията на стрехите на полимерната изолационна обвивка съответстват на изискванията на IEC/TS 60815-3.

Използване:

Вентилният отвод е предназначен за използване в електроразпределителни мрежи с номинално напрежение 10 kV с изолирана неутрала, със заземена през дъгогасителна бобина неутрала, със заземена през активно съпротивление неутрала или с комбинирано заземяване на неутралата през дъгогасителна бобина и активно съпротивление.

Съответствие на предлаганото изделие със стандартизационните документи:

Вентилният отвод трябва да отговаря на приложимите български и международни стандарти, включително на посочените по-долу и на техните валидни изменения и поправки или еквиваленти:

- БДС EN 60099-4:2014 „Вентилни отводи. Част 4: Металооксидни вентилни отводи без разрядници за електрически системи за променливо напрежение (IEC 60099-4:2014)"; и
- IEC/TS 60815-3:2008 „Selection and dimensioning of high-voltage insulators intended for use in polluted conditions – Part 3: Polymer insulators for a.c. systems".

Изисквания към документацията и изпитванията:

№ по ред	Наименование	Приложение № (или текст)
1.	Точно обозначение на типа, производителя и страна на произход	№ 2.1 (тип: AZC_15_ /AZC150)
2.	Техническо описание, гарантирани параметри, волт-секундна характеристика, използвани материали и принадлежности (аксесоари)	№ 2.1
3.	Чертежи с размери и надлъжен разрез	№ 2.2

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№ по ред	Наименование	Приложение № (или текст)
4.	Протоколи от типови изпитвания на английски или български език, проведени от независима изпитвателна лаборатория – заверени копия, с приложен списък на отделните изпитвания на български език	№ 2.3
5.	Сертификат/акредитация на независимата изпитвателна лаборатория, провела типовите изпитвания по т. 4 – заверено копие	№ 2.4
6.	Изисквания за транспортиране и манипулиране	№ 2.5
7.	Инструкции за монтиране и за експлоатация и обслужване	№ 2.5
8.	Експлоатационна дълготрайност, год.	№ 2.6 (20 год.)

Забележка: Всички оригинални документи трябва да бъдат на български език или с превод на български език. Каталозите и изпитвателните протоколи могат да бъдат и само на английски език.

Технически данни:

1. Характеристики на работната среда

№ по ред	Характеристика	Стойност
1.1	Място на монтиране	На открито/закрито
1.2	Максимална околна температура	+ 40°C
1.3	Минимална околна температура	Минус 25°C
1.4	Относителна влажност	До 100 %
1.5	Надморска височина	До 1000 m
1.6	Други работни условия	Съгласно т. 5.4.1 от БДС EN 60099-4

2. Параметри на електроразпределителната мрежа

№ по ред	Параметър	Стойност
2.1	Номинално напрежение	10 000 V
2.2	Най-високо напрежение на съоръженията	12 000 V
2.3	Най-високо напрежение на системата	10 800 V
2.4	Номинална честота	50 Hz
2.5	Брой на фазите	3

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2.6	Заземяване на звездния център	• През дъгогасителна бобина; • изолиран звезден център; • през активно съпротивление; или • през дъгогасителна бобина комбинирана с активно съпротивление.
2.7	Максимална стойност на временните пренапрежения (при земно съединение) / максимална продължителност на временните пренапрежения:	-
2.7a	заземяване през дъгогасителна бобина; или изолиран звезден център	11,8 kV/2 часа
2.7b	заземяване през активно съпротивление; или през дъгогасителна бобина комбинирана с активно съпротивление	10,8 kV/3 s
2.8	Изолационно ниво:	-
2.8a	Обявено издържано мълниево импулсно напрежение (върхова стойност)	75 kV
2.8b	Обявено краткотрайно (1 min) издържано напрежение с промишлена честота (50 Hz) (ефективна стойност)	28 kV
2.9	Ток на късо съединение в мястото на монтиране на вентилния отвод - максимален ток при трифазно късо съединение	15 kA

3. Свързване в системата и защитавани съоръжения

№ по ред	Наименование	Изискване
3.1	Свързване в системата	Между фаза и земя
3.2	Защитавани съоръжения	• Разпределителни трансформатори 10/0,4 kV, свързани директно към въздушна електропроводна линия (ВЛ) или чрез присъединена към ВЛ кабелна линия; • кабелни линии 10 kV; • входове на разпределителните уредби; • КРУ в елегазова изолационна среда (GIS)

4. Технически характеристики

№ по ред	Характеристика	Изискване	Гарантирано предложение
4.1	Обявено издържано напрежение при атмосферни пренапрежения 1,2/50 μs	min 75 kV	120 kV
4.2	Обявено издържано 1 min напрежение с промишлена честота 50 Hz при мокра изолация	min 28 kV	46 kV

4.3	Ниво на частичните разряди при 1,05 U_c	max 10 pC	10 pC
4.4	Материал, от който е изработено нелинейното съпротивление (варистора)	ZnO	ZnO
4.5	Материал, от който е изработена изолационната обвивка	Полимер	Полимер - Силиконов каучук
4.6	Материал, от който са изработени принадлежностите (аксесоарите)	Неръждаема стомана	Неръждаема стомана
4.7	Якост на опън	min 1 kN	1 kN
4.8	Якост на усукване	min 50 Nm	50 Nm
4.9	Якост на огъване	min 200 Nm	250 Nm

5. Принадлежности (аксесоари)

№ по ред	Наименование	Изискване	Гарантирано предложение
5.1	Аксесоари за присъединяване на вентилния отвод към тоководещи части и към заземителния контур	Резбови съединения (шпилки) с резба М12, съоръжени съответно с две гайки и две подложни шайби и средства срещу самоотвиване	Резбови съединения (шпилки) с резба М12, съоръжени съответно с две гайки и две подложни шайби и средства срещу самоотвиване
5.2	Възможност на резбовите съединения за присъединяване на две кабелни обувки	Да	Да

6. Технически параметри

№ по ред	Параметър	Изискване	Гарантирано предложение
6.1	Трайно работно напрежение, U_C	min 10,8 kV	12,7 kV
6.2	Обявено напрежение, U_r	min 13,5 kV	15 kV
6.3	Номинален разряден ток, I_n (8/20 μs)	10 kA	10 kA
6.4	Силнотоков импулс (4/10 μs)	100 kA	100 kA
6.5	Разряден клас на линията	2	2
6.6	Устойчивост на ток на късо съединение	min 20 kA/0,2 s	20 kA/0,2 s
6.7	Остатъчно напрежение при номинален разряден ток I_n, U_{res}	max 42 kV	42 kV
6.8	Устойчивост на продължителен токов импулс	min 250 A/2000 μs	500 A/2000 μs

6.9	Стойност на временните пренапрежения съгласно приложение D на БДС EN 60099-4:	-	-
6.9a	с продължителност 3 s	min 14 kV	15 kV
6.9b	с продължителност 100 s	min 13 kV	14 kV
6.9c	с продължителност 7200 s	min 11,8 kV	12,5 kV
6.10	Изолационно разстояние по повърхността	min 370 mm	555 mm
6.11	Височина без аксесоарите за присъединяване	max 350 mm	231 mm
6.12	Тегло, kg	Да се посочи	1,8 kg

Наименование на материала: Вентилен отвод метало-оксиден тип без искрови разрядници, 20 kV, 10 kA, клас 1

Съкратено наименование на материала: Вентилен отвод ZnO, 20 kV / 10 кА / клас 1

Област: В – Въздушни електропроводни линии СрН
Н – Трансформаторни постове

Категория: 20 – Защита от пренапрежения

Мерна единица: Брой

Аварийни запаси: Да

Характеристика на материала:

Метало-оксиден (ZnO) вентилен отвод без искрови разрядници, за монтиране на закрито и открито, с трайно работно напрежение min 21,6 kV, с номинален разряден ток 10 kA, с разряден клас на линията 1, с полимерна изолационната обвивка, с принадлежности (аксесоари) за свързване между тоководещи части и земя. Конфигурацията на стрехите на полимерната изолационна обвивка съответстват на изискванията на IEC/TS 60815-3.

Използване:

Вентилният отвод е предназначен за използване в електроразпределителни мрежи с номинално напрежение 10 kV с изолирана неутрала, със заземена през дъгогасителна бобина неутрала, със заземена през активно съпротивление неутрала или с комбинирано заземяване на неутралата през дъгогасителна бобина и активно съпротивление в райони с интензивност на мълниеносната дейност до 100 часа годишно.

Съответствие на предлаганото изделие със стандартизационните документи:

Вентилният отвод трябва да отговаря на приложимите български и международни стандарти, включително на посочените по-долу и на техните валидни изменения и поправки или еквиваленти:

- БДС EN 60099-4:2014 „Вентилни отводи. Част 4: Металооксидни вентилни отводи без разрядници за електрически системи за променливо напрежение (IEC 60099-4:2014)"; и
- IEC/TS 60815-3:2008 „Selection and dimensioning of high-voltage insulators intended for use in polluted conditions – Part 3: Polymer insulators for a.c. systems".

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Изисквания към документацията и изпитванията:

№ по ред	Наименование	Приложение № (или текст)
1.	Точно обозначение на типа, производителя и страна на произход	№ 2.1 (тип:AZBD_27_ /AZBD270)
2.	Техническо описание, гарантирани параметри, волт-секундна характеристика, използвани материали и принадлежности (аксесоари)	№ 2.1
3.	Чертежи с размери и надлъжен разрез	№ 2.2
4.	Протоколи от типови изпитвания на английски или български език, проведени от независима изпитвателна лаборатория – заверени копия, с приложен списък на отделните изпитвания на български език	№ 2.3
5.	Сертификат/акредитация на независимата изпитвателна лаборатория, провела типовите изпитвания по т. 4 – заверено копие	№ 2.4
6.	Изисквания за транспортиране и манипулиране	№ 2.5
7.	Инструкции за монтиране и за експлоатация и обслужване	№ 2.5
8.	Експлоатационна дълготрайност, год.	№ 2.6 (20 год.)

Забележка: Всички оригинални документи трябва да бъдат на български език или с превод на български език. Каталозите и изпитвателните протоколи могат да бъдат и само на английски език.

Технически данни:

1. Характеристики на работната среда

№ по ред	Характеристика	Стойност
1.1	Място на монтиране	На открито/закрито
1.2	Максимална околна температура	+ 40°C
1.3	Минимална околна температура	Минус 25°C
1.4	Относителна влажност	До 100 %
1.5	Надморска височина	До 1000 m
1.6	Интензивност на мълниеносната дейност	До 100 часа годишно
1.7	Други работни условия	Съгласно т. 5.4.1 от БДС EN 60099-4

2. Параметри на електроразпределителната мрежа

№ по ред	Параметър	Стойност
2.1	Номинално напрежение	20 000 V
2.2	Най-високо напрежение на съоръженията	24 000 V
2.3	Най-високо напрежение на системата	21 600 V
2.4	Номинална честота	50 Hz
2.5	Брой на фазите	3
2.6	Заземяване на звездния център	• През дъгогасителна бобина; • изолиран звезден център; • през активно съпротивление; или • през дъгогасителна бобина комбинирана с активно съпротивление.
2.7	Максимална стойност на временните пренапрежения (при земно съединение) / максимална продължителност на временните пренапрежения:	-
2.7a	заземяване през дъгогасителна бобина; или изолиран звезден център	23,7 kV/2 часа
2.7b	заземяване през активно съпротивление; или през дъгогасителна бобина комбинирана с активно съпротивление	21,6 kV/3 s
2.8	Изолационно ниво:	-
2.8a	Обявено издържано мълниево импулсно напрежение (върхова стойност)	125 kV
2.8b	Обявено краткотрайно (1 min) издържано напрежение с промишлена честота (50 Hz) (ефективна стойност)	50 kV
2.9	Ток на късо съединение в мястото на монтиране на вентилния отвод - максимален ток при трифазно късо съединение	15 kA

3. Свързване в системата и защитавани съоръжения

№ по ред	Наименование	Изискване
3.1	Свързване в системата	Между фаза и земя
3.2	Защитавани съоръжения	• Разпределителни трансформатори 20/0,4 kV, свързани директно към въздушна електропроводна линия (ВЛ) или чрез присъединена към ВЛ кабелна линия; • кабелни линии 20 kV;

		• входове на разпределителните уредби; • КРУ в елегазова изолационна среда (GIS)

4. Технически характеристики

№ по ред	Характеристика	Изискване	Гарантирано предложение
4.1	Обявено издържано напрежение при атмосферни пренапрежения 1,2/50 μs	min 125 kV	150 kV
4.2	Обявено издържано 1 min напрежение с промишлена честота 50 Hz при мокра изолация	min 50 kV	56 kV
4.3	Ниво на частичните разряди при 1,05 U_c	max 10 pC	10 pC
4.4	Материал, от който е изработено нелинейното съпротивление (варистора)	ZnO	ZnO
4.5	Материал, от който е изработена изолационната обвивка	Полимер	Полимер - Силиконов каучук
4.6	Материал, от който са изработени принадлежностите (аксесоарите)	Неръждаема стомана	Неръждаема стомана
4.7	Якост на опън	min 1 kN	15 kN
4.8	Якост на усукване	min 50 Nm	70 Nm
4.9	Якост на огъване	min 200 Nm	350 Nm

5. Принадлежности (аксесоари)

№ по ред	Наименование	Изискване	Гарантирано предложение
5.1	Аксесоари за присъединяване на вентилния отвод към тоководещи части и към заземителния контур	Резбови съединения (шпилки) с резба M12, съоръжени съответно с две гайки и две подложни шайби и средства срещу самоотвиване	Резбови съединения (шпилки) с резба M12, съоръжени съответно с две гайки и две подложни шайби и средства срещу самоотвиване
5.2	Възможност на резбовите съединения за присъединяване на две кабелни обувки	Да	Да

6. Технически параметри

№ по ред	Параметър	Изискване	Гарантирано предложение
6.1	Трайно работно напрежение, U_C	min 21,6 kV	22 kV
6.2	Обявено напрежение, U_r	min 27 kV	27 kV
6.3	Номинален разряден ток, I_n (8/20 μs)	10 kA	10 kA
6.4	Силнотоков импулс (4/10 μs)	100 kA	100 kA
6.5	Разряден клас на линията	1	1
6.6	Устойчивост на ток на късо съединение	min 20 kA/0,2 s	20 kA/0,2 s
6.7	Остатъчно напрежение при номинален разряден ток I_n, U_{res}	max 80 kV	76,6 kV
6.8	Устойчивост на продължителен токов импулс	min 250 A/2000 μs	250 A/2000 μs
6.9	Стойност на временните пренапрежения съгласно приложение D на БДС EN 60099-4:	-	-
6.9a	с продължителност 3 s	min 28 kV	31 kV
6.9b	с продължителност 100 s	min 25 kV	25,3 kV
6.9c	с продължителност 7200 s	min 23,7 kV	24 kV
6.10	Изолационно разстояние по повърхността	min 540 mm	750 mm
6.11	Височина без аксесоарите за присъединяване	max 350 mm	270 mm
6.12	Тегло, kg	Да се посочи	2,7 kg

Наименование на материала: Вентилен отвод метало-оксиден тип без искрови разрядници, 20 kV, 10 kA, клас 2

Съкратено наименование на материала: Вентилен отвод ZnO, 20 kV / 10 kA / клас 2

Област: В – Въздушни електропроводни линии СрН
Н – Трансформаторни постове

Категория: 20 – Защита от пренапрежения

Мерна единица: Брой

Аварийни запаси: Да

Характеристика на материала:

Метало-оксиден (ZnO) вентилен отвод без искрови разрядници, за монтиране на закрито и открито, с трайно работно напрежение min 21,6 kV, с номинален разряден ток 10 kA, с разряден клас на линията 2, с полимерна изолационната обвивка, с принадлежности (аксесоари) за свързване между тоководещи части и земя. Конфигурацията на стрехите на полимерната изолационна обвивка съответстват на изискванията на IEC/TS 60815-3.

Използване:

Вентилният отвод е предназначен за използване в електроразпределителни мрежи с номинално напрежение 20 kV с изолирана неутрала, със заземена през дъгогасителна бобина неутрала, със заземена през активно съпротивление неутрала или с комбинирано заземяване на неутралата през

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дъгогасителна бобина и активно съпротивление в райони с интензивност на мълниеносната дейност над 100 часа годишно или с преобладаващ брой потребители с повишени изисквания за осигуреност на електроснабдяването.

Съответствие на предлаганото изделие със стандартизационните документи:

Вентилният отвод трябва да отговаря на приложимите български и международни стандарти, включително на посочените по-долу и на техните валидни изменения и поправки или еквиваленти:

- БДС EN 60099-4:2014 „Вентилни отводи. Част 4: Металооксидни вентилни отводи без разрядници за електрически системи за променливо напрежение (IEC 60099-4:2014) "; и
- IEC/TS 60815-3:2008 „Selection and dimensioning of high-voltage insulators intended for use in polluted conditions – Part 3: Polymer insulators for a.c. systems".

Изисквания към документацията и изпитванията:

№ по ред	Наименование	Приложение № (или текст)
1.	Точно обозначение на типа, производителя и страна на произход	№ 2.1 (тип: AZC_27_ /AZC270)
2.	Техническо описание, гарантирани параметри, волт-секундна характеристика, използвани материали и принадлежности (аксесоари)	№ 2.1
3.	Чертежи с размери и надлъжен разрез	№ 2.2
4.	Протоколи от типови изпитвания на английски или български език, проведени от независима изпитвателна лаборатория – заверени копия, с приложен списък на отделните изпитвания на български език	№ 2.3
5.	Сертификат/акредитация на независимата изпитвателна лаборатория, провела типовите изпитвания по т. 4 – заверено копие	№ 2.4
6.	Изисквания за транспортиране и манипулиране	№ 2.5
7.	Инструкции за монтиране и за експлоатация и обслужване	№ 2.5
8.	Експлоатационна дълготрайност, год.	№ 2.6 (20 год.)

Забележка: Всички оригинални документи трябва да бъдат на български език или с превод на български език. Каталозите и изпитвателните протоколи могат да бъдат и само на английски език.

Технически данни:

1. Характеристики на работната среда

№ по ред	Характеристика	Стойност
1.1	Място на монтиране	На открито/закрито

1.2	Максимална околна температура	+ 40°C
1.3	Минимална околна температура	Минус 25°C
1.4	Относителна влажност	До 100 %
1.5	Надморска височина	До 1000 m
1.6	Интензивност на мълниеносната дейност	Над 100 часа годишно
1.7	Други работни условия	Съгласно т. 5.4.1 от БДС EN 60099-4

2. Параметри на електроразпределителната мрежа

№ по ред	Параметър	Стойност
2.1	Номинално напрежение	20 000 V
2.2	Най-високо напрежение на съоръженията	24 000 V
2.3	Най-високо напрежение на системата	21 600 V
2.4	Номинална честота	50 Hz
2.5	Брой на фазите	3
2.6	Заземяване на звездния център	• През дъгогасителна бобина; • изолиран звезден център; • през активно съпротивление; или • през дъгогасителна бобина комбинирана с активно съпротивление.
2.7	Максимална стойност на временните пренапрежения (при земно съединение) / максимална продължителност на временните пренапрежения:	-
2.7a	заземяване през дъгогасителна бобина; или изолиран звезден център	23,7 kV/2 часа
2.7b	заземяване през активно съпротивление; или през дъгогасителна бобина комбинирана с активно съпротивление	21,6 kV/3 s
2.8	Изолационно ниво:	-
2.8a	Обявено издържано мълниево импулсно напрежение (върхова стойност)	125 kV
2.8b	Обявено краткотрайно (1 min) издържано напрежение с промишлена честота (50 Hz) (ефективна стойност)	50 kV
2.9	Ток на късо съединение в мястото на монтиране на вентилния отвод - максимален ток при трифазно късо съединение	15 kA

3. Свързване в системата и защитавани съоръжения

№ по ред	Наименование	Изискване
3.1	Свързване в системата	Между фаза и земя
3.2	Защитавани съоръжения	• Разпределителни трансформатори 20/0,4 kV, свързани директно към въздушна електропроводна линия (ВЛ) или чрез присъединена към ВЛ кабелна линия; • кабелни линии 20 kV; • входове на разпределителните уредби; • КРУ в елегазова изолационна среда (GIS)

4. Технически характеристики

№ по ред	Характеристика	Изискване	Гарантирано предложение
4.1	Обявено издържано напрежение при атмосферни пренапрежения 1,2/50 μs	min 125 kV	150 kV
4.2	Обявено издържано 1 min напрежение с промишлена честота 50 Hz при мокра изолация	min 50 kV	56 kV
4.3	Ниво на частичните разряди при 1,05 U_c	max 10 pC	10 pC
4.4	Материал, от който е изработено нелинейното съпротивление (варистор)	ZnO	ZnO
4.5	Материал, от който е изработена изолационната обвивка	Полимер	Полимер - Силиконов каучук
4.6	Материал, от който са изработени принадлежностите (аксесоарите)	Неръждаема стомана	Неръждаема стомана
4.7	Якост на опън	min 1 kN	1 kN
4.8	Якост на усукване	min 50 Nm	50 Nm
4.9	Якост на огъване	min 200 Nm	250 Nm

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5. Принадлежности (аксесоари)

№ по ред	Наименование	Изискване	Гарантирано предложение
5.1	Аксесоари за присъединяване на вентилния отвод към тоководещи части и към заземителния контур	Резбови съединения (шпилки) с резба М12, съоръжени съответно с две гайки и две подложни шайби и средства срещу самоотвиване	Резбови съединения (шпилки) с резба М12, съоръжени съответно с две гайки и две подложни шайби и средства срещу самоотвиване
5.2	Възможност на резбовите съединения за присъединяване на две кабелни обувки	Да	Да

6. Технически параметри

№ по ред	Параметър	Изискване	Гарантирано предложение
6.1	Трайно работно напрежение, U_C	min 21,6 kV	22 kV
6.2	Обявено напрежение, U_r	min 27 kV	27 kV
6.3	Номинален разряден ток, I_n (8/20 μs)	10 kA	10 kA
6.4	Силнотоков импулс (4/10 μs)	100 kA	100 kA
6.5	Разряден клас на линията	2	2
6.6	Устойчивост на ток на късо съединение	min 20 kA/0,2 s	20 kA/0,2 s
6.7	Остатъчно напрежение при номинален разряден ток I_n, U_{res}	max 75 kV	75 kV
6.8	Устойчивост на продължителен токов импулс	min 250 A/2000 μs	500 A/2000 μs
6.9	Стойност на временните пренапрежения съгласно приложение D на БДС EN 60099-4:	-	-
6.9a	с продължителност 3 s	min 28 kV	28,5 kV
6.9b	с продължителност 100 s	min 26 kV	26 kV
6.9c	с продължителност 7200 s	min 23,7 kV	23,7 kV
6.10	Изолационно разстояние по повърхността	min 540 mm	760 mm
6.11	Височина без аксесоарите за присъединяване	max 425 mm	276 mm
6.12	Тегло, kg	Да се посочи	2,7 kg

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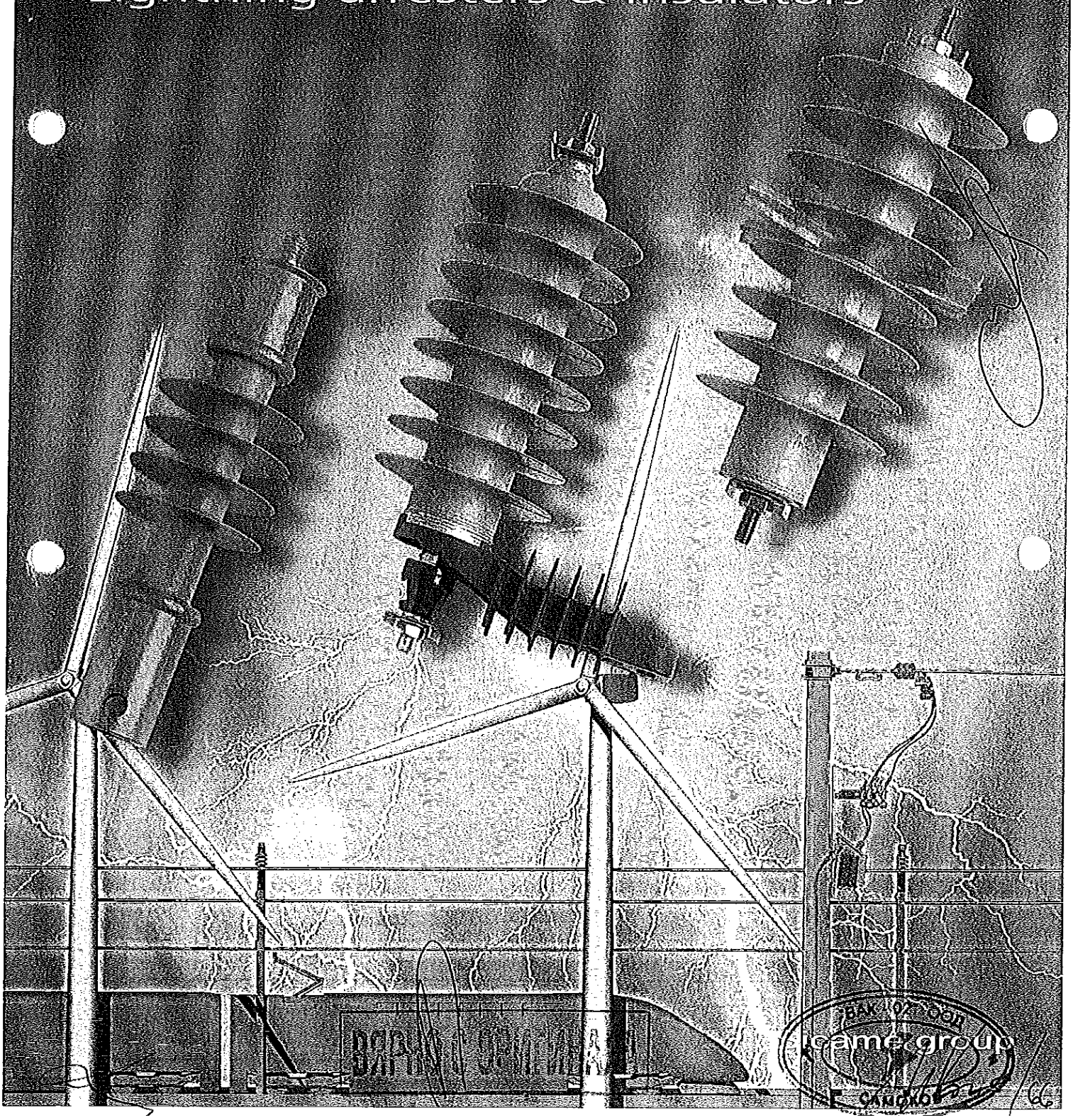
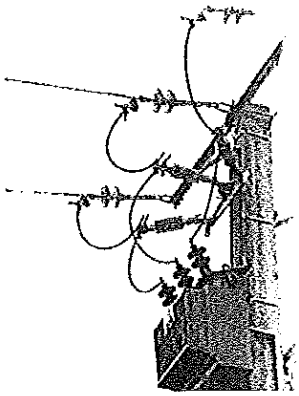
Приложение 21

Dervasil

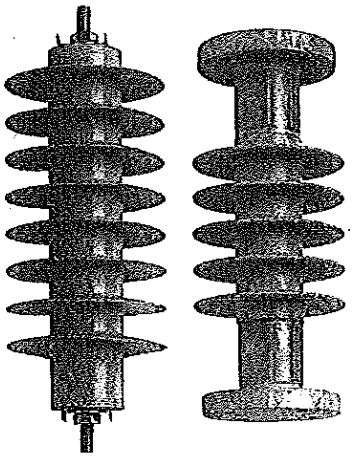
Medium voltage networks
Lightning arresters & Insulators





Our experience

With 20 years know-how in the field of Medium Voltage network protection, DERVASIL designs and manufactures lightning arresters with zinc oxide varistors and synthetic housings.

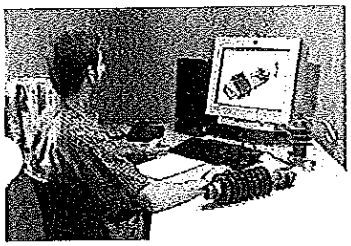


Our products

DERVASIL offers:

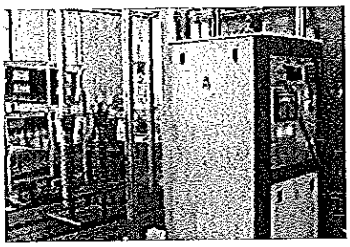
›› A range of latest generation arresters:
5 kA or 10 kA arresters with fault indicator or disconnector.
Arresters for power follow current breaking.
D.C. voltage arresters.
DERVASIL arresters do not have internal spark gaps. They exhibit stable characteristics, with practically constant, very short response times (30 to 50 ns), and better behaviour under pollution.
Direct injection of Silicone Rubber ensures both absolute sealing, exceptional resistance to pollution and excellent behaviour without explosion in case of short-circuit
They have been tested in accordance with the latest version of IEC Standard 60099-4.

›› New range of composite insulators: suspension insulators, tension insulators and support insulators.



Our R & D department

DERVASIL has comprehensive calculation and testing equipment for the design of lightning arresters. Our facilities are available to customers for specific applications.



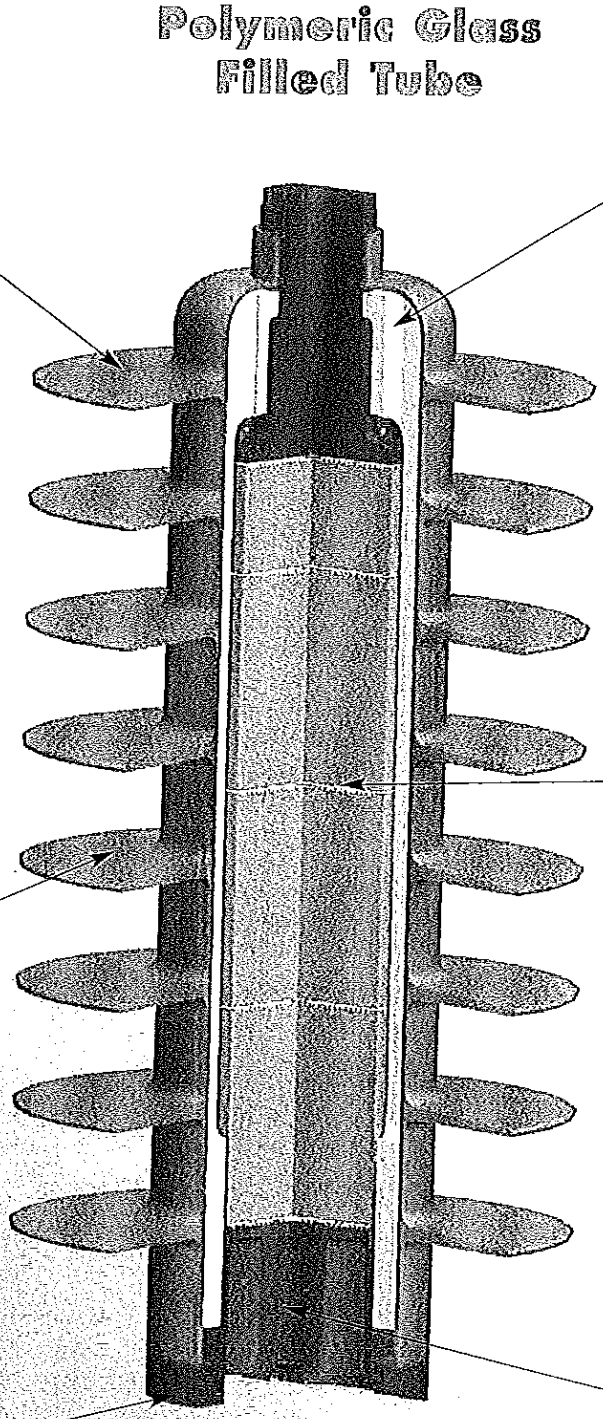
Our quality and environmental system

DERVASIL is ISO 9001 and ISO 14001 system certified. Our production process is approved by EDF and incorporates all routine tests required by IEC Standard 60099-4.

ВЯРНО С ОРИГИНАЛА

"ВАК - 02" ООД САМОКОВ

HIGH RELIABILITY ARRESTERS
AZB / EZB / AZC SERIES



Direct injection of Silicone Rubber over the internal module. This ensures both sealing of the varistor/tube interface and the geometry of external insulation to guarantee length of leakage distance.

Polymeric Glass Filled Tube, up-sized greatly to withstand service and mounting mechanical strength requirements.

Use of Silicone Rubber:
- The stability of the SiO molecule gives to Silicone Rubber excellent inherent resistance to UV radiation, pollution and flame without the need for of special additives.
- When new, Silicone material is already very hydrophobic. It has moreover the property of restoring this hydrophobic characteristic after strong electrical discharge activity due to salt fogs and pollution.

The contacts between metal oxide varistors are provided by spring washers, which are specially designed to distribute lightning current impulses on the varistor surface and to increase arrester energy capability.

Identification and traceability ensured by engraved marking.

Substantial connecting electrodes to fix power arc feet during internal short-circuit and thus to avoid arrester breaking down.

ВЯРНО С ОРИГИНАЛА

"ВАК - 02" ООД
САМОКОВ

Application Guide

This guide provides recommendations for selection and application of DERVASIL lightning arresters to be used for overvoltage protection.

DERVASIL Lightning Arrester Technology:

DERVASIL Lightning arrester is a combination of zinc oxide varistors, internal fiber glass structure and Silicone rubber housing. DERVASIL offers two technologies.

AZB / EZB /AZC series:

Zinc oxide varistors are connected in series with aluminium electrodes into polymeric tube. The Silicone rubber is directly injected into the tube and over the zinc oxide varistor stack. This ensures both sealing and geometry of external insulation.
This construction provides both absolute sealing, exceptional resistance to pollution and excellent behaviour without explosion in case of short-circuits.

AZBD / EZBD series:

Zinc oxide varistors are connected in series with aluminium electrodes to form a complete stack. This stack is tightly wrapped with glass filament impregnated with epoxy resin. This assembly is cured to form a rigid and mechanically strong rod.
The Silicone rubber is directly injected over this rod and over aluminium electrodes to ensure both sealing and geometry of external insulation. This construction reduces external dimensions and weight and improves mechanical performance of lightning arresters.

Basic characteristics of DERVASIL Lightning Arrester for three phase system

Nominal discharge current In and line discharge class:

In IEC 600099-4 the energy absorption capability of lightning arrester is linked to the nominal discharge current In and to the line discharge class. As a general rule, the following values of In and line class are suitable:

In system where line distances between arresters are below 5 km or for areas with low ground flash density and low earth resistance, 5 kA lightning arresters may be sufficient. For areas with high lightning flash density or high earth resistance, 10 kA class 1 lightning arrester are preferable.

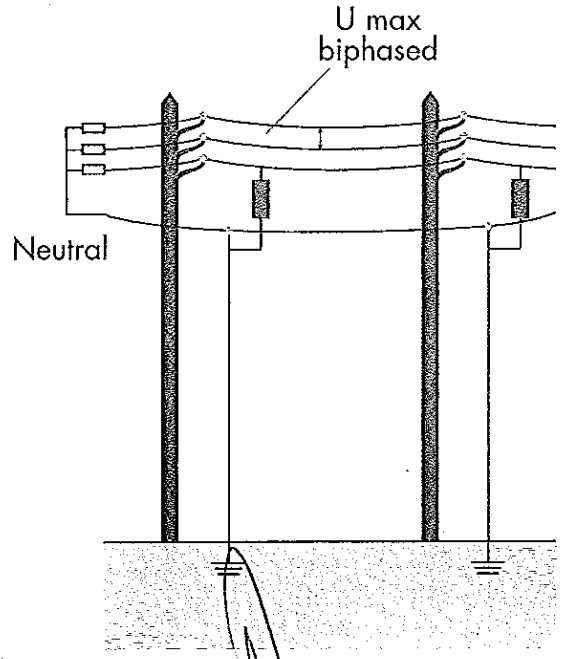
For better protection level or for important installations 10 kA class 2 lightning arrester are recommended.

For specific applications as cable or capacitor bank protection, DERVASIL experts can determine good choice.

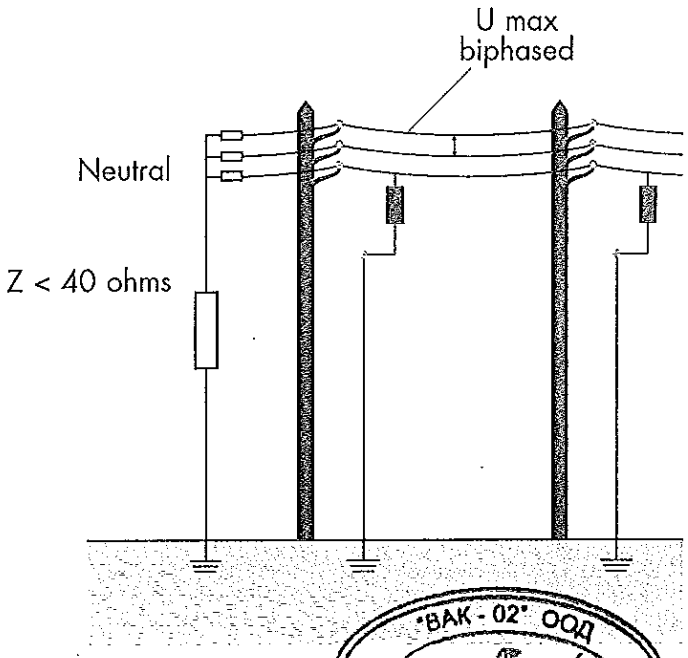
Continuous Operating Voltage Uc :

Uc is the maximum permissible voltage which may be continuously applied between the lightning arrester terminals. As a general rule, Uc should be:

System with solidly grounded neutral
Uc higher than 0.58*Un max system

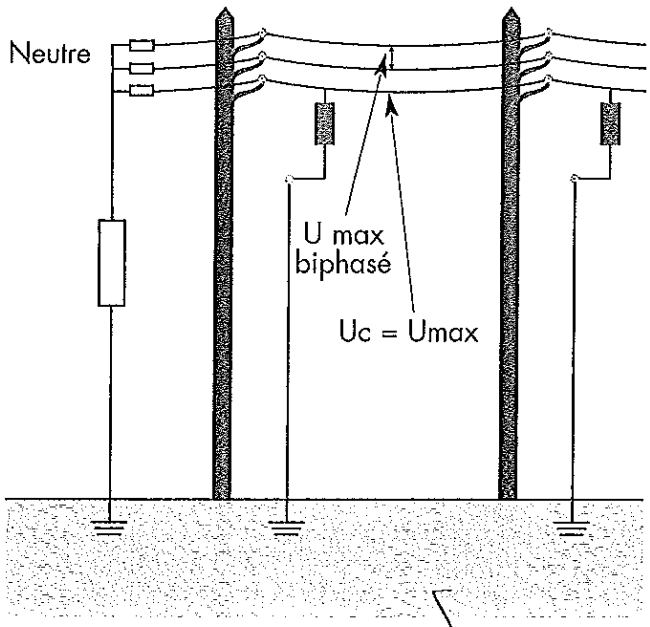


System with low ohmic neutral
Uc higher than 0.87*Un max system



System with high impedance grounded, compensated or ungrounded neutral

Uc higher than Un max system



Rated Voltage Ur :

Ur is the maximum power frequency temporary voltage applied for 10s for which the lightning arrester is calculated in order to pass operating duty test (IEC 60099-4 standard).

Ur is calculated by DERVASIL for each lightning arrester.

Commonly Applied Voltage Rating of Dervasil Arrester (kV)

System Line to Line Voltage (kV)		Solidly Grounded Neutral	Low Ohmic Neutral	High impedance, compensated or Underground Neutral
Nominal	Maximum			
6.9	7.25	6	9	9
10	11	9	12	15
10	11.8	9	12	15
10.6	12	9	12	15
11	12	9	12	15
11.4	12	9	12	15
12	13.2	9	15	18
12.6	13.8	9	15	18
13.4	15	9	15	18
15	16.5	12	18	21
15	18	12	18	21
15.4	17.5	12	18	21
20	22	15	24	27
22	24	18	27	30
23	24.5	18	27	30
25	27.5	21	30	33
30	33	24	36	42
33	36	27	42	...
34.5	36.5	27	42	...

Lightning Impulse Protective Level

The lightning impulse protective level (LIPL) of lightning arrester is the maximum residual voltage at nominal discharge current In.

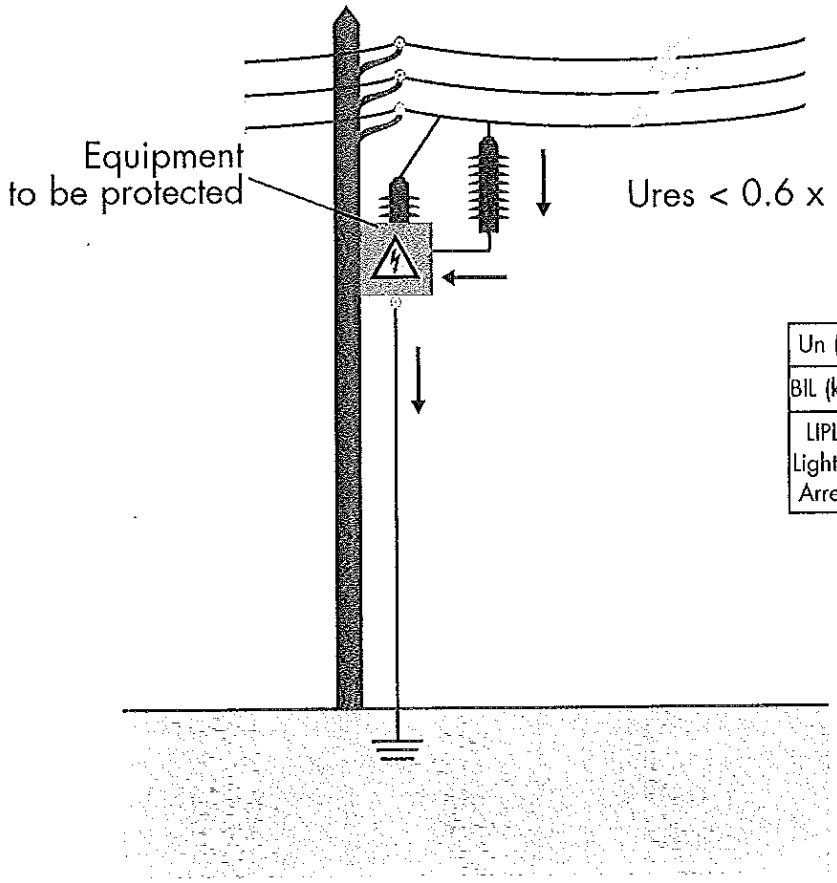
When lightning impulse wave reaches equipment to be protected, current discharge flows through lightning arrester and connecting cables.

Overvoltage on equipment is the sum of lightning arrester residual voltage and induced voltage in cables. To warranty good protection, Protective Level of lightning arrester must be much lower than lightning impulse withstand voltage of the equipment.

To take into account live ageing of insulation material, we recommend:

LIPL lower than 0.6*BIL

Following Basic Insulation Levels (BIL) are defined by IEC 60071-1 according nominal voltage of the system.



Un (kV)	3.6	7.2	12	17.5	24	36
BIL (kV)	40	60	75	95	125	170
LIPL of Lightning Arrester	24	36	45	57	75	102

Basic characteristics of DERVASIL Lightning Arrester for DC voltage

Continuous Operating Voltage Ucdc :

Ucdc is the maximum permissible voltage which may be continuously applied between the lightning arrester terminals.

European standard EN 50163 defines several voltage values:

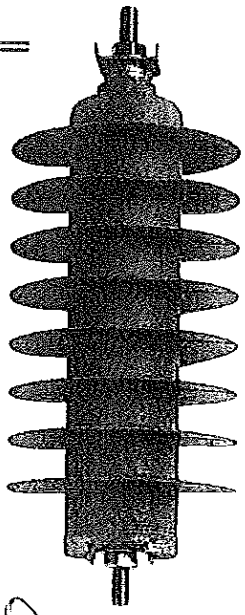
Umax1 : Highest permanent voltage
Umax2 : Highest non-permanent voltage present for maximum 300s

As general rules we recommend **Ucdc** higher than Umax2

Following table gives Umax1, Umax2, recommended **Ucdc** and lightning arrester type for most frequent DC network :

Nominal Voltage (V)	Umax 1 (V)	Umax 2 (V)	Recommanded Ucdc (V)	Recommanded Lightning Arrester
600	720	770	1000	AZE 010T
750	900	950	1200	AZE 012T
1500	1800	1950	2400	AZE 020T
3000	3600	3900	4000	AZE 040T

AZC series General characteristics



Tested in accordance with I.E.C 60099-4 standard.

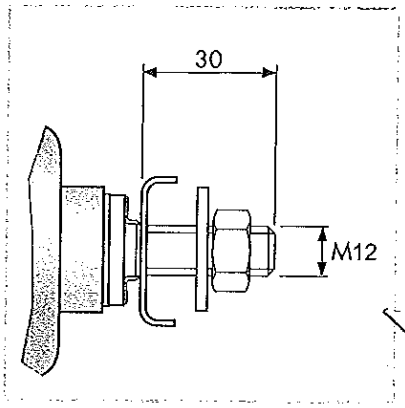
Zinc oxide varistors.

Silicone rubber housing.

Outdoor and indoor use.

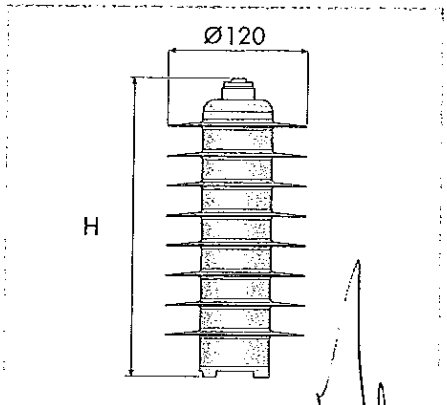
High resistance to vibrations.

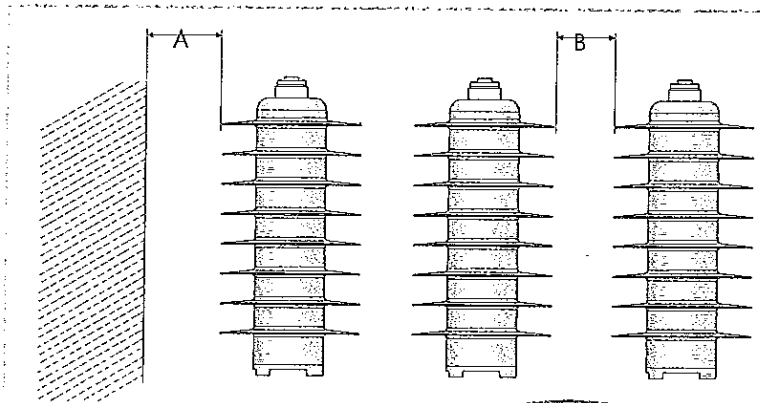
High resistance to vandalism.



Physical characteristics

Arrester type	Leakage distance (mm)	Height H (mm)	Unit weight (kg)	Insulation withstand of housing (kV)		Mounting clearances	
				Lightning impulse 1.2/50 µs	50 Hz 60s Wet	A min (mm)	B min (mm)
AZC_ 03_	400	185	1.2	100	37	110	130
AZC_ 06_	400	185	1.4	100	37	110	130
AZC_ 09_	400	185	1.5	100	37	140	160
AZC_ 12_	400	185	1.6	100	37	140	160
AZC_ 15_	555	231	1.8	120	46	180	200
AZC_ 18_	555	231	2.1	120	46	180	200
AZC_ 21_	710	254	2.3	130	51	240	260
AZC_ 24_	710	254	2.4	130	51	240	260
AZC_ 27_	760	276	2.7	150	56	270	290
AZC_ 30_	1 000	345	3.0	190	70	320	340
AZC_ 33_	1 000	345	3.1	190	70	340	360
AZC_ 39_	1 000	345	3.2	190	70	340	360
AZC_ 42_	1 000	345	3.4	190	70	360	380



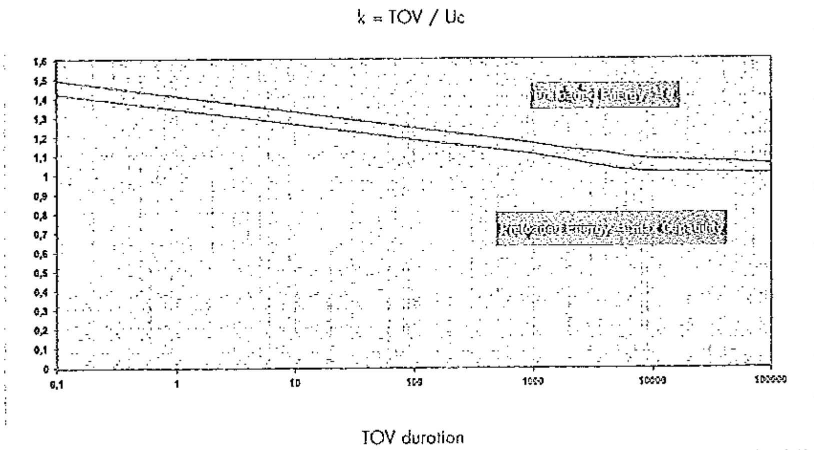


A.C medium voltage network protection
10 kA arrester - Class 2

Electrical and mechanical characterisitcs

Nominal discharge current:	10 kA 8/20 μs impulse
Line discharge class:	2
High current withstand:	2 x 100 kA 4/10μs impulses
Long duration current withstand:	18 x 500 A 2000 μs impulses
Energy absorption capacity	5.5 kJoule/kV of Uc for 2 x 2000 μs impulses 4.6 kJoule/kV of Uc for one 4/10 μs impulse
Rated frequency	48 to 62 Hz
Service temperature	- 40°C to + 40°C (+ 60°C short duration)
Specified continuous load (SCL)	100 N.m
Specified short term load (SSL)	250 N.m
Max tension strength	1 kN
Max torsion strength	50 N.m
Pollution area I.E.C 60815	3
Short circuit rating after over voltage failure as Appendix 0 of I.E.C 60099-4	20000 A for 0.2s / 600 A for 1s

Temporary over voltage capability



AZC line arrester does not have spark gaps in series. The zinc oxide varistors are designed to withstand the continuous phase to ground voltage of network. They are capable of bearing increased operational voltages over a long period. The temporary over voltage characteristics give the duration T and corresponding TOV with respect to continuous voltage Uc.

The curve E = 0 is valid for arresters without energy preloading. The other curve is valid for arresters, which are already absorbed impulses corresponding to their maximum energy absorption capability.

Protective characteristics

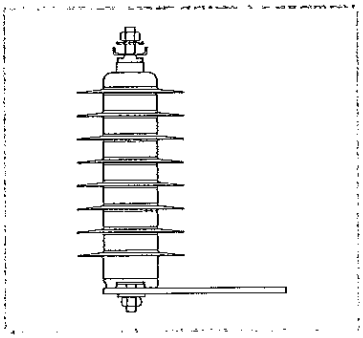
Arrester type	Ur Rated voltage (kVrms)	Uc Continuous operating voltage (kVrms)	Residual voltage wave 1/4 μs at 10 kA (kV)	Residual voltage wave 8/20 μs (kV)					Residual voltage wave 30/80 μs (kV)	
				2.5 kA	5 kA	10 kA Nominal discharge current	20 kA	40 kA	125 A	500 A
AZC_ 03_	3	2.55	11.7	9.3	9.9	10.6	11.9	13.8	7.8	8.5
AZC_ 06_	6	5.1	18.7	14.9	16.0	17.0	19.1	22.1	12.6	13.6
AZC_ 09_	9	8.4	29.8	23.8	25.4	27.1	30.4	35.2	20.0	21.7
AZC_ 12_	12	10.2	36.9	29.4	31.4	33.5	37.6	43.6	24.7	26.8
AZC_ 15_	15	12.7	48.0	38.3	40.9	42.0	49.0	56.7	32.2	34.8
AZC_ 18_	18	15.3	55.0	43.9	46.9	50.0	56.2	65.0	36.9	40.0
AZC_ 21_	21	17.5	66.1	52.7	56.4	60.1	67.5	78.1	44.4	48.0
AZC_ 24_	24	19.5	73.2	58.3	62.4	66.5	74.7	86.5	49.1	53.1
AZC_ 27_	27	22.0	84.3	67.2	71.9	75.0	86.0	99.6	56.6	61.2
AZC_ 30_	30	24.4	91.3	72.8	77.9	83.0	93.2	107.9	61.3	66.3
AZC_ 33_	33	27.0	102.4	81.7	87.4	93.1	104.6	121.0	68.7	74.4
AZC_ 39_	39	32.0	120.6	96.2	102.8	109.6	123.1	142.5	80.9	87.6
AZC_ 42_	42	35.0	127.0	101.0	108.0	115.5	129.2	149.6	84.0	91.9

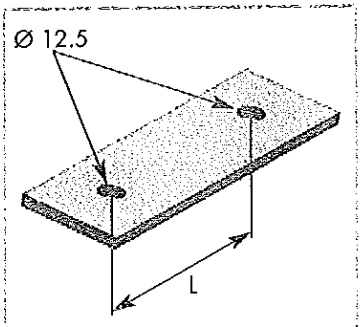
ВЯРНО С ОРИГИНА...

"ВАК-02" САМОКОВ

Accessories

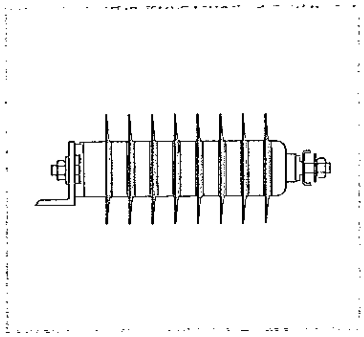
Basic configurations

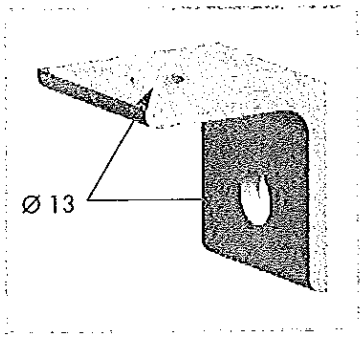




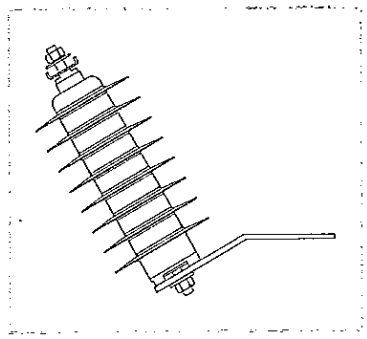
Bracket	L (mm)
EZX 1	100
EZX 2	150
EZX 3	210

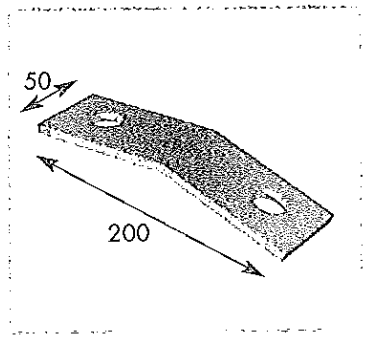
Arrester rated voltage Ur (kVrms)	3	6	9	12	15	18	21	24	27	30	33	36
Bracket reference	EZX 1		EZX 2				EZX 3					





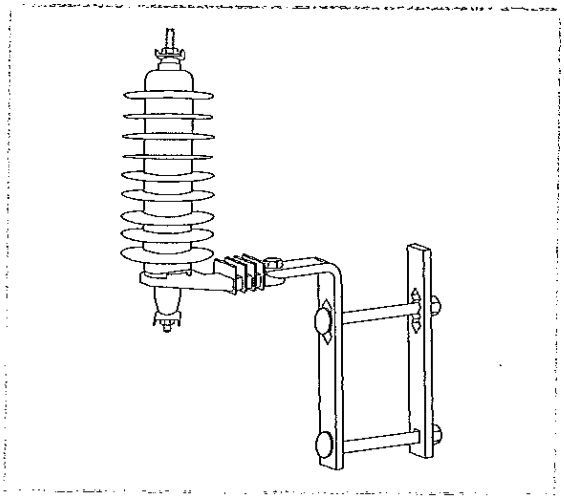
Arrester rated voltage Ur (kVrms)	3	6	9	12	15	18	21	24	27	30	33	36
Bracket reference	AZ 50 50											



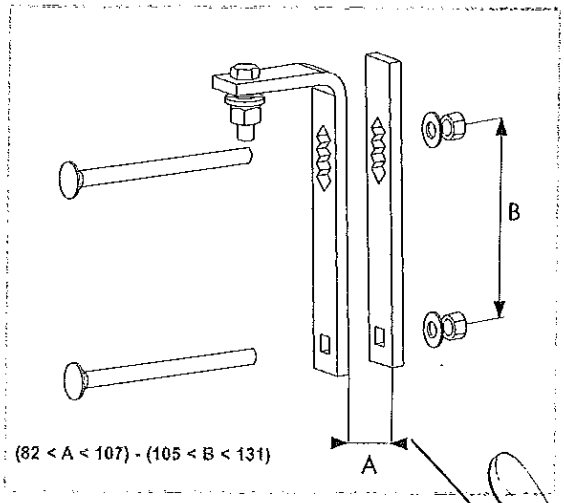


Arrester rated voltage Ur (kVrms)	3	6	9	12	15	18	21	24	27	30	33	36
Bracket reference	AZPTR											

Optional bracket



Shown with AZB--2 arrester

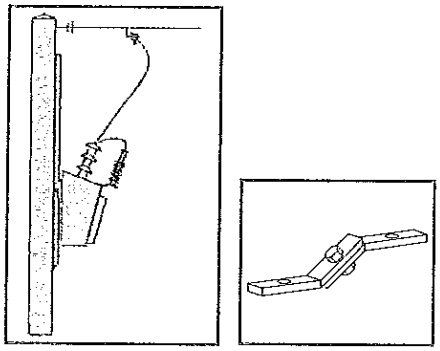


Bracket AZNEMA

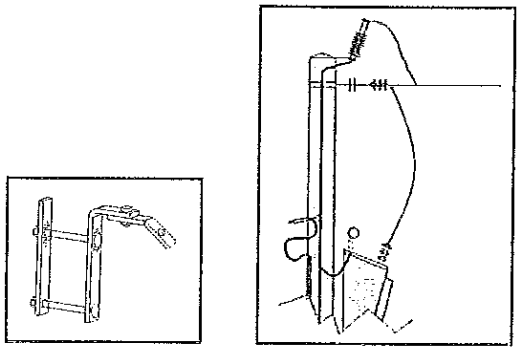
Available options with basic configurations including EZX, AZ 50-50 or AZPTR brackets.

