



MINISTERIO DE CIENCIA
Y TECNOLOGÍA

L.C.O.E.

LABORATORIO CENTRAL OFICIAL
DE ELECTROTECNIA



FUNDACIÓN PARA EL FOMENTO
DE LA INNOVACIÓN INDUSTRIAL
E.T.S. DE INGENIEROS INDUSTRIALES



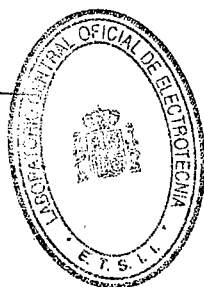
TEST REPORT

Requested by:	José María Rodríguez	Nº of test report:	200305350262/M Test Report modified due to a change in the commercial name (model) requested by the client
Address:	c/ Terral, 5 28223 Madrid	Nº of Pages:	8 + 2 appendix
Tested device:	Lightning rod equipped with triggering device	Beginning of test date:	05/09/02
Model:	Eritech Interceptor SI 60	End of test date:	05/09/02
Type / Reference nº:	Prototype s/n	Issue date:	22/05/03
Applied Standards:	UNE 21186		

Tests performed by:

Head of the HV Department.

Miguel Corriols



Fernando Garnacho Vecino

VALIDITY CONDITIONS FOR THIS DOCUMENT:

- Tests results refer only to the tested sample.
- The tested sample is described in this report, and corresponds to that originally received, together with the modifications that, during the tests, should have been made in order to accomplish the test requirements. These modifications, if any, are documented in LCOE files.
- Partial reproduction of this document is forbidden.
- Should this test report present any correction, it must be considered void.

THIS DOCUMENT IS AN UNOFFICIAL TRANSLATION FROM THE ORIGINAL IN SPANISH LANGUAGE. IN CASE OF DISPUTE OR DOUBT, ONLY THE ORIGINAL IN SPANISH WILL BE VALID

INDEX



1. TESTED DEVICE – TEST DATE
2. APPLIED STANDARDS
3. TEST PROCEDURE
4. EQUIPMENT AND SOFTWARE USED DURING THE TESTS
5. RESULTS

1. TESTED DEVICE

LIGHTNING ROD EQUIPPED WITH TRIGGERING DEVICE

MANUFACTURED BY: José María Rodríguez
MODEL: Eritech Interceptor SI 60

Type / Reference n°: Prototype s/n

(see drawings and/or components list in appendix B)

Testing date: 05th September 2002

**2. APPLIED STANDARDS**

- UNE Standard 21186/98, "Protección de estructuras, edificaciones y zonas abiertas mediante pararrayos con dispositivo de cebado", appendix C, "Procedimiento de evaluación de un PDC".

NOTE: Taking into account the statistical nature of the performed test, LCOE has applied the internal procedure PS3-UNE 21186/98, which fixes the values of some of the test parameters, within the band established in UNE 21186/98 and NF C17-102/95 Standards.

