

CERTIFICAT D'ESSAI N° : **25 857**
 TEST CERTIFICATE No :
 PROTOCOLO DE PRUEBAS N° :

Nombre de pages :
 Number of pages : **8**
 Cantidad de paginas :

Client - Customer - Cliente : **ALSTOM T&D LIMITADA**
CARRERA 70 NO 23-91
P.O.B. 14440
SANTAFE DE BOGOTA DC COLOMBIA

Référence et date de la commande : **E-1598 EBSA P.O. 01783**
 Customer's order, reference and date : **13.01.00**
 Referencia y fecha del pedido :

Référence Alstom : **XH9128W**
 Alstom order No :
 Referencia Alstom : **05.01.00**

Type - Type - Tipo : **TRANSFORMADOR DE TENSION CAPACITIVO**
CCV 123

Tension la plus élevée du réseau :
 Highest system voltage : **123 kV**
 Tension la mas alta del red :

Fréquence nominale :
 Rated frequency : **60 Hz** ✓
 Frecuencia nominal :

Poste N° Item No Poste N°	Quantité Quantity Cantidad	Rapport de transformation Transformation ratio Relacion de transformacion	Circuit Winding Arrollamiento	Puissance Burden Potencia	Classe Class Clase	Normes Standards Normas
2	9	115 000/V3 // 110/V3 V	a-n	50 VA ✓	0.2 ✓	CEI 186/358
Capacidad : 8 800 pF + 10 % - 5 %						

N° de fabrication :
 Serial No : **00-XH912802-001 a 009**
 No de fabricaciòn :

3 EX.

Référence client :
 Customer reference :
 Referencia del cliente :

Date de réception :
 Date of inspection :
 Fecha de ensayo :

Responsable Contrôle Final :
 Final Inspection Responsible : **G.NGUYEN VAN SANG**
 Responsable del Control Final :

po. he

Représentant du client :
 Customer's agent :
 Representante del cliente :

Responsable Qualité :
 Quality Manager : **V.DENIZEAUX**
 Responsable del Calidad :

[Handwritten signature]



Certificat établi le :
 Certificate established on : **12/05/00**
 Certificado echo le :

CERTIFICAT D'ESSAI N° :
 TEST CERTIFICATE No : **25 847**
 PROTOCOLO DE PRUEBAS N°:

Page N°:
 Pages N°: **2**
 Pagina N°:

Essais effectués - Tests done - Ensayos efectuados						
Références	Consistance des essais	Tension	Fréquence	Durée	Conclusion	
Reference	Table of contents	Voltage	Frequency	Duration	Conclusion	
Referencia	Contenido de las pruebas	Tension (kV)	Frecuencia (Hz)	Duracion (s)	Conclusion (C) (S)	
IEC186/358	Vérification du marquage des bornes - Marquage des plaques signalétiques - Conformité aux plans. Verification of terminal markings - Rating plates markings - Conform to drawing. Verificación de la designacion y marcado de los bornes - Conformidad con los planos.				C	
IEC186/358	Essais diélectriques à fréquence industrielle des enroulements primaires. Power frequency tests on primary windings Ensayos dielectricos de los arrollamientos primarios.					
IEC186/358	Essais diélectriques à fréquence industrielle des enroulements secondaires entre eux et masse. Power frequency tests on secondary windings between secondaries and to earth. Ensayos dielectricos de los arrollamientos secundarios entre ellos y la massa.	3	50	72	S	
IEC186/358	Erreur de rapport et de déphasage- essais individuels Routine tests for ratio error and phase displacement. Medida del error de relacion y defasage.				C	
IEC186/358	Erreur composée - essais individuels. Routine tests for composite error. Error resultante.					
IEC186/358	Essai de décharges partielles. Partial discharges test. Prueba de descargas parciales.				S	
IEC186/358	Essais diélectriques à fréquence industrielle sur C total Power frequency tests on C total Prueba dieléctrica en la C total	230	50	72	S	
IEC186/358	Essais diélectriques à fréquence industrielle sur C1 Inf +C2 Power frequency tests on C1 Low + C2 Prueba dieléctrica en la C1 Inf + C2					
IEC186/358	Essais diélectriques à fréquence industrielle de la self d'accord Power frequency tests on HV impedance Prueba dieléctrica en la impedancia AT	10	400	18	S	
IEC186/358	Essais diélectriques entre N et la terre Power frequency tests between N and earth Prueba dieléctrica entre N y la tierra	4	50	72	S	
IEC186/358	Essais diélectriques entre HF et la terre Power frequency tests between HF and earth Prueba dieléctrica entre AF y la tierra	4	50	72	S	
IEC186/358	Essais diélectriques du transformateur MT Power frequency tests on MV transformer Prueba dieléctrica del transformador MT	38	400	18	S	
	Essais surtension entre spires. Over-voltage inter-turns test. Ensayo de sobretension entre espiras.					