Application exemples

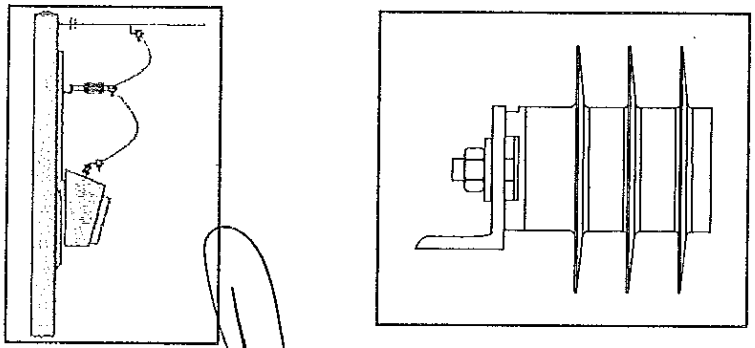
Vertical position on transformer tank with 2 AZPTR brackets



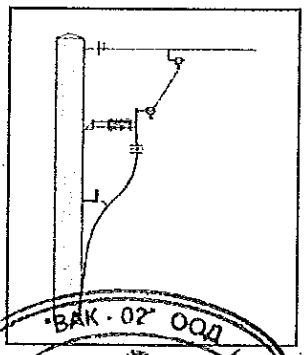
Vertical position on cross arm with AZPTR and AZNEMA brackets



Horizontal position on transformer support with AZ 50 - 50 brackets

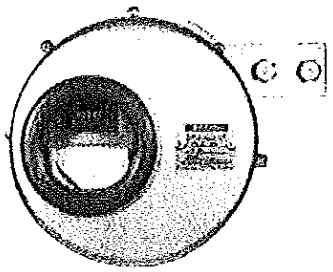


Horizontal position with AZ 50 - 50 brackets



ZC-B1M Surge counter with leakage current meter for Dervasil lightning arrester

Technical description

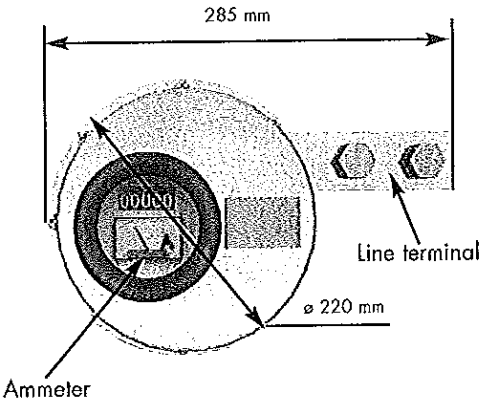


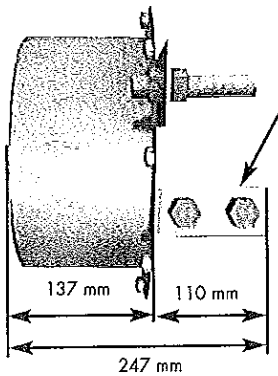
ZC-B1M Surge counter is a device to record the number of lightning and switching surge discharges. ZC-B1M Surge counter can be used with class 1 & 2 DERVASIL lightning arresters and also similar arresters of other manufacturers.
Number of discharges is recorded by 5-digit cyclometer and readings can be taken through the inspection window.Leakage current of lightning arrester is measured by 0-3mA scale reading milliammeter.
ZC-B1M Surge counter does not need any auxiliary power supply

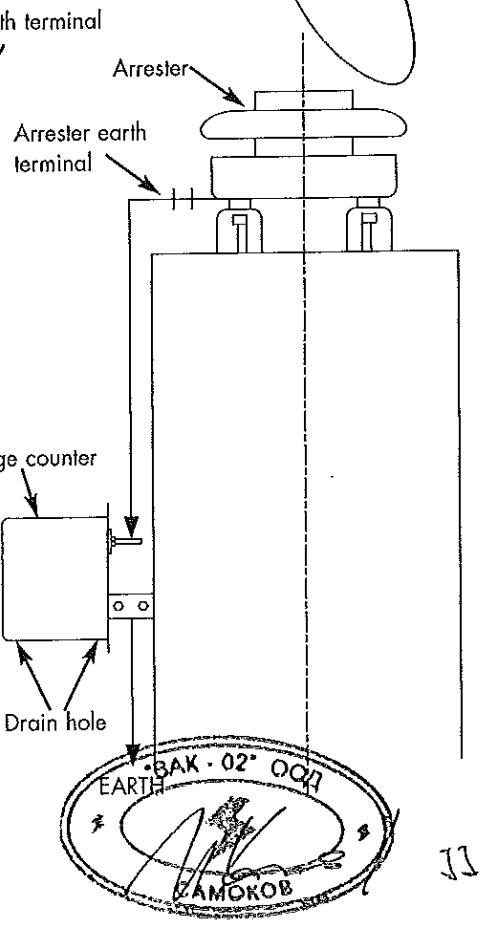
Performance

ZC-B1M Surge counter operates on lightning impulse current (8/20μs wave) more than 100A and can operate perfectly if the interval of multiple lightning strokes is more than 0.2s.
Potential across the ZC-B1M Surge counter is less than 50V crest under normal operating conditions.
Residual voltage at 10kA(8/20μs wave) of the ZC-B1M Surge counter is less than 3 kV and has negligible effect on the protection level of the lightning arrester.
Discharge current capability is 100kA (4/10μs wave) and 1000A (2ms rectangular wave)

Dimensions







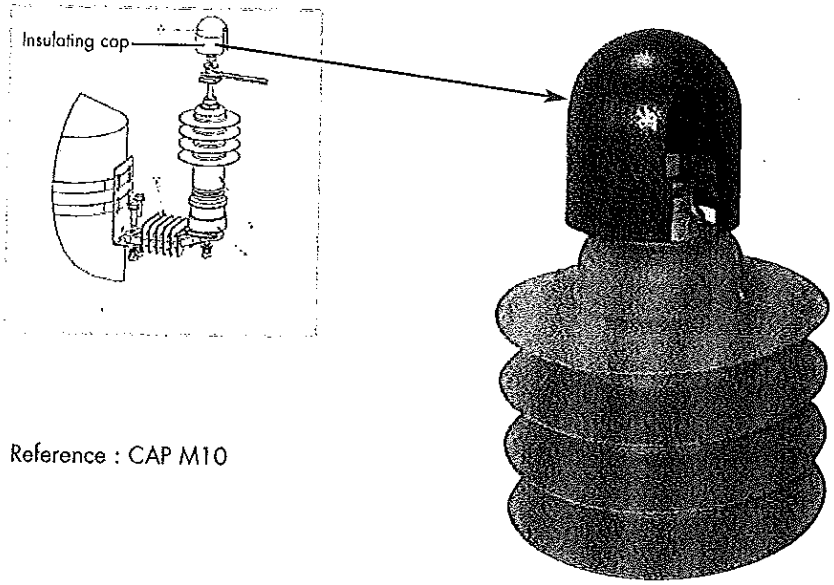
Installation

ZC-B1M Surge counter is connected between the earth terminal of the lightning arrester and the earth. It should be mounted as close as possible to the lightning arrester and length of connecting wires should be as short as possible. The connecting wire used between surge counter and lightning arrester should an insulated wire with impulse withstand voltage more than 5 kV.

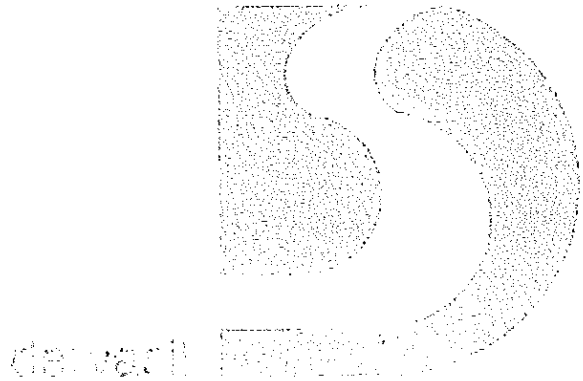
Insulating cap
for Dervasil lightning arrester

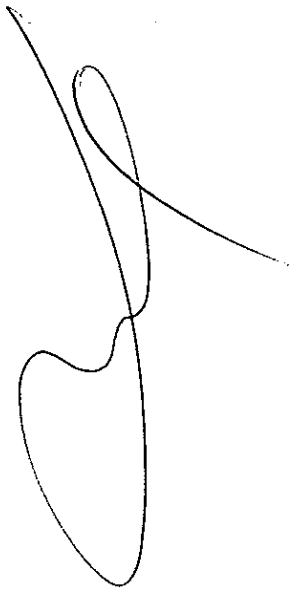
Technical description

The Dervasil insulating cap (Polyamid molded) is especially designed to feet on lighting arrester.



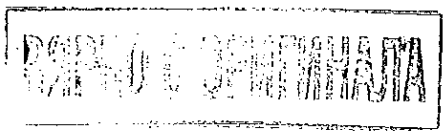
Reference : CAP M10





This documentation is not as per agreement.
Items represented are proposed while stock lasts.
DERVASIL reserve the right to stop production
or modify specifications without prior notice.

Non-contractual pictures



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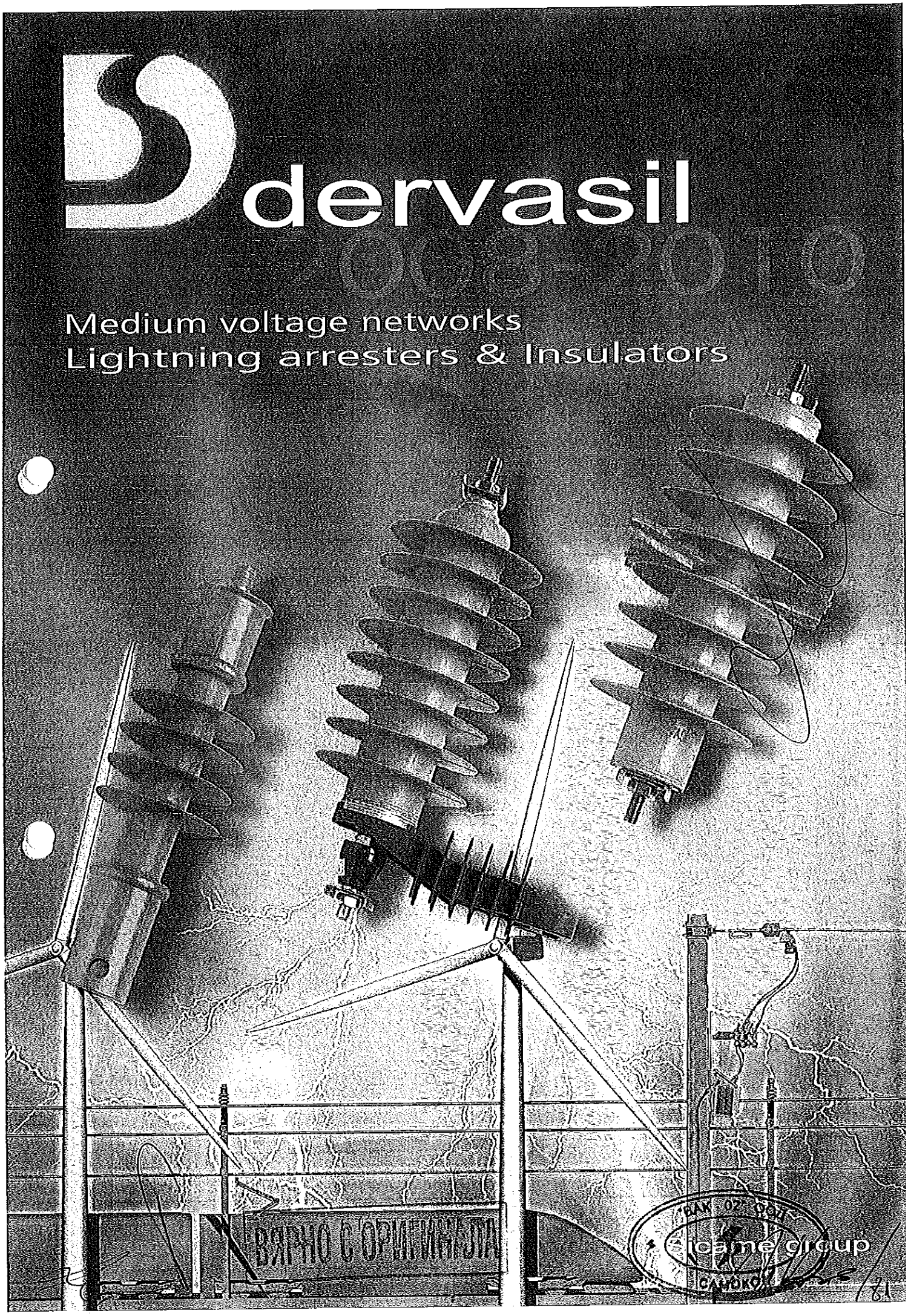
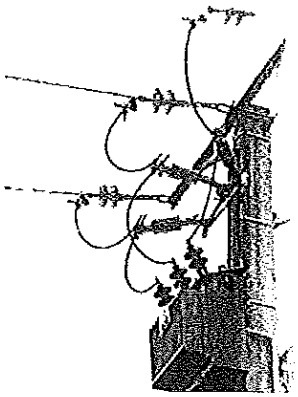
Email : info@dervasil.com

sicame group

Dervasil

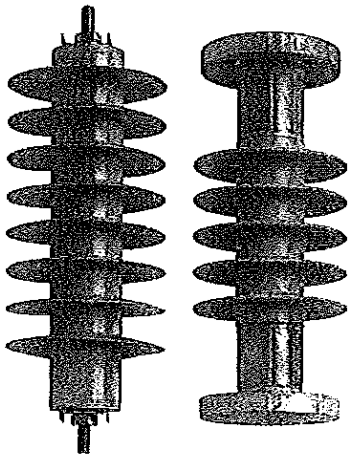
Medium voltage networks
Lightning arresters & Insulators





Our experience

With 20 years know-how in the field of Medium Voltage network protection, DERVASIL designs and manufactures lightning arresters with zinc oxide varistors and synthetic housings.

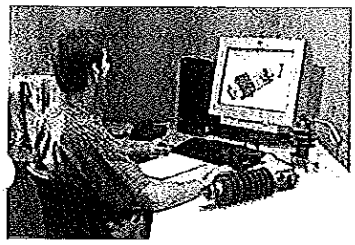


Our products

DERVASIL offers:

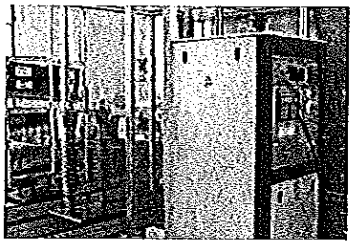
›› A range of latest generation arresters:
5 kA or 10 kA arresters with fault indicator or disconnector.
Arresters for power follow current breaking.
D.C. voltage arresters.
DERVASIL arresters do not have internal spark gaps. They exhibit stable characteristics, with practically constant, very short response times (30 to 50 ns), and better behaviour under pollution.
Direct injection of Silicone Rubber ensures both absolute sealing, exceptional resistance to pollution and excellent behaviour without explosion in case of short-circuit
They have been tested in accordance with the latest version of IEC Standard 60099-4.

›› New range of composite insulators: suspension insulators, tension insulators and support insulators.



Our R & D department

DERVASIL has comprehensive calculation and testing equipment for the design of lightning arresters. Our facilities are available to customers for specific applications.



Our quality and environmental system

DERVASIL is ISO 9001 and ISO 14001 system certified. Our production process is approved by EDF and incorporates all routine tests required by IEC Standard 60099-4.

AFAQ ISO 9001 AFAQ ISO 14001 CERTIFIED IQNet MANAGEMENT SYSTEM

Application Guide

This guide provides recommendations for selection and application of DERVASIL lightning arresters to be used for overvoltage protection.

DERVASIL Lightning Arrester Technology:

DERVASIL Lightning arrester is a combination of zinc oxide varistors, internal fiber glass structure and Silicone rubber housing.
DERVASIL offers two technologies.

AZB / EZB /AZC series:

Zinc oxide varistors are connected in series with aluminium electrodes into polymeric tube. The Silicone rubber is directly injected into the tube and over the zinc oxide varistor stack. This ensures both sealing and geometry of external insulation.
This construction provides both absolute sealing, exceptional resistance to pollution and excellent behaviour without explosion in case of short-circuits.

AZBD / EZBD series:

Zinc oxide varistors are connected in series with aluminium electrodes to form a complete stack. This stack is tightly wrapped with glass filament impregnated with epoxy resin. This assembly is cured to form a rigid and mechanically strong rod.
The Silicone rubber is directly injected over this rod and over aluminium electrodes to ensure both sealing and geometry of external insulation. This construction reduces external dimensions and weight and improves mechanical performance of lightning arresters.

Basic characteristics of DERVASIL Lightning Arrester for three phase system

Nominal discharge current In and line discharge class:

In IEC 600099-4 the energy absorption capability of lightning arrester is linked to the nominal discharge current In and to the line discharge class. As a general rule, the following values of In and line class are suitable:

In system where line distances between arresters are below 5 km or for areas with low ground flash density and low earth resistance, 5 kA lightning arresters may be sufficient. For areas with high lightning flash density or high earth resistance, 10 kA class 1 lightning arrester are preferable.

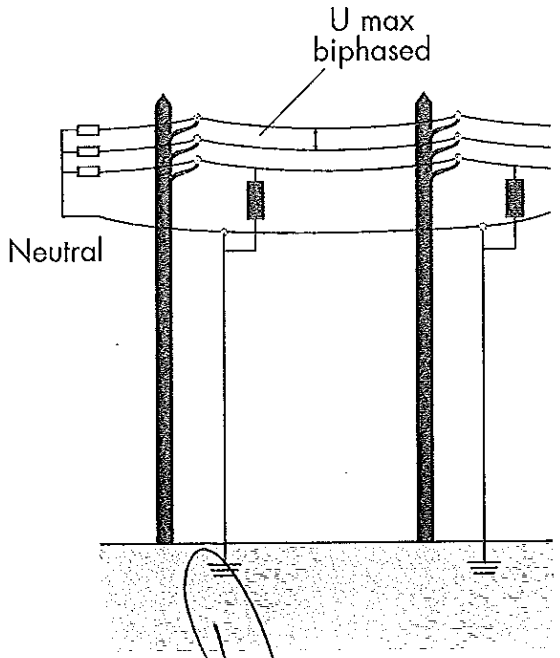
For better protection level or for important installations 10 kA class 2 lightning arrester are recommended.

For specific applications as cable or capacitor bank protection, DERVASIL experts can determine good choice.

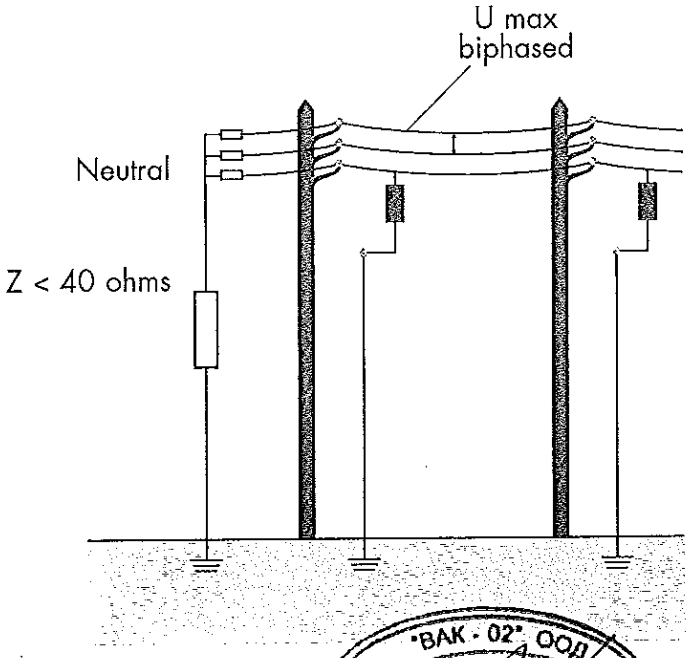
Continuous Operating Voltage Uc :

Uc is the maximum permissible voltage which may be continuously applied between the lightning arrester terminals. As a general rule, Uc should be:

System with solidly grounded neutral
Uc higher than 0.58*Un max system

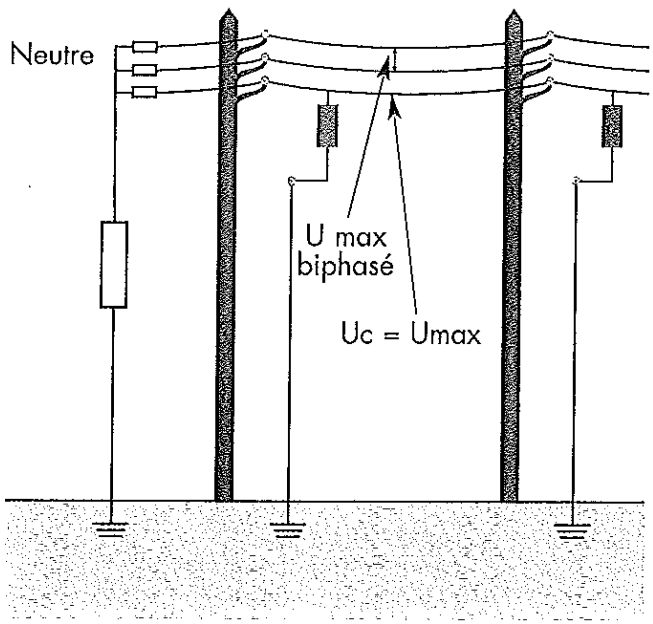


System with low ohmic neutral
Uc higher than 0.87*Un max system



System with high impedance grounded, compensated or ungrounded neutral

Uc higher than Un max system



Rated Voltage Ur :

Ur is the maximum power frequency temporary voltage applied for 10s for which the lightning arrester is calculated in order to pass operating duty test (IEC 60099-4 standard).

Ur is calculated by DERVASIL for each lightning arrester.

Commonly Applied Voltage Rating of Dervasil Arrester (kV)

System Line to Line Voltage (kV)		Solidly Grounded Neutral	Low Ohmic Neutral	High impedance, compensated or Underground Neutral
Nominal	Maximum			
6.9	7.25	6	9	9
10	11	9	12	15
10	11.8	9	12	15
10.6	12	9	12	15
11	12	9	12	15
11.4	12	9	12	15
12	13.2	9	15	18
12.6	13.8	9	15	18
13.4	15	9	15	18
15	16.5	12	18	21
15	18	12	18	21
15.4	17.5	12	18	21
20	22	15	24	27
22	24	18	27	30
23	24.5	18	27	30
25	27.5	21	30	33
30	33	24	36	42
33	36	27	42	...
34.5	36.5	27	42	...

Lightning Impulse Protective Level

The lightning impulse protective level (LIPL) of lightning arrester is the maximum residual voltage at nominal discharge current In.

When lightning impulse wave reaches equipment to be protected, current discharge flows through lightning arrester and connecting cables.

Overvoltage on equipment is the sum of lightning arrester residual voltage and induced voltage in cables. To warranty good protection, Protective Level of lightning arrester must be much lower than lightning impulse withstand voltage of the equipment.

To take into account live ageing of insulation material, we recommend:

LIPL lower than 0.6*BIL

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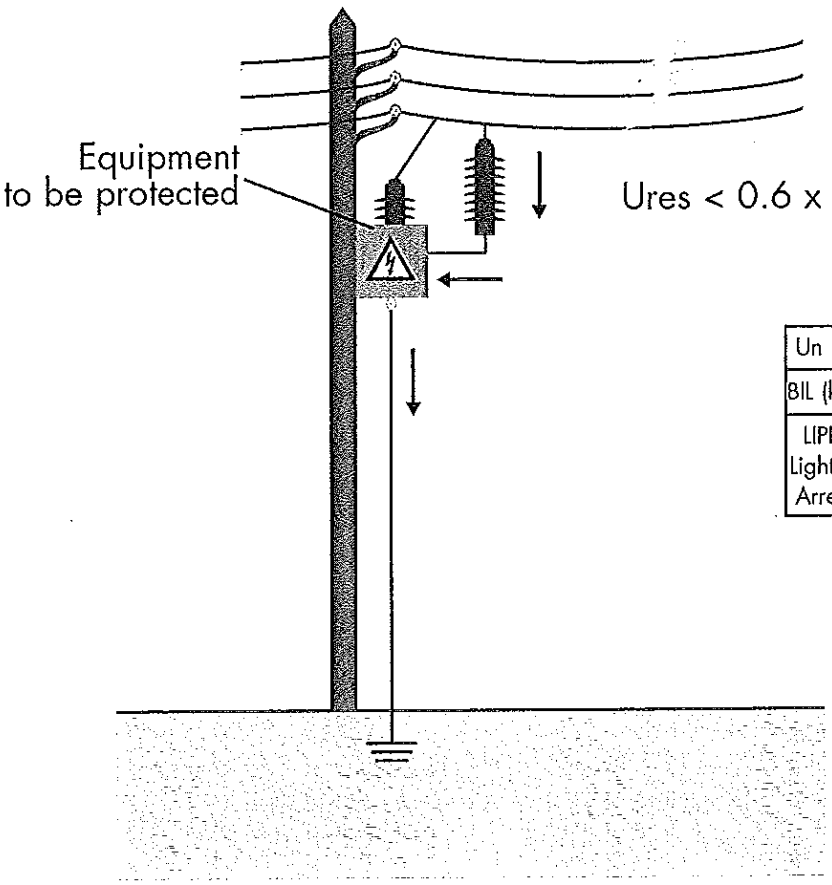
Following Basic Insulation Levels (BIL) are defined by IEC 60071-1 according nominal voltage of the system.



Un (kV)	3.6	7.2	12	17.5	24	36
BIL (kV)	40	60	75	95	125	170
LIPL of Lightning Arrester	24	36	45	57	75	102

Basic characteristics of DERVASIL Lightning Arrester for DC voltage

Continuous Operating Voltage Ucdc :

Ucdc is the maximum permissible voltage which may be continuously applied between the lightning arrester terminals.

European standard EN 50163 defines several voltage values:

Umax1 : Highest permanent voltage
Umax2 : Highest non-permanent voltage present for maximum 300s

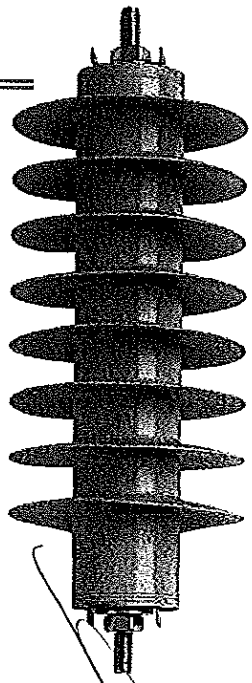
As general rules we recommend **Ucdc** higher than Umax2

Following table gives Umax1, Umax2, recommended **Ucdc** and lightning arrester type for most frequent DC network :

Nominal Voltage (V)	Umax 1 (V)	Umax 2 (V)	Recommanded Ucdc (V)	Recommanded Lightning Arrester
600	720	770	1000	AZE 010T
750	900	950	1200	AZE 012T
1500	1800	1950	2400	AZE 020T
3000	3600	3900	4000	AZE 040T

A.C medium voltage network protection
10 kA arrester - Class 1

AZBD series General characteristics



Tested in accordance with I.E.C 60099-4 standard.

Zinc oxide varistors.

Silicone rubber housing.

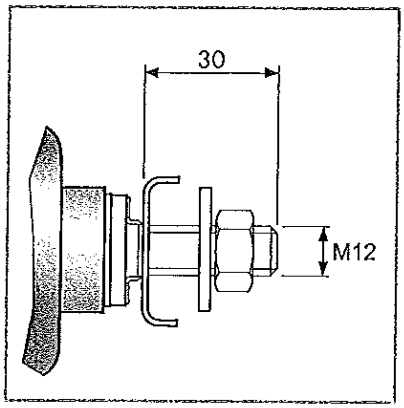
Outdoor and indoor use.

High resistance to vibrations.

High resistance to vandalism.

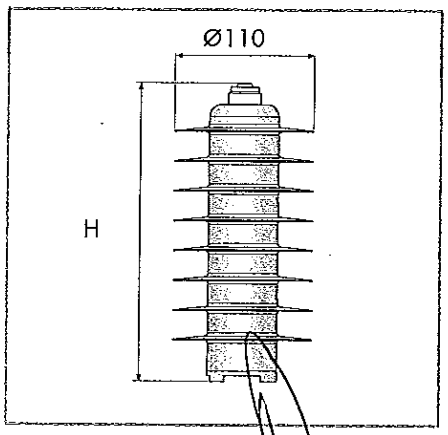
High mechanical resistance.

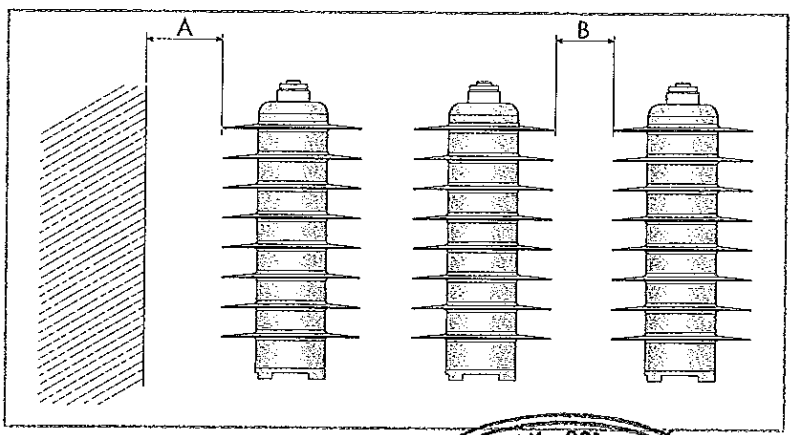
Can be used as cable support.



Physical characteristics

Arrester type	Leakage distance (mm)	Height H (mm)	Unit weight (kg)	Insulation withstand of housing (kV)		Mounting clearances	
				Lightning impulse 1.2/50 µs	50 Hz 60s Wet	A min (mm)	B min (mm)
AZBD_03_	230	140	1.2	100	37	110	130
AZBD_06_	230	140	1.4	100	37	110	130
AZBD_09_	315	170	1.5	100	37	140	160
AZBD_12_	375	180	1.6	100	37	140	160
AZBD_15_	500	195	1.8	120	46	180	200
AZBD_18_	540	230	2.1	120	46	180	200
AZBD_21_	660	245	2.3	130	51	240	260
AZBD_24_	660	245	2.4	130	51	240	260
AZBD_27_	750	270	2.7	150	56	270	290
AZBD_30_	830	305	3.0	190	70	320	340
AZBD_33_	960	320	3.1	190	70	340	360
AZBD_36_	960	320	3.2	190	70	340	360
AZBD_39_	1 050	360	3.2	190	70	340	360
AZBD_45_	1 050	360	3.2	190	70	360	380



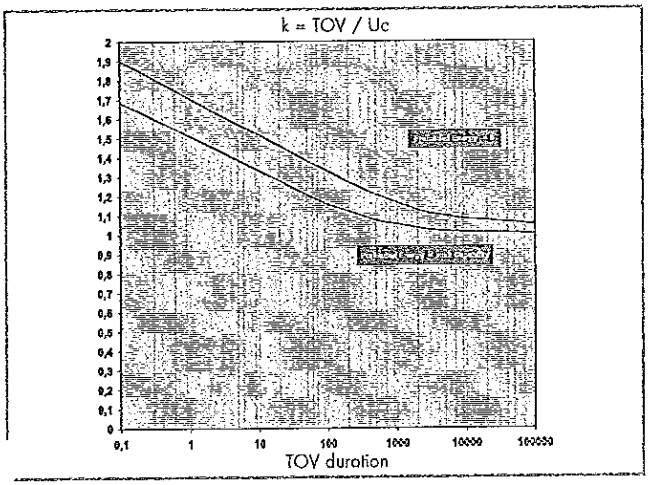


A.C medium voltage network protection
10 kA arrester - Class 1

Electrical and mechanical characteristics

Nominal discharge current:	10 kA 8/20 µs impulse
Line discharge class:	1
High current withstand:	2 x 100 kA 4/10µs impulses
Long duration current withstand:	18 x 250 A 2000 µs impulses
Energy absorption capacity	1.8 kJoule/kV of Uc for one x 2000 µs impulse 4.6 kJoule/kV of Uc for one 4/10 µs impulse
Rated frequency	48 to 62 Hz
Service temperature	- 40°C to + 40°C (+ 60°C short duration)
Specified continuous load (SCL)	200 N.m
Specified short term load (SSL)	350 N.m
Max tension strength	15 kN
Max torsion strength	70 N.m
Pollution area I.E.C 60815	3
Short circuit rating after over voltage failure as Appendix 0 of I.E.C 60099-4	20000 A for 0.2s / 600 A for 1s

Temporary over voltage capability

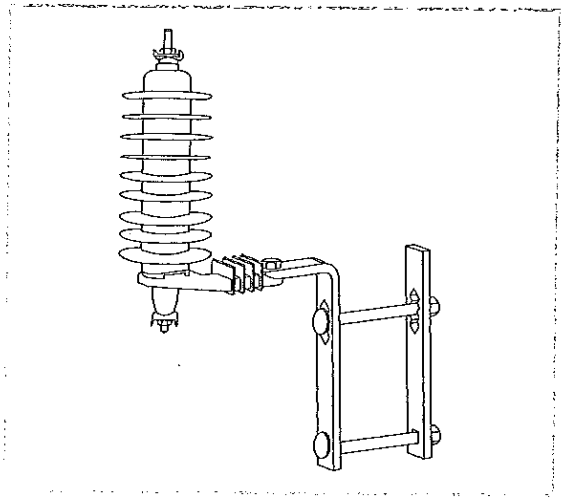


AZBD line arrester does not have spark gaps in series. The zinc oxide varistors are designed to withstand the continuous phase to ground voltage of network. They are capable of bearing increased operational voltages over a long period. The temporary over voltage characteristics give the duration T and corresponding TOV with respect to continuous voltage Uc.
The curve E = 0 is valid for arresters without energy preloading. The other curve is valid for arresters, which are already absorbed impulses corresponding to their maximum energy absorption capability.

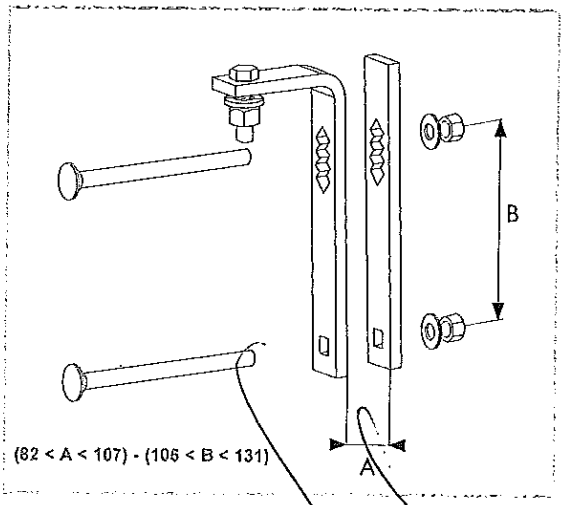
Protective characteristics

Arrester type	Ur Rated voltage (kVrms)	Uc Continuous operating voltage (kVrms)	Residual voltage wave 1/4 µs at 10 kA (kV)	Residual voltage wave 8/20 µs (kV)					Residual voltage wave 30/80 µs (kV)	
				2.5 kA	5 kA	10 kA Nominal discharge current	20 kA	40 kA	125 A	500 A
AZBD_03_	3	2.55	11.1	8.7	9.3	10.1	11.3	13.6	7.2	7.8
AZBD_06_	6	5.1	22.8	17.6	19.0	20.7	23.2	26.9	14.7	15.9
AZBD_09_	9	8.4	36.9	28.5	30.8	33.5	37.5	43.6	23.8	25.8
AZBD_12_	12	10.2	40.9	31.6	34.2	37.2	41.7	48.4	26.4	28.6
AZBD_15_	15	12.7	48.0	37.1	40.1	43.6	48.8	56.7	31.0	33.6
AZBD_18_	18	15.3	64.6	49.9	54.0	58.7	65.7	76.3	42.7	46.3
AZBD_21_	21	17.5	73.2	56.5	61.2	63	74.5	86.5	47.2	51.2
AZBD_24_	24	19.5	73.2	56.5	61.2	63	74.5	86.5	47.2	51.2
AZBD_27_	27	22.0	84.3	65.1	70.5	76.6	85.8	99.6	54.4	59.0
AZBD_30_	30	24.4	102.4	79.1	85.7	93.1	104.3	121.0	66.1	71.7
AZBD_33_	33	27.0	102.4	79.1	85.7	93.1	104.3	121.0	66.1	71.7
AZBD_36_	36	29.0	109.5	84.6	91.5	99.5	111.4	129.4	70.6	76.6
AZBD_39_	39	32.0	109.5	84.6	91.5	99.5	111.4	129.4	70.6	76.6
AZBD_42_	42	35.0	127.6	98.6	106.7	116.0	129.9	150.8	82.4	89.3

Optional bracket



Shown with AZB--2 arrester

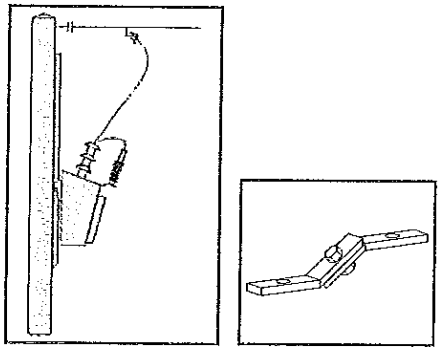


Bracket AZNEMA

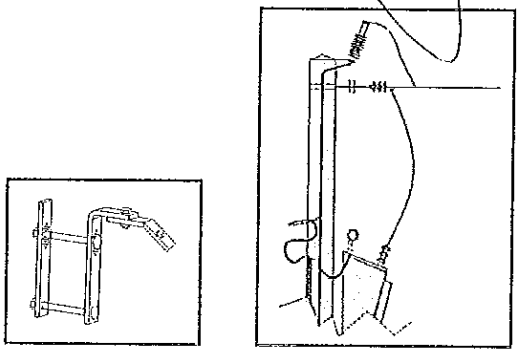
Available options with basic configurations including EZX, AZ 50-50 or AZPTR brackets.

Application exemples

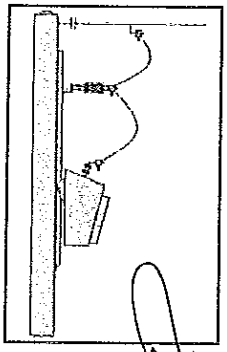
Vertical position on transformer tank with 2 AZPTR brackets

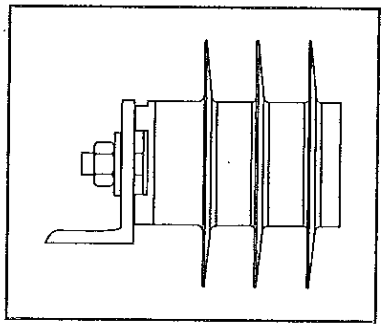


Vertical position on cross arm with AZPTR and AZNEMA brackets

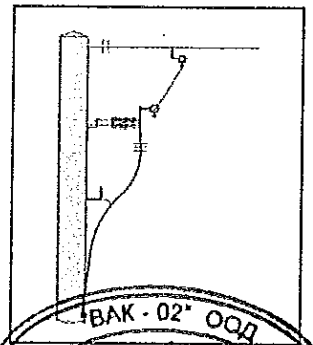


Horizontal position on transformer support with AZ 50 - 50 brackets





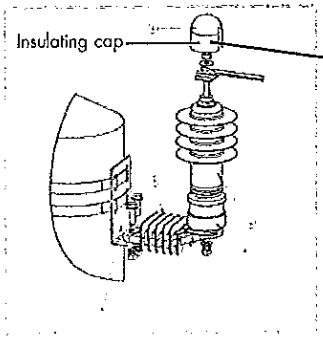
Horizontal position with AZ 50 - 50 brackets

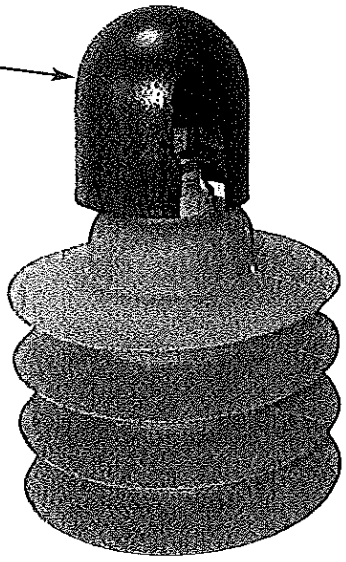


Insulating cap
for Dervasil lightning arrester

Technical description

The Dervasil insulating cap (Polyamid molded) is especially designed to feet on lighting arrester.





Reference : CAP M10

Lightning arrester specification

QUESTIONS REGARDING THE NETWORK

• Rated Voltage ..... Un = ... Kv

• Monophased ❑ Biphased ❑ Triphased ❑

• How is the neutral?
❑ Solidly grounded
❑ Distributed
❑ High resistor grounded or compensated
❑ Isolated

• Network type
Urban ❑ Yes ❑ No
Rural ❑ Yes ❑ No
Percentage cables / Over head lines =.....
Earth line ❑ Yes ❑ No

APPLICATION QUESTIONNAIRE

• Calculation according different types of network
Uc = lighting arrester maximum operating voltage
Un = system nominal voltage

• Solidly grounded neutral ..... Uc = 0,58 x 1,1 x Un
• Low ohmic neutral ..... Uc = 0,87 x 1,1 x Un
• High impedance grounded
or compensated or isolated neutral ..... Uc = 1,1 x Un

• Arrester Class
❑ In = 5kA
❑ In = 10kA class 1
❑ In = 10kA class 2

Residual voltage at In...Ures = ... kV
Temporary over voltage withstand.....
TOV = ... kV
Duration..... = ... s

• Leakage distance ..... d = ... mm

• Accesssories
❑ Disconnector
❑ Fault indicator
❑ Surge counter

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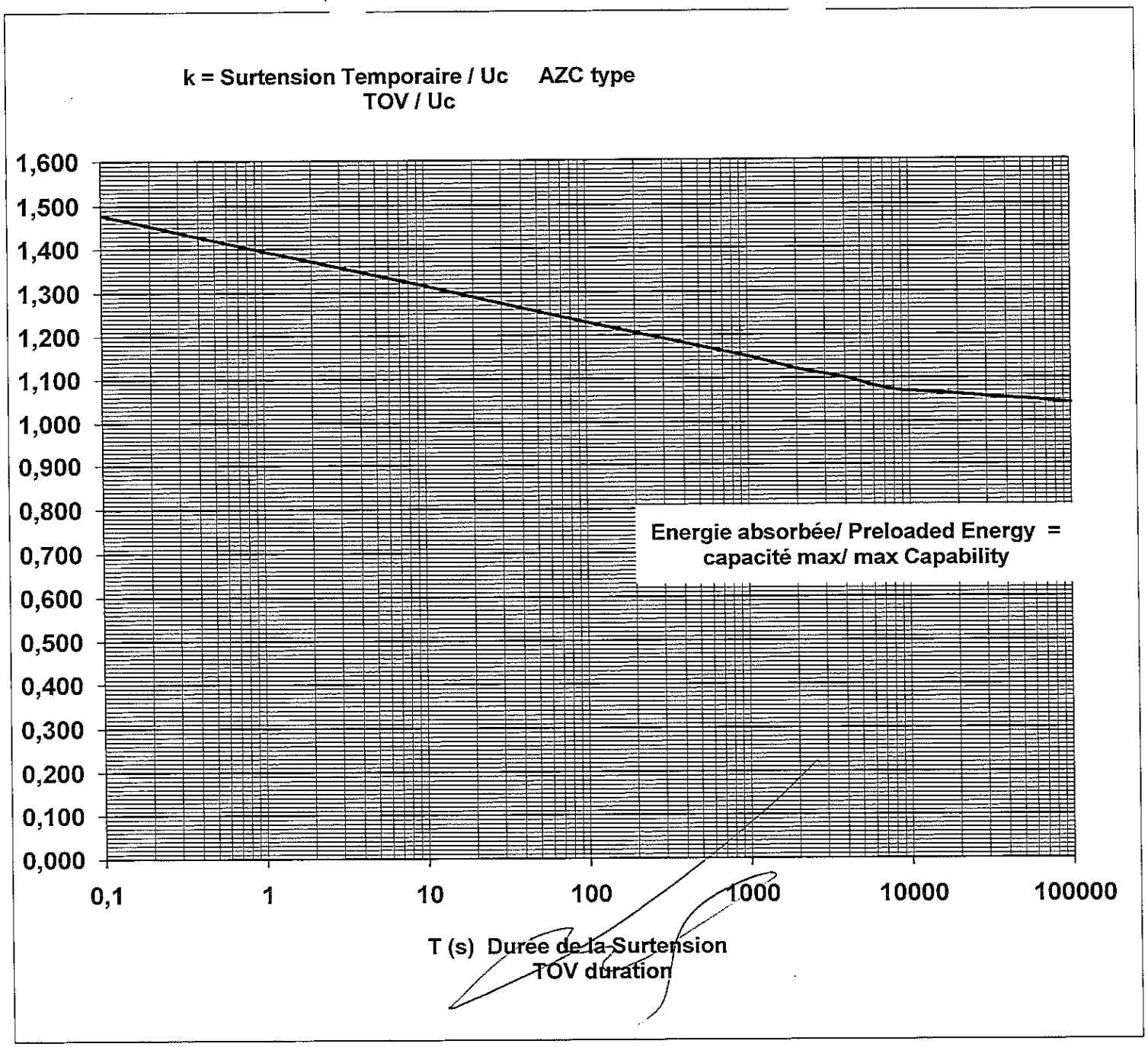
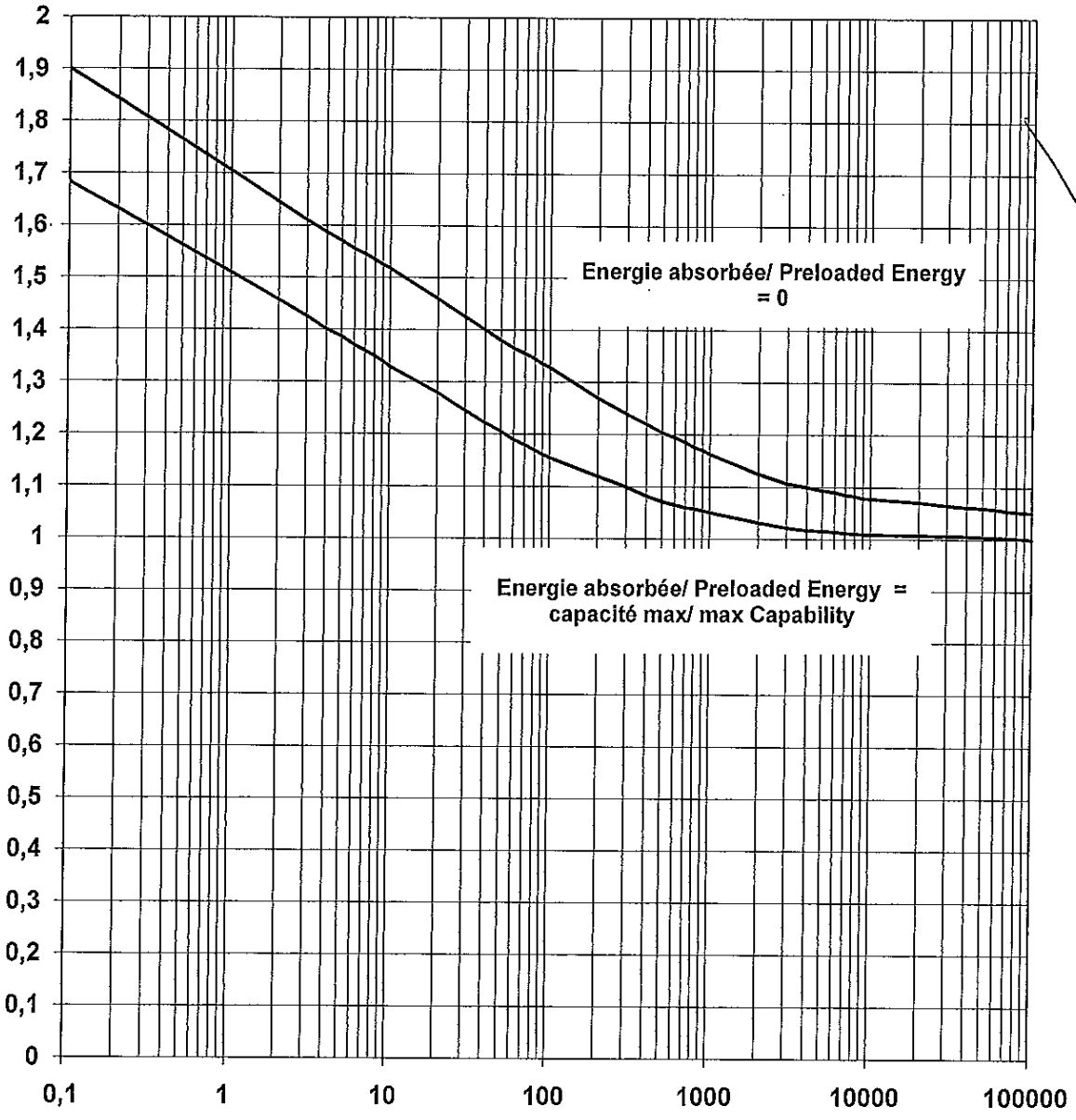

k = Surtension Temporaire / Uc AZC type
TOV / Uc
1,600
1,500
1,400
1,300
1,200
1,100
1,000
0,900
0,800
0,700
0,600
0,500
0,400
0,300
0,200
0,100
0,000
0,1
1
10
100
1000
10000
100000
Energie absorbée/ Preloaded Energy =
capacité max/ max Capability
T (s) Durée de la Surtension
TOV duration

k = Surtension Temporaire / Uc
TOV / Uc
TOV CURVES FOR AZBD



T (s) Durée de la Surtension
TOV duration

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Materials Data Sheet

Product	Lightning Arrester	AZBD - AZC
Date	15/04/2011	
Version	1	

Composition part	Material group	Materials	% in mass	End of live
Active Part				
Varistors	Ceramic	ZnO	51,0%	Recycling
Wrapping Tube	Plastics	Epoxy	3,9%	Incineration process
Housing and filling				
	Polymer	Silicone	22,7%	Incineration process
Termination / Conductors				
Connecting electrodes	Aluminium alloy		10,6%	Recycling
End Cap Terminals	Stanless steel	304	7,8%	Recycling
Packaging				
	Cardboard	Cardboard	3,9%	Recycling
			100,0%	

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Декларация за съответствие на материала

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Данни за материалите

Продукт	Вентилен отвод	AZBD - AZC
Дата	15/04/2011	
Версия	1	

Съставна част	Група материали	Материали	% в маса	Край на жизнен цикъл
Активна част				Процес на рециклиране и изгаряне
Варистори	Керамични	ZnO	51.0 %	
Облицована тръба	Пластмасови	Епоксидна	3.9 %	
Корпус и пълнеж				Процес на изгаряне
	Полимер	Силикон	22.7 %	
Клема / Проводници				
Свързващи електроди	Алуминиева сплав		10.6 %	Рециклиране
Краен цокъл на клемите	Неръждаема стомана	304	7.8 %	Рециклиране
Опаковка				
	Картон	Картон	3.9 %	Рециклиране

100 %

AZBD - AZC

на основание чл. 2 от ЗЗЛД

"ВАК - 02" ООД
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DECLARATION
DECLARATION

CLIENT/*CUSTOMER* : CEZ

Nous, DERVASIL
We,

2 route de POPENOT, 42800 ST JOSEPH (France)

Déclarons sous notre seule responsabilité, que les produits :
declare under our sole responsibility that the products :

PARAFOUDRES
LIGHTNING ARRESTERS types:

AZC_15_ / AZC 150

auxquels se réfère cette déclaration,
to which this declaration relates

sont conformes à la (aux) norme(s) ou autres(s) documents normatif(s) :
correspond to required products for tender of CEZ and are in conformity with the following standard(s) or other normative document(s) :

EN 60099-4 (05-2009), IEC/TS 60815-3

St JOSEPH, le/The 16/07/2013

M.DZIRI Responsable Qualité Environnement
ent Manager

на основание чл. 2 от ЗЗЛД

e autorisé
Name and *rized person*

на основание чл. 2 от ЗЗЛД

Directeur
ral Manager

Nom & signature du signataire autorisé
Name and signature or equivalent marking of authorized person

Cette Déclaration de Conformité est conforme à la norme européenne EN45014 "Critères généraux pour les déclarations de conformité des fournisseurs". Les bases pour ces critères ont été trouvées dans la documentation internationale, et particulièrement dans : ISO/IEC Guide 22, 1982 "Information sur les déclarations de conformité des fabricants avec les normes et autres spécifications techniques".

This Declaration of Conformity is suitable to the European Standard EN 45014 "General criteria for supplier's declaration of conformity". The basis for the criteria has been found in international documentation, particularly in ISO/IEC Guide 22, 1982 "Information on manufacturer's declaration of conformity with standards or other technical specifications".

САМОКОВ

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ДЕКЛАРАЦИЯ

КЛИЕНТ: CEZ

Ние, DERVASIL
2 route de POPENOT, 42800 ST JOSEPH (Франция)

Декларираме на своя собствена отговорност, че продуктите:

Вентилни отдоди тип AZC_15_/AZC 150

за които се отнася тази декларация,
отговарят на изискваните продукти за търга на ЧЕЗ и са в съответствие със следните стандарти или други нормативни документи:

EN 60099-4 (05-2009), IEC/TS 60815-3

St JOSEPH, 16/07/2013

на основание чл. 2 от ЗЗЛД

"ВАК - 02" ООД
САМОКОВ

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DECLARATION
DECLARATION

CLIENT/*CUSTOMER* : CEZ

Nous, DERVASIL
We,

2 route de POPENOT, 42800 ST JOSEPH (France)

Déclarons sous notre seule responsabilité, que les produits :
declare under our sole responsibility that the products :

PARAFOUDRES
LIGHTNING ARRESTERS types:

AZBD_27_ / AZBD 270

auxquels se réfère cette déclaration,
to which this declaration relates

sont conformes à la (aux) norme(s) ou autres(s) documents normatif(s) :
correspond to required products for tender of CEZ and are in conformity with the following standard(s) or other normative document(s) :

EN 60099-4 (05-2009), IEC/TS 60815-3

St JOSEPH, le/The 16/07/2013

M.DZIRI Responsable Qualité Environnement
Quality Environment Manager
на основание чл. 2 от ЗЗЛД

Nom & signature du signataire autorisé
Name and signature or equivalent marking of authorized person

C. GAZZOLA Directeur
General Manager
на основание чл. 2 от ЗЗЛД

Nom & signature du signataire autorisé
Name and signature or equivalent marking of authorized person

Cette Déclaration de Conformité est conforme à la norme européenne EN45014 "Critères généraux pour les déclarations de conformité des fournisseurs". Les bases pour ces critères ont été trouvées dans la documentation internationale, et particulièrement dans : ISO/IEC Guide 22, 1982 "Information sur les déclarations de conformité des fabricants avec les normes et autres spécifications techniques".

This Declaration of Conformity is suitable to the European Standard EN 45014 "General criteria for supplier's declaration of conformity". The basis for the criteria has been found in international documentation, particularly in ISO/IEC Guide 22, 1982 "Information on manufacturer's declaration of conformity with standards or other technical specifications".