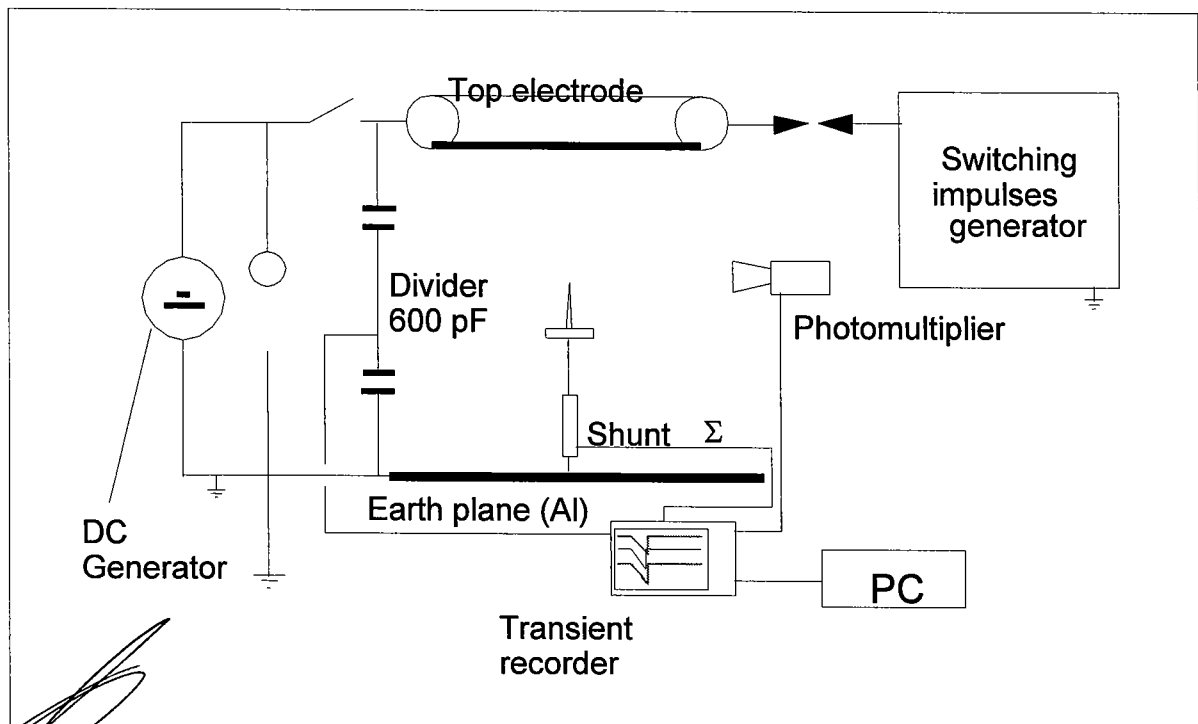
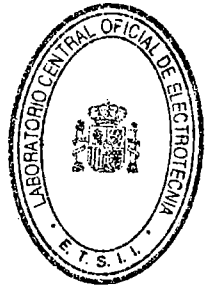
NO TEXT UNDER THIS LINE

b) At the beginning of the impulses series applied to the reference rod:

Atmospheric pressure: 710 mmHg
 Ambient temperature: 24 °C