S : satisfaisant - satisfactory - satisfactorio

SERVICE QUALITÉ

ALSTOM T&D conforme - conforme
 Transformateurs de Mesure S.A.
 51, av. Jean Jaurès - B.P. 380
 92541 MONTRouGE Cedex France
 Tél. 33 (0)1 47 46 61 11
 Fax 33 (0)1 46 57 74 25

CERTIFICAT D'ESSAI N°
 TEST CERTIFICATE N°
 PROTOCOLO DE PRUEBAS N°

25 857

Page - Pagina N° **3**

Résultat des essais de précision-Results of the accuracy tests-Resultado de los ensayos del precision.

Appareil N° Serial N° Aparato N°	Couplage et Circuit Coupling and Circuits Acoplamiento y arrollamiento	Charge en VA et Cos 0.8 Burden in VA and power factor 0.8 Carga en VA y Cos 0.8	Nombre de UN Times rated primary Fraccion de	Erreur de rapport en % Ratio error in % Error de relacion en %	Déphasage en minutes Phase error in minutes Defasaje en minutos	Observations Notes Observaciones
00-XH9128 02-001	a-n	50	1.2 1 0.8	-0.05 -0.04 -0.04	+1 +1 +0.5	
		10	1.2 1 0.8	+0.06 +0.06 +0.06	0 0 0	
00-XH9128 02-002	a-n	50	1.2 1 0.8	-0.05 -0.05 -0.05	+2.5 +2 +2	
		10	1.2 1 0.8	+0.04 +0.04 +0.04	+1.5 +1 +1	
00-XH9128 02-003	a-n	50	1.2 1 0.8	-0.05 -0.05 -0.05	+1.5 +1.5 +1	
		10	1.2 1 0.8	+0.05 +0.05 +0.05	+0.5 +0.5 +0.5	

CERTIFICAT D'ESSAI N°
 TEST CERTIFICATE N°
 PROTOCOLO DE PRUEBAS N°

25 857

Page - Pagina N° 4

Résultat des essais de précision-Results of the accuracy tests-Resultado de los ensayos del precision.

Appareil N° Serial N° Aparato N°	Couplage et Circuit Coupling and Circuits Acoplamiento y arrollamiento	Charge en VA et Cos 0.8 Burden in VA and power factor 0.8 Carga en VA y Cos 0.8	Nombre de UN Times rated primary Fraccion de	Erreur de rapport en % Ratio error in % Error de relacion en %	Déphasage en minutes Phase error in minutes Defasaje en minutos	Observations Notes Observaciones
00-XH9128 02-004	a-n	50	1.2	-0.08	+1.5	
			1	-0.08	+1.5	
			0.8	-0.08	+1.5	
		10	1.2	+0.02	+0.5	
			1	+0.02	+0.5	
			0.8	+0.02	+0.5	
00-XH9128 <u>02-005</u>	a-n	50 ✓	1.2	-0.05 ✓	+2.5 ✓	
			1	-0.05 ✓	+2 ✓	
			0.8	-0.05 ✓	+2 ✓	
		10 ✓	1.2	+0.04 ✓	+1 ✓	
			1	+0.05 ✓	+1 ✓	
			0.8	+0.05 ✓	+1 ✓	
00-XH9128 02-006	a-n	50	1.2	-0.08	+2	
			1	-0.07	+1.5	
			0.8	-0.07	+1.5	
		10	1.2	+0.02	+1	
			1	+0.03	+0.5	
			0.8	+0.03	+0.5	



Opérateur :
 Operator :

CERTIFICAT D'ESSAI N°
 TEST CERTIFICATE N°
 PROTOCOLO DE PRUEBAS N°

25 857

Page - Pagina N° **5**

Résultat des essais de précision-Results of the accuracy tests-Resultado de los ensayos del precision.