САМОКОВ

dervasil

ДЕКЛАРАЦИЯ

КЛИЕНТ: CEZ

Ние, DERVASIL
2 route de POPENOT, 42800 ST JOSEPH (Франция)

Декларираме на своя собствена отговорност, че продуктите:

Вентилни отдоди тип AZBD_27_/AZBD 270

за които се отнася тази декларация,
Отговарят на изискваните продукти за търга на ЧЕЗ и са в съответствие със следните стандарти или други нормативни документи:

EN 60099-4 (15-2019), IEC/TS 60815-3

St JOSEPH, 16/07/2013

на основание чл. 2 от ЗЗЛД

"ВАК - 02" ООД
САМОКОВ

dervasil

DECLARATION
DECLARATION

CLIENT/*CUSTOMER* : CEZ

Nous, DERVASIL
We,

2 route de POPENOT, 42800 ST JOSEPH (France)

Déclarons sous notre seule responsabilité, que les produits :
declare under our sole responsibility that the products :

PARAFOUDRES
LIGHTNING ARRESTERS types:

AZC_27_ / AZC 270

auxquels se réfère cette déclaration,
to which this declaration relates

sont conformes à la (aux) norme(s) ou autres(s) documents normatif(s) :
correspond to required products for tender of CE and are in conformity with the following standard(s) or other normative document(s) :

EN 60099-4 (05-2009), IEC/TS 60815-3

St JOSEPH, le/The 16/07/2013

M.DZIRI Responsable Qualité Environnement
Quality Environment Manager

на основание чл. 2 от ЗЗЛД

Nom & signature du signataire autorisé
Name and signature or equivalent marking of authorized person

C. GAZZOLA Directeur
General Manager

на основание чл. 2 от ЗЗЛД

Nom & signature du signataire autorisé
Name and signature or equivalent marking of authorized person

Cette Déclaration de Conformité est conforme à la norme européenne EN45014 "Critères généraux pour les déclarations de conformité des fournisseurs". Les bases pour ces critères ont été trouvées dans la documentation internationale, et particulièrement dans : ISO/IEC Guide 22, 1982 "Information sur les déclarations de conformité des fabricants avec les normes et autres spécifications techniques".

This Declaration of Conformity is suitable to the European Standard EN 45014 "General criteria for supplier's declaration of conformity". The basis for the criteria has been found in international documentation, particularly in ISO/IEC Guide 22, 1982 "Information on manufacturer's declaration of conformity with standards or other technical specifications".

САМОКОВ

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ДЕКЛАРАЦИЯ

КЛИЕНТ: CEZ

Ние, DERVASIL
2 route de POPENOT, 42800 ST JOSEPH (Франция)

Декларираме на своя собствена отговорност, че продуктите:

Вентилни отдоди тип AZC_27_/AZC 270

за които се отнася тази декларация,
отговарят на изискваните продукти за търга на ЧЕЗ и са в съответствие със следните стандарти или други нормативни документи:

EN 60099-4 (05-2009), IEC/TS 60815-3

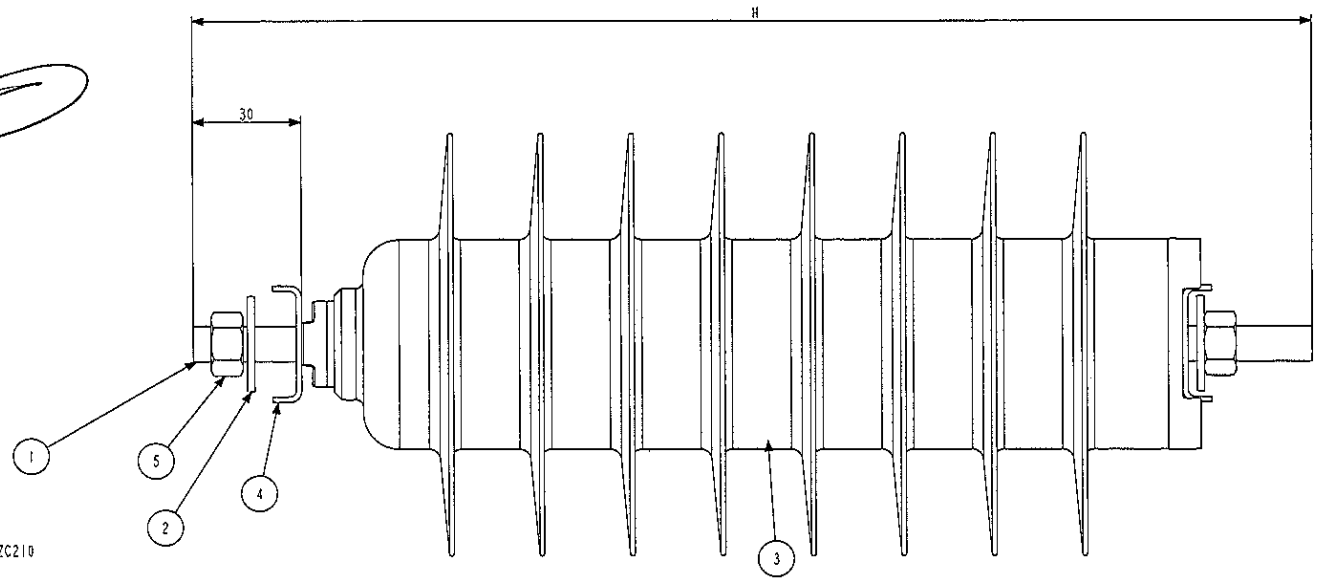
St JOSEPH, 16/07/2013

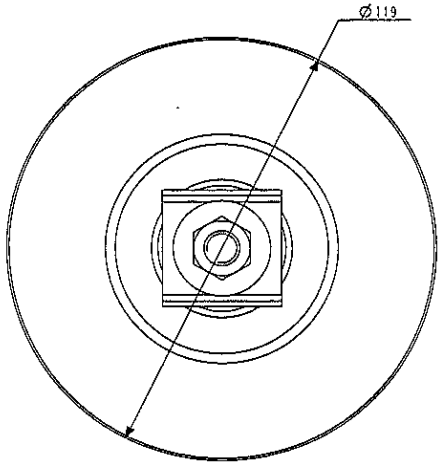
на основание чл. 2 от ЗЗЛД

"ВАК - 02" ООД
САМОКОВ

100

N° modif.	IND.	DESIGNATION	VISA	DATE
	A	création		





Arrester module type	Height (mm) H	Minimum leakage distance (mm)	Ur Rated Voltage (kVrms)	Uc Continuous operating Voltage (kVrms)	Weight (kg)
AZC 030	185,0±1,3	400	3	2,55	1,2
AZC 060	185,0±1,3	400	6	5,1	1,4
AZC 090	185±2,3	400	9	8,4	1,5
AZC 120	185±2,3	400	12	10,2	1,6
AZC 150	231,0±3,3	555	15	12,7	1,8
AZC 180	231,0±3,3	555	18	15,3	2,1
AZC 210	254,0±4,3	710	21	17,5	2,3
AZC 240	254,0±4,3	710	24	19,5	2,4
AZC 270	276,0±5,3	760	27	22,0	2,7
AZC 300	345,0±5,3	1000	30	24,4	3,0
AZC330	345,0±5,3	1000	33	27,0	3,1
AZC 360	345,0±6,3	1000	36	29,0	3,2
AZC 390	345,0±6,3	1000	39	32,0	3,2

	5	2	H_10			
99D52493	4	2	SERRE-CABLE			
99B000307	3	1	C_21			
99A102652	2	2	RONDELLE_1_10			
	1	2	TIGE_10_45			
N° PLAN	repère	nbre	Désignation	Référence	Matière	Observation

TOLERANCES GENERALES : js/JS13 — TRAITEMENT :

Gamme AZC_xx0

CODE ARTICLE :

dervasil
groupe SICAME

route de POPENOT - 42800 ST JOSEPH
tel : 04.77.75.29.98. fax : 04.77.83.22.80.

DESSINE PAR : MD — FORMAT : A2

DATE :23/06/2009 — ECHELLE : 1,000

VERIFIE PAR : — PAGE : 1/1

PLAN N° - DRAWING N° - PLANO N°

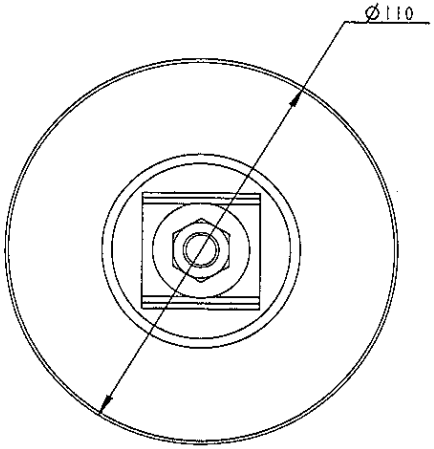
99B000302A

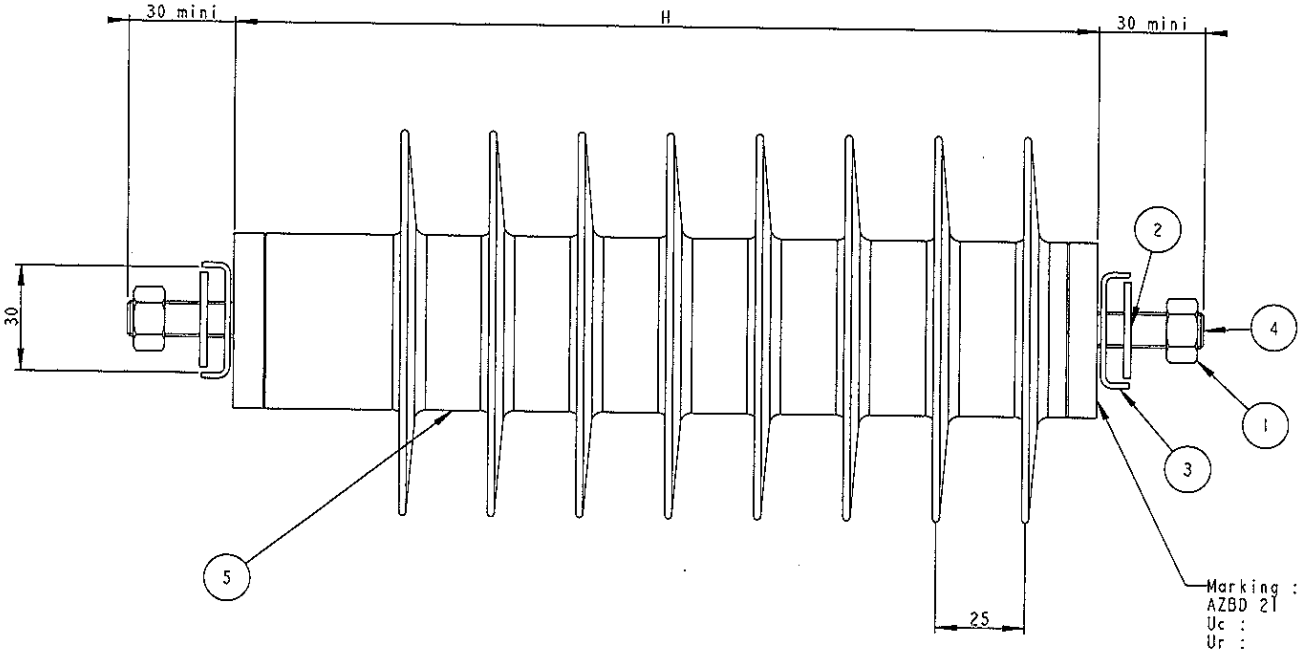
Pour chiffrage 2-2

CAMOKOB

BAK - 02

N° modif.	IND.	DESIGNATION	VISA	DATE
	A	création		
	B	Ajout du tableau	MD	20/03/2009
120	C	Ajout profondeur AZBD450	MD	06/08/2010
	D	Ajout AZBD 180 Pologne	MS	10/02/2011





Arrester module type	Height (mm)	Minimum leakage distance (mm)	Ur	Uc	Weight (kg)
AZBD 030	140,0±1,0	230	3	2,55	1,2
AZBD 060	140,0±1,4	230	6	5,1	1,4
AZBD 090	170,0±2,4	315	9	8,4	1,5
AZBD 120	180,0±2,4	375	12	10,2	1,6
AZBD 150	195,0±3,0	500	15	12,7	1,8
AZBD 180	230,4±3,4	540	18	15,3	2,1
AZBD 210	245,0±4,4	660	21	17,5	2,3
AZBD 240	245,0±4,4	660	24	19,5	2,4
AZBD 270	270,0±5,0	750	27	22	2,7
AZBD 300	305,0±6,0	830	30	24,4	3,0
AZBD 330	320,0±6,4	960	33	27	3,1
AZBD 360	320,0±6,4	960	36	29	3,2
AZBD 390	360,0±7,4	1050	39	32	3,2
AZBD 420	360,0±7,4	1050	42	35	3,2
AZBD 450	360,0±7,4	1050	45	36	3,3
AZBD 180 Pologne	202,0±3,4	525	18	16	3,4

	5	1	AZBD			
998991045	4	2	Tige filetée M10x45	B991045	Inox A2	
998000029	3	2	Serre câble	B000029	Inox	
	2	2	Rondelle L10	T041647	Inox A2	
	1	2	Ecrou H10	N071265	Inox A2	
N° PLAN	repère	nbre	Désignation	Référence	Matière	Observation

TOLERANCES GENERALES : Js/JS13 — TRAITEMENT :

Gamme AZBD - - 0

CE DOCUMENT NE PEUT ETRE REPRODUIT OU COMMUNIQUE SANS ACCORD PREALABLE DE LA SOCIETE DERVASIL — CODE ARTICLE :

dervasil
groupe SICAME

route de POPINOT - 42800 ST JOSEPH
tel : 04.77.75.29.98. fax : 04.77.83.22.80.

DESSINE PAR : LD — FORMAT : A3
DATE : 29/04/2009 — ECHELLE : 1:1
VERIFIE PAR : SM — PAGE : 1/1

PLAN N° - DRAWING N° - PLANO N°

99B000224D

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AZC ARRESTER - TYPE TESTS TABLE ACCORDING IEC 600099-4

AZC arresters have same housing and same rating than AZB arresters
AZC arresters are fitted with Varistor OTOWA type TV4136FE2

TYPE TEST DESIGNATION	Clauses of IEC 60099-4 (2004-05)	Test reports	Sample to be tested according IEC 600099-4	Validation for AZC
INSULATION WITHSTAND TEST ON THE ARRESTER HOUSING	10.8.2	CESI A5/003636	Longuest housing i.e AZB 36	Dry Impulse level of tested sample= 190 kVpeak Wet Power frequency withstand of tested sample = 70.7 kV AZC arresters has same housing and same rating than AZB arresters **Test report is valid for AZC arresters**
RESIDUAL VOLTAGE TEST	10.8.3	OTOWA F1-44006008-1	ZnO varistor type TV4136FE2for AZC arrester Ur=6.25kV	IEC 60099-4 standard allows to perform test on arrester varistor. AZC.arresters are fitted with Varistor OTOWA type TV4136FE2 **Test report is valid for AZC arresters**
LONG DURATION CURRENT IMPULSE WITHSTAND TEST	10.8.4	OTOWA F1-44006008-1	ZnO varistor type TV4136FE2for AZC arrester Ur=6.25kV	IEC 60099-4 standard allows to perform test on arrester varistor. AZC.arresters are fitted with Varistor OTOWA type TV4136FE2 **Test report is valid for AZC arresters**

"ВАК - 02" ООД САМОКОВ

Приложение 2.3

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AZC ARRESTER - TYPE TESTS TABLE ACCORDING IEC 600099-4

HIGH CURRENT IMPULSE OPERATING DUTY TEST **- ACCELERATED AGEING TEST**	10.8.5 8.5.2	OTOWA F1-44006008-1	ZnO varistor type TV4136FE2f or AZC arrester Ur=6.25kV	IEC 60099-4 standard requires to perform test on varistor. AZC.arresters are fitted with Varistor OTOWA type TV4136FE2 **Test report is valid for AZC**
- HIGH CURRENT AND SWITCHING SURGE OPERATING DUTY TEST	8.5.3	OTOWA F1-44006008	ZnO varistor type TV4136FE2f or AZC arrester Ur=6.25kV	IEC 60099-4 standard requires to perform test on arrester section **Test report is valid for AZC**
SHORT CIRCUIT TEST	10.8.7 Annex N	CESI A5/022760	Surge Arrester AZB36 Ur=36 kV	IEC 60099-4 standard requires to perform test on arrester with longuest housing and highest rated voltage. AZC arresters has same housing and same rating than AZB arresters Tested sample has same design (housing shape & material, internal parts, varistor) than AZC **Test report is valid for AZC**
INTERNAL PARTIAL DISCHARGE TEST	10.8.8	CESI A5/003599	Surge Arrester AZB36 Ur=36 kV	IEC 60099-4 standard requires to perform test on arrester with longuest housing and highest rated voltage. AZC arresters has same housing and same rating than AZB arresters Tested sample has same design (housing shape & material, internal parts, varistor) than AZC **Test report is valid for AZC**
TEST OF BENDING MOMENT	10.8.9	CESI A4/509502	Surge Arrester AZB36 Ur=36 kV	IEC 60099-4 standard requires to perform test on arrester with longuest housing and highest rated voltage. AZC arresters has same housing and same rating than AZB arresters Tested sample has same design (housing shape & material, internal parts, varistor) than AZC **Test report is valid for AZC**

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AZC ARRESTER - TYPE TESTS TABLE ACCORDING IEC 600099-4

MOISTURE INGRESS TEST	10.8.13	CESI A4/509306	Surge Arrester AZB36 Ur=36 kV	IEC 60099-4 standard requires to perform test on arrester with longuest housing and highest rated voltage. AZC arresters has same housing and same rating than AZB arresters Tested sample has same design (housing shape & material, internal parts, varistor) than AZC **Test report is valid for AZC**
WEATHER AGEING TEST	10.8.14 Serie A: 1000h	CESI AT-A5/022740	Surge Arrester AZB27 Ur=27 kV	Test was performed on arrester with minimum specific distance AZB27.. AZC arresters has same housing and same rating than AZB arresters **Test report is valid for AZC**

St Joseph on
May 28th, 2013

dervasil
SAS au capital de 907 190 €
Route de Popenot - 42800 SAINT-JOSEPH
Tél. 04 77 75 29 98 - Fax 04 77 83 22 80
RC St-Etienne 423 136 977 - Code NAF 312 A

105

AZC ВЕНТИЛЕН ОТВОД – ТАБЛИЦА ЗА ТИПОВЕ ТЕСТОВЕ СЪГЛАСНО IEC 600099-4

Вентилните отводи AZC имат еднакъв корпус и категория като вентилните отводи AZB
Вентилните отводи AZC са оборудвани с Варистор OTOWA тип TV4136FE2

ПРЕДНАЗНАЧЕНИЕ НА ИЗПИТАНИЕТО	Клаузи от IEC 60099-4 (2004- 05)	Доклад от изпитанието	Мостра за тестване съгласно IEC 600099- 4	Утвърждаване за AZC
ИЗПИТАНИЕ НА ИЗОЛАЦИОННАТА УСТОЙЧИВОСТ НА КОРПУСА НА ВЕНТИЛНИЯ ОТВОД	10.8.2	CESI A5/003636	Най-дълъг корпус - AZB 36	Ниво на импулса при сухо състояние на тестваната мостра = 190 kVpeak Устойчивост при промишлена честота и влажно състояние на тестваната мостра = 70.7 kV Вентилните отводи AZC имат еднакъв корпус и категория като вентилните отводи AZB **Този доклад е валиден за вентилни отводи AZC**
ИЗПИТАНИЕ НА ОСТАТЪЧНО НАПРЕЖЕНИЕ	10.8.3	OTOWA F1-44006008-1	Варистор ZnO тип TV4136FE2f или вентилен отвод AZC Ur=6.25kV	Стандартът IEC 60099-4 позволява да се прави изпитание върху варистора на вентилния отвод. Вентилните отводи AZC са оборудвани с Варистор OTOWA тип TV4136FE2 **Този доклад е валиден за вентилни отводи AZC**
ИЗПИТАНИЕ ЗА УСТОЙЧИВОСТ НА ДЪЛГОТРАЕН ТОКОВ ИМПУЛС	10.8.4	OTOWA F1-44006008-1	Варистор ZnO тип TV4136FE2f или вентилен отвод AZC Ur=6.25kV	Стандартът IEC 60099-4 позволява да се прави изпитание върху варистора на вентилния отвод. Вентилните отводи AZC са оборудвани с Варистор OTOWA тип TV4136FE2 **Този доклад е валиден за вентилни отводи AZC**

на основание чл. 2 от ЗЗЛД

ВАК 02 ООД
САМОКОВ

AZC ВЕНТИЛЕН ОТВОД – ТАБЛИЦА ЗА ТИПОВЕ ТЕСТОВЕ СЪГЛАСНО IEC 600099-4

ИЗПИТАНИЕ ПРИ РАБОТЕН РЕЖИМ С ВИСОКО-ТОКОВ ИМПУЛС **- Изпитание с ускорено стареене**	10.8.5 8.5.2	OTOWA F1-44006008-1	Варистор ZnO тип 7V4136FE2f или вентилен отвод AZC Ur=6.25kV	Стандартът IEC 60099-4 изисква да се правят изпитания върху варистора. Вентилните отводи AZC са оборудвани с Варистор OTOWA тип TV4136FE2 **Този доклад е валиден за AZC**
- Изпитание при режим с високо-токов импулс и комутационно пренапрежение	8.5.3	OTOWA F1- 44006008	Варистор ZnO тип TV4136FE2f или вентилен отвод AZC Ur=6.25kV	Стандартът IEC 60099-4 изисква да се правят изпитания върху сектор от вентилния отвод. **Този доклад е валиден за AZC**
ИЗПИТАНИЕ НА КЪСО СЪЕДИНЕНИЕ	10.8.7 Приложение N	CESI A5/022760	Вентилен отвод AZB36 Ur=36 kV	Стандартът IEC 60099-4 изисква да се провеждат изпитания върху вентилния отвод с най-дълъг корпус и най-високо номинално напрежение. Вентилните отводи AZC имат еднакъв корпус и категория като вентилните отводи AZB. Изпитваната мостра има същия дизайн като AZC (форма на корпуса и материал, вътрешни части, варистор) **Този доклад е валиден за AZC**
ИЗПИТАНИЕ С ВЪТРЕШНО ЧАСТИЧНО РАЗРЕЖДАНЕ	10.8.8	CESI A5/003599	Вентилен отвод AZB36 Ur=36 kV	Стандартът IEC 60099-4 изисква да се провеждат изпитания върху вентилния отвод с най-дълъг корпус и най-високо номинално напрежение. Вентилните отводи AZC имат еднакъв корпус и категория като вентилните отводи AZB Изпитваната мостра има същия дизайн като AZC (форма на корпуса и материал, вътрешни части, варистор) **Този доклад е валиден за AZC**
ИЗПИТАНИЕ НА ОГЪВАЩ МОМЕНТ	10.8.9	CESI A4/509502	Вентилен отвод AZB36 Ur=36 kV	Стандартът IEC 60099-4 изисква да се провеждат изпитания върху вентилния отвод с най-дълъг корпус и най-високо номинално напрежение. Вентилните отводи AZC имат еднакъв корпус и категория като вентилните отводи AZB Изпитваната мостра има същия дизайн като AZC (форма на корпуса и материал, вътрешни части, варистор) **Този доклад е валиден за AZC**

САМОКОВ
ВАК 02. 1 ДОА

AZC ВЕНТИЛЕН ОТВОД – ТАБЛИЦА ЗА ТИПОВЕ ТЕСТОВЕ СЪГЛАСНО IEC 600099-4

ИЗПИТАНИЕ С ПРОНИКВАНЕ НА ВЛАГА	10.8.13	CESI A4/509306	Вентилен отвод AZB36 Ur=36 kV	Стандартът IEC 60099-4 изисква да се провеждат изпитания върху вентилния отвод с най-дълъг корпус и най-високо номинално напрежение. Вентилните отводи AZC имат еднакъв корпус и категория като вентилните отводи AZB Изпитваната мостра има същия дизайн като AZC (форма на корпуса и материал, вътрешни части, варистор) **Този доклад е валиден за AZC**
ИЗПИТАНИЕ С АТМОСФЕРНО СТАРЕЕНЕ	10.8.14 Серия А: 1000h	CESI AT-A5/022740	Вентилен отвод AZB27 Ur=27 kV	Изпитанието е извършено върху вентилния отвод при минимално специфично разстояние AZB27.. Вентилните отводи AZC имат еднакъв корпус и категория като вентилните отводи AZB **Този доклад е валиден за AZC**

"ВАК - 02" ООД САМОКОВ

Test Report

CESI n° 0030 Approved

Client	Dervasil – Saint Joseph - (France)
Tested equipment	Housing for polymer housed metal-oxide surge arrester type AZB 36
Tests carried out	Insulation withstand tests
Standards/Specifications	IEC 60099-4 (2004-05)
Test date	from February 07, 2005 to February 07, 2005

No. of pages	13	**No. of pages annexed**	4
Issue date	May 04 , 2005		
Prepared	BU PeC - L. Podavitte		
Verified	BU PeC - R. Malgesini		
Approved	BU PeC - M. de Nigris		

CESI
TECNICO SPERIMENTALE ITALIANO
Business Unit

CESI
Centro Elettrotecnico
Sperimentale Italiano
Giacinto Motta spa
Via R. Rubattino 54
20134 Milano - Italia
Telefono +39 022125 1
Fax +39 0221255440
http://www.cesi.it
Capitale sociale
interamente versato
Codice fiscale e numero
iscrizione CCIAA 00793580150
Sezione Ordinaria
N. R.E.A. 429222
P.I. IT00793580150

ВЯРНО С ОРИГИНАЛА

"ВАК - 02" ООД
САМОКОВ

Tests witnessed by:----

Identification of the object:

The Manufacturer guarantees that the tested object is manufactured according to the submitted drawings.
CESI checked that these drawings adequately represent in shape and dimensions the essential details and the parts of the tested object.
These drawings, identified by CESI and numbered A5021441 No. 1-3-4-5 , have been returned to the Client.

The data necessary to permit repetition of the tests are contained in the document marked: ---

- dielectric tests with impulse voltage	**: peak voltage: ± 3 %; time parameters: ± 10 %**
- dielectric tests with impulse current	**: peak value: ± 3 %; time parameters: ± 10 %**
- dielectric tests with alternating voltage	**: voltage (rms): ± 3 %**
dielectric tests with direct voltage	**: voltage: ± 3 %**

The measurement uncertainties are estimated at the level of twice the standard deviation (corresponding, in the case of normal distribution, to confidence level of about 95%) and have to be considered as maximum values

Laboratory information

Receipt date of the sample	February 01, 2005
Test location	CESI – Via Rubattino 54 – Milan
CESI testing team	Mr L. Podavitte , Mr I. Guacci, Mr M. Gregori
Test laboratory	P180
Activity code	26892R

ВЯРНО С ОРИГИНАЛА

"ВАК - 02" ООД САМОКОВ

A1001IG

110

Rated characteristics of the tested object assigned by the Client

Metal-oxide surge arrester	
Manufacturer	Dervasil
Year of manufacture	2004
Geometrical characteristics measured on the test sample	
Height	345 mm
Number of sheds	12
Shed diameter	119 mm
Shed spacing	25 mm
Arcing distance	370 mm
Creepage (leakage)distance	1020 mm
Core diameter	59 mm
Other characteristics	
Housing material	Silicone rubber
Housing color	grey

Name and signature of Client's witness:

ВЯРНО С ОРИГИНАЛА

"ВАК - 02" ООД САМОКОВ

Photograph of the test object

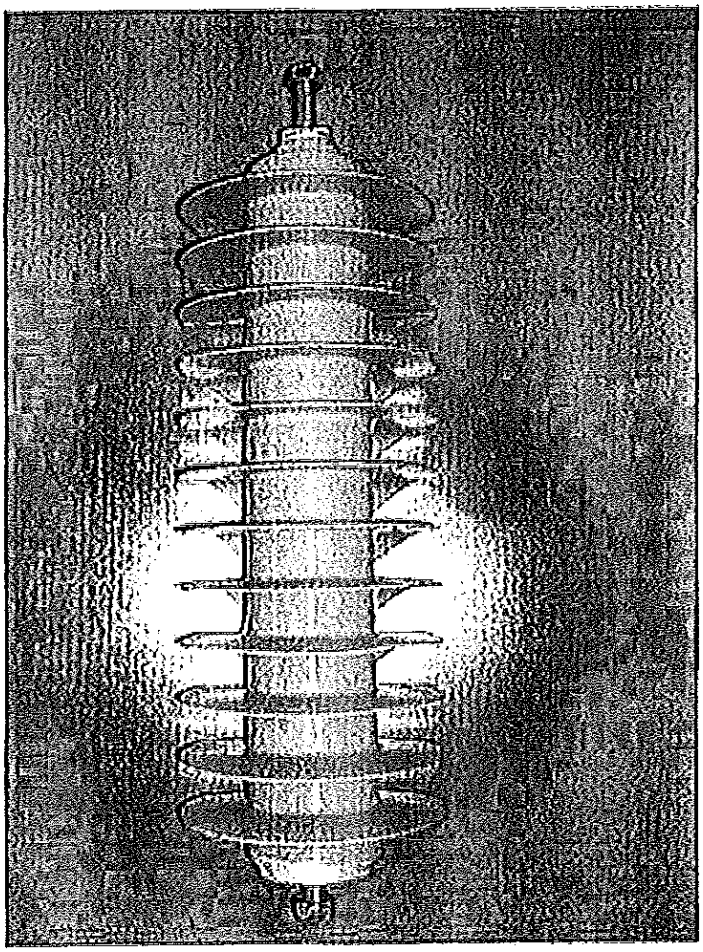

Photo no. 1

ВЯРНО С ОРИГИНАЛА

"ВАК - 02" ООД САМОКОВ

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Photograph of the test arrangement

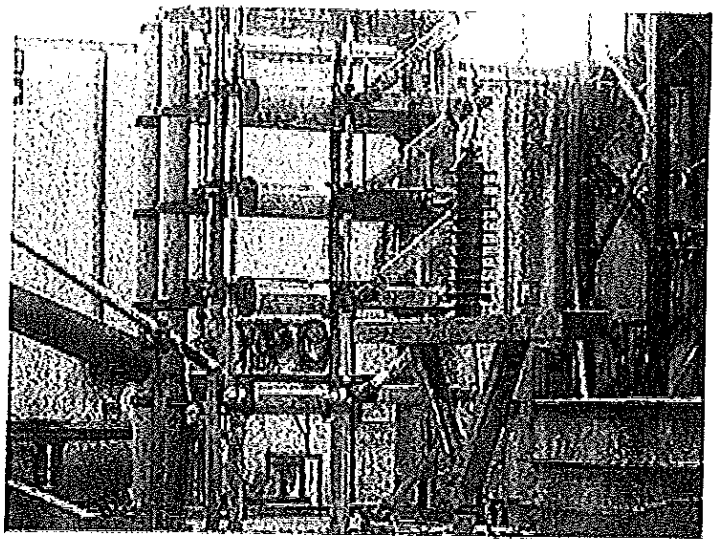

Photo no. 2

A12651G

"BAK - 02" OOO
OAMOKOB

Reference Standard

IEC 60099-4 (2004-05): "Metal-oxide surge arrester without gaps for a.c. system", clause 8.2

Test carried out and identification of the test objects

Test carried out	Number of test objects	Test object identification
Dry lightning impulse withstand tests	1	IWT1
Wet power frequency withstand tests	1	IWT1

Test procedure

Dry lightning impulse withstand test

The test sample has been submitted to fifteen voltage impulses for each polarity having waweshape 1,2/50 µs and peak value equal to 190,0 kVpeak .The test has been performed in dry condition.

Wet power frequency withstand test

The power frequency voltage has been applied for 60 second on the sample at the value equal to 70,71 kVrms .The test has been performed in wet condition (as defined by IEC st. 60060-1 (1989))

Summary of test results

Dry lightning impulse withstand test

Non flashover occurred during any of the impulse application

Wet power frequency withstand test

Non flashover occurred

The test result is positive

"ВАК - 02" ООД САМОКОВ

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A1016IG

Dry lightning impulse withstand voltage test

Test No.: 1

Test object: Housing for polymer housed metal-oxide surge arrester
Test circuit: A0002
Arrangement: see photograph pag n.6

Atmospheric conditions and correction factor			
b	t_d/t_w	h	K_t
kPa	°C	g / m³	
101,83	11 (6)	4,49	0,968

Date: February 07, 2005

test condition	polarity	impulse generator charging voltage	voltage required U	voltage applied U x K_t	A: (o) withstand (x) flashover B: oscillogram No. C: peak voltage [kV] D: time to discharge (µs)														
		kV	kV_{peak}	kV_{peak}															
IWT1	negative	93,0	190,0	183,4	A	o	o	o	o	o	o	o	o	o	o	o	o	o	o
					B	03													
					C	183,5	183,6	183,5	183,8	183,6	183,6	183,6	183,5	183,5	183,5	183,6	183,8	183,8	183,8	183,8
					D														
IWT1	positive	93,0	190,0	183,4	A	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o
					B	04													
					C	182,5	183,5	184,0	183,6	183,8	183,6	183,6	183,8	183,8	183,	183,8	183,5	183,6	183,6	183,6
					D														

"BAK - 02" OOD
CAMOKOB

continued

A1048IG

Wet power frequency withstand voltage test

Test No.: 2

Test object: Housing for polymer housed metal-oxide surge arrester
Test circuit: A0058-A0059
Arrangement: see photograph pag n.6

Atmospheric conditions and correction factor			
b	t_d/t_w	h	K_t
kPa	°C	g / m³	
101,03	12/5	2,99	1,0

	Precipitation conditions				
	Precipitation rate (mm/min)			Water temperature	Water resistivity
	top	center	bottom	°C	Ω * m
vertical	1,2	1,2	1,2	11	100
horizontal	1,2	1,2	1,2		

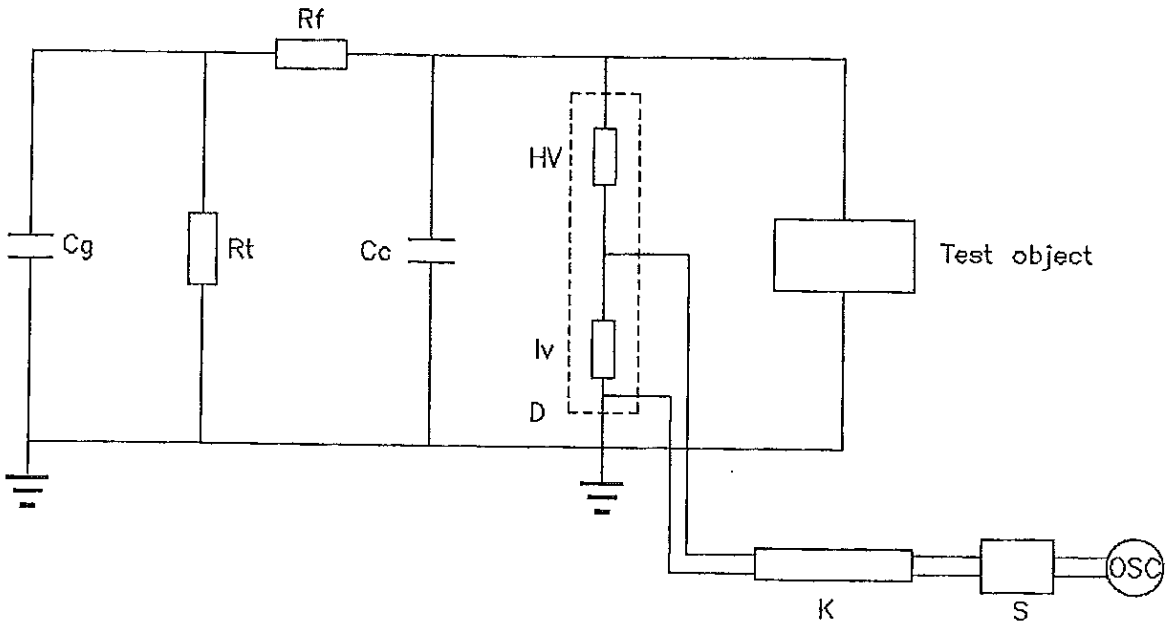
Date: February 07, 2005

test condition	voltage		test voltage				test duration	Test result	Notes
	required U	applied U x K_t	V_1	$V_{AT} = k_1 V_1$ (k_1 = 3500)	V_2	$V_{AT} = k_2 V_2$ (k_2 = ---)			
	kV_{rms}	kV_{rms}	V_{rms}	kV_{rms}	V_{rms}	kV_{rms}	s		
IWT1	70,71	70,71	20,20	70,71	---	---	60	withstand	

continued

"BAK - 02" DOO CAMOKOB

Circuit A0002



Impulse generator

No. of stages: 2
C_g: 250 nF
R_t: 280 Ω (140 x 2)
R_f: 320 Ω (140+60+40+80)
C_C: 0,6 nF

Voltage measuring system CESI No. 9792

D - divider PASSONI & VILLA type RC series CESI No. 6700; scale factor 25662,7
HV - high voltage capacitance 600 pF
Iv - low voltage unit CESI No. 6704
K - coaxial cable
S - attenuation and termination unit CESI No. 14924
OSC - digital oscilloscope type TEKTRONIX TDS 430A CESI No. 14232

	Measured waveshape		
	polarity	time	oscillogram
		µs	No.
front	negative	1,04	01
tail		54,8	02

	Check of the test circuit		
	Charging voltage V_c	Measured voltage V_m	η $V_m / (V_c \cdot n_{stages})$
polarity	kV/stage	kV	
negative	72,0	142,0	0,986

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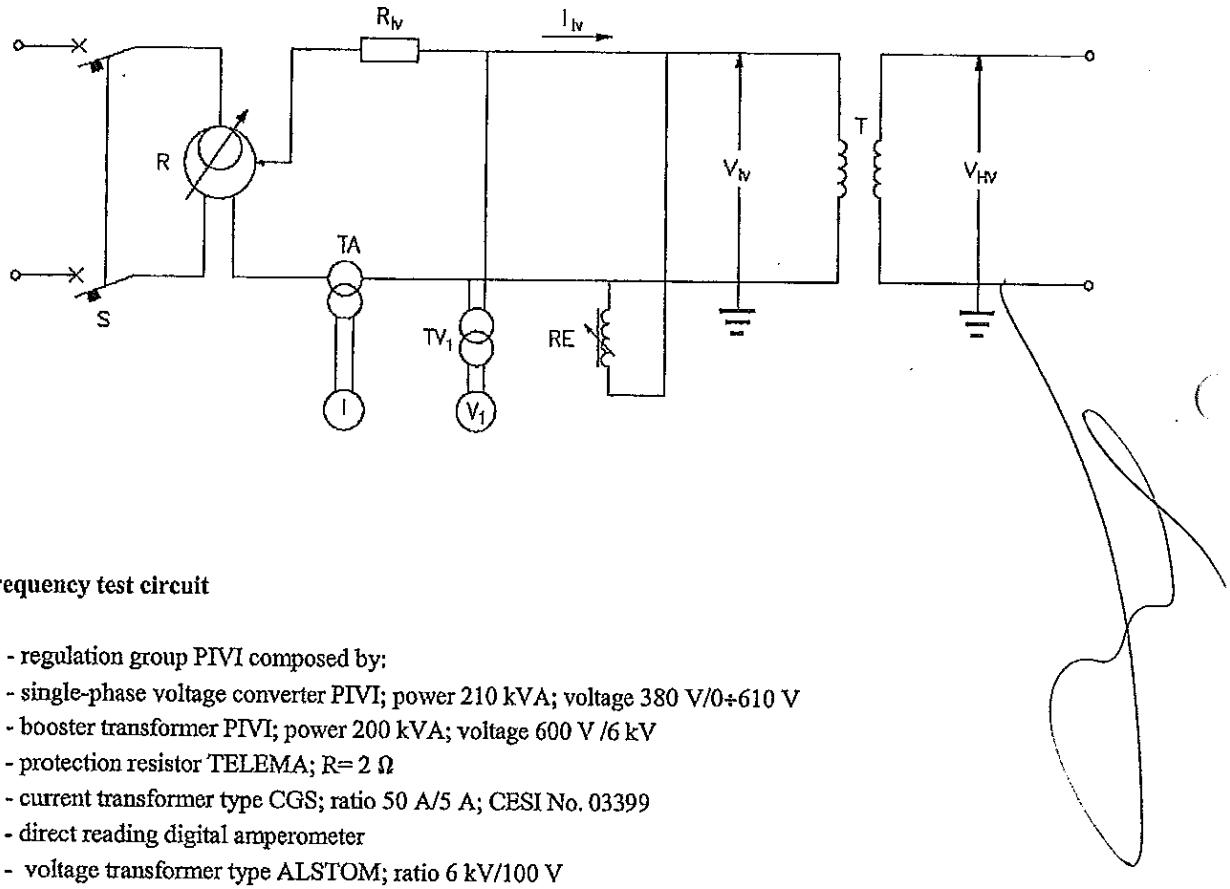
Circuit A0058



Power frequency test circuit

R - regulation group PIVI composed by:
- single-phase voltage converter PIVI; power 210 kVA; voltage 380 V/0÷610 V
- booster transformer PIVI; power 200 kVA; voltage 600 V /6 kV

R_{lv} - protection resistor TELEMA; R= 2 Ω

TA - current transformer type CGS; ratio 50 A/5 A; CESI No. 03399

I - direct reading digital amperometer

TV_1 - voltage transformer type ALSTOM; ratio 6 kV/100 V

V_1 - digital voltmeter AGILENT 34401A; CESI No. 23082

T - booster transformer CGE mod. KOC; secondary winding power 700 kVA; voltage 6 kV /350 kV; No. of units 1; ratio 3500

RE - variable reactor PIVI; power 600 kVA(not used)

Tripping of the circuit breaker S

I_N	k_{TA}	instantaneous tripping			time delayed tripping		
		setting			setting		
		s_1	s_1 3 I_N	t_1	s_2	s_2 3 I_N	t_2
5	10	1	5	0,05	0,5	2,5	0,05

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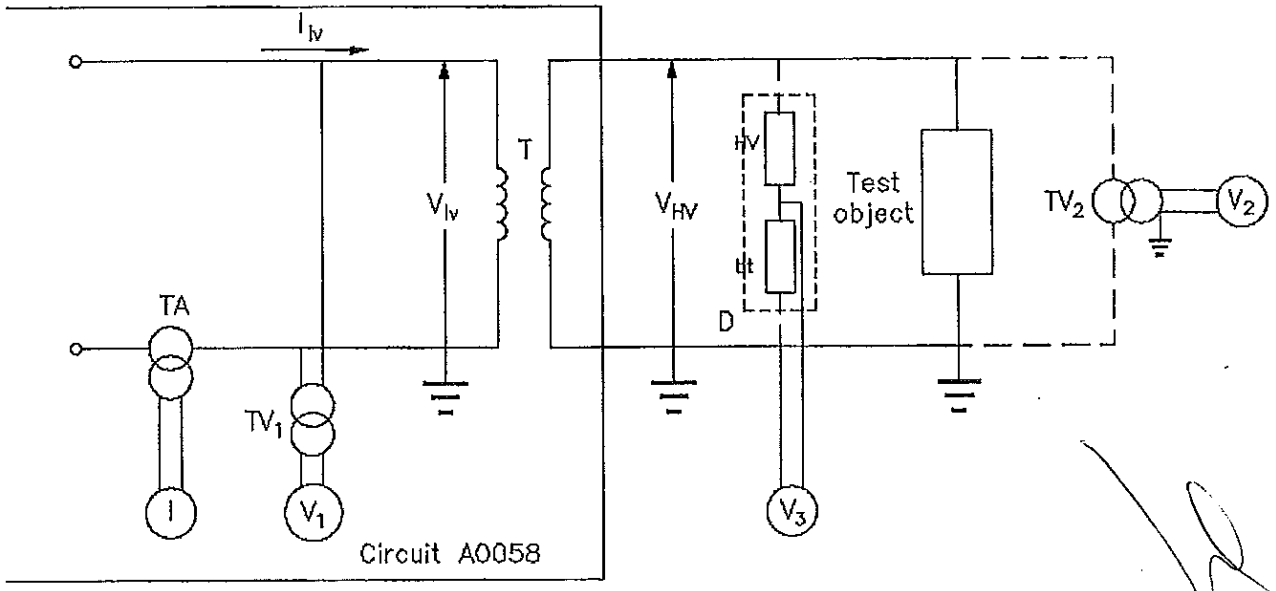
Circuit A0059



Power frequency measuring circuit

TA - current transformer type CGS; ratio 50 A/5 A; CESI No. 03399
I. - direct reading digital amperometer
TV_1 - voltage transformer type ALSTOM; ratio 6 kV/100 V
V_1 - digital voltmeter AGILENT 34401A CESI No. 23082

D - voltage divider / type RC series; voltage / kV; HV capacitance / pF; CESI No. /; low voltage arm CESI No. / scale factor /
V_3 - voltmeter CESI No. Not used

TV_2 - voltage transformer type SCARPA & MAGNANO; ratio 130/100 V; CESI No.5133
V_2 - digital voltmeter AGILENT 34401A CESI No. 23083

Functional check of the test circuit Date: February 07, 2005

Low voltage				High voltage $k_2 = 1300$		$k_3 = ---$		k_t
V_1	V_{lv}	I	I_{lv}	V_2	V_{HV}	V_3	V_{HV}	V_{HV} / V_1
V	V	A	A	V	kV	V	kV	3500
14,27	856,2	--	1,0	38,34	48,83	---	---	3492

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A0059IG

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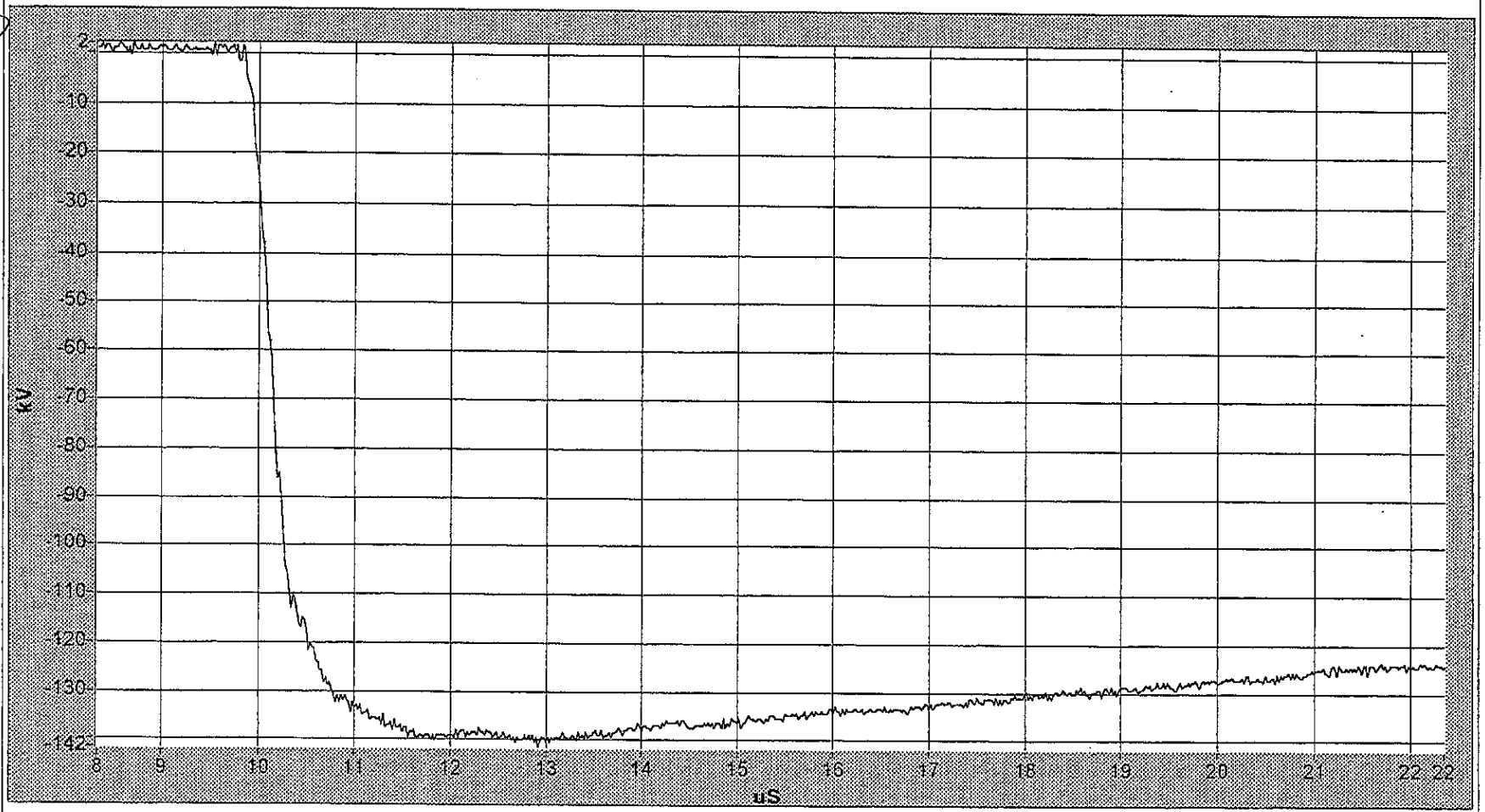
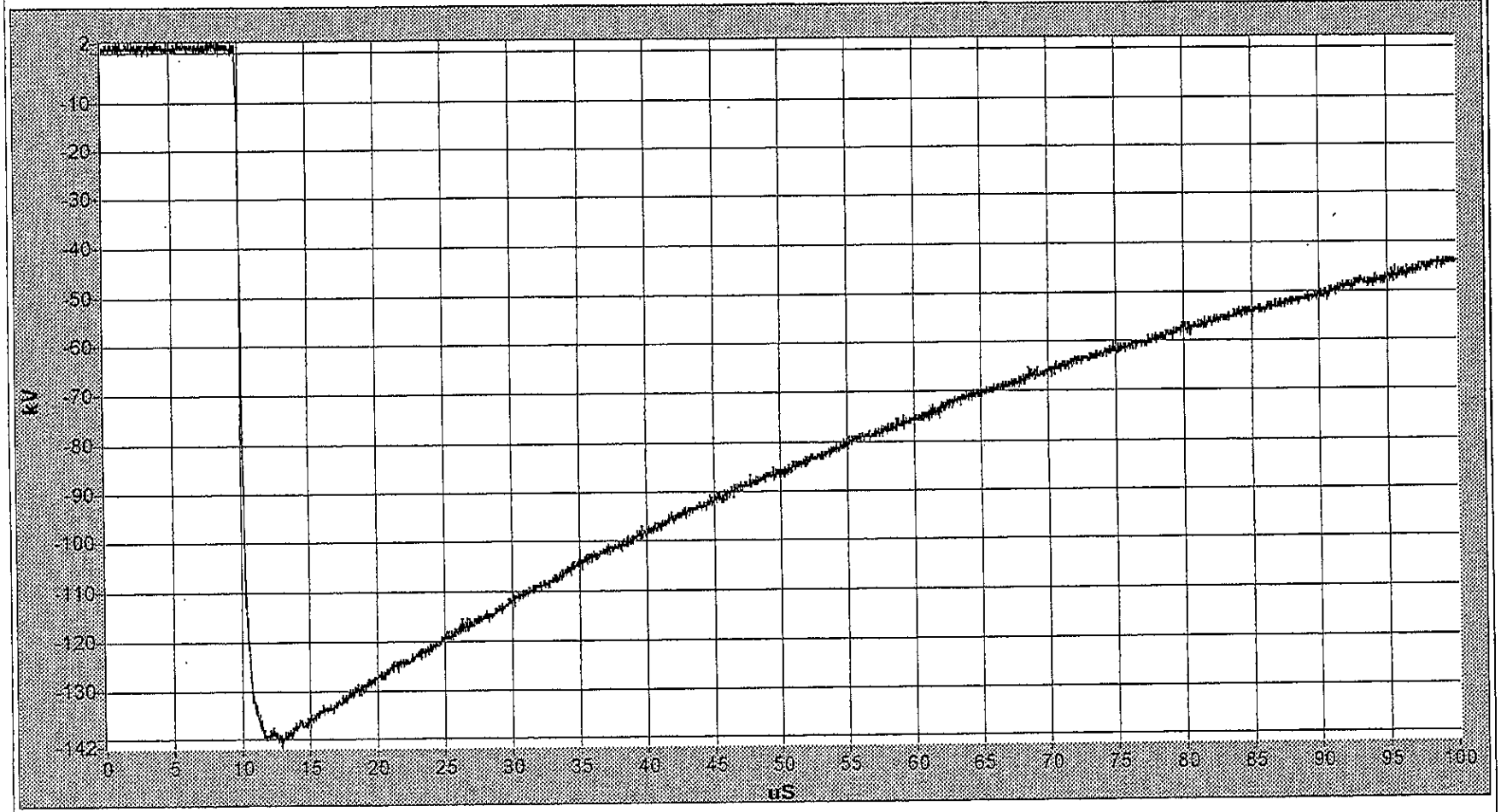
CESI A5/003636, n.1



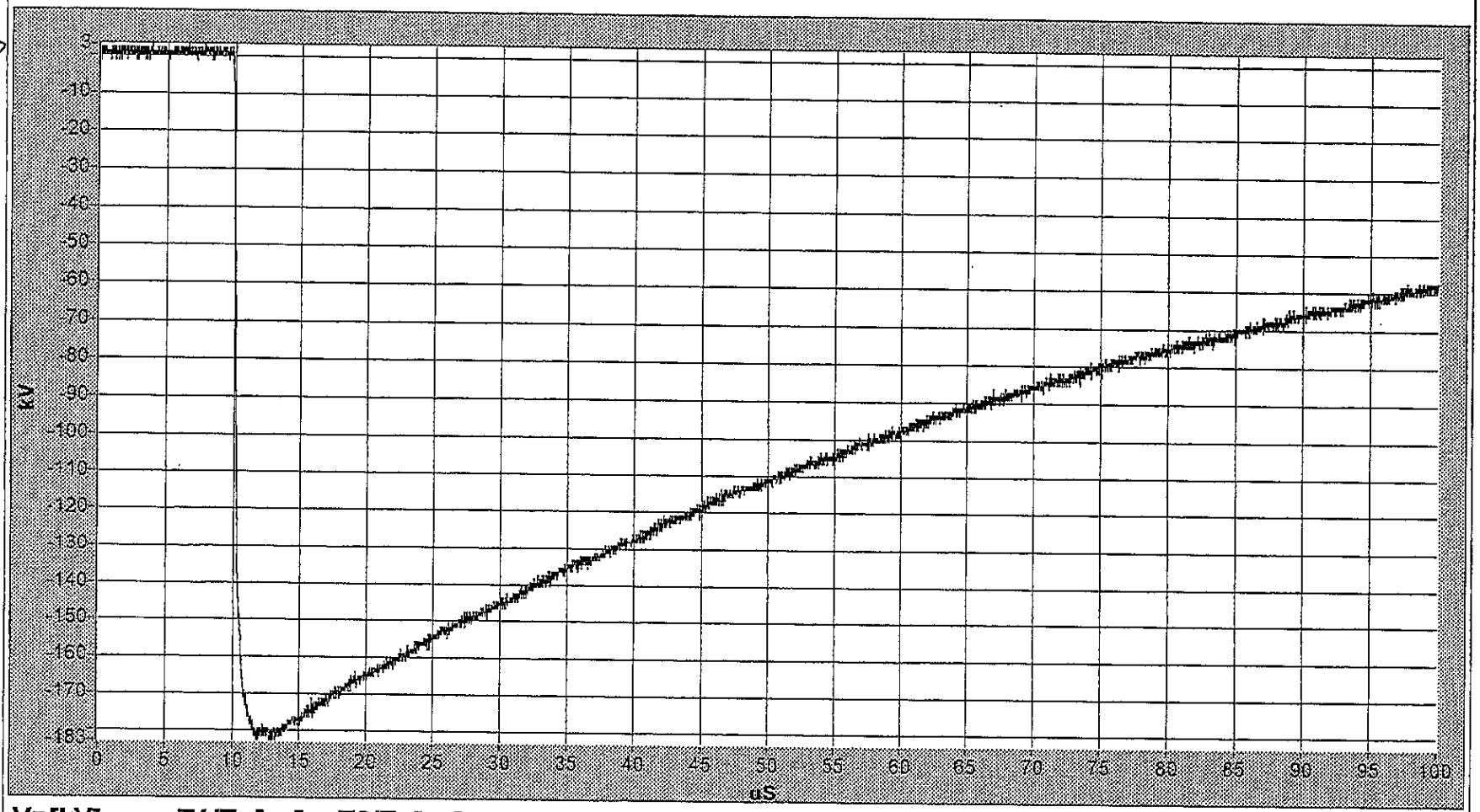
Vp[kV]	T1/Tp[us]	T2/Tc[us]
-142.585	1.038	54.855

