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ТЕХНИЧЕСКО ПРЕДЛОЖЕНИЕ

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. № PPD 17-158

ДО: „ЧЕЗ РАЗПРЕДЕЛЕНИЕ БЪЛГАРИЯ" АД,

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Представлявано от Александър Викторов Приходков – пълномощник на Изпълнителния директор с нотариално заверено пълномощно № 5487/06.12.2017 на нотариус № 473 – Мина Стоилова
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УВАЖАЕМИ ГОСПОЖИ И ГОСПОДА,

Предоставям на Вашето внимание предложението ни за изпълнение на обществена поръчка с реф. PPD 17-158 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.

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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 (словом: двадесет и четири) 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.
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.*

ЦИОНЕРНО ДРУЖЕСТВО ФИЛКАБ 16 ПЛОВДИВ

Дата: 30.03.2018 г. Декларатор:

На основание чл. 2 от ЗЗЛД

- Пълномощник на
р с нотариално
5487/06.12.2017 на
рилова

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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	OCP2-12S-NFF; TYCO Electronics Raychem; Индия
2.	Техническо описание, гарантирани параметри, волт-секундна характеристика, използвани материали и принадлежности (аксесоари)	Приложение 2.1.
3.	Чертежи с размери и надлъжен разрез	Приложение 2.4.

№ 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	**Приложение 2.6.**
5.	Сертификат/акредитация на независимата изпитвателна лаборатория, провела типовите изпитвания по т. 4 – заверено копие	**Приложение 2.8.**
6.	Изисквания за транспортиране и манипулиране	**Приложение 2.9.**
7.	Инструкции за монтиране и за експлоатация и обслужване	**Приложение 2.10.**
8.	Експлоатационна дълготрайност, год.	>35 години

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

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	106 kV
4.2	Обявено издържано 1 min напрежение с промишлена честота 50 Hz при мокра изолация	min 28 kV	47 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
4.6	Материал, от който са изработени принадлежностите (аксесоарите)	Неръждаема стомана	да
4.7	Якост на опън	min 1 kN	2 kN
4.8	Якост на усукване	min 50 Nm	50 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	да
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 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	40 kA
6.7	Остатъчно напрежение при номинален разряден ток I_n, U_{res}	max 42 kV	38,9 kV
6.8	Устойчивост на продължителен токов импулс	min 250 A/2000 μs	530 A/2 ms
6.9	Стойност на временните пренапрежения съгласно приложение D на БДС EN 60099-4:	-	-
6.9a	с продължителност 3 s	min 14 kV	16,6 kV
6.9b	с продължителност 100 s	min 13 kV	15,4 kV
6.9c	с продължителност 7200 s	min 11,8 kV	14,95

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6.10	Изолационно разстояние по повърхността	min 370 mm	384 mm
6.11	Височина без аксесоарите за присъединяване	max 350 mm	183 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".

Изисквания към документацията и изпитванията:

№ по ред	Наименование	Приложение № (или текст)
1.	Точно обозначение на типа, производителя и страна на произход	DA1-27D-F0F0N0; TYCO Electronics Raychem; Индия
2.	Техническо описание, гарантирани параметри, волт-секундна характеристика, използвани материали и принадлежности (аксесоари)	**Приложение 2.2.**

№ по ред	Наименование	Приложение № (или текст)
3.	Чертежи с размери и надлъжен разрез	**Приложение 2.5.**
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	**Приложение 2.7.**
5.	Сертификат/акредитация на независимата изпитвателна лаборатория, провела типовите изпитвания по т. 4 – заверено копие	**Приложение 2.8.**
6.	Изисквания за транспортиране и манипулиране	**Приложение 2.9.**
7.	Инструкции за монтиране и за експлоатация и обслужване	**Приложение 2.10.**
8.	Експлоатационна дълготрайност, год.	>35 години

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

№ по ред	Параметър	Стойност
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	196 kV

4.2	Обявено издържано 1 min напрежение с промишлена честота 50 Hz при мокра изолация	min 50 kV	85 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
4.6	Материал, от който са изработени принадлежностите (аксесоарите)	Неръждаема стомана	да
4.7	Якост на опън	min 1 kN	2 kN
4.8	Якост на усукване	min 50 Nm	50 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	да
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	21,6 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	21 kA / 0,2 s
6.7	Остатъчно напрежение при номинален разряден ток I_n, U_{res}	max 80 kV	71,6 kV
6.8	Устойчивост на продължителен токов импулс	min 250 A/2000 µs	325 A / 2 ms
6.9	Стойност на временните пренапрежения съгласно приложение D на БДС EN 60099-4:	-	-
6.9a	с продължителност 3 s	min 28 kV	30,65 kV

6.9b	с продължителност 100 s	min 25 kV	26,46 kC
6.9c	с продължителност 7200 s	min 23,7 kV	23,8 kV
6.10	Изолационно разстояние по повърхността	min 540 mm	627 mm
6.11	Височина без аксесоарите за присъединяване	max 350 mm	247 mm
6.12	Тегло, kg	Да се посочи	2,0 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 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	OCP2-22S-NFF; TYCO Electronics Raychem; Индия

№ по ред	Наименование	Приложение № (или текст)
2.	Техническо описание, гарантирани параметри, волт-секундна характеристика, използвани материали и принадлежности (аксесоари)	**Приложение 2.3.**
3.	Чертежи с размери и надлъжен разрез	**Приложение 2.4.**
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	**Приложение 2.6.**
5.	Сертификат/акредитация на независимата изпитвателна лаборатория, провела типовите изпитвания по т. 4 – заверено копие	**Приложение 2.8.**
6.	Изисквания за транспортиране и манипулиране	**Приложение 2.9.**
7.	Инструкции за монтиране и за експлоатация и обслужване	**Приложение 2.10.**
8.	Експлоатационна дълготрайност, год.	>35 години

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

№ по ред	Параметър	Стойност
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	180 kV
4.2	Обявено издържано 1 min напрежение с промишлена честота 50 Hz при мокра изолация	min 50 kV	80 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
4.6	Материал, от който са изработени принадлежностите (аксесоарите)	Неръждаема стомана	да
4.7	Якост на опън	min 1 kN	2 kN
4.8	Якост на усукване	min 50 Nm	50 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	да
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	27,5 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	40 kA/0,2 s
6.7	Остатъчно напрежение при номинален разряден ток I_n, U_{res}	max 75 kV	71,3 kV
6.8	Устойчивост на продължителен токов импулс	min 250 A/2000 μs	530 A/2 ms

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www.filkab.com

№ по ред	Параметър	Изискване	Гарантирано предложение
6.9	Стойност на временните пренапрежения съгласно приложение D на БДС EN 60099-4:	-	-
6.9a	с продължителност 3 s	min 28 kV	29,88 kV
6.9b	с продължителност 100 s	min 26 kV	28,2 kV
6.9c	с продължителност 7200 s	min 23,7 kV	23,71 kV
6.10	Изолационно разстояние по повърхността	min 540 mm	758 mm
6.11	Височина без аксесоарите за присъединяване	max 425 mm	299 mm
6.12	Тегло, kg	Да се посочи	3,0 kg

На основание чл. 2 от ЗЗЛД

Дата: 30.03.2018 г.

Декларатор:

ЗЕМНО ДРУЖЕСТВО * ФИЛКАБ 16 ПЛОВДИВ *

Пълномощник на
с нотариално
5487/06.12.2017 на
илова

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Приложение 2 към Техническо предложение

ИЗИСКВАНИ ДОКУМЕНТИ ОТ ТЕХНИЧЕСКИ ИЗИСКВАНИЯ И СПЕЦИФИКАЦИИ

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Приложение 2 към Техническо предложение

ИЗИСКВАНИ ДОКУМЕНТИ ОТ ТЕХНИЧЕСКИ ИЗИСКВАНИЯ И СПЕЦИФИКАЦИИ

Приложение 2.1.

Bowthorpe

OCP Series

Distribution Surge Arrester

Metal oxide arrester
Polymeric Housing
IEC 60099-4, Ed 2.0
Nominal discharge current: 10kA
Line discharge class: 2
High current impulse 4/10 µs: 100kA
Energy absorption capability at
– Line discharge imp.: 6kJ/kV Uc
Long Duration Ipeak 530A

Continuous operating voltage
Uc: 12kV
Rated voltage
Ur: 15kV

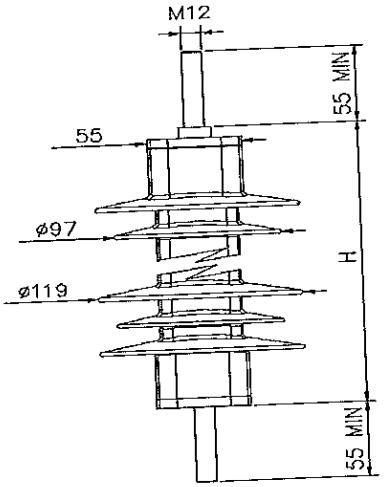
Outdoor application
Rated short circuit current: 40 kA
Low Current 600 A
Non-shattering design

OCP2-12□-□□□

Standard Creep S
Long Creepage L

Mounting
Ground Lead
Line Lead

Dimensions



Arrester Housing

		S	L
Impulse voltage	1,2/50 µs kV	106	128
Power frequency voltage	-wet: kV	47	57
Overall length, (H)	mm	183	220
Flashover distance	mm	178	214
Creepage Length	mm	384	505
Weight	kg	1.8	1.8
No of Sheds:		5	7
Cantilever strength*	Nm	350	350
Pull strength*	N	2000	2000
Max. Torque M12*	Nm	50	50

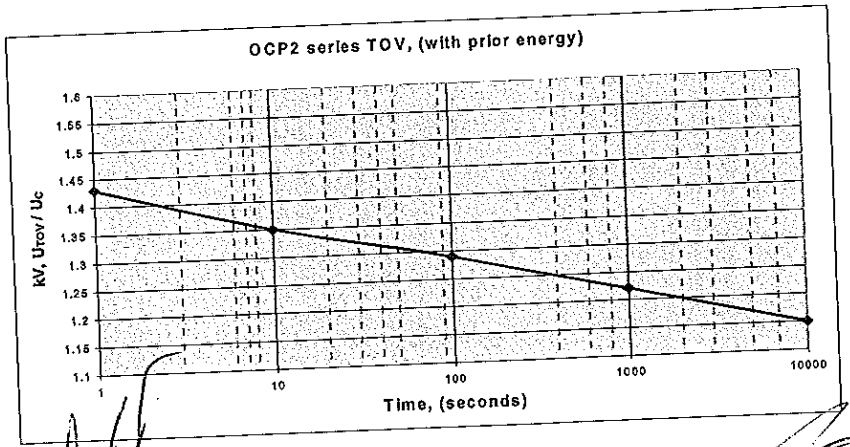
100% Routine testing
- Residual Voltage
- Reference Voltage
- Partial Discharge

Residual Voltages (kV)

Lightning current impulse 8/20 µs			Steep lightning current impulse		Switching current impulse 30/60 µs	
5 kA	10 kA	20 kA	10 kA	1/20 µs	125 A	500 A
36.7	38.9	43.4	40.4		29.5	31.1

Power frequency voltage versus time

1 Sec. TOV: 17.2 kV
100 Sec. TOV: 15.4 kV



Marking

Bowthorpe
MO Surge Arrester
50/60 Hz
IEC 60099-4
Isc 40 kA
In 10 kA Class 2
OCP2-12
Uc: 12 kV
Ur: 15 kV
Manufacturing Year

MVSA-118-000-39/04-1

For Technical Sales and Information please e-mail: surgearresters@tycoelectronics.com or telephone: +49 89 6089378 or +353 61 470846

Print Date:
03/02/2005 17:15:12

OCP series naming and order query description:

Example: OCP = "Open Cage Polymeric"

OCP0 – 12S – ABC

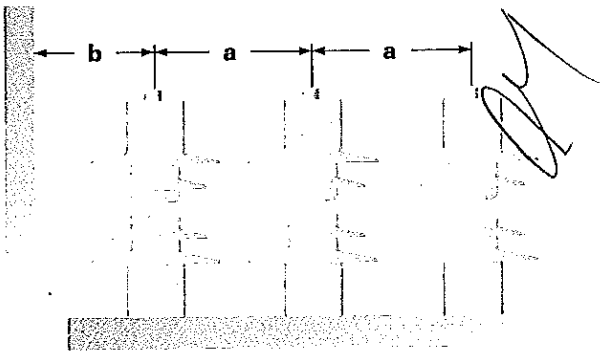
Line discharge class:
0 = 5kA
1 = 10kA class 1
2 = 10kA class 2

Uc

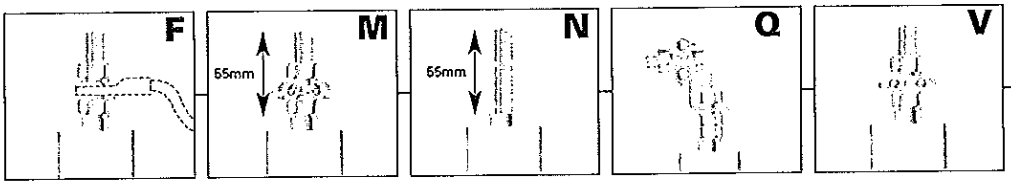
Housing creepage:
S = standard creepage
L = extended creepage

Accessory selection
M = Mounting bracket
E = Earth connection
L = Line connection

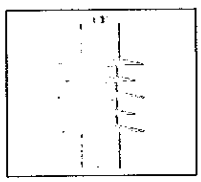
System Voltage Um	ph/ph (a)	ph/ground (b)
12	185	165
24	315	295
36	445	425



Line lead accessories



Arrester Type = Continuous Operating Voltage U_c in kV



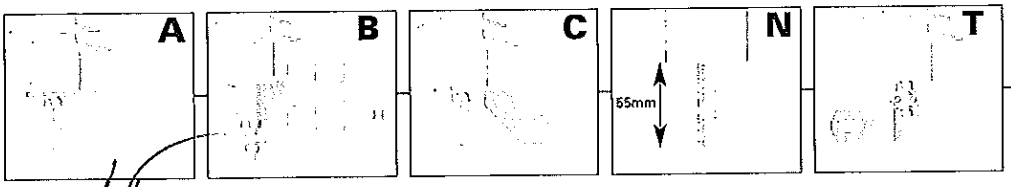
OCP□-

03 04 05 06
08 09 10 12
15 18 20 21
22 24

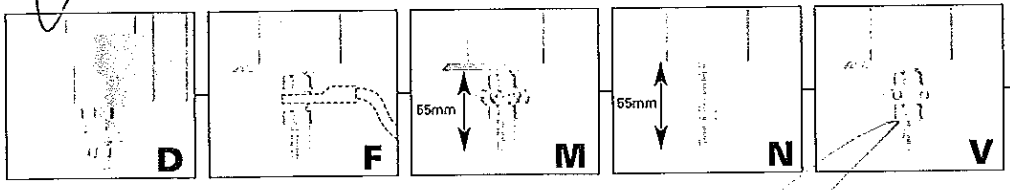
OCP□– 12□– □□□

All accessories use M12 stainless steel studs

Mounting accessories



Ground lead accessories



Additional accessory options available on request. Please contact: surgearresters@tycoelectronics.com with your specific requirement.

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Приложение 2 към Техническо предложение

ИЗИСКВАНИ ДОКУМЕНТИ ОТ ТЕХНИЧЕСКИ ИЗИСКВАНИЯ И СПЕЦИФИКАЦИИ

Приложение 2.2.

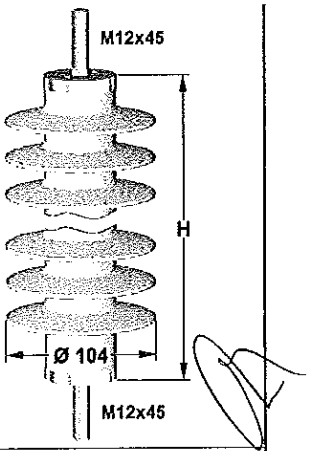
Bowthorpe EMP Distribution Surge Arrester — *DA Series (IEC)*

Zinc Oxide Arrester (Standard IEC 60099-4, Ed 2.1)

DA Voltage range	**4 – 45**	**kV**
Rated Voltage	**27**	**kV**
Continuous Operating Voltage	**21.6**	**kV**

D A[1] 1[2] -27[3] D[4] -L L[5] E E[6] M M[7]

[1] Distribution Arrester
[2] Class
[3] Rated Voltage - U_R
[4] Housing creepage code
[5] Line lead accessory
[6] Earth lead accessory
[7] Mounting accessory



Main Features		Arrester Housing - D **	Unit	
Housing	Silicone	Impulse voltage 1.2/50 µs	kV	196
Nominal discharge current - I_n	10 kA (8/20 µs)	Power frequency voltage - wet	kV	85
Line discharge class:	1	Overall length (H)	mm	247
High current impulse	100 kA (4/10 µs)	Flashover distance	mm	252
Energy Absorption Capability:		Creepage Length	mm	627
(IEC 60099-4, clause 8.5)	5.6 kJ/kV	Weight	kg	2.0
Long duration current Imp.	325 A (2000 µs)	No of Sheds		8
Short circuit rating (pre-failing method):		Cantilever strength *	Nm	350
Rated short-circuit I_{sc}	21 kA (0.2 s)	Pull strength	N	2000
Low short-circuit current	600 A (1.0 s)	Max. Torque M12 *	Nm	50

- Safe non-shattering design
- Suitable for installation in polluted environments
- Silicone directly moulded onto the core

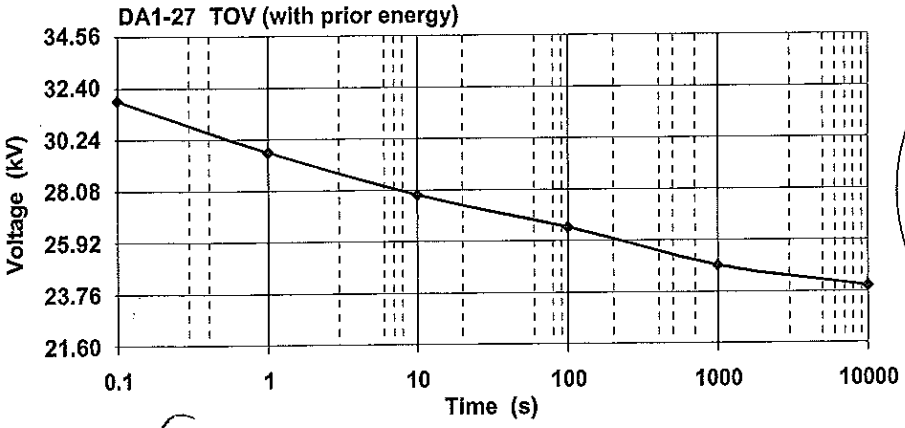
* Ref: Thermo-mechanical & bending moment test 60099-4
** Other housing sizes available – Please contact Product Management
100% Routine testing: Residual Voltage, Reference Voltage, PD.

Residual Voltages (kV)

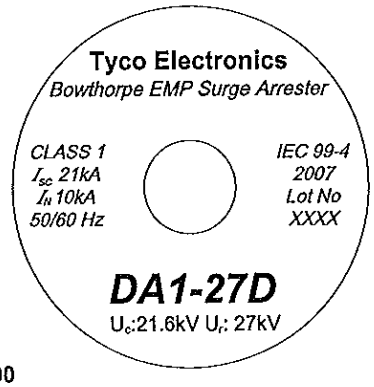
Lightning current impulse 8/20 µs:			Steep lightning current impulse 1/20 µs:	Switching current impulse 30/60 µs:	
5 kA	10 kA	20 kA	10 kA	125 A	500 A
67.2	71.6	78.4	75.2	53.8	56.9

Power frequency voltage versus time

1 s. TOV: 29.70 kV
100 s. TOV: 26.46 kV



Marking



MVSA-724-22/13-0

For Technical and Sales Information please e-mail: surgearresters@tycoelectronics.com or visit http://energy.tycoelectronics.com

ВЯРНО С ОРИГИНАЛА

АКЦИОНЕРНО ДРУЖЕСТВО ФИЛКАБ 16 ПЛОВДИВ

Energy Division

Tyco Electronics
Our commitment. Your advantage.

DAx series arrester ordering information and accessory selection table:

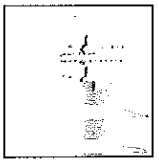
Z	Z	Z	-	Y	Y	M	-	1	2	3	4	5	6	-	P

Naming convention cross reference:
ZZZ = series type: DA0 for 5kA arrester; DA1 for 10kA, class1 arrester.
YY = Ur
M = Housing code

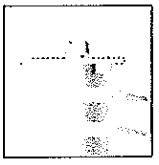
1 Line lead accessories

Bxxxxx
Birdcap with F accessory

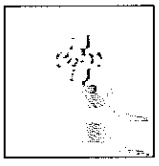
Exxxxx
Birdcap with M accessory



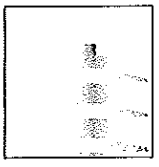
Fxxxxx
Std Washers for Lug-45mm Stud



Hxxxxx
Cap screw & Spring Washer

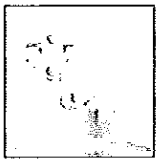


Mxxxxx
Star Washers for 45mm Stud



Oxxxxx
No Stud. No Accessories

Pxxxxx
S-Clamp



Qxxxxx
L-Clamp

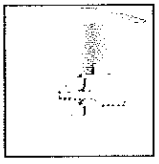
2 Line lead options

x0xxxx	No Line Lead Wire
x1xxxx	0.5m 16sq Copper Line Lead & 1-off M12 lug
x2xxxx	1m 16sq Copper Line Lead & 1-off M12 lug
x3xxxx	1m 16sq Copper Line Lead & no lug
x4xxxx	0.5m 35sq Copper Line Lead & 1-off M12 lug
x5xxxx	1m 35sq Copper Line Lead & 1-off M12 lug
x6xxxx	1m 35sq Copper Line Lead & no lug

3 Ground lead accessories:

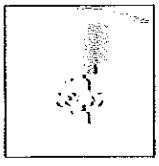
xxDxxx
Disconnect + M accessory

xxExxx
Disconnect + F accessory



xxFxxx
Std Washers for Lug-45mm Stud

xxHxxx
M12*25 Cap screw & Spring Washer



xxMxxx
Star Washers for 45mm Stud

xxOxxx
No Stud. No Accessories

4 Ground lead options

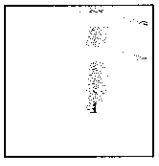
xxx0xx	No Line Lead Wire
xxx1xx	0.5m 16sq Copper Line Lead & 1-off M12 lug
xxx2xx	1m 16sq Copper Line Lead & 1-off M12 lug
xxx3xx	1m 16sq Copper Line Lead & no lug
xxx4xx	0.5m 35sq Copper Line Lead & 1-off M12 lug
xxx5xx	1m 35sq Copper Line Lead & 1-off M12 lug
xxx6xx	1m 35sq Copper Line Lead & no lug

5 Mounting brackets:

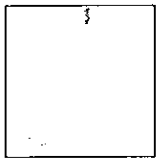
xxxxAx
Straight 2 hole Mounting Bracket

xxxxBx
Insulating bracket

xxxxEx
DIN metal bracket, (galvanised)

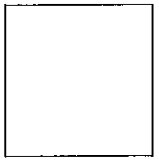


xxxxNx
No Mounting Accessories

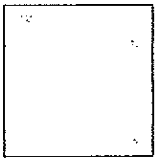


xxxxPx
Pedestal Mounting Base (Siemens equivalent)

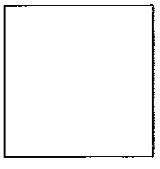
6 Mounting bracket options:



xxxxx0
No Option



xxxxx1
Metric Nema Cross Arm Bracket



xxxxx6
T - mounting bracket

Packaging

I	Individual Packing (as standard)
S	Standard 3 Pack, (with accessories loose in boxes)
B	Bulk Packing

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Приложение 2 към Техническо предложение

ИЗИСКВАНИ ДОКУМЕНТИ ОТ ТЕХНИЧЕСКИ ИЗИСКВАНИЯ И СПЕЦИФИКАЦИИ

Приложение 2.3.

Bowthorpe OCP Series

Distribution Surge Arrester

Metal oxide arrester
Polymeric Housing
IEC 60099-4, Ed 2.0
Nominal discharge current: 10kA
Line discharge class: 2
High current impulse 4/10 µs: 100kA
Energy absorption capability at
– Line discharge imp.: 6kJ/kV Uc
Long Duration Ipeak 530A

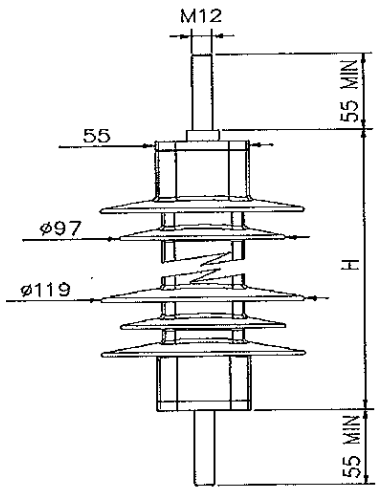
Continuous operating voltage
Uc: 22kV
Rated voltage
Ur: 27.5kV

Outdoor application
Rated short circuit current: 40 kA
Low Current 600 A
Non-shattering design

OCP2-22□-□□□

Standard Creep S
Long Creepage L
Mounting
Ground Lead
Line Lead

Dimensions



Arrester Housing

		S	L
Impulse voltage	1,2/50 µs kV	180	205
Power frequency voltage	-wet: kV	80	91
Overall length, (H)	mm	299	340
Flashover distance	mm	293	334
Creepage Length	mm	758	885
Weight	kg	3	3.5
No of Sheds:		11	13
Cantilever strength*	Nm	350	350
Pull strength*	N	2000	2000
Max. Torque M12*	Nm	50	50

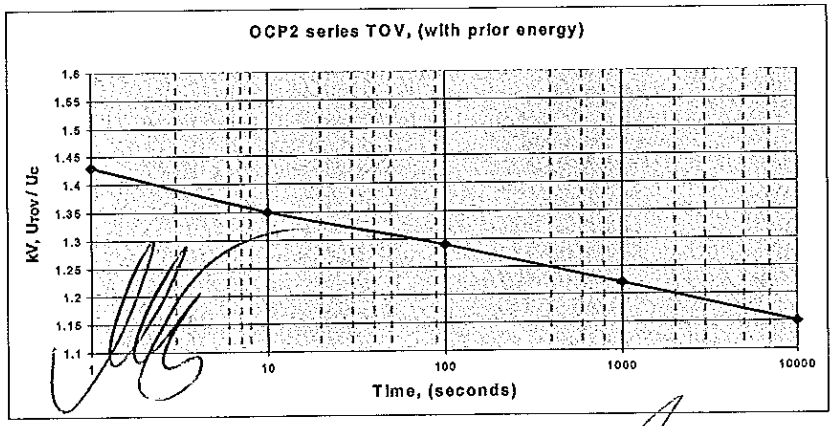
100% Routine testing
- Residual Voltage
- Reference Voltage
- Partial Discharge

Residual Voltages (kV)

Lightning current impulse 8/20 µs			Steep lightning current impulse		Switching current impulse 30/60 µs	
5 kA	10 kA	20 kA	10 kA	1/20 µs	125 A	500 A
67.3	71.3	79.5	74.1		54.1	56.9

Power frequency voltage versus time

1 Sec. TOV: 31.5 kV
100 Sec. TOV: 28.2 kV



Marking

Bowthorpe
MO Surge Arrester
50/60 Hz
IEC 60099-4
Isc 40 kA
In 10 kA Class 2
OCP2-22
Uc: 22 kV
Ur: 28 kV
Manufacturing Year

MVSA-123-000-39/04-1

OCP series naming and order query description:

Example: OCP = "Open Cage Polymeric"

OCP0 – 12S – ABC

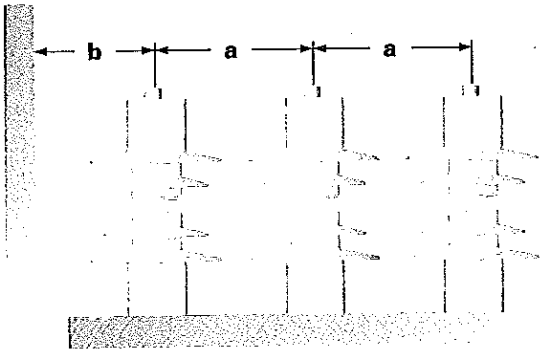
Line discharge class:
0 = 5kA
1 = 10kA class 1
2 = 10kA class 2

Uc

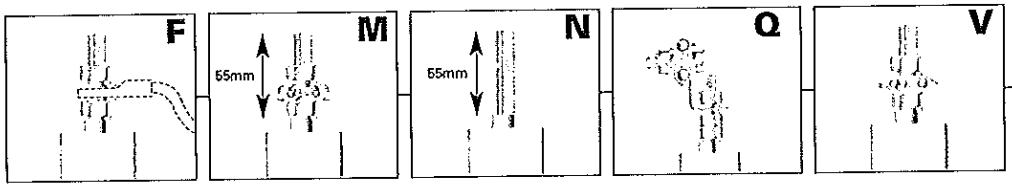
Housing creepage:
S = standard creepage
L = extended creepage

Accessory selection
M = Mounting bracket
E = Earth connection
L = Line connection

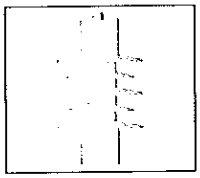
System Voltage Um	ph/ph (a)	ph/ground (b)
12	185	165
24	315	295
36	445	425



Line lead accessories



Arrester Type = Continuous Operating Voltage U_c in kV



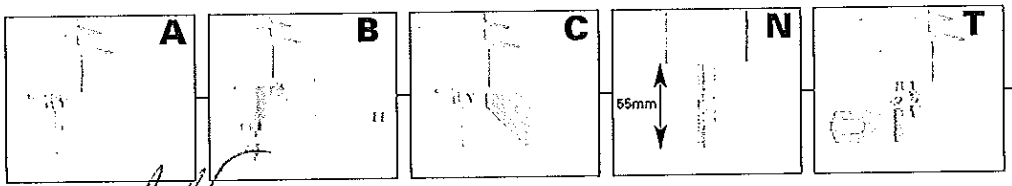
OCP□-

03 04 05 06
08 09 10 12
15 18 20 21
22 24

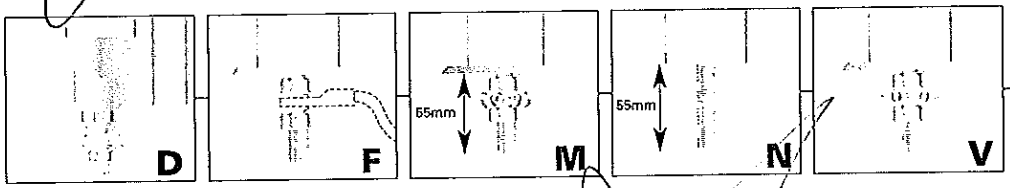
OCP□– 12□– □□□

All accessories use M12 stainless steel studs

Mounting accessories



Ground lead accessories



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Приложение 2 към Техническо предложение

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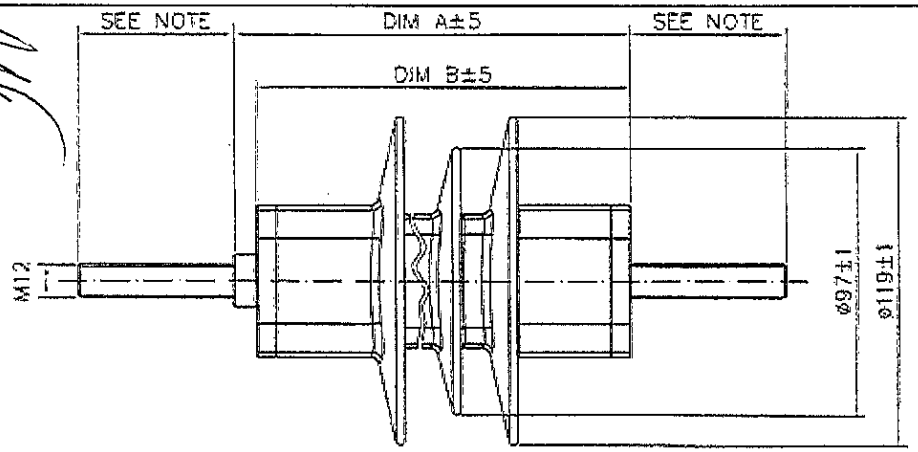
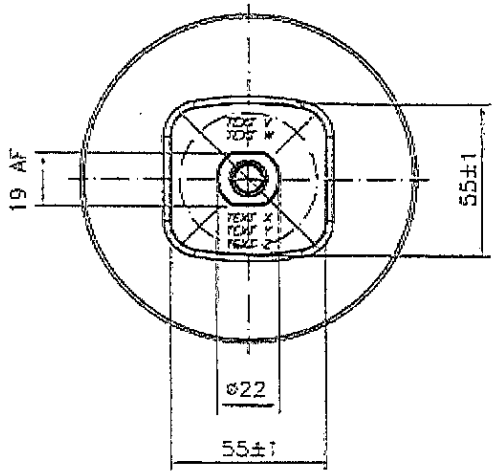
Приложение 2.4.



SCD



PRODUCT	SHEDS	DIM A	DIM B	TEXT V	TEXT W	TEXT X	TEXT Y	TEXT Z
OCP2-03S	5	183	175	OCP2-03S	In 10kA,Class 2	Uc 3kV	Ur 3.75kV	Isc 40kA
OCP2-03L	7	220	212	OCP2-03L	In 10kA,Class 2	Uc 3kV	Ur 3.75kV	Isc 40kA
OCP2-04S	5	183	175	OCP2-04S	In 10kA,Class 2	Uc 4kV	Ur 5kV	Isc 40kA
OCP2-04L	7	220	212	OCP2-04L	In 10kA,Class 2	Uc 4kV	Ur 5kV	Isc 40kA
OCP2-05S	5	183	175	OCP2-05S	In 10kA,Class 2	Uc 5kV	Ur 6.25kV	Isc 40kA
OCP2-05L	7	220	212	OCP2-05L	In 10kA,Class 2	Uc 5kV	Ur 6.25kV	Isc 40kA
OCP2-06S	5	183	175	OCP2-06S	In 10kA,Class 2	Uc 6kV	Ur 7.5kV	Isc 40kA
OCP2-06L	7	220	212	OCP2-06L	In 10kA,Class 2	Uc 6kV	Ur 7.5kV	Isc 40kA
OCP2-08S	5	183	175	OCP2-08S	In 10kA,Class 2	Uc 8kV	Ur 10kV	Isc 40kA
OCP2-08L	7	220	212	OCP2-08L	In 10kA,Class 2	Uc 8kV	Ur 10kV	Isc 40kA
OCP2-09S	5	183	175	OCP2-03S	In 10kA,Class 2	Uc 9kV	Ur 11.25kV	Isc 40kA
OCP2-09L	7	220	212	OCP2-09L	In 10kA,Class 2	Uc 9kV	Ur 11.25kV	Isc 40kA
OCP2-10S	5	183	175	OCP2-10S	In 10kA,Class 2	Uc 10kV	Ur 12.5kV	Isc 40kA
OCP2-10L	7	260	212	OCP2-10L	In 10kA,Class 2	Uc 10kV	Ur 12.5kV	Isc 40kA
OCP2-12S	5	183	175	OCP2-12S	In 10kA,Class 2	Uc 12kV	Ur 15kV	Isc 40kA
OCP2-12L	7	220	212	OCP2-12L	In 10kA,Class 2	Uc 12kV	Ur 15kV	Isc 40kA
OCP2-15S	7	220	212	OCP2-15S	In 10kA,Class 2	Uc 15kV	Ur 18.75kV	Isc 40kA
OCP2-15L	9	260	252	OCP2-15L	In 10kA,Class 2	Uc 15kV	Ur 18.75kV	Isc 40kA
OCP2-18S	9	260	252	OCP2-18S	In 10kA,Class 2	Uc 18kV	Ur 22.5kV	Isc 40kA
OCP2-18L	11	299	291	OCP2-18L	In 10kA,Class 2	Uc 18kV	Ur 22.5kV	Isc 40kA
OCP2-19S	9	260	252	OCP2-19S	In 10kA,Class 2	Uc 19kV	Ur 23.75kV	Isc 40kA
OCP2-19L	11	299	291	OCP2-19L	In 10kA,Class 2	Uc 19kV	Ur 23.75kV	Isc 40kA
OCP2-20S	9	260	252	OCP2-20S	In 10kA,Class 2	Uc 20kV	Ur 25kV	Isc 40kA
OCP2-20L	11	299	291	OCP2-20L	In 10kA,Class 2	Uc 20kV	Ur 25kV	Isc 40kA
OCP2-21S	11	299	291	OCP2-21S	In 10kA,Class 2	Uc 21kV	Ur 26.25kV	Isc 40kA
OCP2-21L	13	340	332	OCP2-21L	In 10kA,Class 2	Uc 21kV	Ur 26.25kV	Isc 40kA
OCP2-22S	11	299	291	OCP2-22S	In 10kA,Class 2	Uc 22kV	Ur 27.5kV	Isc 40kA
OCP2-22L	13	340	332	OCP2-22L	In 10kA,Class 2	Uc 22kV	Ur 27.5kV	Isc 40kA
OCP2-24S	11	299	291	OCP2-24S	In 10kA,Class 2	Uc 24kV	Ur 30kV	Isc 40kA
OCP2-24L	13	340	332	OCP2-24L	In 10kA,Class 2	Uc 24kV	Ur 30kV	Isc 40kA

NOTE:-
CANT. STRENGTH = 350Nm
TENSION STRENGTH = 2kN
TORQUE = 50Nm
HIGH SHORT CIRCUIT = 40kA
LOW SHORT CIRCUIT = 600A
STD STUD LENGTH 55±2mm. OTHER LENGTHS AVAILABLE DEPENDING ON ACCESSORY SELECTION
SEE DRG No MV-OCP2-0008S-S FOR HOUSING PRINT

No SHEDS	CREEPAGE	DRY ARC DIST
5	380	176
7	505	214
9	632	254
11	758	293
13	885	334

REV	DATE	SIGN	MODIFICATION	APP
D	11/04	JM	ORIGINAL ISSUE	

tyco ELECTRONICS

ENERGY DIVISION

Bowthorpe EMP

BOWTHORPE, EMP
BAY 100-109
CRANMORE WKD. EST.
SHANNON
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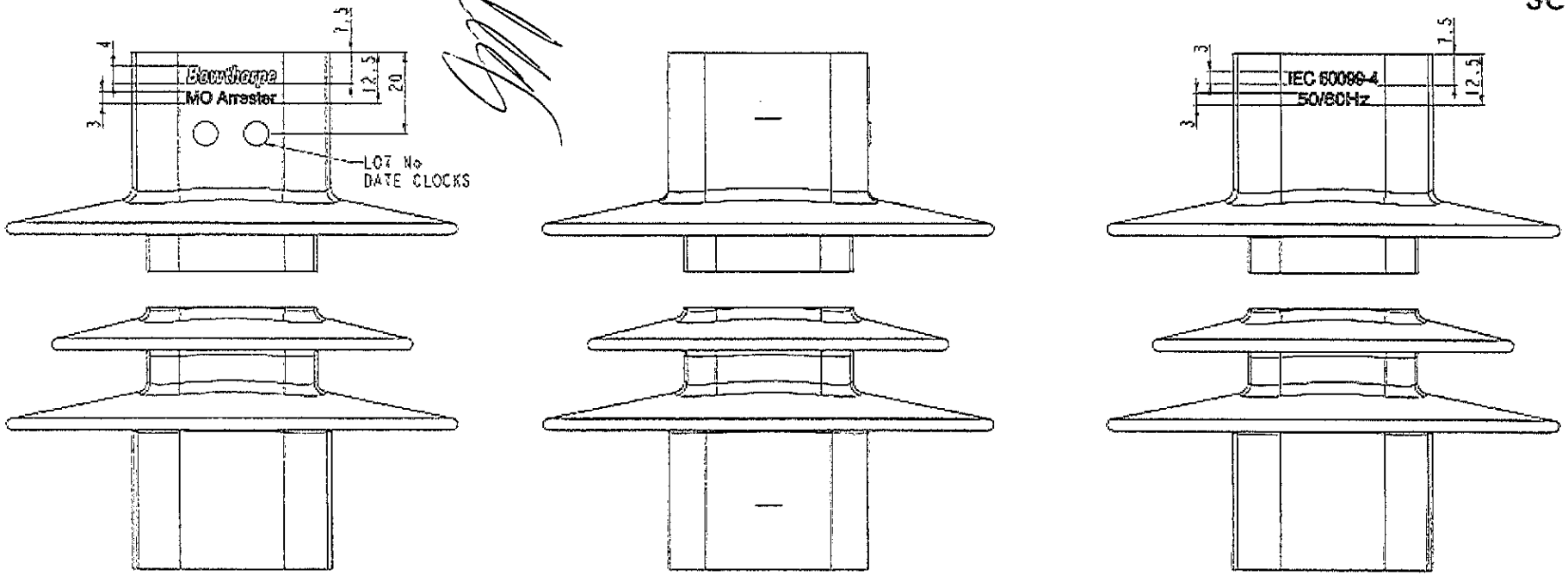
DRW	J McGOUGH	01/11/04		PCN	SEE NOTE
CHECK				MATL	
APP	BN	1/05			
SCALE	N/S				

TITLE
MV SURGE ARRESTER
OCP2 RANGE

DRG NO: MV-OCP2-0003T-S | SHEET 1 OF 1 | REV: D

SCD



NOTES.-
Bowthorpe text font Univers 86 Extra Black Oblique
All remaining text font Arial
All print 0.25mm high

REV	DATE	SIGN	MODIFICATION	APP
0	15/04	JM	ORIGINAL ISSUE	

tyco ELECTRONICS

ENERGY DIVISION

Bowthorpe EMP

BOWTHORPE EMP
BAY 600-634
SHANNON TRD. EST.
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DRN	D MULLIGAN	01/04/04		PCN	-
CHECK	D BOWDEN	1/04		MATL	
APP	B MCGRAW				
SCALE	1:1				

TITLE: HOUSING TEXT
MV SURGE ARRESTER
OCP2 RANGE

DWG NO: MV-OCP2-600034-S | SHEET 1 OF 1 | REV 0

ВЯРНО С ОРИГИНАЛА

ЗАО "АКЦИОНЕРНО ДРУЖЕСТВО "ВИПОЛИВ" ФИЛКАБ 16

ФИЛКАБ АД
ул. Коматевско шосе 92
4004 Пловдив, България
Т +359 32 277 171
Ф +359 32 671 133
office@filkab.com
www.filkab.com

Приложение 2 към Техническо предложение

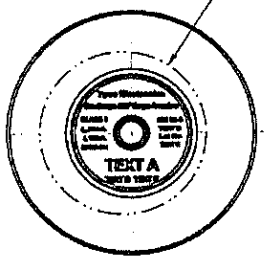
ИЗИСКВАНИ ДОКУМЕНТИ ОТ ТЕХНИЧЕСКИ ИЗИСКВАНИЯ И СПЕЦИФИКАЦИИ

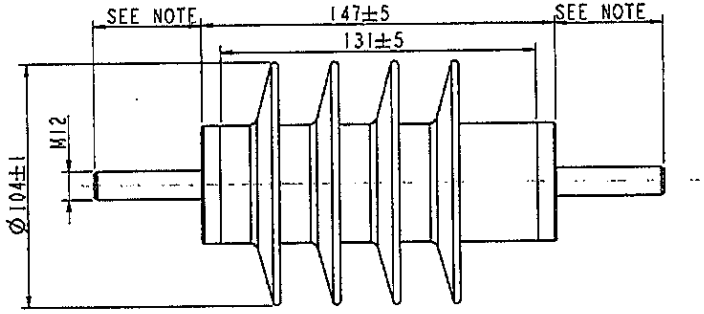
Приложение 2.5.

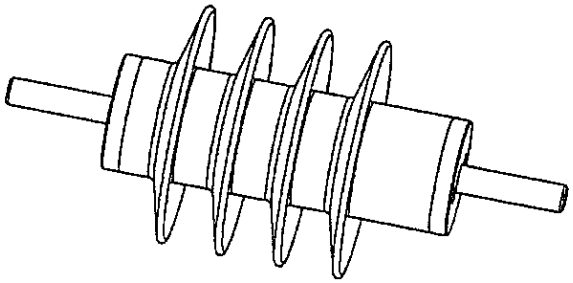
SCD

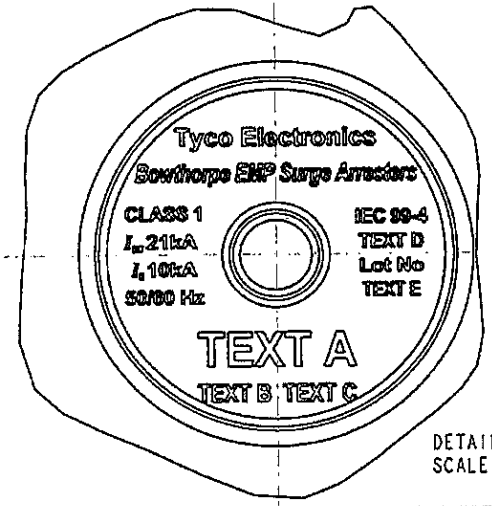
PRODUCT	TEXT A	TEXT B	TEXT C	TEXT D	TEXT E
DAI-04A	DAI-04A	Uc 3.2kV	Ur 4kV	YEAR	XXXX
DAI-06A	DAI-06A	Uc 4.8kV	Ur 6kV	YEAR	XXXX
DAI-08A	DAI-08A	Uc 6.4kV	Ur 8kV	YEAR	XXXX
DAI-10A	DAI-10A	Uc 8kV	Ur 10kV	YEAR	XXXX
DAI-12A	DAI-12A	Uc 9.6kV	Ur 12kV	YEAR	XXXX

SEE DETAIL A









DETAIL A
SCALE 3:2

TENSION STRENGTH = 350Nm
TENSION STRENGTH = 2kN
TORQUE = 50Nm
HIGH SHORT CIRCUIT = 21kA
LOW SHORT CIRCUIT 600A
CREEPAGE = 329
DRY ARC DISTANCE = 152
STD STUD LENGTH 45±2. OTHER LENGTHS AVAILABLE DEPENDING ON ACCESSORY SELECTION
ALL DIMS IN mm
SEE DRAWING No MV-DAI-00436-S FOR LABEL PRINT

REV	DATE	SIGN	MODIFICATION	APP
0	09/07	JM	ORIGINAL ISSUE	

Tyco Electronics
Bowthorpe Surge Arrester

BAY 100-105
SHANNON IND. EST.
SHANNON
CO. CLARE
IRELAND

DRN	J MULLIGAN	17/09/07	
CHECK	PAT FITZG		
APP	D McGOWAN		
PCN	SEE ABOVE		

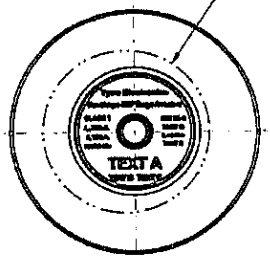
TITLE
IEC MV SURGE ARRESTER
DAI-xxA RANGE

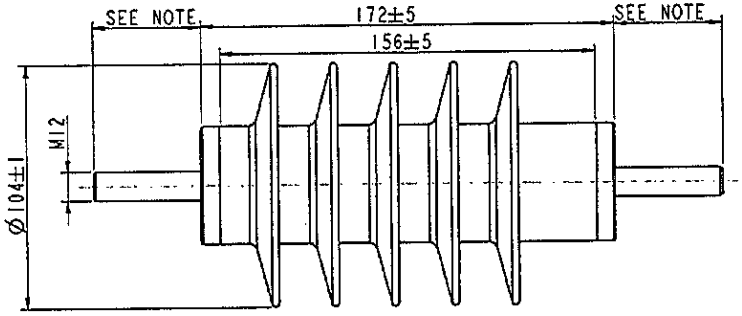
DRG NO MV-DAI-00428-S
SHEET 1 OF 1
0

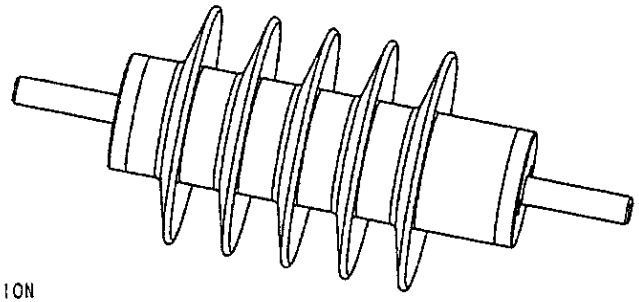
SCD

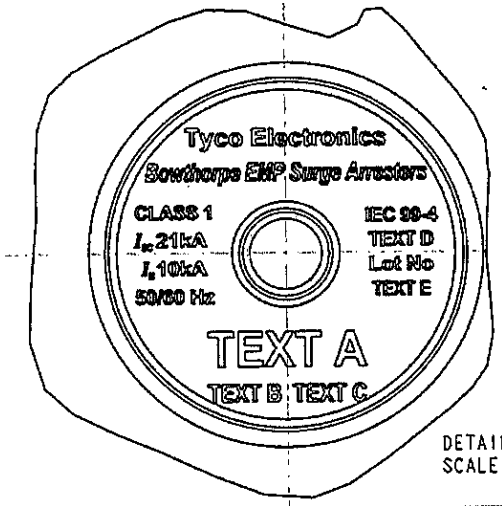
PRODUCT	TEXT A	TEXT B	TEXT C	TEXT D	TEXT E
DAI-04B	DAI-04B	Uc 3.2kV	Ur 4kV	YEAR	XXXX
DAI-06B	DAI-06B	Uc 4.8kV	Ur 6kV	YEAR	XXXX
DAI-08B	DAI-08B	Uc 6.4kV	Ur 8kV	YEAR	XXXX
DAI-10B	DAI-10B	Uc 8kV	Ur 10kV	YEAR	XXXX
DAI-12B	DAI-12B	Uc 9.6kV	Ur 12kV	YEAR	XXXX
DAI-15B	DAI-15B	Uc 12kV	Ur 15kV	YEAR	XXXX

SEE DETAIL A









DETAIL A
SCALE 3:2

CANT. STRENGTH = 350Nm
TENSION STRENGTH = 2kN
TORQUE = 50Nm
HIGH SHORT CIRCUIT = 21kA
LOW SHORT CIRCUIT 600A
CREEPAGE = 404mm
DRY ARC DISTANCE = 177mm
STD STUD LENGTH 45±2. OTHER LENGTHS
AVAILABLE DEPENDING ON ACCESSORY SELECTION
ALL DIMS IN mm
SEE DRAWING No MV-DAI-00436-S FOR LABEL PRINT

REV	DATE	SIGN	MODIFICATION	APP
0	09/07	JM	ORIGINAL ISSUE	

Tyco Electronics
Bowthorpe Surge Arrester

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IRELAND

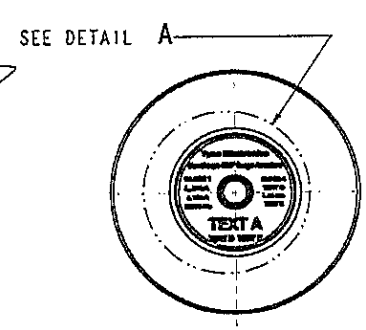
DRN	J MULLIGAN	17/09/07	
CHECK	PAT FITZG		
APP	B McGOVAN		
PCN	SEE ABOVE		

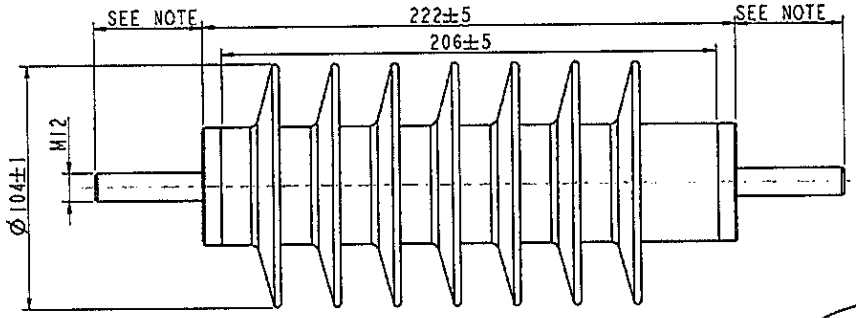
TITLE
IEC MV SURGE ARRESTER
DAI-xxB RANGE

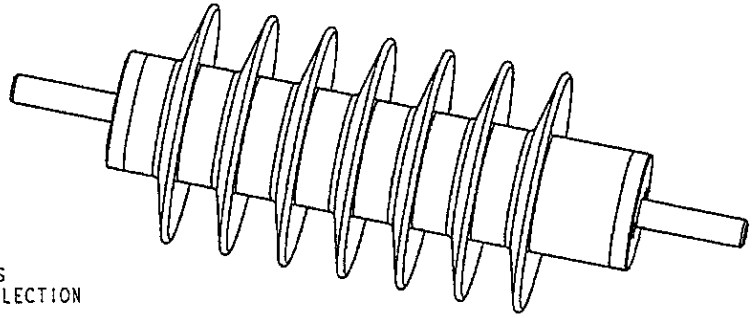
DRG NO MV-DAI-00429-S
SHEET 1 OF 1
REV 0

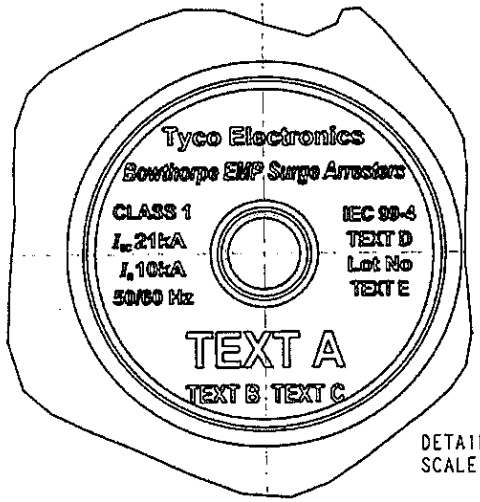
SCD

PRODUCT	TEXT A	TEXT B	TEXT C	TEXT D	TEXT E
DA1-08C	DA1-08C	Uc 6.4kV	Ur 8kV	YEAR	XXXX
DA1-10C	DA1-10C	Uc 8kV	Ur 10kV	YEAR	XXXX
DA1-12C	DA1-12C	Uc 9.6kV	Ur 12kV	YEAR	XXXX
DA1-15C	DA1-15C	Uc 12kV	Ur 15kV	YEAR	XXXX
DA1-18C	DA1-18C	Uc 14.4kV	Ur 18kV	YEAR	XXXX
DA1-21C	DA1-21C	Uc 16.8kV	Ur 21kV	YEAR	XXXX
DA1-22C	DA1-22C	Uc 17.6kV	Ur 22kV	YEAR	XXXX









DETAIL A
SCALE 3:2

CANT. STRENGTH = 350Nm
TENSION STRENGTH = 2kN
TORQUE = 50Nm
HIGH SHORT CIRCUIT = 21kA
LOW SHORT CIRCUIT 600A
CREEPAGE = 553mm
DRY ARC DISTANCE = 227mm
STD STUD LENGTH 45±2. OTHER LENGTHS
AVAILABLE DEPENDING ON ACCESSORY SELECTION
ALL DIMS IN mm
SEE DRAWING No MV-DA1-00436-S FOR LABEL PRINT

REV	DATE	SIGN	MODIFICATION	APP
0	09/07	JM	ORIGINAL ISSUE	

Tyco Electronics
Bowthorpe Surge Arrester

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CHECK	PAT FITZG		
APP	B McGOWAN		
PCN	SEE ABOVE		

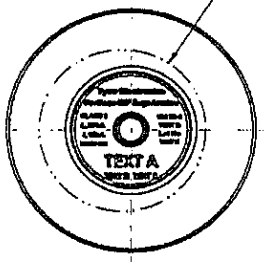
TITLE
IEC MV SURGE ARRESTER
DA1-xxC RANGE

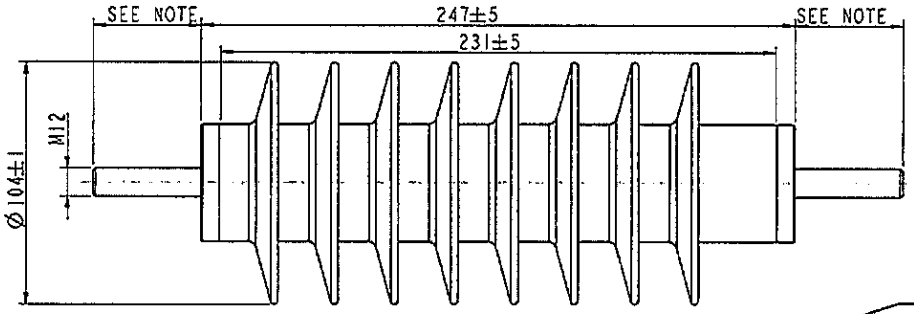
DRG NO MV-DA1-00430-S | SHEET 1 OF 1 | REV 0

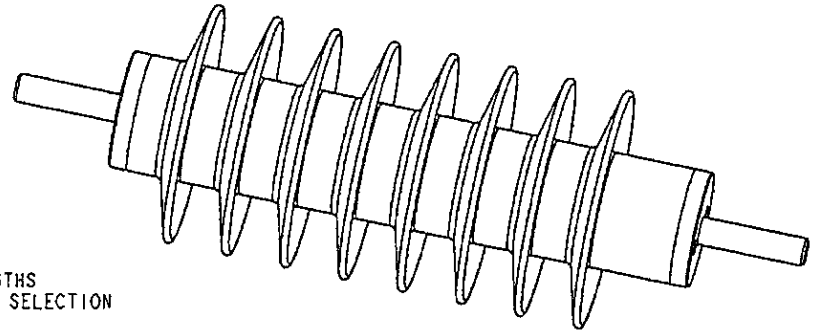
PRODUCT	TEXT A	TEXT B	TEXT C	TEXT D	TEXT E
DAI-15D	DAI-15D	Uc 12kV	Ur 15kV	YEAR	XXXX
DAI-18D	DAI-18D	Uc 14.4kV	Ur 18kV	YEAR	XXXX
DAI-21D	DAI-21D	Uc 16.8kV	Ur 21kV	YEAR	XXXX
DAI-22D	DAI-22D	Uc 17.6kV	Ur 22kV	YEAR	XXXX

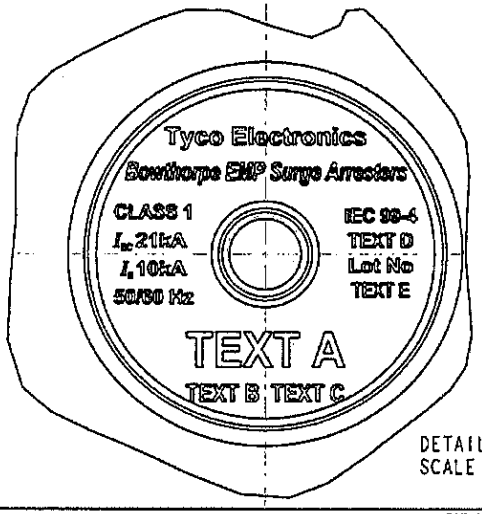
SCD

SEE DETAIL A









DETAIL A
SCALE 3:2

CANT. STRENGTH = 350Nm
TENSION STRENGTH = 2kN
TORQUE = 50Nm
HIGH SHORT CIRCUIT = 21kA
LOW SHORT CIRCUIT 600A
CREEPAGE = 627mm
DRY ARC DISTANCE = 252mm
STD STUD LENGTH 45±2. OTHER LENGTHS
AVAILABLE DEPENDING ON ACCESSORY SELECTION
ALL DIMS IN mm
SEE DRAWING No MV-DAI-00436-S FOR LABEL PRINT

REV	DATE	SIGN	MODIFICATION	APP
0	10/09/07	JH	ORIGINAL ISSUE	

Tyco Electronics
Bowthorpe Surge Arrester

BAY 100-105
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SHANNON
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IRELAND

DRN	J MULLIGAN	17/09/07	
CHECK	PAT FITZG		
APP	D McGOWAN		
PCN	SEE ABOVE		

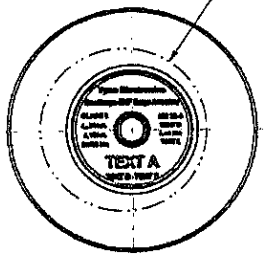
TITLE
IEC MV SURGE ARRESTER
DAI-xxD RANGE

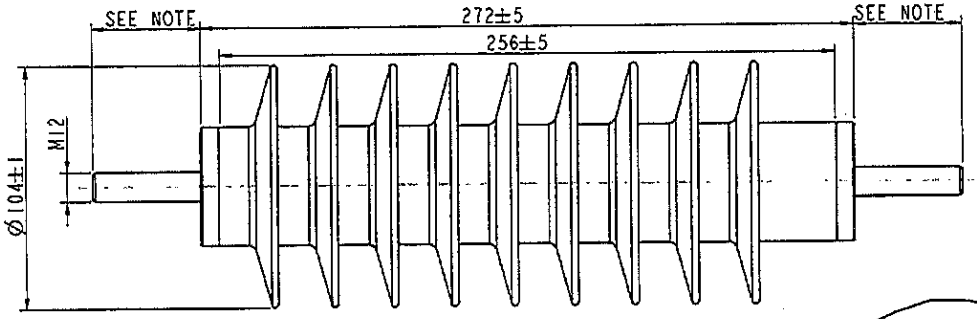
DRG NO MV-DAI-00431-S
SHEET 1 OF 1
REV 0

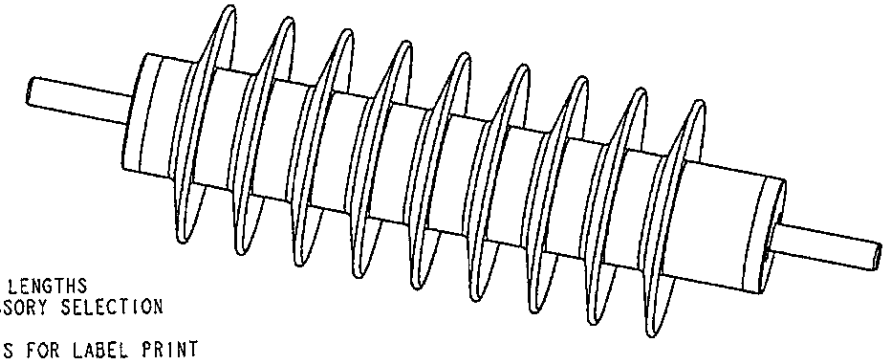
SCD

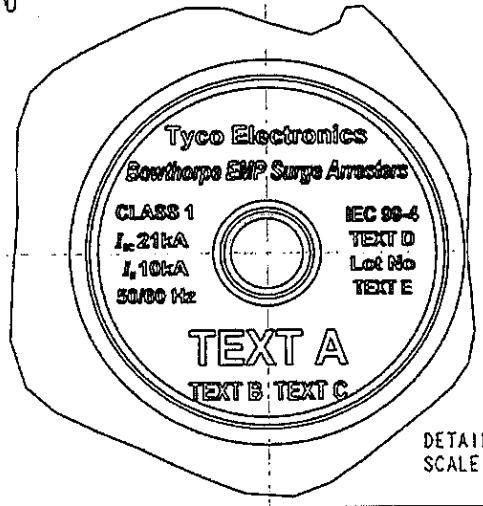
PRODUCT	TEXT A	TEXT B	TEXT C	TEXT D	TEXT E
DAI-18E	DAI-18E	Uc 14.4kV	Ur 18kV	YEAR	XXXX
DAI-21E	DAI-21E	Uc 16.8kV	Ur 21kV	YEAR	XXXX
DAI-22E	DAI-22E	Uc 17.6kV	Ur 22kV	YEAR	XXXX
DAI-24E	DAI-24E	Uc 19.2kV	Ur 24kV	YEAR	XXXX

SEE DETAIL A









DETAIL A
SCALE 3:2

CANT. STRENGTH = 350Nm
TENSION STRENGTH = 2kN
TORQUE = 50Nm
HIGH SHORT CIRCUIT = 21kA
LOW SHORT CIRCUIT 600A
CREEPAGE = 702mm
DRY ARC DISTANCE = 277mm
STD STUD LENGTH 45±2. OTHER LENGTHS
AVAILABLE DEPENDING ON ACCESSORY SELECTION
ALL DIMS IN mm
SEE DRAWING No MV-DAI-00436-S FOR LABEL PRINT

REV	DATE	SIGN	MODIFICATION	APP
0	09/07	JM	ORIGINAL ISSUE	

Tyco Electronics
Bowthorpe Surge Arrester

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DRN	D MULLIGAN	17/09/07
CHECK	PAT FITZG	
APP	D McGOWAN	
PCN	SEE ABOVE	

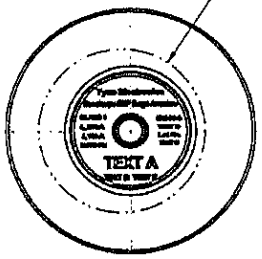
TITLE
IEC MV SURGE ARRESTER
DAI-xxE RANGE

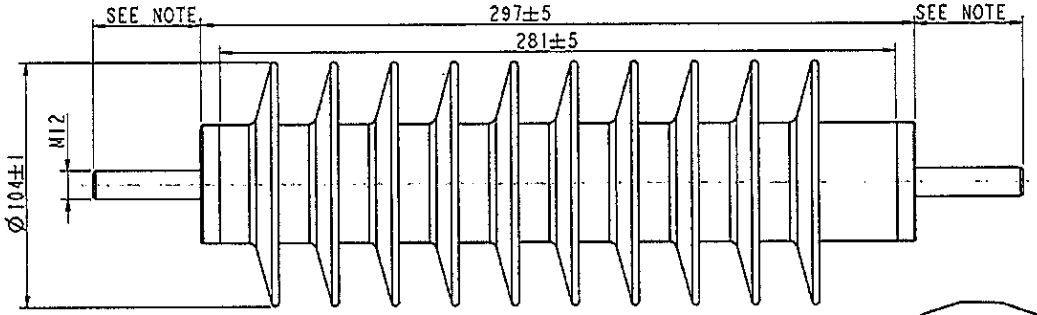
DRG NO MV-DAI-00432-S | SHEET 1 OF 1 | REV 0

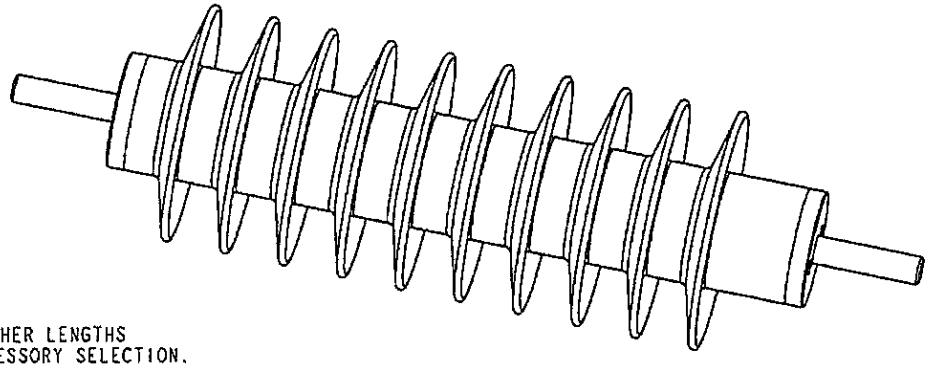
SCD

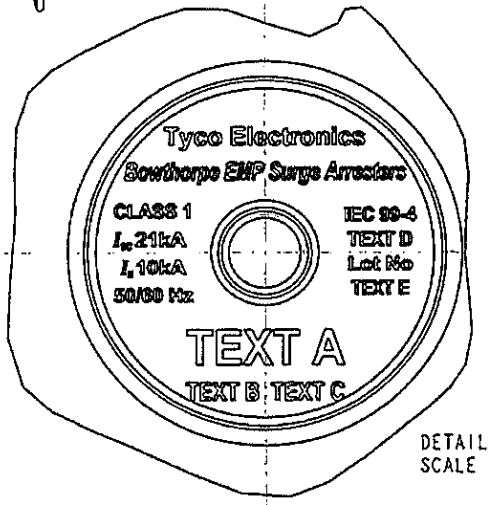
PRODUCT	TEXT A	TEXT B	TEXT C	TEXT D	TEXT E
DAI-18F	DAI-18F	Uc 14.4kV	Ur 18kV	YEAR	XXXX
DAI-21F	DAI-21F	Uc 16.8kV	Ur 21kV	YEAR	XXXX
DAI-22F	DAI-22F	Uc 17.6kV	Ur 22kV	YEAR	XXXX
DAI-24F	DAI-24F	Uc 19.2kV	Ur 24kV	YEAR	XXXX
DAI-27F	DAI-27F	Uc 21.6kV	Ur 27kV	YEAR	XXXX
DAI-30F	DAI-30F	Uc 24kV	Ur 30kV	YEAR	XXXX

SEE DETAIL A









DETAIL A
SCALE 3:2

CANT. STRENGTH = 350Nm
TENSION STRENGTH = 2kN
TORQUE = 50Nm
HIGH SHORT CIRCUIT = 21kA
LOW SHORT CIRCUIT 600A
CREEPAGE = 776mm
DRY ARC DISTANCE = 302mm
STD STUD LENGTH 45±2mm. OTHER LENGTHS AVAILABLE DEPENDING ON ACCESSORY SELECTION.
SEE DRAWING No MV-DAI-00436-S FOR LABEL PRINT

REV	DATE	SIGN	MODIFICATION	APP
0	09/07	JM	ORIGINAL ISSUE	

Tyco Electronics
Bowthorpe Surge Arrester

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SHANNON IND. EST.
SHANNON
CO. CLARE
IRELAND

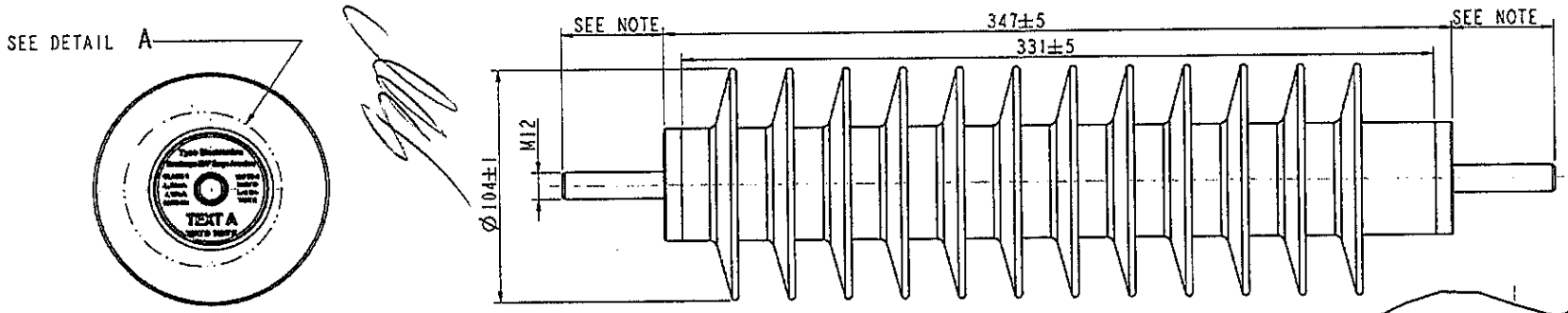
DRN	J MOLLICAN	17/09/07	
CHECK	PAT FITZG		
APP	D McGOWAN		
PCN	SEE ABOVE		

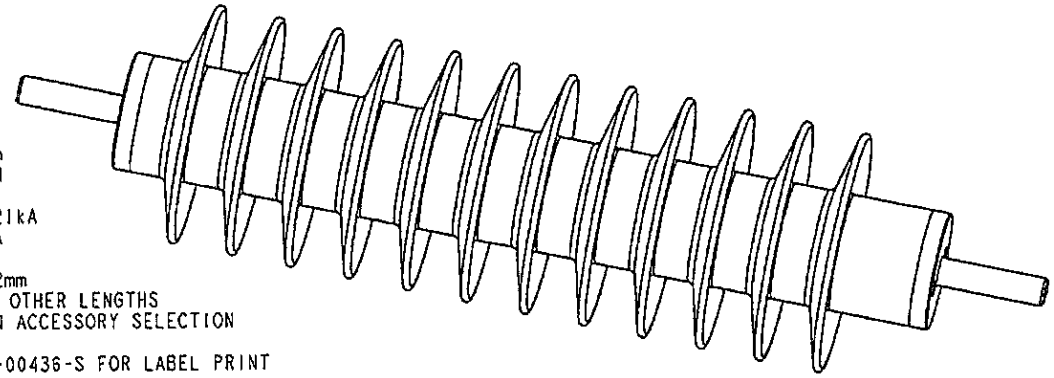
TITLE
IEC MV SURGE ARRESTER
DAI-xxF RANGE

DRG NO MV-DAI-00433-S
SHEET 1 OF 1
0

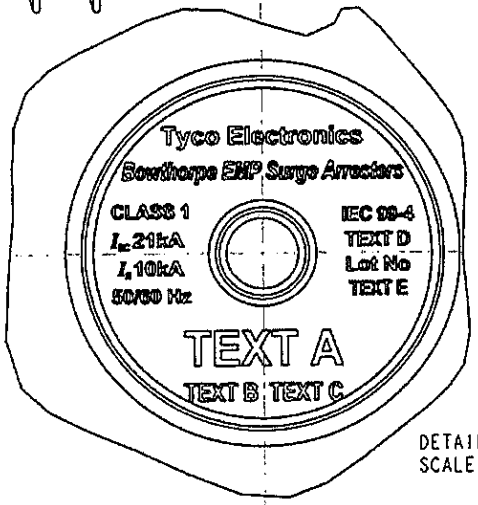
SCD

PRODUCT	TEXT A	TEXT B	TEXT C	TEXT D	TEXT E
DAI-24G	DAI-24G	Uc 19.2kV	Ur 24kV	YEAR	XXXX
DAI-27G	DAI-27G	Uc 21.6kV	Ur 27kV	YEAR	XXXX
DAI-30G	DAI-30G	Uc 24kV	Ur 30kV	YEAR	XXXX
DAI-33G	DAI-33G	Uc 26.4kV	Ur 33kV	YEAR	XXXX
DAI-36G	DAI-36G	Uc 28.8kV	Ur 36kV	YEAR	XXXX





CANT. STRENGTH = 350Nm
TENSION STRENGTH = 2kN
TORQUE = 50Nm
HIGH SHORT CIRCUIT = 21kA
LOW SHORT CIRCUIT 600A
CREEPAGE = 925mm
DRY ARC DISTANCE = 352mm
STD STUD LENGTH 45±2. OTHER LENGTHS
AVAILABLE DEPENDING ON ACCESSORY SELECTION
ALL DIMS IN mm
SEE DRAWING No MV-DAI-00436-S FOR LABEL PRINT



DETAIL A
SCALE 3:2

REV	DATE	SIGN	MODIFICATION	APP
-0	09/07	JM	ORIGINAL ISSUE	

Tyco Electronics — Bowthorpe Surge Arrester

DRN	J MULLIGAN	17/08/07	
CHECK	PAT FITZG		
APP	B McGOWAN		
PCN	SEE ABOVE		

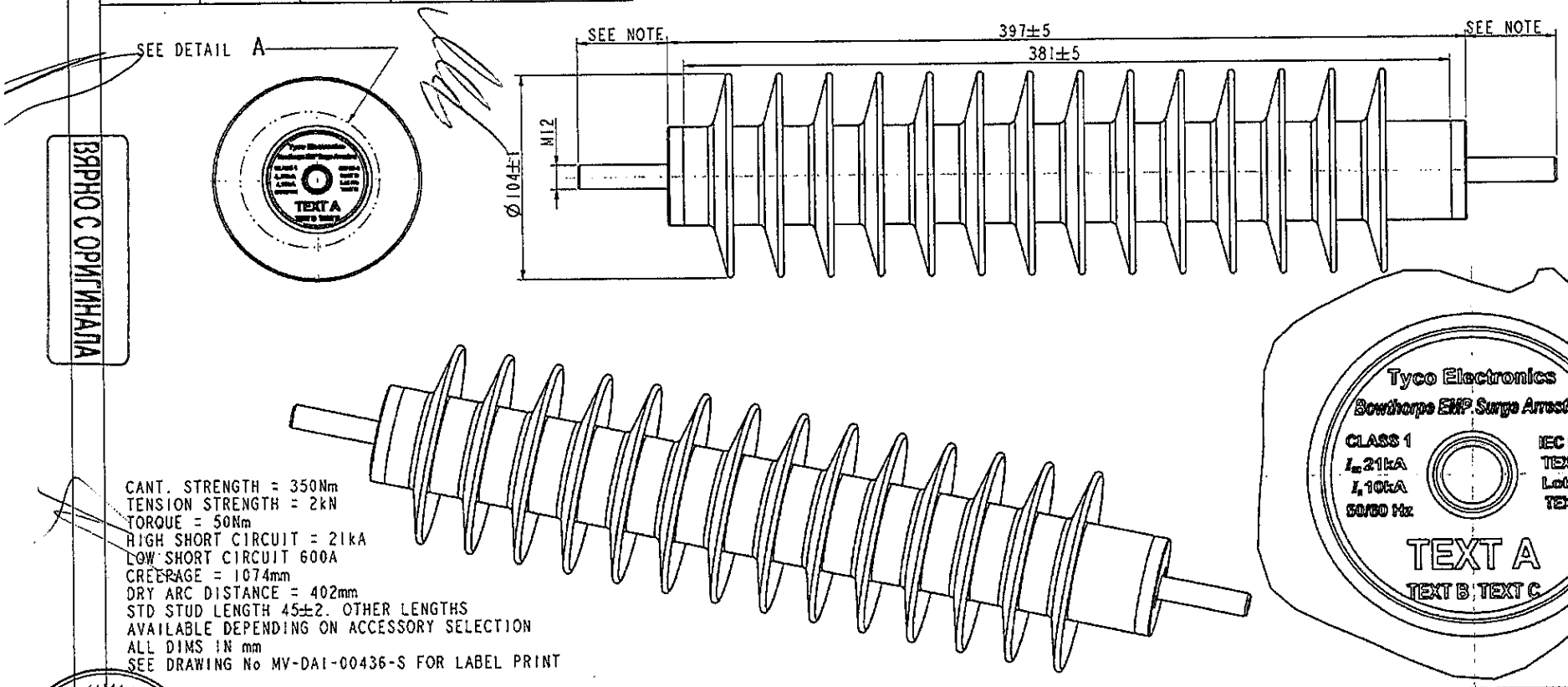
BAY 100-105
SHANNON IND. EST.
SHANNON
CO. CLARE
IRELAND

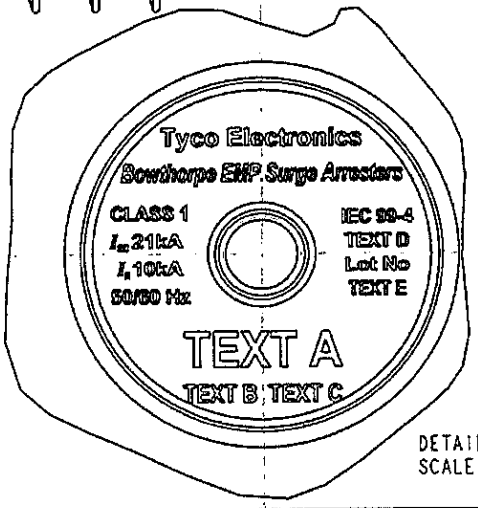
TITLE
IEC MV SURGE ARRESTER
DAI-xxG RANGE

DRG NO MV-DAI-00434-S | SHEET 1 OF 1 | 0

SCD

PRODUCT	TEXT A	TEXT B	TEXT C	TEXT D	TEXT E
DAI-27H	DAI-27H	Uc 21.6kV	Ur 27kV	YEAR	XXXX
DAI-30H	DAI-30H	Uc 24kV	Ur 30kV	YEAR	XXXX
DAI-33H	DAI-33H	Uc 26.4kV	Ur 33kV	YEAR	XXXX
DAI-36H	DAI-36H	Uc 28.8kV	Ur 36kV	YEAR	XXXX
DAI-39H	DAI-39H	Uc 31.2kV	Ur 39kV	YEAR	XXXX
DAI-42H	DAI-42H	Uc 33.6kV	Ur 42kV	YEAR	XXXX
DAI-45H	DAI-45H	Uc 36kV	Ur 45kV	YEAR	XXXX





DETAIL A
SCALE 3:2

CANT. STRENGTH = 350Nm
TENSION STRENGTH = 2kN
TORQUE = 50Nm
HIGH SHORT CIRCUIT = 21kA
LOW SHORT CIRCUIT 600A
CREEPAGE = 1074mm
DRY ARC DISTANCE = 402mm
STD STUD LENGTH 45±2. OTHER LENGTHS
AVAILABLE DEPENDING ON ACCESSORY SELECTION
ALL DIMS IN mm
SEE DRAWING No MV-DAI-00436-S FOR LABEL PRINT

REV	DATE	SIGN	MODIFICATION	APP
A	09/07	JM	ORIGINAL ISSUE	

Tyco Electronics
Bowthorpe Surge Arrester

BAY 100-105
SHANNON IND. EST.
SHANNON
CO. CLARE
IRELAND

DRN	D NULLICAN	27/09/07	
CHECK	PAT FITZG		
APP	D McGOWAN		
PGM	SEE ABOVE		

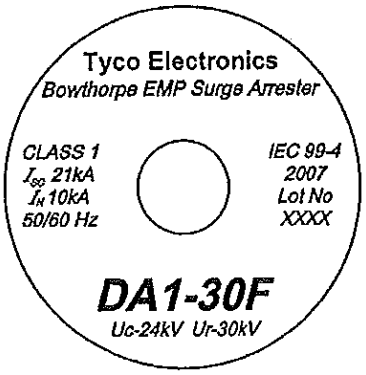
TITLE
IEC MV SURGE ARRESTER
DAI-xxH RANGE

DWG NO MV-DAI-00435-S
SHEET 1 OF 1
REV 0

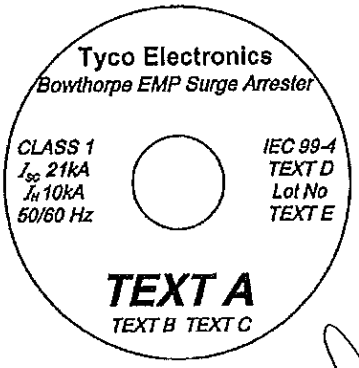
SCD

REV	DATE	SIGN	MODIFICATION	APP
0	09/07	JM	ORIGINAL ISSUE	

PRODUCT	SHEDS	TEXT A	TEXT B	TEXT C	TEXT D	TEXT E
DA1-04A	4	DA1-04A	Uc 3.2kV	Ur 4kV	YEAR of MANUFACTURE	LOT No
DA1-04B	5	DA1-04B	Uc 3.2kV	Ur 4kV		
DA1-06A	4	DA1-06A	Uc 4.8kV	Ur 6kV		
DA1-06B	5	DA1-06B	Uc 4.8kV	Ur 6kV		
DA1-08A	4	DA1-08A	Uc 6.4kV	Ur 8kV		
DA1-08B	5	DA1-08B	Uc 6.4kV	Ur 8kV		
DA1-08C	7	DA1-08C	Uc 6.4kV	Ur 8kV		
DA1-10A	4	DA1-10A	Uc 8kV	Ur 10kV		
1-10B	5	DA1-10B	Uc 8kV	Ur 10kV		
A1-10C	7	DA1-10C	Uc 8kV	Ur 10kV		
DA1-12A	4	DA1-12A	Uc 9.6kV	Ur 12kV		
DA1-12B	5	DA1-12B	Uc 9.6kV	Ur 12kV		
DA1-12C	7	DA1-12C	Uc 9.6kV	Ur 12kV		
DA1-15B	5	DA1-15B	Uc 12kV	Ur 15kV		
DA1-15C	7	DA1-15C	Uc 12kV	Ur 15kV		
DA1-15D	8	DA1-15D	Uc 12kV	Ur 15kV		
DA1-18C	7	DA1-18C	Uc 14.4kV	Ur 18kV		
DA1-18D	8	DA1-15D	Uc 14.4kV	Ur 18kV		
DA1-18E	9	DA1-18E	Uc 14.4kV	Ur 18kV		
DA1-18F	10	DA1-18F	Uc 14.4kV	Ur 18kV		
DA1-21C	7	DA1-21C	Uc 16.8kV	Ur 21kV		
DA1-21D	8	DA1-21D	Uc 16.8kV	Ur 21kV		
DA1-21E	9	DA1-21E	Uc 16.8kV	Ur 21kV		
DA1-21F	10	DA1-21F	Uc 16.8kV	Ur 21kV		
DA1-22C	7	DA1-22C	Uc 17.6kV	Ur 22kV		
DA1-22D	8	DA1-22D	Uc 17.6kV	Ur 22kV		
DA1-22E	9	DA1-22E	Uc 17.6kV	Ur 22kV		
DA1-22F	10	DA1-22F	Uc 17.6kV	Ur 22kV		
DA1-24E	9	DA1-24E	Uc 19.2kV	Ur 24kV		
A1-24F	10	DA1-24F	Uc 19.2kV	Ur 24kV		
A1-24G	12	DA1-24G	Uc 19.2kV	Ur 24kV		
DA1-27F	10	DA1-27F	Uc 21.6kV	Ur 27kV		
DA1-27G	12	DA1-27G	Uc 21.6kV	Ur 27kV		
DA1-27H	14	DA1-27H	Uc 21.6kV	Ur 27kV		
DA1-30F	10	DA1-30F	Uc 24kV	Ur 30kV		
DA1-30G	12	DA1-30G	Uc 24kV	Ur 30kV		
DA1-30H	14	DA1-30H	Uc 24kV	Ur 30kV		
DA1-33G	12	DA1-33G	Uc 26.4kV	Ur 33kV		
DA1-33H	14	DA1-33H	Uc 26.4kV	Ur 33kV		
DA1-36G	12	DA1-36G	Uc 28.8kV	Ur 36kV		
DA1-36H	14	DA1-36H	Uc 28.8kV	Ur 36kV		
DA1-39H	14	DA1-39H	Uc 31.2kV	Ur 39kV		
DA1-42H	14	DA1-42H	Uc 33.6kV	Ur 42kV		
DA1-45H	14	DA1-45H	Uc 36kV	Ur 45kV		



DA1-30F SAMPLE LABEL



BLANK LABEL

Tyco Electronics

ENERGY DIVISION

Bowthorpe EMP Surge Arrester

BAY 100-109
SHANNON IND. EST.
SHANNON
CO. CLARE
IRELAND

DRN	B MULLIGAN	17/09/07	JM	PCN	
CHECK	P FITZGERALD		PF	MAT'L	
APP	B McGOWAN	30.11	[illegible]		
SCALE	1:1				

TITLE

IEC MV SURGE ARRESTER
DA1 ARRESTER LABEL

DRG NO	MV-DA1-00436-S	SHEET 1	REV A

ВЯРНО С ОРИГИНАЛА

ФИЛКАБ 16

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www.filkab.com

Приложение 2 към Техническо предложение

ИЗИСКВАНИ ДОКУМЕНТИ ОТ ТЕХНИЧЕСКИ ИЗИСКВАНИЯ И СПЕЦИФИКАЦИИ

Приложение 2.6.

Превод от английски език

OCP2 Квалификации, ENG					
No.	Изпитание	Лаборатория	№ на протокола	60099-4, Издание 1.2 (2001) Клауза	60099-4, Издание 2.0 (2004) Еквивалентна клауза
1	Тест за издръжливост на изолацията върху корпуса на предпазителя	CESI	13060	9.7.2	10.8.2
2	Изпитвания за остатъчно напрежение	CESI	11666	9.7.3	10.8.3
3	Тест за устойчивост на импулсен ток на късо съединение	CESI	510783	9.7.4	10.8.4
4	Изпитвания за устойчивост при работа	CESI	11670	9.7.5	10.8.5
5	Тестове за късо съединение	CESI	522781	9.7.7	10.8.7
6	Тестове за вътрешно-частични разряди	CESI	14190	9.7.8	10.8.8
7	Изпитване на огъващия момент	CESI	507956	13.7.2	10.8.9 (10.8.9.3)
8	Тест за влагоустойчивост	CESI	507955	9.7.9	10.8.13
9	Тест за износоустойчивост	EGU	8915/A3/04	9.7.10	10.8.14
10	Изпитване на съотношение на напрежение с промишлена честота към времето	CESI	521820	5.10, Annex D	6.10, Annex D

OCP2 Qualification, ENG					
No.	Test	Lab	Test Report Number	60099-4, Edition 1.2 (2001) Clause	60099-4, Edition 2.0 (2004) Equivalent Clause
1	Insulation withstand tests on the arrester housing	CESI	13060	9.7.2	10.8.2
2	Residual voltage tests	CESI	11666	9.7.3	10.8.3
3	Long-duration current impulse withstand test	CESI	510783	9.7.4	10.8.4
4	Operating duty tests	CESI	11670	9.7.5	10.8.5
5	Short-circuit tests	CESI	522781	9.7.7	10.8.7
6	Internal partial discharge tests	CESI	14190	9.7.8	10.8.8
7	Test of the bending moment	CESI	507956	13.7.2	10.8.9 (10.8.9.3)
8	Moisture Ingress Test	CESI	507955	9.7.9	10.8.13
9	Weather Ageing Test	EGU	8915/A3/04	9.7.10	10.8.14
10	Power –frequency voltage versus time characteristics on an arrester	CESI	521820	5.10, Annex D	6.10, Annex D

ВЯРНО С ОРИГИНАЛА

АКЦИОНЕРНО ДРУЖЕСТВО * ФИЛКАБ 16 * ПЛОВДИВ *

tyco Electronics

Energy Division
http://energy.tycoelectronics.com

Confidential 23-2005

Tyco confidential

Bowthorpe EMP

Test Report

Type	**OCP2**
PPR Number	**PPR-1827**
Test	Insulation withstand Test
Specification	IEC 60099-4 (2001-12)

Test Information:

Laboratory	CESI
Date	28/04/2004
External Test Ref	AT-A4/013060
Report Prepared By	D Pirola
Test Verified by	A Sironi
Test Approved by	M de Nigris

Tyco Approvals:

R&D Manager
Brendan Normoyle — Date 25/02/2005

Technology Manager
Kwong Tong — Date 25/02/2005

Product Manager
Brian McGowan — Date 25/02/2005

На основание чл. 2 от ЗЗЛД

На основание чл. 2 от ЗЗЛД

n

lectronics.com

АКЦИОНЕРНО ДРУЖЕСТВО ФИЛКАБ 16 ПЛОВДИВ

ВЯРНО С ОРИГИНАЛА

client	TYCO, Electronics Energy Division - Shannon (Ireland)
equipment under test	Housing for polymer housed metal-oxide surge arrester type OCP2 10 kA
tests performed	Insulation withstand tests
normative documents	IEC 60099-4 (2001-12)
receipt date of the sample	April 27, 2004
test date	from April 27, 2004 to April 28, 2004
no. of pages	13 no. of pages annexed 05

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	June 10, 2004	
prepared	PeC/TEST - [illegible]	
verified	PeC/TEST - [illegible]	
approved	PeC/TEST - [illegible]	

На основание чл. 2
от ЗЗЛД

ВЯРНО С ОРИГИНАЛА

АКЦИОНЕРНО ДРУЖЕСТВО ФИЛКАБ 16

tests witnessed by: ---

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 represents in shape and dimensions the essential details and the parts of the tested object.
This drawings identified by CESI and numbered **A4/509282 no. 01** are 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 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.

На основание чл. 2
от ЗЗЛД

L. Tiziani

P180

43160L

АКЦИОНЕРНО ДРУЖЕСТВО * ФИЛКАБ 16 * ПЛОВДИВ *

ВЯРНО С ОРИГИНАЛА

pages annexed

Oscillograms: 04 pages

reference document annexed

Manufacturer's drawing of surge arrester type OCP2 identified by CESI and numbered as **A4/509282 no. 01**

Test object characteristics

type: Housing for polymer housed metal oxide surge arrester

electrical characteristics (claimed by the client)

type	OCP2 10 kA
manufacturer's name	TYCO Electronics Energy division
line discharge class	2
rated voltage - U_r [kV]	30,0
continuous operating voltage - U_c [kV]	24,0
dry lightning impulse withstand voltage [kV_{peak}]	185
wet power frequency withstand voltage	90
rated frequency - [Hz]	50-60
year of manufacture	2004

geometrical characteristics (measured on the test sample)

total height [mm]	300 (not including studs)
arcing distance [mm]	295
creepage (leakage) distance [mm]	760
number of large sheds	6
large shed diameter [mm]	117
number of small sheds	5
small shed diameter [mm]	97
core dimensions [mm]	55 x 55

other characteristics

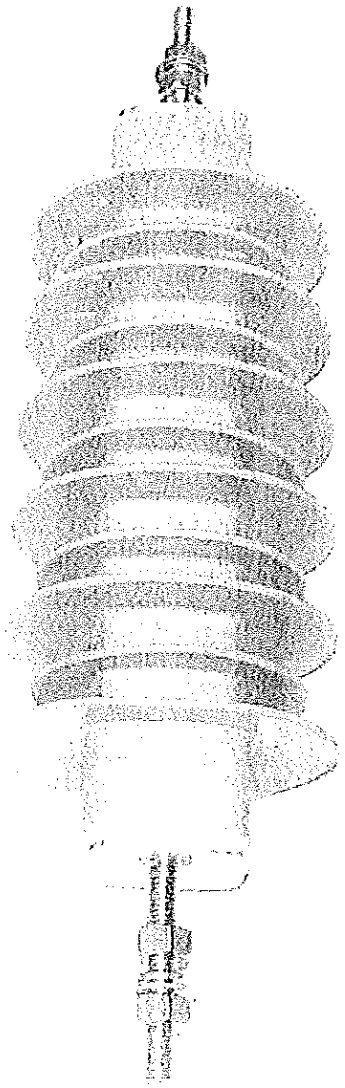
housing material	polymeric
housing color	grey

Note: The tested sample used for insulation withstand test was without active parts

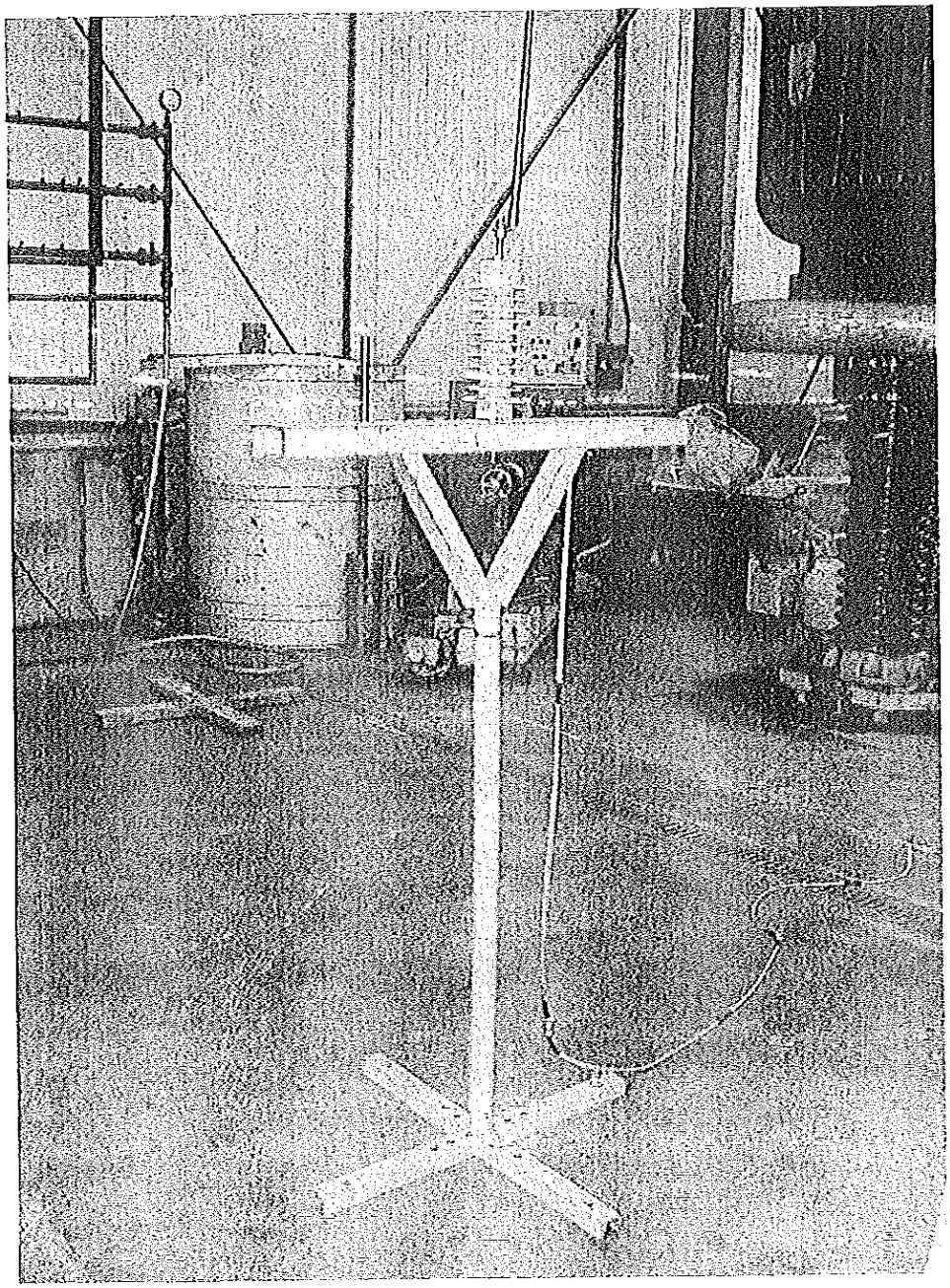
ВЯРНО С ОРИГИНАЛА

АКЦИОНЕРНО ДРУЖЕСТВО * ФИЛКАБ 16 * ПЛОВДИВ *

panoramic view of the test object



panoramic view of the test arrangement for insulation withstand test



ВЯРНО С ОРИГИНАЛА

АКЦИОНЕРНО ДРУЖЕСТВО ФИЛКАБ 16 ПЛОВДИВ

Reference standard

IEC 60099-4 (2001-12) " Metal-oxide surge arrester without gaps for a.c. system" at clause 7.2

Test carried out

test carried out	number of sample tested
dry lightning impulse withstand test	1
wet power frequency withstand test	1

Test procedure

Dry lightning impulse withstand test

The test sample has been submitted to fifteen voltage impulses for each polarity having waveshape 1,2/50 μs and peak value equal to 185 kV_{peak}. The test has been performed in dry condition.

Wet power frequency withstand test

The power frequency voltage level has been applied for 60 seconds on the sample at the value equal to 90 kV_{rms}. 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

The surge arresters housing were submitted to 15 voltage impulses of each polarity.
No flashover occurred during any of the impulse application

Wet power frequency withstand voltage test

The surge arresters housing were submitted to 1 minute power frequency voltage application under wet conditions.
No flashover occurred.

The test result is positive

ВЯРНО С ОРИГИНАЛА

АКЦИОНЕРНО ДРУЖЕСТВО * ФИЛКАБ 16 * ПЛОВДИВ *

Dry lightning impulse withstand voltage test according to IEC 60099-4

test object: Housing for polymer housed metal oxide surge arrester type OCP2 10 kA
test circuit: A002
arrangement: see pag. 6

atmospheric conditions and correction factor			
b	t	h	K_t
kPa	°C	g / m³	
100,1	20 (14)	8,8	0,975

date: April 27, 2004

sample number	polarity	charging voltage	peak voltage required U	peak voltage applied U × K_t															
		kV	kV	kV	A: flashover (x) withstand (o)														
					B: oscillogram no.														
					C: peak voltage														
					D: time to discharge [μs]														
1	neg	91,5	185,0	180,5	A	o	o	o	o	o	o	o	o	o	o	o	o	o	o
					B														03
					C	180,4	180,5	181,0	180,4	180,7	180,1	181,0	180,2	180,3	180,0	180,6	180,4	180,4	180,4	180,5
					D														
1	pos	91,5	185,0	180,5	A	o	o	o	o	o	o	o	o	o	o	o	o	o	o
					B														04
					C	180,2	180,6	180,3	180,2	180,2	180,2	180,3	180,2	180,4	180,5	180,2	180,4	180,6	180,6	180,1
					D														

Wet power frequency withstand voltage test according to IEC 60099-4

test object: Housing for polymer housed metal oxide surge arrester type OCP2 10 kA
test circuit: A058-A059
arrangement: see pag. 6

atmospheric conditions and correction factor			
b	t	h	K_t
kPa	°C	g / m³	
100,5	20	—	1,00

	precipitation conditions				
	precipitation rate mm / min			water temperature	water resistivity
	top	center	bottom	°C	Ω × m
vertical	-	1,6	-	17	104
horizontal	-	1,4	-		

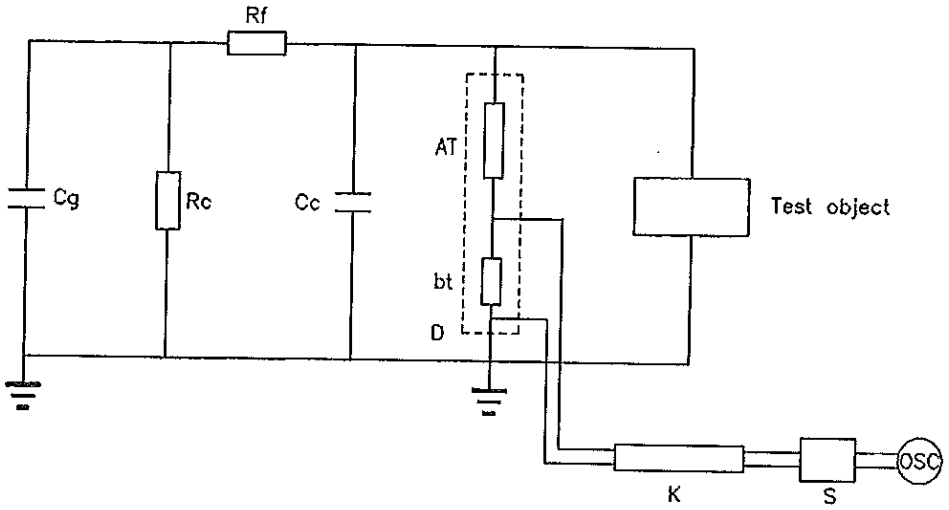
date: April 28, 2004

test sample (no.)	voltage required U	voltage correction factor	voltage applied U × K_t	test duration	test result	note
	kV_{rms}	K_t	kV_{rms}	s		
1	90,0	1,00	90,0	60	withstand	

Note: - the voltage was directly measured with "calibrated voltage transformer" k = 1300 in parallel to the sample

ВЯРНО С ОРИГИНАЛА

circuit A002



impulse generator

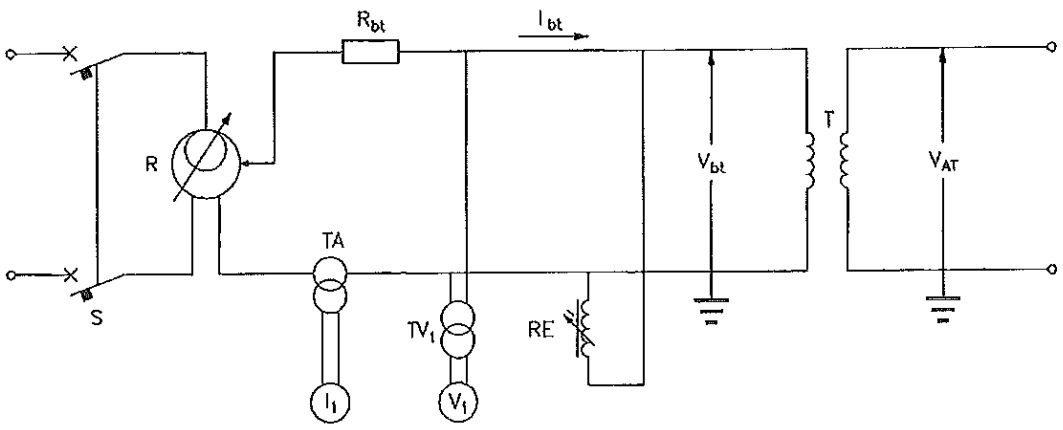
plant P180
no. of stages 2
C_g 250 nF
R_c 280 Ω (2 x 140 Ω)
R_f 300 Ω (1 x 140 Ω + 2 x 60 Ω + 1 x 40 Ω)
C_c 0,6 nF
$R_{tot\ charging}$ 268 kΩ

measuring system CESI no. 9792
voltage divider (D) CESI no. 6700 ; type RC series; scale factor 25299,7
high voltage capacitance 600 pF
low voltage unit (b_t), CESI no. 6704
coaxial cable (K)
attenuation and termination unit (S), CESI no. 14924
digital oscilloscope (Osc) CESI no. 14232; type TEKTRONIX TDS 430A

	measured waveshape		
		time	oscillogram
	polarity	μs	no.
front	positive	1,21	01
tail		55,0	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	91,5	180,4	0,98

circuit A058



power frequency test circuit - plant P180

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

RE : variable reactor PIVI (not used)
T : booster transformer CGE mod. KOC; secondary winding power 700 kVA; voltage 6 kV/700 kV; no. of units 2; ratio /
R_{bt} : protection resistor 2 Ω
TA : current transformer type CGS; ratio 50 A/5 A; CESI no.03399
I_1 : amperometer
TV_1 : voltage transformer type CGS; ratio 6 kV/100 V; CESI no.03384
V_1 : voltmeter ESCORT EDM-3150; CESI no.14469

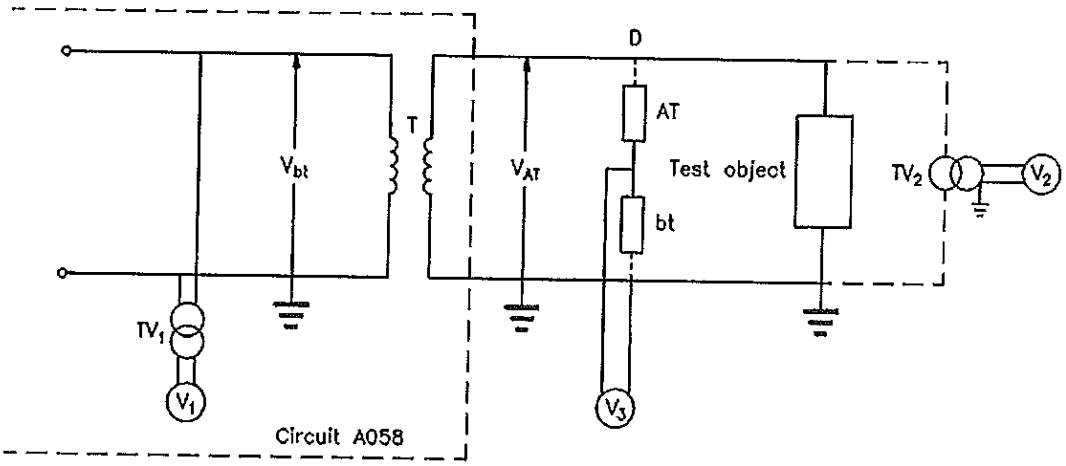
tripping of the circuit breaker S

I_N	k_{TA}	instantaneous tripping			time delayed tripping		
		settings			settings		
		s_1	$s_1 \cdot I_N$	t_1	s_2	$s_2 \cdot I_N$	t_2
5	10	1	5	0,05	0,5	2,5	0,05

ВЯРНО С ОРИГИНАЛА

АКЦИОНЕРНО ДРУЖЕСТВО ФИЛКАБ 16 ПЛОВДИВ

circuit A059



power frequency measuring circuit - plant P180

TV_1: voltage transformer type CGS ; mat. 7595859 ; ratio 6000V/100V
V_1 : voltmeter ESCORT EDM-3150; CESI no. 014469
D : voltage divider type RC series (not used)
V_3 : voltmeter (not used)
TV_2: voltage transformer type SCARPA & MAGNANO; ratio 130 kV/100 V; CESI no.05132
V_2 : voltmeter ESCORT EDM-3150; CESI no. 014470

functional check of the test circuit

date: April 28, 2004

low voltage				high voltage				k_1
				k_2 = --		k_3 = ----		
V_1	V_{bt}	I_1	I_{bt}	V_2	V_{AT}	V_3	V_{AT}	V_{AT} / V_1
V	V	A	A	V	kV	V	kV	
--	--	--	--	--	--	--	--	--

ВЯРНО С ОРИГИНАЛА
АКЦИОНЕРНО ДРУЖЕСТВО ФИЛКАБ 16 СОФИЯ

Type approval test 04-2005

Original issue 04-2005

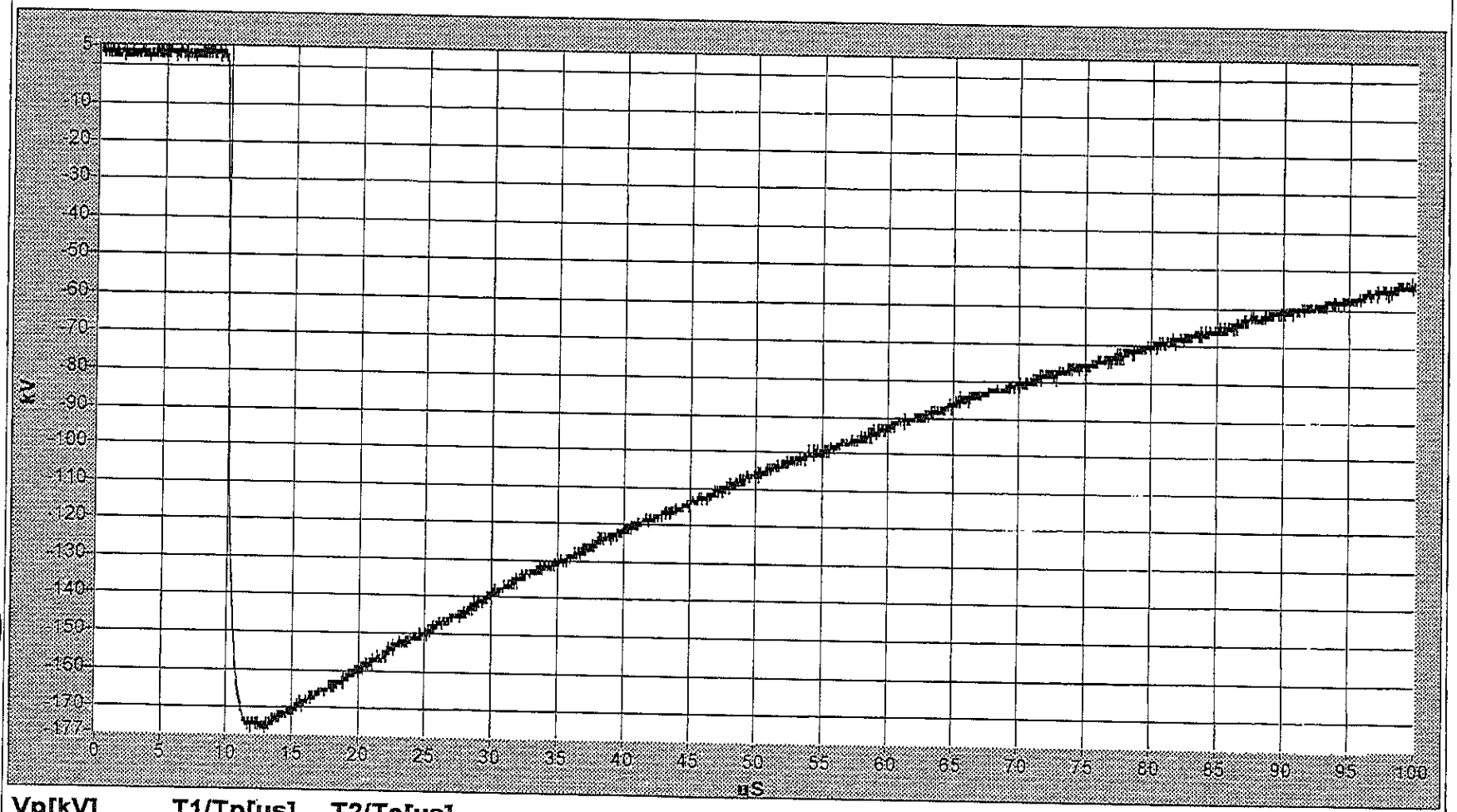
CESI A4/013060, n.1

Vp[kV]	T1/Tp[us]	T2/Tc[us]
-180.433	1.224	54.984

ВЯРНО С ОРИГИНАЛА

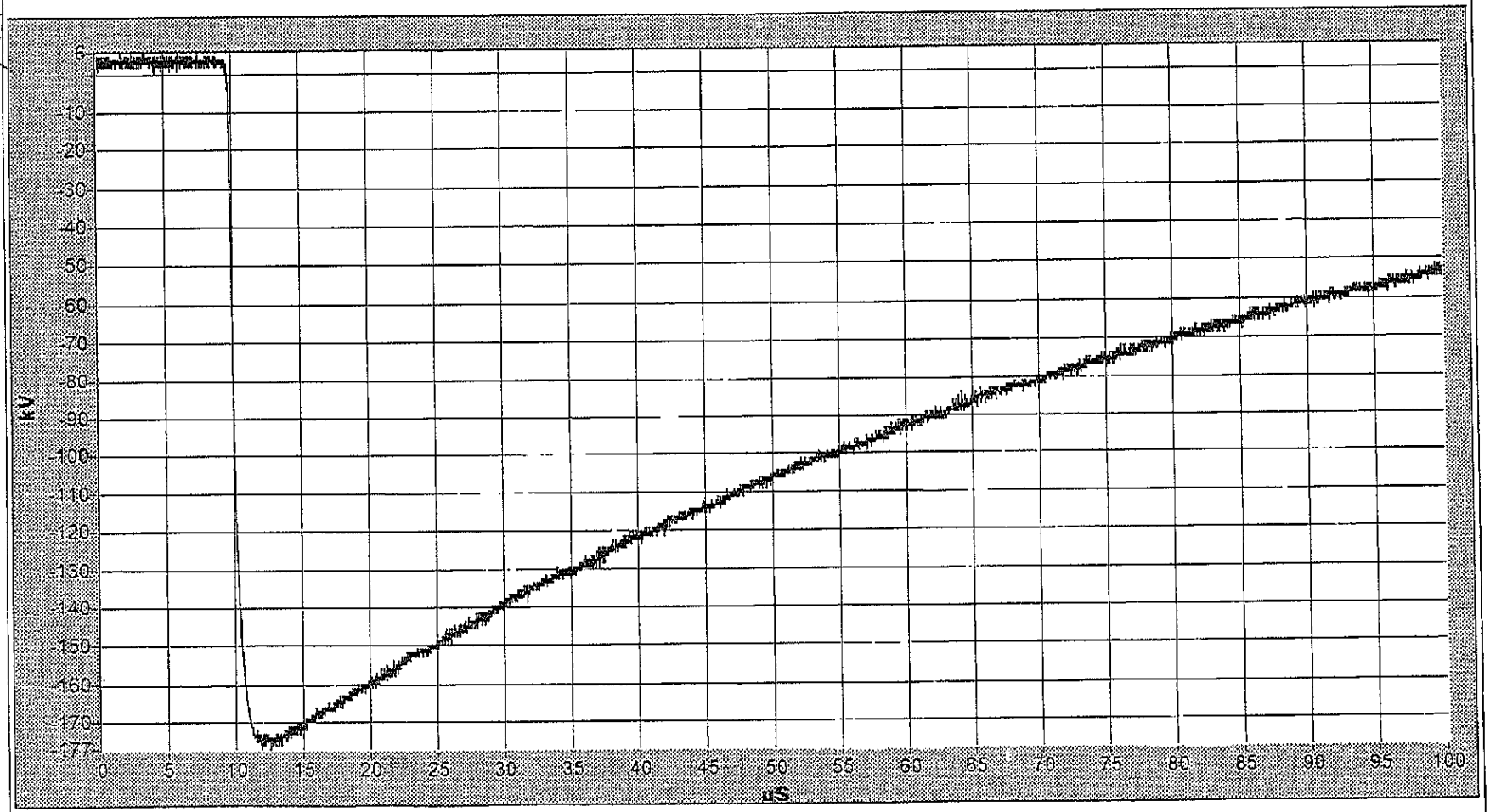
АКЦИОНЕРНО ДРУЖЕСТВО * ФИЛКАБ 16 * ПЛОВДИВ *

CESI A4/013060, n.2



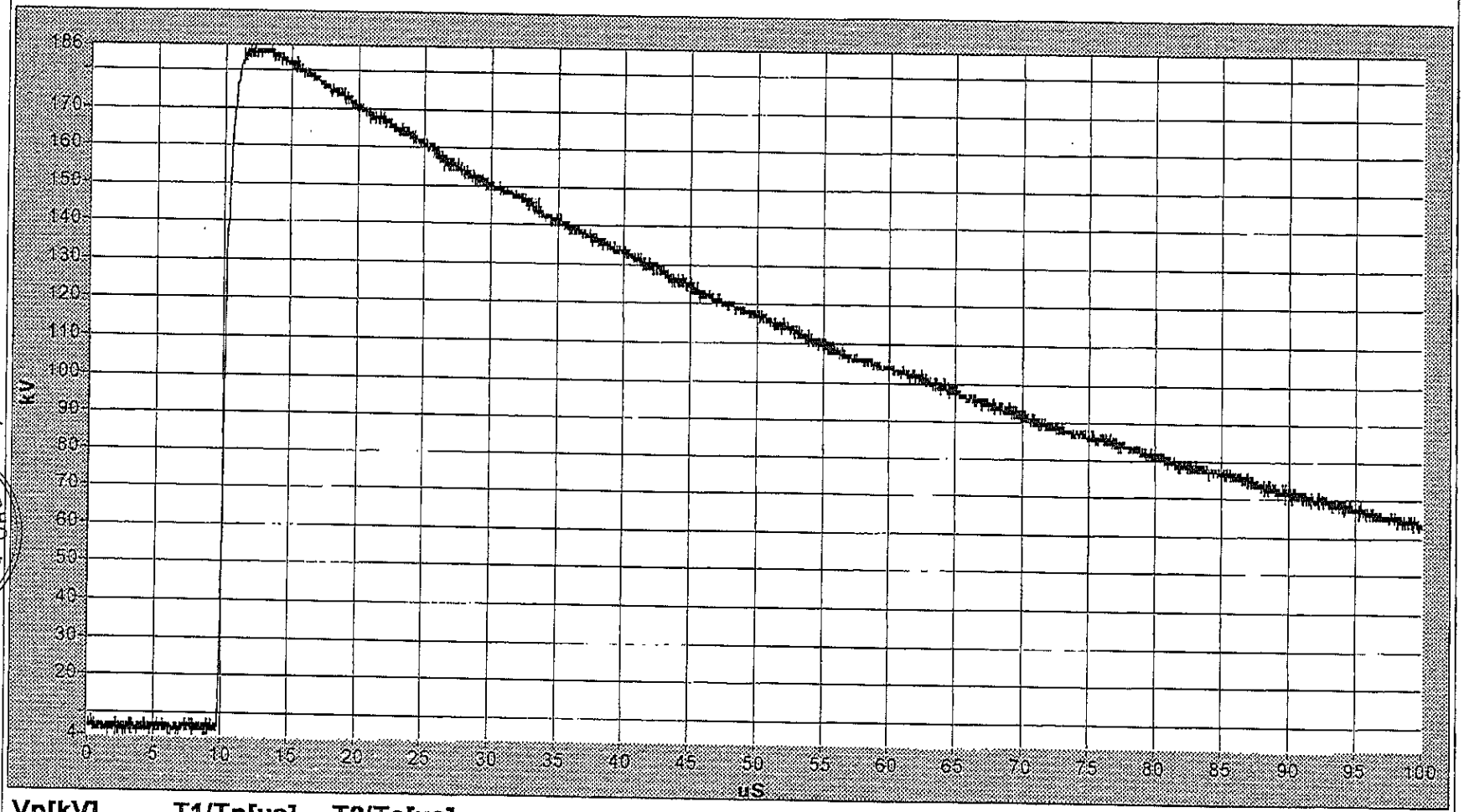
Vp[kV]	T1/Tp[us]	T2/Tc[us]
-180.433	1.224	54.984

CESI A4/013060, n.3



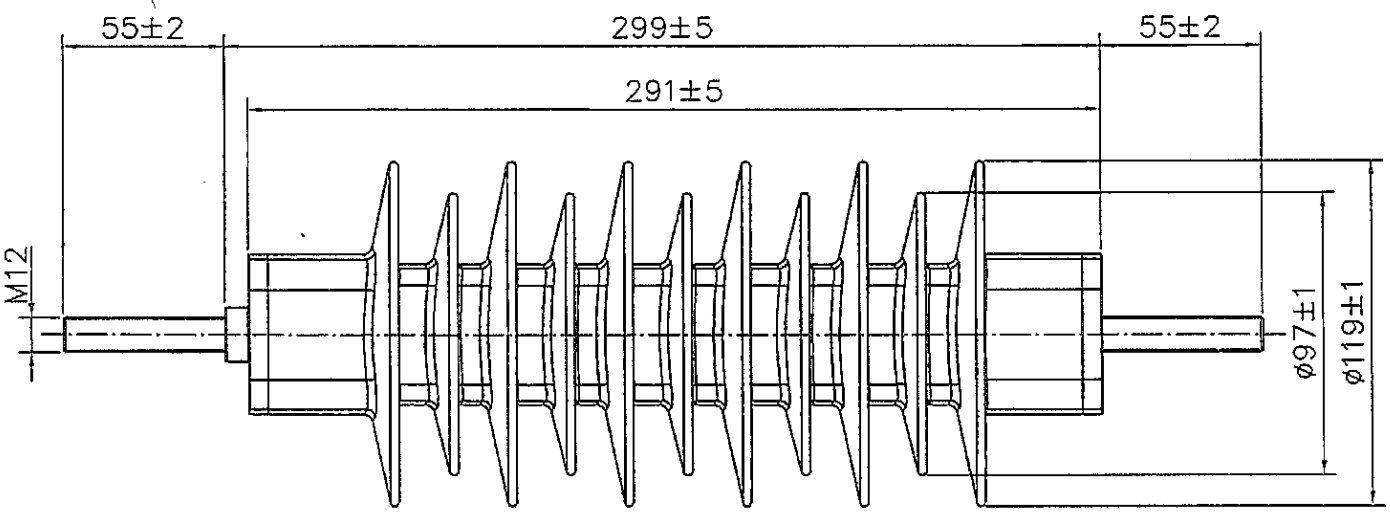
Vp[kV]	T1/Tp[us]	T2/Tc[us]
-180.522	1.257	54.657

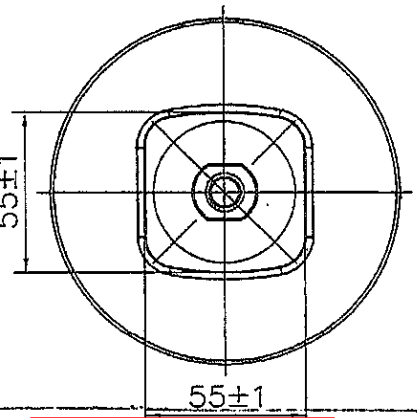
CESI A4/013060, n.4



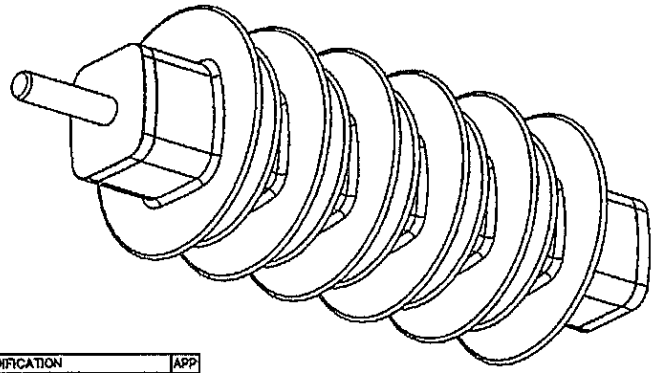
Vp[kV]	T1/Tp[us]	T2/Tc[us]
180.099	1.291	56.069

SCD





NOTE:–
Uc = 24kV
NOM CREEPAGE = 758mm
NOM DRY ARC DIST = 293mm
CANT. STRENGTH = 350Nm
TENSION STRENGTH = 2kN
TORQUE = 50Nm
HIGH SHORT CIRCUIT = 40kA
LOW SHORT CIRCUIT = 600A



REV	DATE	SIGN	MODIFICATION	APP
0	04/04	JM	ORIGINAL ISSUE	

tyco ELECTRONICS

Bowthorpe EMP

BOWTHORPE EMP
BAY 100–700
SHANNON IND. EST.
SHANNON
CO. CLARE
IRELAND

DRN	J MULLIGAN	23/04/04	
CHECK	D NORMOYLE		
APP	P McCORAN		
SCALE	2:5		

PCN ******–000

MATL

TITLE
OCP2–24S
SURGE ARRESTER

DRG NO MV–OCP2–00057–S SHEET 1 OF 1 REV 0

ВЯРНО С ОРИГИНАЛА

tyco Electronics

Energy Division
http://energy.tycoelectronics.com

Bowthorpe EMP

Test Report

Type	**OCP2**
PPR Number	**PPR-1828**
Test Specification	Residual voltage test IEC 60099-4 (2001-12)

Test Information:

Laboratory	CESI
Date	30/04/2004
External Test Ref	AT-A4/011666
Report Prepared By	M Gregori
Test Verified by	A Sironi
Test Approved by	V Scarioni

Tyco Approvals:

R&D Manager
Brendan Normoyle — Date 25/02/2005

Technology Manager
Kwong Tong — Date 25/02/2005

Product Manager
Brian McGowan — Date 25/02/2005

На основание чл. 2
от ЗЗЛД

For further information contact:
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Bay 100 - 109
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Fax: + 353-61-472676
Email: mvsurgearresters@tycoelectronics.com

ВЯРНО С ОРИГИНАЛА

АКЦИОНЕРНО ДРУЖЕСТВО * ФИЛКАБ 16 * ПЛОВДИВ *

client	TYCO Electronics Energy Division - Shannon (IRL)
equipment under test	Polymer housed metal-oxide surge arrester type OCP2
tests performed	Residual voltage test
normative documents	IEC 60099-4 (2001-12)
receipt date of the sample	April 15, 2004
test date	from April 27, 2004 to April 30, 2004
no. of pages	18 no. of pages annexed 32

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

n° 0030

first issue date	May 25, 2004	
prepared	PeC/TEST -	
verified	PeC/TEST -	
approved	PeC/TEST -	

На основание чл. 2
от ЗЗЛД

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 drawings identified by CESI and numbered A4/503147, 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.