Appareil N° Serial N° Aparato N°	Couplage et Circuit Coupling and Circuits Acoplamiento y arrollamiento	Charge en VA et Cos 0.8 Burden in VA and power factor 0.8 Carga en VA y Cos 0.8	Nombre de UN Times rated primary Fraccion de	Erreur de rapport en % Ratio error in % Error de relacion en %	Déphasage en minutes Phase error in minutes Defasaje en minutos	Observations Notes Observaciones
00-XH9128 02-007	a-n	50	1.2	-0.09	+1.5	
			1	-0.09	+1.5	
			0.8	-0.09	+1.5	
		10	1.2	+0.01	+0.5	
			1	+0.01	+0.5	
			0.8	+0.01	+0.5	
00-XH9128 02-008	a-n	50	1.2	-0.04	+1	
			1	-0.03	+0.5	
			0.8	-0.03	+0.5	
		10	1.2	+0.06	0	
			1	+0.07	0	
			0.8	+0.07	0	
00-XH9128 02-009	a-n	50	1.2	-0.05	+2.5	
			1	-0.05	+2.5	
			0.8	-0.04	+2.5	
		10	1.2	+0.05	+1.5	
			1	+0.05	+1.5	
			0.8	+0.05	+1	

MEDICION DE LA CAPACIDAD A LA ALTA FRECUENCIA Y LA RESISTANCIA SERIE EQUIVALENTE

00-XH912802/001

Frequency	30 kHz	Cs	8.824 nF	Rs	10.545 OHMS
Frequency	34 kHz	Cs	8.825 nF	Rs	10.326 OHMS
Frequency	38 kHz	Cs	8.828 nF	Rs	10.145 OHMS
Frequency	43 kHz	Cs	8.830 nF	Rs	10.058 OHMS
Frequency	48 kHz	Cs	8.832 nF	Rs	9.996 OHMS
Frequency	54 kHz	Cs	8.836 nF	Rs	9.890 OHMS
Frequency	61 kHz	Cs	8.840 nF	Rs	9.750 OHMS
Frequency	68 kHz	Cs	8.842 nF	Rs	9.726 OHMS
Frequency	77 kHz	Cs	8.848 nF	Rs	9.700 OHMS
Frequency	86 kHz	Cs	8.857 nF	Rs	9.632 OHMS
Frequency	97 kHz	Cs	8.864 nF	Rs	9.705 OHMS
Frequency	109 kHz	Cs	8.872 nF	Rs	9.673 OHMS
Frequency	122 kHz	Cs	8.891 nF	Rs	9.632 OHMS
Frequency	138 kHz	Cs	8.917 nF	Rs	9.545 OHMS
Frequency	155 kHz	Cs	8.944 nF	Rs	9.498 OHMS
Frequency	174 kHz	Cs	8.978 nF	Rs	9.495 OHMS
Frequency	196 kHz	Cs	9.021 nF	Rs	9.409 OHMS
Frequency	220 kHz	Cs	9.079 nF	Rs	9.365 OHMS
Frequency	247 kHz	Cs	9.150 nF	Rs	9.337 OHMS
Frequency	278 kHz	Cs	9.243 nF	Rs	9.317 OHMS
Frequency	313 kHz	Cs	9.367 nF	Rs	9.289 OHMS
Frequency	352 kHz	Cs	9.528 nF	Rs	9.261 OHMS
Frequency	396 kHz	Cs	9.739 nF	Rs	9.228 OHMS
Frequency	445 kHz	Cs	10.018 nF	Rs	9.193 OHMS
Frequency	500 kHz	Cs	10.395 nF	Rs	9.153 OHMS



Opérateur :
Operator :
Intervenante : MD-CV
Date : 05/05/2000
Température 25°C

CERTIFICAT D'ESSAI N°
TEST CERTIFICATE N°
PROTOCOLO DE PRUEBAS N°

25 857

Page - Pagina N°

7

<u>Aparato N°</u>	<u>50Hz</u>	
	<u>Tg en 10-3</u>	<u>Capacidad en pF</u>
00-XH912802-001	0.64	8822
00-XH912802-002	0.62	8820
00-XH912802-003	0.63	8802
00-XH912802-004	0.49	8841
00-XH912802-005 ✓	0.48	8829
00-XH912802-006	0.48	8802
00-XH912802-007	0.48	8809
00-XH912802-008	0.48	8793
00-XH912802-009	0.48	8831

5.26 x 10⁴



Opérateur :
Operator :
Interveniente :
Date :
Température :

MD-CV
03/02/2000
25°C

DESCARGAS PARCIALES

<u>Aparato N°</u>	<u>Um en kV</u>	<u>DP en pC</u>	<u>0,7 Um en kV</u>	<u>DP en pC</u>
00-XH912802-001	123	<10	86	< 5
00-XH912802-002	123	<10	86	< 5
00-XH912802-003	123	<10	86	< 5
00-XH912802-004	123	<10	86	< 5
00-XH912802-005	123	<10	86	< 5
00-XH912802-006	123	<10	86	< 5
00-XH912802-007	123	<10	86	< 5
00-XH912802-008	123	<10	86	< 5
00-XH912802-009	123	<10	86	< 5

Las tensiones de pruebas de descargas parciales estan alcanzadas durante el decrecimiento de la tension despues de la prueba dieléctrica a frecuencia industrial (Procedimiento A IEC 44.1-44.2...).