 Relative humidity: 34 %

c) At the end of the test series:

Atmospheric pressure: 709 mmHg
 Ambient temperature: 25 °C
 Relative humidity: 34 %



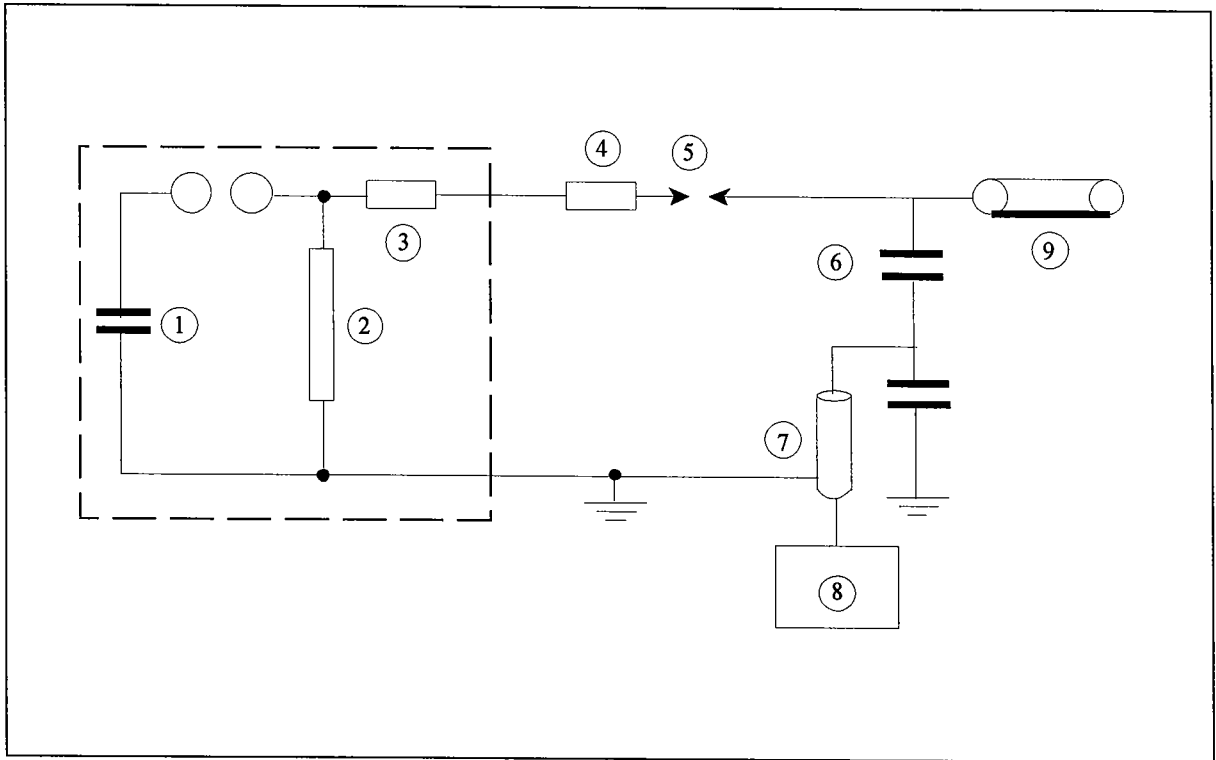
Scheme n°1. Test arrangement.

