December 1, 2014

Honorable Kathleen Burgess
Secretary
State of New York
Public Service Commission
Three Empire State Plaza
Albany, New York 12223

Subject: New York Public Service Commission approval request for Arteche medium voltage class Metering Instrument Transformers

Dear Ms. Burgess,

We are pleased to submit for your consideration and approval the Arteche medium voltage metering class instrument transformers. This submittal has been endorsed by Mr. Peter Kouriliours of NYSEG as evidenced by his Letter of Intent which is part of this submittal for approval.

A complete set of the information required as part of the New York Codes, Rules and Regulations 16 CRR-NY93.6 has been shipped to your attention. Our company address is:

Arteche USA
18503 Pines Blvd. Suite 313
Pembroke Pines, FL 33029

The manufacturing facility is located at:

Arteche Transformadores y Tecnologia S.A. de C.V
Km. 73.54 Antigua Carretera Mexico Queretaro
Tepeji del Rio de Ocampo, 42850 Hidalgo, Mexico

A couple of clarifying notes regarding our approval request are in order:

First, we hired KV Consulting an independent metrological laboratory to perform calibration testing of our factory test equipment. Mr. Vladimir Khalin, MSEE, CQA was the person on site who completed the Certificates of Calibration with NIST traceability. Mr. Khalin is widely considered an expert in test equipment calibration and was an original member of the IEEE C57.13 Revision Working Group at the time that the IEEE Standard C57.13-2008 was submitted to the IEEE-SA Standards Board for approval. The Certificates of Calibration and associated information are part of this submittal for approval.

Secondly, this initial approval application is for the following Arteche Models: CRH-36; VRJ-17; URS-36; VRS-36; URU-52; and VRU-52. The remainder of the models identified in the Letter of Intent submitted by Mr. Peter Kourliouros with NYSEG will be submitted for approval at a later date.

We hope that you will find our submittal clear and concise. If you require any additional information, please don't hesitate to contact me at the below numbers.

Sincerely,

Glen Banks

Arteche USA
Regional Sales Director
gbanks@artecheusa.com
859- 963-6092

arteche

October 31, 2014

Subject: New York Public Service Commission approval request for Arteche medium voltage class Metering Instrument Transformers

Dear Mr. Resca,

We are pleased to submit for your consideration and approval the Arteche medium voltage metering class instrument transformers. This submittal has been endorsed by Mr. Peter Kouriliours of NYSEG as evidenced by his Letter of Intent which is part of this submittal for approval.

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arteche

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Sincerely,

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arteche

Table of Contents

According to the requirements stated in the document 16 CRR-NY 93.6; each of the previous sections contain the following information:

- ✓ Model Description
- ✓ Sample Routine Test Report
- ✓ Arteche Factory Test Report
- ✓ Outline Drawing
- ✓ Nameplate Drawing
- ✓ Certified Test Report by Independent Laboratory
- ✓ Annex

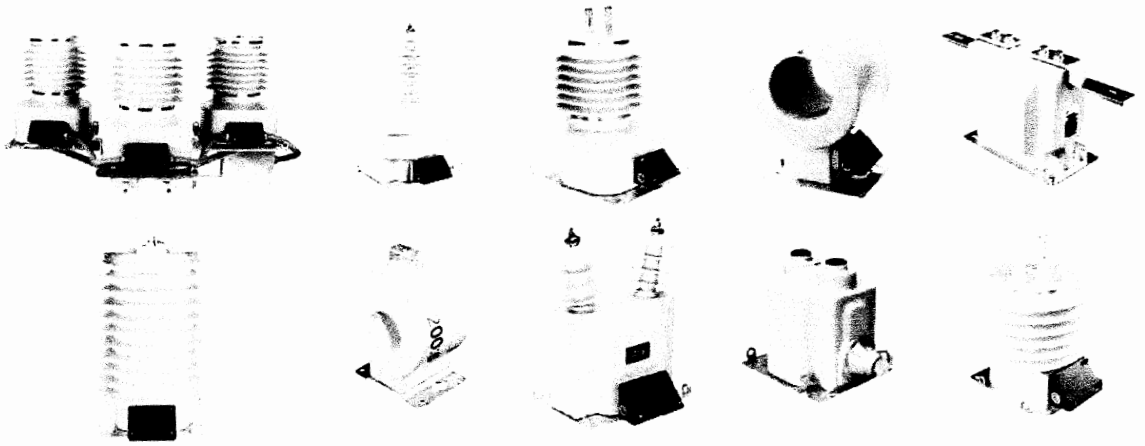
EXECUTIVE SUMMARY

Arteche Group is an international leader in the development of solutions for the generation, transmission, distribution and industrial markets. Our technological capabilities, financial independence and experience gained over 65 years; ensure that our products achieve the highest levels of quality and reliability. Arteche Group is currently organized in four strategic business units to respond to customer needs: Instrument Transformers, Smart Grid, Power Quality and Turnkey Solutions (for wind farms).

Arteche has been supplying instrument transformers to the North American market for over 20 years initially through a private labeling agreement with Kuhlman Electric and later through a partnership with ABB. In 2012 Arteche separated its medium voltage instrument transformer business from ABB and has been going direct to the market with its own sales and marketing team since then. Overall, Arteche has over 1,000,000 units installed worldwide.

Arteche Medium Voltage Instrument Transformers are oil free, manufactured with vacuum casting or with automatic pressure gelation (APG) for high dielectric strength. The Cycloaliphatic Epoxy (CEP) Resin for external insulation provides for long creepage distance, robust mechanical strength, and excellent arc tracking properties and resistance to UV exposure. These transformers can be used under challenging operating conditions, such as extreme temperatures (-50ºC; +50ºC), salty or polluted environments, areas under seismic hazard, violent winds or high altitude. Hydrophobic Cycloaliphatic Resin (HCEP) is an available option to increase capabilities with some of these application conditions. Arteche transformers are an excellent option for use in metering applications due to their exceptional accuracy. Their frequency response, allows them to successfully be used in applications such as power quality monitoring and harmonic measurement as well.

The assurance of our success is based on offering high quality, reliable products and solutions that enable our customers to achieve their business objectives. We further differentiate our company by building long lasting relationships with our customers. These relationships are forged by our commitment to reliable and highly adaptable service that nurtures lasting relationships built on confidence and trust.



Arteche USA; 18503 Pines Blvd., Suite 313,
Pembroke Pines, FL., 33029 USA

T. 954-438-9499; F. 954-438-9959;
www.arteche.com

arteche

PRODUCT SUMMARY

Current Transformers

Outdoor CT's

Type	Primary Amps	Primary Volts
CRH-36	5 through 600/1200A	34.5kV

Voltage Transformers

Outdoor VT's

Type	Primary Volts	Sec Volts	Thermal Burden
VRJ-17	2400V Through 14400V	120 V	1500 VA
URS-36	16800V Through 20125V	120 V	1000 VA
VRS-36	8310V Through 34500V	120V	1000 VA
URU-52	27600V Through 27600V	115 V	2500 VA
VRU-52	27600V Through 46000V	115 V	3000 VA

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www.arteche.com

SECTION 1: MODEL CRH-36

Outdoor CT's

Description:

The CR Series are dry type outdoor service current transformers. The core is encapsulated with Type B epoxy resin for excellence in internal dielectric properties and mechanical strength. The external layer of Cycloaliphatic resin provides resistance to ultraviolet rays and the effects of tracking and erosion on the exterior of the module. The device is maintenance free, ensuring a long mechanical and electrical life.

Partial Discharge measurements exceed IEEE C57.13 2008 requirements.

Available Ratios:

The CRH-36 family of CT's allows for revenue metering of at least 0.3% accuracy over a current range of 5A up to 600/1200A at 30C. The below table summarizes the ratios that are available.

PRI:SEC	Continuous Thermal Current Rating Factor @ 30°C	IEEE METER ACCURACY CLASS
5:5	2.0	0.3B-1.8
10:5	2.0	0.3B-1.8
15:5	2.0	0.3B-1.8
20:5	2.0	0.3B-1.8
25:5	2.0	0.3B-1.8
30:5	2.0	0.3B-1.8
40:5	2.0	0.3B-1.8
50:5	2.0	0.3B-1.8
75:5	2.0	0.3B-1.8
100:5	2.0	0.3B-1.8
150:5	2.0	0.3B-1.8
200:5	2.0	0.3B-1.8
300:5	2.0	0.3B-1.8
400:5	2.0	0.3B-1.8
500:5	2.0	0.3B-1.8
600:5	2.0	0.3B-1.8
800:5	2.0	0.3B-1.8
1000:5	1.5	0.3B-1.8
1200:5	1.5	0.3B-1.8
10/20:5	3.0/2.0	0.3B-1.8/0.3B1.8
25/50:5	3.0/2.0	0.3B-1.8/0.3B1.8
30/60:5	3.0/2.0	0.3B-1.8/0.3B1.8
50/100:5	3.0/2.0	0.3B-1.8/0.3B1.8
75/150:5	3.0/2.0	0.3B-1.8/0.3B1.8

100/200:5	3.0/2.0	0.3B-1.8/0.3B1.8
150/300:5	3.0/2.0	0.3B-1.8/0.3B1.8
200/400:5	3.0/2.0	0.3B-1.8/0.3B1.8
300/600:5	3.0/2.0	0.3B-1.8/0.3B1.8
400/800:5	3.0/2.0	0.3B-1.8/0.3B1.8
500/1000:5	3.0/1.5	0.3B-1.8/0.3B1.8
600/1200:5	3.0/1.5	0.3B-1.8/0.3B1.8

Construction:

The core is built from high permeability grain oriented silicon steel laminations for low losses. The windings are copper wire with copper plate double isolation. The concentric distribution of the coils prevents magnetic flux leakage, achieving greater accuracy and higher capacity to withstand mechanical stresses in adverse operating conditions.

Secondary Terminals and Cover: The secondary terminals are furnished with brass quick connectors. The secondary terminal cover is made of plastic material and sealed with 4 screw type lugs.

Base Plates:

The transformers are furnished with galvanized steel base plates.

Primary Bar:

The primary consists of two platted copper bars that have been punched for NEMA 2 holes connections to easily accommodate the primary connection utilizing the H1-H2 polarity markings.

Nameplate:

Each CT ships with an engraved steel nameplate affixed to the CT base plate using rivets. The nameplate contains production serial number as well as all data required by the latest revision of ANSI C57.13.

Polarity Marking:

Polarity marking is accomplished by using white silicon dots on both the primary and secondary sides.

Testing:

The CRH-36 design has undergone design type testing in accordance with IEEE C57.13 (latest edition), Section 8. The test report is included with this submittal. Furthermore, all units produced undergo production testing to verify accuracy and phase angle error in accordance with Section 8, C57.13 (latest edition). A sample production test report is included with this submittal.

Nº **14016589** # TESTS CERTIFICATE

CUSTOMER: ARTECHE TYT,	CURRENT TRANSFORMER QUANTITY: 1
CUSTOMER'S REF.: IBERDROLA PROTOTYPES	TYPE: CRH-36 HIGHEST VOLTAGE: 36.5 KV.

PRIMARY (A)	SECONDARY (A)	BURD (VA)	CLASS	FACTOR	VKP	Io	Rs 75º
2000 (H1-H2)	5 (X1-X5)	B-1.8	0.3				

STANDARD:	ROUTINE TEST		CALCULATED VALUES			
IEEE C57.13/2008	POWER-FREQ.T.: P/S+E: 70	KV.	I.SECURITY F./ACCURACY LIMIT			
FREQUENCY: 60 Hz	P/P:	KV.	TERMIN	RS75º(Ω)	V	A
EXT.CURRENT RATING:	S/E: 2,5	KV.	X1-X5			
120%	S/S:	KV.				
THER. RATING: 90KA/1''	PARTIAL DISCHARGES ≤ 50 pC 38,3 KV.					
DYNAM. RATING: 171 KA	OVERVOLTAGE INTERTURN TEST 200V 180Hz 40Sec.					
TEMP: -40º/+40ºC	VERIF. OF TERMINALS MARKINGS AND POLARITY					

ACCURACY TEST							MEASURED VALUES	
							L.SECUR. F./ACCUR. LIMIT	
TRANSFO. Nº.	RATIO	TERMIN.	BURDEN (VA)	% OF RATED CURRENT	± PORCEN CURRENT ERROR	± PHASE DISPL. IN MIN.	V	A
14016589/ 1	2000/5 A	X1-X5	B0.1	120	+0.10	+0.1		
				100	+0.10	+0.1		
				10	+0.10	+0.7		
			B0.2	120	−0.10	+0.1		
				100	+0.10	+0.1		
				10	+0.09	+0.7		
			B0.5	120	+0.10	+0.2		
				100	+0.10	+0.2		
				10	+0.09	+0.9		
			B0.9	120	−0.09	+0.3		
				100	+0.09	−0.4		
				10	+0.07	+1.3		
			B1.0	120	+0.08	0		
				100	+0.08	0		
				10	+0.06	+0.7		
			B1.8	120	+0.07	+0.7		
				100	+0.07	+0.6		
				10	+0.06	+1.5		
	1600/5 A	X2-X5	B0.1	100	+0.13	+0.2		
	1500/5 A	X1-X4	B0.1	100	-0.01	+0.2		
	1200/5 A	X1-X3	B0.1	100	-0.01	+0.2		

Initials JLAS
Date 3/10/14
INS 01

Date: 03/10/2014 Certified Correct: Emiliano Hernandez J
E.H.T

Nº 14016589

TESTS CERTIFICATE

ACCURACY TEST							MEASURED VALUES	
							L.SECUR. F./ACCUR. LIMIT	
TRANSFO. N°.	RATIO	TERMIN.	BURDEN (VA)	% OF RATED CURRENT	± PORCEN CURRENT ERROR	± PHASE DISPL. IN MIN.	V	A
	1100/5 A	X2-X4	B0.1	100	-0.01	−0.5		
	800/5 A	X2-X3	B0.1	100	-0.02	+0.2		
	500/5 A	X4-X5	B0.1	100	+0.38	+2.4		
	400/5 A	X1-X2	B0.1	100	-0.12	+1.8		
	300/5 A	X3-X4	B0.1	100	-0.16	+4.5		

Ocial de México
Initials JLAS
Date 3/10/14
INS 010

000056

Transformadores y Tecnología, S.A. de C.V.
Km. 73,54 Ant. Carretera México – Querétaro
42850 Tepeji Del Río de Ocampo, Estado de Hidalgo.
T.+52 55 41 47 60 42 F. +52 77 37330366

F-LE-018
PARTIAL DISCHARGES TEST ***** 1 OF 1 SHEET *****

F-LE-003

	SERIALNUMBER: 14016589	TYPE: CRH-36	Max System Voltage = 36.5 KV					

NUMBER		PRIOR DIELECTRIC TEST			AFTER DIELECTRIC TEST 38.3/22.1 KV					
SERIAL NUMBER	CONSECUTIVE	INICIAL VOLTAGE	LAST VOLTAGE	q max (PC) Vmax	INICIAL VOLTAGE	LAST VOLTAGE	PC LEVEL	DATE	INSPECTOR	OBSERVATIONS
	2				———	———	1 pC 1pC	03/10/2014	RRM	
POWER FREQUENCY APPLIED VOLTAGE TEST(70 kV rms)			60Hz.	60Seg.						

INSPECTOR
JOSE LUIS ARRIETA SANCHEZ

Ccial de México
Initials: LAS
Date: 3/10/14
INS: 010

arteche
LABORATORIO ELÉCTRICO
MEDIA TENSION
SUPERVISOR ARTECHE
GUSTAVO ALCANTAR MAGAÑA.

000060

Nº 14016589

TESTS CERTIFICATE

CUSTOMER: ARTECHE LYT,	CURRENT TRANSFORMER QUANTITY:
CUSTOMER'S REF.: IBERDROLA PROTOTYPES	TYPE: CRB-36 HIGHEST VOLTAGE: 36.5 KV.

PRIMARY (A)	SECONDARY (A)	BURD (VA)	CLASS	FACTOR	VKP	Io	Rs 75°
2000 (H1-H2)	5 (X1-X5)	B-1.8	0.3				

STANDARD:	ROUTINE TEST		CALCULATED VALUES			
IEEE C57.13/2008	POWER-FREQ. P/S+E: 70	KV.	I.SECURITY F./ACCURACY LIMIT			
FREQUENCY: 60 Hz	P/P:	KV.	TERMIN	RS75°(Ω)	V	A
EXT.CURRENT RATING:	S/E: 2,5	KV.	X1-X5			
[illegible]	S/S:	KV.				
THER. RATING: 90KA/1''	PARTIAL DISCHARGES ≤ [illegible] pC 38,5 KV.					
DYNAM. RATING: 171 KA	OVERVOLTAGE INTERTURN TEST 200V 180Hz 40Sec.					
TEMP: -10°/+40°C	VERIF. OF TERMINALS MARKINGS AND POLARITY					

ACCURACY TEST							MEASURED VALUES	
				% OF	± PORCEN	± PHASE	I.SECUR.F./ACCUR.LIMIT	
TRANSFO. Nº.	RATIO	TERMIN.	BURDEN (VA)	RATED CURRENT	CURRENT ERROR	DISPL. IN MIN.	V	A
14016589/ 1	2000/5 A	X1-X5	B0.1	120	+0.10	+0.1		
				100	+0.10	-0.1		
				10	+0.10	-0.7		
			B0.2	120	+0.10	-0.1		
				100	+0.10	+0.1		
				10	-0.09	+0.7		
			B0.5	120	-0.10	+0.2		
				100	+0.10	+0.2		
				10	+0.09	+0.9		
			B0.9	120	+0.09	+0.3		
				100	+0.09	-0.4		
				10	+0.07	+1.3		
			B1.0	120	+0.08	0		
				100	-0.08	0		
				10	-0.06	+0.7		
			B1.8	120	-0.07	+0.7		
				100	+0.07	+0.6		
				10	+0.06	+1.5		
	1600/5 A	X2-X5	B0.1	100	+0.13	+0.2		
	1500/5 A	X1-X4	B0.1	100	-0.01	+0.2		
	1200/5 A	X1-X3	B0.1	100	[illegible]0.01	+0.2		

Date: 0[illegible]/[illegible]0/2014 Certified Correct: Emiliano Hernandez T. EHT

Cdad de México
JLAS
3/10/14
INS 010

Nº 14016589

TESTS CERTIFICATE

ACCURACY TEST							MEASURED VALUES	
TRANSFO. Nº	RATIO	TERMIN.	BURDEN (VA)	% OF RATED CURRENT	± PORCEN CURRENT ERROR	± PHASE DISPL IN MIN.	I SECOND./ACCUR. LIMIT	
							V	A
	1200/5 A	X2-X4	40	5%	-0.01	0.5		
	600/5 A	X2-X3	25	5%	-0.02	0.2		
	300/5 A	X4-X5	200	100%	-0.38	2.4		
	400/5 A	X1-X4	200	100%	-0.12	+1.8		
	600/5 A	X3-X5	400	5%	-0.16	+4.5		

Coast de México
Initials JLAS
Date 3/10/14
INS 010

000062

ARTECHE USA.

TEST REPORT - MV CURRENT TRANSFORMER

CUSTOMER:
RATIO 400:5 A
ACCURACY 0.3 B0-1.8/T200

MODEL: CRH-36
R.F. 2.0
QTY 1
CODE: 756861080

SERIAL NUMBER: 14015744

UNIT #	RATIO	%Is	60 Hz METERING ACCURACY		60 Hz EXITATION & RELAYING		DIELECTRIC TEST			TESTED/ DATE
			R.F.C	P.A.	Iex @ EMF	ERROR	HIPOT LEVEL	P.D. Pc	P.D. INCEPTION	
4	X1-X2	R.F.	0.9992	+1.0	212.60	0.099	25.2	0	43	28/08/2014
	400:5A	100	0.9992	+1.1						
X1-X2	B0.1	10	0.9994	+3.2			34.5	0		
	B0.2	R.F.	0.9993	+1.1						
		100	0.9993	+1.1						
		10	0.9995	+2.7						
	B0.5	R.F.	0.9995	+1.4						
		100	0.9995	+1.4						
		10	0.9998	+3.0						
	B0.9	R.F.	0.9997	+1.3						
		100	0.9997	+1.3						
		10	1.0000	+2.4						
	B1.0	R.F.	0.9998	+0.4						
		100	0.9998	+0.4						
		10	1.0002	+1.0						
	B1.8	R.F.	1.0002	-0.2						
		100	1.0002	-0.2						
		10	1.0012	+0.5						

HIGH RATIO **LOW RATIO (if DUAL RATIO)**

SECONDARY RESISTANCE @ 75 C 0.233 ohms
SECONDARY RESISTANCE @ 75 C ------- Ohms

CALCULATED LIMITING E.M.F. 212.60 Volts
CALCULATED LIMITING E.M.F. ------- **Volts**

POWER DIELECTRIC TEST, PRIMARY WINDING, 1 minute @ 60 Hz 70 KV

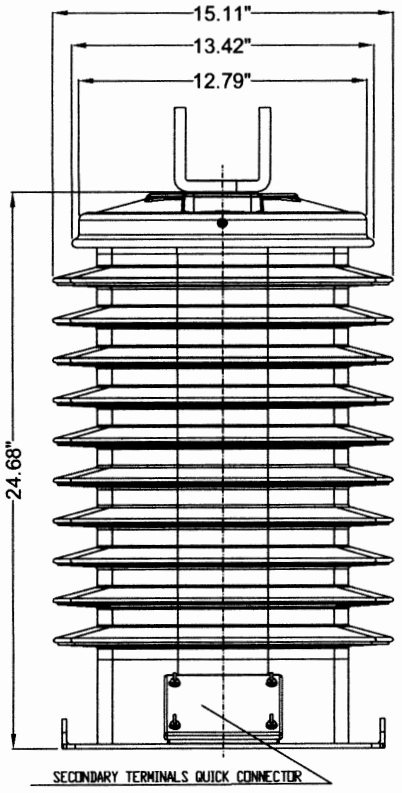
POWER DIELECTRIC TEST, SECONDARY WINDING, 1 minute @ 60 Hz 2.5 KV

IDUCED TEST, VOLTAGE 400 VOLTS @ 180 Hz FOR 40 SECONDS

E. C.

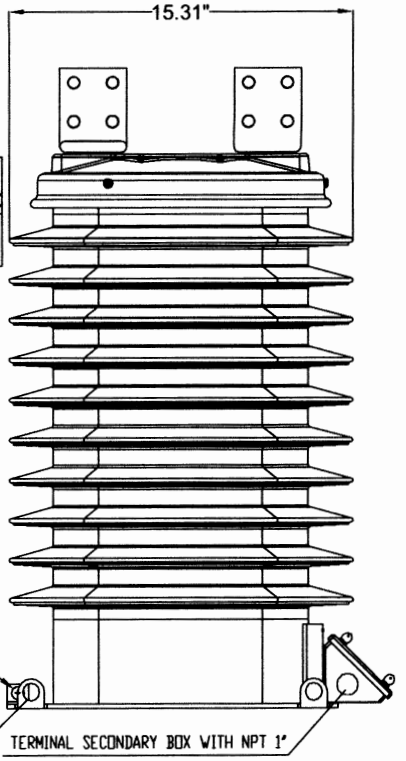
Made in Mexico By:

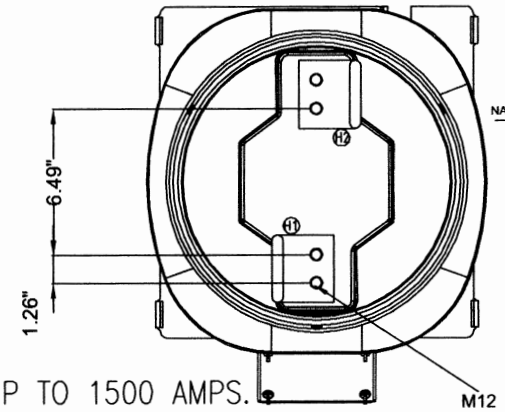
Reviewer, Aproval.



Approx. weight: 253.53 lb

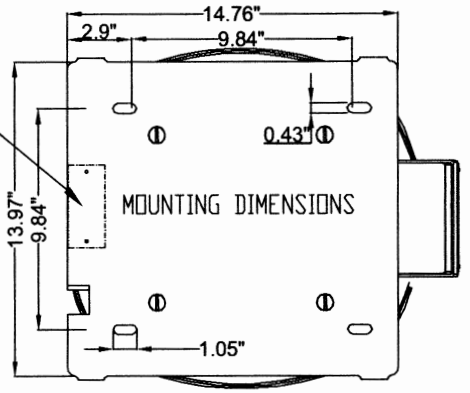
Creep distance: 47.83in



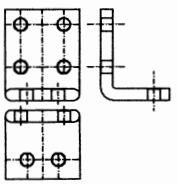


UP TO 1500 AMPS.

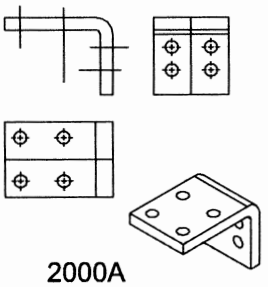
NAME PLATE



PRIMARYL TERMINAL

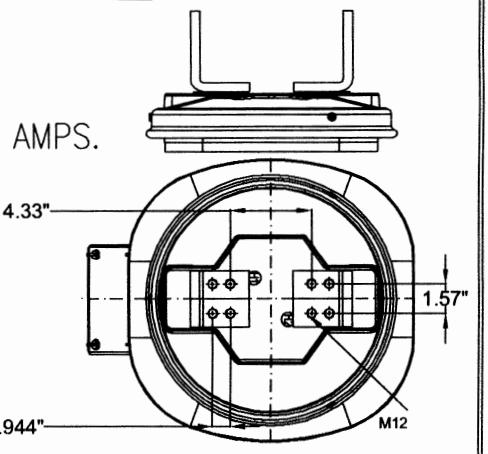


1500A



2000A

UP TO 2000 AMPS.



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Approximate dimensions in inches

CURRENT TRANSFORMER CRH–36

Date	Approved	Drawing Nº
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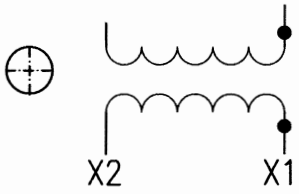

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SERIAL NUMBER

TYPE CRH–36 CURRENT TRANSFORMER

N.S.V. 34.5 kV CAT.N° 756861001
B.I.L. 200 kV FW 60 Hz

SEC. TERM.	CURRENT RATIO	ACCURACY @ 60 Hz METERING	RELAYING	RF @ 30 °C
X1–X2	5:5	0.3B-1.8	T-200	2.0

INDUSTRY CANADA APPROVAL No. AE–

arteche

NAMEPLATE

CT CRH–36

AREA: Oficina de Sistemas de Distribución (Distribution Systems Office)

REPORT Nr.: K3421-168C-2014

CLIENT:
TRANSFORMADORES Y TECNOLOGÍA, S. A. DE C. V.

ADDRESS: Antigua Carretera Federal México-Querétaro Km. 73.540 Tlaxinacalpan Tepeji del Río, Tepeji del Rio de Ocampo Hidalgo. C.P. 42855

TITLE: Prototype tests on Current Transformer CRH-36

SUMMARY:

Object Tested:

Current transformer, type CRH-36, Serial number 14013543, BIL: 200 kV, CT Ratio: 200:5 A, Class: 34.5 kV, Overcurrent factor 4 In, Accuracy: 0.15 B0.1-B1.8, frequency 60 Hz. Brand Arteche.

Test Performed:

1.- Impulse
2.- Open – Circuit Voltage
3.- Voltage Applied (Wet Withstand)

Standards:

IEEE C57.13-2008

Result: SATISFACTORY

Remark: - This report and results cover the tested sample only and no contain the totality type tests. Confidential document.