На основание чл. 2 от ЗЗЛД

Podavitte - I. Guacci

e arrester laboratory

keywords: 12015R, 23810H, 31020W, 46030U, 53001D

ВЯРНО С ОРИГИНАЛА

АКЦИОНЕРНО ДРУЖЕСТВО * ПЛОВДИВ * ФИЛКАБ 16

ВЕРНО С ОРИГИНАЛА

АКЦИОНЕРНО ДРУЖЕСТВО ВНИИКАБ

Pages annexed:

- oscillograms n.31 pages
- TYCO drawing n. OCP2-5, CESI n.A4/503147-01; n.1 page

Test object characteristics

type: Polymer housed metal-oxide surge arrester section

electrical characteristics (claimed by the client)

manufacturer's name	TYCO Electronics Energy Division - Shannon (IRL)
nominal discharge current - I_n [kA]	10,0
rated voltage - U_r [kV]	0,980 x $U_{rel.}$
continuous operating voltage - U_c [kV]	0,784 x $U_{rel.}$
reference current - $I_{ref.}$ [mA]	5,0
line discharge class	2
rated frequency - [Hz]	50
year of manufacture	2004

geometrical characteristics (measured on the test sample)

height [mm]	139
number of sheds	n.2 large - n.1 small
shed diameter [mm]	118 large - 96 small

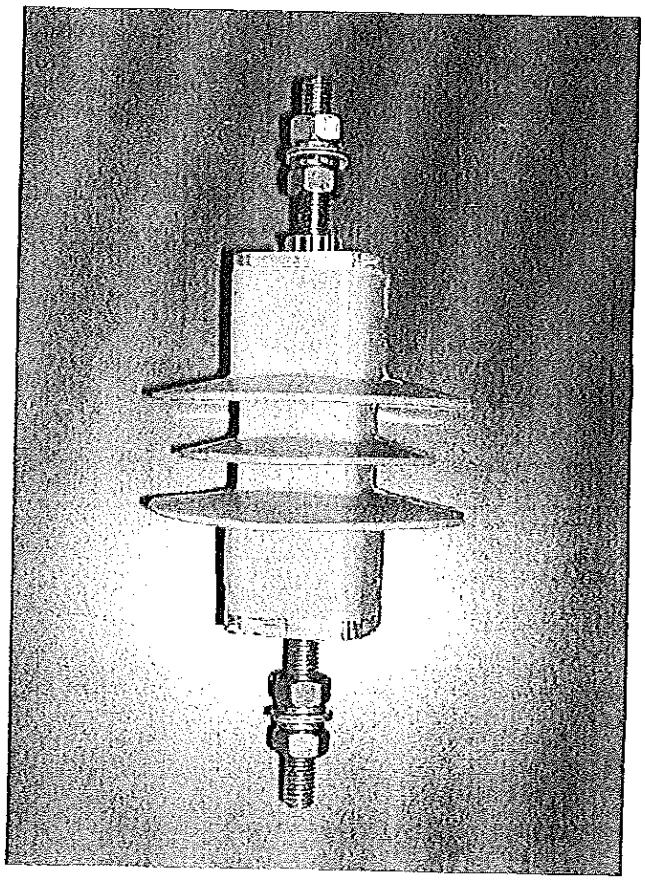
other characteristics

housing material	SILICONE
housing color	GREY

ВЯРНО С ОРИГИНАЛА

АКЦИОНЕРНО ДРУЖЕСТВО * ФИЛКАБ 16 * ПЛОВДИВ *

Photograph of the test sample.



Reference Standard

IEC 60099-4 (2001-12) Clause 7.3
" Metal-oxide surge arrester without gaps for a.c. system"

Test carried out

test carried out	number of sample tested
Lightning impulse residual voltage test	3
Switching impulse residual voltage test	
Steep current impulse residual voltage test	

Test object identification

test object names	identification of test sample (given by the client)
polymer housed metal-oxide surge arrester section	RV1 - RV2 - RV3

ВЯРНО С ...

АКЦИОНЕРНО ДРУЖЕСТВО * ФИЛКАБ 16 * ПЛОВДИВ *

Test procedure

- The power frequency voltage at reference current (Iref. = 5 mA) was measured in both polarities, required by the Client

- The lightning impulse residual voltage with current waveshape having front time equal to 8 μs and time to half value equal to 20 μs at the following values has been measured at following current levels:

  I_N = 10 kA
  0,5 I_N = 5 kA
  2 I_N = 20 kA

- The switching impulse residual voltage with current waveshape having front time greater then to 30 μs but less than 100 μs and time to half value roughly twice at following current has been measured according to table 3 of the reference standard

  I = 125 A
  I = 500 A

- The steep current residual voltage at I_N with current waveshape having front time equal to 1 μs and time to half value not longer than 20 μs has been measured.
  The inductive error was measured replacing the surge arresters section with a metal blocks having the same dimensions. The inductive correction was applied by substracting the impulse shape measured on the surge arrester sections and the impulse shape on the metal block.

- The power frequency voltage at reference current (Iref.= 5 mA) has been measured in both polarities

ВЯРНО С ОРИГИНАЛА

Power frequency voltage-current characteristics before test.

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

date: April 27, 2004

sample no. RV2

oscill.	voltage	current	current	current	power	3rd harmonic amplitude
no.	kV	+ mA_{cr}	- mA_{cr}	mA_{rms}	W	μA
1	6,93	5,00	4,47	1,62	7,25	---
2	6,96	5,64	5,04	1,79	8,03	---

sample no. RV1

oscill.	voltage	current	current	current	power	3rd harmonic amplitude
no.	kV	+ mA_{cr}	- mA_{cr}	mA_{rms}	W	μA
3	6,99	5,04	4,58	1,6	7,13	---
4	6,93	5,56	5,04	1,75	7,82	---

sample no. RV3

oscill.	voltage	current	current	current	power	3rd harmonic amplitude
no.	kV	+ mA_{cr}	- mA_{cr}	mA_{rms}	W	μA
5	6,93	5,04	4,51	1,64	7,44	---
6	6,98	5,64	5,00	1,79	8,14	---

ВЯРНО С ОРИГИНАЛА

АКЦИОНЕРНО ДРУЖЕСТВО * ПЛОВДИВ * ФИЛКАБ 16

Lightning impulse residual voltage test.

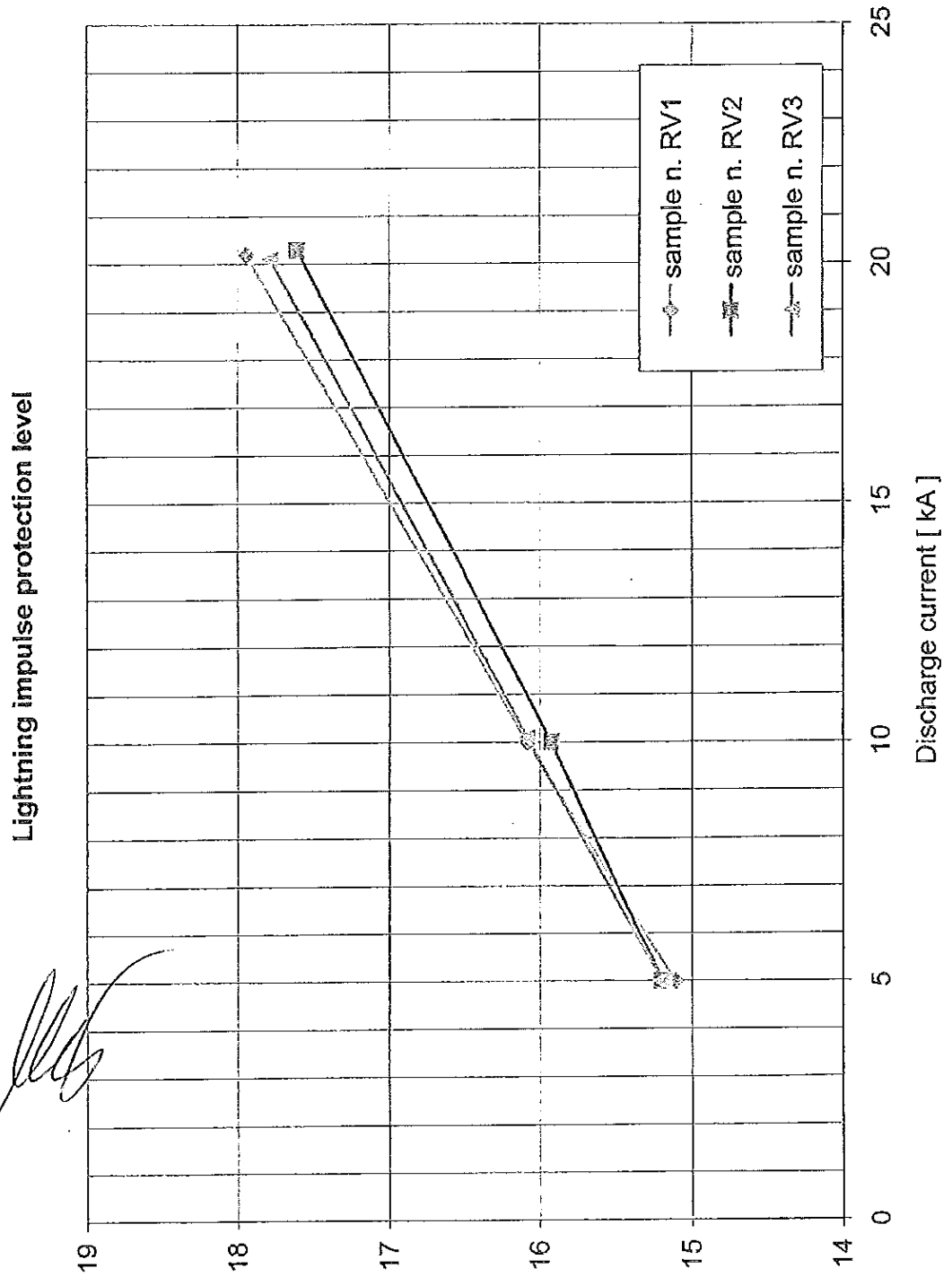
test object: Polymer housed metal-oxide surge arrester section
test circuit: A014

date: April 27, 2004

sample	requested current	charging voltage	oscillogram	current waveshape	discharge current	residual voltage	lightning impulse protection level
no.		kV	no.	μs	kA	kV	kV
RV1	0,5 × I_N	21,6	10	8,4/18,6	5,00	15,11	see relevant curve in the following page
	I_N	29,1	7	8,5/18,4	10,0	16,08	
	2,0 × I_N	45,0	13	8,5/18,4	20,2	17,94	
RV2	0,5 × I_N	21,7	11	8,4/18,6	5,00	15,19	
	I_N	29,1	8	8,5/18,4	10,0	15,92	
	2,0 × I_N	45,0	14	8,5/18,4	20,3	17,61	
RV3	0,5 × I_N	21,7	12	8,4/18,6	5,00	15,19	
	I_N	29,1	9	8,5/18,4	10,1	16,08	
	2,0 × I_N	45,0	15	8,5/18,4	20,10	17,78	

		oscilloscope settings		
		sampling division	input	attenuation
		μs	V_{dv}	
current	0,5 I_N	5	0,5	20:5
	I_N		0,5	50:5
	2 I_N		1,0	50:5
voltage	0,5 I_N		1,0	20:5
	I_N		1,0	20:5
	2 I_N		1,0	20:5

ВЯРНО С ОРИГИНАЛА



Switching impulse residual voltage test.

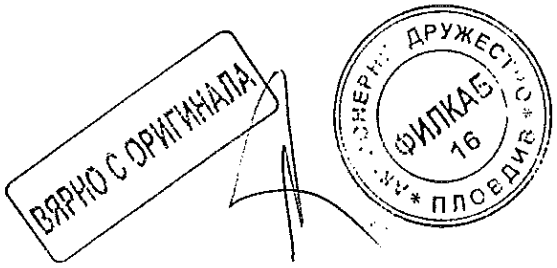
test object: Polymer housed metal-oxide surge arrester section

test circuit: A014A

date: April 27, 2004

sample	requested current	charging voltage	oscillogram	current waveshape	discharge current	residual voltage	switching impulse protection level
no.	A	kV	no.	μs	A	kV	kV
RV1	125	12,7	16	32,0/82,0	123	12,12	12,84
	500	15,2	19	34,0/79,0	500	12,73	
RV2	125	12,7	17	32,0/82,0	129	12,12	
	500	15,2	20	34,0/79,0	510	12,73	
RV3	125	12,7	18	32,0/82,0	128	12,20	
	500	15,2	21	34,0/79,0	496	12,84	

	oscilloscope settings		
	sampling division	input	attenuation
	μs	V_{div}	
current	20	0,5	5:5 (125 A) - 20:5 (500 A)
voltage	20	0,7	20:5



Steep current impulse residual voltage test.
measurement of the inductive error

test object: Tets sample replaced by an aluminium blocks have same dimension as the test sampled
test circuit: A014B

date: April 30, 2004

sample	charging voltage	oscillogram	current waveshape	discharge current	peak voltage	inductive error
	kV	no.	μs	kA	V	
Aluminium blocks	32,7	22	0,97/2,11	10,0	1210	2% ÷ 20% (1)

	oscilloscope settings		
	sampling division	input	attenuation
	μs	V_{div}	
current	1	2,0	x 10
voltage	1	1,0	/

(1) = correction is required.

ВЯРНО С ОРИГ.

АКЦИОНЕРНО ДРУЖЕСТВО ФИЛКАБ 16 ПЛОВДИВ

Steep current impulse residual voltage test.

test object: Polymer housed metal-oxide surge arrester section
test circuit: A014B

date: April 30, 2004

sample	charging voltage	oscillogram	current waveshape	discharge current	residual voltage	steep current impulse protection level
no.	kV	no.	µs	kA	kV	kV
RV1	32,6	23	0,97/2,1	9,95	16,64	16,72
RV2	32,8	24		10,0	16,64	
RV3	33,2	25		9,95	16,72	

	oscilloscope settings		
	sampling division	input	attenuation
	µs	V_{dv}	
wave 1 - current	1,0	2,0	x 10
wave 2 - voltage		5,0	/
wave M2 - corrected voltage		4,0	/

Power frequency voltage-current characteristics after test.

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

date: April 30, 2004

sample no. RV2

oscill.	voltage	current	current	current	power	3rd harmonic amplitude
no.	kV	+ mA_{cr}	- mA_{cr}	mA_{rms}	W	μA
26	7,18	5,06	4,52	1,62	7,01	---
27	7,11	5,66	5,00	1,76	7,54	---

sample no. RV1

oscill.	voltage	current	current	current	power	3rd harmonic amplitude
no.	kV	+ mA_{cr}	- mA_{cr}	mA_{rms}	W	μA
28	6,97	5,06	4,70	1,65	7,08	---
29	6,97	5,48	5,06	1,75	7,63	---

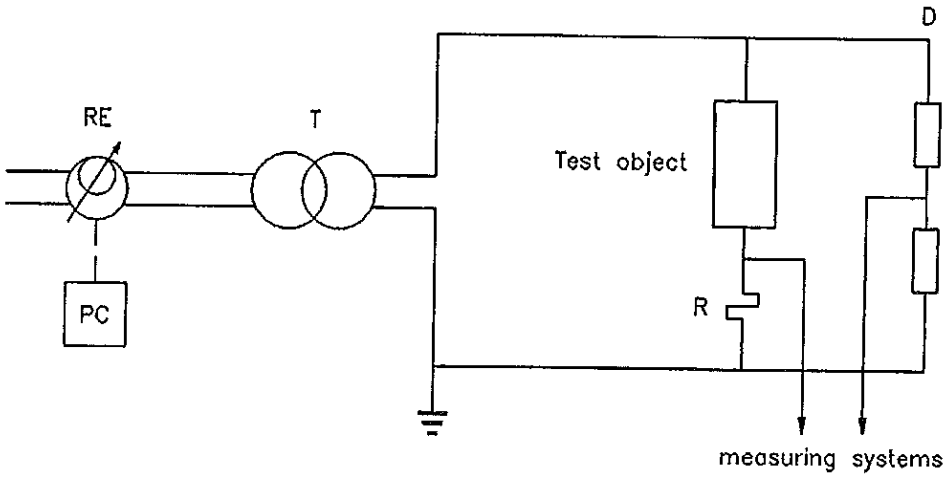
sample no. RV3

oscill.	voltage	current	current	current	power	3rd harmonic amplitude
no.	kV	+ mA_{cr}	- mA_{cr}	mA_{rms}	W	μA
30	7,04	5,12	4,70	1,65	7,29	---
31	7,18	5,36	5,12	1,76	7,75	---

ВЯРНО С ОРИГИНАЛА

АКЦИОНЕРНО ДРУЖЕСТВО ФИЛКАБ 16 ПЛОВДИВ

circuit A019



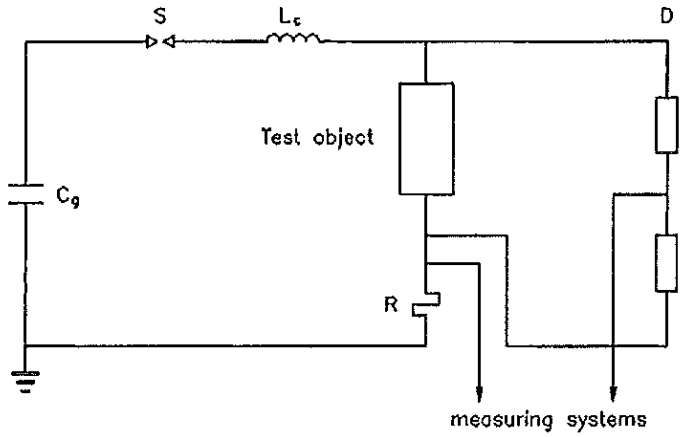
power frequency supply

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. 30223-30224
type Data Precision DATA 6100

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

circuit A014



impulse generator

plant P177
no. of stages 1
C_g 4,98 μF
L_c 10 μH
S spark gap

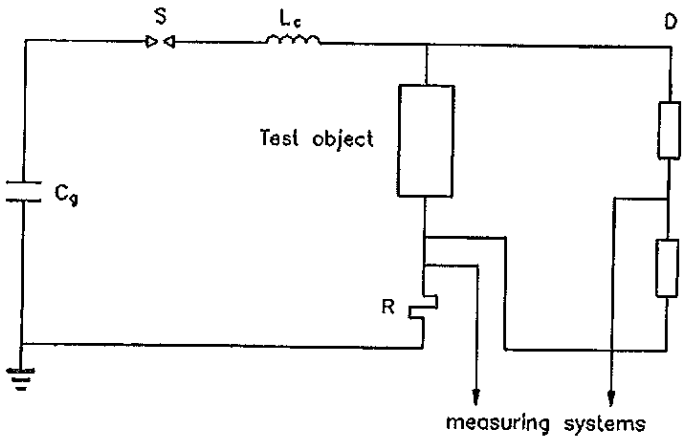
current shunt (R) CESI no. 6042; R = 0,002Ω ; 100 kA
electro optical system CESI no. 11517/518
oscilloscope CESI no. 13217
type Tektronix TDS 540A

voltage divider (D) CESI no.11120 ; k = 1010
electro optical system CESI no.11519/520
oscilloscope CESI no. 13217
type Tektronix TDS 540A

ВЯРНО С ОРИГИНАЛА

АКЦИОНЕРНО ДРУЖЕСТВО ФИЛКАБ 16 ПЛОВДИВ

circuit A014A



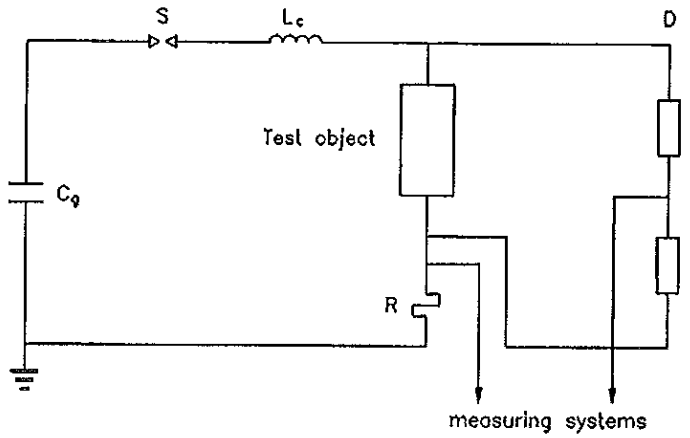
Impulse generator

plant P177
no. of stages 1
C_g 6,64 μF
L_c 100 μH
S spark gap

current shunt (R) CESI no. 6039 ; R = 0,02Ω ; 10 kA
electro optical system CESI no. 11517/518
oscilloscope CESI no. 13217
type Tektronix TDS 540A

voltage divider (D) CESI no.11120 ; k = 1010
electro optical system CESI no.11519/520
oscilloscope CESI no. 13217
type Tektronix TDS 540A

circuit A014B



Impulse generator

plant P177
no. of stages 1
C_g 0,25 μF
L_c 1 μH
S spark gap

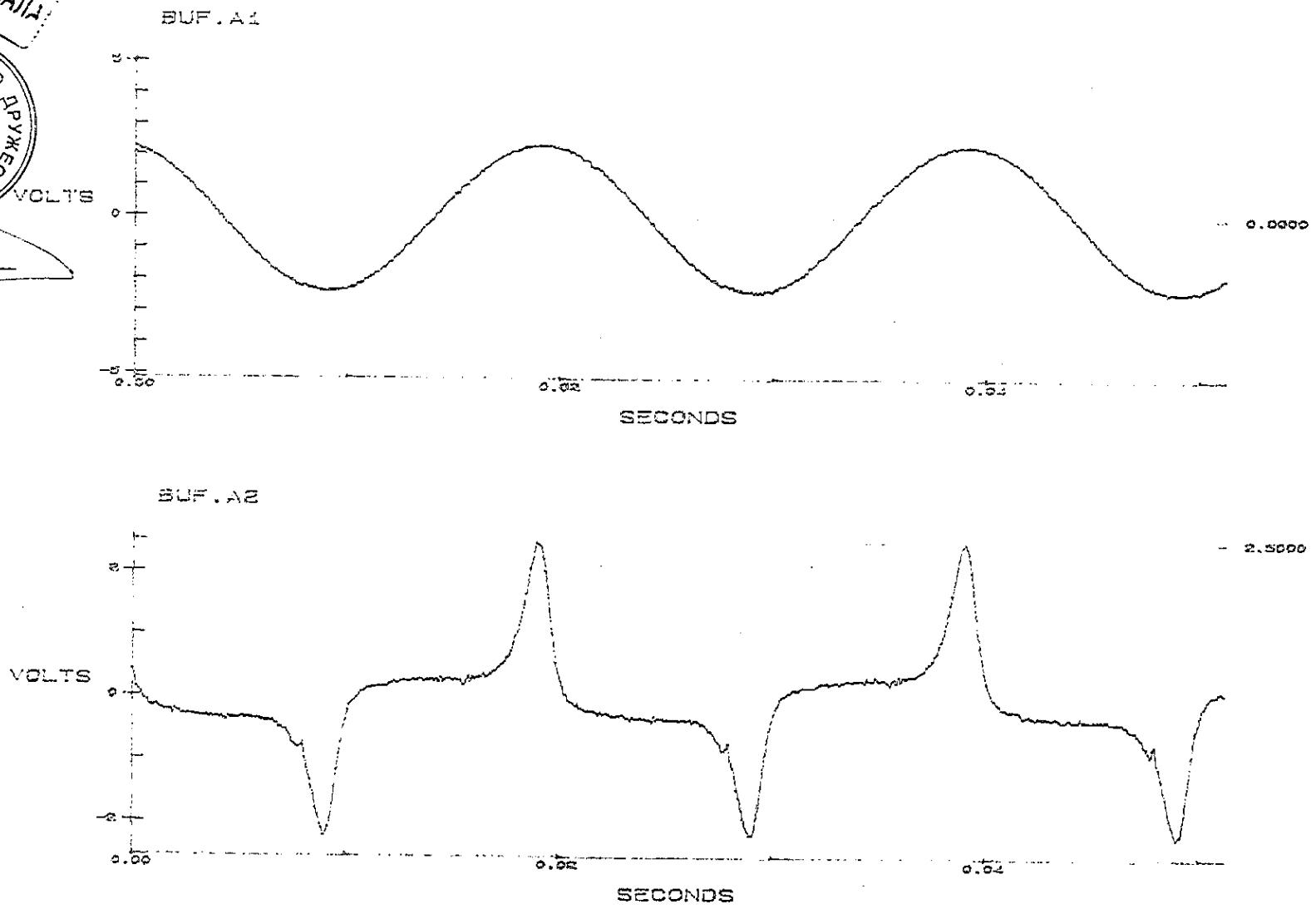
current TA (R) type Pearson CESI no.8250 ; 0,01 V x A
oscilloscope CESI no. 11873
type Tektronix TDS 540A

voltage divider (D) CESI no.11120 ; k = 1010
oscilloscope CESI no. 11873
type Tektronix TDS 540A

ВЯРНО С ОРИГИНАЛА

АКЦИОНЕРНО ДРУЖЕСТВО * ПЛОВДИВ * ФИЛКАБ 16

CESI TEST A4/011666 oscillogram n. 1



Original issue 03-2005

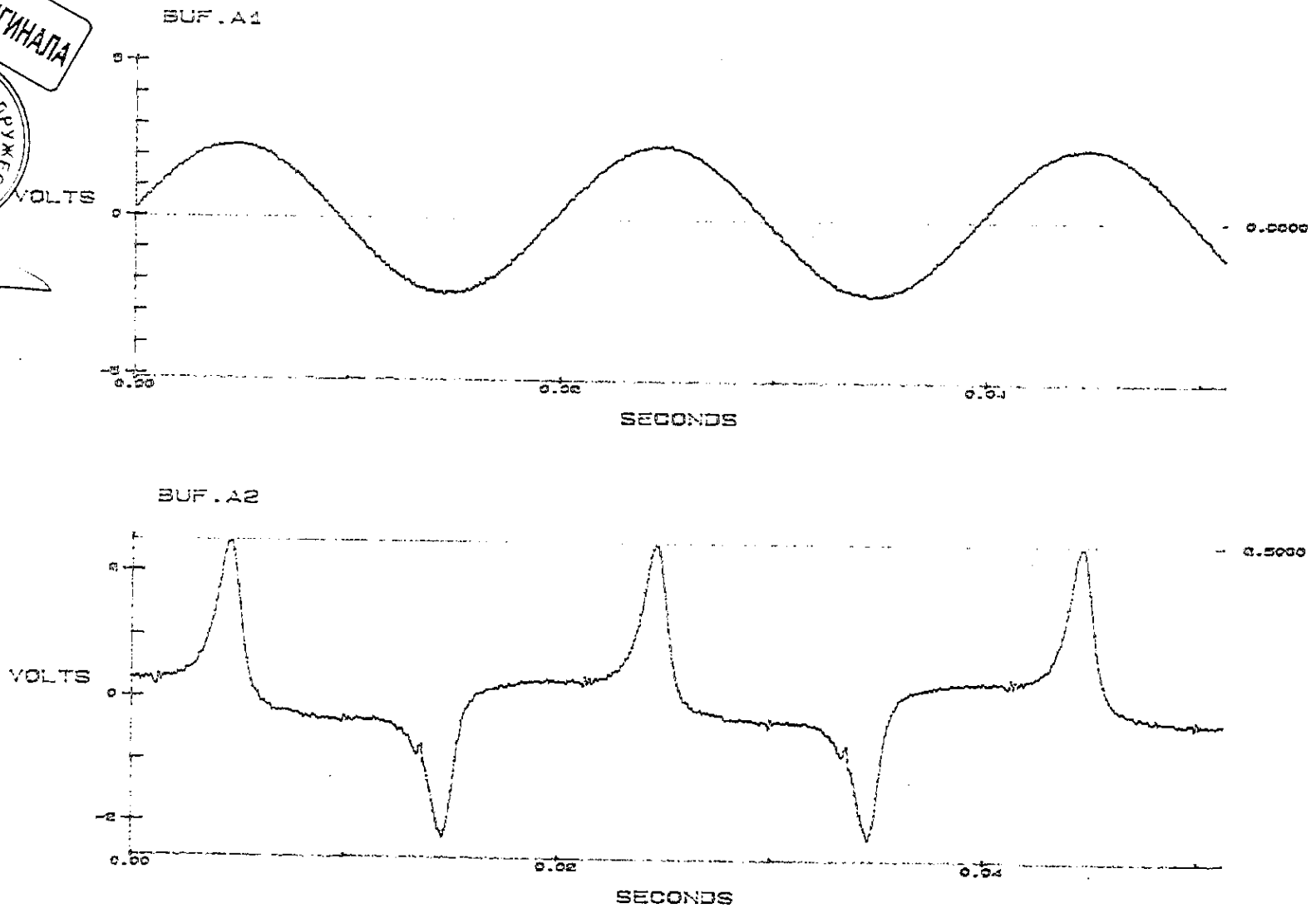
Top confidential

CESI TEST A4/011666 oscillogram n. 2

ВЯРНО С ОРИГИНАЛА

АКЦИОНЕРНО ДРУЖЕСТВО ФИЛКАБ 16 ПЛОВДИВ

CES TEST A4/011666 oscillogram n. 3

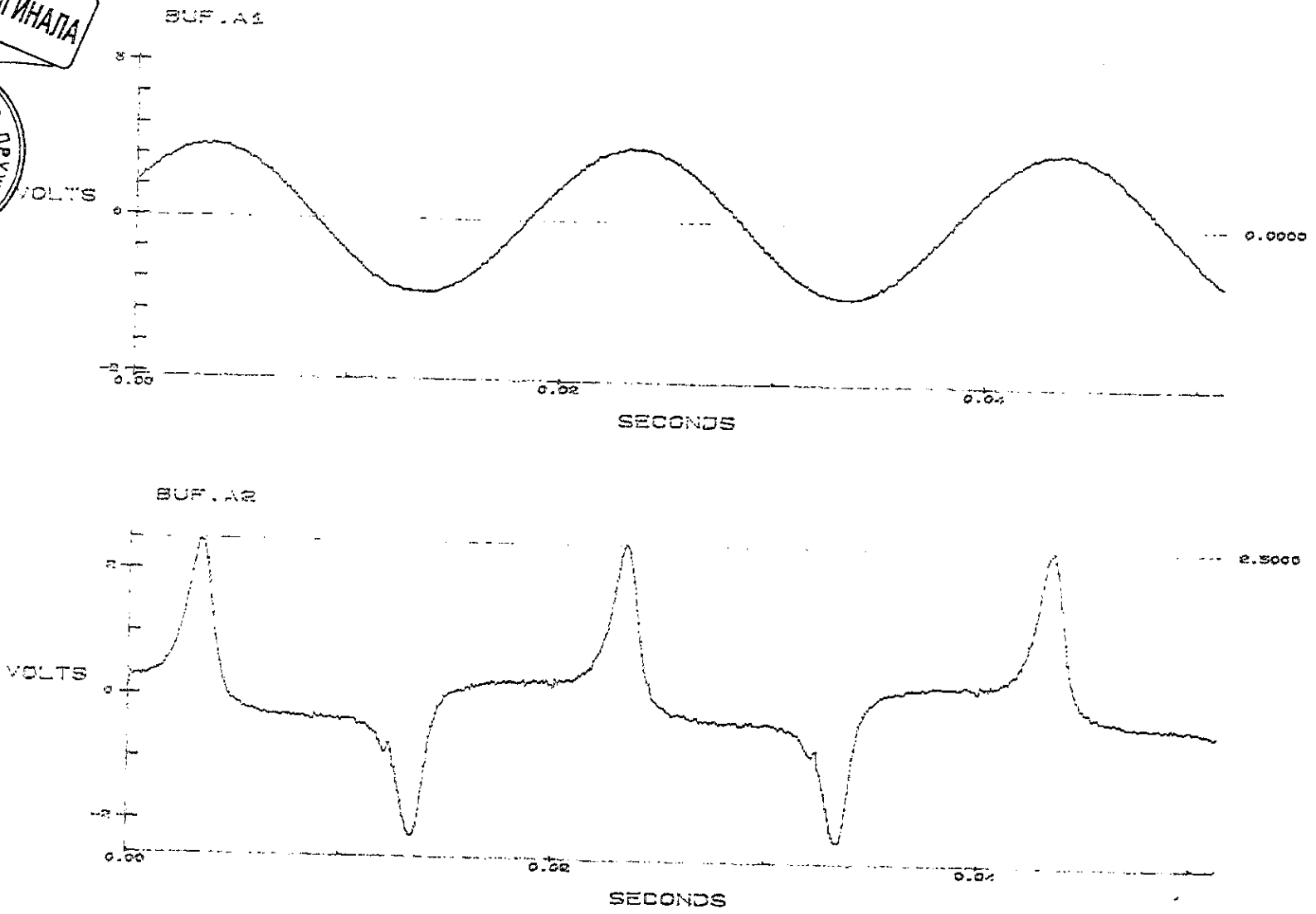


CESI TEST A4/011666 oscillogram n. 4

ВЯРНО С ОРИГИНАЛА

АКЦИОНЕРНО ДРУЖЕСТВО * ФИЛКАБ 16 * ПЛОВДИВ *

CESI TEST A4/011666 oscillogram n. 5



Original Issue 03-2003

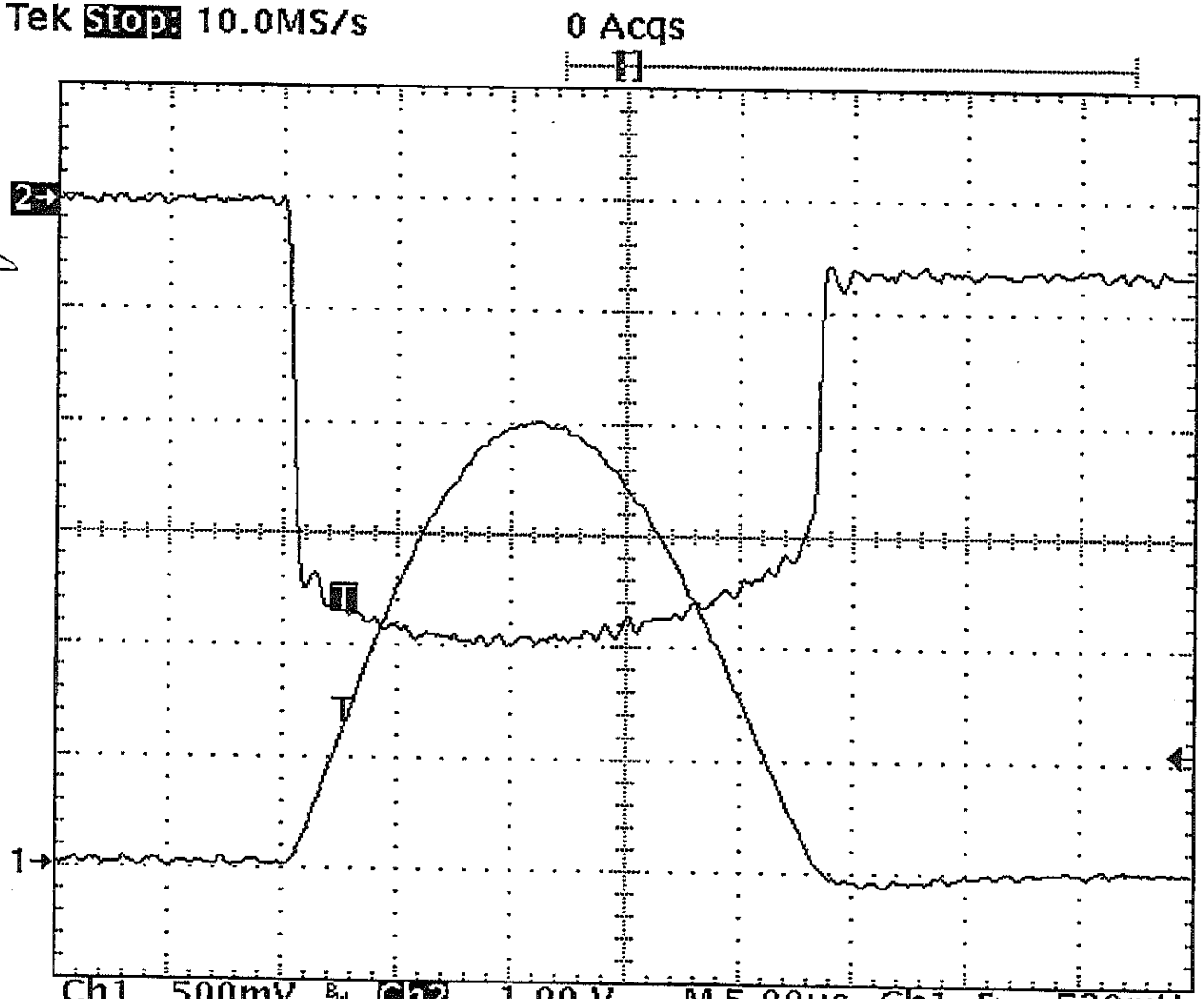
Type confidential

CESI TEST A4/011666 oscillogram n. 6

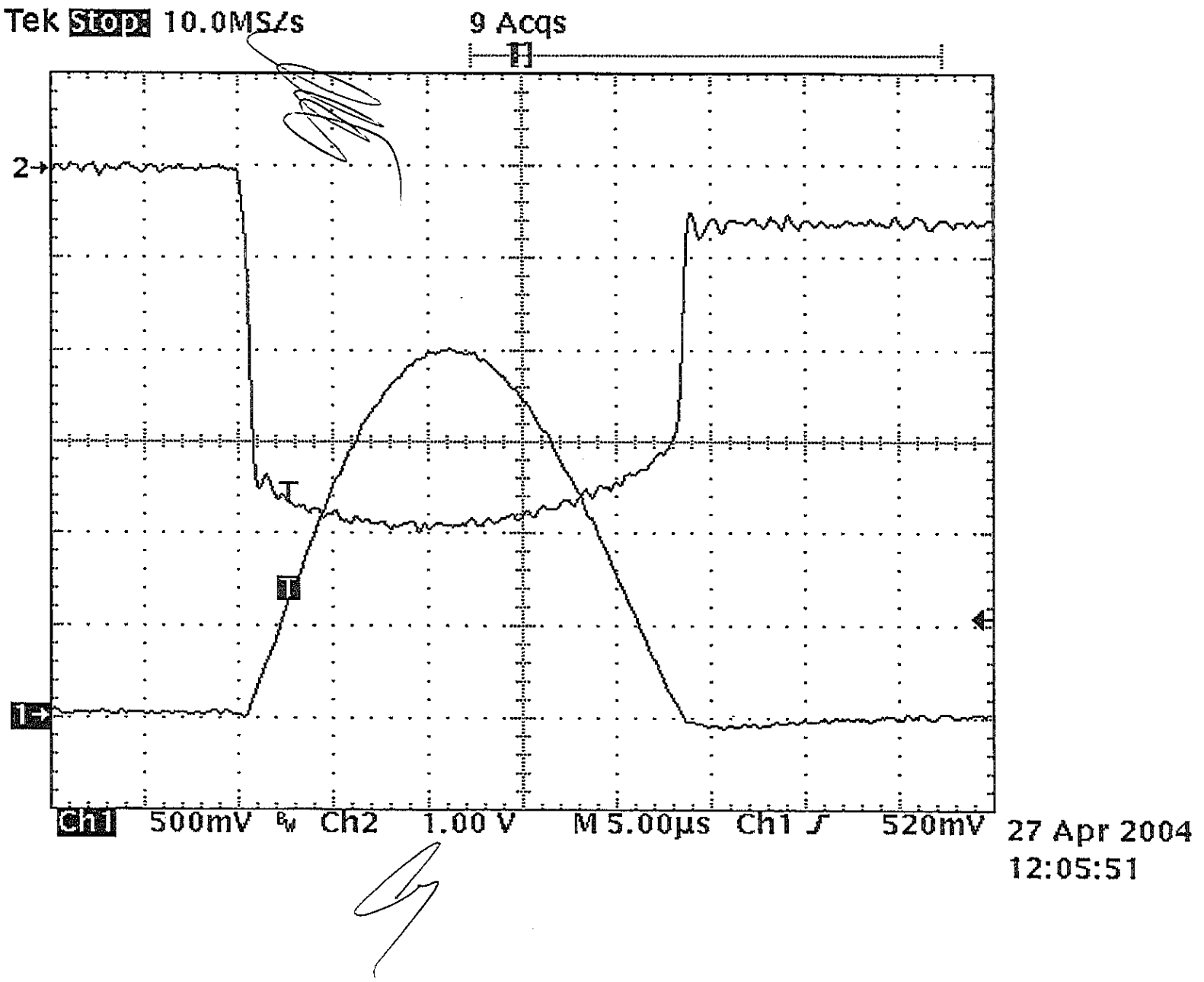
ВЯРНО С ОРИГИНАЛА

АКЦИОНЕРНО ДРУЖЕСТВО ФИЛКАБ 16 ПЛОВДИВ

CESI TEST A4/011666 oscillogram n. 7

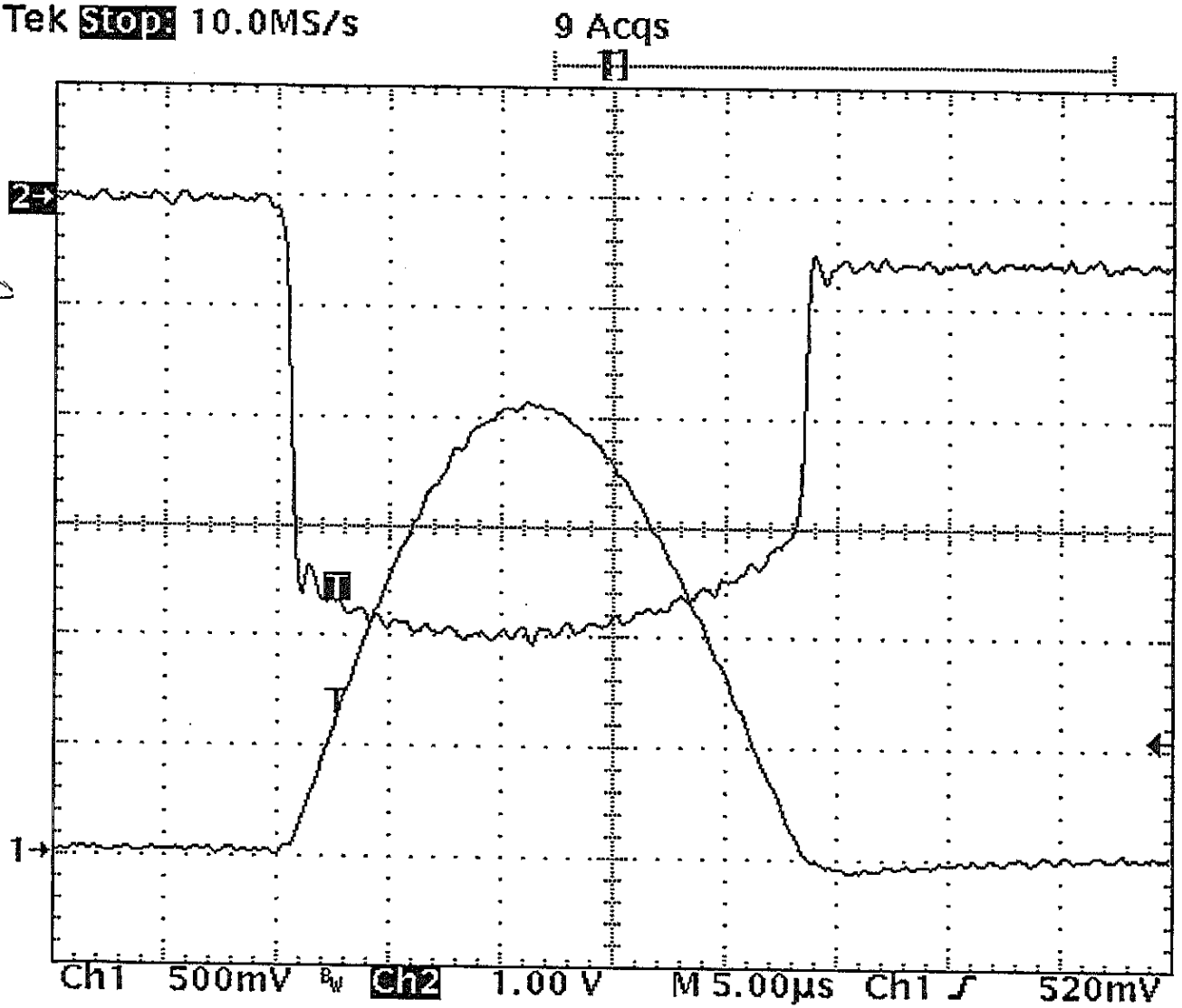


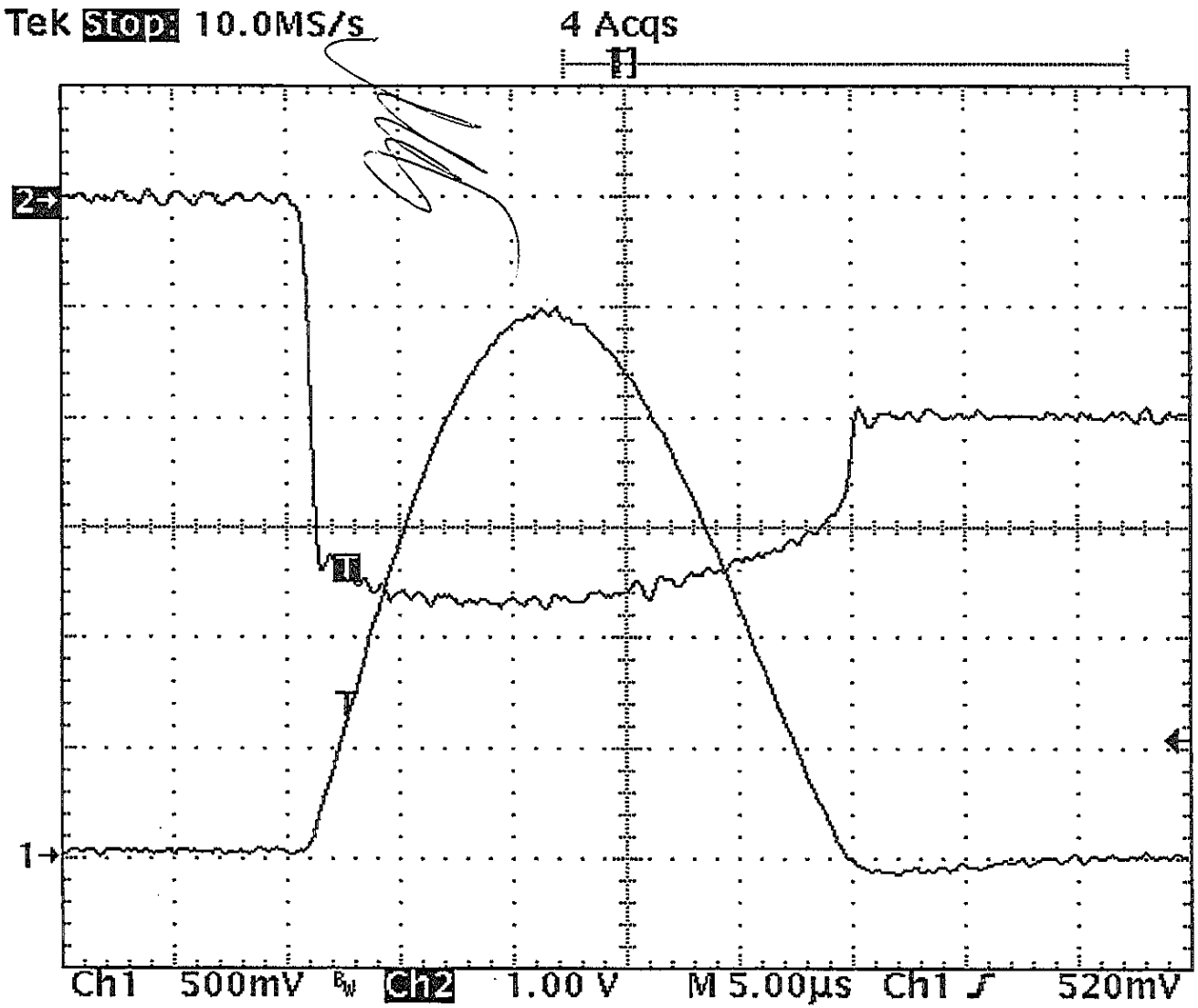
27 Apr 2004
11:59:18



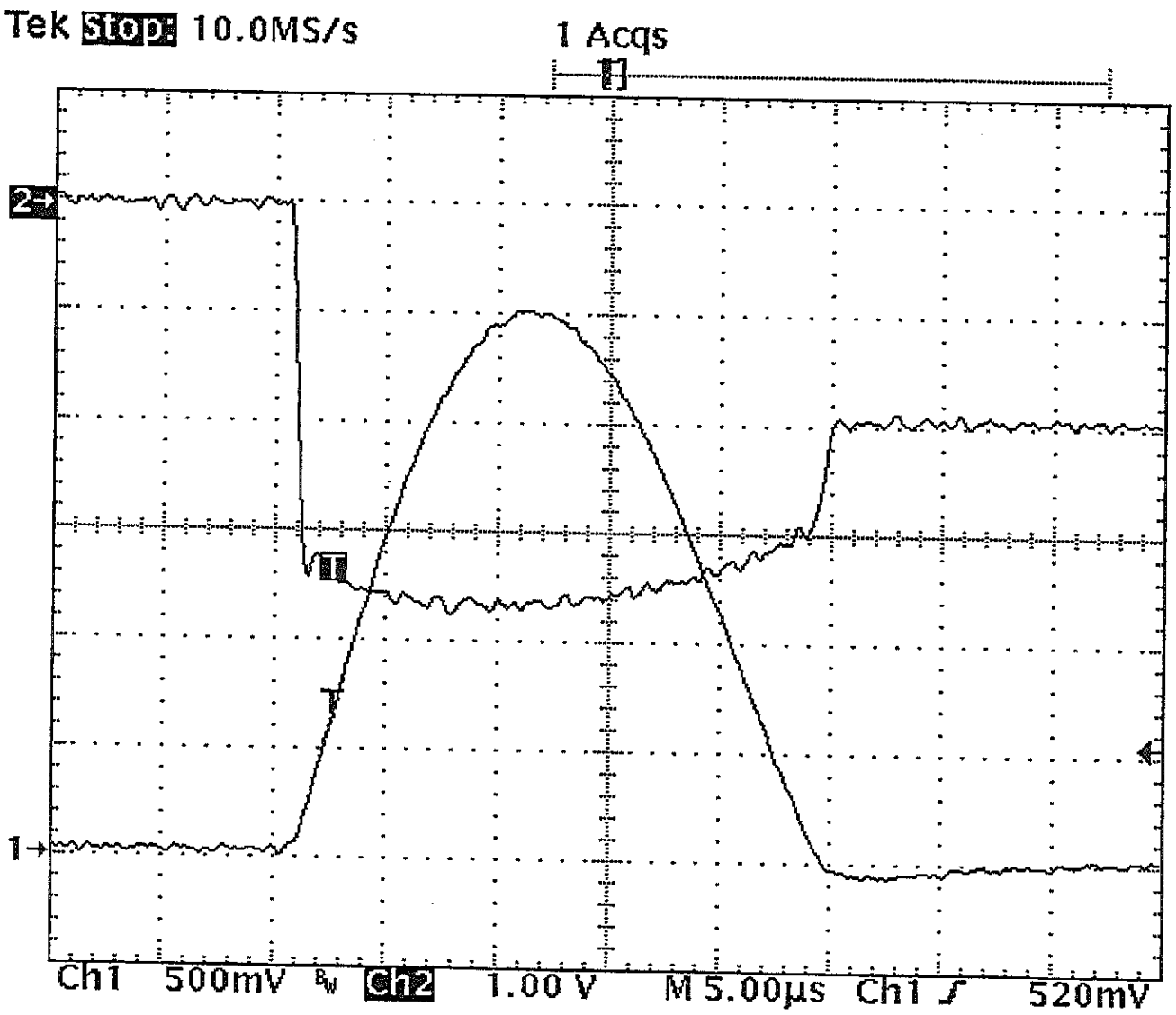
CESI TEST A4/011666 oscillogram n. 8

CESI TEST A4/011666 oscillogram n. 9





CESI TEST A4/011666 oscillogram n. 10



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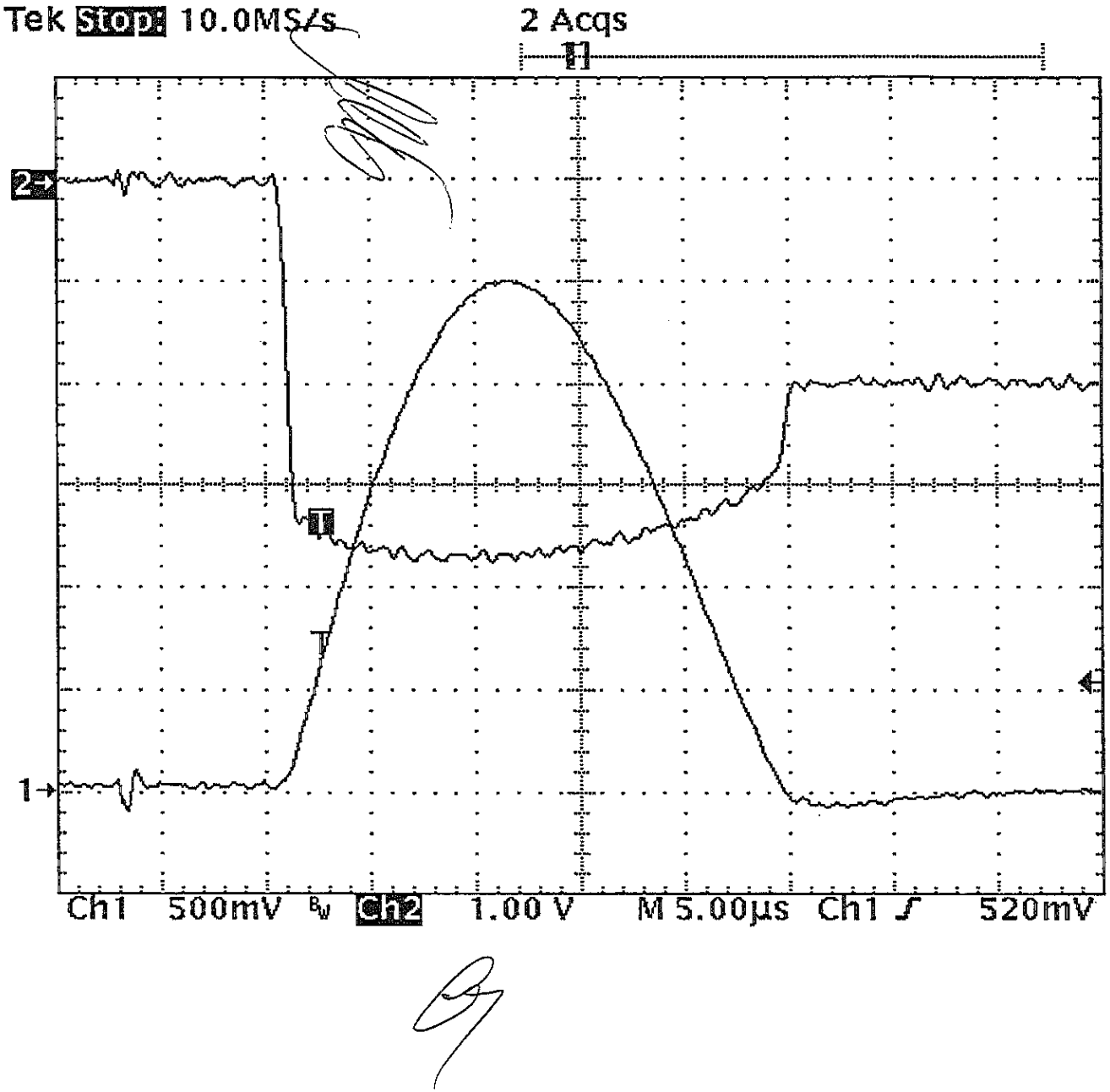
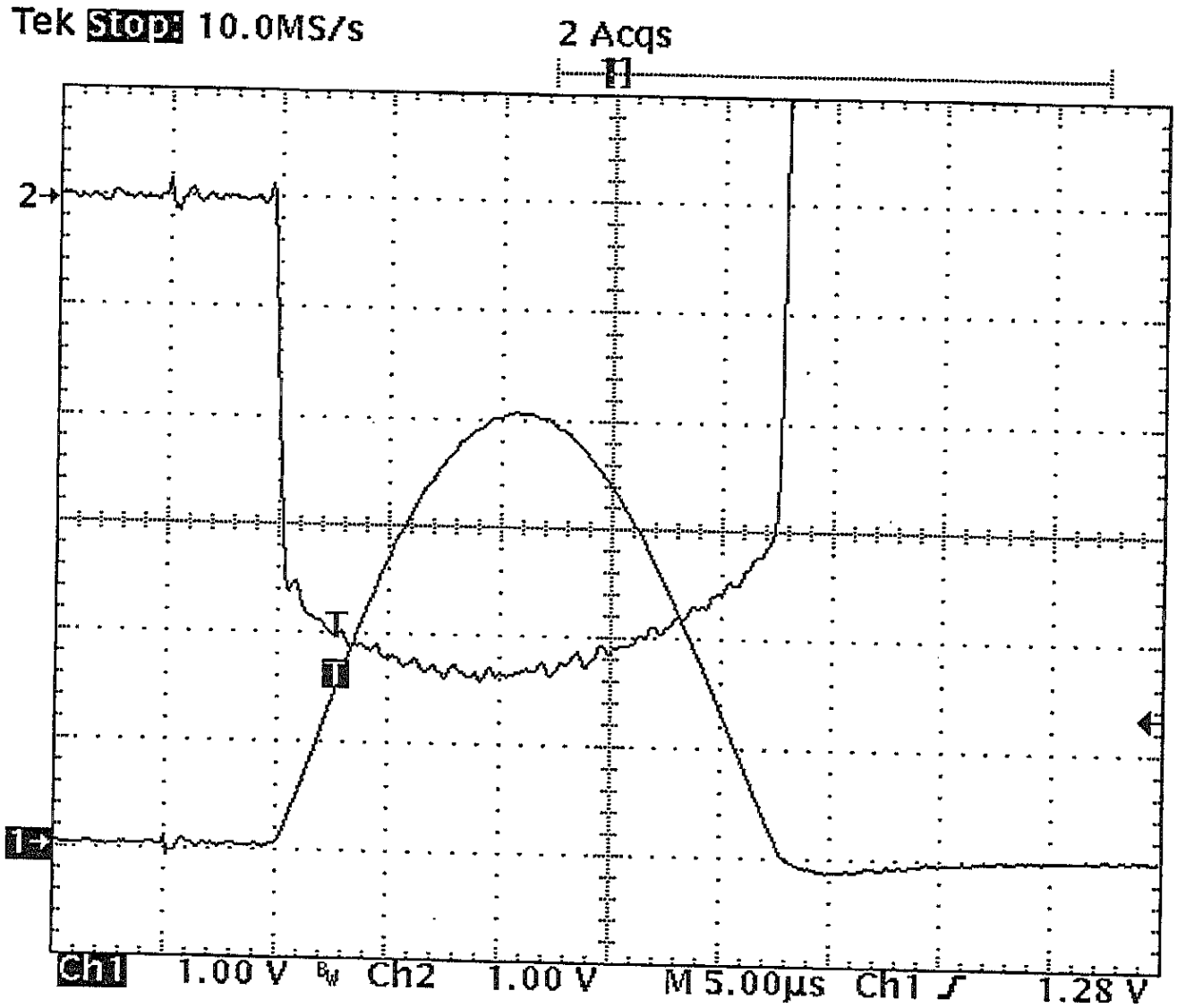


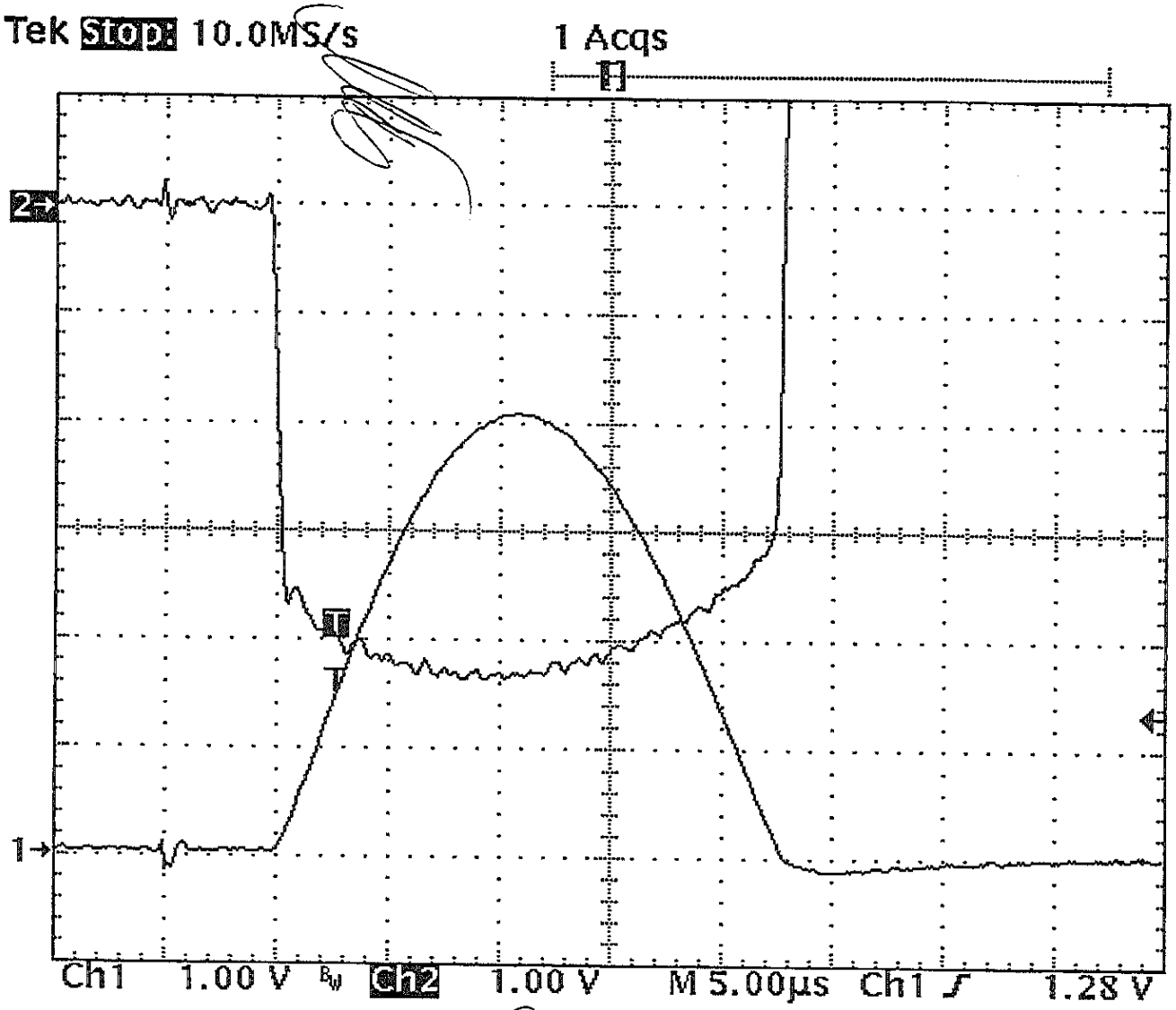
CESI TEST A4/011666 oscillogram n. 12

ВЯРНО С ОРИГИНАЛА

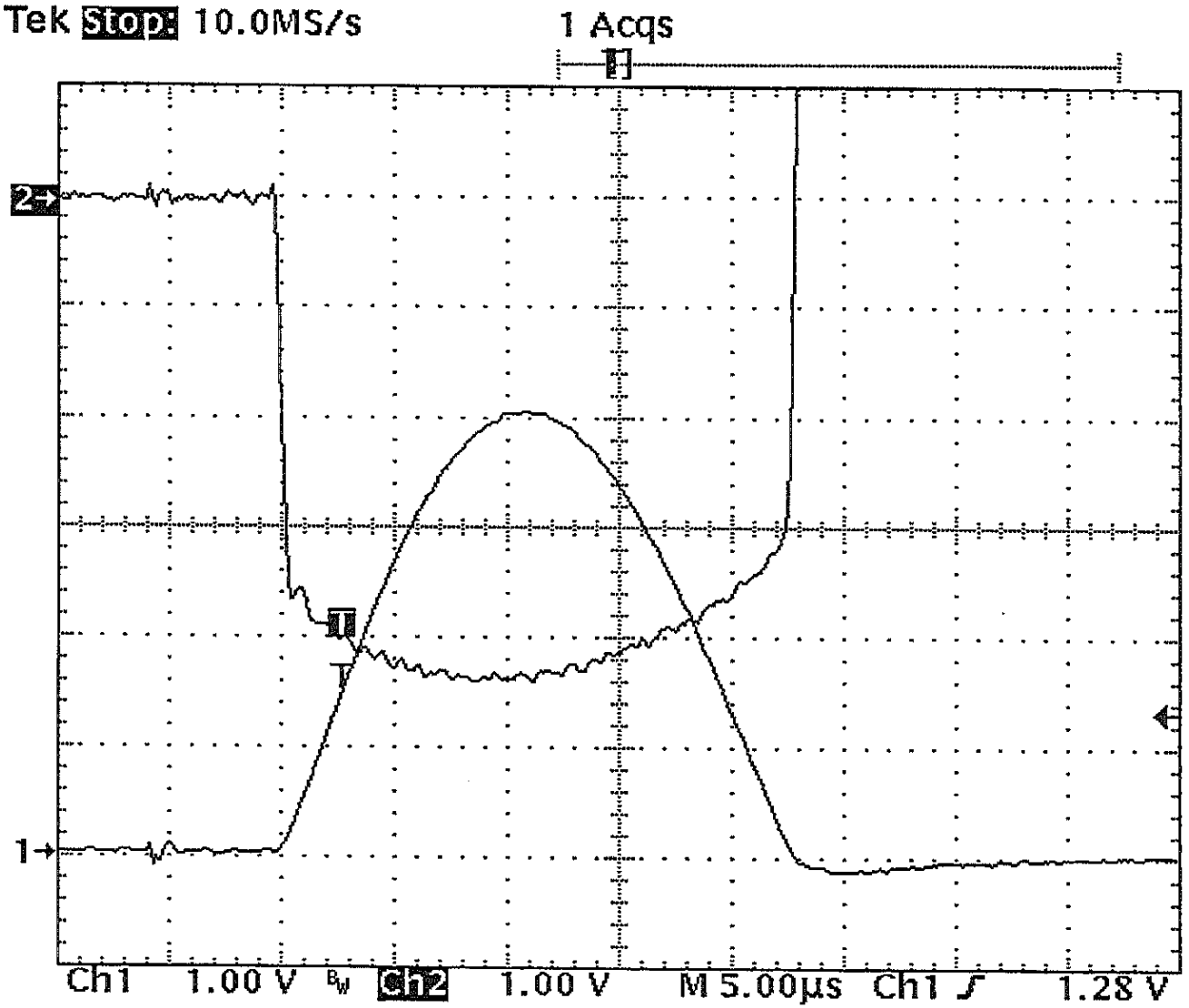
ФИЛКАБ АД ВИДИН АКЦИОНЕРНО ДРУЖЕСТВО 16



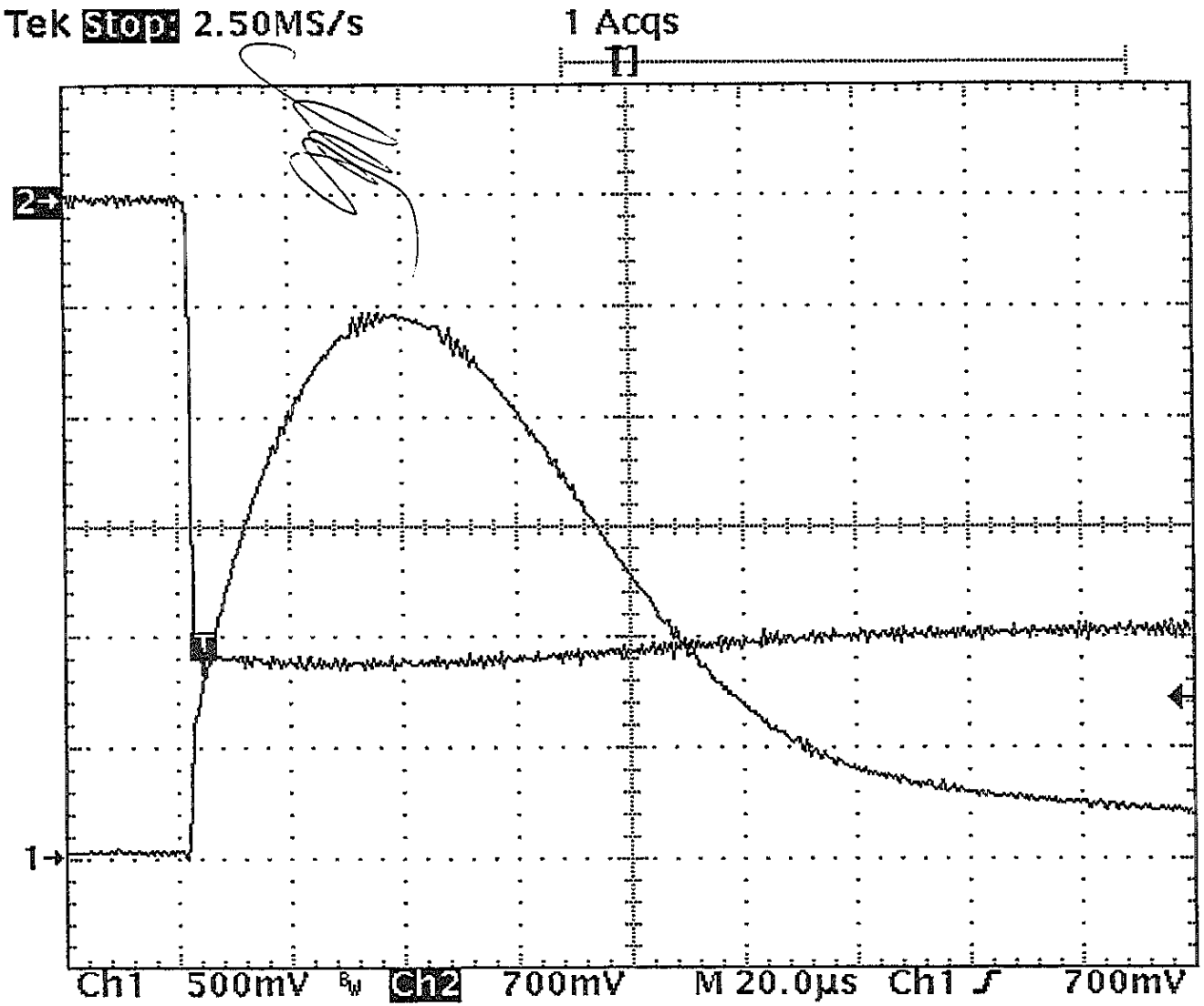
CESI TEST A4/011666 oscillogram n. 13



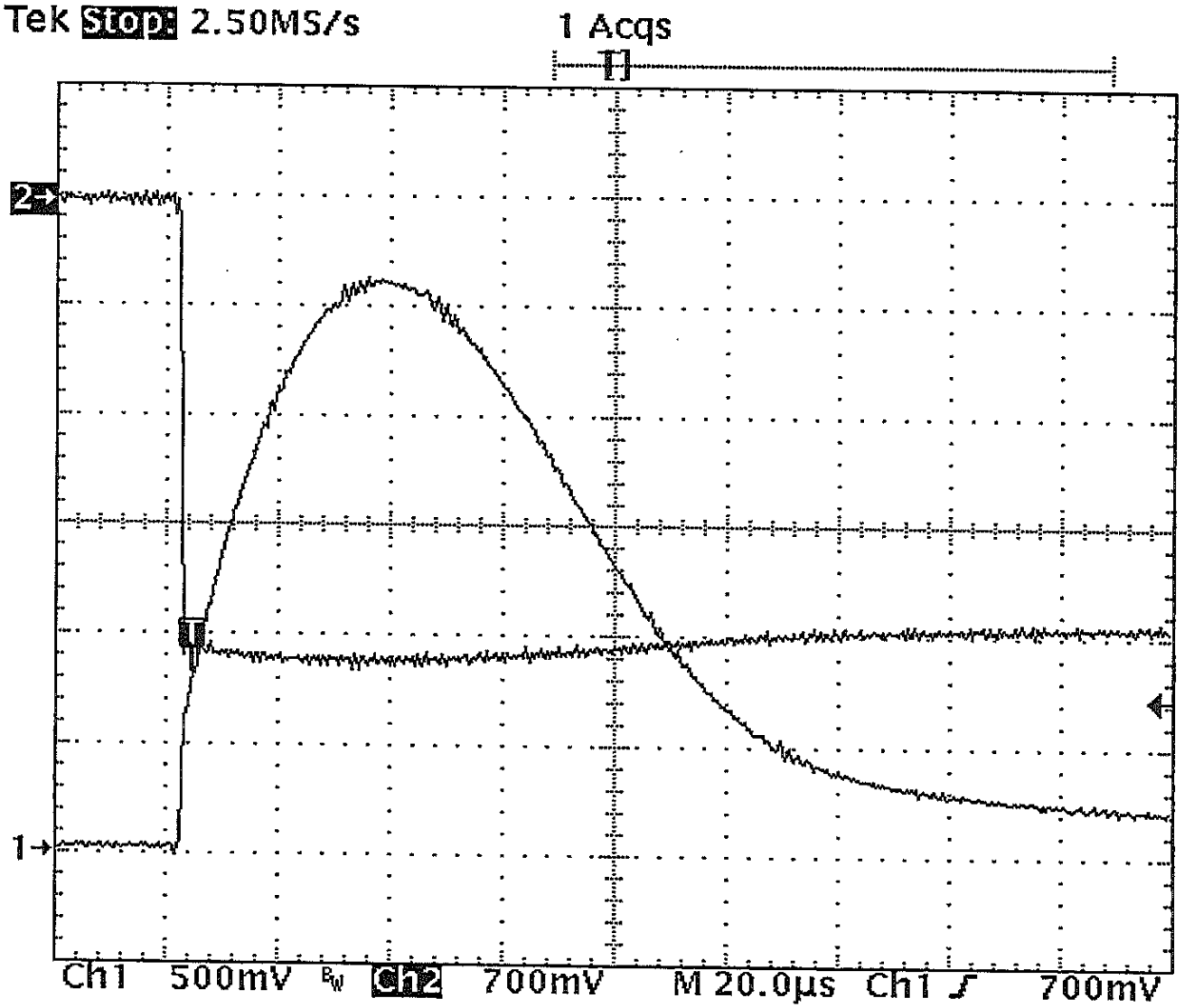
CESI TEST A4/011666 oscillogram n. 14



CESI TEST A4/011666 oscillogram n. 15



CESI TEST A4/011666 oscillogram n. 16

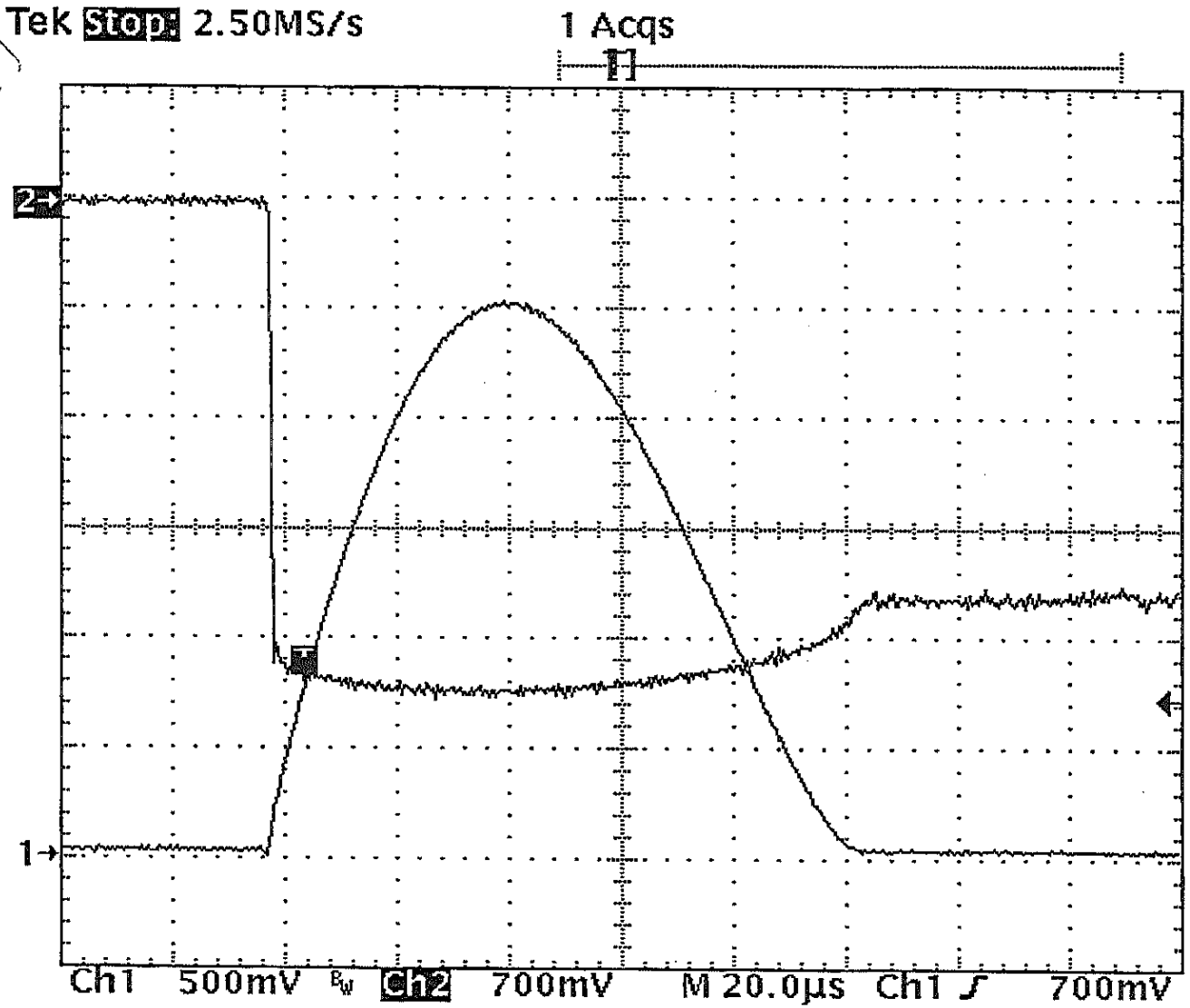


CESI TEST A4/011666 oscillogram n. 17

CESI TEST A4/011666 oscillogram n. 18

ВЯРНО С ОРИГИНАЛА

ИНЖЕНЕРНО ДРУЖЕСТВО ФИЛКАБ 16 ПЛОВДИВ



CESI TEST A4/011666 oscillogram n. 19

Original issue 03-2005

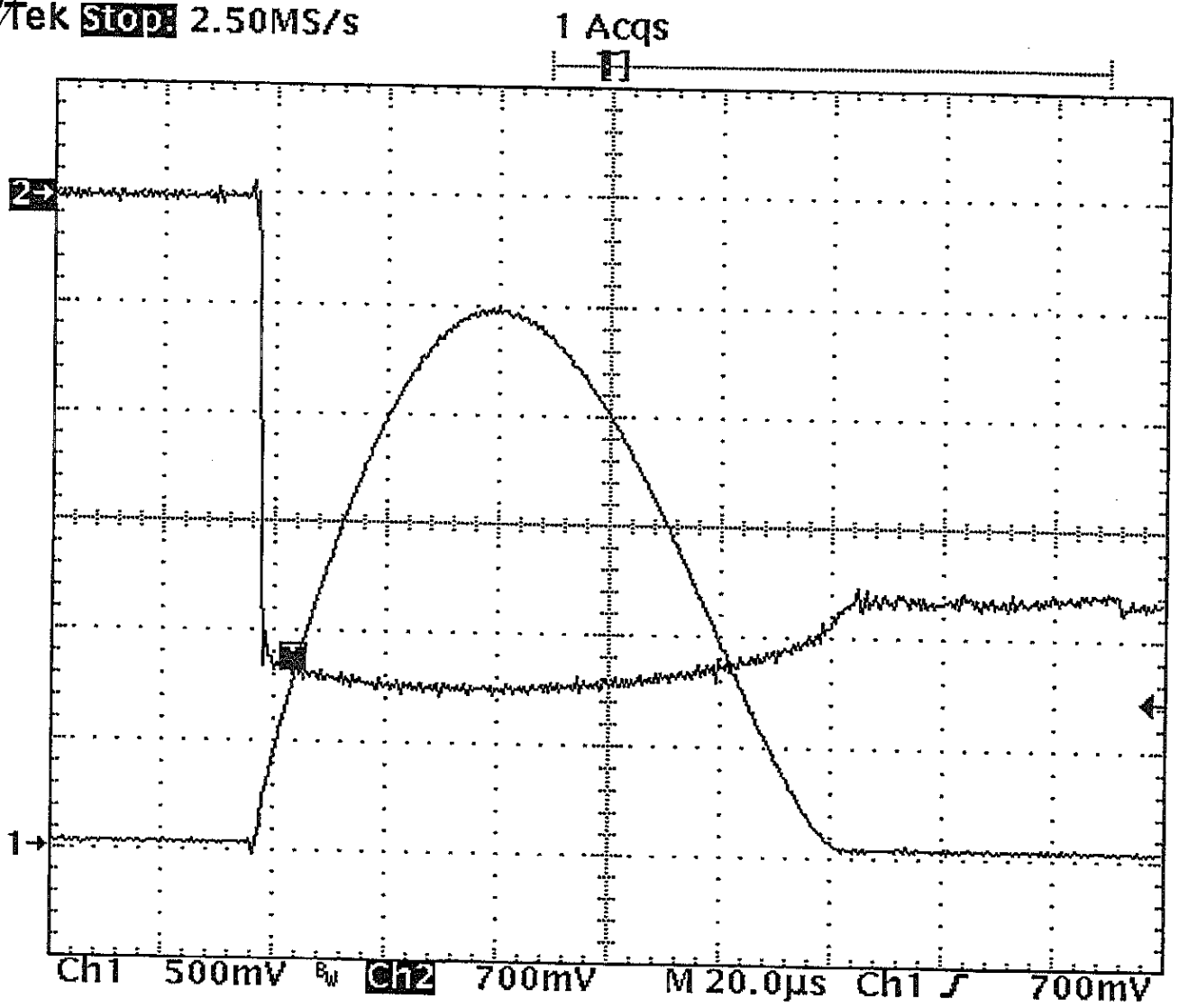
Data confidential

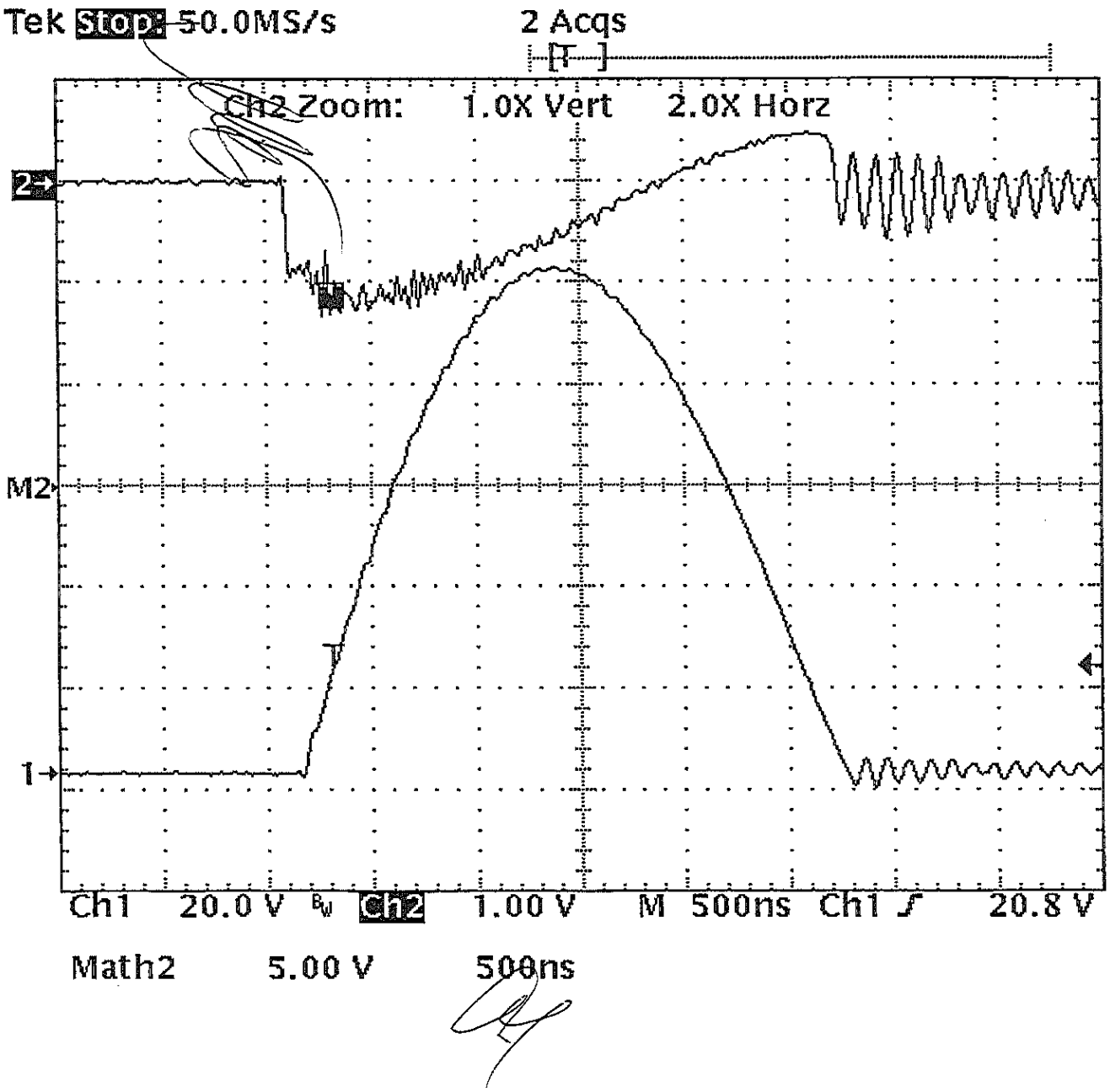
CESI TEST A4/011666 oscillogram n. 20

ВЯРНО С ОРИГИНАЛА

АКЦИОНЕРНО ДРУЖЕСТВО * ПЛОВДИВ * ФИЛКАБ 16

CESI TEST A4/011666 oscillogram n. 21



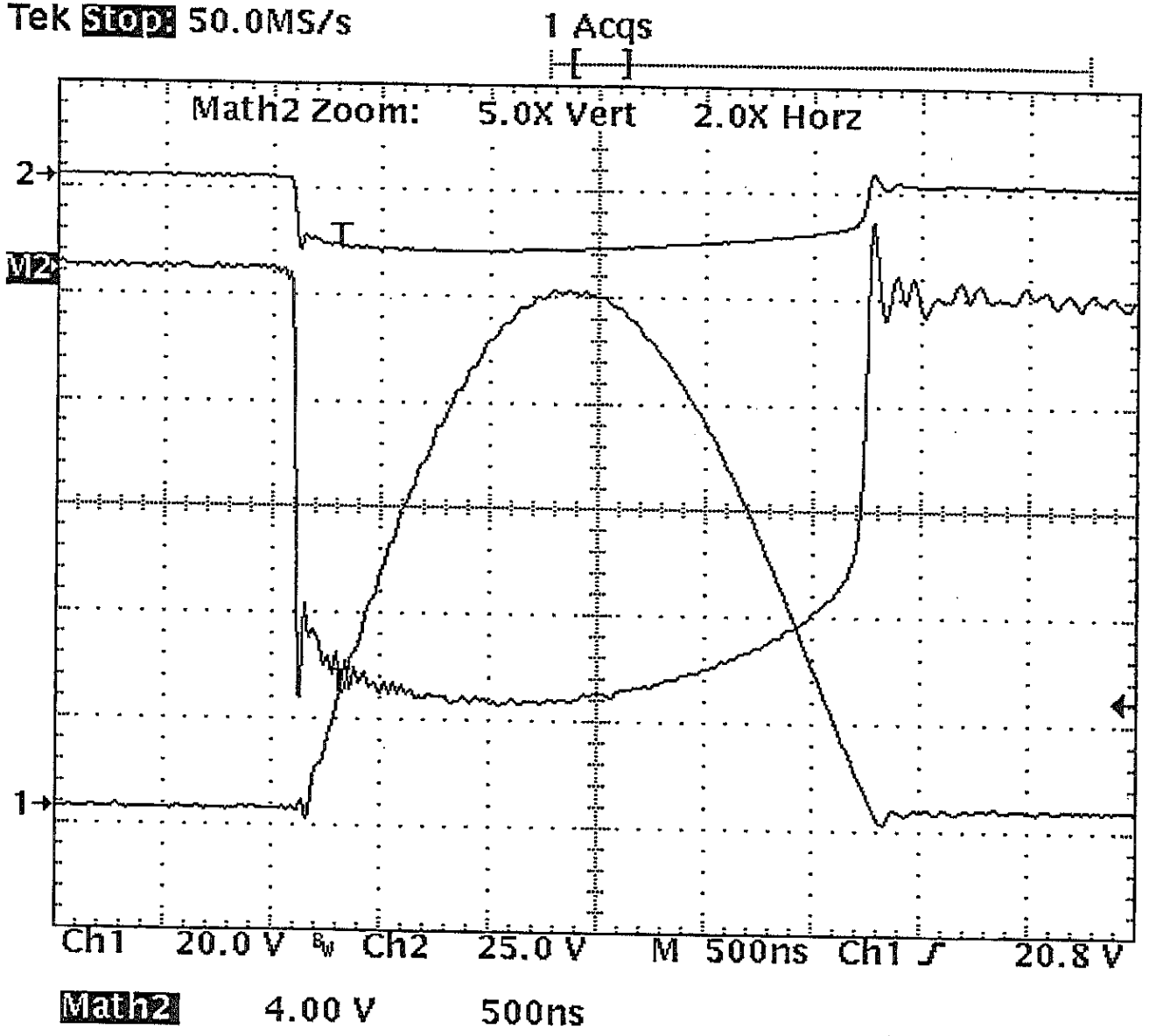


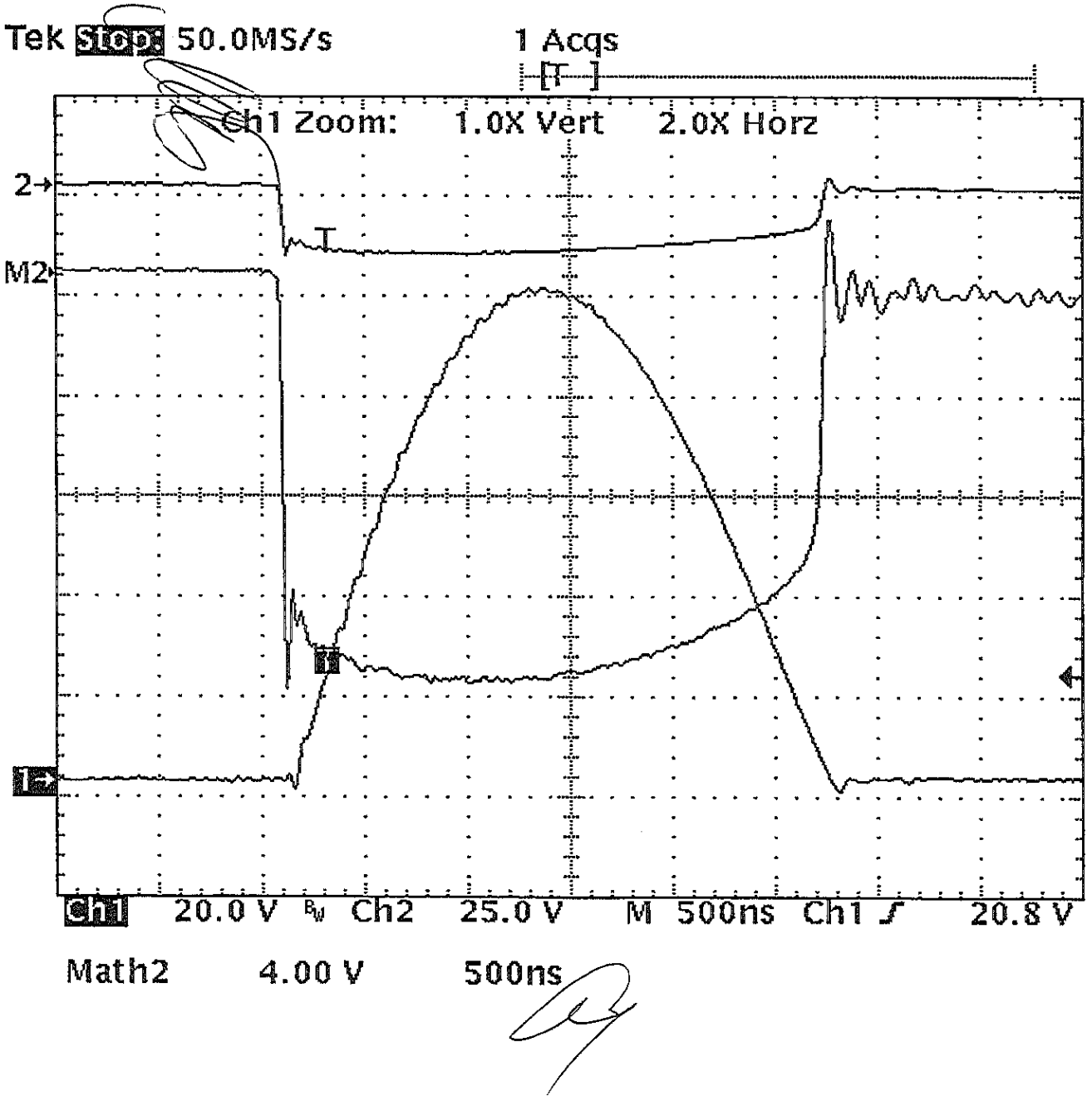
CESI TEST A4/011666 oscillogram n. 22

ВЯРНО С ОРИГИНАЛА

АКЦИОНЕРНО ДРУЖЕСТВО * ПЛОВДИВ * ФИЛКАБ 16

CESI TEST A4/011666 oscillogram n. 23

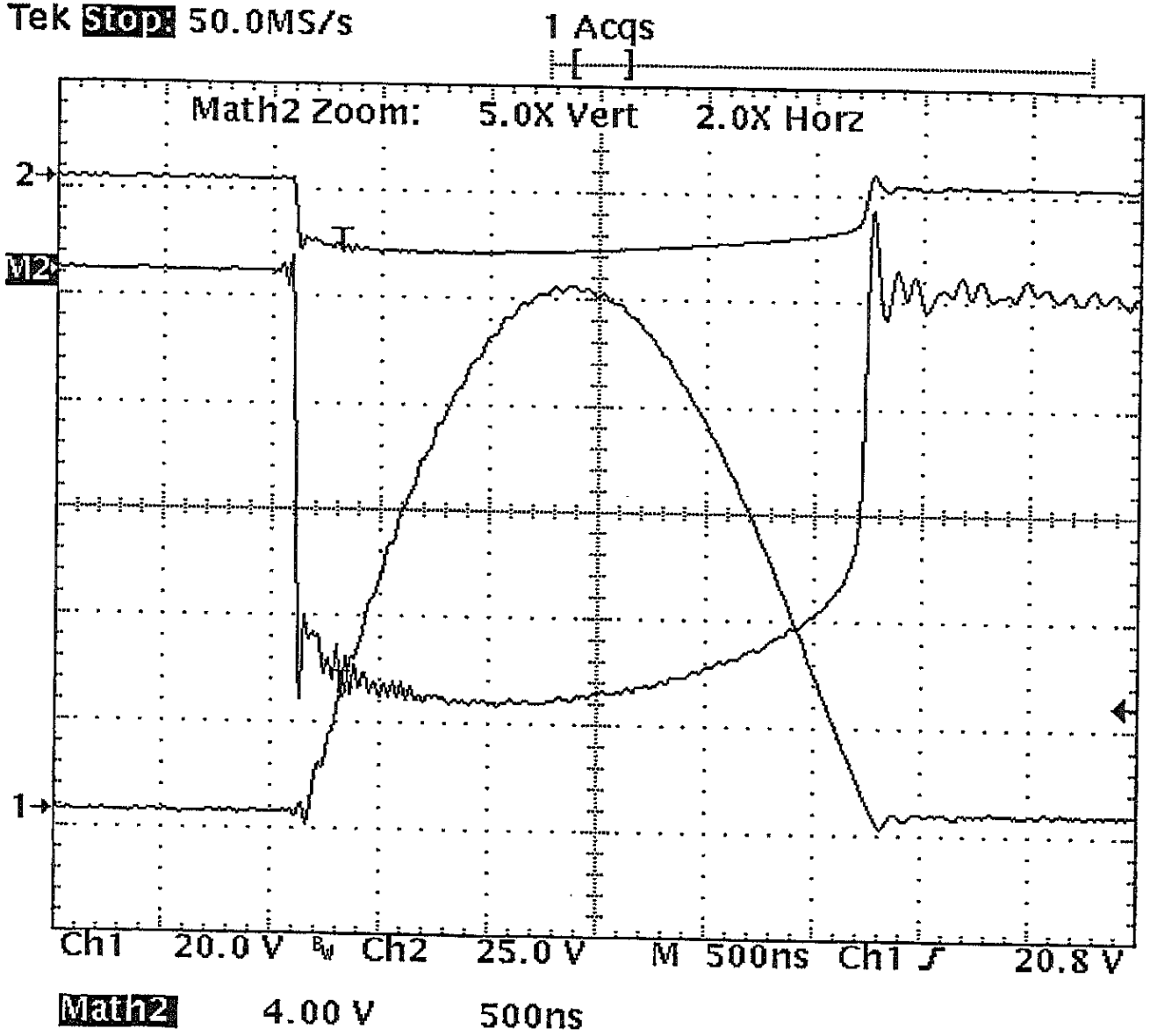




CESI TEST A4/011666 oscillogram n. 24

ВЯРНО С ОРИГИНАЛА

АКЦИОНЕРНО ДРУЖЕСТВО ФИЛКАБ 16 ПЛОВДИВ



CESI TEST A4/011666 oscillogram n. 25

Original issue 03-2005

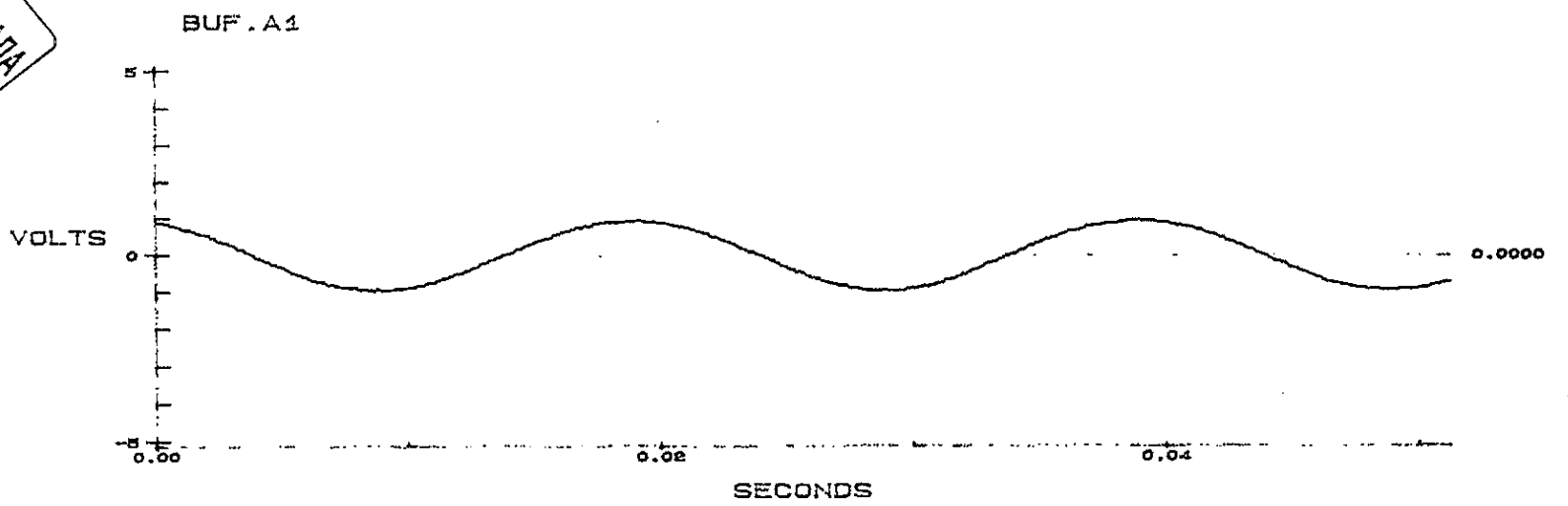
Type certificate

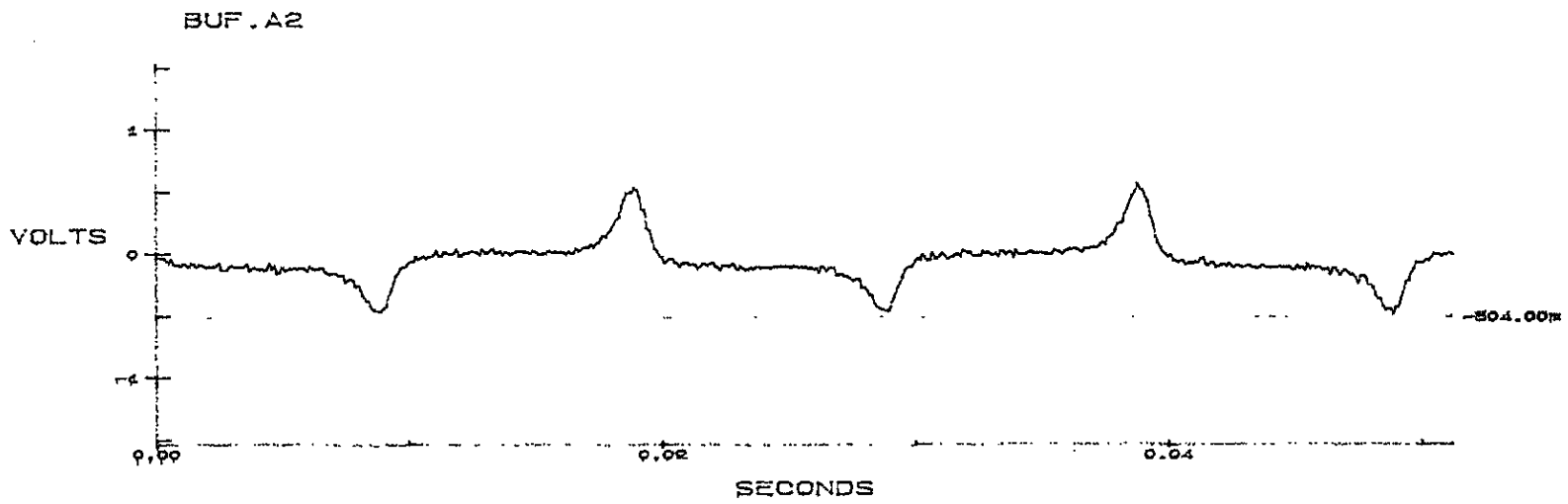
CESI TEST A4/011666 oscillogram n. 26

ВЯРНО С ОРИГИНАЛА

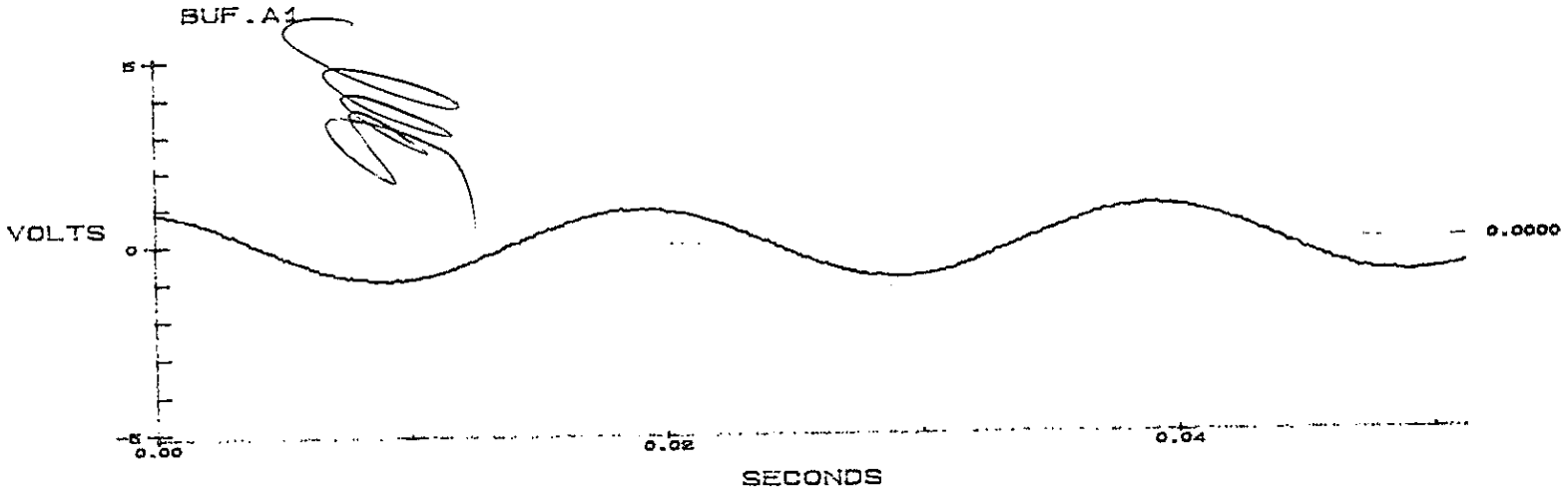
АКЦИОНЕРНО ДРУЖЕСТВО * ПЛОВДИВ * ФИЛКАБ 16