CESI A5/003636, n.2



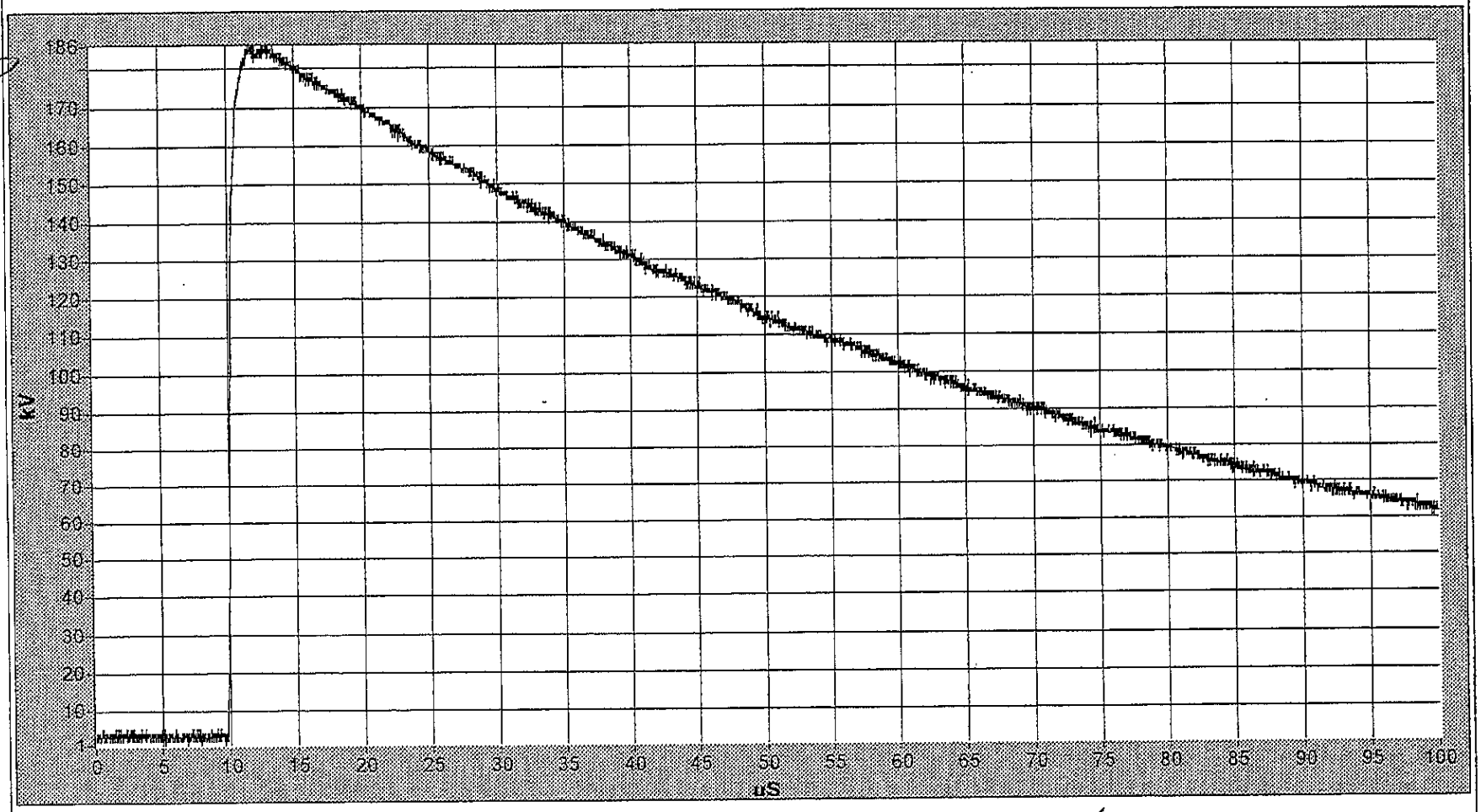
Vp[kV]	T1/Tp[us]	T2/Tc[us]
-142.585	1.038	54.855

CESI A5/003636, n.3



Vp[kV]	T1/Tp[us]	T2/Tc[us]
-183.552	1.075	55.292

CESI A5/003636, n.4



Vp[kV]	T1/Tp[us]	T2/Tc[us]
182.538	1.017	56.066

DERVASIL
Lightning Arrester
Class 2

Report No.	F1-44006002-1

TEST REPORT

METAL-OXIDE ARRESTER BLOCKS

TYPE	TV4136FE2
Uc	5kV
NOMINAL DISCHARGE CURRENT	10kA class2

OTOWA Electric Industrial Co., LTD
7-18,Meishincho-3chome, Amagasaki-city,
Hyogo Pref., 661-0021 Japan
TEL: +81 66429-3541 FAX: +81 66426-0535

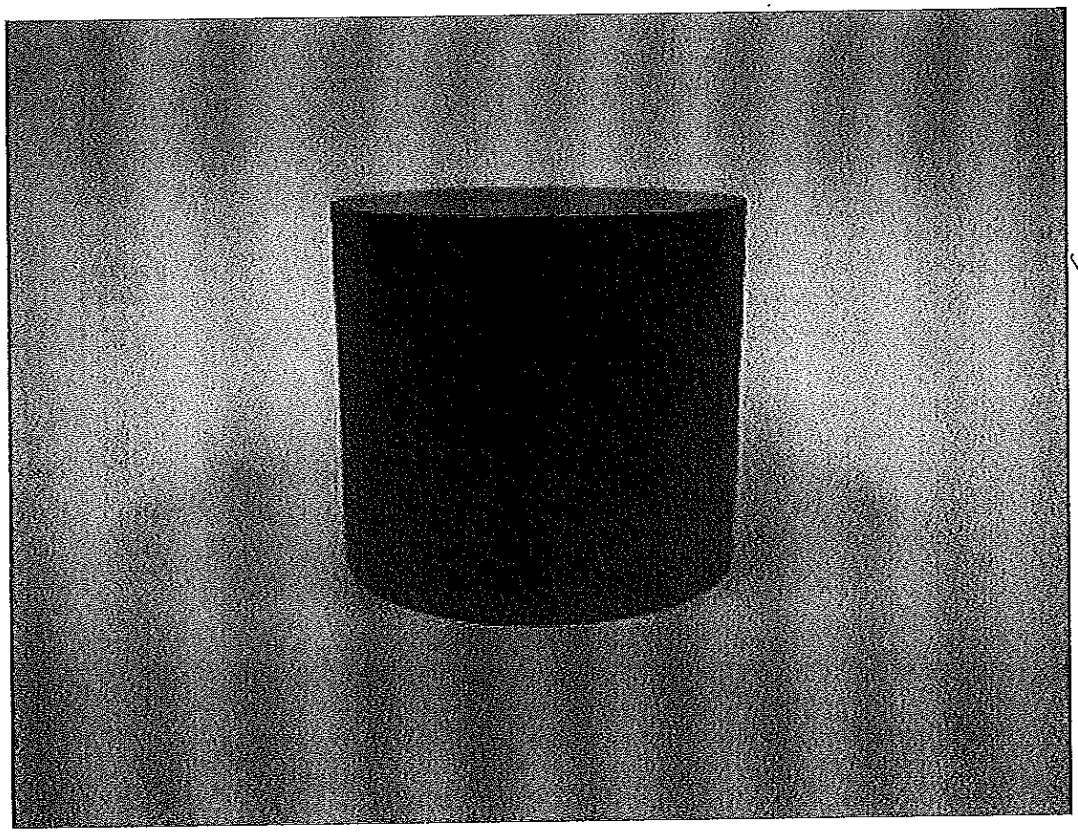


Photo 1. Test sample

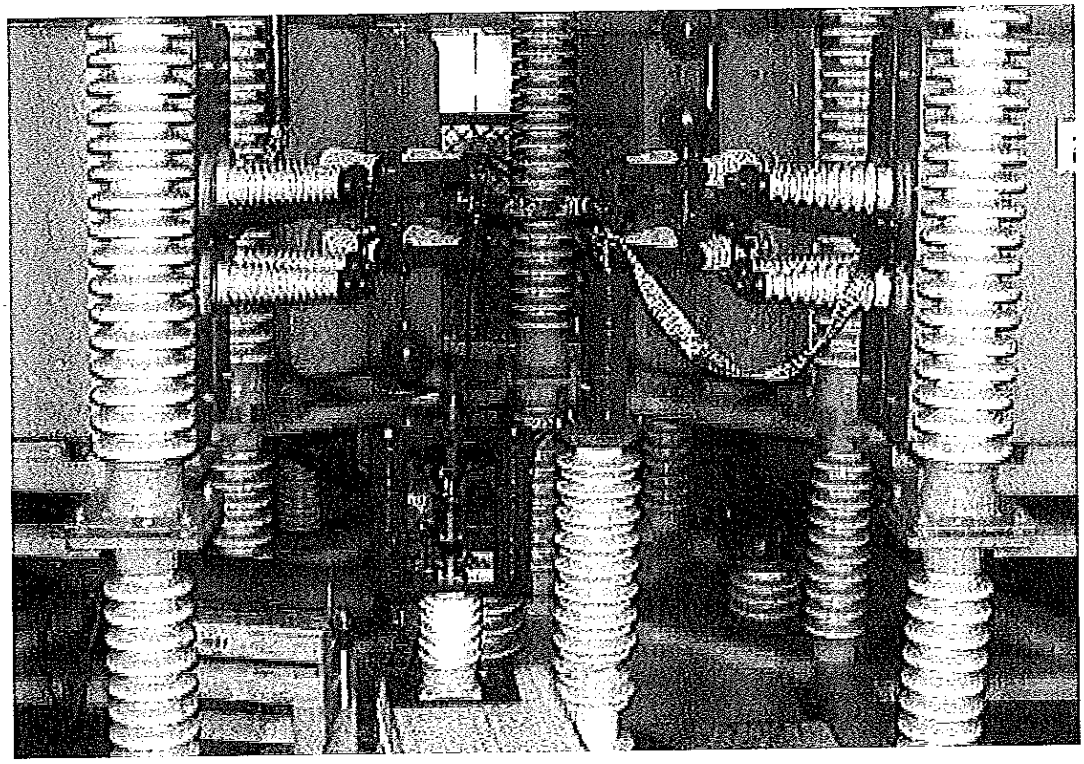


Photo 2. Test equipment

SPECIFICATION OF TEST BLOCKS

Type	Dimensions (mm)		Rated Voltage (kV)	MCOV (kV)	Current with stand	
	Diameter	Height	IEC	IEC	4/10 μ s	2ms
TV4136FE2	41±0.8	36±1.0	6.25	5.00	100kA	500A

Nominal discharge current In:10kA(8/20 μ s)
Referent current Iref: 2mA

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1. Reference voltage measurements.

The test was made on 3 blocks with AC 60Hz.

Type	Sample	Resistive component of current = 2mA peak
		Reference voltage Uref (kVrms)
TV4136FE2	1	6.34
	2	6.38
	3*1	6.36

※1 : OSC Fig.1-1

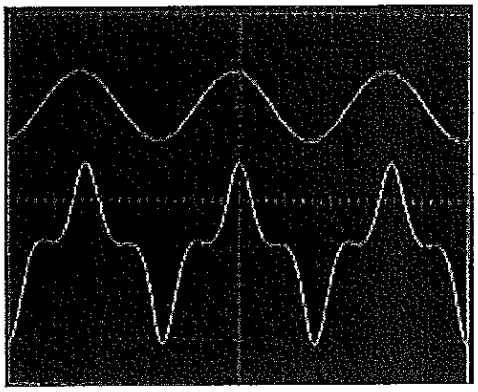


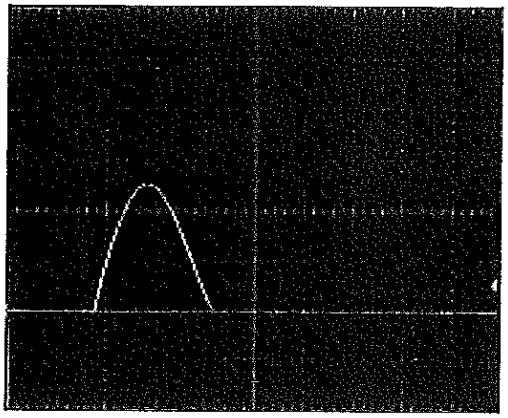
Fig. 1-1

2. Residual Voltage test

2-1. Nominal discharge current test

The residual voltage test with nominal discharge current impulse (8/20 μ s) was made on 3 blocks. Positive current impulses in the range from 1.5kA to 20kA were applied on each block.

Type	Sample	Residual voltage (kV)									
		1.5 kA		2.5kA		5.0kA		10 kA		20kA	
		I kA	V kV	I kA	V kV	I kA	V kV	I kA	V kV	I kA	V kV
TV4136FE-2K	1	1.53	13.9	2.5	14.2	5.7	15.2	10.1	16.2	21.4	17.7
	2	1.54	13.9	2.5	14.3	5.6	15.3	10.0	16.3	21.3	18.3
	3*2	1.50	13.8	2.5	14.3	5.6	15.3	10.0	16.3	21.6	17.1
Impulse shape		※2 : OSC Fig.2-1 8.4 /19.2 μ s									



X: 10 μ s/div Y: 4.1kA/div

Fig. 2-1

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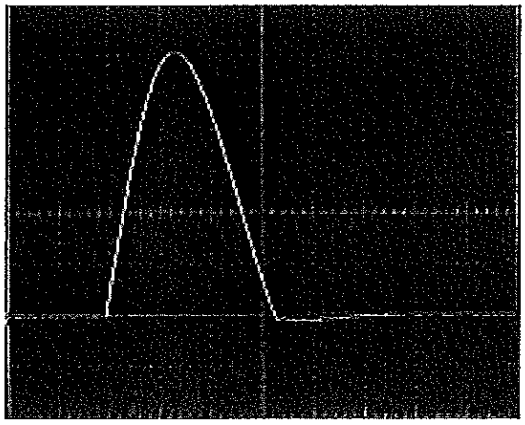
2-2. Steep current impulse test

The residual voltage test with steep current impulse (1/20 μ s) was made on the 3 blocks. A positive 10kA current impulse was applied on each block

Type	Sample	Residual voltage (kV)	
		I kA	V kV
TV4136FE-2K	1	10.2	17.8
	2	10.2	18.0
	3*3	10.2	17. 8
Impulse shape	※3 : OSC Fig.2-2 1.0 / 2.4 μ s		



X: 1 μ s/div Y: 2kA/div

Fig. 2-2

3. Long duration current impulse withstand test

The long duration current impulse withstand test was made on 3 blocks in accordance with clause 7.4 of IEC 600099-4.

The lightning current impulse (8/20 μ s) residual voltage was measured before and after the test.

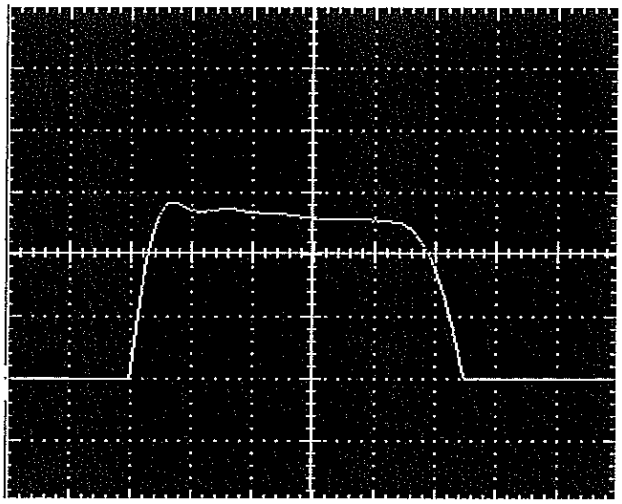
Each long duration current impulse test consists of 18 discharge operations divided into six groups of three operations.

Intervals between operations were 60 s and between groups such that the sample cools to near ambient temperature.

Test sample No. (4136GB25)		4	5	6
Measurement of residual voltage before test (Pre-Test V10kA)	Current (kA)	10.3	10.3	10.3
	Voltage (kV)	15.4	15.4	15.5
Long duration current impulses	Current (A)*5	504-508	503-507	503-508
	Duration (ms)	2.0	2.0	2.0
	Residual voltage (kV)	12.2~12.3	12.2~12.4	12.2~12.5
Number of impulse	Total / Group	18/3	18/3	18/3
Injection energy (kJ)		12.2	12.2	12.2
Measurement of residual voltage after test (Post-Test V10kA)	Current (A)	10.3	10.3	10.3
	Voltage (kV)	15.4	15.4	15.5
Percentage change (%)		±0	±0	±0
Test result		passed	passed	passed

ambient temperature: 18 ~ 20 ℃

※5 : OSC Fig.3-1



X: 500 μ s/div Y: 202A/div

Fig. 3-1

ВЯРНО С ОРИГИНАЛА

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4 . Accelerated ageing test

Accelerated ageing test was made on 5kV MCOV blocks (TV4136FE2) in accordance with clause 7.5.2 of IEC 60099-4.

3 blocks were stressed at 5.75(1.15xUc) kV for 1000 hours at temperature of 115±2℃.

The watts loss was measured after 2 hours and 1000 hours on each block.

Test results shows that watts loss of each block measured after 1000 hours are lower than those measured after 2 hours, or continuous decrease in watts loss was demonstrated on each block.

Test sample No.		7	8	9
2 hour after energization ambient temperature :115℃	Applied Voltage (kVrms)	5.75	5.75	5.75
	Power loss (W)	4.6	4.8	4.9
1000 hour after energization ambient temperature :115℃	Applied Voltage (kVrms)	5.75	5.75	5.75
	Power loss (W)	2.6	2.5	2.7

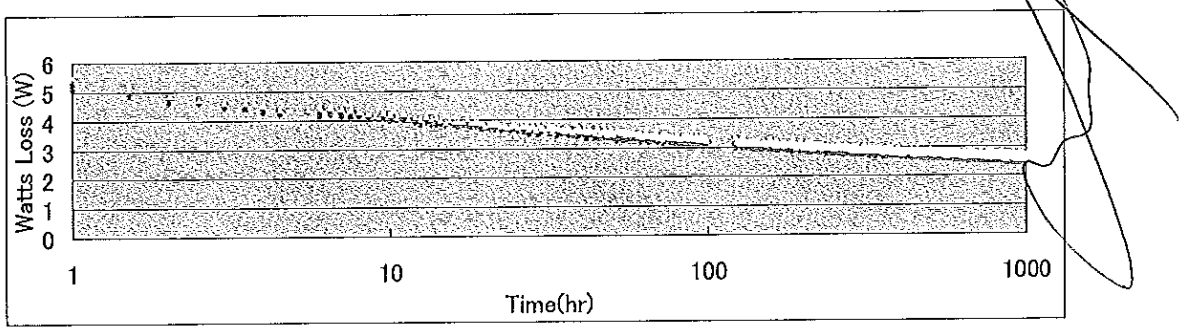


Fig.4-1

5. Switching surge operating duty tests

Operating duty tests was made on 3 samples consisting of 5kV Uc (IEC) blocks in accordance with clause 7.5 of IEC 60099-4(1998).

1) Measurement of residual voltage

At first part of the operating duty test, a lightning impulse (8/20μs) residual voltage measurement was made with nominal discharge current.

2) Conditioning

The samples was exposed to the conditioning test consisting of twenty 8/20 lightning current impulses. The impulses were applied while the sample was energized at power frequency voltage stress of 1.2Uc. The lightning current impulses were applied in 4 groups of 5 impulses. The interval between the impulses was 50 to 60 seconds and the interval between groups was 25 to 30 minutes. The polarity of the current impulse was same as that of the half cycle of power frequency voltage during which it occurs and was applied 60 electrical degrees before the peak of the power frequency voltage.

3) High current impulse test

The samples were subjected to one high current impulse of 100 kA (4/10us) at ambient temperature. Then the test samples were preheated up to 60 degree centigrade in an oven. Then the samples were subjected to the second high current impulse of 100kA (4/10us).

4) Long duration impulse tesut

The samples were subjected to two long duration impulse of 500A (2ms) at ambient temperature. The time intervals between impulses shall be 50s to 60s.

Within about 100ms after second impulse, the power frequency voltage of Ur and the elevated continuous operating voltage (Uc) were applied for a time period of 10s and 30min respectively to prove thermal stability. After the test samples were cooled down to the temperature close to ambient conditions, the measurement of residual voltage was made.

5) Results

The thermal stability was observed on each sample.

The residual voltage measured after the test did not change more than 5% from the value measured before the test on each sample.

No damage was observed on each sample after the test.

Therefore, the samples passed the high current impulse operating duty test.

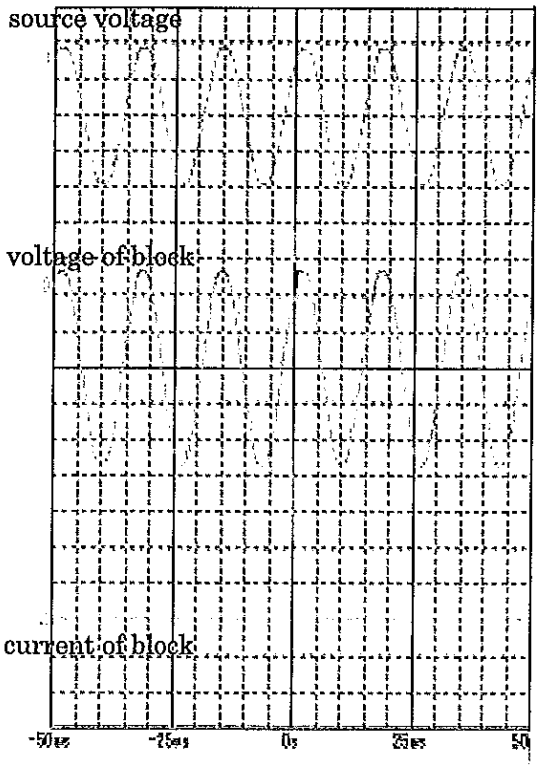
Table 5-1 Result of operating duty test

Test sample No.			1	2	3
Conditioning with lightning current impulse (10kA, 8/20μs)	Applied voltage [kVrms]		6.2	6.2	6.2
	Current of impulse [kA]		*9 10.0-10.3	10.0-10.4	10.0-10.4
	Number of impulses: Total /per group		20/5	20/5	20/5
	Time between: the impulses / the group		25-30 min / 60sec	25-30 min / 62sec	25-30 min / 59sec
High current impulse (100kA, 4/10μs)	First current impulse [kA]		*10 101.6	101.7	101.3
	Second current impulse [kA]		100.5	100.7	100.2
Long duration current impulse (500A, 2ms)	First current impulse [A]		*11 505	510	505
	Second current impulse [A]		500	505	500
	Elevated Ur (10 sec) applied voltage [kVrms]		*12 6.4	6.4	6.4
	Elevated Uc (30 min)	Applied voltage [kVrms]	5.1	5.1	5.1
		Leakage current [mA] (1min→30min)	*13 13.75-0.3	5.3-0.6	2.8-0.1
Residual voltage (at 10kA, 8/20μs)	Initial	Current [kA]	9.84	10.24	9.92
		Voltage [kV]	15.80	16.00	15.90
	Final	Current [kA]	10.05	10.05	10.09
		Voltage [kV]	16.66	16.60	16.66
	Percent change		+5.44%	+3.75%	+4.78%

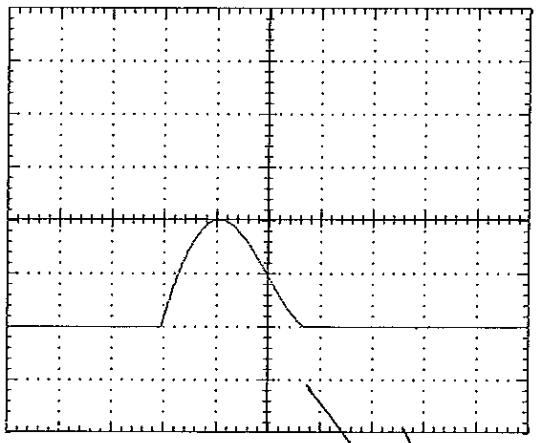
*9 : Chart & OSC (Fig.5-1)
*10 : OSC (Fig.5-2)
*11 : OSC (Fig.5-3)
*12 : Chart (Fig.5-4)
*13 : Chart (Fig.5-5)

Fig.5-1 Nominal discharge current at rated duty-cycle voltage: Sample No.3

Chart (1st impulse)

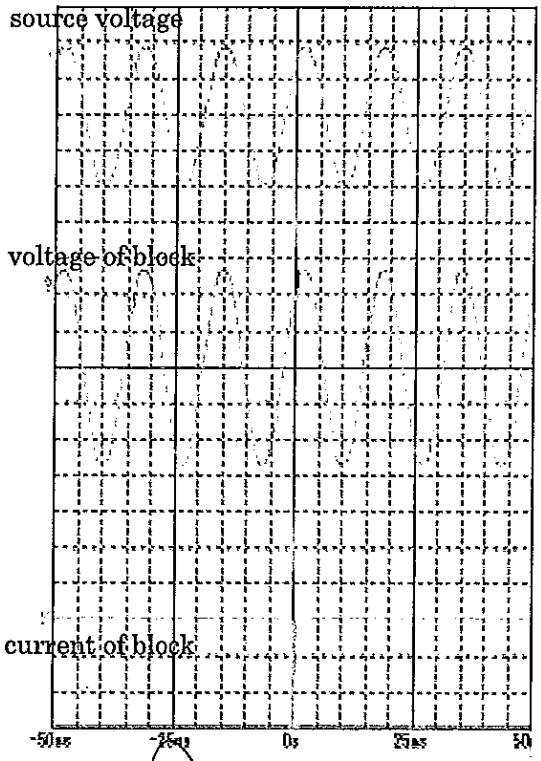


OSC of discharge current (1st impulse)

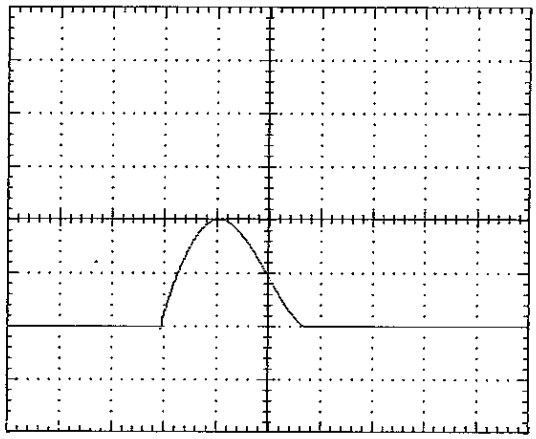


x: 10μs/div
y: 5kA/div

Chart (20th impulse)



OSC of discharge current (20th impulse)



x: 10μs/div
y: 5kA/div

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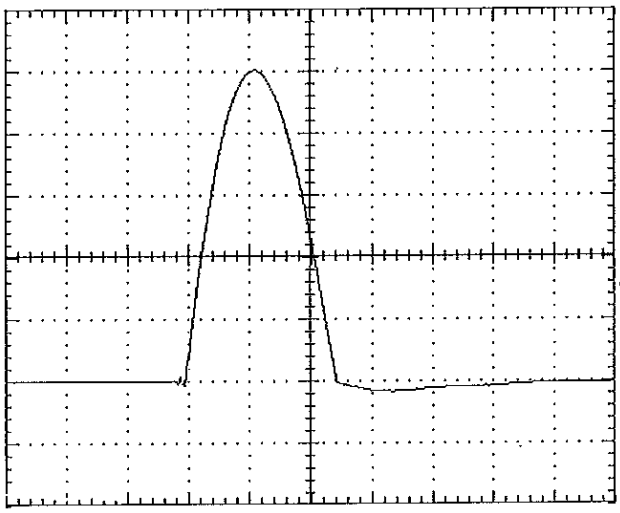
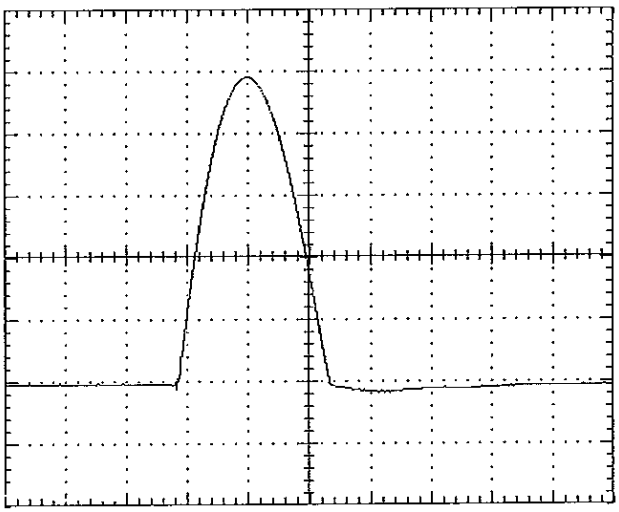
Fig.5-2 OSC of discharge High current (1st impulse): Sample No.3
(ambient temperature)



x: 5μs/div
y: 20.2kA/div

Fig.5-3 OSC of discharge High current (2nd impulse): Sample No.3
(preheat: 60 degree centigrade)



x: 5μs/div
y: 20.2kA/div

Fig.5-4 Elevated Ur voltage, 10sec (after high current impulse): Sample No.3

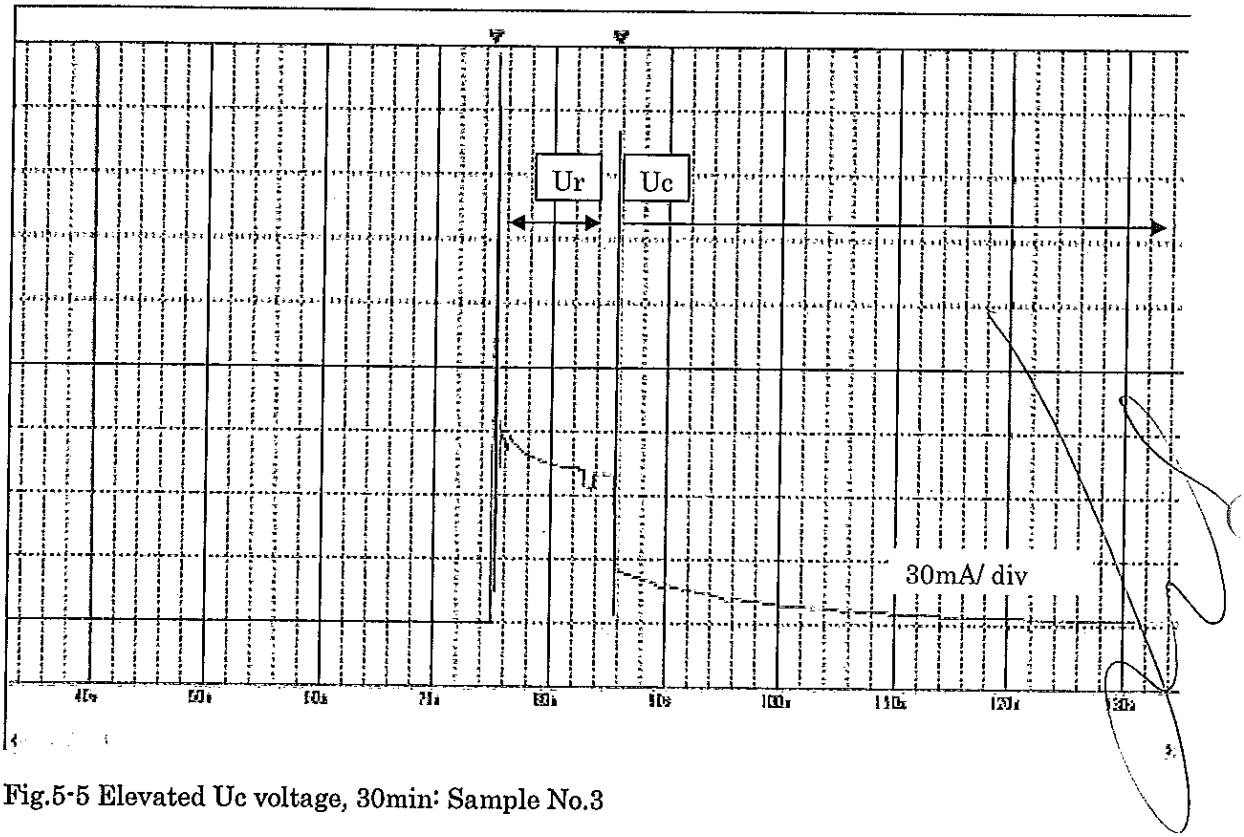
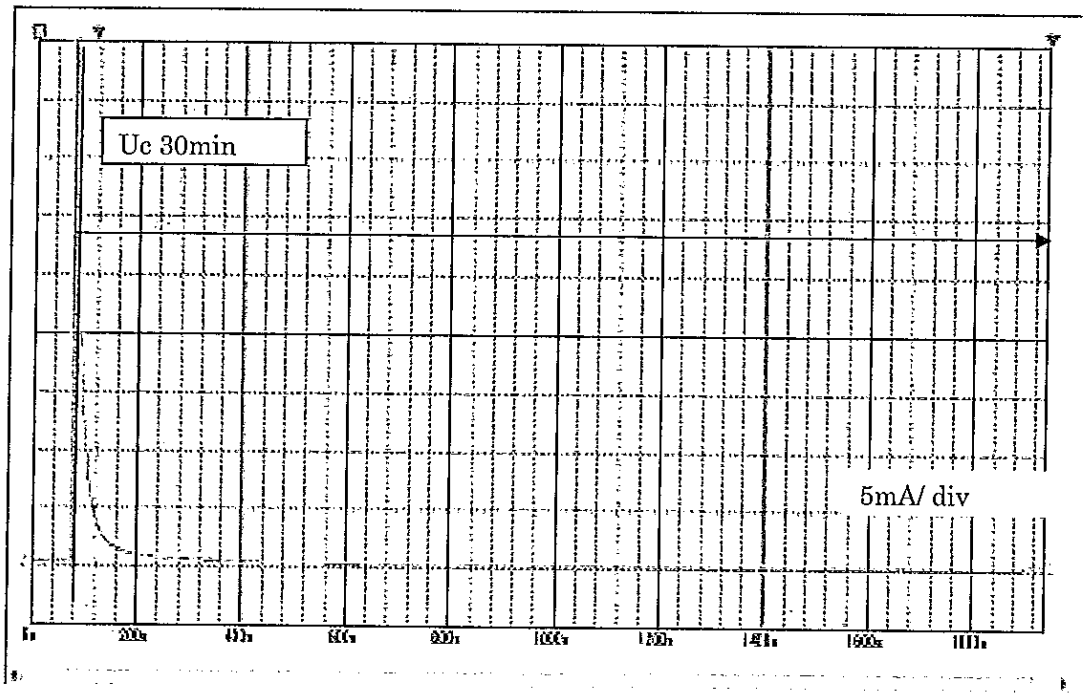


Fig.5-5 Elevated Uc voltage, 30min: Sample No.3



Test Report

CESI

Client	DERVASIL Saint Joseph – FRANCE
Tested equipment	Polymer housed metal-oxide surge arresters without gaps for a.c. systems
Tests carried out	Short-circuit tests
Standards/Specifications	IEC 60099-4 (2001)
Test date	from March 15, 2004 to March 15, 2004

No. of pages	21	**No. of pages annexed**	8
Issue date	May 12, 2005		
Prepared	PeC - P. BECCARINI		
Verified	PeC - D. GIORDANI		
Approved	PeC - M. de NIGRIS		

на основание чл. 2 от ЗЗЛД

CESI
CENTRO ELETTROTECNICO SPERIMENTALE ITALIANO
Business Unit
Prove a Componenti

на основание чл. 2 от ЗЗЛД

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20134 Milano - Italia
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Capitale
Codice
Iscrizione CCIAA 00793550150

ВЯРНО С ОРИГИНАЛА

САМОКОВ

Tests witnessed by

Mr. Gazzola DERVASIL - Saint Joseph - FRANCE
Mr. Rousset DERVASIL - Saint Joseph - FRANCE

Identification of the object Effected.
The Manufacturer guarantees that the tested object is manufactured according to the submitted drawings.
CESI checked that these drawings adequately represent in shape and dimensions the essential details and the parts of the tested object.
These drawings identified by CESI and numbered:
- A5/021441 No.1 to 10,
- A5/021444 No.1,
- A5/021445 No.1

have been returned to the Client.

Only for laboratory requirement, in order to reproduce the test conditions, all the laboratory data are contained in the document marked: A4/008123

The measurement uncertainties of the test results reported in the document are the following:
voltage: ± 5 % ; current: ± 5 % ; time: ± 5 %
The measurement uncertainties are estimated at the level of twice the standard deviation (corresponding, in the case of normal distribution, to a confidence level of about 95 %) and have to be considered as maximum values.

Receipt date of the sample March 15, 2004

Activity code 41285B

D1002IG

Contents	Page	Test date
Rated characteristics of the tested object assigned by the Client	4	
Test arrangement	5	
Tests performed		
High-current short-circuit tests with 20,5 kA for 0,20 s	6	March 15, 2004
High-current short-circuit tests with 12,4 kA for 0,20 s	7	March 15, 2004
High-current short-circuit tests with 6,00kA for 0,20 s	8	March 15, 2004
Low-current short-circuit tests with 603 A for 1,00 s	9	March 15, 2004
Test circuit	10	
Photos	11 to 21	
Pages annexed		
Oscillograms (No.8)		

"BAK - 02" OOD
CAMOKOB

Rated characteristics of the tested object assigned by the Client

Metal-oxide surge arrester	
Manufacturer	DERVASIL – Saint Joseph - FRANCE
Type	AZB 36
Drawing	99B524923A
Rated voltage (Ur)	36kV
Maximum continuous operating voltage (Uc)	29kV
Rated frequency	50/60 Hz
Nominal discharge current (8/20 µs impulse shape)	10kA
Line discharge class	1
Pressure relief class	
High current	for 0,20 s ; 20,0 kA
Low current	for 1,00 s ; 0,60 kA

ВЯРНО С ОРИГИНАЛА

"ВАК - 02" ООД
САМОКОВ

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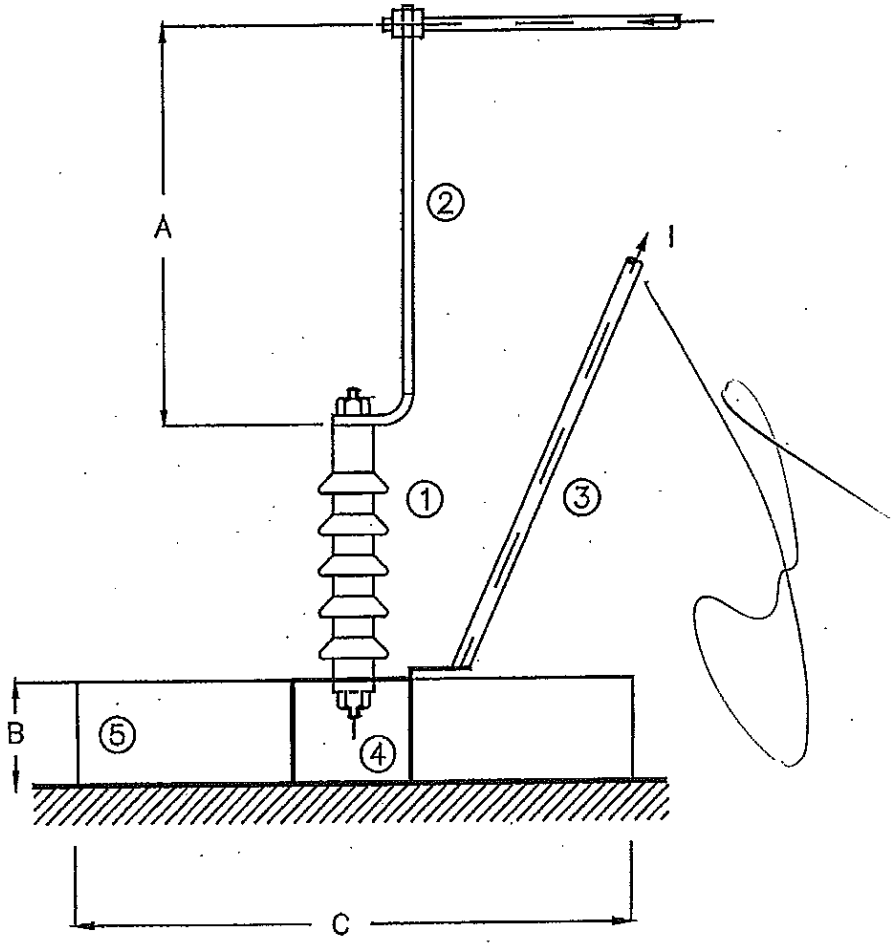
D8000 - Test arrangement



1 : Surge arrester
2 : Flexible conductor
3 : Rigid conductor
4 : Support
5 : Circular enclosure

A : 1,00 m
B : 0,40 m
C : 1,80 m

The arrester to be tested was fixed on a support at 0,40 m to ground in the middle of a circular enclosure of 1,80 m in diameter.
The live side of the supply was connected to the upper end of the arrester while the return circuit, earthed, was connected to the lower end.

D1079IG

High-current short-circuit tests with 20,5 kA for 0,20 s

Test circuit : See D0046 Power factor : <0,15 Frequency : 50 Hz

Test arrangement : See D8000

To achieve the internal discharge, the surge arrester has been faulted by means of on overvoltage application using an auxiliary low power source.
The short-circuit current of the auxiliary low power source has been set at about 2,00 A.
The voltage applied to the arrester was risen in order to get a current equal to 50 mA peak (i.e. 55.kVpk) and kept at this value till arrester failure.
The pre-failure process duration was 6 minutes.
The short-circuit test was performed 4 minutes after the completion of the pre-failure process.

Prospective test current			
Oscillogram		rms value	Peak value
No.	Sheets	kA	kA
4	1	20,5	57,5

Condition of the apparatus before the tests: new

Date: March 15, 2004

Test	Oscillogram		Arrester under test	Duration	Test voltage	Test current		Photos		Notes
						Peak value	rms value	Before the test	After the test	
No.	No.	Sheets	No.	S	KV	kA	kA	No.	No.	No.
1	7	1	PVIII	0,20	37,0	47,3	20,5	1	2 - 3	-

Condition of the apparatus after the tests:

The arrester remained connected to the supply and return circuits.
Moderate damages to the housing of the arrester.
No pieces were projected inside or outside the circular enclosure.
No flame was noted after the test.

High-current short-circuit tests with 12,4 kA for 0,20 s

Test circuit : See D0046 Power factor : <0,15 Frequency : 50 Hz

Test arrangement : See D8000

To achieve the internal discharge, the surge arrester has been faulted by means of on overvoltage application using an auxiliary low power source.
The short-circuit current of the auxiliary low power source has been set at about 2,00 A.
The voltage applied to the arrester was risen in order to get a current equal to 50 mA peak (i.e. 55kVpk) and kept at this value till arrester failure.
The prefailure process duration was 6 minutes and 20 seconds.
The short-circuit test was performed 7 minutes after the completion of the prefailure process.

Prospective test current			
Oscillogram		rms value	Peak value
No.	Sheets	kA	kA
9	1	12,4	35,1

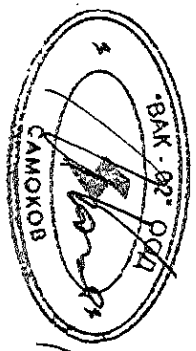
Condition of the apparatus before the tests: new

Date: March 15, 2004

Test	Oscillogram		Arrester under test	Duration	Test voltage	Test current		Photos		Notes
						Peak value	rms value	Before the test	After the test	
No.	No.	Sheets	No.	s	kV	kA	kA	No.	No.	No.
2	10	1	PV	0,20	37,0	25,3	12,4	4	5 to 7	-

Condition of the apparatus after the tests:

The arrester remained connected to the supply and return circuits.
Strong damages to the housing of the arrester.
No block fragment was projected inside or outside the circular enclosure.
One silicon rubber housing piece was found inside the circular enclosure.
No flame was noted after the test



D1232IG

High-current short-circuit tests with 6,00kA for 0,20 s

Test circuit : See D0046 Power factor : <0,15 Frequency : 50 Hz

Test arrangement : See D8000
To achieve the internal discharge, the surge arrester has been faulted by means of on overvoltage application using an auxiliary low power source.
The short-circuit current of the auxiliary low power source has been set at about 2,0 A.
The voltage applied to the arrester was risen in order to get a current equal to 50 mA peak (i.e. 55 kVpk) and kept at this value till arrester failure.
The prefailure process duration was 4 minutes and 20 seconds.
The short-circuit test was performed 4 minutes after the completion of the prefailure process.

Prospective test current			
Oscillogram		rms value	Peak value
No.	Sheets	kA	kA
11	1	6,00	17,4

Condition of the apparatus before the tests: new

Date: march 3,2004

Test	Oscillogram		Arrester under test	Duration	Test voltage	Test current		Photos		Notes
						Peak value	rms value	Before the test	After the test	
No.	No.	Sheets	No.	S	kV	kA	kA	No.	No.	No.
3	12	1	PVI	0,20	37,0	14,8	6,00	-	8 - 9	-

Condition of the apparatus after the tests:

The arrester remained connected to the supply and return circuits.
Moderate damages to the housing of the arrester.
No pieces were projected inside or outside the circular enclosure.
No flame was noted after the test.

D1080IG

Low-current short-circuit tests with 603 A for 1,00 s

Test circuit : See D0046 Power factor : < 0,15 Frequency : 50 Hz

Test arrangement : See D8000
To achieve the internal discharge, the surge arrester has been faulted by means of on overvoltage application using an auxiliary low power source.
The short-circuit current of the auxiliary low power source has been set at about 2,00 A.
The voltage applied to the arrester was risen in order to get a current equal to 50 mA peak (i.e. 55 kVpk) and kept at this value till arrester failure.
The prefailure process duration was 4 minutes and 30 seconds.
The short-circuit test was performed 4 minutes after the completion of the prefailure process.

Prospective test current			
Oscillogram		rms value	Peak value
No.	Sheets	A	kA
13	1	603	1,70

Condition of the apparatus before the tests: new

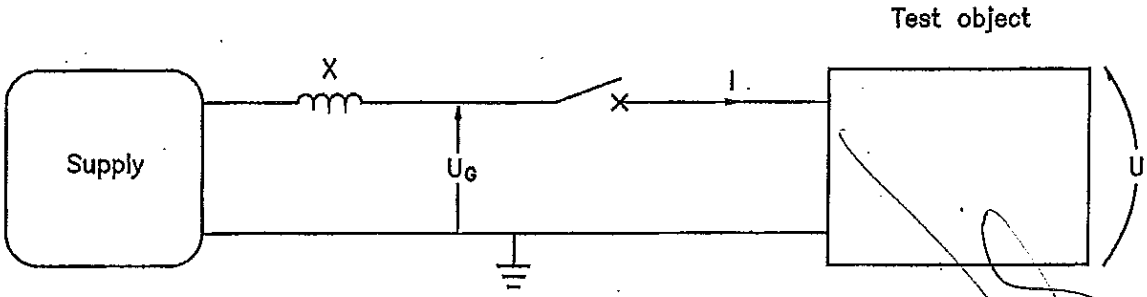
Date: March 15, 2004

Test	Oscillogram		Arrester under test	Duration	Test voltage	Test current		Photos		Notes
						Peak value	rms value	Befor the test	After the test	
No.	No.	Sheets	No.	S	kV	kA	A	No.	No.	No.
4	14	1	PVII	1,00	37,0	1,22	603	-	10 - 11	-

Condition of the apparatus after the tests:

The arrester remained connected to the supply and return circuits.
Light damages to the housing of the arrester.
No pieces were projected inside or outside the circular enclosure.
No flame was noted after the test.

Test circuit D0046



Symbols used in this diagram are the same as those on the oscillograms.

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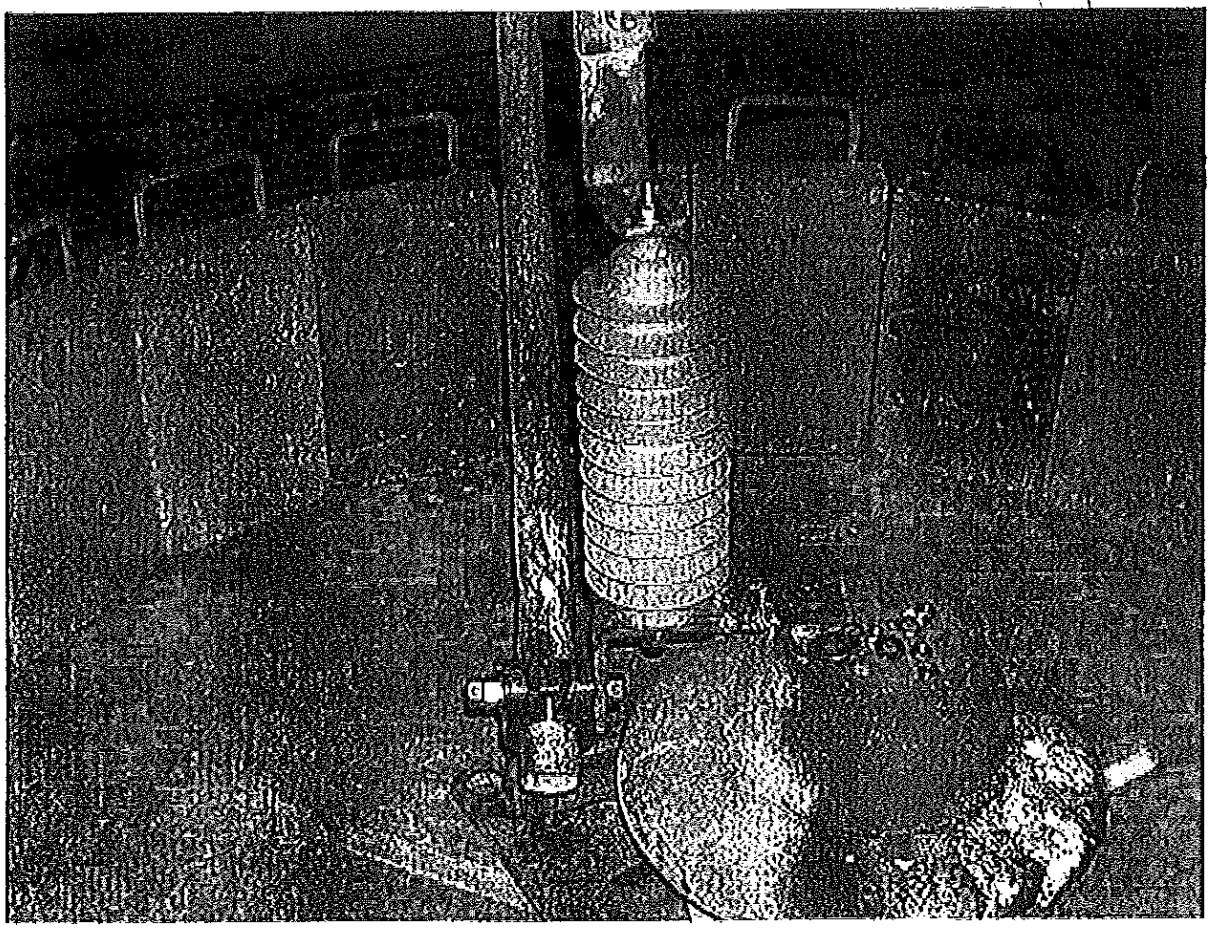