DATE: 10/13/2014	FILE: K3421-168-2014	APPROVED BY:	REVISED BY:
PREPARED BY:			
ING. RUBÉN JARAMILLO VACIO SIGNATARIO		**ING. JAIME ENCINAS ROSAS** JEFE DE LA OFICINA DE SISTEMAS DE DISTRIBUCIÓN	**ING. RICARDO MARTÍNEZ TORRES** JEFE DEL DEPARTAMENTO DE DISTRIBUCIÓN

Report Nr: K3421-168C-2014
Sheet: 2 of 4
Date: 10/13/2014

DEPARTAMENTO DE DISTRIBUCIÓN
OFICINA DE SISTEMAS DE DISTRIBUCIÓN

CURRENT TRANSFORMER CHARACTERISTICS

Current transformer model CRH-36

Brand:	ARTECHE
Serial:	14013543
Class:	34.5 kV
BIL:	200 kV
Frequency:	60 Hz
Accuracy	0.15 B0.1-B1.8
Ratio:	200:5 Amps
Terminals:	X1-X2
RF:	4
Dynamic Current:	54 kA
Standards	IEEE C57.13-2008

Equipment test:

High Current Source brand HV TEST serial 15S0005 calibrated
Temperature Recorder YEW serial D55090 calibrated.
Resistance Meter brand TETTEX serial 156078 calibrated
High Voltage Source General Electric serial 1971416 calibrated
Generator for induced voltage test General Electric serial 80524 calibrated
Cronometer STEREN serial CLK-150 calibrated
Power Analyzer YEW WT3000 serial 91GC30735 calibrated
Impulse Voltage System HAEFELY 06100547.10.1 calibrated

Uncentainty declarated
With a k=2 for confidence level of 95%
Uncertainty: ±1.98 %

DOCUMENTO FIRMADO ELECTRONICAMENTE

Tested By: **Ing. Jesus Ulises Avalos Perez**
Ingeniero de Pruebas

DOCUMENTO FIRMADO ELECTRONICAMENTE

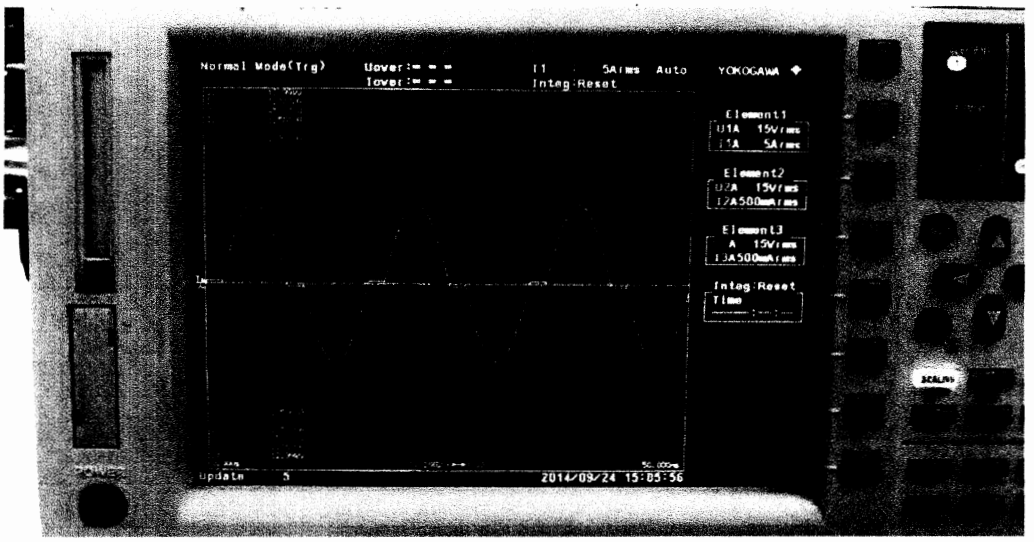
Checked By **Ing. Jaime Encinas Rosas**
Encargado de Oficina de Sistemas de Distribución

Report Nr: K3421-168C-2014
Sheet: 4 of 4
Date: 10/13/2014

DEPARTAMENTO DE DISTRIBUCIÓN
OFICINA DE SISTEMAS DE DISTRIBUCIÓN

Open Circuit Test

Current Applied=	800 A
Voltage measured=	83.78 Vrms = 145.106 Vpeak



Result: **Satisfactory**

Wet withstand

Primary winding 10 seconds @ 60 Hz 70 kV

Result: **Satisfactory**

DOCUMENTO FIRMADO ELECTRONICAMENTE

Tested By: **Ing. Jesus Ulises Avalos Perez**
Ingeniero de Pruebas

DOCUMENTO FIRMADO ELECTRONICAMENTE

Checked By **Ing. Jaime Encinas Rosas**
Encargado de Oficina de Sistemas de Distribución

ÁREA: High Current Office

TEST REPORT: K3422-179C-2014.	
CLIENT:	**ARTECHE TRANSFORMADORES Y TECNOLOGÍA S.A. DE C.V.**
ADDRESS:	km 73,540 Antigua Carretera México Querétaro, Tepeji del Río de Ocampo Edo. de Hidalgo C.P. 42850, Tel.:+52 (773) 7332034.
TÍTLE:	Short time withstand current test carried out on a current transformer. - **Type:** CRH-36 - **Ratio:** 200:5 - **N.S.V:** 34.5 kV - **Brand**: ARTECHE. - **Made in:** México.

SUMMARY:

Object under test:
Current transformer, type CRH-36, brand ARTECHE, serial number: 14013543.

Applied standards:
IEEE C57.13-2008 Clause 6.6.1 & 6.6.2

Test performed:
6.6.1 Short-time mechanical current rating. (54 kA)
6.6.2 Short-time thermal current rating. (20 kA, 1s)

Test results:
The assessment of the compliance of the tested current transformer with the requirements of the short-time withstand current tests, were not performed by LAPEM. So, in this report are declared only the test values applied.
The test data declared in this report is for the exclusive use of the owner, who is in his full right to use them at his convenience.

This report and results relate only to the tested sample and no contain the whole type test. Confidential document.

DATE: 2014-09-18 FILE: K3422-179-2014	APROVED BY:	AUTHORIZED BY:
TESTED BY: Genaro Arturo Ruiz Carlo Testing Enginner	Juan Carlos Martínez Magdaleno Head of High Current Laboratory	Ricardo A Martínez Torres **Head of Distribution Departament**

DISTRIBUTION DEPARTMENT-HIGH CURRENT LABORATORY

TEST REPORT

CLIENT: **ARTECHE TRANSFORMADORES Y TECNOLOGÍA S.A. DE C.V.**

MANUFACTURER: **ARTECHE TRANSFORMADORES Y TECNOLOGÍA S.A. DE C.V.**

EQUIPMENT TESTED: **CURRENT TRANSFORMER.**

TYPE: **CRH-36**

SERIAL No: **14013543.**

CHARACTERISTICS:

Brand: ARTECHE	**Dynamic Current: 54 kA**	**Accuracy**	**0.15 B0.1-B1.8**
N.S.V.: 34.5 kV	**Thermal Current: 20 kA (1 s)**	**Metering**	**1 % to 150%**
Ratio: 200: 5	**Frequency: 60 Hz**	**RF@30°C**	**4.0**

STANDARDS:
IEEE C57.13-2008 Clause 6.6.1 & 6.6.2

TESTS PERFORMED:
6.6.1 Short-time mechanical current rating. (54 kA)
6.6.2 Short-time thermal current rating. (20 kA, 1s)

Date of the test: August 27, 2014
Date of receipt of the transformer: August 27, 2014

RESULTS:
The assessment of the compliance of the tested current transformer with the requirements of the short- time withstand current tests, were not performed by LAPEM. So, in this report are declared only the test values applied.

THIS REPORT INCLUDES:

Pages: 6	**Photographs: 1**
Oscillograms: 3	**Drawings: 1**
Diagrams: -	**Others: -**

Genaro Arturo Ruiz Carlo, Eng.
Tested by

Genaro Arturo Ruiz Carlo, Eng.
Authorized Signatory

The results expressed within this report refer only to the tested object(s).

42220101

Irapuato, Gto. México; September 18, 2014.

1. - OTHER CHARACTERISTICS ASSIGNED BY THE MANUFACTURER.

2. - WITNESS DURING TESTS:

Name: Company

--- ---

3. - PURPOSE OF THE TEST.

The purpose of the tests is to demonstrate the mechanical & thermal capability of the transformer to withstand short circuit stresses.

4. - STANDARDS APPLIED:

IEEE C57.13-2008 Clause 6.6.1 & 6.6.2

5. - TEST REQUIREMENTS:

- **6.6.1 Short-time mechanical current rating**

The short-time mechanical current rating shall be the rms value of the ac component of a displaced (asymmetrical) primary current wave that the transformer is capable of withstanding with the secondary winding short-circuited. "Capable of withstanding" shall be interpreted to mean that if subjected to this duty, the current transformer shall show no damage and shall be capable of meeting the other applicable requirements of this standard.

- **6.6.2 Short-time thermal current rating**

The 1 s thermal current rating of a current transformer is the rms symmetrical primary current that can be carried for 1 s with the secondary winding short-circuited without exceeding in any winding the limiting.

6. - TEST CIRCUIT:

The transformer under test is connected to the low voltage side of the short circuit transformer. The short circuit is made by closing the synchronized device, and the clearing of the short circuit is made by the opening of the back circuit breaker, then the time during which the current flows through the Device Under test is obtained. See figure 1.

7. - TESTS RESULTS AND UNCERTAINTY OF MEASUREMENT:

See page 4 for test values obtained.

7.1. - VISUAL INSPECTION:

The tested transformer didn't show any damage at least on the outside part, the external dimensions are still in accordance with drawing 4287041

7.2. - CONCLUSIONS:

The current transformer tested did not show indications of damage during the tests; this laboratory didn't carry out any other verification.

7.3. - PHOTOGRAPHS:

This report not includes photographs of the transformer.

7.4. - OSCILLOGRAMS:

This report includes the oscillograms that show the results of the short time current tests.

Av. Apaseo Ote. s/n Cd. Industrial. C.P. 36630 Irapuato, Gto. México.
Tel: (462) 6 23 94 00

DISTRIBUTION DEPARTMENT-HIGH CURRENT LABORATORY

REPORT: K3422-179C-2014

TEST RESULTS AND UNCERTAINTY OF MEASUREMENT

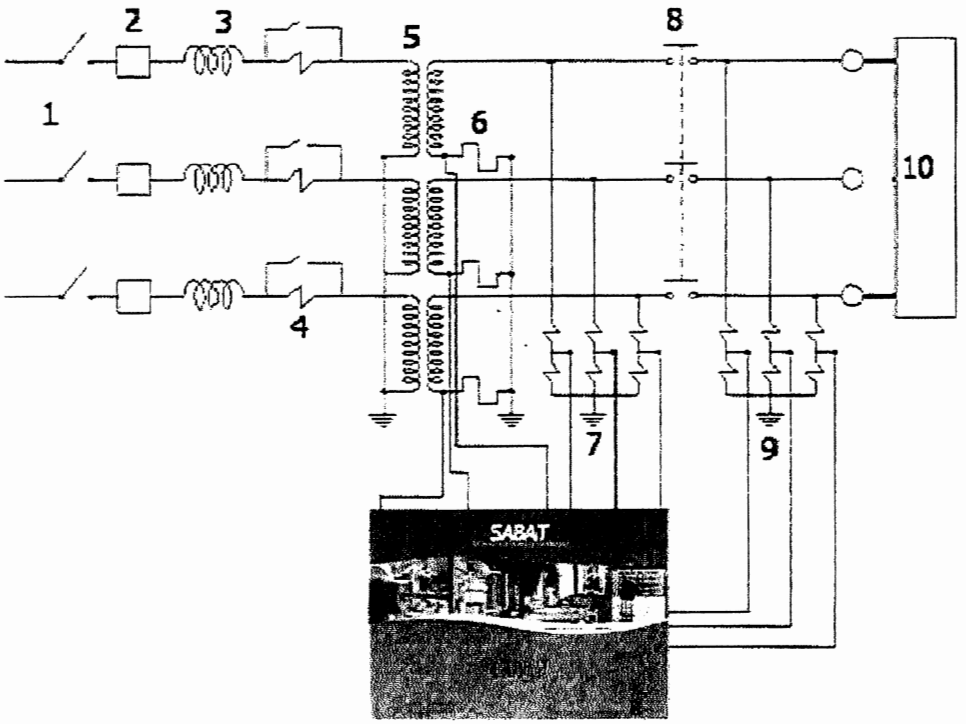
Test circuit	Oscillo-gram	Test	Voltage Test V	Peak Current Obtained kA	Peak Current Required kA	Current rms Obtained kA	Current rms Required kA	Time Obtained s	Time Required s	I^2t Obtained kA^2s	I^2t Required kA^2s
C01 01	001	Calibration Current	----	44.93	----	17.95	----	0.16	----	----	----
C01 01	002	Dynamic Current	----	54.94	54.00	----	----	0.16	0.10	----	----
C01 01	003	Thermal Current	----	----	----	21.38	20.00	0.91	1.00	419.70	400.00

The numerical value of expanded uncertainty (U) with a coverage factor k=2 and a level of confidence of approximately 95% : For current: 1.0% and for voltage: 1.5%

DISTRIBUTION DEPARTMENT-HIGH CURRENT LABORATORY

REPORT: K3422-179C-2014

Figure 1



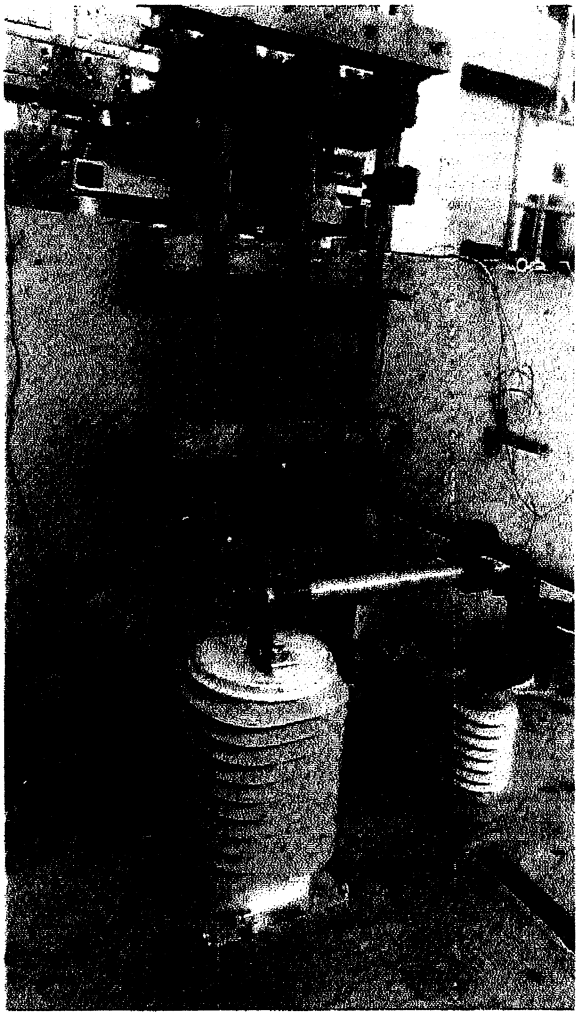
(1) Manual no Load Circuit Switch
(2) Back Circuit Breaker
(3) Limiting Reactors
(4) Limiting Resistors
(5) Short Circuit Transformer
(6) Current Shunt Meter. Measuring link: CFOCFA and CFOCFC, with calibration in force.
(7) Voltage dividers
(8) Synchronized Closing Devices
(9) Voltage dividers. Measuring link: CFOTFAD and CFOTFCD, with calibration in force.
(10) Device under test
(11) Control and data acquisition system SABAT with calibration in forcé.

Av. Apaseo Ote. s/n Cd. Industrial C.P. 36630 Irapuato, Gto. México.
Tel: (462) 6 23 94 00

DISTRIBUTION DEPARTMENT-HIGH CURRENT LABORATORY

REPORT: K3422-179C-2014

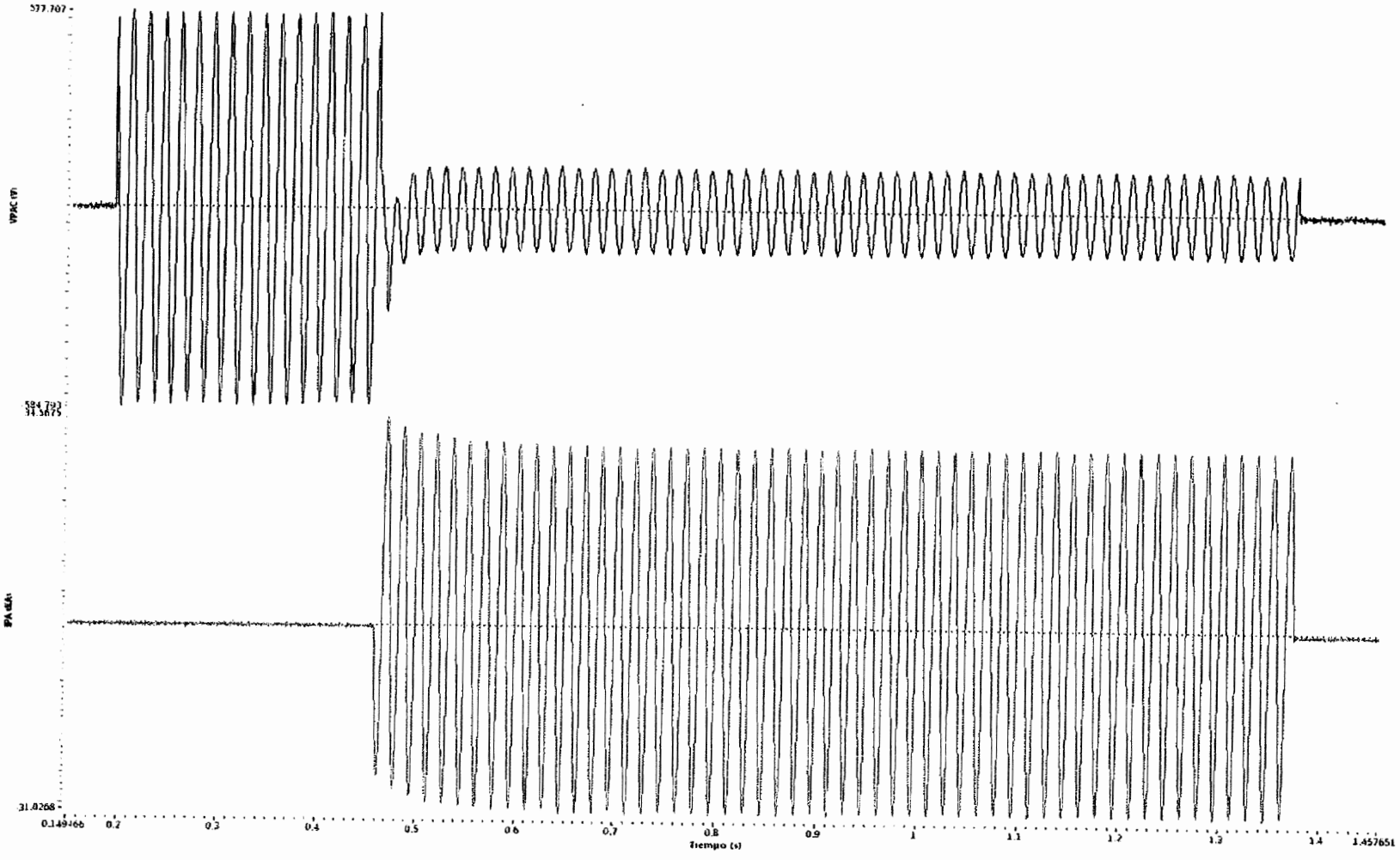
PHOTOGRAPHS



42220105

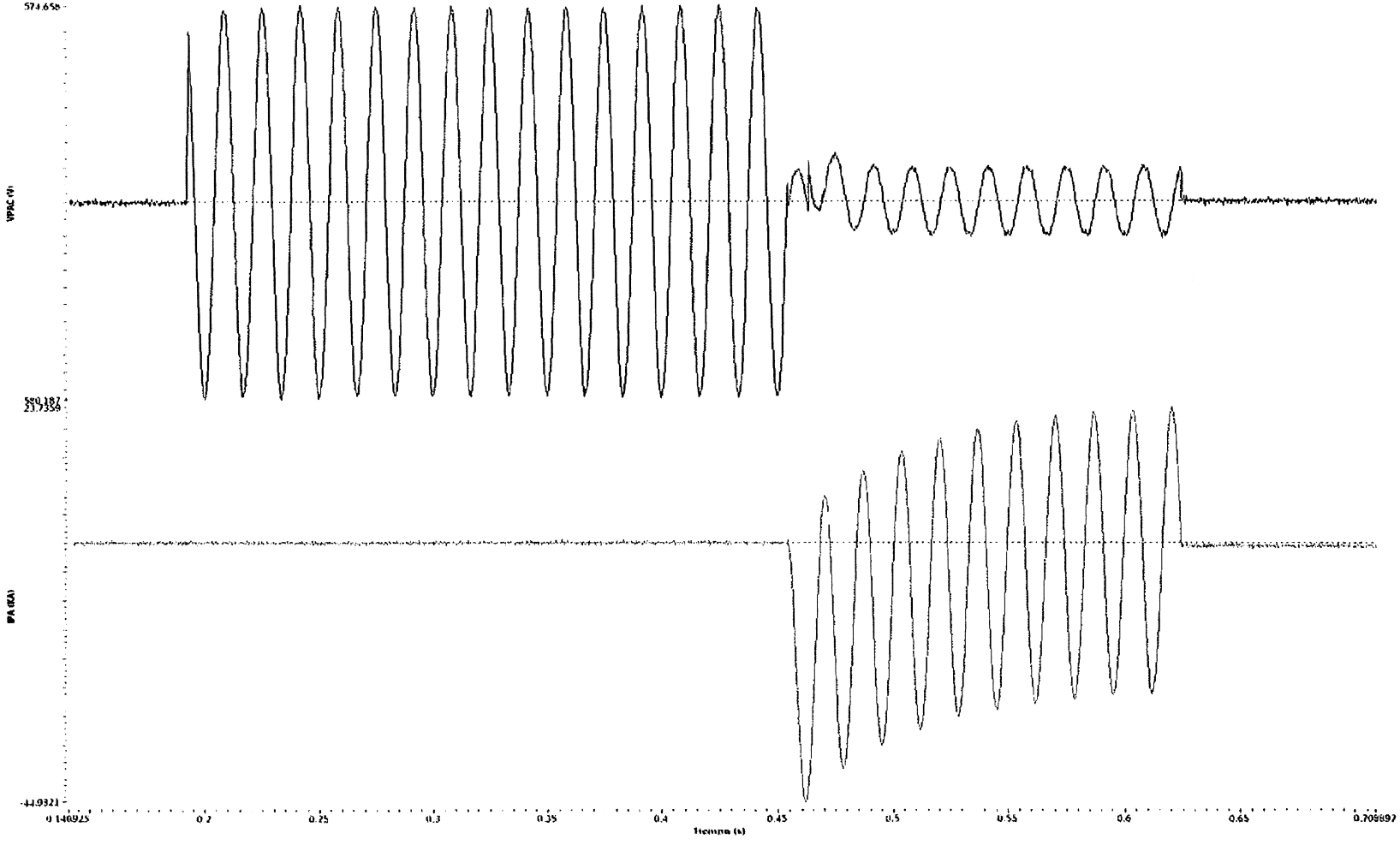
K3422 179C-2014 **Prueba No.:** 3 **Tipo de prueba:** CORTO CIRCUITO **Date:** 27/08/2014

Descripción: Short-time thermal current rating Current transformer, type CRH-36



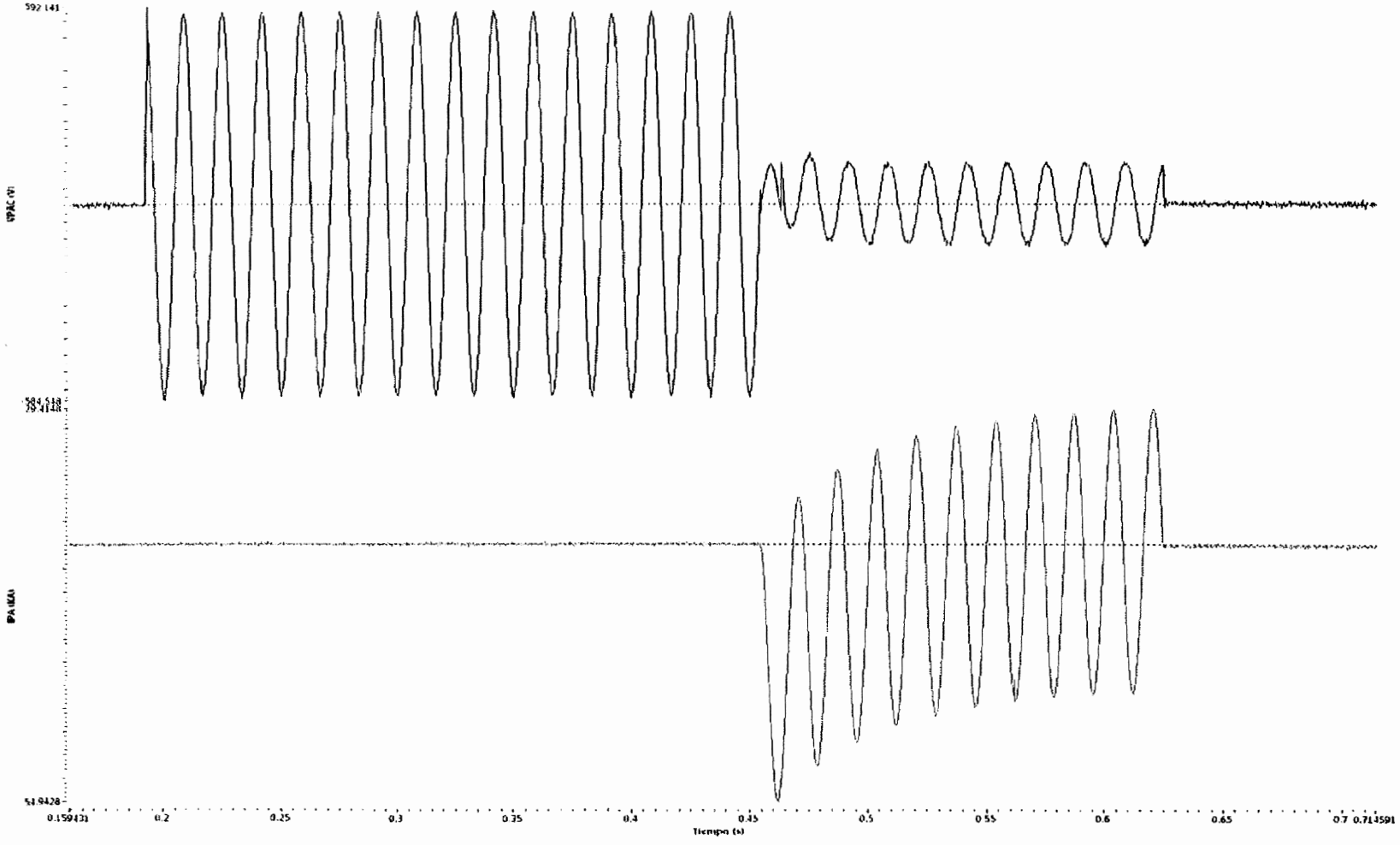
K3422 179C-2014 **Prueba No.:** 1 **Tipo de prueba:** CORTO CIRCUITO **Date:** 27/08/2014

Descripción: Calibration Short time withstand current test Current transformer, type CRH-36



K3422 179C-2014 **Prueba No.:** 2 **Tipo de prueba:** CORTO CIRCUITO **Date:** 27/08/2014

Descripción: Short-time mechanical current rating Current transformer, type CRH-36



arteche

SECTION 2: MODEL VRJ-17

Description:

The UR/VR series are dry type outdoor service voltage transformers. The core is encapsulated with Type B epoxy resin for excellence in internal dielectric properties and mechanical strength. The external layer of Cycloaliphatic resin provides resistance to ultraviolet rays and the effects of tracking and erosion on the exterior of the module. The device is maintenance free, ensuring a long mechanical and electrical life.

Partial Discharge measurements exceed IEEE C57.13 2008 requirements.

Available Ratios:

The VRJ-17 family of VT's allows for revenue metering of at least 0.3% accuracy over a voltage range of 2400V up to 14400V at 30C. The below table summarizes the ratios that are available.

RATIO	Accuracy / Burden	Total Thermal Burden (Typical)
20:1	0.3 W,X,M,Y,Z	1500 VA
30:1	0.3 W,X,M,Y,Z	1500 VA
35:1	0.3 W,X,M,Y.Z	1500 VA
40:1	0.3 W,X,M,Y,Z	1500 VA
60:1	0.3 W,X,M,Y,Z	1500 VA
63.5:1	0.3 W,X,M,Y,Z	1500 VA
70:1	0.3 W,X,M,Y,Z	1500 VA
100:1	0.3 W,X,M,Y,Z	1500 VA
110:1	0.3 W,X,M,Y,Z	1500 VA
120:1	0.3 W,X,M,Y,Z	1500 VA

Construction:

The core is built from high permeability grain oriented silicon steel laminations for low losses. The windings are copper wire with copper plate double isolation. The concentric distribution of the coils prevents magnetic flux leakage, achieving greater accuracy and higher capacity to withstand mechanical stresses in adverse operating conditions.

Secondary Terminals and Cover:

The secondary terminals are furnished with brass quick connectors. The secondary terminal cover is made of plastic material and sealed with 4 screw type lugs.

Base Plates:

The transformers are furnished with galvanized steel base plates.

Primary Terminal:

The primary terminal consists of brass threaded rod that easily accommodates connectors such asTE-4T, NEMA 2 hole or NEMA 4 hole utilizing the H1-H2 polarity markings.

Nameplate:

Each VT ships with an engraved steel nameplate affixed to the VT base plate using rivets. The nameplate contains production serial number as well as all data required by the latest revision of ANSI C57.13.

Polarity Marking:

Polarity marking is accomplished by using white silicon dots on both the primary and secondary sides.

Testing:

The VRJ-17 design has undergone design type testing in accordance with IEEE C57.13 (latest edition), Section 8. The test report is included with this submittal. Furthermore, all units produced undergo production testing to verify accuracy and phase angle error in accordance with Section 8, C57.13 (latest edition). A sample production test report is included with this submittal.

Nº 14016584 TESTS CERTIFICATE

CUSTOMER: ARTECHE TyT	VOLTAGE TRANSFO (S) QUANTITY: 2
CUSTOMER'S REF.: IBERDROLA PROTOTYPES	TYPE: VRJ-17 HIGHEST VOLTAGE: 15.5 KV.