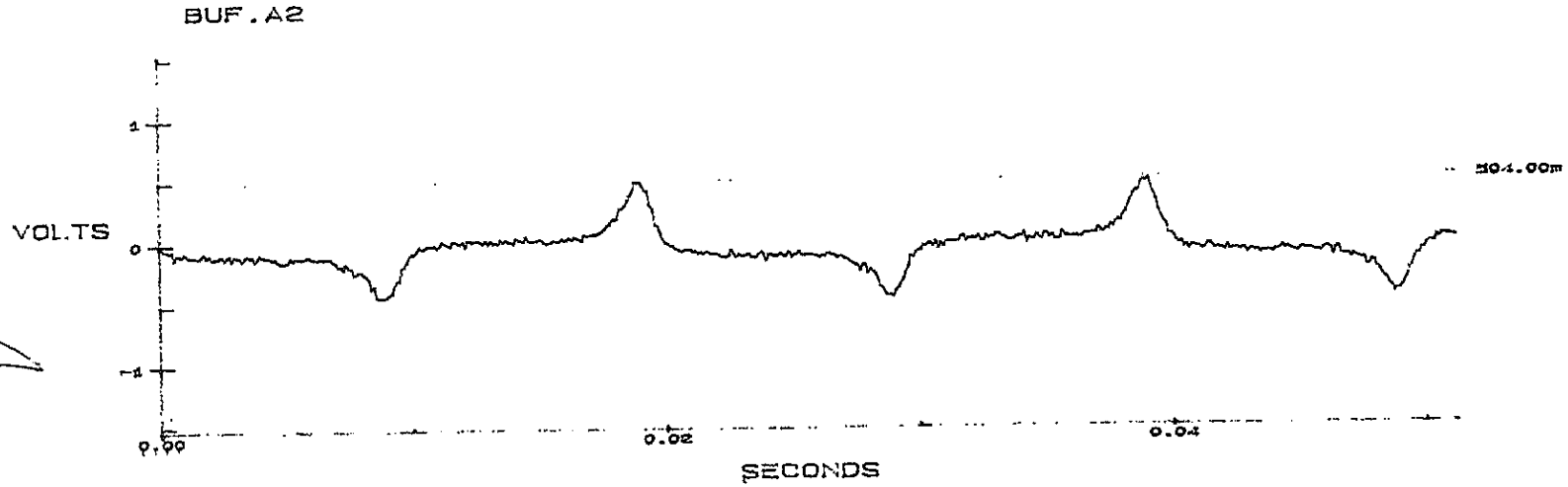
CESI TEST A4/011666 oscillogram n. 27

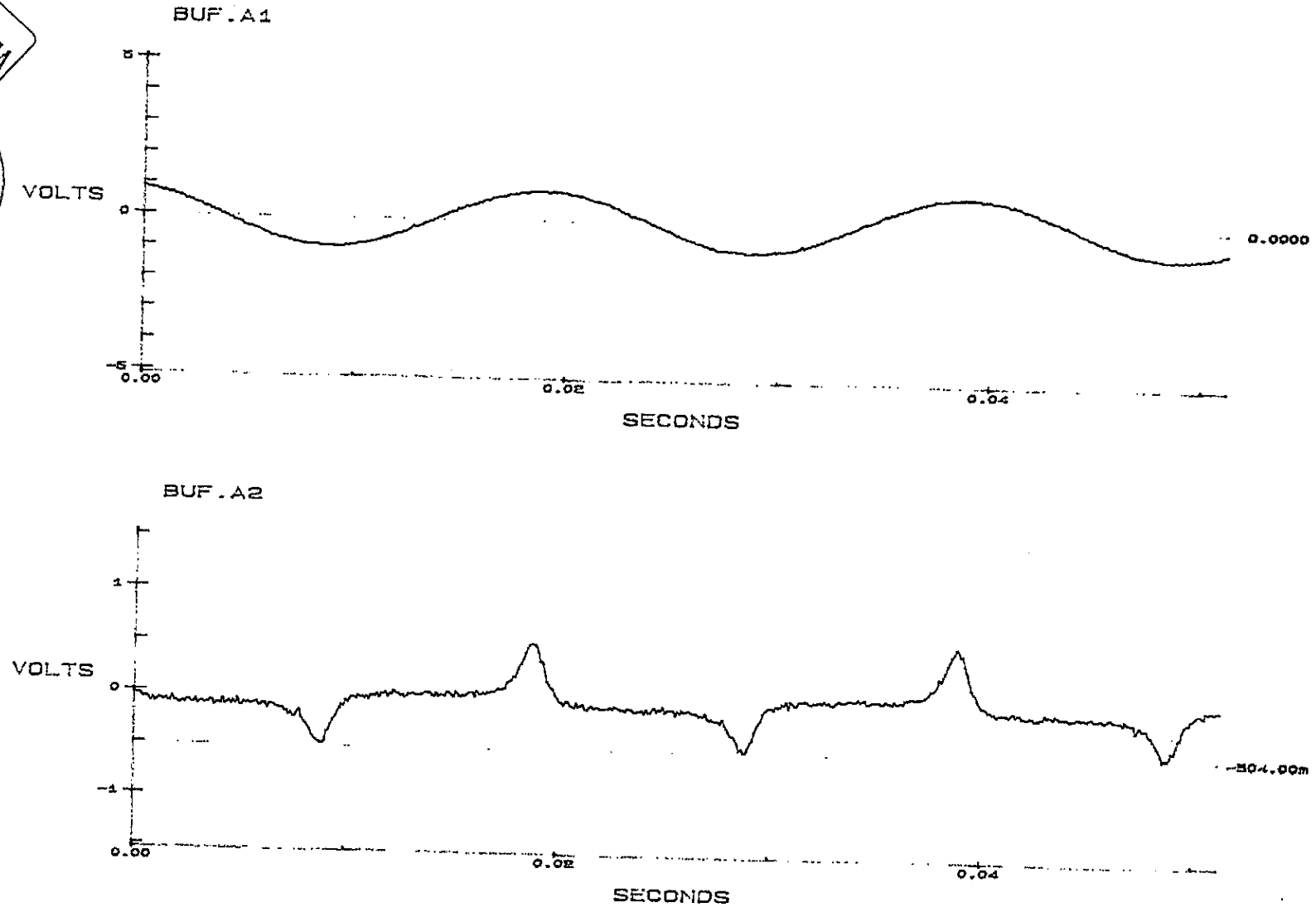




CESI TEST A4/01666 oscillogram n. 28







CESI TEST A4/011666 oscillogram n. 29

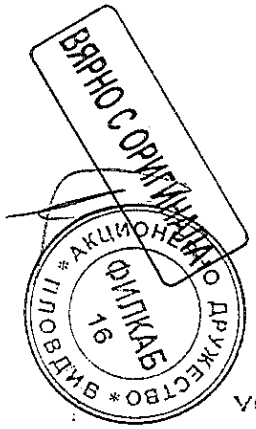
Original Issue 03-2015

Test confidential

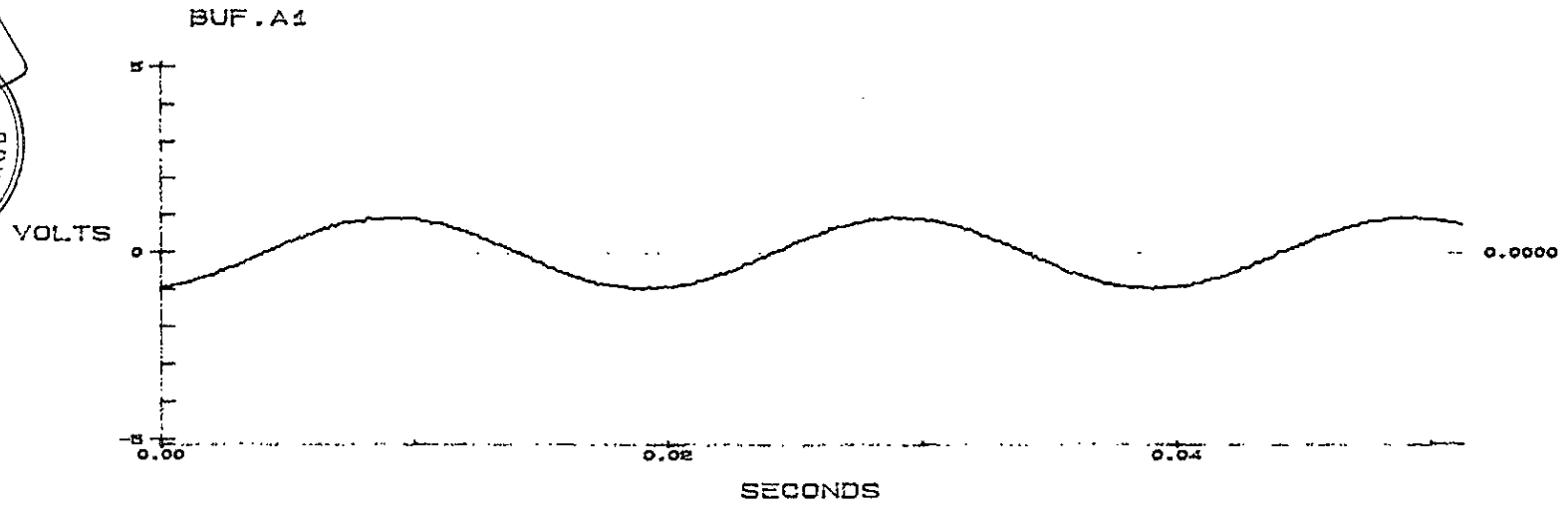
CESI TEST A4/011666 oscillogram n. 30

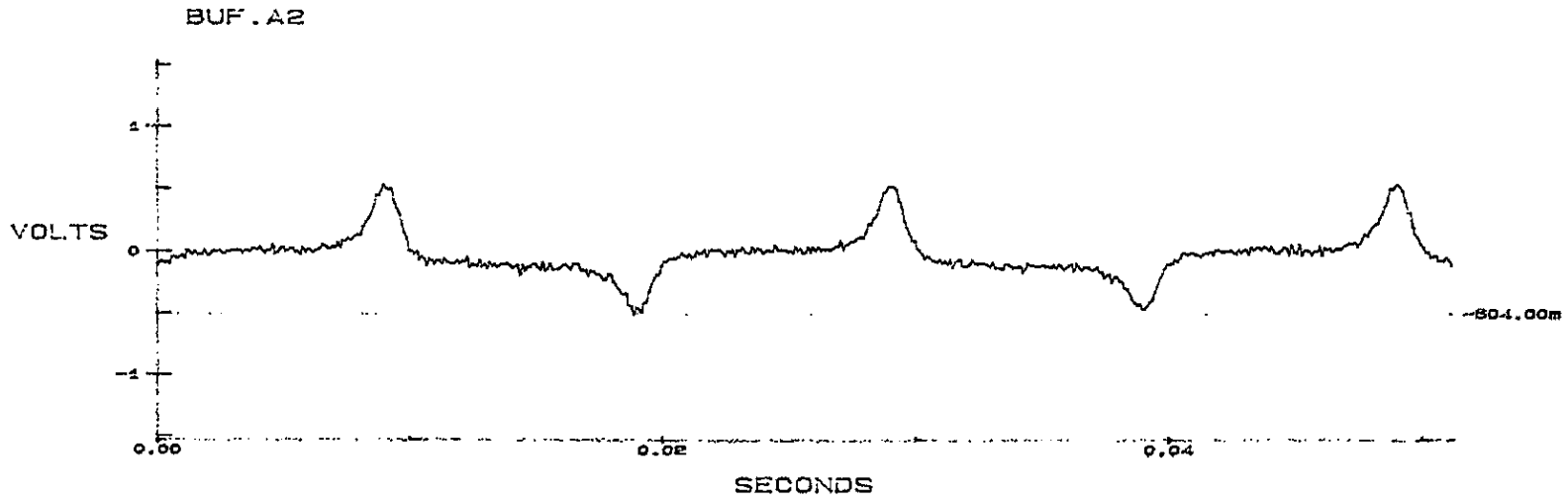
ВЯРНО С ОРИГИНАЛА

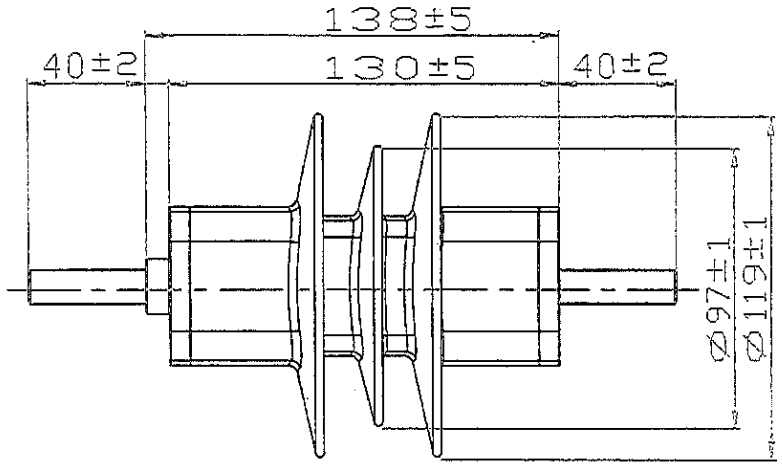
АКЦИОНЕРНО ДРУЖЕСТВО * ПЛОВДИВ * ФИЛКАБ 16

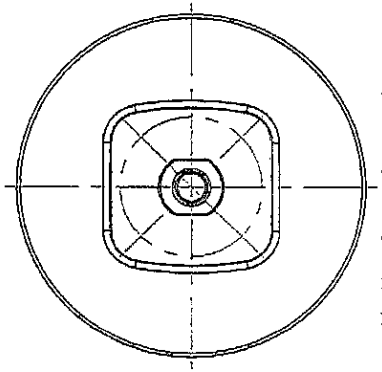


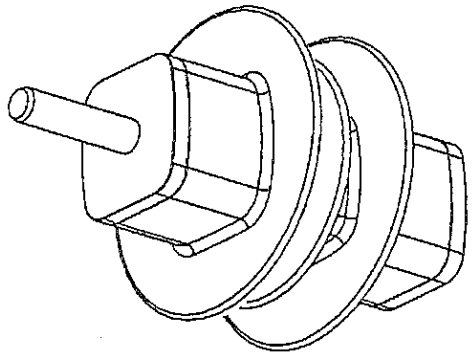
CESI TEST A4/011666 oscillogram n. 31











CREEPAGE=265mm
DRY ARC DIST=138mm

DATA

tyco ELECTRONICS

ENERGY DIVISION

Sowthorpe EMP

SOWTHERPE EMP
BAY 100-103
SHANNON IND. EST.
SHANNON
CO. CLARE
IRELAND

DRN	J MULLIGAN	01/04/04		PCN	[redacted]-000
CHECK				MAT'L	
APP					
SCALE	2/3				

TITLE
5kV 10kA DCP2 SURGE ARRESTER PRODUCT

DRG NO DCP2-5 SHEET 1 OF 1 REV

tyco Electronics

Energy Division
http://energy.tycoelectronics.com

Bowthorpe EMP

Test Report

Type	**OCP2**
PPR Number	**PPR-1950**
Test	Long Duration Current Impulse Withstand Test
Specification	IEC 60099-4 (2001-12)

Test Information:

Laboratory	CESI
Date	07/09/2004
External Test Ref	AT-A4510783
Report Prepared By	M Gregori
Test Verified by	A Sironi
Test Approved by	M de Nigris

Tyco Approvals:

R&D Manager
Brendan Normoyle — Date 25/02/2005

Technology Manager
Kwong Tong — Date 25/02/2005

Product Manager
Brian McGowan — Date 25/02/2005

На основание чл. 2 от ЗЗЛД

For further information contact:
sion

На основание чл. 2 от ЗЗЛД

coelectronics.com

ВЯРНО С ОРИГИНАЛА

АКЦИОНЕРНО ... ФИЛКАБ 16 ПЛОВДИВ

client	TYCO Electronics Energy Division - Shannon (IRL)
equipment under test	Polymer housed metal-oxide surge arrester type OCP2
tests performed	Long duration current impulse withstand tests
normative documents	IEC 60099-4 (2001-12) and Client request

receipt date of the sample	August 31, 2004	
test date	**from** September 01, 2004	**to** September 07, 2004
no. of pages	18	**no. of pages annexed** 22

n° 0030

first issue date September 10, 2004

prepared	PeC/TEST -	На основание чл. 2 от ЗЗЛД
verified	PeC/TEST -	
approved	PeC/TEST -	

CESI
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Sperimentale Italiano
Giacinto Motta SpA

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Capitale sociale 8 550 000 Euro
interamente versato
Codice fiscale e numero
iscrizione CCIAA 00793580150

Registro Imprese di Milano
Sezione Ordinaria
N. R.E.A. 429222
P.I. IT00793580150

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 drawings identified by CESI and numbered. A4/503147, one page, is annexed to this document.

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

На основание чл. 2 от ЗЗЛД

Podavitte - I. Guacci

7 surge arrester laboratory

0H, 31020W, 46030U, 53001D

ВЯРНО С ОРИГИНАЛА

АКЦИОНЕРНО ДРУЖЕСТВО * ПЛОВДИВ * ФИЛКАБ 16

Pages annexed:

- oscillogram n.21 pages
- TYCO drawing n. OCP2-5, CESI n.A4/503147-01; n.1 page

ВЯРНО С ОРИГИНАЛА

Test object characteristics

type: Polymer housed metal-oxide surge arrester section

electrical characteristics (claimed by the client)

manufacturer's name	TYCO Eletronics Energy Division - Shannon (IRL)
nominal discharge current - I_N [kA]	10
rated voltage - U_r [kV]	0,980 x $U_{ref.}$
continuous operating voltage - U_c [kV]	0,784 x $U_{ref.}$
reference current - $I_{ref.}$ [mA]	5
line discharge class	2 (*)
rated frequency - [Hz]	50
year of manufacture	2004

geometrical characteristics (measured on the test sample)

height [mm]	139
number of sheds	n.2 large - n.1 small
shed diameter [mm]	118 large - 96 small

other characteristics

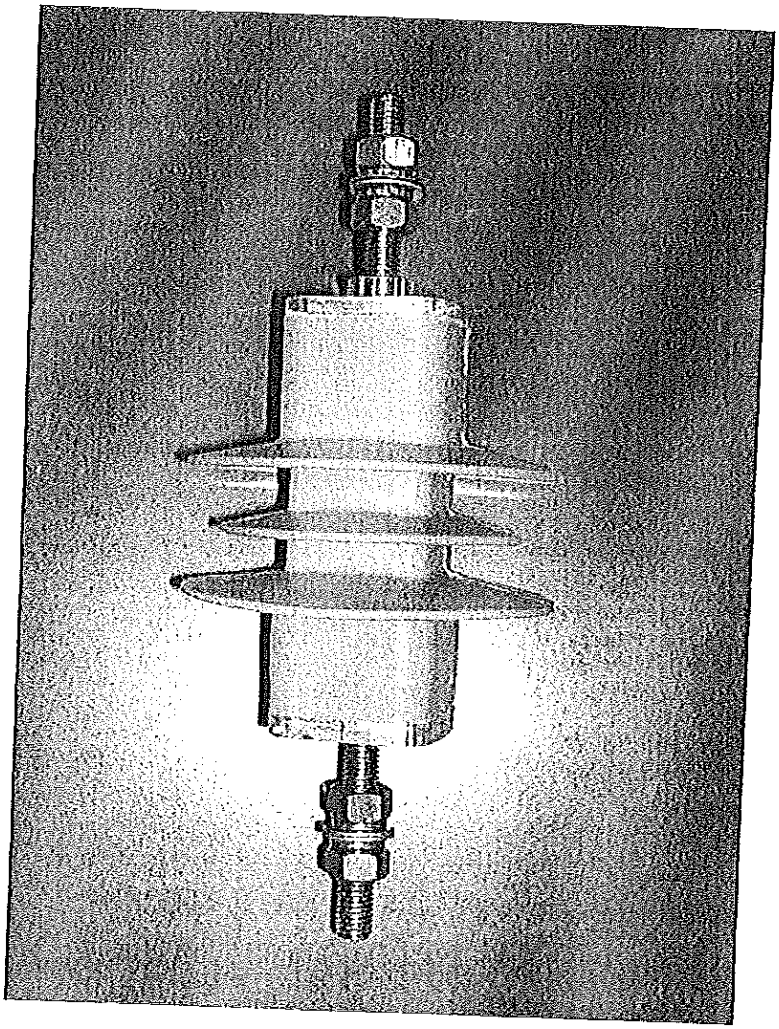
housing material	SILICONE
housing color	GREY

(*) Note: Upon Client request the test was carried out with an energy of the single shot equal to 15,5 kJ (i.e. 3,05 kJ/kV-U_c).Such energy is higher than the energy calculated for class 2 arrester according to IEC procedure (see CESI report A4/011673).The test is therefore more severe.

ВЯРНО С ОРИГИНАЛА

АКЦИОНЕРНО ДРУЖЕСТВО ФИЛИКАБ 16 ПЛОВДИВ

Photograph of the test sample.



Reference Standard

IEC 60099-4 (2001-12) Clause 7.4.3
" Metal-oxide surge arrester without gaps for a.c. system"

Test carried out

test carried out	number of sample tested
Long duration current impulse withstand test	3

Test object identification

test object names	identification of test sample (given by manufacturer)
polymer housed metal-oxide surge arrester section	LD1 - LD2 - LD3

Test procedure

- The measurement of the power frequency voltage at reference current (I_{ref} = 5 mA) has been performed

- The lightning impulse residual voltage at I_N = 10 kA has been measured

- Eighteen long duration current impulses with the specified energy and a virtual duration of 2000 μs have been applied in six groups of three operations.
  Intervals between operations of the same groups have been about 60 seconds; between different groups the samples have been let to cool down to near ambient temperature

- After eighteenth impulses the test sample have been cool down to ambient temperature and a nineteenth impulse has been applied

- The measurement of the lightning impulse residual voltage at I_N has been repeated

Visual inspection and summary of test result

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	%
LD1	10,1	16,00	10,0	15,84	1,0
LD2	10,1	16,08	10,0	16,00	0,5
LD3	10,1	15,92	10,0	15,84	0,5

The test has been performed without disconnector.

The visual inspection of the metal-oxide surge arrester after the test has revealed no sign of physical damage. 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%).
The oscillographic record of the 19th impulse doesn't reveal any sign of internal discharge.
All acceptance criteria according to the reference standard are satisfied and therefore the result is to be considered positive.

ВЯРНО С ОРИГИНАЛА

АКЦ.СНЕРНО ДРУЖЕСТВО * ПЛОВДИВ * ФИЛКАБ 16

Power frequency voltage-current characteristics.

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

date: September 01, 2004

sample no. LD1						
oscill.	voltage	current	current	current	power	3rd harmonic amplitude
no.	kV	+ mA_{cr}	- mA_{cr}	mA_{rms}	W	μA
1	6,77	5,10	4,91	1,876	8,959	---

sample no. LD2						
oscill.	voltage	current	current	current	power	3rd harmonic amplitude
no.	kV	+ mA_{cr}	- mA_{cr}	mA_{rms}	W	μA
2	6,79	5,03	4,73	1,812	8,540	---

sample no. LD3						
oscill.	voltage	current	current	current	power	3rd harmonic amplitude
no.	kV	+ mA_{cr}	- mA_{cr}	mA_{rms}	W	μA
3	6,74	5,09	4,83	1,851	8,734	

Long duration current impulse withstand test.

lightning impulse residual voltage measurement at I_N before the test

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

date: September 02, 2004

sample	requested current	charging voltage	oscillogram	current waveshape	discharge current	residual voltage
no.		kV	no.	µs	kA	kV
LD1	I_N	29,4	4	8,5/19,0	10,1	16,00
LD2		29,4	5		10,1	16,08
LD3		29,4	6		10,1	15,92

	oscilloscope settings		
	sampling division	input	attenuation
	µs	V_{eff}	
current	5,0	0,5	50:5
voltage		1,0	20:5

ВЯРНО С ОРИГИНАЛА

Long duration current impulse withstand test.

test object: Polymer housed metal-oxide surge arrester section
test circuit: A017

date: September 07, 2004

sample	impulse	charging voltage V_c	oscillogram	peak current I	residual voltage V_r	energy E
no.	no.	kV	no.	A	kV	kJ
LD1	1	15,3		535	12,83	15,77
	2	15,3		535	12,83	15,71
	3	15,4	7	530	12,83	15,63
	4	15,3		540	12,83	15,87
	5	15,3		540	12,83	15,70
	6	15,4		530	12,83	15,60
	7	15,3		535	12,83	15,70
	8	15,3		540	12,83	15,86
	9	15,4	10	535	12,83	15,71
	10	15,3		540	12,83	15,95
	11	15,3		535	12,83	15,73
	12	15,4		535	12,83	15,71
	13	15,3		540	12,83	16,07
	14	15,3		540	12,83	15,92
	15	15,4		530	12,83	15,60
	16	15,3		535	12,83	15,70
	17	15,3		535	12,83	15,70
	18	15,4	13	540	12,83	15,77

measured waveshape	
virtual duration	virtual total duration
μs	μs
2200	2910

oscilloscope settings			
	sampling division	input	attenuation
	μs	V_{div}	
current	50,0	1,0	10:5
voltage		0,5	50:5

cont'd

cont'd

date: September 07, 2004

sample	impulse	charging voltage V_c	oscillogram	peak current I	residual voltage V_r	energy E
no.	no.	kV	no.	A	kV	kJ
LD2	1	15,3		540	12,83	15,86
	2	15,3		535	12,83	15,60
	3	15,4	8	535	12,83	15,65
	4	15,3		540	12,83	15,67
	5	15,3		545	12,83	16,22
	6	15,4		530	12,83	15,60
	7	15,3		548	12,83	16,16
	8	15,3		540	12,83	16,06
	9	15,4	11	535	12,83	16,20
	10	15,3		540	12,83	15,94
	11	15,3		530	12,83	15,60
	12	15,4		545	12,83	16,16
	13	15,3		540	12,83	15,96
	14	15,3		530	12,83	15,58
	15	15,4		530	12,83	15,58
	16	15,3		540	12,83	16,00
	17	15,3		540	12,83	15,91
	18	15,4	14	535	12,83	15,58

measured waveshape

virtual duration	virtual total duration
µs	µs
2200	2910

oscilloscope settings

	sampling division	input	attenuation
	µs	$V_{d.c.}$	
current	50,0	1,0	10:5
voltage		0,5	50:5

cont'd

ВЯРНО С ОРИГИНАЛА

АКЦИОНЕРНО ДРУЖЕСТВО ФИЛКАБ 16 ПЛОВДИВ

cont'd

date: September 07, 2004

sample	impulse	charging voltage V_c	oscillogram	peak current I	residual voltage V_r	energy E
no.	no.	kV	no.	A	kV	kJ
LD3	1	15,3		558	12,83	16,34
	2	15,3		548	12,83	16,22
	3	15,4	9	544	12,83	16,12
	4	15,3		548	12,83	16,23
	5	15,3		545	12,83	16,15
	6	15,4		535	12,83	15,70
	7	15,3		560	12,83	15,52
	8	15,3		545	12,83	16,10
	9	15,4	12	540	12,83	16,06
	10	15,3		555	12,83	16,30
	11	15,3		545	12,83	16,08
	12	15,4		540	12,83	15,86
	13	15,3		555	12,83	16,26
	14	15,3		545	12,83	16,06
	15	15,4		538	12,83	15,86
	16	15,3		550	12,83	16,24
	17	15,3		550	12,83	16,20
	18	15,4	15	545	12,83	16,06

measured waveshape	
virtual duration	virtual total duration
μs	μs
2200	2910

oscilloscope settings			
	sampling division	input	attenuation
	μs	V_{dv}	
current	50,0	1,0	10:5
voltage		0,5	50:5

cont'd

Long duration current impulse withstand test.
(check the integrity of the internal parts with an additional shot at ambient temperature)
test object: Polymer housed metal-oxide surge arrester section
test circuit: A014

date: September 07, 2004

sample	impulse	charging voltage V_c	oscillogram	peak current I	residual voltage V_r	energy E
no.	no.	kV	no.	A	kV	kJ
LD1	19	15,3	16	540	12,83	15,88
LD2	19	15,3	17	548	12,83	16,06
LD3	19	15,3	18	550	12,83	16,16

measured waveshape	
virtual duration	virtual total duration
μs	μs
2200	2910

oscilloscope settings			
	sampling division	input	attenuation
	μs	V_{div}	
current	50,0	1,0	10:5
voltage		0,5	50:5

cont'd

ВЯРНО С ОРИГИНАЛА

АКЦИОНЕРНО ДРУЖЕСТВО ФИЛКАБ 16 ПЛОВДИВ

Long duration current impulse withstand test.

lightning impulse residual voltage measurement at I_N after the test

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

date: September 07, 2004

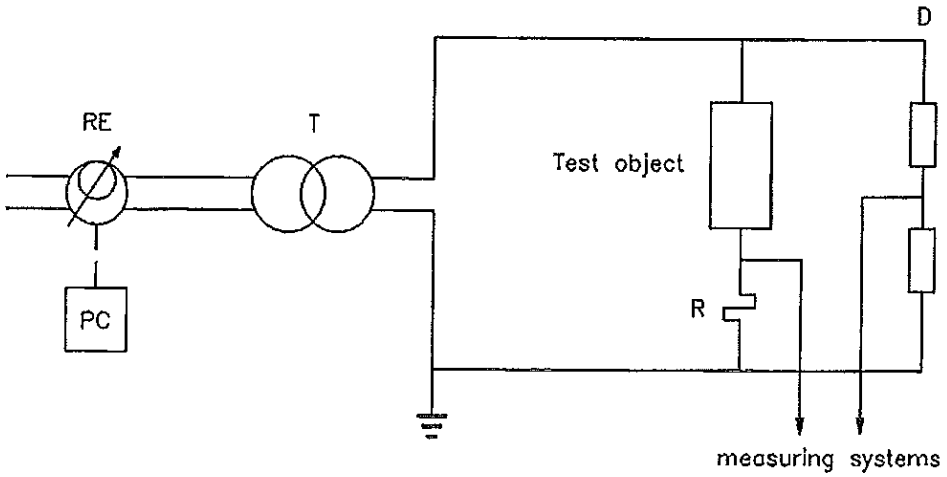
sample	requested current	charging voltage	oscillogram	current waveshape	discharge current	residual voltage
no.		kV	no.	µs	kA	kV
LD1	I_N	29,4	19	8,5/19,0	10,0	15,84
LD2		29,4	20		10,0	16,00
LD2		29,4	21		10,0	15,84

	oscilloscope settings		
	sampling division	input	attenuation
	µs	V_{div}	
current	5,0	0,5	50:5
voltage		1,0	20:5

ВЯРНО С ОРИГИНАЛА

АКЦИОНЕРНО ДРУЖЕСТВО ФИЛКАБ 16 ПЛОВДИВ

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 Specialtrafo ; power 30 kVA ; voltage 200 V/ 15 kV

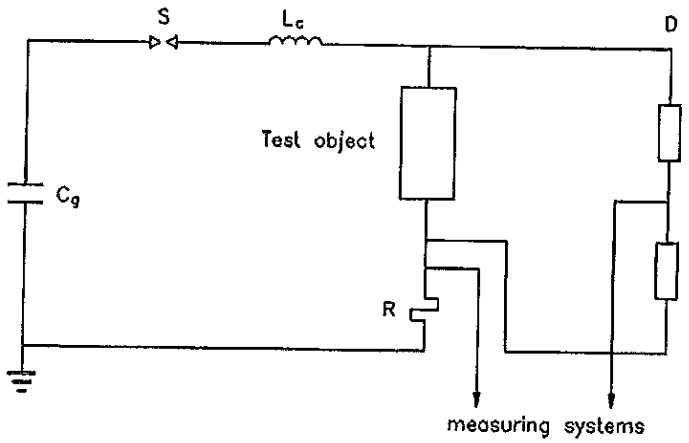
current shunt (R) CESI no. 11537 ; R =811,94 Ω
oscilloscope CESI no. 9090
type RTD 710 A

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

ВЯРНО С ОРИГИНАЛА

АКЦИОНЕРНО ОБЩЕСТВО ФИЛКАБ 16 ПЛОВДИВ

circuit A014



impulse generator

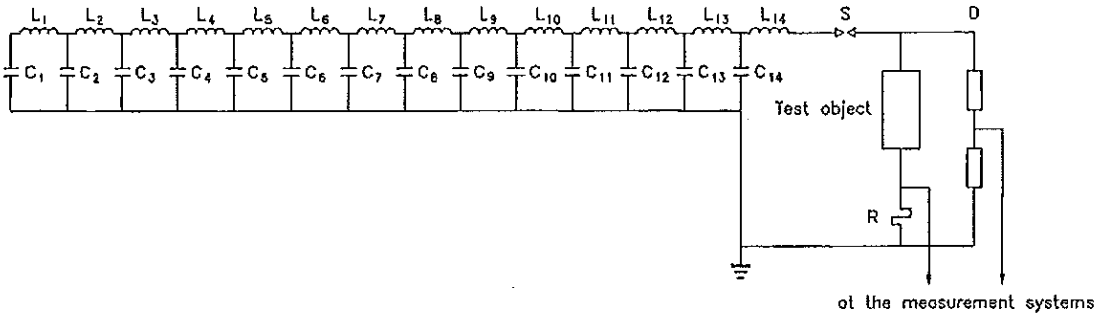
plant P177
no. of stages 1
C_g 4,98 μF
L_c 10 μH
S spark gap

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

voltage divider (D) CESI no.11120; k = 1010
electro optical system CESI no.11519/520
oscilloscope CESI no. 13217
type Tektronix TDS 540A

circuit A017

long duration withstand impulse test



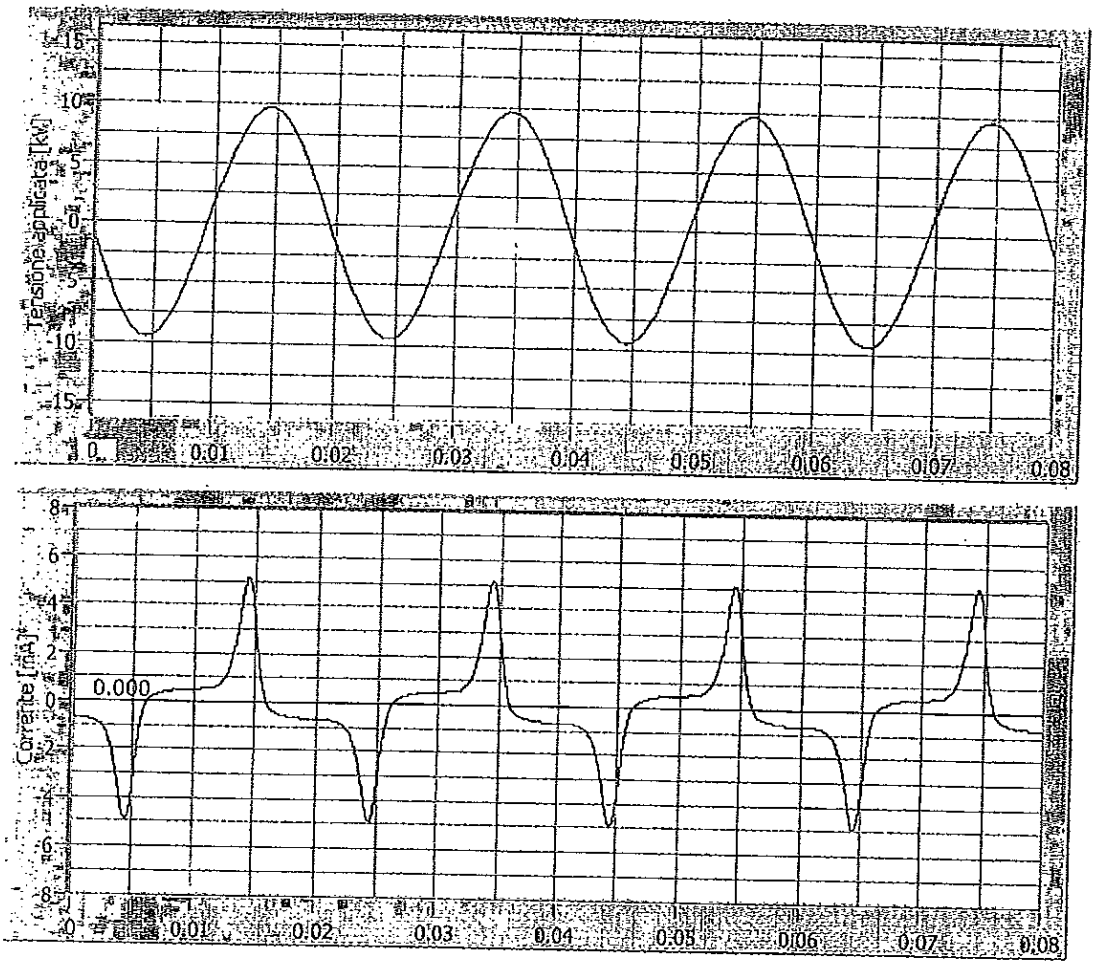
impulse generator

plant P177

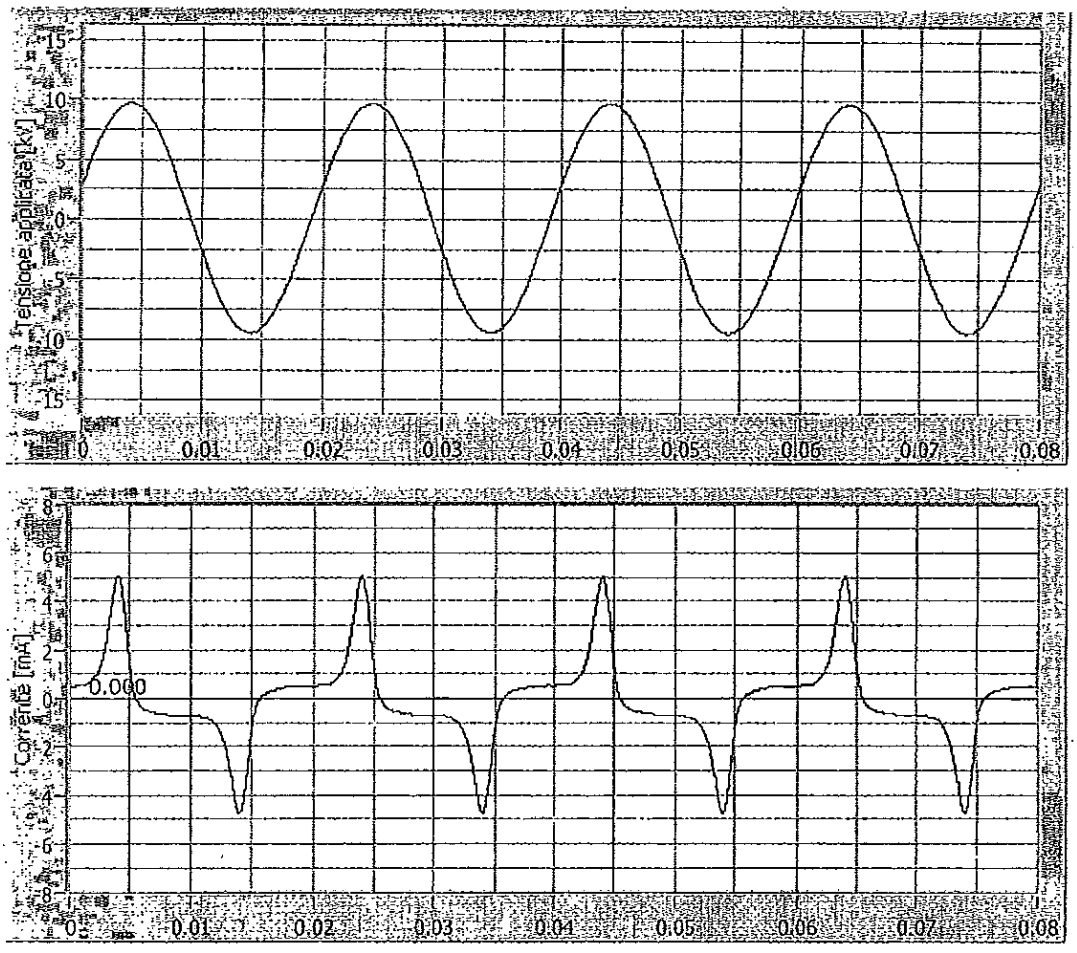
C_1 ... C_{12}: capacitors 18,75 μF
L_1 ... L_{11} : inductors 666 μH
L_{12}inductor (500+666) μH
S spark gap

shunt (R) CESI no. 60 ; R = 0,010 Ω ; 20 kA
electro optical system CESI no. 11519/520
oscilloscope CESI no. 13217 ; type Tektronix TDS 540A

voltage divider (D) CESI no.11120 ; k = 1010
electro optical system CESI no.8008/8014
oscilloscope CESI no. 13217 ; type Tektronix TDS 540A



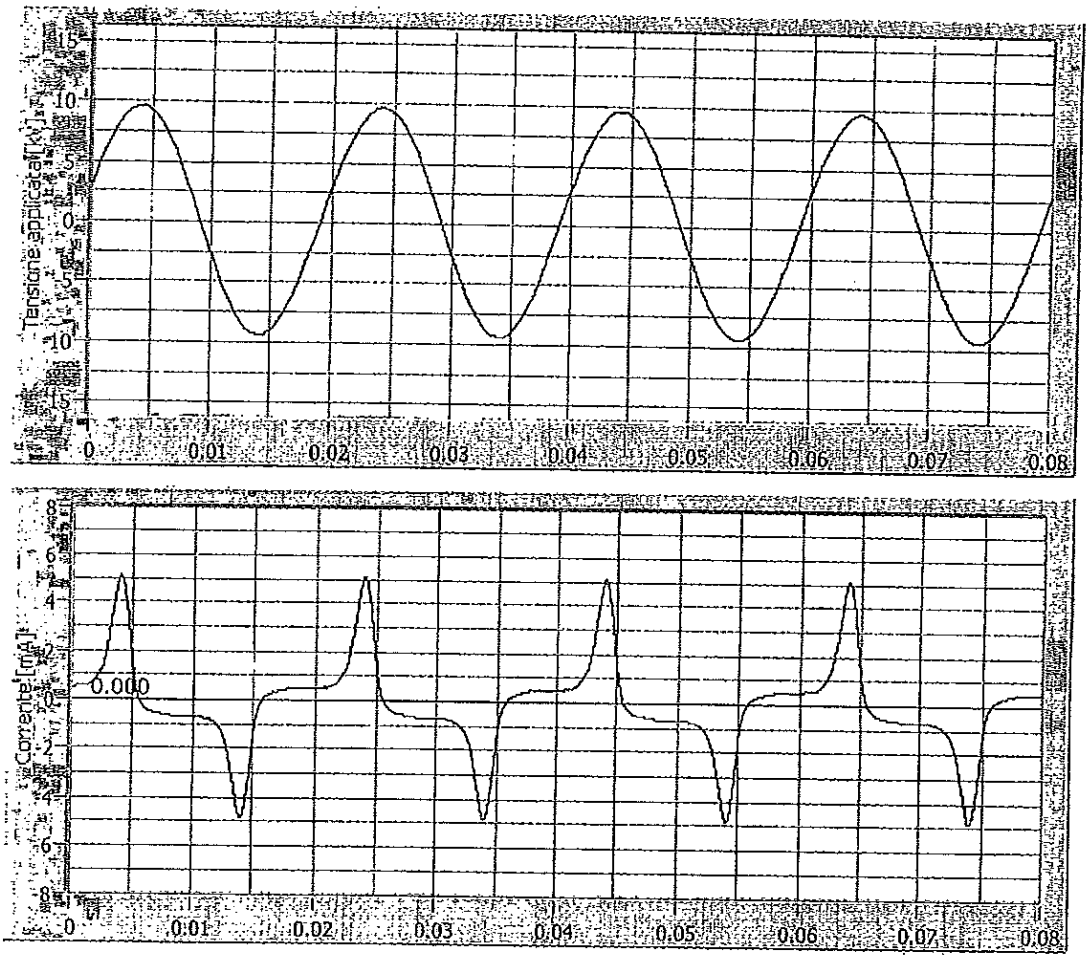
CESI AT- A4510783 oscillogram n. 1



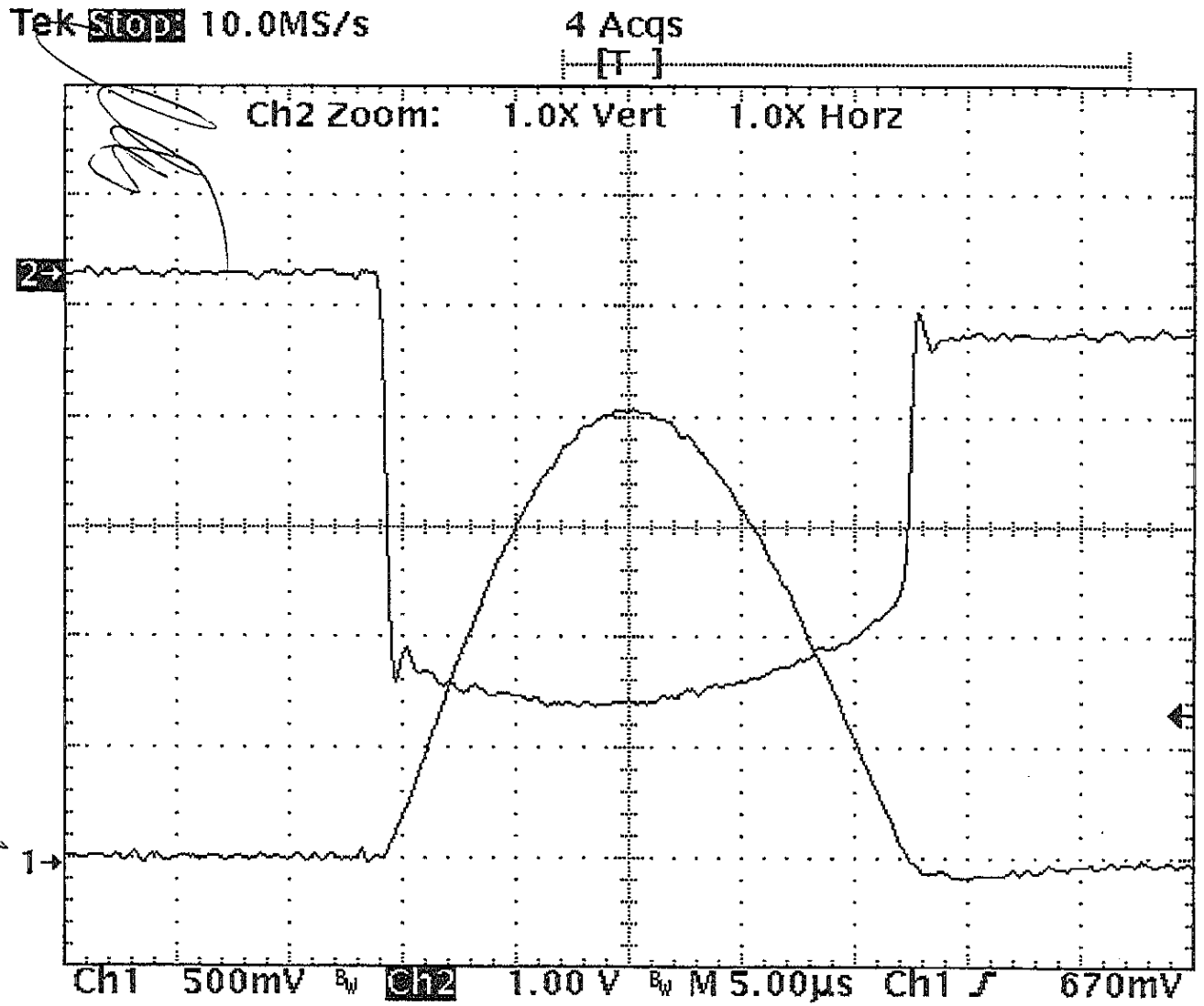
CESI AT - A4510783 oscillogram n. 2

ВЯРНО С ОРИГИНАЛА

ФИЛКАБ 16 ПЛОВДИВ

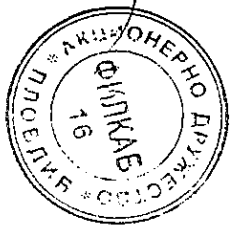


CESI AT- A4510783 oscillogram n. 3

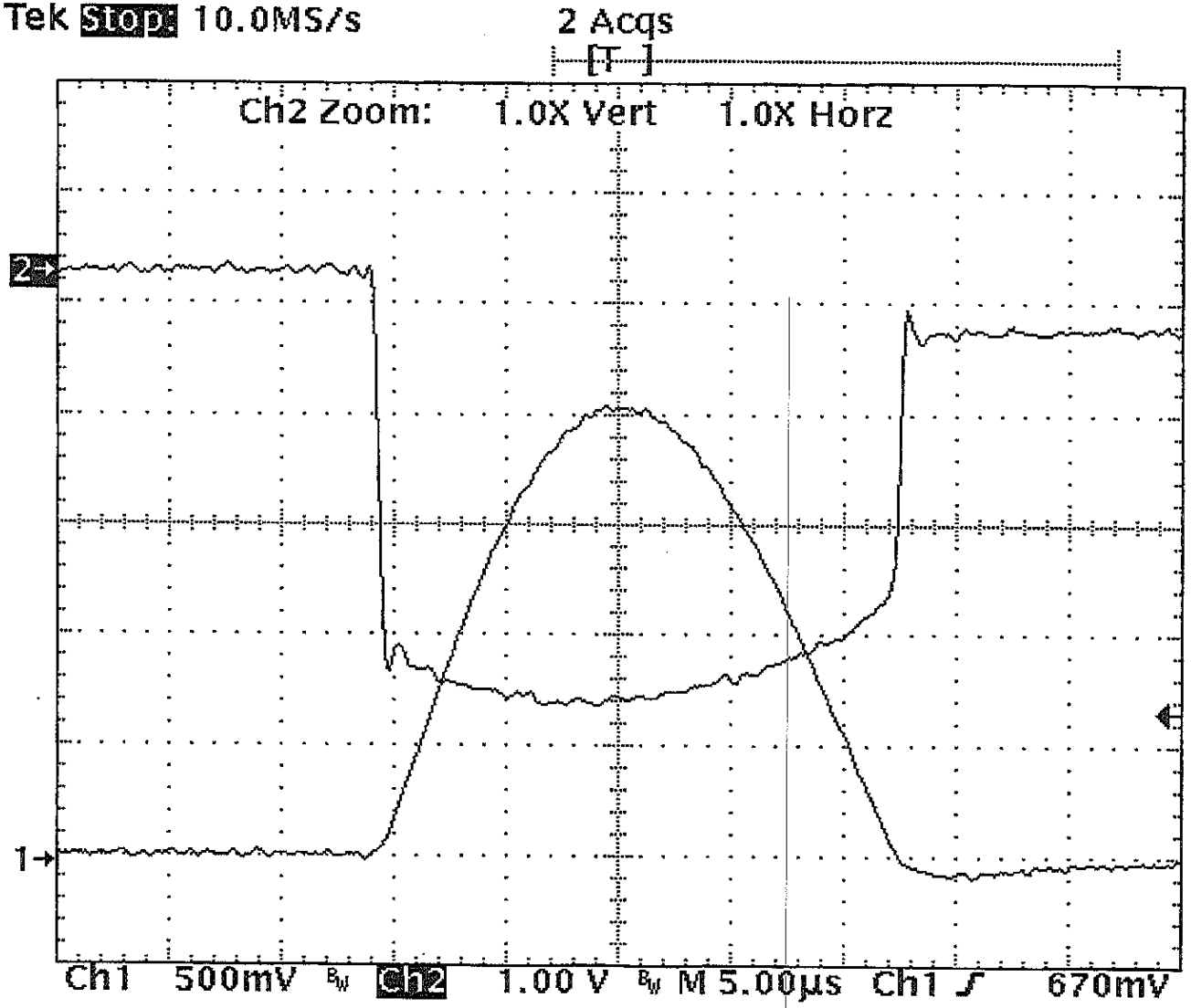


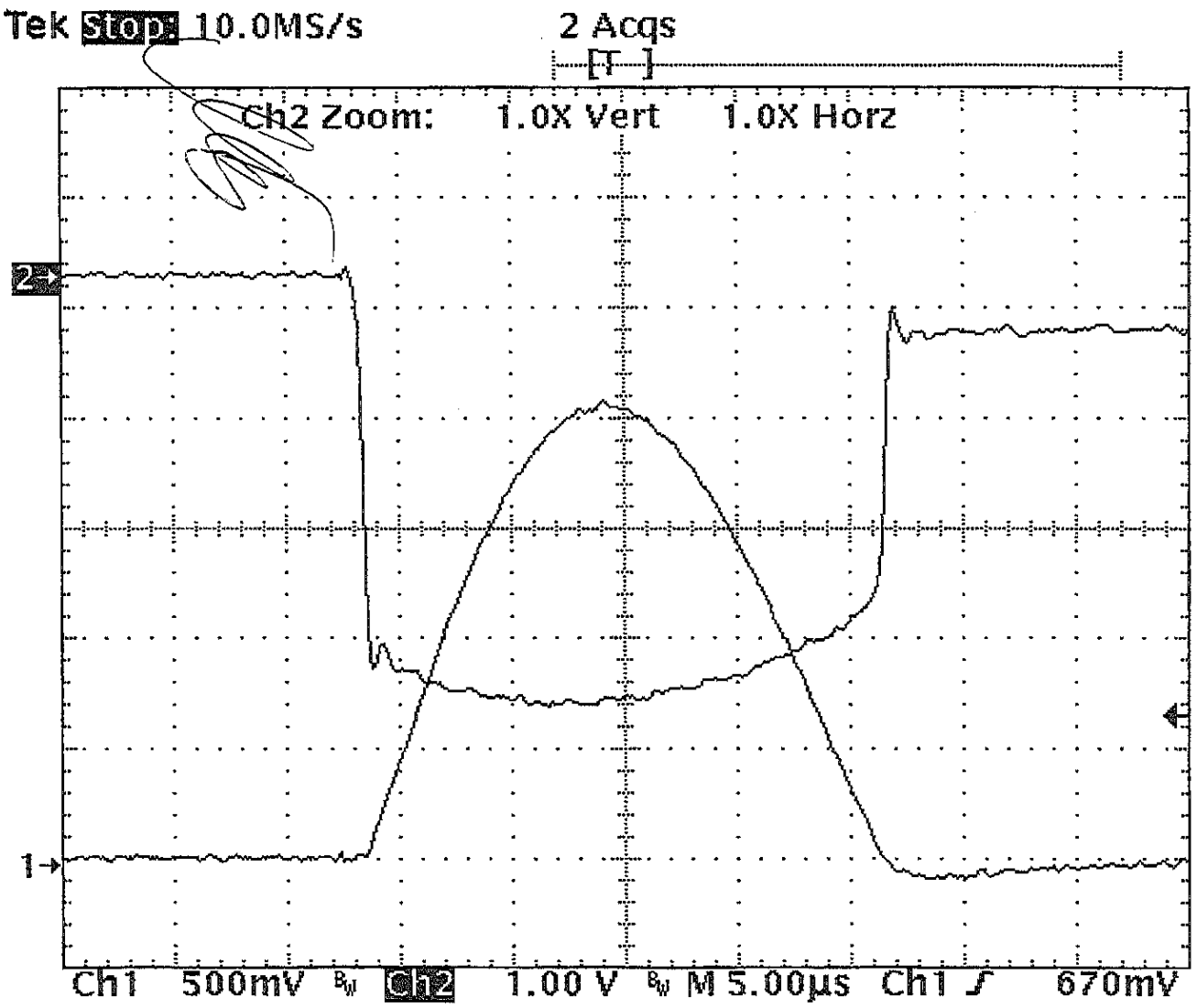
CESI TEST A4510783 oscillogram n. 4

ВЯРНО С ОРИГИНАЛА



CESI TEST A4510783 oscillogram n. 5



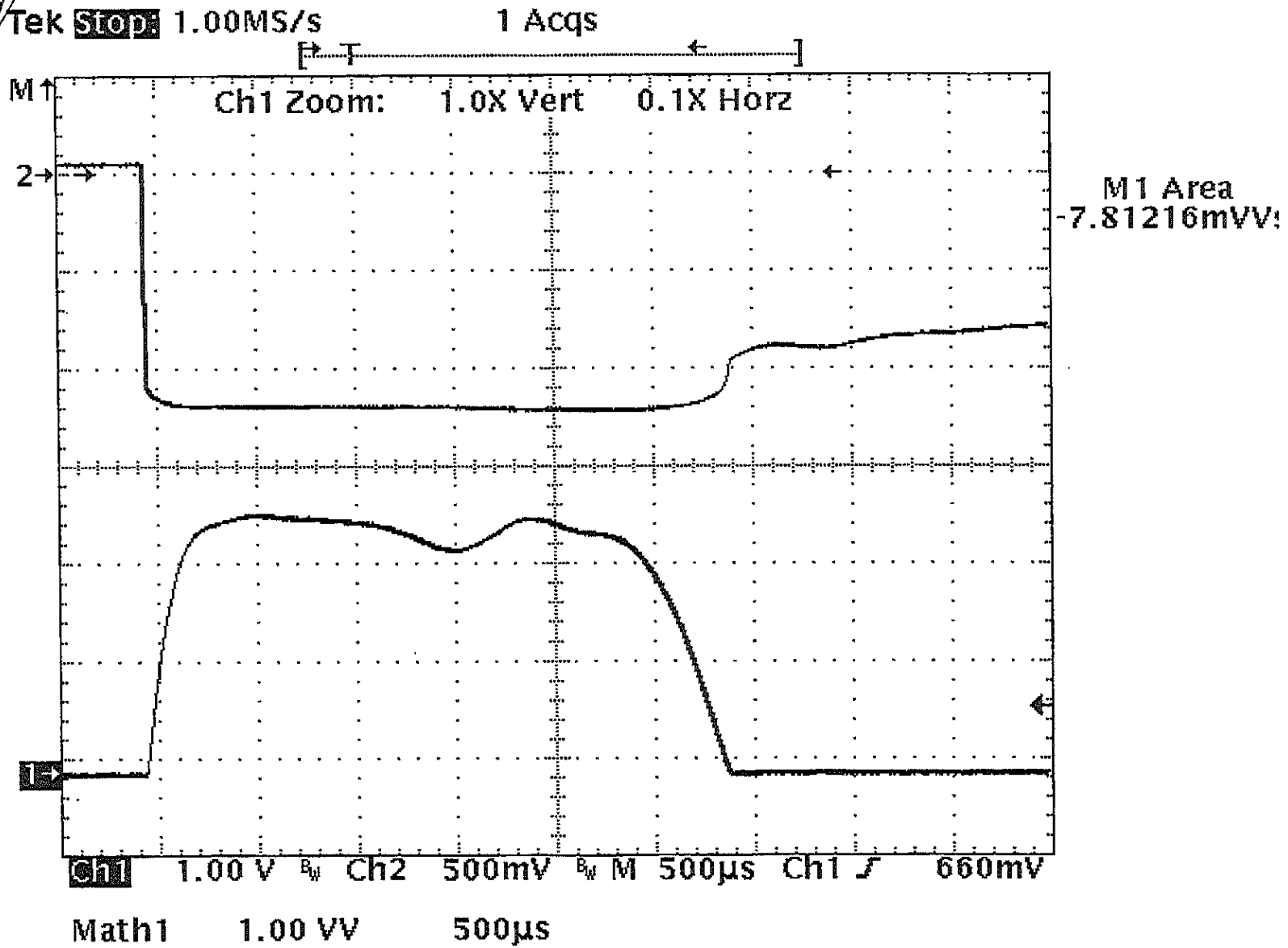


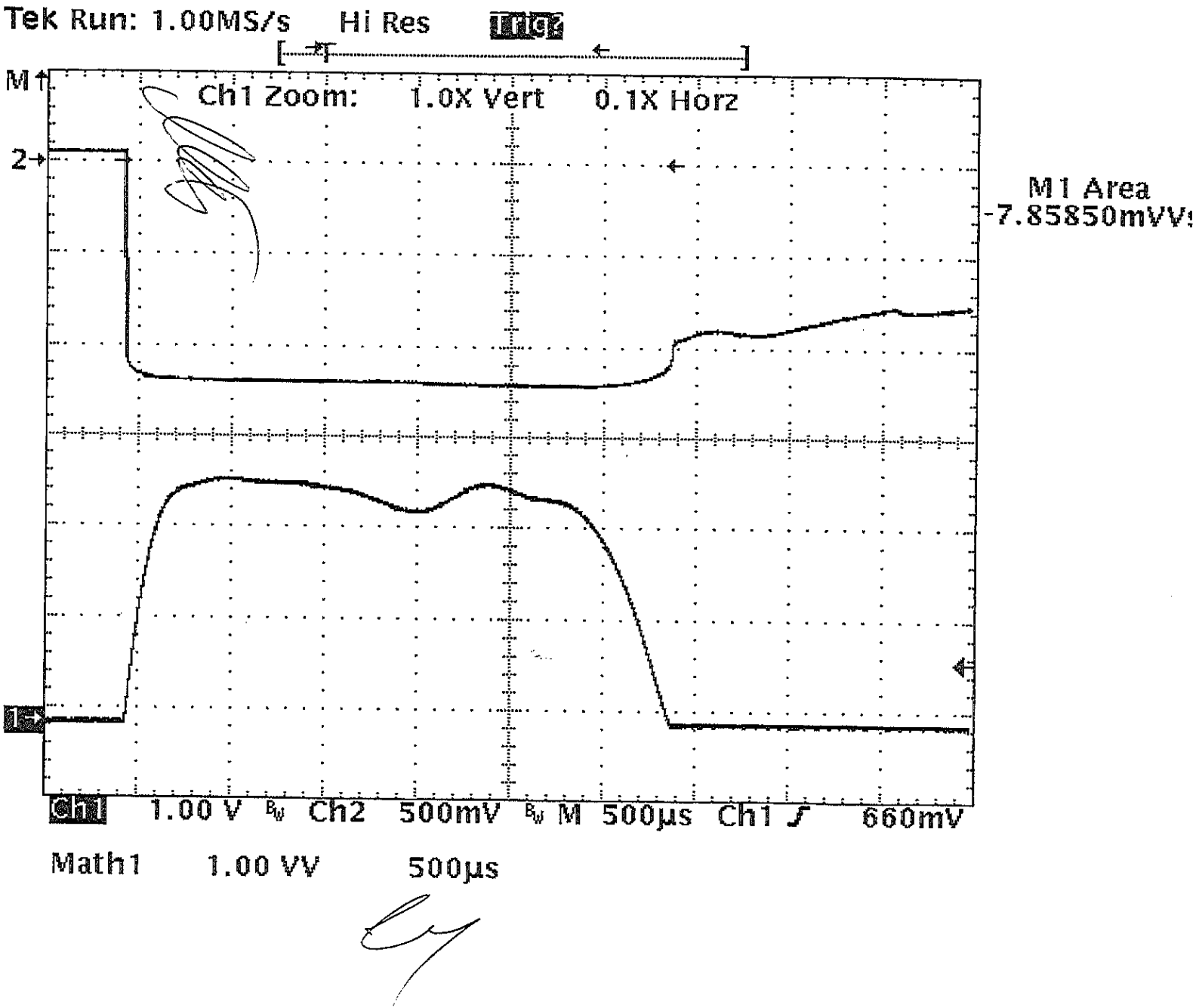
CESI TEST A4510783 oscillogram n. 6

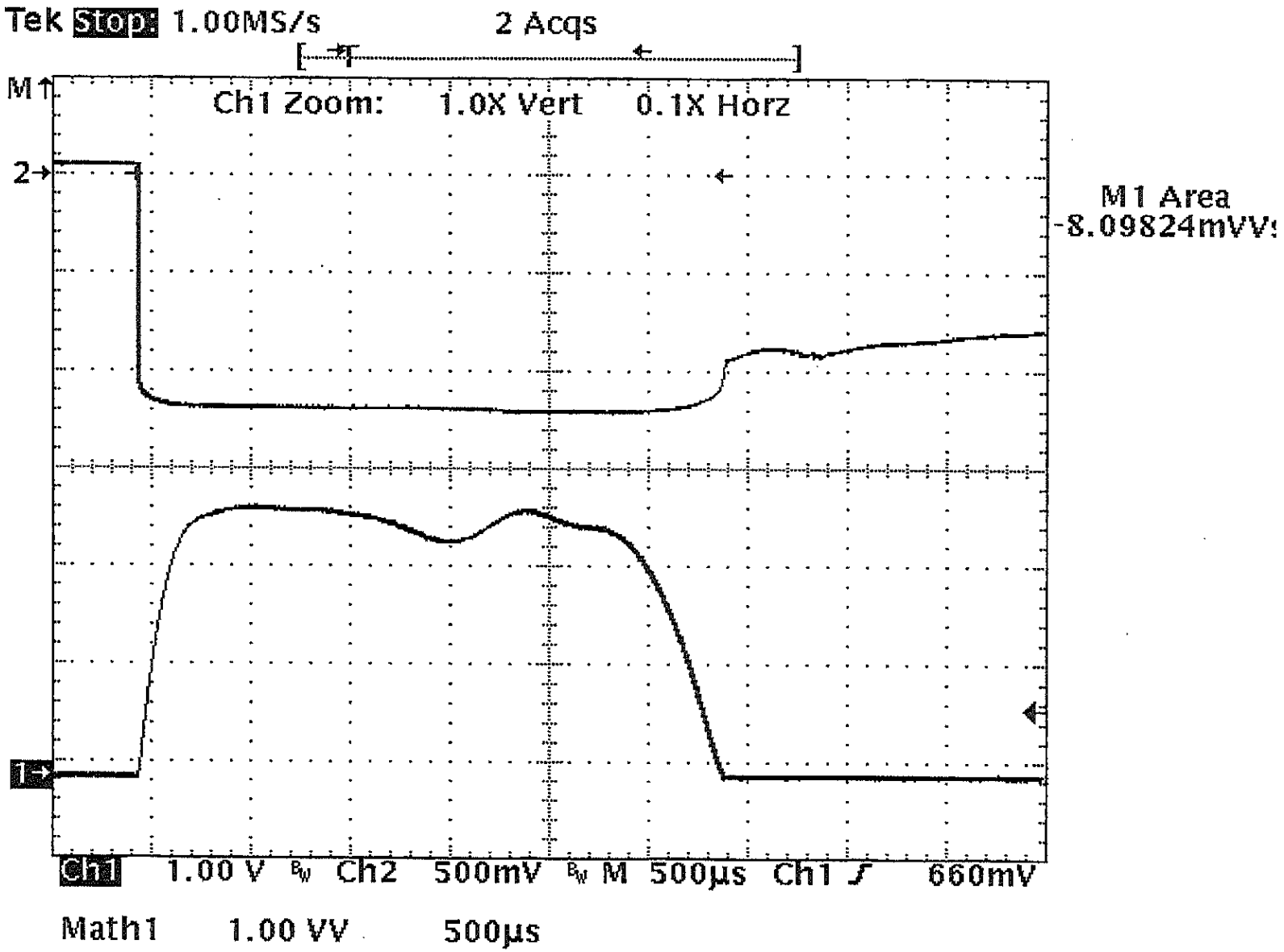
ВЯРНО С ОРИГИНАЛА

АКЦИОНЕРНО ДРУЖЕСТВО * ВИДИВ * ФИЛКАБ 16

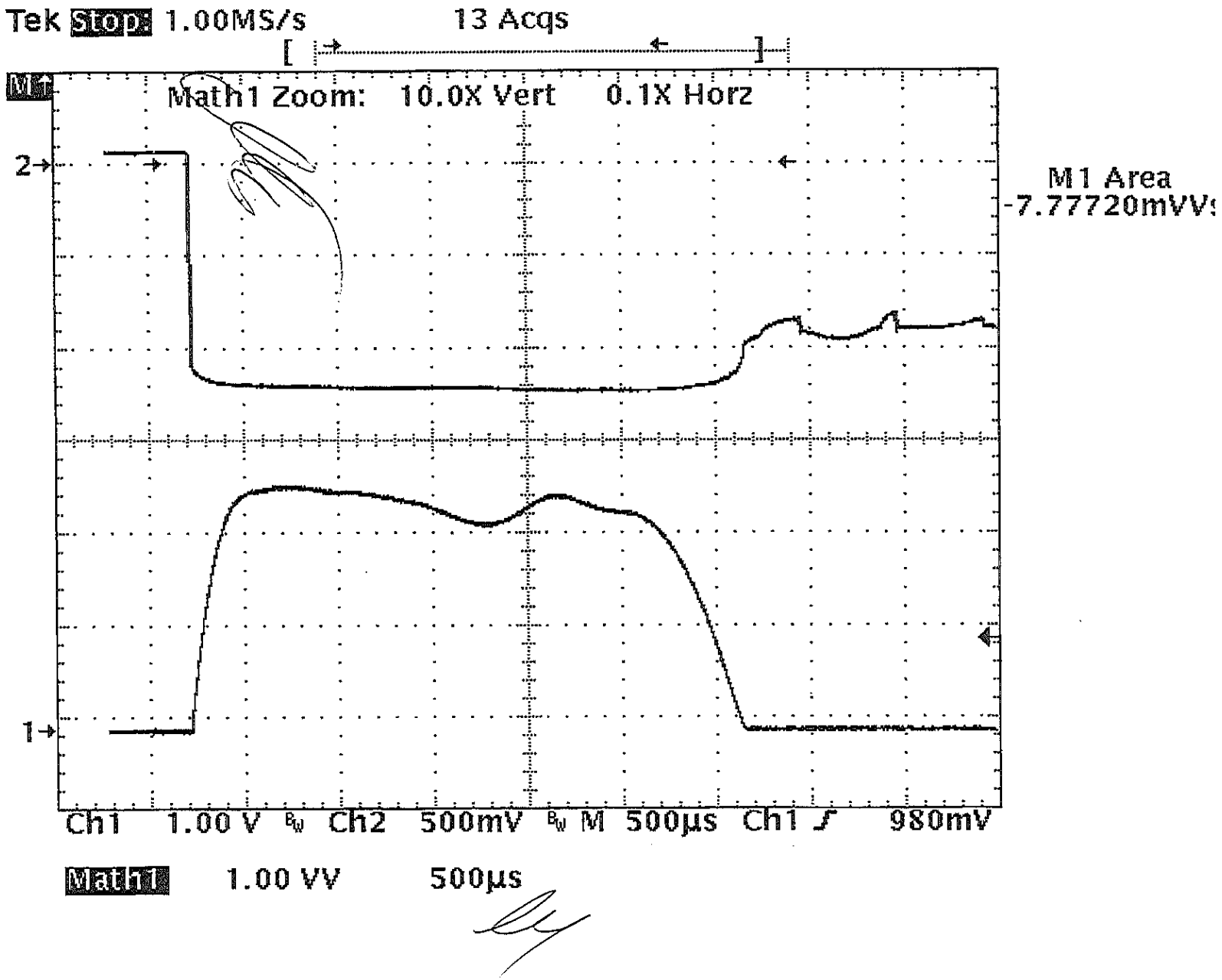
CESI TEST A4510783 oscillogram n. 7

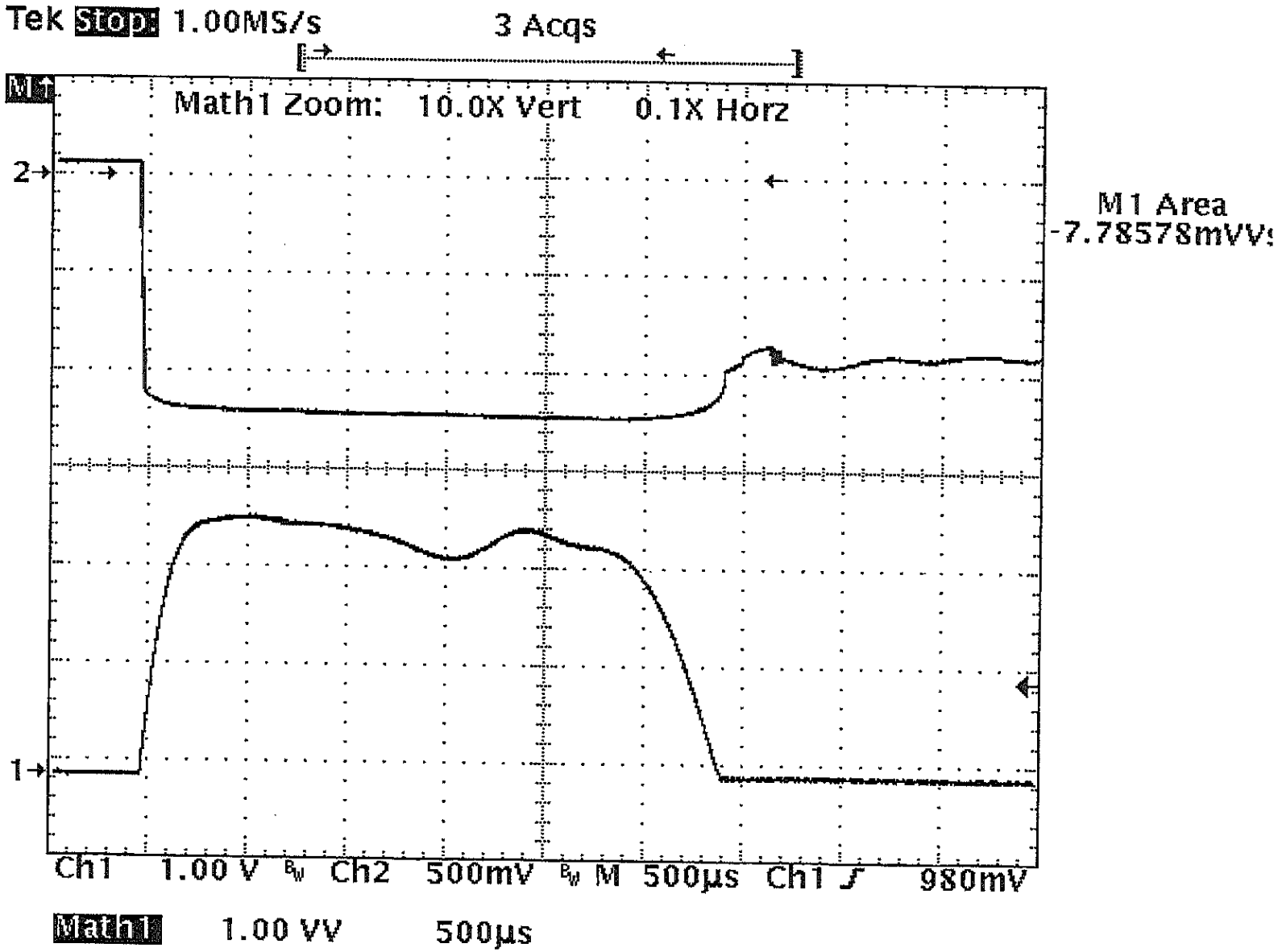




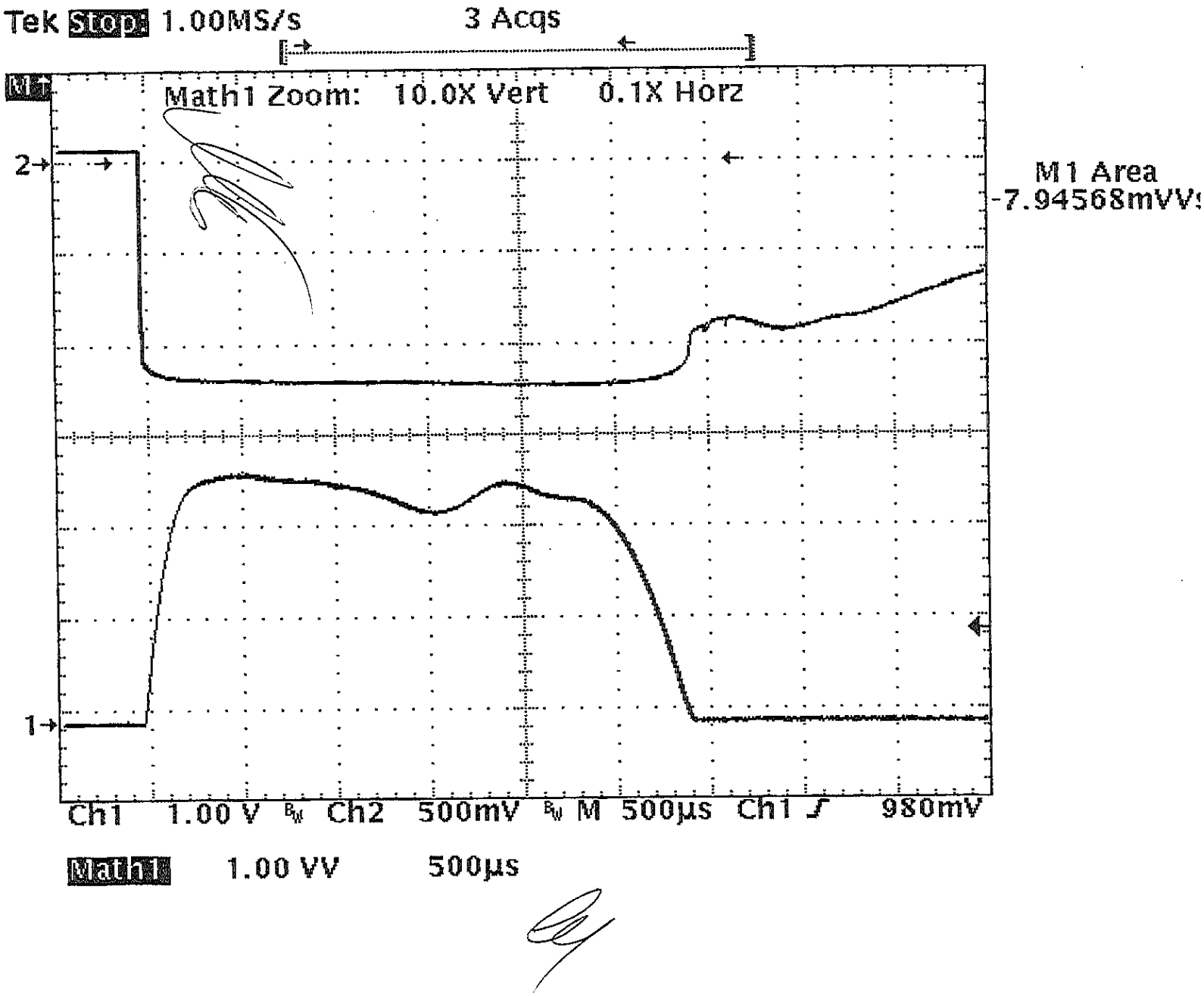


CESI TEST A4510783 oscillogram n. 9

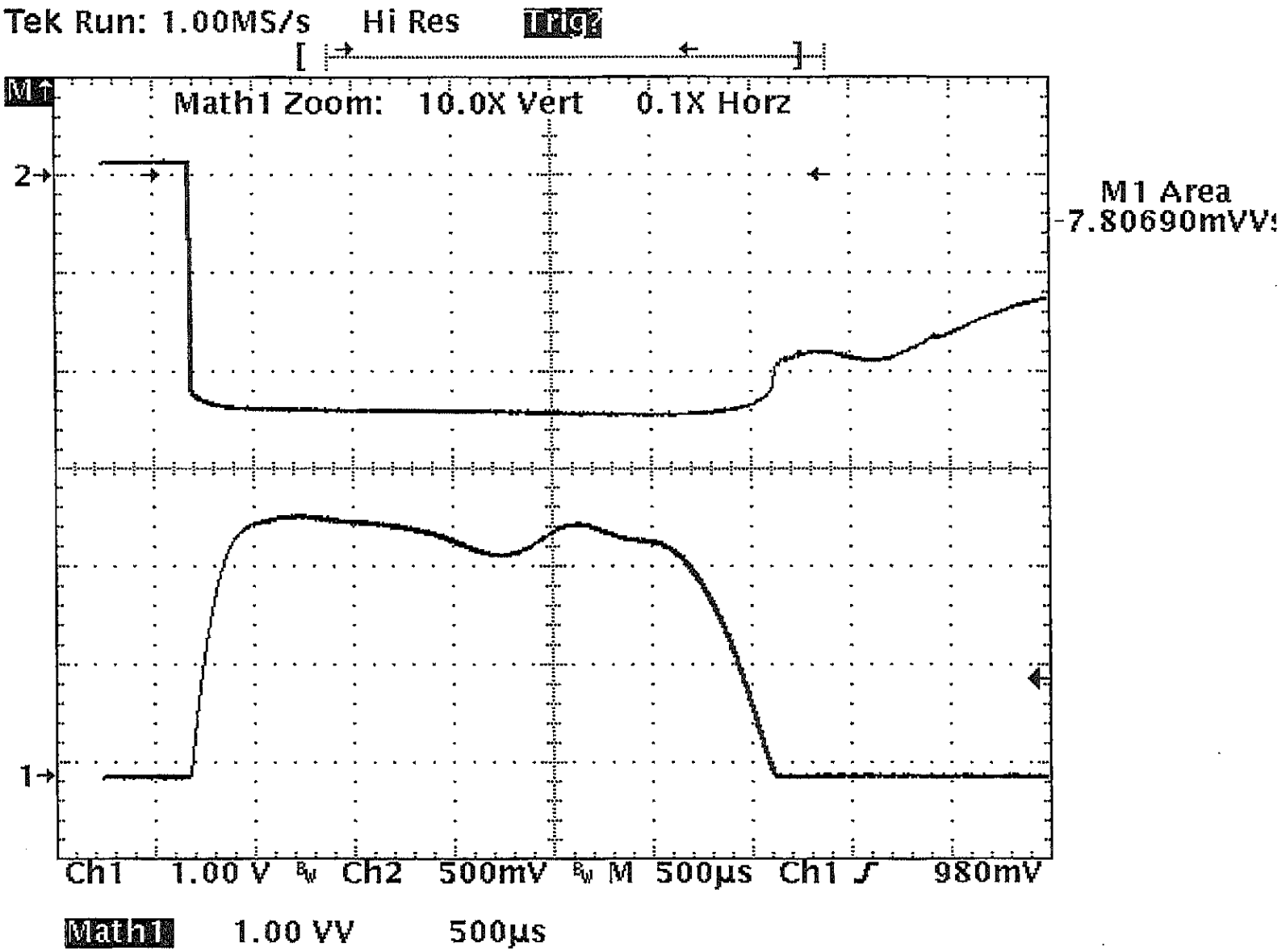




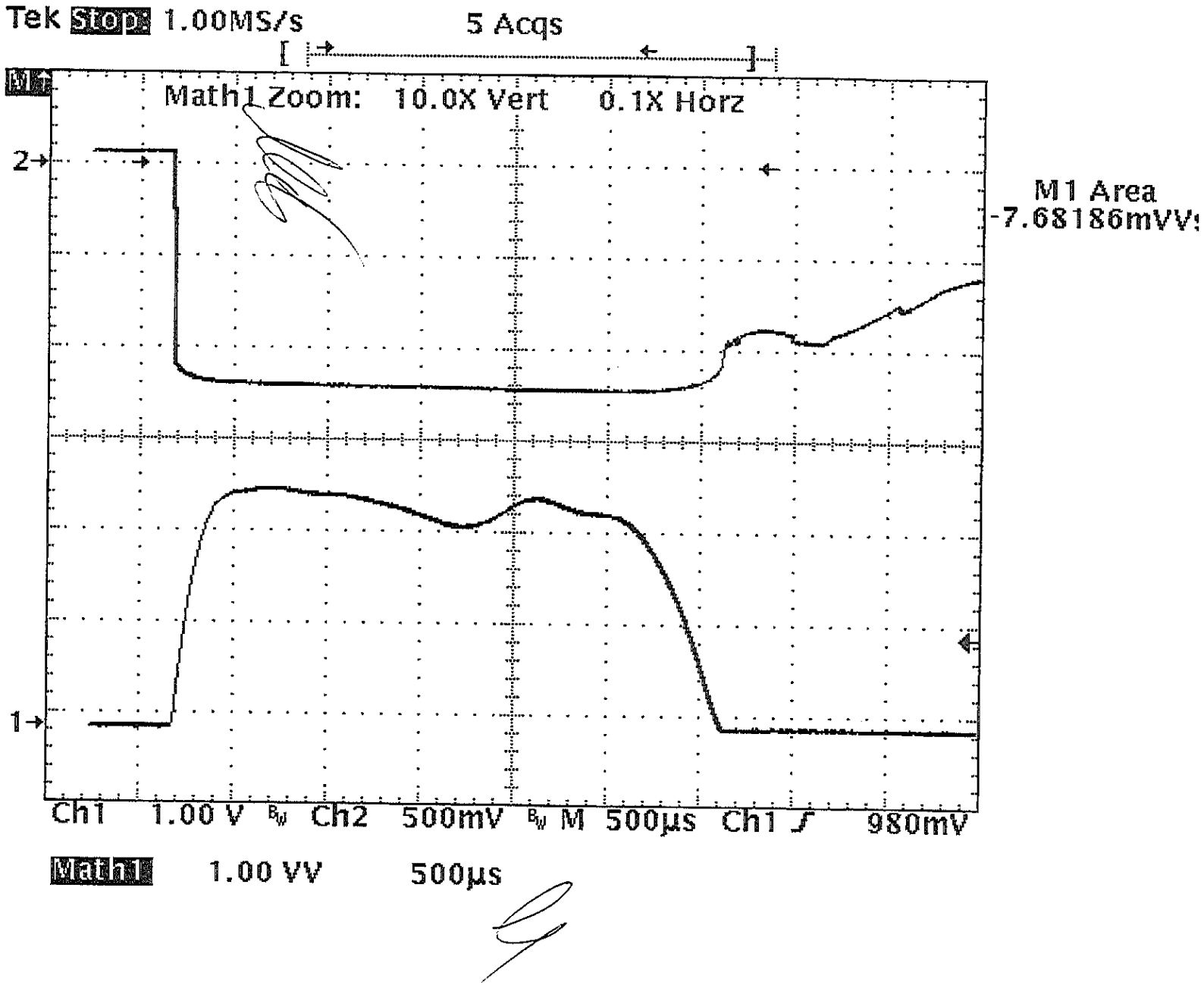
CESI TEST A4510783 oscillogram n. 11



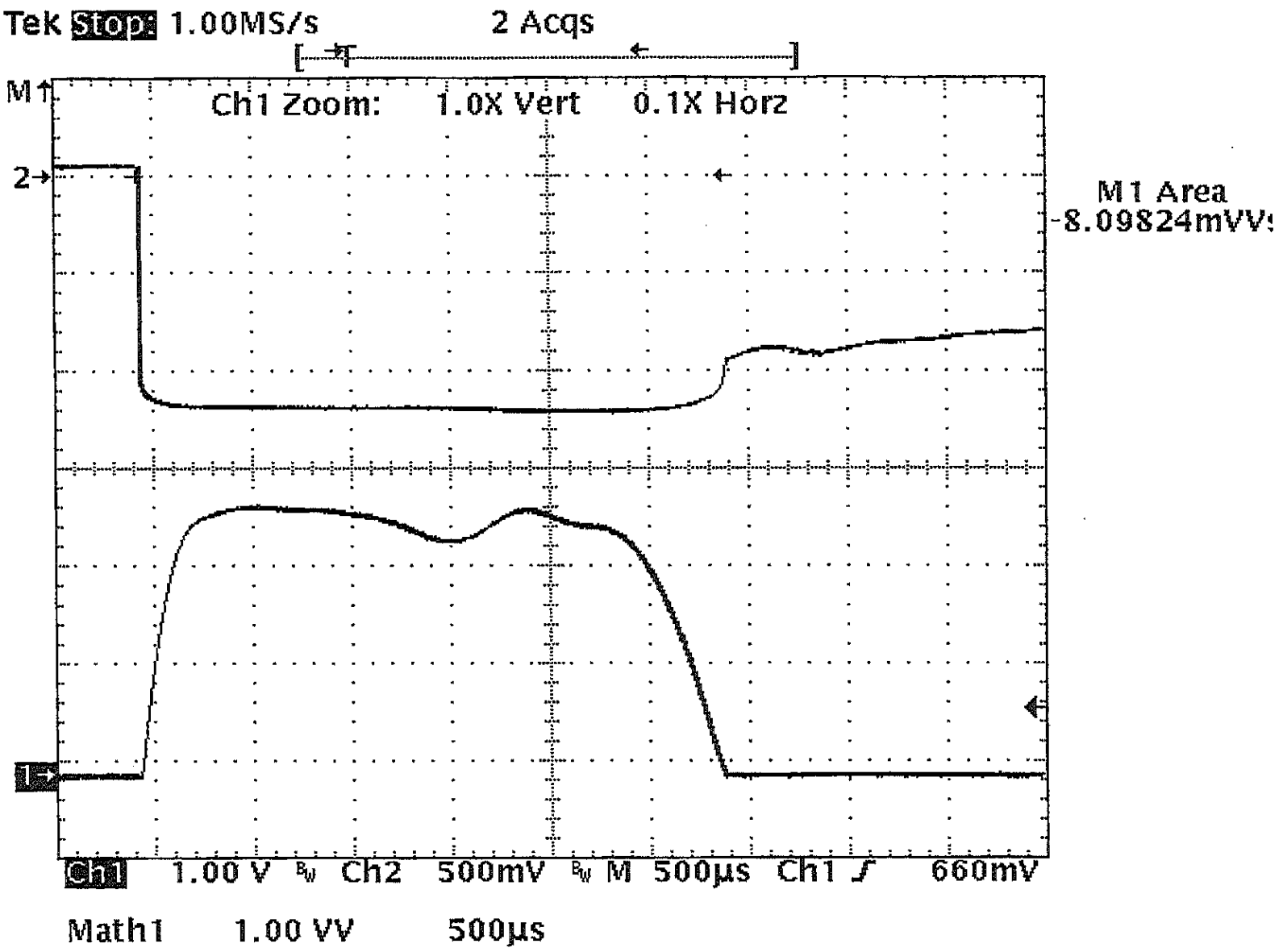
CESI TEST A4510783 oscillogram n. 12

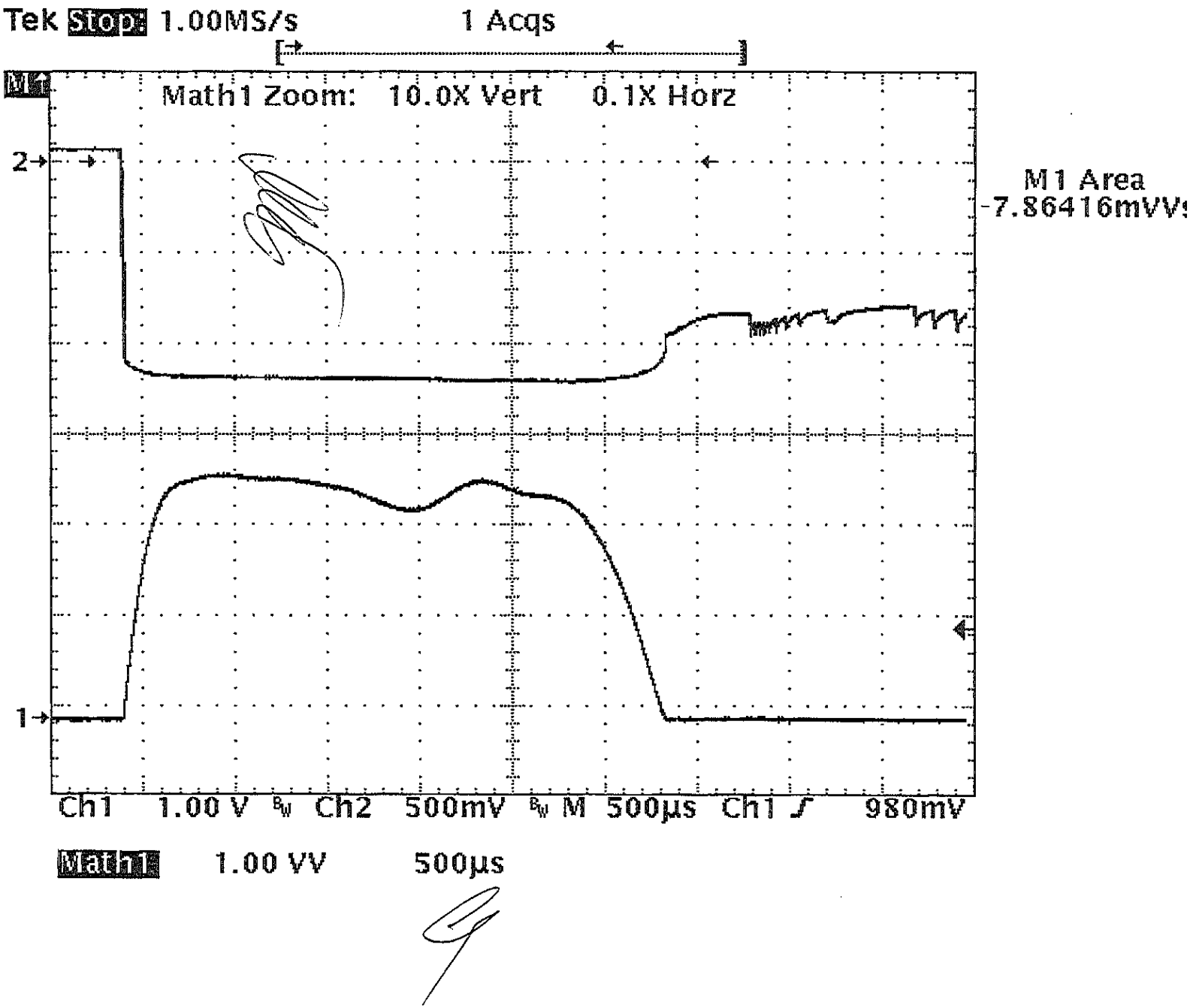


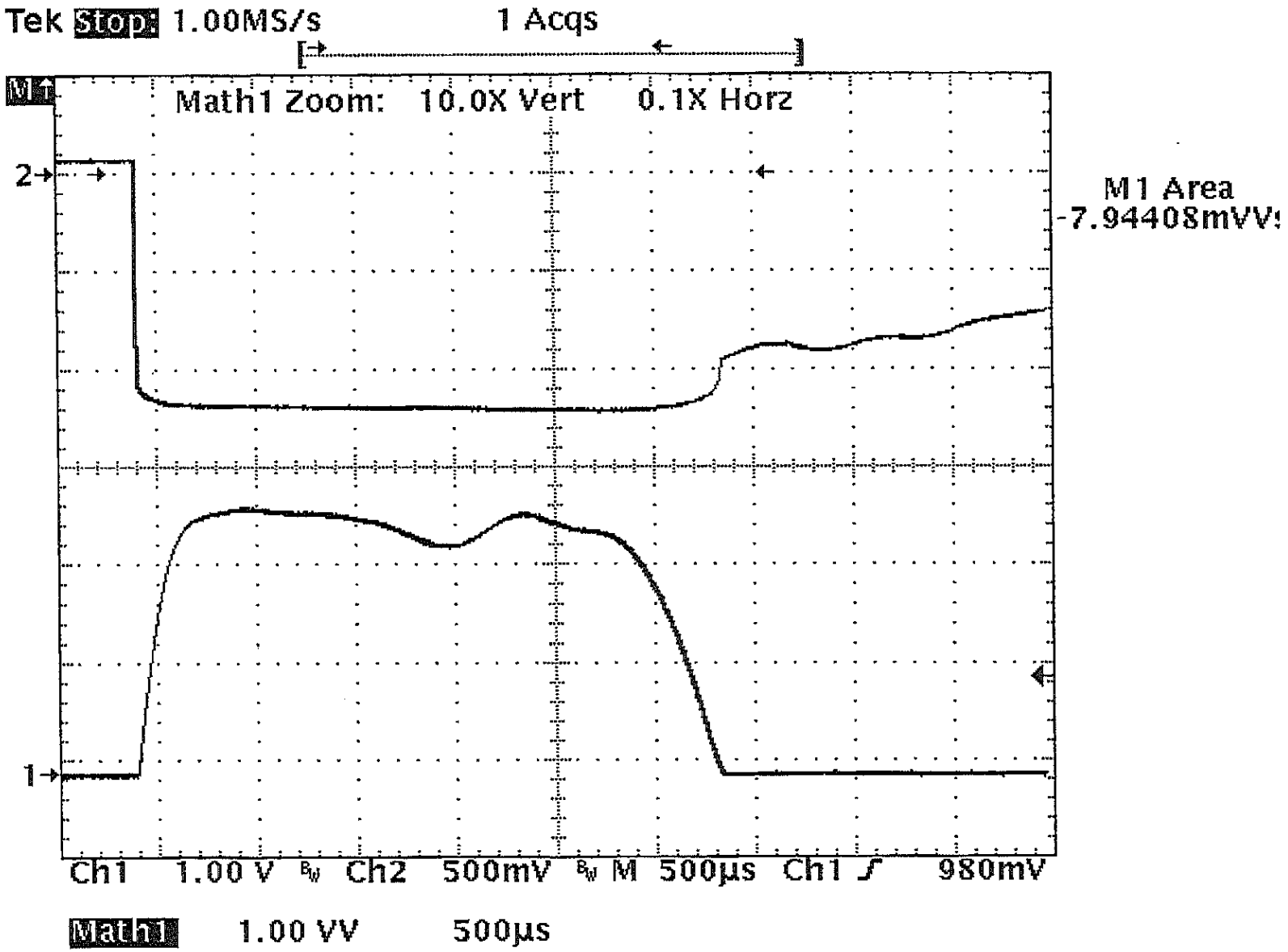
DESI TEST A4510783 oscillogram n. 13



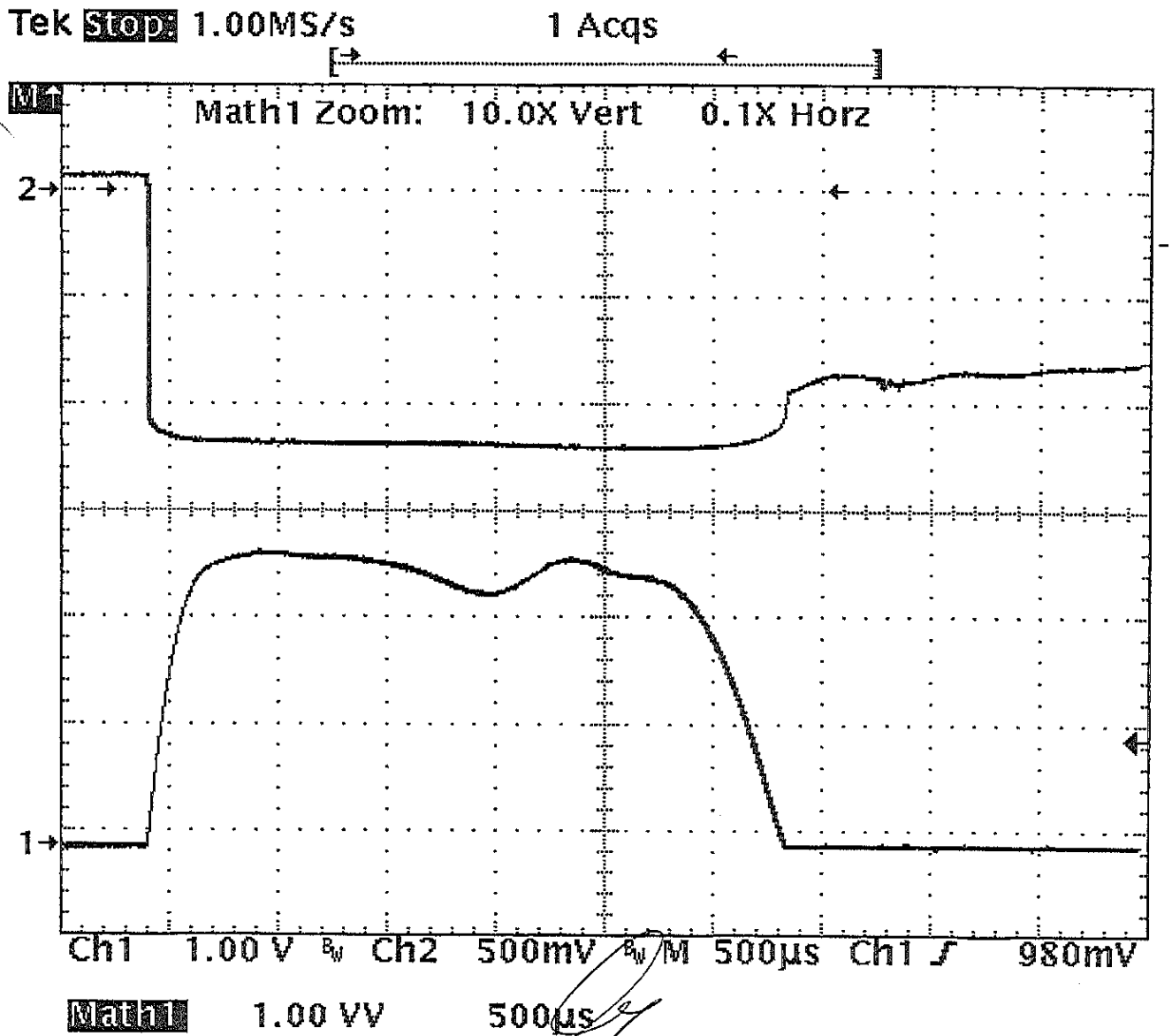
CESI TEST A4510783 oscillogram n. 15





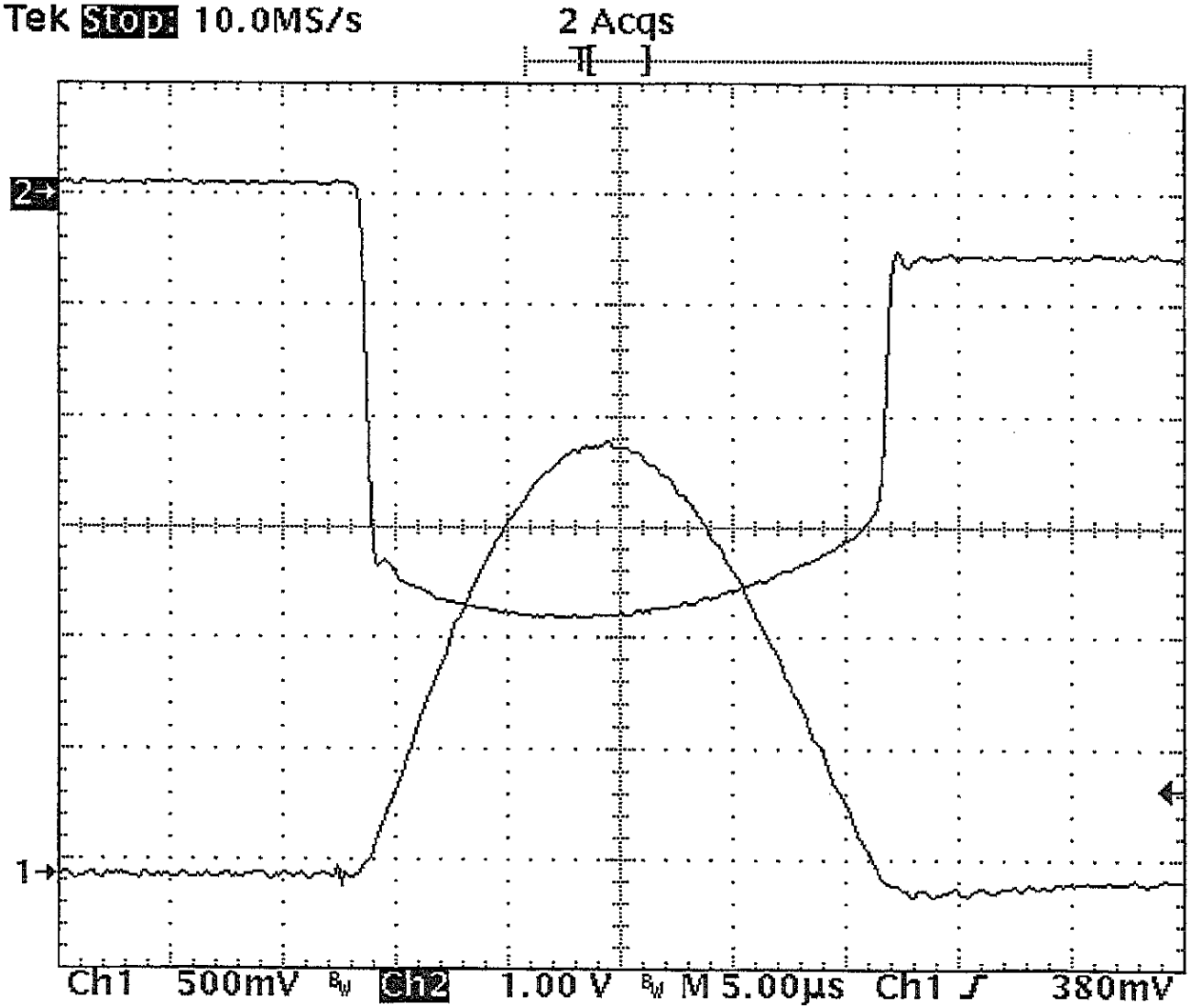


ESI TEST A4510783 oscillogram n. 17



CESI TEST A4510783 oscillogram n. 18

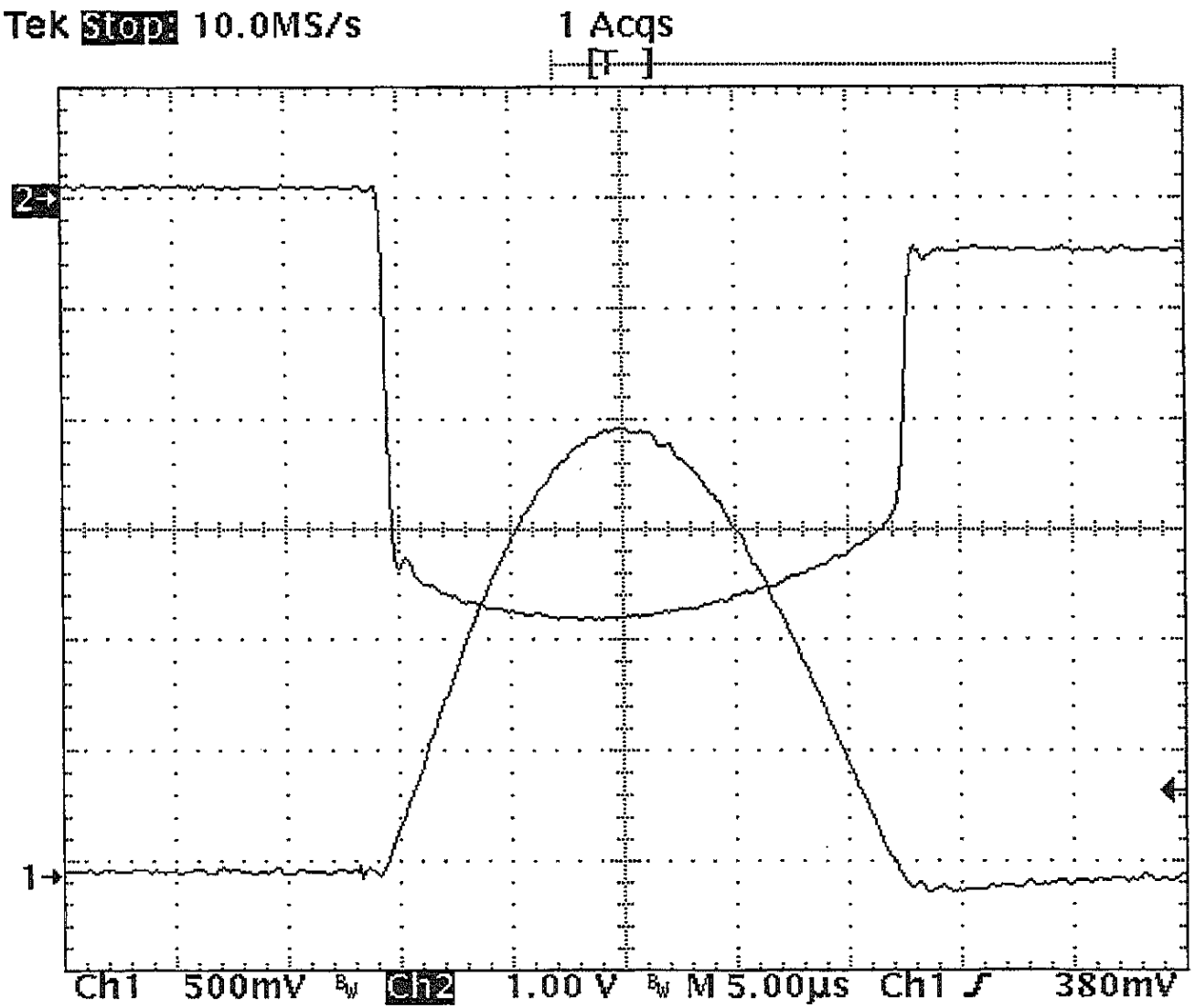
CESI TEST A4510783 oscillogram n. 19



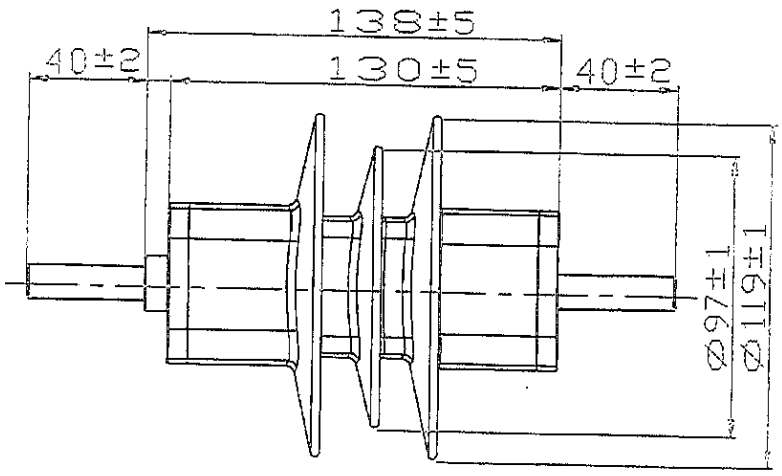
CESI TEST A4510783 oscillogram n. 20

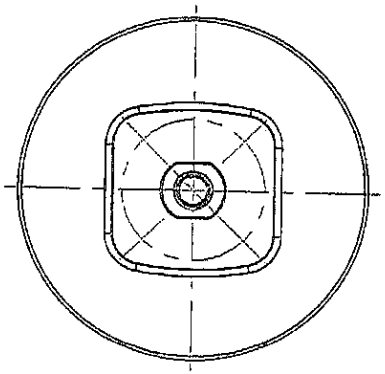
ВЯРНО С ОРИГИНАЛА

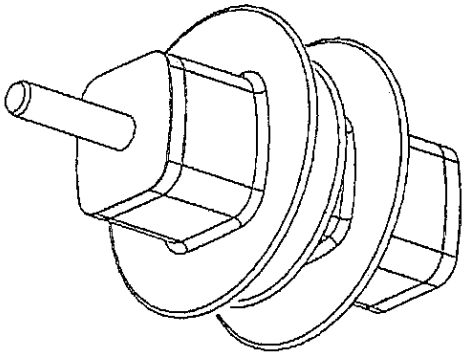
АКЦИОНЕРНО ДРУЖЕСТВО ФИЛКАБ 16 ПЛОВДИВ



TEST A4510783 oscillogram n. 21







CREEPAGE=265mm
DRY ARC DIST=138mm

tyco ELECTRONICS — ENERGY DIVISION

Bowthorpe EMP

BOWTHORPE EMP
BAY 100-109
SHANNON IND. EST.
SHANNON
CO. CLARE
IRELAND

DRN	J MULLIGAN	01/04/04	PCN	
CHECK			MAT'L	
APP				
SCALE	2/5			

TITLE: 5kV 10kA DCP2 SURGE ARRESTER PRODUCT

DRG NO: DCP2-5 — SHEET 1 OF 1 — AV

tyco Electronics

Energy Division
http://energy.tycoelectronics.com

Original Issued 03/2005

Tyco Confidential

Bowthorpe EMP

Test Report

Type	**OCP2**
PPR Number	**PPR-1975**
Test Specification	Accelerated ageing test of the resistor blocks IEC 60099-4 (2001-12)

Test Information:

Laboratory	CESI
Date	02/08/2004
External Test Ref	AT-A4517696
Report Prepared By	L. Podavitte
Test Verified by	A Sironi
Test Approved by	M de Nigris

Tyco Approvals:

R&D Manager
Brendan Normoyle — Date 25/02/2005

Technology Manager
Kwong Tong — Date 25/02/2005

Product Manager
Brian McGowan — Date 25/02/2005

На основание чл. 2 от ЗЗЛД

For further information contact:
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Fax: + 353-61-472676
Email: mvsurgearresters@tycoelectronics.com

ВЯРНО С ОРИГИНАЛА

АКЦИОНЕРНО ФИЛИАЛ 16 ПЛОВДИВ

client	Tyco Electronics Energy Division - Shannon (IRL)
equipment under test	Metal oxide resistors blocks section type OCP2
tests performed	Accelerated ageing test of the resistor blocks
normative documents	IEC 60099-4 (2001-12)
receipt date of the sample	June 16 , 2004
test date	from June 16, 2004 to August 02, 2004
no. of pages	14 no. of pages annexed 13

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		October 29 , 2004
prepared	PeC/TEST -	L
verified	PeC/TEST -	A
approved	PeC/TEST -	M

На основание чл. 2
от ЗЗЛД

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 drawings identified by CESI and numbered A4503147 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 %
- 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 a confidence level of about 95 %) and have to be considered as maximum values.

laboratory information

CESI testing team: L.Podavitte , M. Gregori
I. Guacci

test laboratory: C228 Surge arrester laboratory

activity code: 38993O
keywords: 12015R, 23810H, 31020W, 46030U, 53001D

ВЯРНО С ОРИГИНАЛА

ФИЛКАБ 16 ПЛОВДИВ

page annexed: oscillograms n. 12 pages

- TYCO Drawing no.OCP2-5; CESI n. A5/004333 n. 01, one page

ВЯРНО С ОРИГИНАЛА

Test object characteristics

The test was carried out on three samples of resistor blocks section surrounded by the same material as in the actual surge arrester. A view of the test samples is shown on page 5. The characteristics of the test samples are listed in the tables below.