Opérateur :

Operator :

Intervinente :

Date :

Température :

MD-CV
03/05/2000
25°C

Test Certificate

page 1 of 4

Customer: Alsthom Balteau, Montrouge **France**

Confirmation no.: 98'412

Description: Precision C and tan delta measuring bridge

Type: 2809a

Serial no.: 134'514

Date of test: October-16-1998

Test technician: O. Aschwanden

Approved by: P. Kaufmann



Tettex Instruments certifies that this equipment has been duly inspected and tested prior to shipment. Its mechanical, electrical and operational performance was found to be in accordance with, or better than the manufacturing specifications. A copy of this test certificate is on file at Tettex Instruments and available for review at any time.

Test Certificate for Precision C and tan delta Bridge

Type : 2809 2809a

Serial Number : *134'514*

Software : *V.10/2 . .*

Power Supply : *230. V .50. Hz*

Configuration :
 Printer 5974 built-in yes no
 Printer Interface RS 232C built-in yes no
 Computer Interface RS 232C built-in yes no

Additional equipment : Type : *5.516 . .* S/N : *135'821*
 Type : S/N :

The measurement is performed by comparison with reference standards, standard measuring equipment or on the basis of documented calibration techniques.
 The reference standards and the standard measuring equipment are traceable to the national measurement standards, according to ISO 9001 / EN 29001.

Tested with the following equipment, according to internal testprocedure No 17881-00-*.4

Standard Capacitors:

C1 Type	3320/100	S/N : <i>PM 521 . .</i>
C2 Type	3320/1000	S/N : <i>PM 523 . .</i>
C3 Type	3320/1000	S/N : <i>PM 524 . .</i>
C4 Type	3320/10000	S/N : <i>PM 530 . .</i>
C5 Type	3370/100	S/N :

Tan delta Standard :	Type	3722 spez	S/N : <i>139'777 . .</i>
AC Calibrator :	Type	<i>Dalton 4200</i>	S/N : <i>PM 623 . .</i>

Required measurement accuracy :

C :	± 0.01 % rdg	± 0.01 % fs	(50Hz)
C :	± 0.05 % rdg	± 0.02 % fs	(1000Hz)
Tan δ :	± 1 % rdg	± 1*10 ⁻⁵ fs	(50Hz)
Tan δ :	± 1 % rdg	± 1*10 ⁻⁴ fs	(1000Hz)
Utest :	± 2 % rdg		

Measuring uncertainty : C : ± 0.01 %

The dielectric tests were carried out with the following prevailing measuring conditions :

- temperature = *23* °C

The results refer exclusively to the object. This Test Certificate may not be published or forwarded other than in full. *PA*
 tc2809b.doc/23.Mar 98/PKa

Tettex Instruments	Type 2809	Order Number : <i>98412</i>
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1. Break down test

CN: C5

CX: $\approx 900\text{pF}$ only as load, with spark gap = 30mm

	U _{test} [kV]	C [pF]	tan δ [*10 ⁻⁵]	o.k.
Readings before flash over				<input type="checkbox"/>
Flash over voltage		-----	-----	<input type="checkbox"/>
Readings after flash over				<input type="checkbox"/>

2. Accuracy of U test measurement

measured with AC Calibrator

U test nominal	U test measured	o.k.
	$\pm 2\%$	
2 kV	2.003	<input checked="" type="checkbox"/>
10 kV	9.915	<input checked="" type="checkbox"/>
50 kV	49.61	<input checked="" type="checkbox"/>

3a. Accuracy of C measurements CX > CN

U_{test} = 2 kV

CN = C2 (1000 pF)

CX	certified value [pF]	measured value $\pm 0.02\%$	tan δ value $\leq 1 \cdot 10^{-5}$	o.k.
C3	999.99	999.982	$0.4 \cdot 10^{-5}$	<input checked="" type="checkbox"/>
C4	10000.5	10001.1	$0.1 \cdot 10^{-5}$	<input checked="" type="checkbox"/>

3b. Accuracy of C measurements CX < CN

U_{test} = 2 kV

CN = C2 (1000 pF)

CX	certified value [pF]	measured value $\pm 0.02\%$	tan δ value $\leq 5 \cdot 10^{-5}$	o.k.
C1	100.001	100.001	$0.1 \cdot 10^{-5}$	<input checked="" type="checkbox"/>

4. Accuracy of tan δ measurements at line frequency

U_{test} = 2 kV

CN = C2 (1000 pF) CX = C3 (1000 pF)