PRIMARY (V)	SECONDARY (V)	BURD. (VA)	CLASS	THER B.
7200 (H1-H2)	120 (x1-x2)	Z	0.3	1500

STANDARD:	ROUTINE TESTS
IEEE C57.13/2008	POWER-FREQUENCY TEST: P/S+E: 34 KV.
FREQUENCY: 60 Hz	INDUCED OVERVOLTAGE TEST: 34 KV.
RATED VOLT. FACTOR: 1.1Un	POWER-FREQUENCY TEST: S/E: 2.5 KV.
	S/S: KV.
SEC. INTERDEPENDENCE: ( )	PARTIAL DISCHARGES ≤ 50 pC 16,3 KV.
TEMP: -40°/+40°C	VERIFICATION OF TERMINALS MARKINGS AND POLARITY

ACCURACY TEST

TRANSFOR. Nº.	RATIO	TERMIN.	BURDEN (VA)			% OF RATED VOLTAGE	± PORCEN. VOLTAGE ERROR	± PHASE DISPL. IN MIN.
			x1-x2					
14016584/2	7200/120	x1-x2	0			110	+0.28	0
						100	+0.28	0
						90	+0.28	0
			W			110	+0.25	0
						100	+0.25	0
						90	+0.25	0
			X			110	+0.20	0
						100	+0.20	0
						90	+0.20	-2
			Y			110	+0.05	-2
						100	+0.05	-2
						90	+0.05	-2
			Z			110	-0.23	-7
						100	-0.23	-7
						90	-0.23	-7

Distr. de Mexico
Inspis JLAS
Date 3/10/14
INS 010

Date: 17/09/14 Certified Correct: FJTB

000022 A

Transformadores y Tecnología, S.A. de C.V.
Km. 73,54 Ant. Carretera México – Querétaro
42850 Tepeji Del Río de Ocampo, Estado de Hidalgo.
T.+52 55 41 47 60 42 F. +52 77 37330366

F-LE-018
PARTIAL DISCHARGES TEST ***** 1 OF 1 SHEET *****

F-LE-003

	SERIALNUMBER: 14016584	TYPE: VR.i-17	Max System Voltage = 15.5 KV					

NUMBER		PRIOR DIELECTRIC TEST			AFTER DIELECTRIC TEST 16.2 KV					
SERIAL NUMBER	CONSECUTIVE	INICIAL VOLTAGE	LAST VOLTAGE	q max (PC) Vmax	INICIAL VOLTAGE	LAST VOLTAGE	PC LEVEL	DATE	INSPECTOR	OBSERVATIONS
	2				———	———	1 pC	03/10/2014	RRM	
POWER FREQUENCY APPLIED VOLTAGE TEST(34 kV rms)		60Hz.		60Seg.						

INSPECTOR
JOSE LUIS ARRIETA SANCHEZ

JCAS
3/10/14

arteche
LABORATORIO ELÉCTRICO
MEDIA TENSIÓN

SUPERVISOR ARTECHE
GUSTAVO ALCANTAR MAGAÑA.

Nº 1401.6584

TESTS CERTIFICATE

CUSTOMER: ARTECHE TyT,	VOLTAGE TRANSFO (S)
	QUANTITY: 1
CUSTOMER'S REF.: IBERDROLA PROTOTYPES	TYPE: VRC 17
	HIGHEST VOLTAGE: 17,5 KV.

PRIMARY (V)	SECONDARY (V)	BURD. (VA)	CLASS	THER B.
7200 (H1-H2)	120 (x1-x2)	X	0,3	1500

STANDARD:	ROUTINE TESTS	
IEEE C57.13/2008	POWER-FREQUENCY TEST: P/S-E: 34	KV.
FREQUENCY: 60 Hz	INDUCED OVERVOLTAGE TEST: 58	KV.
RATED VOLT. FACTOR: 1.0/8h	POWER-FREQUENCY TEST: S/E: 2.5	KV.
	S/S:	KV.
SEC. INTERDEPENDENCE: ( )	PARTIAL DISCHARGES: <10 pC 20.3	KV.
TEMP: -40°/+40°C	VERIFICATION OF TERMINALS MARKINGS AND POLARITY	

ACCURACY TEST

TRANSFOR. Nº	RATIO	TERMIN.	BURDEN (VA)			% OF RATED VOLTAGE	± PORCEN VOLTAGE ERROR	± PHASE DISPL IN MIN
			x1-x2					
1401.6584/ 2	7200/120	x1-x2	0			110	+0.19	0
						100	+0.21	0
						90	+0.21	0
			W			110	+0.16	0
						100	+0.18	0
						90	+0.18	0
			X			110	+0.13	0
						100	+0.14	0
						90	+0.14	0
			Y			110	0	-2
						100	-0.01	-2
						90	-0.03	-3
			Z			110	-0.29	-7
						100	-0.28	-7
						90	-0.28	-7

Date: 17/09/14 Certified Correct:

LLAS

3/10/14

ARTECHE USA.

TEST REPORT- MV VOLTAGE TRANSFORMER

MODEL:	VRJ-17		
RATIO:	20:1	QTY:	1
ACCURACY:	0.3 0-Y	CODE:	757131020
SERIAL NUMBER:	13003935		

APPLIED VOLTAGE DIELECTRIC TEST.

POWER DIELECTRIC TEST, PRIMARY WINDING, 1 minute @ 60 Hz. 19 KV.
POWER DIELECTRIC TEST, SECONDARY WINDING, 1 minute @ 60Hz. 2.5 KV.
APPROVED: R.R.M. DATE: 07/03/2013

INDUCED VOLTAGE TEST.

INDUCED VOLTAGE TEST, 4800 VOLTS @ 180 Hz FOR 40 SECONDS.

APPROVED: R.R.M. DATE: 07/03/2013

POLARITY TEST.

POLARITY: OK DATE: 07/03/2013 APPROVED: F.J.R.C.

ACCURACY TEST

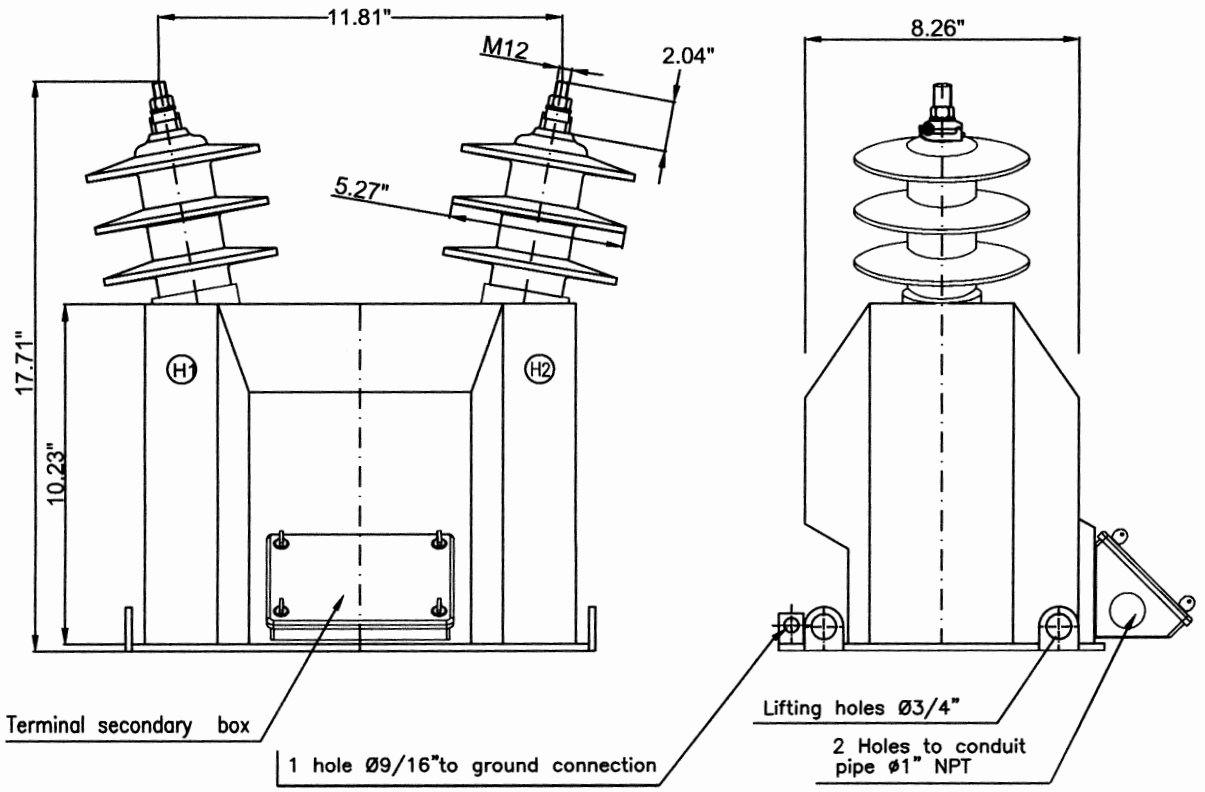
UNIT N°	RATIO	BURDEN	60 Hz. METERING ACCURACY						TESTED DATE
			110%		100%		90%		
			R.F.C.	P.A.	R.F.C.	P.A.	R.F.C.	P.A.	
1	20:1 X1-X2	0	0.9992	-1	0.9991	-1	0.9991	-1	07/03/2013
		W	0.9997	-1	0.9997	-1	0.9996	-1	
		X	1.0003	0	1.0002	0	1.0002	0	
		M	1.0007	+1	1.0006	+1	1.0006	0	
		Y	1.0024	-1	1.0024	-2	1.0023	-2	
		Z							
		ZZ							

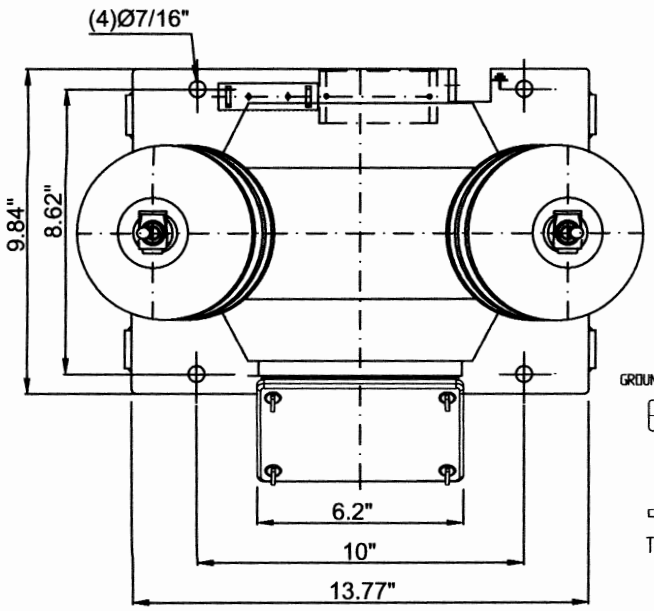
PARTIAL DISCHARGES	
STANDARD LEVEL: ≤ 50 pC	
HIPOT LEVEL:	5.8 KV.
DATE:	07/03/2013
APPROVED:	R.R.M.

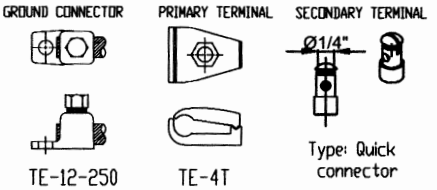
Made in Mexico By:

Reviewer, Aproval: E.C.C.

This product was approved according to IEEE C57.13 2008 standard.







APPROX. WEIGHT 94.7 Lbs.

CREEP DISTANCE 21.2 in

STRIKE DISTANCE 10.82 in

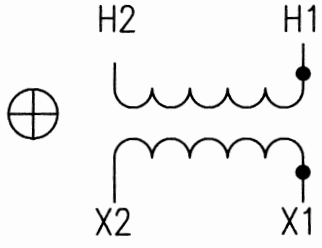
arteche

Approximate dimensions in inches

VOLTAGE TRANSFORMER VRJ-17

Date	Approved	Drawing N°
28/10/13	R.E.S.	4286770

arteche



SERIAL NUMBER

TYPE: VRJ–17 VOLTAGE TRANSFORMER

N.S.V. 15 kV CAT.N° 757120120
B.I.L. 110 kV FW 60 Hz

VOLTAGE		RATIO	ACCURACY @60Hz	THERMAL @30°C
PRI.	SEC.			
H1–H2 14400V	120V	120:1	0.3 W,X,M,Y,Z	1500VA

INDUSTRY CANADA APPROVAL No. AE–

arteche

NAMEPLATE

VT VRJ–17

AREA: Oficina de Sistemas de Distribución

REPORT Nr.: K3421-238A-2014

CLIENT: **ARTECHE**
TRANSFORMADORES Y TECNOLOGÍA S. A. DE C. V.

ADDRESS: Km. 73.540 Antigua Carretera México-Querétaro Tepeji de Río
de Ocampo Estado de Hidalgo, C.P. 42850
Tel: +52(773)73 32 034

TITLE: Prototype test on voltage transformer VRJ-17 brand ARTECHE.

SUMMARY:

OBJECT TESTED
Voltage transformer type VRJ-17, Nr. 14016584001, Ratio: 60:1, NSV: 15 kV, BIL: 110 kV, Frequency: 60 Hz. Thermal burden: 1500 VA, Accuracy Class: 0.3 WXMYZ, Primary H1-H2: 7200 V, Secondary X1-X2: 120 V. Brand ARTECHE.

Test Performed:

Wet 60 Hz 10 s withstand test
Impulse (BIL) Test
Temperature Rise Test

Standards:

IEEE Std C57.13-2008

Result: SATISFACTORY

Remark: - This report and results cover the tested sample only and no contain the totality type tests. Confidential document.

DATE: 2014/10/13	FILE: K3421-238	APPROVED BY:	REVISED BY:
PREPARED BY:		DOCUMENTO FIRMADO ELECTRÓNICAMENTE **ING. JAIME ENCINAS ROSAS** JEFE DE LA OFICINA DE SISTEMAS DE DISTRIBUCIÓN	DOCUMENTO FIRMADO ELECTRÓNICAMENTE **ING. RICARDO MARTÍNEZ TORRES** JEFE DE DEPARTAMENTO DE DISTRIBUCIÓN
DOCUMENTO FIRMADO ELECTRÓNICAMENTE **ING. RUBÉN [illegible] VACIO** SIGNATARIO			

DEPARTAMENTO DE DISTRIBUCIÓN
OFICINA DE SISTEMAS DE DISTRIBUCIÓN

CHARACTERISTICS
Voltage transformer type VRJ-17
Serial: 14016584001
NSV: 15 kV
BIL: 110 kV
Frequency: 60 Hz

VOLTAGE				RATIO	Accuracy @	THERMAL
PRIMARY		SECONDARY			60 Hz	@ 30°C
H1-H2	7200 V	X1-X2	120 V	_60:1	0.3 WXMYZ	1500 VA

Wet 60 Hz 10 seconds withstand test.
Voltage applied to: H1-H2
Grounded: X1-X2-Frame
Voltage test: 34 kV
Time test: 10 seconds
Result: Satisfactory

Impulse (BIL) test

Impulse	Up (kV)	T1(µs)	T2(µs)	Tc(µs)
1	77.59	1.1	49.1	
4	132.7	1.01		1.47
5	131.3	0.98		1.51
6	120.2	1.1	49.1	
7	77.59	1.1	49.1	
8	132.2	1		1.46
9	131.9	0.98		1.41
10	120.1	1.11	49.1	

Equipment test:
Impulse generator 750 kV, Haefely, Nr. GA2006.
Impulse voltage resistive divider 600 kV, serial Nr. 061000547061000547.10.1, Haefely.
Oscilloscope Nr. D55980.
High Voltage test equipment 60 Hz, 300 kV, Nr. 1972416.
Temperature Recorder YEW serial D55090 calibrated.
Resistance Meter brand TETTEX serial 156078 calibrated
Uncentainty
With a k=2 for confidence level of 95%
AC Voltage Uncertainty: ±0.7 %
Impulse Voltage Uncertainty: ±1.7 %
Temperature Uncertainty: ±1.98 %

DOCUMENTO FIRMADO ELECTRONICAMENTE

Tested By: **Ruben Jaramillo Vacio**
Ingeniero de Pruebas

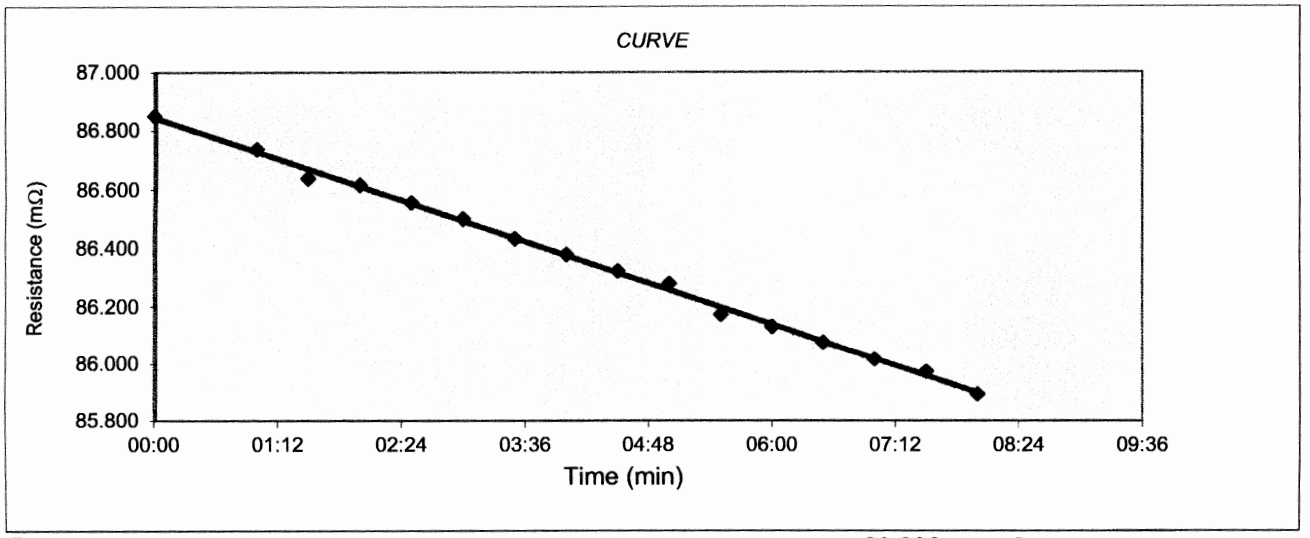
DOCUMENTO FIRMADO ELECTRONICAMENTE

Checked By **Jaime Encinas Rosas**
Encargado de Oficina de Sistemas de Distribución

DEPARTAMENTO DE DISTRIBUCIÓN
OFICINA DE SISTEMAS DE DISTRIBUCIÓN

Temperature rise test, winding H1-H2

Nr.	Time	Resistance
/	min	mΩ
/	00:00	86.8500
1	01:00	86.7360
2	01:30	86.6380
3	02:00	86.6150
4	02:30	86.5550
5	03:00	86.5000
6	03:30	86.4320
7	04:00	86.3780
8	04:30	86.3220
9	05:00	86.2790
10	05:30	86.1720
11	06:00	86.1290
12	06:30	86.0750
13	07:00	86.0160
14	07:30	85.9730
15	08:00	85.8930



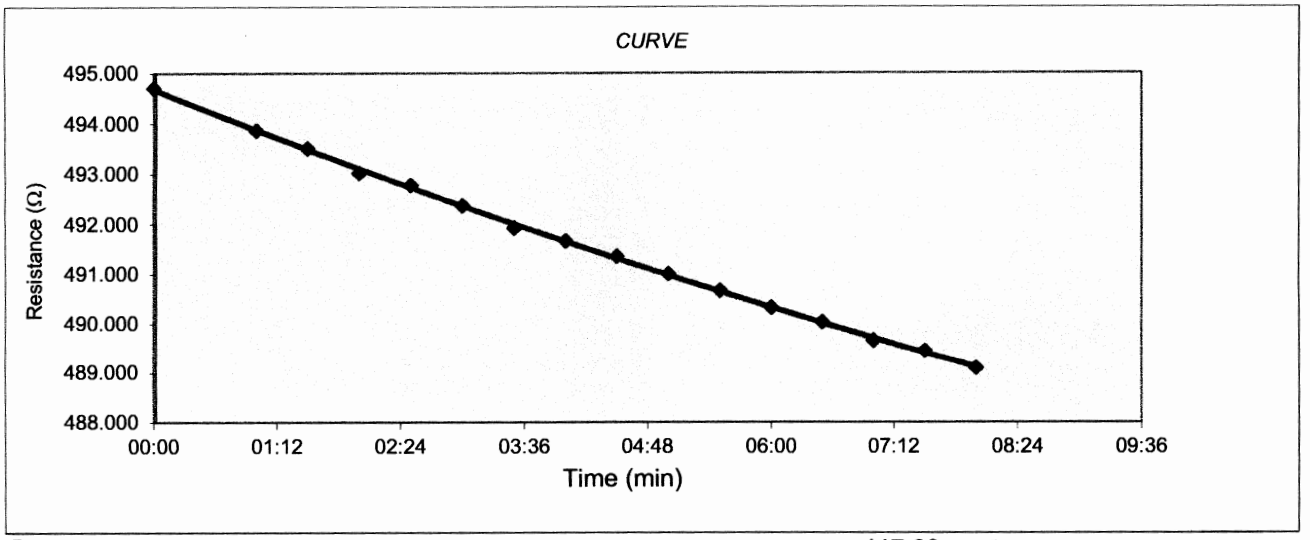
R0 =	Reference resistance of the winding	69.038	mΩ	
R =	Resistance of the winding at the time of shutdown	86.85	mΩ	
Θ0 =	Temperature in degree Celsius correspondig to the reference resistance of the winding	24	°C	
Θ =	Ambient temperature corresponding at the time of shutdown	22	°C	
Θk =	Temperature in the degree Celsius corresponding to the resistance of the winding at time of shutdown	90.69	°C	
Δ Θ / ambient	Average temperature rise of a winding	**68.69**	**°C < 80°C Satisfactory**	**a 1780 mosl**

Voltage test: 7200 V, thermal burden: 1500 VA

DEPARTAMENTO DE DISTRIBUCIÓN
OFICINA DE SISTEMAS DE DISTRIBUCIÓN

Temperature rise test, winding X1-X2

Nr.	Time	Resistance
/	min	Ω
/	00:00	494.7000
1	01:00	493.8600
2	01:30	493.5100
3	02:00	493.0200
4	02:30	492.7800
5	03:00	492.3700
6	03:30	491.9300
7	04:00	491.6700
8	04:30	491.3600
9	05:00	491.0000
10	05:30	490.6700
11	06:00	490.3200
12	06:30	490.0300
13	07:00	489.6600
14	07:30	489.4500
15	08:00	489.1000



R_0 =	Reference resistance of the winding	417.63	Ω
R =	Resistance of the winding at the time of shutdown	494.7	Ω
Θ_0 =	Temperature in degree Celsius correspondig to the reference resistance of the winding	24	ºC
Θ =	Ambient temperature corresponding at the time of shutdown	23	ºC
Θk =	Temperature in the degree Celsius corresponding to the resistance of the winding at time of shutdown	71.70	ºC
Δ Θ / ambient	Average temperature rise of a winding	**48.70**	**ºC < 80ºC Satisfactory**

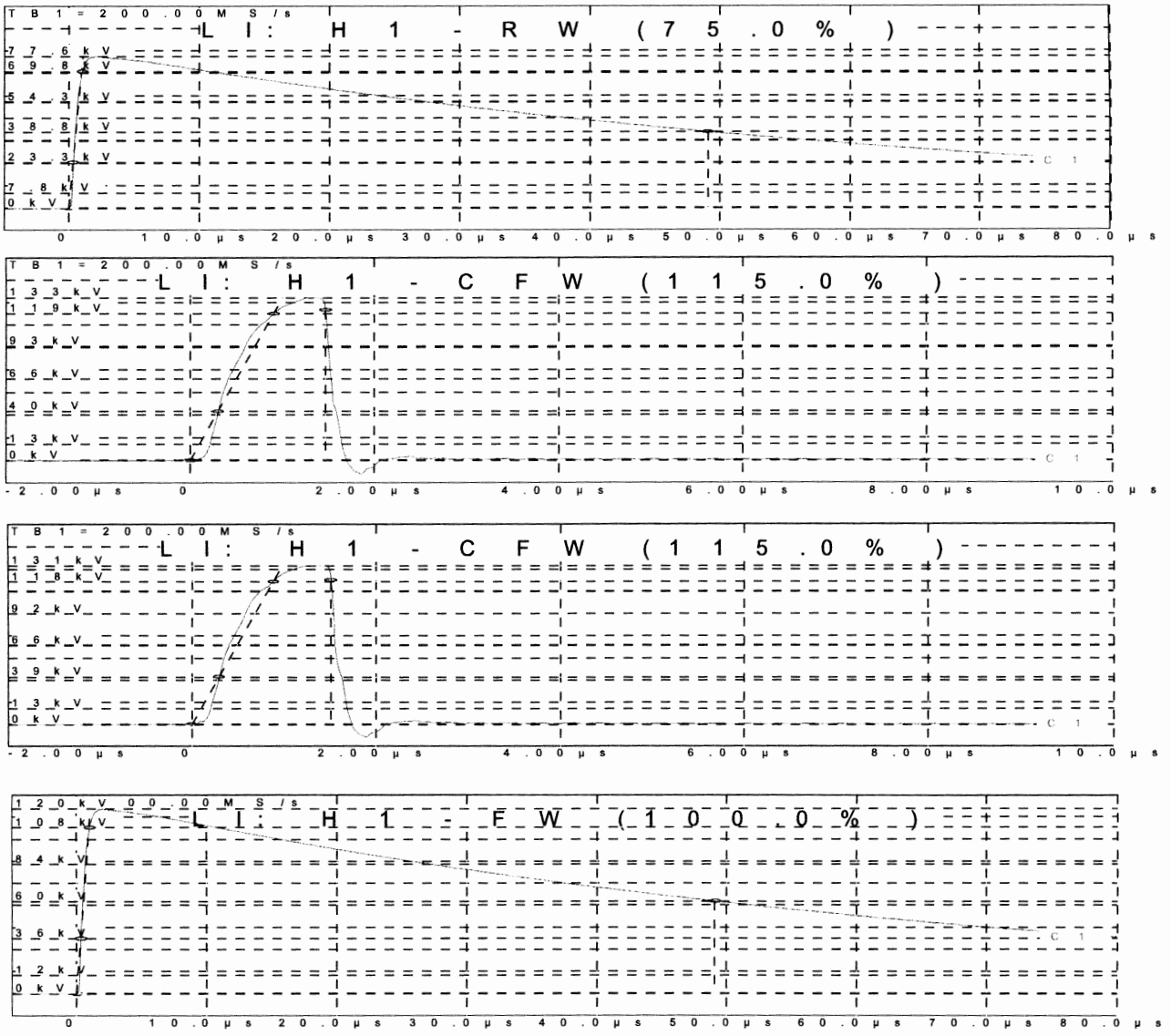
a 1780 mosl

Voltage test: 7200 V, thermal burden: 1500 VA

DEPARTAMENTO DE DISTRIBUCIÓN
OFICINA DE SISTEMAS DE DISTRIBUCIÓN

Impulse (BIL) test

Voltage applied to: H1
Grounded: X1-X2-Frame



Result: Satisfactory

DOCUMENTO FIRMADO ELECTRONICAMENTE

Tested By: **Ruben Jaramillo Vacio**
Ingeniero de Pruebas

DOCUMENTO FIRMADO ELECTRONICAMENTE

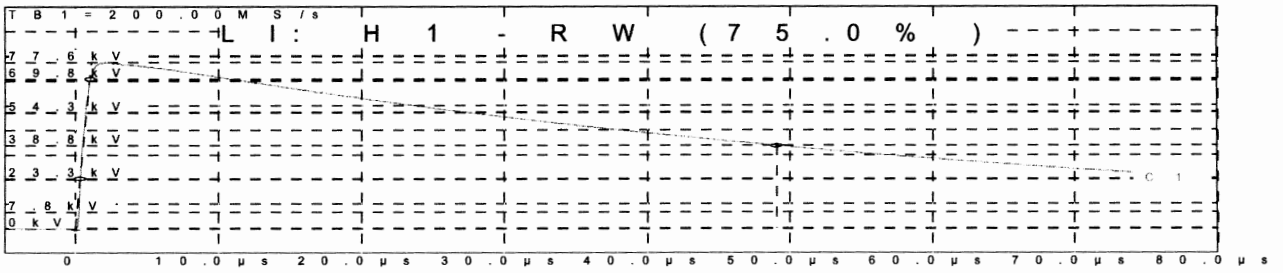
Checked By **Jaime Encinas Rosas**
Encargado de Oficina de Sistemas de Distribución

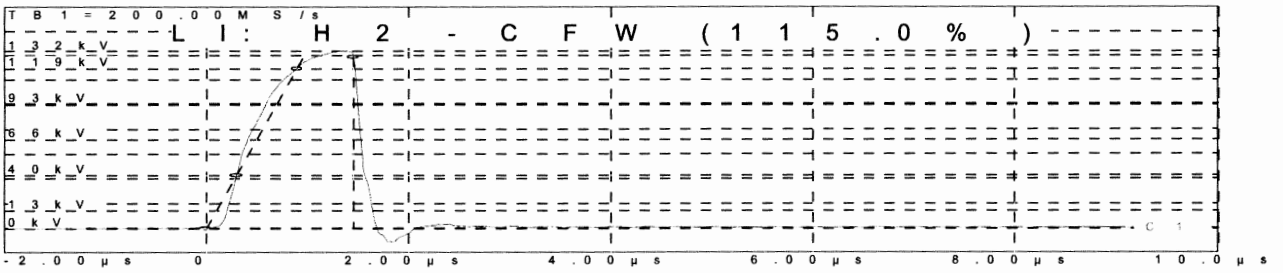
Report Nr: K3421-238A-2014
Sheet: 6 of 6
Date: 13/10/2014

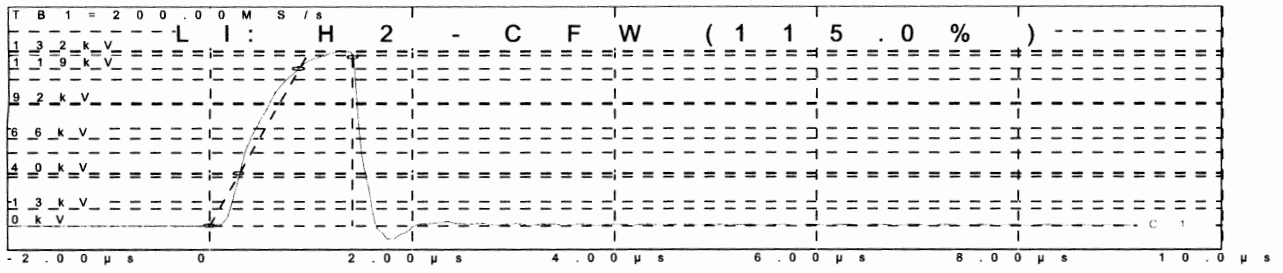
DEPARTAMENTO DE DISTRIBUCIÓN
OFICINA DE SISTEMAS DE DISTRIBUCIÓN

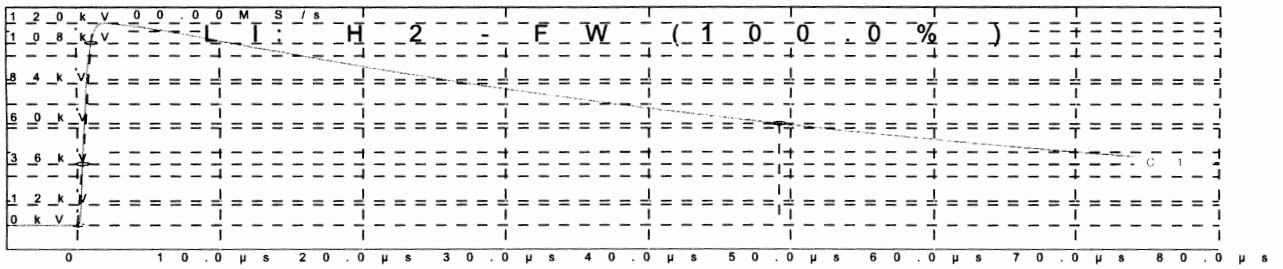
Impulse (BIL) test

Voltage applied to: H2
Grounded: X1-X2-Frame









Result: Satisfactory

DOCUMENTO FIRMADO ELECTRONICAMENTE

Tested By: **Ruben Jaramillo Vacio**
Ingeniero de Pruebas

DOCUMENTO FIRMADO ELECTRONICAMENTE

Checked By **Jaime Encinas Rosas**
Encargado de Oficina de Sistemas de Distribución

ÁREA: High Current Office

TEST REPORT: K3422-199B-2014.	
CLIENT:	**ARTECHE TRANSFORMADORES Y TECNOLOGÍA S.A. DE C.V.**
ADDRESS:	km 73,540 Antigua Carretera México Querétaro, Tepeji del Río de Ocampo Edo. de Hidalgo C.P. 42850, Tel.:+52 (773) 7332034.
TÍTLE:	Short time withstand current test carried out on a voltage transformer. - **Type:** VRJ-17 - **Ratio:** 60:1 - **Brand**: ARTECHE. - **Made in:** México.