Photo No.1

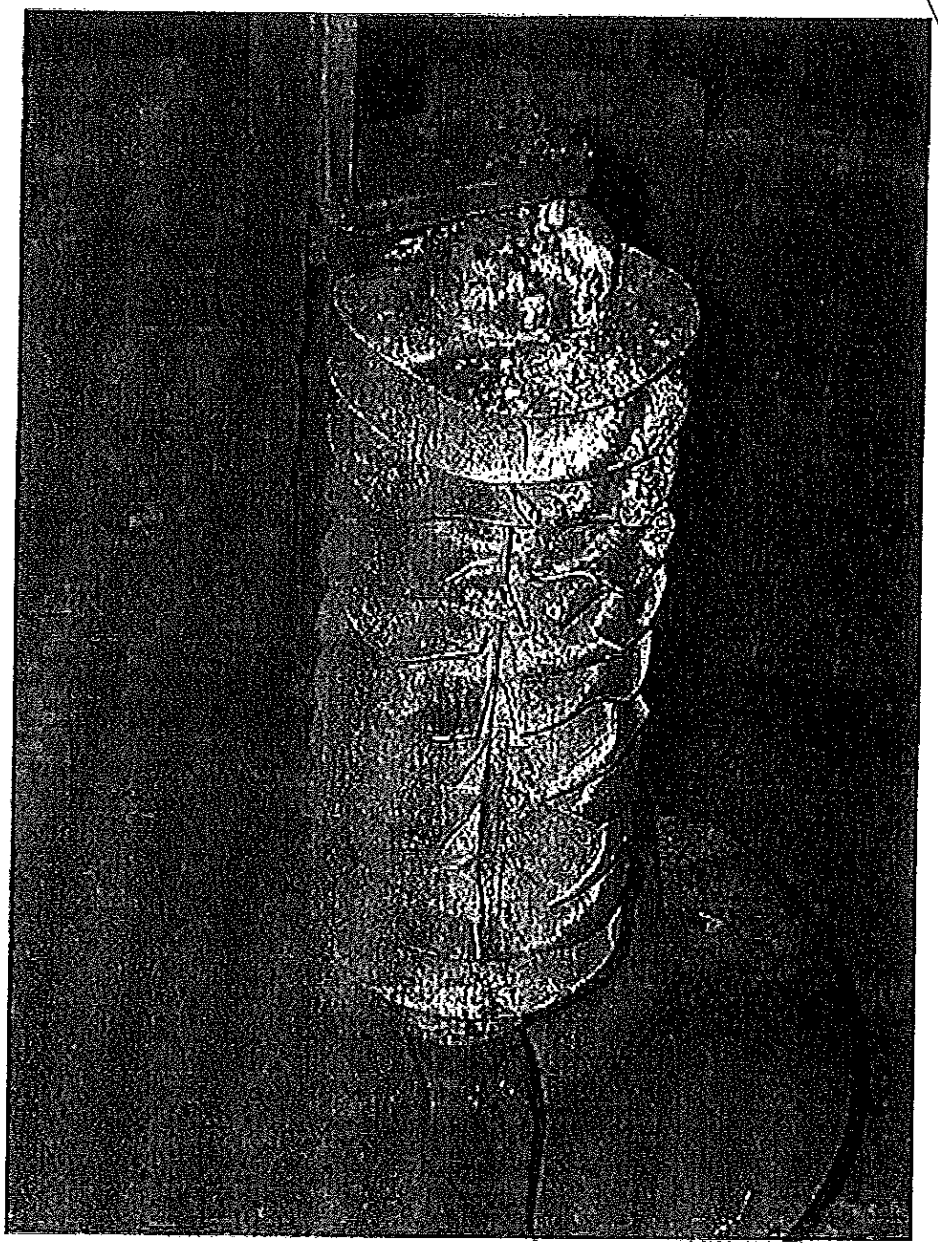

Photo No.2

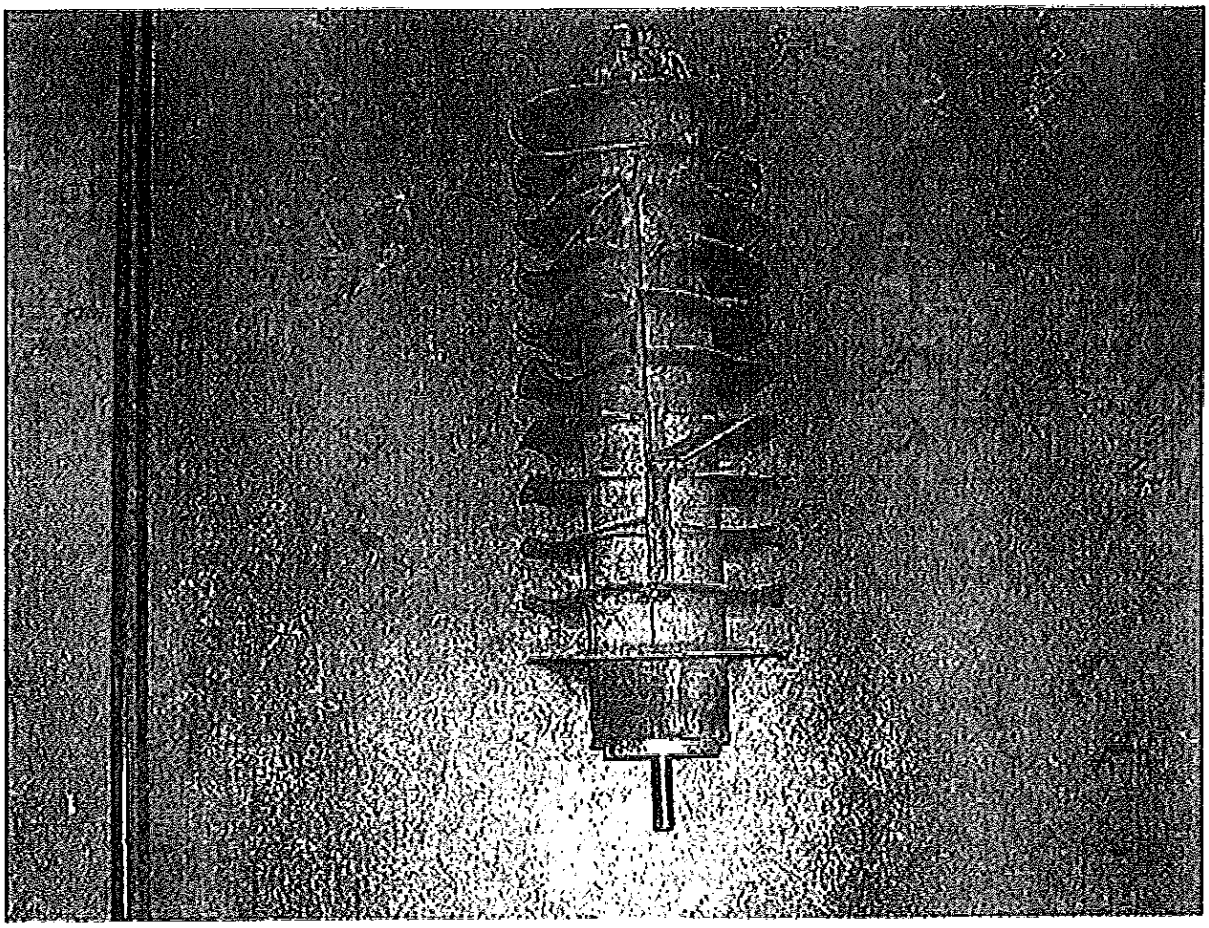

Photo No.3

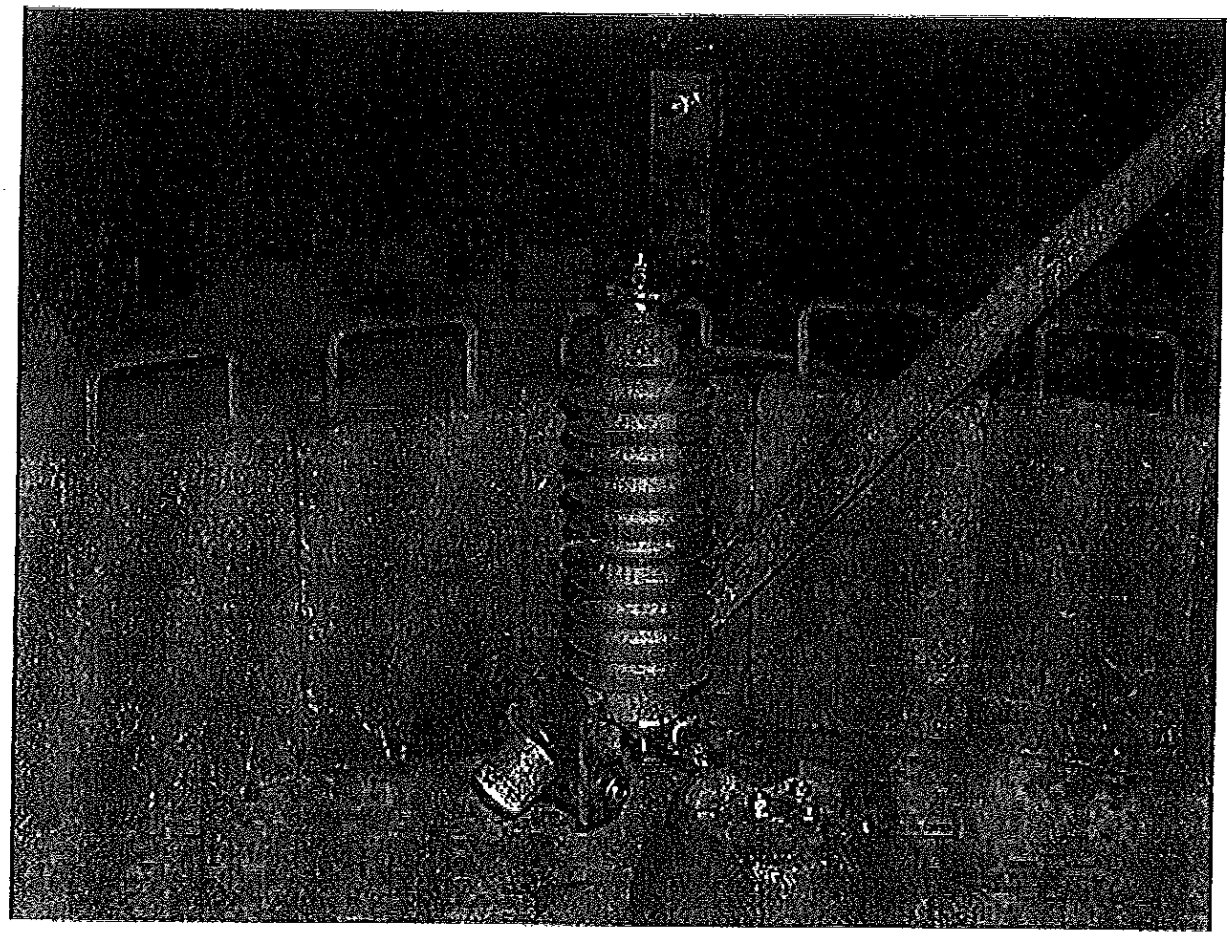

Photo No.4

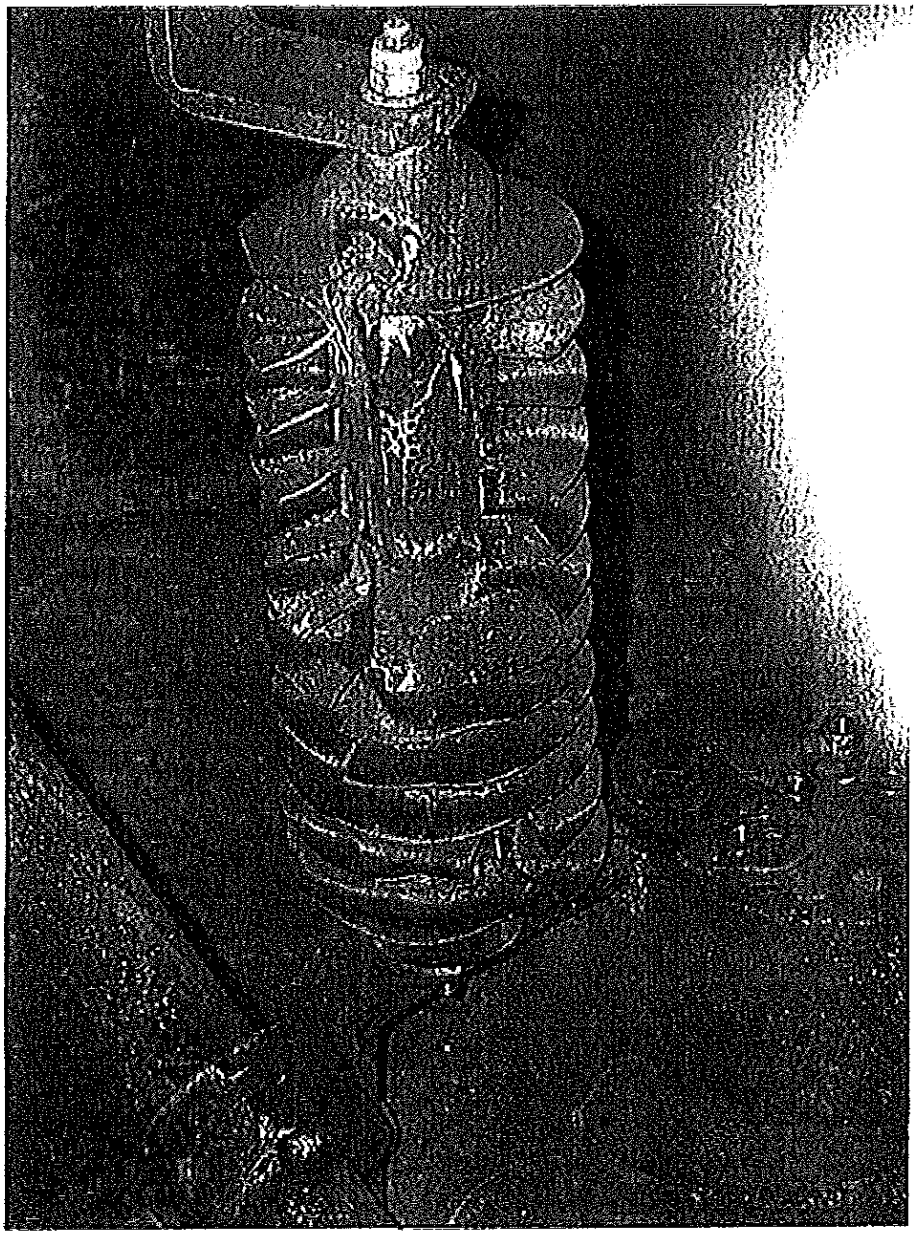

Photo No.5

Photo No.6

ВЯРНО С ОРИГИНАЛА

"ВАК - 027" ООД
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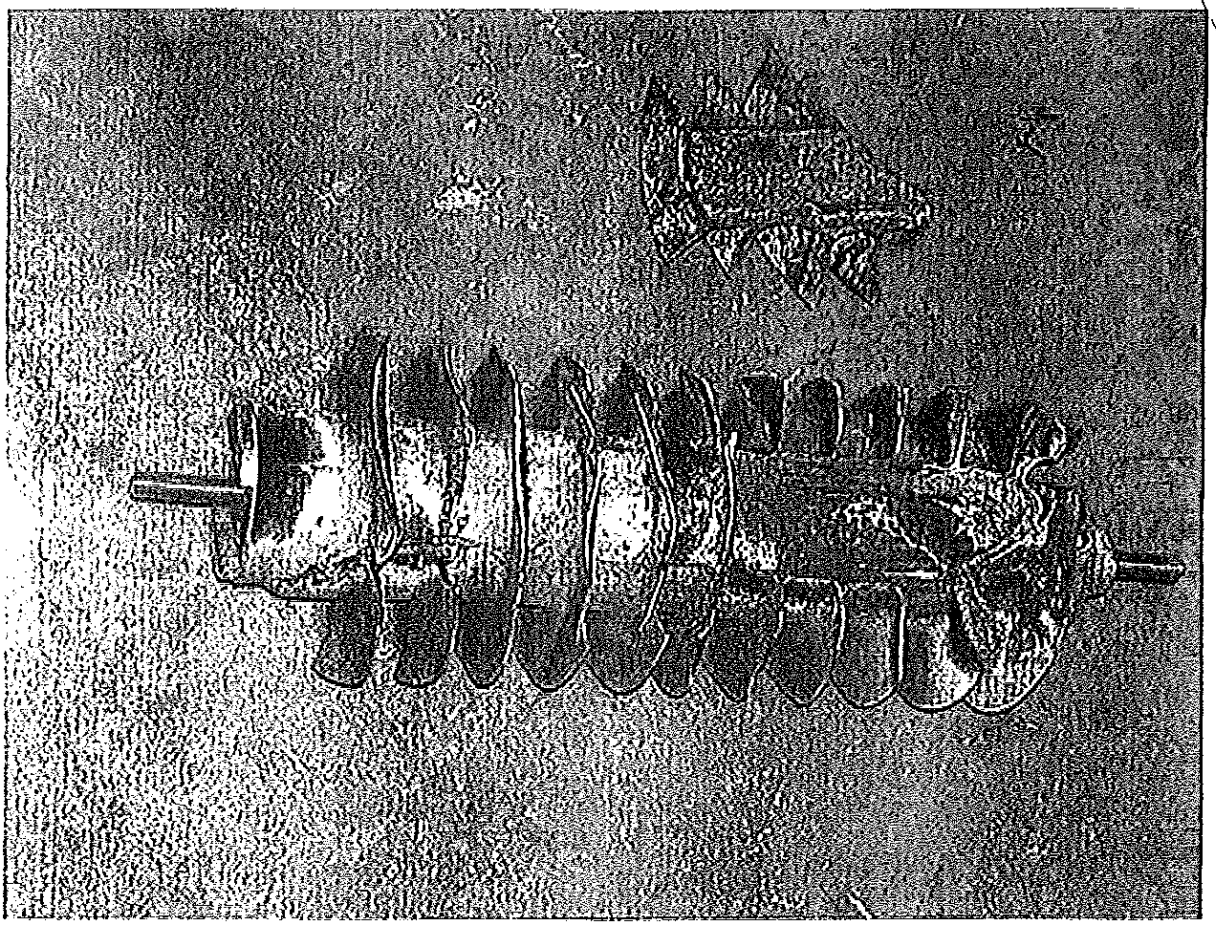

Photo No.7

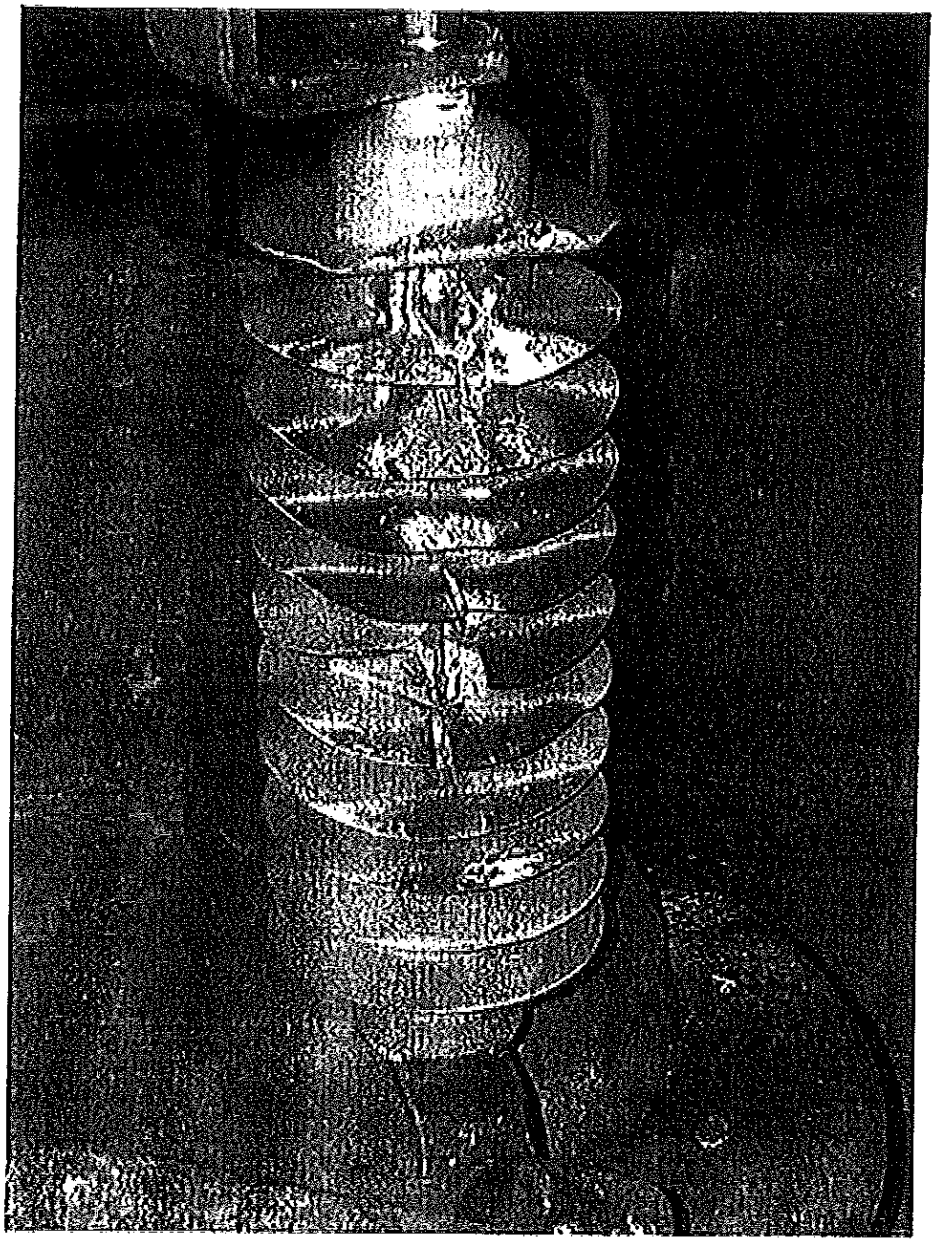

Photo No.8

"BAK - 02" OOD
САМОКОВ

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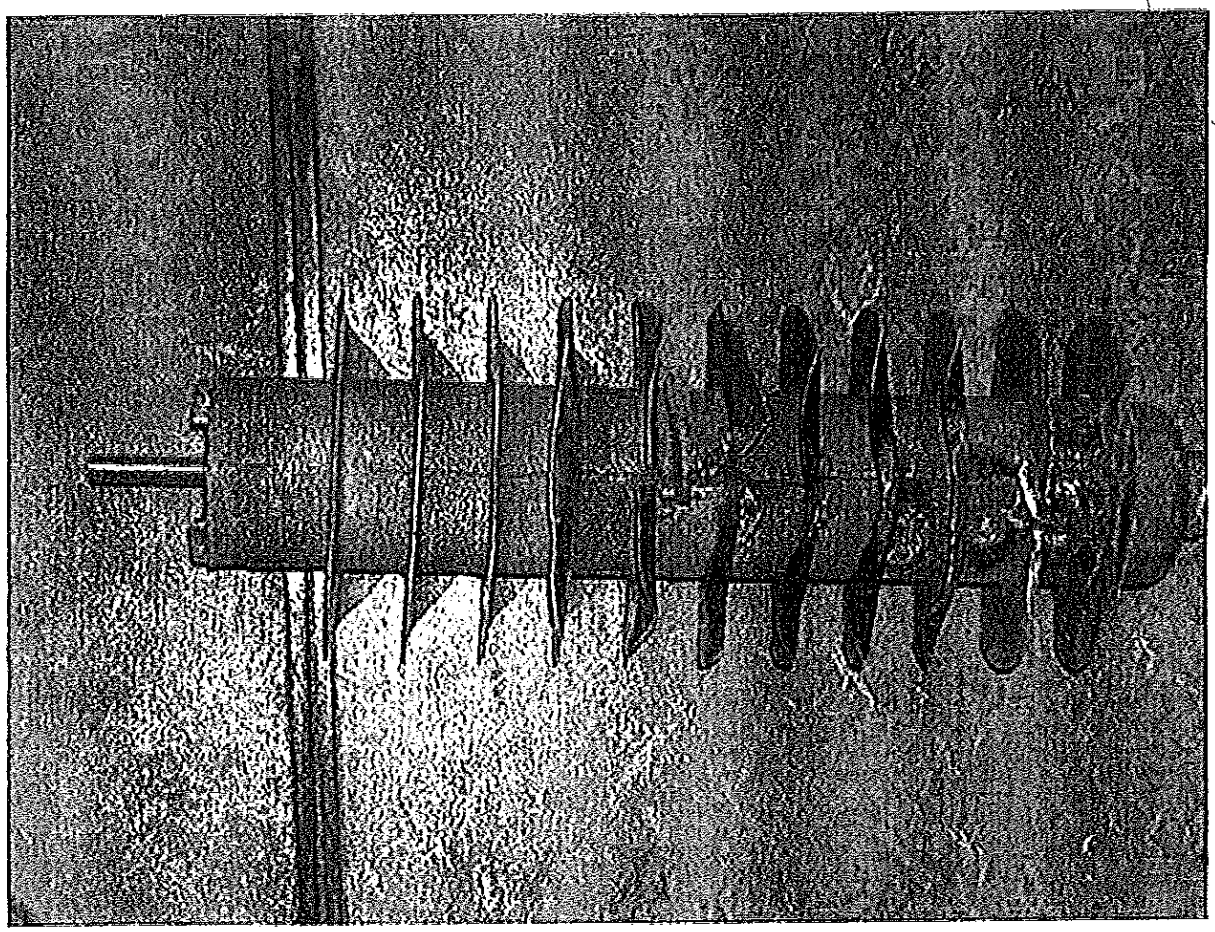


Photo No.9

"BAK - 02" OOД
САМОКОВ

157

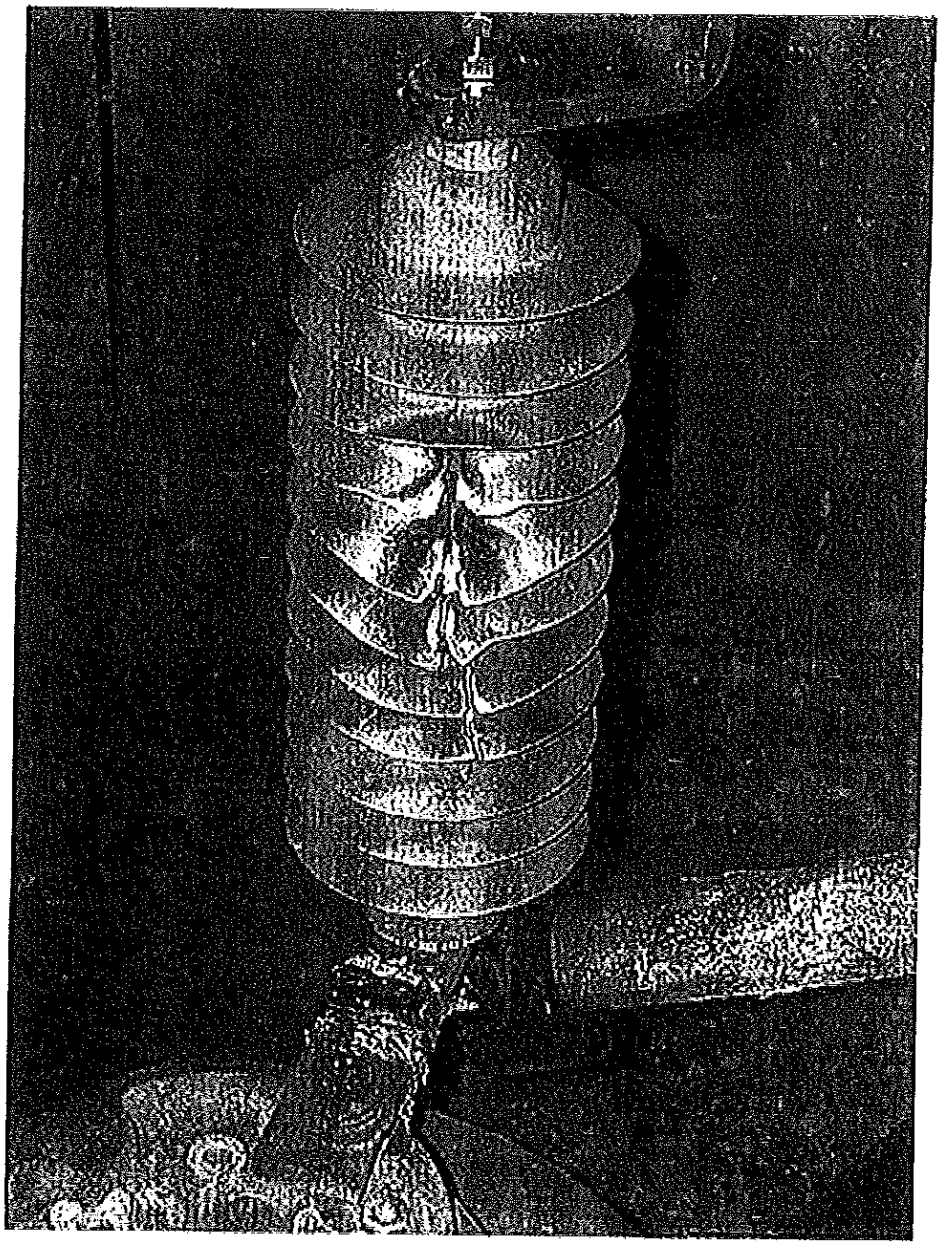


Photo No.10

"ВАК - 02" ООД
САМОКОВ

158

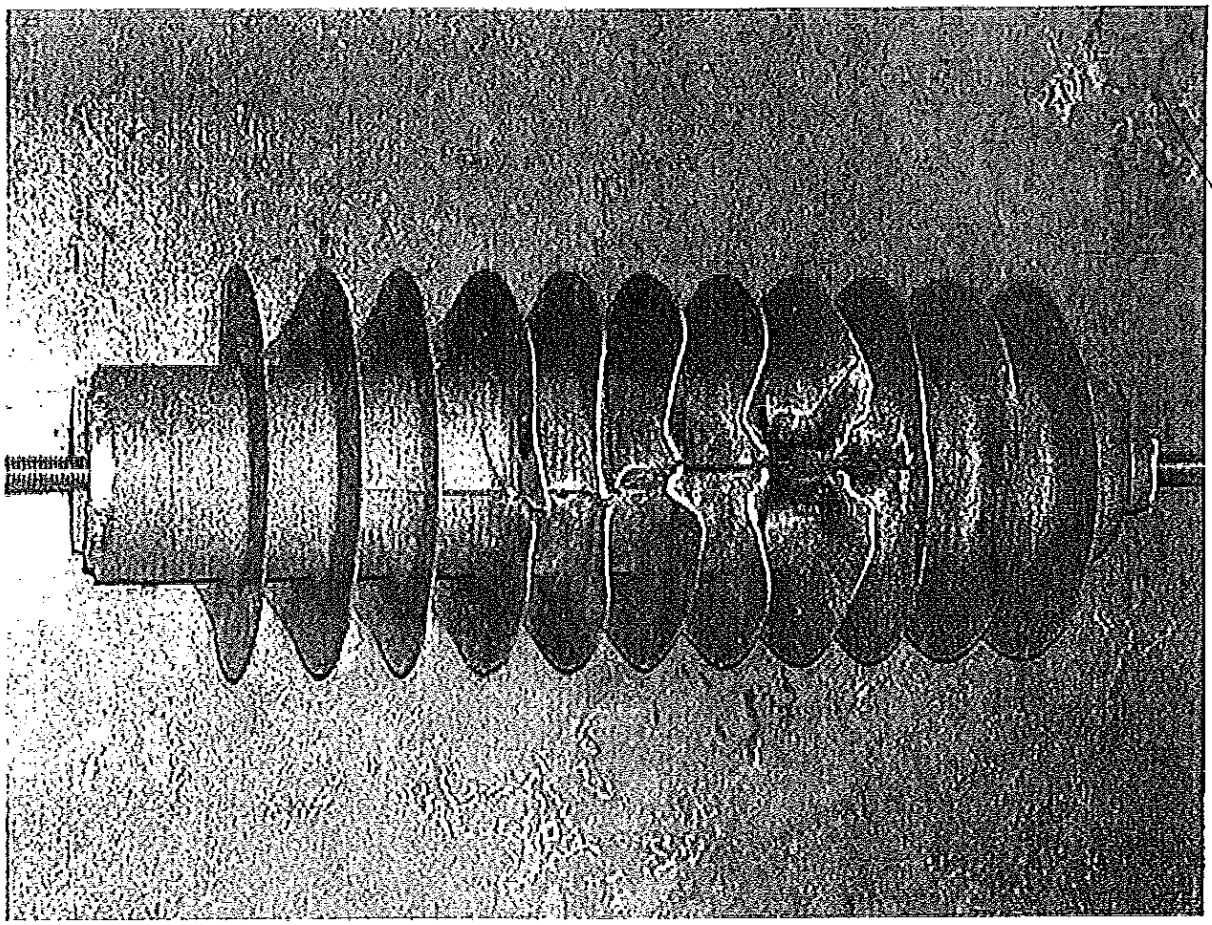
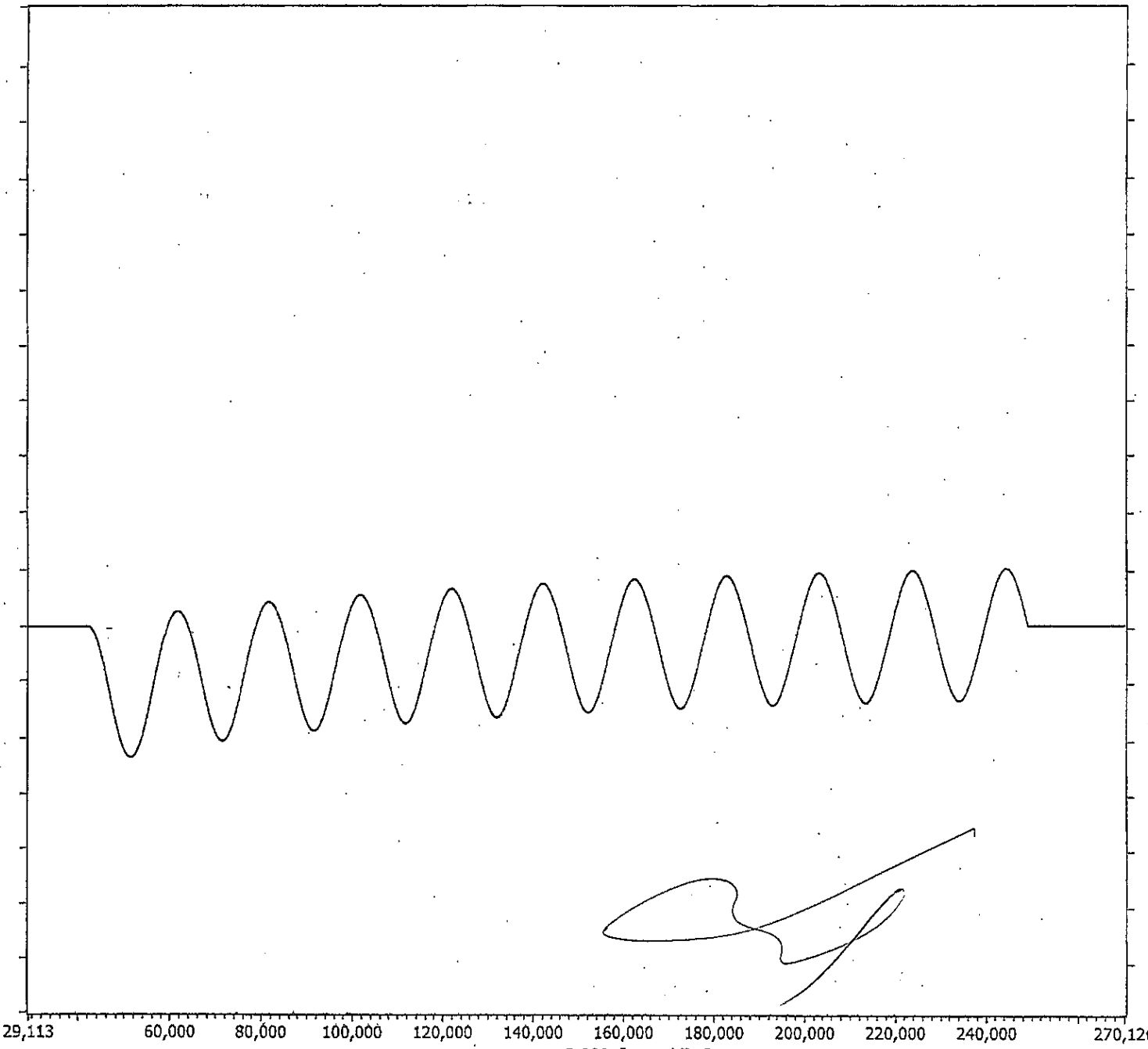


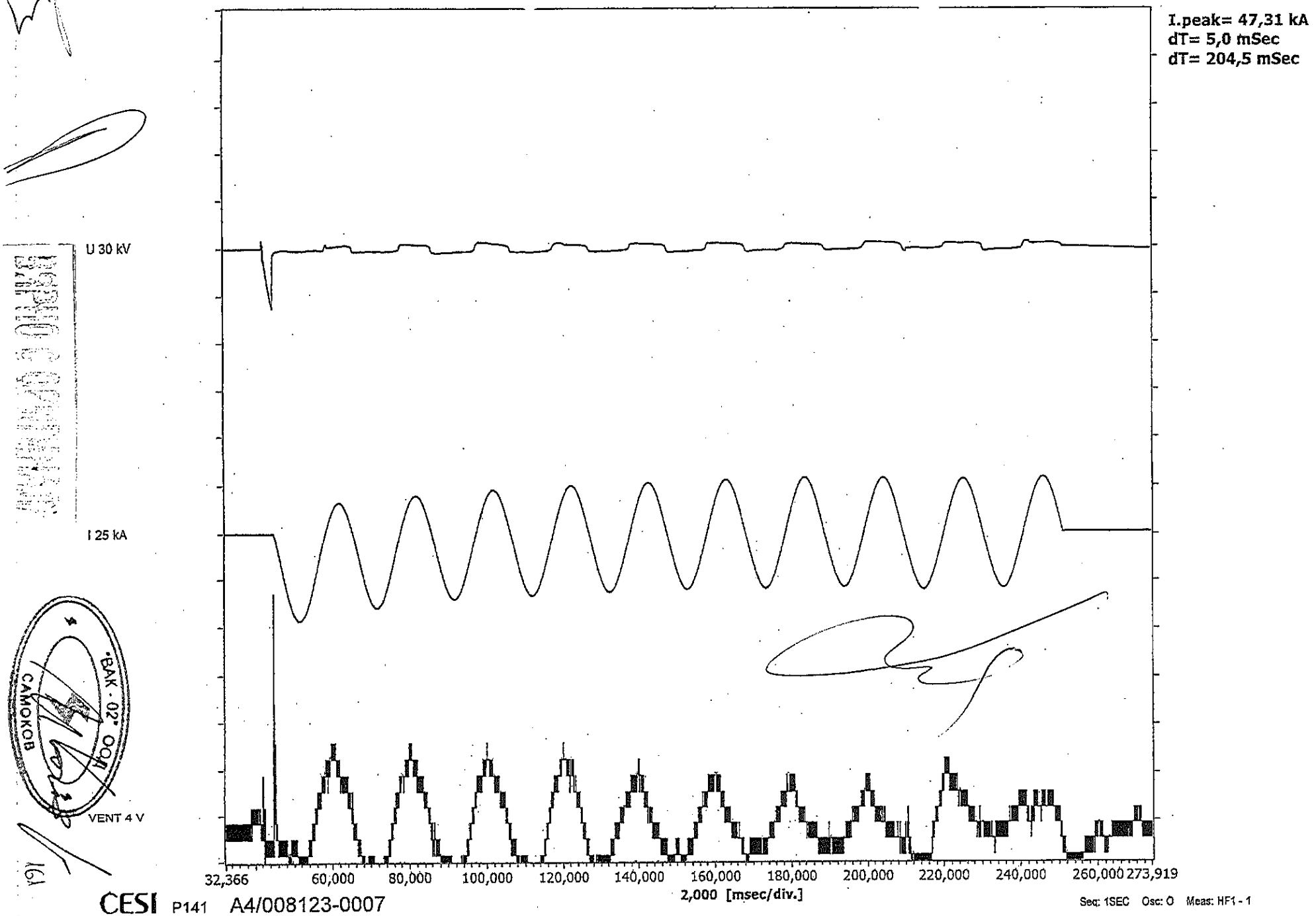
Photo No.11

159

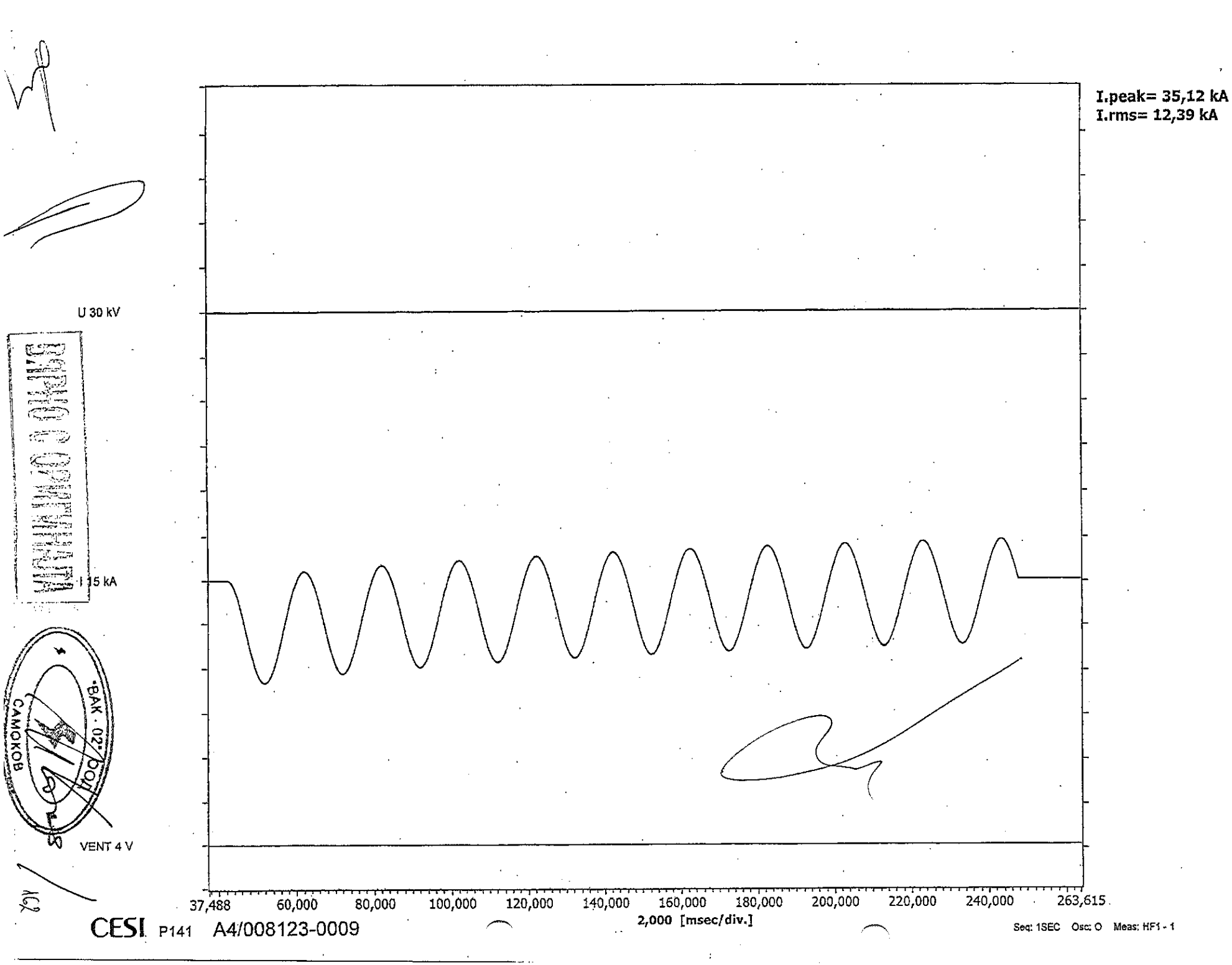


CESI P141 A4/008123-0004

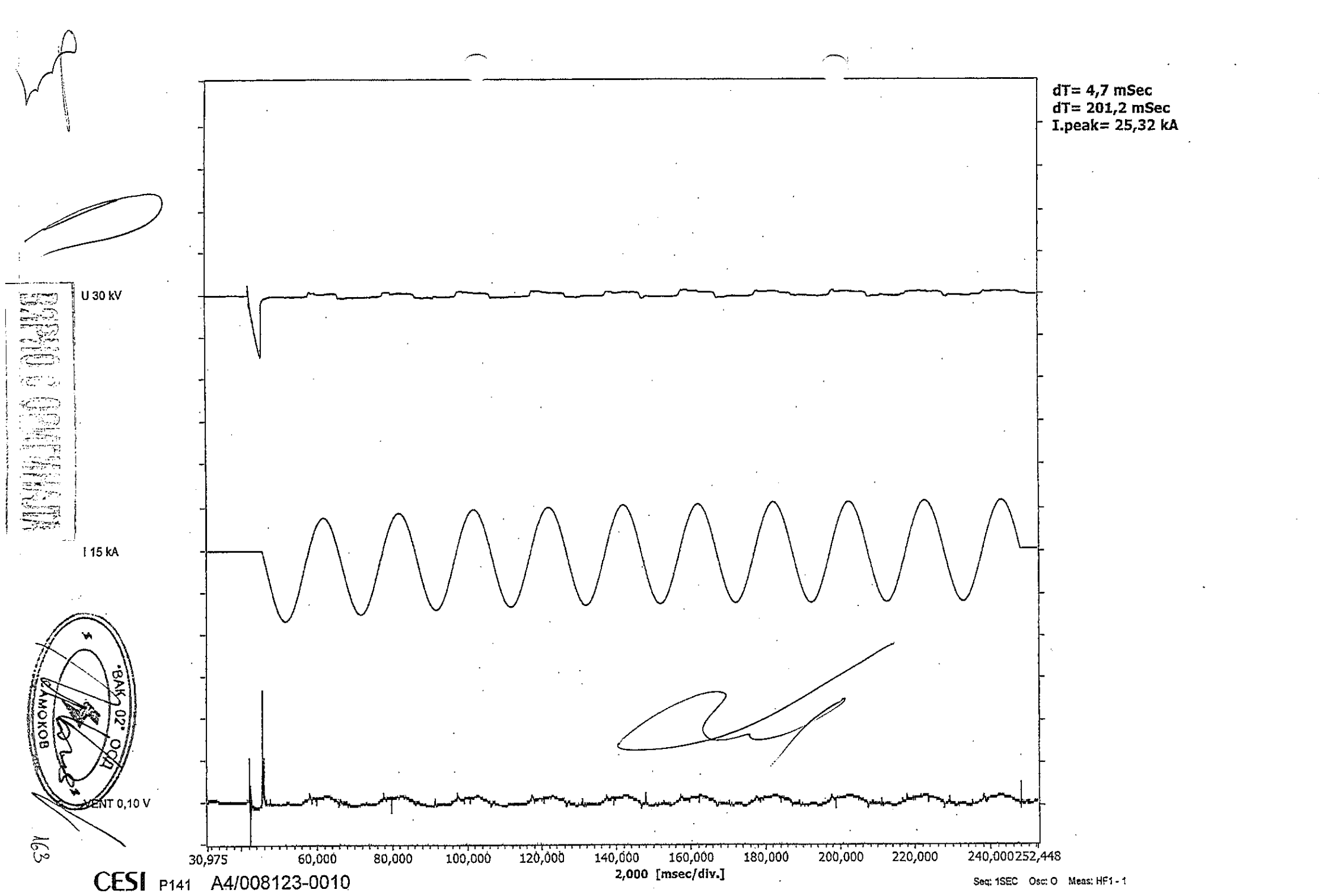
Seq: 1SEC Osc: 0 Meas: HF1 - 1



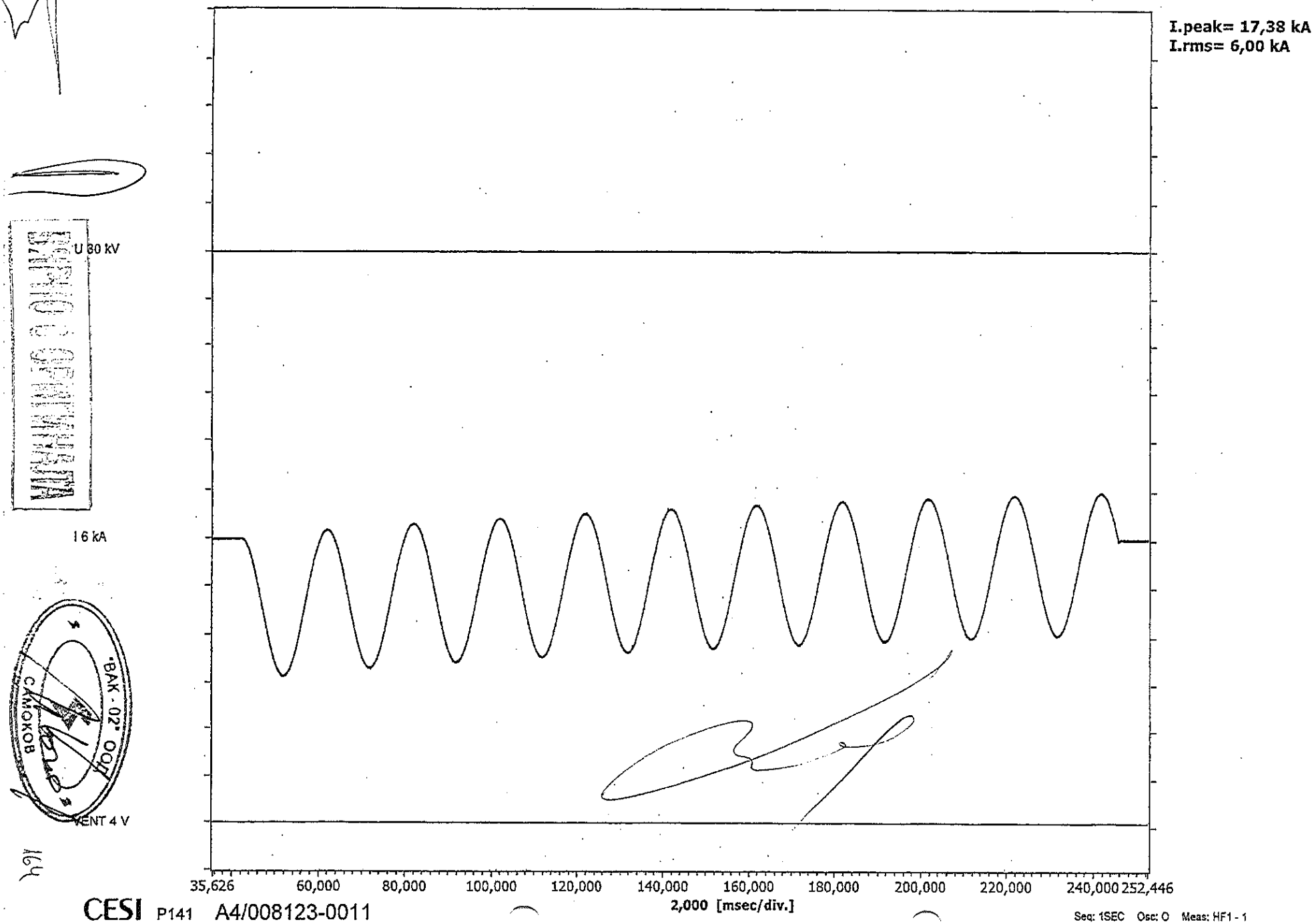
CESI P141 A4/008123-0007



CESI P141 A4/008123-0009

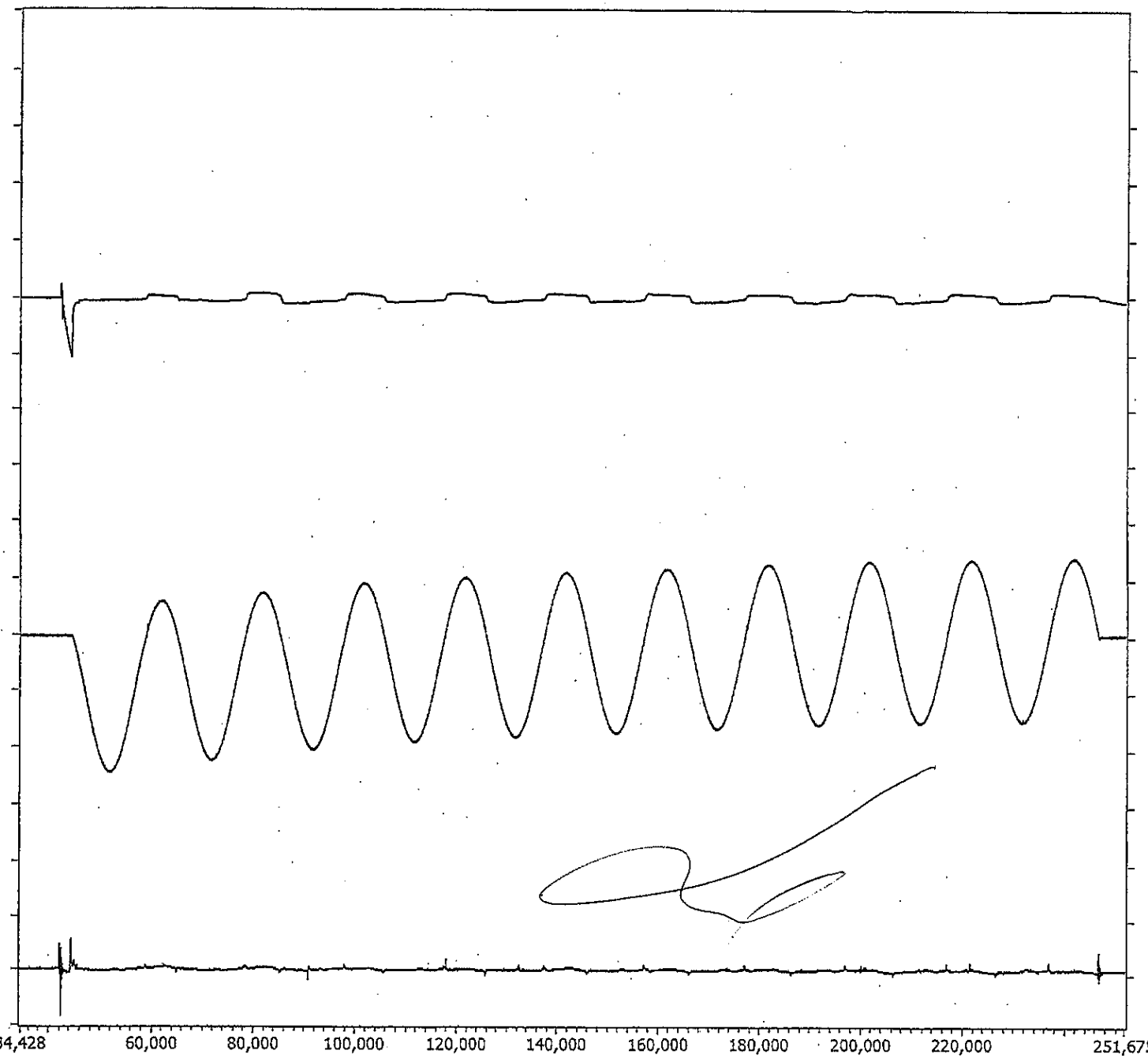


CESI P141 A4/008123-0010



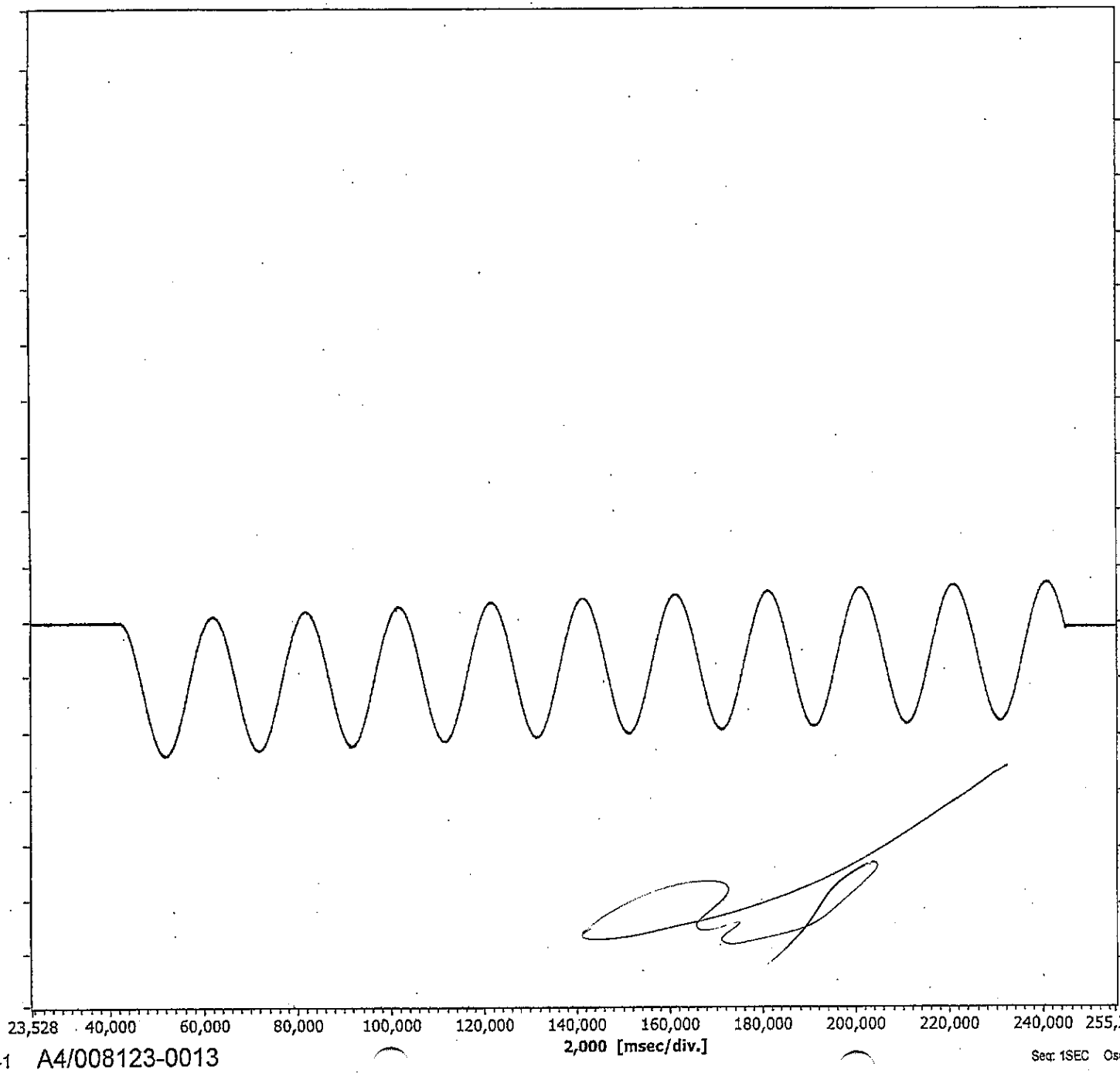
CESI P141 A4/008123-0011

Seq: 1SEC Osc: 0 Meas: HF1 - 1

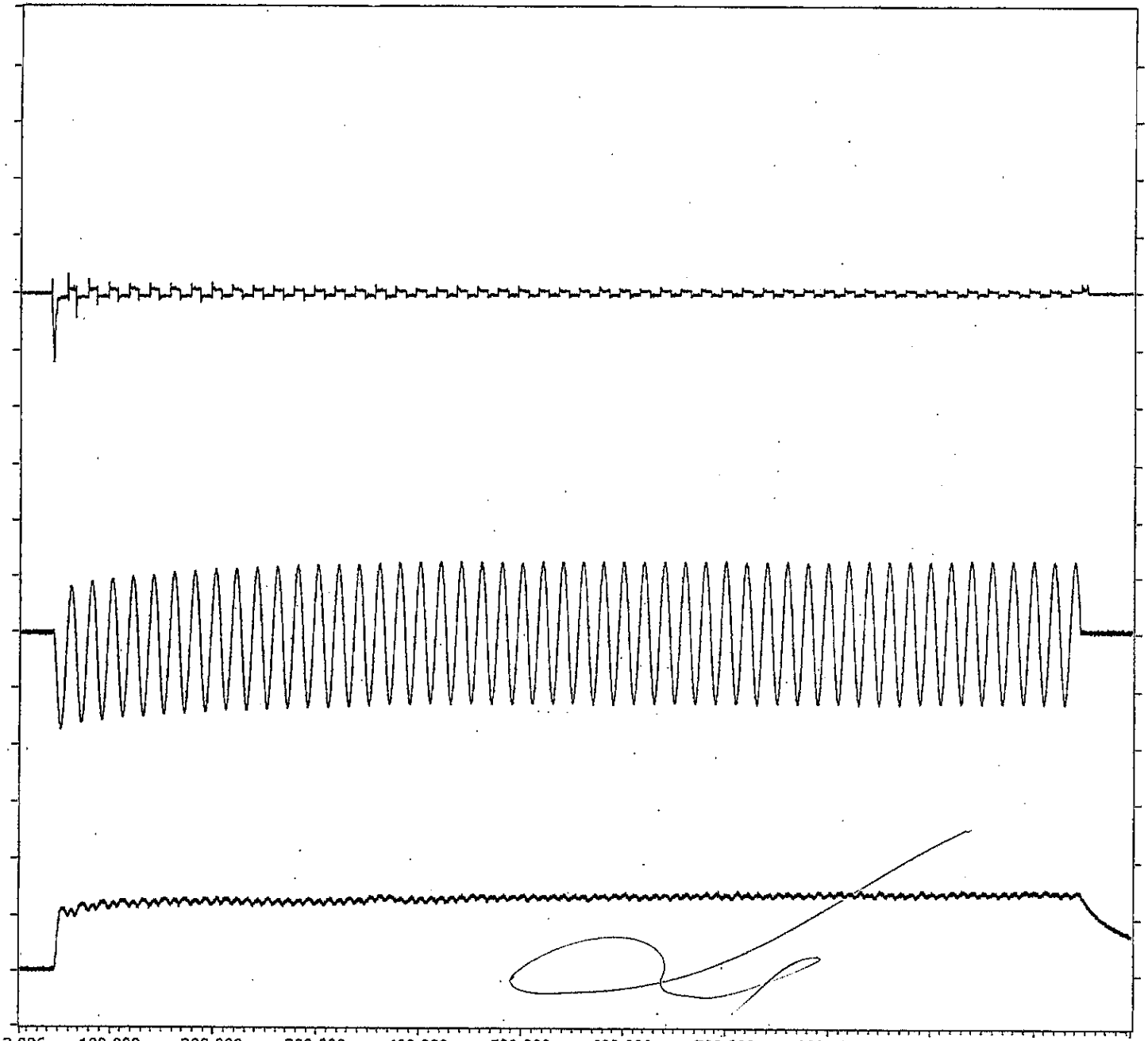


CESI P141 A4/008123-0012

Seq: 1SEC Osc: O Meas: HF1 - 1



CESI P141 A4/008123-0013



CESI P141 A4/008123-0014

Test Report

CESI

Client	Dervasil -- Saint Joseph - (France)
Tested equipment	Housing for polymer housed metal-oxide surge arrester type AZB 36
Tests carried out	Partial discharge test
Standards/Specifications	IEC 60099-4 (2004-05)
Test date	from February 09, 2005 to February 09, 2005

n. 0030

No. of pages	11	**No. of pages annexed**	3
Issue date	May 04, 2005		
Prepared	BU PeC - M. Gregori		
Verified	BU PeC - R. Malgesini		
Approved	BU PeC - M. de Nigris		

на основание чл. 2 от ЗЗЛД

CESI ELETTROTECNICO SPERIMENTALE ITALIANO

на основание чл. 2 от ЗЗЛД

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http://www.cesi.it
Capitale sociale € 550 000 Euro interamente versato
Codice fiscale e numero iscrizione CCIAA 00793580150
Registro Imprese di Milano Sezione Ordinaria
N. REA 429222
P.I. IT00793580150

ВЯРНО С ОРИГИНАЛА

БАНКО СЛАМОКОВ

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Tests witnessed by:------

Identification of the object: The Manufacturer guarantees that the tested object is manufactured according to the submitted drawings.
CESI checked that these drawings adequately represent in shape and dimensions the essential details and the parts of the tested object.
These drawings, identified by CESI and numbered A5021441 No. 1 to 10 – A5021444 No.1 – A5021445No. 1, have been returned to the Client.