Tan delta standard	calculated* Capacitance [pF]	measured Capacitance [pF]	certified tan δ [-]	measured tan δ [-]	o.k.
No. 1	999.99	999.982	$1.077 \cdot 10^{-5}$	$1.4 \cdot 10^{-5}$	<input checked="" type="checkbox"/>
No. 2	999.99	999.982	$1.096 \cdot 10^{-4}$	$1.11 \cdot 10^{-4}$	<input checked="" type="checkbox"/>
No. 3	999.99	999.982	$1.093 \cdot 10^{-3}$	$1.084 \cdot 10^{-3}$	<input checked="" type="checkbox"/>
No. 4	999.87	999.847	$1.093 \cdot 10^{-2}$	$1.084 \cdot 10^{-2}$	<input checked="" type="checkbox"/>
No. 5	988.25	988.232	$1.090 \cdot 10^{-1}$	$1.084 \cdot 10^{-1}$	<input checked="" type="checkbox"/>
No. 6	452.47	459.146	1.089	1.080	<input checked="" type="checkbox"/>

The results refer exclusively to the object. This Test Certificate may not be published or forwarded other than in full. ^{9/4}
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Tettex Instruments	Type 2809	Order Number :	98412
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5. Accuracy of $\tan\delta$ measurements at 1000 Hz

U_{test} = 200 V

CN = C2 (1000 pF) CX = C3 (1000 pF)

Tan delta standard	calculated* Capacitance	measured Capacitance	certified tan δ	measured tan δ	o.k.
	[pF]	[pF]	[-]	[-]	
No. 1	999,99	999,974	$2,154 \cdot 10^{-4}$	$1,70 \cdot 10^{-4}$	<input checked="" type="checkbox"/>
No. 2	999,98	999,955	$2,192 \cdot 10^{-3}$	$2,116 \cdot 10^{-3}$	<input checked="" type="checkbox"/>
No. 3	999,51	999,619	$2,186 \cdot 10^{-2}$	$2,151 \cdot 10^{-2}$	<input checked="" type="checkbox"/>
No. 4	954,38	956,147	$2,186 \cdot 10^{-1}$	$2,152 \cdot 10^{-1}$	<input checked="" type="checkbox"/>
No. 5	173,84	177,888	2,180	2,105	<input checked="" type="checkbox"/>

*The instrument measures the equivalent parallel circuit, but the test object is a equivalent series circuit.

$$C_{XP} = C_{XS} \cdot 1 / (1 + \tan^2 \delta)$$

C_{XP} = equivalent parallel capacitance (measured)

C_{XS} = equivalent series capacitance (test sample)

6. Final checks

- Test of interference effect o.k.
- ~~Inductance measurement~~ o.k.
- Frequency measurement o.k.
- Printer Interface (Option) o.k.
- Computer Interface (Option) o.k.
- External Current Comparator Ratio o.k.
- ~~48 hours burn in test~~ o.k.

Date of test : 16.10.1998

Tested by : O. Aschwanden

The results refer exclusively to the object. This Test Certificate may not be published or forwarded other than in full. ^{7k}
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Tettex Instruments	Type 2809	Order Number :	98472
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TRANSMISSION & DISTRIBUTION ALTERACOES :
Transformadores de Medido - EXATIDAO

ESTA OF REVISA E SUBSTITUI A
ANTERIOR DATADA DE :
28/12/99

4ª VIA-TESTE

ORDEM DE FABRICAÇÃO

Nº 99.5190 DATA 26/01/2000

1 - CLIENTE

RAZÃO SOCIAL ALSTOM T&D TRANSFORMATEURS DE MESURE S/A		CÓDIGO 01127	
SEU PEDIDO Nº XH-9128	ITEM 02	DATA PEDIDO 17/12/1999	C.N.P.J. / -
ENDEREÇO / CEP / BAIRRO / CIDADE / U.F. / PARA ENTREGA BP 690,50 AV JEAN JAURES 00000-000 FRANCE		MONTRouGE	
ENDEREÇO / CEP / BAIRRO / CIDADE / U.F. / PARA COBRANÇA			

2 - EQUIPAMENTO EXTERIOR TRANSFORMADOR DE CORRENTE

QUANTIDADE 9	CORRENTE(S) PRIMÁRIA(S) E SECUNDÁRIA(S) NOMINAL(S) 225x450-5A		
TIPO QR-123/2	NORMA IEC-185/87	TENSAO MAXIMA 123,00 (kv)	CLASSE E CARGA DE EXATIDÃO 30VA-CL-0,2 FS±5
FREQUÊNCIA 60 (Hz)	FATOR TÉRMICO 1,20 xln	CORR.TÉRMICA 31,5KA/3s	CORRENTE DINÂMICA 80KA
TENSAO SUPORTÁVEL À FREQUÊNCIA INDUSTRIAL PRIM: 230,0 (kv) SEC: 3,0 (kv)		NBI 550 (kv)	
OBS: - VER COF TECNICA - ISOLADOR 20SA-TIφi=150 - PREÇO CIF		ENTREGA FOT. FÁBRICA 17/05/2000 FOB. SP CAPITAL CIF	PROPOSTA Nº I9P-9202 REPRESENTANTE --- INSPEÇÃO CONIATAR ALSTOM CHILE PREÇO BASE OUT/1999