Type: metal oxide resistor blocks section

electrical characteristics (claimed by the client)

manufacturer's name of tested sections	Tyco Electronics Energy Division - Shannon (IRL)
line discharge class	2
nominal discharge current - I_N [kA]	5
rated voltage - U_r [kV]	0,98 * $U_{ref.}$
continuous operating voltage - U_c [kV]	0,784 * $U_{ref.}$
reference current - $I_{ref.}$ [mA]	5
rated frequency [Hz]	50
year of manufacture	2004

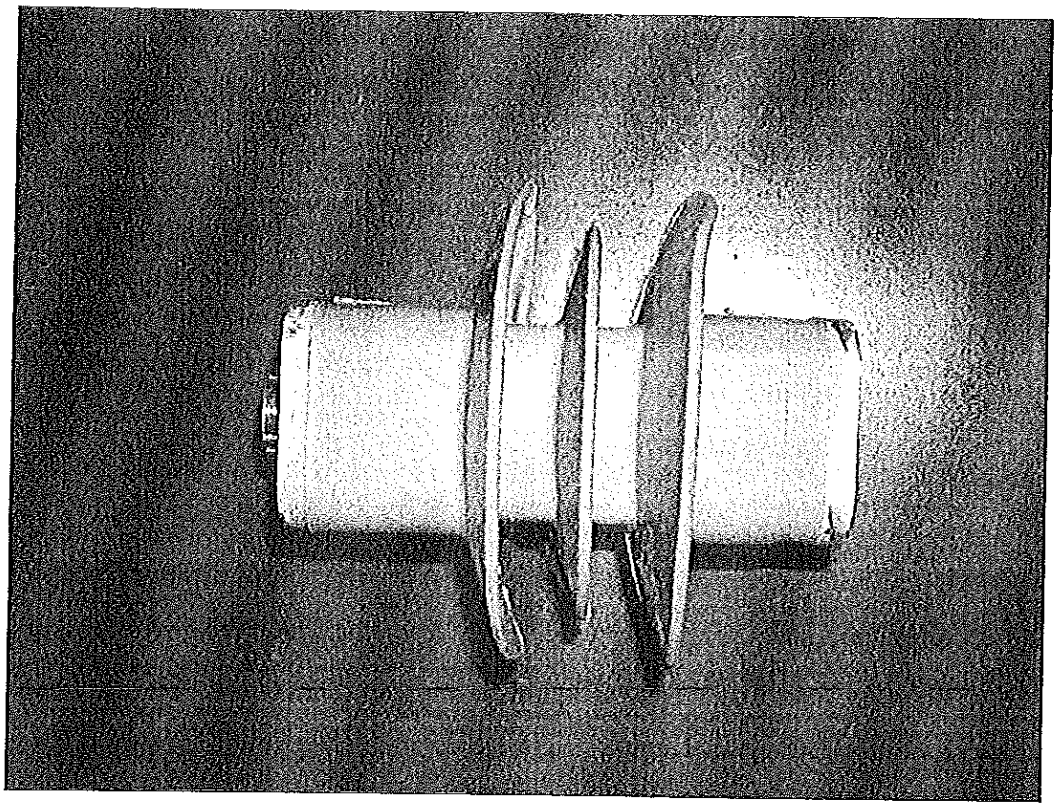
geometrical characteristics measured on tested section

total height [mm]	140
tube diameter [mm]	55

ВЯРНО С ОРИГИНАЛА

АКЦИОНЕРНО ДРУЖЕСТВО * ПЛОВДИВ * ФИЛКАБ 16

photograph of tested section



Reference standard

IEC 60099-4 (2001-12): " Metal-oxide surge arrester without gaps for a.c. system" - Clause 7.5.2

Test carried out and identification

Test carried out	Number of sample tested	test object identification
Accelerated ageing test	3	AG7 - AG8 - AG9

Test procedure

The test has been performed on three sample of resistor blocks sections surrounded by the same material as in the actual surge arrester.

The test voltage U_{ct} has been calculated as:

$U_{ct} = K_c * 1.15 * U_{ref} = 0,784 * 1,15 * 6,58 = 5,93$ kV

where:
- K_c is equal to the ratio U_c/U_{ref} claimed by the manufacturer
- 1.15 is the voltage unbalance factor as determined by the manufacturer
- U_{ref} is the measured reference voltage

The test samples has been placed in separate chambers (not sealed) and then positioned in the oven The oven has been heated up to 115 °C and then the samples has been energized at a the power frequency voltage of 5,93 kV_{rms} for a total duration of 1000 hours while maintained at a temperature of 115 °C ± 4 °C. Power losses and the temperature have been monitored continuously during the test (see oscillogram 10,11 and 12). More detailed data, are given for measurement carried out at the beginning (two hours after energization) and at the end of the test.

note: a scheme of test chamber and test oven are annexed to this test report in pag 11 and 12

ВЯРНО С ОРИГИНАЛА

АКЦИОНЕРНО ДРУЖЕСТВО * ФИЛКАБ 16 * ПЛОВДИВ

Summary of the test result

Details of the measurements carried out at the beginning (two hours after energization) and at the end of the test are given in the table below. The trend of the power losses monitored during the test is shown on the oscillogram n. 10, 11 and 12.

Metal-Oxide resistors n.	AG7	AG8	AG9
Ageing Test Voltage = U_{test} [kV]	5,93		
P_{1c} [W] (after 2 hours)	3,39	2,93	3,03
T_{1c} [°C] (after 2 hours)	112,0	112,9	113,0
P_{2c} [W] (after 1000 hours)	2,26	2,12	2,15
T_{2c} [°C] (after 1000 hours)	113,9	115,3	115,9
$k_{ct} = P_{2c}/P_{1c}$	0,666	0,723	0,709

Evaluation criteria according to IEC 60099-4 (2001-12)

The ratio P_{2c}/P_{1c} was less than 1.0 for all samples.

Where:

P_{2c} is the power losses measured at the end of the test

P_{1c} is the power losses measured at the beginning of the test (two hours after energization)

No correction factor to the test voltage during the operating duty test relevant to the accelerated ageing test has to be applied.

ВЯРНО С ОРИГИНАЛА

АКЦИОНЕРНО ДРУЖЕСТВО ФИЛКАБ 16 ПЛОВДИВ

Accelerated ageing test. IEC 60099-4

Power frequency voltage-current characteristics at ambient temperature

test object: metal-oxide resistors blocks section
test circuit: A019

date: June 16, 2004

sample no. AG7

oscill.	voltage	current	current	current	power	3rd harmonic amplitude
no.	kV	+ mA_{cr}	- mA_{cr}	mA_{rms}	W	μA
1	6,56	5,00	4,621	1,727	7,715	---

sample no. AG8

oscill.	voltage	current	current	current	power	3rd harmonic amplitude
no.	kV	+ mA_{cr}	- mA_{cr}	mA_{rms}	W	μA
2	6,58	5,00	4,454	1,654	7,269	---

sample no. AG9

oscill.	voltage	current	current	current	power	3rd harmonic amplitude
no.	kV	+ mA_{cr}	- mA_{cr}	mA_{rms}	W	μA
3	6,54	5,00	4,518	1,686	7,464	---

ВЯРНО С ОРИГИНАЛА АКЦИОНЕРНО ДРУЖЕСТВО ФИЛКАБ 16 ПЛОВДИВ

Accelerated ageing test. IEC 60099-4

Power frequency voltage-current characteristics at the beginning of the test

test object: metal-oxide resistor blocks section
test circuit: A019B

date: June 21,2004

sample no. AG7					
oscillogram.	voltage	current	current	power	Temperature
n.	kV	+ mA_{cr}	- mA_{cr}	W	°C
4	5,93	1,74	1,62	3,39	112,0

sample no. AG8					
oscillogram.	voltage	current	current	power	temperature
n.	kV	+ mA_{cr}	- mA_{cr}	W	°C
5	5,93	1,53	1,46	2,93	112,9

sample no. AG9					
oscillogram.	voltage	current	current	power	temperature
n.	kV	+ mA_{cr}	- mA_{cr}	W	°C
6	5,93	1,55	1,49	3,03	113,0

ВЯРНО С ОРИГИНАЛА

АКЦИОНЕРНО ДРУЖЕСТВО ФИЛКАБ 16 ПЛОВДИВ

Accelerated ageing test. IEC 60099-4

Power frequency voltage-current characteristics at the end of the test

test object: metal oxide resistor blocks section
test circuit: A019B

date: August 02, 2004

sample no. AG7					
oscillogram.	voltage	current	current	power	Temperature
n.	kV	+ mA_{cr}	- mA_{cr}	W	°C
7/10	5,93	1,23	1,15	2,26	113,9

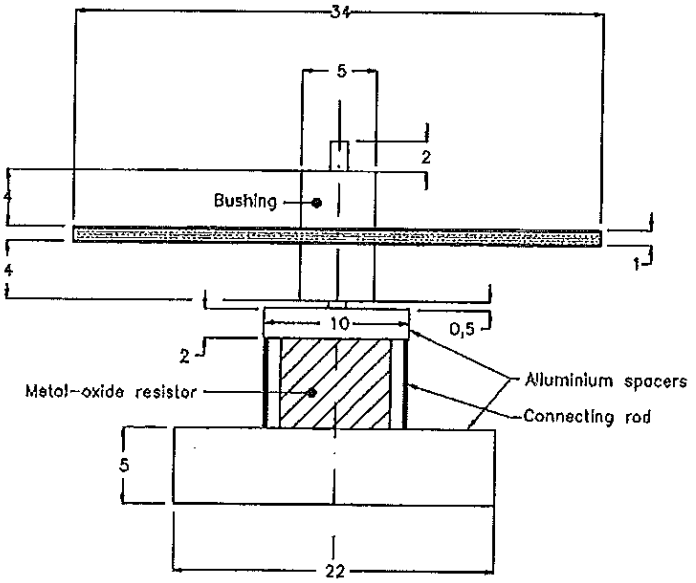
sample no. AG8					
oscillogram.	voltage	current	current	power	temperature
n.	kV	+ mA_{cr}	- mA_{cr}	W	°C
8/11	5,93	1,11	1,09	2,26	115,3

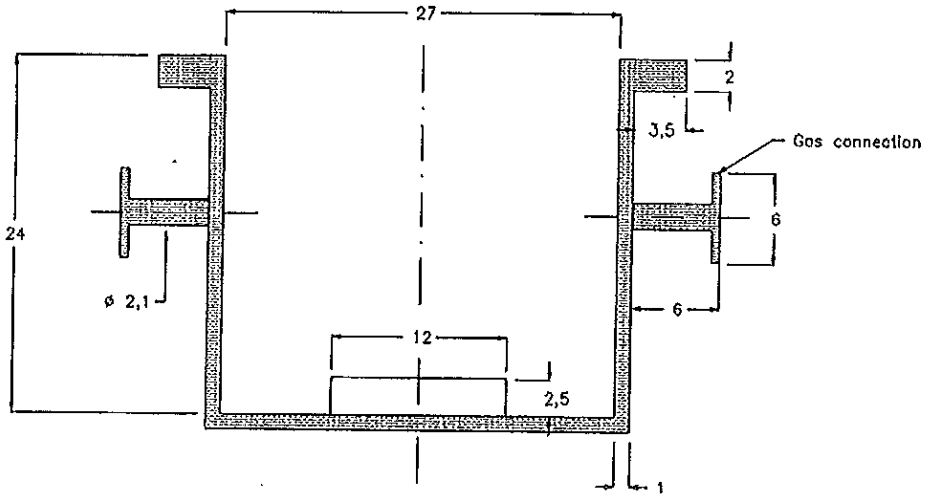
sample no. AG9					
oscillogram.	voltage	current	current	power	temperature
n.	kV	+ mA_{cr}	- mA_{cr}	W	°C
9/12	5,93	1,09	1,08	2,15	115,9

ВЯРНО С ОРИГИНАЛА

ФИЛКАБ 16

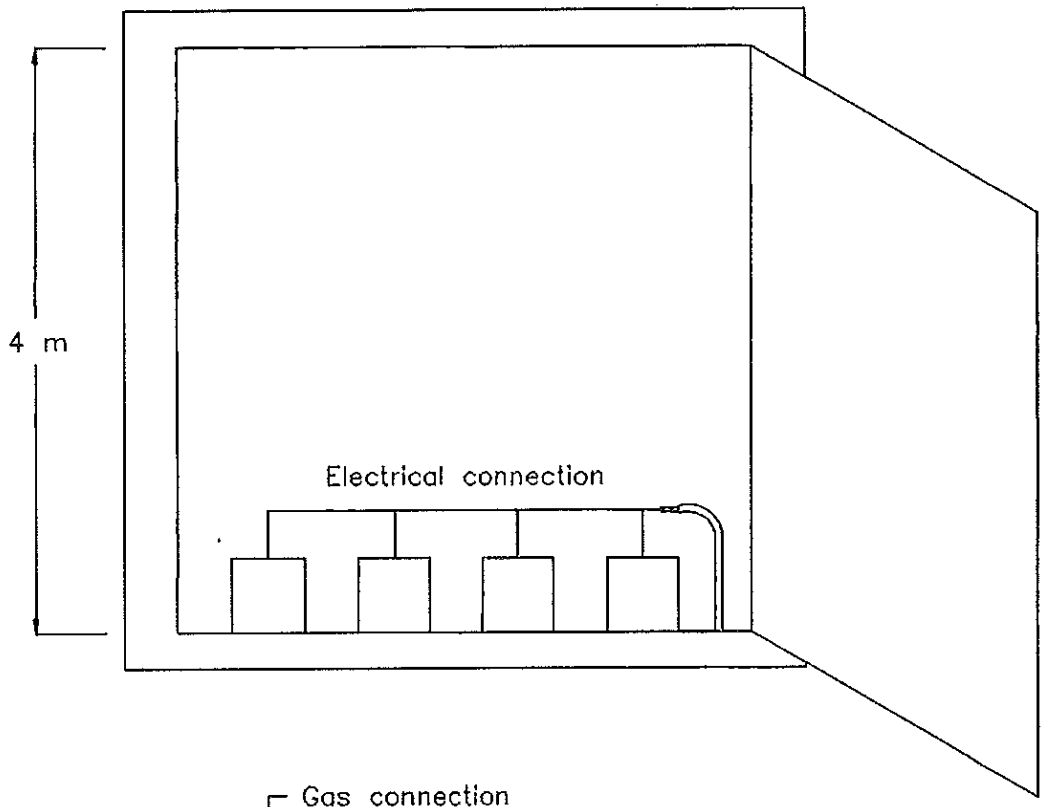
General scheme of the chamber

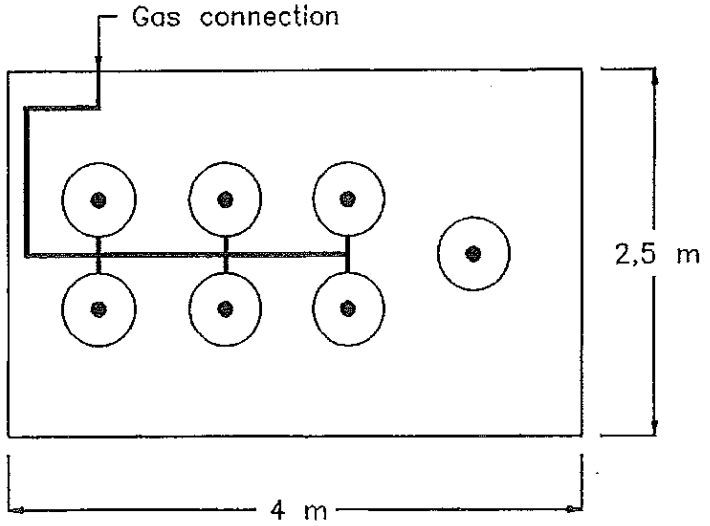




all dimension are in cm.

Disposition of the chamber in test oven



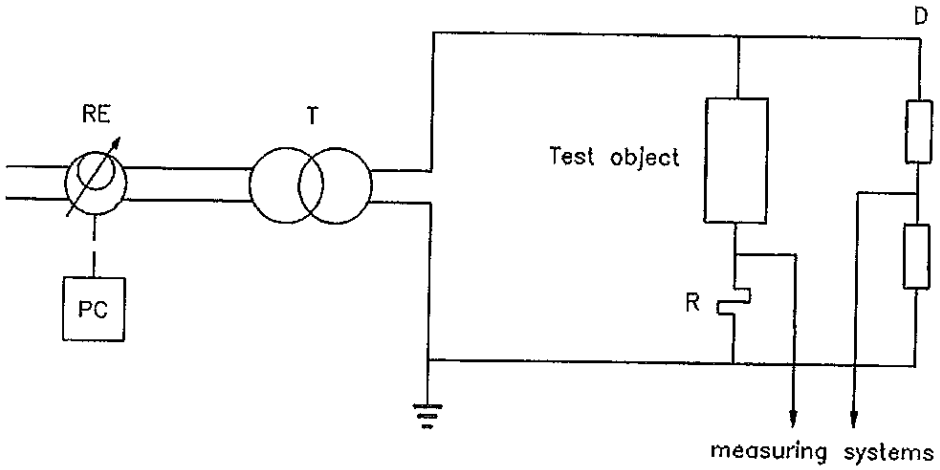


no gas has been used since the test was carried out in open air

ВЯРНО С ОРИГИНАЛА

АКЦИОНЕРНО ДРУЖЕСТВО ФИЛКАБ 16 ПЛОВДИВ

circuit A019



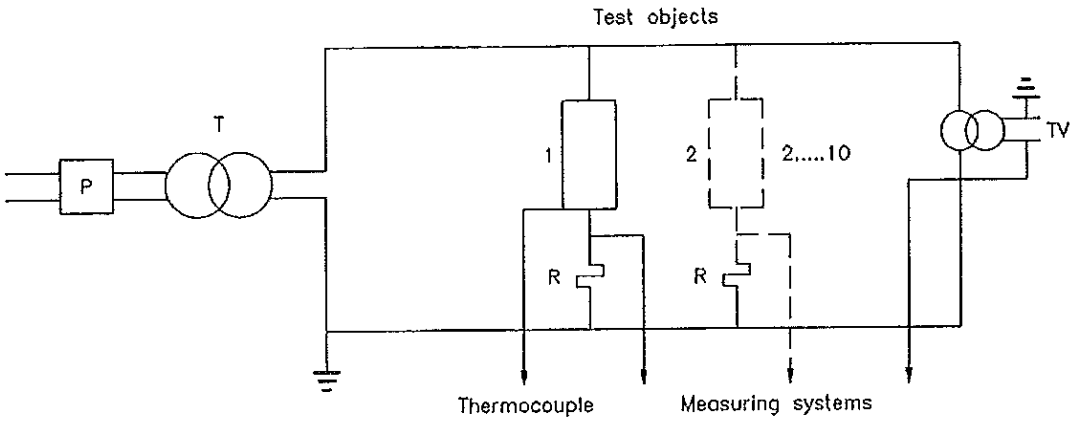
power
frequency supply

RE : programmable supply CESI no. 23702-32191 ; type Larcet A.C. Power Source 5000 P.S.
PC : personal computer
T : transformer type SPECIAL TRAFO ; power 30 kVA ; voltage 220V/ 15 kV

current shunt (R) CESI no.11536 ; R = 100,4 Ω ;
oscilloscope CESI no. 30223-30224
type DATA PRECISION DATA 6100

voltage divider (D) CESI no.11120 k=1010
electro optical system CESI no.11521/522 ; attenuation 50:5
oscilloscope CESI no. 30223-30224
type DATA PRECISION DATA 6100

circuit A019B



power frequency supply

RE : power supply
T : transformer type PIVI ; power 10 kVA ; voltage 220 V/ 12,5 kV

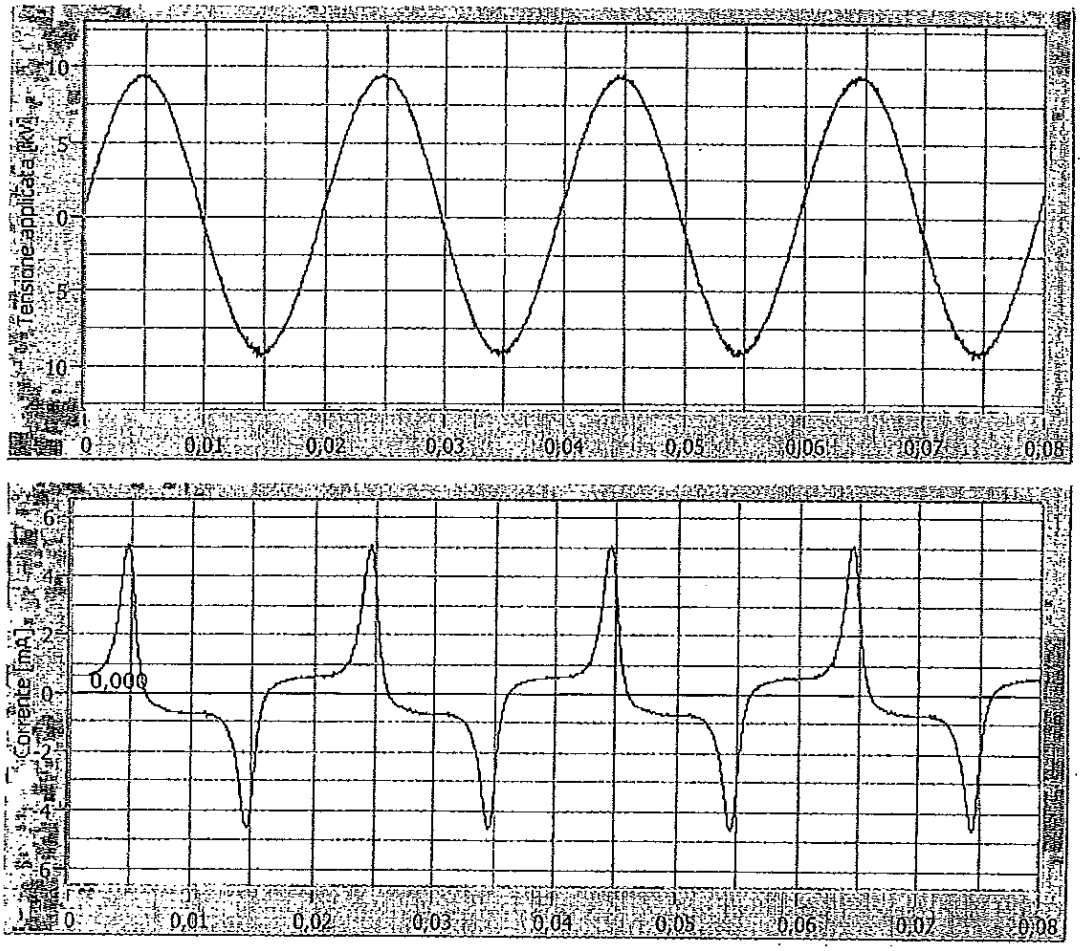
current shunt (R) R = 1000 Ω ; type SECI

voltage transformer (D) CESI 30000:100

acquisition system type NATIONAL INSTRUMENTS SCXI-1001

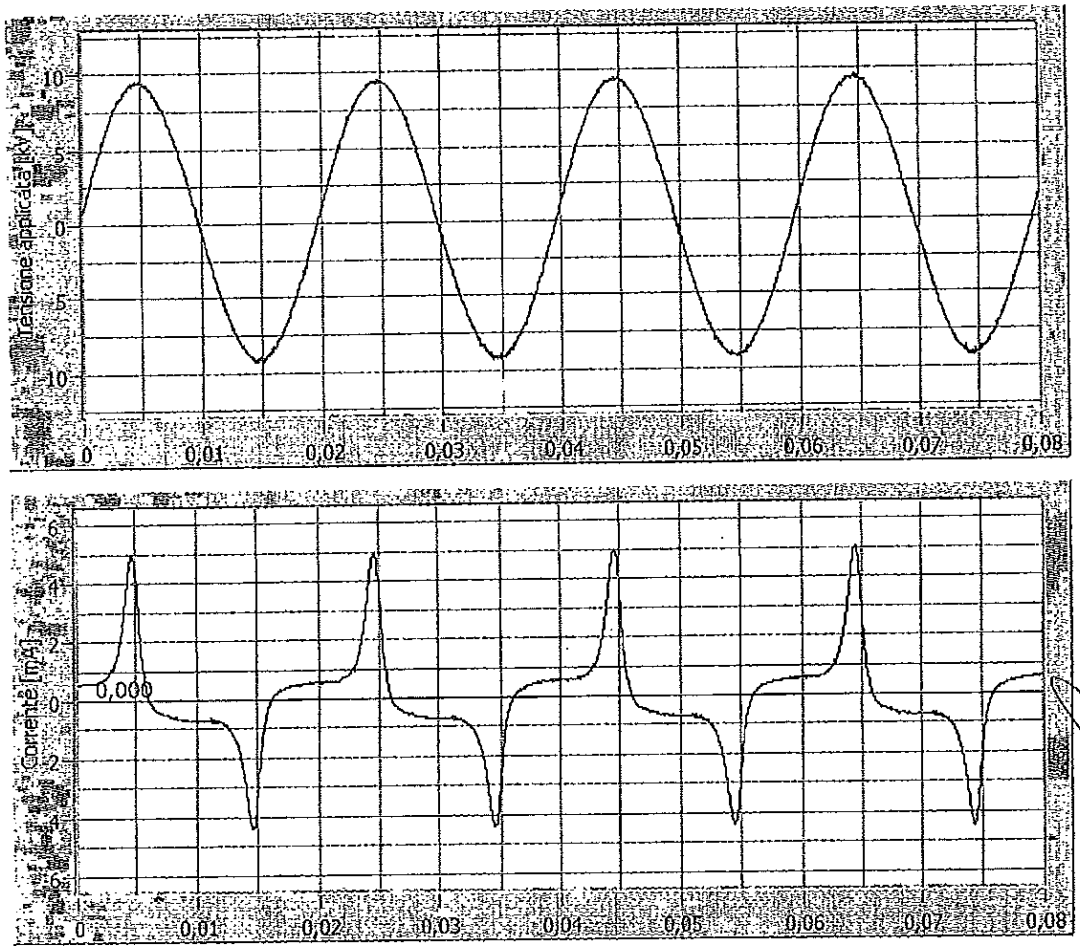
ВЯРНО С ОРИГИНАЛА

АКЦИОНЕРНО ФИЛКАБ 16 ПЛОВДИВ



10 kA Sample 1 Class 2

CESI PeC A4517696 oscillogram n. 1

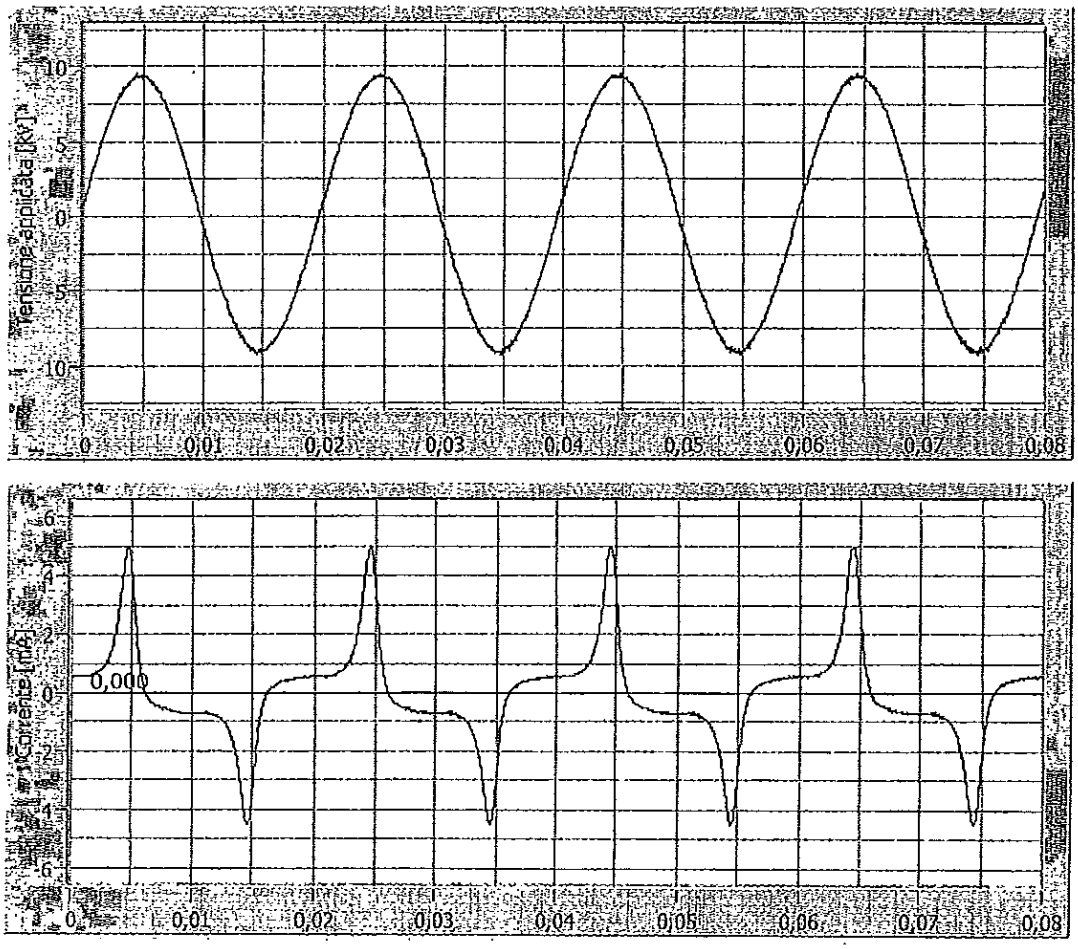


10 kA Sample 2 Class 2

CESI PeC A4517696 oscillogram n. 2

ВЯРНО С ОРИГИНАЛА

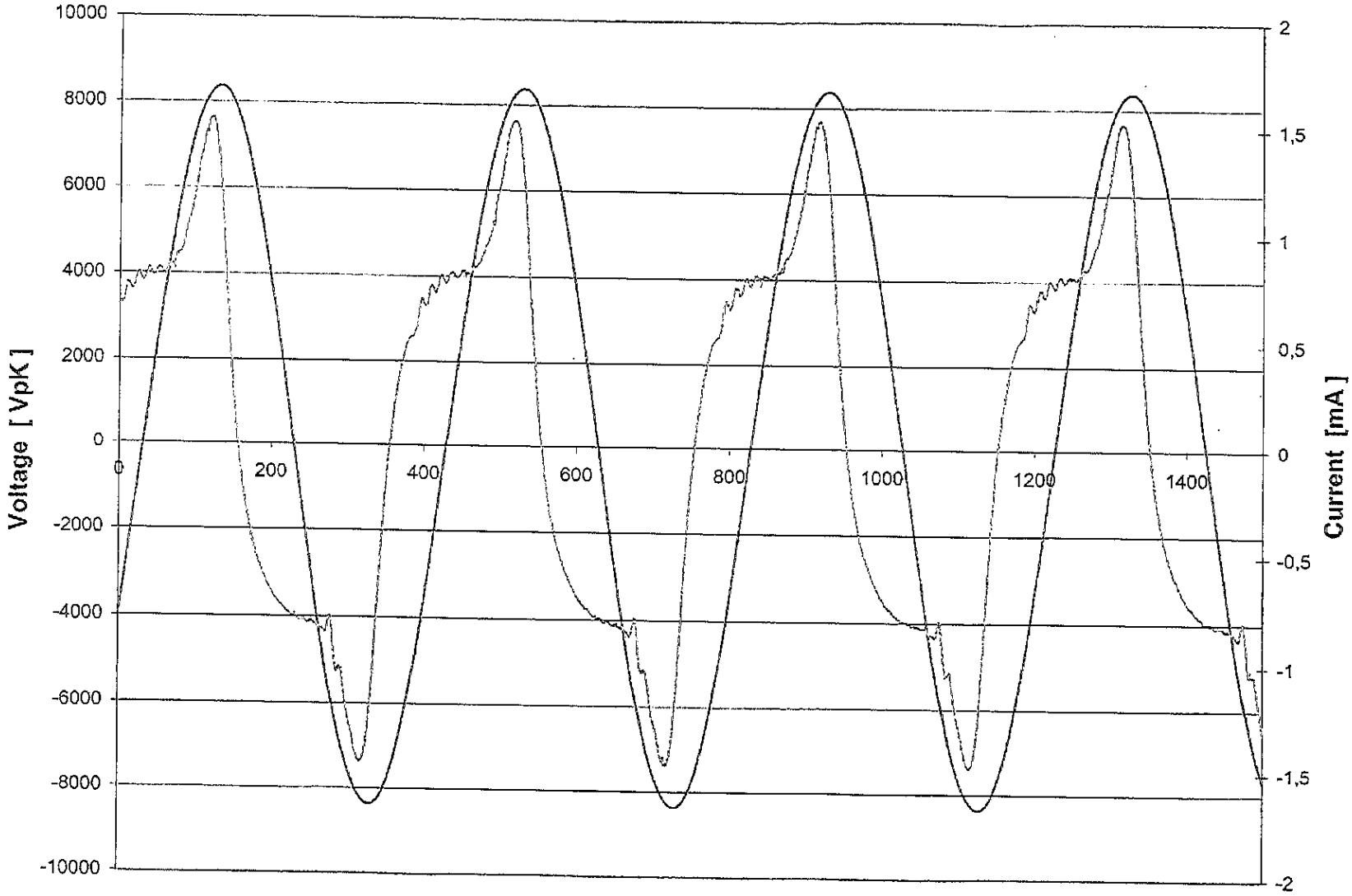
АКЦИОНЕРНО ДРУЖЕСТВО ФИЛКАБ 16 ПЛОВДИВ



10 kA Sample 3 Class 2

CESI PeC A4517696 oscillogram n. 3

CESI PeC A4517696 oscillogram n. 4

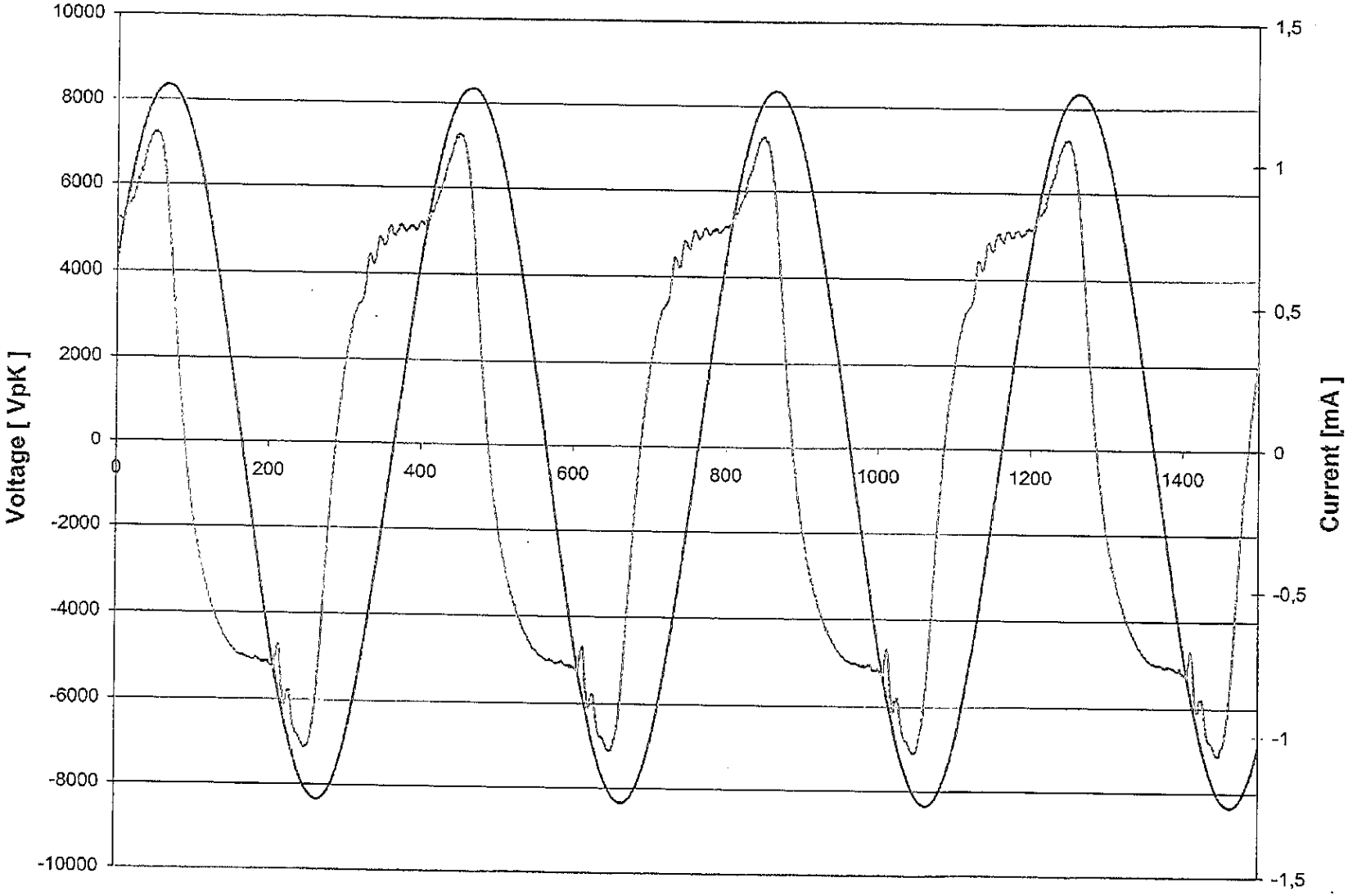


ESI PeC A4517696 oscillogram n. 5

CESI PeC A4517696 oscillogram n. 6

CESI PeC A4517696 oscillogram n. 7

CESI PeC A4517696 oscillogram n. 8



CESI PeC A4517696 oscillogram n. 9

CESI PeC A4517696 oscillogram n. 10

ВЯРНО С ОРИГИНАЛА

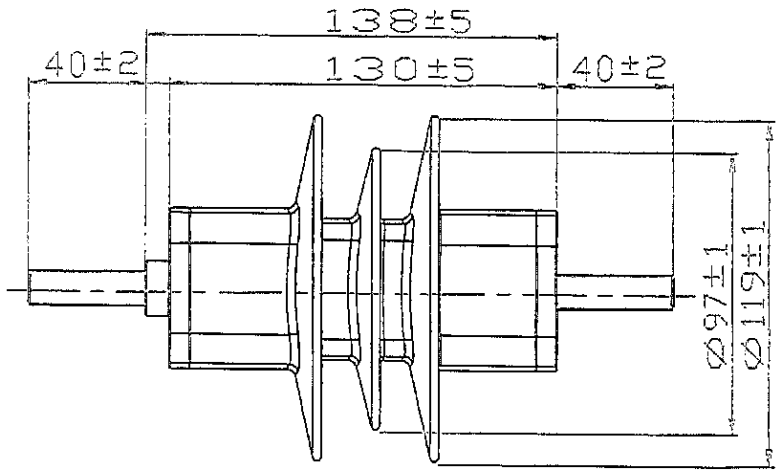
АКЦИОНЕРНО ДРУЖЕСТВО * ФИЛКАБ 16 * ПЛОВДИВ

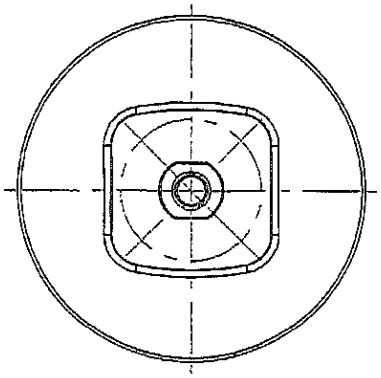
CESI PeC A4517696 oscillogram n. 11

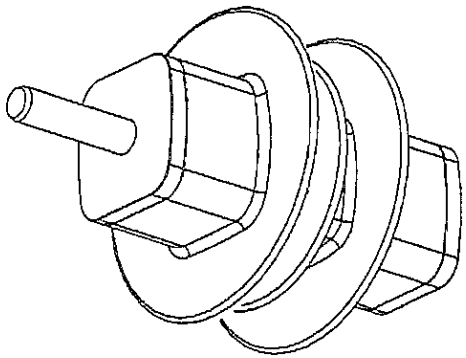
CESI PeC A4517696 oscillogram n. 12

ВЯРНО С ОРИГИНАЛА

АКЦИОНЕРНО ДРУЖЕСТВО * ПЛОВДИВ * ФИЛКАБ 16







CREEPAGE=265mm
DRY ARC DIST=138mm

tyco ELECTRONICS

ENERGY DIVISION

Sowthorpe EMP

SOWTHORPE EMP
BAY 300-109
SHANNON IND. EST.
SHANNON
CO. CLARE
IRELAND

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DRN	J MULLIGAN	02/04/04		PCN	---000
CHECK				MAT'L	
APP					
SCALE	2:5				

TITLE
5kV 10kA DCP2 SURGE ARRESTER PRODUCT

DRG NO DCP2-5 SHEET 1 OF 1 REV

tyco Electronics

Energy Division
http://energy.tycoelectronics.com

Bowthorpe EMP

Test Report

Type	**OCP2**
PPR Number	**PPR-1976**
Test	Short Circuit Tests
Specification	IEC 60099-4 (2004-05)

Test Information:

Laboratory	CESI
Date	11/11/2004
External Test Ref	A4/522781
Report Prepared By	P Beccarini
Test Verified by	A Sironi
Test Approved by	V Scarioni

Tyco Approvals:

R&D Manager
Brendan Normoyle — Date 25/02/2005

Technology Manager
Kwong Tong — Date 25/02/2005

Product Manager
Brian McGowan — Date 25/02/2005

На основание чл. 2 от ЗЗЛД

For further information contact:
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Bay 100 - 109
Shannon Industrial Estate
Co. Clare, Ireland
Tel: + 353-61-472885
Fax: + 353-61-472676
Email: mvsurgearresters@tycoelectronics.com

ВЯРНО С ОРИГИНАЛА

АКЦИОНЕРНО ДРУЖЕСТВО ФИЛКАБ 16

Test Report

CESI n° 0030 Approved

Client	TYCO ELECTRONICS ENERGY DIVISION Shannon - IRELAND
Tested equipment	Polymeric housed metal-oxide surge arrester Type OCP2
Tests carried out	Short-circuit tests
Standards/Specifications	IEC 60099-4 (2004)
Test date	**from** November 10, 2004 **to** November 11, 2004

No. of pages	22	**No. of pages annexed**	13
Issue date	December 15, 20		
Prepared	PeC - P. BECCA		
Verified	PeC - A. SIRON		
Approved	PeC - M. de NIC		

На основание чл. 2 от ЗЗЛД

На основание чл. 2 от ЗЗЛД

ВЯРНО С ОРИГИНАЛА

Tests witnessed by

Mr. Normoyle Brendan TYCO
Ms. Claire O'Keeffe TYCO

Identification of the object effected.
The Manufacturer guarantees that the tested object is manufactured according to the submitted drawing.
CESI checked that this drawing adequately represents in shape and dimensions the essential details and the parts of the tested object.
This drawing identified by CESI and numbered A4/522916 No.1 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: A4/518477

The measurement uncertainties of the test results reported in the document are the following:
voltage: ± 5 % ; current: ± 5 % ; time: ± 5 % ; temperature: ± 2 °C
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 November 3, 2004

Activity code 43160L

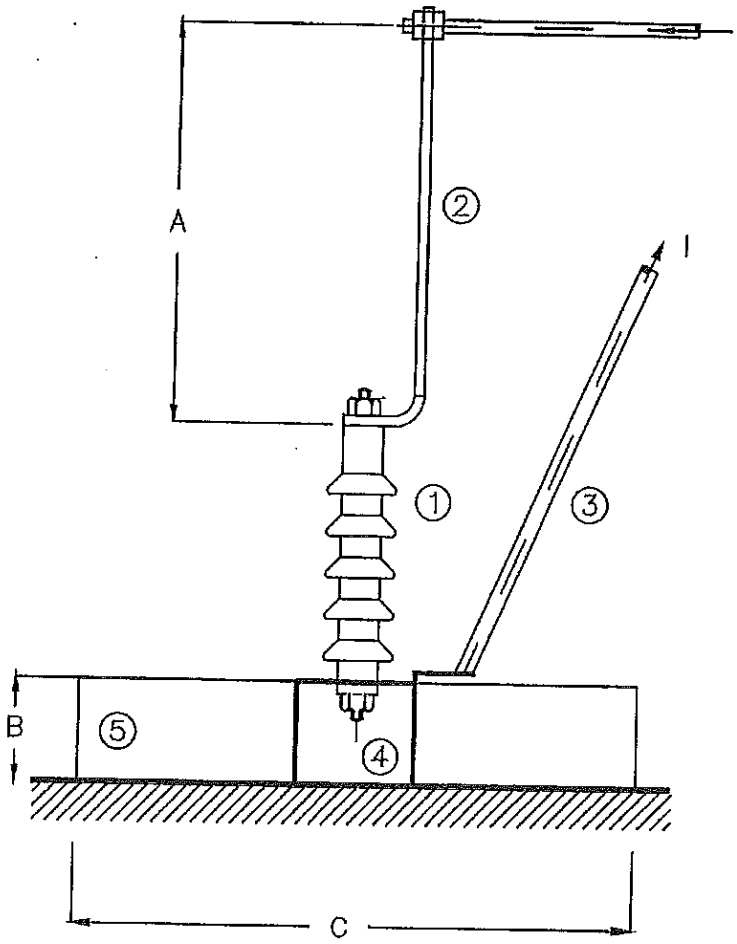
ВЯРНО С ОРИГИНАЛА

АКЦИОНЕРНО ДРУЖЕСТВО * ФИЛКАБ 16 * ПЛОВДИВ *

Rated characteristics of the tested object assigned by the Client

Metal-oxide surge arrester		
Manufacturer		BOWTHORPE
Type		OCP2
Drawing		MV-OCP2-00107-S-2
Rated voltage (Ur)		36,25 kV
Maximum continuous operating voltage (Uc)		29 kV
Rated frequency		50/60 Hz
Nominal discharge current (8/20 µs impulse shape)		10 kA
Pressure relief class		
High current	for 0,2 s ;	40,0 kA
Low current	for 1,0 s ;	0,60 kA

D8000 - Test arrangement



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

A : 1,0 m
B : 0,4 m
C : 1,8 m

The arrester to be tested was fixed on a support at 0,4 m to ground in the middle of a circular enclosure of 1,8 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.

High-current short-circuit test with 25,2 kA for 0,20 s

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

Test arrangement : See D8000 and photo No.1
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 11,0 A
The voltage applied to the arrester was risen in order to get a current equal to 50mA (0-peak)(i.e. 54kVpk) and kept at this value till arrester failure.
The pre-failure process duration was 8 minutes and 30 seconds.
The short-circuit test was performed 15minutes after the completion of the pre-failure process.

Prospective test current			
Oscillogram		rms value	Peak value
No.	Sheets	kA	KA
4	1	25,2	65,6

Condition of the apparatus before the tests: new, see photo No.2.

Date: November 10, 2004

Test	Oscillogram		Arrester under test	Duration	Test voltage	Test current		Venting time		Notes
						Peak value	rms value			
No.	No.	Sheets	No.	s	kV	kA	kA	ms	-	No.
1	6	2	OCP2	0,20	24,5	46,6	25,2	0.9	-	-

Condition of the apparatus after the tests: see photos No.3 and 4.

- The arrester structure remained almost intact.
- The arrester remained connected to the supply and return circuit.
- No fragment were found inside or outside the circular enclosure.
- No flame was noted after the test.

ВЯРНО С ОРИГИНАЛА

АКЦИОНЕРНО ДРУЖЕСТВО ФИЛКАБ 16 ВИДОВДИВ

High-current short-circuit test with 39.2 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 9,00 A.
The voltage applied to the arrester was risen in order to get a current equal to 50mA (0-peak)(i.e. 54kVpk) and kept at this value till arrester failure.
The pre-failure process duration was 7 minutes and 0 seconds.
The short-circuit test was performed 9 minutes after the completion of the pre-failure process.

Prospective test current			
Oscillogram		rms value	Peak value
No.	Sheets	kA	KA
19	1	43,3	121

Condition of the apparatus before the tests: new, see photo No.5.

Date: November 11, 2004

Test	Oscillogram		Arrester under test	Duration	Test voltage	Test current		Venting time		Notes
						Peak value	rms value			
No.	No.	Sheets	No.	s	kV	kA	kA	ms	-	No.
2	21	2	OCP2	0,20	24,5	102	39,2	1,1	-	-

Condition of the apparatus after the tests: see photos No.6 and 7.

- The arrester structure remained almost intact.
- The upper connection was found detached due to melting of the stud.
- No fragment were found inside or outside the circular enclosure.
- No flame was noted after the test.

High-current short-circuit test with 13.0 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 11,0 A.
The voltage applied to the arrester was risen in order to get a current equal to 50mA (0-peak)(i.e. 54 kVpk) and kept at this value till arrester failure.
The pre-failure process duration was 5 minutes and 30 seconds.
The short-circuit test was performed 10 minutes after the completion of the pre-failure process.

Prospective test current			
Oscillogram		rms value	Peak value
No.	Sheets	kA	kA
23	1	13,2	36,2

Condition of the apparatus before the tests: new, see photo No.8.

Date: November 11, 2004

Test	Oscillogram		Arrester under test	Duration	Test voltage	Test current			Venting time	Notes
						Peak value	rms value			
No.	No.	Sheets	No.	s	kV	kA	kA	-	ms	No.
3	25	2	OCP2	0,20	24,5	30,4	13,0	-	1,2	-

Condition of the apparatus after the tests: see photos No.9 and 10.

- The arrester structure remained almost intact.
- The arrester remained connected to the supply and return circuit.
- No pieces were projected inside or outside the circular enclosure.
- No flame was noted after the test.

ВЯРНО С ОРИГИНАЛА

Low-current short-circuit test with 0,62 kA 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 11,0 A.
The voltage applied to the arrester was risen in order to get a current equal to 50mA (0-peak)(i.e. 54 kVpk) and kept at this value till arrester failure.
The pre-failure process duration was 5 minutes and 50 seconds.
The short-circuit test was performed 9 minutes after the completion of the pre-failure process.

Prospective test current			
Oscillogram		rms value	Peak value
No.	Sheets	kA	kA
30	1	0,62	-

Condition of the apparatus before the tests: new, see photo No.11.

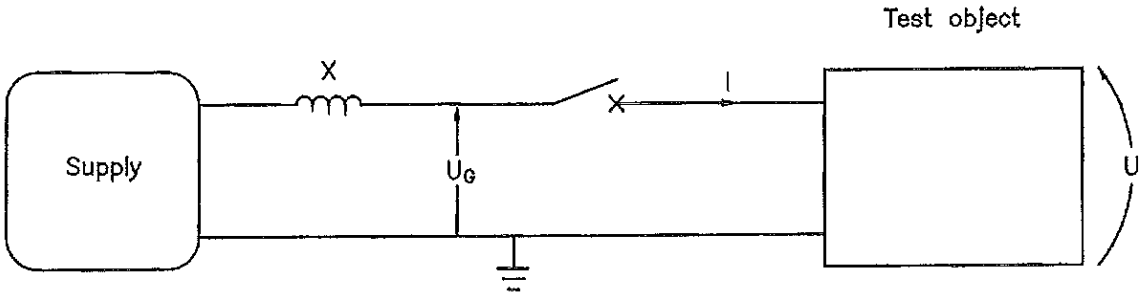
Date: November 11, 2004

Test	Oscillogram		Arrester under test	Duration	Test voltage	Test current			Venting time	Notes
						Peak value	rms value			
No.	No.	Sheets	No.	s	kV	kA	kA	-	ms	No.
4	32	2	OCP2	1,00	24,5	-	0,62	-	2,90	-

Condition of the apparatus after the tests: see photo No.12.

- The arrester structure remained almost intact.
- The arrester remained connected to the supply and return circuit.
- 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.

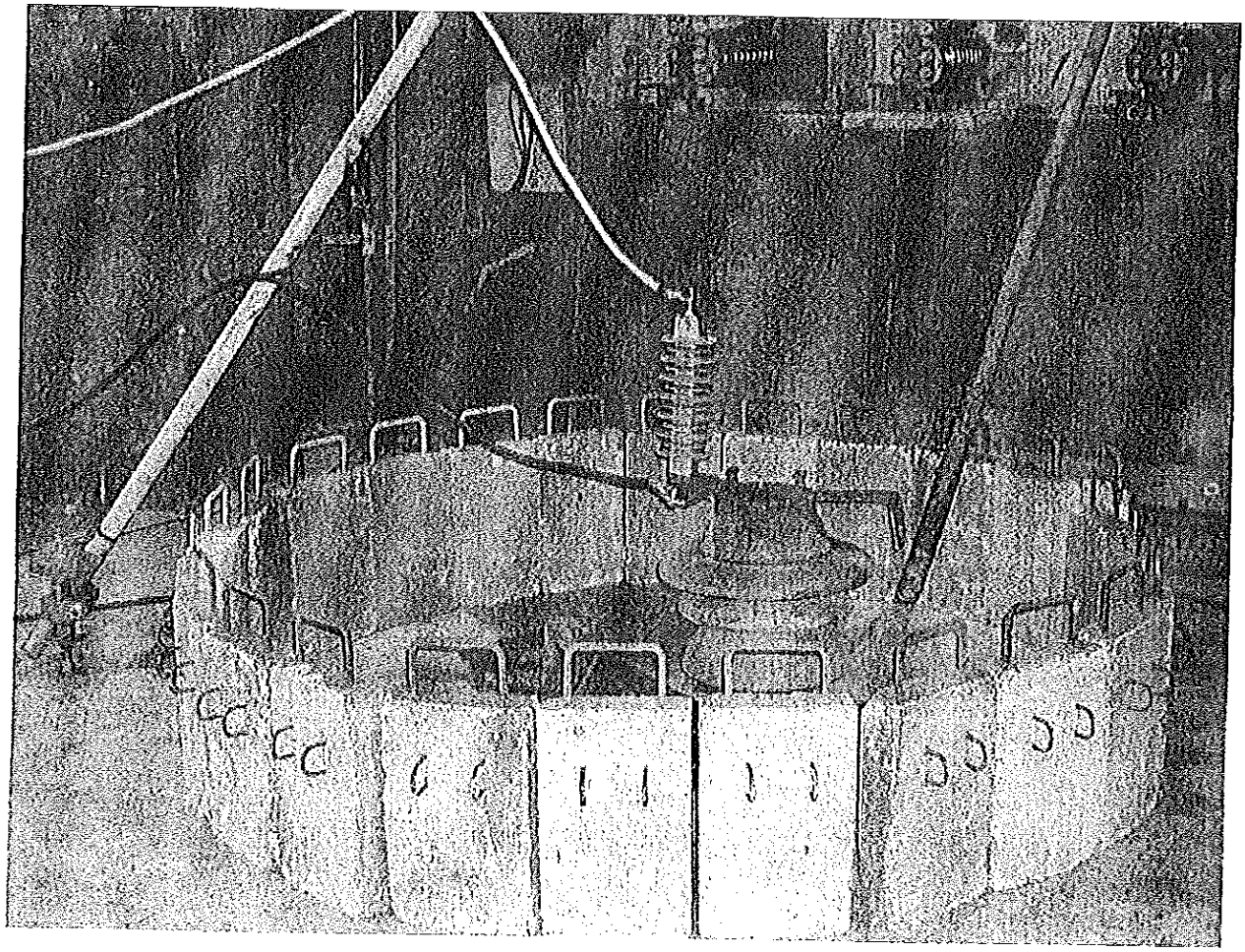


Photo no. 1

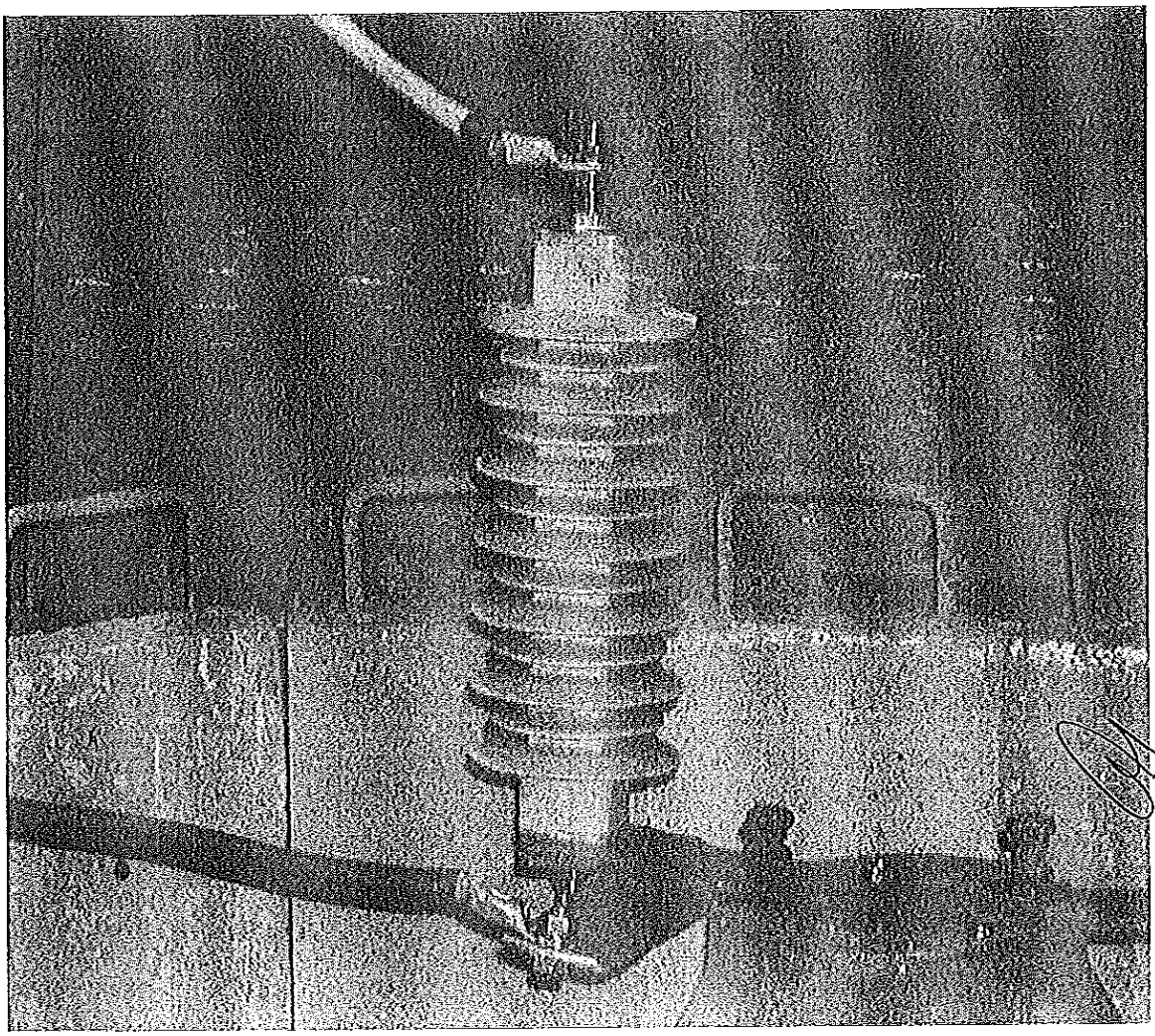


Photo no. 2

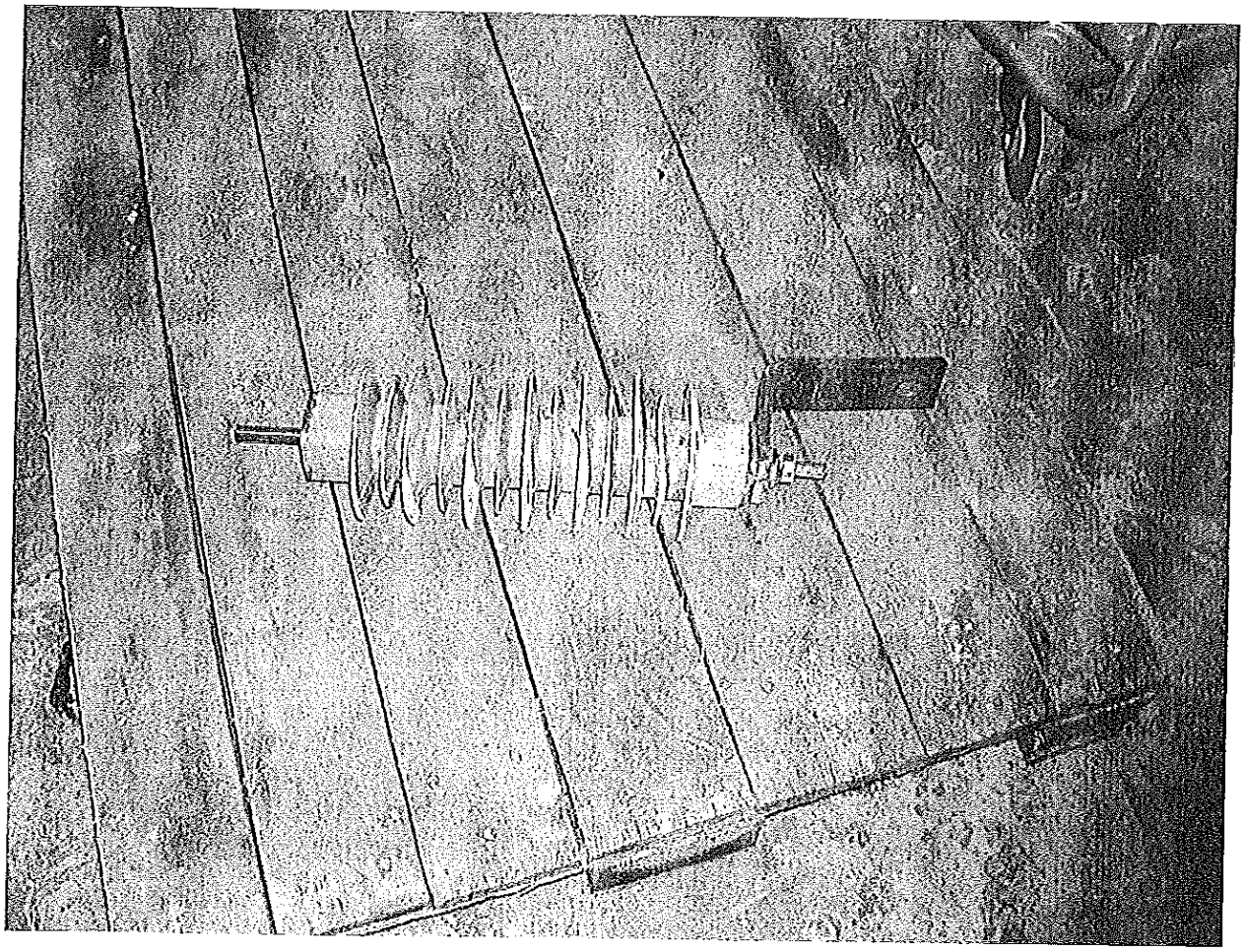
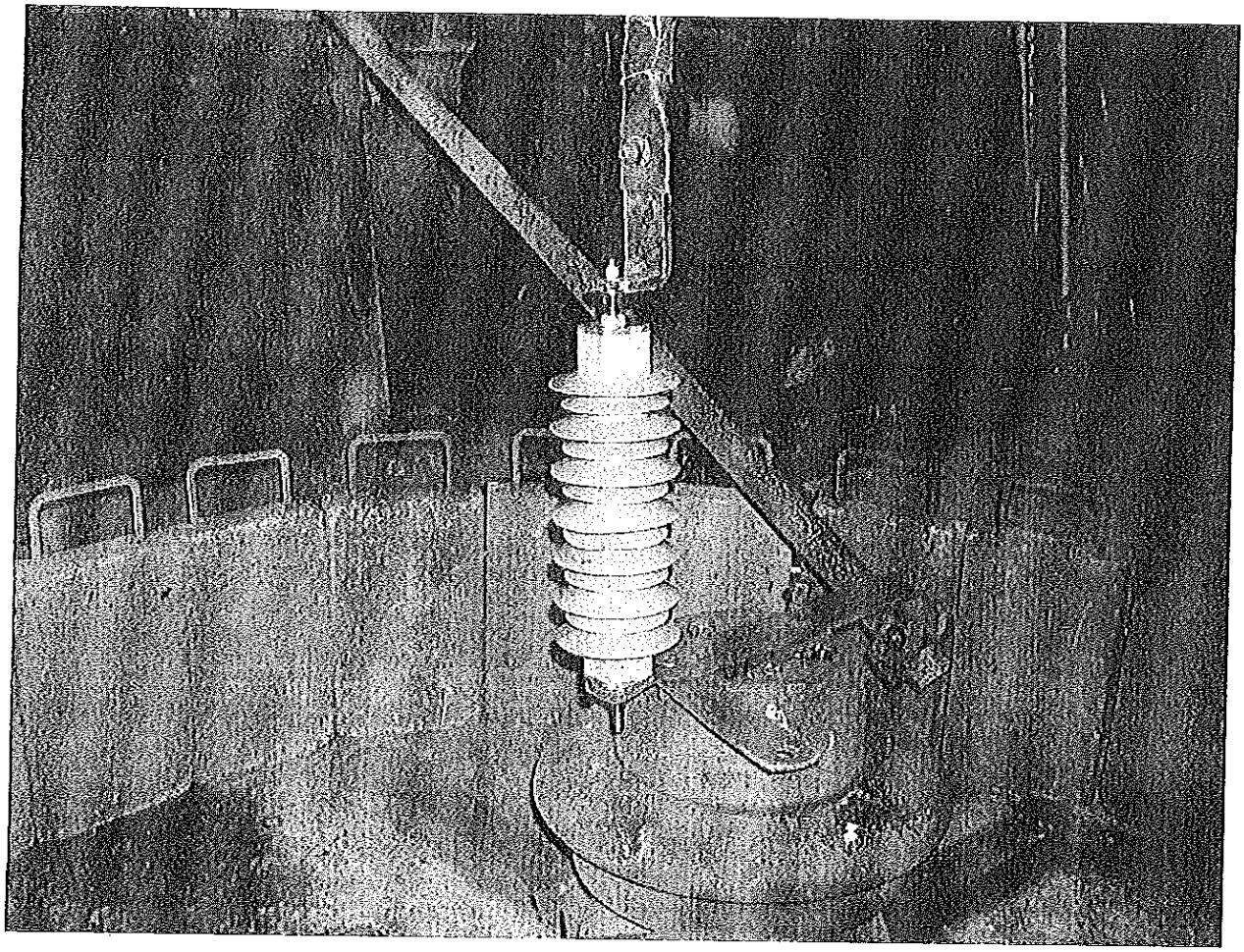


Photo no. 3

Photo no. 4



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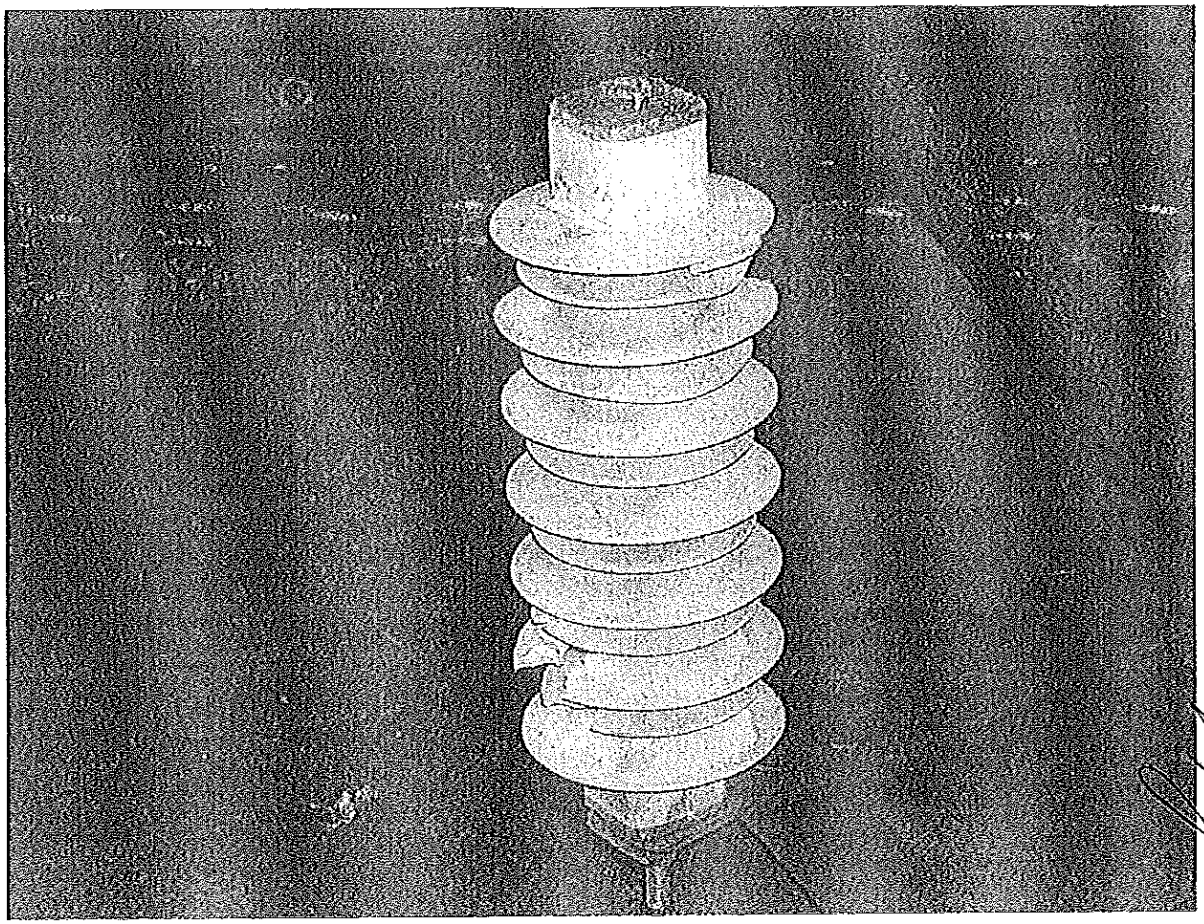


Photo no. 6

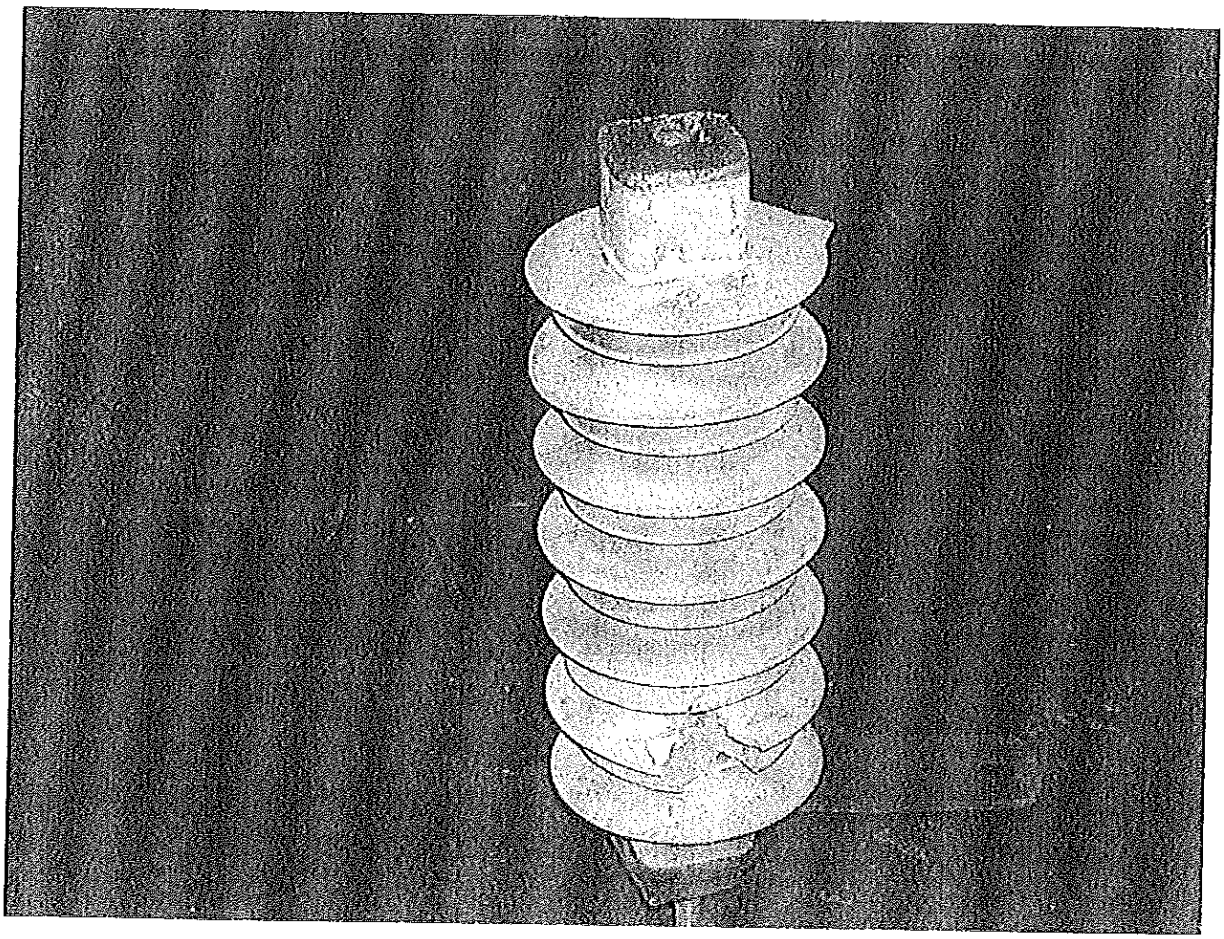
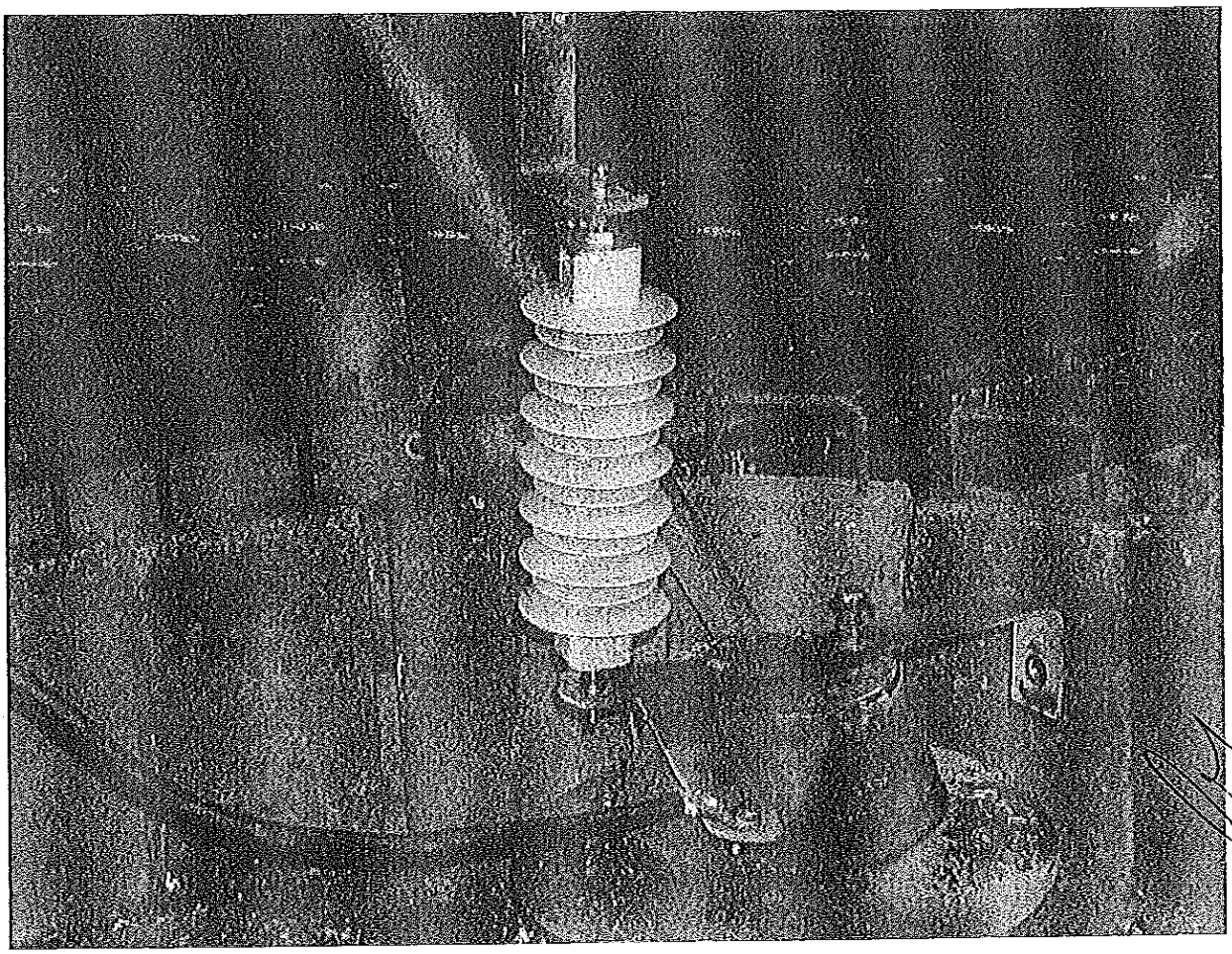


Photo no. 7



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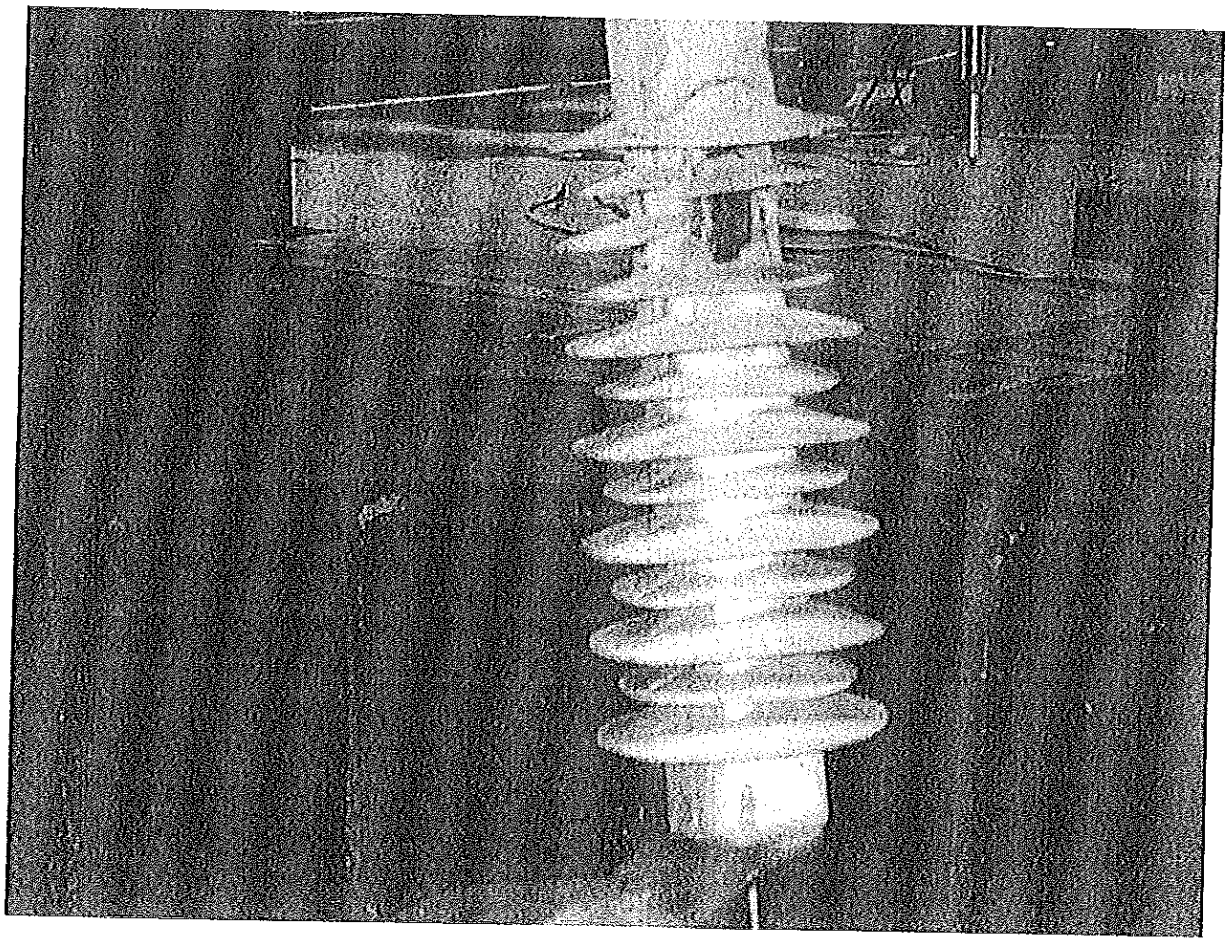

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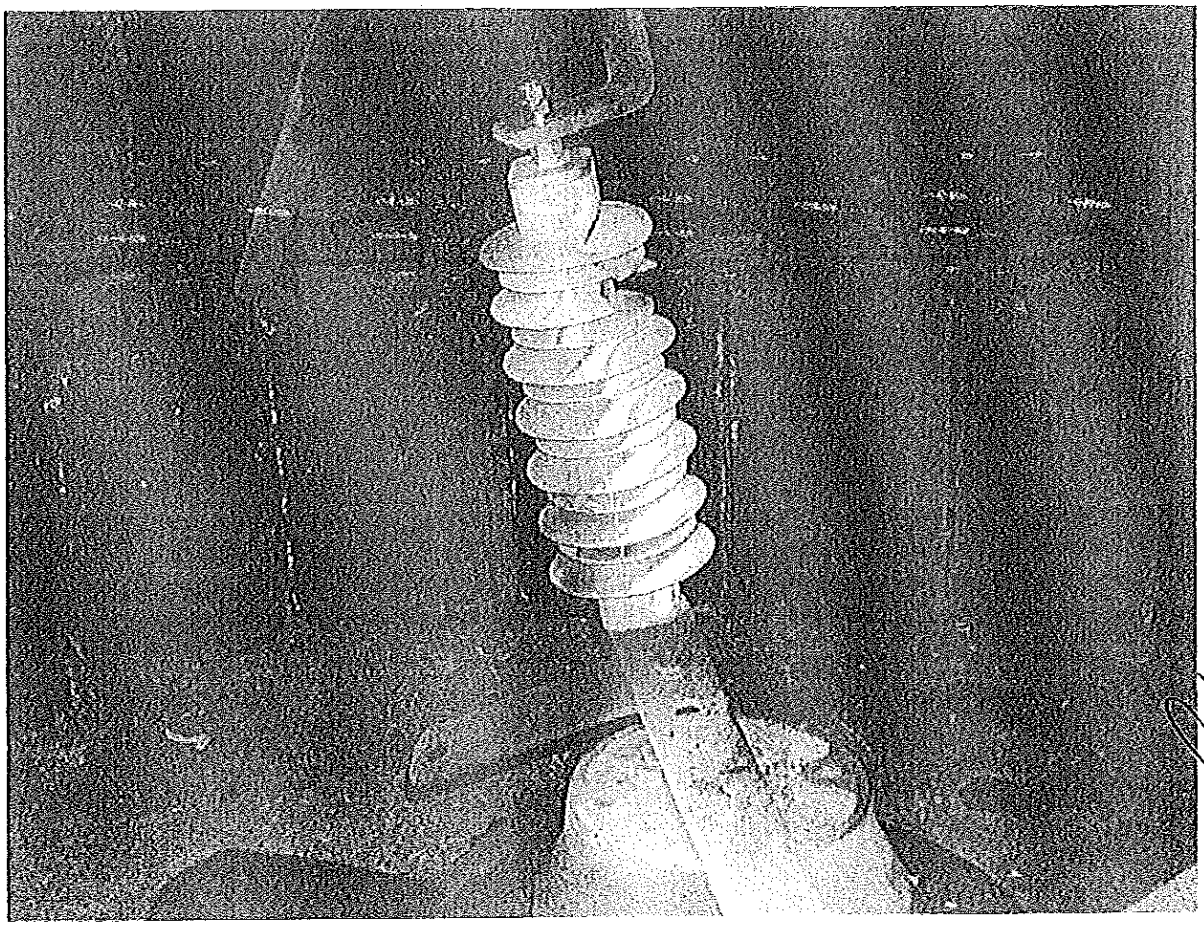

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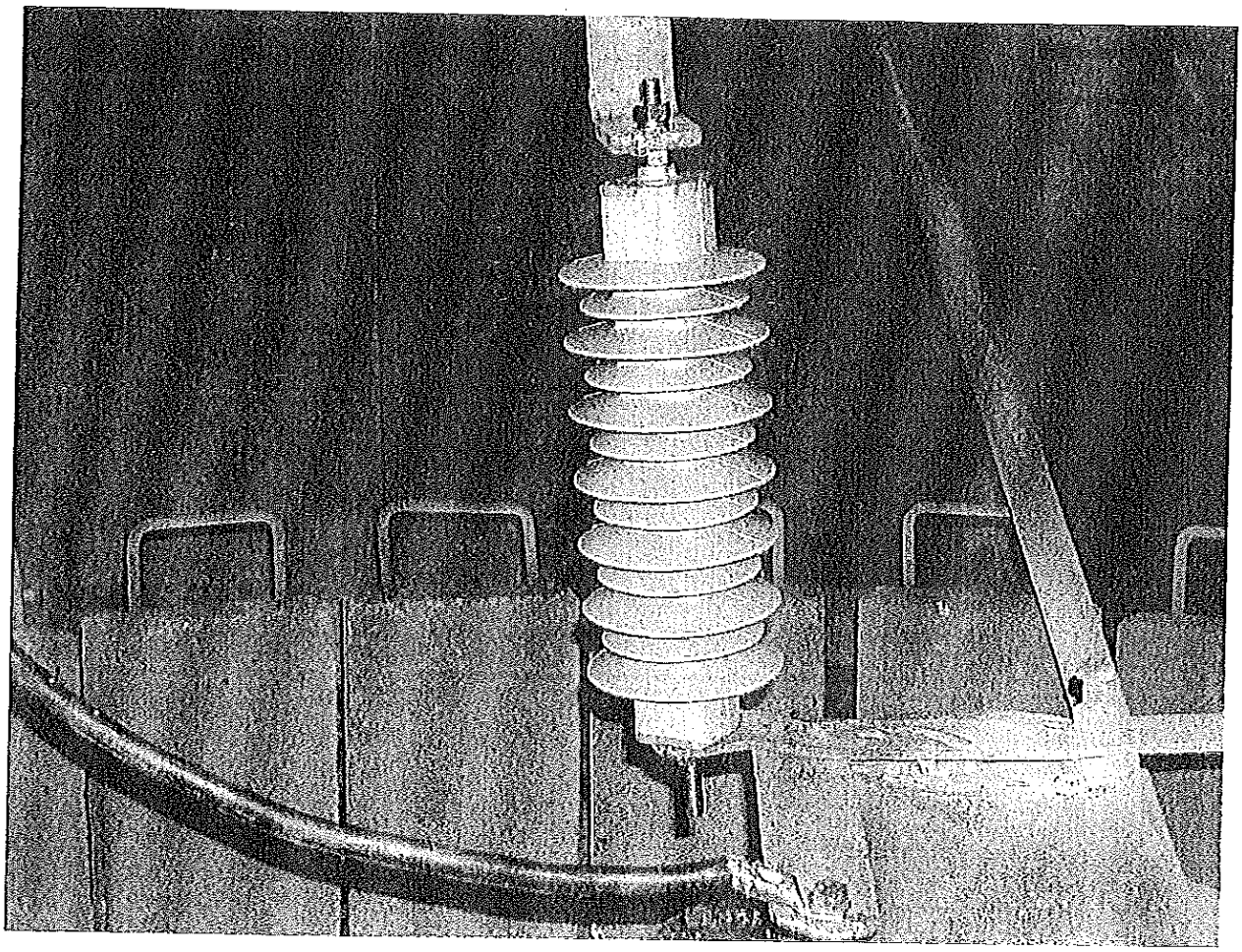

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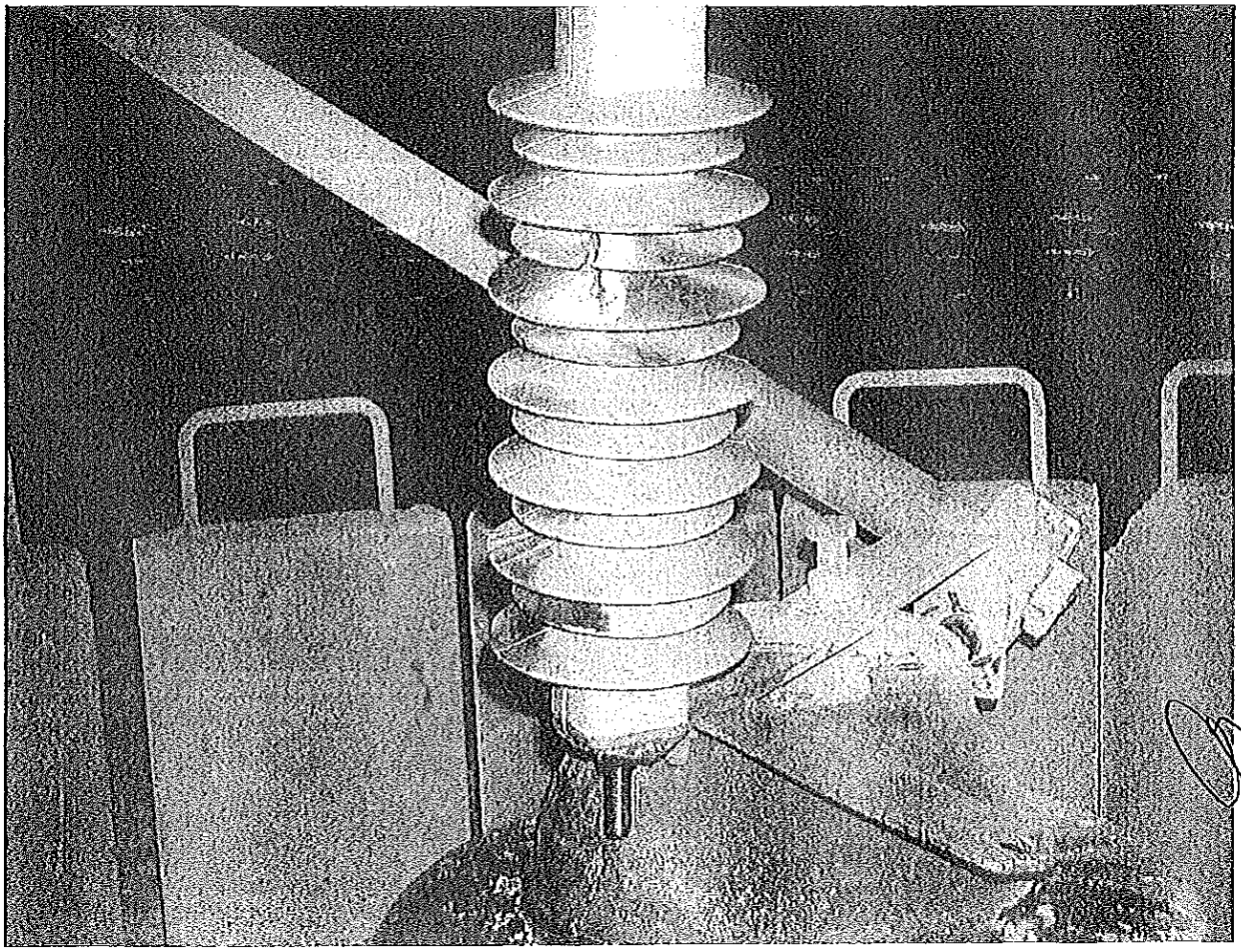


Photo no. 12

I.peak= 65,63 kA
dT=.204,1 mSec

U 30 kV

I 35 kA

VENT 4 V

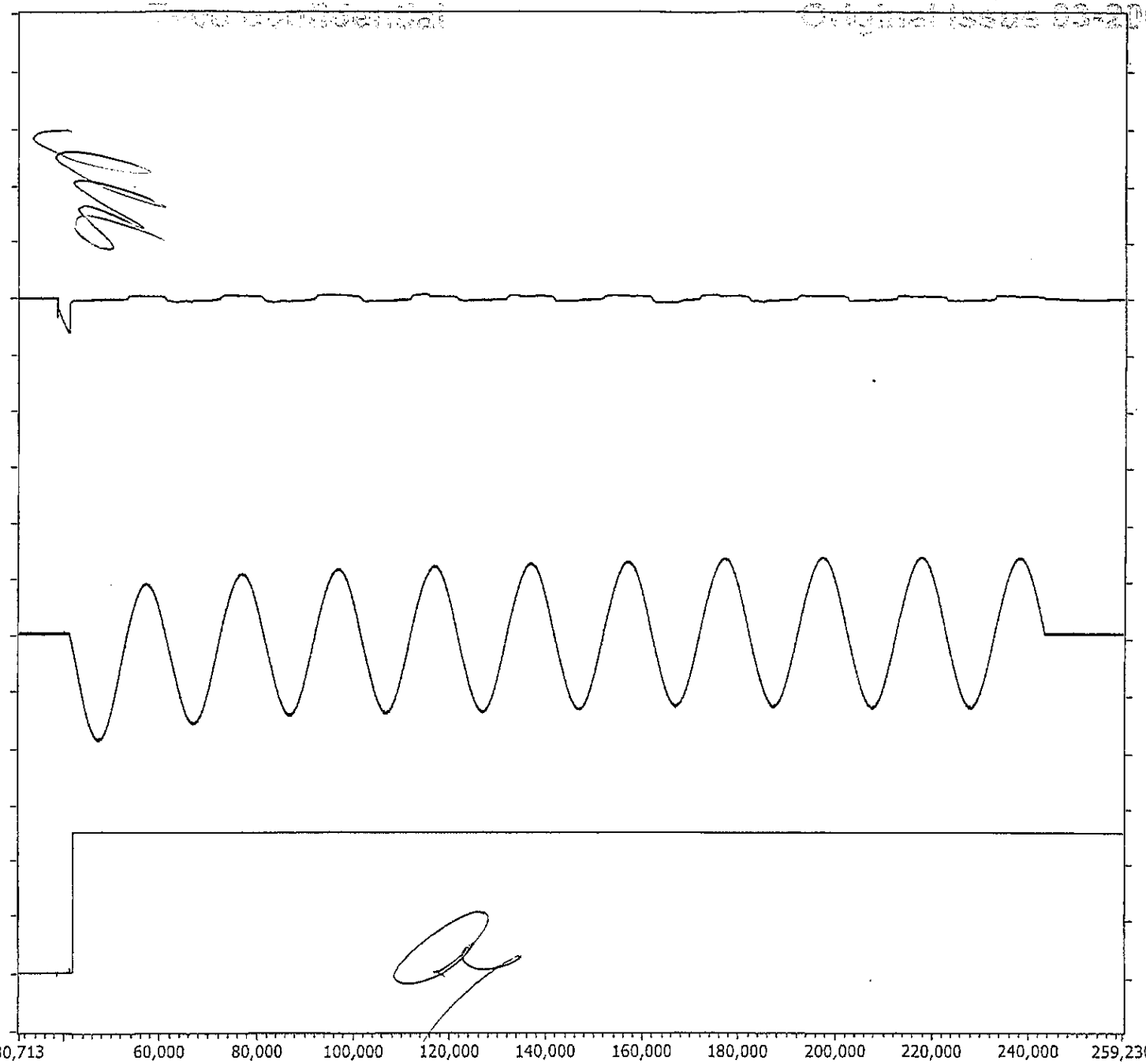
27,307 40,000 60,000 80,000 100,000 120,000 140,000 160,000 180,000 200,000 220,000 240,000 260,000 273,907

2,000 [msec/div.]