SUMMARY:

Object under test:
Voltage transformer, type VRJ-17, brand ARTECHE, serial number: 14016584001.

Applied standards:
IEEE C57.13-2008 Clause 7.7

Test performed:
Short-circuit capability.

Test results:
The assessment of the compliance of the tested voltage transformer with the requirements of the short-time withstand current tests, were not performed by LAPEM. So, in this report are declared only the test values applied.
The test data declared in this report is for the exclusive use of the owner, who is in his full right to use them at his convenience.

DATE: 2014-10-28 FILE: K3422-199-2014	**APRÓVED BY:**	AUTHORIZED BY:
TESTED BY: DOCUMENTO FIRMADO ELECTRÓNICAMENTE Genaro Arturo Ruiz Carlo Testing Enginner	DOCUMENTO FIRMADO ELECTRÓNICAMENTE Juan Carlos Martínez Magdaleno Head of High Current Laboratory	DOCUMENTO FIRMADO ELECTRÓNICAMENTE Ricardo A Martínez Torres **Head of Distribution Departament**

DISTRIBUTION DEPARTMENT-HIGH CURRENT LABORATORY

REPORT: K3422-199B-2014

TEST REPORT

CLIENT: ARTECHE TRANSFORMADORES Y TECNOLOGÍA S.A. DE C.V.

MANUFACTURER: ARTECHE TRANSFORMADORES Y TECNOLOGÍA S.A. DE C.V.

EQUIPMENT TESTED: VOLTAGE TRANSFORMER.

TYPE: VRJ-17

SERIAL No: 14016584001

CHARACTERISTICS:
Brand: ARTECHE
Ratio: 60:1
Rated Power: 1500VA
Primary rated voltage: 7200 V
Secondary rated voltage: 120 V
BIL: 110 kV

STANDARDS:
IEEE C57.13-2008 Clause 7.7

TESTS PERFORMED:
Short-circuit capability

Date of the test: September 30, 2014
Date of receipt of the transformer: September 30, 2014

RESULTS:
The assessment of the compliance of the tested voltage transformer with the requirements of the short- time withstand current tests, were not performed by LAPEM. So, in this report are declared only the test values applied.

THIS REPORT INCLUDES:

Pages: 6
Oscillograms: 1
Diagrams: -
Photographs: 1
Drawings: 1
Others: -

DOCUMENTO FIRMADO ELECTRÓNICAMENTE

Genaro Arturo Ruiz Carlo, Eng.
Tested by

DOCUMENTO FIRMADO ELECTRÓNICAMENTE

Genaro Arturo Ruiz Carlo, Eng.
Authorized Signatory

The results expressed within this report refer only to the tested object(s).

42220101

Irapuato, Gto. México; October 28, 2014.

DISTRIBUTION DEPARTMENT-HIGH CURRENT LABORATORY
REPORT: K3422-199B-2014

1. - OTHER CHARACTERISTICS ASSIGNED BY THE MANUFACTURER.
Accuracy: 0.3 W,X,M,Y,Z

2. - WITNESS DURING TESTS:
Name: Company
— —

3. - PURPOSE OF THE TEST.

The purpose of the tests is to demonstrate the mechanical & thermal capability of the transformer to withstand short circuit stresses.

4. - STANDARDS APPLIED:
IEEE C57.13-2008 Clause 7.7

5. - TEST REQUIREMENTS:
- **7.7 Short-circuit capability**

Voltage transformer shall be capable of withstanding for 1 s the mechanical and thermal stresses resulting from a shot circuit on the secondary terminals with full voltage maintained on the primary terminals.

6. - TEST CIRCUIT:
The transformer under test is connected to the low voltage side of the short circuit transformer. The short circuit is made by closing the synchronized device, and the clearing of the short circuit is made by the opening of the back circuit breaker, then the time during which the current flows through the Device Under test is obtained. See figure 1.

7. - TESTS RESULTS AND UNCERTAINTY OF MEASUREMENT:
See page 4 for test values obtained.

7.1. - VISUAL INSPECTION:
The tested transformer didn't show any damage at least on the outside part.

7.2. - CONCLUSIONS:
The voltage transformer tested did not show indications of damage during the tests; this laboratory didn't carry out any other verification.

7.3. - PHOTOGRAPHS:
This report not includes photographs of the transformer.

7.4. - OSCILLOGRAMS:
This report includes the oscillograms that show the results of the short time current tests.

42220102

DISTRIBUTION DEPARTMENT-HIGH CURRENT LABORATORY

REPORT: K3422-199B-2014

TEST RESULTS AND UNCERTAINTY OF MEASUREMENT

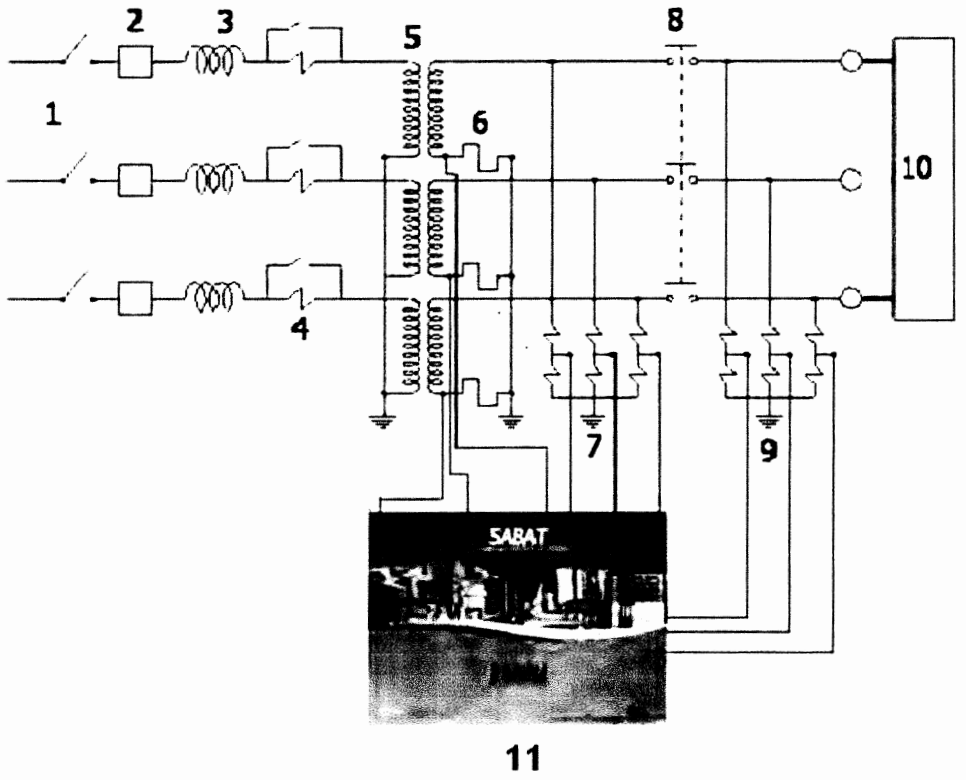
Test circuit	Oscillogram	Test	Voltage Test V	Voltage RMS Obtained kA	Current rms Obtained kA	Time Obtained s	Time Required s	I^2t Obtained kA^2s	I^2t Required kA^2s
C01 01	001	Short-circuit capability	120.0	120.90	319.0	1.00	1.0	-----	-----

The numerical value of expanded uncertainty (U) with a coverage factor k=2 and a level of confidence of approximately 95% : For current: 1.0% and for voltage: 1.5%

DISTRIBUTION DEPARTMENT-HIGH CURRENT LABORATORY

REPORT: K3422-199B-2014

Figure 1



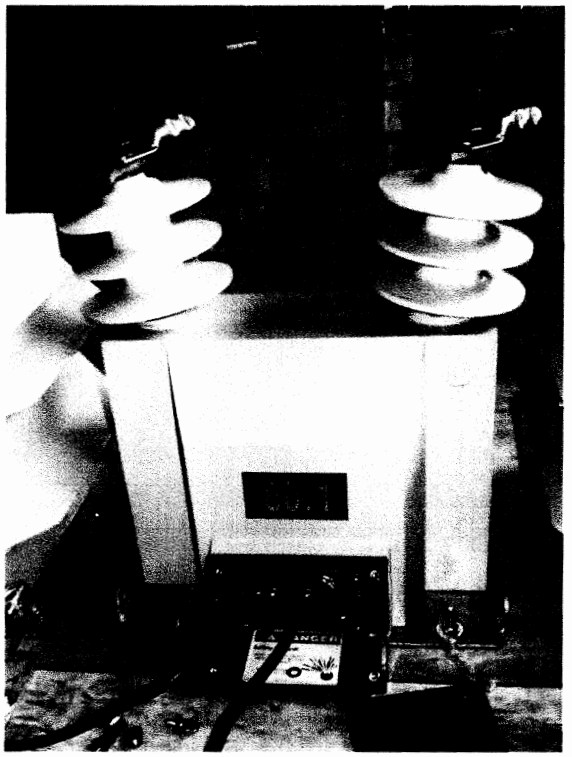
(1) Manual no Load Circuit Switch
(2) Back Circuit Breaker
(3) Limiting Reactors
(4) Limiting Resistors
(5) Short Circuit Transformer
(6) Current Shunt Meter. Measuring link: CFOCFA and CFOCFC, with calibration in force.
(7) Voltage dividers
(8) Synchronized Closing Devices
(9) Voltage dividers. Measuring link: CFOTFAD and CFOTFCD, with calibration in force.
(10) Device under test
(11) Control and data acquisition system SABAT with calibration in forcé.

42220104

DISTRIBUTION DEPARTMENT-HIGH CURRENT LABORATORY

REPORT: K3422-199B-2014

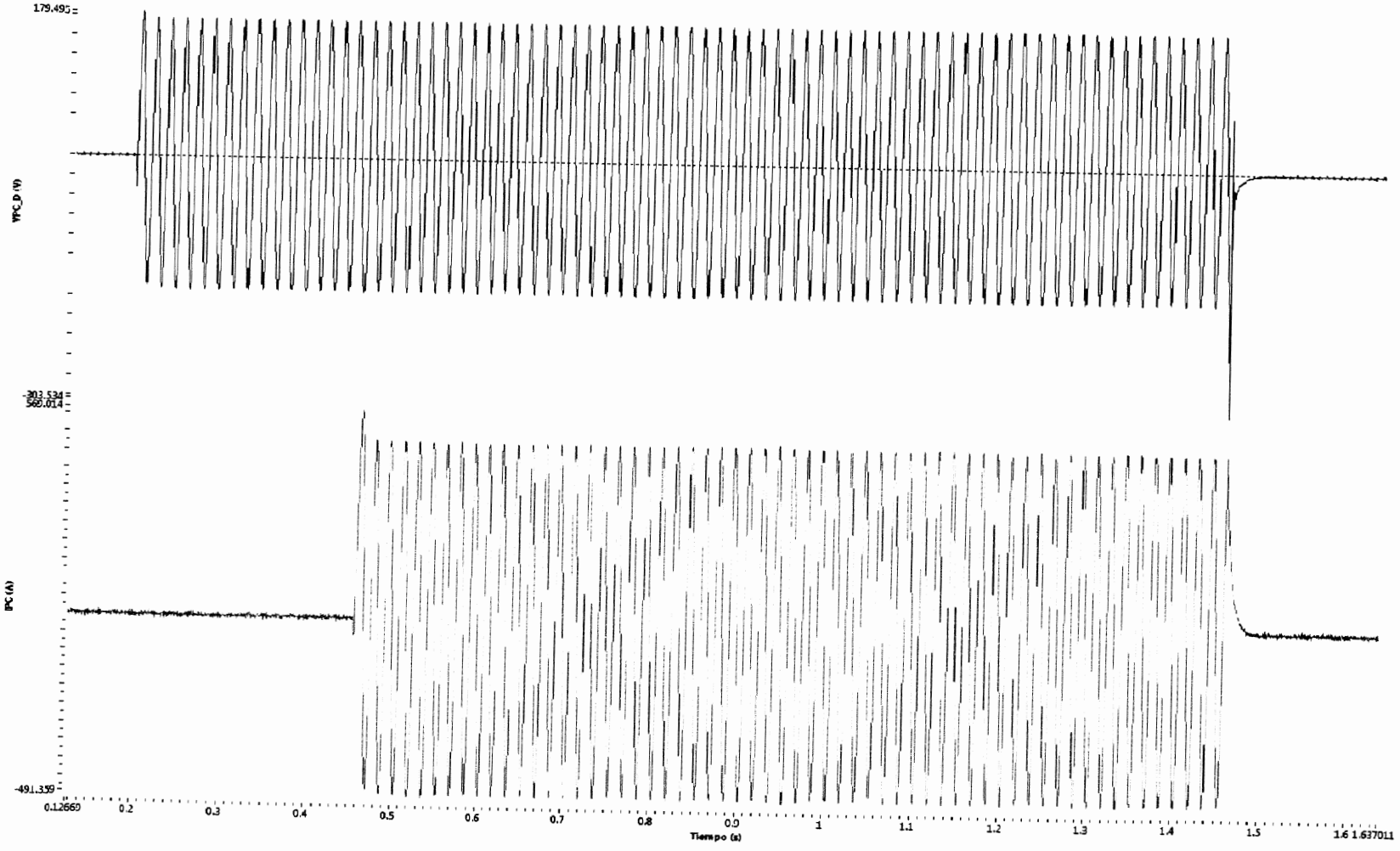
PHOTOGRAPHS



42220105

K3422 199B/2014 **Prueba No.:** 1 **Tipo de prueba:** CORTO CIRCUITO **Fecha:** 30/09/2014

Descripción: Prueba de corriente de aguante de corta duración a Transformador de Potencial Inductuvo VRJ-17 Marca Arteche
No presenta evidencia de daño fisico durante la prueba N.S. 14016584001



arteche

SECTION 3: MODEL URS-36

Description:

The UR/VR series are dry type outdoor service voltage transformers. The core is encapsulated with Type B epoxy resin for excellence in internal dielectric properties and mechanical strength. The external layer of Cycloaliphatic resin provides resistance to ultraviolet rays and the effects of tracking and erosion on the exterior of the module. The device is maintenance free, ensuring a long mechanical and electrical life.

Partial Discharge measurements exceed IEEE C57.13 2008 requirements.

Available Ratios:

The URS-36 family of VT's allows for revenue metering of at least 0.3% accuracy over a voltage range of 16800V up to 20125V at 30C. The below table summarizes the ratios that are available.

RATIO	Accuracy / Burden	Total Thermal Burden (Typical)
140:1	0.3 W,X,M,Y	1000 VA
140/240:1	0.3 W,X,M,Y	1000 VA
166:1	0.3 W,X,M,Y	1000 VA
175:1	0.3 W,X,M,Y	1000 VA
175/300:1	0.3 W,X,M,Y	1000 VA

Construction:

The core is built from high permeability grain oriented silicon steel laminations for low losses. The windings are copper wire with copper plate double isolation. The concentric distribution of the coils prevents magnetic flux leakage, achieving greater accuracy and higher capacity to withstand mechanical stresses in adverse operating conditions.

Secondary Terminals and Cover:

The secondary terminals are furnished with brass quick connectors. The secondary terminal cover is made of plastic material and sealed with 4 screw type lugs.

Base Plates:

The transformers are furnished with galvanized steel base plates.

Primary Terminal:

The primary terminal consists of brass threaded rod that easily accommodates connectors such asTE-4T, NEMA 2 hole or NEMA 4 hole utilizing the H1-H2 polarity markings.

Nameplate:

Each VT ships with an engraved steel nameplate affixed to the VT base plate using rivets. The nameplate contains production serial number as well as all data required by the latest revision of ANSI C57.13.

Polarity Marking:

Polarity marking is accomplished by using white silicon dots on both the primary and secondary sides.

Testing:

The URS-36 design has undergone design type testing in accordance with IEEE C57.13 (latest edition), Section 8. The test report is included with this submittal. Furthermore, all units produced undergo production testing to verify accuracy and phase angle error in accordance with Section 8, C57.13 (latest edition). A sample production test report is included with this submittal.

N° 14016585

TESTS CERTIFICATE

CUSTOMER: ARTECHE TyT,	VOLTAGE TRANSFO (S) QUANTITY: 1
CUSTOMER'S REF.: IBERDROLA PROTOTYPES	TYPE: URS-36 HIGHEST VOLTAGE: 36.5 KV.

PRIMARY (V)	SECONDARY (V)	BURD. (VA)	CLASS	THER B.
20125 (H1-H2)	115 (X1-X2)	Z	0,3	1000

	ROUTINE TESTS
STANDARD: IEEE C57.13/2008	POWER-FREQUENCY TEST: P/S+E: KV.
FREQUENCY: 60 Hz	INDUCED OVERVOLTAGE TEST: 70 KV.
RATED VOLT. FACTOR: 1.1Un	POWER-FREQUENCY TEST: S/E: 2.5 KV.
	S/S: KV.
SEC. INTERDEPENDENCE: ( )	PARTIAL DISCHARGES ≤ 50 pC 38,3 KV.
TEMP: -40°/+40°C	VERIFICATION OF TERMINALS MARKINGS AND POLARITY

ACCURACY TEST

TRANSFOR. N°.	RATIO	TERMIN.	BURDEN (VA)			% OF RATED VOLTAGE	± PORCEN. VOLTAGE ERROR	± PHASE DISPL IN MIN.
			X1-X2					
14016585/ 2	20125/115	X1-X2	0			110	+0.26	0
						100	+0.27	0
						90	+0.27	0
			W			110	+0.24	+1
						100	+0.24	+1
						90	+0.24	+1
			X			110	+0.20	0
						100	+0.20	0
						90	+0.20	0
			Y			110	+0.08	-2
						100	+0.08	-2
						90	+0.08	-2
			Z			110	-0.22	-7
						100	-0.22	-7
						90	-0.22	-7

Initials JLAS
Date 3/10/14

Date: 18/09/14 Certified Correct: E.C.C.

000023-A

arteche

Transformadores y Tecnología, S.A. de C.V.
Km. 73,54 Ant. Carretera México – Querétaro
42850 Tepeji Del Río de Ocampo, Estado de Hidalgo.
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F-LE-018
PARTIAL DISCHARGES TEST ***** 1 OF 1 SHEET *****

F-LE-003

	SERIALNUMBER: 14016585	TYPE: URS-36	Max System Voltage = 36.5 KV						
NUMBER	PRIOR DIELECTRIC TEST			AFTER DIELECTRIC TEST 38.3/22.1 KV					
SERIAL NUMBER	CONSECUTIVE	INICIAL VOLTAGE	LAST VOLTAGE	q max (PC) Vmax	INICIAL VOLTAGE	LAST VOLTAGE	PC LEVEL	DATE	INSPECTOR	OBSERVATIONS
	2				———	———	1 pC 1pC	03/10/2014	RRM	
POWER FREQUENCY APPLIED VOLTAGE TEST(70 kV rms)			180Hz.	40Seg.						

INSPECTOR
JOSE LUIS ARRIETA SANCHEZ

Ciat de México
Initials: JAS
Date: 3/10/14
INS: 010

arteche
LABORATORIO ELÉCTRICO
MEDIA TENSIÓN
SUPERVISOR ARTECHE
GUSTAVO ALCANTAR MAGAÑA.

000030

Nº 14016585

TESTS CERTIFICATE

CUSTOMER: ARTECHE TyT,	VOLTAGE TRANSFO (S)
	QUANTITY: 1
CUSTOMER'S REF.: IBERDROLA PROTOTYPES	TYPE: UKS-36
	HIGHEST VOLTAGE: 36.5 KV.

PRIMARY (V)	SECONDARY (V)	BURD. (VA)	CLASS	THER B.
20125 (H1-H2)	115 (X1-X2)	Z	0,3	1000

	ROUTINE TESTS
STANDARD:	POWER-FREQUENCY TEST P/S+E: KV.
IEEE C57.13/2008	
FREQUENCY: 60 Hz	INDUCED OVERVOLTAGE TEST: [illegible] KV.
RATED VOLT. FACTOR: 1.1Un	POWER-FREQUENCY TEST S/E: [illegible] KV.
	S/S: KV.
SEC. INTERDEPENDENCE: ( )	PARTIAL DISCHARGES ≤ [illegible] pC 38,5 KV.
TEMP: -40°/+40°C	VERIFICATION OF TERMINALS MARKINGS AND POLARITY

ACCURACY TEST

TRANSFOR. Nº.	RATIO	TERMIN.	BURDEN (VA)			% OF RATED VOLTAGE	± PORCEN VOLTAGE ERROR	± PHASE DISPL IN MIN
			X1-X2					
14016585/ 2	20125/115	X1-X2	0			110	-0.26	0
						100	+0.27	0
						90	-0.27	0
			W			110	+0.24	+1
						100	+0.24	+1
						90	+0.24	+1
			X			110	+0.20	0
						100	+0.20	0
						90	+0.20	0
			Y			110	+0.08	-2
						100	+0.08	-2
						90	0.08	-2
			Z			110	-0.22	-7
						100	-0.22	-7
						90	-0.22	-7

Date: 18/09/14 Certified Correct:

E.C.E.

JLAS

3/10/14

arteche

ARTECHE USA.

TEST REPORT- MV VOLTAGE TRANSFORMER

MODEL:	URS-36		
RATIO:	166:1	QTY:	1
ACCURACY:	0.3 Y	CODE:	757871166
SERIAL NUMBER:	13004363		

APPLIED VOLTAGE DIELECTRIC TEST.

POWER DIELECTRIC TEST, PRIMARY WINDING, 1 minute @ 60 Hz. N/A KV.
POWER DIELECTRIC TEST, SECONDARY WINDING, 1 minute @ 60Hz. 2.5 KV.
APPROVED: R.R.M. DATE: 19/03/2013

INDUCED VOLTAGE TEST.

INDUCED VOLTAGE TEST, 70000 VOLTS @ 180 Hz FOR 40 SECONDS.

APPROVED: R.R.M. DATE: 19/03/2013

POLARITY TEST.

POLARITY: OK DATE: F.J.T.B. APPROVED: 19/03/2013

ACCURACY TEST

UNIT N°	RATIO	BURDEN	60 Hz. METERING ACCURACY						TESTED DATE
			110%		100%		90%		
			R.F.C.	P.A.	R.F.C.	P.A.	R.F.C.	P.A.	
1	166:1 X1-X2	0	0.9990	0	0.9990	0	0.9990	0	19/03/2013
		W	0.9993	0	0.9993	0	0.9993	0	
		X	0.9996	-1	0.9996	-1	0.9996	-1	
		M	0.9998	+2	0.9998	+1	0.9998	+1	
		Y	1.0008	-2	1.0008	-2	1.0008	-2	
		Z							
		ZZ							

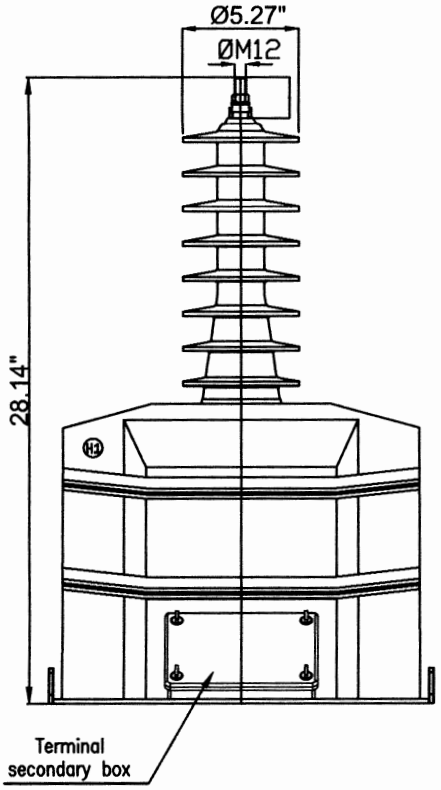
PARTIAL DISCHARGES	
STANDARD LEVEL: ≤ 50 pC	
HIPOT LEVEL:	36.2 KV.
DATE:	
APPROVED:	F.J.R.C.

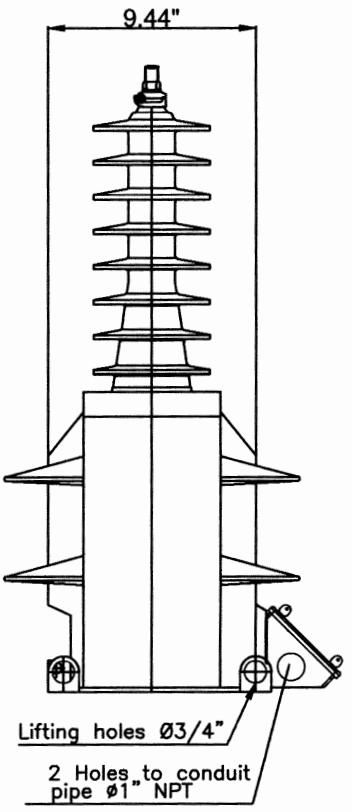
Made in Mexico By:

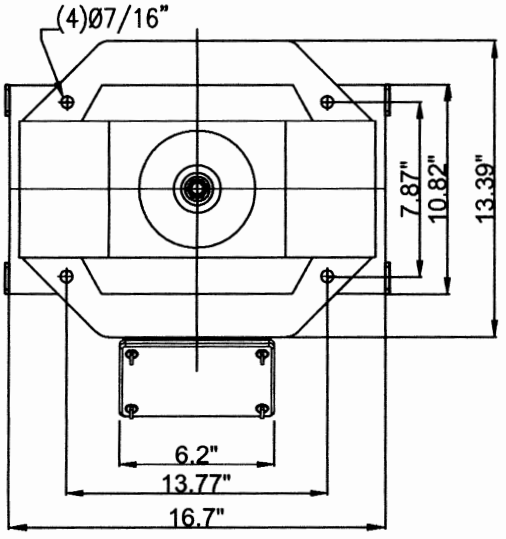
Reviewer, Aproval: F. C. C.