3 - TESTES

Aparelho(s) nº(s) 99.5190 - 01 A 09

1 - ENSAIO A FREQUÊNCIA INDUSTRIAL (Duração-60Seg.)

a-Tensão aplicada primário e secundário: OK
b-Tensão aplicada secundário(s) e terra: OK
c-Tensão aplicada bobinas do primário: OK

2 - VERIFICAÇÃO DA POLARIDADE: OK

3 - VERIFICAÇÃO DE RELAÇÃO: OK

4 - VERIFICAÇÃO DA EXATIDÃO P/SECUNDÁRIOS DE PROTEÇÃO

$U_0 = F \cdot I_n \cdot Z_n = \quad \quad \quad V$
 $Z_n = \sqrt{(\text{Renr} \cdot 75^\circ C + Z_c \cos \theta)^2 + (Z_c \sin \theta)^2}$
 $\text{Renr} \cdot 75^\circ C = \quad \quad \quad \Omega \quad Z_c = \quad \quad \quad \Omega$
 $Z_n = \quad \quad \quad \Omega \quad I_{os} = \quad \quad \quad A \quad \epsilon \% = I_o \times 100 / F \times I_{sn}$

U₀-tensão a F x I_n
I_o-corrente de excitação
Z_c-impedância de carga
Z_n-impedância total
F -Fator de Sobrecorrente

5 - ENSAIO DE TENSÃO INDUZIDA (Duração 60 seg.)

I = I_{sn} ou V_s 4500 V_{crista} Resultado: OK

DATA 09/05/00 VISO, DGQ DATA INSPETOR



ENSAYO DE SOBRETENSION ENTRE ESPIRAS TC

OF Nº 9 9 5 1 9 0

CLIENTE *ALSTOM*


PEDIDO Nº *XH-9128*

Frec. de Ensayo = **60** Hz Duration = **60** Segundos

Nº	In(A)xft	U(V)	Med-M Prot-P	Operador	Equipos	Fecha	Verification de la Relación	Operador	Equipos	Fecha
01	6	16	M	687	MUP-001	14-04				
02	"	16	"	687	AMP-018	14-04				
03	"	16	"	687		14-04				
04	"	16	"	687		14-04				
05	"	16	"	687		14-04				
06	"	16	"	687		14-04				
07	"	16	"	687		14-04				
08	"	16	"	687		14-04				
09	"	15	"	687		14-04				

Obs.:

VERIFICACIÓN DEL FACTOR DE SEGURIDAD (Fs) DEL ARROLLAMIENTO DE MEDICIÓN



OF N° 99 5130
 CLIENTE ALSTOM
 PEDIDO N° 4-3128

$R_{sec} - 75^{\circ}C = 0,163 \quad (\Omega)$	$Z_n = \sqrt{(R_{sec} - 75^{\circ}C + Z_c \cdot \cos\phi)^2 + (Z_c \cdot \sin\phi)^2}$	$Z_n = 1,32 \quad (\Omega)$
$Z_c - CARGA = 1,2 \quad (\Omega)$	$U_o = F_s \cdot I_{sn} \cdot Z_n$	$U_o \leq 33 \quad (V)$
$F_s \leq 5$	$I_{exc} \geq 0,1 \cdot I_{sn} \cdot F_s$	$I_{exc} \geq 2,500 \quad (mA)$

U_o - Tensión al Factor de Seguridad I_{exc} - Valor Eficaz de la Corriente de Excitación F_s - Factor de Seguridad
 I_{sn} - Corriente Secundaria Nominal Z_n - Impedancia Nominal Total

N°	Terminales	I_{exc} (mA)	U_o (V)	Operador	Equipos	Fecha
01	151 - 152	2500	14	687	MUD-001	14-04
02	"	"	14	687	ANP-018	14-04
03	"	"	14	687		14-04
04	"	"	14	687		14-04
05	"	"	14	687		14-04
06	"	"	14	687		14-04
07	"	"	14	687		14-04
08	"	"	14	687		14-04
09	"	"	13	687		14-04

Fecha 09/05/00 Visto DGQ [Signature] Fecha Visto Inspector [Signature]