CESI P141 A4/518477-0004

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

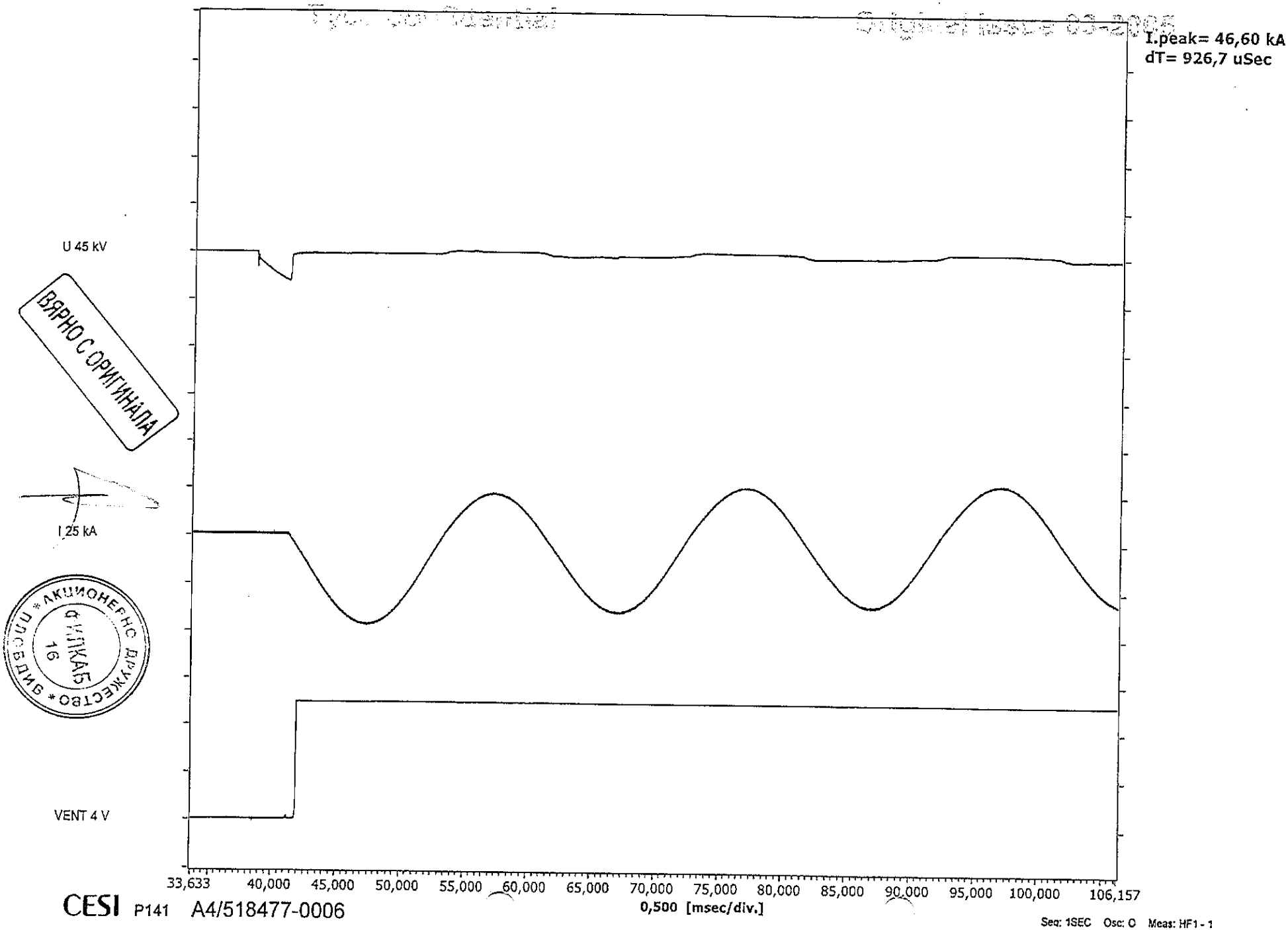
231

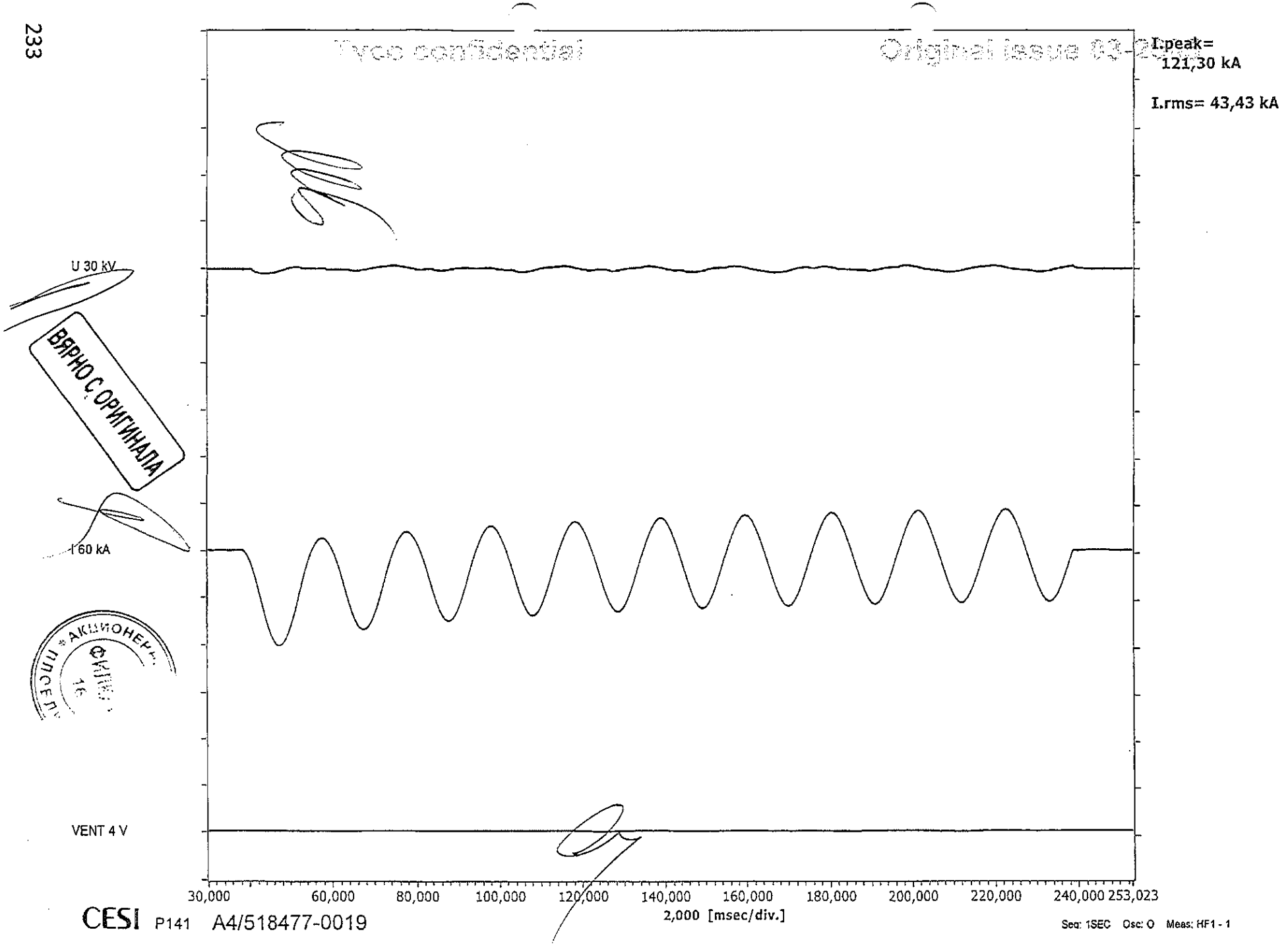


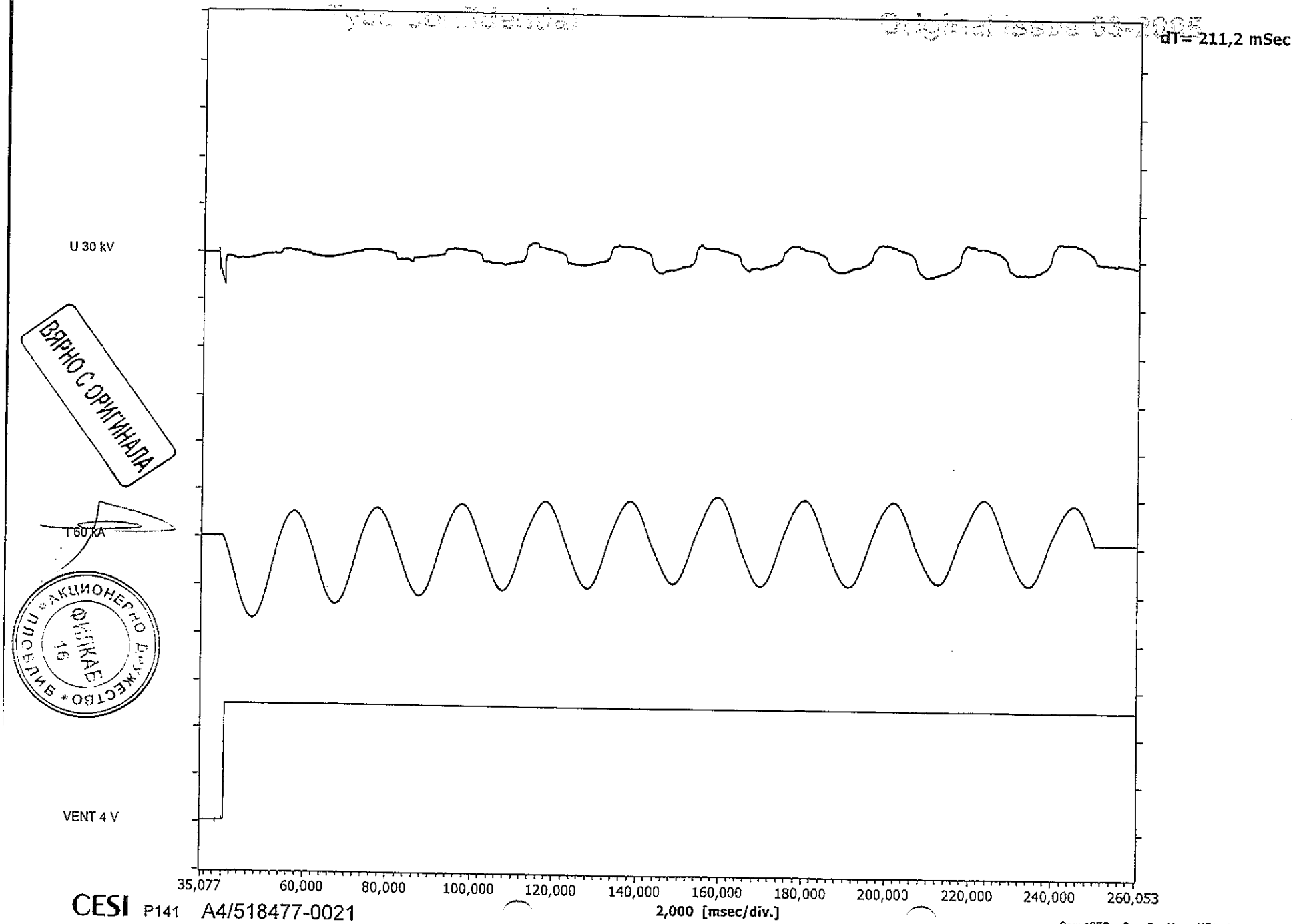
ВЯРНО С ОРИГИНАЛА

CESI P141 A4/518477-0006

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



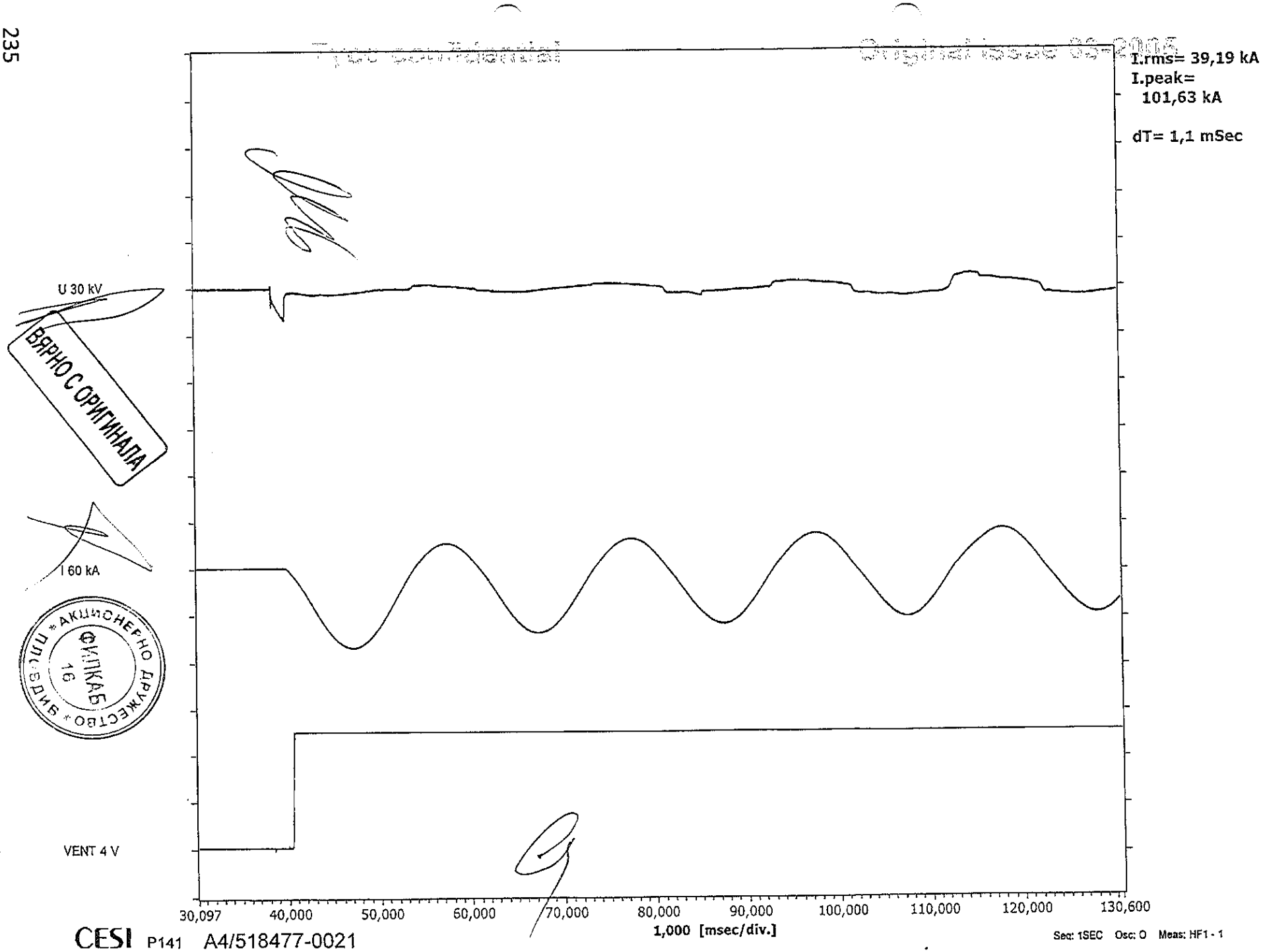




ВЯРНО С ОРИГИНАЛА

АКЦИОНЕРНО ДРУЖЕСТВО * ВИЛЕПОШ * ФИЛИКАБ 16

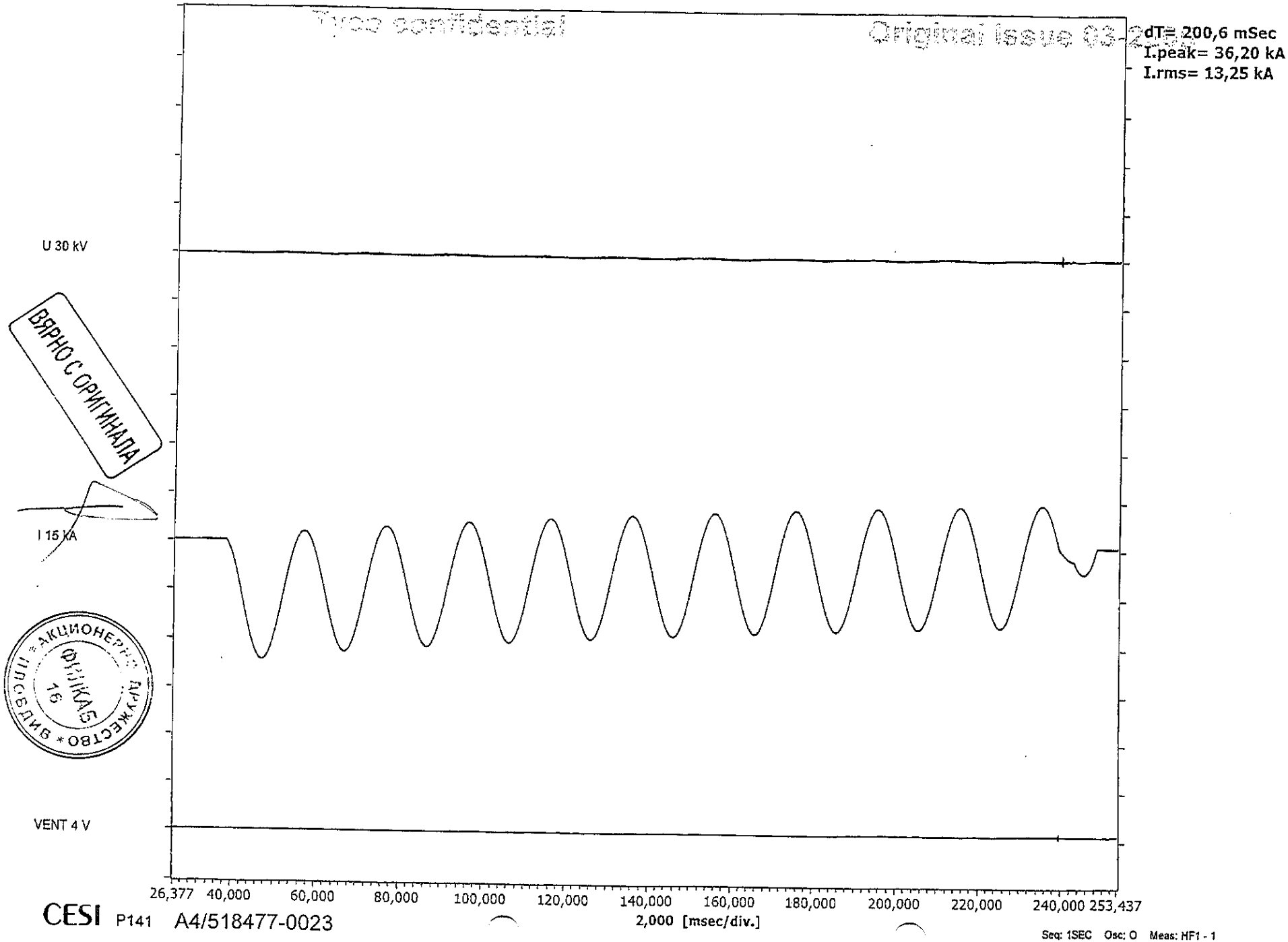
CESI P141 A4/518477-0021



ВЯРНО С ОРИГИНАЛА

ФИЛКАБ 16

CESI P141 A4/518477-0021



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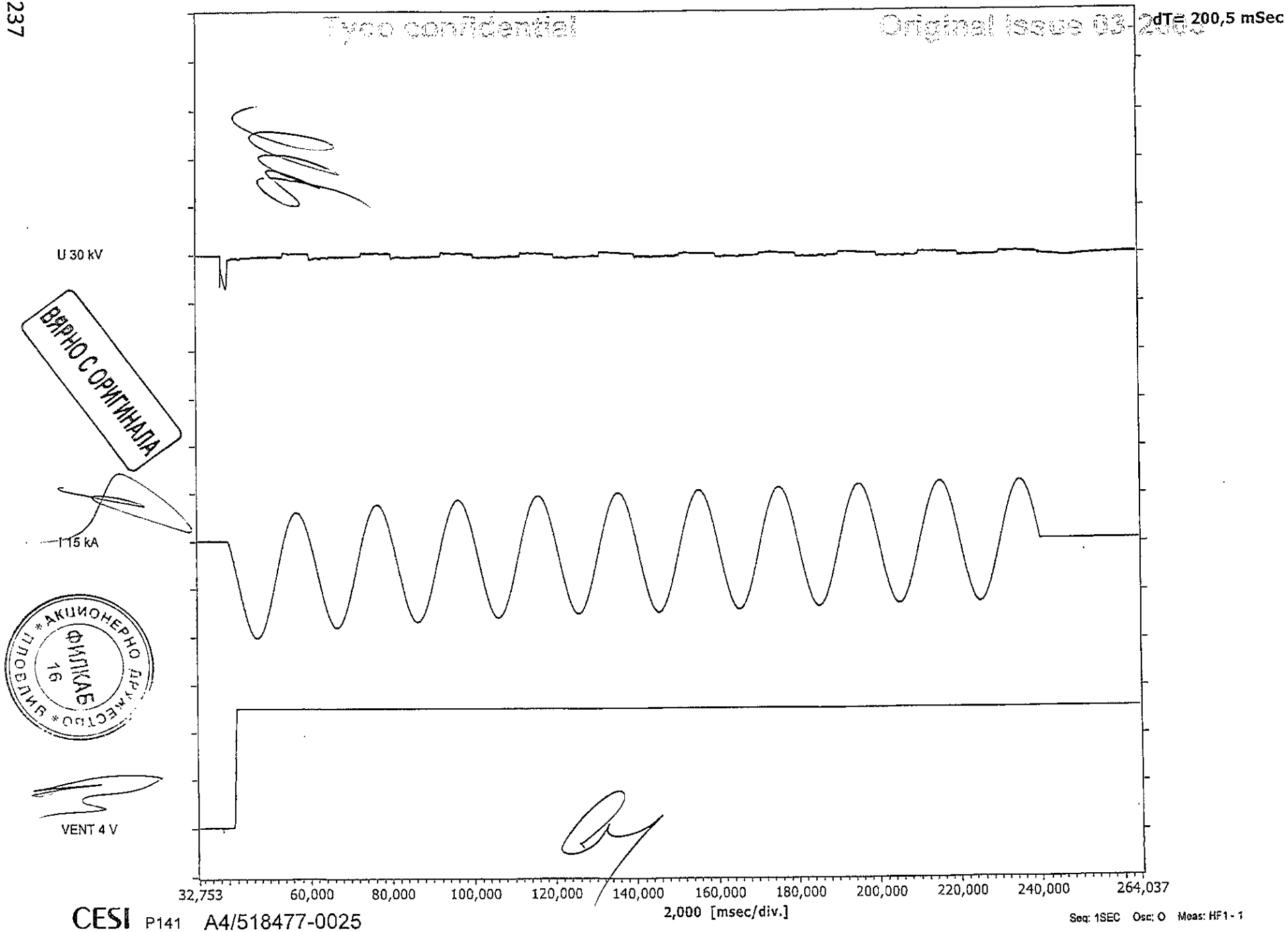
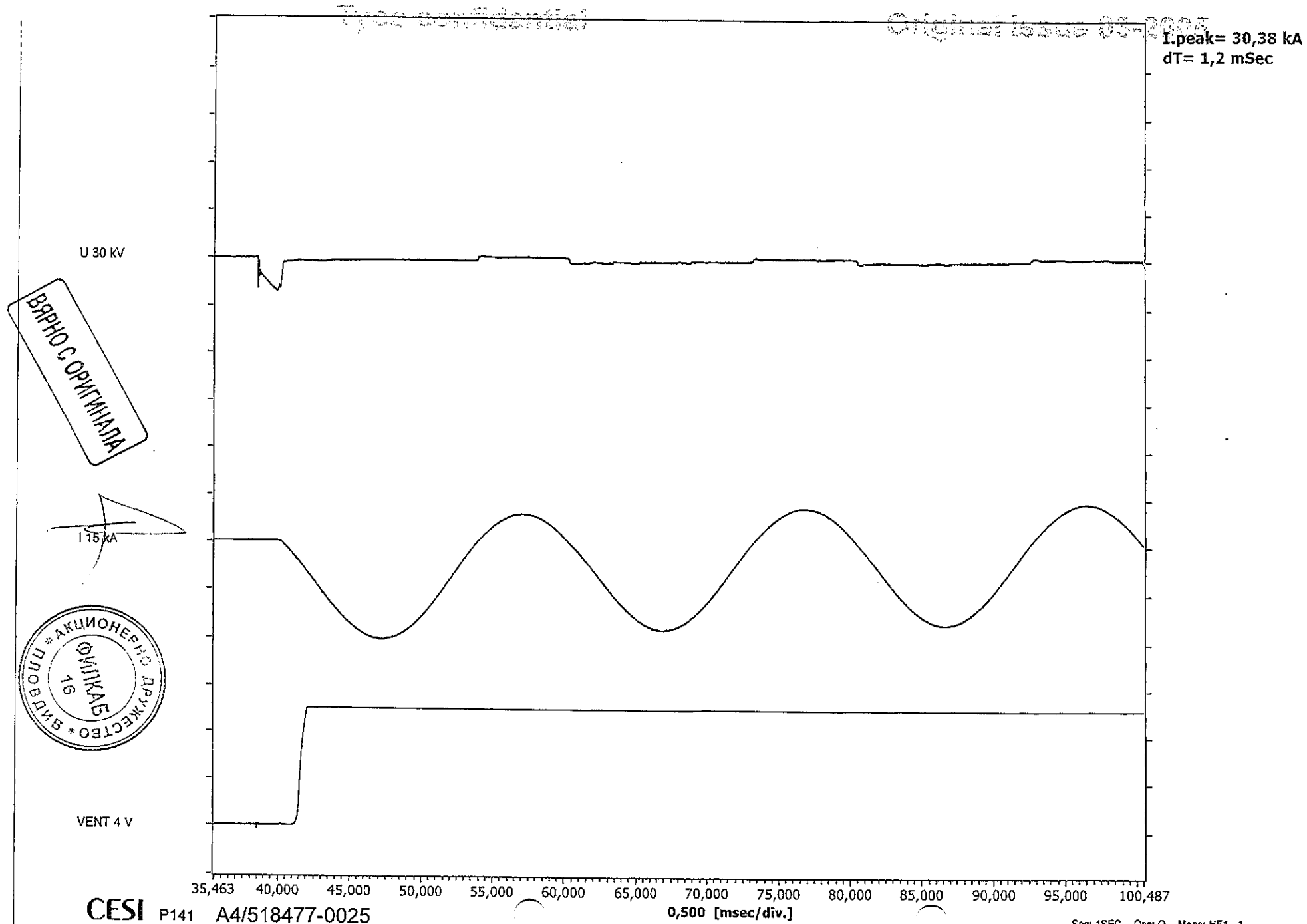


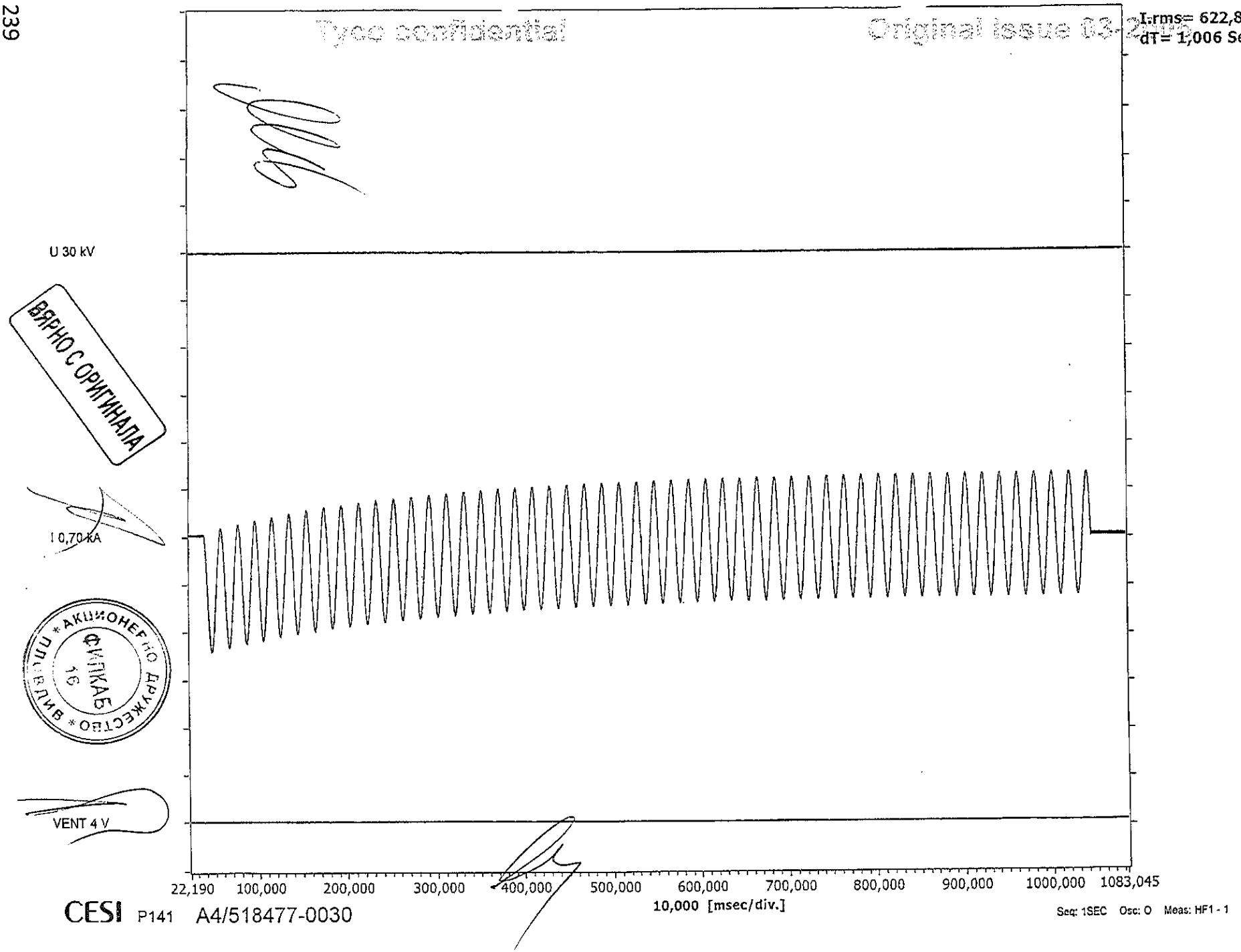
ВЯРНО С ОРИГИНАЛА

АКЦИОНЕРНО ДРУЖЕСТВО * ВИЛОВЛИЩ * ФИЛКАБ 16

CESI P141 A4/518477-0025



CESI P141 A4/518477-0025



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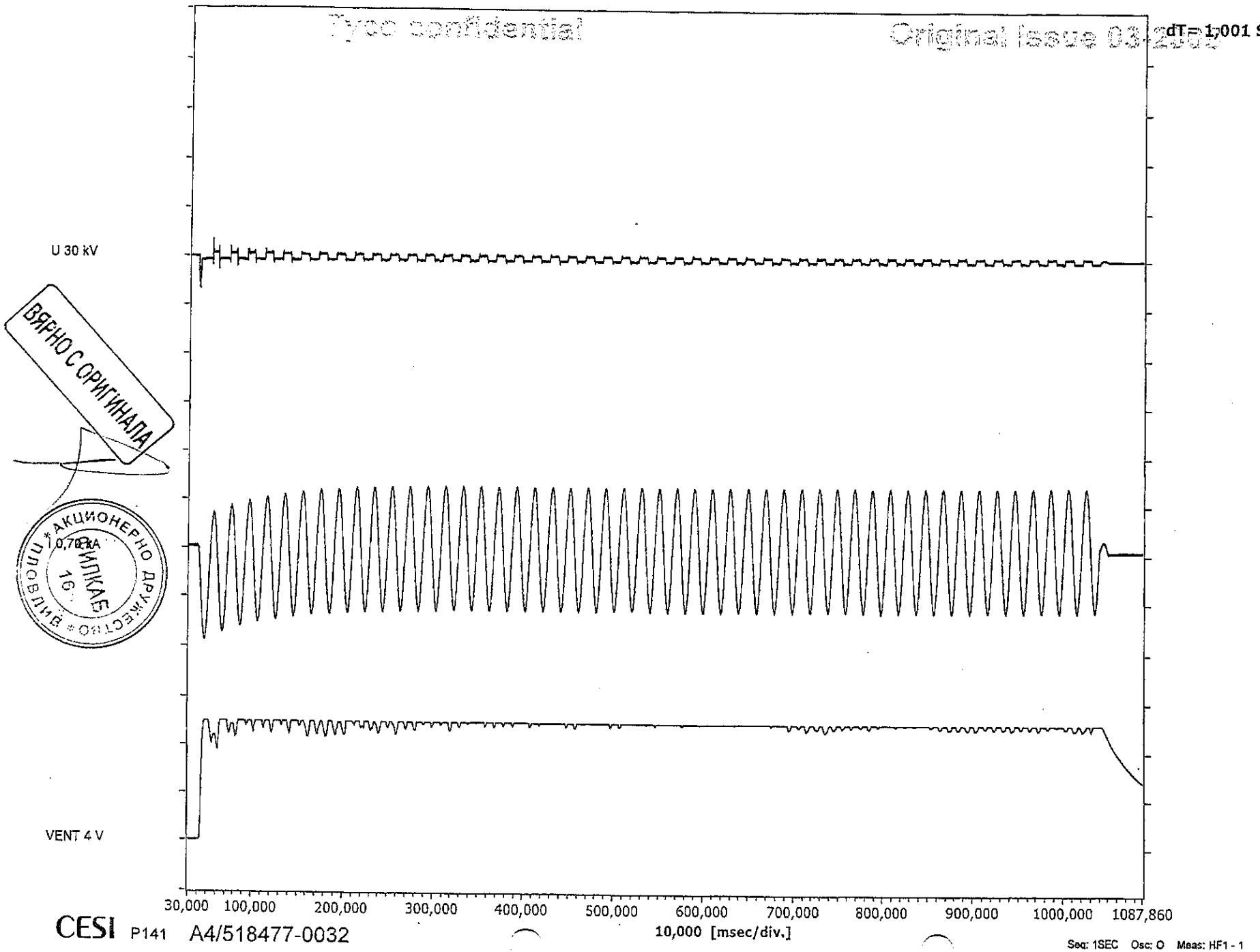

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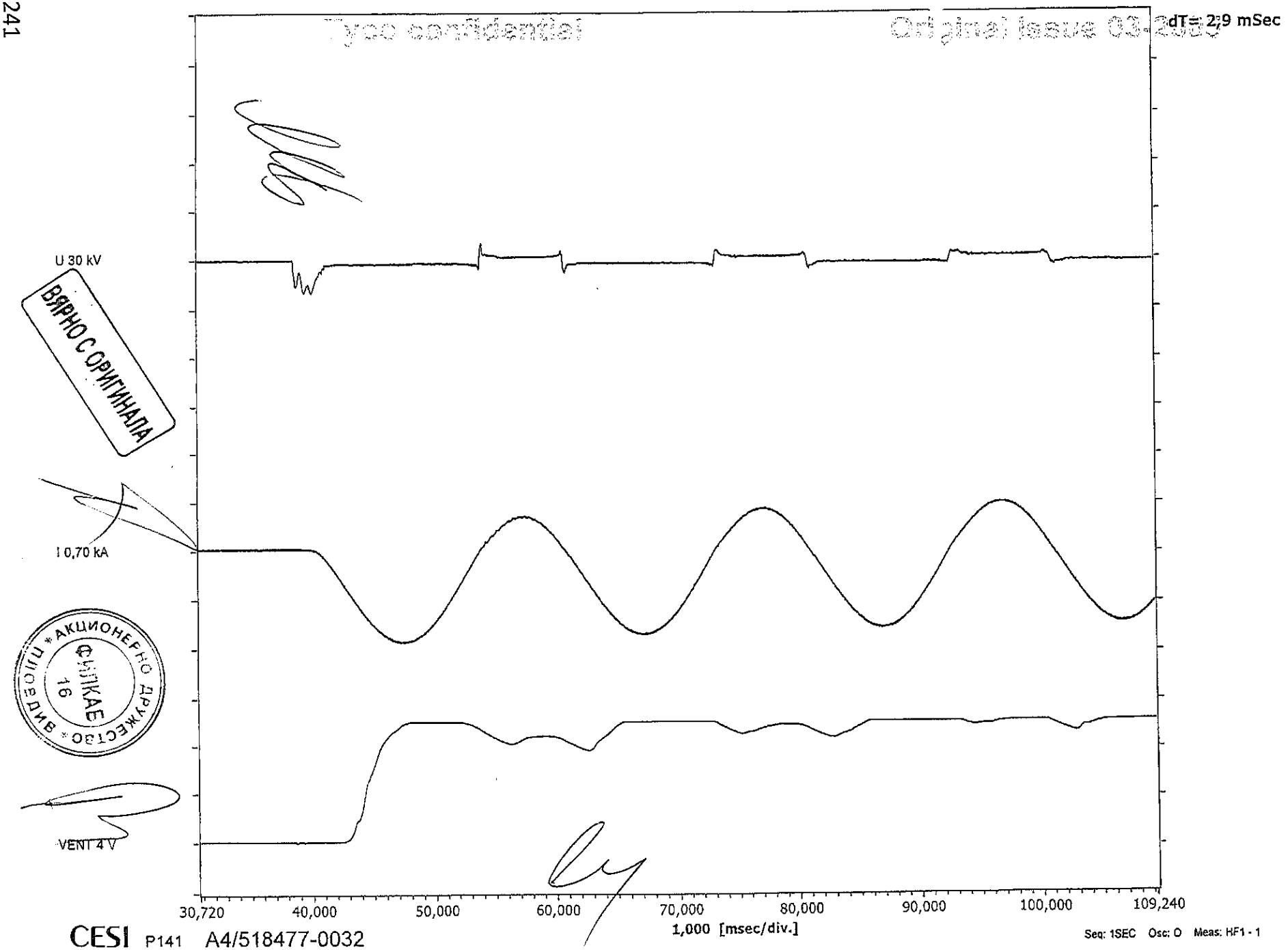
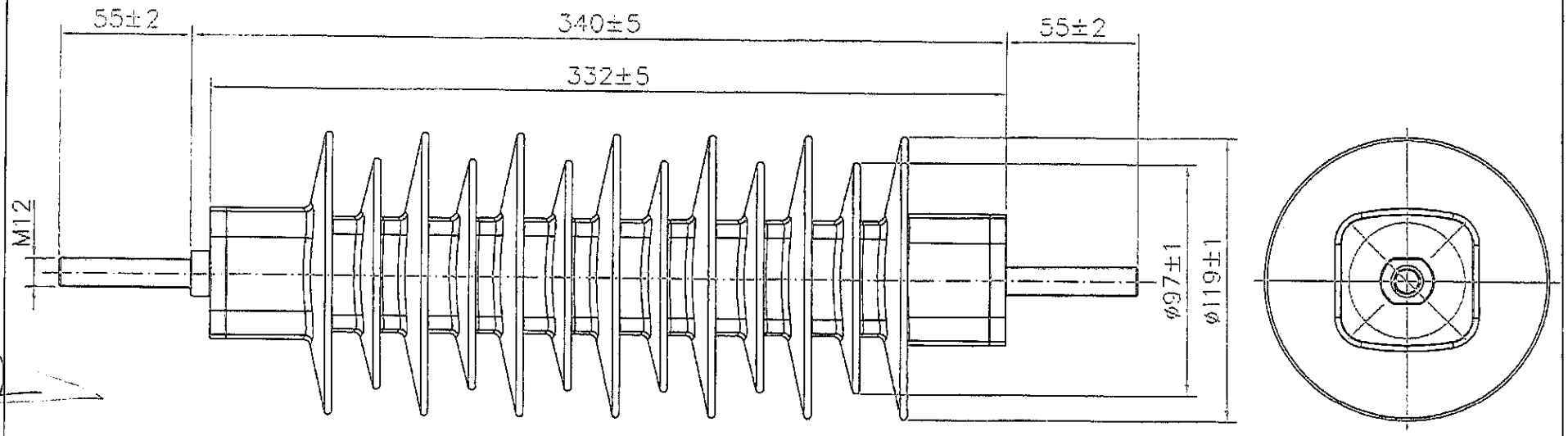
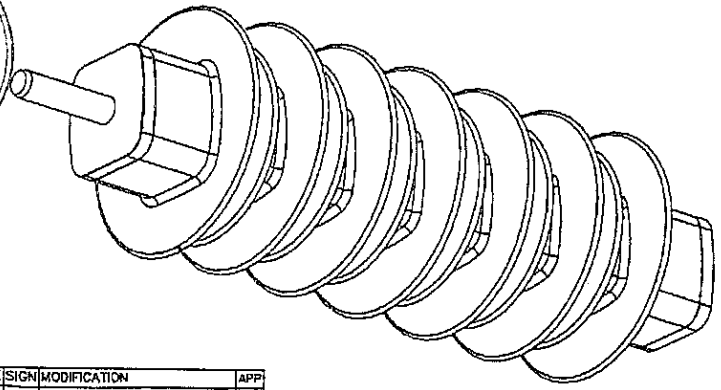


CESI P141 A4/518477-0032

SCD





NOTE:–
Uc = 29kV
NOM CREEPAGE = 885mm
NOM DRY ARC DIST = 334mm
CANT. STRENGTH = 350Nm
TENSION STRENGTH = 2kN
TORQUE = 50Nm
HIGH SHORT CIRCUIT = 40kA
LOW SHORT CIRCUIT = 600A

REV	DATE	SIGN	MODIFICATION	APP
0	04/04	JM	ORIGINAL ISSUE	
1	04/04	JM	TOLERANCES ADDED	
2	05/04	JM	CREEPAGE INCREASED FROM 825mm TO 885mm	

tyco ELECTRONICS

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DRN	J MULLIGAN	17/04/04	PCN	**
CHECK	S NORMOYLE		MAT'L	
APP	D McGOWAN			
SCALE	2:5			

BOWTHORPE EMP
WAY 100–102
SHANNON IND. EST.
SHANNON
CO. CLARE
IRELAND

–29S
ARRESTER

SHEET 1 OF 1 | REV 2

ВЯРНО С ОРИГИНАЛА

*АКЦИОНЕРНО ДРУЖЕСТВО ФИЛКАБ 16

На основание чл. 2
от ЗЗЛД

tyco Electronics

Energy Division
http://energy.tycoelectronics.com

Bowthorpe EMP

Test Report

Type	**OCP2**
PPR Number	**PPR-1824**
Test	Internal Partial discharge tests
Specification	IEC 60099-4 (2001-12)

Test Information:

Laboratory	CESI
Date	28/04/2004
External Test Ref	AT-A4/014190
Report Prepared By	D Pirola
Test Verified by	A Sironi
Test Approved by	M de Nigris

Tyco Approvals:

R&D Manager			
Brendan Normoyle	Si	Date	25/02/2005
Technology Manager			
Kwong Tong	Si	Date	25/02/2005
Product Manager			
Brian McGowan	Si	Date	25/02/2005

На основание чл. 2
от ЗЗЛД

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Email: mvsurgearresters@tycoelectronics.com

ВЯРНО С ОРИГИНАЛА

АКЦИОНЕРНО ДРУЖЕСТВО * ПЛОВДИВ * СИЛКАБ 16

client	TYCO, Electronics Energy Division - Shannon (Ireland)
equipment under test	Polymer housed metal-oxide surge arrester type OCP2 10 kA
tests performed	Internal partial discharges tests
normative documents	IEC 60099-4 (2001-12)
receipt date of the sample	April 27, 2004
test date	from April 28, 2004 to April 28, 2004
no. of pages	11 no. of pages annexed 04

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	June 10, 2004	
prepared	PeC/TEST -	На основание чл. 2 от ЗЗЛД
verified	PeC/TEST -	
approved	PeC/TEST -	

ВЯРНО С ОРИГИНАЛА

АКЦИОНЕРНО ДРУЖЕСТВО * ФИЛКАБ 16 * ПЛОВДИВ *

CESI
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Sperimentale Italiano
Giacinto Motta SpA

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Telefono +39 022125.1
Fax +39 0221255440
www.cesi.it

Capitale sociale 8 550 000 Euro
interamente versato
Codice fiscale e numero
iscrizione CCIAA 00793580150

Registro Imprese di Milano
Sezione Ordinaria
N. R.E.A. 429222
P.I. IT00793580150

tests witnessed by: ---

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 represents in shape and dimensions the essential details and the parts of the tested object.
This drawings identified by CESI and numbered **A4/509282 no. 01** are 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 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: L. Tiziani

test laboratory: P180

activity code: 43160L

ВЯРНО С ОРИГИНАЛА

ФИЛКАБ 16

Page annexed:

oscillograms (03 pages)

Reference document annexed:

Manufacturer's drawing of surge arrester type OCP2 identified by CESI and numbered as **A4/509282, no. 01**

Test object characteristics

type: Polymer housed metal oxide surge arrester

electrical characteristics (claimed by the client)

type	OCP2 10 kA
manufacturer's name	TYCO Electronics Energy division
line discharge class	2
rated voltage - U_n [kV]	30,0
continuous operating voltage - U_c [kV]	24,0
rated frequency - [Hz]	50-60
year of manufacture	2004

geometrical characteristics (measured on the test sample)

total height [mm]	385
arcing distance [mm]	295
creepage (leakage) distance [mm]	760
number of large sheds	6
large shed diameter [mm]	117
number of small sheds	5
small shed diameter [mm]	97
core dimensions [mm]	55 x 55

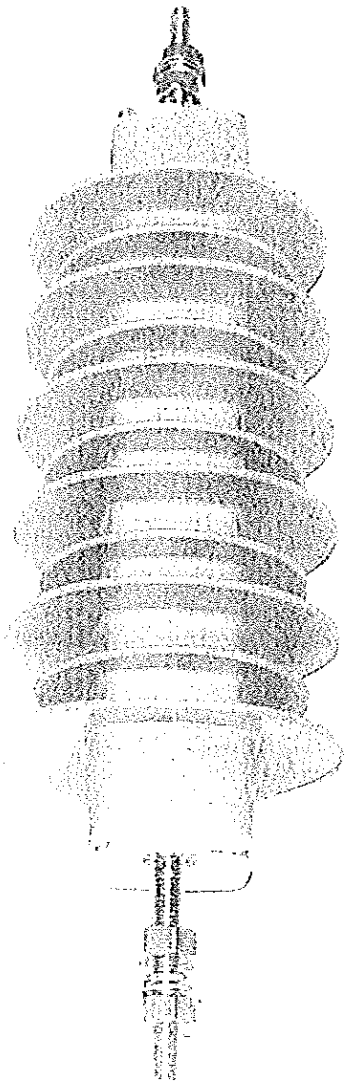
other characteristics

housing material	polymeric
housing color	grey

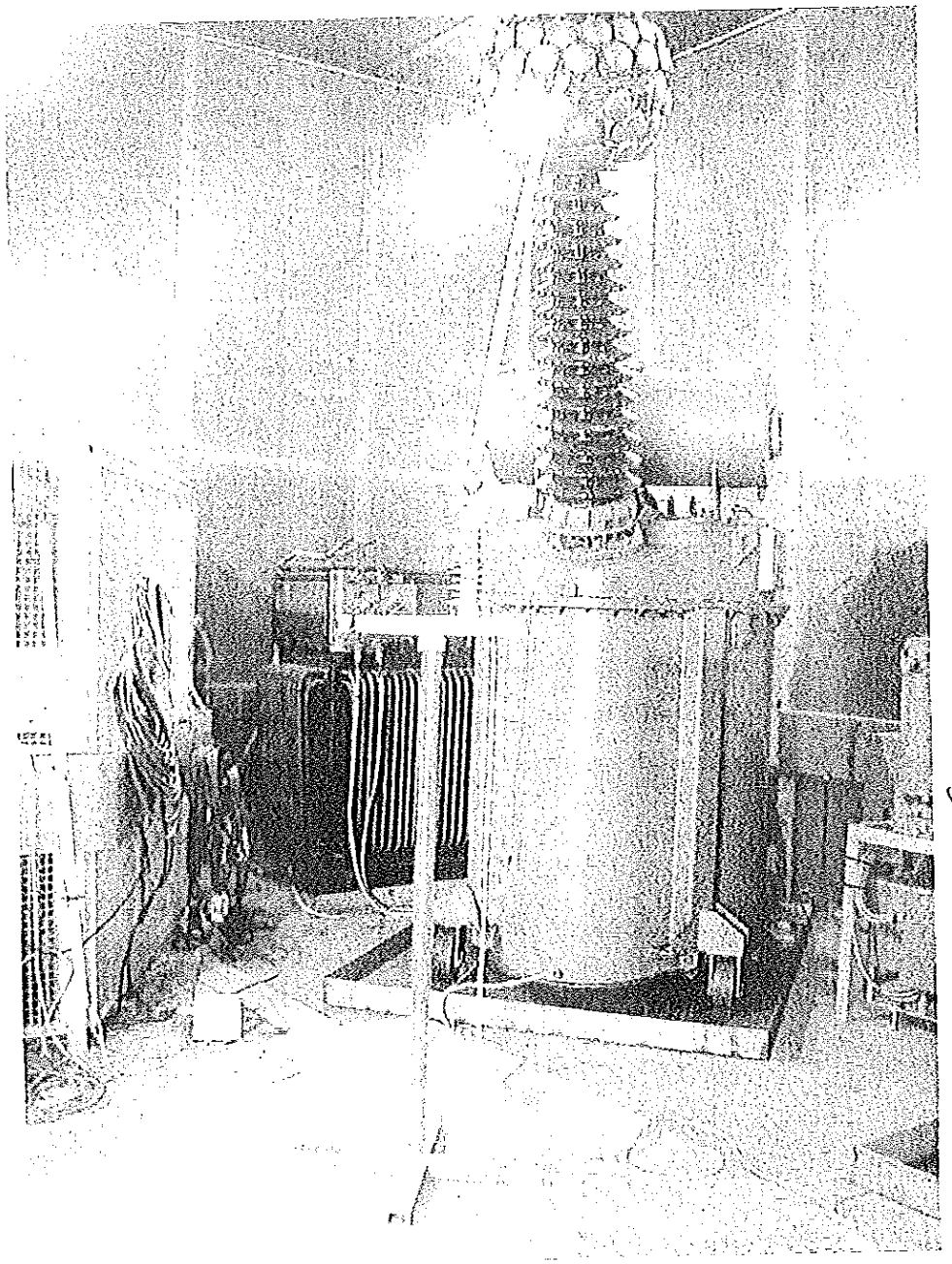
ВЯРНО С ОРИГИНАЛА

АКЦИОНЕРНО ДРУЖЕСТВО * ФИЛКАБ 16 * ПЛОВДИВ *

panoramic view of the test object



panoramic view of the test arrangement for partial discharges test



Reference standard

IEC 60099-4 (2001-12)
IEC 60270 (2000-12)

Test carried out

polymer housed metal-oxide surge arrester unit	test carried out
type OCP2	Partial discharge test

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.

Measurement of partial discharges

test object: polymer housed metal oxide surge arrester type OCP2 10 kA
test circuit: A022
measurement circuit: A027

atmospheric conditions		
b	t	h
kPa	°C	g / m³
100,3	20 (15)	10,1

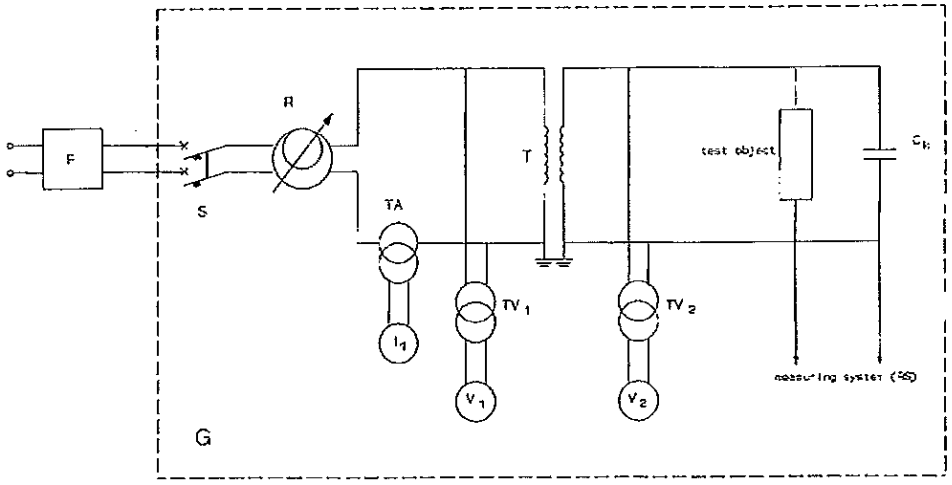
date: April 28, 2004

	applied voltage	duration of voltage application	temperature of the test object	partial discharge measurement voltage increase Q max	voltage decrease Q max	oscillogram	note
	kV_{rms}	sec	°C	pC	pC	no.	
Background noise	0		20	≤ 1		02	
U_r	30,0	10	20	≤ 1			
1,05 U_c	25,2	measure	20		≤ 1	03	

oscillogram 01: test circuit calibration

Circuit A027

Plant P220. High voltage circuit
partial discharges measurement



F : wide band filter TELEC; 380 V; 100 A
G : Faraday cage
S : single phase circuit breaker SACE; 600 V; 400 A
R : regulator CORMES; power 66 kVA; voltage 380 V/0 ÷ 220 V
T : booster transformer PIVI; power 250 kVA; voltage 200-400 V/250 kV
C_k : coupling capacitor PIVI; 300 pF; 250 kV
TA : current transformer CGS; ratio 150-300 A/5 A
TV_1: voltage transformer 440/100 V
V_1 : analogic voltmeter
TV_2: voltage transformer PIVI; ratio 250 kV/100 V
V_2 : voltmeter FLUKE; CESI no. 06393

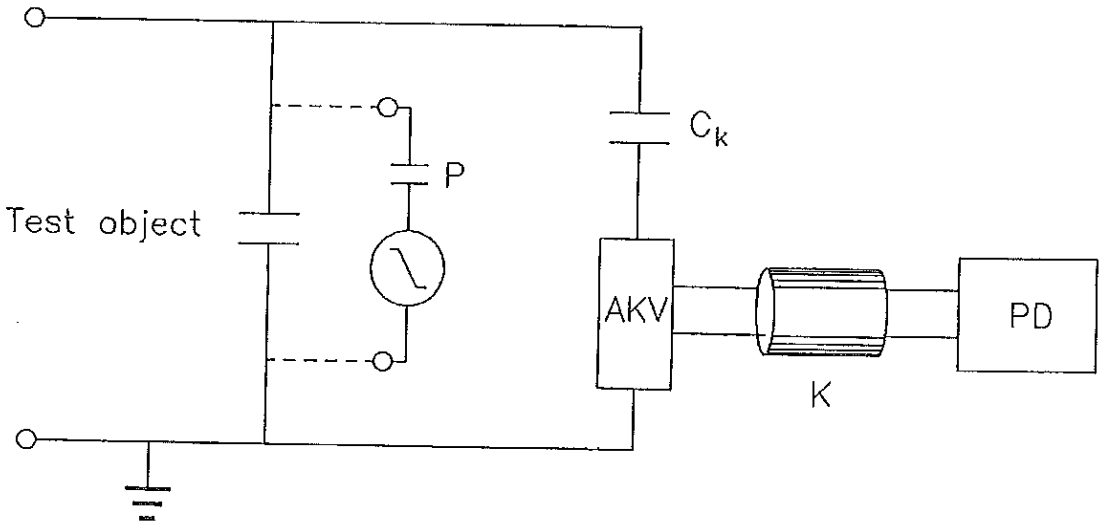
ВЯРНО С ОРИГИНАЛА

АКЦИОНЕРНО ДРУЖЕСТВО ФИЛКАБ 16 * ПЛОВДИВ

Circuit A022

Partial discharges measurement

Direct circuit - scheme 1a



P:	calibrator
C_k:	coupling capacitor PIVI; 300 pF; 250 kV
AKV:	matching coupling quadripole HAEFELY TRENCH; type AKV 573; CESI No.13290
K:	special, multi-wire, connecting cable (AKV KB)
PD:	partial discharge detector HAEFELY TRENCH; type PD DETECTOR TE 571; CESI No.13281

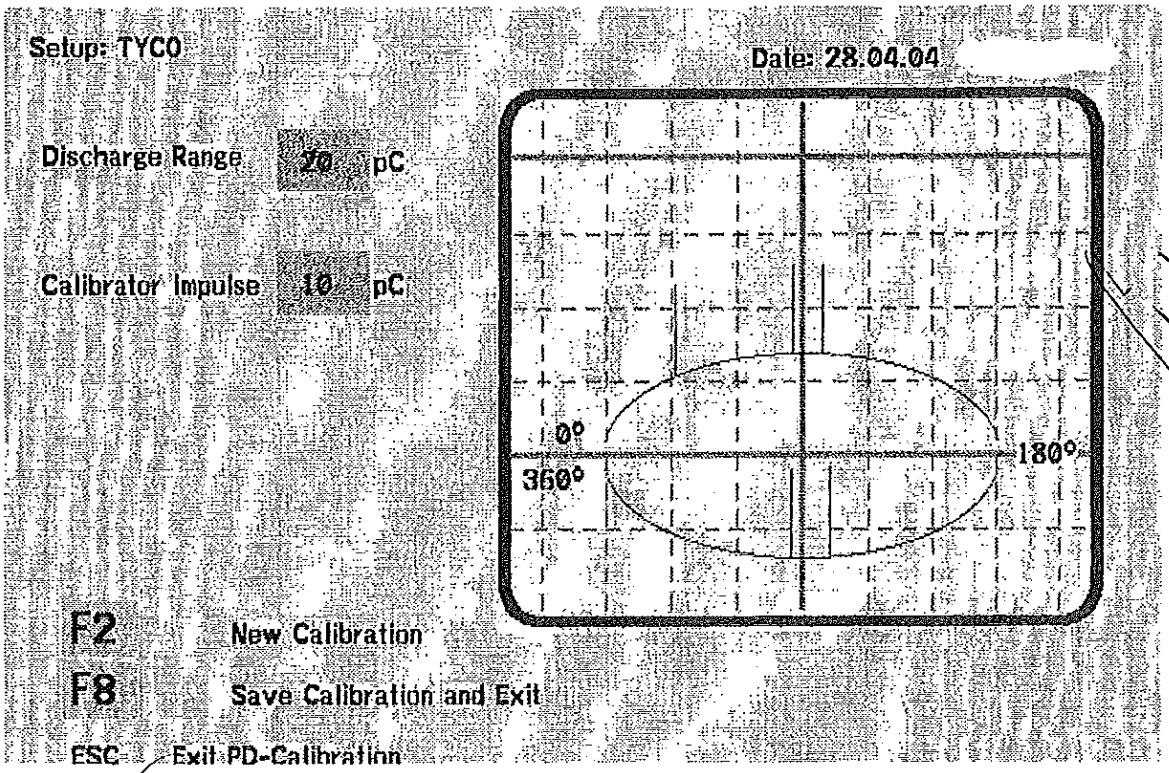
HAEFELY TRENCH TETTEX PD-DETECTOR

Info: 1
Measurement name:
Comment:
1st PD Range: 20 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: 35 kV

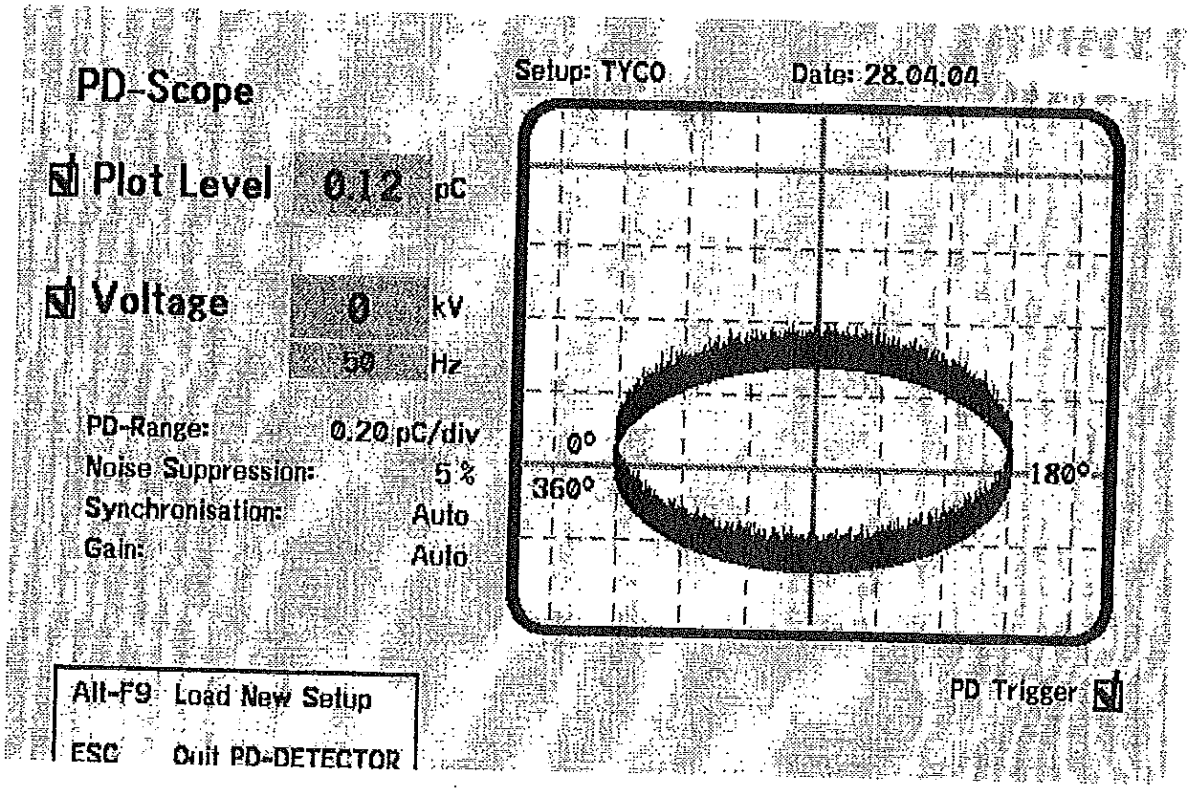
Remarks:



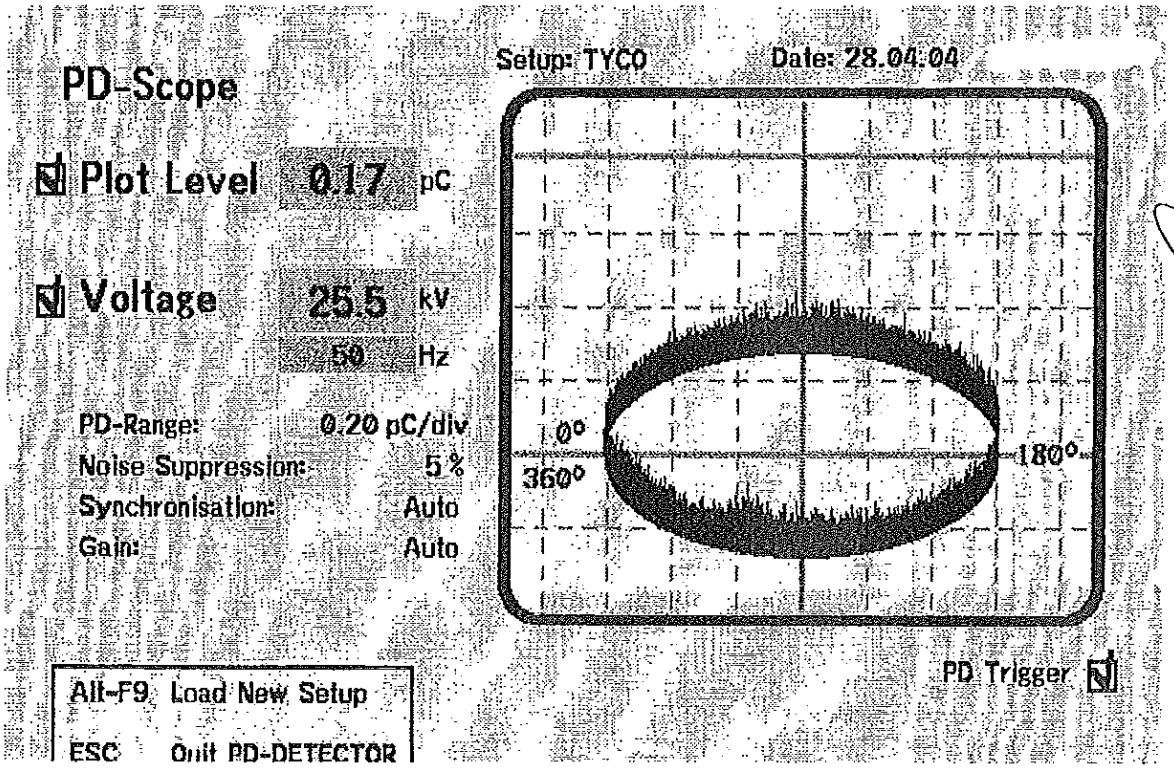
CESI TEST AT-A4/014190 oscillogram 01

ВЯРНО С ОРИГИНАЛА

АКЦИОНЕРНО ДРУЖЕСТВО ФИЛКАБ 16 ПЛОВДИВ



CESI TEST AT-A4/014190 oscillogram 02

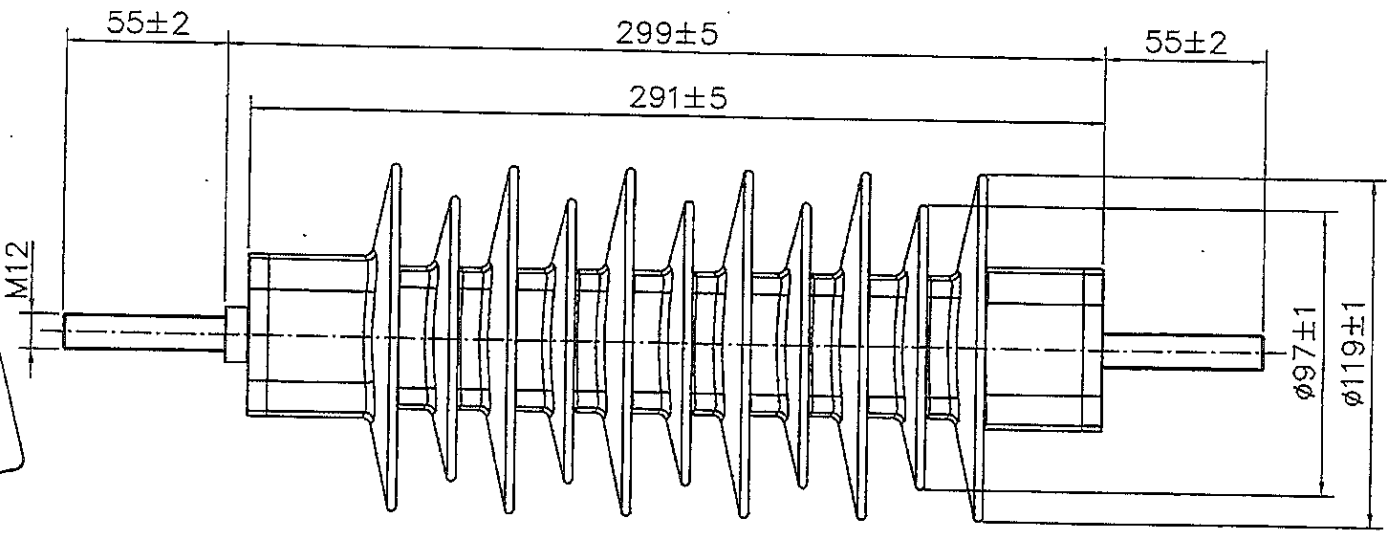


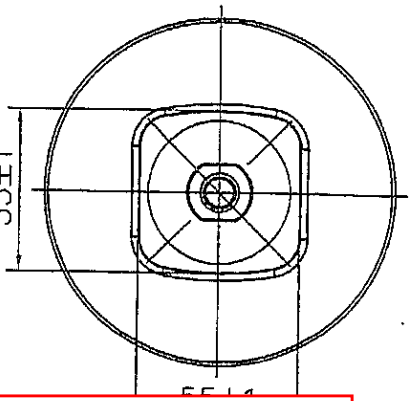
CESI TEST AT-A4/014190 oscillogram 03

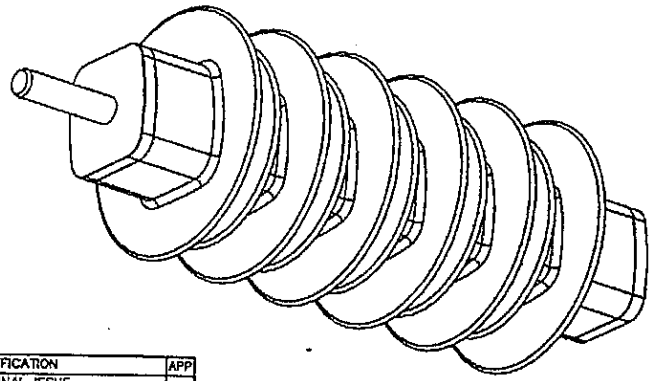
ВЯРНО С ОРИГИНАЛА

АКЦИОНЕРНО ДРУЖЕСТВО * ФИЛКАБ 16 * ПЛОВДИВ

SCD







NOTE:–
Uc = 24kV
NOM CREEPAGE = 758mm
NOM DRY ARC DIST = 293mm
CANT. STRENGTH = 350Nm
TENSION STRENGTH = 2kN
TORQUE = 50Nm
HIGH SHORT CIRCUIT = 40kA
LOW SHORT CIRCUIT = 600A

REV	DATE	SIGN	MODIFICATION	APP
0	04/04	JM	ORIGINAL ISSUE	

tyco ELECTRONICS

Bowthorpe EMP

DRN	J MULLIGAN	23/04/04	
CHECK	B NORMOYLE		
APP	B McGOWAN		
SCALE	2:5		

PCN ******–000

MATL

TITLE

OCP2–24S
SURGE ARRESTER

DRG NO MV–OCP2–00057–S

SHEET 1 OF 1

REV 0

tyco Electronics

Energy Division
http://energy.tycoelectronics.com

Bowthorpe EMP

Test Report

Type	**OCP2**
PPR Number	**PPR-1977**
Test	Power frequency voltage versus time test
Specification	IEC 60099-4 (2004-05)

Test Information:

Laboratory	CESI
Date	09/12/2004
External Test Ref	A4/521820
Report Prepared By	M Gregori
Test Verified by	A Sironi
Test Approved by	M de Nigris

Tyco Approvals:

R&D Manager
Brendan Normoyle — Date 25/02/2005

Technology Manager
Kwong Tong — Date 25/02/2005

Product Manager
Brian McGowan — Date 25/02/2005

На основание чл. 2
от ЗЗЛД

For further information contact:
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Tel: + 353-61-472885
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Email: mvsurgearresters@tycoelectronics.com

ВЯРНО С ОРИГИНАЛА

АКЦИОНЕРНО ДРУЖЕСТВО ФИЛКАБ 16 * ПЛОВДИВ *

Test Report

CESI Sinal n° 0030 Approved

Client	TYCO Electronics Energy Division – Shannon (IRL)
Tested equipment	Polymer housed metal-oxide surge arrester type OCP2
Tests carried out	Power frequency voltage versus time test
Standards/Specifications	IEC 60099-4 (2004-05)
Test date	**from** December 03, 2004 **to** December 09, 2004

No. of pages	16	**No. of pages annexed**	27
Issue date	December		
Prepared	BU PeC -		
Verified	BU PeC -		
Approved	BU PeC -		

На основание чл. 2
от ЗЗЛД

ВЯРНО С ОРИГИНАЛА

АКЦИОНЕРНО ДРУЖЕСТВО ФИЛИКАБ ПЛОВДИВ

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Fax +39 0221255440
http://www.cesi.it
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Codice fiscale e numero iscrizione CCIAA 00793580150
Registro Imprese di Milano
Sezione Ordinaria
N. R.E.A. 429222
P.I. IT00793580150

Tests witnessed by: ----

Identification of the object: The Manufacturer guarantees that the tested object is manufactured according to the submitted drawing.
CESI checked that this drawing adequately represents in shape and dimensions the essential details and the parts of the tested object.
This drawing, identified by CESI and numbered A4503147 No. 1, is annexed to this document.

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

Test location CESI – Via Rubattino 54 – Milan

CESI testing team Mr L. Podavitte

Test laboratory P177

Activity code 43160L

ВЯРНО С ОРИГИНАЛА

АКЦИОНЕРНО ДРУЖЕСТВО ФИЛКАБ 16 ПЛОВДИВ

Pages annexed:

Oscillograms n. 24 pages

TYCO drawing n.OCP2-5, CESI n. A4503147 , n. 1 page

TYCO document n. 041103/OCP2-THC (thermal equivalency); CESI n.524527, n.1 page

TYCO Technical data n. 041202/OCP2 TOV curve V.4 ; CESI n. A4524512, n.1 page

Test object characteristics

type: Polymer housed metal-oxide surge arrester section (thermal equivalent)

electrical characteristics (assigned by the client)

manufacturer's name	TYCO Electronics Energy division - Shannon (IRL)
nominal discharge current - I_N [kA]	10,0
rated voltage – U_r [kV]	0,980 x Uref.
continuous operating voltage - U_c [kV]	0,784 x Uref.
reference current - $I_{ref.}$ [mA]	5,0
line discharge class	2
rated frequency - [Hz]	50 - 60
year of manufacture	2004

geometrical characteristics (measured on the test sample)

height [mm]	139
number of sheds	n.2 large- n.1 small
shed diameter [mm]	118 large - 96 small

other characteristics

housing material	silicone
housing color	grey

NOTE:The surge arresters were tested with the additional thermal insulation supplied by the Client.
The verification of the thermal equivalency according to annexe B was carried out by the Client (see report n.A4524527)
Upon Client request the test was carried out with an energy equal to 15,5 kJ for each single shot applied. The approach is different from the IEC approach for class 2 surge arresters (based on the calculated energy) and results is an higher energy (see CESI report A4/503158). The test is therefore more severe.

ВЯРНО С ОРИГИНАЛА

АКЦИОНЕРНО ДРУЖЕСТВО ФИЛКАБ 16 ПЛОВДИВ

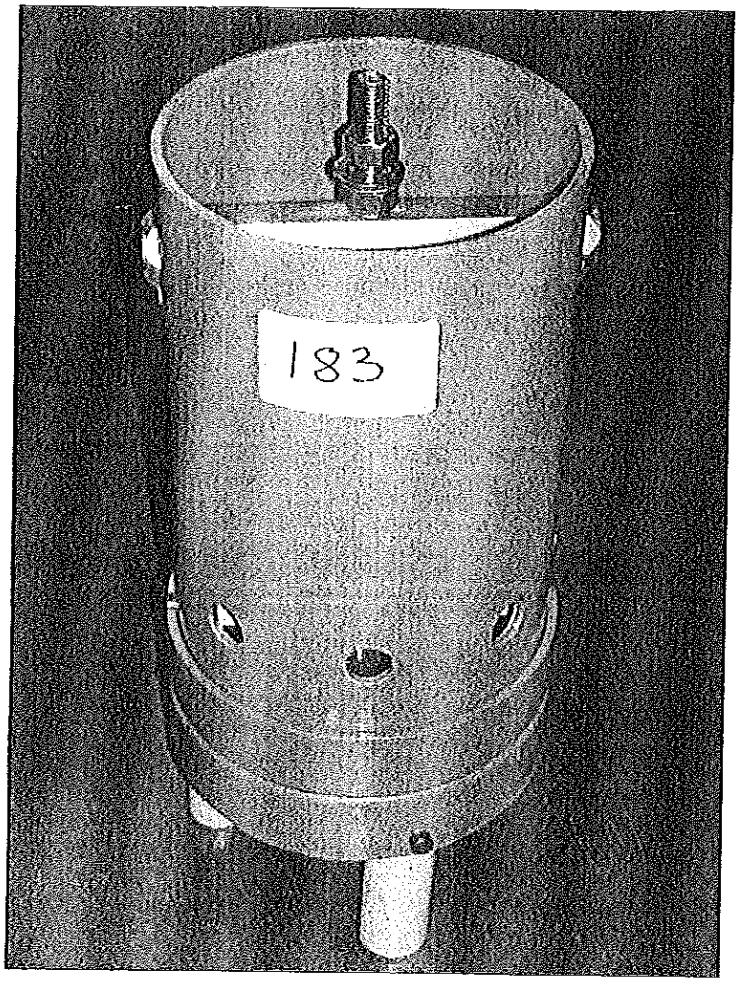


Photo no. 1
Photograph of the prorated section

ВЯРНО С ОРИГИНАЛА

АКЦИОНЕРНО ДРУЖЕСТВО ФИЛКАБ 16 ПЛОВДИВ

Reference standard

The test was carried according to the IEC 60099-4 (2004) Standard – Annexed D

" Metal-oxide surge arrester without gaps for a.c. system "

Test carried out

test carried out	number of sample tested
power frequency voltage versus time test	3

Test object identification

test object names	identification of test sample (assigned by the client)
polymer housed metal-oxide surge arrester section	183 – 190 - 222

ВЯРНО С ОРИГИНАЛА

АКЦИОНЕРНО ДРУЖЕСТВО ФИЛКАБ 16 * ПЛОВДИВ *

Test procedure

- The power frequency voltage at reference current (I_{ref} = 5 mA) has been carried out.
- The voltage correction factors have been calculated according to reference standard
- The samples have been kept in an oven at the temperature of 60 °C till thermal equilibrium
- Two long duration current impulse having duration 2000μs and specified energy 15,5 kJ have been applied and a time shorter than 100 ms after the application of the second long duration current impulse the sample has been energized at Utov (declared by the manufacturer) and then the voltage Uc' has been applied for 30 min, in order to verify the thermal stability.
- Three samples were tested as specified below:
  - one sample at the voltage U_{TOV}=1,43*U_c' for a time duration T_{TOV} equal to 1 sec. (sample n.183)
  - one sample at the voltage U_{TOV}=1,29*U_c' for a time duration T_{TOV} equal to 100 sec. (sample n.190)
  - one sample at the voltage U_{TOV}=1,22*U_c' for a time duration T_{TOV} equal to 1000 sec. (sample n.222)

Summary of test results

- The thermal stability was achieved for all tested sample.
- The visual inspection of the test sample has revealed no sign of physical damage.
- **All acceptance criteria are satisfied and therefore the curve claimed by the manufacturer is to be considered verified.**

ВЯРНО С ОРИГИНАЛА

АКЦИОНЕРНО ДРУЖЕСТВО * ФИЛКАБ 16 * ПЛОВДИВ *

Power frequency voltage versus time test.

Power frequency voltage-current characteristics

Test circuit: A0019

Date: December 03, 2004

Sample No.183						
oscillogram	voltage	current	current	current	Power	3rd harmonic amplitude
No.	kV	+ mA_{cr}	- mA_{cr}	mA_{rms}	W	µA
1	6,67	5,14	4,80	1,70	8,39	--

Sample No. 190						
oscillogram	voltage	current	current	current	Power	3rd harmonic amplitude
No.	kV	+ mA_{cr}	- mA_{cr}	mA_{rms}	W	µA
2	6,59	5,05	4,73	1,72	8,00	--

Sample No.222						
oscillogram	voltage	current	current	current	Power	3rd harmonic amplitude
No.	kV	+ mA_{cr}	- mA_{cr}	mA_{rms}	W	µA
3	6,69	5,02	4,71	1,77	8,31	--

ВЯРНО С ОРИГИНАЛА

АКЦИОНЕРНО ДРУЖЕСТВО ФИЛКАБ 16 ПЛОВДИВ

Power frequency voltage versus time test.

voltage correction factor calculations

test object: Polymer housed metal-oxide surge arrester type section

sample	U_{ref} [1]	KU_r [2]	KU_c [3]	U_r' [4]	U_c' [5]
no.	kV			kV	kV
183	6,67	0,980	0,784	6,537	5,229
190	6,59			6,458	5,167
222	6,69			6,556	5,245

The factors used for the calculation of the test voltages allow to cover all possible arresters of the series within manufacturer's tolerances so that requirement at clause 7.3 of the reference standard is satisfied.

[1] U_{refmin} : measured reference voltage
[2] KU_r : maximum guarantees factor for calculation of U_r
[3] KU_c : maximum guarantees factor for calculation of U_c
[4] U_r' : corrected rated voltage [4] = [1] × [2]
[5] U_c' : corrected continuous operating voltage [5] = [1] × [3]

Switching surge operating duty test. IEC 60099-4 Standard

Application of the long duration impulses, of the temporary overvoltage U_{TOV} and evaluation of thermal stability

Test circuit: A0124-A0130-A0020

Sample No.: 183

Preheating temperature: 61 °C

Date: December 06, 2004

Long duration current impulses application

Oscillogram	Impulse	Charging voltage	Residual voltage	Discharge current	Energy
No.	No.	kV	kV	A	kJ
4	1	15,0	12,80	490	16,10
5	2	15,0	12,84	485	15,80

Measured waveshape	
virtual front time µs	virtual total duration µs
2200	2910

U_{TOV} voltage application

Oscillogram	Time	Voltage	Current	Current
No.	s	kV	+ A_{cr}	- A_{cr}
6	0	7,477	2,30	3,20
7	1		2,20	2,90

U_c' voltage application

Oscillogram	Time	Voltage	Current	Current	Power
No.	s	kV	+ mA_{cr}	- mA_{cr}	W
8	0	5,229	2,04	2,16	3,80
	5		0,76	0,74	0,995
	10		0,70	0,73	0,830
9	15		0,67	0,71	0,760
	20		0,66	0,67	0,690
	25		0,64	0,65	0,680
10	30		0,63	0,64	0,660

ВЯРНО С ОРИГИНАЛА

АКЦИОНЕРНО ДРУЖЕСТВО ФИЛКАБ 16 ПЛОВДИВ

continued

continued

Sample No.: 190

Preheating temperature: 61 °C

Date: December 05,2004

Long duration current impulses application

Oscillogram	Impulse	Charging voltage	Residual voltage	Discharge current	Energy
No.	No.	kV	kV	A	kJ
11	1	15,0	12,76	490	16,15
12	2	15,0	12,80	480	15,97

Measured waveshape	
virtual front time	virtual total duration
µs	µs
2200	2910

U_{TOV} voltage application

Oscillogram	Time	Voltage	Current	Current
No.	s	kV	+ mA_{cr}	- mA_{cr}
13	0	6,67	93,0	128,0
14	100		14,0	16,0

U_c' voltage application

Oscillogram	Time	Voltage	Current	Current	Power
No.	s	kV	+ mA_{cr}	- mA_{cr}	W
15	0	5,167	0,75	0,83	1,04
	5		0,71	0,76	0,84
	10		0,70	0,74	0,77
16	15		0,68	0,73	0,72
	20		0,65	0,71	0,68
	25		0,64	0,70	0,65
17	30		0,63	0,69	0,64

ВЯРНО С ОРИГИНАЛА

АКЦИОНЕРНО ДРУЖЕСТВО * ЕЛКАБ 16 * ПЛОВДИВ *

continued

continued

Sample No.: 222

Preheating temperature: 61 °C

Date: December 09, 2004

Long duration current impulses application

Oscillogram	Impulse	Charging voltage	Residual voltage	Discharge current	Energy
No.	No.	kV	kV	A	kJ
18	1	15,0	12,84	480	15,65
19	2	15,0	12,84	480	15,55

Measured waveshape	
virtual front time	virtual total duration
µs	µs
2200	2910

U_{TOV} voltage application

Oscillogram	Time	Voltage	Current	Current
No.	s	kV	+ mA_{cr}	- mA_{cr}
20	0	6,398	20,0	28,0
21	10	6,398	2,0	3,0

U_c' voltage application

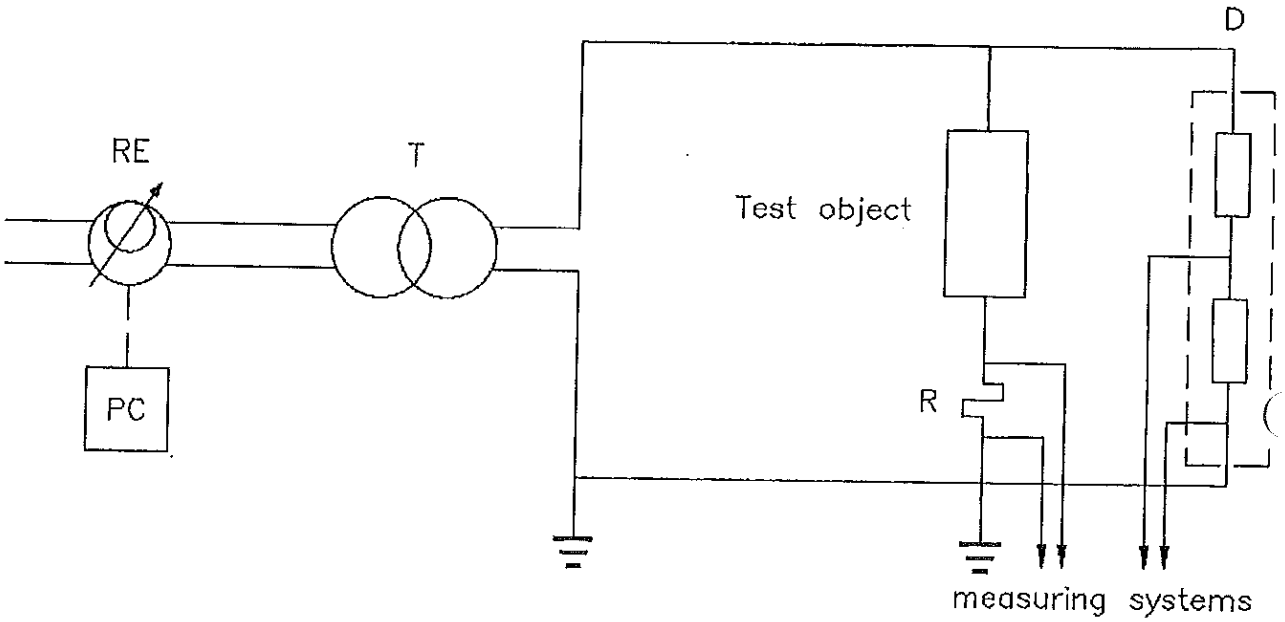
Oscillogram	Time	Voltage	Current	Current	Power
No.	s	kV	+ mA_{cr}	- mA_{cr}	W
22	0	5,245	0,67	0,71	0,761
	5		0,66	0,70	0,742
	10		0,66	0,69	0,720
23	15		0,65	0,68	0,655
	20		0,64	0,67	0,625
	25		0,63	0,66	0,620
24	30		0,62	0,65	0,610

ВЯРНО С ОРИГИНАЛА

АКЦИОНЕРНО ДРУЖЕСТВО ФИЛКАБ 16 ПЛОВДИВ

continued

Circuit A0019



Power frequency supply

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

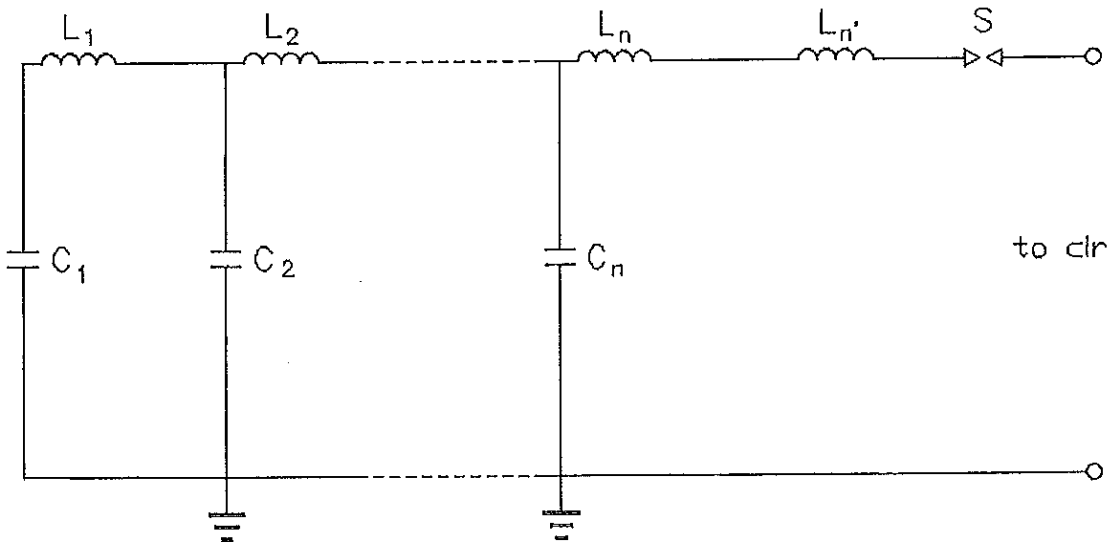
Current measuring system

R - Current shunt CESI No.31120; R= 941,4 Ω
- Electro optical system CESI No. -- ; attenuation
OSC - Oscilloscope type SONY TEKTRONIX RTD 710; CESI No.6318

Voltage measuring system

D - Voltage divider SAGI; CESI No.11120
- Electro optical system CESI No.11521/1522; attenuation 50:5
OSC - Oscilloscope type SONY TEKTRONIX RTD 710; CESI No.6318

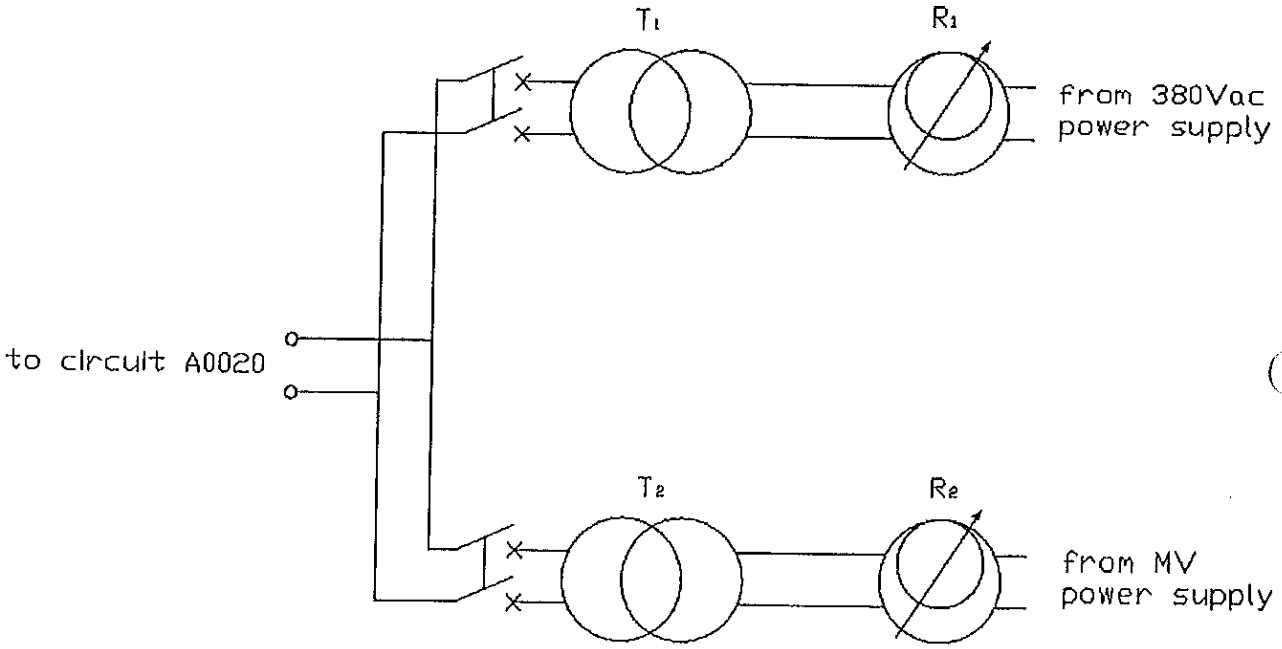
Circuit A0124



Impulse generator circuit

$C_1 \ldots C_{12}$	- capacitors 18,75 µF
$L_1 \ldots L_{11}$	- inductors 666 µH
L_{12}	- inductor (500 +600) µH
S	- spark-gap

Circuit A0130



Power-frequency circuit

from 380Vac power supply

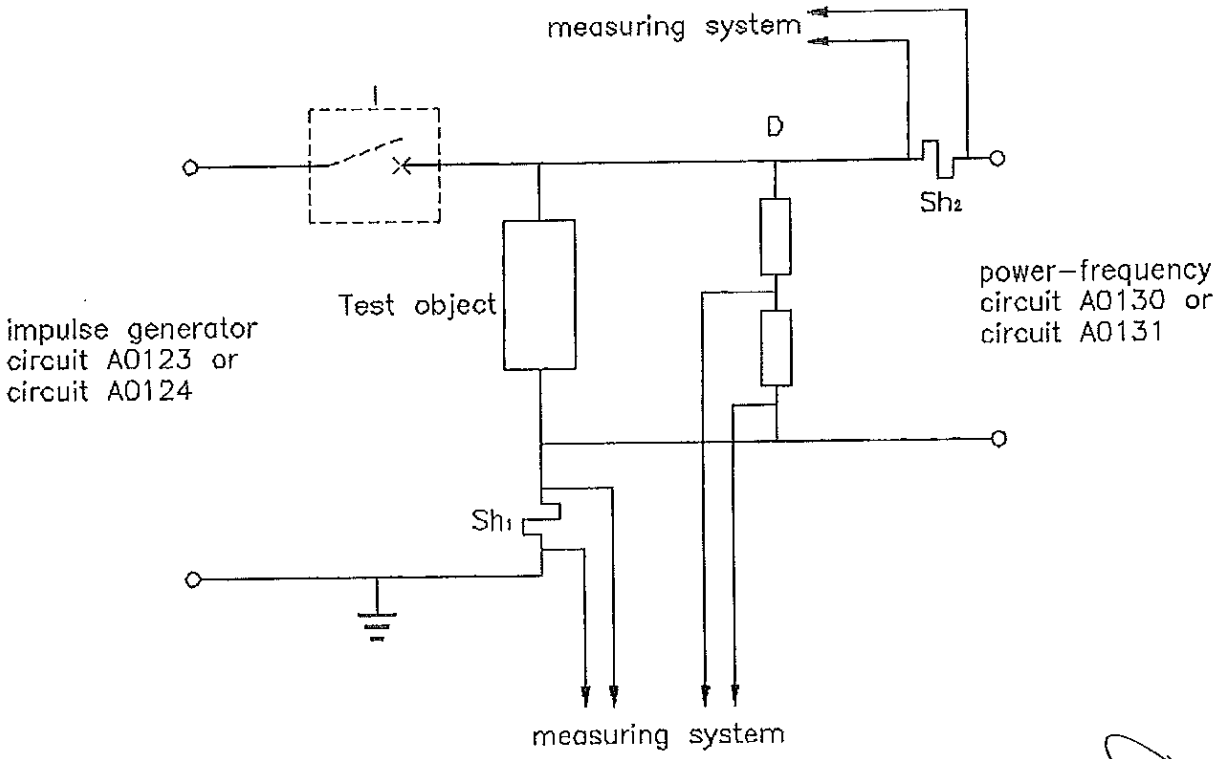
R_1 - single-phase voltage regulator CORMES; power 20 kVA; voltage 380/04220 Vac

T_1 - voltage transformer type SPECIALTRASFO; power 30 kVA; voltage 200-400 V/15-30 kV

from Medium Voltage (MV) power supply

R_2-T_2 - voltage regulator group BONNEFOND; power 3x350 kVA; voltage 23 kV/046*$\sqrt{3}$ kV

Circuit A0020



Impulse generator circuit A0123

I - Circuit-breaker

Impulsive current measuring system

Sh_1 - Current shunt CESI No.6042; R= 2 m Ω
- Electro optical system CESI No.11517/518; attenuation 300:5

OSC_1 - Oscilloscope type TEKTRONIX TDS 540A; CESI No.13217 (on channel No.1)

Power frequency voltage measuring system circuit A013

D - Voltage divider SAGI; CESI No.13027
- Electro optical system CESI No.11521/522; attenuation 20:5

OSC_2 - Oscilloscope type TEKTRONIX TDS 460A; CESI No.14434 (on channel No.2)

OSC_3 - Oscilloscope type SONY TEKTRONIX RTD 710A ; CESI No.9090 (on channel No.1)

Power frequency current measuring system circuit A013

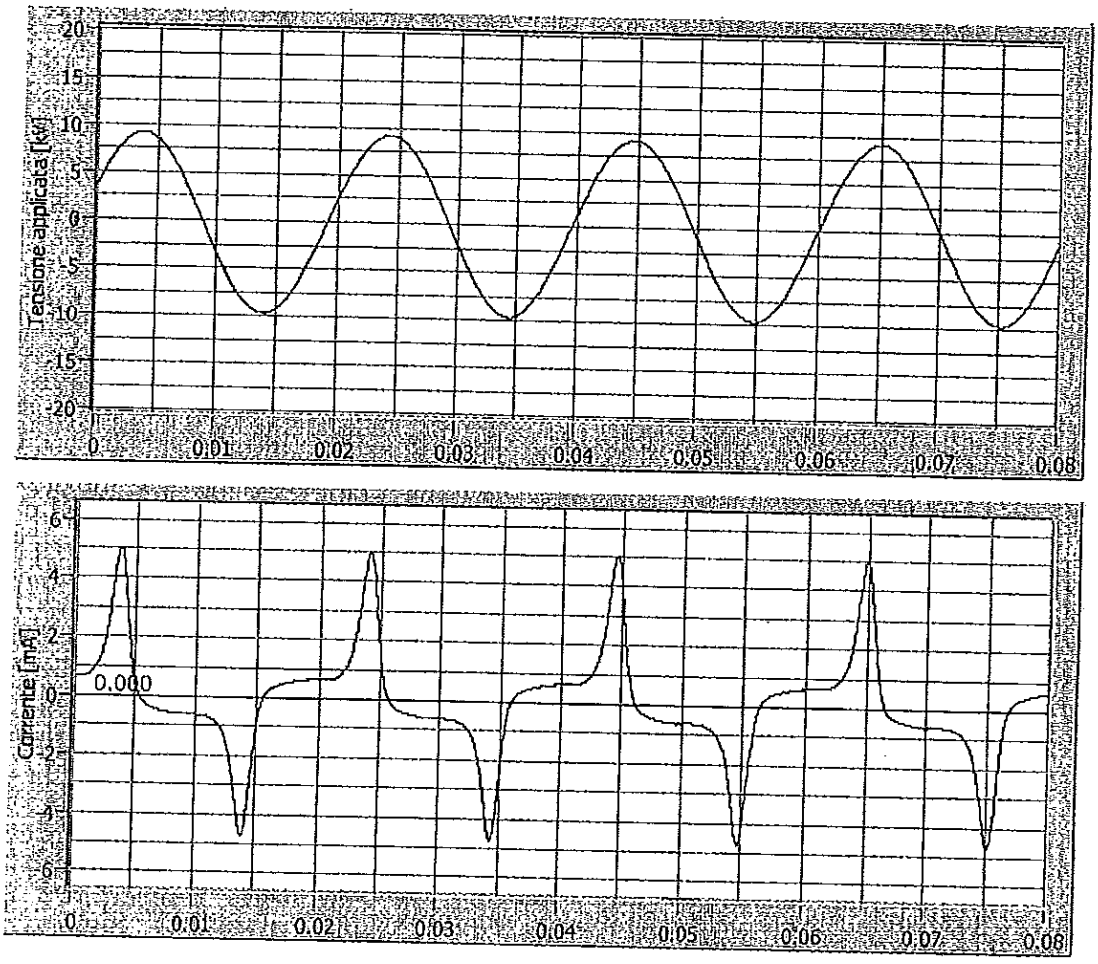
Sh_2(TOV) - Current shunt CESI ; R= 100 Ω (TOV 1000sec. – 100 sec.) – Pearson 1 V*A CESI No.9099 (TOV 1 sec.);

Sh_2 (MCOV) - Current shunt CESI R= 500 –1000 Ω
- Electro optical system CESI No. 8011/17; attenuation 300-5:5

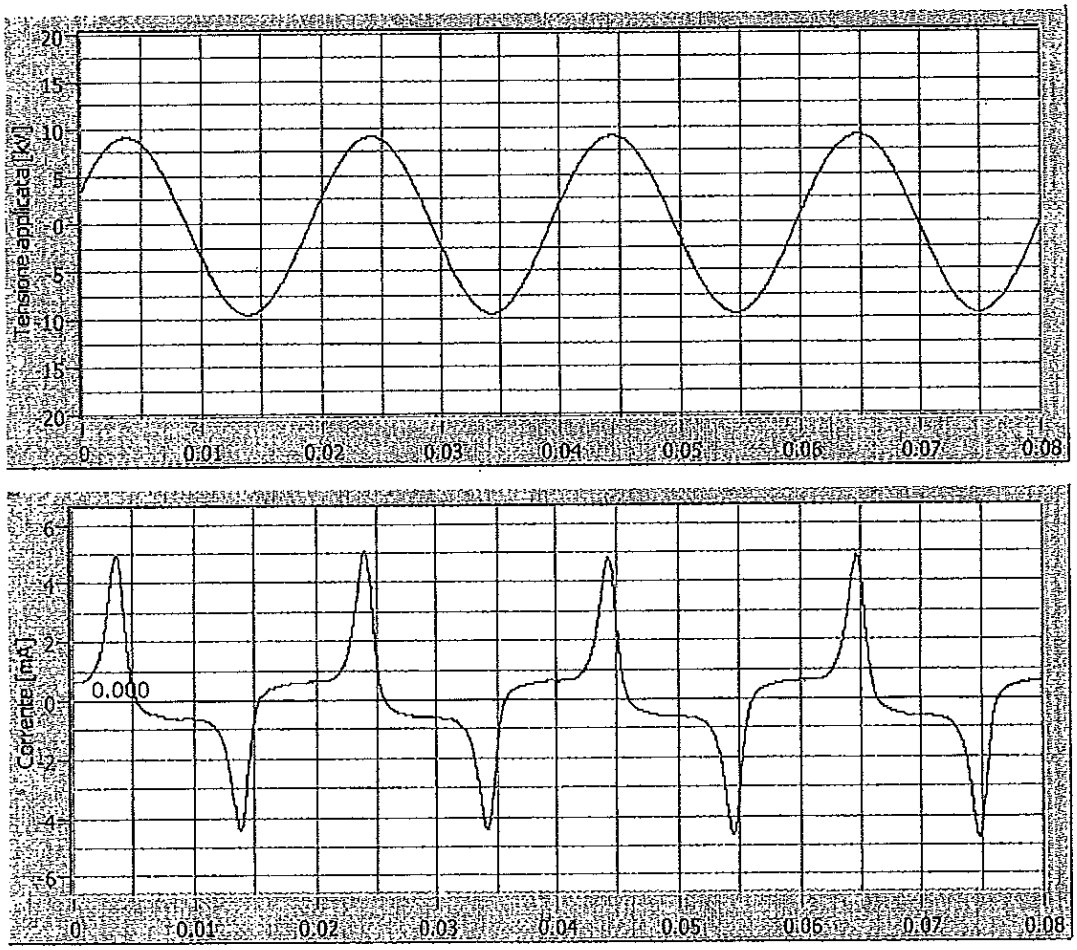
OSC_2 - Oscilloscope type SONY TEKTRONIX RTD 710A ; CESI No.9090 ; CESI No.13217 (on channel No.2)

ВЯРНО С ОРИГИНАЛА!

АКЦИОНЕРНО ДРУЖЕСТВО ФИЛКАБ 16 ПЛОВДИВ



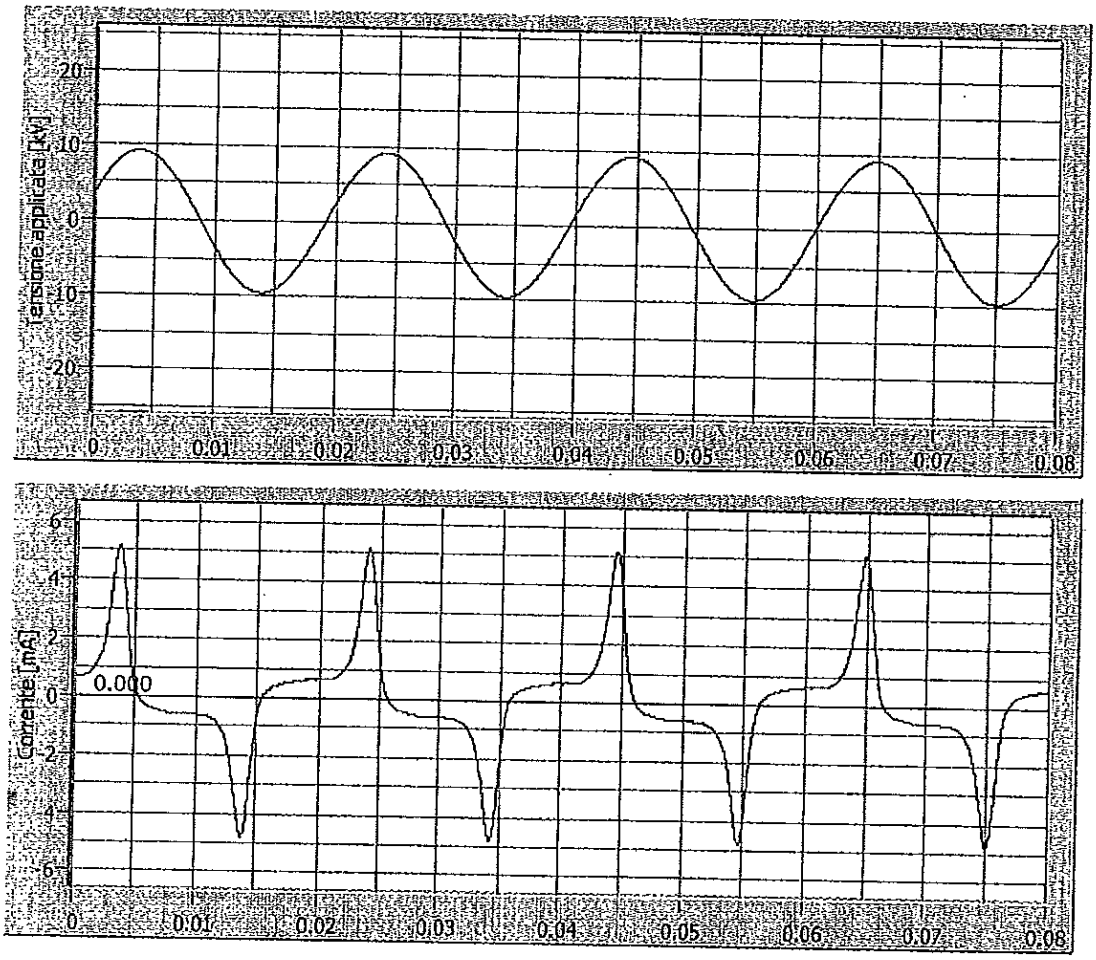
CESI Pec A4521820 oscillogram n.1



CESI Pec A4521820 oscillogram n.2

ВЯРНО С ОРИГИНАЛА

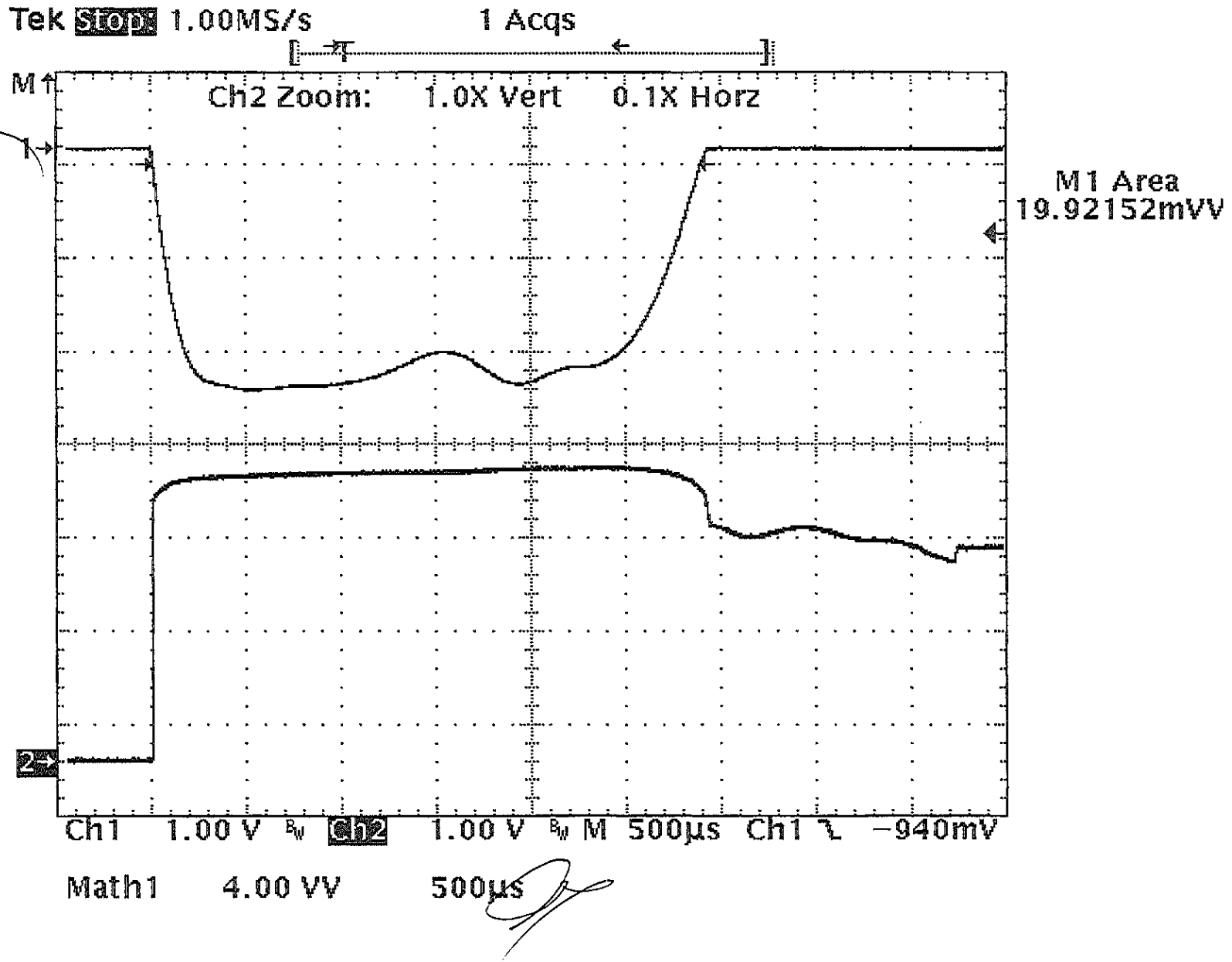
АКЦИОНЕРНО ДРУЖЕСТВО ФИЛКАБ 16 ПЛОВДИВ

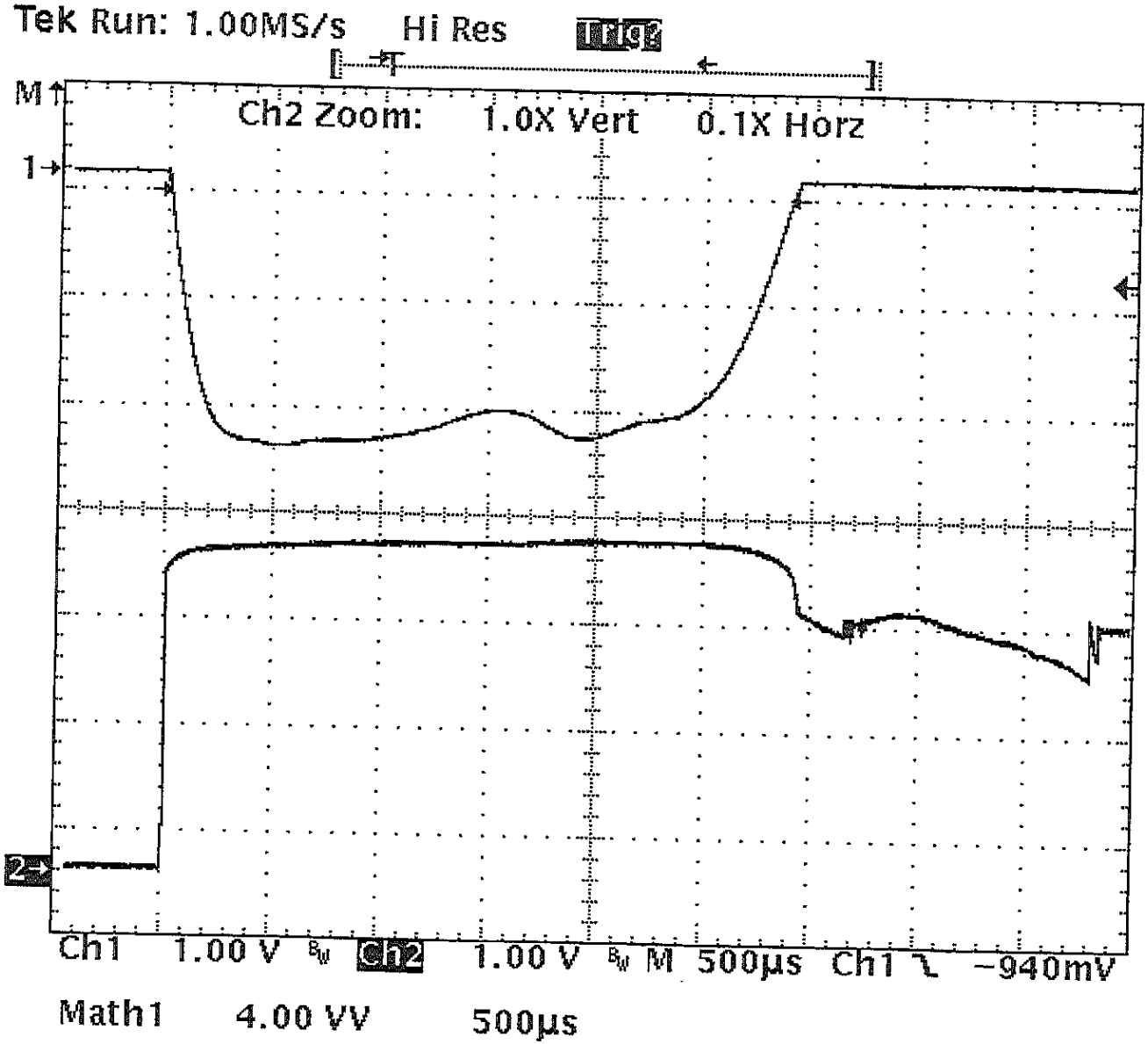


CESI Pec A4521820 oscillogram n.3

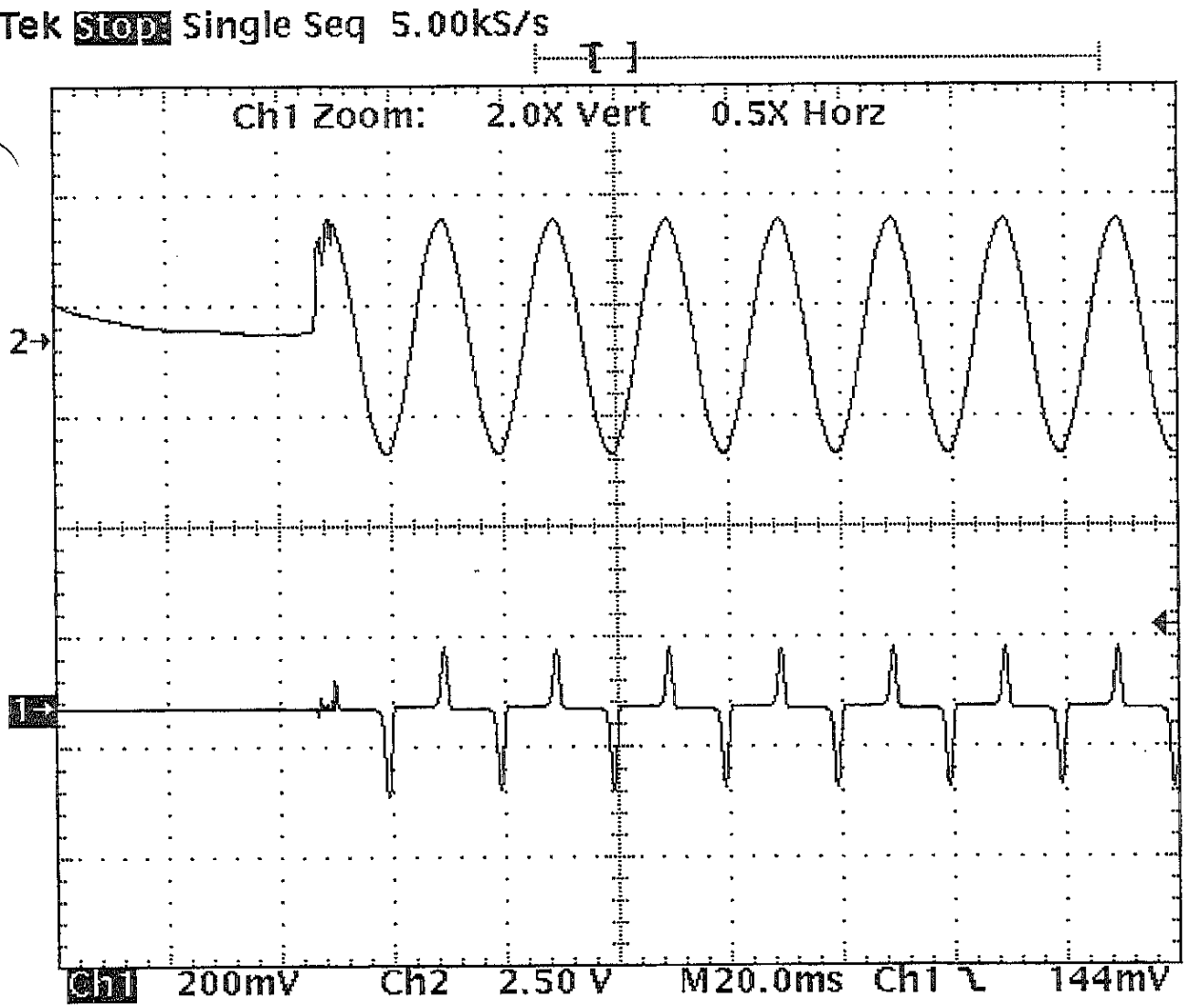
ВЯРНО С ОРИГИНАЛА

АКЦИОНЕРНО ДРУЖЕСТВО * ПЛОВДИВ * ФИЛКАБ 16

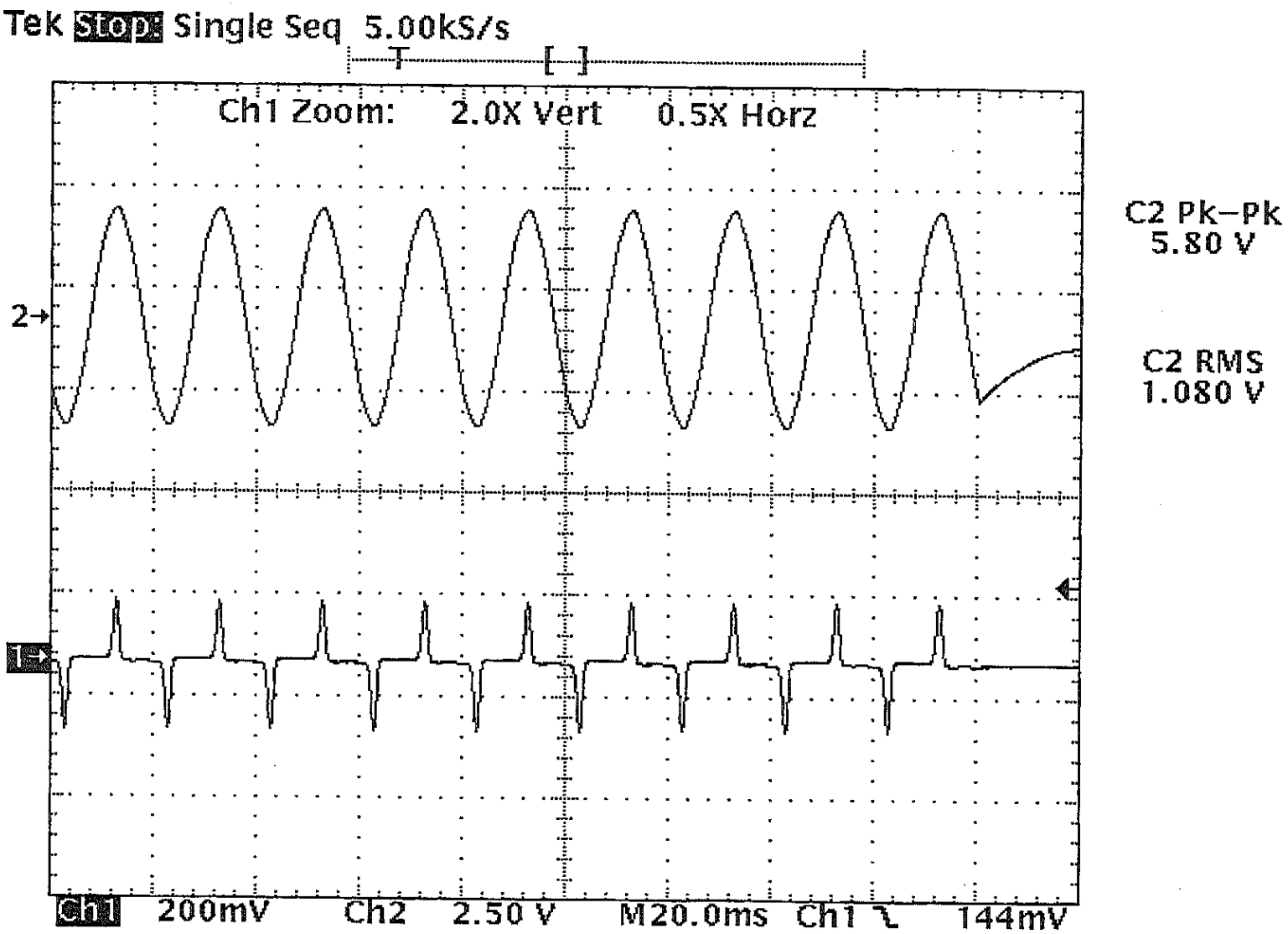




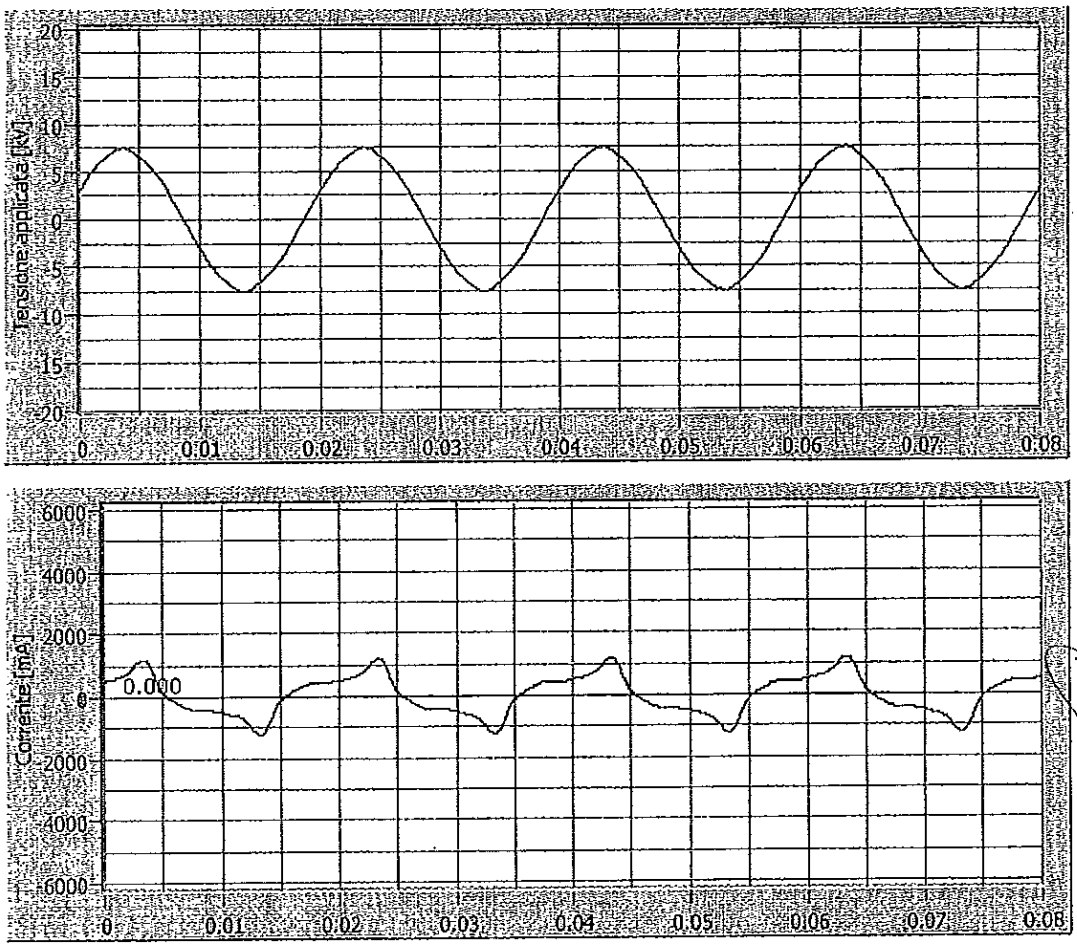
oscillogram n. 5



CESI PeC A4521820 oscillogram.B 6



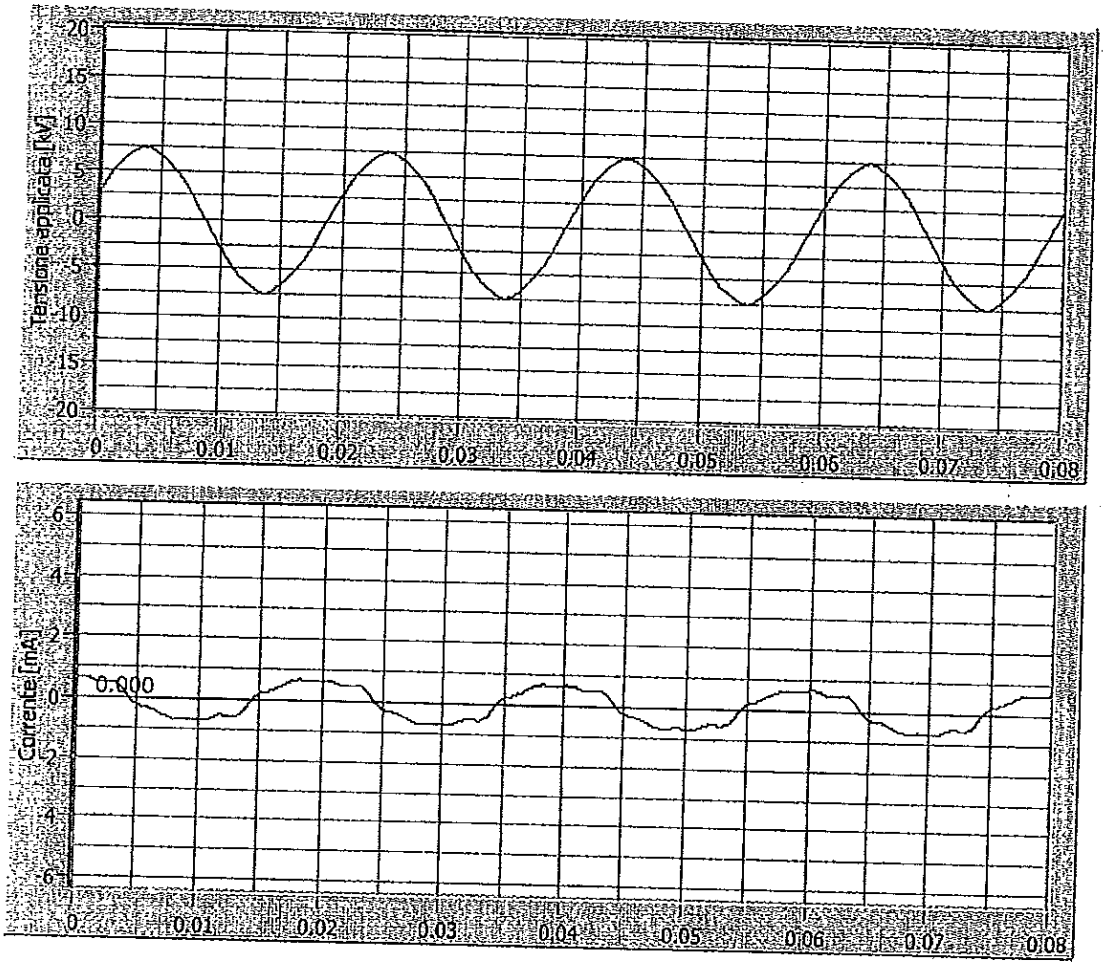
CESI PeC A4521820 oscillogram n. 7



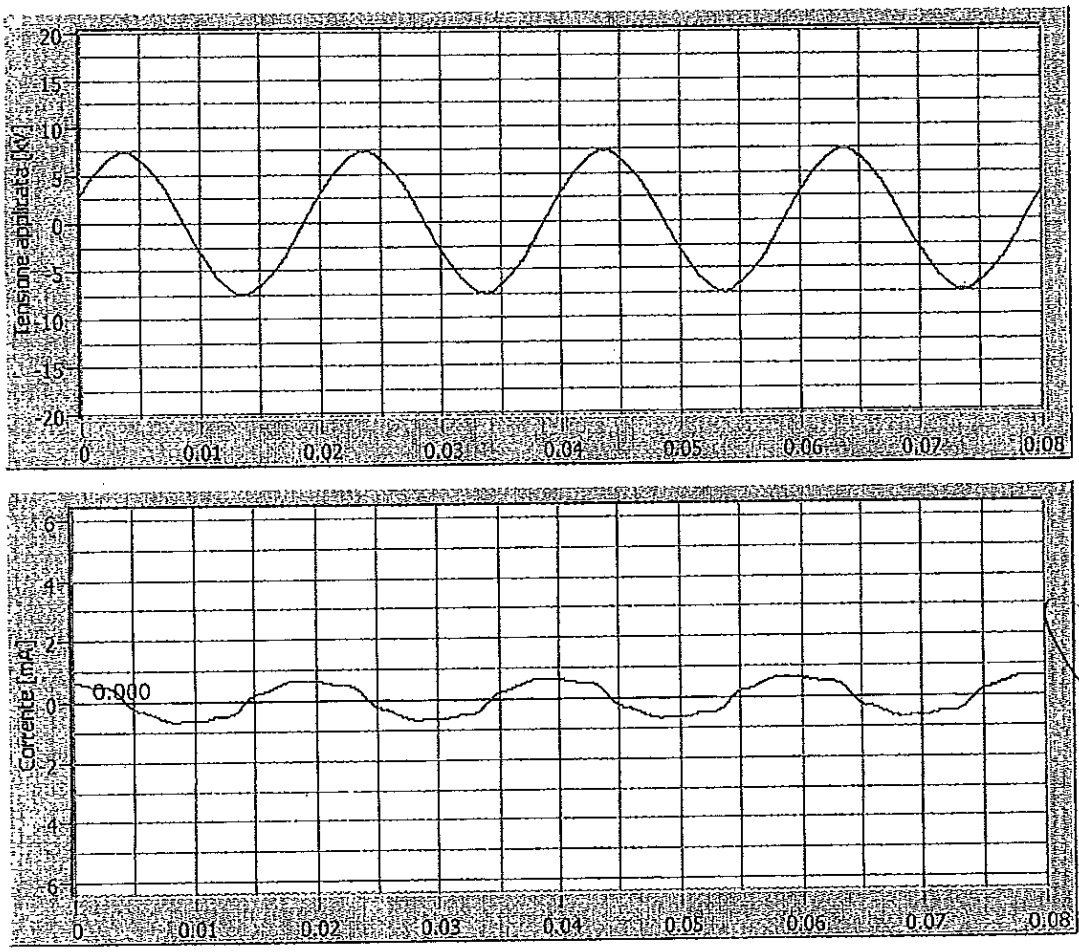
CESI Pec A4521820 oscillogram n.8

ВЯРНО С ОРИГИНАЛА

АКЦИОНЕРНО ДРУЖЕСТВО * ФИЛКАБ 16 * ПЛОВДИВ *



CESI Pec A4521820 oscillogram n.9



CESI Pec A4521820 oscillogram n.10

ВЯРНО С ОРИГИНАЛА

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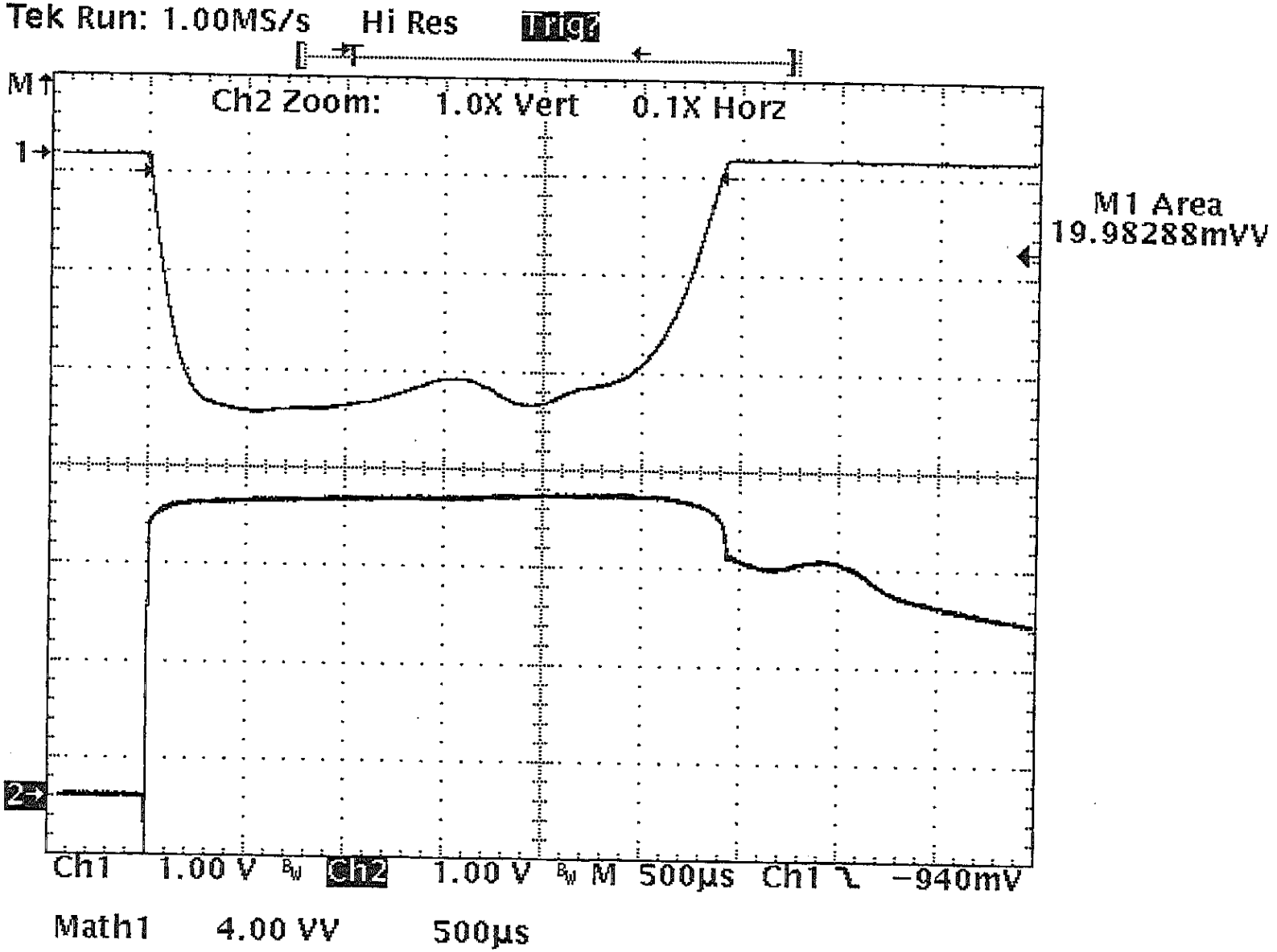
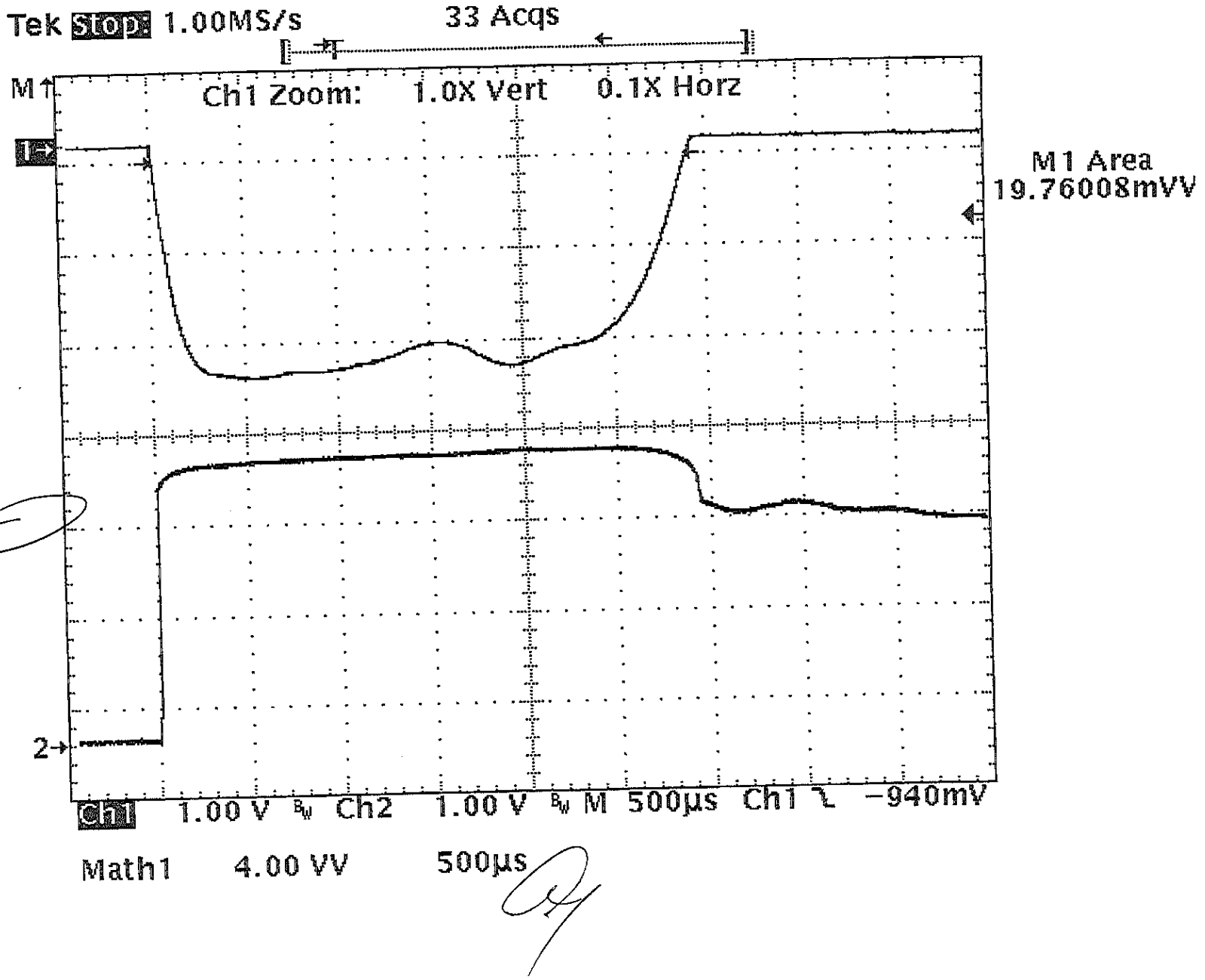