This product was approved according to IEEE C57.13 2008 standard.

arteche







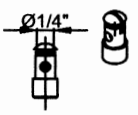
GROUND CONNECTOR

TE-12-250

PRIMARY TERMINAL

TE-4T

SECONDARY TERMINAL



Type: Quick connector

APPROX. WEIGHT
174 lbs.

CREEP DISTANCE
49.6 in

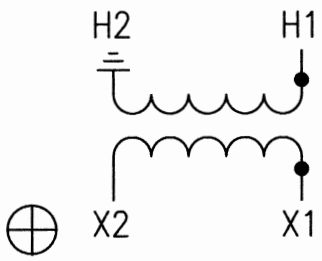
STRIKE DISTANCE
25.2 in

arteche

Approximate dimensions in inches

VOLTAGE TRANSFORMER URS–36

Date	Approved	Drawing Nº
28/10/13	R.E.S.	4286773



arteche

SERIAL NUMBER

TYPE URS–36 VOLTAGE TRANSFORMER

N.S.V. 34.5 kV CAT.N° 757860175
B.I.L. 200 kV FW 60 Hz

VOLTAGE		RATIO	ACCURACY @ 60 Hz	THERMAL @ 30 °C
PRI.	SEC.			
H1–H2 20125V	115V	175:1	0.3 W,X,M,Y	1000VA

INDUSTRY CANADA APPROVAL No. AE–

arteche

NAMEPLATE

VT URS–36

AREA: Oficina de Sistemas de Distribución

REPORT Nr.: K3421-238B-2014

CLIENT: **ARTECHE**
TRANSFORMADORES Y TECNOLOGÍA S. A. DE C. V.

ADDRESS: Km. 73.540 Antigua Carretera México-Querétaro Tepeji de Río
de Ocampo Estado de Hidalgo, C.P. 42850
Tel: +52(773)73 32 034

TITLE: Prototype test on voltage transformer URS-36 brand ARTECHE.

SUMMARY:

OBJECT TESTED
Voltage transformer type URS-36, Nr. 14016585001, Ratio: 175:1, NSV: 34.5 kV, BIL: 200 kV, Frequency: 60 Hz. Thermal burden: 1000 VA, Accuracy Class: 0.3 WXMYZ, Primary H1-H2: 20125 V, Secondary X1-X2: 115 V Brand ARTECHE.

Test Performed:

Wet 60 Hz 10 s withstand test
Impulse (BIL) Test
Temperature Rise Test

Standards:

IEEE Std C57.13-2008

Result: SATISFACTORY

Remark: - This report and results cover the tested sample only and no contain the totality type tests. Confidential document.

DATE: 2014/10/20	FILE: K3421-238	APPROVED BY:	REVISED BY:
PREPARED BY:			
ING. RUBEN JARAMILLO VACIO SIGNATARIO		**ING. JAIME ENCINAS ROSAS** JEFE DE LA OFICINA DE SISTEMAS DE DISTRIBUCIÓN	**ING. RICARDO MARTÍNEZ TORRES** JEFE DE DEPARTAMENTO DE DISTRIBUCIÓN

DEPARTAMENTO DE DISTRIBUCIÓN
OFICINA DE SISTEMAS DE DISTRIBUCIÓN

CHARACTERISTICS
Voltage transformer type URS-36
Serial: 14016585001
NSV: 34.5 kV
BIL: 200 kV
Frequency: 60 Hz

VOLTAGE				RATIO	Accuracy @ 60 Hz	THERMAL @ 30°C
PRIMARY		SECONDARY				
H1-H2	20125 V	X1-X2	115 V	_175:1	0.3 WXMYZ	1000VA

Wet 60 Hz 10 seconds withstand test.
Voltage applied to: H1-H2
Grounded: X1-X2-Frame
Voltage test: 70 kV
Time test: 10 seconds
Result: Satisfactory

Impulse (BIL) test

Impulse	Up (kV)	T1(µs)	T2(µs)	Tc(µs)
1	156.2	1.13	50.4	
2	233.5	1.01		3.56
3	233.2	1.1		3.66
4	205.3	1.14	50.4	

Equipment test:
Impulse generator 750 kV, Haefely, Nr. GA2006.
Impulse voltage resistive divider 600 kV, serial Nr. 061000547061000547.10.1, Haefely.
Oscilloscope Nr. D55980.
High Voltage test equipment 60 Hz, 300 kV, Nr. 1972416.
Temperature Recorder YEW serial D55090 calibrated.
Resistance Meter brand TETTEX serial 156078 calibrated
Uncentainty
With a k=2 for confidence level of 95%
AC Voltage Uncertainty: ±0.7 %
Impulse Voltage Uncertainty: ±1.7 %
Temperature Uncertainty: ±1.98 %

DOCUMENTO FIRMADO ELECTRONICAMENTE

Tested By: **Ruben Jaramillo Vacio**
Ingeniero de Pruebas

DOCUMENTO FIRMADO ELECTRONICAMENTE

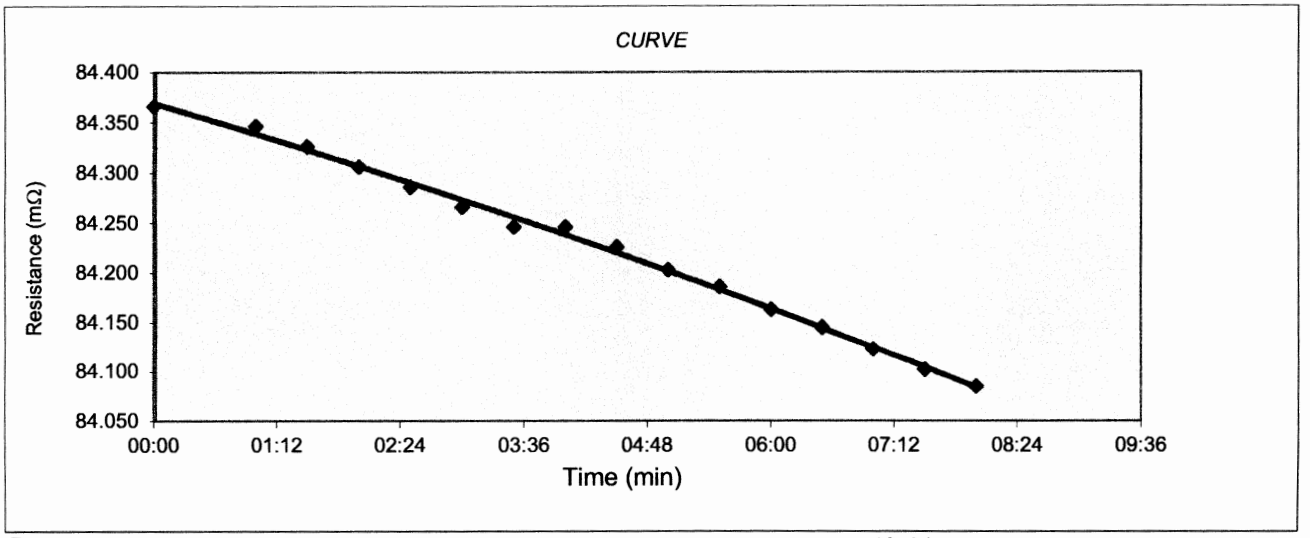
Checked By **Jaime Encinas Rosas**
Encargado de Oficina de Sistemas de Distribución

Report Nr: K3421-238B-2014
Sheet: 3 of 5
Date: 13/10/2014

DEPARTAMENTO DE DISTRIBUCIÓN
OFICINA DE SISTEMAS DE DISTRIBUCIÓN

Temperature rise test, winding X1-X2

Nr.	Time	Resistance
/	min	mΩ
/	00:00	84.3660
1	01:00	84.3460
2	01:30	84.3260
3	02:00	84.3060
4	02:30	84.2860
5	03:00	84.2660
6	03:30	84.2460
7	04:00	84.2460
8	04:30	84.2260
9	05:00	84.2030
10	05:30	84.1860
11	06:00	84.1630
12	06:30	84.1450
13	07:00	84.1230
14	07:30	84.1020
15	08:00	84.0850



R_0 =	Reference resistance of the winding	78.44	mΩ
R =	Resistance of the winding at the time of shutdown	84.366	mΩ
Θ_0 =	Temperature in degree Celsius correspondig to the reference resistance of the winding	24	ºC
Θ =	Ambient temperature corresponding at the time of shutdown	22	ºC
Θ_k =	Temperature in the degree Celsius corresponding to the resistance of the winding at time of shutdown	43.53	ºC
$\Delta\Theta$ / ambient	Average temperature rise of a winding	**21.53**	**ºC < 80ºC a 1780 mosl Satisfactory**

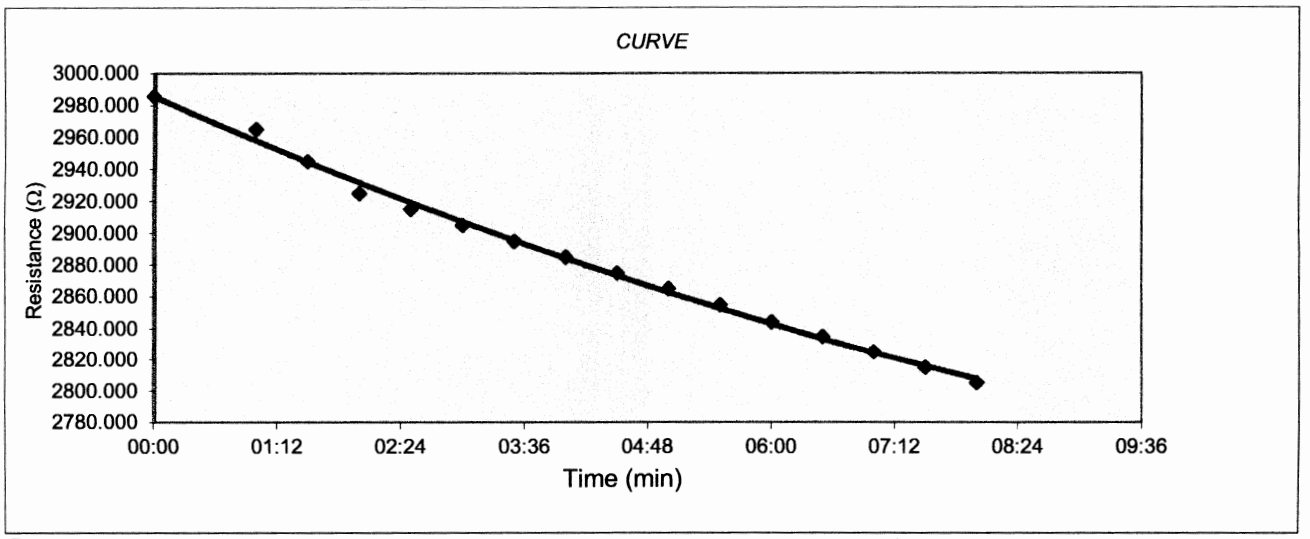
Voltage test: 20125V, thermal burden: 1000 VA

Report Nr: K3421-238B-2014
Sheet: 4 of 5
Date: 13/10/2014

DEPARTAMENTO DE DISTRIBUCIÓN
OFICINA DE SISTEMAS DE DISTRIBUCIÓN

Temperature rise test, winding H1-H2

Nr.	Time	Resistance
/	min	Ω
/	00:00	2985.6
1	01:00	2965.0
2	01:30	2945.0
3	02:00	2925.0
4	02:30	2915.0
5	03:00	2905.0
6	03:30	2895.0
7	04:00	2885.0
8	04:30	2875.0
9	05:00	2865.0
10	05:30	2855.0
11	06:00	2844.0
12	06:30	2835.0
13	07:00	2825.0
14	07:30	2815.0
15	08:00	2805.0



R_0 =	Reference resistance of the winding	2727.5	Ω
R =	Resistance of the winding at the time of shutdown	2985.6	Ω
Θ_0 =	Temperature in degree Celsius correspondig to the reference resistance of the winding	24	ºC
Θ =	Ambient temperature corresponding at the time of shutdown	23	ºC
Θk =	Temperature in the degree Celsius corresponding to the resistance of the winding at time of shutdown	48.46	ºC
$\Delta \Theta$ / ambient	Average temperature rise of a winding	**25.46**	**ºC < 80ºC a 1780 mosl Satisfactory**

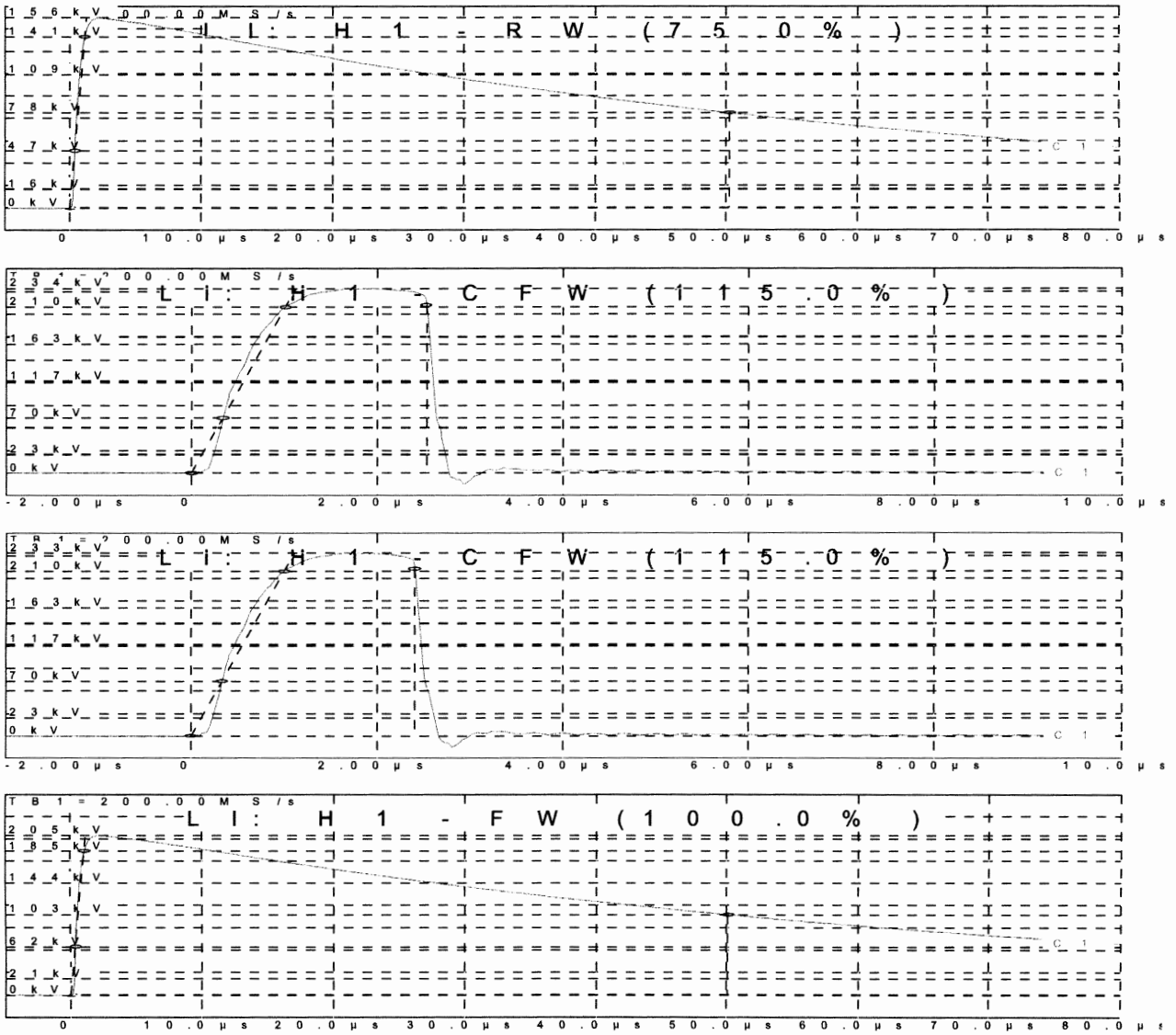
Voltage test: 20125V, thermal burden: 1000 VA

Report Nr: K3421-238B-2014
Sheet: 5 of 5
Date: 13/10/2014

DEPARTAMENTO DE DISTRIBUCIÓN
OFICINA DE SISTEMAS DE DISTRIBUCIÓN

Impulse (BIL) test

Voltage applied to: H1
Grounded: X1-X2-Frame



Result: Satisfactory

DOCUMENTO FIRMADO ELECTRONICAMENTE

Tested By: **Ruben Jaramillo Vacio**
Ingeniero de Pruebas

DOCUMENTO FIRMADO ELECTRONICAMENTE

Checked By **Jaime Encinas Rosas**
Encargado de Oficina de Sistemas de Distribución

ÁREA: High Current Office

TEST REPORT: K3422-199C-2014.

CLIENT: **ARTECHE TRANSFORMADORES Y TECNOLOGÍA S.A. DE C.V.**

ADDRESS: km 73,540 Antigua Carretera México Querétaro, Tepeji del Río de Ocampo Edo. de Hidalgo C.P. 42850, Tel.:+52 (773) 7332034.

TÍTLE: Short time withstand current test carried out on a voltage transformer.

- **Type:** URS-36
- **Ratio:** 175:1
- **Brand**: ARTECHE.
- **Made in:** México.

SUMMARY:

Object under test:
Voltage transformer, type URS-36, brand ARTECHE, serial number: 14016585001

Applied standards:
IEEE C57.13-2008 Clause 7.7

Test performed:
Short-circuit capability

Test results:
The assessment of the compliance of the tested voltage transformer with the requirements of the short-time withstand current tests, were not performed by LAPEM. So, in this report are declared only the test values applied.
The test data declared in this report is for the exclusive use of the owner, who is in his full right to use them at his convenience.

DATE: 2014-10-28 FILE: K3422-199-2014	**APRÓVED BY:**	AUTHORIZED BY:
TESTED BY: DOCUMENTO FIRMADO ELECTRÓNICAMENTE Genaro Arturo Ruiz Carlo Testing Enginner	DOCUMENTO FIRMADO ELECTRONICAMENTE Juan Carlos Martínez Magdaleno Head of High Current Laboratory	DOCUMENTO FIRMADO ELECTRONICAMENTE Ricardo A Martínez Torres **Head of Distribution Departament**

DISTRIBUTION DEPARTMENT-HIGH CURRENT LABORATORY

REPORT: K3422-199C-2014

TEST REPORT

CLIENT: ARTECHE TRANSFORMADORES Y TECNOLOGÍA S.A. DE C.V.

MANUFACTURER: ARTECHE TRANSFORMADORES Y TECNOLOGÍA S.A. DE C.V.

EQUIPMENT TESTED: VOLTAGE TRANSFORMER.

TYPE: URS-36

SERIAL No: 14016585001

CHARACTERISTICS:
Brand: ARTECHE
Ratio: 175:1
Primary rated voltage: 20125 V
Secondary rated voltage: 115 V

STANDARDS:
IEEE C57.13-2008 Clause 7.7

TESTS PERFORMED:
Short-circuit capability

Date of the test: September 30, 2014
Date of receipt of the transformer: September 30, 2014

RESULTS:
The assessment of the compliance of the tested voltage transformer with the requirements of the short- time withstand current tests, were not performed by LAPEM. So, in this report are declared only the test values applied.

THIS REPORT INCLUDES:

Pages: 6
Oscillograms: 1
Diagrams: -
Photographs: 1
Drawings: 1
Others: -

DOCUMENTO FIRMADO ELECTRÓNICAMENTE

Genaro Arturo Ruiz Carlo, Eng.
Tested by

DOCUMENTO FIRMADO ELECTRÓNICAMENTE

Genaro Arturo Ruiz Carlo, Eng.
Authorized Signatory

The results expressed within this report refer only to the tested object(s).

42220101

Irapuato, Gto. México; October 28, 2014.

DISTRIBUTION DEPARTMENT-HIGH CURRENT LABORATORY

REPORT: K3422-199C-2014

1. - OTHER CHARACTERISTICS ASSIGNED BY THE MANUFACTURER.

Accuracy: 0.3 W,X,M,Y,Z

2. - WITNESS DURING TESTS:

Name: Company

--- ---

3. - PURPOSE OF THE TEST.

The purpose of the tests is to demonstrate the mechanical & thermal capability of the transformer to withstand short circuit stresses.

4. - STANDARDS APPLIED:

IEEE C57.13-2008 Clause 7.7

5. - TEST REQUIREMENTS:

- **7.7 Short-circuit capability**

Voltage transformers shall be capable of withstanding for 1 s the mechanical and thermal stresses resulting from a shot circuit on the secondary terminals with full voltage maintained on the primary terminals.

6. - TEST CIRCUIT:

The transformer under test is connected to the low voltage side of the short circuit transformer. The short circuit is made by closing the synchronized device, and the clearing of the short circuit is made by the opening of the back circuit breaker, then the time during which the current flows through the Device Under test is obtained. See figure 1.

7. - TESTS RESULTS AND UNCERTAINTY OF MEASUREMENT:

See page 4 for test values obtained.

7.1. - VISUAL INSPECTION:

The tested transformer didn't show any damage at least on the outside part.

7.2. - CONCLUSIONS:

The voltage transformer tested did not show indications of damage during the tests; this laboratory didn't carry out any other verification.

7.3. - PHOTOGRAPHS:

This report not includes photographs of the transformer.

7.4. - OSCILLOGRAMS:

This report includes the oscillograms that show the results of the short time current tests.

42220102

DISTRIBUTION DEPARTMENT-HIGH CURRENT LABORATORY

REPORT: K3422-199C-2014

TEST RESULTS AND UNCERTAINTY OF MEASUREMENT

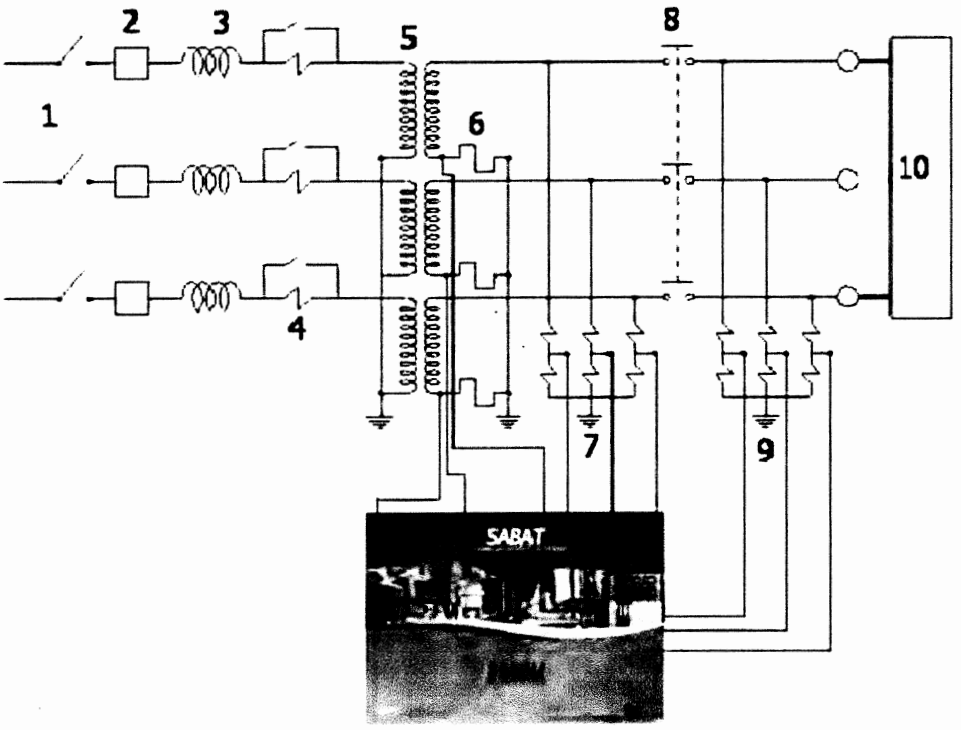
Test circuit	Oscillogram	Test	Voltage Test V	Voltage RMS Obtained kA	Current rms Obtained kA	Time Obtained s	Time Required s	I^2t Obtained kA^2s	I^2t Required kA^2s
C01 01	001	Short-circuit capability	117.56	115.00	341.79	1.00	1.0	----	----

The numerical value of expanded uncertainty (U) with a coverage factor k=2 and a level of confidence of approximately 95% : For current: 1.0% and for voltage: 1.5%.

DISTRIBUTION DEPARTMENT-HIGH CURRENT LABORATORY

REPORT: K3422-199C-2014

Figure 1



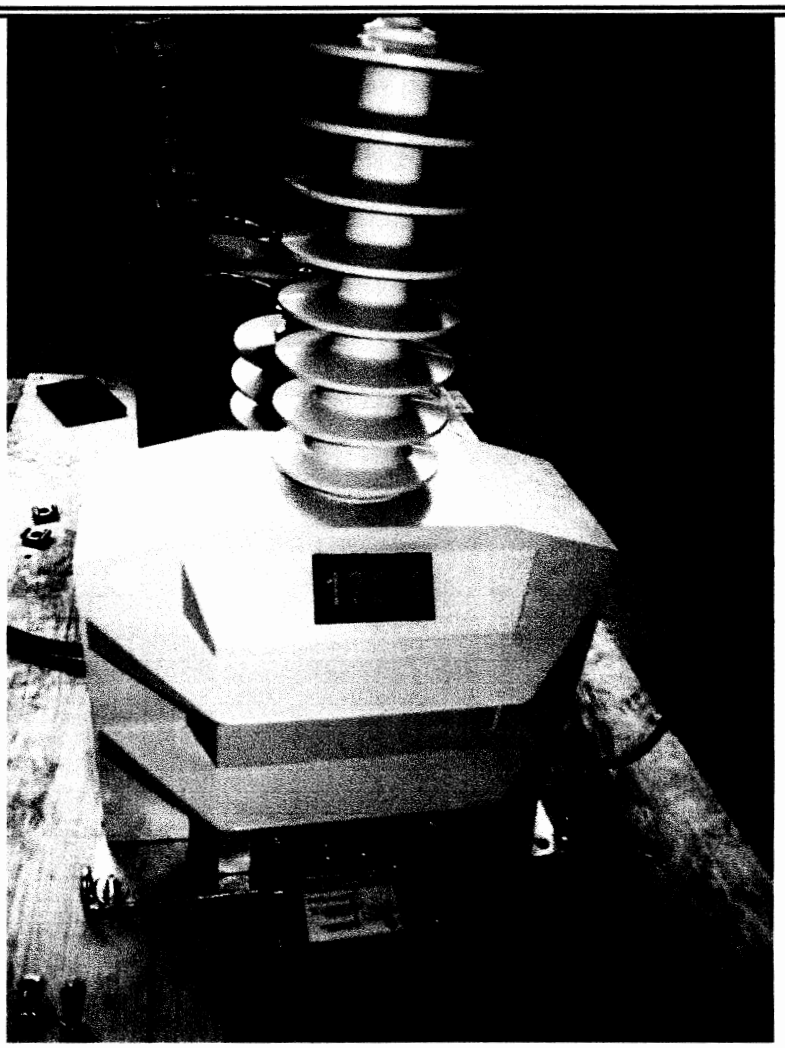
(1) Manual no Load Circuit Switch
(2) Back Circuit Breaker
(3) Limiting Reactors
(4) Limiting Resistors
(5) Short Circuit Transformer
(6) Current Shunt Meter. Measuring link: CFOCFA and CFOCFC, with calibration in force.
(7) Voltage dividers
(8) Synchronized Closing Devices
(9) Voltage dividers. Measuring link: CFOTFAD and CFOTFCD, with calibration in force.
(10) Device under test
(11) Control and data acquisition system SABAT with calibration in forcé.