ALSTOM

ENSAYOS DIELECTRICOS Y DESCARGAS PARCIALES TC

OF N° 9 9 5 1 9

CLIENTE ALSTOM

PELIDO N°

X11 - 9129

N°	Ensayos Dielectricos a Frec. Ind. de los Arrol. Prim. 230 KV, 1min		Operador	Equipos	Fecha	Um = 1/√3 KV 1,1Um/√3 pc	Equipos	Operador	Fecha	Ensayo Dielectrico a Frec. Ind. de los Arrol. Sec. y Tierra 30 KV, 1min		Operador	Equipos	Fecha
	A	R								A	R			
01	A		1155	MCA.001	18-04	A	MCA.001	1155	18-04	A		687	MCA.01	14-
02	A		"		"	A		"	"	A		687		14-
03	A		"		"	A		"	"	A		687		14-
04	A		"		"	A		"	"	A		687		14-
05	A		"		"	A		"	"	A		687		14-
06	A		"		"	A		"	"	A		687		14-
07	A		"		"	A		"	"	A		687		14-
08	A		"		"	A		"	"	A		687		14-
09	A		"		"	A		"	"	A		687		14-

A - Aprobado

R - Rechazado

Fecha

09/05/00

Visig-DGG



Fecha

Inspector



MEDICION DEL FACTOR DE PERDIDAS DIELECTRICAS DEL AISLAMIENTO (Tangente Delta)

ALSTOM

OF N° 995190

CLIENTE ALSTOM

PEDIDO N° XH-9129

T. Ambiente	23 °C	U.R. Del Aire	65 %	Tension del Ensayo	10 KV
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N°	Cx(pF)	Teng.Delta	Operador	Equipos	Fecha	Factor de Correcion(K)	
						T. °C	K
01	1017.5	0.159	1155	PTD002	18-04		
02	1033.5	0.150	"		"	0	1.67
03	1037.0	0.156	"		"	2	1.61
04	969.5	0.147	"		"	4	1.55
05	1000.0	0.149	"		"	6	1.49
06	1025.0	0.155	"		"	8	1.43
07	992.0	0.149	"		"	10	1.36
08	1007.0	0.159	"		"	12	1.30
09	991.5	0.148	"		"	14	1.23
						16	1.16
						18	1.08
						20	1.00
						22	0.93
						24	0.86
						26	0.80
						28	0.74
						30	0.69
						32	0.65
						34	0.60
						36	0.56
						38	0.52
						40	0.48
						42	0.45
						44	0.42

OBS.: QUANDO LA MEDICION ES HECHA A UNA TEMPERATURA DIFERENTE DE 20°C, DESEMOS UTILIZAR LA ECUACION;
 $FPD_{20°C} = K \times FPD_T$ PARA CORRECCION A 20°C.
 FPD 20°C = FACTOR DEL PÉRDIDAS DIELECTRICAS DEL AISLAMIENTO A LA TEMPERATURA (T) DEL LIQUIDO AISLANTE

Fecha 09/04/00

Via PGO
 F.A.M.

Fecha

Inspector

ALSTOM

VERIFICACION DE

LA PRECISION

TC

OF N° 995190

CLIENTE

ALSTOM S/A

PEDIDO N°

XH - 9128

N°	Relacion	Error de Intensidad %	Error de Fase S	Carga Nominal VA	Terminales	Operador	Equipos	Fecha
101	1.2	225 X 450-SA	+0.18	+0.4	7.5	15,-152	1155	Pe X003 15-04
10			+0.17	+1.2				
0.2			+0.17	+0.7				
0.05			+0.17	+0.2				
01	1.2	225 X 450-SA	+0.02	-1.0	30	15,-152		
10			+0.04	1.3				
0.2			-0.02	+0.4				
0.05			-0.04	+1.2				
0.2	1.2	225 X 450-SA	+0.18	+0.1	7.5	15,-152	1155	15-04
10			+0.18	+0.3				
0.2			+0.17	+0.5				
0.05			+0.17	+0.6				
0.2	1.2	225 X 450-SA	-	-0.9	30	15,-152		
10			+0.02	-1.1				
0.2			-0.02	+0.4				
0.05			-0.05	+1.4				