CESI PeC A4521820 oscillogram n. 11

ВЯРНО С ОРИГИНАЛА

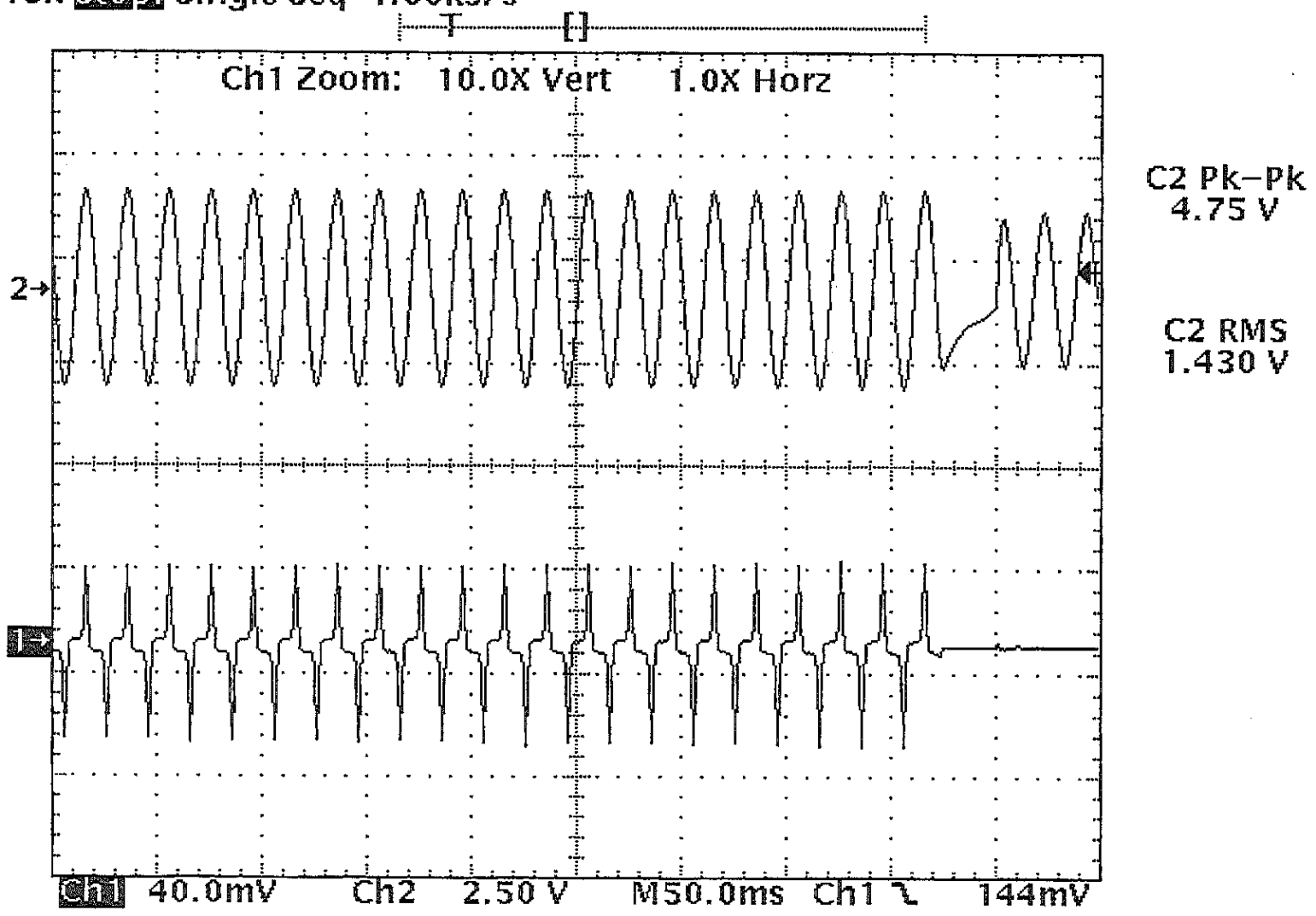
АКЦИОНЕРНО ДРУЖЕСТВО * ВИПОЛИВ * ФИЛИКАБ 16

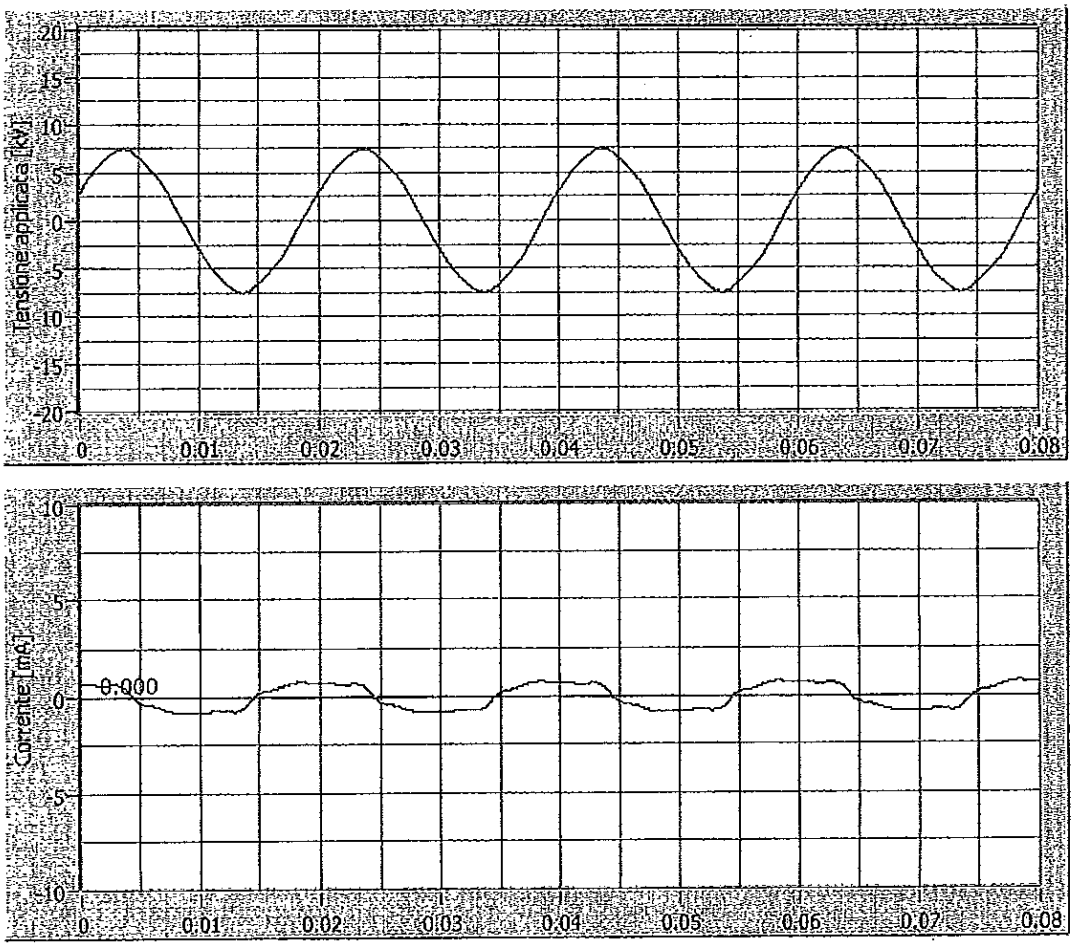


CESI PeC A4521820 oscillogram n.42

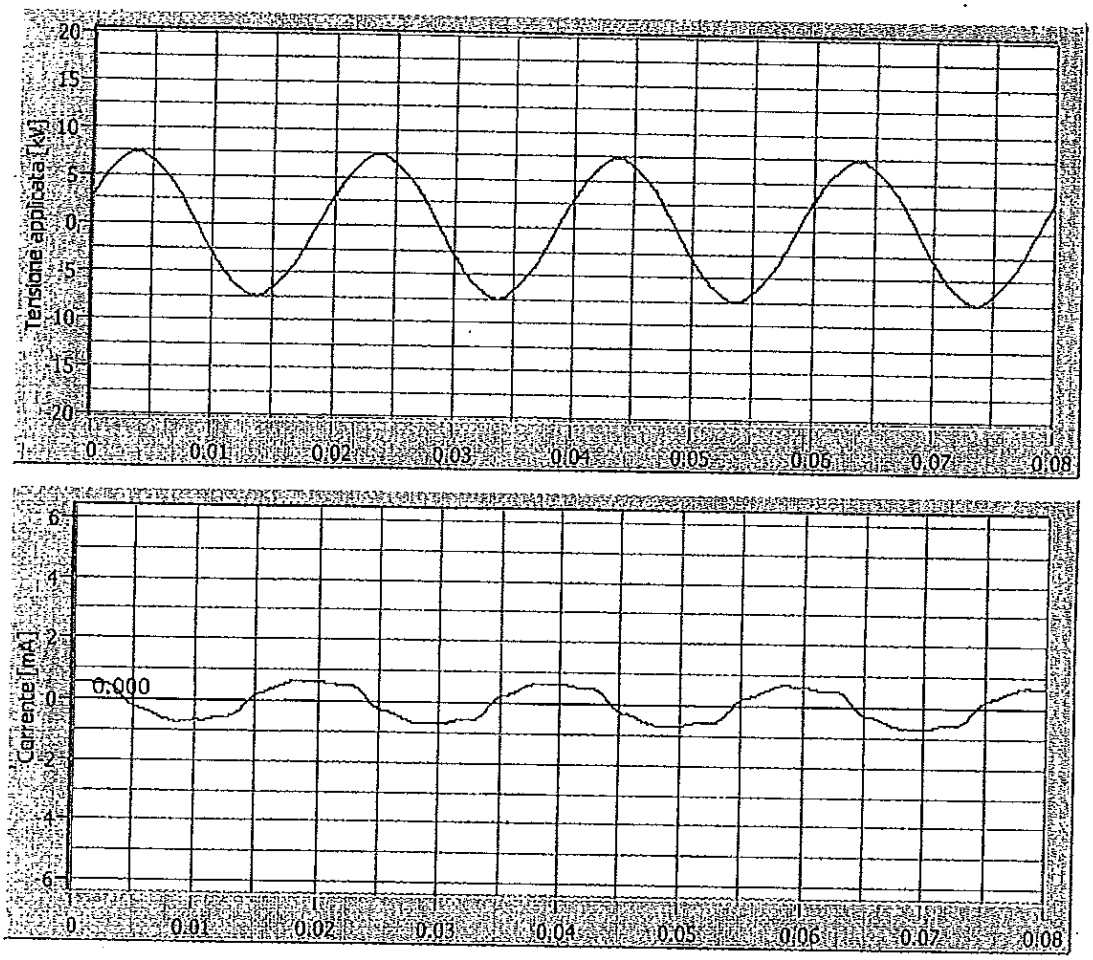
ВЯРНО С ОРИГИНАЛА

CESI PeC A4521820 oscillogram n. 14

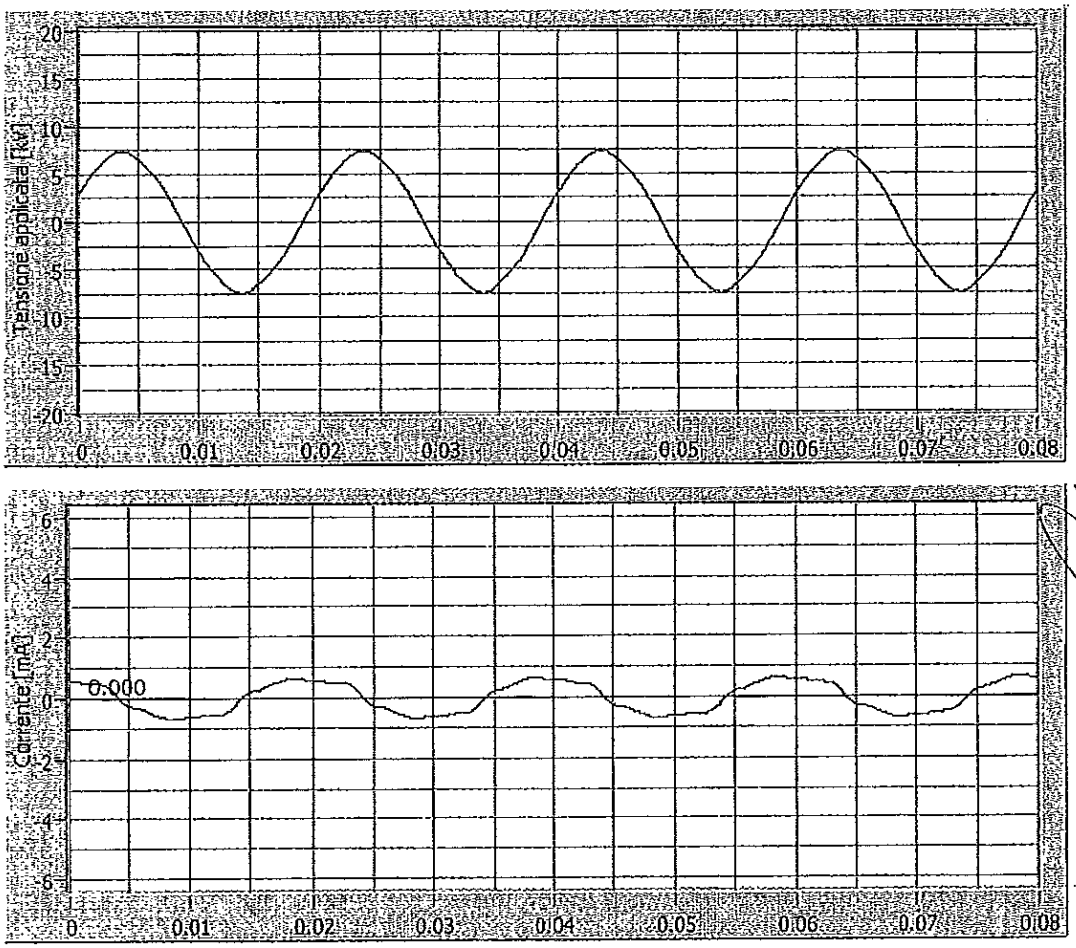




CESI Pec A4521820 oscillogram n.15



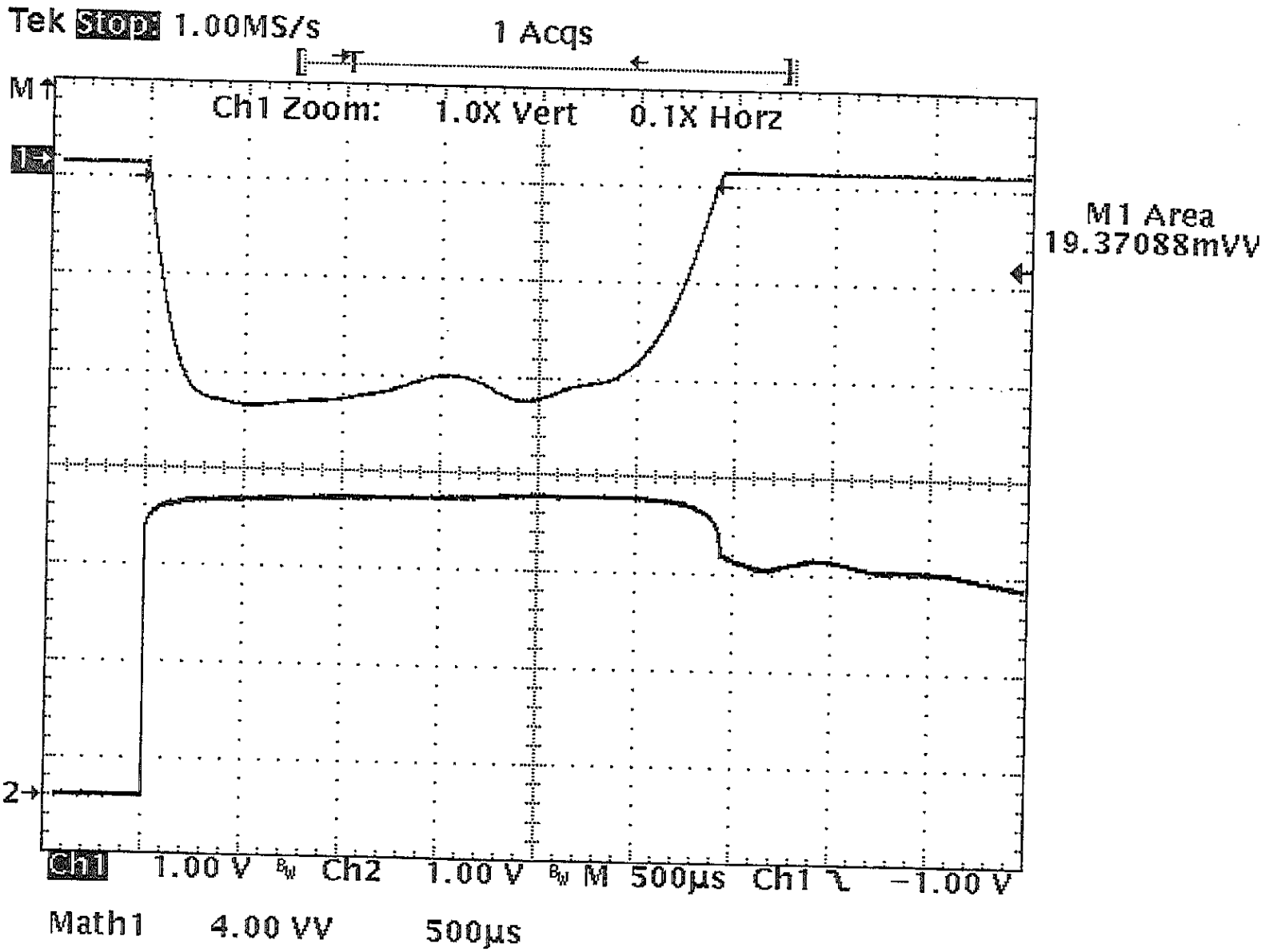
CESI Pec A4521820 oscillogram n.16



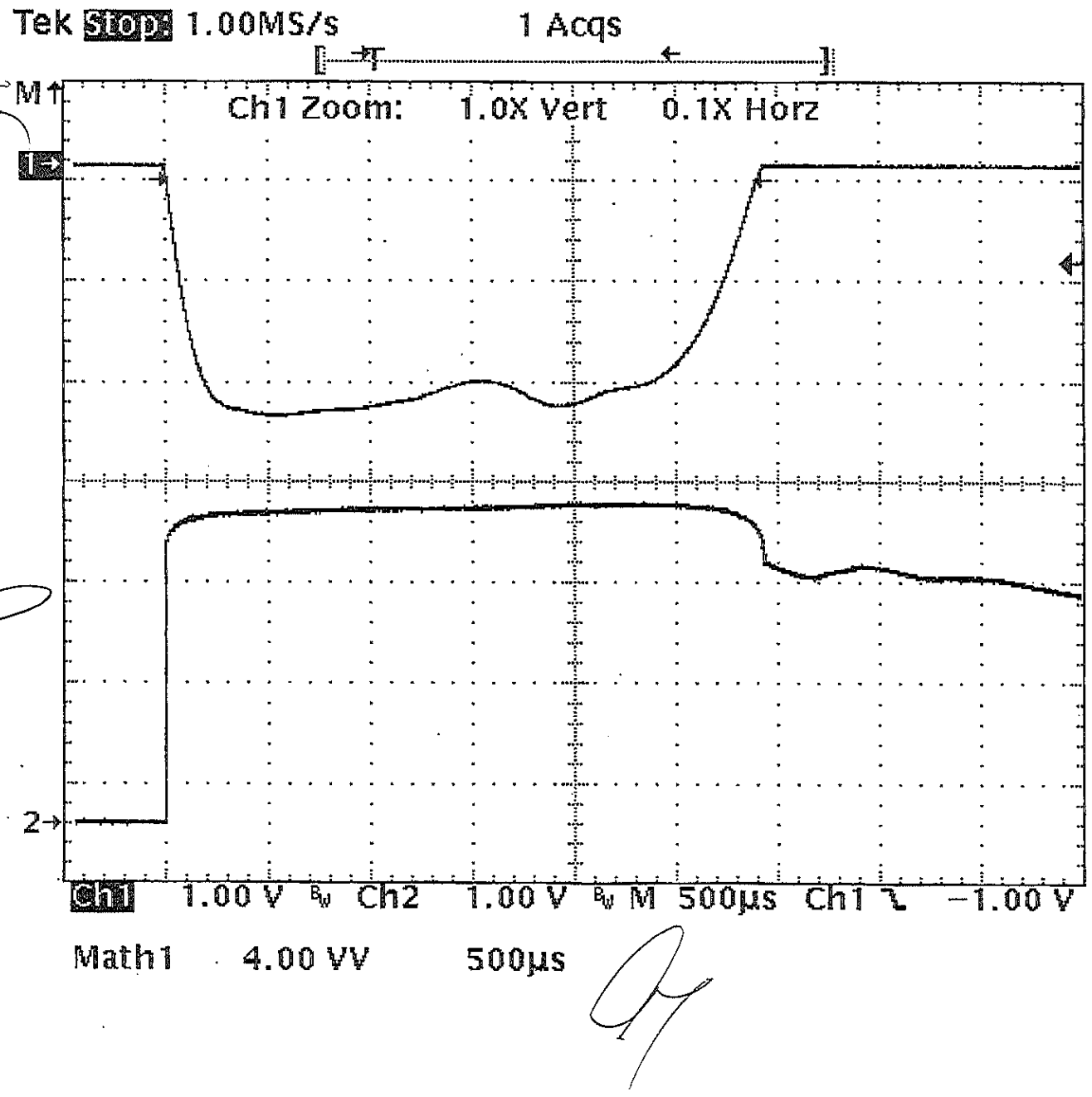
CESI Pec A4521820 oscillogram n.17

ВЯРНО С ОРИГИНАЛА

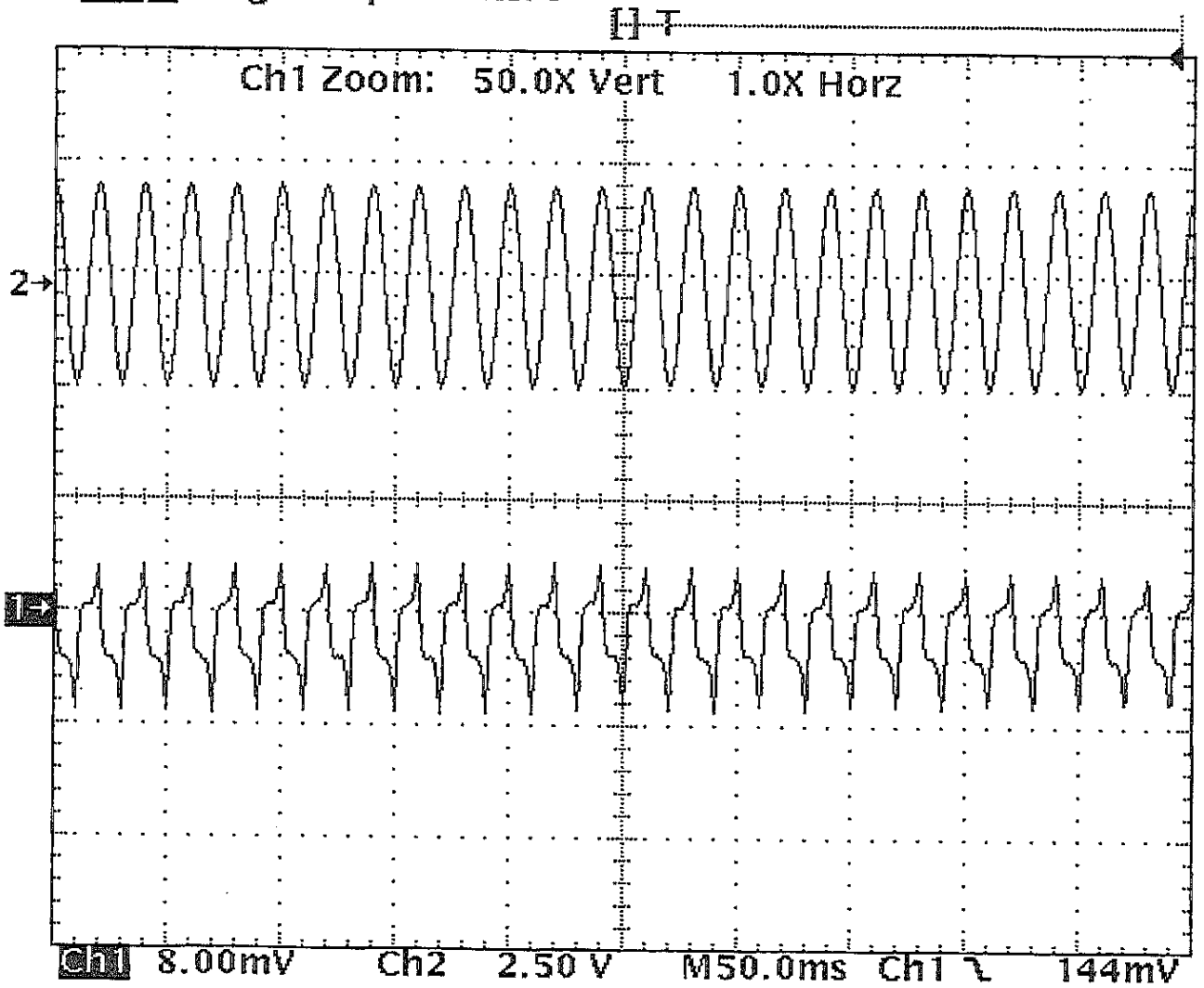
АКЦИОНЕРНО ДРУЖЕСТВО * ПЛОВДИВ * ЕЛКАБ 16



CESI PeC A4521820 oscillogram n. 18



CESI PeC A4521820 oscillogram n. 19

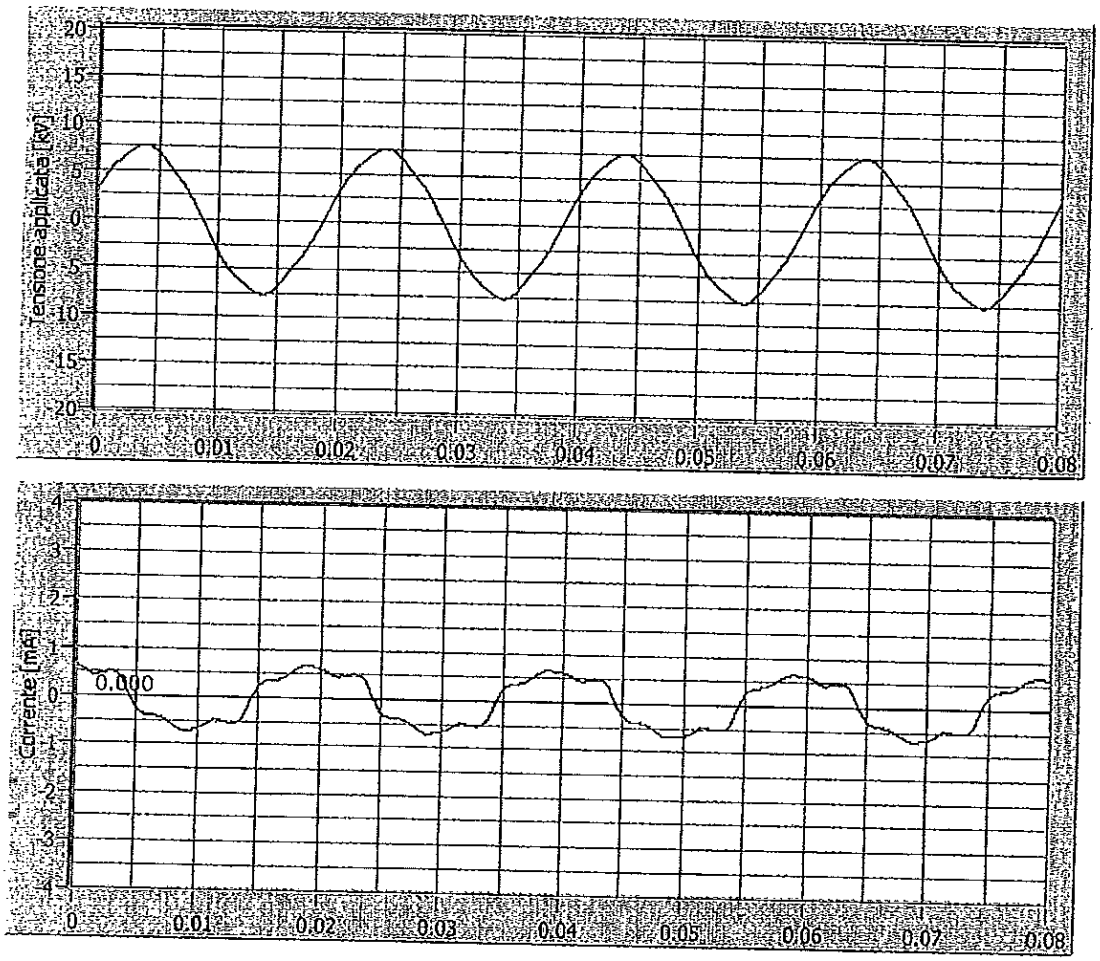


oscillogram n. 20

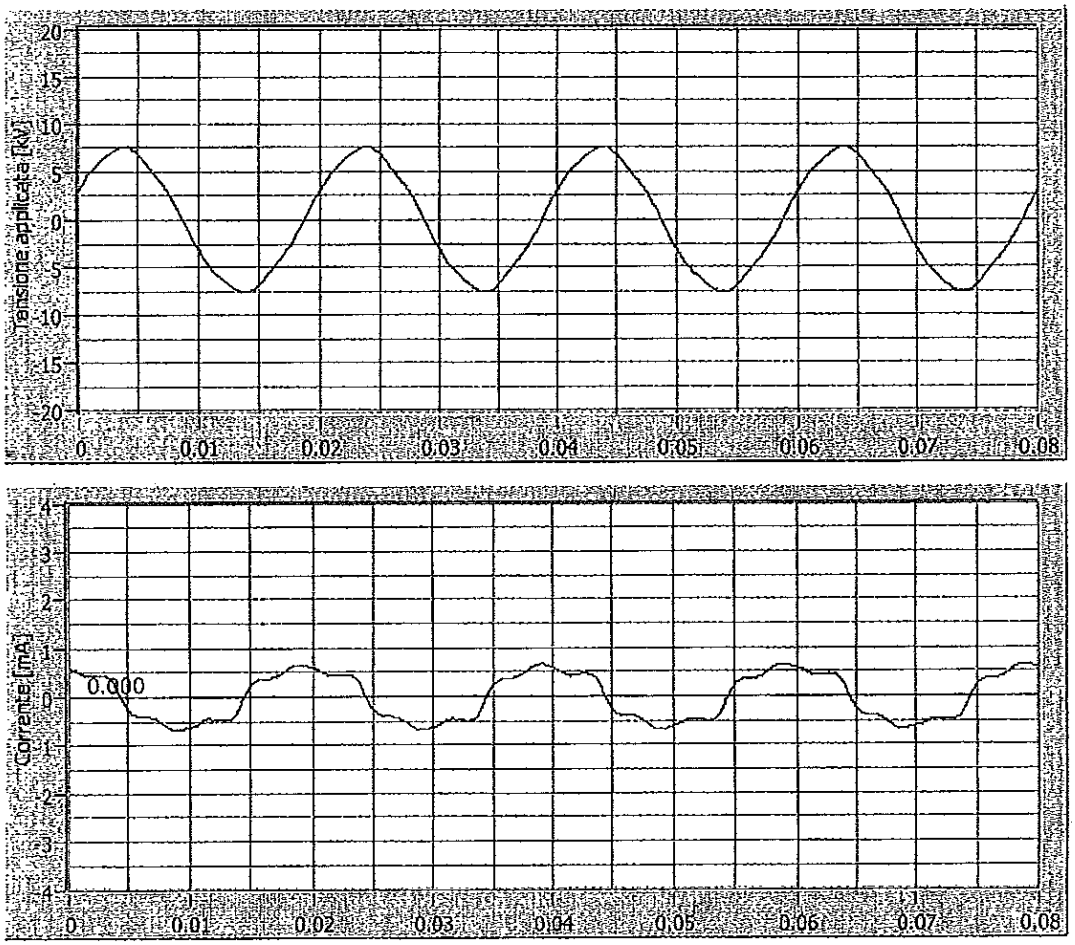
CESI PeC A4521820 oscillogram n. 21

ВЯРНО С ОРИГИНАЛА

АКЦИОНЕРНО ДРУЖЕСТВО ФИЛИКАБ 16 ПЛОВДИВ



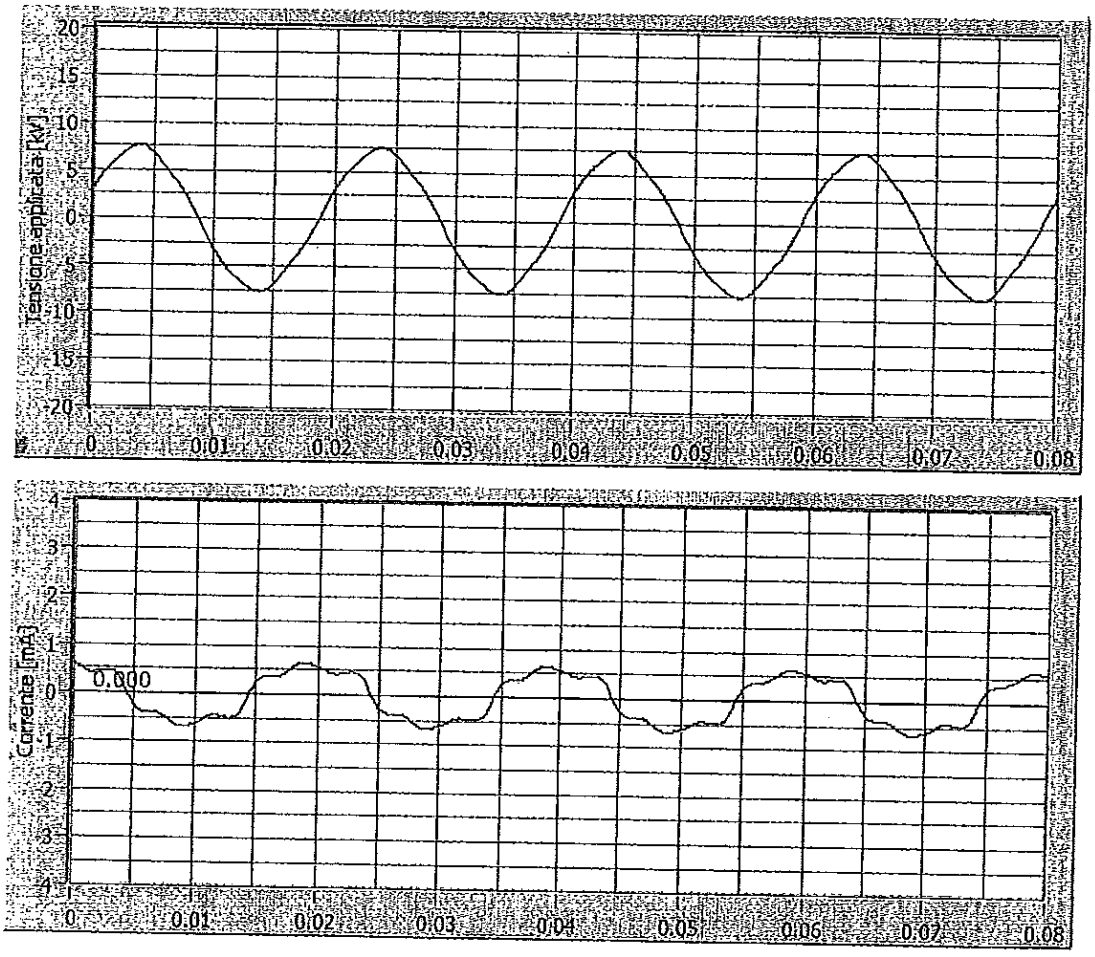
CESI Pec A4521820 oscillogram n.22



CESI Pec A4521820 oscillogram n.23

ВЯРНО С ОРИГИНАЛА

АКЦИОНЕРНО ... ФИЛКАБ 16 ПЛОВДИВ



CESI Pec A4521820 oscillogram n.24

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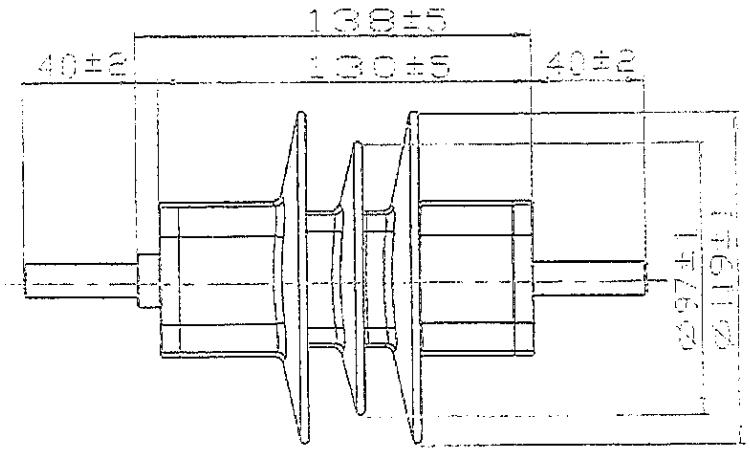
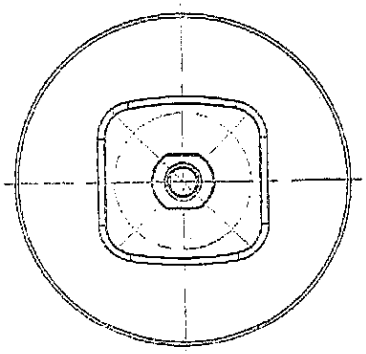
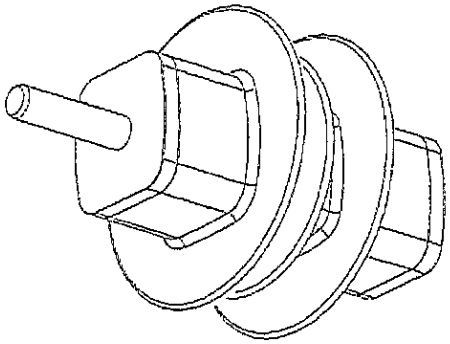
Original issue 03-2006

PROTOCOLLO

Firma







CREEPAGE=265mm
DRY ARC DIST=138mm

ВЯРНО С ОРИГИНАЛА

АКЦИОНЕРНО ДРУЖЕСТВО * ФИЛИКАБ * ПЛОВДИВ

DRN				PCN	
DSGN				MATL	
APP					
SCALE					

TYCO ELECTRONICS

ENERGY DIVISION

Bowthorpe emp

TITLE: 5kV 10kA DCP2 SURGE ARRESTER PRODUCT

DRG NO: DCP2-5

SHEET 1 OF 1

tyco Electronics

Bowthorpe EMP

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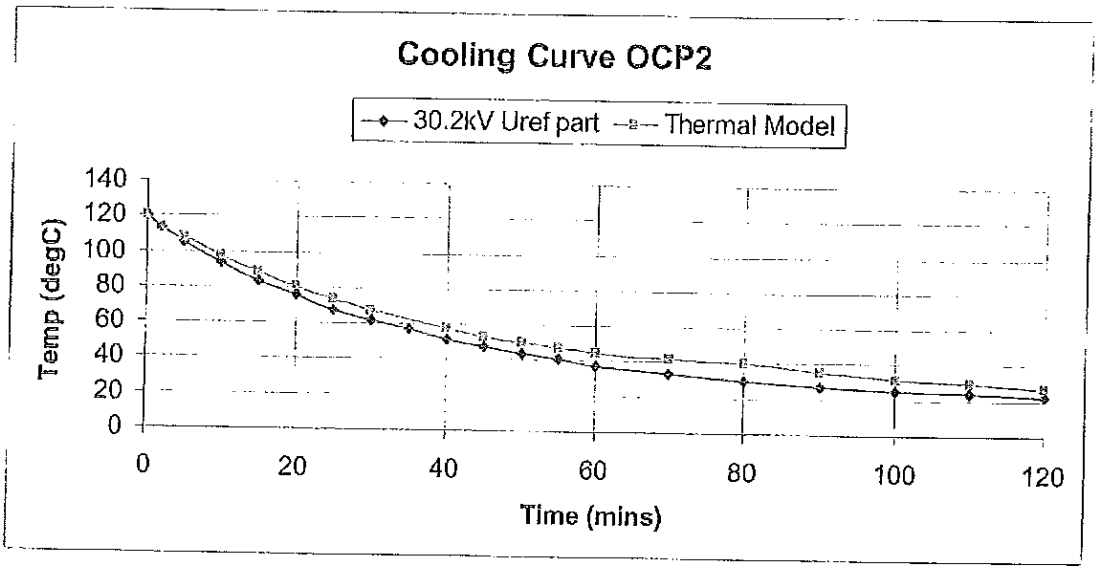
http:// energy.tycoelectronics.com

TEST REPORT

041103/OCP2-THC

OCP2 Thermal behaviour



Test Engineer: Hannah Piper
Senior Test Engineer: Roy Fisher
HV Lab Manager: Kwong Tong

tyco Electronics

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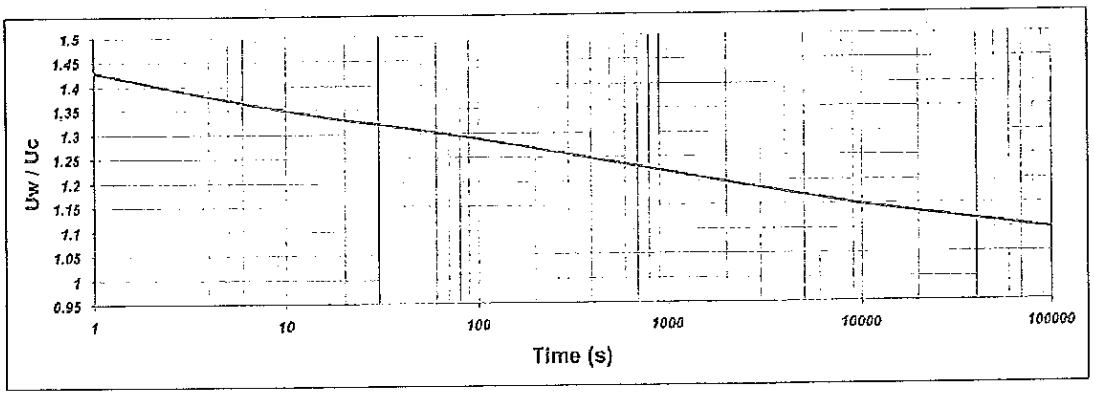
TEST REPORT

041202/OCP2 TOV curve V.4

TOV curve of OCP2 with 2 long duration discharges (total 6.2kJ/kV Uc) prior energy



Test Engineer: Hannah Fleming
Senior Test Engineer: Roy Fisher
HV Lab Manager: Kwong Tong

PROT. n. AL524512
CESI TEST 27 DIC. 2004
COPIA
A

Remark: This TOV curve superseded 041104 OCP2 TOV curve V.3

tyco Electronics

Energy Division
http://energy.tycoelectronics.com

Bowthorpe EMP

Test Report

Type	**OCP2**
PPR Number	**PPR-1854**
Test Specification	Weather Ageing Test IEC 60099-4 (2001-12)

Test Information:

Laboratory	EGU HV Lab
Date	19/03/2004
External Test Ref	8915_A3_04
Report Prepared By	Jonko Tetev
Test Verified by	Vaclav Sklenicka
Test Approved by	

Tyco Approvals:

R&D Manager		
Brendan Normoyle		Date 25/02/2005
Technology Manager		
Kwong Tong		Date 25/02/2005
Product Manager		
Brian McGowan		Date 25/02/2005

На основание чл. 2
от ЗЗЛД

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ВЯРНО С ОРИГИНАЛА

АКЦИОНЕРНО ДРУЖЕСТВО * ФИЛКАБ 16 * ПЛОВДИВ *

EGÚ - HV LABORATORY
190 11 Prague 9 – Běchovice

ACCREDITED TESTING LABORATORY No.: 1029
Accredited by Czech Accreditation Institute , o.p.s.

CUSTOMER:
Tyco Electronics
Shannon Industrial Estate
BAY 100-104
SHANNON
IRELAND

ORDER No.:
PO No. 2250302760

DATE OF TEST:
from 2004-01-20 till 2004-03-19

TEST No.:
8915/04

TEST REPORT
No.: 8915/A3/04

TEST OBJECT: Composite metal oxide surge arrester

TYPE: OCP2 – 24S

PRODUCER: TYCO Electronics, Raychem Shannon, Ireland

TYPE OF TEST: Weather ageing test

TEST STANDARD: IEC 60099-4 Ed.1.2: 2001-12, clause 9.7.10

ACCREDITED TESTING LABORATORY EGÚ - HV LABORATORY PRAGUE No. 1029

На основание чл. 2 от ЗЗЛД

На основание чл. 2 от ЗЗЛД

RATORY:

In Prague 9 -Běchovice: 2004-04-28

ВЯРНО С ОРИГИНАЛА

АКЦИОНЕРНО ДРУЖЕСТВО * ФИЛКАБ 16 * ПЛОВДИВ *

REQUEST
Weather ageing test in accordance with IEC 60099-4 Ed.1.2: 2001-12, test series A: 1000 hours was performed on

COMPOSITE METAL OXIDE SURGE ARRESTER
TYPE OCP2 - 24S

Technical drawing - see Figure 1.

DATE OF TEST SAMPLES DELIVERY
2004 - 01 - 14

TEST STANDARD
The test was performed in accordance with IEC 60099-4 Ed.1.2: 2001-12 "Surge arresters - Part 4: Metal-oxide surge arresters without gaps for a.c.systems".

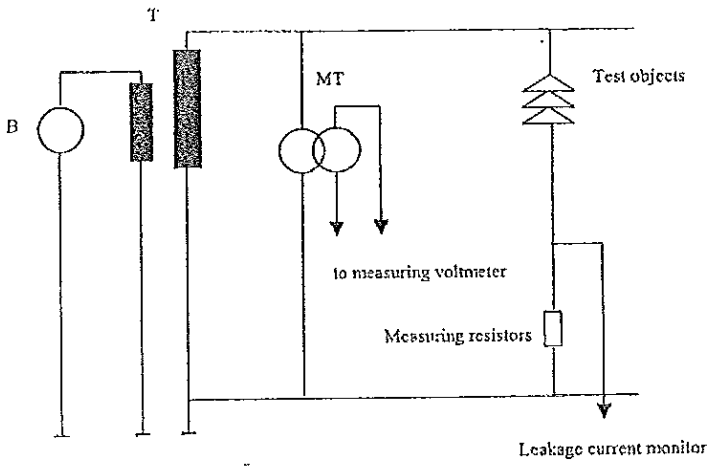
TESTS PERFORMED

	IEC 60099 - 4, clause:
Weather ageing test	9.7.10
Test series A: 1000 hours	9.7.10.2.1
Evaluation of the test	9.7.10.3

METAL OXIDE SURGE ARRESTER MANUFACTURER AND IDENTIFICATION
The insulators were manufactured by TYCO Electronics, Energy Division, Raychem Shannon, BAY 100-109, Shannon Ind. Est., Shannon, Co. Clare, Ireland.

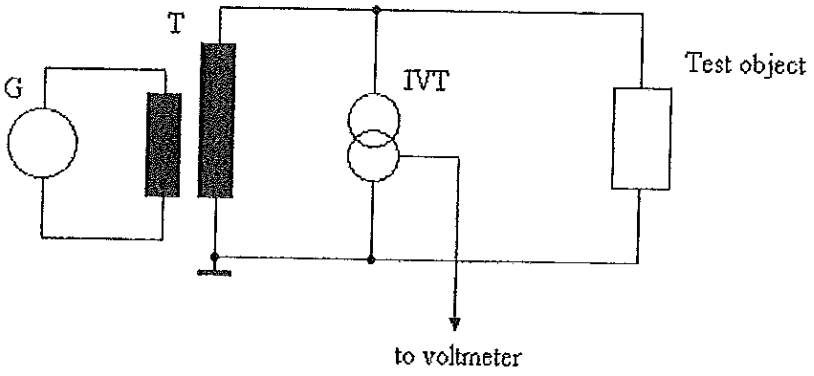
TEST EQUIPMENT

Weather ageing test 1000 hours



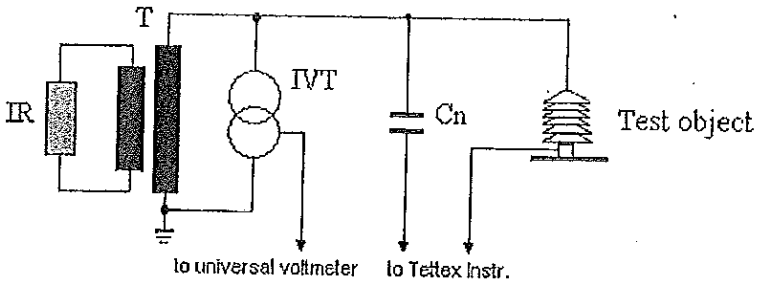
T - test transformer ČKD Praha, 0,65/70 kV, 30 kVA
B - inductive regulator ČKD Praha 3x380/3x 0 - 760V, 45 kVA
MT - voltage measuring transformer UZGT 30, 35 000/100 V, serial No. 76/02021
voltmeter Metra, type MUL 10, serial No. 144320

Measurement of reference voltage



- synchronous generator BEZ Bratislava 6 kV, 1300 kVA, 50 Hz
- test transformer Fischer-Köln, 3-6/250 kV, 250 kVA
- instrument voltage transformer Škoda, 380/√3 kV / 100/√3 V, serial No. 917355
- digitizer ADAM Maurer, serial No. 9401.9620
- universal voltmeter Siemens, type MU 15, serial No. 879953

Measurement of partial discharges



- induced regulator ČKD Praha, 6/0-3 kV, 50 kVA
- test transformer Fischer-Köln, 3-6/250 kV, 250 kVA
- instrument voltage transformer Škoda, 380/√3 kV / 100/√3 V, serial No. 917355
- PD measuring system Tettex, type 2801, serial No. 123989
- universal voltmeter Siemens, type MU 15, serial No. 879953

UNCERTAINTIES OF MEASUREMENTS

TYPE OF MEASUREMENT	UNCERTAINTY
Power-frequency voltage	1,8 %
Partial discharges	8,0 %

The reported expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor k = 2, which for a Normal (Gaussian) distribution corresponds to a coverage probability of approximately 95 %.

ACCREDITED TESTING LABORATORY EGÚ - HV LABORATORY PRAGUE No. 1029

ВЯРНО С ОРИГИНАЛА

АКЦИОНЕРНО ДРУЖЕСТВО ФИЛКАБ 16 ПЛОВДИВ

TEST SAMPLES

Test sample	Type	Uc (kV)
C	OCP2 - 24S	24
G	-	-
I	-	-
O	-	-

TEST SPECIFICATION

Weather ageing test:

Metal oxide surge arrester samples were subjected to a salt fog test in accordance with IEC 60099-4, clause 9.7.10.2.1 (test series A).
The metal oxide surge arresters were energised at a voltage of 24 kV that is continuous operating voltage of tested metal oxide surge arresters.
The protection level of the tripping device was set at 1 A (r.m.s.).
During the test the salt fog was sprayed into the test chamber.
The characteristic of the salt fog were as follows:

Water flow rate: $(0,4 \pm 0,1)$ l/m^3. h
Starting salinity: 5 kg/m^3
Temperature: 20° C ±5 K
Duration of the test: 1000 hours (excluding duration of interruption)

Verification tests:

Before and after weather ageing test the measurement of reference voltage according to IEC 60099-4, clause 6.2 and partial discharges according to IEC 60099-4, clause 7.8 were performed.

TEST RESULTS

The OCP2 - 24S surge arrester **has passed** all requirements of clause 9.7.10 of IEC 60099 – 4 Ed.1: 2001 – 12.

The course of the weather ageing test is given in the following Table 1.

The record of test voltage is given on Figure 2.

Table 1

Test sample	Time of flashover (from the beginning of the test	Duration of voltage interruption	Total duration of voltage interruption (hours)	Salinity (kg/m^3)
Beginning of the test 2004-01-26 at 14.30 hour		0	0	5
G	584	10 h	10 h 10 min	5
O	598	1h 40 min	11 h 50 min	5
I	636	31 h	42 h 50 min	5
OCP2-24S	669	3 h 20 min	46 h 10 min	5
G	678	14 h	60 h 10 min	3,5
G	811	25 h 40 min	85 h 50 min	3,5
O	877	5 h	90 h 50 min	3,5
I	918	8 h	98 h 50 min	3,5
End of the test 2004-03-12 at 9.20 hour			98 h 50 min	3,5
Total duration of the test including interruptions		1099 hours		

The results of the verification tests before and after the weather ageing tests and evaluation of the test are given in Table 2.

Table 2

Sample type	Reference voltage (kV)		Partial discharges (pC)		Visual inspection after test	Evaluation of the test
	before test	after test	before test	after test		
OCP2-24S	32,9	32,4	0,6	1,0	no tracking, erosion or puncture	passed

The results of hydrophobicity measurement (using STRI method) *) are given in Table 3.

Table 3

Sample type	Hydrophobicity before the test	Hydrophobicity after finishing of the test	Hydrophobicity 24 hours after finishing of the test
OCP2-24S	1	7	3

The photographs of the wetted arrester immediately after finishing of the test and 24 hours after finishing of the test are shown on Figure 3.

Note: *) This test is not a subject of laboratory accreditation.

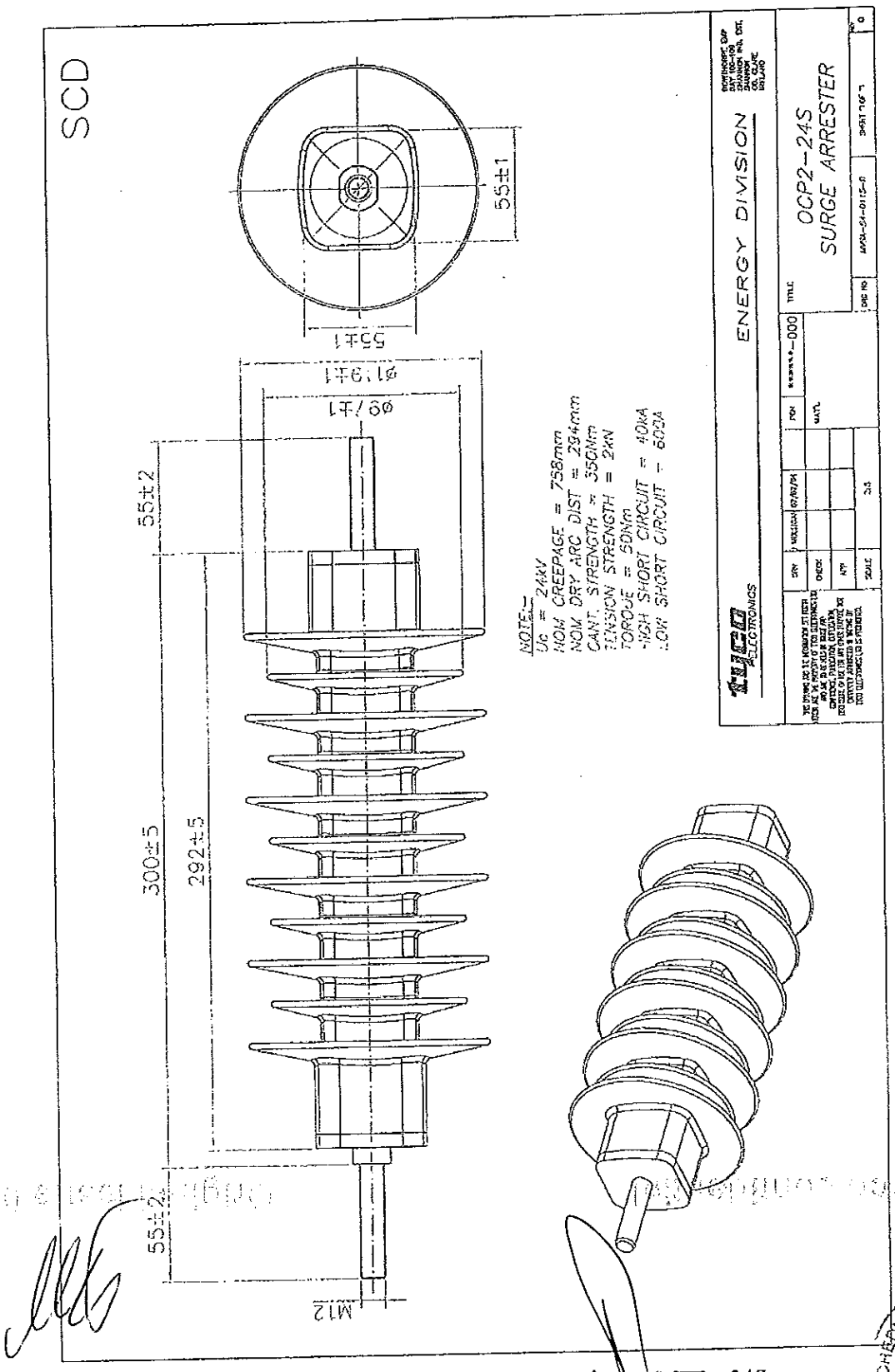


Figure 1: Technical drawing of the arrester type OCP2 - 24S

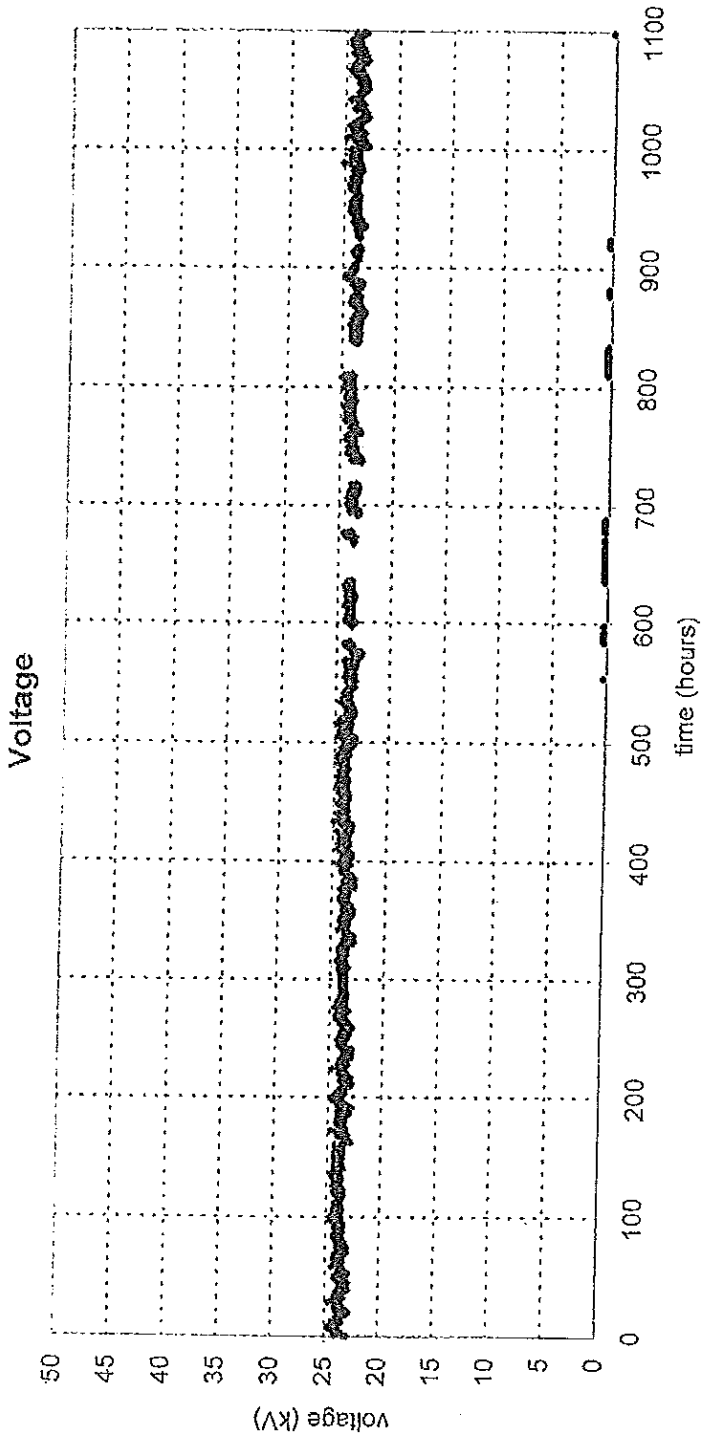


Figure 2: Record of the test voltage during 1000 hour test

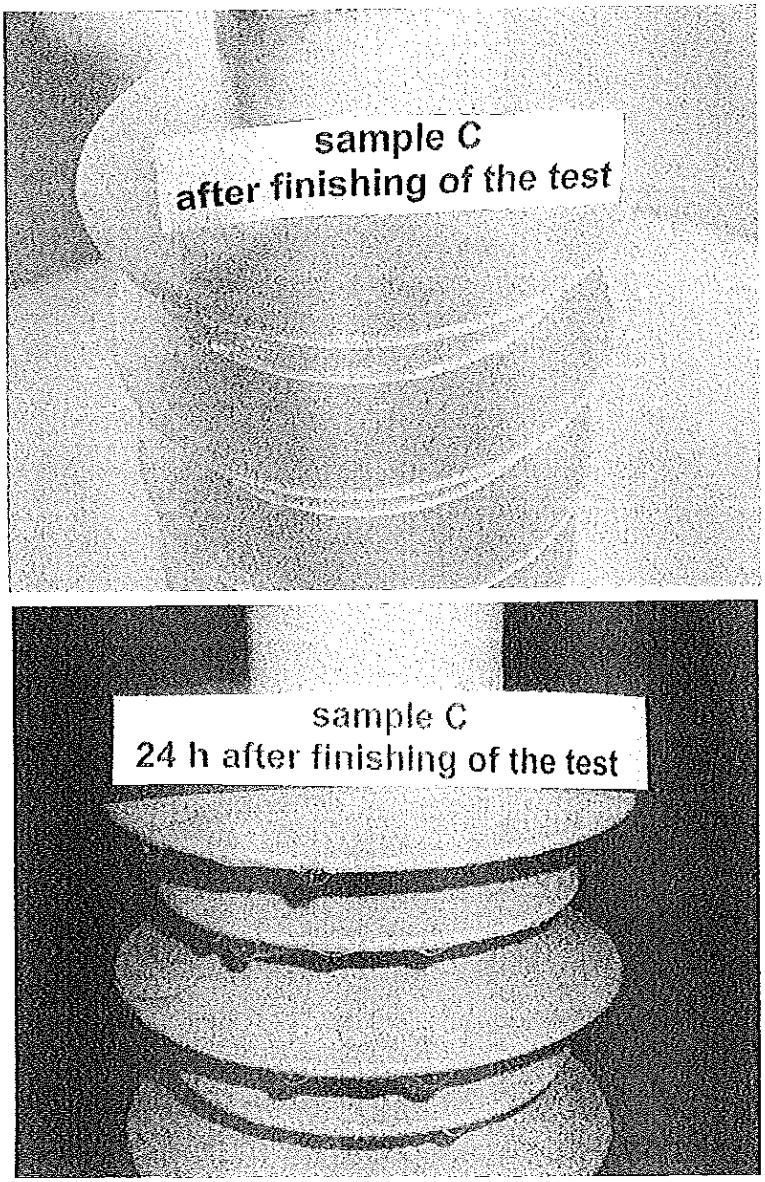


Figure 3: OCP2 – 24S, test sample C

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Energy Division
http://energy.tycoelectronics.com

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Bowthorpe EMP

Test Report

Type	**OCP2**
PPR Number	**PPR-1830**
Test	Switching surge operating duty test
Specification	IEC 60099-4 (2001-12)

Test Information:

Laboratory	CESI
Date	30/04/2004
External Test Ref	AT-A4/011670
Report Prepared By	M Gregori
Test Verified by	A Sironi
Test Approved by	V Scarioni

Tyco Approvals:

R&D Manager			
Brendan Normoyle	S	Date	25/02/2005
Technology Manager			
Kwong Tong	S	Date	25/02/2005
Product Manager			
Brian McGowan	S	Date	25/02/2005

На основание чл. 2
от ЗЗЛД

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Email: mvsurgearresters@tycoelectronics.com

ВЯРНО С ОРИГИНАЛА

АКЦИОНЕРНО ДРУЖЕСТВО * ФИЛКАБ 16 * ПЛОВДИВ *

client	TYCO Electronics Energy Division - Shannon (IRL)
equipment under test	Polymer housed metal-oxide surge arrester type OCP2
tests performed	Switching surge operating duty test
normative documents	IEC 60099-4 (2001-12)
receipt date of the sample	April 15, 2004
test date	from April 27, 2004 to April 30, 2004
no. of pages	25 no. of pages annexed 54

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

n° 0030

first issue date		May 25, 2004
prepared	PeC/TEST	
verified	PeC/TEST	
approved	PeC/TEST	

На основание чл. 2
от ЗЗЛД

ВЯРНО С ОРИГИНАЛА

ФИЛКАБ 16

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 drawings identified by CESI and numbered A4/503147, 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

На основание чл. 2 от ЗЗЛД

davitte - I. Guacci

ge arrester laboratory

10H, 31020W, 46030U, 53001D

ВЯРНО С ОРИГИНАЛА

АКЦИОНЕРНО ДРУЖЕСТВО * ПЛОВДИВ * ФИЛКАБ 16

Pages annexed:

- oscillograms n.52 pages
- TYCO drawing n. OCP2-5; CESI n. A4/503147, n. 1 page
- TYCO document n.041103/OCP2-THC (thermal equivalency); CESI n. A4/524527, n. 1 page

Test object characteristics

type: Polymer housed metal-oxide surge arrester section (thermal equivalent)

electrical characteristics (claimed by the client)

manufacturer's name	TYCO Electronics Energy Division - Shannon (IRL)
nominal discharge current - I_N [kA]	10
rated voltage - U_r [kV]	0,980 x $U_{rel.}$
continuous operating voltage - U_c [kV]	0,784 x $U_{rel.}$
reference current - $I_{rel.}$ [mA]	5
line discharge class	2
rated frequency - [Hz]	50
year of manufacture	2004

geometrical characteristics (measured on the test sample)

height [mm]	139
number of sheds	n.2 large - n.1 small
shed diameter [mm]	118 large - 96 small

other characteristics

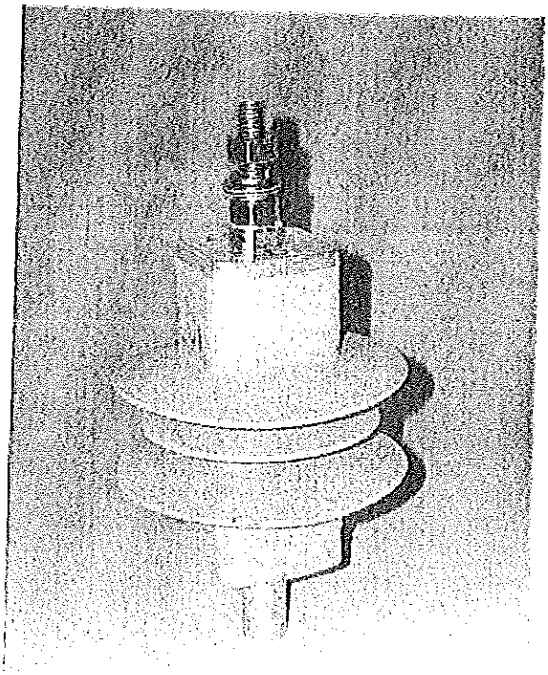
housing material	SILICONE
housing color	GREY

NOTE The surge arresters were tested with the additional thermal insulation supplied by the Client. The verification of the thermal equivalency according to annexe B was carried out by the Client (see annexed report A4/524527)

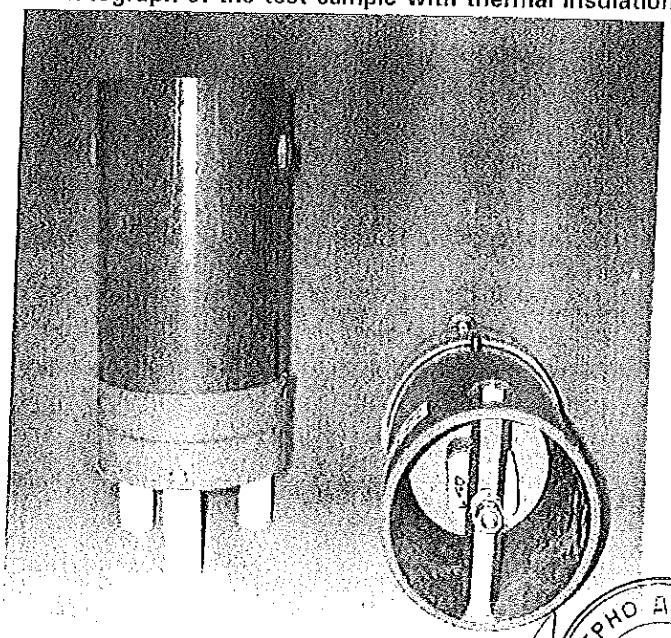
ВЯРНО С ОРИГИНАЛА

АКЦИОНЕРНО ДРУЖЕСТВО * ФИЛКАБ 16 * ПЛОВДИВ *

Photograph of the test sample.



Photograph of the test sample with thermal insulation



ВЯРНО С ОРИГИНАЛА

АКЦИОНЕРНО ДРУЖЕСТВО ФИЛКАБ 16 ПЛОВДИВ

Reference Standard

IEC 60099-4 (2001-12) Clause 7.5.4 ,
" Metal-oxide surge arrester without gaps for a.c. system"

Test carried out

test carried out	number of sample tested
switching surge impulse operating duty test	3

Test object identification

test object names	identification of test sample (given by manufacturer)
polymer housed metal-oxide surge arresters section	OD1 - OD2 - OD3

Test procedure

- The power fequency reference voltage at I_{ref} = 5,0 mA has been measured
- The lightning impulse residual voltage at I_N = 10 kA has been measured
- The switching impulse impulse residual voltage at 125 A has been measured
- The voltage correction factors have been calculated according to reference standard
- The preconditioning has been performed on surge arrester at ambient temperature according to reference standard as per the following procedure:
  - Twenty shots 8/20 μs at I_N have been applied superimposed to the power frequency at the voltage level 1.2*U_c'. The shots have been applied in four groups of five impulses. The interval between impulses of the same group was 50-60 seconds while the interval between groups was 30 minutes. The polarity of the impulses was the same as that of the half cycle of power frequency voltage during which it occurred (positive) and they were applied 60 electrical degrees before the peak of the power frequency.
- The samples have been let to cool down to ambient temperature
- Two high current impulses having waveshape 4/10 μs and peak value equal to 100 kA has been applied
- The surge arrester sections have been kept in an oven at the temperature of 60 °C till thermal equilibrium
- Two long duration current impulses with a virtual duration equal to 2000 μs and with the specified calculated energy (for the line discharge class 2) has been applied with one minute time interval. A time shorter than 100 ms after the application of the second long duration current impulse the sample has been energized at U_r' for 10 sec. and then at the voltage U_c' for 30 min. to verify the thermal stability.
- The lightning impulse residual voltage at I_N = 10 kA has been measured during two consecutive shots

Visual inspection and summary of test result

variation of lightning impulse residual voltage test

test object	before test		after test		variation
	discharge current	residual voltage	discharge current	residual voltage	
	kA	kV	kA	kV	%
OD1	10,20	16,08	10,00	16,08	0
OD2	10,10	16,00	10,20	16,08	+ 0,5
OD3	10,10	16,00	10,00	16,08	+ 0,5

The test has been been performed without disconnector.

The visual inspections of the test sample after the test has revealed no sign of physical damage. The variation of lightning impulse residual voltage before and after the test was less then 5%.
The thermal stability was achieved.
The oscillogram of the two last impulses do not reveal any sign of breakdown.
All acceptance criteria are satisfied and therefore the test result is positive.

ВЯРНО С ОРИГИНАЛА

АКЦИОНЕРНО ДРУЖЕСТВО * ПЛОВДИВ * ФИЛКАБ 16

Switching surge operating duty test.

Power frequency voltage-current characteristics

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

date: April 27, 2004

sample no. OD1

oscill.	voltage	current	current	current	power	3rd harmonic amplitude
no.	kV	+ mA_{cr}	- mA_{cr}	mA_{rms}	W	μA
1	6,73	4,99	4,47	1,66	7,48	---

sample no. OD2

oscill.	voltage	current	current	current	power	3rd harmonic amplitude
no.	kV	+ mA_{cr}	- mA_{cr}	mA_{rms}	W	μA
3	6,80	4,97	4,60	1,66	7,41	---

sample no. OD3

oscill.	voltage	current	current	current	power	3rd harmonic amplitude
no.	kV	+ mA_{cr}	- mA_{cr}	mA_{rms}	W	μA
5	6,79	4,98	4,51	1,58	7,63	---

ВЯРНО С ОРИГИНАЛА

АКЦИОНЕРНО ДРУЖЕСТВО ФИЛКАБ 16 ПЛОВДИВ

Switching surge operating duty test.

lightning impulse residual voltage measurement before the test

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

date: April 27, 2004

sample	requested current	charging voltage	oscillogram	current waveshape	discharge current	residual voltage
no.		kV	no.	µs	kA	kV
OD1	I_N	29,0	7	8,5/18,4	10,20	16,08
OD2	I_N	29,0	8		10,10	16,00
OD3	I_N	29,0	9		10,10	16,00

	oscilloscope settings		
	sampling division	input	attenuation
	µs	V_{eff}	
current	5	0,5	50:5
voltage		1,0	20:5

ВЯРНО С ОРИГИНАЛА

АКЦИОНЕРНО ДРУЖЕСТВО * ПЛОВДИВ * ФИЛКАБ 16

Switching surge operating duty test..
Switching impulse residual voltage measurement

test object: Polymer housed metal-oxide surge arrester section
test circuit: A014A

date: April 27, 2004

sample	requested current	charging voltage	oscillogram	current waveshape	discharge current	residual voltage
no.	A	kV	no.	µs	A	kV
OD1	125	12,7	10	32,0/82,0	128	11,92
OD2	125	12,7	11	32,0/82,0	131	11,92
OD3	125	12,7	12	32,0/82,0	122	11,92

	oscilloscope settings		
	sampling division	input	attenuation
	µs	V_{div}	
current	20	0,5	5:5
voltage	20	0,7	20:5

ВЯРНО С ОРИГИНАЛА

АКЦИОНЕРНО ДРУЖЕСТВО * ФИЛКАБ 16 * ПЛОВДИВ *

Switching surge operating duty test.

voltage correction factor and energy calculations

test object: Polymer housed metal-oxide surge arrester section

date: April 28, 2004

sample	U_{ref} [1]	KU_r [2]	KU_c [3]	U_r' [4]	U_c' [5]	U_*' [6]
no.	kV			kV	kV	kV
OD1	6,73	0,980	0,784	6,60	5,28	6,33
OD2	6,80			6,66	5,33	6,40
OD3	6,79			6,65	5,32	6,39

The manufacturer guarantees that the factors used for the calculation of the test voltages allow to cover all possible arresters of the series within manufacturer's tolerances.
So that requirement at clause 6.3 of the reference standard is satisfied

[1] U_{ref} : measured reference voltage
[2] KU_r : factor claimed by the manufacturer for calculation of U_r'
[3] KU_c : factor claimed by the manufacturer for calculation of U_c'
[4] U_r' : corrected rated voltage [4] = [1] × [2]
[5] U_c' : corrected continuous operating voltage [5] = [1] × [3]
[6] U_*' : corrected voltage to be applied during the preconditioning [6] = [5] × 1,2

sample	U_r'	U_L	V_{res}	T	Z	W	W'
no.	kV	kV	kV	μs	Ω	kJ	kJ / kV
OD1	6,60	21,12	11,92	2000	15,84	13,846	2,098
OD2	6,66	21,31		2000	15,98	14,008	2,103
OD3	6,65	21,28		2000	15,96	13,981	2,102

V_{res} : switching impulse residual voltage
U_L , T , Z : see table 4 of IEC 60099-4 Standard
W = $V_{res} \times (U_L - V_{res}) \times (T / Z)$

ВЯРНО С ОРИГИНАЛА

АКЦИОНЕРНО ДРУЖЕСТВО * ПЛОВДИВ * ФИЛКАБ 16

Switching surge operating duty test.

conditioning

test object: Polymer housed metal-oxide surge arrester section
test circuit: A015

date: April 28, 2004

imp.	osc.	sample no. OD1 charging voltage	sample no. OD1 peak current	osc.	sample no. OD2 charging voltage	sample no. OD2 peak current	osc.	sample no. OD3 charging voltage	sample no. OD3 peak current
no.	no.	kV	kA	no.	kV	kA	no.	kV	kA
1	13	51,5	10,2		51,5	10,5		51,5	10,2
2		51,4	10,5		51,4	10,5		51,5	10,3
3		51,5	10,3		51,4	10,4		51,4	10,1
4		51,5	10,4		51,5	10,4		51,5	10,2
5	14	51,5	10,3	15	51,5	10,4	16	51,4	10,2
6		51,5	10,3		51,4	10,4		51,4	10,4
7		51,4	10,3		51,5	10,3		51,4	10,4
8		51,4	10,2		51,5	10,4		51,5	10,3
9		51,5	10,5		51,5	10,4		51,5	10,3
10	17	51,5	10,3	18	51,4	10,5	19	51,5	10,4
11		51,4	10,4		51,5	10,6		51,5	10,1
12		51,4	10,4		51,5	10,6		51,4	9,9
13		51,5	10,4		51,5	10,5		51,4	10,1
14		51,5	10,3		51,4	10,4		51,5	10,1
15		51,5	10,4		51,5	10,6		51,4	10,2
16		51,4	10,4		51,5	10,5		51,7	9,8
17		51,4	10,5		51,7	9,8		51,7	10,1
18		51,6	10,6		51,7	9,6		51,7	9,8
19		51,5	10,6		51,8	10,7		51,6	10,0
20	20	51,4	10,6	21	51,7	10,5	22	51,6	9,8

power frequency voltage applied to the test sample	sample no.OD1	sample no.OD2	sample no.OD3
	6,33 kV	6,40 kV	6,39 kV

	oscilloscope settings		
	sampling time	input	attenuation
	ms	V_{fs}	
current	20	0,2	50:5
voltage	20	1,0	50:5

ВЯРНО С ОРИГИНАЛА

АКЦИОНЕРНО ДРУЖЕСТВО * ПЛОВДИВ * ФИЛКАБ 16

Switching surge operating duty test.

conditioning (second part)

test object: Polymer housed metal-oxide surge arrester section
test circuit: A014B

date: April 28, 2004

sample	impulse	charging voltage	oscillogram	discharge current
no.	no.	kV	no.	kA
OD1	1	77,0 x 2	23	97,5
	2	78,0 x 2	26	99,9
OD2	1	78,0 x 2	24	100,0
	2	78,0 x 2	27	99,9
OD3	1	78,0 x 2	25	100,2
	2	78,0 x 2	28	100,2

current waveshape	front	4,5 μs
	tail	9,5 μs
	opposite polarity	2,4 %

	oscilloscope settings		
	sampling division	input	attenuation
	μs	V_{eff}	
current	2	0,8	300:5
voltage	/	/	/

note:

ВЯРНО С ОРИГИНАЛА

АКЦИОНЕРНО ДРУЖЕСТВО * ПЛОВДИВ * ФИЛКАБ 16

Switching surge operating duty test.

application of long duration impulses, of the rated voltage U_r' and evaluation of thermal stability

test object: Polymer housed metal-oxide surge arrester section
test circuit: A017-A020
sample no. OD1
preheating temperature: 62 °C

date: April 29, 2004

long duration current impulses application

oscillogram	impulse	charging voltage	residual voltage	discharge current	energy
no.	no.	kV	kV	A	kJ
29	1	14,70	12,62	435	13,75
30	2	14,75	12,62	440	13,90

measured waveshape	
virtual front time	virtual total duration
μs	μs
2200	2910

U_r' voltage application

oscillogram	time	voltage	current	current
no.	s	kV	+ mA_{cr}	- mA_{cr}
31	0	6,60	71,0	45,0
32	10		26,0	16,0

U_c' voltage application

oscillogram	time	voltage	current	current	power
no.	minutes	kV	+ mA_{cr}	- mA_{cr}	W
33	0	5,28	2,70	2,50	4,75
	5		2,15	2,05	2,37
	10		2,10	2,00	2,24
34	15		2,05	1,98	2,20
	20		2,00	1,95	2,10
	25		1,95	1,90	2,05
35	30		1,90	1,90	2,00

cont'd

cont'd
sample no. OD2
preheating temperature: 62°C

date: April 29, 2004
long duration current impulse application

oscillogram	impulse	charging voltage	residual voltage	discharge current	energy
no.	no.	kV	kV	A	kJ
36	1	14,80	12,62	440	14,24
37	2	14,85	12,62	445	14,45

measured waveshape

virtual duration	virtual total duration
μs	μs
2200	2910

U_r' voltage application

oscillogram	time	voltage	current	current
no.	s	kV	+ mA_{cr}	- mA_{cr}
38	0	6,66	103,0	66,0
39	10		33,0	22,0

U_c' voltage application

oscillogram	time	voltage	current	current	power
no.	minutes	kV	+ mA_{cr}	- mA_{cr}	W
40	0	5,33	3,00	2,80	5,57
	5		2,10	1,95	2,21
	10		2,05	1,90	2,11
41	15		2,00	1,90	2,07
	20		1,98	1,88	2,00
	25		1,95	1,85	1,95
42	30		1,90	1,85	1,92

cont'd

ВЯРНО С ОРИГИНАЛА

АКЦИОНЕРНО ДРУЖЕСТВО * ПЛОВДИВ * ФИЛКАБ 16

Switching surge impulse operating duty test.

Check of the integrity of internal parts with additional shots and final lightning impulses residual voltage measurement after the test.

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

date: April 30, 2004

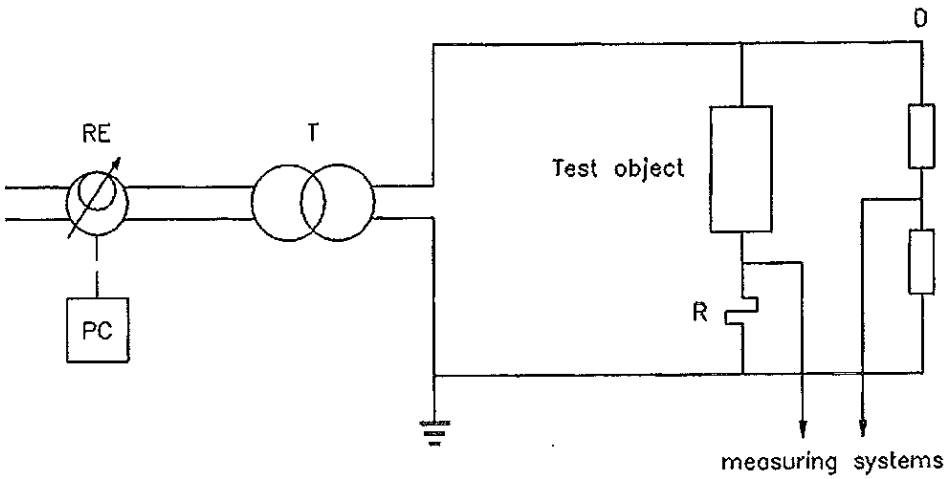
sample	requested current	charging voltage	oscillogram	current waveshape	discharge current	residual voltage
no.		kV	no.	μs	kA	kV
OD1	I_N	29,5	50	8,6/18,4	10,00	16,08
OD1		29,5	51		10,00	16,08
OD2		29,5	52		10,10	16,08
OD2		29,5	53		10,20	16,08
OD3		29,5	54		10,00	16,00
OD3		29,5	55		10,00	16,08

	oscilloscope settings		
	sampling time	input	attenuation
	μs	V_{fs}	
current	5,0	0,5	50:5
voltage		1,0	20:5

ВЯРНО С ОРИГИНАЛА

АКЦИОНЕРНО ДРУЖЕСТВО * ПЛОВДИВ * ФИЛКАБ 16

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

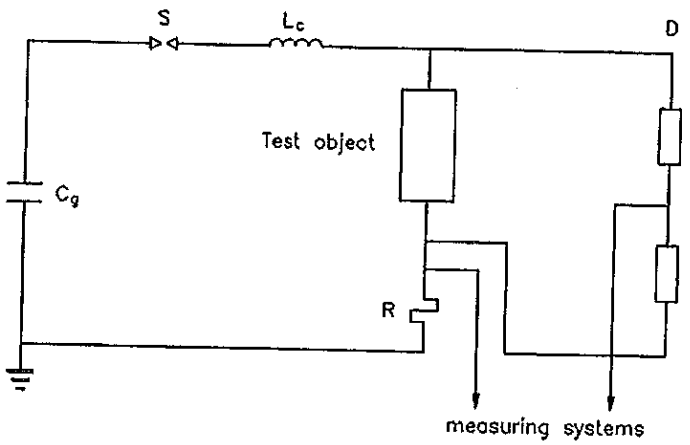
current shunt (R) CESI no. 11537; R = 811,94 Ω
oscilloscope CESI no.30223-30224
type Data Precision DATA 6100

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

АКЦИОНЕРНО ДРУЖЕСТВО ФИЛКАБ 16 ПЛОВДИВ

circuit A014



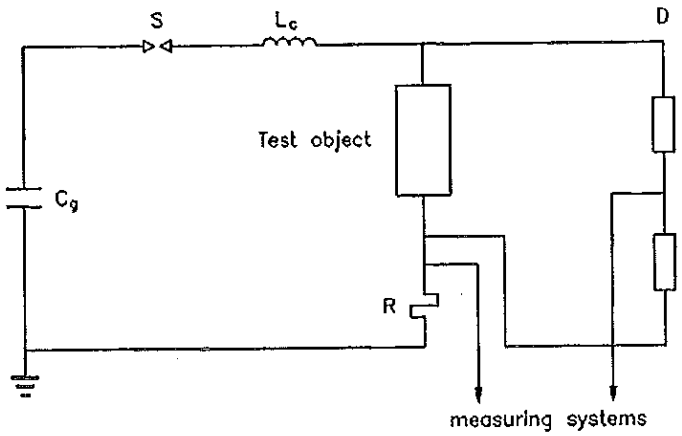
impulse generator

plant P177
no. of stages 1
C_g 4,98 μF
L_c 10 μH
S spark gap

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

voltage divider (D) CESI no.11120 ; k =1010
electro optical system CESI no.11519/520 ; attenuation 20:5
oscilloscope CESI no.13217
type Tektronix TDS 540A

circuit A014A



impulse generator

plant P177
no. of stages 1
C_g 6,64 μF
L_c 100 μH
S spark gap

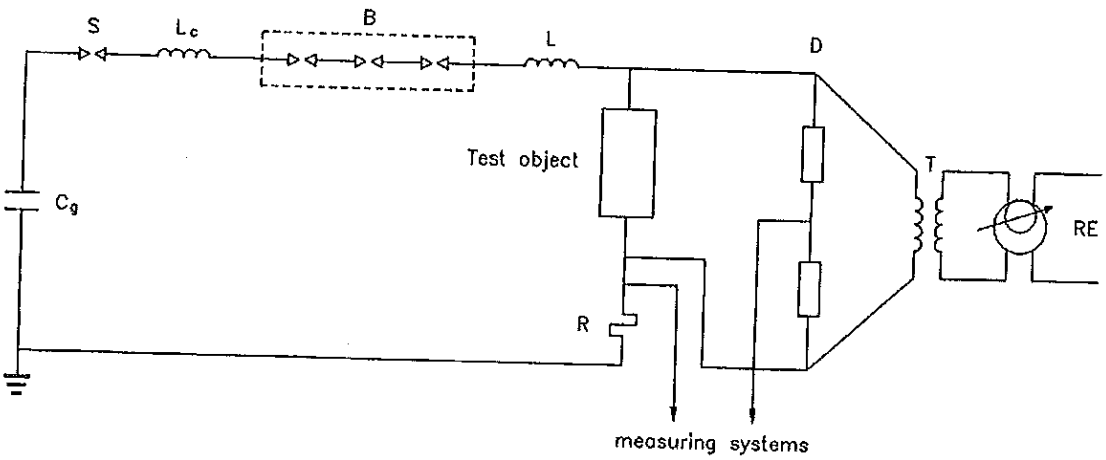
current shunt (R) CESI no.6039 ; R =0,020 Ω ; 10 kA
electro optical system CESI no.11517/518
oscilloscope CESI no. 13217
type Tektronix TDS 540A

voltage divider (D) CESI no.11120; k = 1010
electro optical system CESI no.11519/520
oscilloscope CESI no.13217
type Tektronix TDS 540A

ВЯРНО С ОРИГИНАЛА

АКЦИОНЕРНО ДРУЖЕСТВО * ПЛОВДИВ * ФИЛКАБ 16

circuit A015



impulse generator

plant P177
no. of stages 1
C_g 2,49 μF
L inductance of the circuit
L_c 20 μH
S spark gap
additonal block has been added

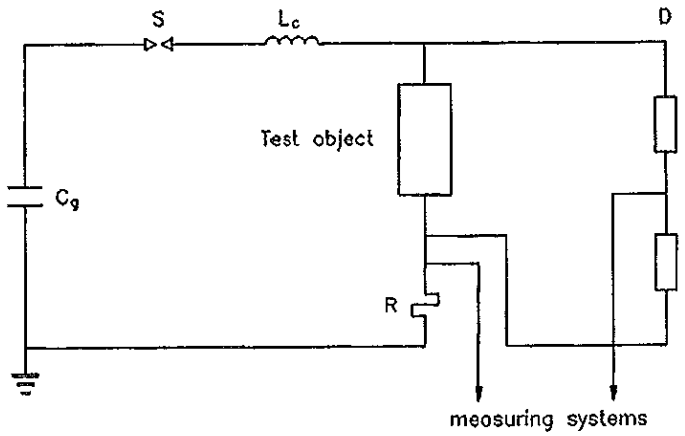
power frequency supply

RE: regulator type CORMES; power 20 kVA; voltage 220 V/ 0 V ÷ 220 V
T : transformer type Specialtrasfo; power 30 kVA; voltage 200 V/ 15 kV
B : bloking gaps

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

voltage divider (D) CESI no.11120; k = 1010
electro optical system CESI no. 11519/520
oscilloscope CESI no. 13217
type Tektronix TDS 540A

circuit A014B



impulse generator

plant P177
no. of stages
C_g 3,32 μF
L_c / μH
S spark gap
and in addition four blocks in parallel

current shunt (R) CESI no.6042 ; R = 0,002 Ω ; 100 kA
electro optical system CESI no.11517/518 ; attenuation 300:5
oscilloscope CESI no.13217
type Tektronix TDS 540A

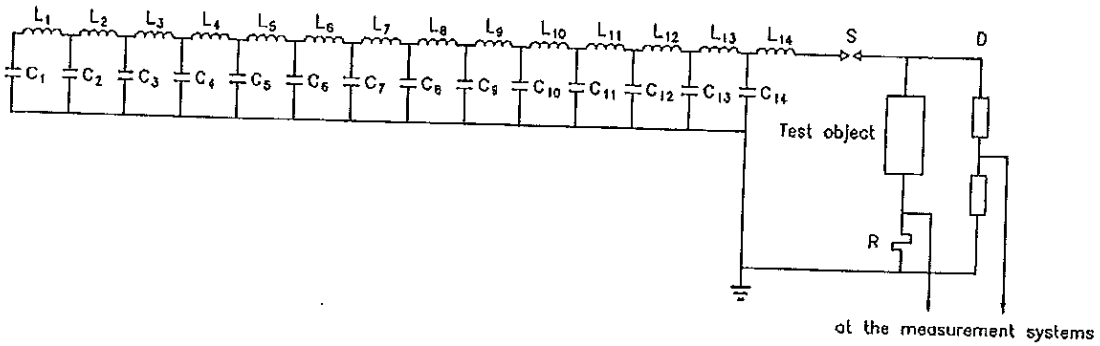
voltage divider (D) CESI no./
electro optical system CESI no./
oscilloscope CESI no. /

ВЯРНО С ОРИГИНАЛА

АКЦИОНЕРНО ДРУЖЕСТВО ФИЛКАБ 16 * ПЛОВДИВ *

circuit A017

long duration withstand impulse test



impulse generator

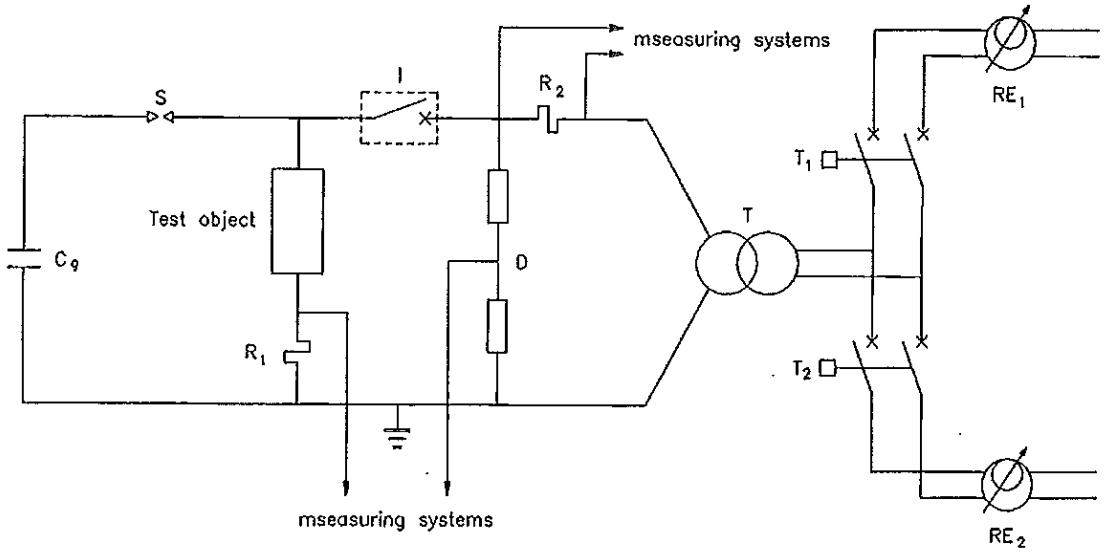
plant P177

C_1 ... C_{12}: capacitors 37,5 μF
L_1 ... L_{12} : inductors 666 mH
L_{13}inductor 500 mH
S spark gap

shunt (R) CESI no. 6042 ; R = 0,002 Ω ; 100 kA
electro optical system CESI no. 11519/520
oscilloscope CESI no. 13217 ; type Tektronix TDS 540A

voltage divider (D) CESI no.11120 ; k = 1010
electro optical system CESI no. 8010/8017
oscilloscope CESI no. 13217 ; type Tektronix TDS 540A

circuit A020



impulse generator

plant P177

C_g circuit A017 see pag.24

power frequency supply

RE_1 regulator type BONNEFOND ; power 3x350 kVA ; voltage 23 kV/0 V ÷ 10,39 kV
RE_2 regulator type CORMES ; power 20 kVA ; voltage 220 V/0 V ÷ 220 V
T transformer type Specialtrasfo ; power 30 kVA ; voltage 200 V/ 15 kV
I insulated circuit breaker type

current shunt (R_1) CESI no. 6041 ; R = 0,010 Ω ; 20 kA
electro optical system CESI no. 11519/11520; attenuation 5:5
oscilloscope CESI no. 13217 ; type Tektronix TDS 540A

current shunt for TOV (R) ; R = 500 Ω
electro optical system CESI no.14236/14237; attenuation 300:10
oscilloscope CESI no. 14456 type Tektronix TDS 430A

current shunt for MCOV(R) ; R =1000 Ω
electro optical system CESI no.14246/14247; attenuation 10:10
oscilloscope CESI no.30223-30224 type DATA 6100

voltage divider CESI no. 11120 ; k = 1010
electro optical system CESI no. 8010/8017 ; attenuation 50:5
oscilloscope CESI no.14456 -13217 - 30223/224 type Tektronix TDS 430A - 540A - DATA 6100

CESI TEST A4/011670 oscillogram n. 1

Original issue 03-2003

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CESI TEST A4/011670 oscillogram n. 3