4. EQUIPMENT AND SOFTWARE USED DURING THE TESTS

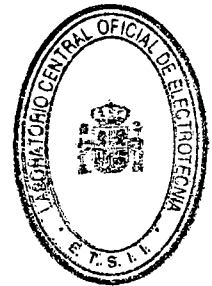
The impulses generation and measuring systems, as well as the direct voltage generation system are shown in the next pages of this test report. Additionally, The auxiliary equipment and software that follows have been used:

- Photomultiplier, reference code III-1-FOTO-003
- Temperature and humidity meter RICHARD, reference code III-1-TH-001
- Atmospheric pressure meter, reference code III-1-BARO-002
- Coaxial shunt , 10 Ohms, reference code III-1-SH-010
- Software, reference code III-1-SOFT-011

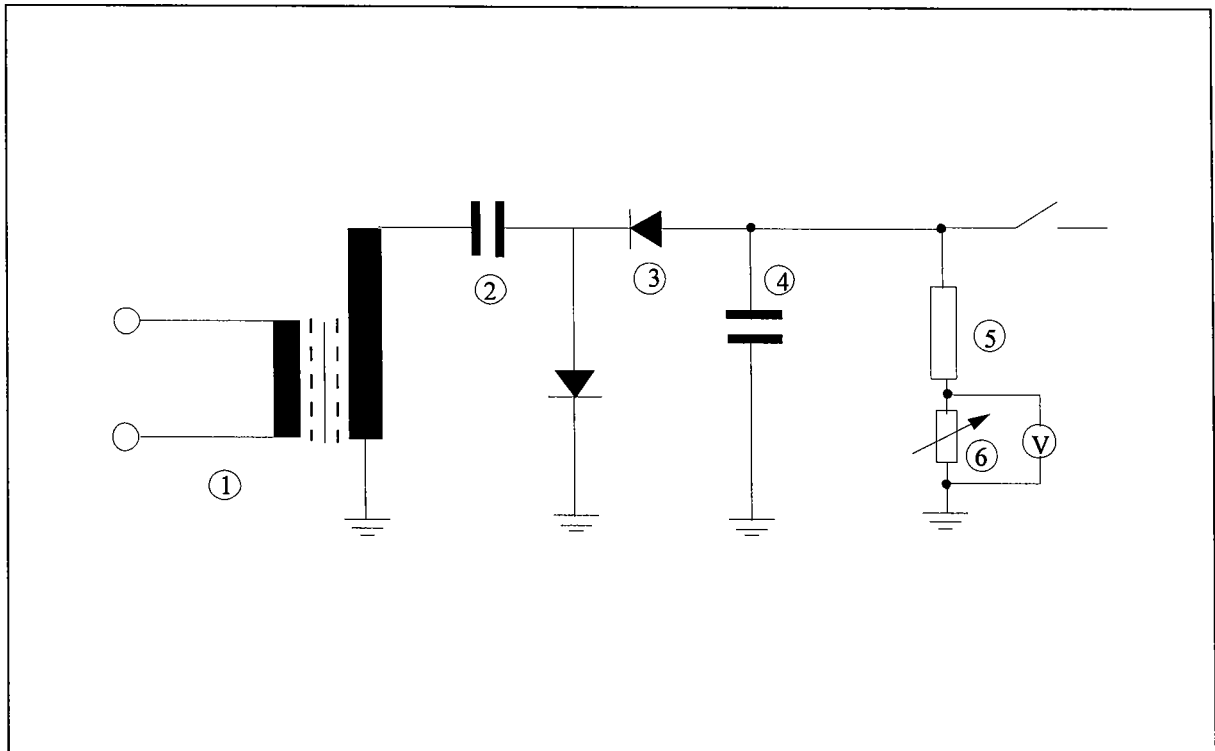
**SWITCHING IMPULSES GENERATION AND MEASURING SYSTEM
1,3 MV**