42220104

DISTRIBUTION DEPARTMENT-HIGH CURRENT LABORATORY

REPORT: K3422-199C-2014

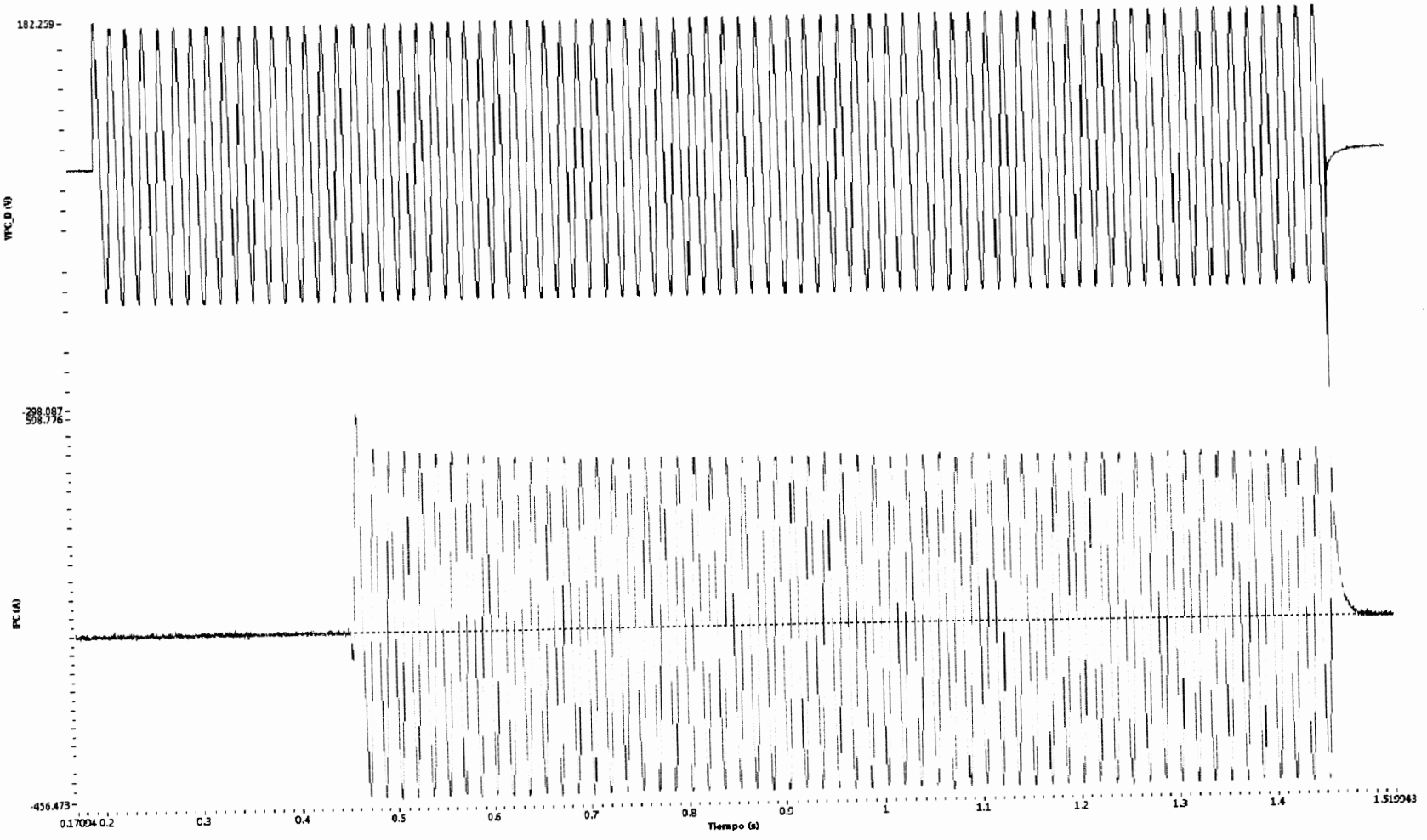
PHOTOGRAPHS



42220105

K3422 199C/2014 **Prueba No.:** 1 **Tipo de prueba:** CORTO CIRCUITO **Fecha:** 30/09/2014

Descripción: Short time withstand current test carried out on a voltage transformer.URS-36 brand Arteche
N.S. 14016585001



SECTION 4: MODEL VRS-36

Description:

The UR/VR series are dry type outdoor service voltage transformers. The core is encapsulated with Type B epoxy resin for excellence in internal dielectric properties and mechanical strength. The external layer of Cycloaliphatic resin provides resistance to ultraviolet rays and the effects of tracking and erosion on the exterior of the module. The device is maintenance free, ensuring a long mechanical and electrical life.

Partial Discharge measurements exceed IEEE C57.13 2008 requirements.

Available Ratios:

The VRS-36 family of VT's allows for revenue metering of at least 0.3% accuracy over a voltage range of 8310V up to 34500V at 30C. The below table summarizes the ratios that are available.

RATIO	Accuracy / Burden	Total Thermal Burden (Typical)
69.25 / 166:1	0.3 W,X,M,Y	500 VA-500 VA
140:1	0.3 W,X,M,Y	1000 VA
140/240:1	0.3 W,X,M,Y	1000 VA
166:1	0.3 W,X,M,Y	1000 VA
175:1	0.3 W,X,M,Y	1000 VA
175/300:1	0.3 W,X,M,Y	1000 VA
220:1	0.3 W,X,M,Y	1000 VA
240/400:1	0.3 W,X,M,Y	1000 VA
300:1	0.3 W,X,M,Y	1000 VA
300/500:1	0.3 W,X,M,Y	1000 VA

Construction:

The core is built from high permeability grain oriented silicon steel laminations for low losses. The windings are copper wire with copper plate double isolation. The concentric distribution of the coils prevents magnetic flux leakage, achieving greater accuracy and higher capacity to withstand mechanical stresses in adverse operating conditions.

Secondary Terminals and Cover:

The secondary terminals are furnished with brass quick connectors. The secondary terminal cover is made of plastic material and sealed with 4 screw type lugs.

Base Plates:

The transformers are furnished with galvanized steel base plates.

Primary Terminal:

The primary terminal consists of brass threaded rod that easily accommodates connectors such asTE-4T, NEMA 2 hole or NEMA 4 hole utilizing the H1-H2 polarity markings.

Nameplate:

Each VT ships with an engraved steel nameplate affixed to the VT base plate using rivets. The nameplate contains production serial number as well as all data required by the latest revision of ANSI C57.13.

Polarity Marking:

Polarity marking is accomplished by using white silicon dots on both the primary and secondary sides.

Testing:

The VRS-36 design has undergone design type testing in accordance with IEEE C57.13 (latest edition), Section 8. The test report is included with this submittal. Furthermore, all units produced undergo production testing to verify accuracy and phase angle error in accordance with Section 8, C57.13 (latest edition). A sample production test report is included with this submittal.

N° **14016586**

TESTS CERTIFICATE

CUSTOMER: ARTECHE TyT,	VOLTAGE TRANSFO (S) QUANTITY: 1
CUSTOMER'S REF.: IBERDROLA PROTOTYPES	TYPE: VRS-36 HIGHEST VOLTAGE: 36.5 KV.

PRIMARY (V)	SECONDARY (V)	BURD. (VA)	CLASS	THER B.
34500 (H1-H2)	115 (X1-X2)	Z	0,3	1500

	ROUTINE TESTS	
STANDARD: IEEE C57.13/2008	POWER-FREQUENCY TEST: P/S+E: 70	KV.
FREQUENCY: 60 Hz	INDUCED OVERVOLTAGE TEST: 70	KV.
RATED VOLT. FACTOR: 1.1Un	POWER-FREQUENCY TEST: S/E: 2.5	KV.
	S/S:	KV.
SEC. INTERDEPENDENCE: ( )	PARTIAL DISCHARGES ≤ 50 pC 38,3	KV.
TEMP: -40°/+40°C	VERIFICATION OF TERMINALS MARKINGS AND POLARITY	

ACCURACY TEST

TRANSFOR. N°.	RATIO	TERMIN.	BURDEN (VA)			% OF RATED VOLTAGE	± PORCEN VOLTAGE ERROR	± PHASE DISPL. IN MIN.
			X1-X2					
14016586/2	34500/115	X1-X2		O		110	+0.25	0
						100	+0.25	0
						90	+0.25	0
				W		110	+0.22	+1
						100	+0.22	+1
						90	+0.22	+1
				X		110	+0.19	0
						100	+0.19	0
						90	+0.19	0
				Y		110	+0.06	-1
						100	+0.06	-1
						90	+0.06	-1
				Z		110	-0.23	-4
						100	-0.23	-4
						90	-0.23	-4

Control de Calidad
Inicials JLAS
Data 3/10/14
INS. 010

Date: 18/09/14 Certified Correct: E.C.C.

000024-A

arteche

Transformadores y Tecnología, S.A. de C.V.
Km. 73,54 Ant. Carretera México – Querétaro
42850 Tepeji Del Río de Ocampo, Estado de Hidalgo.
T.+52 55 41 47 60 42 F. +52 77 37330366

F-LE-018
PARTIAL DISCHARGES TEST ***** 1 OF 1 SHEET *****

F-LE-003

	SERIALNUMBER: 14016586	TYPE: VRS-36	Max System Voltage = 36.5 KV						
NUMBER		PRIOR DIELECTRIC TEST			AFTER DIELECTRIC TEST 38.3 KV					
SERIAL NUMBER	CONSECUTIVE	INICIAL VOLTAGE	LAST VOLTAGE	q max (PC) Vmax	INICIAL VOLTAGE	LAST VOLTAGE	PC LEVEL	DATE	INSPECTOR	OBSERVATIONS
	2				____	____	1 pC	03/10/2014	RRM	
POWER FREQUENCY APPLIED VOLTAGE TEST(70 kV rms)		60Hz.	60Seg.							

INSPECTOR
JOSE LUIS ARRIETA SANCHEZ

Cciat de México
Initials JCAS
Date 3/10/14
INS: 010

arteche
LABORATORIO ELÉCTRICO
MEDIA TENSIÓN
SUPERVISOR ARTECHE
GUSTAVO ALCANTAR MAGAÑA

000035

Nº 14016586

TESTS CERTIFICATE

CUSTOMER: ARTECHE TyT,	VOLTAGE TRANSFO (S) QUANTITY: 1
CUSTOMER'S REF.: IBERDROLA PROTOTYPES	TYPE: VRS-36 HIGHEST VOLTAGE: 36.5 KV.

PRIMARY (V)	SECONDARY (V)	BURD. (VA)	CLASS	THER B.
34500 (H1-H2)	115 (X1-X2)	Z	0,3	1500

	ROUTINE TESTS	
STANDARD: IEEE C57.13/2008	POWER-FREQUENCY TEST: P/S+E: 70	KV.
FREQUENCY: 60 Hz	INDUCED OVERVOLTAGE TEST: 70	KV.
RATED VOLT. FACTOR: 1.1Un	POWER-FREQUENCY TEST: S/E: 2.5	KV.
	S/S:	KV.
SEC. INTERDEPENDENCE: ( )	PARTIAL DISCHARGES < 50 pC 38,3	KV.
TEMP: -40°/+40°C	VERIFICATION OF TERMINALS MARKINGS AND POLARITY	

ACCURACY TEST

TRANSFOR. Nº	RATIO	TERMIN	BURDEN (VA)			% OF RATED VOLTAGE	± PORCEN VOLTAGE ERROR	± PHASE DISPL IN MIN
			X1-X2					
1401658672	34500/115	X1-X2		0		110	+0.25	0
						100	+0.25	0
						90	+0.25	0
				W		110	+0.22	+1
						100	+0.22	+1
						90	+0.22	+1
				X		110	+0.19	0
						100	+0.19	0
						90	+0.19	0
				Y		110	+0.06	-1
						100	+0.06	-1
						90	+0.06	-1
				Z		110	-0.23	-4
						100	-0.23	-4
						90	-0.23	-4

Date: 18/09/14

Certified Correct:

E.C.E.

Initials JLAS
Date 3/10/14

000036

ARTECHE USA.

TEST REPORT- MV VOLTAGE TRANSFORMER

MODEL:	VRS-36		1
RATIO:	300:1	QTY:	
ACCURACY:	0.3 Y	CODE:	757919999
SERIAL NUMBER SERIES:	12009213		

APPLIED VOLTAGE DIELECTRIC TEST.

POWER DIELECTRIC TEST, PRIMARY WINDING, 1 minute @ 60 Hz. 70 KV.
POWER DIELECTRIC TEST, SECONDARY WINDING, 1 minute @ 60Hz. 2.5 KV.
APPROVED: E.C.C. DATE: 20/06/2012.

INDUCED VOLTAGE TEST.

INDUCED VOLTAGE TEST, 69000 VOLTS @ 180 Hz FOR 40 SECONDS.

APPROVED: R.R.M. DATE: 20/06/2012.

POLARITY TEST.

POLARITY: OK DATE: 20/06/2012. APPROVED: E.C.C.

ACCURACY TEST

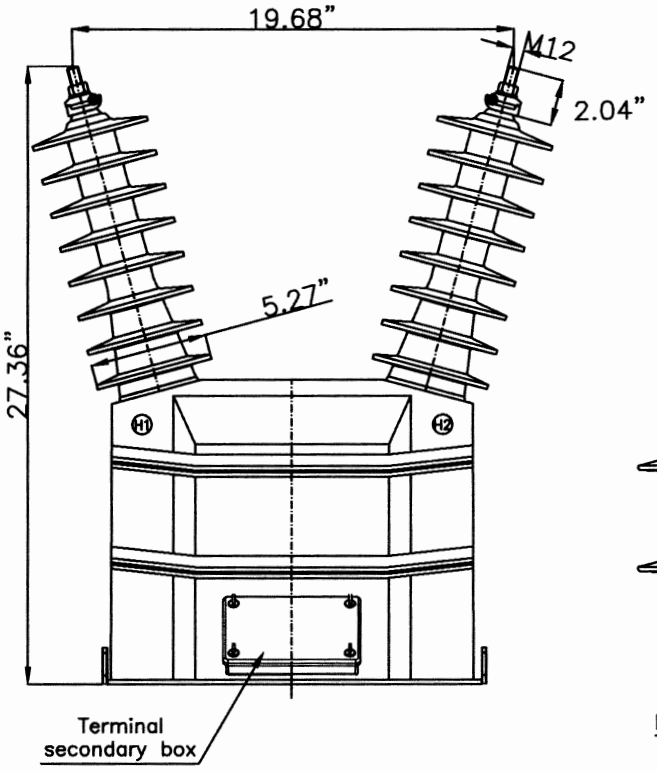
UNIT N°	RATIO	BURDEN	60 Hz. METERING ACCURACY						TESTED DATE
			110%		100%		90%		
			R.F.C.	P.A.	R.F.C.	P.A.	R.F.C.	P.A.	
1	300:1V X1-X2	0	0.9987	0	0.9987	0	0.9987	0	20/06/2012. E.C.C.
		W	0.9990	0	0.9990	0	0.9990	0	
		X	0.9993	-1	0.9993	-1	0.9993	-1	
		M	0.9996	+2	0.9996	+2	0.9996	+2	
		Y	1.0006	-2	1.0006	-2	1.0006	-1	
		Z							
		ZZ							

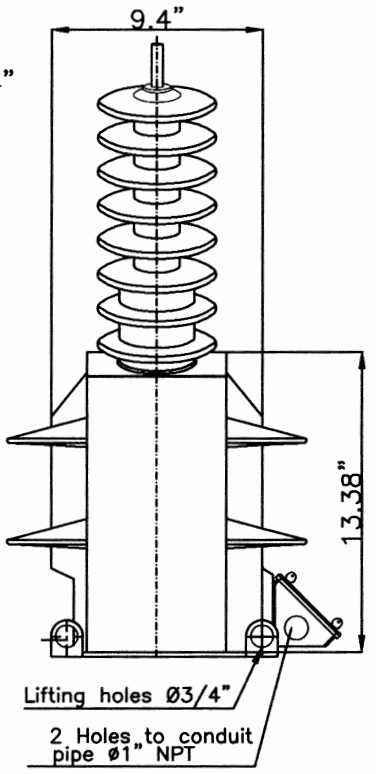
PARTIAL DISCHARGES	
STANDARD LEVEL: ≤ 50 pC	
HIPOT LEVEL:	36.2 KV.
DATE:	20/06/2012
APPROVED:	E.C.C.

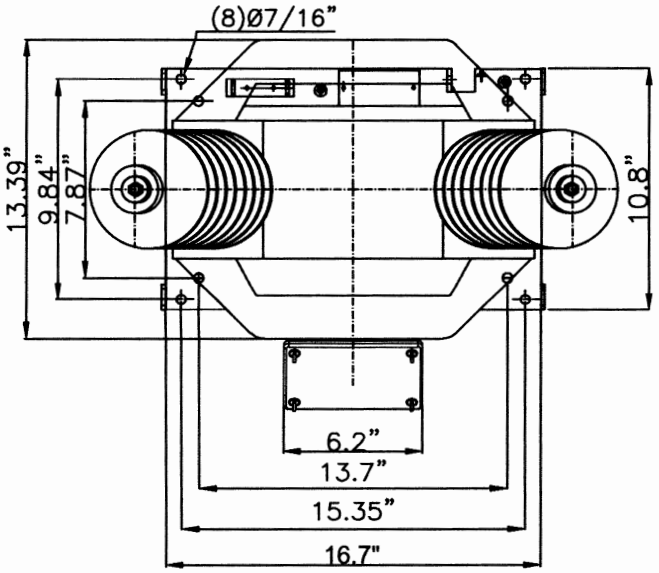
Made in Mexico By:

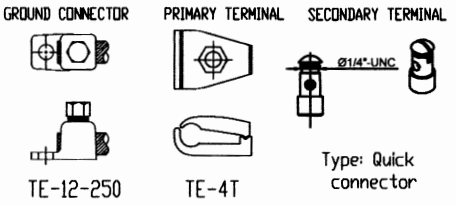
Reviewer, Aproval: E.C.C.

This product was approved according to IEEE C57.13 2008 standard.









STRIKE DISTANCE 17.71" in

CREEP DISTANCE 49.2 in

APPROX. WEIGHT 183 lbs.

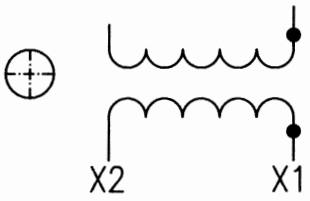
arteche

Approximate dimensions in inches

VOLTAGE TRANSFORMER VRS–36

Date	Approved	Drawing N°
29.11.13	R.E.S.	4286825

arteche



SERIAL NUMBER

TYPE: VRS-36 VOLTAGE TRANSFORMER

N.S.V. 34.5 kV CAT.N° 757920300
B.I.L. 200 kV FW 60 Hz

VOLTAGE		RATIO	ACCURACY @60 Hz	THERMAL @30 °C
PRI.	SEC.			
H1–H2 34500V	115V	300:1	0.3 W,X,M,Y	1000VA

INDUSTRY CANADA APPROVAL No. AE–

arteche

NAMEPLATE

VT VRS-36

AREA: Oficina de Sistemas de Distribución

REPORT Nr.: K3421-238C-2014

CLIENT: **ARTECHE**
TRANSFORMADORES Y TECNOLOGÍA S. A. DE C. V.

ADDRESS: Km. 73.540 Antigua Carretera México-Querétaro Tepeji de Río
de Ocampo Estado de Hidalgo, C.P. 42850
Tel: +52(773)73 32 034

TITLE: Prototype test on voltage transformer VRS-36 brand ARTECHE.

SUMMARY:

OBJECT TESTED
Voltage transformer type VRS-36, Nr. 14016586001, Ratio: 300:1, NSV: 34.5 kV, BIL: 200 kV, Frequency: 60 Hz. Thermal burden: 1500 VA, Accuracy Class: 0.3 WXMYZ, Primary H1-H2: 34500 V, Secondary X1-X2: 115 V. Brand ARTECHE.

Test Performed:

Wet 60 Hz 10 s withstand test
Impulse (BIL) Test
Temperature Rise Test

Standards:

IEEE Std C57.13-2008

Result: SATISFACTORY

Remark: - This report and results cover the tested sample only and no contain the totality type tests. Confidential document.

DATE: 2014/10/29	FILE: K3421-238	APPROVED BY:	REVISED BY:
PREPARED BY: DOCUMENTO FIRMADO ELECTRÓNICAMENTE **ING. RUBÉN JARAMILLO VACIO** SIGNATARIO		DOCUMENTO FIRMADO ELECTRÓNICAMENTE **ING. JAIME ENCINAS ROSAS** JEFE DE LA OFICINA DE SISTEMAS DE DISTRIBUCIÓN	DOCUMENTO FIRMADO ELECTRÓNICAMENTE **ING. RICARDO MARTÍNEZ TORRES** JEFE DE DEPARTAMENTO DE DISTRIBUCIÓN

Con fecha 29 de octubre de 2014 el presente documento, consta de 06 fojas, así como la información que de él se genere, se clasifica como reservado por parte del titular del Laboratorio de Pruebas de Equipos y Materiales de la Comisión Federal de Electricidad, con fundamento en los Artículo 3 Fracción III, IV, V, VI y XV, Artículo 14 Fracción I y II, Artículo 15, 16 y 21 de la Ley de Federal de Transparencia y Acceso a la Información Pública Gubernamental; Artículo 26, 27, 30 y 34 Fracción I y II del Reglamento de la Ley Federal de Transparencia y Acceso a la Información Pública Gubernamental; Lineamiento Primero, Cuarto, Quinto, Sexto. Décimo Quinto y Vigésimo Quinto de los Lineamientos Generales para la Clasificación y Desclasificación de la Información de las Dependencias y Entidades de la Administración Pública Federal. Asimismo, esta información permanecerá con este carácter durante el periodo de 12 años a partir de la fecha de su clasificación, o bien al momento en que se actualice alguno de los supuestos previstos en el Artículo 34 de dicho Reglamento. Así lo proveyó y rubrica el Ing. Luis Javier Freyre Rizo titular de la Gerencia del Laboratorio de Pruebas de Equipos y Materiales de la Comisión Federal de Electricidad.

DATE: 2014/10/29	**FILE:** K3421-238	APPROVED BY:	REVISED BY:
PREPARED BY:			
ING. RUBÉN JARAMILLO VACIO SIGNATARIO		**ING. JAIME ENCINAS ROSAS** JEFE DE LA OFICINA DE SISTEMAS DE DISTRIBUCIÓN	**ING. RICARDO MARTÍNEZ TORRES** JEFE DE DEPARTAMENTO DE DISTRIBUCIÓN

DEPARTAMENTO DE DISTRIBUCIÓN
OFICINA DE SISTEMAS DE DISTRIBUCIÓN

CHARACTERISTICS
Voltage transformer type VRS-36
Serial: 14016586001
NSV: 34.5 kV
BIL: 200 kV
Frequency: 60 Hz

VOLTAGE				RATIO	Accuracy @ 60 Hz	THERMAL @ 30°C
PRIMARY		SECONDARY				
H1-H2	34500 V	X1-X2	115 V	_300:1	0.3 WXMYZ	1500 VA

Wet 60 Hz 10 seconds withstand test.
Voltage applied to: H1-H2
Grounded: X1-X2-Frame
Voltage test: 70 kV
Time test: 10 seconds
Result: Satisfactory

Impulse (BIL) test

Impulse	Up (kV)	T1(µs)	T2(µs)	Tc(µs)
1	156.5	1.12	50.2	
4	235.2	1.07		3.62
5	234.8	1.07		3.65
6	210.6	1.09	50.2	
7	156.4	1.13	50.2	
8	234.3	1.06		3.78
9	235.3	1.09		3.7
10	205.5	1.09	50.1	

Equipment test:
Impulse generator 750 kV, Haefely, Nr. GA2006.
Impulse voltage resistive divider 600 kV, serial Nr. 061000547061000547.10.1, Haefely.
Oscilloscope Nr. D55980.
High Voltage test equipment 60 Hz, 300 kV, Nr. 1972416.
Temperature Recorder YEW serial D55090 calibrated.
Resistance Meter brand TETTEX serial 156078 calibrated
Uncentainty
With a k=2 for confidence level of 95%
AC Voltage Uncertainty: ±0.7 %
Impulse Voltage Uncertainty: ±1.7 %
Temperature Uncertainty: ±1.98 %

DOCUMENTO FIRMADO ELECTRONICAMENTE

Tested By: **Ruben Jaramillo Vacio**
Ingeniero de Pruebas

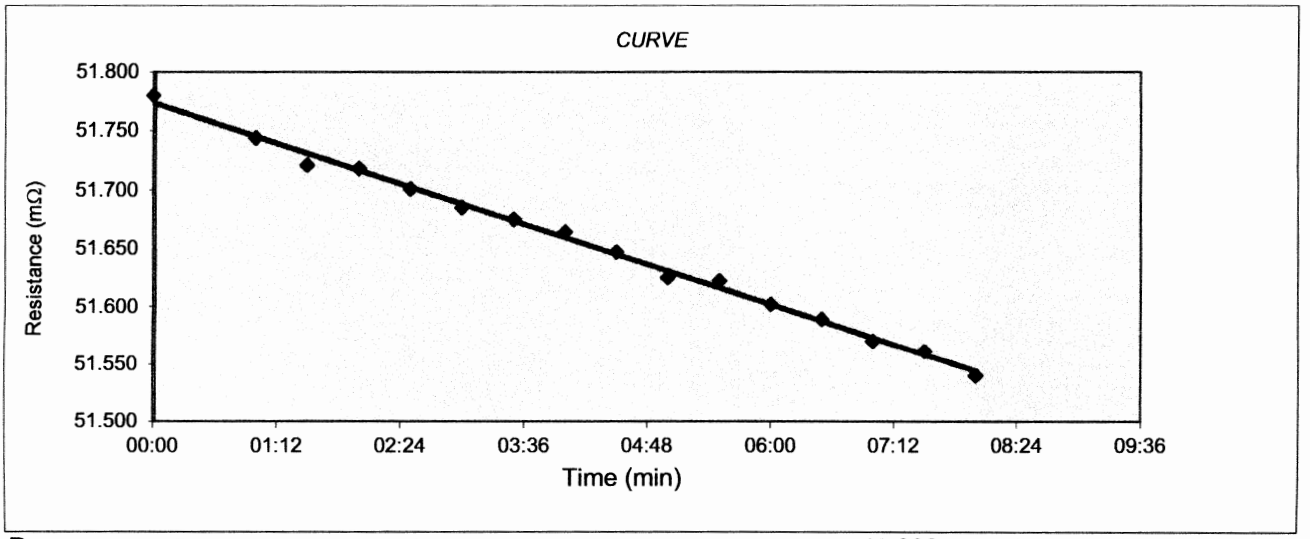
DOCUMENTO FIRMADO ELECTRONICAMENTE

Checked By **Jaime Encinas Rosas**
Encargado de Oficina de Sistemas de Distribución

DEPARTAMENTO DE DISTRIBUCIÓN
OFICINA DE SISTEMAS DE DISTRIBUCIÓN

Temperature rise test, winding X1-X2

Nr.	Time	Resistance
/	min	mΩ
/	00:00	51.7800
1	01:00	51.7440
2	01:30	51.7210
3	02:00	51.7180
4	02:30	51.7010
5	03:00	51.6850
6	03:30	51.6750
7	04:00	51.6640
8	04:30	51.6470
9	05:00	51.6250
10	05:30	51.6220
11	06:00	51.6020
12	06:30	51.5890
13	07:00	51.5700
14	07:30	51.5610
15	08:00	51.5400



R_0 =	Reference resistance of the winding	45.293	mΩ
R =	Resistance of the winding at the time of shutdown	51.78	mΩ
Θ_0 =	Temperature in degree Celsius correspondig to the reference resistance of the winding	24	°C
Θ =	Ambient temperature corresponding at the time of shutdown	22	°C
Θ_k =	Temperature in the degree Celsius corresponding to the resistance of the winding at time of shutdown	61.02	°C
$\Delta\Theta$ / ambient	Average temperature rise of a winding	**39.02**	**°C < 80°C a 1780 mosl**

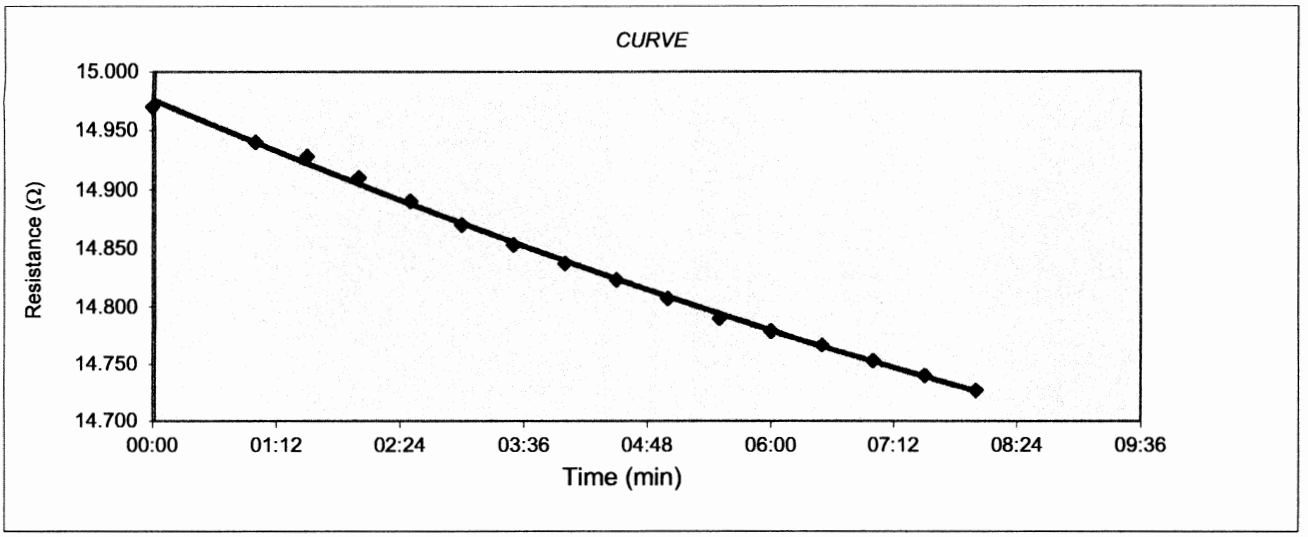
Satisfactory

Voltage test: 34500 V, thermal burden: 1500 VA

DEPARTAMENTO DE DISTRIBUCIÓN
OFICINA DE SISTEMAS DE DISTRIBUCIÓN

Temperature rise test, winding H1-H2

Nr.	Time	Resistance
/	min	Ω
/	00:00	14.9700
1	01:00	14.9400
2	01:30	14.9280
3	02:00	14.9100
4	02:30	14.8900
5	03:00	14.8700
6	03:30	14.8530
7	04:00	14.8370
8	04:30	14.8230
9	05:00	14.8070
10	05:30	14.7900
11	06:00	14.7790
12	06:30	14.7670
13	07:00	14.7530
14	07:30	14.7400
15	08:00	14.7270



R_0 =	Reference resistance of the winding	13.01	Ω	
R =	Resistance of the winding at the time of shutdown	14.97	Ω	
Θ_0 =	Temperature in degree Celsius correspondig to the reference resistance of the winding	24	ºC	
Θ =	Ambient temperature corresponding at the time of shutdown	23	ºC	
Θk =	Temperature in the degree Celsius corresponding to the resistance of the winding at time of shutdown	62.94	ºC	
Δ Θ / ambient	Average temperature rise of a winding	**39.94**	**ºC < 80ºC Satisfactory**	**a 1780 mosl**