ВЯРНО С ОРИГИНАЛ

АКЦИОНЕРНО ДРУЖЕСТВО * ПЛОВДИВ * ФИЛКАБ 16

CESI TEST A4/011670 oscillogram n. 5

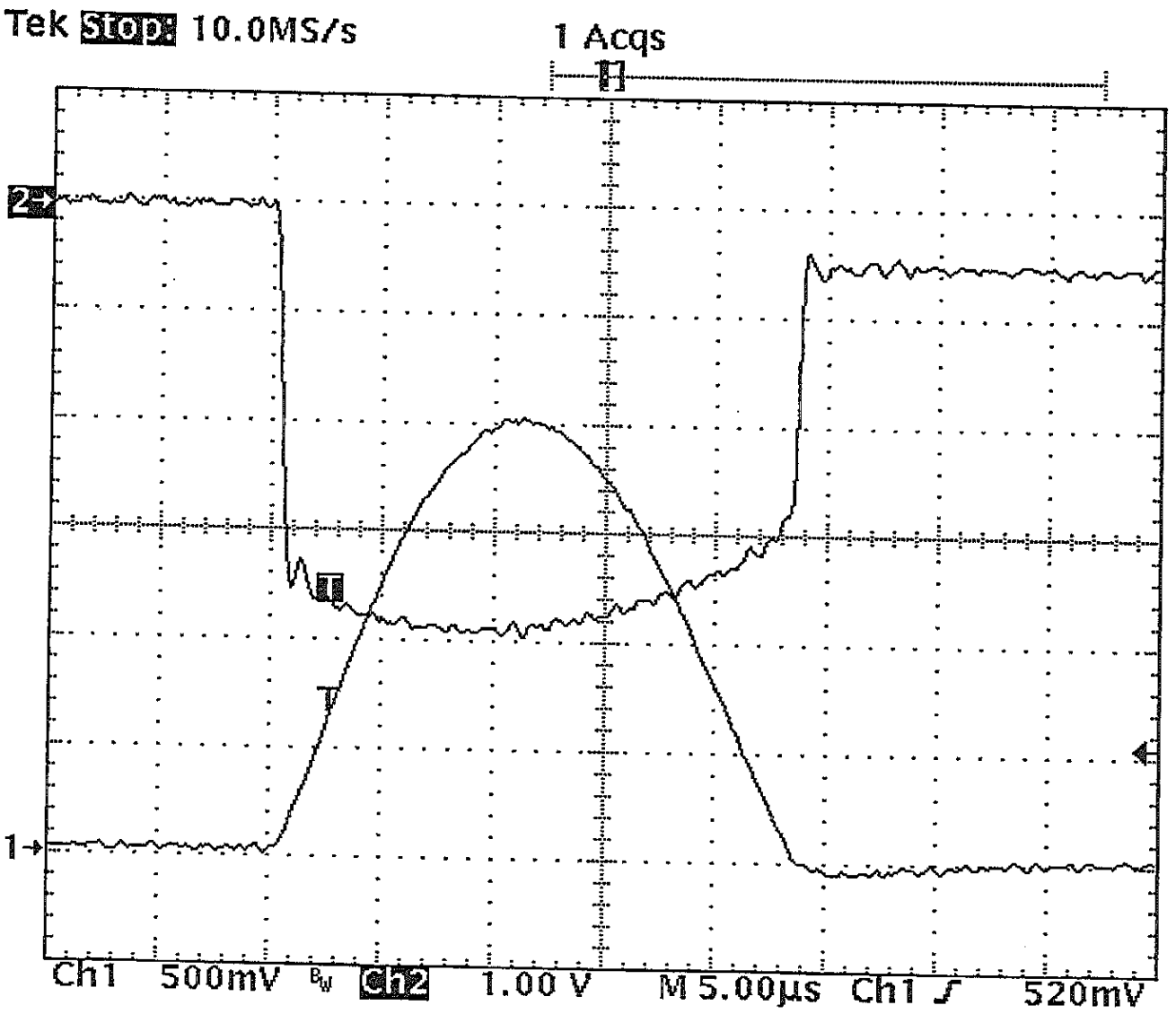
ВЯРНО С ОРИГИНАЛА

АКЦИОНЕРНО ДРУЖЕСТВО ФИЛКАБ 16 ПЛОВДИВ

CESI TEST A4/011670 oscillogram n. 7

ВЯРНО С ОРИГИНАЛА

АКЦИОНЕРНО ДРУЖЕСТВО ФИЛКАБ 16 ПЛОВДИВ



CESI TEST A4/011670 oscillogram n. 8

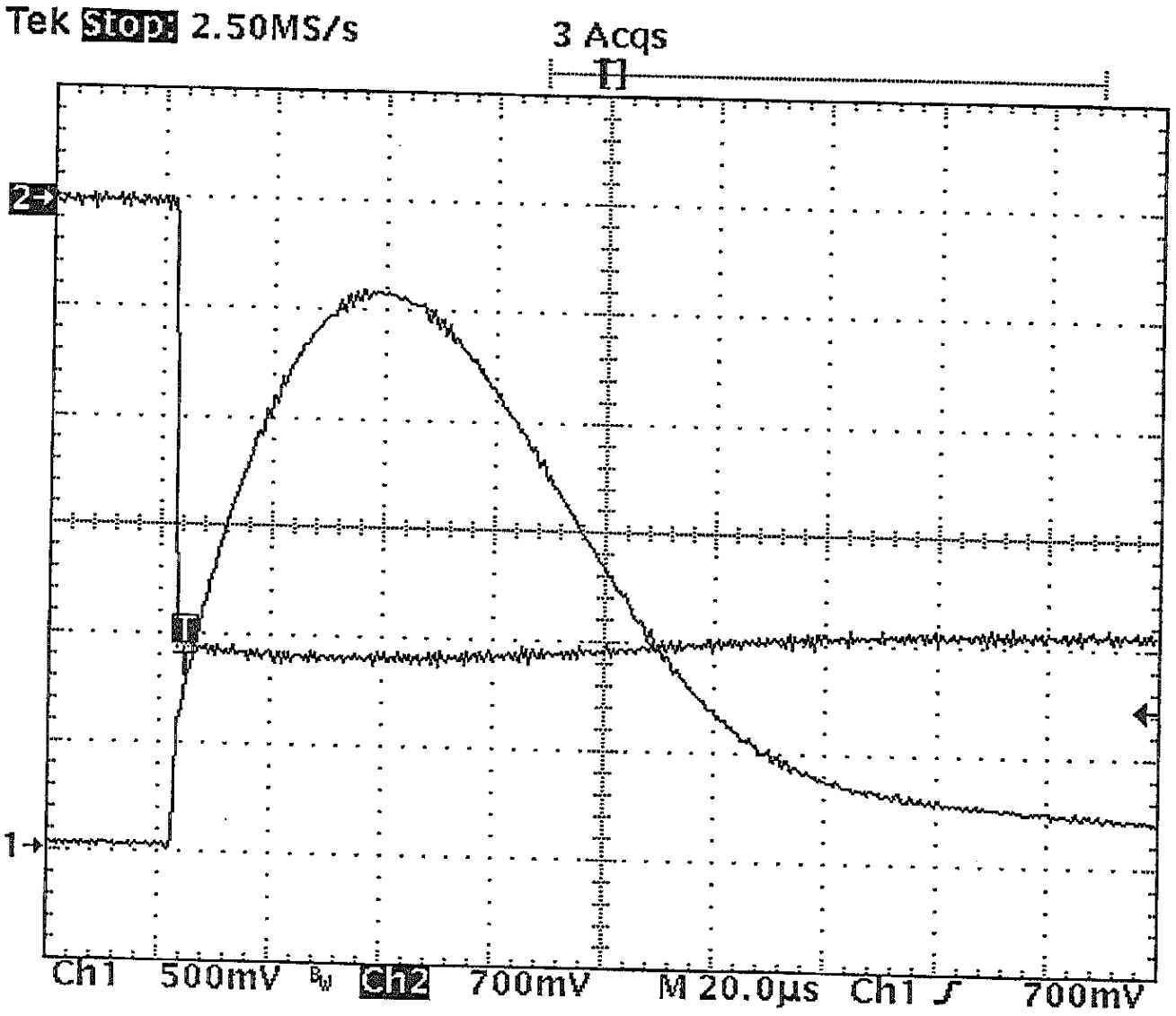
ВЯРНО С ОРИГИНАЛА

АКЦИОНЕРНО ДРУЖЕСТВО * ФИЛКАБ * ПЛОВДИВ 16

CESI TEST A4/011670 oscillogram n. 9

ВЯРНО С ОРИГИНАЛА

АКЦИОНЕРНО ДРУЖЕСТВО ФИЛКАБ 16 ПЛОВДИВ

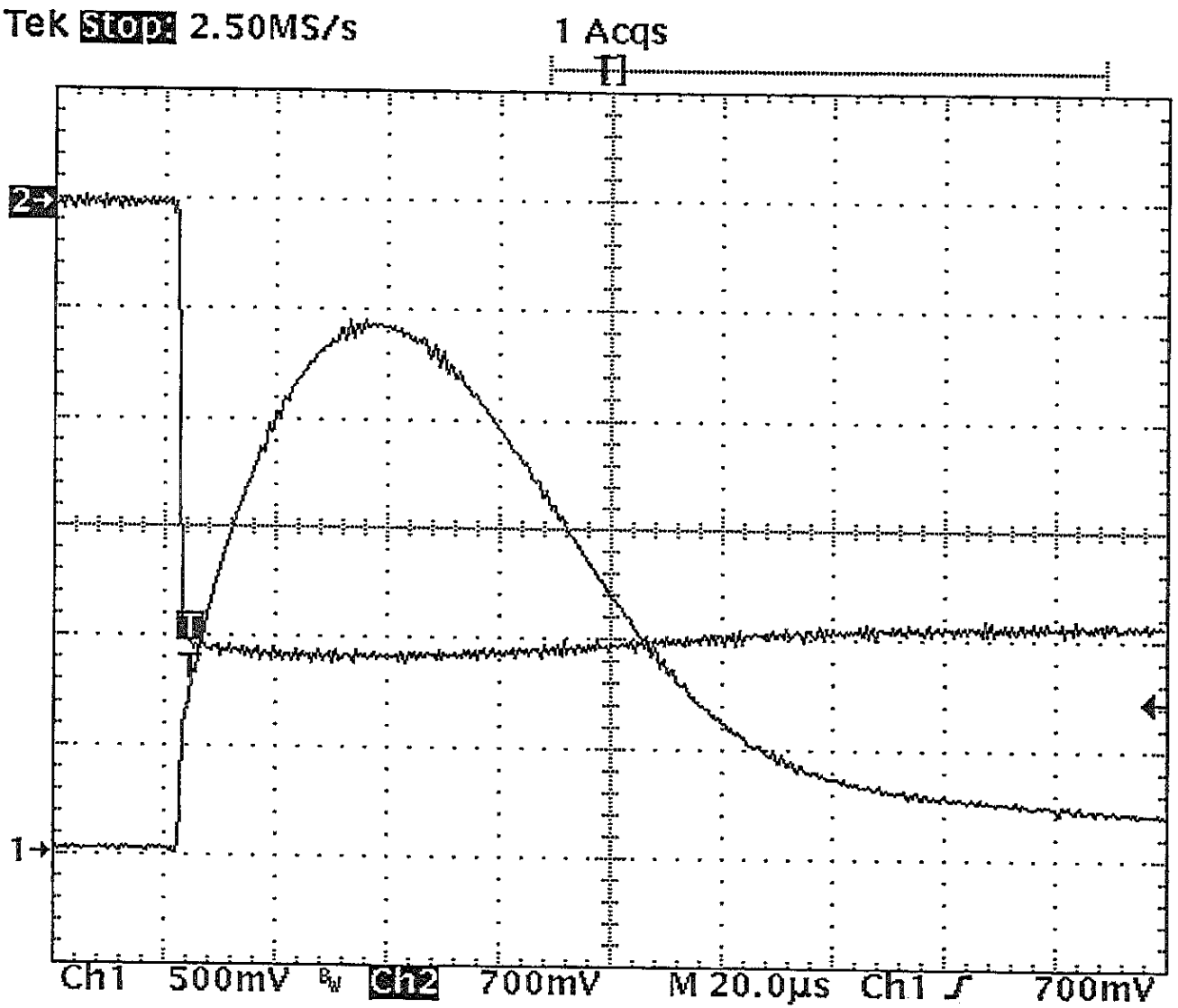


CESI TEST A4/011670 oscillogram n. 10

CESI TEST A4/011670 oscillogram n. 11

ВЯРНО С ОРИГИНАЛА

АКЦИОНЕРНО ДРУЖЕСТВО * ПЛОВДИВ * КАБЕЛКАБ 16



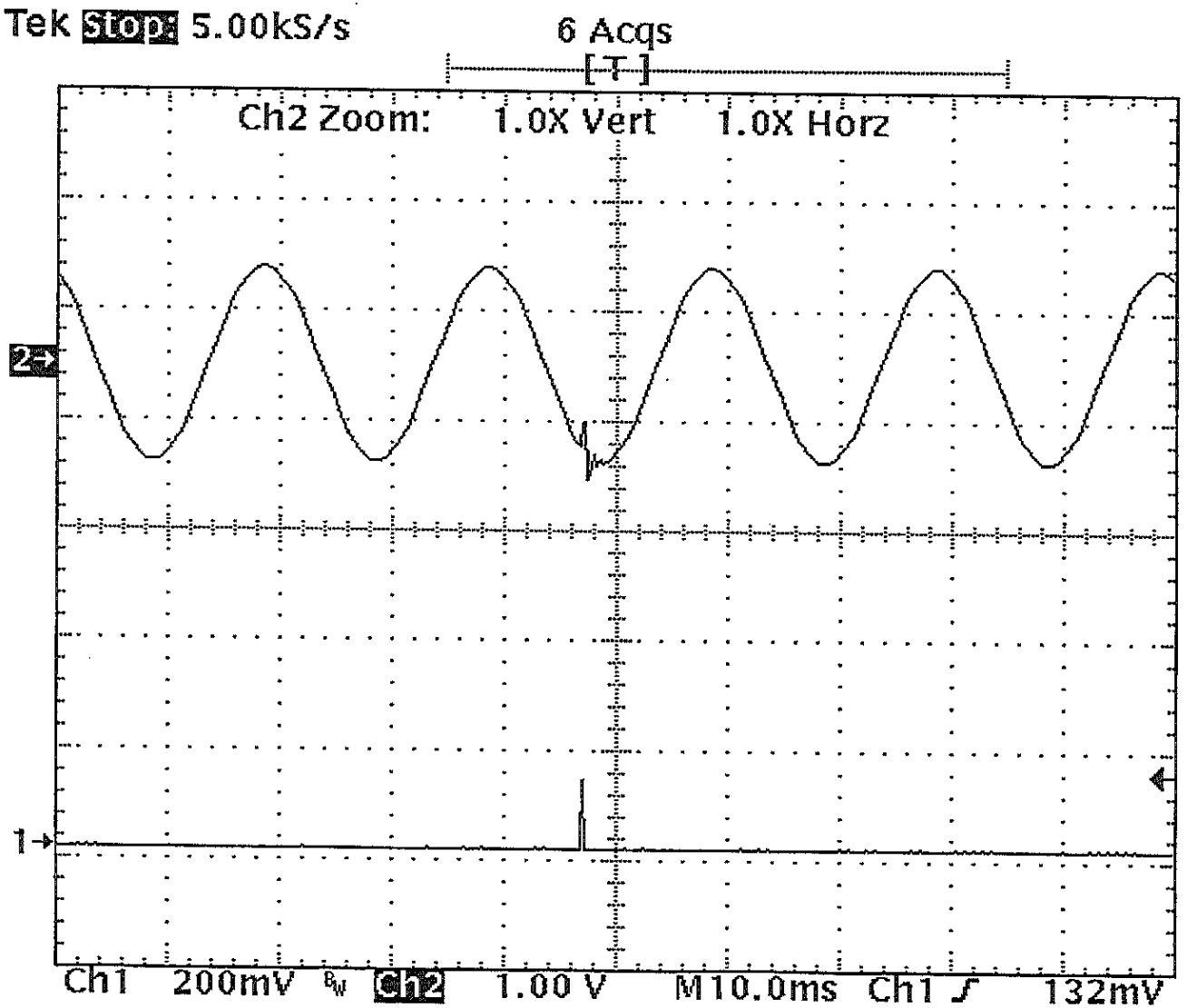
CESI TEST A4/011670 oscillogram n. 12

ВЯРНО С ОРИГИНАЛА

CESI TEST A4/011670 oscillogram n. 13

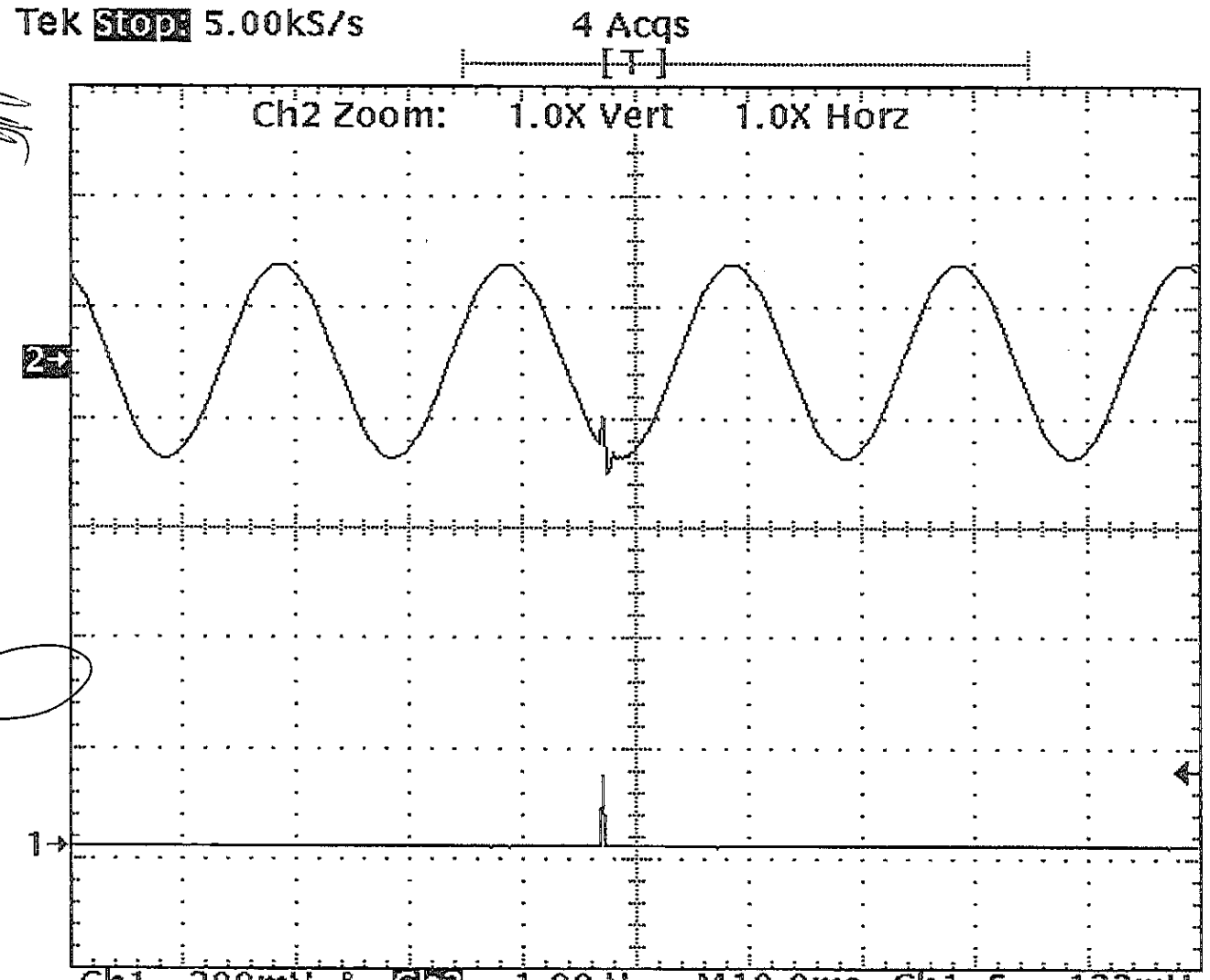
ВЯРНО С ОРИГИНАЛА

АКЦИОНЕРНО ДРУЖЕСТВО * ПЛОВДИВ * ФИЛКАБ 16

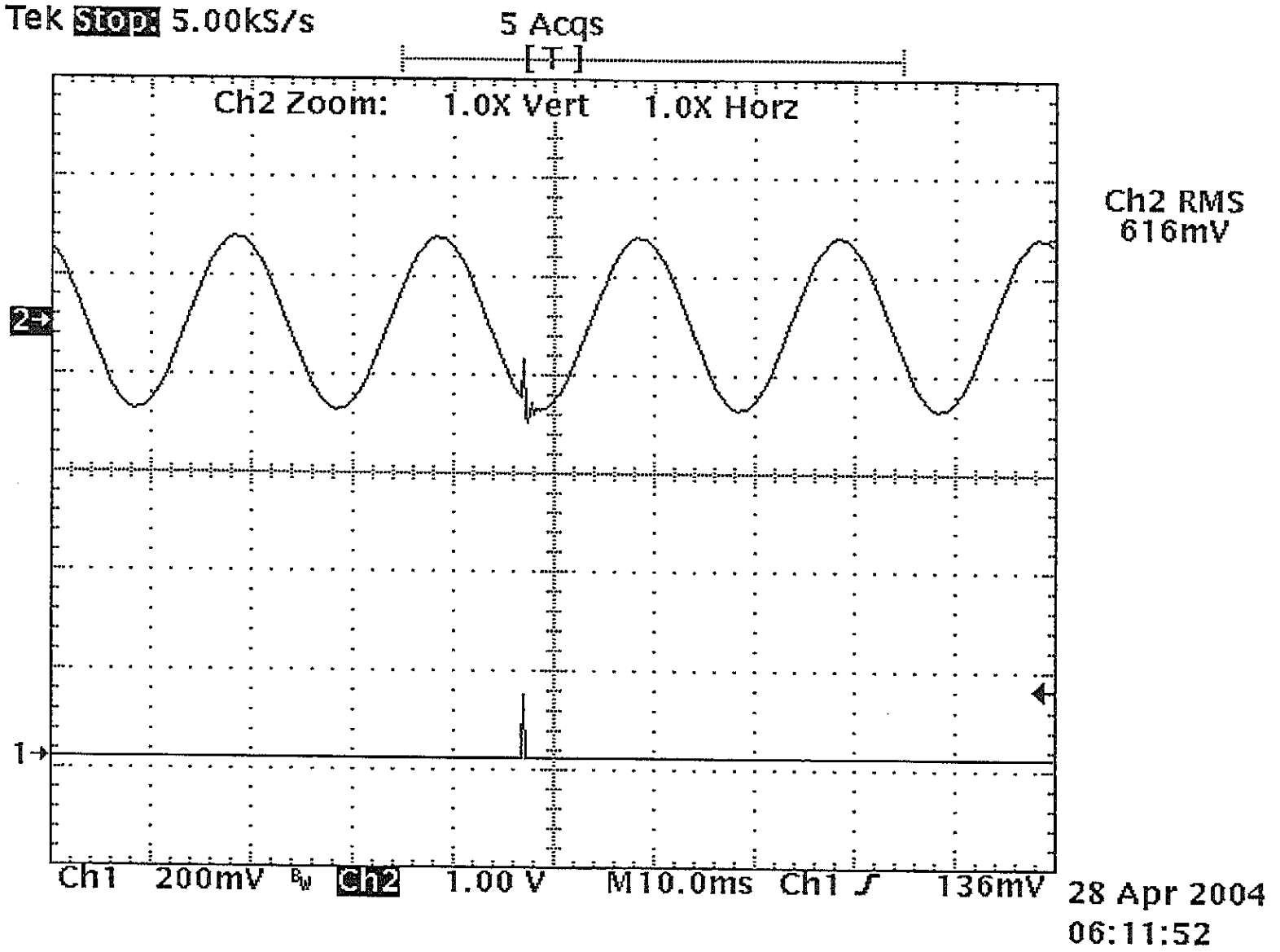


CESI TEST A4/011670 oscillogram n. 14

ВЯРНО С ОРИГИНАЛА



CESI TEST A4/011670 oscillograph n. 15



CESI TEST A4/011670 oscillogram n. 16

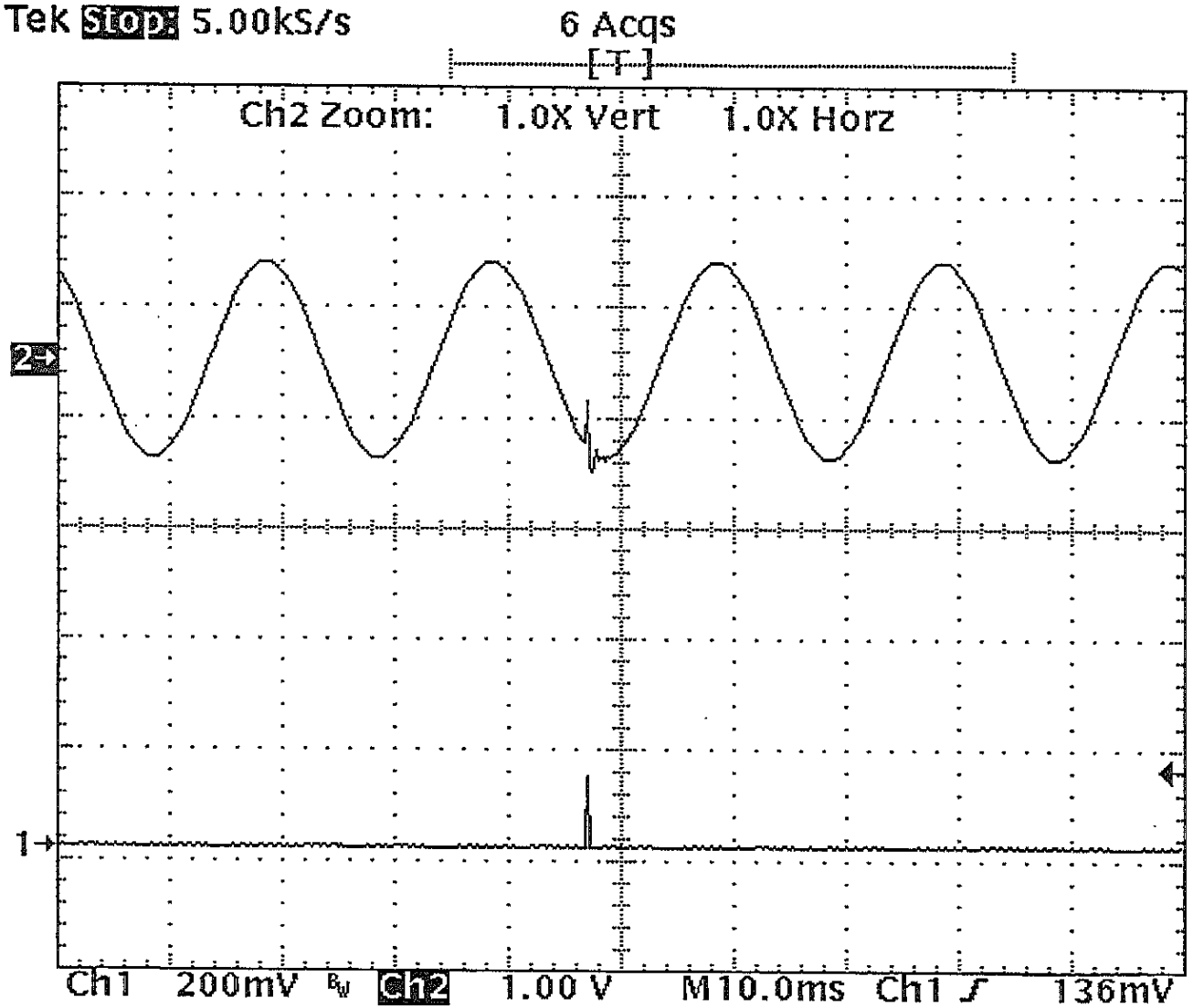
ВЯРНО С ОРИГИНАЛА

АКЦИОНЕРНО ДРУЖЕСТВО ПОЛИЕЛИВ ФИЛКАБ 16

CESI TEST A4/011670 oscillogram n. 17

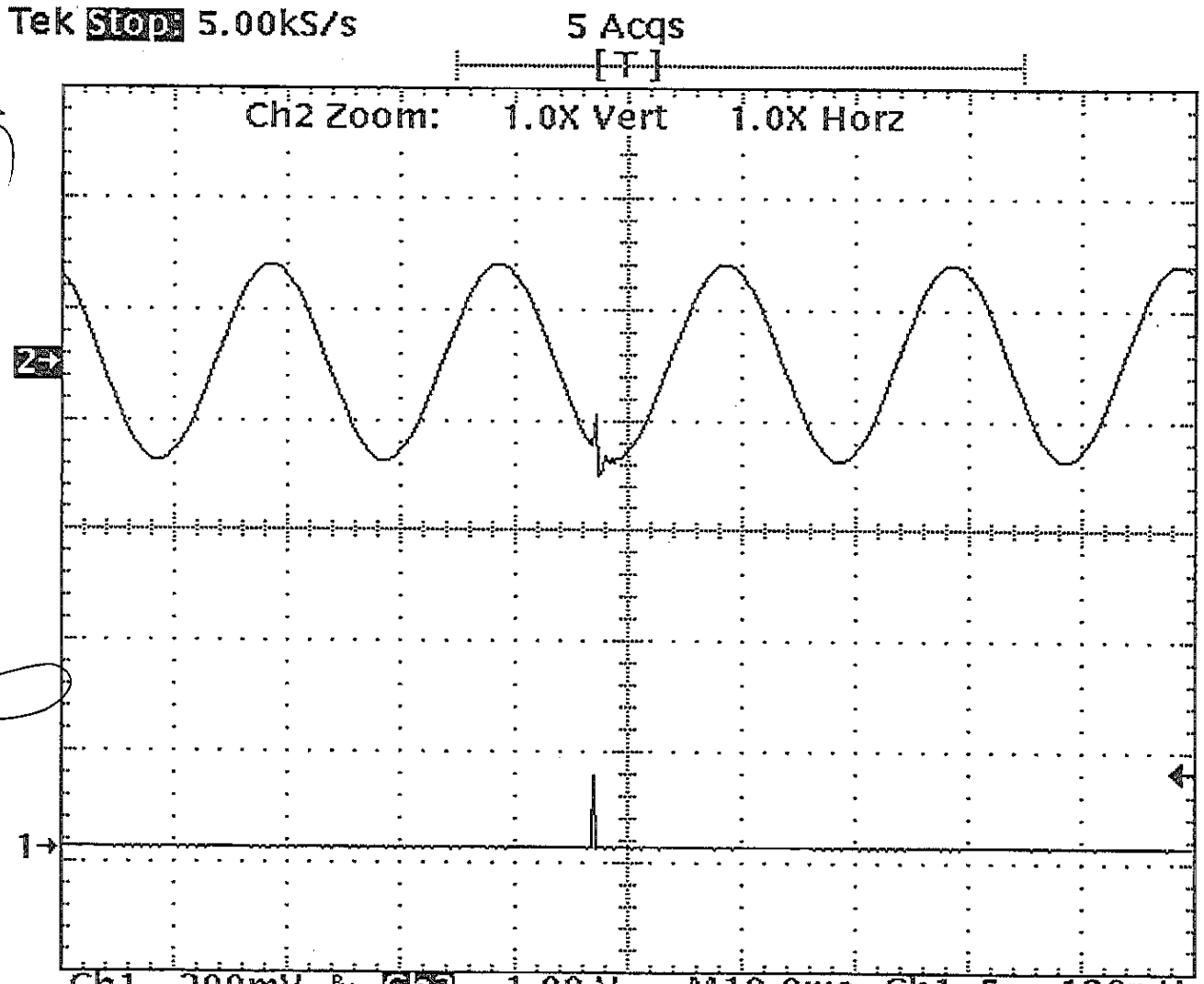
ВЯРНО С ОРИГИНАЛА

АКЦИОНЕРНО ДРУЖЕСТВО ФИЛКАБ 16 ПЛОВДИВ

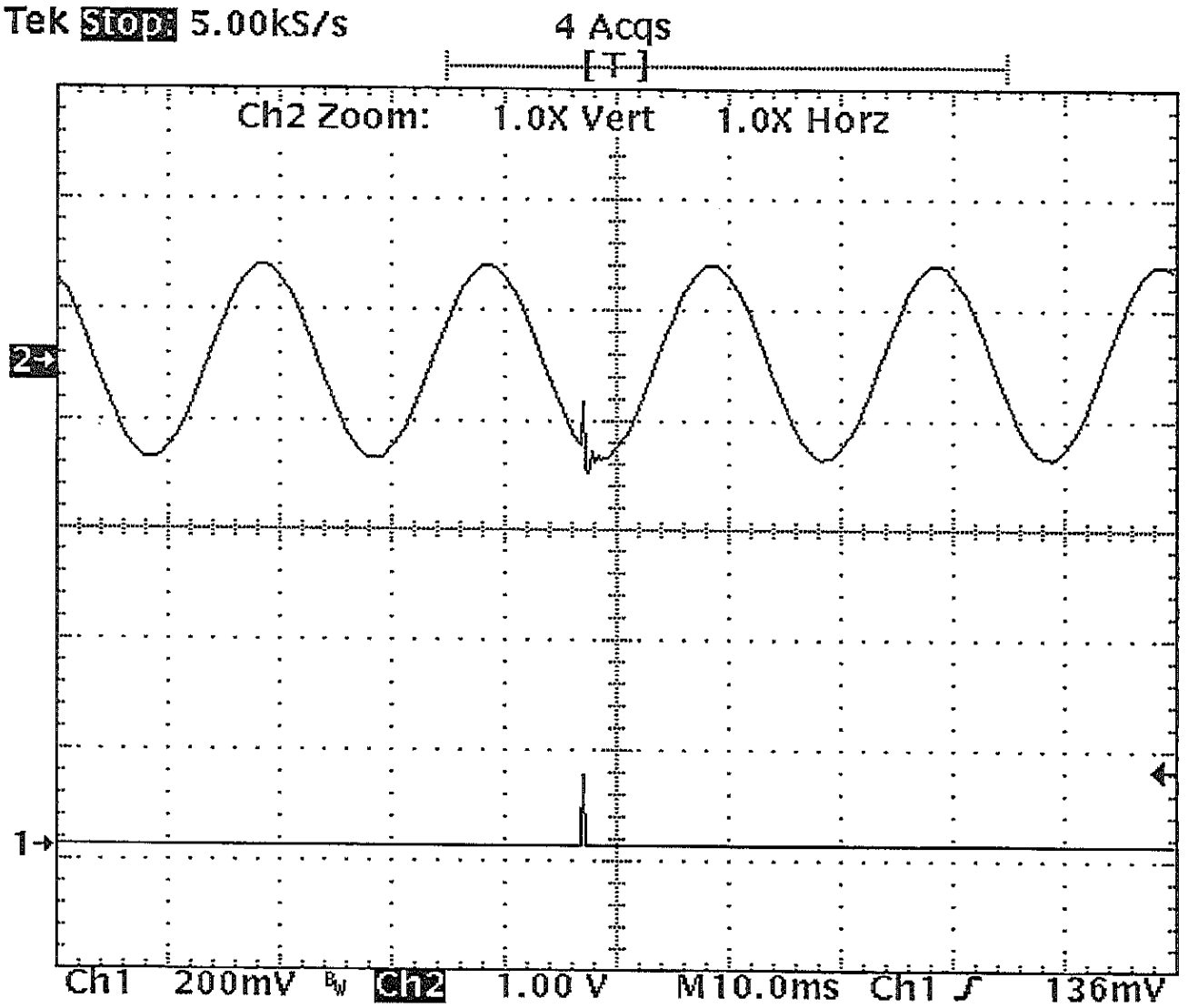


CESI TEST A4/011670 oscillogram n. 18

ВЯРНО С ОРИГИНАЛА



CESI TEST A4/011670 oscillogram n. 19



CESI TEST A4/011670 oscillogram n. 20

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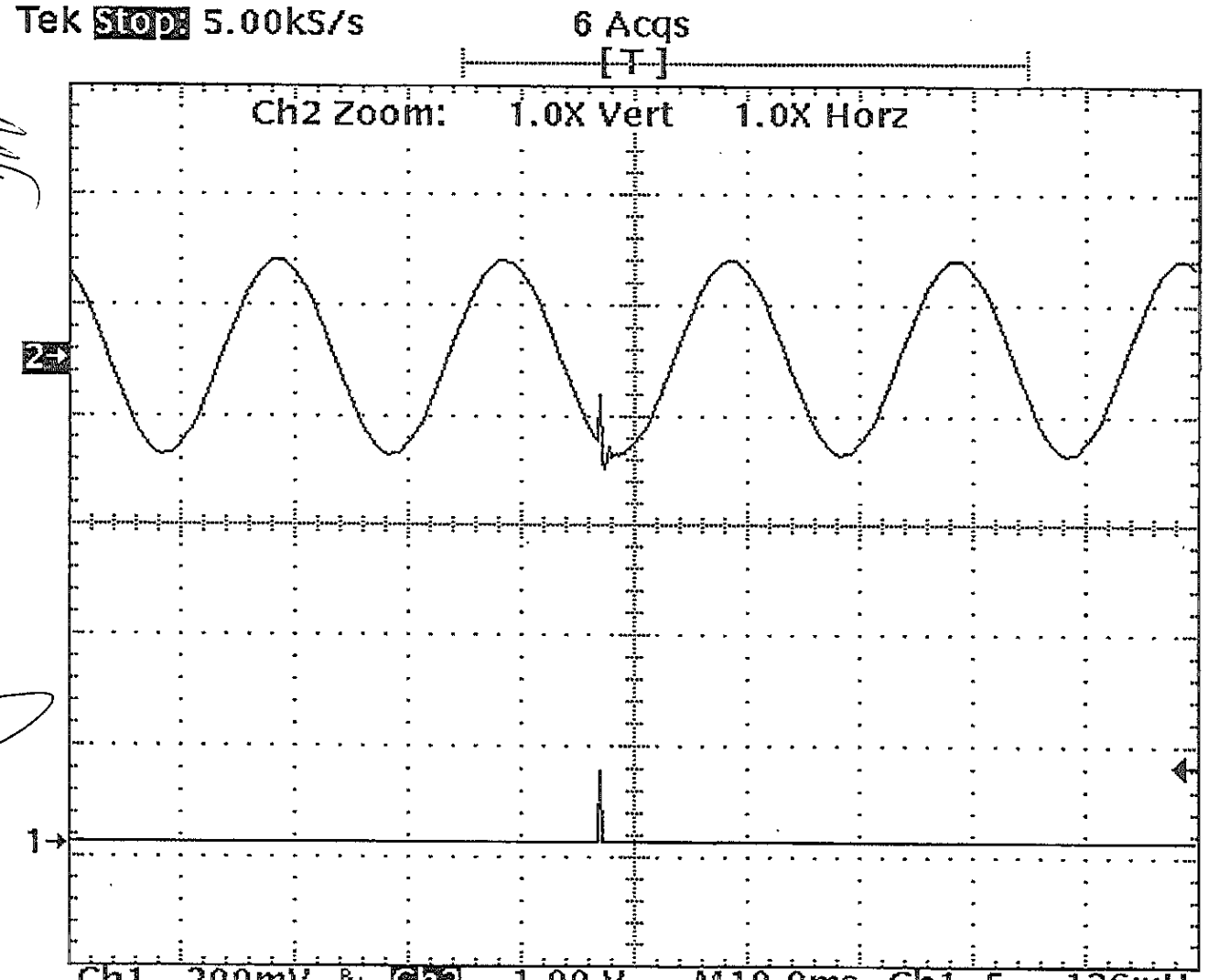
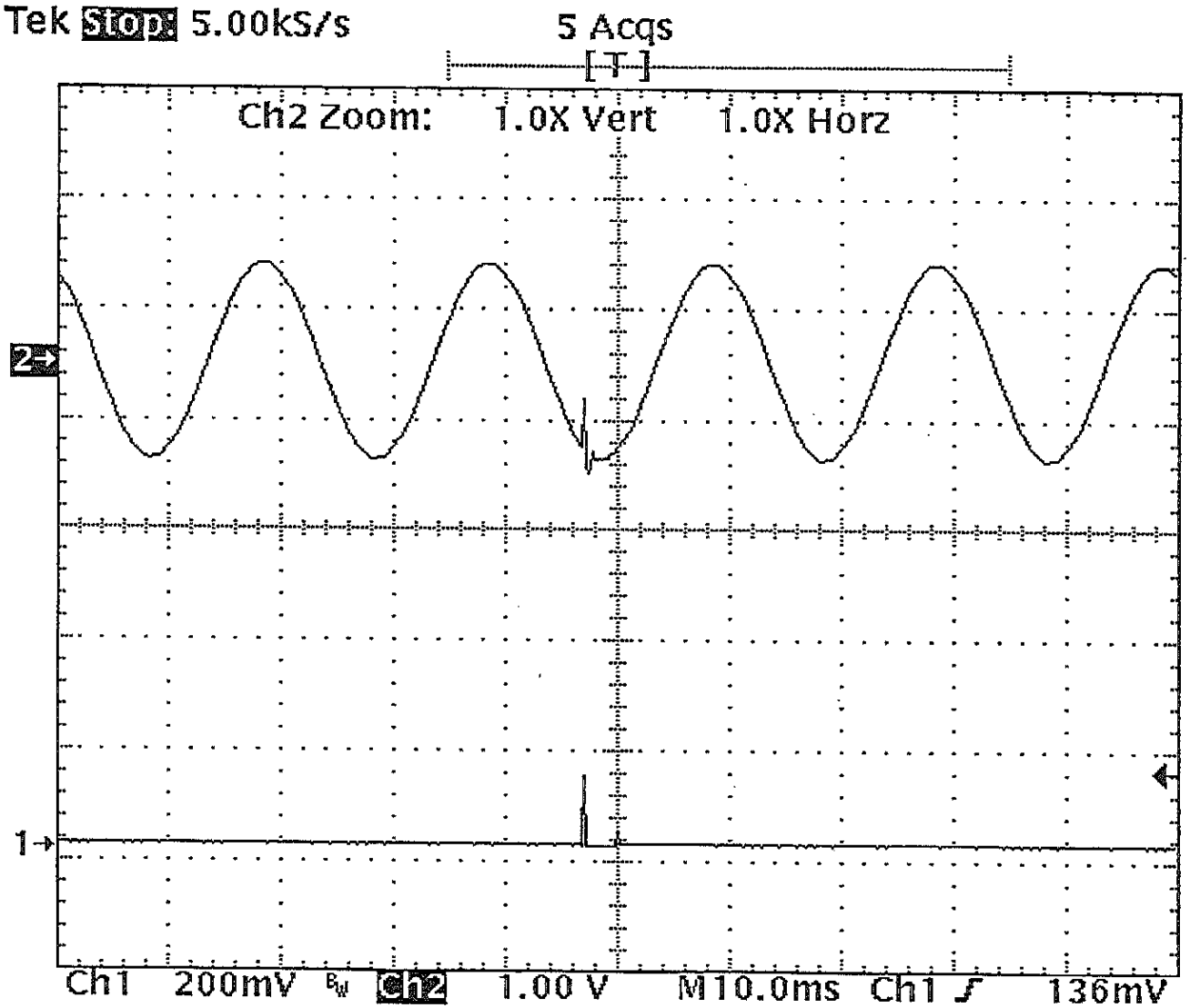


CESI TEST A4/011670 oscillogram n.21



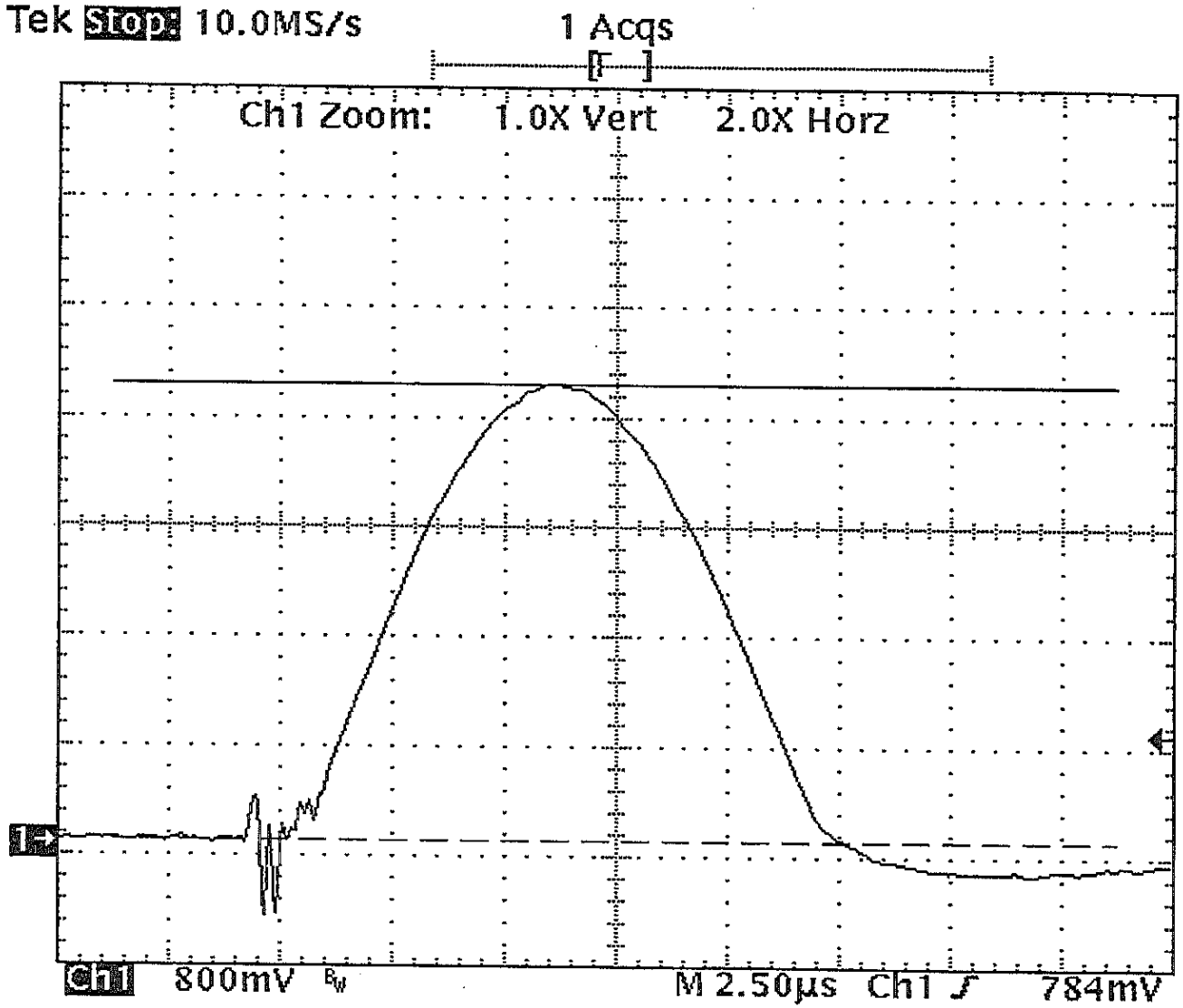
CESI TEST A4/011670 oscillogram n. 22

ВЯРНО С ОРИГИНАЛА

CESI TEST A4/011670 oscillogram n. 23

ВЯРНО С ОРИГИНАЛ:

АКЦИОНЕРНО ДРУЖЕСТВО "ПЛОВДИВ" ФИЛКАБ 16



CESI TEST A4/011670 oscillogram n. 25

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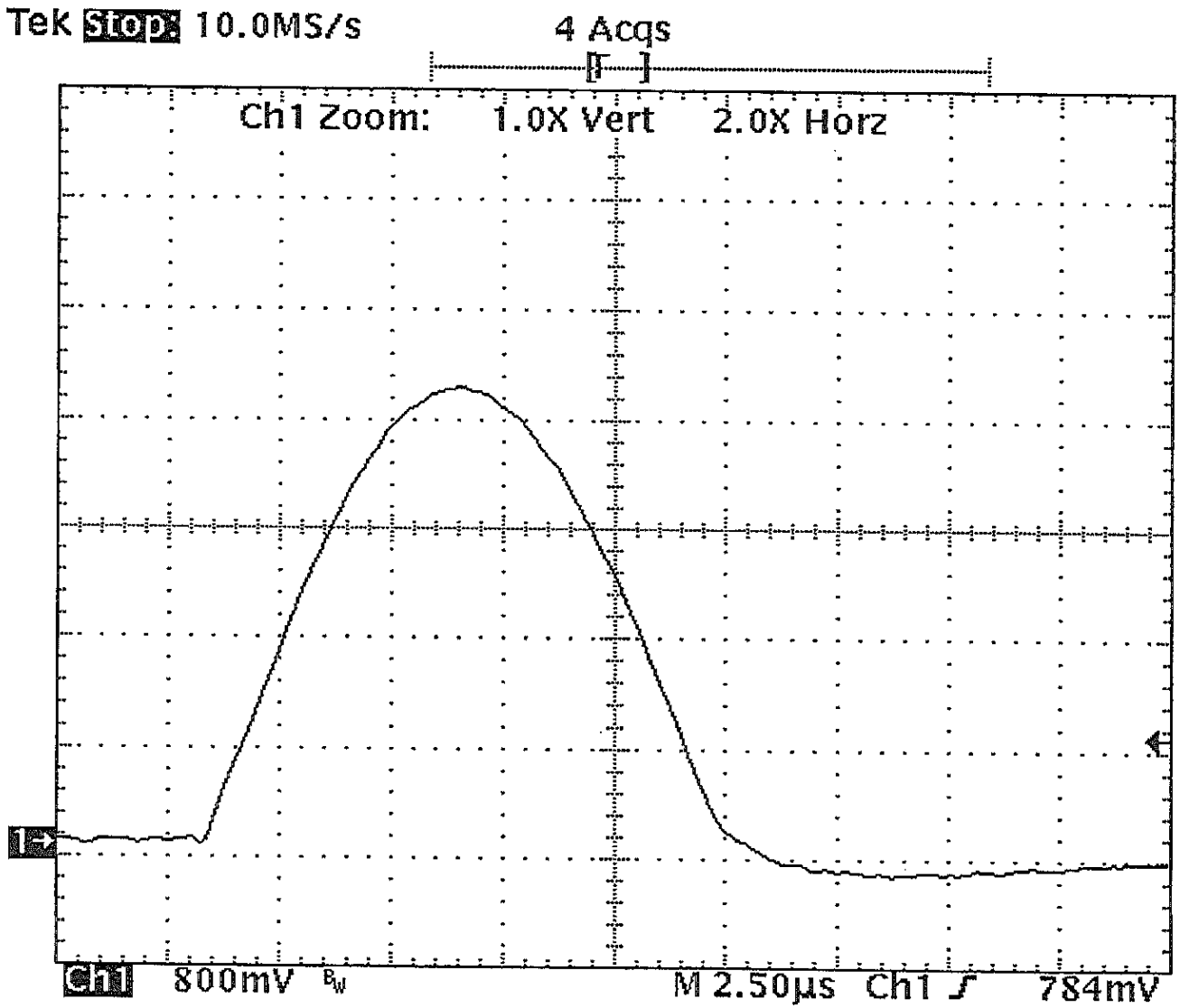
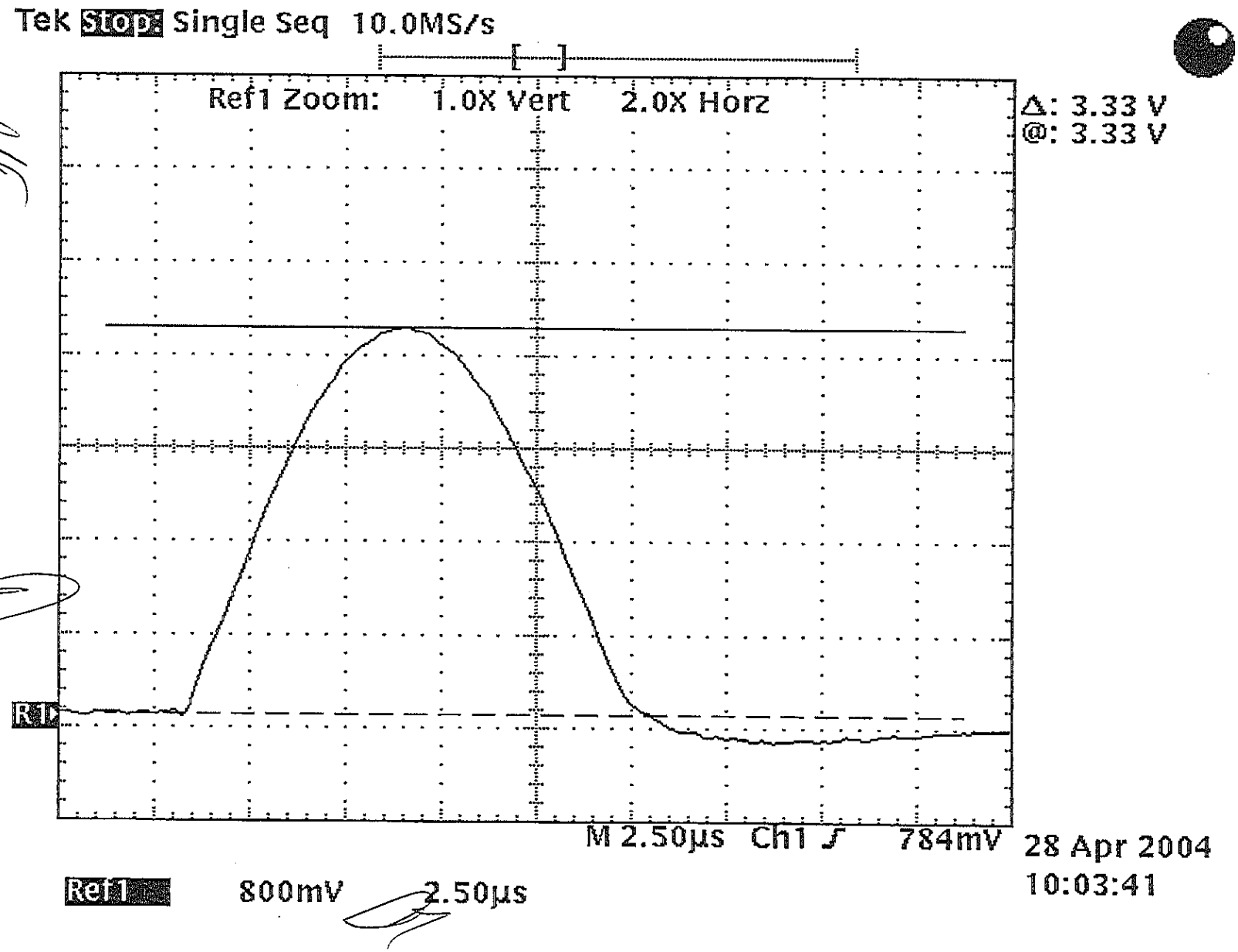


28 Apr 2004
09:43:32

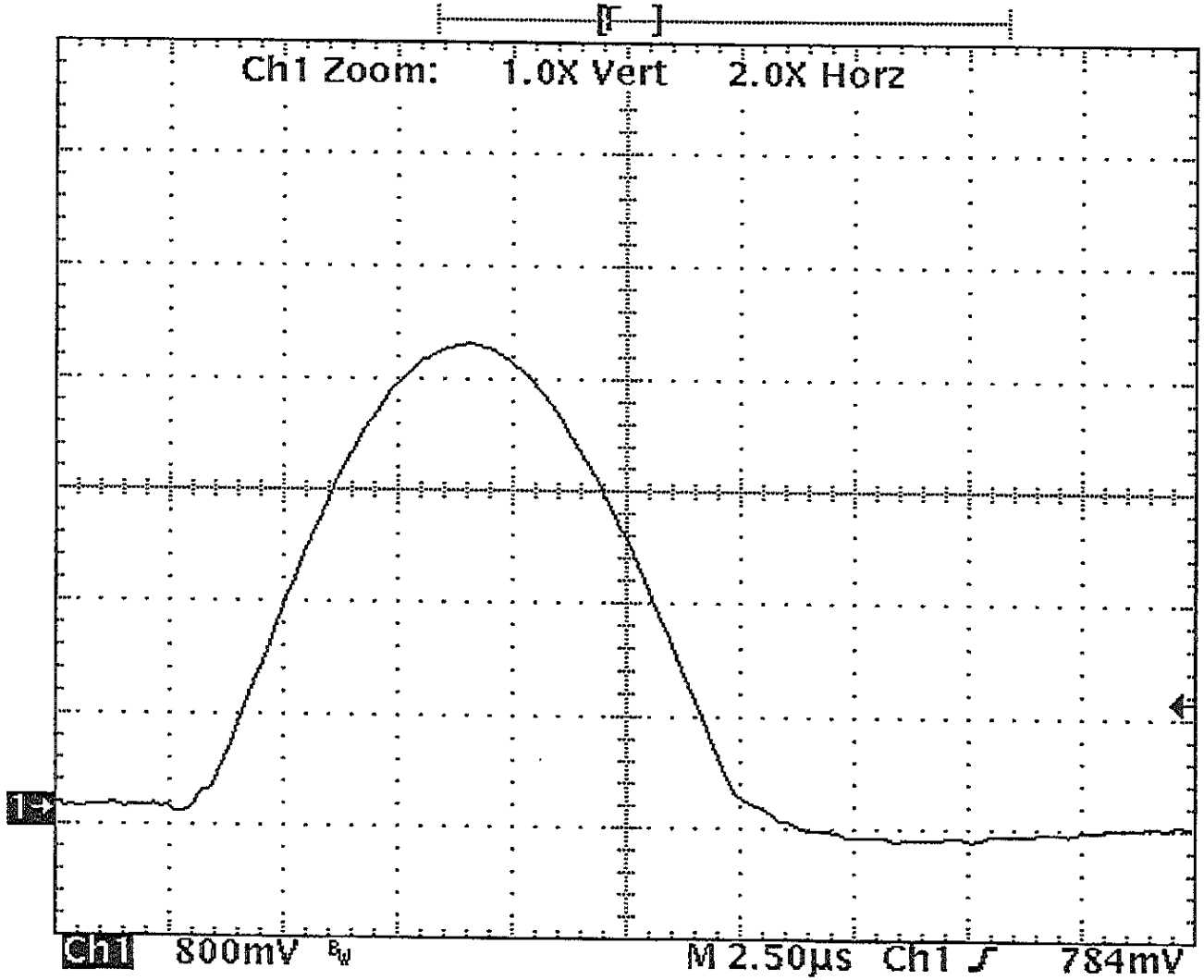
CESI TEST A4/011670 oscillogram n. 26

ВЯРНО С ОРИГИНАЛА

АКЦИОНЕРНО ДРУЖЕСТВО ФИЛИКАЕ ПЛОВДИВ 16



CESI TEST A4/011670 oscillogram n. 27



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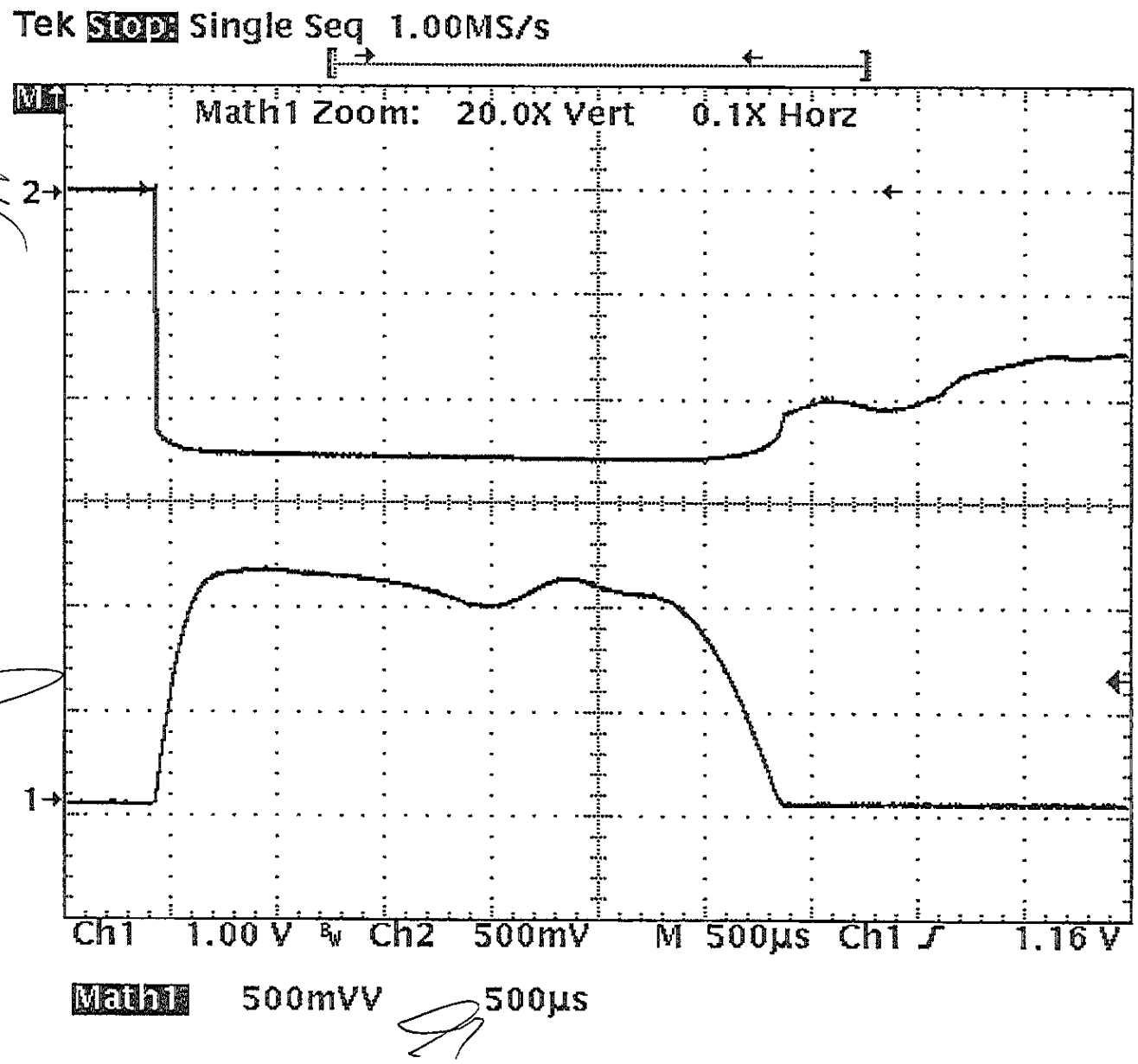
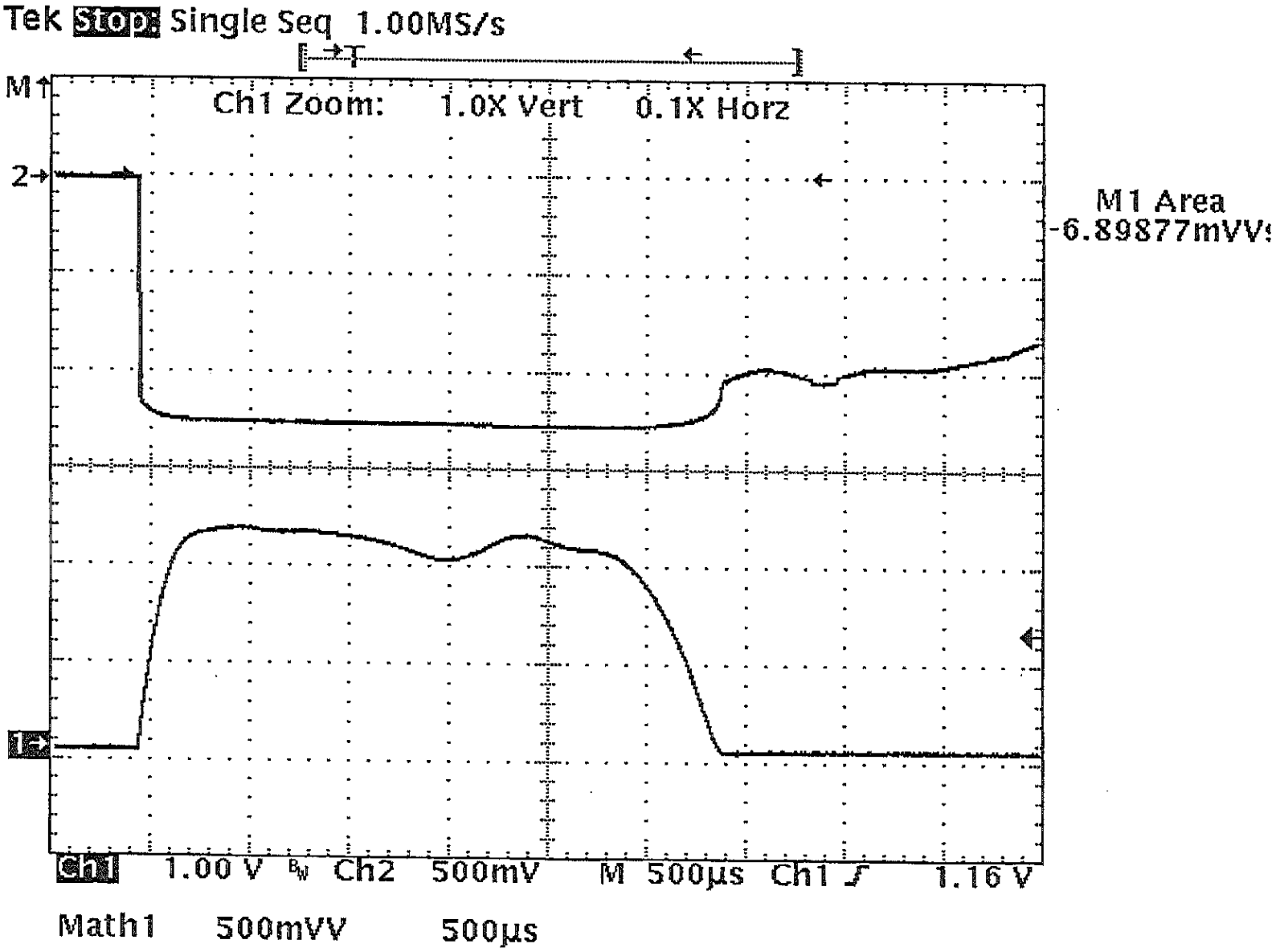
CESI TEST A4/011670 oscillogram n. 28

ВЯРНО С ОРИГИНАЛА

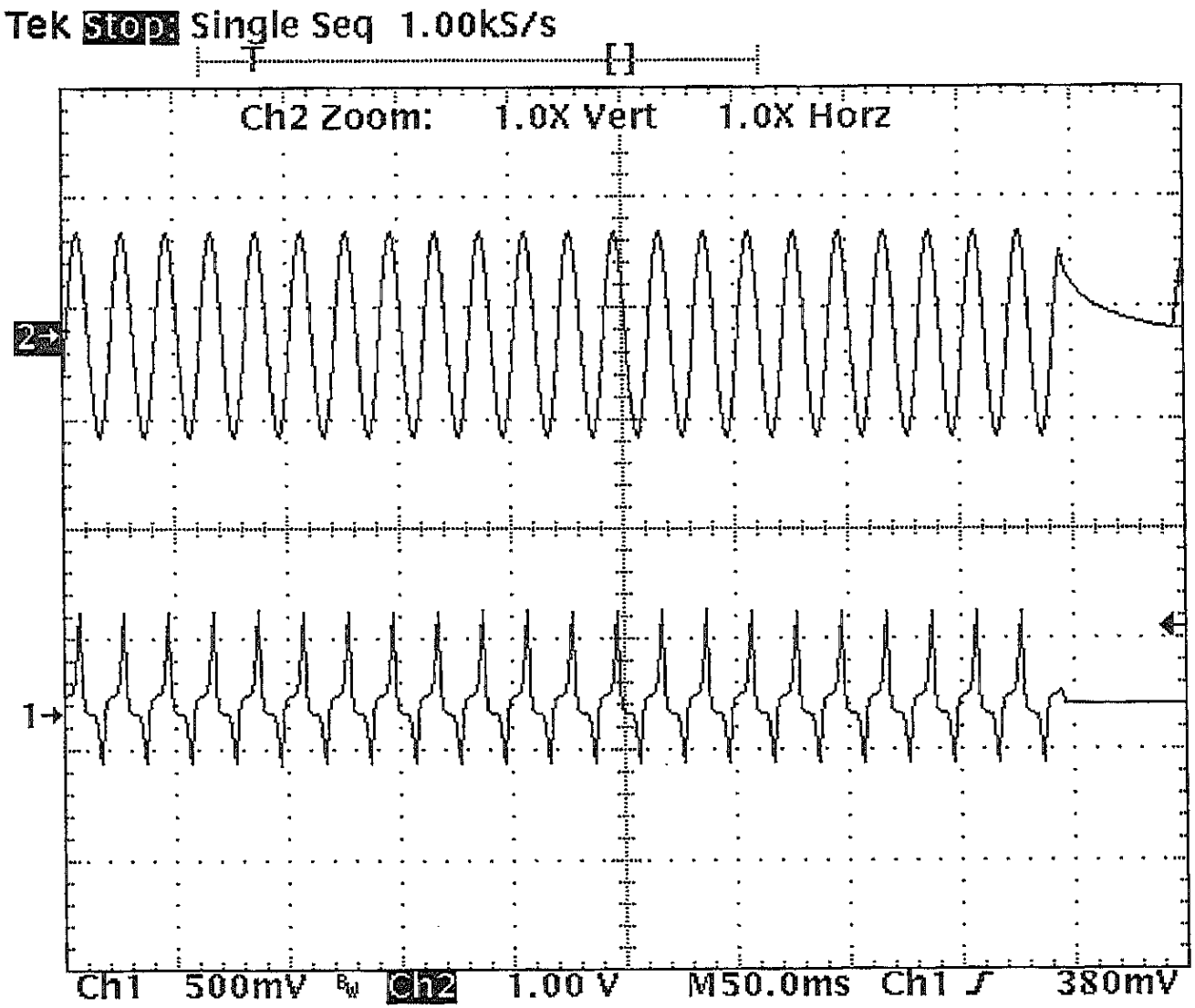


CESI TEST A4/011670 oscillogram n 29

ВЯРНО С ОРИГИНАЛА



CESI TEST A4/011670 oscillogram n. 31



CESI TEST A4/011670 oscillogram n. 33

ВЯРНО С ОРИГИНАЛА

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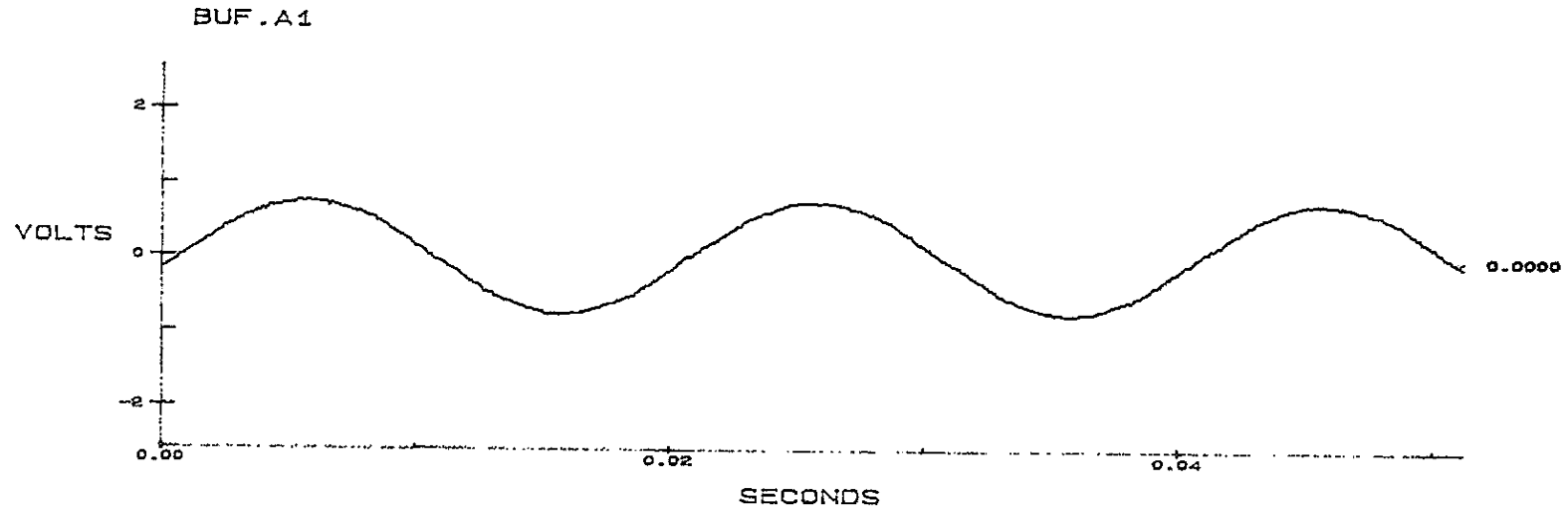
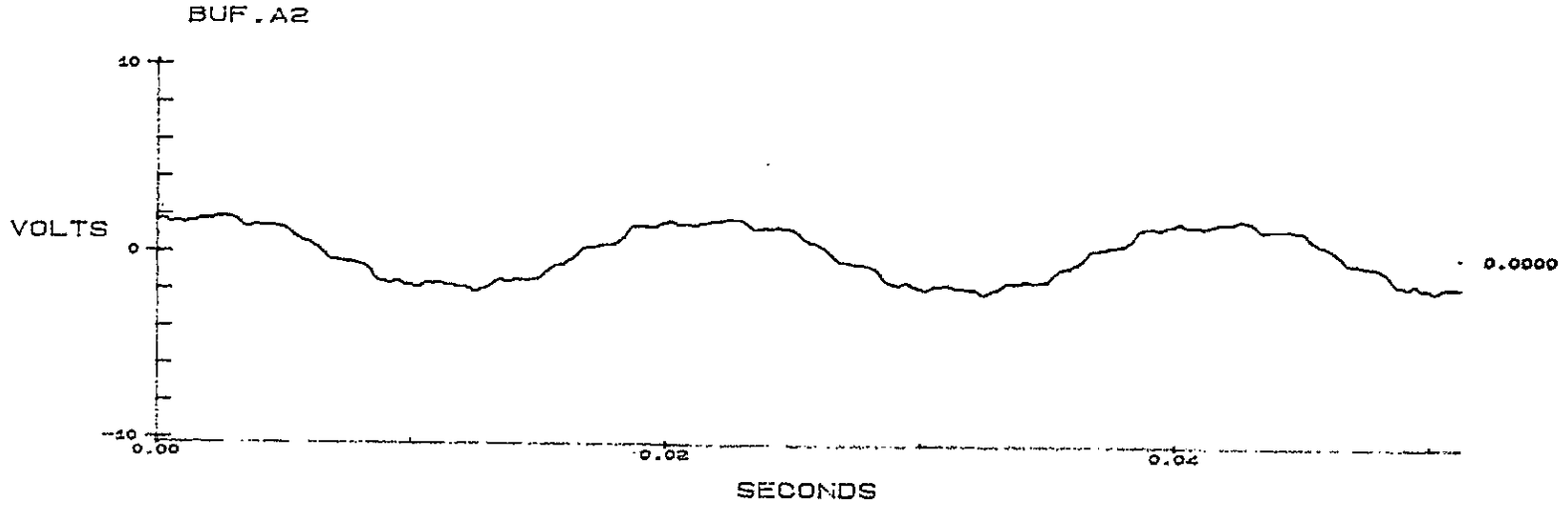


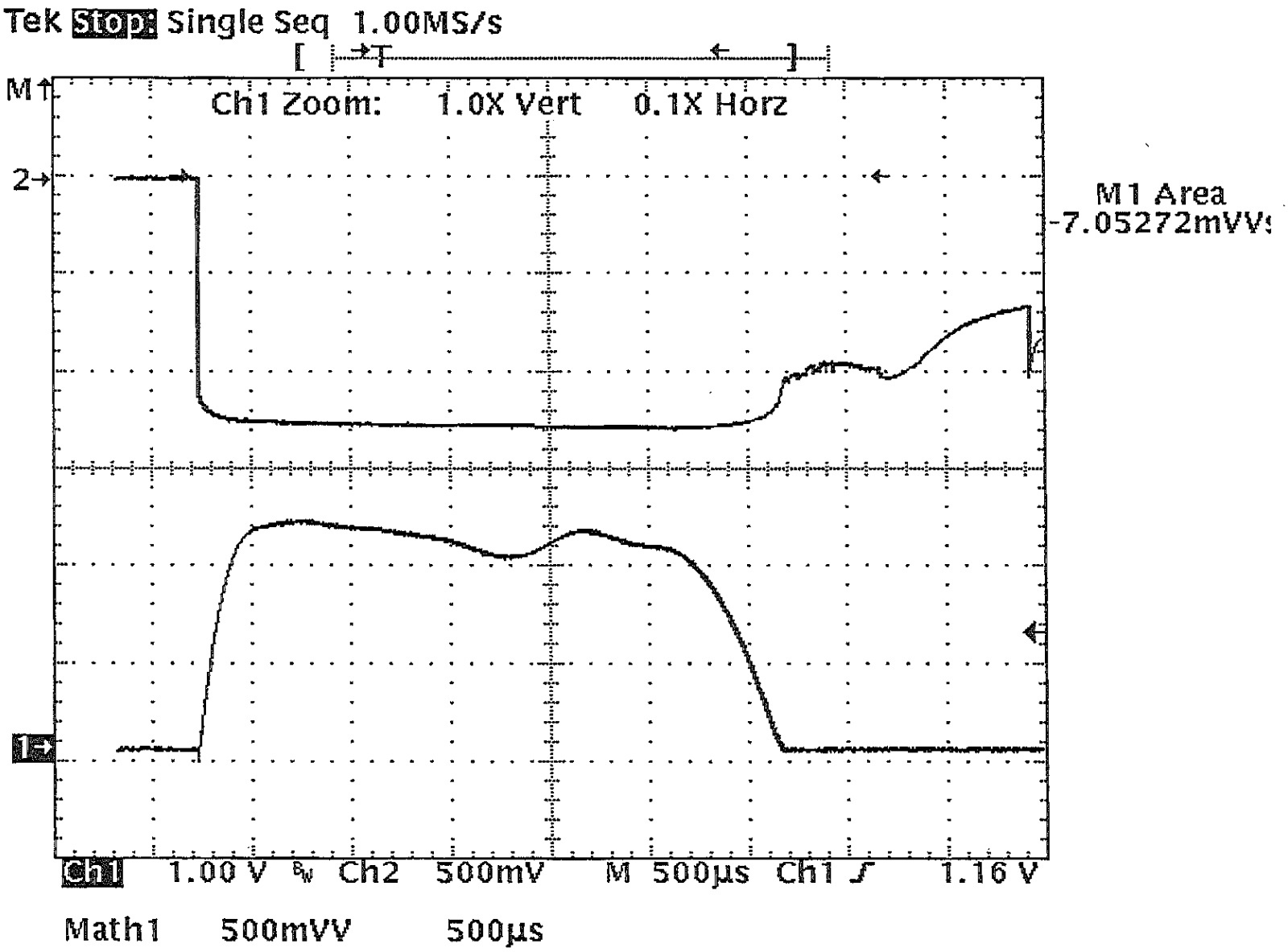


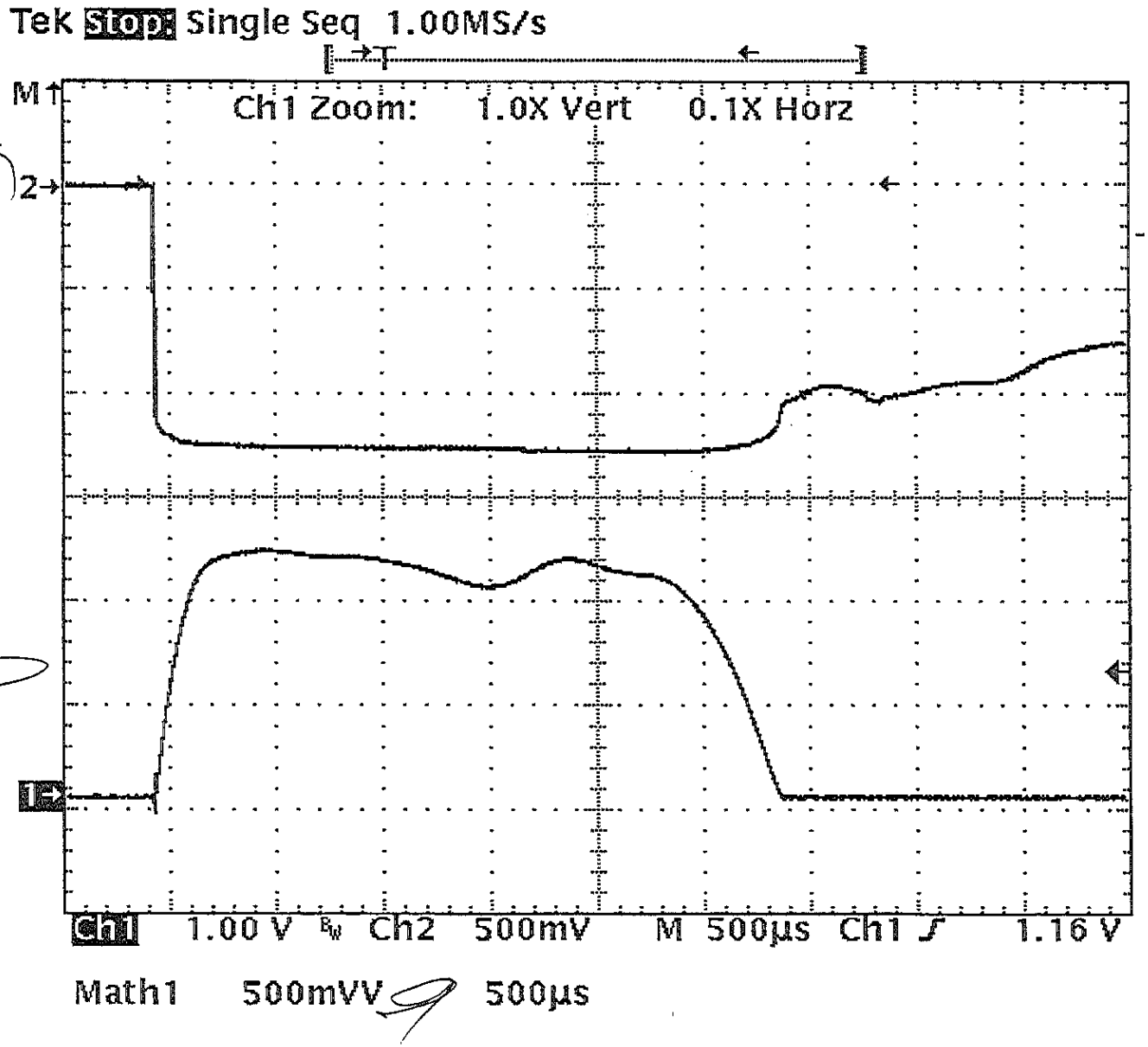
CESI TEST A4/011670 oscillogram n. 34

CESI TEST A4/011670 oscillogram n. 35

ВЯРНО С ОРИГИНАЛА

АКЦИОНЕРНО ДРУЖЕСТВО ФИЛКАБ 16 ПЛОВДИВ





CESI TEST A4/011670 oscillogram p. 37

ВЯРНО С ОРИГИНАЛА

CESI TEST A4/011670 oscillogram n. 38

Original issue 03-2005

Type certificate

CESI TEST A4/011670 oscillogram n.39

ВЯРНО С ОРИГИНАЛА

АКЦИОНЕРНО ДРУЖЕСТВО ФИЛКАБ 16 ПЛОВДИВ

CESI TEST A4/011670 oscillogram n. 40

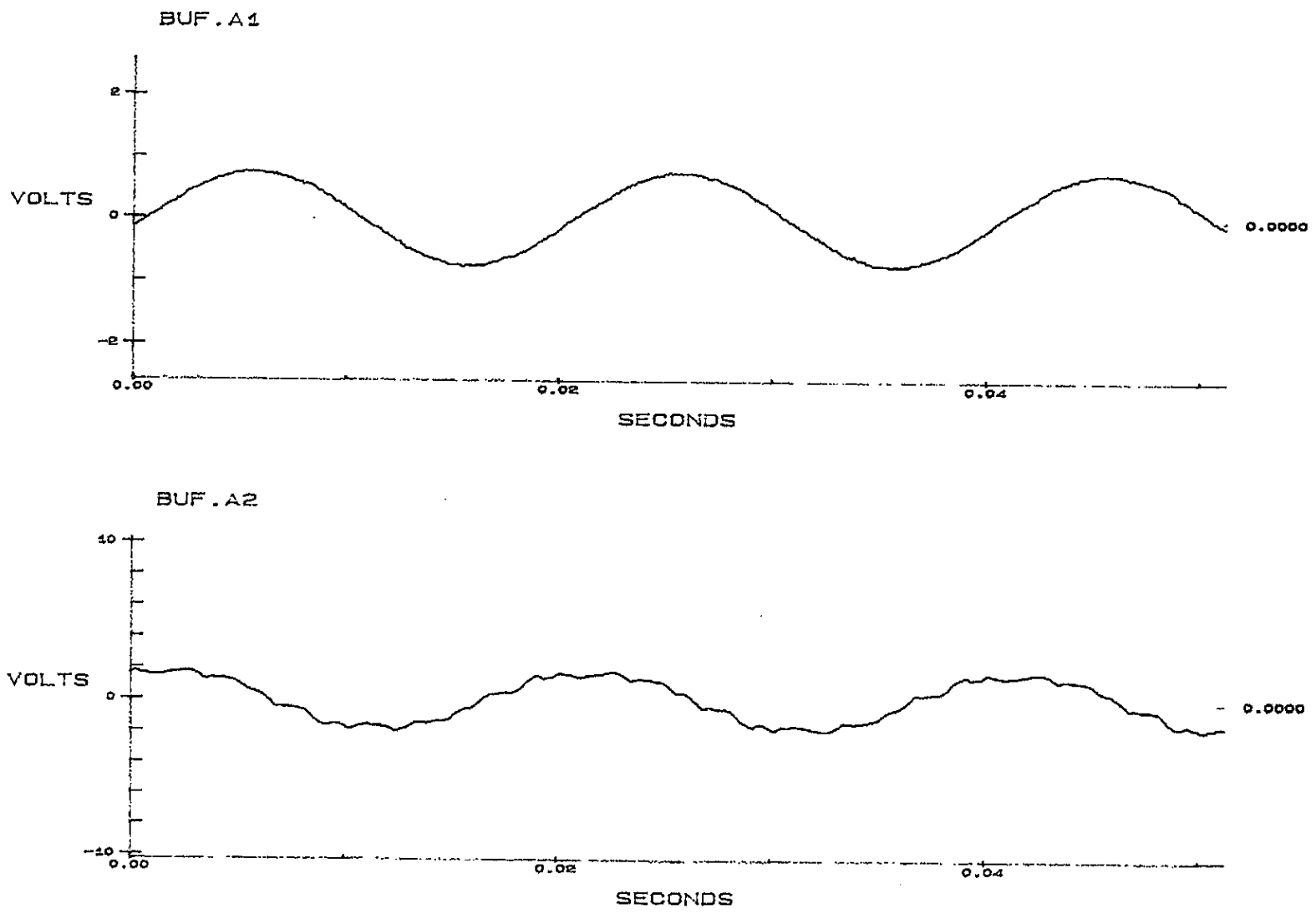
ВЯРНО С ОРИГИНАЛА

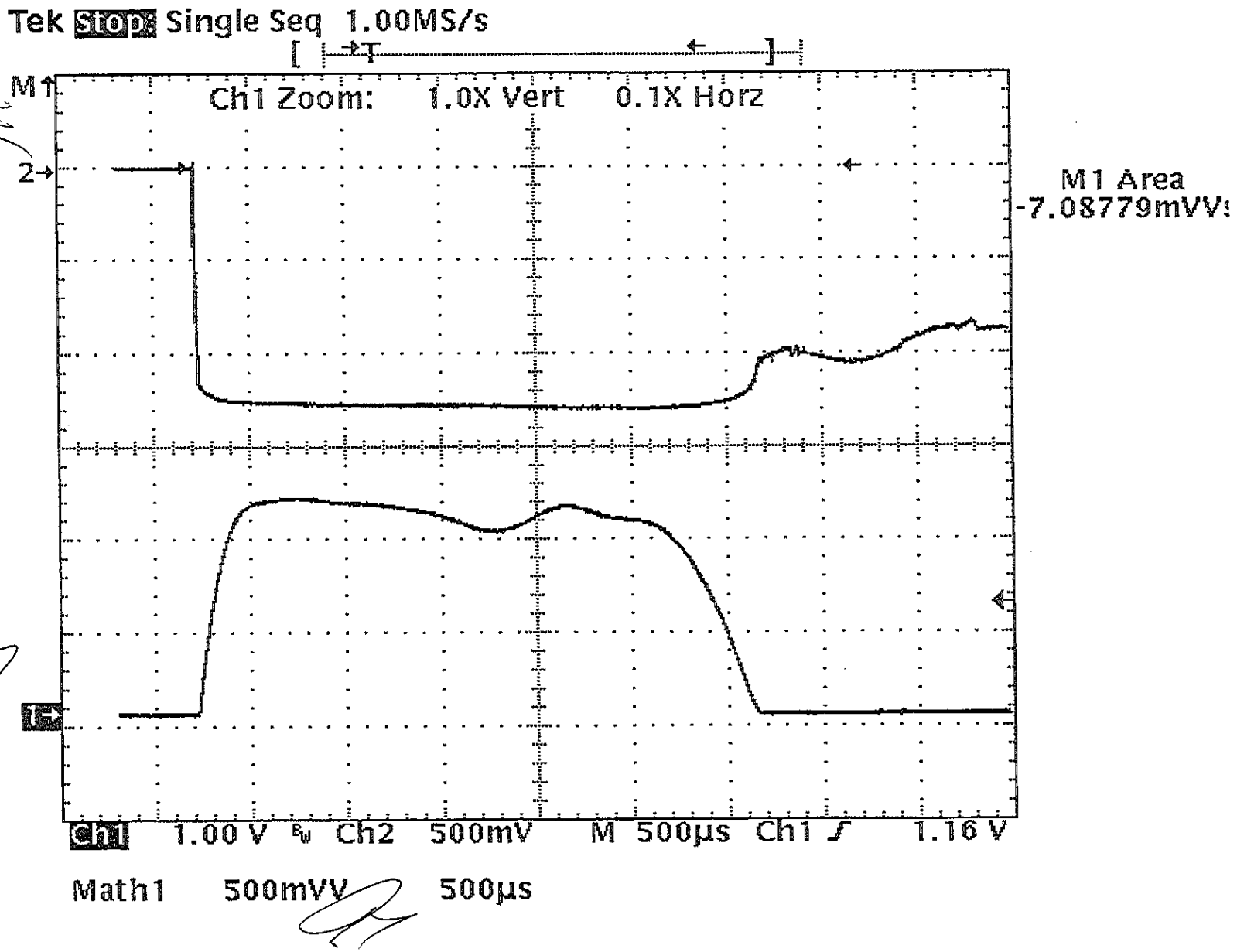
АКЦИОНЕРНО ДРУЖЕСТВО * ПЛОВДИВ * ФИЛКАБ 16

CESI TEST A4/011670 oscillogram n. 41

ВЯРНО С ОРИГИНАЛА

CESI TEST A4/011670 oscillogram n. 42





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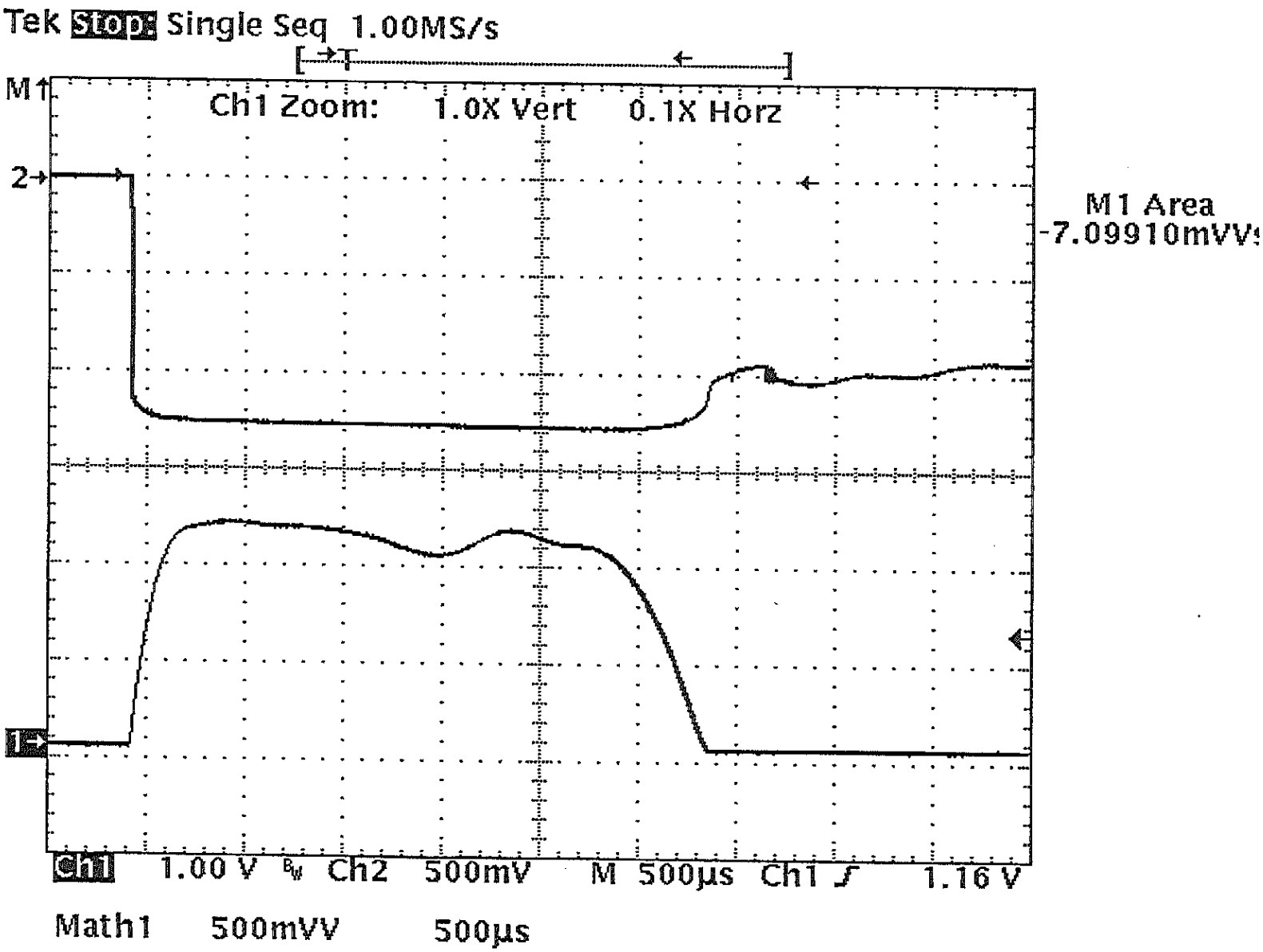

CESI TEST A4/011670 oscillogram n. 44

ВЯРНО С ОРИГИНАЛА

CESI TEST A4/011670 oscillogram n. 45

ВЯРНО С ОРИГИНАЛА

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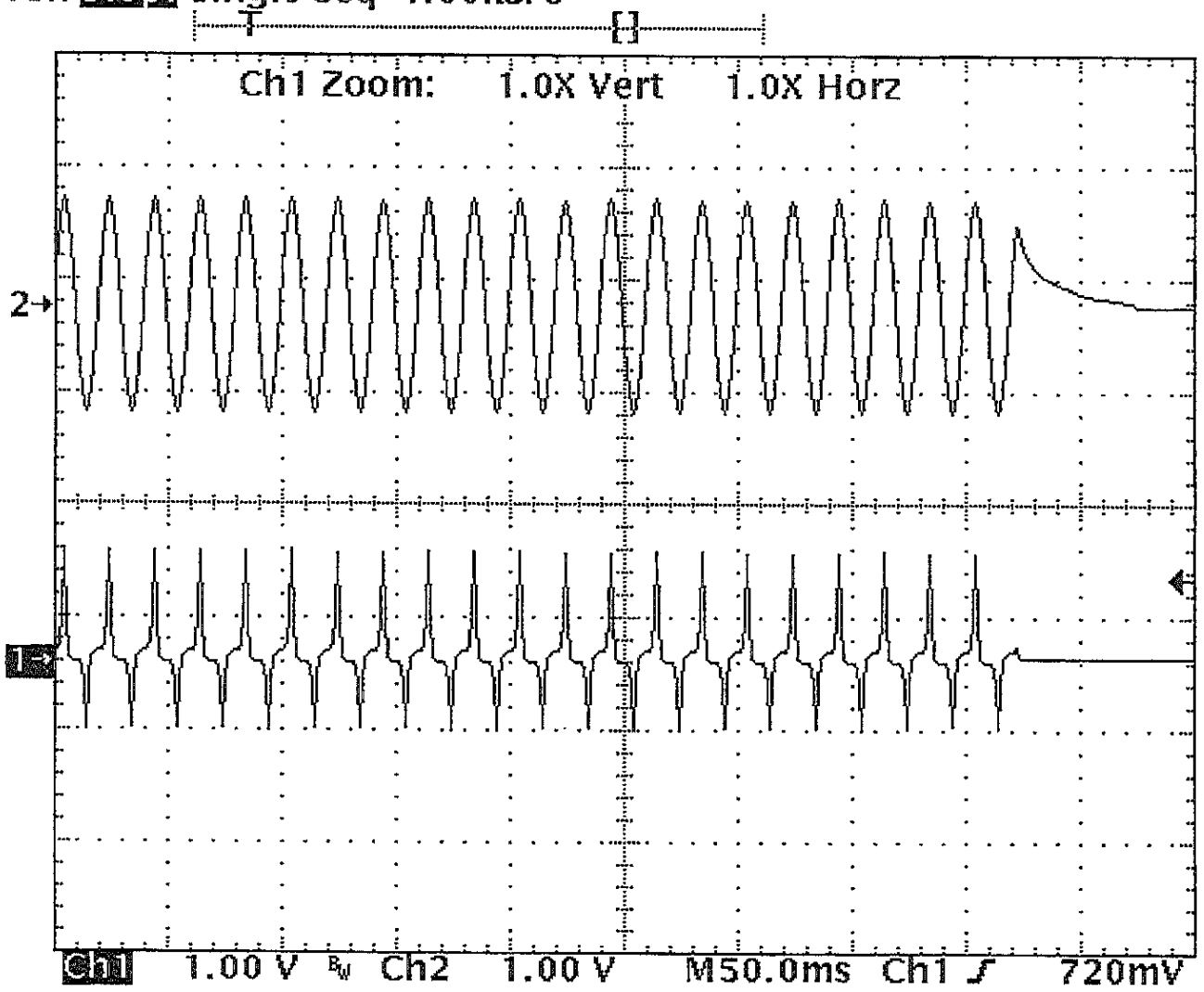

CESI TEST A4/011670 oscillogram n. 47

ВЯРНО С ОРИГИНАЛА

АКЦИОНЕРНО ДРУЖЕСТВО * ПЛОВДИВ * ФИЛКАБ 16

CESI TEST A4/011670 oscillogram n. 48

Type certificate Original issue 03-2005

CESI TEST A4/011670 oscillogram n. 49

ВЯРНО С ОРИГИНАЛА

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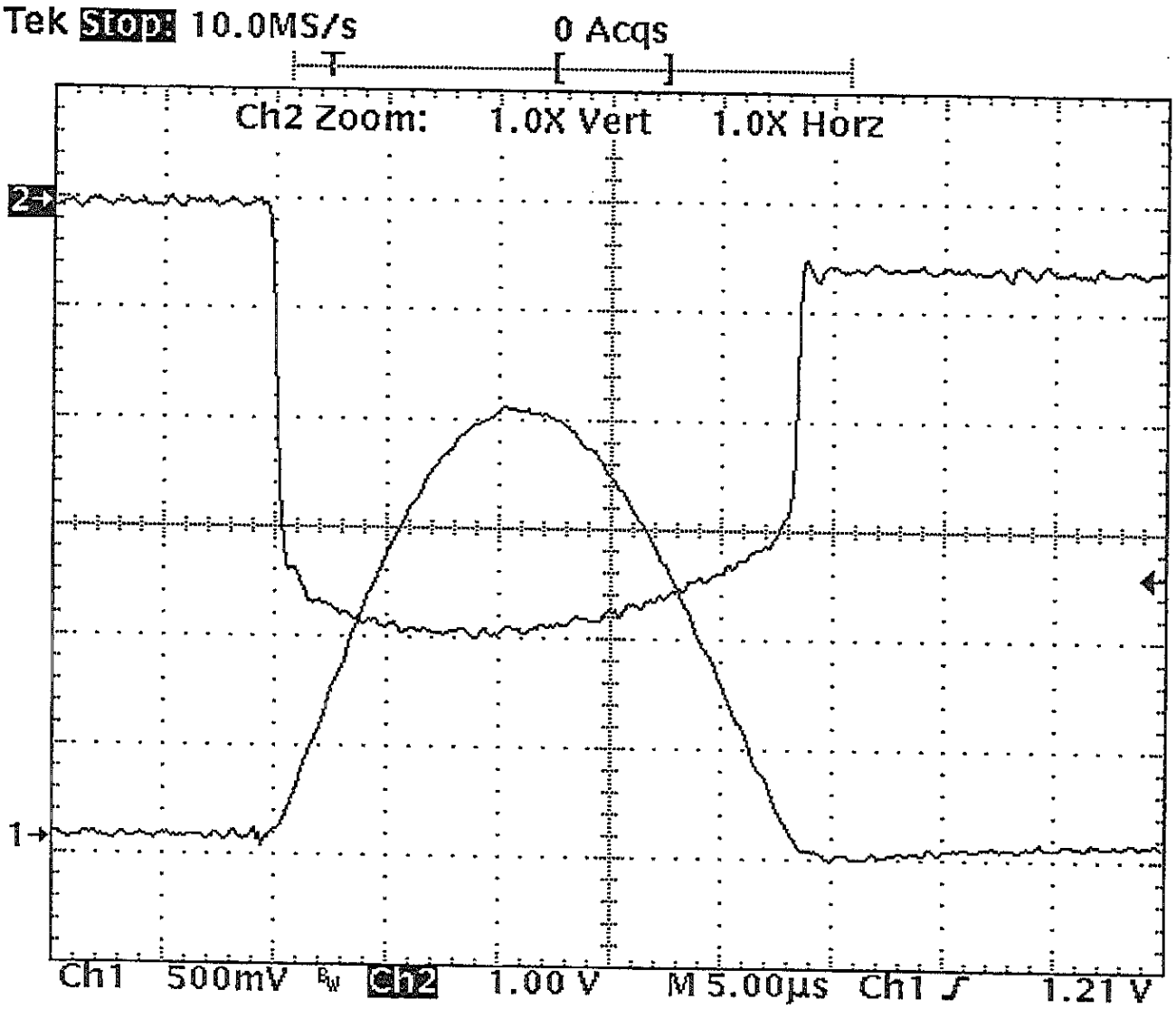

CESI TEST A4/011670 oscillogram n. 51

ВЯРНО С ОРИГИНАЛА

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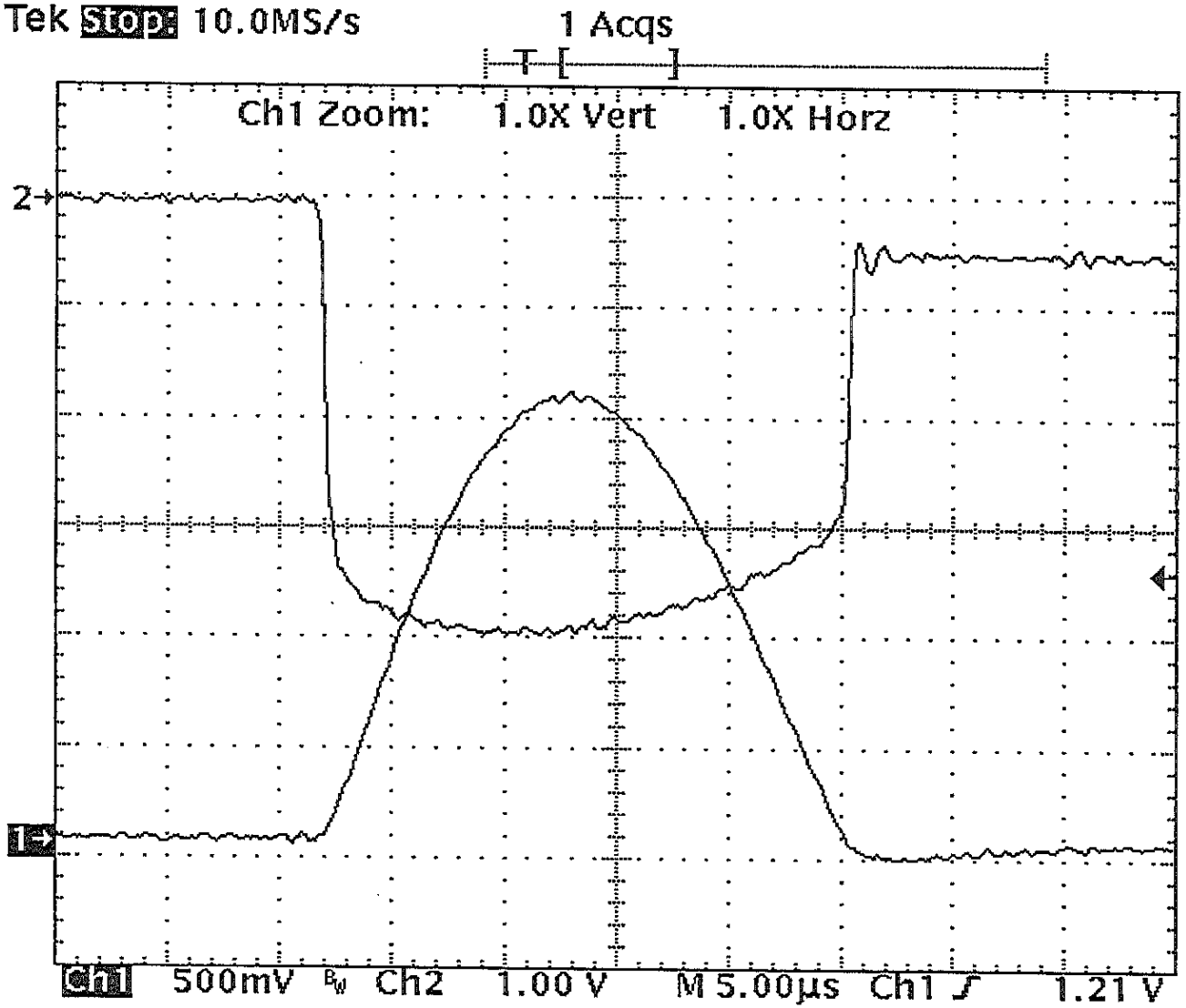
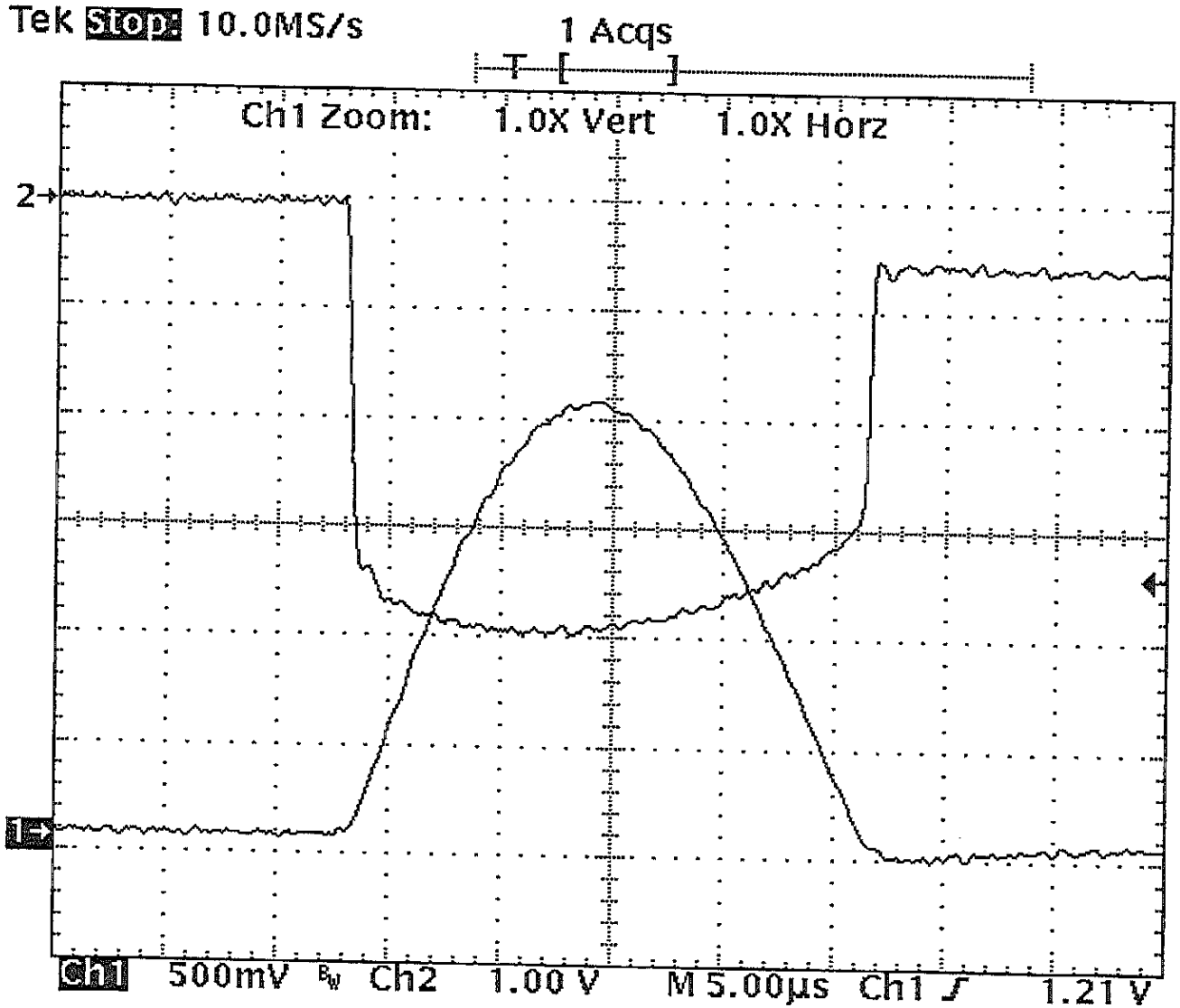


CESI TEST A4/011670 oscillogram n. 52

ВЯРНО С ОРИГИНАЛА

CESI TEST A4/011670 oscillogram n. 53



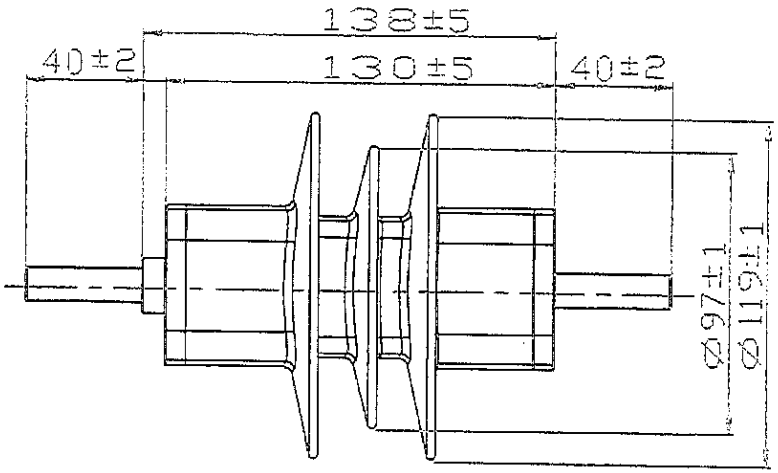
CESI TEST A4/011670

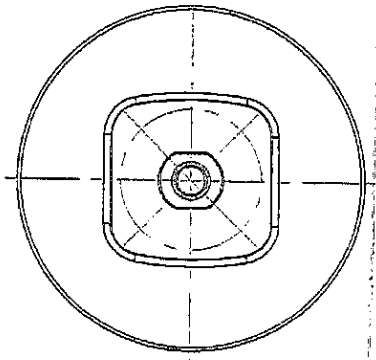
oscillogram n. 54

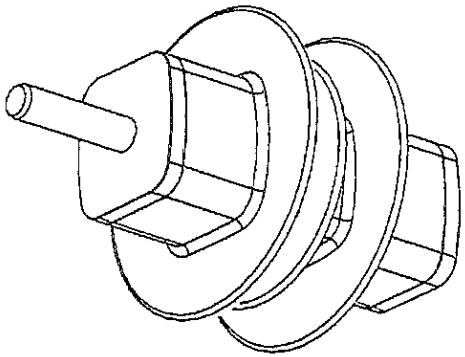
ВЯРНО С ОРИГИНАЛА

АКЦИОНЕРНО ДРУЖЕСТВО ПЛОВДИВ ФИЛКАБ 16

CESI TEST A4/011670 oscillogram n. 55







CREEPAGE=265mm
DRY ARC DIST=138mm

TYCO ELECTRONICS

ENERGY DIVISION

Southorpe EMP

SOUTHORPE EMP
BAY 100-109
SHANNON IND. EST.
SHANNON
CO. CLARE
IRELAND

DRN	J HULLIGAN	01/04/04	
CHECK			
APP			
SCALE	2:5		

PCN [redacted]-000

MAT'L

TITLE
5kV 10kA OCP2 SURGE ARRESTER PRODUCT

DRG NO OCP2-5

SHEET 1 OF 1

REV

tyco Electronics

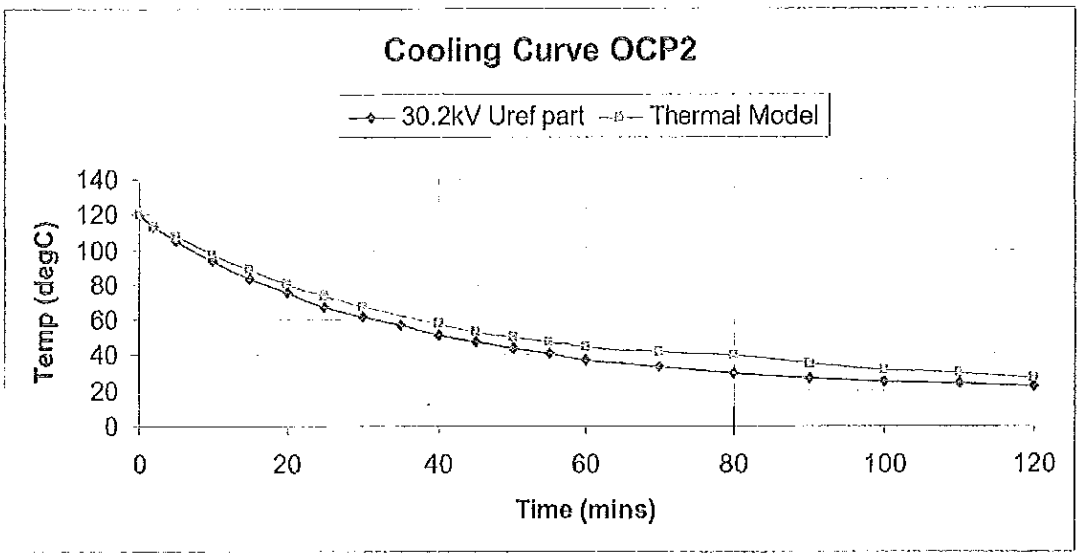
Bowthorpe EMP

Stevenson Road
Brighton, East Sussex
England BN2 0DF
Tel: + 44 (0)1273 692 591
Fax: + 44 (0)1273 676 637
http:// energy.tycoelectronics.com

TEST REPORT

041103/OCP2-THC

OCP2 Thermal behaviour



На основание чл. 2
от ЗЗЛД

PROT. n. A4/52452
CESI
TEST
COPIA
A
27 DIC. 2004

На основание чл. 2
от ЗЗЛД

ВЯРНО С ОРИГИНАЛА

ФИЛКАБ АД
ул. Коматевско шосе 92
4004 Пловдив, България
Т +359 32 277 171
Ф +359 32 671 133
office@filkab.com
www.filkab.com

Приложение 2 към Техническо предложение

ИЗИСКВАНИ ДОКУМЕНТИ ОТ ТЕХНИЧЕСКИ ИЗИСКВАНИЯ И СПЕЦИФИКАЦИИ

Приложение 2.7.

Списък на проведените изпитвания на Вентилни разрядници тип DA1 съгласно IEC 60099-4, 2006-07 изд. 2.1

№	Типово изпитване	Лаб.	№ на протокола	т. от стандарта IEC 60099-4	№ на документа
1	Изпитване на изолацията на външната обвивка	EGU	9301/A/07	10.8.2	2276
2	Тест на остатъчни напрежения	CESI	A7020275	10.8.3	2277
3	Продължителен токов импулс	CESI	A7020276	10.8.4	2278
4	Работно натоварване	CESI	A7020582	10.8.8	2279
5	Тест токове на късо съединение	CESI	A7029908	10.8.7	2280
6	Частични разряди	CESI	A7031384,A7031450	10.8.8	-
7	Усукващ момент	CESI	A7031450	10.8.9	2281
8	Устойчивост на проникване на влага	CESI	A7031384	10.8.13	2282
9	Устойчивост на климатични въздействия	EGU	7725/A/07	10.8.14	2283
10	Характеристика – време/напрежение	CESI	A7020280	6.10, Annex D	2285

ВЯРНО С ОРИГИНАЛА

АКЦИОНЕРНО ДРУЖЕСТВО * ФИЛКАБ 16 * ПЛОВДИВ *

Tyco Electronics

DA1 qualification summary
(IEC 60099-4, 2006-07 Ed 2.1)

No.	*Type Test*	*Lab*	*Test Report Number*	*60099-4 2006-07 Ed. 2.1*	*PPR Number*
1	Insulation withstand tests on the arrester housing	EGU	9301/A/07	10.8.2	2276
2	Residual voltage tests	CESI	A7020275	10.8.3	2277
3	Long-duration current impulse withstand test	CESI	A7020276	10.8.4	2278
4	Operating duty tests	CESI	A7020582	10.8.5	2279
5	Short-circuit tests	CESI	A7029908	10.8.7	2280
6	Internal partial discharge tests	CESI	Refer to A7031384 and A7031450	10.8.8	-
7	Test of the bending moment	CESI	A7031450	10.8.9	2281
8	Moisture Ingress Test	CESI	A7031384	10.8.13	2282
9	Weather Ageing Test	EGU	7725/A/07	10.8.14	2283
10	Power –frequency voltage versus time characteristics on an arrester	CESI	A7020280	6.10, Annex D	2285

All type tests were carried out at independent accredited test laboratories:

- EGU - HV laboratory, Prague Czech Republic
- CESI - HV laboratory, Milan, Italy

For further information contact: surgearresters@tycoelectronics.com

ВЯРНО С ОРИГИНАЛА

АКЦИОНЕРНО ДРУЖЕСТВО * ФИЛКАБ 16 * ПЛОВДИВ *

DA1 - Distribution Surge Arrester
Bending Moment
Type Test Report

Tyco Electronics

Our commitment. Your advantage.