The data necessary to permit repetition of the tests are contained in the document marked: ---

- dielectric tests with impulse voltage	: peak voltage: ± 3 %; time parameters: ± 10 %
- dielectric tests with impulse current	: peak value: ± 3 %; time parameters: ± 10 %
- dielectric tests with alternating voltage	: voltage (rms): ± 3 %
dielectric tests with direct voltage	: voltage: ± 3 %

The measurement uncertainties are estimated at the level of twice the standard deviation (corresponding, in the case of normal distribution, to confidence level of about 95%) and have to be considered as maximum values

Laboratory information

Receipt date of the sample	February 01, 2005
Test location	CESI – Via Rubattino 54 – Milan
CESI testing team	Mr L. Podavitte
Test laboratory	P177
Activity code	26892R

A1001IG

ВЯРНО С ОРИГИНАЛА

"ВАК - 02" ООД САМОКОВ

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Rated characteristics of the tested object assigned by the Client

Metal-oxide surge arrester	
Manufacturer	Dervasil – Saint Joseph - (France)
Block manufacturer	Epcos
Year of manufacture	2005
Electrical characteristics	
Nominal discharge current (I_r)	10 kA
Line discharge class	1
Rated voltage (U_r)	36 kV
Continuous operating voltage (U_c)	29 kV
Rated frequency	50-60 Hz
Geometrical characteristics measured on the test sample	
Total height (only surge arrester)	345 mm
Number of sheds	12
Shed diameter	119 mm
Shed spacing	25 mm
Core diameter	59 mm
Other characteristics	
Housing material	silicone rubber
Housing color	grey

Name and signature of Client's witness:

A1307IG

ВЯРНО С ОРИГИНАЛА

"ВАК - 02" ООД САМОКОВ

Photograph of the test object

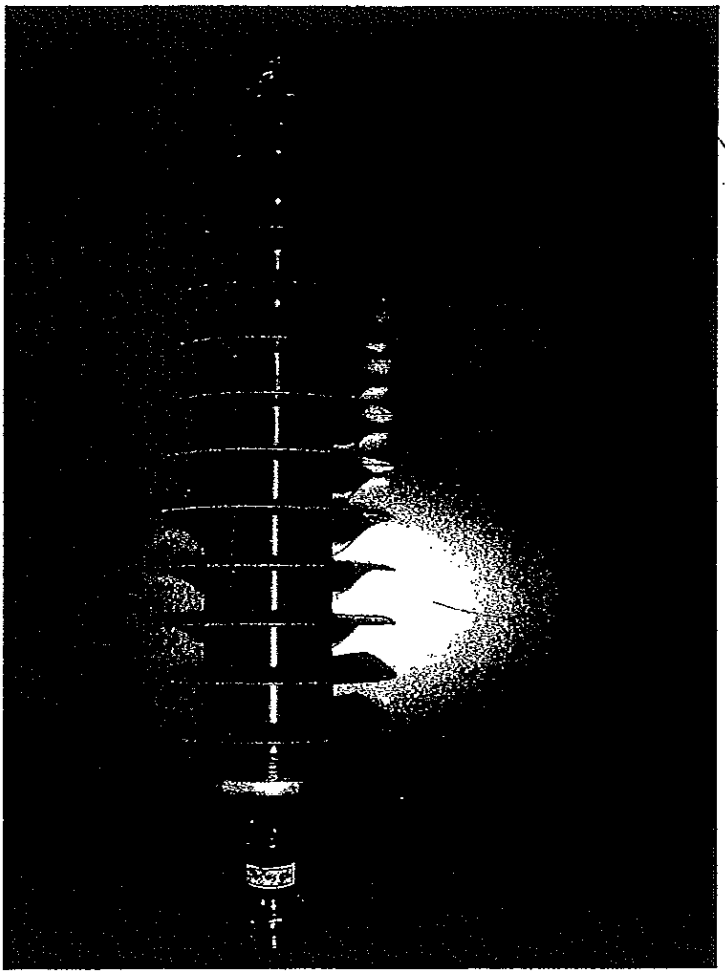

Photo no. 1

"ВАК - 02" ООД
САМОКОВ

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Reference Standard

IEC 60099-4 (2004-05): "Metal-oxide surge arrester without gaps for a.c. system", clause 10.8.8

Test carried out and identification of the test objects

Test carried out	Number of test objects	Test object identification
Partial discharge test	1	PD1

ВЯРНО С ОРИГИНАЛА

"ВАК - 02" ООД САМОКОВ

1/3

Test procedure

The application voltage has been increased up to rated voltage (U_r) and maintained for 10 sec.
The voltage has been decreased to 1,05 times the continuous operating voltage (U_c) and the partial discharge level has been measured according to the reference standard (IEC 60270).

Summary of test results

The partial discharge level found was less than 1 pC (background noise).
The test result is to be considered positive.

"ВАК - 02" ООД
САМОКОВ

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Test setting for the test

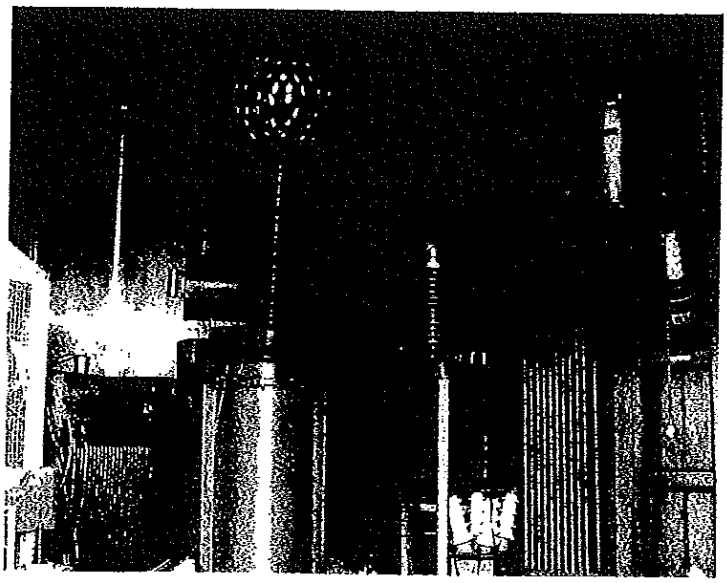


Photo no. 2

ВЯРНО С ОРИГИНАЛА

"ВАК - 02" ООД
САМОКОВ

135

Measurement of partial discharges

Test circuit: A0127
Measurement circuit: A0022 "direct" calibration:55 pC/mV see oscillogram. no.01 – background noise ≤ 1 pC see oscillogram no.02
Arrangement: see pag. 8

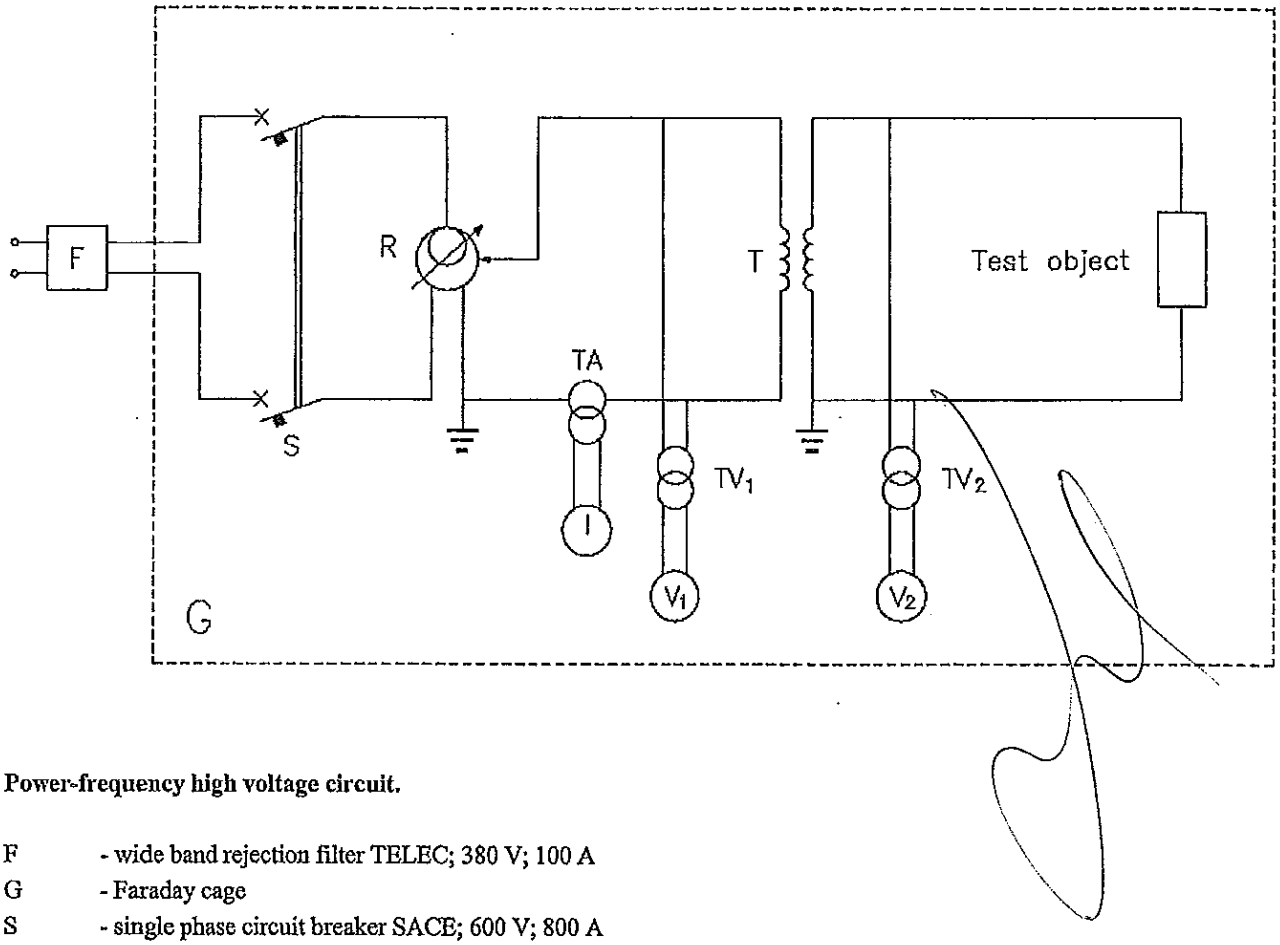
Atmospheric conditions and correction factor			
b	t_d/t_w	h	Relative umidity
kPa	°C	g / m³	%
99,70	18(12)	7,39	48,2

Date: February 09, 2005

Test sample	Applied voltage	Duration of voltage application	Temperature of the test object	Partial discharge measurement		Oscillogram	Notes
				voltage increase Q max	voltage decrease Q max		
	KV_{rms}	s	°C	pC	pC	No.	
MI	36,00	2-10	18	—	—	—	
MI	30,45	60	18		≤ 1	03	

continued

Circuit A0127

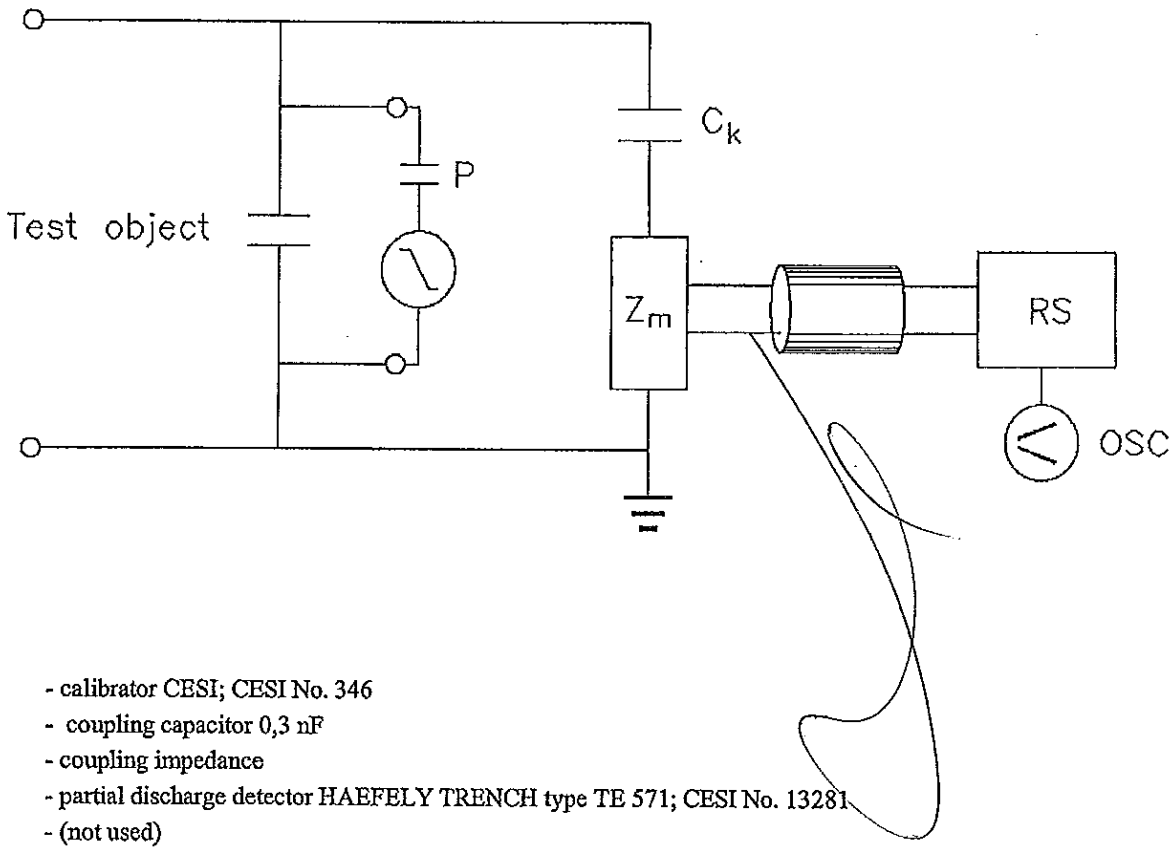


Power-frequency high voltage circuit.

F	- wide band rejection filter TELEC; 380 V; 100 A
G	- Faraday cage
S	- single phase circuit breaker SACE; 600 V; 800 A
R	- regulator CORMES; power 66 kVA; voltage 380 V/0÷220 V
TA	- current transformer CGS, ratio 150-300 A/5 A
I	- analogic amperometer
TV_1	- voltage transformer; ratio 440 V/ 100 V
V_1	- analogic voltmeter
T	- booster transformer PIVI; power 250 kVA; voltage 200-400 V/250 kV
TV_2	- voltage transformer PIVI; ratio 250 kV/ 100 V
V_2	- direct reading digital voltmeter FLUKE; CESI No. 06393

Circuit A0022

Partial discharges measurement
Direct circuit - Scheme 1a



P - calibrator CESI; CESI No. 346
C_k - coupling capacitor 0,3 nF
Z_m - coupling impedance
RS - partial discharge detector HAEFELY TRENCH type TE 571; CESI No. 13281
OSC - (not used)

HAEFELY TRENCH TETTEX

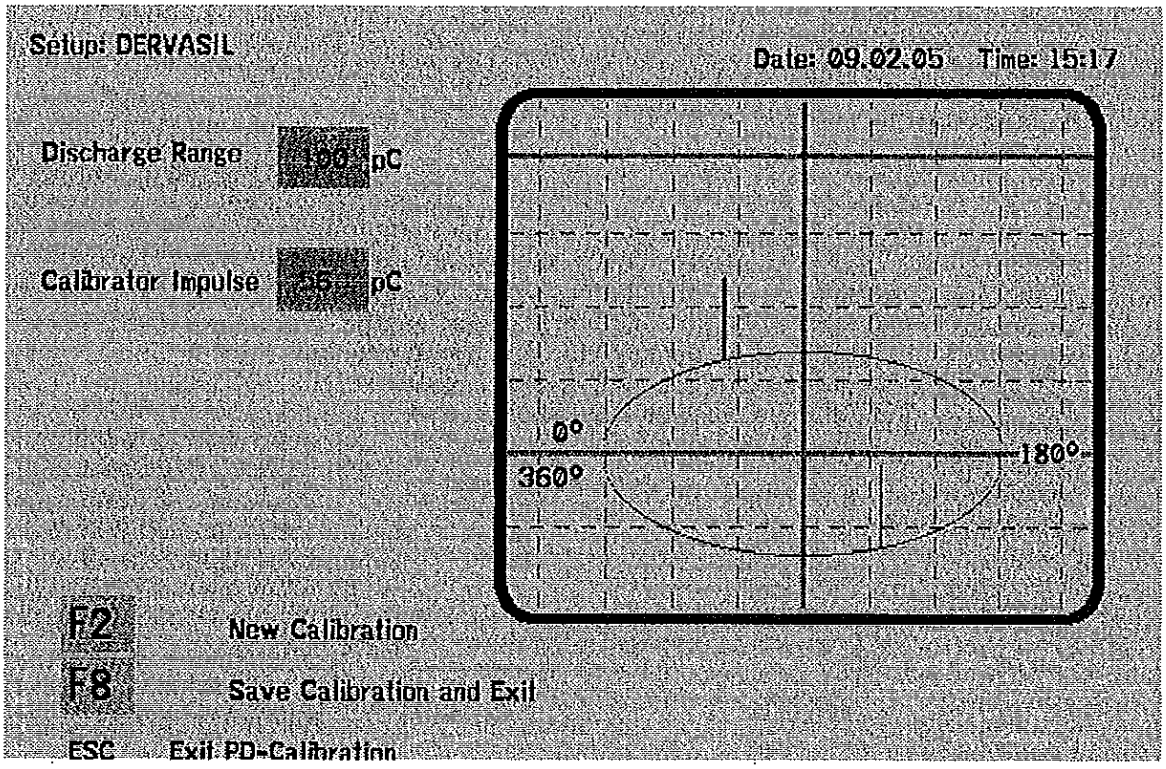
PD-DETECTOR

Info: 1
Measurement name:
Comment:
1st PD Range: 100 pC
Noise Suppression: 5 %
Test Measuring Time: 15 s

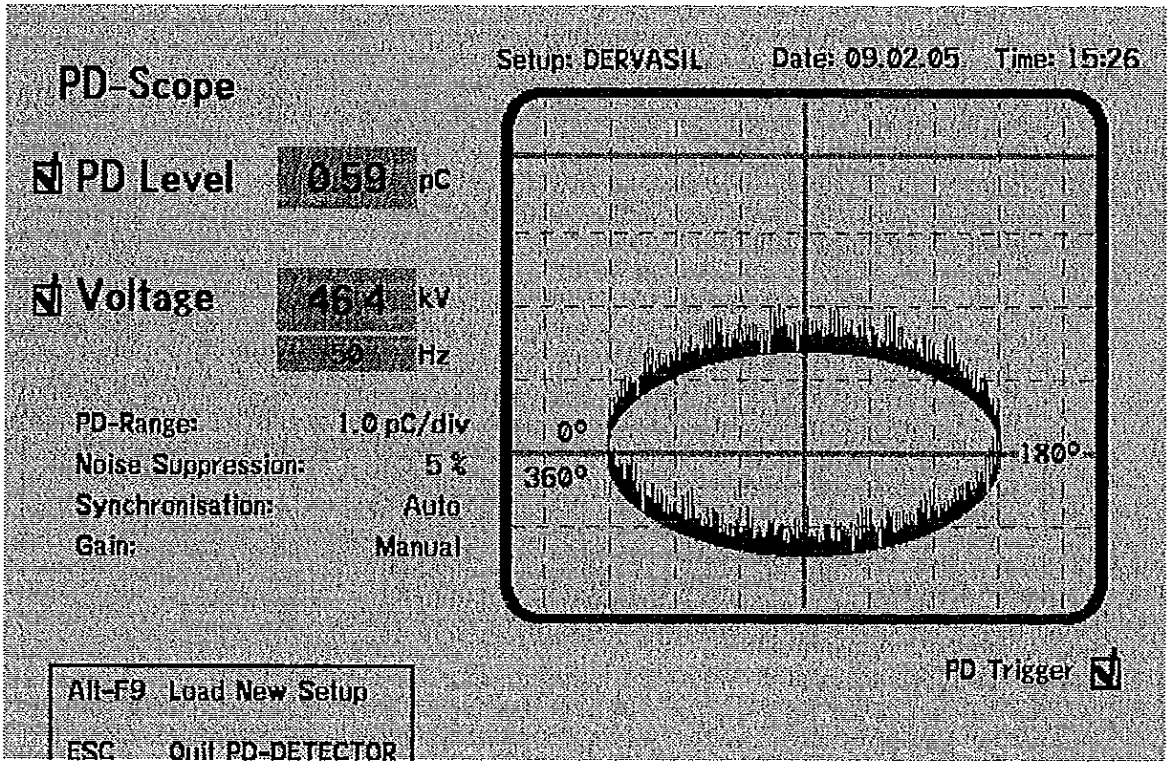
Start date: 00.00.00
Start time: 00:00

2nd PD Range: Not applied
Lockout Time: 7.3 usec
Voltage Range: 15 kV

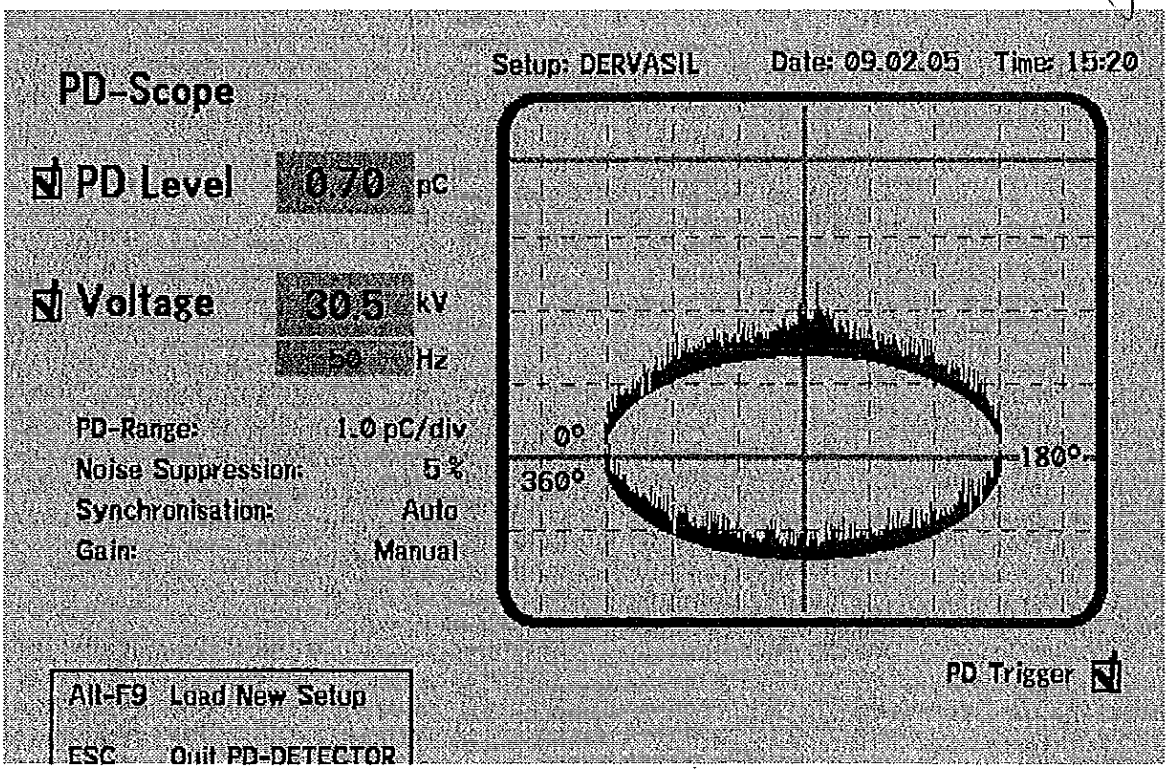
Remarks:



CESI PeC A5003599 oscillogram n. 1



CESI PeC A5003599 oscillogram n. 2



CESI PeC A5003599 oscillogram n. 3

ВЯРНО С ОРИГИНАЛА

"ВАК - 02" ООД
ГАМОКОВ

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client	Dervasil - Saint Joseph (France)
equipment under test	Polymer housed metal-oxide surge arrester type AZB-36
tests performed	Bending moment test
normative documents	IEC 60099-4 (2004-05), Clause 10.8.9
receipt date of the sample	June 14, 2004
test date	from June 17, 2004 to July 16, 2004
no. of pages	21 no. of pages annexed 22

the test results relate only to the sample tested
this document shall not be reproduced except in full without the written approval of CESI

first issue date	July 20, 2004	
prepared	PeC/TEST - M. Gregori	на основание чл. 2 от ЗЗЛД
verified	PeC/TEST - A. Sironi	
approved	PeC/TEST - M. de Nigris	CENTRO ELETTROTECNICO SPERIMENTALE ITALIANO на основание чл. 2 от ЗЗЛД

"ВАК - 02" ООД
САМОКОВ

tests witnessed by: /

Identification of the object: The manufacturer guarantees that the tested object is manufactured according to the submitted drawings.
CESI checked that drawing adequately represents in shape and dimension the essential detail and the parts of the tested object.
The drawing identified by CESI and numbered A4/509437 n. 01, one page, is annexed to this document.

Only for laboratory requirement, in order to reproduce the test conditions, all the laboratory data are contained in the document marked: —

The measurement uncertainties of the test results reported in this document are the following:
- dielectric tests with impulse voltage : **peak voltage: ± 3 % ; time parameters: ± 10 %**
- dielectric tests with impulse current : **peak value: ± 3 % ; time parameters: ± 10 %**
- dielectric tests with alternating voltage : **voltage (rms): ± 3 %**

The measurement uncertainties are estimated at the level of twice the standard deviation (corresponding, in the case of normal distribution, to a confidence level of about 95 %) and have to be considered as maximum values.

---

laboratory information

CESI testing team: Mr F. Mazzarella

test laboratory: P177 surge arrester laboratory

activity code: 41285B
keywords: 12015R, 23810H, 31020W, 46030U, 53001D

ВЯРНО С ОРИГИНАЛА

"ВАК - 02" ООД САМОКОВ

АТ3

contents	page	test date
Test object characteristics	4	
Reference standard	5	
Test procedure	6	
Summary of test result	7	
Initial measurement	8 ÷ 10	June 17, 2004
Test setting for bending application	11 ÷ 12	
Bending application	13	June 18, 2004
Water immersion test	13	July 13 ÷ 16, 2004
Verification test	14 ÷ 17	July 16, 2004
Technical data of the test circuit	18 ÷ 21	

Pages annexed:

- oscillograms n.21 pages
- Dervasil Drawing no.99B524923A; CESI n. A4/509437 n. 01, one page

Test object characteristics

type: Polymer housed metal-oxide surge arrester section

electrical characteristics (claimed by the client)

manufacturer's name	DERVASIL
nominal discharge current - I_N [kA]	10
rated voltage - U_r [kV]	36
continuous operating voltage - U_c [kV]	29
reference current - I_{ref} [mA]	5
line discharge class	-
rated frequency - [Hz]	50
dynamic cantilever [N*m]	200
year of manufacture	2004

geometrical characteristics (measured on the test sample)

height [mm]	339
number of sheds	11
shed diameter [mm]	115
core diameter [mm]	59,4

other characteristics

housing material	polymeric
housing color	grey

Reference Standard

IEC 60099-4 (2004-05) edition 2.0 at clause 10.8.9.3 for polymer housed surge arresters without enclose gas volume.
" Metal-oxide surge arrester without gaps for a.c. system"

Test carried out

test carried out	number of sample tested
initial measurements	3
bending application	
water immersion	
test evaluation	

Test object identification

test object names	identification of test sample (given by the client)
polymer housed metal-oxide surge arrester	BM1 - BM2 - BM3

ВЯРНО С ОРИГИНАЛА

"ВАК - 02" ООД САМОКОВ

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Test procedure

The test consisted of the following steps:

Initial measurement

- Watt losses has been measured at $0,8*U_c$
- Internal partial discharge have been measured.
  The application voltage has been increased up to rated voltage (U_r) and maintained for 10 sec. Then the voltage has been decreased to 1,05 times the continuous operating voltage (U_c) and the partial discharge level has been measured according to the reference standard.
- The lightning impulse residual voltage has been measured at the nominal discharge current I_N

Bending application

The test sample has been mounted in upright position. The specified load of 200 N*m (corresponding to 588 N applied to the free terminal on the sample having 339 height) was applied perpendicular to the axis. The load was increased at constant speed, mantained at the specified value for about 60 to 90 seconds and then decreased to zero.

Water immersion test

The sample has been immersed in a vessel, in boliling deionized water with 1 Kg/m^3 of NaCl for 42 hours. At the end the samples remained in the vessel until the water cooled to 50°C.

Verification test at ambient temperature

- The visual inspection was carried out
- Watt losses measurement at $0,8*U_c$ has been repeated
- Partial discharge measurement has been repeated at $1,05*U_c$
- The lightning impulse residual voltage test has been repeated at nominal discharge current I_N

ВЯРНО С ОРИГИНАЛА

"ВАК - 02" ООД САМОКОВ

Summary of test result

Visual inspection

The visual inspection of the polymer housed metal oxide surge arrester after test has revealed no sign of physical damage.

Bending application

The force-deflection curve does not show significant discontinuity.
The permanent deflection is not significant.

Electrical measurement

- Variation of watt losess at $0,8*U_c$

sample	before test		after test		variation
	voltage	power	voltage	power	
	kV	W	kV	W	%
BM1	24,25	0,394	24,03	0,459	+ 16,50
BM2	23,82	0,408	23,66	0,389	- 4,65
BM3	24,12	0,438	24,02	0,429	- 2,05

The variation of watt losses before and after the test was less then 20% (maximum allowed variation according to reference standard is 20%).

- variation of lightning impulse residual voltage at I_N

sample	before test		after test		variation
	discharge current	residual voltage	discharge current	residual voltage	
	kA	kV	kA	kV	%
BM1	10,0	99,42	10,0	100,4	1,0
BM2	10,0	99,61	10,0	100,8	1,2
BM3	10,0	100,2	10,0	101,2	1,0

The variation of lightning impulse residual voltage before and after the test was less then 5% (maximum allowed variation according to reference standard is 5%).

- Measured partial discharge level was less than 1 pC (background noise) before and after the test.

All acceptance criteria are satisfied. Therefore the test result is positive

"ВАК - 02" ООД САМОКОВ

Power frequency voltage-current characteristics - before bending moment.

test object: Polymer housed metal-oxide surge arrester
test circuit: A019

date: June 17, 2004

sample no. BM1						
oscill.	voltage	current	current	current	power	3rd harmonic amplitude
no.	kV	+ mA_{cr}	- mA_{cr}	mA_{rms}	W	μA
1	24,25	0,327	0,510	0,233	0,394	---

sample no. BM2						
oscill.	voltage	current	current	current	power	3rd harmonic amplitude
no.	kV	+ mA_{cr}	- mA_{cr}	mA_{rms}	W	μA
2	23,82	0,327	0,490	0,238	0,408	---

sample no. BM3						
oscill.	voltage	current	current	current	power	3rd harmonic amplitude
no.	kV	+ mA_{cr}	- mA_{cr}	mA_{rms}	W	μA
3	24,12	0,306	0,489	0,233	0,438	---

Measurement of partial discharges - before bending moment

test object: Polymer housed metal-oxide surge arrester
test circuit: A012
measurement circuit: A022 ("direct" calibration : 50 pC)
arrangement: ---

atmospheric conditions		
b	t	h
kPa	°C	g / m³
--	25	--

date: June 17, 2004

test condition	applied voltage	duration of voltage application	temperature of the test object	partial discharge measurement				oscillogram	note
				voltage increase		voltage decrease			
				CRO readout	Q max	CRO readout	Q max		
	kV_{rms}	sec	°C	mV	pC	mV	pC	no.	
BM1	36,0	10	25	--	≤ 1				
	30,5	measure	25			--	≤ 1	--	
BM2	36,0	10	25	--	≤ 1				
	30,5	measure	25			--	≤ 1	--	
BM3	36,0	10	25	--	≤ 1				
	30,5	measure	25			--	≤ 1	--	

Note: background noise ≤ 1 pC

Bending moment test.

lightning impulse residual voltage measurement - before bending moment

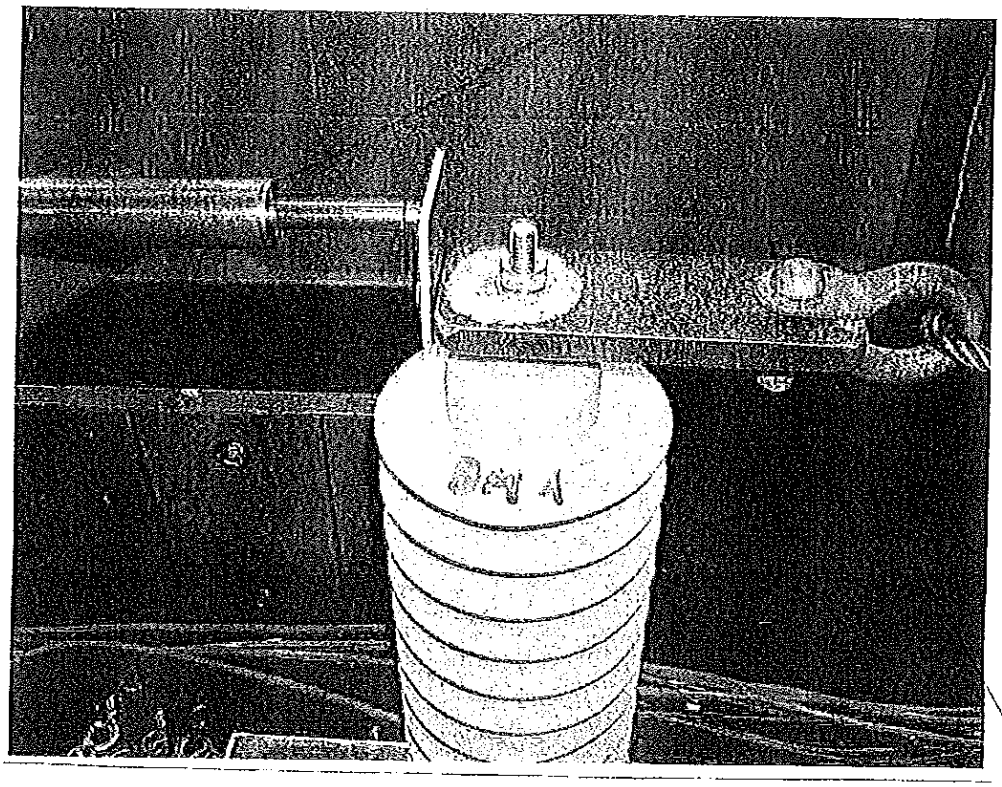
test object: Polymer housed metal-oxide surge arrester
test circuit: A014

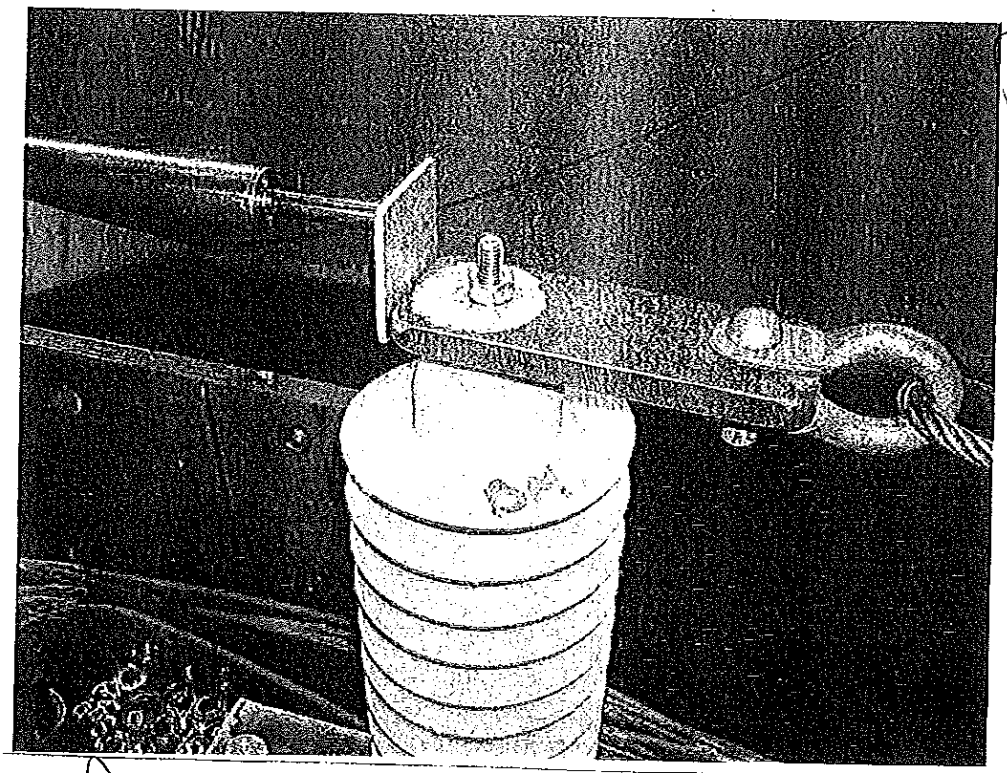
date: June 17, 2004

sample	requested current	charging voltage	oscillogram	current waveshape	discharge current	residual voltage
no.		kV	no.	μs	kA	kV
BM1	I_N	63 x 2	4	8,2/19,6	10,0	99,42
BM2	I_N	63 x 2	5	8,2/19,6	10,0	99,61
BM3	I_N	63 x 2	6	8,2/19,6	10,0	100,2

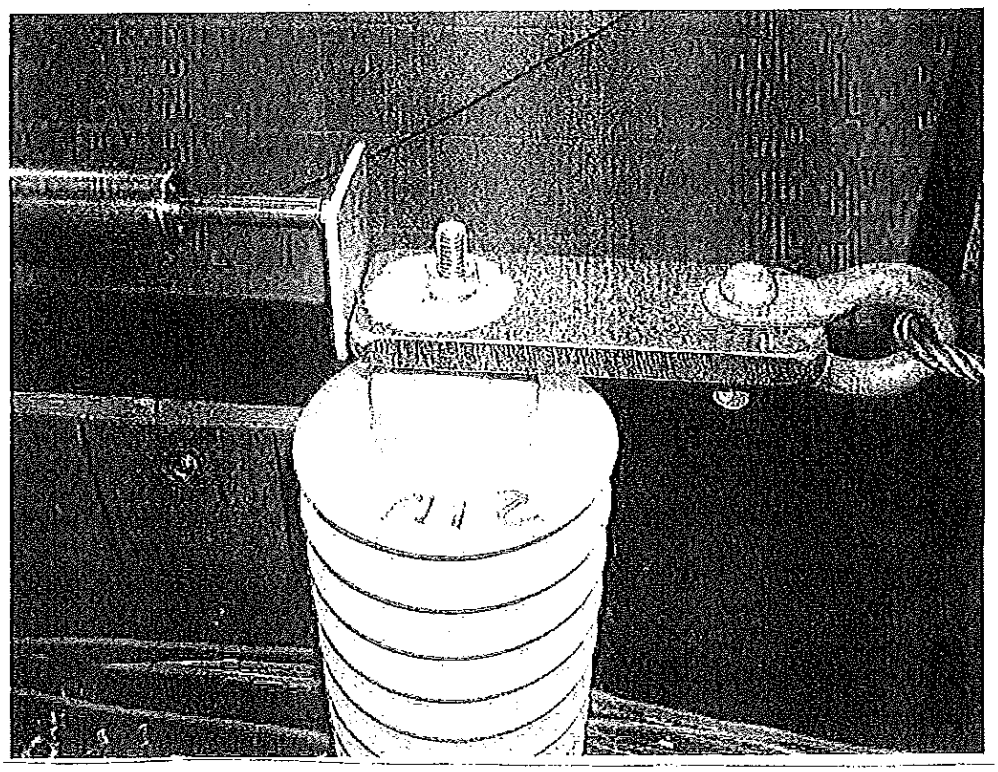
	oscilloscope settings		
	sampling division	input	attenuation
	μs	V_{div}	
current	5	0,5	50:5
voltage	5	0,8	50:5

Test setting for bending application.





Test setting for bending application.



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Bending application:

Test date: June 28, 2004

The test sample was mounted in upright position. The specified load (corresponding to the maximum bending moment of 200 N*m) was applied perpendicular to the axis to the free end of the surge arrester. The load was increased at constant speed, maintained at the specified value for about 60 to 90 seconds and then decreased to zero.
A view of the test arrangement is shown in the photos pages n. 11 - 12 .
The curve of the load&deflection versus time is shown in the oscillogram n.07 (sample BM1) - n.08 (sample BM2) - n. 09 (sample BM3)
The curve of the load versus deflection is shown in the oscillogram n.10 (sample BM1) - n.11 (sample BM2) - 12 (sample BM3).

water immersion test:

Test date: July 13÷16, 2004

The sample has been immersed in a vessel, in boiling deionized water with 1 Kg/m^3 of NaCl for 4 2 hours. At the end the samples remained in the vessel until the water cooled to 50°C and maintained at this temperature in the vessel until verification tests.

"ВАК - 03" ООД САМОКОВ

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visual examination:

test date: July 16, 2004

The surge arrester has been visually inspected.

No sign of physical damage was detected.

Power frequency voltage-current characteristics - after bending moment.

test object: Polymer housed metal-oxide surge arrester
test circuit: A019

date: June 16, 2004

sample no. BM1						
oscill.	voltage	current	current	current	power	3rd harmonic amplitude
no.	kV	+ mA_{cr}	- mA_{cr}	mA_{rms}	W	µA
13	24,03	0,323	0,300	0,223	0,459	---

sample no. BM2						
oscill.	voltage	current	current	current	power	3rd harmonic amplitude
no.	kV	+ mA_{cr}	- mA_{cr}	mA_{rms}	W	µA
14	23,66	0,316	0,293	0,216	0,389	---

sample no. BM3						
oscill.	voltage	current	current	current	power	3rd harmonic amplitude
no.	kV	+ mA_{cr}	- mA_{cr}	mA_{rms}	W	µA
15	24,02	0,321	0,291	0,2176	0,429	---

"ВАК - 02" ООД САМОКОВ

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Measurement of partial discharges - after bending moment

test object: Polymer housed metal-oxide surge arrester

test circuit: A012

measurement circuit: A022 ("direct" calibration : 50 pC - see oscillogram no.16)

arrangement: —

atmospheric conditions		
b	t	h
kPa	°C	g / m³
--	25	--

date: June 16, 2004

test condition	applied voltage	duration of voltage application	temperature of the test object	partial discharge measurement				oscillogram	note
				voltage increase		voltage decrease			
				CRO readout	Q max	CRO readout	Q max		
	kV_{rms}	sec	°C	mV	pC	mV	pC	no.	
BM1	36,0	10	25	--	≤ 1				
	30,5	measure	25			--	≤ 1	18	
BM2	36,0	10	25	--	≤ 1				
	30,5	measure	25			--	≤ 1	19	
BM3	36,0	10	25	--	≤ 1				
	30,5	measure	25			--	≤ 1	20	

Note: background noise ≤ 1 pC - see oscillogram no.17

Bending moment test.

lightning impulse residual voltage measurement - after bending moment

test object: Polymer housed metal-oxide surge arrester
test circuit: A014

date: June 16, 2004

sample	requested current	charging voltage	oscillogram	current waveshape	discharge current	residual voltage
no.		kV	no.	µs	kA	kV
BM1	I_N	63 x 2	21	8,2/19,6	10,0	100,4
BM2	I_N	63 x 2	22	8,2/19,6	10,0	100,8
BM3	I_N	63 x 2	23	8,2/19,6	10,0	101,2

	oscilloscope settings		
	sampling division	input	attenuation
	µs	V_{div}	
current	5	0,5	50:5
voltage	5	0,8	50:5

ВЯРНО С ОРИГИНАЛА

"ВАК - 02" ООД САМОКОВ

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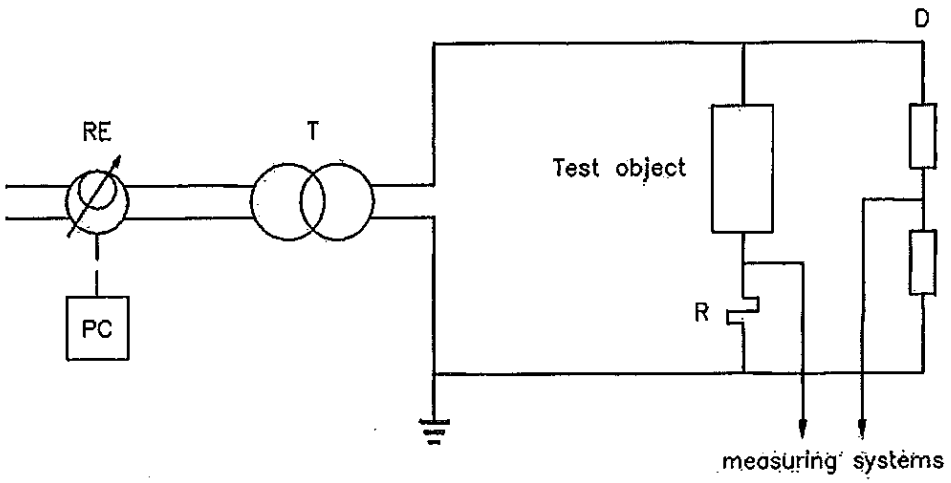
circuit A019



power frequency supply

RE : programmable supply CESI no. 23702-32191 ; type Larcet A.C. Power Source 5000 P.S.
PC : personal computer
T : transformer type Specialtrasfo ; power 30 kVA ; voltage 200 V/15-30 kV

current shunt (R) CESI no. 11537 ; R = 867,8 Ω
oscilloscope CESI no.9090
type Tektronix RTD 710A

voltage divider (D) CESI no. 11120 k= 1010
electro optical system CESI no.11519/520 ; attenuation 50:5
oscilloscope CESI no.30223-30224
type Data Precision DATA 6100

ВЯРНО С ОРИГИНАЛА

"ВАК - 02" ООД САМОКОВ

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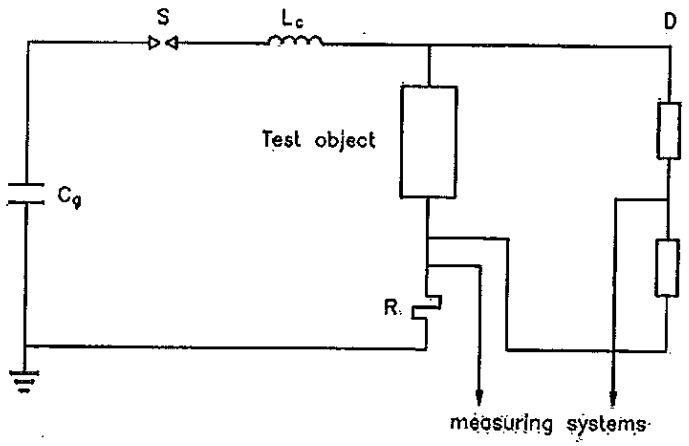
circuit A014



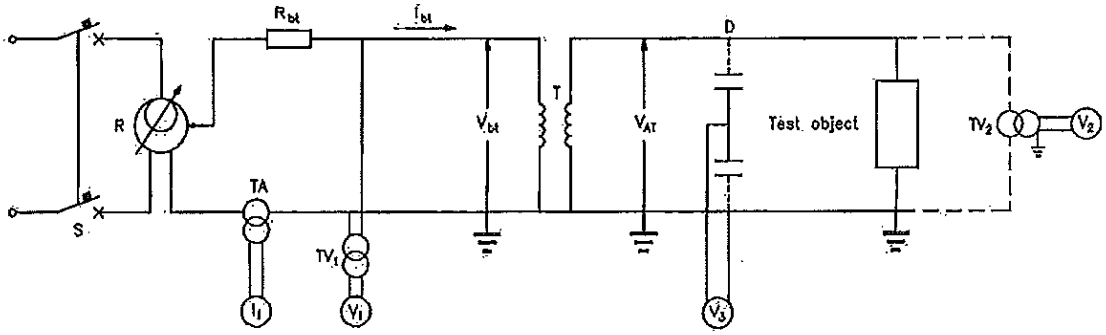
impulse generator

plant P177
no. of stages 2
C_g 2,49 μF
L_c 18 μH
S spark gap

current shunt (R) CESI no. 6042; R = 0,002Ω ; 100 kA
electro optical system CESI no. 11517/518
oscilloscope CESI no. 13217
type Tektronix TDS 540A

voltage divider (D) CESI no. 13027 k = 2029
electro optical system CESI no. 11521/522
oscilloscope CESI no. 13217
type Tektronix TDS 540A

circuit A012



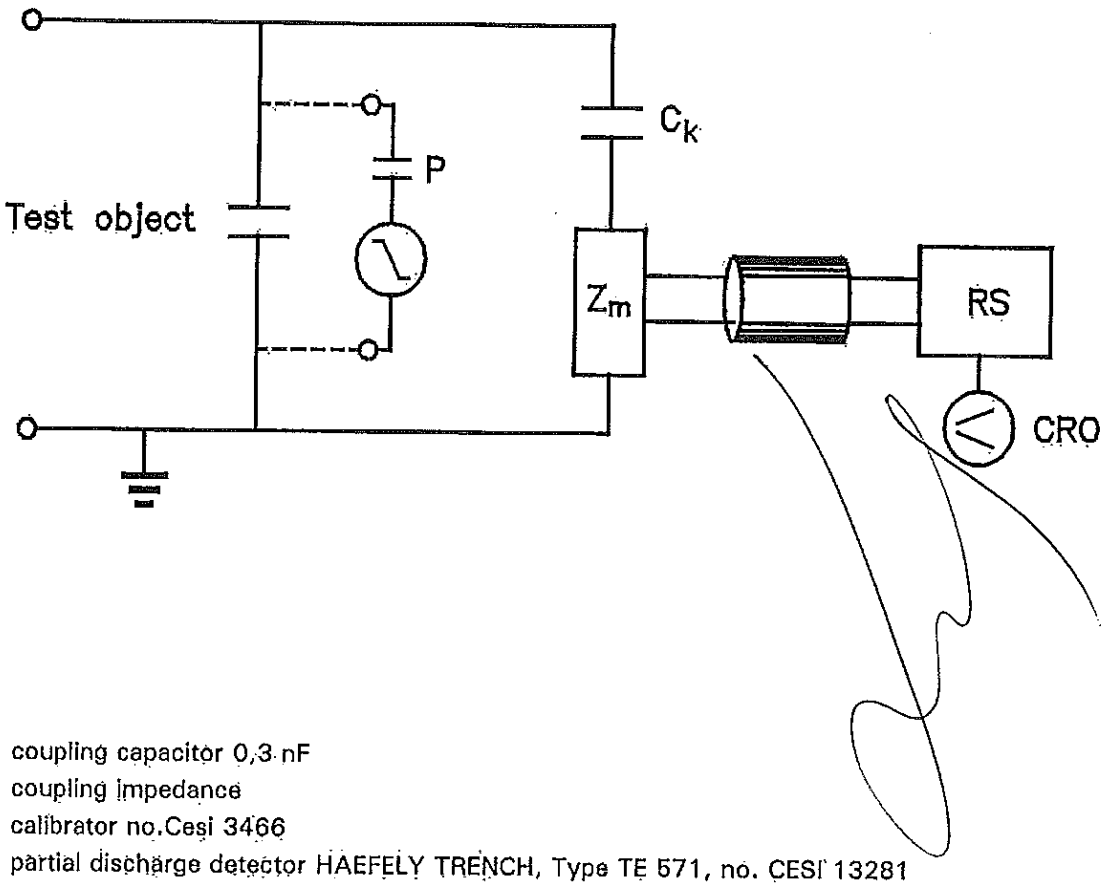
power frequency test circuit

R : regulator type CORMES;power 66 kVA ; voltage 380 V/0 ÷ 0,22 kV
TA ; current trasformer CGS; ratio 150-300/5
I_1 ; amperometer direct reading INDEX
TV_1: voltage transformer CGS ; ratio 220-440/100
V_1 : voltmeter direct reading TSE
R_{bt} : protection resistor --- Ω
T : booster transformer PIVI ; power 250 kVA ; voltage 200-400 V/250 kV
TV_2: voltage transformer type CGS ; CESI no. 287; ratio 30000/100
V_2 : voltmeter CESI no. 6393

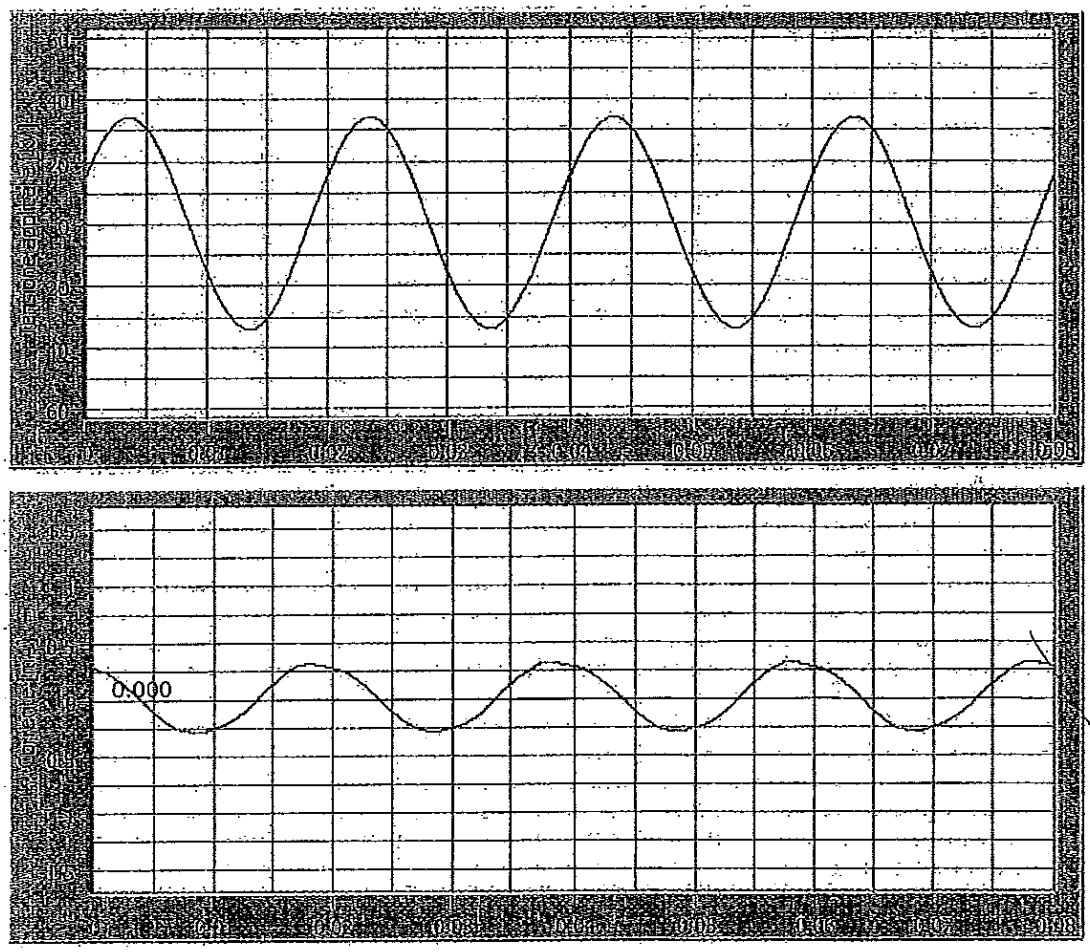
circuit A022

partial discharges measurement

direct circuit
scheme 1a



C_k : coupling capacitor 0,3 nF
Z_m : coupling impedance
P : calibrator no.Cesi 3466
RS : partial discharge detector HAEFELY TRENCH, Type TE 571, no. CESI 13281
CRO: oscilloscope (not used)