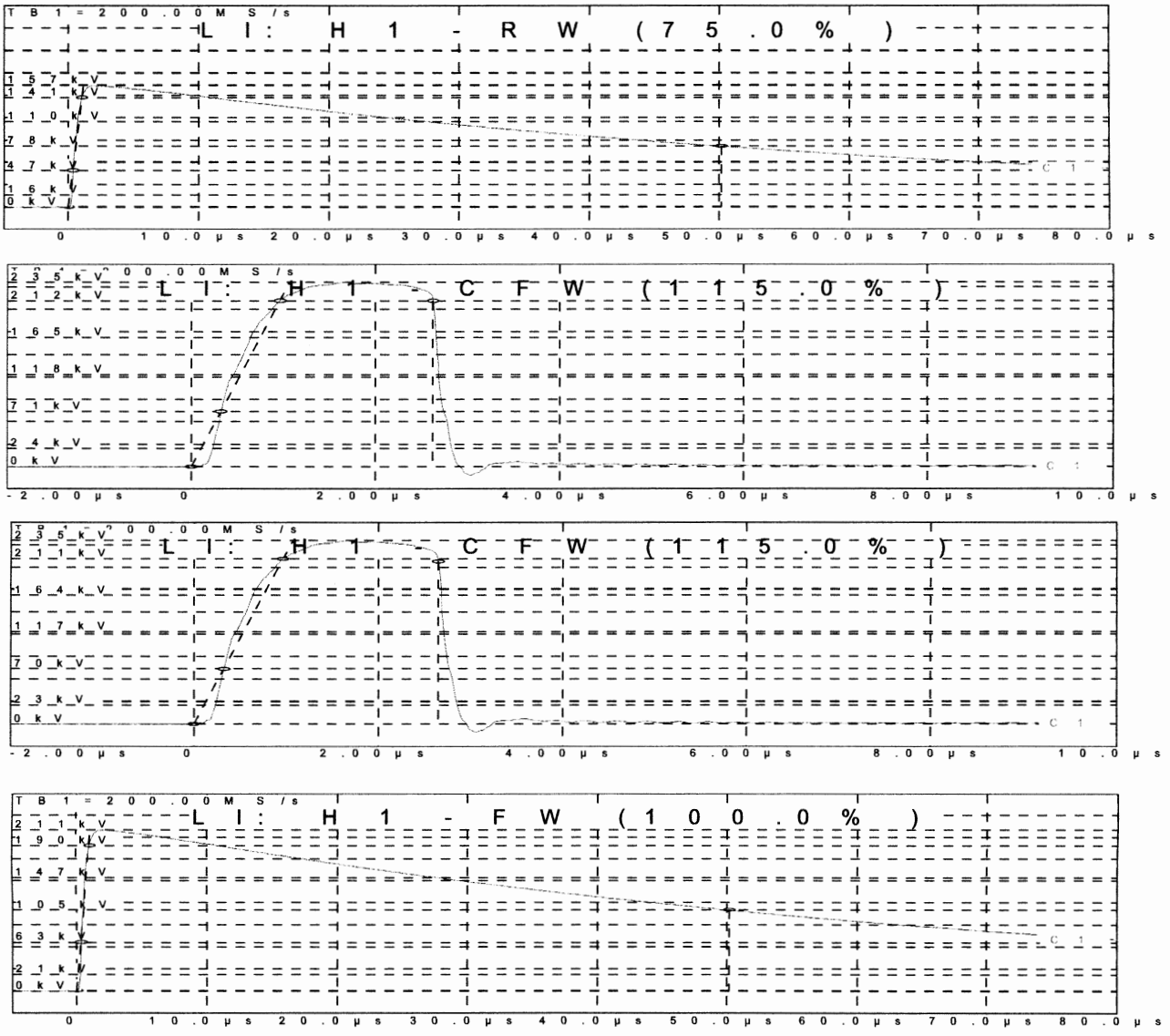
Voltage test: 34500 V, thermal burden: 1500 VA

Report Nr: K3421-238C-2014
Sheet: 5 of 6
Date: 13/10/2014

DEPARTAMENTO DE DISTRIBUCIÓN
OFICINA DE SISTEMAS DE DISTRIBUCIÓN

Impulse (BIL) test

Voltage applied to: H1
Grounded: X1-X2-Frame



Result: Satisfactory

DOCUMENTO FIRMADO ELECTRONICAMENTE

Tested By: **Ruben Jaramillo Vacio**
Ingeniero de Pruebas

DOCUMENTO FIRMADO ELECTRONICAMENTE

Checked By **Jaime Encinas Rosas**
Encargado de Oficina de Sistemas de Distribución

CFE
COMISIÓN FEDERAL DE ELECTRICIDAD

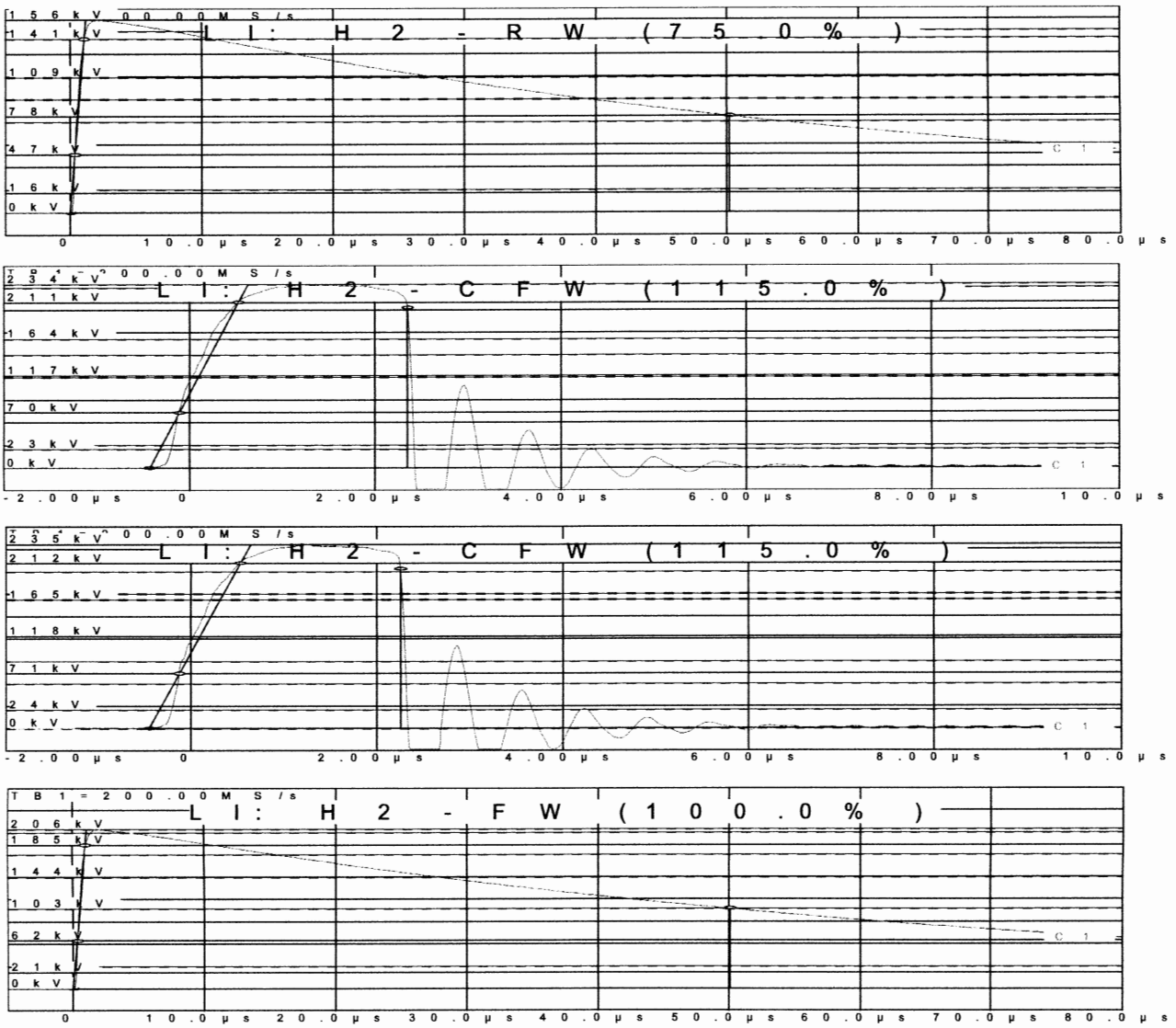
Dirección de Modernización
Laboratorio de Pruebas de Equipos y Materiales
LAPEM

Report Nr: K3421-238C-2014
Sheet: 6 of 6
Date: 13/10/2014

DEPARTAMENTO DE DISTRIBUCIÓN
OFICINA DE SISTEMAS DE DISTRIBUCIÓN

Impulse (BIL) test

Voltage applied to: H2
Grounded: X1-X2-Frame



Result: Satisfactory

DOCUMENTO FIRMADO ELECTRONICAMENTE

Tested By: **Ruben Jaramillo Vacio**
Ingeniero de Pruebas

DOCUMENTO FIRMADO ELECTRONICAMENTE

Checked By **Jaime Encinas Rosas**
Encargado de Oficina de Sistemas de Distribución

Av. Apaseo Ote. s/n Cd. Industrial. C.P. 36541 Irapuato, Gto. México.
Tel: (462) 6 23 94 00

ÁREA: High Current Office

TEST REPORT: K3422-199A-2014.	
CLIENT:	**ARTECHE TRANSFORMADORES Y TECNOLOGÍA S.A. DE C.V.**
ADDRESS:	km 73,540 Antigua Carretera México Querétaro, Tepeji del Río de Ocampo Edo. de Hidalgo C.P. 42850, Tel.:+52 (773) 7332034.
TÍTLE:	Short time withstand current test carried out on a voltage transformer. - **Type:** VRS-36 - **Ratio:** 300:1 - **Brand**: ARTECHE. - **Made in:** México.

SUMMARY:

Object under test:
Voltage transformer, type VRS-36, brand ARTECHE, serial number: 14016586001

Applied standards:
IEEE C57.13-2008 Clause 7.7

Test performed:
Short-circuit capability

Test results:
The assessment of the compliance of the tested voltage transformer with the requirements of the short-time withstand current tests, were not performed by LAPEM. So, in this report are declared only the test values applied.
The test data declared in this report is for the exclusive use of the owner, who is in his full right to use them at his convenience.

DATE: 2014-10-28 FILE: K3422-199-2014	**APRÓVED BY:**	AUTHORIZED BY:
TESTED BY: DOCUMENTO FIRMADO ELECTRÓNICAMENTE Genaro Arturo Ruiz Carlo Testing Enginner	DOCUMENTO FIRMADO ELECTRÓNICAMENTE Juan Carlos Martínez Magdaleno Head of High Current Laboratory	DOCUMENTO FIRMADO ELECTRÓNICAMENTE Ricardo A Martínez Torres **Head of Distribution Departament**

DISTRIBUTION DEPARTMENT-HIGH CURRENT LABORATORY

REPORT: K3422-199A-2014

TEST REPORT

CLIENT: **ARTECHE TRANSFORMADORES Y TECNOLOGÍA S.A. DE C.V.**

MANUFACTURER: **ARTECHE TRANSFORMADORES Y TECNOLOGÍA S.A. DE C.V.**

EQUIPMENT TESTED: **VOLTAGE TRANSFORMER.**

TYPE: **VRS-36**

SERIAL No: **14016586001**

CHARACTERISTICS:
Brand: ARTECHE
Ratio: 300: 1
Rated Power: 1500VA
Primary rated voltage: 34500 V
Secondary rated voltage: 115 V

STANDARDS:
IEEE C57.13-2008 Clause 7.7

TESTS PERFORMED:
Short-circuit capability

Date of the test: September 30, 2014
Date of receipt of the transformer: September 30, 2014

RESULTS:
The assessment of the compliance of the tested voltage transformer with the requirements of the short- time withstand current tests, were not performed by LAPEM. So, in this report are declared only the test values applied.

THIS REPORT INCLUDES:

Pages: 6
Oscillograms: 1
Diagrams: -
Photographs: 1
Drawings: 1
Others: -

DOCUMENTO FIRMADO ELECTRÓNICAMENTE

Genaro Arturo Ruiz Carlo, Eng.
Tested by

DOCUMENTO FIRMADO ELECTRÓNICAMENTE

Genaro Arturo Ruiz Carlo, Eng.
Authorized Signatory

The results expressed within this report refer only to the tested object(s).

42220101

Irapuato, Gto. México; October 28, 2014.

DISTRIBUTION DEPARTMENT-HIGH CURRENT LABORATORY
REPORT: K3422-199A-2014

1. - OTHER CHARACTERISTICS ASSIGNED BY THE MANUFACTURER.
Accuracy: 0.3 W,X,M,Y,Z

2. - WITNESS DURING TESTS:
Name: Company
--- ---

3. - PURPOSE OF THE TEST.

The purpose of the tests is to demonstrate the mechanical & thermal capability of the transformer to withstand short circuit stresses.

4. - STANDARDS APPLIED:
IEEE C57.13-2008 Clause 7.7

5. - TEST REQUIREMENTS:
- **7.7 Short-circuit capability**

Voltage transformers shall be capable of withstanding for 1 s the mechanical and thermal stresses resulting from a shot circuit on the secondary terminals with full voltage maintained on the primary terminals.

6. - TEST CIRCUIT:
The transformer under test is connected to the low voltage side of the short circuit transformer. The short circuit is made by closing the synchronized device, and the clearing of the short circuit is made by the opening of the back circuit breaker, then the time during which the current flows through the Device Under test is obtained. See figure 1.

7. - TESTS RESULTS AND UNCERTAINTY OF MEASUREMENT:
See page 4 for test values obtained.

7.1. - VISUAL INSPECTION:
The tested transformer didn't show any damage at least on the outside part.

7.2. - CONCLUSIONS:
The voltage transformer tested did not show indications of damage during the tests; this laboratory didn't carry out any other verification.

7.3. - PHOTOGRAPHS:
This report not includes photographs of the transformer.

7.4. - OSCILLOGRAMS:
This report includes the oscillograms that show the results of the short time current tests.

42220102

DISTRIBUTION DEPARTMENT-HIGH CURRENT LABORATORY

REPORT: K3422-199A-2014

TEST RESULTS AND UNCERTAINTY OF MEASUREMENT

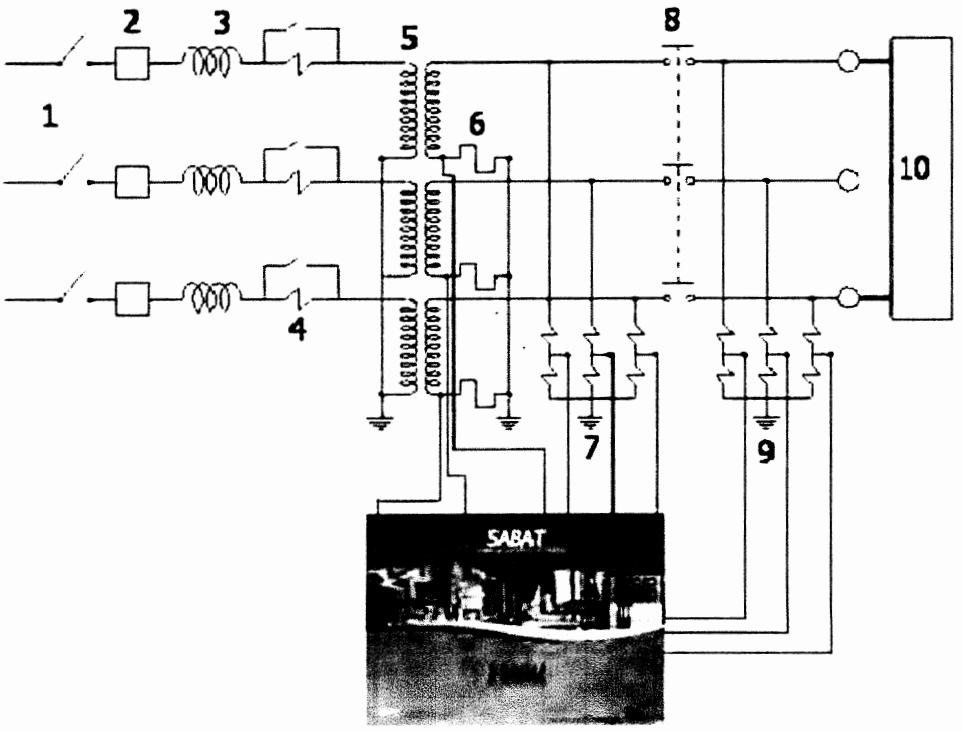
Test circuit	Oscillogram	Test	Voltage Test V	Voltage RMS Obtained kA	Current rms Obtained kA	Time Obtained s	Time Required s	I^2t Obtained kA^2s	I^2t Required kA^2s
C01 01	001	Short-circuit capability	115.0	117.89	360.0	1.00	1.0	----	----

The numerical value of expanded uncertainty (U) with a coverage factor k=2 and a level of confidence of approximately 95% : For current: 1.0% and for voltage: 1.5%

DISTRIBUTION DEPARTMENT-HIGH CURRENT LABORATORY

REPORT: K3422-199A-2014

Figure 1



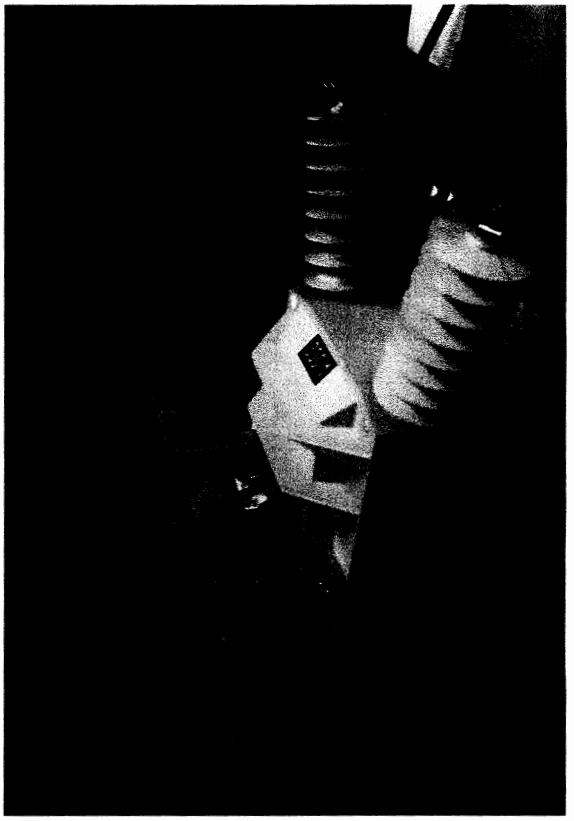
(1) Manual no Load Circuit Switch
(2) Back Circuit Breaker
(3) Limiting Reactors
(4) Limiting Resistors
(5) Short Circuit Transformer
(6) Current Shunt Meter. Measuring link: CFOCFA and CFOCFC, with calibration in force.
(7) Voltage dividers
(8) Synchronized Closing Devices
(9) Voltage dividers. Measuring link: CFOTFAD and CFOTFCD, with calibration in force.
(10) Device under test
(11) Control and data acquisition system SABAT with calibration in forcé.

42220104

DISTRIBUTION DEPARTMENT-HIGH CURRENT LABORATORY

REPORT: K3422-199A-2014

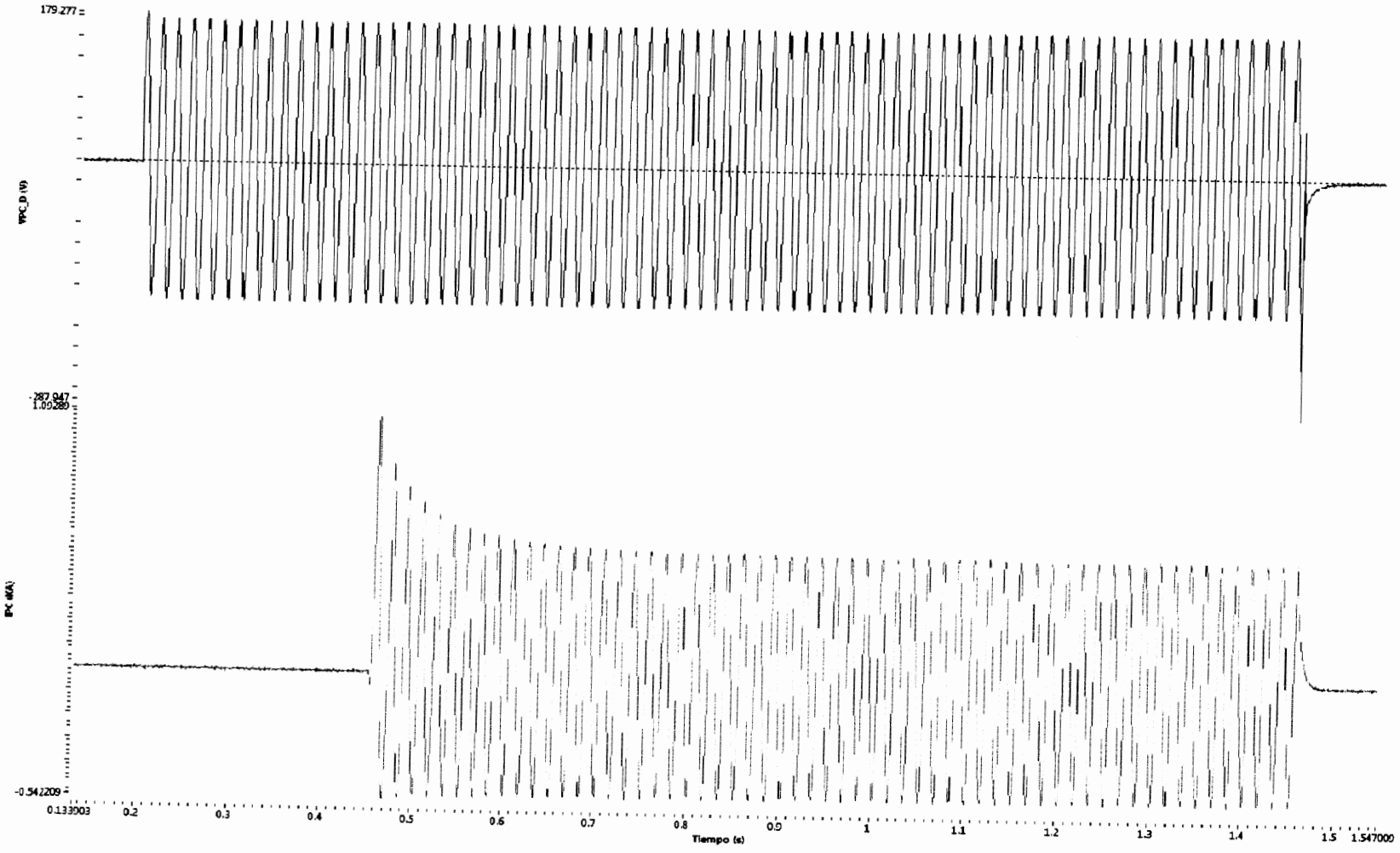
PHOTOGRAPHS



42220105

K3422 199A/2014 **Prueba No.:** 1 **Tipo de prueba:** CORTO CIRCUITO **Fecha:** 30/09/2014

Descripción: Short time withstand current test carried out on a voltage transformer. VRS-36 Brand Arteche
N.S. 14016586001



arteche

SECTION 5: MODEL URU-52

Description:

The UR/VR series are dry type outdoor service voltage transformers. The core is encapsulated with Type B epoxy resin for excellence in internal dielectric properties and mechanical strength. The external layer of Cycloaliphatic resin provides resistance to ultraviolet rays and the effects of tracking and erosion on the exterior of the module. The device is maintenance free, ensuring a long mechanical and electrical life.

Partial Discharge measurements exceed IEEE C57.13 2008 requirements.

Available Ratios:

The URU-52 family of VT's allows for revenue metering of at least 0.3% accuracy over a voltage range of 27600V up to 34500V at 30C. The below table summarizes the ratios that are available.

RATIO	Accuracy / Burden	Total Thermal Burden (Typical)
240:1	0.3 W,X,M,Y,Z,ZZ	2500 VA
240:1-1	0.3 W,X,M,Y,Z	1250 VA & 1250 VA
240/400:1	0.3 W,X,M,Y,Z	2500 VA
240:1	0.15 W,X,M,Y,Z	2500 VA
240/400&240/400:1	0.3 W,X,M,Y,Z	1250 VA & 1250 VA

Construction:

The core is built from high permeability grain oriented silicon steel laminations for low losses. The windings are copper wire with copper plate double isolation. The concentric distribution of the coils prevents magnetic flux leakage, achieving greater accuracy and higher capacity to withstand mechanical stresses in adverse operating conditions.

Secondary Terminals and Cover:

The secondary terminals are furnished with brass quick connectors. The secondary terminal cover is made of plastic material and sealed with 4 screw type lugs.

Base Plates:

The transformers are furnished with galvanized steel base plates.

Primary Terminal:

The primary terminal consists of brass threaded rod that easily accommodates connectors such asTE-4T, NEMA 2 hole or NEMA 4 hole utilizing the H1-H2 polarity markings.

Nameplate:

Each VT ships with an engraved steel nameplate affixed to the VT base plate using rivets. The nameplate contains production serial number as well as all data required by the latest revision of ANSI C57.13.

Polarity Marking:

Polarity marking is accomplished by using white silicon dots on both the primary and secondary sides.

Testing:

The URU-52 design has undergone design type testing in accordance with IEEE C57.13 (latest edition), Section 8. The test report is included with this submittal. Furthermore, all units produced undergo production testing to verify accuracy and phase angle error in accordance with Section 8, C57.13 (latest edition). A sample production test report is included with this submittal.

Nº 14016588 TESTS CERTIFICATE

CUSTOMER: ARTECHE TyT,	VOLTAGE TRANSFO (S) QUANTITY: 2
CUSTOMER'S REF.: IBERDROLA PROTOTYPES	TYPE: URU-52 HIGHEST VOLTAGE: 48.3 KV.

PRIMARY (V)		SECONDARY (V)		BURD. (VA)	CLASS	THER B.
27600	(H1-H2)	115	(X1-X3)	0.3 ZZ	--	3000
		69	(X2-X3)	0.3Z	--	

STANDARD:	**ROUTINE TESTS**
IEEE C57.13/2008	POWER-FREQUENCY TEST: P/S+E: KV.
FREQUENCY: 60 Hz	INDUCED OVERVOLTAGE TEST: 95 KV.
RATED VOLT. FACTOR: 1.1Un	POWER-FREQUENCY TEST: S/E: 2.5 KV.
	S/S: KV.
SEC. INTERDEPENDENCE: ( )	PARTIAL DISCHARGES ≤ 50 pC 50,7 KV.
TEMP: -40º/+40ºC	VERIFICATION OF TERMINALS MARKINGS AND POLARITY

ACCURACY TEST

TRANSFOR. Nº.	RATIO	TERMIN.	BURDEN (VA)			% OF RATED VOLTAGE	± PORCEN. VOLTAGE ERROR	± PHASE DISPL IN MIN.
14016588/2	27600:115	X1-X3	0			110	+0.30	0
						100	+0.30	0
						90	+0.30	0
			W			110	+0.28	0
						100	+0.28	0
						90	+0.28	0
			X			110	+0.25	0
						100	+0.25	0
						90	+0.25	0
			M			110	+0.24	+1
						100	+0.24	+1
						90	+0.24	+1
			Y			110	+0.19	-2
						100	+0.19	-2
						90	+0.19	-2
			Z			110	+0.02	-4
						100	+0.02	-4
						90	+0.02	-4
			ZZ			110	-0.26	-9
						100	-0.26	-9
						90	-0.26	-9
	27600:69	X2-X3	0			110	+0.30	0
						100	+0.30	0
						90	+0.30	0
			W			110	+0.28	0
						100	+0.28	0

Date: 01/10/14 Certified Correct:

Date 3/10/14

000027

Nº 14016588 TESTS CERTIFICATE

ACCURACY TEST								
TRANSFOR . Nº.	RATIO	TERMIN.	BURDEN (VA)			% OF RATED VOLTAGE	± PORCEN. VOLTAGE ERROR	± PHASE DISPL. IN MIN.
						90	+0.28	0
			X			110	+0.24	0
						100	+0.24	0
						90	+0.24	0
			M			110	+0.23	+1
						100	+0.23	+1
						90	+0.23	+1
			Y			110	+0.14	+1
						100	+0.14	+1
						90	+0.14	+1
			Z			110	-0.12	-3
						100	-0.12	-3
						90	-0.12	-3

Cust. de México
Initials JLAS
Date 3/10/14
INS 010

Transformadores y Tecnologia, S.A. de C.V.
Km. 73,54 Ant. Carretera México – Querétaro
42850 Tepeji Del Rio de Ocampo, Estado de Hidalgo.
T.+52 55 41 47 60 42 F. +52 77 37330366

F-LE-018
PARTIAL DISCHARGES TEST *****

1 OF 1 SHEET *****

F-LE-003

		SERIALNUMBER: 14016588	TYPE: URU-52		Max System Voltage = 48.3 KV					
NUMBER		PRIOR DIELECTRIC TEST			AFTER DIELECTRIC TEST 50.7 KV					
SERIAL NUMBER	CONSECUTIVE	INICIAL VOLTAGE	LAST VOLTAGE	q max (PC) Vmax	INICIAL VOLTAGE	LAST VOLTAGE	PC LEVEL	DATE	INSPECTOR	OBSERVATIONS
	2				______	______	1 pC	03/10/2014	RRM	
POWER FREQUENCY APPLIED VOLTAGE TEST(95 kV rms)		180Hz.	40Seg.							