1. 12 stages capacitor, 126,7 μF each
2. Tail equivalent resistor, 12 x 35.000 Ohm
3. Internal front resistor, 12 x 8.000 Ohm
4. External front resistor, 200 kOhm
5. External sphere gap
6. Capacitive divider 600 pF
7. Coaxial cable, 75 Ohm
8. Measuring instrument: Digital recorder Tektronix TDS
9. Top electrode



DIRECT VOLTAGE GENERATION AND MEASURING SYSTEM 100 kV



1. HV Transformer: 220/80.000 V
2. Serial capacitor: 0,11 μ F; $U_N = 22 / 3$ kV
3. Diode
4. Parallel capacitor: 1,76 μ F; $U_N = 130$ kV
5. Resistor 100,20 MOhm $\pm 0,1$ %; $I_{max} = 1$ mA
6. Variable resistor: 0 ... 110 kOhm; $\pm 0,02$ %; $I_{max} = 7,1$ mA



5. RESULTS

Appendix A to this test report shows the list of the results obtained for the time to breakdown for each impulse.

The mean times-to-breakdown, $\langle T'_{PDC} \rangle$ y $\langle T'_{PR} \rangle$, obtained respectively as the mean value of the times-to-breakdown of each series of impulses, have been referred to the corresponding reference wave shape, as specified in paragraph C.4.2. in the Standard, with the aim of obtaining the standards times-to-breakdown $\langle T_{PDC} \rangle$ y $\langle T_{PR} \rangle$, whose difference $\langle T_{PR} \rangle - \langle T_{PDC} \rangle$ is defined as the "gain in time to breakdown", t .

The results obtained in the test are shown in table 1.

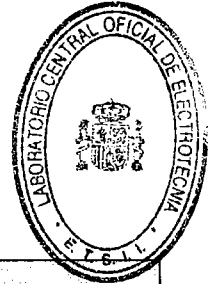


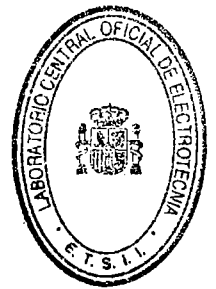
Table 1. Test results.

Mean time-to-breakdown for the reference arrester $\langle T'_{PR} \rangle$	Mean time-to-breakdown for the ESE arrester $\langle T'_{PDC} \rangle$	Difference between the mean times obtained experimentally $\langle T'_{PR} \rangle - \langle T'_{PDC} \rangle$	Gain in time to breakdown t $\langle T_{PR} \rangle - \langle T_{PDC} \rangle$	Uncertainty associated to results (*)
319,1 μ s	266,0 μ s	53,1 μ s	63 μ s	$\pm 12 \mu$ s

(*) Uncertainty calculated on the basis of the metrological viability study performed in this LCOE.