Fecha

09/05/00

Viso DGA



Fecha

Inspector



ALSTOM

VERIFICACION DE

LA PRECISION

TC

OF N° 995190

CLIENTE

ALSTOM S/A

PEDIDO N°

XH-9128

N°	xln	Relacion	Error de Intensidad %	Error de Fase δ	Carga Nominal VA	Terminales	Operador	Equipos	Fecha
03	1.2	225 X 450-SA	+0.18	+0.6	7.5	15-152	155	PE X003	15-04
	1.0		+0.18	+0.3					
	0.2		+0.17	+0.6					
	0.05		+0.17	+0.3					
03	1.2	225 X 450-SA	-	-0.6	30	15-152			
	1.0		+0.01	-1.2					
	0.2		-0.03	+0.6					
	0.05		-0.04	+1.1					
04	1.2	225 X 450-SA	+0.18	+0.1	7.5	15-152	155		15-04
	1.0		+0.18	+0.2					
	0.2		+0.17	+0.9					
	0.05		+0.16	+0.9					
04	1.2	225 X 450-SA	-	-0.5	30	15-152			
	1.0		+0.01	-0.9					
	0.2		-0.02	+0.5					
	0.05		-0.04	+1.4					

Fecha

09/05/00

Viso DGA

Fecha

Inspector

ALSTOM

VERIFICACION DE

LA PRECISION

TC

OF N°

9 9 5 1 9 0

CLIENTE

ALSTOM S/A

PEDIDO N°

XH - 9128

N°	x/n	Relacion	Error de Intensidad %	Error de Fase S	Carga Nominal VA	Terminales	Operador	Equipos	Fecha
05	1.2	225 X 450-SA	+0.16	+0.8	7.5	15-152	1155	PE X003	15-04
	1.0		+0.16	+0.9					
	0.2		+0.15	+1.0					
	0.05		+0.15	+0.9					
05	1.2	225 X 450-SA	-0.05	+0.7	30	15-152			
	1.0		-0.03	-0.7					
	0.2		-0.08	+1.3					
	0.05		-0.09	+0.5					
06	1.2	225 X 450-SA	+0.17	+0.5	7.5	15-152	1155		15-04
	1.0		+0.17	+0.3					
	0.2		+0.16	+0.6					
	0.05		+0.16	+0.5					
06	1.2	225 X 450-SA	-0.02	-0.4	30	15-152			
	1.0		-0.02	-0.6					
	0.2		-0.04	+0.4					
	0.05		-0.07	+1.5					

Fecha

09/05/00

Visto DGA

Fecha

Inspector

ALSTOM

VERIFICACION DE

LA PRECISION

TC

OF N° 995170

CLIENTE

ALSTOM S/A

PEDIDO N°

XH-9128

N°	x/n	Relacion	Error de Intensidad %	Error de Fase δ	Carga Nominal VA	Terminales	Operator	Equipos	Fecha
07	6.2	225 X 450-SA	+0.19	+0.1	7.5	15-152	1155	PEX003	15-04
	1.0		+0.19	-0.3					
	0.2		+0.18	+0.1					
	0.05		+0.18	+0.1					
07	1.2	225 X 450-SA	+0.03	-1.4	30	15-152			
	1.0		+0.04	-1.6					
	0.2		-0.1	-0.4					
	0.05		-0.01	+0.5					
08	1.2	225 X 450-SA	+0.18	+0.1	7.5	15-152	1155		15-04
	1.0		+0.17	+0.2					
	0.2		+0.16	+0.6					
	0.05		+0.16	+0.9					
08	1.2	225 X 450-SA	-0.05	+1.0	30	15-152			
	1.0		-0.03	-0.1					
	0.2		-0.07	+0.9					
	0.05		-0.05	+0.3					

Fecha

09/05/00

Visto DGA



Fecha



Inspector

ALSTOM

VERIFICACION DE

LA PRECISION

TC

OF N° 995190

CLIENTE

ALSTOM S/A

PEDIDO N°

XH-9128

N°	xln	Relacion	Error de Intensidad %	Error de Fase δ	Carga Nominal VA	Terminales	Operador	Equipos	Fecha
09	1.2	225 X 450-SA	ta18	ta1	7.5	15-152	1155	PEX003	15.04
	1.0		ta18	-a2					
	0.2		ta16	ta4					
	0.05		ta16	ta6					
09	1.2	225 X 450-SA	ta02	-15	30	15-152			
	1.0		ta04	-14					
	0.2		-a	-a5					
	0.05		-a03	+05					

Fecha

09/05/00

Viso DGA

Fecha

Inspector

ENSAYO DE
HERMETICIDAD
EN FRIO

ALSTOM

OF N° 9 9 5 3 9 0

CLIENTE ALSTOM S/A

PEDIDO N°
KH - 9128

Presion = 0,7

(Kg/cm²)

Tiempo de aplicacion = 01:00

N°	Operador	Equipos	Resultado	Fecha	Observaciones
01	1031	CEN - 001	A	09/05	
02	"		A	"	
03	"		A	"	
04	"		A	"	
05	"		A	"	
06	"		A	"	
07	"		A	"	
08	"		A	"	
09	"		A	"	

Resultado

A = Aprobado

R = Rechazado

Fecha 09/05/00

 950

Fecha



Inspector