Tyco Electronics Bowthorpe EMP

Test Report

Type	**DA1**
PPR Number	**PPR-2276**
Test Specification	Insulation withstand tests on the arrester housing IEC 60099-4 (2006-07) Ed. 2.1

Test Information:

Laboratory	EGU
Date	16/11/2007
External Test Ref	9301/A/07
Test Performed by	M. Brosch
Test Approved by	V. Sklenicka

Tyco Approvals:

R&D Manager
Brendan Normoyle

Date 28/11/2007

На основание чл. 2
от ЗЗЛД

Product Manager

Brian McGowan

Date 28/11/2007

For further information contact:
Tyco Electronics Energy Division
Bay 100-109
Shannon Industrial Estate
Co. Clare, Ireland
Tel:+ 353-61-472885
Fax: + 353-61-472676
Email: mvsurgearresters@tycoelectronics.com

E G U - H V Laboratory a. s.

High voltage testing laboratory

Areál výzkumných ústavů 267, Praha 9, Běchovice

ilac-MRA

L 1029

ACCREDITED TESTING LABORATORY No.: 1029
Accredited by Czech Accreditation Institute, o.p.s.

CUSTOMER:
Tyco Electronics
Shannon Industrial Estate
100-104 BAY
SHANNON
IRELAND

ORDER No.:
2250310811
2250310637

DATE OF TEST:
from 2007-09-10 till 2007-10-09

TEST No.:
9301/07

TEST REPORT

No.: 9301/A/07

TEST OBJECT: SURGE ARRESTERS

TYPE : DA1

PRODUCER: TYCO Electronics

TEST STANDARD: IEC 60060-1:1989, IEC60099-4:2006-07 Ed. 2.1

На основание чл. 2
от ЗЗЛД

In Prague 9 - Běchovice: 2007-11-16

ВЯРНО С ОРИГИНАЛА

АКЦИОНЕРНО ДРУЖЕСТВО * ПЛОВДИВ * ФИЛКАБ 16

TEST OBJECTS:

SURGE ARRESTERS

Housing Type	DA1-xxA	DA1-xxB	DA1-xxC	DA1-xxE	DA1-xxF	DA1-xxG
Arrester Drawing	DA1-xxA-N0N0N0	DA1-xxB-N0N0N0	DA1-xxC-N0N0N0	DA1-xxE-N0N0N0	DA1-xxF-N0N0N0	DA1-xxG-N0N0N0
Figure	1	2	3	4	5	6
Sheds	4	5	7	9	10	12
Product Length (mm)	147	172	222	272	297	347
Creepage (mm)	329	404	553	702	776	925
Dry arc distance (mm)	152	177	227	277	302	352

DATE OF DELIVERY

2007-09-07 and 2007-09-20

SCHEDULE OF TESTS

Insulation withstand tests on the arrester housing

1. Lightning impulse voltage test — IEC 60099-4, clause 8.2.6
2. Wet power-frequency voltage test — IEC 60099-4, clause 8.2.8

TEST PROCEDURE

1. Dry lightning impulse voltage test

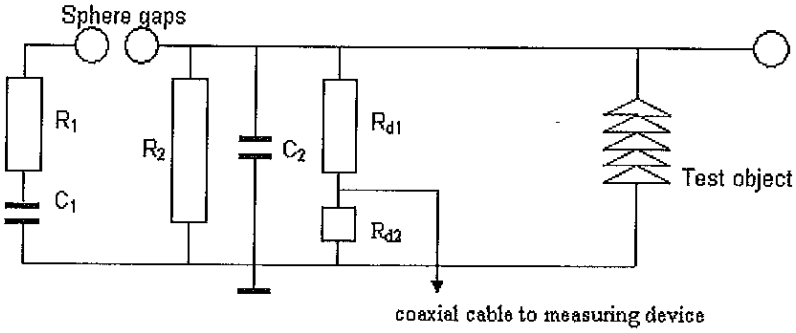
Test was carried out in compliance with IEC 60099-4, clause 8.2.6 and in compliance with IEC 60060-1, clause 20.1.2.

Fifteen impulses of both positive and negative polarities were applied to the test object at the given lightning impulse voltage. This procedure was repeated to determine the maximum withstand lightning impulse voltage level (U_{MWLI}).

The wave shape of the test lightning impulse is given in Figure 7.

The test arrangement is given on Figure 8.

Testing and measuring devices:



impulse generator TuR Dresden 750 kV, 30 kJ
R_{d1}/R_{d2} - resistive divider Haefely, type R 800, serial No. 554333
measuring system Haefely Trench, type HiAS 743, serial No. 080649-01
measuring system for atmosferic conditions, COMET, D4130, serial No. 04900257

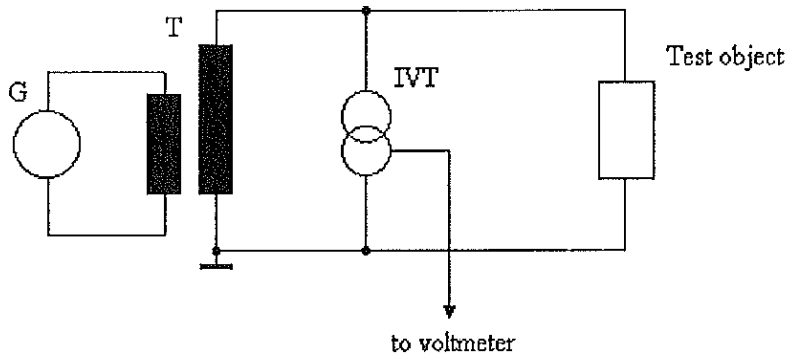
2. Wet power-frequency voltage test

Test was carried out in compliance with IEC 60099-4, clause 8.2.8 and in compliance with IEC 60060-1, clause 17.

The one minute maximum wet power-frequency withstand voltage (U_{MW}) was measured according to IEC 60060-1, clause 17.1.

The test arrangement is given on Figure 9.

Testing and measuring devices:



G - synchronous generator BEZ Bratislava 6 kV, 1300 kVA, 50 Hz
T - test transformer Fischer-Köln, 3-6/250 kV, 250 kVA
IVT – instrument voltage transformer Škoda, 380/√3 kV / 100/√3 V, serial No. 917355
universal voltmeter Siemens, type MU 15, serial No. 879953
measuring system for atmosferic conditions, COMET, D4130, serial No. 04900257
digital stop-watch Speedo

UNCERTAINTY OF MEASUREMENT

QUANTITY	UNCERTAINTY k=2	
Lightning impulse voltage	U_m	1,5 %
	T_1	2,6 %
	T_2	2,2 %
Power-frequency voltage	1,7 %	
Temperature	0,7 °C	
Air pressure	0,04 kPa	
Relative humidity	4 %	
Time	0,2 %	

The reported expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor k = 2, which for a normal distribution corresponds to a coverage probability of approximately 95 %.

LIST OF SYMBOLS

All measured voltages are corrected for the standard reference atmosphere according to IEC 60060-1, clause 11.

All measured data including values of atmospheric conditions as well as corresponding correction factors are given in the following tables where:

b atmospheric pressure (kPa),
t air temperature (°C),
RH relative humidity (%),

k_1 air density correction factor,
k_2 humidity correction factor,
K_t atmospheric correction factor,

r.i. average value of rainfall intensity (mm/min):
v.c. - vertical component,
h.c. - horizontal component,
ρ water resistivity (Ωm)

U_{MWLI} dry lightning impulse maximum withstand voltage (kV), corresponding to standard reference atmosphere

U_{MW} wet power-frequency maximum withstand voltage (kV), corresponding to standard reference atmosphere (test duration - 60 s).

TEST RESULTS

1. Dry lightning impulse voltage test

Table 1

Type of the arrester	DA1-xxA		DA1-xxB		DA1-xxC		DA1-xxE		DA1-xxF		DA1-xxG	
Polarity	+	-	+	-	+	-	+	-	+	-	+	-
b (kPa)	99,1		97,7		98,1		98,2		98,2		98,2	
t (°C)	17,4		20,9		18,1		19,4		19,4		19,4	
RH (%)	58,2		58,1		59,2		52,9		52,9		52,9	
k_1	0,987	0,987	0,961	0,961	0,975	0,975	0,971	0,971	0,971	0,971	0,971	0,971
k_2	1,000	1,000	1,000	1,000	1,000	1,000	1,000	0,999	0,999	0,998	0,997	0,997
K_t	0,987	0,987	0,961	0,961	0,975	0,975	0,972	0,970	0,970	0,969	0,969	0,969
U_{MWLI}	**187**	**134**	**160**	**161**	**220**	**194**	**244**	**229**	**256**	**247**	**273**	**275**

2. Wet power-frequency voltage test

Table 2

Type of the arrester		DA1-xxA	DA1-xxB	DA1-xxC	DA1-xxE	DA1-xxF	DA1-xxG
b (kPa)		99,5	99,0	99,0	99,0	99,0	99,0
t (°C)		17,1	18,7	18,7	18,7	18,7	18,7
RH (%)		65,0	67,5	67,5	67,5	67,5	67,5
r.i.	v.c.	1,2	1,0	1,0	1,0	1,0	1,0
(mm/min)	h.c.	1,0	1,0	1,0	1,0	1,0	1,0
ρ (Ωm)		104	99	99	99	99	99
k_1		0,992	0,990	0,984	0,982	0,982	0,982
k_2		1,000	1,000	1,000	1,000	1,000	1,000
K_t		0,992	0,990	0,984	0,982	0,982	0,982
U_{MW}		**50**	**56**	**66**	**92**	**102**	**122**

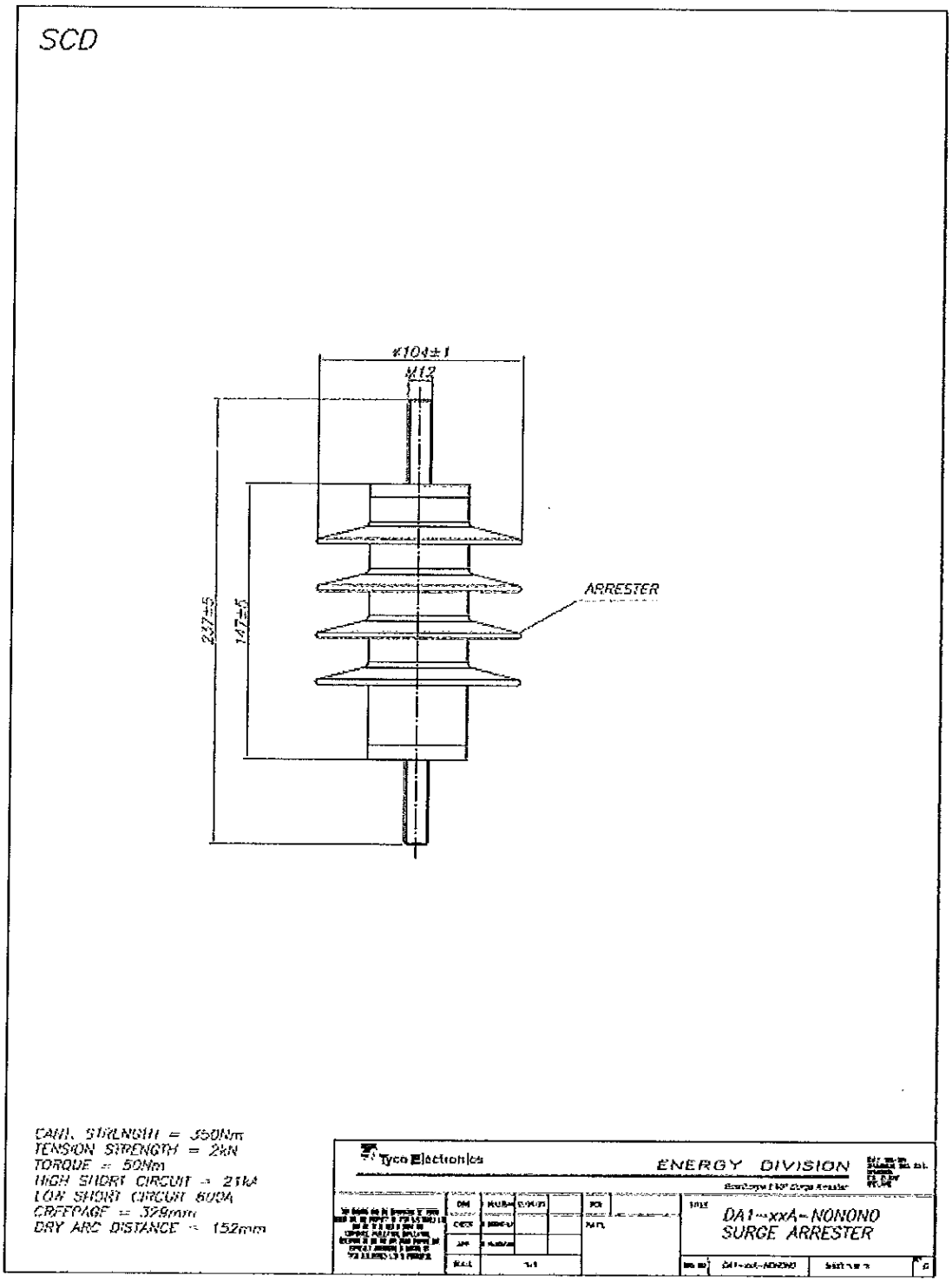


Figure 1
Surge arrester type DA1-xxA, drawing No DA1-xxA-N0N0N0

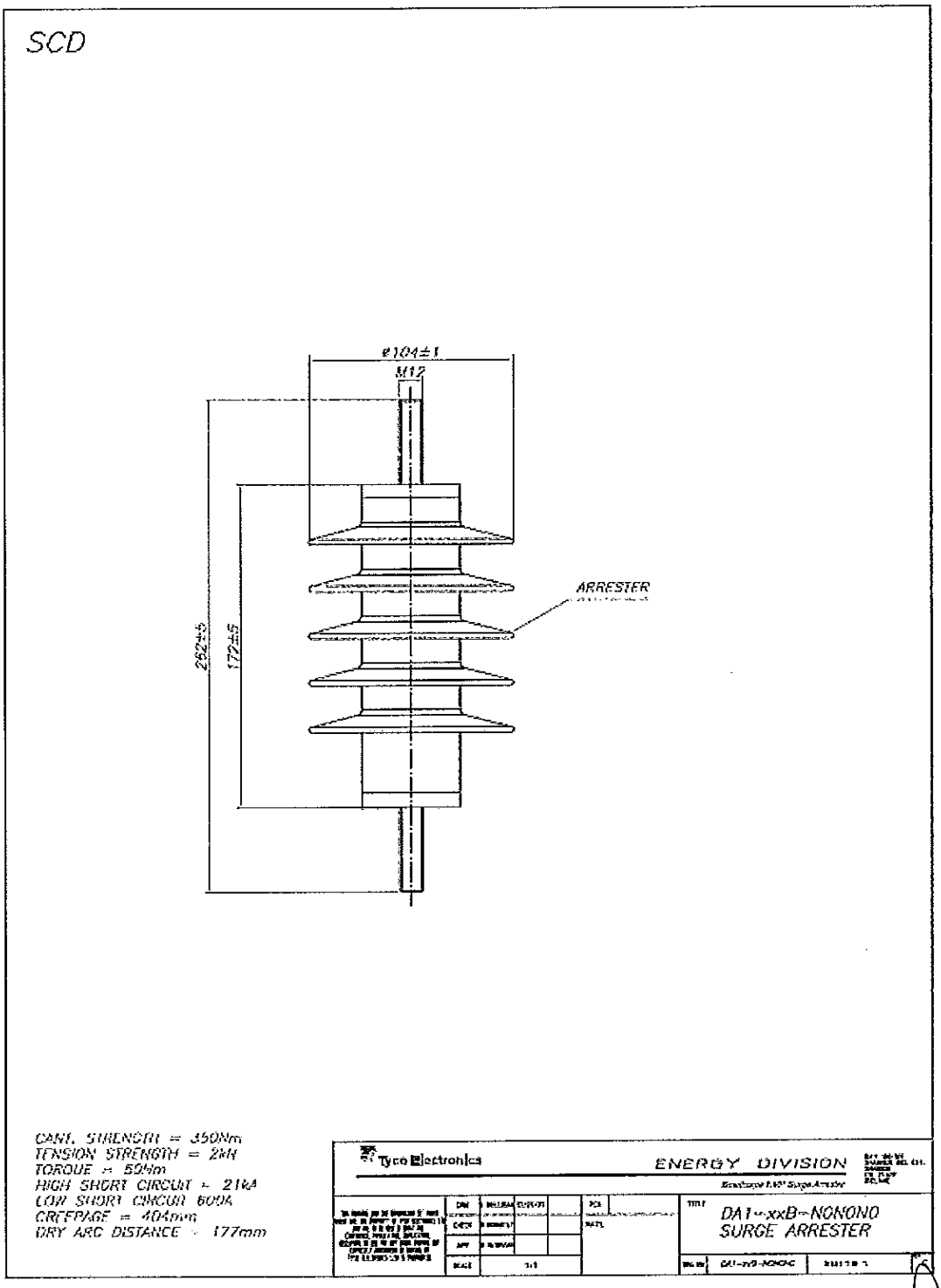


Figure 2
Surge arrester type DA1-xxB, drawing No DA1-xxB-N0N0N0

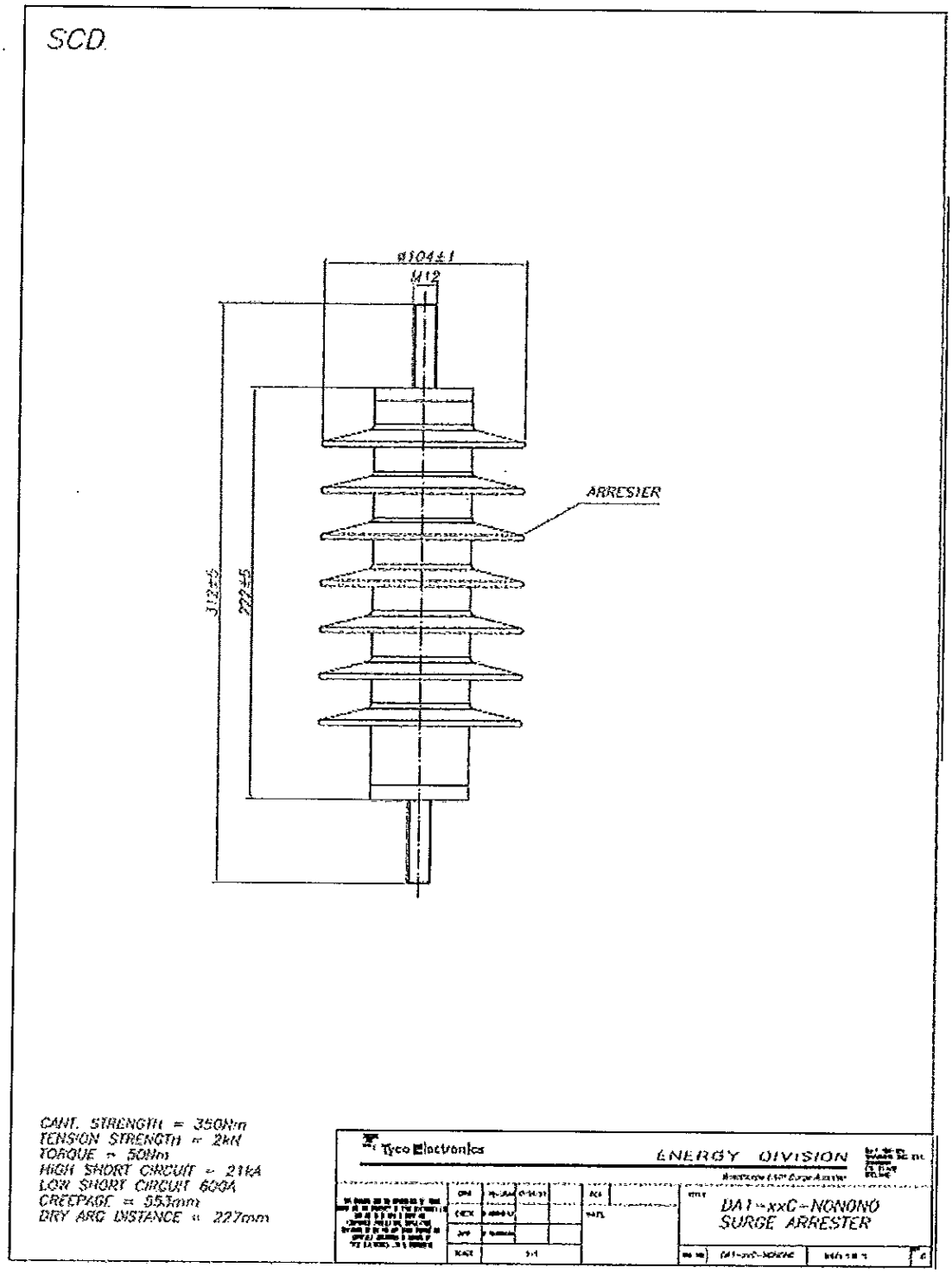


Figure 3
Surge arrester type DA1-xxC, drawing No DA1-xxC-N0N0N0

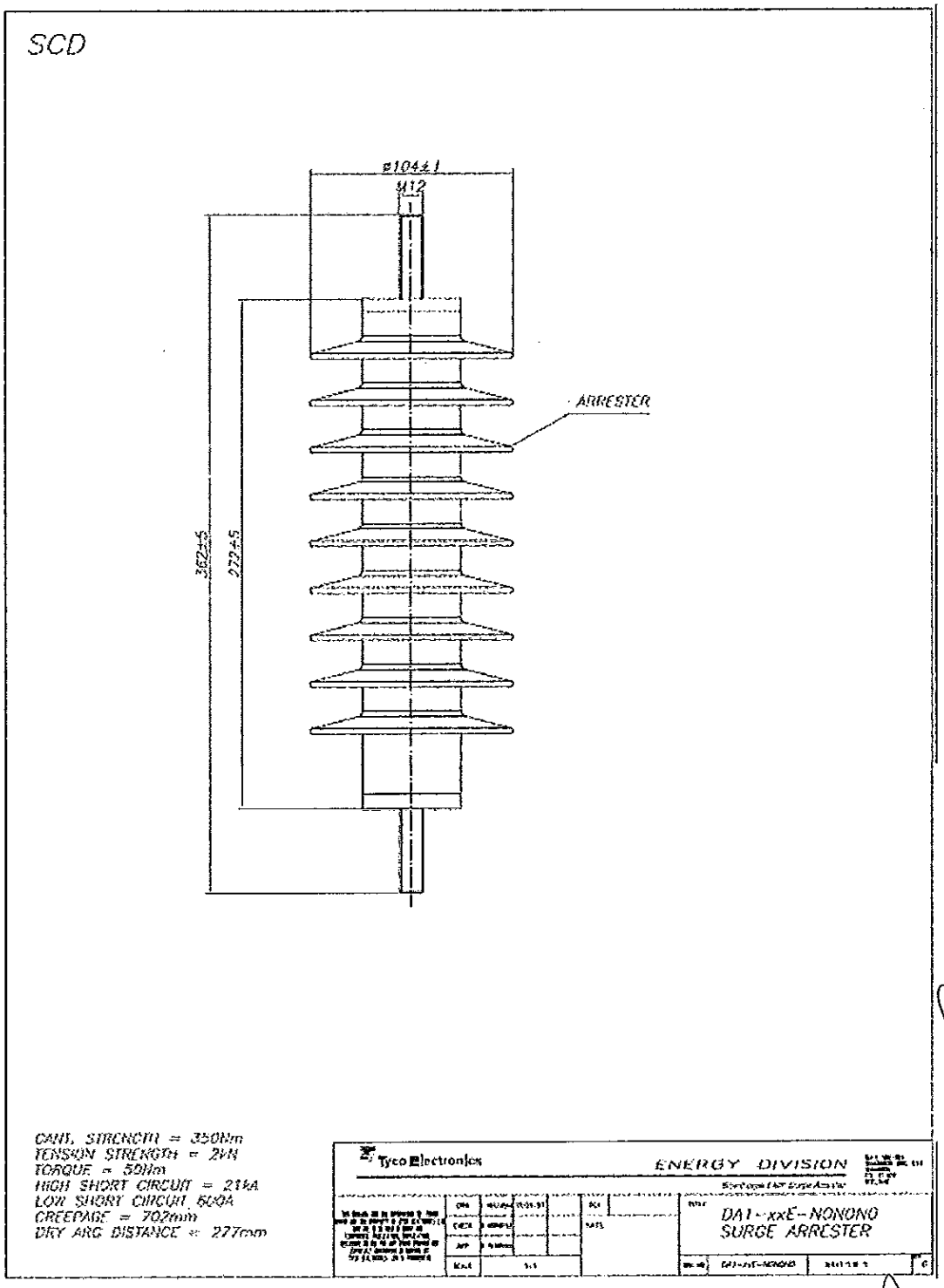


Figure 4
Surge arrester type DA1-xxE, drawing No DA1-xxE-N0N0N0

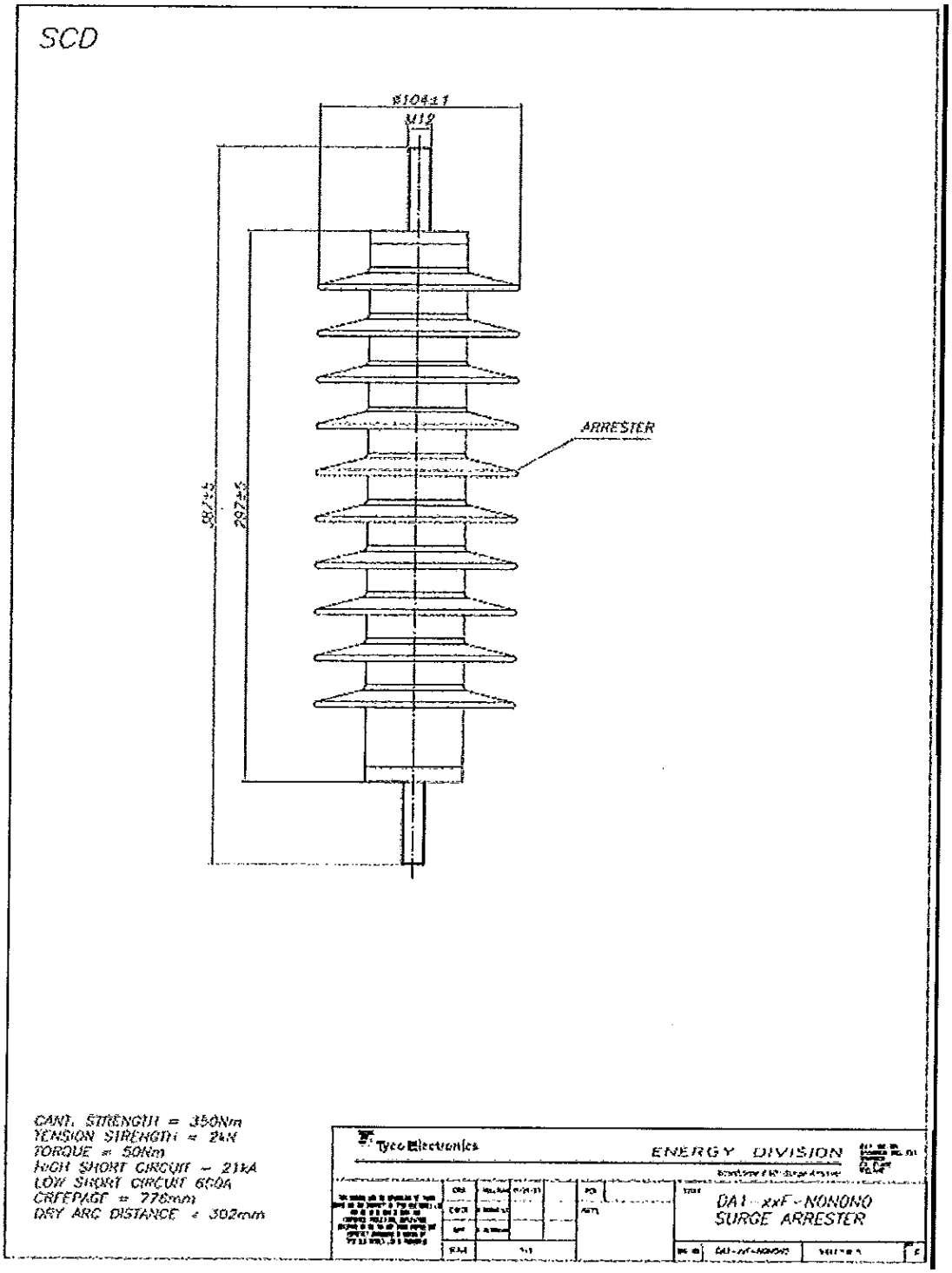


Figure 5
Surge arrester type DA1-xxF, drawing No DA1-xxF-N0N0N0

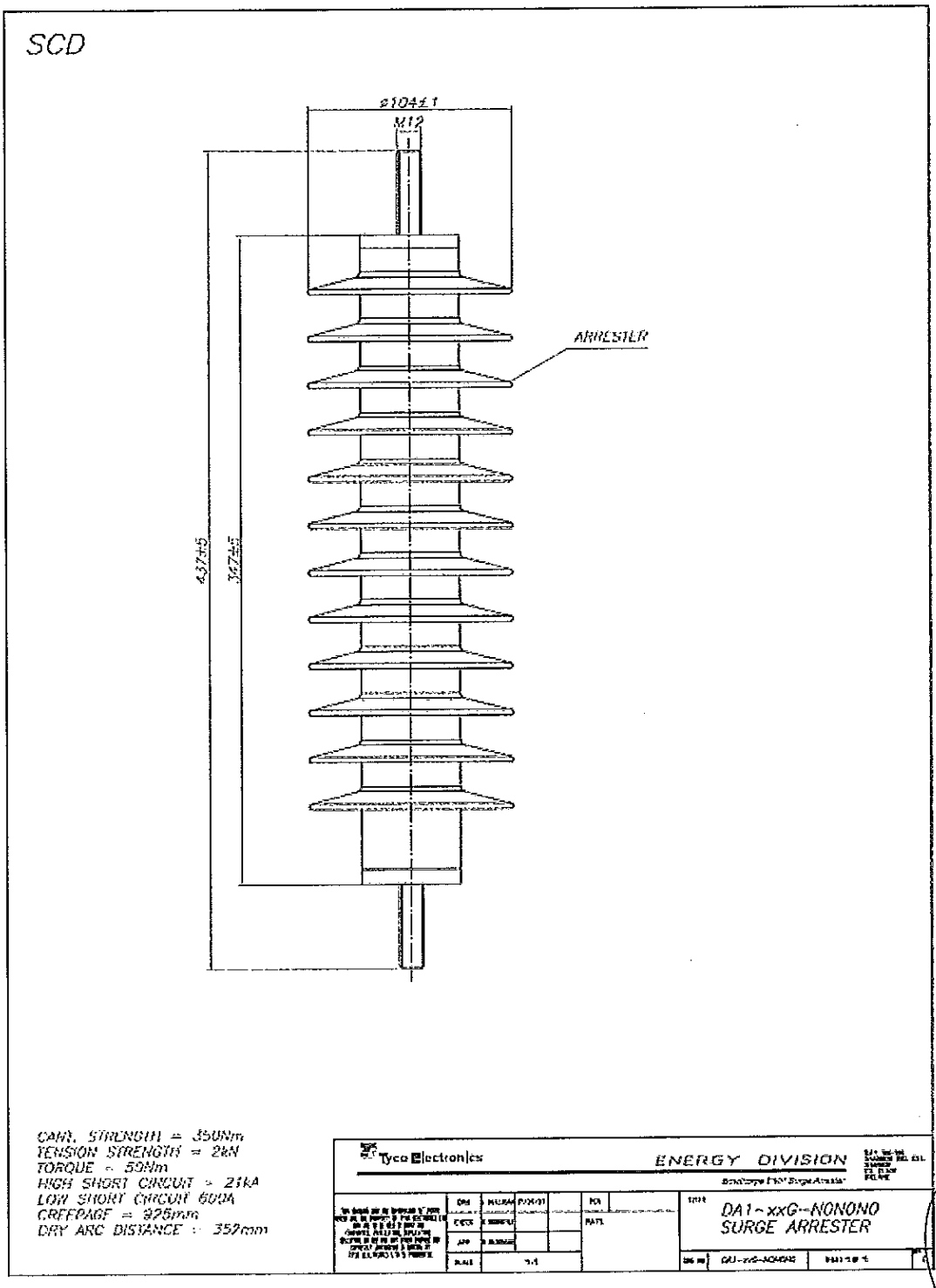
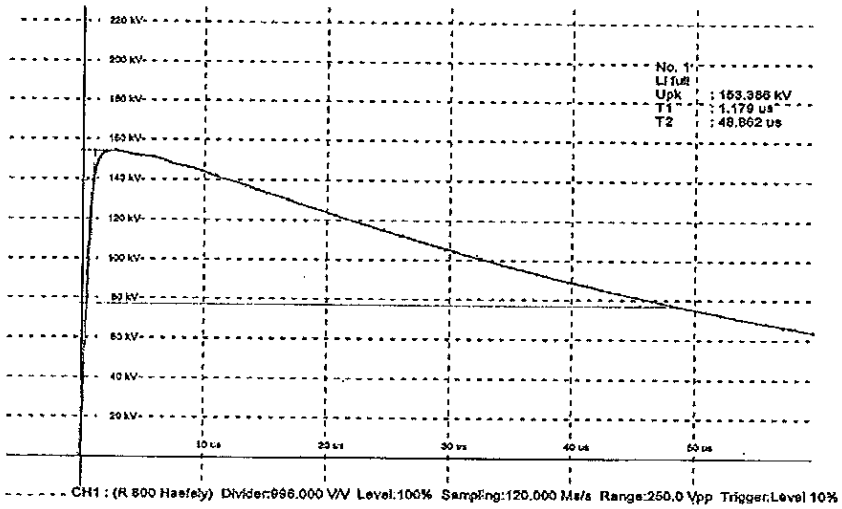


Figure 6
Surge arrester type DA1-xxG, drawing No DA1-xxG-N0N0N0

TYCO ELECTRONICS, SHANNON / OMEZOVAC "B" (IEC 99-4)

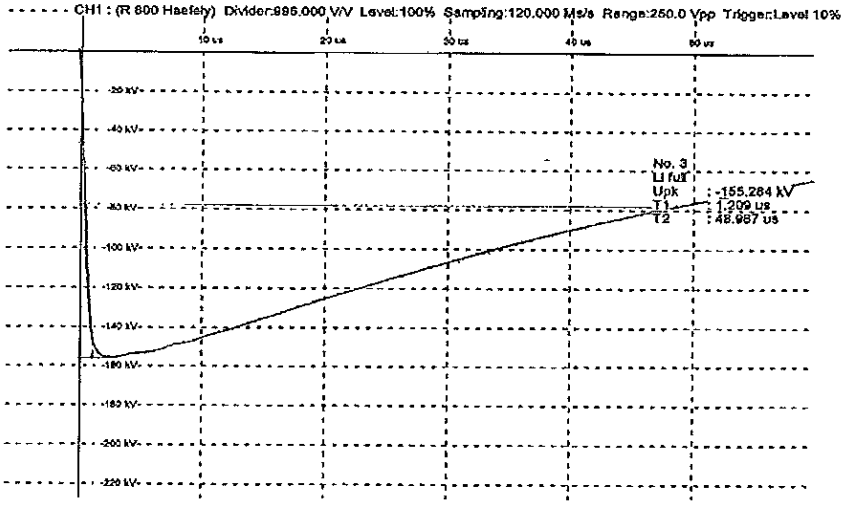
18/09/2007 10:03:41



No. 1
LI full
Upk : 153.386 kV
T1 : 1.179 us
T2 : 48.862 us

TYCO ELECTRONICS, SHANNON / OMEZOVAC "B" (IEC 99-4)

18/09/2007 10:21:45



No. 3
LI full
Upk : -155.284 kV
T1 : 1.209 us
T2 : 48.967 us

Figure 7
The wave shape of the test lightning impulse 1,2/50 μs

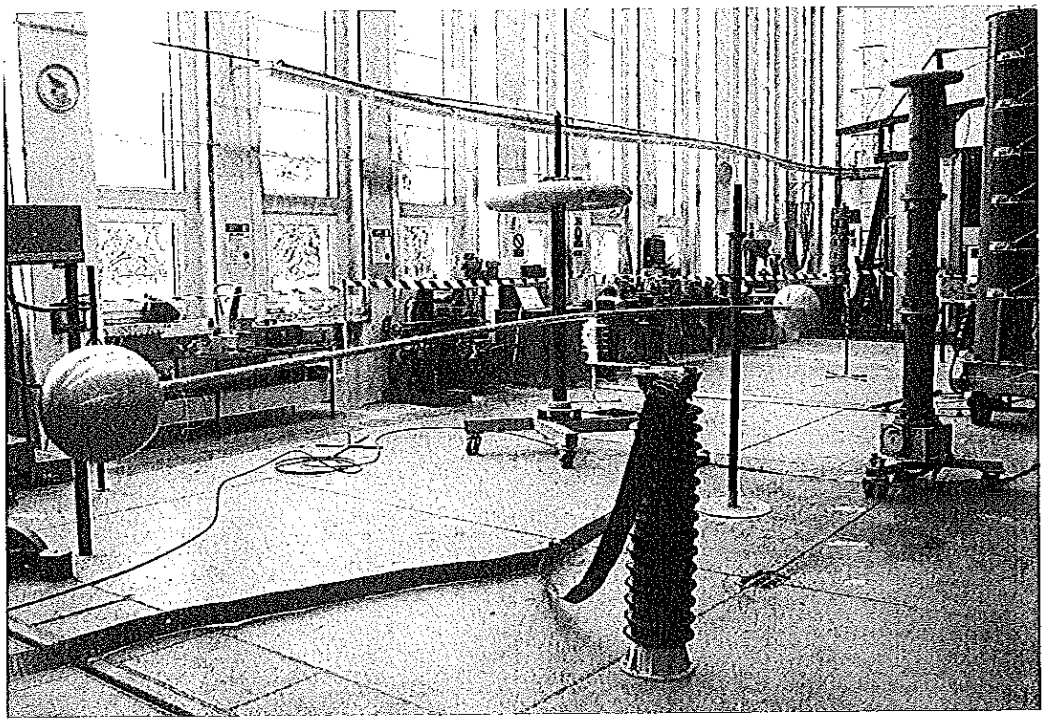


Figure 8
Surge arrester type DA1
test arrangement under the dry lightning impulse voltage test

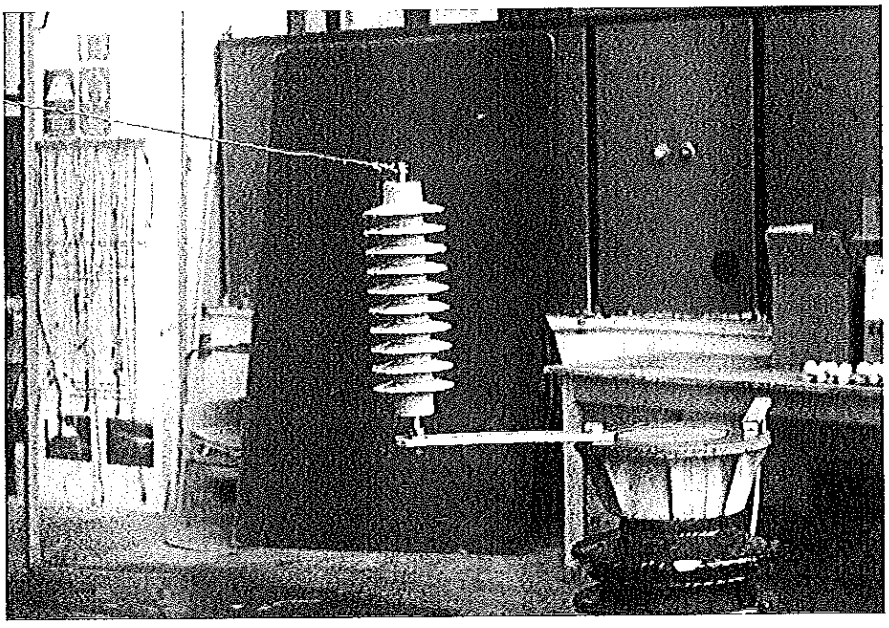
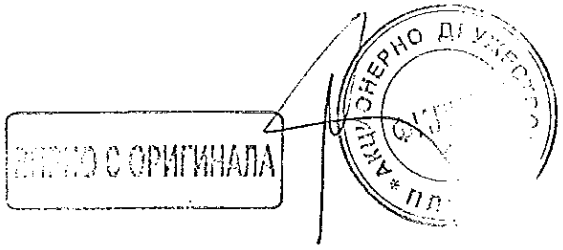


Figure 9
Surge arrester type DA1
test arrangement under the wet power-frequency voltage test


ВЕРНО С ОРИГИНАЛА

DA1 - Distribution Surge Arrester
Residual Voltage Tests
Type Test Report

Tyco Electronics

Our commitment. Your advantage.

Tyco Electronics

Bowthorpe EMP

Test Report

Type	**DA1**
PPR Number	**PPR-2277**
Test	Residual voltage tests
Specification	IEC 60099-4 (2006-07) Ed. 2.1

Test Information:

Laboratory	CESI
Date	3/09/2007
External Test Ref	A7020275
Report Prepared by	M. Gregori
Test Verified by	A. Sironi
Test Approved by	V. Scarioni

Tyco Approvals:

R&D Manager

Brendan Normoyle Date 28/11/2007

Product Manager

Brian McGowan Date 28/11/2007

На основание чл. 2
от ЗЗЛД

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Co. Clare, Ireland
Tel:+ 353-61-472885
Fax: + 353-61-472676
Email: mvsurgearresters@tycoelectronics.com

Client	TYCO Electronics – Shannon (Ireland)
Tested equipment	Polymer–housed metal-oxide surge arrester section type DA1
Tests carried out	Residual voltage tests
Standards/Specifications	IEC 60099-4 – Edition 2.1 (2006-07)
Test date	**From** July 25 , 2007 **to** July 30, 2007

No. of pages	17	**No. of pages annexed**	23
Issue date	September 03, 2007		
Prepared	Unit LABORATORIES		
Verified	Unit LABORATORIES		
Approved	Area COMPONENTS -		

На основание чл. 2
от ЗЗЛД

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Sperimentale Italiano
Giacinto Motta spa

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Fax +39 0221255440
http://www.cesi.it

Capitale sociale 8 550 000 Euro
interamente versato
Codice fiscale e numero
iscrizione CCIAA 00793580150

Registro Imprese di Milano
Sezione Ordinaria
N. R.E.A. 429223
P.I. IT00793580150

ВЯРНО С ОРИГИНАЛА

АКЦИОНЕРНО ДРУЖЕСТВО ФИЛКАБ 16 ПЛОВДИВ

Tests witnessed by: -

Identification of the object: Requested

The Manufacturer guarantees that the tested object is manufactured according to the submitted drawing.
CESI checked that this drawing adequately represents in shape and dimensions the essential details and the parts of the tested object.
This drawing, identified by CESI and numbered A7027907 No. 1, is annexed to this document.

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

Test location an

CESI testing team

Test laboratory

Activity code

На основание чл. 2
от ЗЗЛД

ВЯРНО С ОРИГИНАЛА

content	page	test date
Test object characteristics	4	
Photograph of the test sample	5	
Reference standard	6	
Test carried out	6	
Test object identification	6	
Test procedure	7	
Lightning impulse residual voltage test	from page 8 to 9	July 25, 2007
Switching impulse residual voltage test	10	July 25, 2007
Steep current impulse residual voltage test (measurement of inductive error)	11	July 30, 2007
Steep current impulse residual voltage test	12	July 30, 2007
Reference voltage test	13	July 30, 2007
Technical data	from page 14 to 17	

Pages annexed:
oscillograms n. 22 pages

Document annexed:
Tyco Electronics drawing n.DA1-6.5-NONONO, CESI n. A7027907 - n. 1 page

Test object characteristics

type: Polymer-housed metal-oxide surge arrester sections

electrical characteristics (assigned by the client)

Manufacturer's name	TYCO Electronics – Shannon (Ireland)
type	DA1
Nominal discharge current – I_n [kA]	10
Rated voltage – U_r [kV]	1,045 x Uref
Continuous operating voltage - U_c [kV]	0,836 x Uref
Reference current - $I_{ref.}$ [mA]	5,0
Line discharge class	1
Standard rated frequency - [Hz]	50/60
year of manufacture	2007

View of the test object

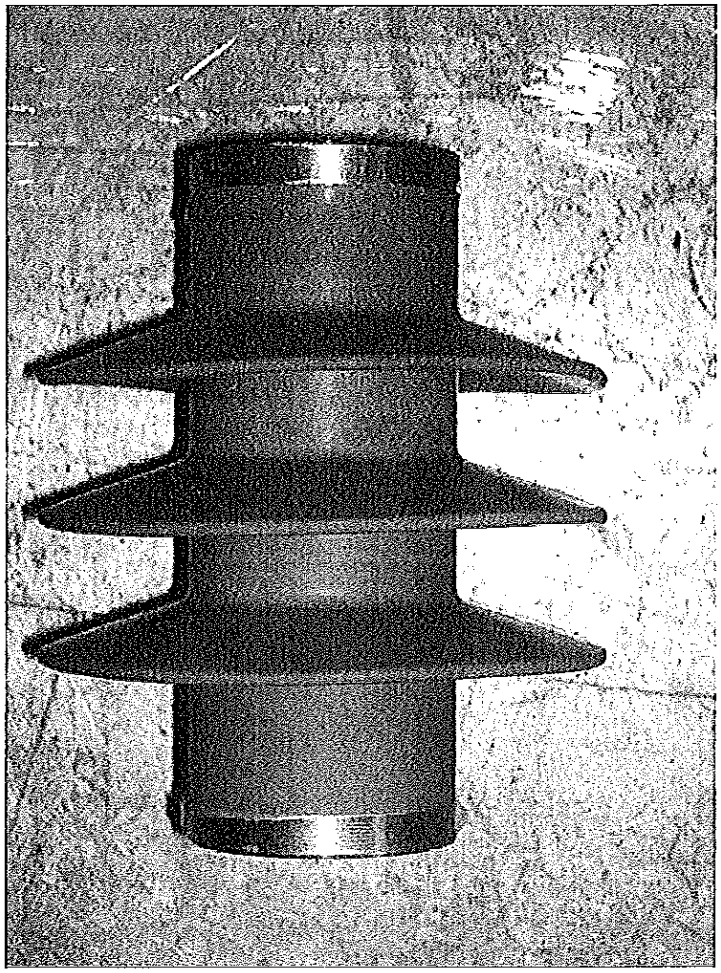


Photo no. 1

Polymer-housed metal-oxide surge arrester section

Reference Standard

IEC 60099-4 – Edition 2.1 (2006-07) - Clause 10.8.3
"Metal-oxide surge arresters without gaps for a.c. system"

Test carried out	Number of sample tested
Lightning impulse residual voltage test	3
Switching impulse residual voltage test	
Steep current impulse residual voltage test	

Test object identification

Test object name	Identification of test sample (given by CESI)
Polymer- housed metal-oxide surge arrester section	RV1-RV2-RV3

Test procedure

The following tests have been carried out on the same three samples

a) Lightning impulse residual voltage test
- wave-shape 8/20 µs
- peak current I_n = 10 kA, 0,5 I_n = 5 kA & 2 I_n =20 kA

b) Switching impulse residual voltage test
- wave-shape front time in the range 30µs to 100µs, tail time twice the virtual time
- peak current 125 A & 500 A (according to table 4 of the reference standard)

c) Steep current impulse residual voltage test
- wave-shape front time equal to 1 µs, tail time less than 20 µs
- peak current I_n = 10 kA
- note Correction of the inductive error
  The inductive error was determined replacing the surge arrester section with a metal part having the same dimensions and measuring the voltage across the metal part in this condition..
  Being the inductive error (peak value) in the range 2% to 20% of the measured residual voltage (peak value) the correction was applied by substracting the impulse voltage shape measured on the surge arrester section and the impulse voltage shape on the metal part.

In addition , upon client request, the reference voltage was measured at the reference current

Test result

See relevant pages .

ВЯРНО С ОРИГИНАЛА

АКЦИОНЕРНО ДРУЖЕСТВО * ФИЛКАБ 16 * ПЛОВДИВ *

Residual voltage tests

Lightning impulse residual voltage test.

Test circuit: A0120

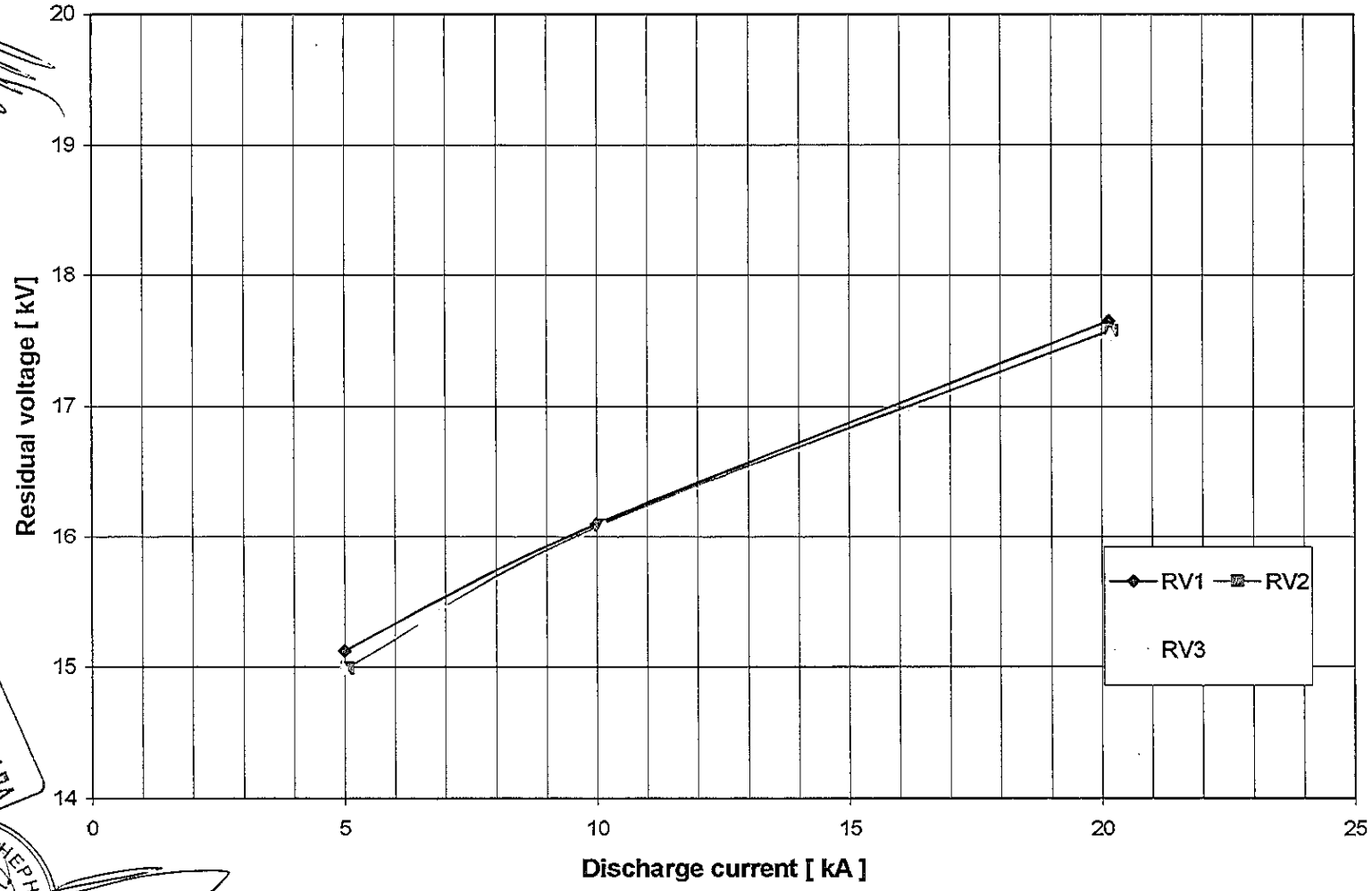
Date: July 25, 2007

Sample	Requested current	Charging voltage	Oscillogram	Current waveshape	Discharge current	Residual voltage	Lightning impulse protection level
No.		kV	No.	µs	kA	kV	kV
RV1	$0,5 \times I_n$	21,8	04	8,9/19,0	5,00	15,12	17,65
	I_n	30,5	01	8,8/18,9	10,0	16,10	
	$2,0 \times I_n$	45,7	07	8,9/19,0	20,14	17,65	
RV2	$0,5 \times I_n$	21,8	05	8,9/19,0	5,05	14,99	
	I_n	30,2	02	8,8/18,9	10,07	16,09	
	$2,0 \times I_n$	45,6	08	8,9/19,0	20,20	17,58	
RV3	$0,5 \times I_n$	21,7	06	8,9/19,0	4,96	14,99	
	I_n	30,0	03	8,8/18,9	10,15	16,08	
	$2,0 \times I_n$	45,5	09	8,9/19,0	20,17	17,55	

	Oscilloscope settings			
	Requested current	sampling division	input	Attenuation
		µs	V_{div}	
Current	$0,5 \times I_n$	5	0,5	20:10
	I_n		1,0	50:10
	$2 \times I_n$		1,0	50:10
Voltage	$0,5 \times I_n$	5	1,0	20:5
	I_n		1,0	20:5
	$2 \times I_n$		1,0	20:5

Notes:

Lightning impulse protection level



Residual voltage tests

Switching impulse residual voltage test.

Test circuit: A0122

Date: July 25, 2007

Sample	Requested current	Charging Voltage	Oscillogram	Current waveshape	Discharge current	Residual voltage	Switching impulse protection level
No.	A	kV	No.	µs	A	kV	kV
RV1	125	13,2	10	31,0/72,0	131	12,06	12,81
	500	18,0	13	33,0/71,0	500	12,80	
RV2	125	13,2	11	31,0/72,0	119	12,02	
	500	18,0	14	33,0/71,0	501	12,81	
RV3	125	13,1	12	31,0/72,0	123	12,11	
	500	18,0	15	33,0/71,0	498	12,80	

	Oscilloscope settings		
	sampling division	Input	attenuation
	µs	V_{div}	
(125 A) Current	20	0,5	10:10
Voltage		1,0	20:5
(500A) Current		0,5	50:10
Voltage		0,5	20:5

Notes:

ВЕРНО С ОРИГИНАЛА

Residual voltage tests

Steep current impulse residual voltage test.

Measurement of the inductive error

Test circuit: A0121B

Date: July 30, 2007

Sample	Charging voltage	Oscillogram	Current waveshape	Discharge current	Peak voltage	Inductive error
No.	kV	No.	µs	kA	V	%
aluminium blocks	35,0,	16	0,95/2,1	10,2	530	2÷20 (1)

	Oscilloscope settings		
	sampling division	input	attenuation
	µs	V_{div}	
Current	1	2	x 10
Voltage		1,0	---

Notes: (1) correction is required

ВЯРНО С ОРИГИНАЛА

АКЦИОНЕРНО ДРУЖЕСТВО ФИЛКАБ 16 ПЛОВДИВ

Residual voltage tests

Steep current impulse residual voltage test.

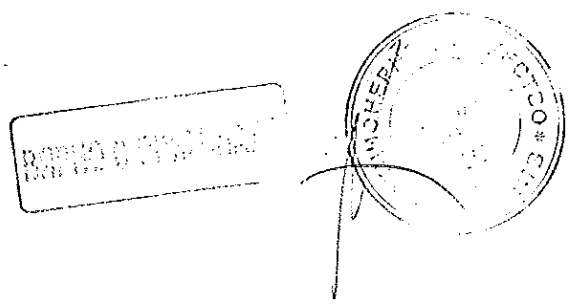
Test circuit: A0121B

Date: July 30, 2007

Sample	Charging voltage	Oscillogram	Current waveshape	Discharge current	Residual voltage	Steep current impulse protection level
No.	kV	No.	µs	kA	kV	kV
RV1	34,1	17	0,95/2,1	10,00	16,93	16,93
RV2	34,1	18		10,11	16,83	
RV3	34,1	19		10,03	16,73	

	Oscilloscope settings		
	sampling division	input	attenuation
	µs	V_{div}	
Current	1	2	x10
Voltage		5,0	---

Notes:



Residual voltage tests

Reference voltage test

Test circuit: A019

Date: July 30, 2007

Sample No. RV1						
oscillogram	voltage	current	current	current	power	3rd harmonic amplitude
No.	kV	+ mA_{cr}	- mA_{cr}	mA_{rms}	W	µA
20	6,82	3,10	5,03	1,55	6,54	---

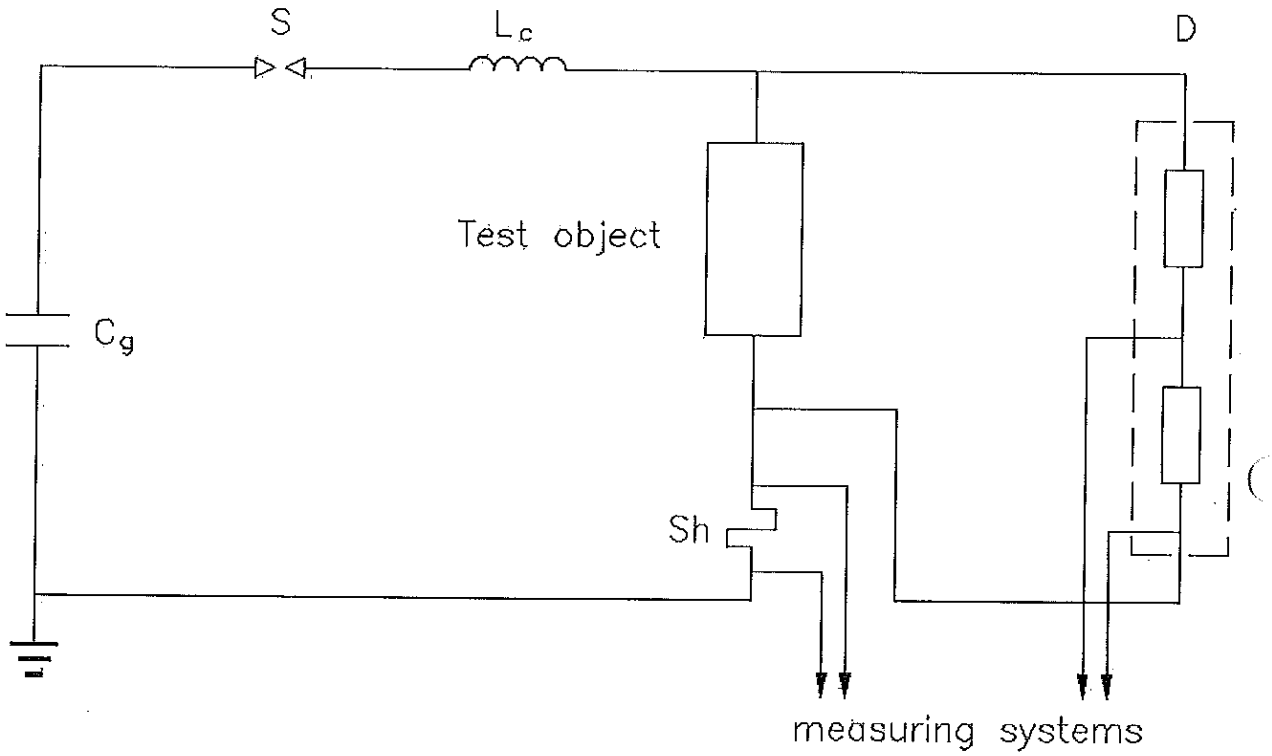
Sample No. RV2						
oscillogram	voltage	current	current	current	power	3rd harmonic amplitude
No.	kV	+ mA_{cr}	- mA_{cr}	mA_{rms}	W	µA
21	6,78	3,08	5,10	1,53	6,59	---

Sample No. RV3						
oscillogram	voltage	current	current	current	power	3rd harmonic amplitude
No.	kV	+ mA_{cr}	- mA_{cr}	mA_{rms}	W	µA
22	6,77	3,20	5,09	1,51	6,64	---

ВЯРНО С ОРИГИНАЛА

АКЦИОНЕРНО ДРУЖЕСТВО ФИЛКАБ 16 ПЛОВДИВ

Circuit A0120



Impulse generator

No. of stages	1
Cg	4,98 µF
Lc	10 µH
S	- Spark-gap

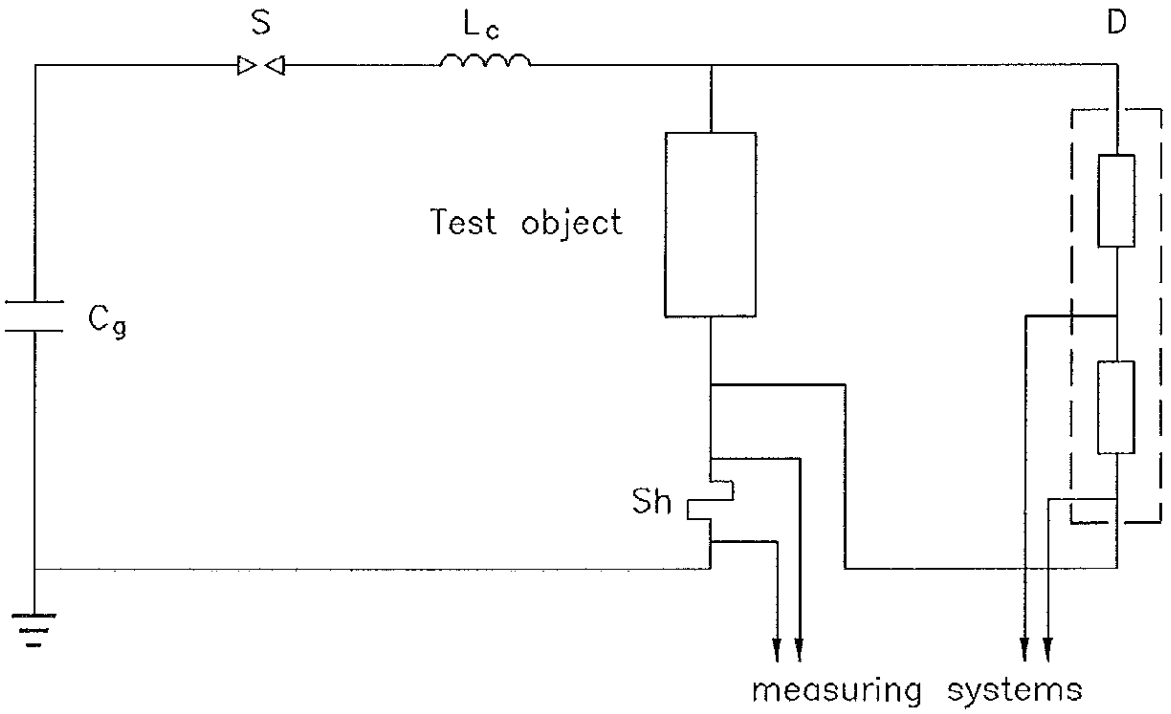
Voltage measuring system.

D	- Voltage divider SAGI; CESI No.11120
	- Electro optical system CESI No.11521/522;
OSC	- Oscilloscope type TEKTRONIX TDS 540A; CESI No.13217 (on channel No.2)

Current measuring system

Sh	- Current shunt CESI No.6042; R= 2 mΩ; peak current= 250 kA
	- Electro optical system CESI No.11517/518;
OSC	- Oscilloscope type TEKTRONIX TDS 540A; CESI No.13217 (on channel No.1)

Circuit A0122



Impulse generator

No. of stages	1
Cg	2,49µF
Lc	120 µH
S	- Spark-gap

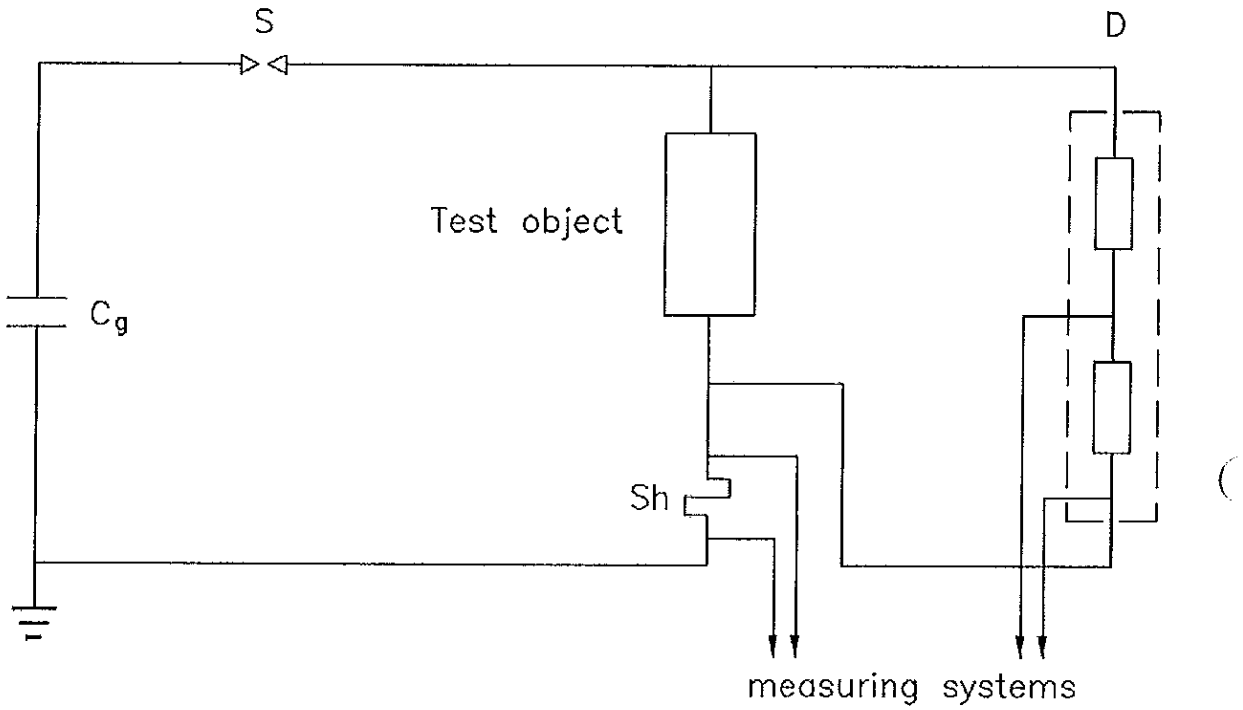
Voltage measuring system.

D	- Voltage divider SAGI; CESI No.13027
	- Electro optical system CESI No 11521/522
OSC	- Oscilloscope type TEKTRONIX TDS 540A; CESI No.13217 (on channel No.2)

Current measuring system

Sh	- Current shunt CESI No.6037; R= 20 mΩ; peak current= 250 kA
	- Electro optical system CESI No11517/518
OSC	- Oscilloscope type TEKTRONIX TDS 540A; CESI No.13217 (on channel No.1)

Circuit A0121B



Impulse generator

No. of stages	1
Cg	0,500 µF

S - Spark-gap

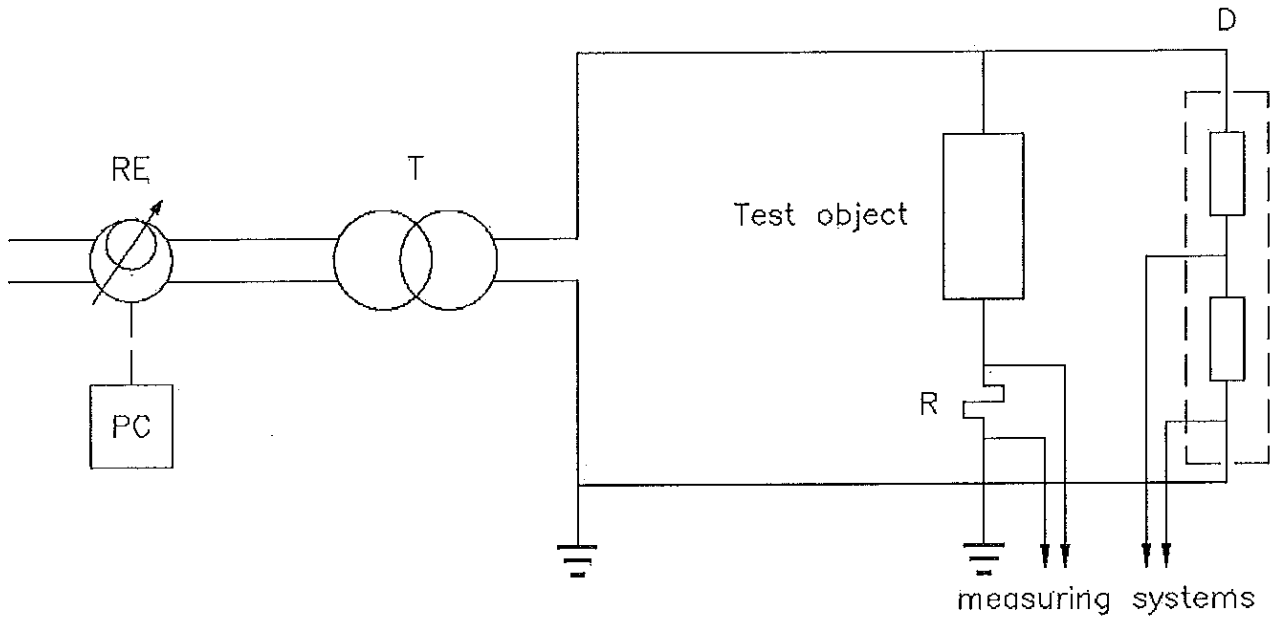
Voltage measuring system.

D	- Voltage divider SAGI; CESI No.11120
OSC	- Oscilloscope type TEKTRONIX TDS 540A; CESI No.13217 (on channel No.2)

Current measuring system

Sh	- Current Pearson CESI No.6042; 0,01 V x A
OSC	- Oscilloscope type TEKTRONIX TDS 540A; CESI No.13217 (on channel No.1)

Circuit A0019



Power frequency supply

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

Current measuring system

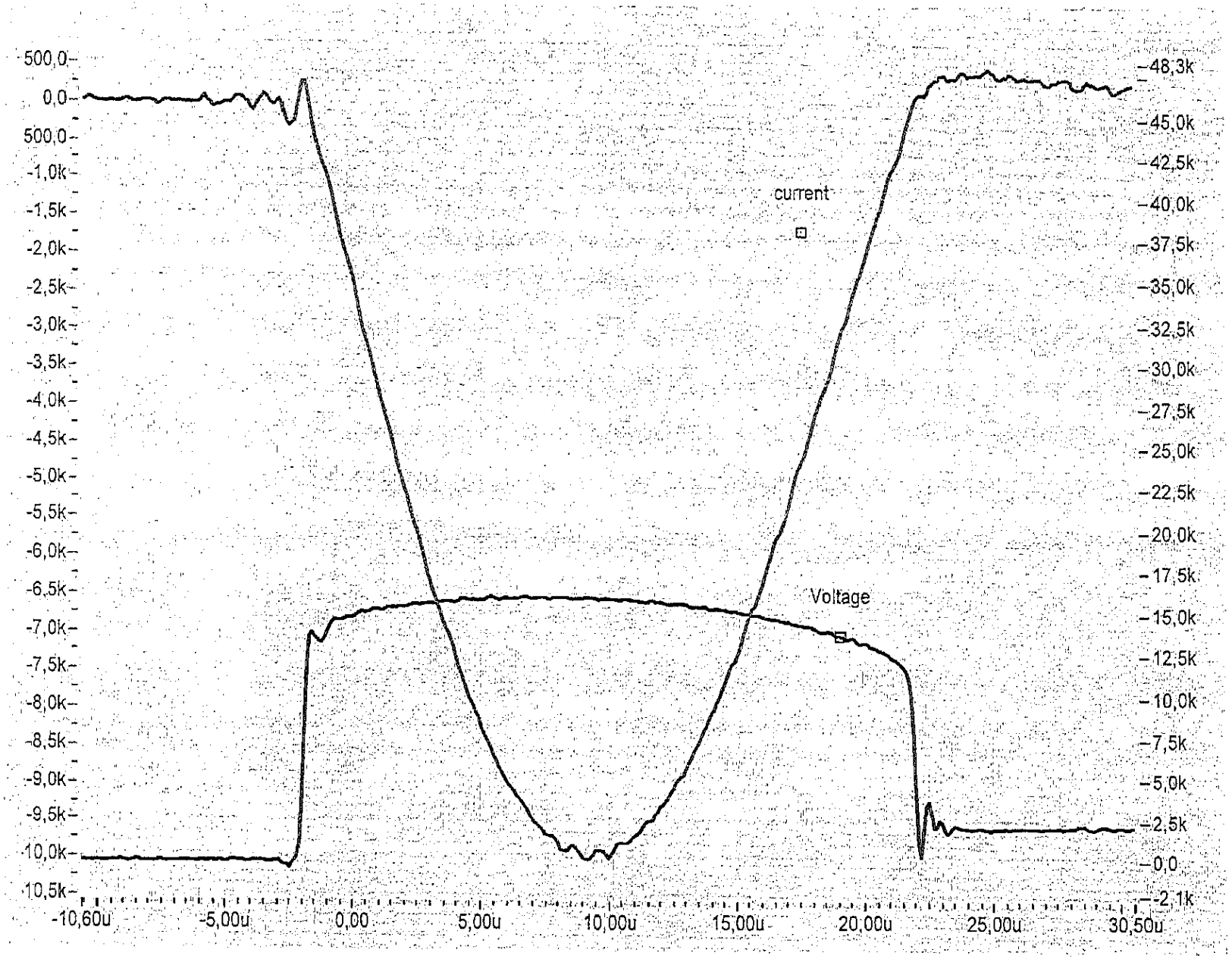
R - Current shunt CESI No.31120; R= 941,4 Ω
- Electro optical system CESI No. -- ; attenuation
OSC - Oscilloscope type SONY TEKTRONIX RTD 710; CESI No.6318

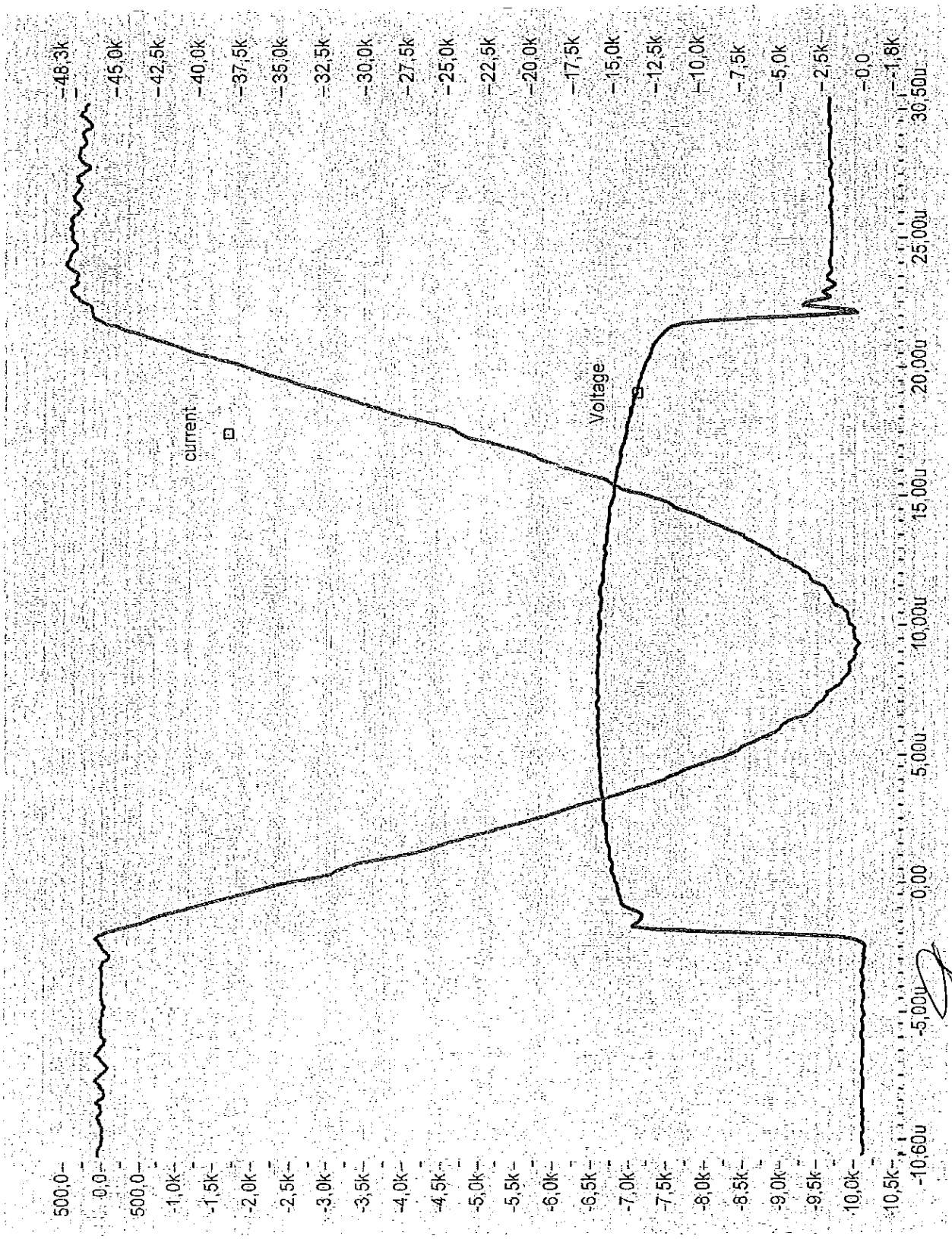
Voltage measuring system

D - Voltage divider SAGI; CESI No.11120
- Electro optical system CESI No.11521/1522; attenuation 50:5
OSC - Oscilloscope type SONY TEKTRONIX RTD 710; CESI No.6318

ВЯРНО С ОРИГИНАЛА

CESI A7020275 Oscillogram n. 1

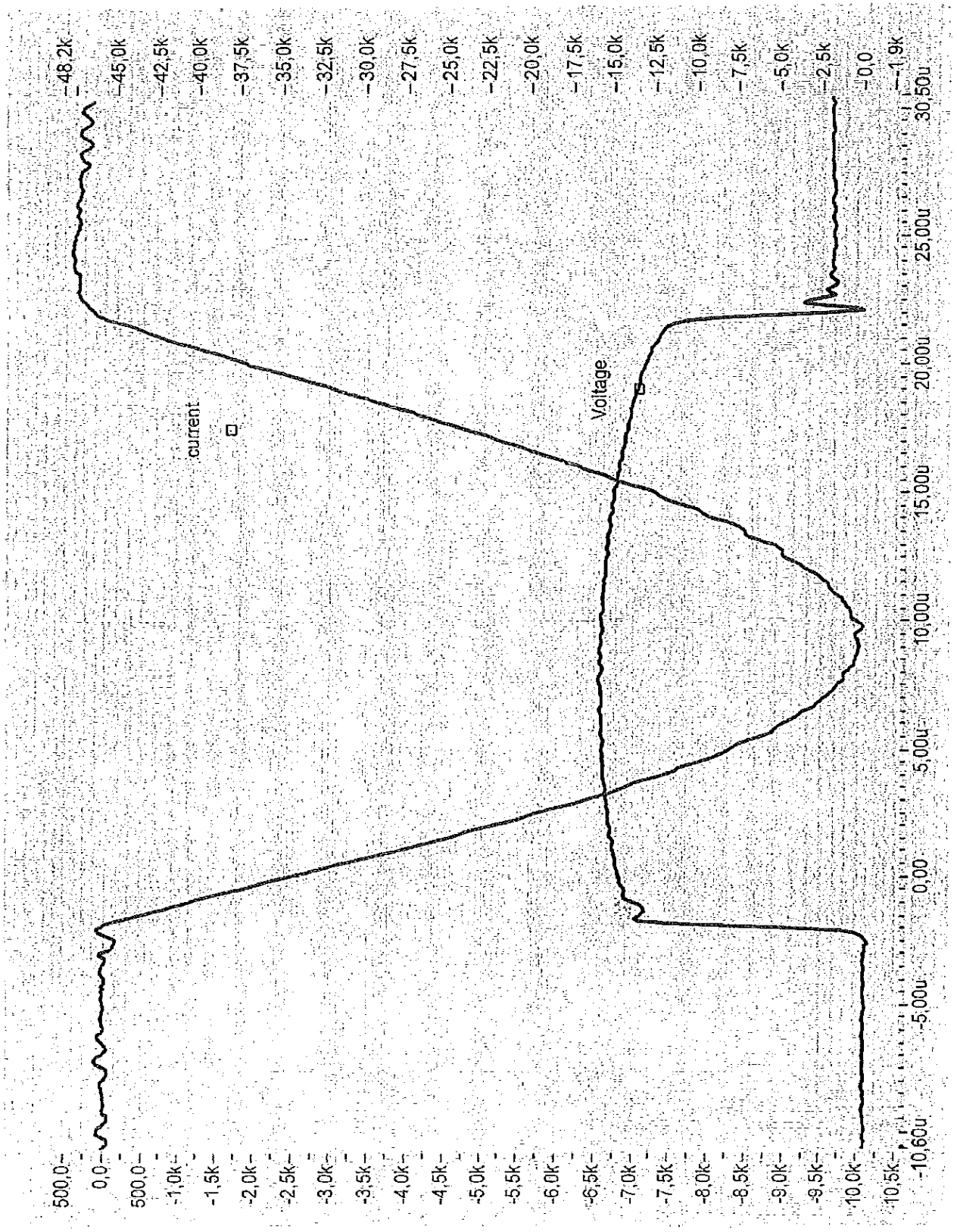




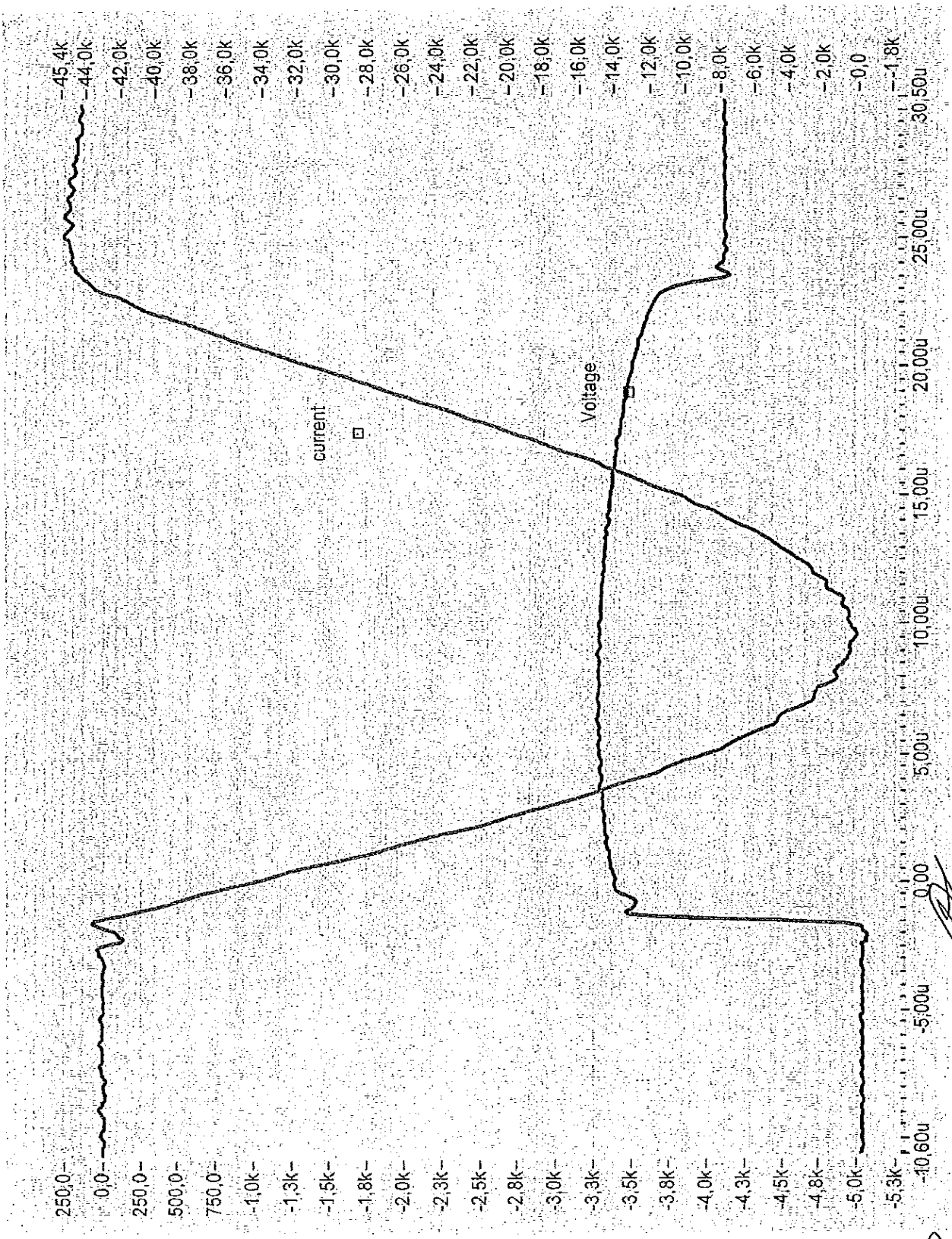
CESI A7020275 Oscillogram n. 2

ВЯРНО С ОРИГИНАЛА

АКЦИОНЕРНО ДРУЖЕСТВО * ПЛОВДИВ * ФИЛКАБ 16



CESI A7020275 Oscillogram n. 3

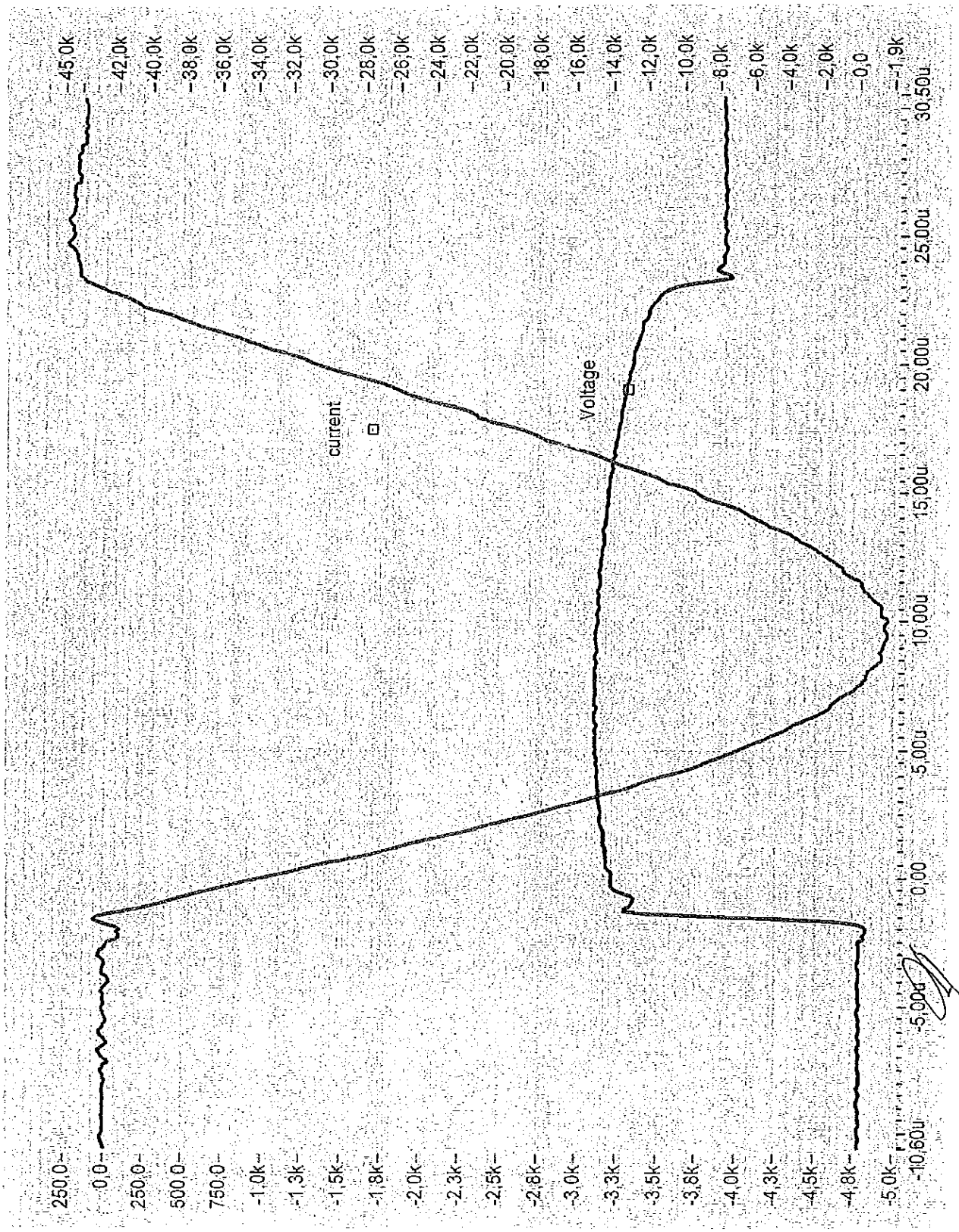


CESI A7020275 Oscillogram n. 4

ВЯРНО С ОРИГИНАЛА

АКЦИОНЕРНО ДРУЖЕСТВО * ПЛОВДИВ * ФИЛКАБ 16

CESI A7020275 Oscillogram n. 5

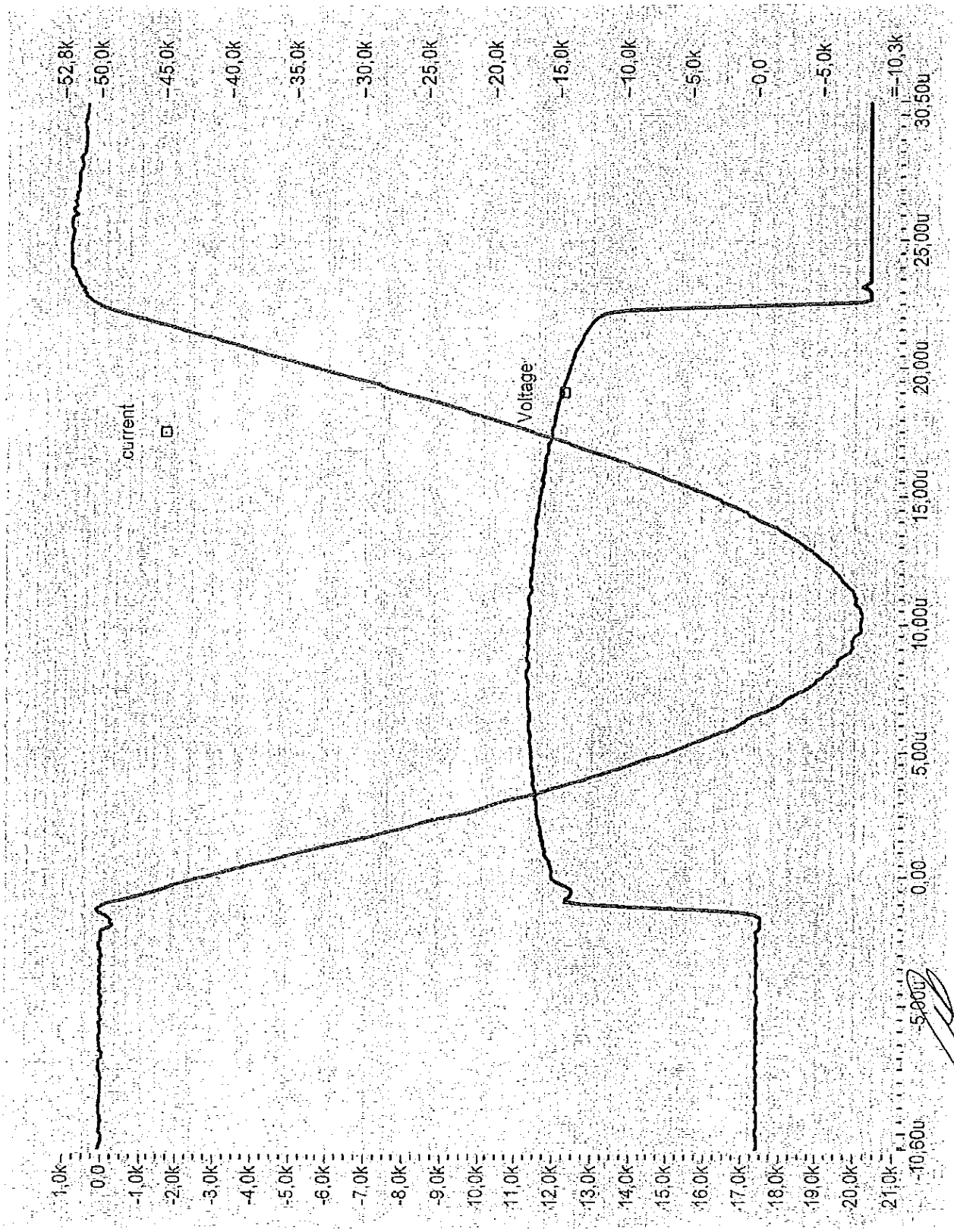


CESI A7020275 Oscillogram n. 6

ВЯРНО С ОРИГИНАЛА

МЕЖДУНАРОДНО ДРУЖЕСТВО * ПЛОВДИВ * ФИЛКАБ 16

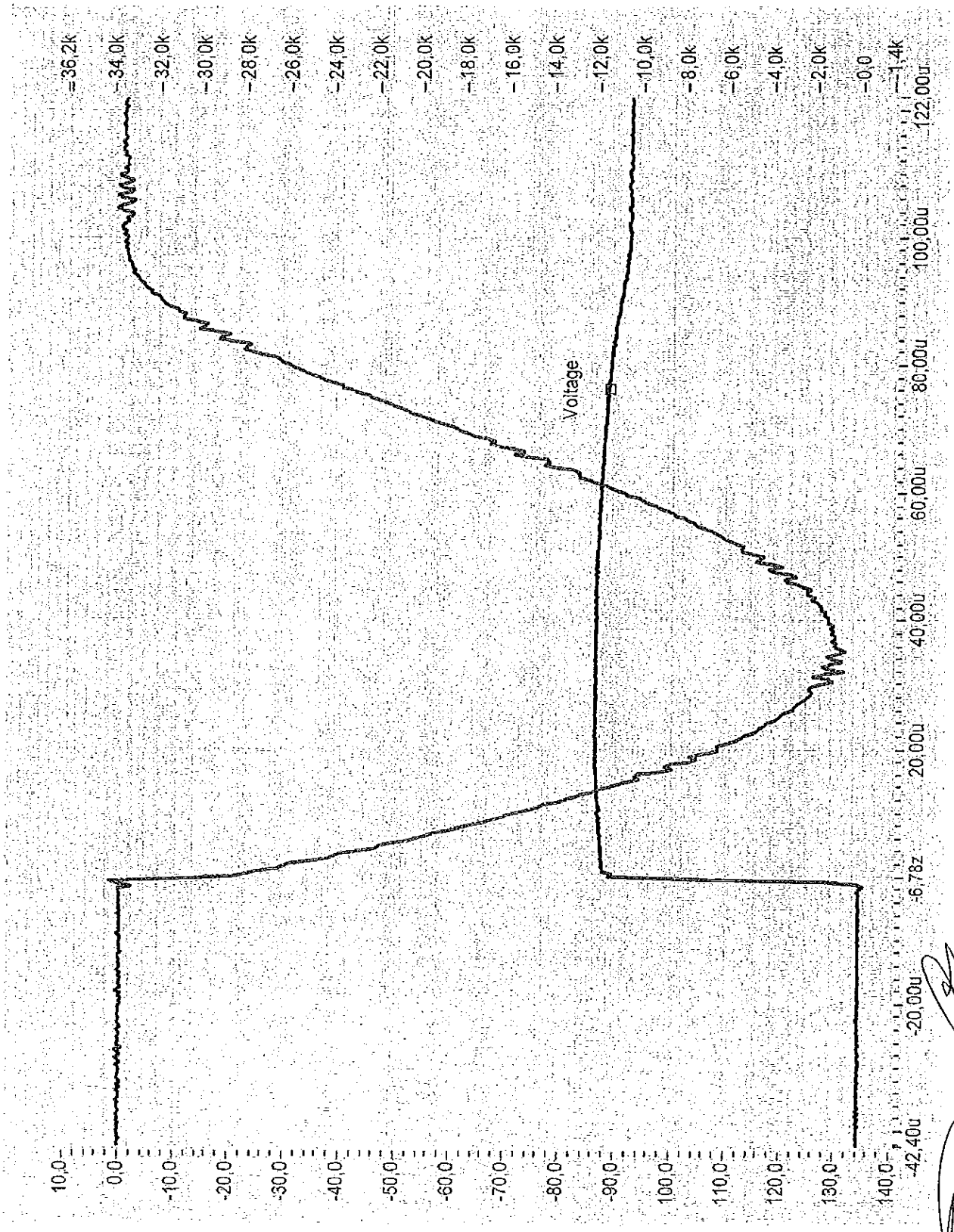
CESI A7020275 Oscillogram n. 7



CESI A7020275 Oscillogram n. 8

ВЯРНО С ОРИГИНАЛА

CESI A7020275 Oscillogram n. 9



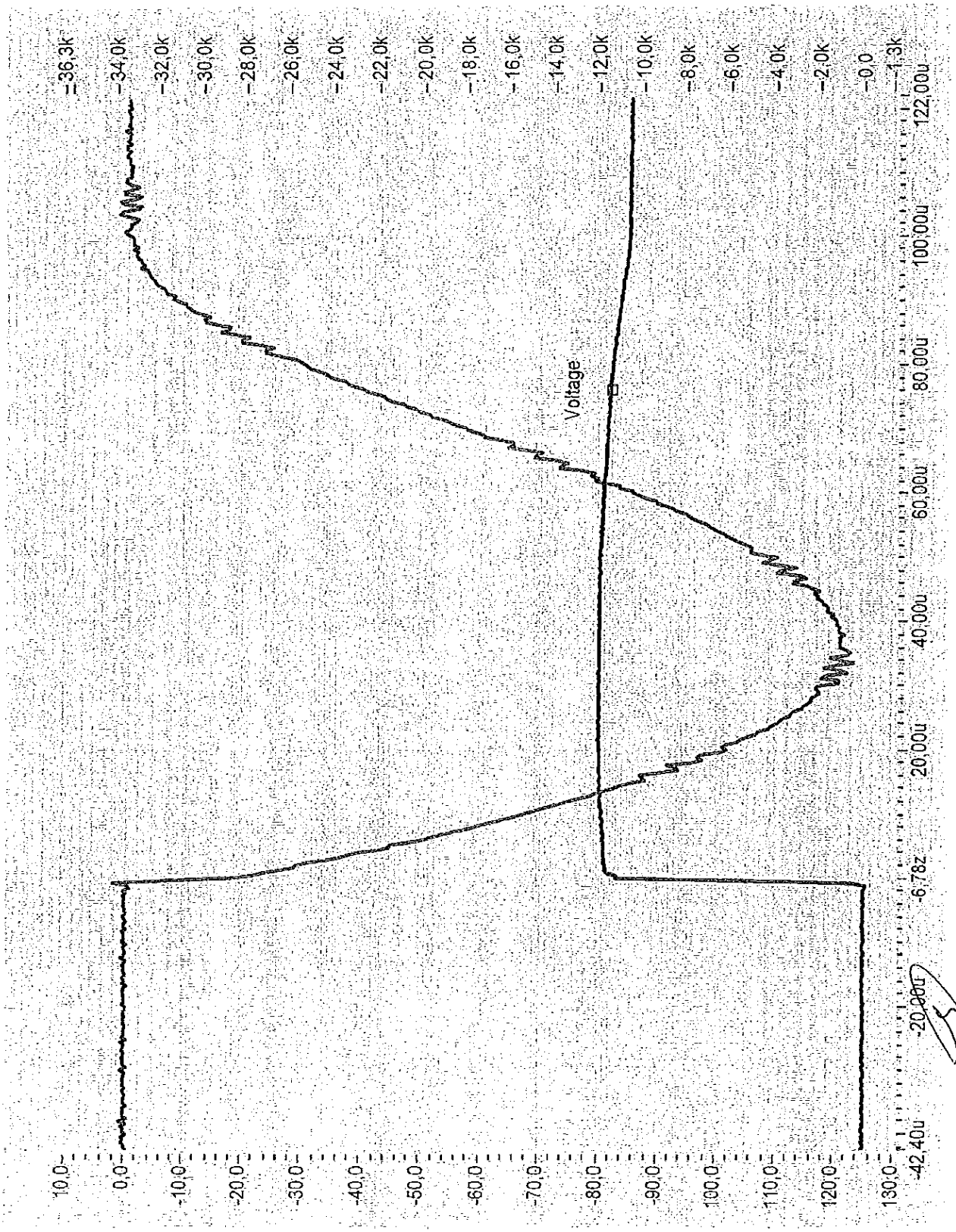
CESI A7020275 Oscillogram n. 10

ВЯРНО С ОРИГИНАЛА

ИНЖЕНЕРНО ДРУЖЕСТВО * ПЛОВДИВ * ФИЛИКАБ 16

CESI A7020275 Oscillogram n. 11

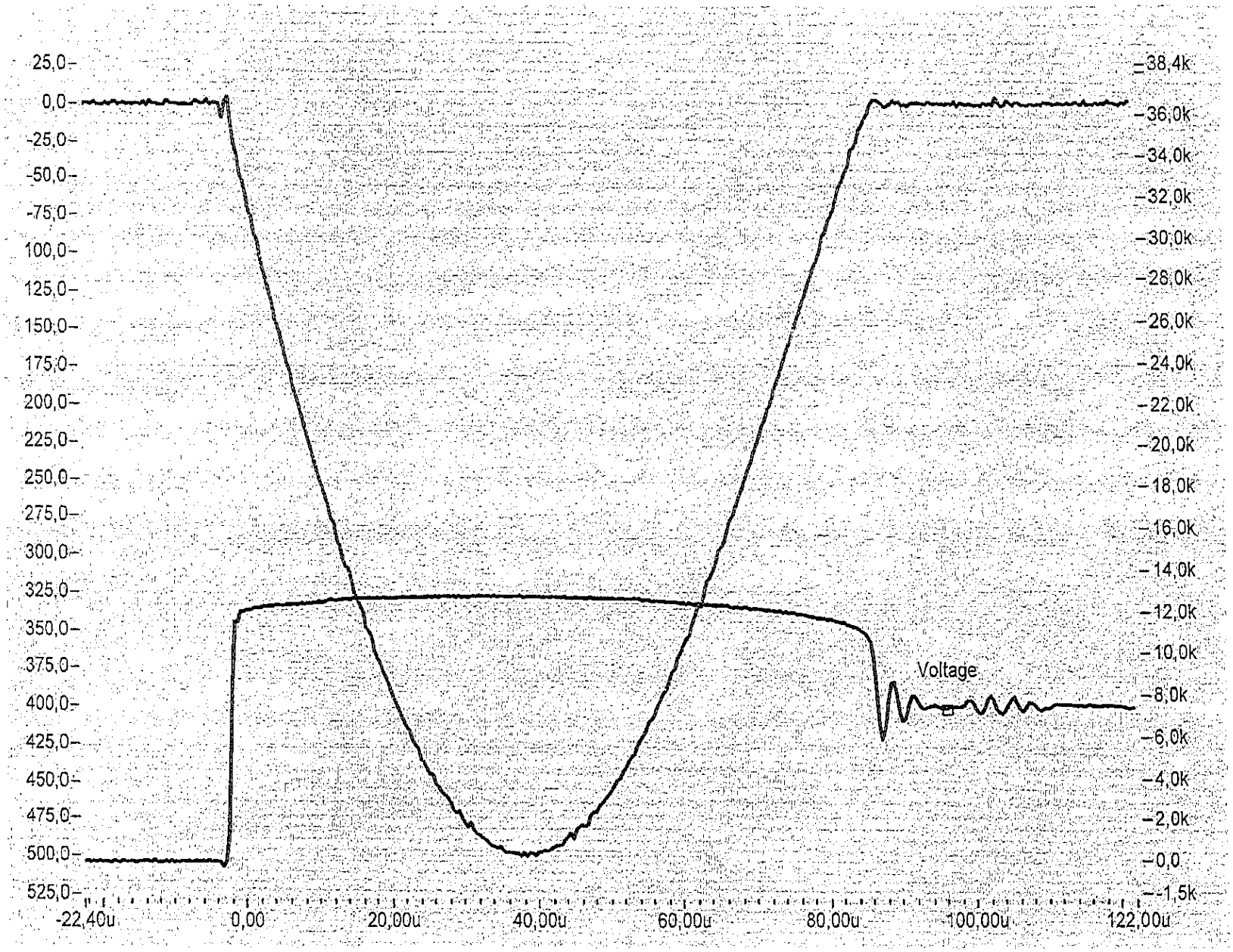
ВЕРНО С ОРИГИНАЛА

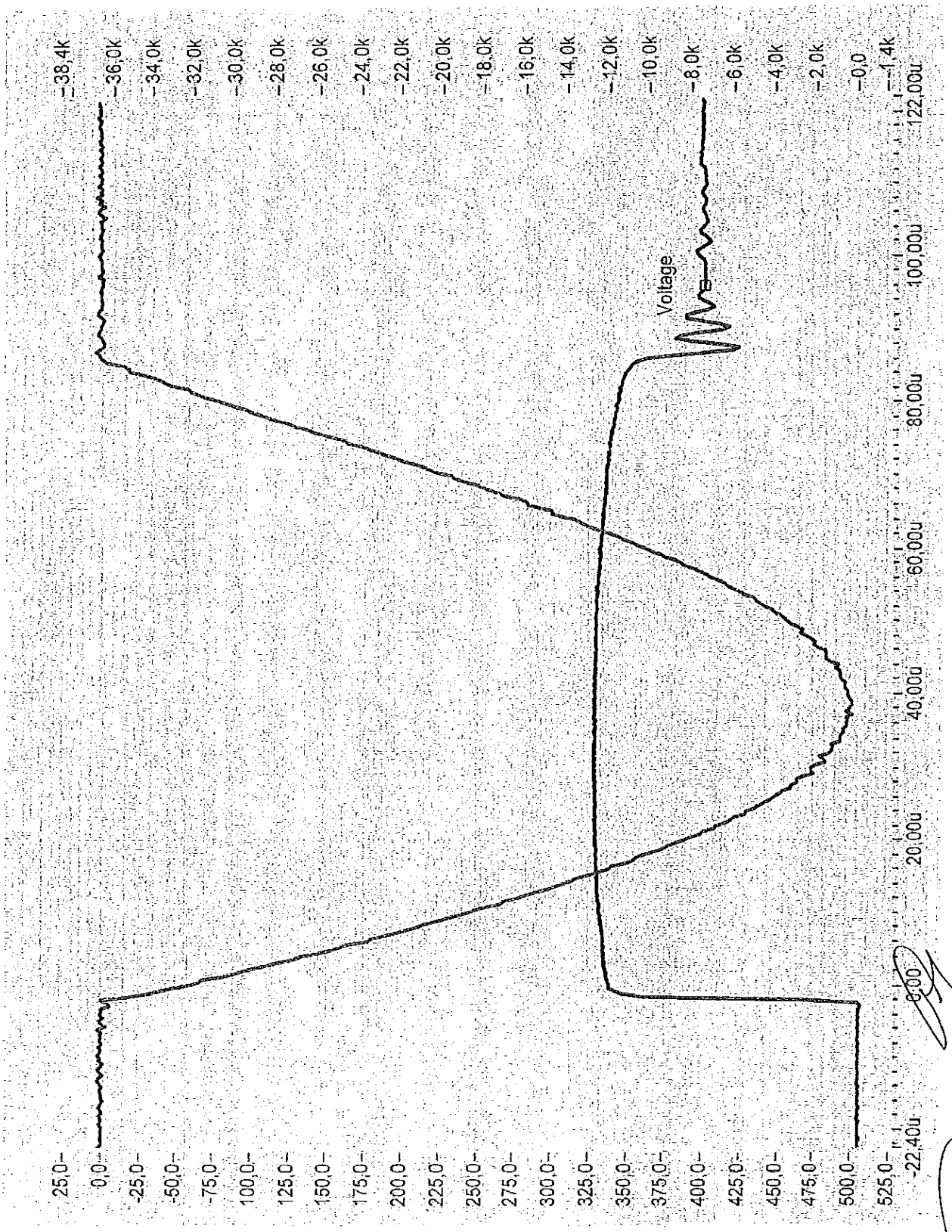


CESI A7020275 Oscillogram n. 12

ВЯРНО С ОРИГИНАЛА

CESI A7020275 Oscillogram n. 13



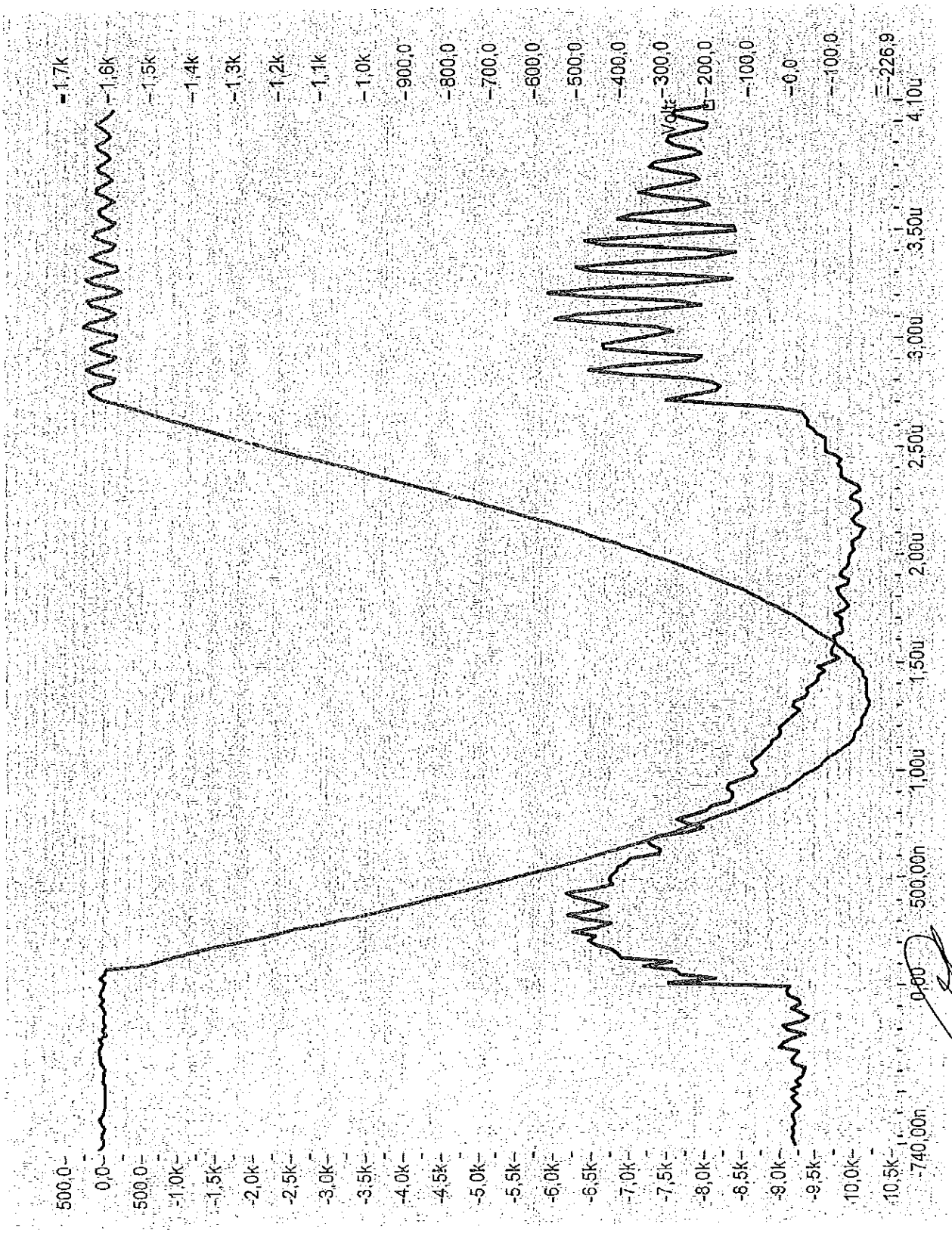


CESI A7020275 Oscillogram n. 14

ВЯРНО С ОРИГИНАЛА

АКЦИОНЕРНО ДРУЖЕСТВО ЕЛКАБ 76 ПЛОВДИВ

CESI A7020275 Oscillogram n. 15



CESI A7020275 Oscillogram n. 16

ВЯРНО С ОРИГИНАЛА

АКЦИОНЕРНО ДРУЖЕСТВО * ПЛОВДИВ * ФИЛИКАБ 16

CESI A7020275 Oscillogram n. 17