And, for whomever it may concern, and requested by Jose María Rodríguez, this test report is issued in Madrid, on May 22nd, 2003.

NO TEXT UNDER THIS LINE



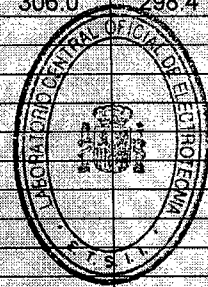
Appendix A
to test report n° 200305350262/M

(Contains lists of results)

A handwritten signature in black ink, consisting of several loops and a long tail, positioned on the left side of the page.

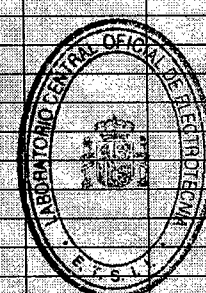
ROD: Eritech Interceptor SI 60

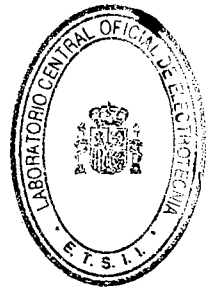
Impulse n°	Voltage	Time U	Time C	Time L	Impulse n°	Voltage	Time U	Time C	Time L
1	647.1	326.9	313.0	309.9	58	672.2	357.6	354.1	346.8
2	654.9	317.1	300.3	257.7	59	635.6	315.6	283.1	278.1
3	681.0	425.8	420.8	414.0	60	623.2	274.1	255.1	244.0
4	640.2	293.0	281.0	270.1	61	641.4	299.4	274.7	253.3
5	627.6	295.0	264.9	260.7	62	601.8	254.1	237.3	202.5
6	645.8	307.2	286.3	268.9	63	645.6	325.3	306.9	271.7
7	619.3	266.0	255.5	250.8	64	648.4	307.1	296.7	295.2
8	608.9	248.4	225.5	194.6	65	626.5	286.9	271.9	236.3
9	643.4	295.3	290.0	287.5	66	680.9	362.7	357.1	356.3
10	627.4	278.4	263.7	261.5	67	665.6	357.7	343.2	342.9
11	635.8	307.6	301.8	299.1	68	609.1	254.4	221.1	164.4
12	624.6	289.2	260.8	256.1	69	647.5	317.2	309.4	300.7
13	651.6	315.9	295.1	285.0	70	626.6	277.3	261.0	188.1
14	631.3	278.2	256.4	222.3	71	658.9	344.0	339.3	330.3
15	610.2	260.1	237.1	227.7	72	665.1	330.0	321.7	300.4
16	619.0	277.4	228.4	197.8	73	683.1	397.9	380.6	378.3
17	659.1	329.7	292.3	292.1	74	628.9	291.2	264.0	252.6
18	629.6	288.0	279.7	262.5	75	628.5	280.2	244.1	237.4
19	639.8	290.6	277.2	227.6	76	640.9	292.0	290.9	230.2
20	635.8	318.0	310.2	278.6	77	675.9	353.1	346.5	328.5
21	628.5	277.2	255.8	231.6	78	647.8	303.1	276.9	273.5
22	636.4	301.8	273.9	267.1	79	631.0	291.0	283.0	272.8
23	655.9	332.0	317.3	316.3	80	611.0	259.6	219.1	211.7
24	646.4	299.0	292.5	292.0	81	641.4	315.0	285.9	282.2
25	649.8	320.0	307.6	307.2	82	602.2	243.2	189.7	189.4
26	607.7	258.2	225.8	204.9	83	648.0	302.9	296.9	285.5
27	672.8	406.8	404.1	403.9	84	634.4	299.1	280.9	279.3
28	637.1	287.7	265.4	259.9	85	609.1	266.8	257.6	202.1
29	612.9	262.2	257.6	207.4	86	623.5	287.7	262.5	230.5
30	602.1	255.8	233.8	234.4	87	641.7	304.2	283.7	278.8
31	654.2	312.4	310.7	309.2	88	627.7	285.6	269.4	248.3
32	628.0	298.6	267.2	265.2	89	591.0	247.3	234.3	195.4
33	604.6	259.7	234.3	212.2	90	635.1	289.3	266.6	246.6
34	602.7	255.2	222.3	217.4	91	593.5	242.9	209.8	186.0
35	624.8	275.3	255.0	175.3	92	628.5	299.0	284.8	242.1
36	625.7	307.8	284.5	250.8	93	650.4	316.1	309.7	309.3
37	629.3	284.6	275.2	238.2	94	646.9	308.6	287.6	287.2
38	646.9	302.3	296.0	289.0	95	655.7	360.2	353.0	352.8
39	643.3	302.8	289.5	275.9	96	631.2	283.3	277.9	262.3
40	650.8	319.1	312.3	312.0	97	636.5	291.3	273.8	263.6
41	623.4	278.8	266.6	258.1	98	673.5	355.6	338.4	331.2
42	648.5	303.9	300.1	220.5	99	637.4	291.9	271.7	272.9
43	641.2	288.9	272.7	268.6	100	640.2	312.6	306.0	298.4
44	655.0	328.6	322.0	315.2	101				
45	645.9	312.4	306.6	203.0	102				
46	636.3	282.3	272.4	268.7	103				
47	628.9	277.7	255.2	254.3	104				
48	644.2	309.7	290.5	288.0	105				
49	655.7	335.4	329.0	301.7	106				
50	617.7	267.6	259.9	214.9	107				
51	634.3	293.5	269.0	265.4	108				
52	648.6	309.3	286.7	276.6	109				
53	654.4	309.1	300.9	296.7	110				
54	640.3	309.6	300.7	299.9	111				
55	663.1	336.7	326.2	325.2	112				
56	629.1	286.0	266.9	242.5	113				
57	610.4	257.4	235.1	165.9	MEDIAS	637.1	300.5	283.6	266.0