CESI TEST A4/509502 oscillogram n. 1

"ВАК - 02" ООД
ОАМОКОВ

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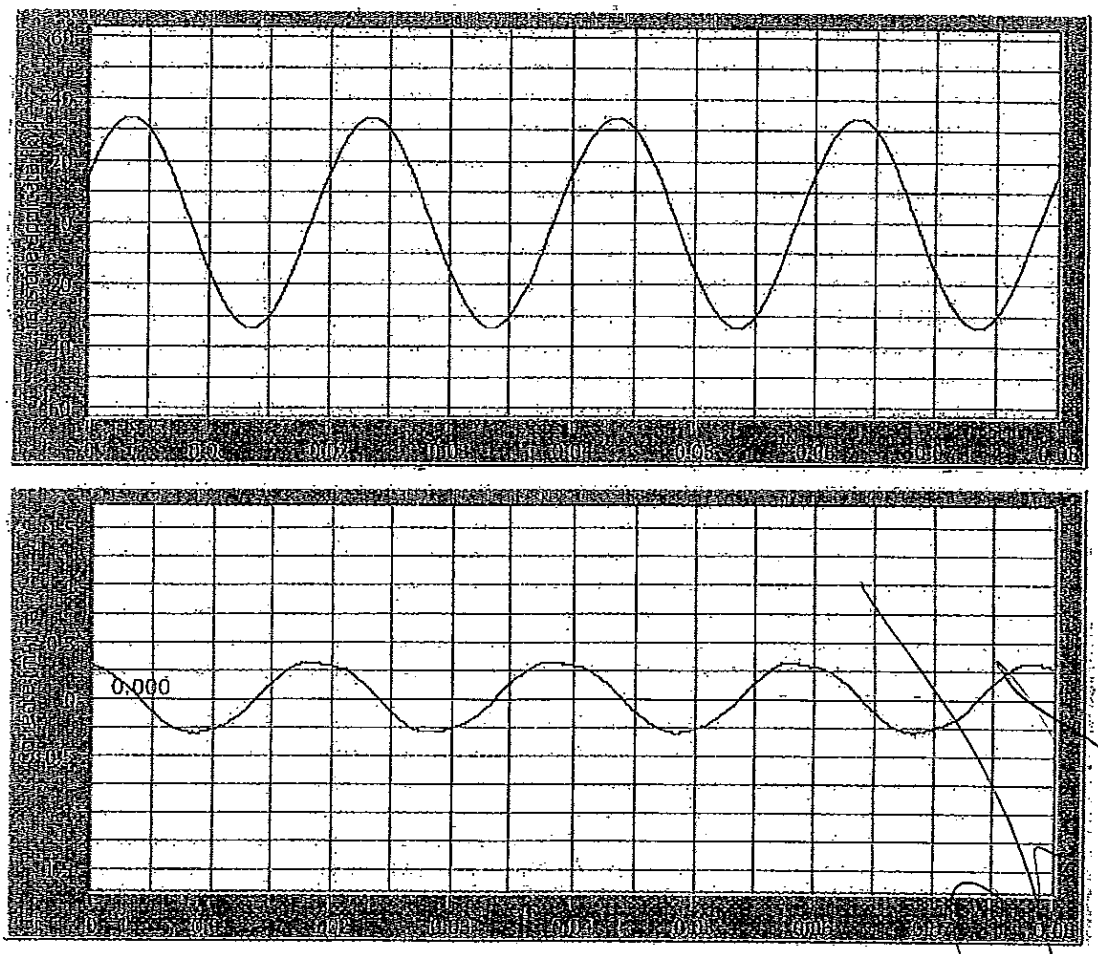
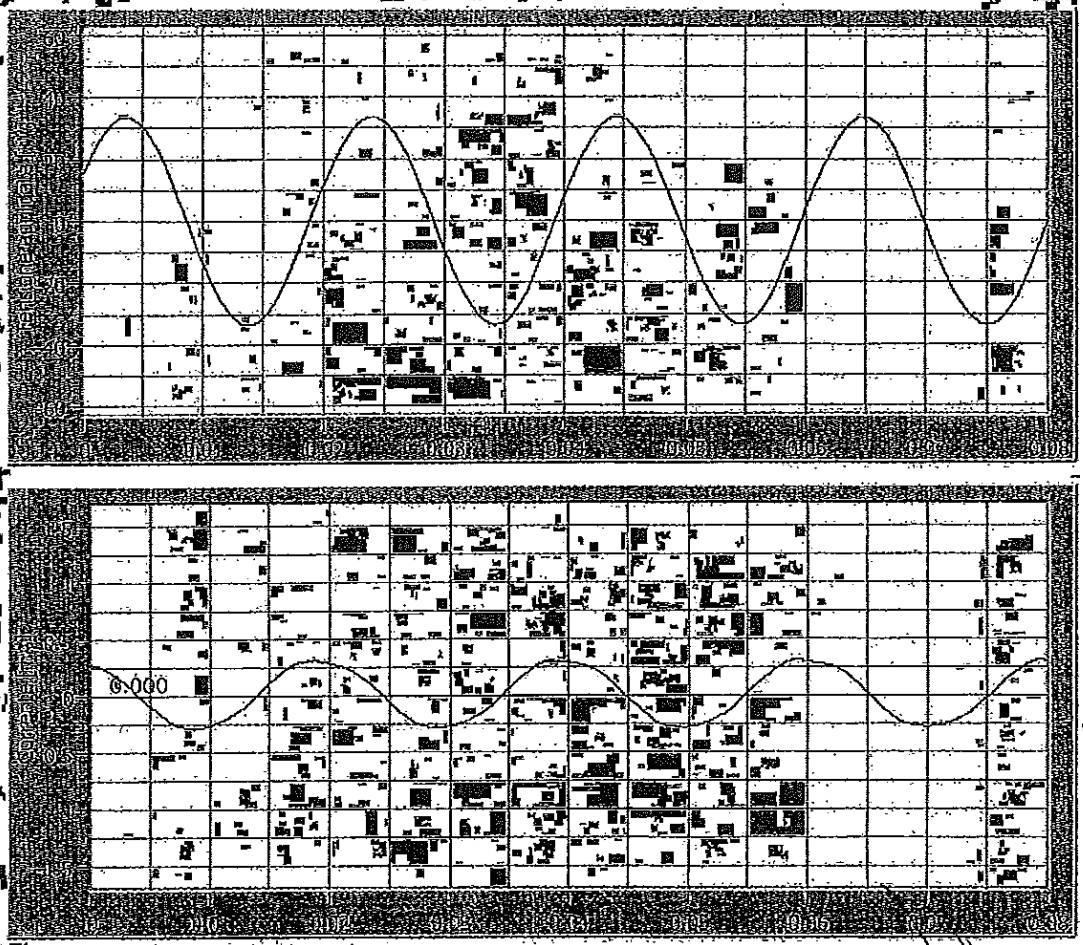


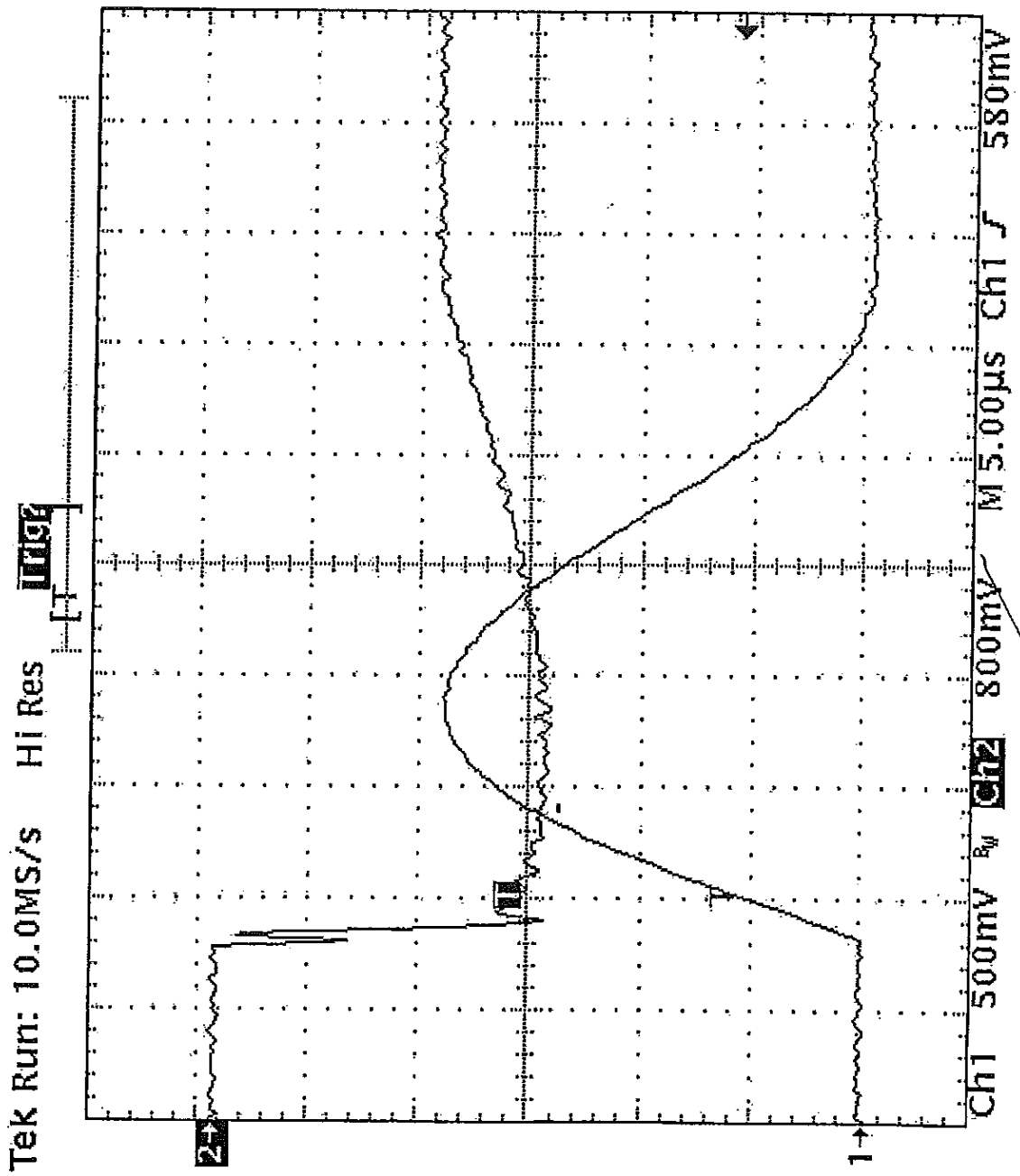
CESI TEST A4/509502 oscillogram n. 2

"BAK - 02" ООД

204



CESI TEST A4/509502 oscillogram n. 3



CESI TEST A4/509502 oscillogram n. 4

ВЕРНО С ОРИГИНАЛА

"ВАК - 02" ООД
САМОКОВ

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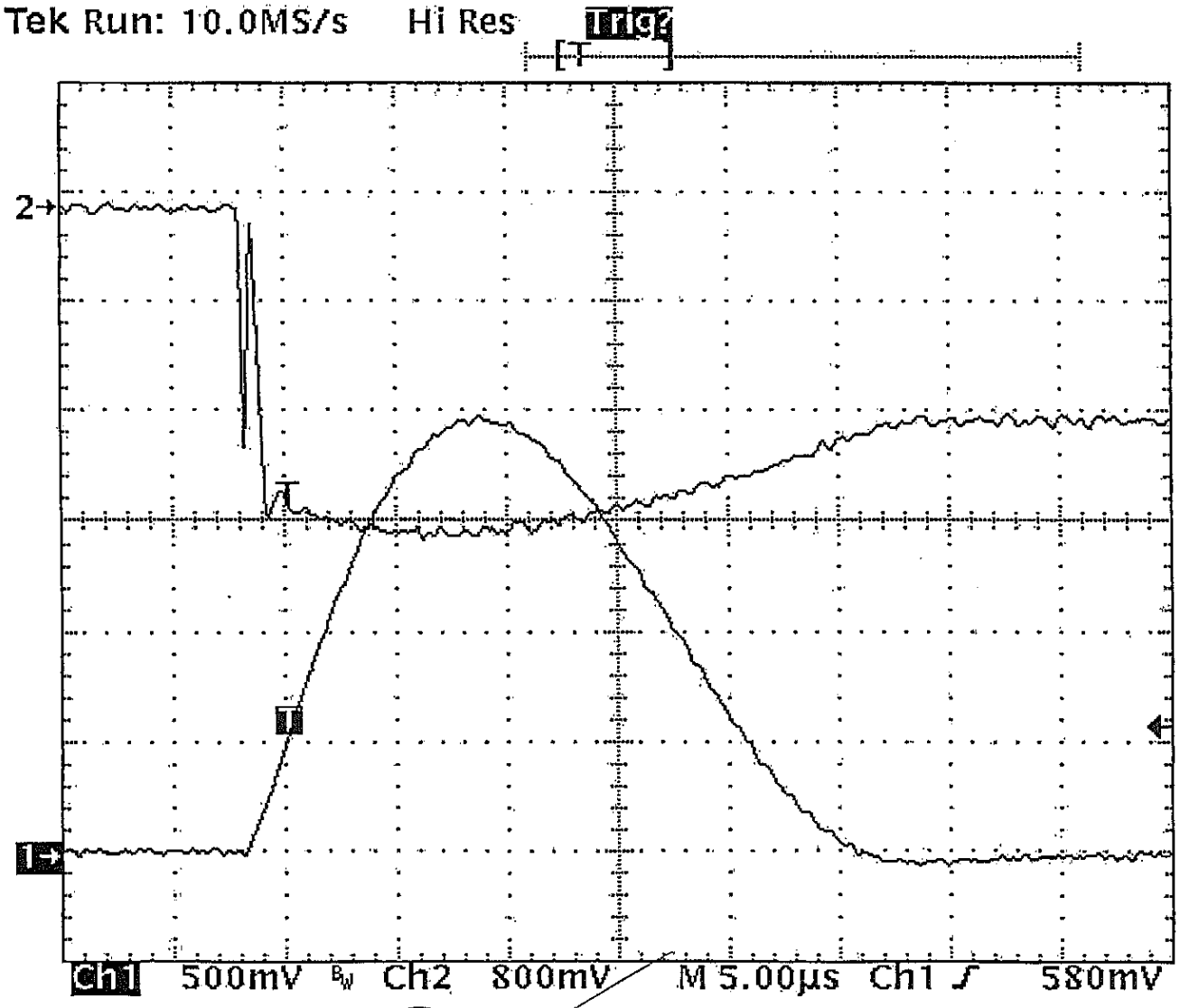
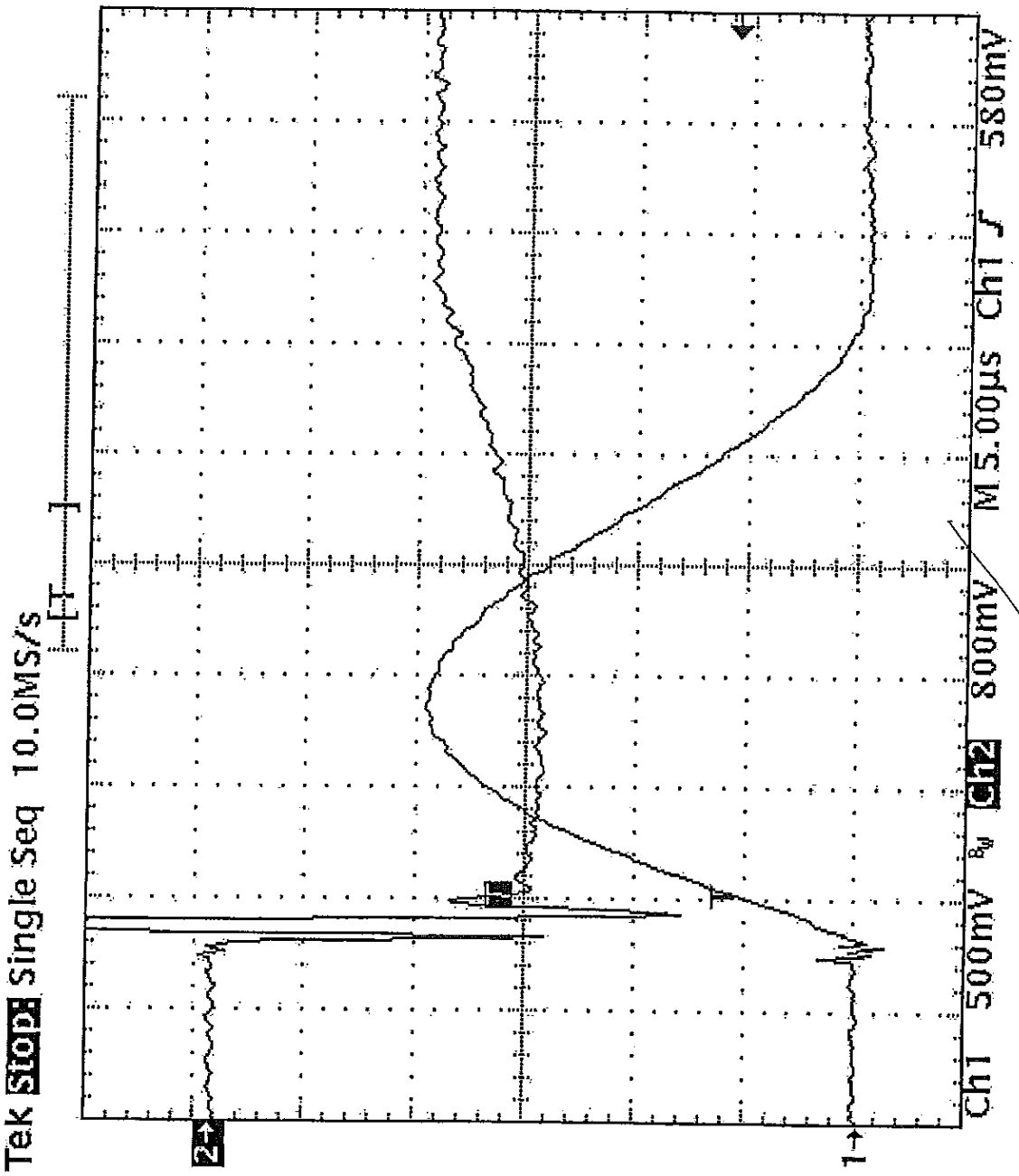
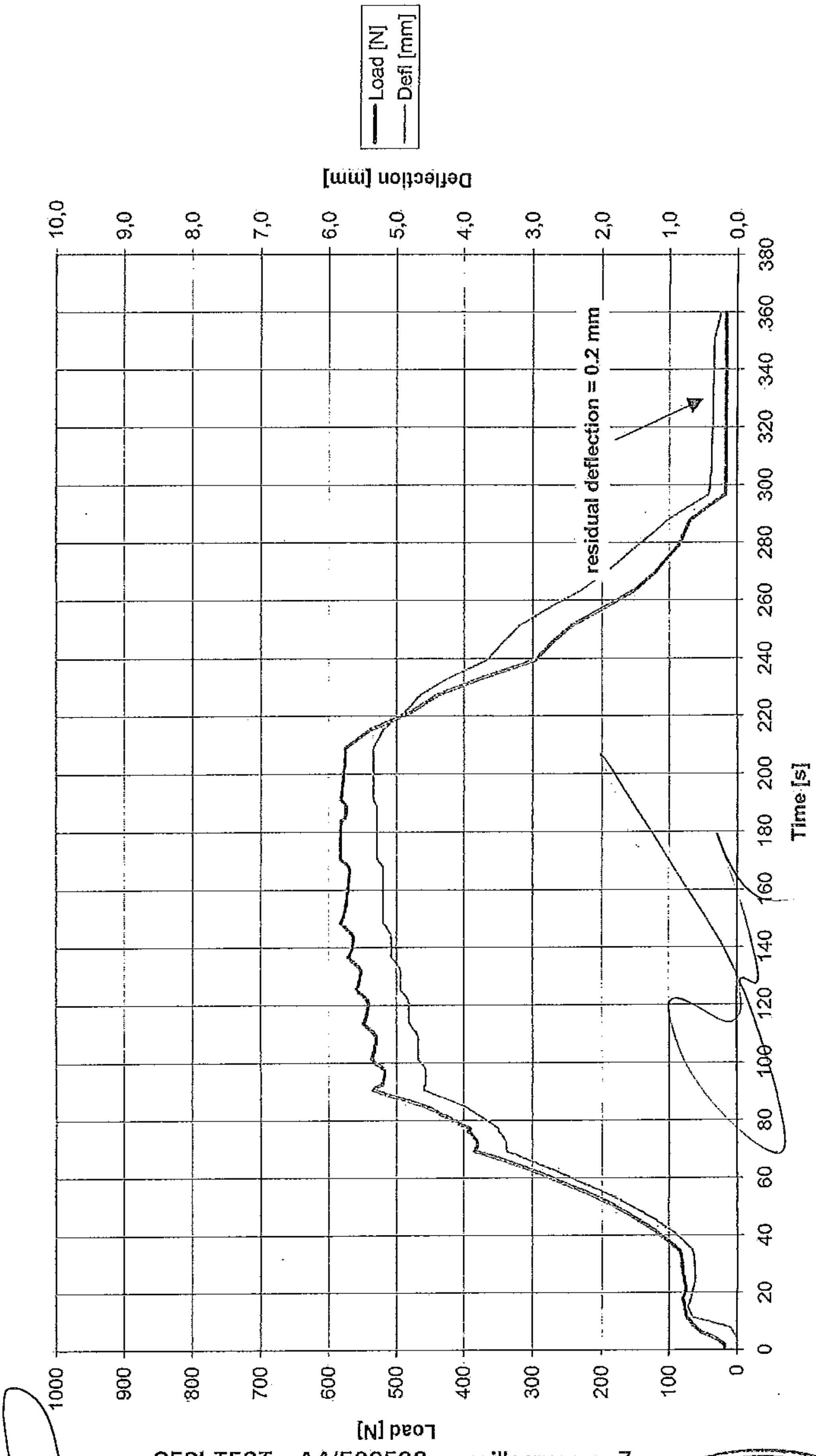
CESI TEST A4/509502 oscillogram n. 5





CESI TEST A4/509502 oscillogram n. 6



CESI TEST A4/509502 oscillogram n. 7

ВЯРНО С ОРИГИНАЛА

"ВАК - 02" ООД САМОКОВ

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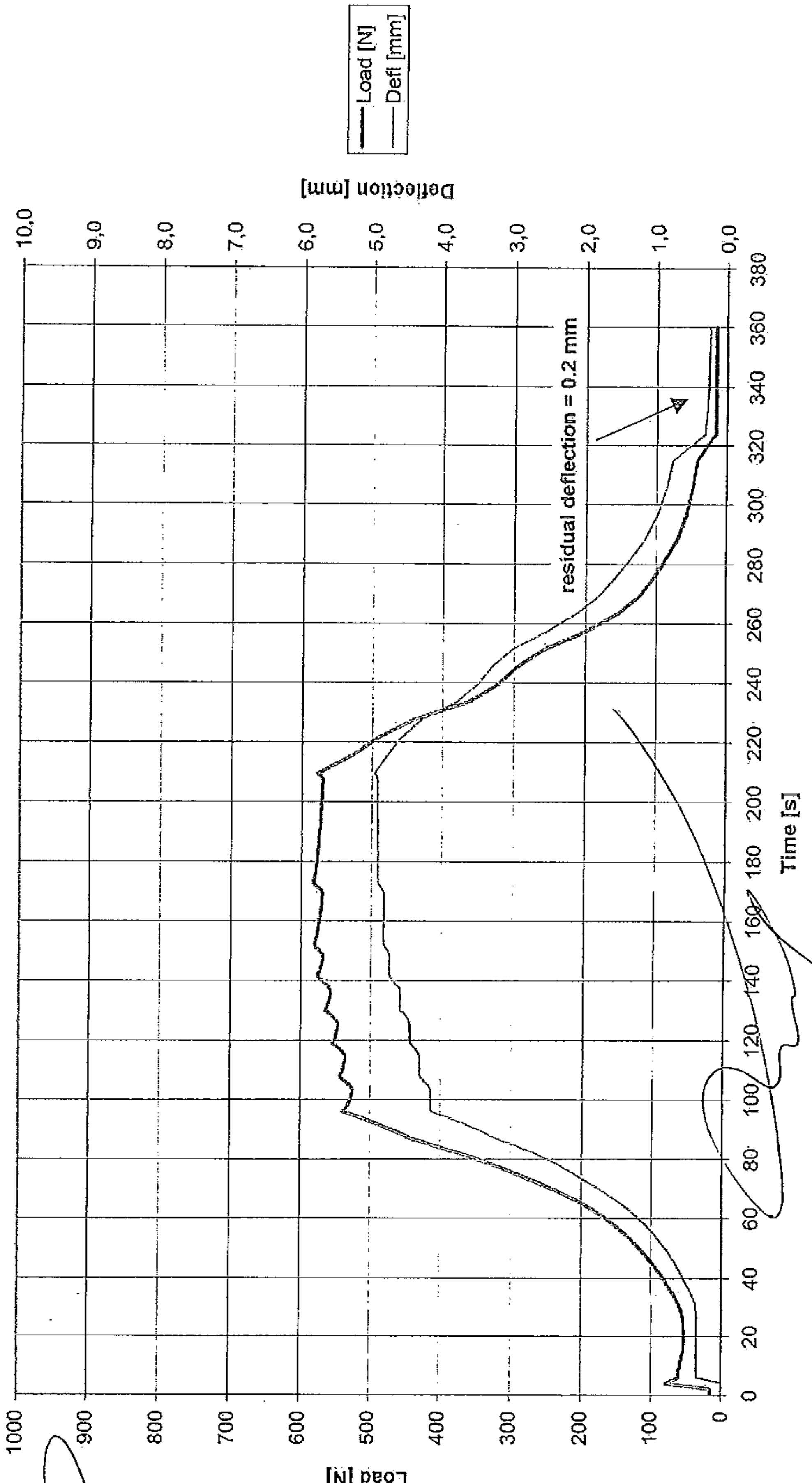
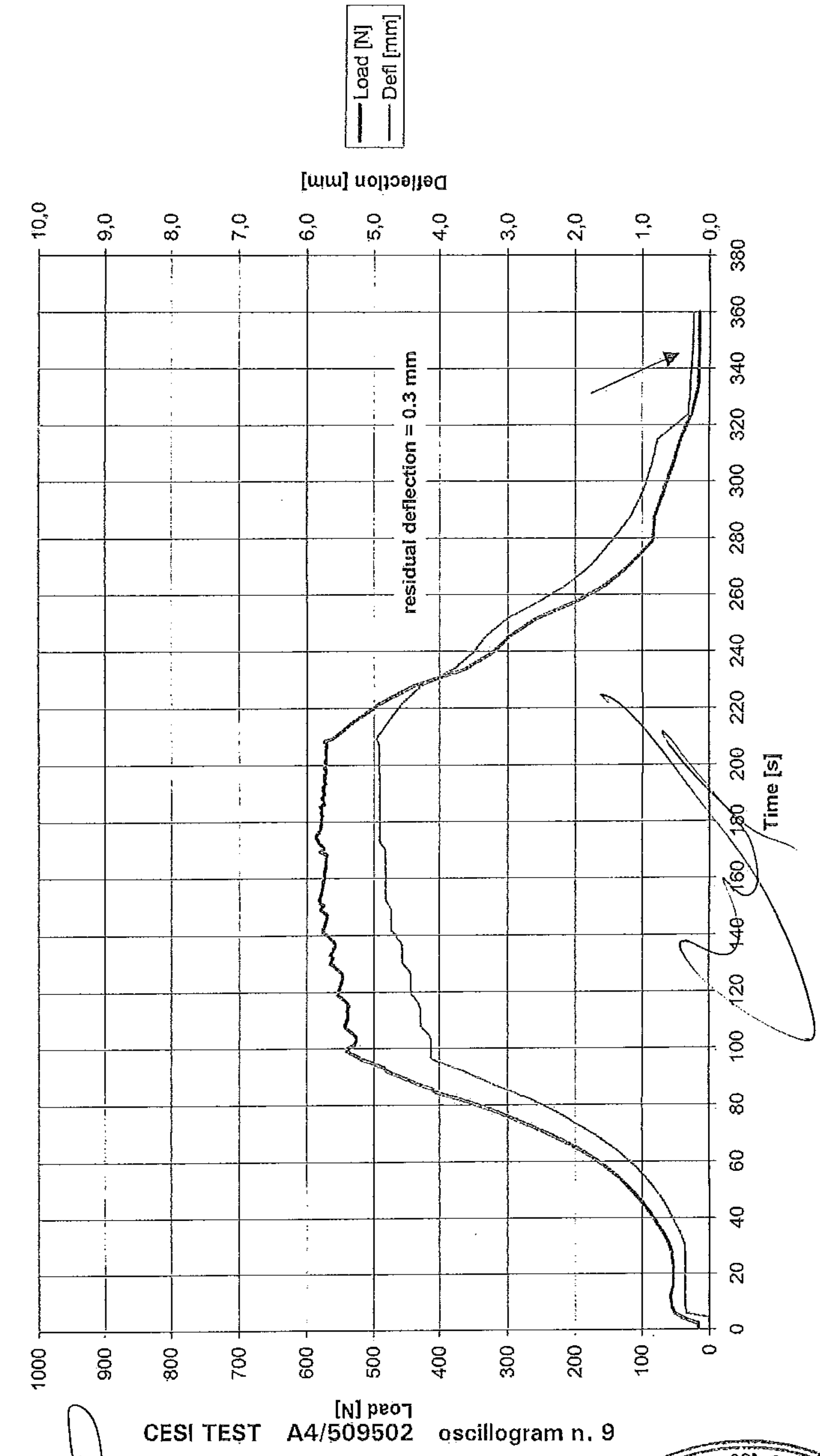


CESI TEST A4/509502 oscillogram n. 8

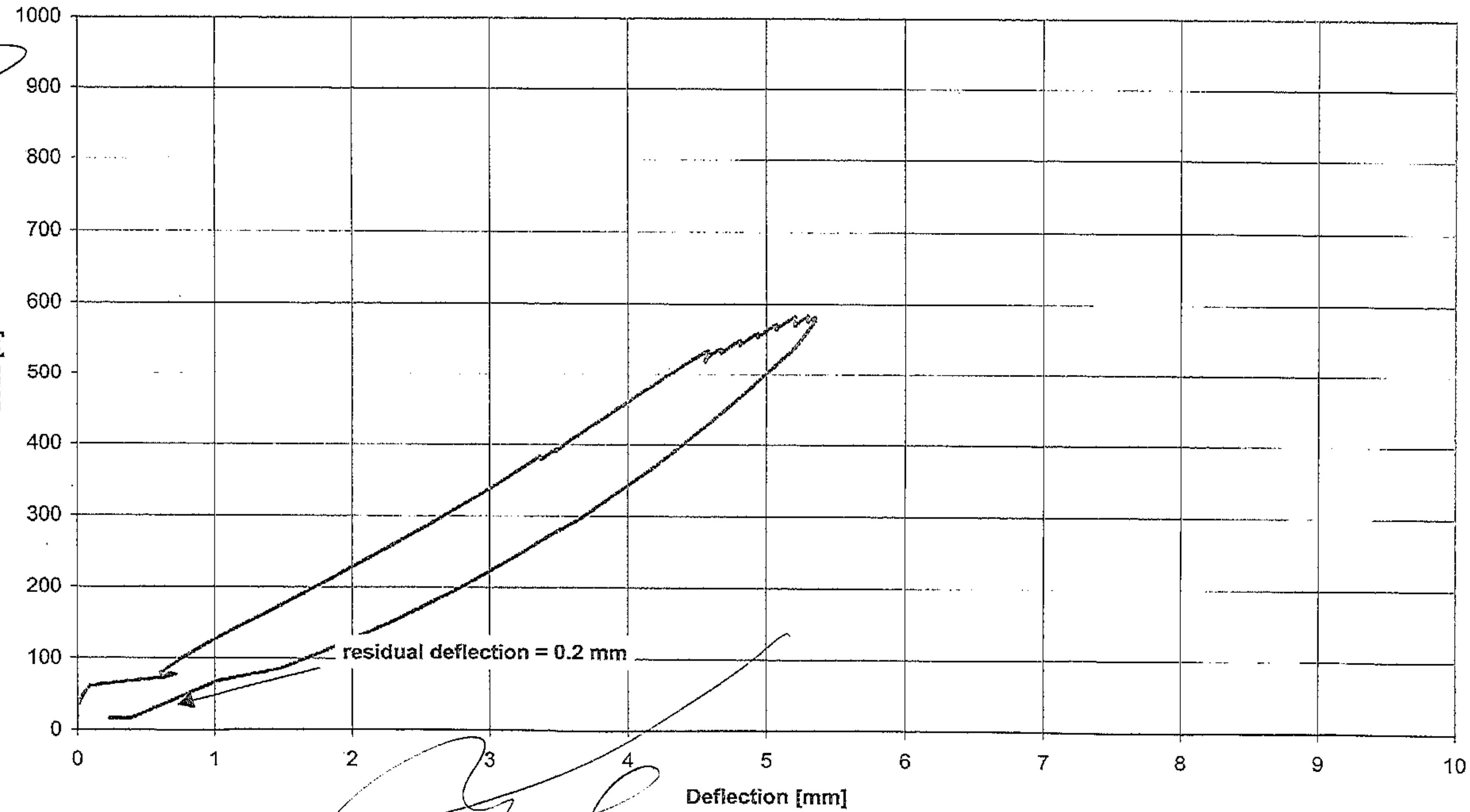
ВЯРНО С ОРИГИНАЛА

"ВАК - 02" ООД САМОКОВ

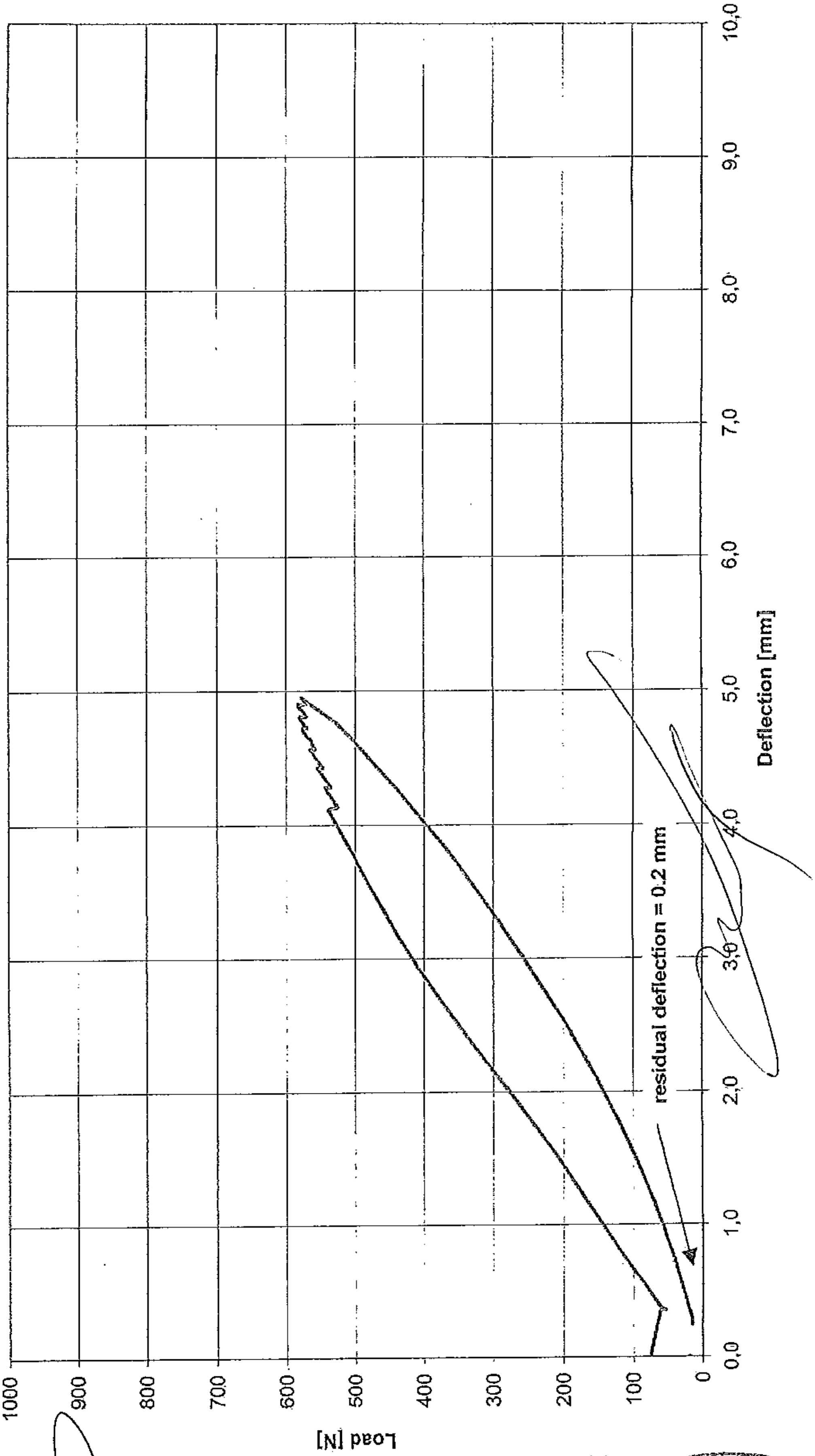
210



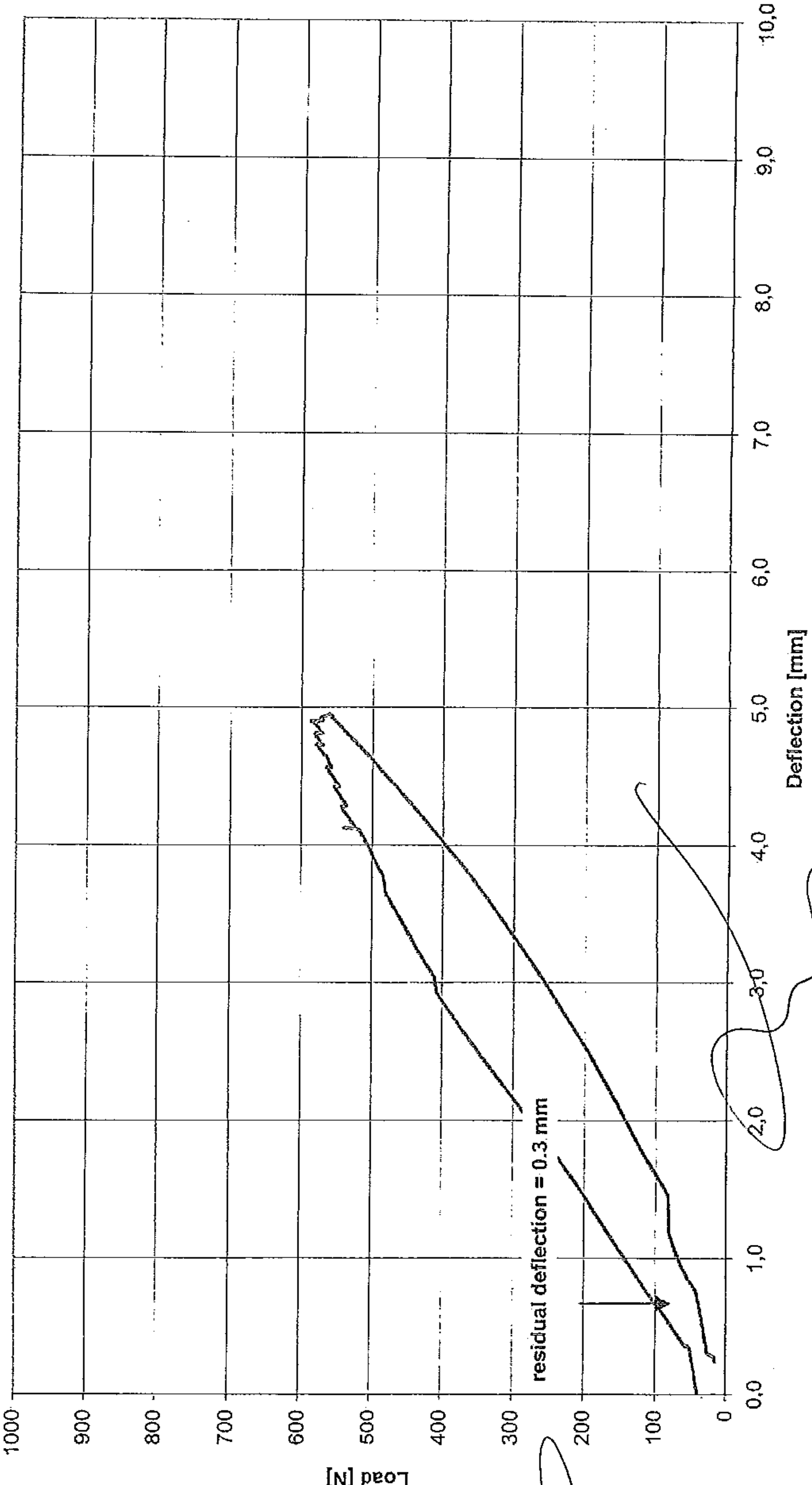
CESI TEST   A4/509502   oscillogram n. 9