ROD: REFERENCE Eritech Interceptor SI 60

Impulse n°	Voltage	Time U	Time C	Time L	Impulse n°	Voltage	Time U	Time C	Time L
1	680.4	400.1	392.8	377.1	58	625.2	275.2	268.3	243.9
2	667.9	382.3	378.5	374.1	59	660.6	359.1	351.8	349.4
3	690.9	392.8	388.4	379.6	60	675.0	353.3	337.4	337.1
4	670.8	377.4	374.2	369.7	61	635.9	287.2	282.7	278.2
5	669.2	341.6	333.7	322.6	62	661.1	319.3	316.0	315.7
6	628.2	287.6	273.1	272.8	63	668.3	335.4	328.5	327.9
7	628.4	298.7	283.6	250.8	64	689.1	385.6	385.5	384.6
8	675.2	370.9	368.2	365.1	65	688.5	383.7	381.9	376.9
9	615.7	275.9	271.0	255.7	66	675.1	387.1	382.2	377.9
10	612.9	268.1	241.0	229.0	67	705.5	524.1	523.2	521.2
11	641.7	312.2	306.5	292.4	68	674.3	386.5	384.5	380.0
12	686.6	450.3	449.0	444.7	69	670.2	345.0	336.8	336.5
13	662.0	328.1	323.9	308.3	70	628.4	279.7	269.9	269.7
14	692.1	389.8	384.9	371.5	71	634.9	286.5	276.1	273.9
15	623.6	284.2	267.9	257.1	72	646.2	295.3	288.2	269.6
16	696.4	407.0	404.6	404.3	73	659.1	323.4	315.0	314.2
17	634.8	295.8	281.5	211.6	74	660.6	322.3	317.5	316.7
18	627.0	281.1	266.8	239.1	75	632.4	288.3	270.1	257.4
19	634.5	294.4	284.8	277.2	76	662.6	337.6	331.5	326.0
20	629.8	284.5	255.8	252.2	77	681.9	373.7	370.8	363.2
21	647.9	324.4	319.7	313.2	78	641.2	304.2	281.5	281.1
22	640.8	304.3	275.3	274.1	79	612.9	267.4	251.3	247.8
23	694.7	414.6	414.6	407.4	80	665.4	342.1	339.7	334.5
24	666.6	340.3	339.8	338.8	81	681.3	371.1	360.5	334.0
25	702.6	547.6	547.5	547.6	82	656.3	313.1	300.4	267.4
26	683.2	388.1	373.7	373.8	83	660.7	355.5	355.4	355.5
27	681.3	357.5	354.2	352.3	84	611.4	260.3	256.4	192.0
28	628.7	284.7	272.5	244.9	85	693.3	392.8	390.5	389.1
29	693.7	444.9	439.3	439.0	86	630.8	295.9	277.4	278.0
30	669.3	366.9	362.3	356.2	87	663.2	334.9	330.2	330.1
31	701.7	426.6	421.5	421.2	88	621.3	273.5	260.9	251.7
32	642.3	297.6	291.4	290.8	89	654.3	346.0	341.2	333.9
33	613.8	262.5	238.1	226.8	90	625.1	301.5	281.5	280.5
34	657.8	331.3	328.3	324.8	91	665.2	337.0	332.2	324.3
35	683.6	447.9	443.8	433.8	92	629.2	289.3	260.5	260.4
36	636.0	295.2	277.5	269.7	93	676.6	361.4	352.2	347.3
37	675.9	357.5	349.8	347.1	94	625.7	278.9	258.5	258.3
38	647.9	295.4	280.5	270.8	95	654.9	338.9	333.7	329.7
39	654.4	342.3	336.7	332.0	96	615.4	276.7	261.6	259.0
40	673.6	357.0	352.7	340.5	97	648.8	309.1	303.9	303.5
41	627.5	277.7	242.4	237.6	98	674.6	363.5	348.1	347.8
42	634.6	278.4	275.1	263.3	99	682.9	402.9	402.8	401.1
43	653.4	321.4	319.7	302.2	100	616.5	266.2	242.8	241.8
44	638.1	338.3	321.6	321.3	101				
45	658.7	319.4	305.3	300.6	102				
46	667.8	339.4	314.2	310.7	103				
47	628.5	286.0	261.4	261.4	104				
48	676.8	358.8	354.5	353.8	105				
49	699.9	520.2	519.8	510.6	106				
50	670.2	340.7	338.5	334.4	107				
51	638.6	309.8	293.3	289.6	108				
52	621.6	273.4	253.7	157.4	109				
53	647.9	346.1	328.5	325.5	110				
54	675.5	349.5	339.7	330.0	111				
55	659.3	341.7	332.7	331.7	112				
56	652.1	311.8	298.3	276.5	113				
57	642.0	291.6	284.0	273.3	MEDIAS	656.1	337.9	328.2	319.1

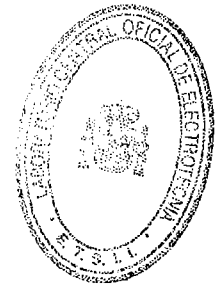
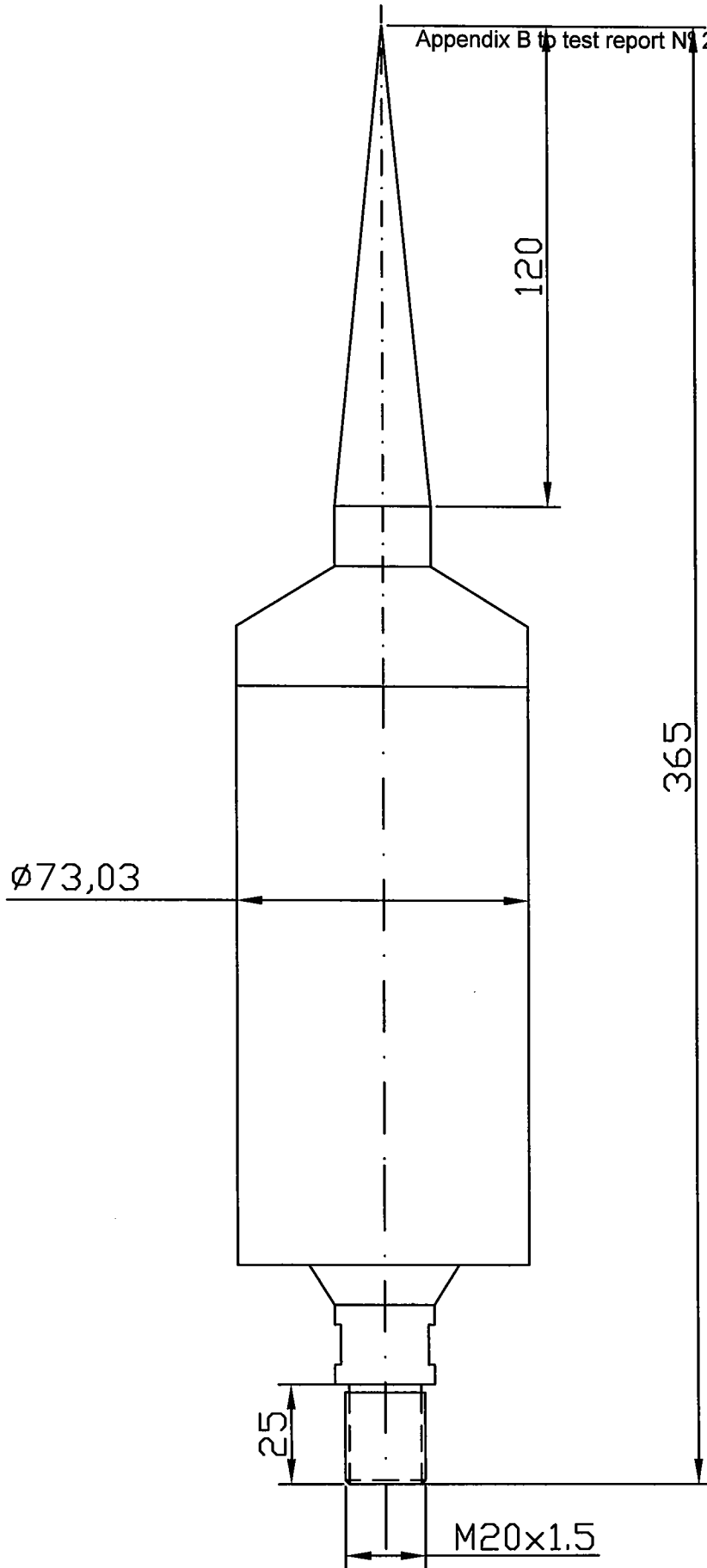




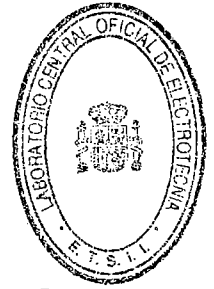
A handwritten signature in black ink, consisting of several overlapping loops and a long tail stroke extending downwards.

Appendix B
to test report n° 200305350262/M

(Contains a draw and list of components)



NAME: ERITECH INTERCEPTOR LIGHTNING CONDUCTOR		
MATERIAL: AISI-316 / POLIPROPILENE		
DRAWING NR.: C2E	DATE: Dec/2002	SCALE: 1:1



LIST OF COMPONENTS OF THE LIGHTNING ROD WITH TRIGGERING

MODEL ERITECH INTERCEPTOR

REF.	DESCRIPTION
C2-01	ERITECH INTERCEPTOR AXIS
C2-02	ERITECH INTERCEPTOR ARRESTER
C2-03	ERITECH INTERCEPTOR CASING
C2-04	ERITECH INTERCEPTOR CLOSE-CONE
C2-05	ERITECH INTERCEPTOR GAP
C2-06	ERITECH INTERCEPTOR ROD
C2—02	ERITECH INTERCEPTOR TRIGGERING DEVICE