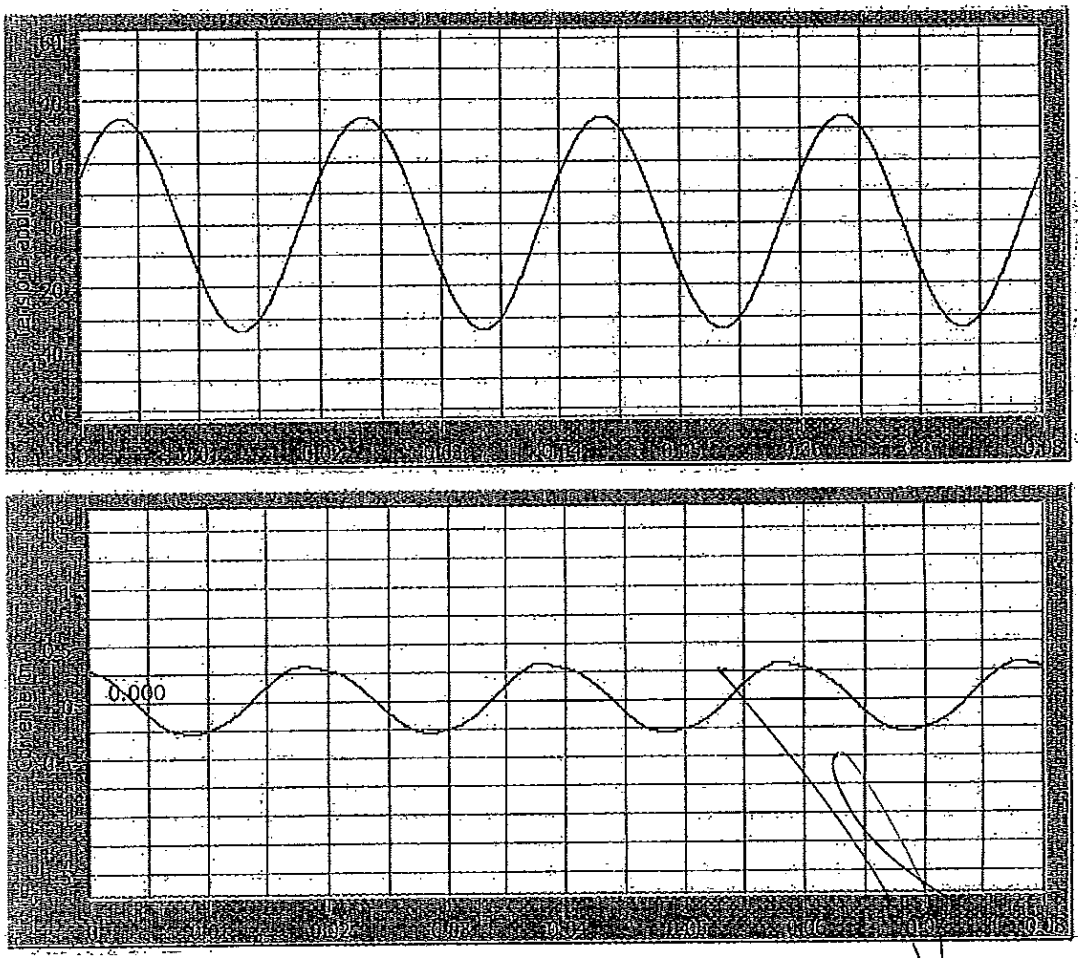
CESI TEST A4/509502 oscillogram n. 10



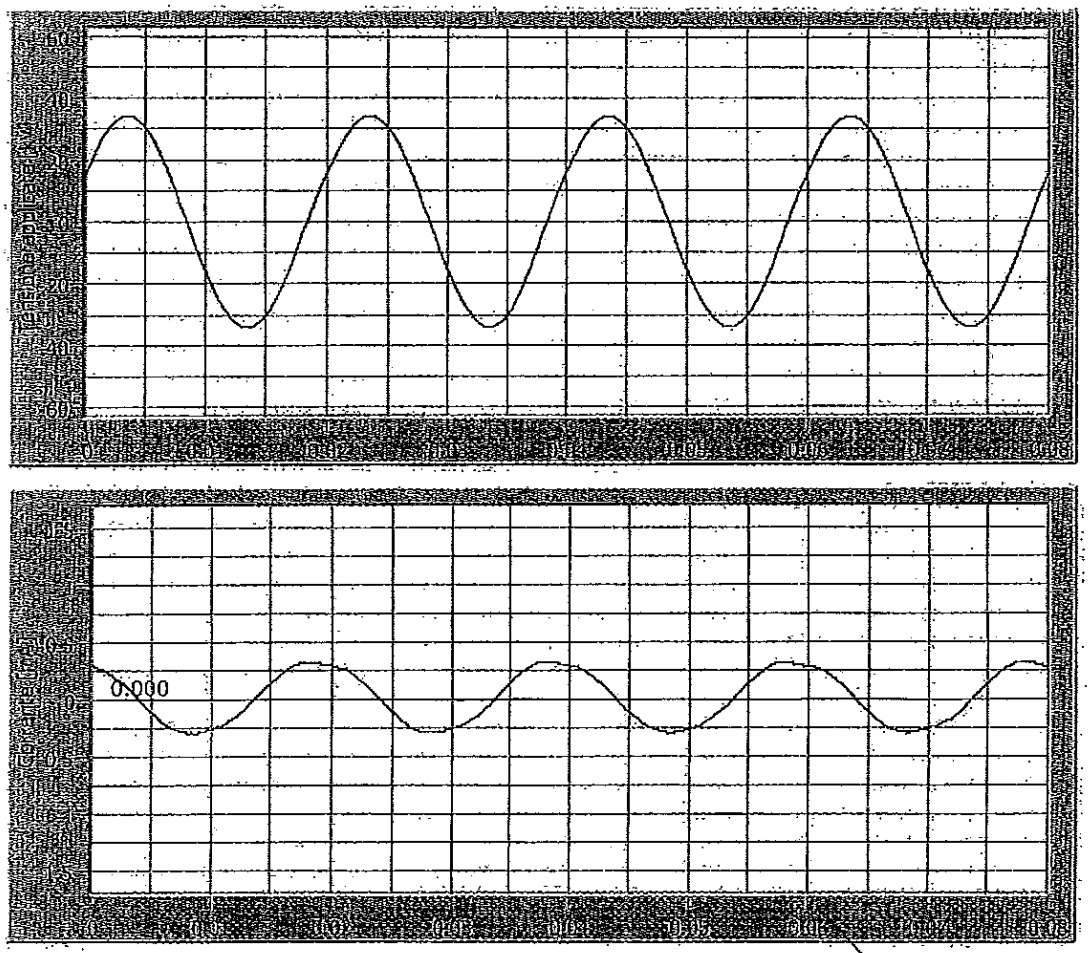
CESI TEST A4/509502 oscillogram n. 11



CESI TEST A4/509502 oscillogram n. 12



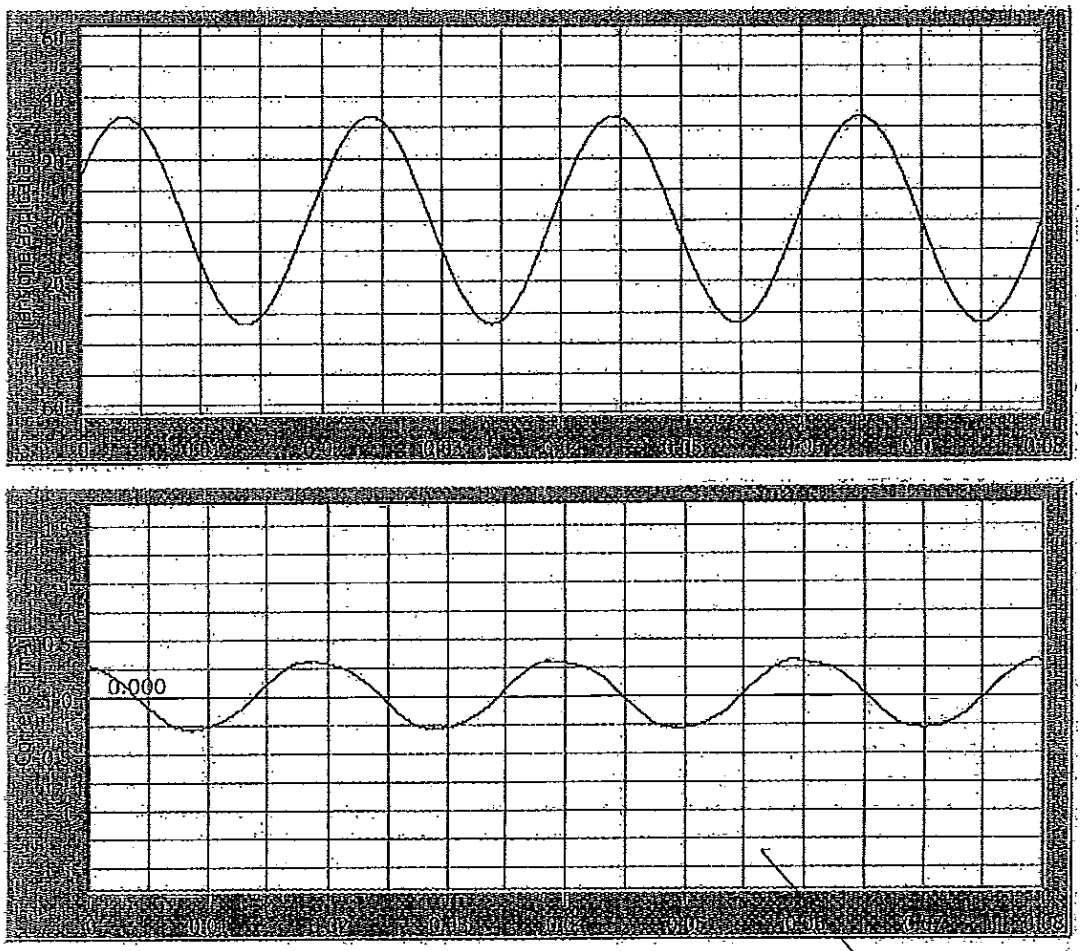
CESI TEST A4/509502 oscillogram n. 13



CESI TEST A4/509502 oscillogram n. 14

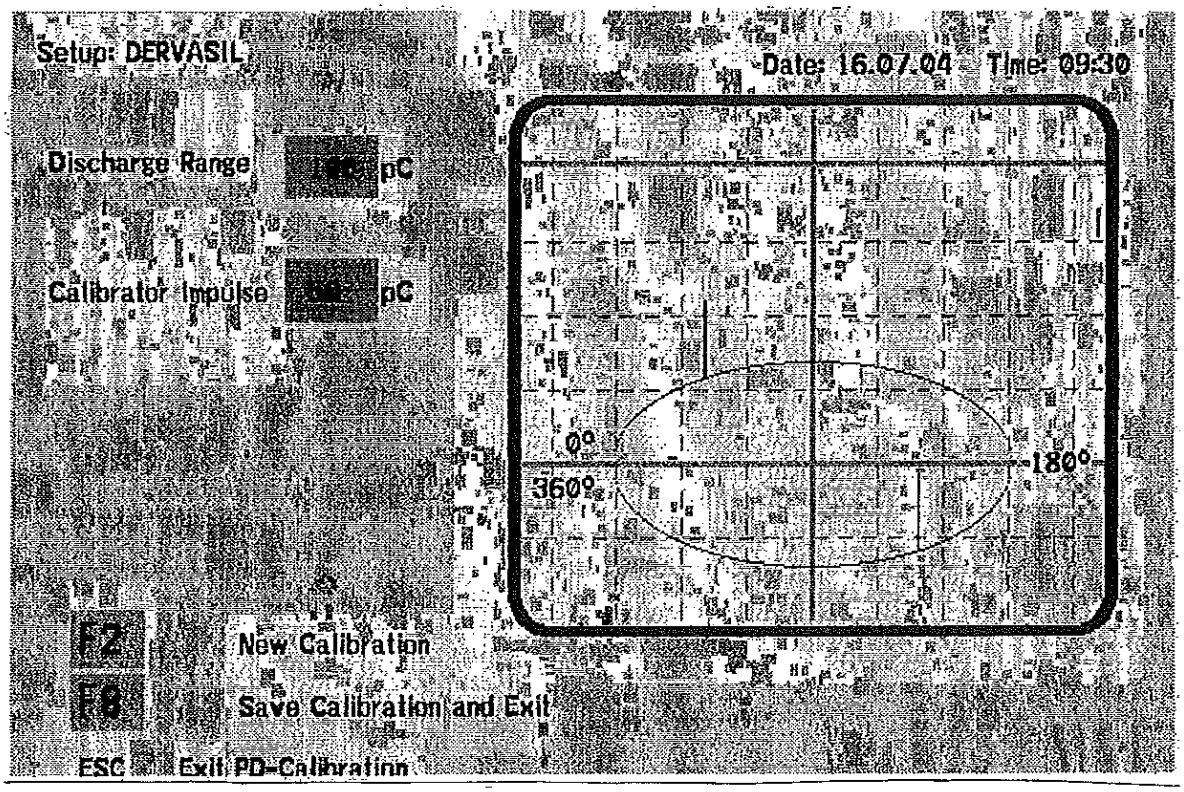
"BAK-02" ООД
САМОКОВ

916

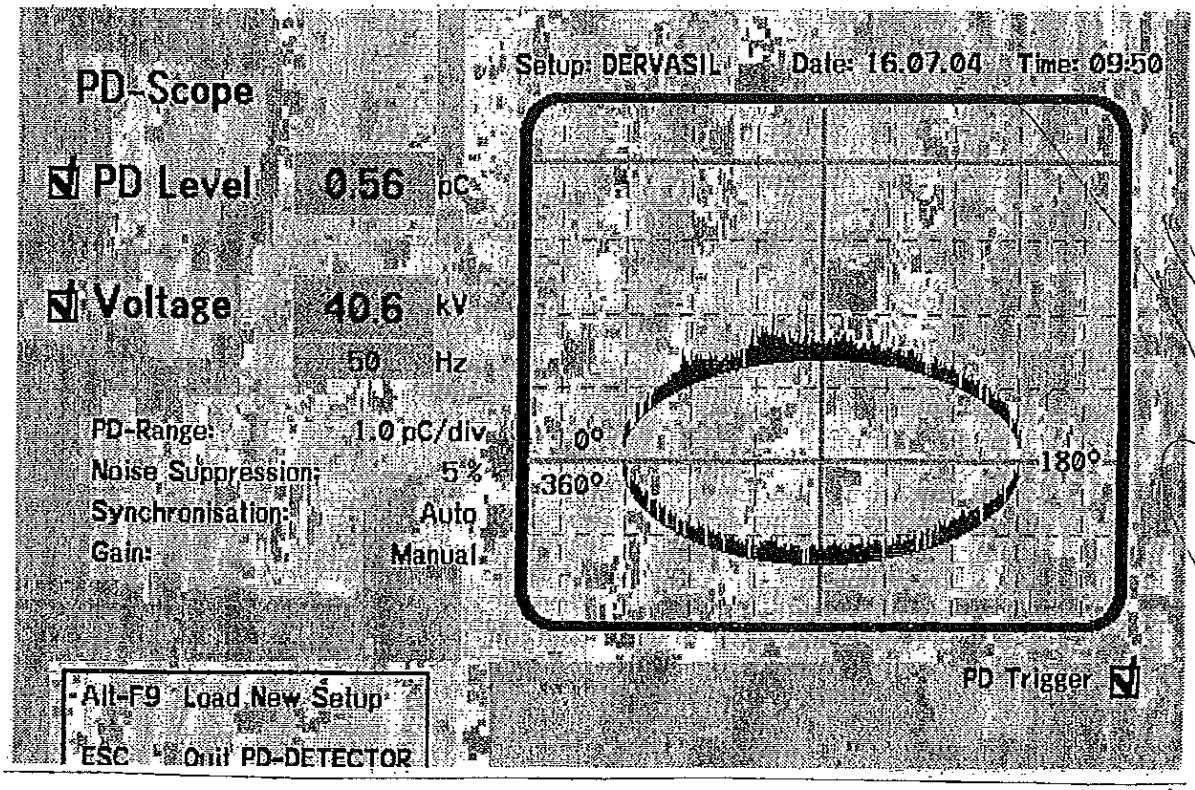


CESI TEST A4/509502 oscillogram n. 15

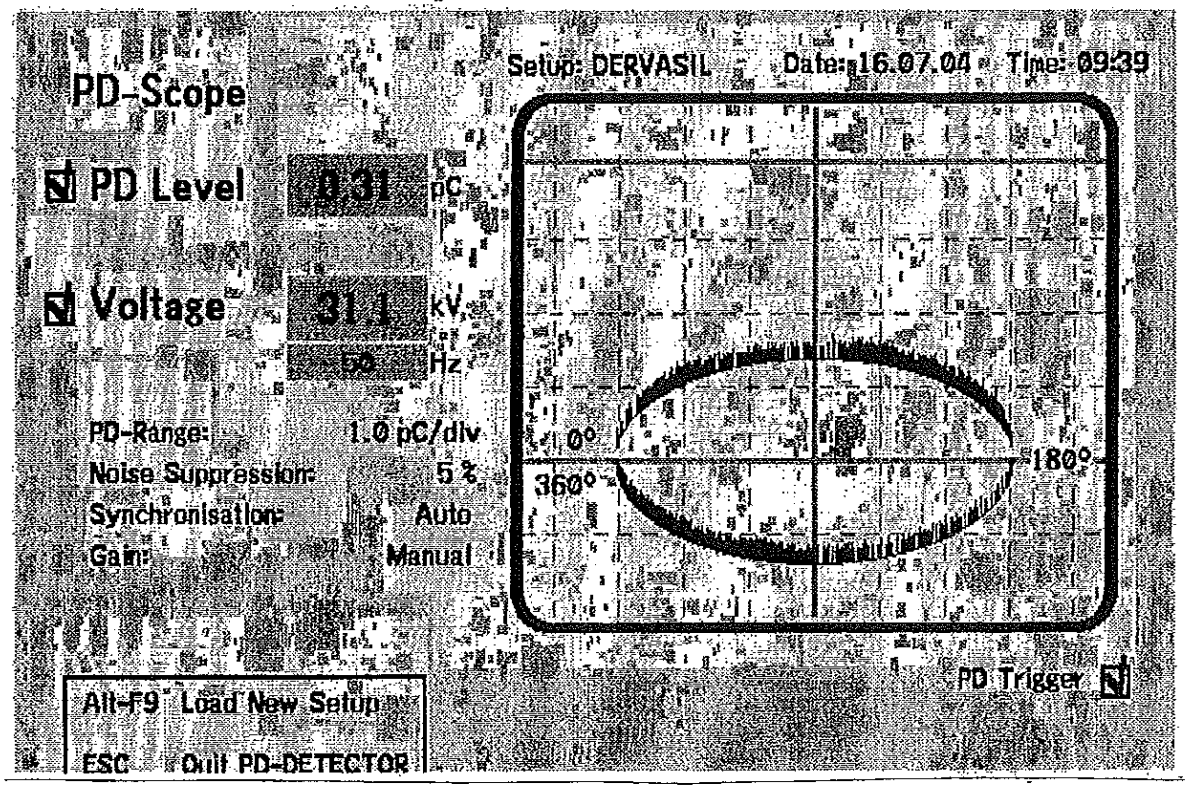
oscillogram no.16



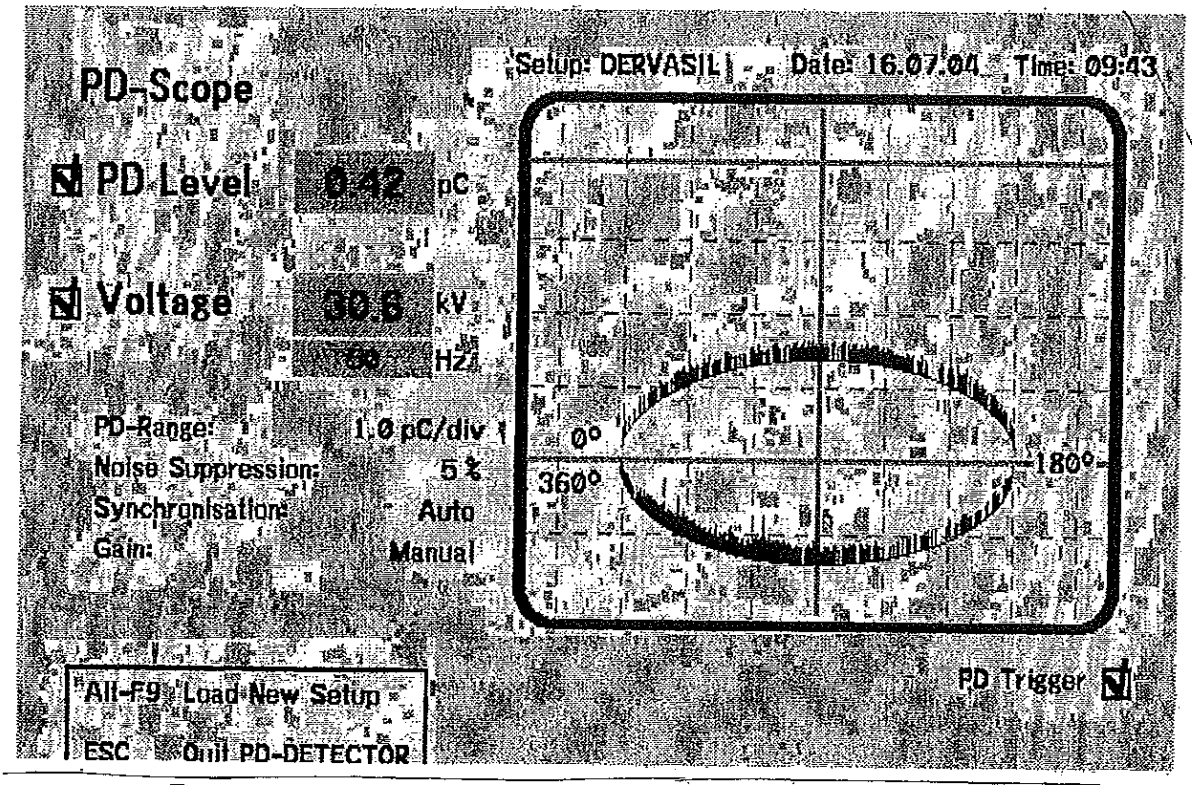
oscillogram no.17



oscillogram no.18



oscillogram no.19

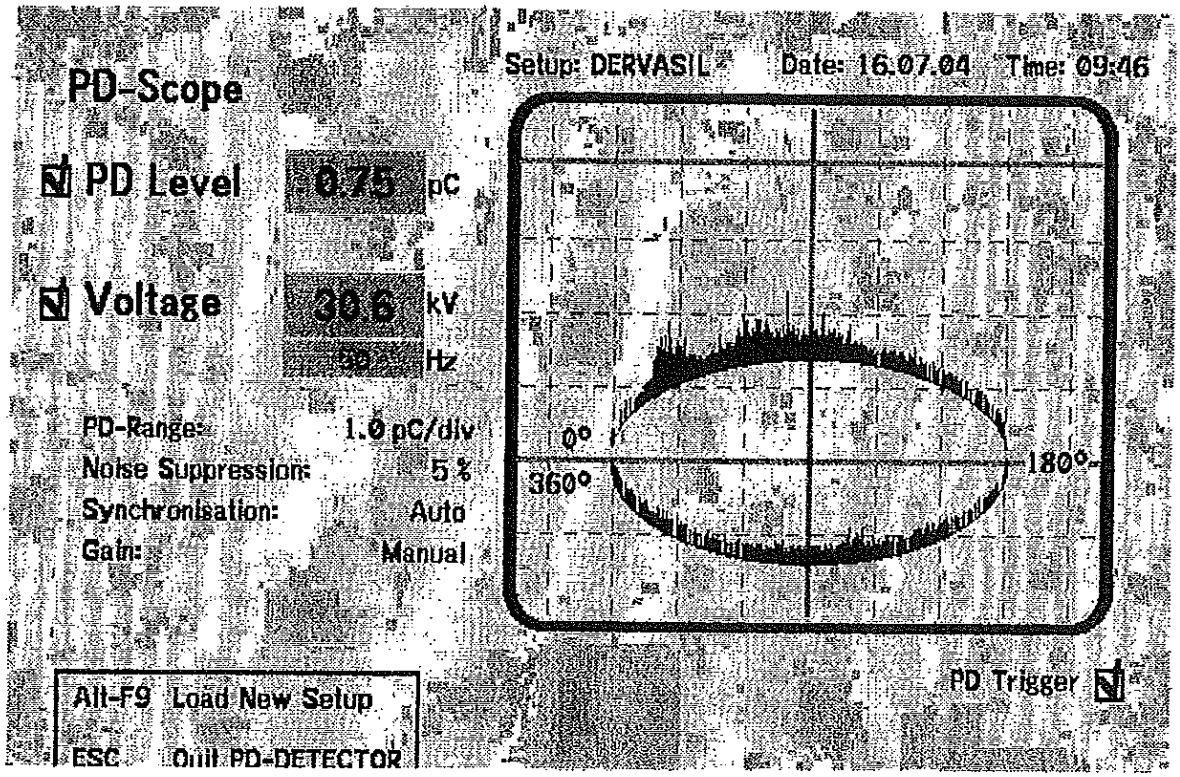


CESI TEST A4/509502

"ВАК - 02" ООД
САМОКОВ

ВЯРНО С ОРИГИНАЛА

oscillogram no.20

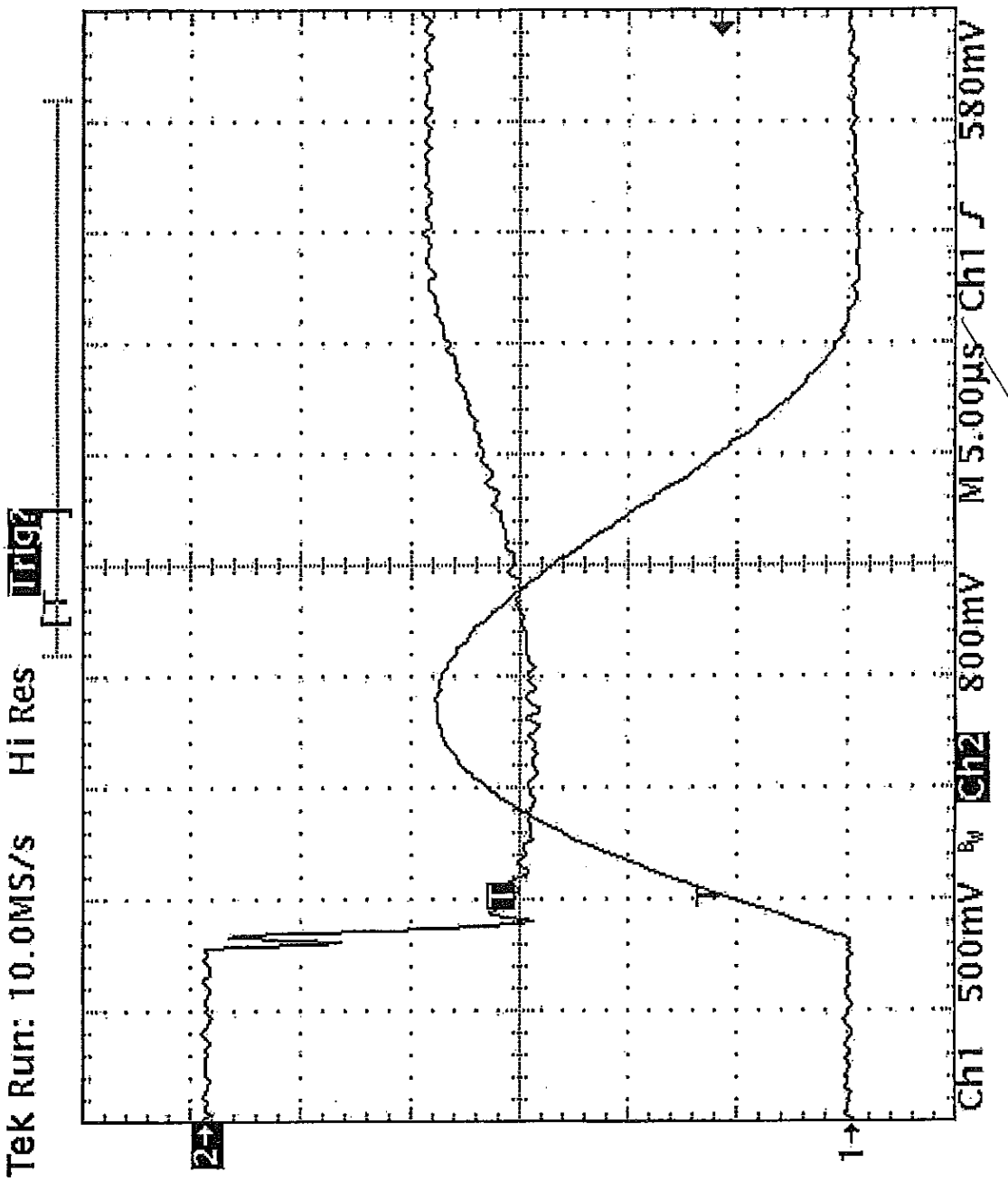


oscillogram no.--

CESI TEST A4/509502

"BAK - 02" OOД
САМОКОВ

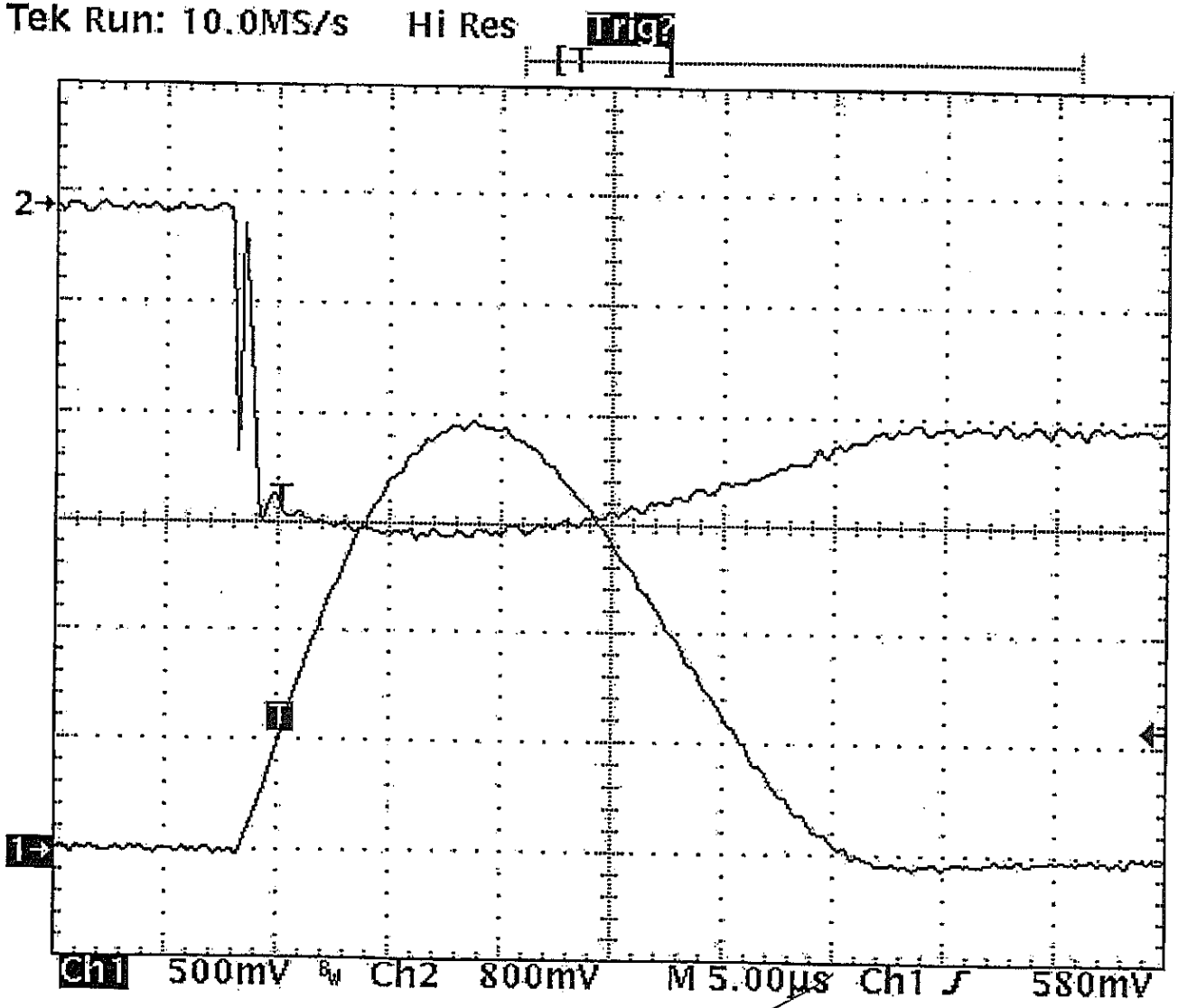
220



CESI TEST A4/509502 oscillogram n. 21

"ВАК - 02" ООД
САМОКОВ

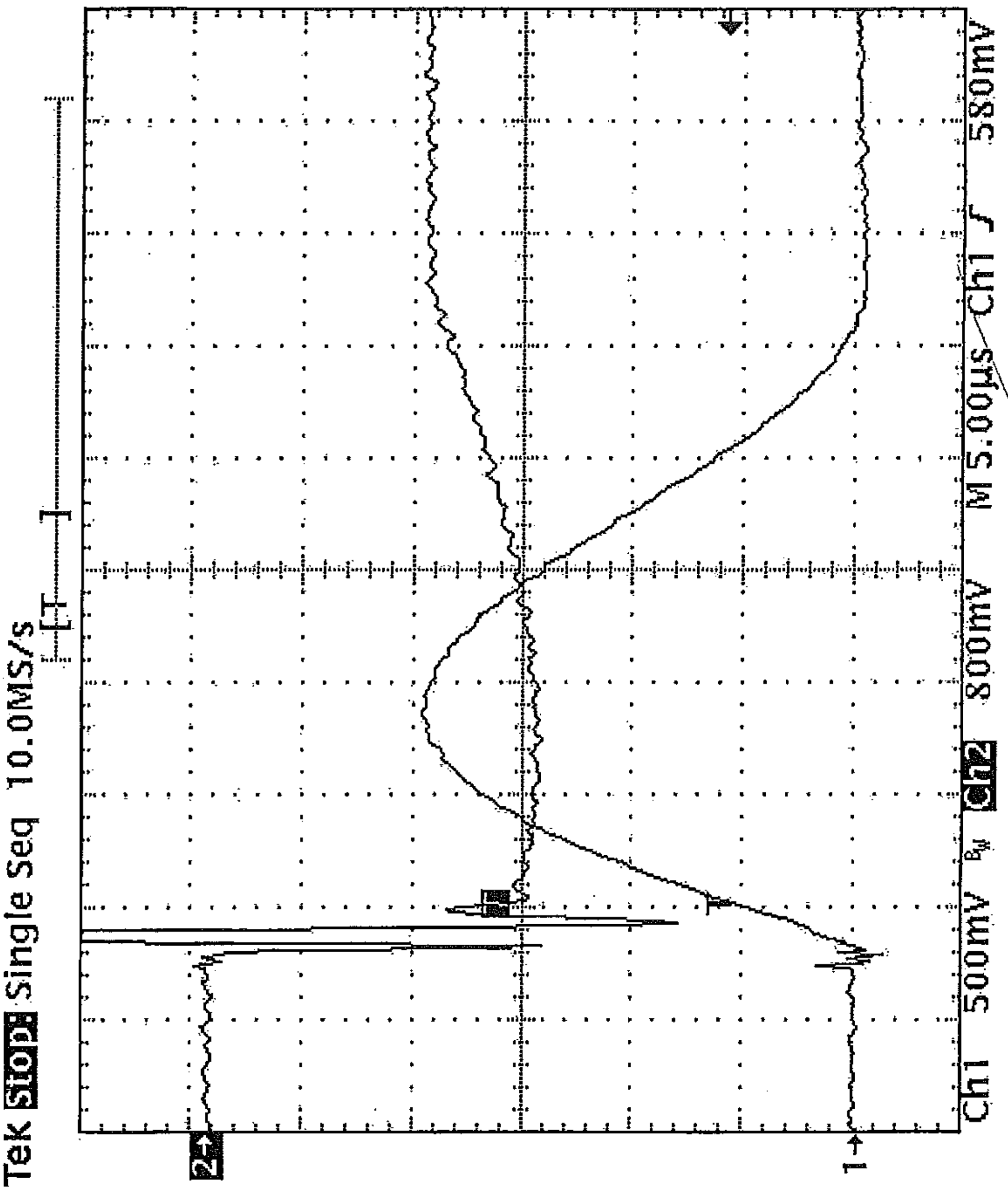
221



CESI TEST A4/509502 oscillogram n. 22

ВАК - 02 - 009
САМОКОВ

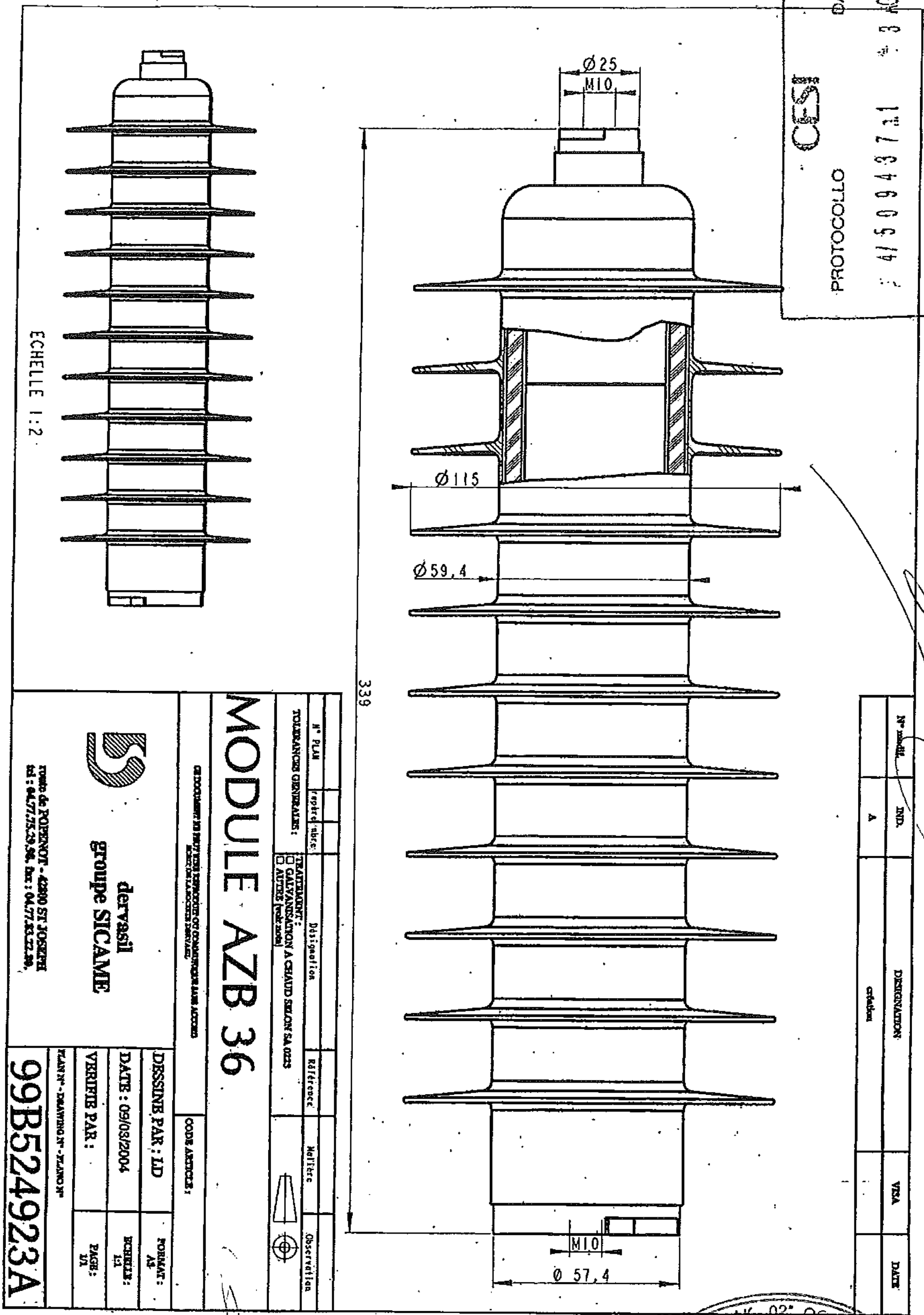
222



CESI TEST A4/509502 oscillogram n. 23

"ВАК - 02" ООД
САМОКОВ

10. Plans / Drawings



CESI PROTOCOLLO A4/509437 DATA 3 AGO 2004 Firma

"ВАК - 02" ООД САМОКОВ

ВЯРНО С ОРИГИНАЛА

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client	Dervasil - Saint Joseph (France)
equipment under test	Polymer housed metal-oxide surge arrester type AZB 36
tests performed	Moisture ingress test
normative documents	IEC 60099-4 (2004-05), Clause 10.8.13
receipt date of the sample	May 03, 2004
test date	from June 17, 2004 to July 16, 2004
no. of pages	24 no. of pages annexed 7

the test results relate only to the sample tested
this document shall not be reproduced except in full without the written approval of CESI

first issue date	July 20, 2004	
prepared	PeC/TEST - M. Gregori	на основание чл. 2 от ЗЗЛД
verified	PeC/TEST - A. Sironi	
approved	PeC/TEST - M. de Nigris	

CESI
CENTRO ELETTROTECNICO SPERIMENTALE ITALIANO
Business Unit
Il Res

на основание чл. 2 от ЗЗЛД

ВЯРНО С ОРИГИНАЛА

САМОКОВ

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tests witnessed by: /

identification of the object: The manufacturer guarantees that the tested object is manufactured according to the submitted drawings.
CESI checked that drawing adequately represents in shape and dimension the essential detail and the parts of the tested object.
The drawing identified by CESI and numbered A4/509437 n. 01, one page, is annexed to this document.

Only for laboratory requirement, in order to reproduce the test conditions, all the laboratory data are contained in the document marked: —

The measurement uncertainties of the test results reported in this document are the following:
- dielectric tests with impulse voltage : **peak voltage: ± 3 % ; time parameters: ± 10 %**
- dielectric tests with impulse current : **peak value: ± 3 % ; time parameters: ± 10 %**
- dielectric tests with alternating voltage : **voltage (rms): ± 3 %**

The measurement uncertainties are estimated at the level of twice the standard deviation (corresponding, in the case of normal distribution, to a confidence level of about 95 %) and have to be considered as maximum values.

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laboratory information

CESI testing team: Mr L. Podavitte

test laboratory: P177 surge arrester laboratory

activity code: 41285B
keywords: 12015R, 23810H, 31020W, 46030U, 53001D

ВЯРНО С ОРИГИНАЛА

"ВАК - 02" ООД САМОКОВ

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Pages annexed:

- 6 oscillograms n.6 pages
- Dervasil Drawing no.99B524923A; CESI n. A4/509437 n. 01, one page

Test object characteristics

type: Polymer housed metal-oxide surge arrester section

electrical characteristics (claimed by the client)

manufacturer's name	DERVASIL
nominal discharge current - I_N [kA]	10
rated voltage - U_r [kV]	36
continuous operating voltage - U_c [kV]	29
reference current - $I_{ref.}$ [mA]	5
line discharge class	1
rated frequency - [Hz]	50
torque load [N*m]	30
static cantilver [N]	300
year of manufacture	2004

geometrical characteristics (measured on the test sample)

height [mm]	339
number of sheds	11
shed diameter [mm]	115
core diameter [mm]	59,4

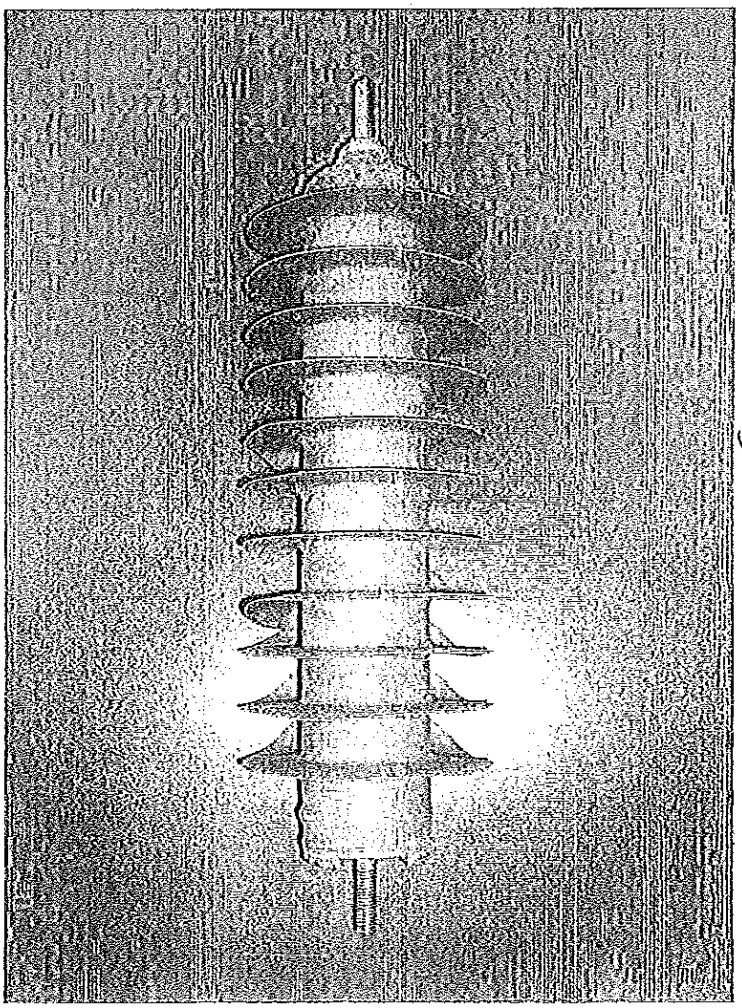
other characteristics

housing material	polymeric
housing color	grey

ВЯРНО С ОРИГИНАЛА

"ВАК - 02" ООД САМОКОВ

Photograph of polymer housed metal-oxide surge arrester.



ВЯРНО С ОРИГИНАЛА

"ВАК - 02" ООД
САМОКОВ

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Reference Standard

IEC 60099-4 (2004-05) edition 2,0 Clause 10.8.13
" Metal-oxide surge arrester without gaps for a.c. system"

Test carried out

test carried out	number of sample tested
initial measurament	1
mechanical preconditioning	
Water immersion test	
verification test	

Test object identification

test object names	identification of test sample (given by the client)
polymer metal-oxide surge arrester	MI

/. 230

Test procedure on samples MI

Initial measurement

- Watt losses has been measured at $0,8*U_c$ = 23,2 kV_{rms}

- Internal partial discharge have been measured.
  The application voltage has been increased up to rated voltage (U_i) and maintained for 10 sec. The voltage has been decreased to 1,05 times the continuous operating voltage (U_c) and the partial discharge level has been measured according to the reference standard.

- The lightning impulse residual voltage has been measured at nominal discharge current I_N

Terminal torque pre-conditioning

- The terminal torque at the value, specified by the manufacturer(30 N*m), has been applied for 30 second.

Thermomechanical preconditioning

- The specimens have been submitted to two 48h thermal cycles of heating and cooling (see fig.6 of the reference standard) while mechanically loaded. The temperature was ranging from +60°C to -40°C. The mechanical load consisted of a cantiliver load at the value specified by the manufacture (i.e. 300 N applied to the free terminal). The direction of the load was changed every 24 hours as specified on fig.6 of the reference standard.

Water immersion test

- The sample has been immersed in a vessel, in boiling deionized water with 1 Kg/m³ of NaCl for 42 hours. At the end the samples remained in the vessel until the water cooled to 50°C.

Verification test at ambient temperature

- Visual inspection

- Watt losses at $0,8*U_c$ has been repeated

- Partial discharge has been repeated at $1,05*U_c$

- The lightning impulse residual voltage has been repeated at nominal discharge current I_N

ВЯРНО С ОРИГИНАЛА

"ВАК - 02" ООД САМОКОВ

Visual inspection and summary of test result.

- The visual inspection of the polymer housed metal oxide surge arrester after test has revealed no sign of physical damage.

- variation of watt losess at $0,8*U_c$

sample	before test		after test		variation
	voltage	power	voltage	power	
	kV	W	kV	W	%
MI	24,11	0,497	23,90	0,435	- 12,47

The variation of watt losses before and after the test was less then 20% (maximum allowed variation according to reference standard is 20%).

- variation of lightning impulse residual voltage at I_N

sample	before test		after test		variation
	discharge current	residual voltage	discharge current	residual voltage	
	kA	kV	kA	kV	%
MI	10,0	101,4	10,0	101,9	0,5

The variation of lightning impulse residual voltage before and after the test was less than 5% (maximum allowed variation according to reference standard is 5%).

- Measured partial discharge level was less than 1 pC (background noise) before and after the test.

All acceptance criteria are satisfied. The test result is positive.

"ВАК - 02" ООД САМОКОВ

ВЕРНО С ОРИГИНАЛА

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Power losess measurement - before preconditioning.

test object: Polymer housed metal-oxide surge arrester
test circuit: A019

date: June 17, 2004

sample no. MI						
oscill.	voltage	current	current	current	power	3rd harmonic amplitude
no.	kV	+ mA_{cr}	- mA_{cr}	mA_{rms}	W	μA
1	24,11	0,306	0,49	0,235	0,497	---

MOD A1168IG

ВЯРНО С ОРИГИНАЛА

"ВАК - 02" ООД САМОКОВ

233

Measurement of partial discharges - before preconditioning

test object: Polymer-housed metal-oxide surge arrester
test circuit: A012
measurement circuit: A022 ("direct" calibration : 50 pC)
arrangement: ---

atmospheric conditions		
b	t	h
kPa	°C	g / m³
--	25	--

date: June 17, 2004

test condition	applied voltage	duration of voltage application	temperature of the test object	partial discharge measurement				oscillogram	note
				voltage increase		voltage decrease			
				CRO readout	Q max	CRO readout	Q max		
	kV_{rms}	sec.	°C	mV	pC	mV	pC	no.	
MI (36 kV)	36,0	10	25	--	--				
	30,5	measure	25			--	≤ 1	--	

Note: background noise ≤ 1 pC

Moisture ingress test.

lightning impulse residual voltage measurement - before preconditioning

test object: Polymer housed metal-oxide surge arrester
test circuit: A014

date: June 17, 2004

sample	requested current	charging voltage	oscillogram	current waveshape	discharge current	residual voltage
no.		kV	no.	µs	kA	kV
M1	I_N	63,0 x 2	2	8,2/19,6	10,0	101,4

	oscilloscope settings		
	sampling division	input	attenuation
	µs	V_{pv}	
current	5	0,5	50:5
voltage	5	1,0	50:5

Preconditoning test:

- **Terminal torque pre - conditioning**

test date: June 21, 2004

- The terminal torque at the value, specified by the manufacturer(30 N*m), has been applied for 30 second.

- **Thermomechanical preconditioning**

test date: June 21÷June 25, 2004

sample	applied load	lower temperature	upper temperature	duration of temperature application	cycles n.	load direction
no.	N	°C	°C	h		degree
MI	300	--	60	24	1	0
MI	300	- 25	--	24	1	180
MI	300	--	+ 45	24	2	270
MI	300	- 40	--	24	2	90

ВЯРНО С ОРИГИНАЛА

"ВАК - 02" ООД САМОКОВ

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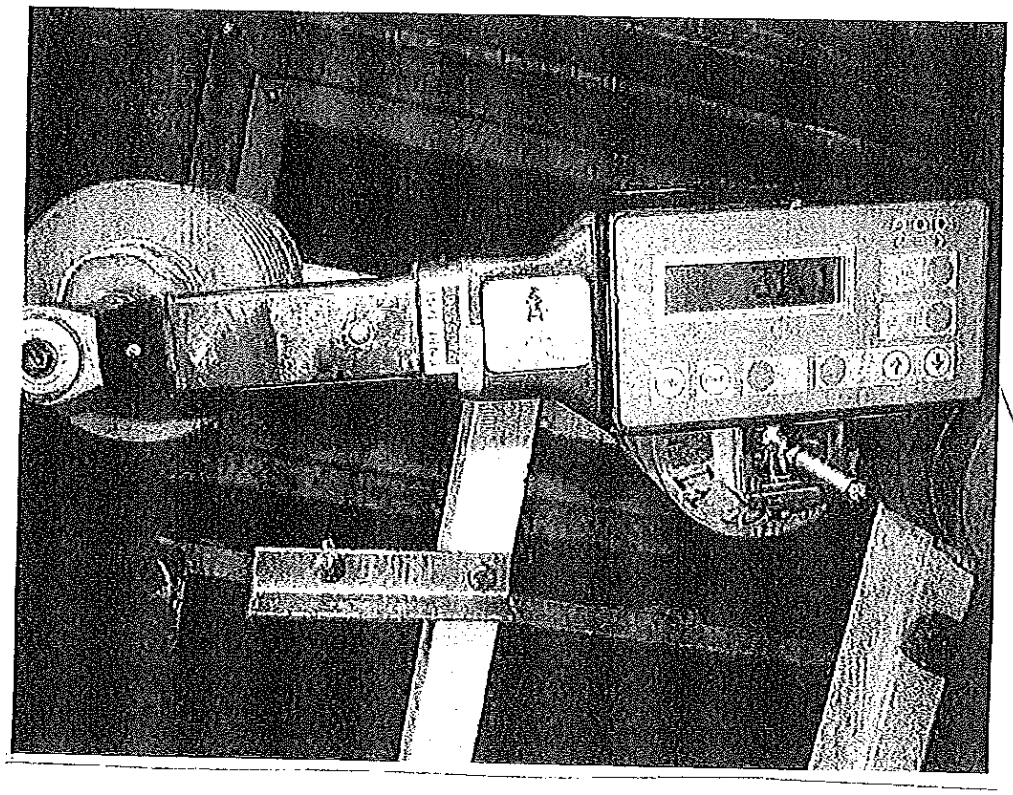
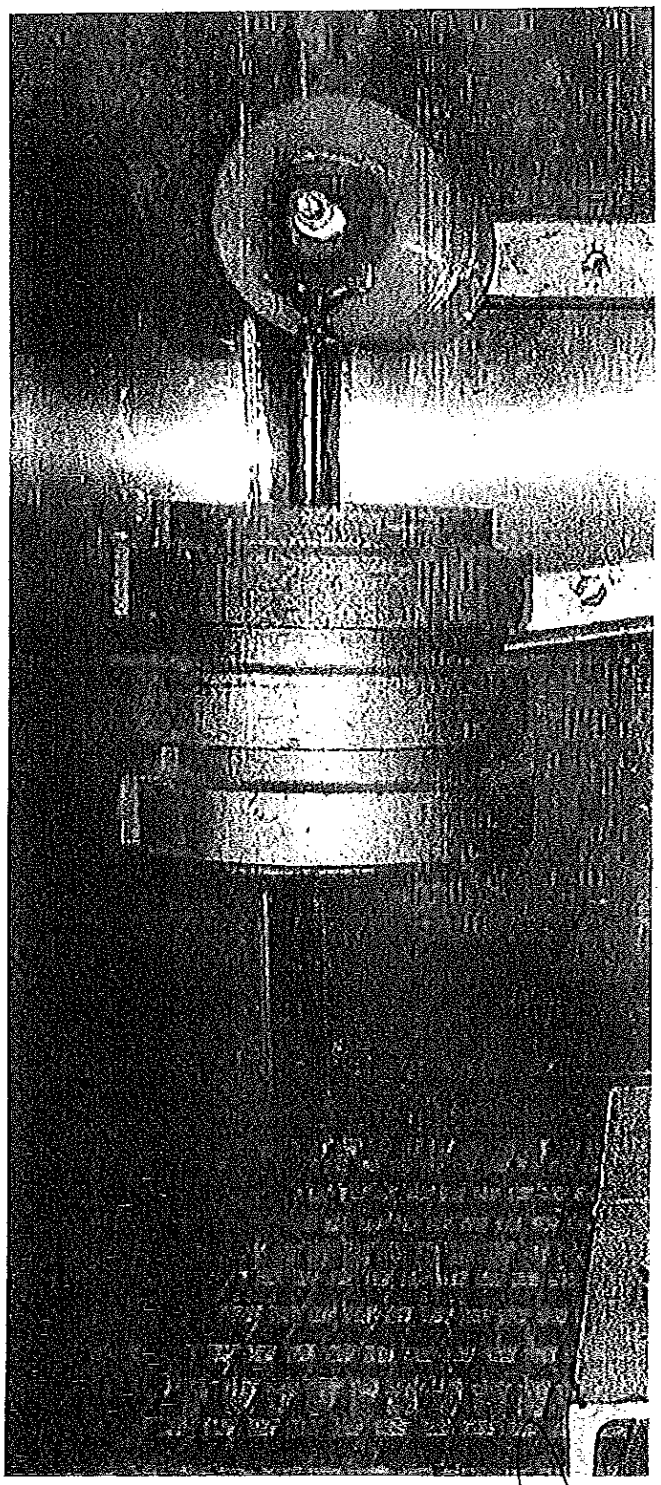
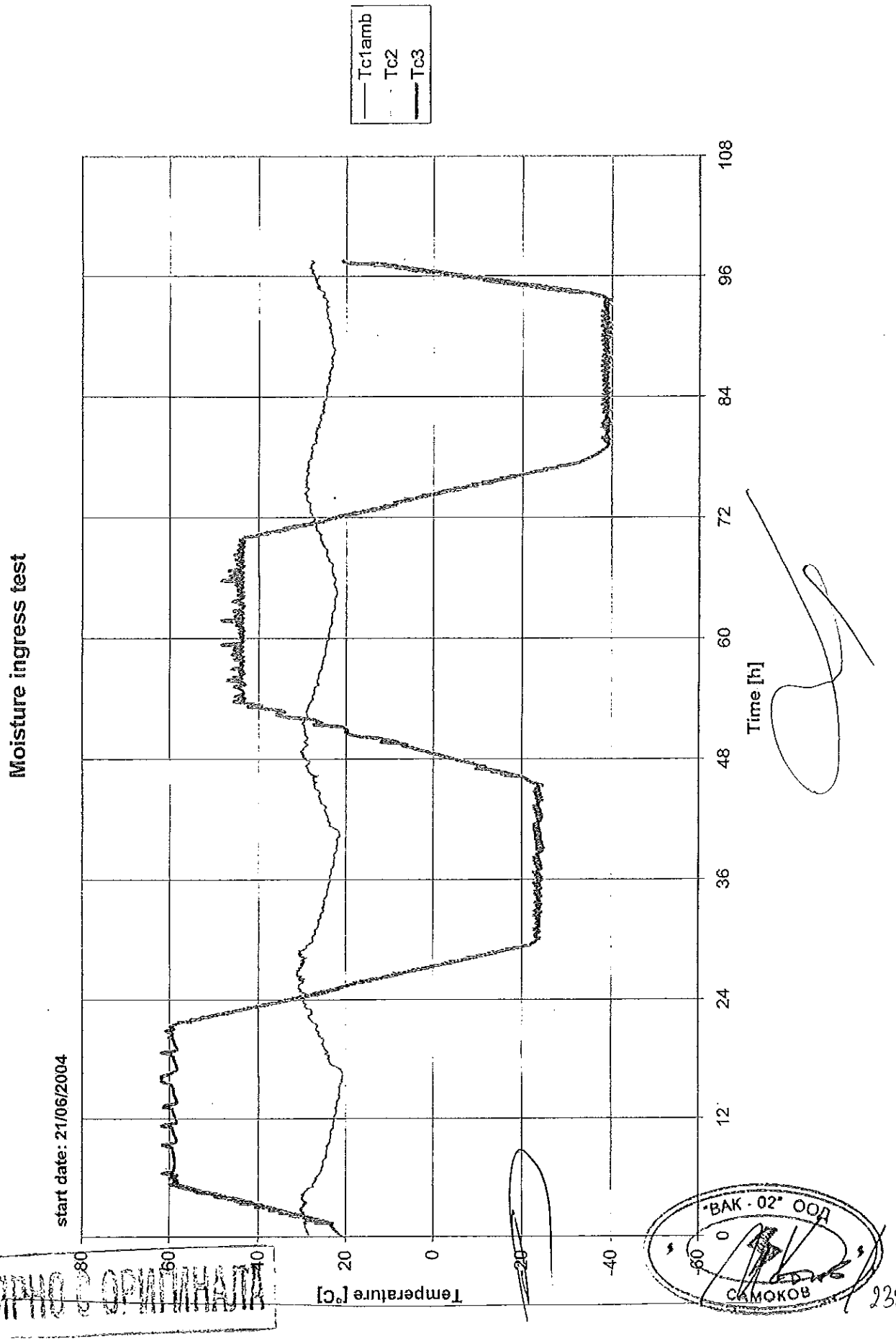
Test setting for terminal torque pre - conditioning



Test setting for thermomechanical pre - conditioning



Temperature cycle about thermomechanical pre - conditioning



water immersion test:

development

Test date: July 13÷16, 2004

The sample has been immersed in a vessel, in boiling deionized water with 1 Kg/m^3 of NaCl for 42 hours. At the end of boiling, the specimens remained in the vassel until the water cools to approximately 50°C and maintained at this temperature in the vassel until verification tests started.

visual examination:

test date: July 16, 2004

The housing of the specimen has been inspected visually.

No visible damage or permanent deformation were noted.

Power losess measurement - after preconditionig.

test object: Polymer housed metal-oxide surge arrester
test circuit: A019

date: July 16, 2004

sample no. M1						
oscill.	voltage	current	current	current	power	3rd harmonic amplitude
no.	kV	+ mA_{cr}	- mA_{cr}	mA_{rms}	W	µA
3	23,9	0,312	0,286	0,213	0,435	--

Measurement of partial discharges - after preconditionig

test object: Polymer housed metal-oxide surge arrester

test circuit: A012

measurement circuit: A022 ("direct" calibration : 50 pC/mV, see oscillogram n.04)

arrangement: —

atmospheric conditions		
b	t	h
kPa	°C	g / m³
–	27	–

date: July 16,2004

test condition	applied voltage	duration of voltage application	temperature of the test object	partial discharge measurement				oscillogram	note
				voltage increase		voltage decrease			
				CRO readout	Q max	CRO readout	Q max		
	kV_{rms}	sec.	°C	mV	pC	mV	pC	no.	
MI (36)	36,0	10	27	–	≤ 1				
	30,5	measure	27			–	≤ 1	06	

Note: background noise ≤ 1 pC, see oscillogram n.05

Moisture ingress test.

lightning impulse residual voltage measurement - after preconditionig

test object: Polymer housed metal-oxide surge arrester
test circuit: AQ14

date: July 16, 2004

sample	requested current	charging voltage	oscillogram	current waveshape	discharge current	residual voltage
no.		kV	no.	μs	kA	kV
MI	I_N	63,0 x 2	07	8,2/19,6	10,0	101,9

	oscilloscope settings		
	sampling division	input	attenuation
	μs	V_{dc}	
current	5	0,5	50:5
voltage	5	1,0	50:5

ВЯРНО С ОРИГИНАЛА

"ВАК - 02" ООД САМОКОВ

MOD.A1146IG

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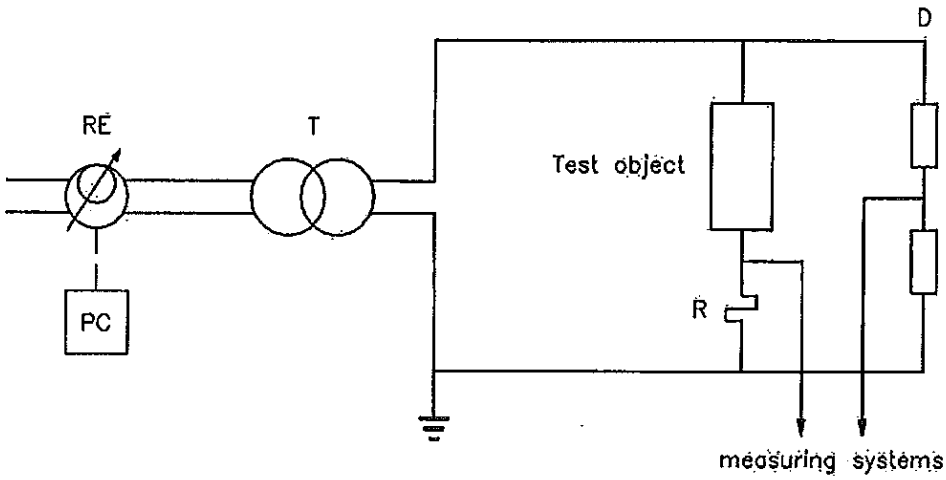
circuit A019



power frequency supply

RE : programmable supply CESI no. 23702-32191 ; type Larcet A.C. Power Source 5000 P.S.
PC : personal computer
T : transformer type Specialtrasfo ; power 30 kVA ; voltage 200 V/15-30 kV

current shunt (R) CESI no. 11537 ; R = 811,94 Ω ;
oscilloscope CESI no.9090
type Tektronix RTD 710A

voltage divider (D) CESI no. 11120 k = 1010
electro optical system CESI no.11519/520 ; attenuation 50:5
oscilloscope CESI no.9090
type Tektronix RTD 710A

ВЯРНО С ОРИГИНАЛА

"ВАК - 02" ООД САМОКОВ

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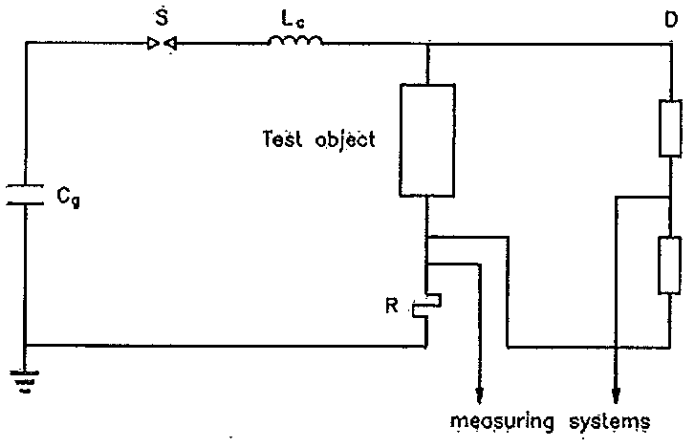
circuit A014



impulse generator

plant P177
no. of stages 1
C_g 4,98 μF
L_c 8 μH
S spark gap

current shunt (R) CESI no. 6042; R = 0,002Ω ; 100 kA
electro optical system CESI no. 11517/518
oscilloscope CESI no. 13217
type Tektronix TDS 540A

voltage divider (D) CESI no. 13027 k= 2029
electro optical system CESI no.11521/522
oscilloscope CESI no.13217
type Tektronix TDS 540A

ВЯРНО С ОРИГИНАЛА

"ВАК - 02" ООД САМОКОВ

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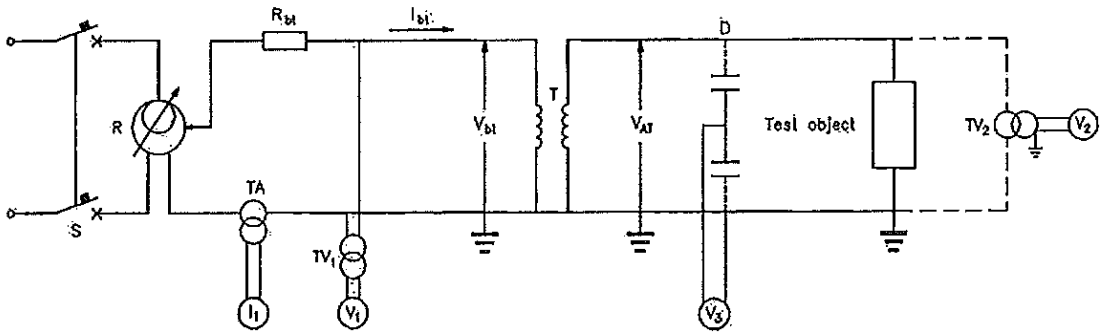
circuit A012



power frequency test circuit

R : regulator type CORMES;power 66 kVA ; voltage 380 V/0 - 0,22 kV
TA : current trasformer CGS; ratio 150-300/5
I_1 : amperometer direct reading INDEX
TV_1: voltage transformer CGS ; ratio 220-440/100
V_1 : voltmeter direct reading TSE
R_{bt} : protection resistor --- Ω
T : booster transformer PIVI ; power 250 kVA ; voltage 200-400 V/250 kV
TV_2: voltage transformer type CGS ; CESI no. 287; ratio 30000/100
V_2 : voltmeter CESI no. 6393

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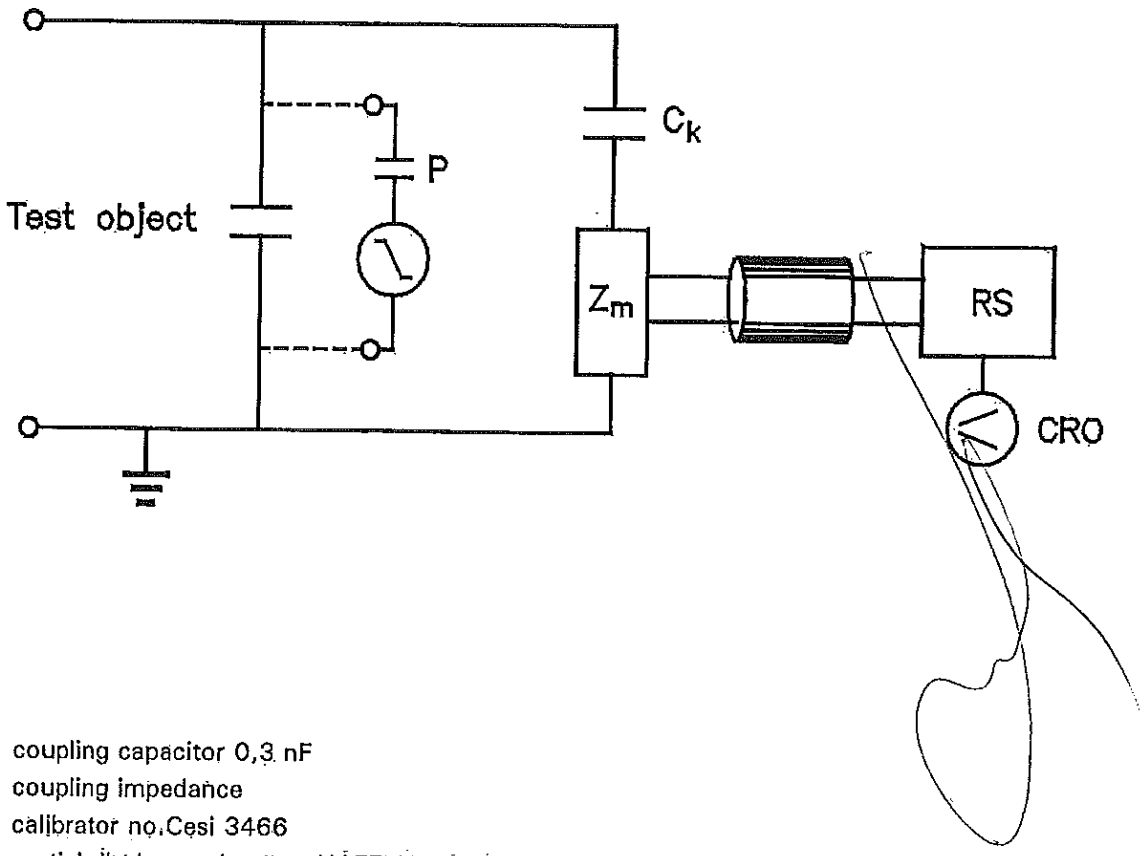
circuit A022

partial discharges measurement

direct circuit
scheme 1a



C_k : coupling capacitor 0,3 nF
Z_m : coupling impedance
P : calibrator no.Cesi 3466
RS : partial discharge detector HAEFELY TRENCH, Type TE 571, no. CESI 13281
CRO: oscilloscope (not used)

ВЯРНО С ОРИГИНАЛА

"ВАК - 02" ООД
САМОКОВ