INSPECTOR
JOSE LUIS ARRIETA SANCHEZ

JLAS
3/10/14

SUPERVISOR ARTECHE
GUSTAVO ALCANTAR MAGAÑA.

Nº 14016588

TESTS CERTIFICATE

CUSTOMER: ARTECHE TyT,	VOLTAGE TRANSFO (S)
	QUANTITY: 1
CUSTOMER'S REF.: IBERDROLA PROTOTYPES	TYPE: URU-52
	HIGHEST VOLTAGE: 48.3 KV.

PRIMARY (V)		SECONDARY (V)		BURD. (VA)	CLASS	THER B.
27600	(H1-H2)	115	(X1-X3)	0.3 ZZ/0.3Z	--	3000
		69	(X2-X3)	0.3 Z	--	

	ROUTINE TESTS	
STANDARD:	POWER-FREQUENCY TEST: P/S+E:	KV.
IEEE C57.13/2008	INDUCED OVERVOLTAGE TEST: 95	KV.
FREQUENCY: 60 Hz	POWER-FREQUENCY TEST: S/E: 2.5	KV.
RATED VOLT. FACTOR: 1.1Un	S/S:	KV.
SEC. INTERDEPENDENCE: ( )	PARTIAL DISCHARGES < 50 pC 50,7	KV.
TEMP: -40°/+40°C	VERIFICATION OF TERMINALS MARKINGS AND POLARITY	

ACCURACY TEST

TRANSFOR. Nº.	RATIO	TERMIN.	BURDEN (VA)			% OF RATED VOLTAGE	± PORCEN VOLTAGE ERROR	± PHASE DISPL. IN MIN
14016588/ 2	27600:115	X1-X2	0			110	+0,29	0
						100	+0,29	0
						90	+0,29	0
			W			110	+0,27	0
						100	+0,27	0
						90	+0,27	0
			X			110	+0,25	0
						100	+0,25	0
						90	-0,25	0
			M			110	+0,24	+1
						100	+0,24	+1
						90	+0,24	+1
			Y			110	+0,18	-2
						100	+0,18	-2
						90	+0,18	-2
			Z			110	+0,01	-4
						100	+0,01	-4
						90	+0,01	-4
			ZZ			110	-0,28	-9
						100	-0,28	-9
						90	-0,28	-9
	27600:69	X2-X2	0			110	+0,29	0
						100	+0,29	0
						90	+0,29	0
			W			110	-0,27	0
						100	-0,27	0

...de Mexico
JLAS
Date 3/10/14

Date: 01/10/14

Certified Correct:

000033

Nº 14016588

TESTS CERTIFICATE

ACCURACY TEST

TRANSFOR. Nº.	RATIO	TERMIN.	BURDEN (VA)			% OF RATED VOLTAGE	± PORCEN VOLTAGE ERROR	± PHASE DISPL IN MIN
						90	0,28	0
			X			110	-0,24	0
						100	0,24	0
						90	-0,24	0
			X			110	-0,24	-1
						100	-0,24	-1
						90	-0,24	-1
			X			110	-0,14	-1
						100	-0,14	-1
						90	-0,14	-1
			X			110	-0,11	-2
						100	-0,11	-2
						90	-0,11	-2

Digitally signed by Marcos JLAS
Date: 3/10/14
INS 01

000034

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ARTECHE USA.

TEST REPORT- MV VOLTAGE TRANSFORMER

MODEL:	URU-52		
RATIO:	240/400:1	**QTY:**	1
ACCURACY:	0.3 Z	**CODE:**	757972400
SERIAL NUMBER:	14011133		

UNIT N°	RATIO	BURDEN	60 Hz METERING ACCURACY						DIELECTRIC TEST						
			110%		100%		90%		H1-HIPOT	P.D.	P.D	H2-HIPOT	P.D.	P.D.	TESTED
			R.F.C	P.A	R.F.C	P.A	R.F.C	P.A	LEVEL	pC	INCEPTION	LEVEL	pC	INCEPTION	DATE
2	X1-X3 240:1	0	0.9976	0	0.9976	0	0.9976	0	33.4	0	41				07/07/14
		W	0.9979	0	0.9979	0	0.9979	0							
		X	0.9982	0	0.9982	0	0.9982	0							
		M	0.9984	+1	0.9984	+1	0.9984	+1							
		Y	0.9992	-2	0.9992	-2	0.9992	-2							
		Z	1.0017	-6	1.0017	-6	1.0017	-6							
		ZZ							48.3	0					
	X2-X3 400:1	0	0.9974	0	0.9974	0	0.9974	0							
		W	0.9976	+2	0.9976	+2	0.9976	+2							
		X	0.9981	+1	0.9981	+1	0.9981	+1							
		M	0.9980	+3	0.9980	+3	0.9980	+3							
		Y	0.9996	0	0.9996	0	0.9996	0							
		Z	1.0029	0	1.0029	0	1.0029	0							
		ZZ													
	Y1-Y3 240:1	O	0.9976	0	0.9976	0	0.9976	0							F.J.T.B.
		W	0.9979	0	0.9979	0	0.9979	0							
		X	0.9982	0	0.9982	0	0.9982	0							
		M	0.9984	+1	0.9984	+1	0.9984	+1							
		Y	0.9992	-2	0.9992	-2	0.9992	-2							
		Z	1.0014	-4	1.0014	-4	1.0014	-4							
		ZZ													
	Y2-Y3 400:1	O	0.9975	0	0.9975	0	0.9975	0							
		W	0.9976	+2	0.9976	+2	0.9976	+2							
		X	0.9981	+1	0.9981	+1	0.9981	+1							
		M	0.9980	+3	0.9980	+3	0.9980	+3							
		Y	0.9996	0	0.9996	0	0.9996	0							
		Z	1.0030	-2	1.0030	-2	1.0030	-2							
		ZZ													

POWER DIELECTRIC TEST, PRIMARY WINDING, 1minute @ 60 Hz 95 **KV**

POWER DIELECTRIC TEST, SECONDARY WINDING,1 minute @ 60 Hz 2.5 **KV**

INDUCED VOLTAGE TEST. 55200 **VOLTS @** 180 **Hz FOR** 40 **SECONDS**

E.C.C.
Reviewer, Aproval.

Made in Mexico By:

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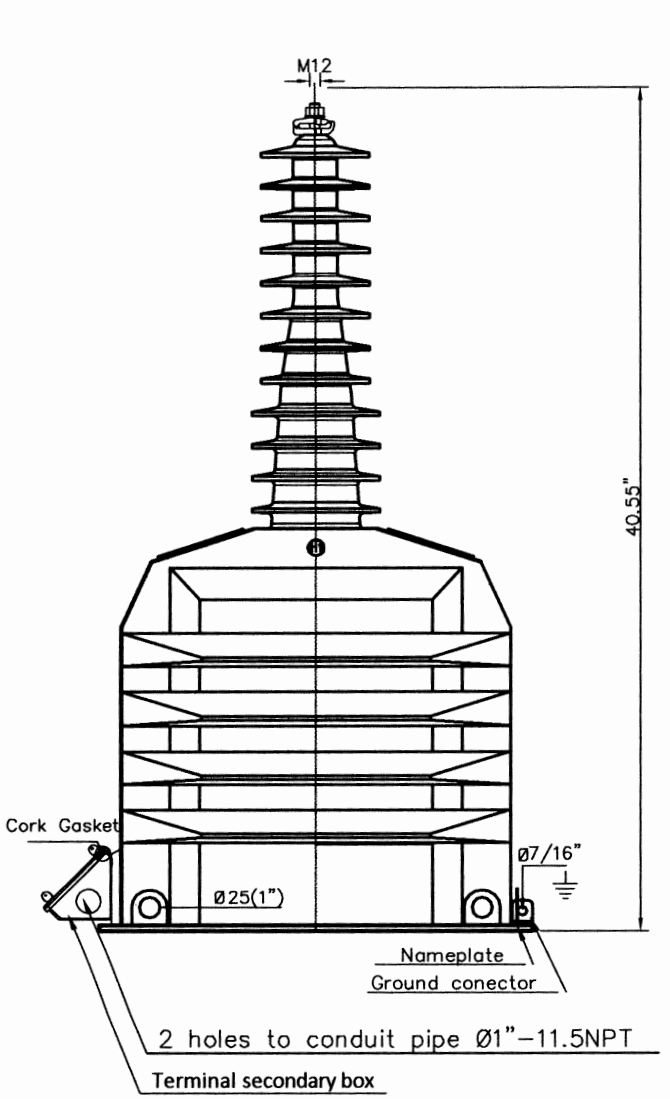
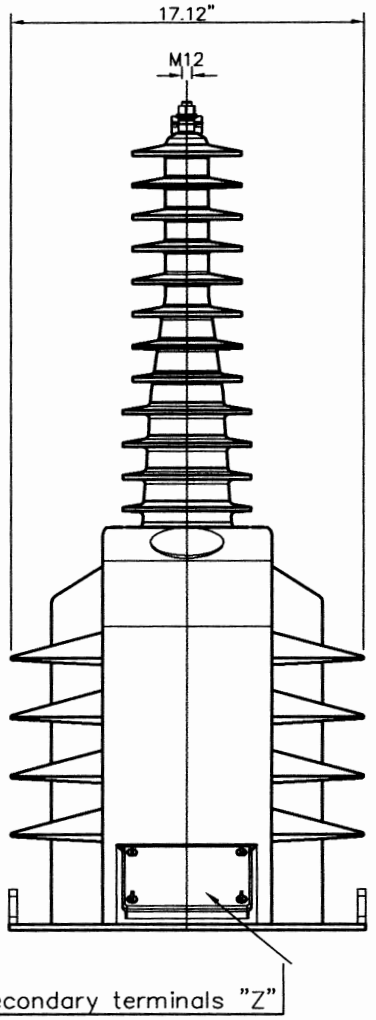
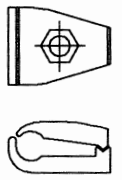
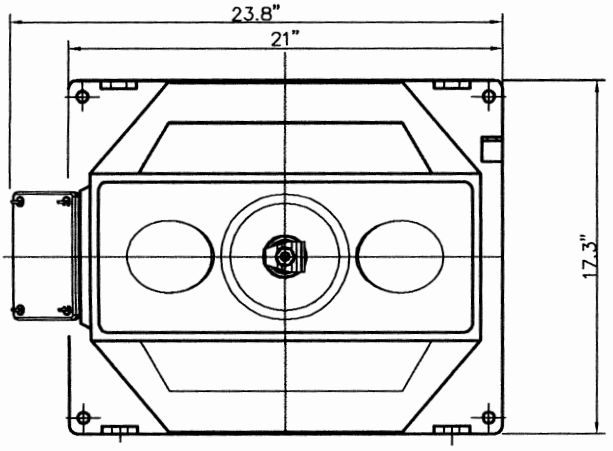
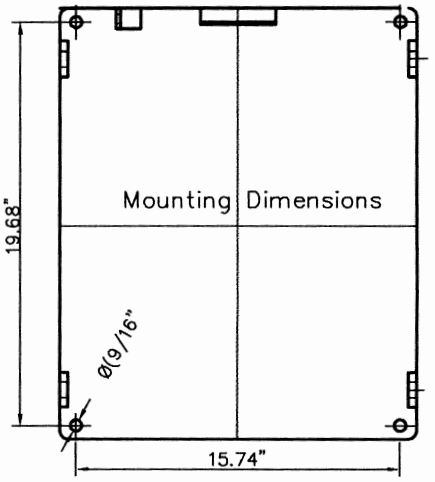


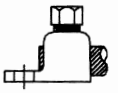




TE-4T
PRIMARY
TERMINAL







TE-12-250
GROUND
CONNECTOR

Secondary terminals detail

TWO SECONDARIES

ONE SECONDARY
WITH TAP

SINGLE SECONDARY

APPROX. WEIGHT	STRIKE DISTANCE
374 Lbs.	38.58 in.
TOLERANCE AS ISO-2768-1-V	CREEP DISTANCE 64.56 in.

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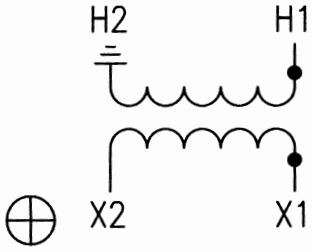
Approximate dimensions in inches

VOLTAGE TRANSFORMER URU–52

Date	Approved	Drawing Nº
15.03.12	R.E.S.	9449585E



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SERIAL NUMBER

TYPE URU–52 VOLTAGE TRANSFORMER

N.S.V. 46 kV CAT.N° 757971240
B.I.L. 250 kV FW 60 Hz

VOLTAGE		RATIO	ACCURACY @ 60 Hz	THERMAL @ 30°C
PRI.	SEC.			
H1–H2 27600	115	240:1	0.3W,X,M,Y,Z,ZZ	2500VA

INDUSTRY CANADA APPROVAL No. AE–

arteche

NAMEPLATE

VT URU–52

AREA: Oficina de Sistemas de Distribución

REPORT Nr.: K3421-238E-2014

CLIENT: **ARTECHE**
TRANSFORMADORES Y TECNOLOGÍA S. A. DE C. V.

ADDRESS: Km. 73.540 Antigua Carretera México-Querétaro Tepeji de Río
de Ocampo Estado de Hidalgo, C.P. 42850
Tel: +52(773)73 32 034

TITLE: Prototype test on voltage transformer URU-52 brand ARTECHE.

SUMMARY:

OBJECT TESTED
Voltage transformer type URU-52, Nr. 14016588001, Ratio: 240:1/400:1, NSV: 46 kV, BIL: 250 kV, Frequency: 60 Hz. Thermal burden: 3000 VA, Accuracy Class: 0.3ZZ/0.3Z, Primary H1-H2: 27600 V, Secondary X2-X3: 69 V. Secondary X1-X3: 115 V Brand ARTECHE.

Test Performed:

Wet 60 Hz 10 s withstand test
Impulse (BIL) Test
Temperature Rise Test

Standards:

IEEE Std C57.13-2008

Result: SATISFACTORY

Remark: - This report and results cover the tested sample only and no contain the totality type tests. Confidential document.

DATE: 2014/10/20	FILE: K3421-238	APPROVED BY:	REVISED BY:
PREPARED BY: DOCUMENTO FIRMADO ELECTRÓNICAMENTE **ING. RUBEN JARAMILLO VACIO** SIGNATARIO		DOCUMENTO FIRMADO ELECTRÓNICAMENTE **ING. JAIME ENCINAS ROSAS** JEFE DE LA OFICINA DE SISTEMAS DE DISTRIBUCIÓN	DOCUMENTO FIRMADO ELECTRÓNICAMENTE **ING. RICARDO MARTÍNEZ TORRES** JEFE DE DEPARTAMENTO DE DISTRIBUCIÓN

DEPARTAMENTO DE DISTRIBUCIÓN
OFICINA DE SISTEMAS DE DISTRIBUCIÓN

CHARACTERISTICS
Voltage transformer type URU-52
Serial: 14016588001
NSV: 46 kV
BIL: 250 kV
Frequency: 60 Hz

VOLTAGE				RATIO	Accuracy @	THERMAL
PRIMARY		SECONDARY			60 Hz	@ 30°C
H1-H2	27600 V	X1-X3	115 V	_240:1	0.3 ZZ	3000VA
H1-H2	27600 V	X2-X3	69 V	_400:1	0.3 Z	

Wet 60 Hz 10 seconds withstand test.
Voltage applied to: H1-H2
Grounded: X1-X2-Frame
Voltage test: 95 kV
Time test: 10 seconds
Result: Satisfactory

Impulse (BIL) test

Impulse	Up (kV)	T1(µs)	T2(µs)	Tc(µs)
1	194.8	1.13	50.4	
2	284.6	1.01		3.56
3	284.6	1.1		3.66
4	253.5	1.14	50.4	

Equipment test:
Impulse generator 750 kV, Haefely, Nr. GA2006.
Impulse voltage resistive divider 600 kV, serial Nr. 061000547061000547.10.1, Haefely.
Oscilloscope Nr. D55980.
High Voltage test equipment 60 Hz, 300 kV, Nr. 1972416.
Temperature Recorder YEW serial D55090 calibrated.
Resistance Meter brand TETTEX serial 156078 calibrated
Uncentainty
With a k=2 for confidence level of 95%
AC Voltage Uncertainty: ±0.7 %
Impulse Voltage Uncertainty: ±1.7 %
Temperature Uncertainty: ±1.98 %

DOCUMENTO FIRMADO ELECTRONICAMENTE

Tested By: **Ruben Jaramillo Vacio**
Ingeniero de Pruebas

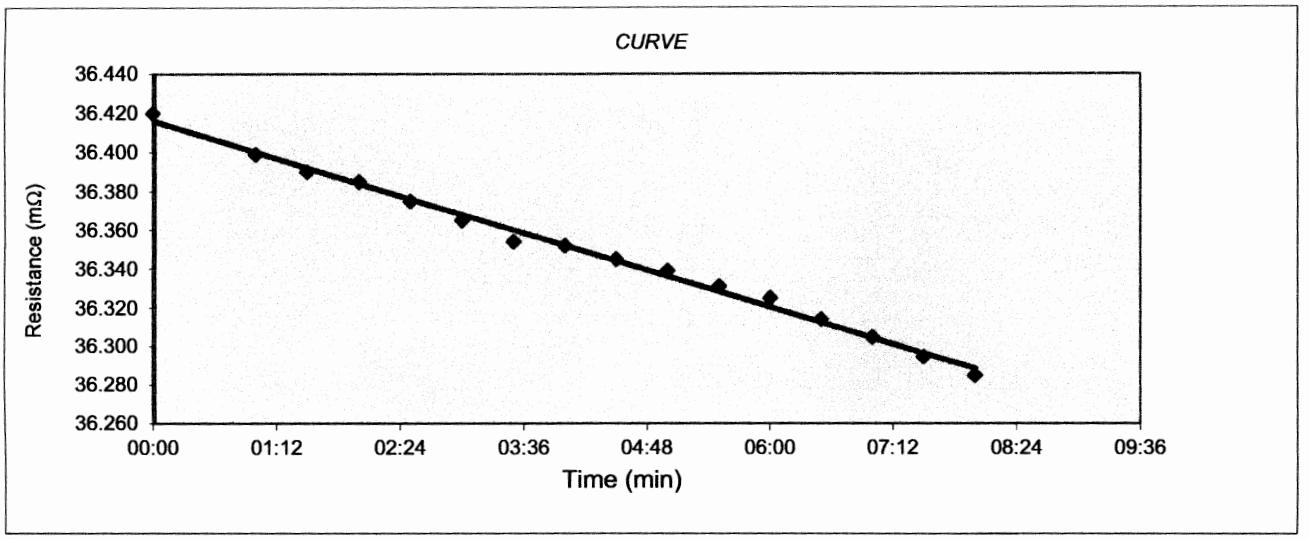
DOCUMENTO FIRMADO ELECTRONICAMENTE

Checked By **Jaime Encinas Rosas**
Encargado de Oficina de Sistemas de Distribución

DEPARTAMENTO DE DISTRIBUCIÓN
OFICINA DE SISTEMAS DE DISTRIBUCIÓN

Temperature rise test, winding X1-X3

Nr.	Time	Resistance
/	min	mΩ
/	00:00	36.4200
1	01:00	36.3990
2	01:30	36.3900
3	02:00	36.3850
4	02:30	36.3750
5	03:00	36.3650
6	03:30	36.3540
7	04:00	36.3520
8	04:30	36.3450
9	05:00	36.3390
10	05:30	36.3310
11	06:00	36.3250
12	06:30	36.3140
13	07:00	36.3050
14	07:30	36.2950
15	08:00	36.2850



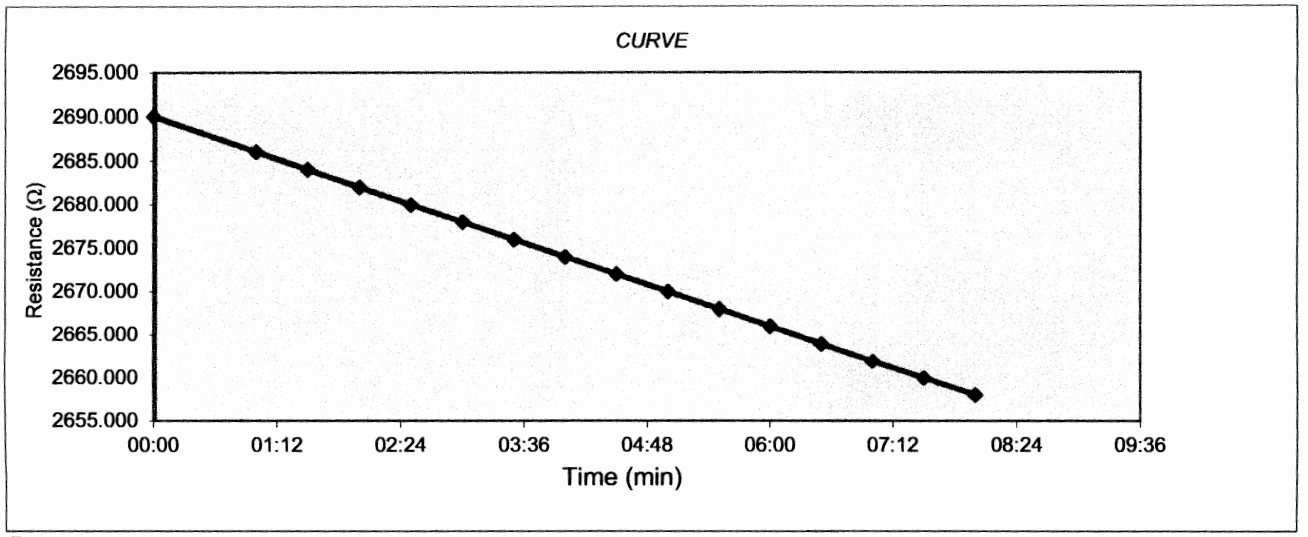
R_0 =	Reference resistance of the winding	32.975	mΩ
R =	Resistance of the winding at the time of shutdown	36.42	mΩ
Θ_0 =	Temperature in degree Celsius correspondig to the reference resistance of the winding	24	ºC
Θ =	Ambient temperature corresponding at the time of shutdown	22	ºC
Θk =	Temperature in the degree Celsius corresponding to the resistance of the winding at time of shutdown	51.01	ºC
$\Delta \Theta$ / ambient	Average temperature rise of a winding	**29.01**	**ºC < 80ºC a 1780 mosl Satisfactory**

Voltage test: 27600V, thermal burden: 3000 VA

DEPARTAMENTO DE DISTRIBUCIÓN
OFICINA DE SISTEMAS DE DISTRIBUCIÓN

Temperature rise test, winding H1-H2

Nr.	Time	Resistance
/	min	Ω
/	00:00	2690.0
1	01:00	2686.0
2	01:30	2684.0
3	02:00	2682.0
4	02:30	2680.0
5	03:00	2678.0
6	03:30	2676.0
7	04:00	2674.0
8	04:30	2672.0
9	05:00	2670.0
10	05:30	2668.0
11	06:00	2666.0
12	06:30	2664.0
13	07:00	2662.0
14	07:30	2660.0
15	08:00	2658.0



R_0 =	Reference resistance of the winding	2489.4	Ω
R =	Resistance of the winding at the time of shutdown	2690	Ω
Θ_0 =	Temperature in degree Celsius correspondig to the reference resistance of the winding	24	°C
Θ =	Ambient temperature corresponding at the time of shutdown	23	°C
Θk =	Temperature in the degree Celsius corresponding to the resistance of the winding at time of shutdown	44.83	°C
$\Delta\Theta$ / ambient	Average temperature rise of a winding	**21.83**	**°C < 80°C a 1780 mosl Satisfactory**

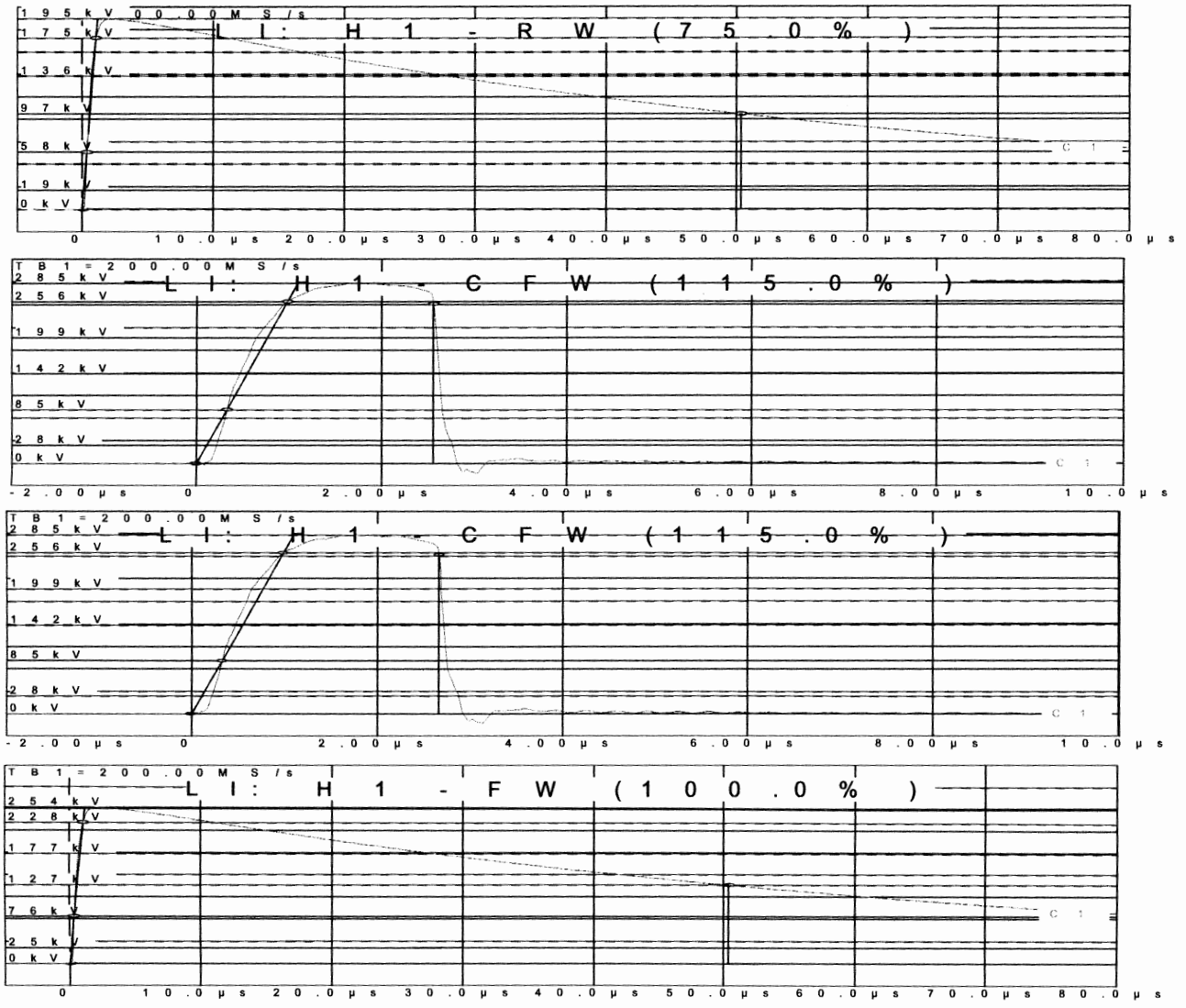
Voltage test: 27600V, thermal burden: 3000 VA

Report Nr: K3421-238E-2014
Sheet: 5 of 5
Date: 13/10/2014

DEPARTAMENTO DE DISTRIBUCIÓN
OFICINA DE SISTEMAS DE DISTRIBUCIÓN

Impulse (BIL) test

Voltage applied to: H1
Grounded: X1-X2-Frame



Result: Satisfactory

DOCUMENTO FIRMADO ELECTRONICAMENTE

Tested By: **Ruben Jaramillo Vacio**
Ingeniero de Pruebas

DOCUMENTO FIRMADO ELECTRONICAMENTE

Checked By **Jaime Encinas Rosas**
Encargado de Oficina de Sistemas de Distribución

arteche

SECTION 6: MODEL VRU-52

Description:

The UR/VR series are dry type outdoor service voltage transformers. The core is encapsulated with Type B epoxy resin for excellence in internal dielectric properties and mechanical strength. The external layer of Cycloaliphatic resin provides resistance to ultraviolet rays and the effects of tracking and erosion on the exterior of the module. The device is maintenance free, ensuring a long mechanical and electrical life.

Partial Discharge measurements exceed IEEE C57.13 2008 requirements.

Available Ratios:

The VRU-52 family of VT's allows for revenue metering of at least 0.3% accuracy over a voltage range of 27600V up to 46000V at 30C. The below table summarizes the ratios that are available.

RATIO	Accuracy / Burden	Total Thermal Burden (Typical)
240:1	0.3 W,X,M,Y,Z,ZZ	3000 VA
240:1-1	0.3 W,X,M,Y,Z	1500 VA & 1500 VA
240/400:1	0.3 W,X,M,Y,Z	3000 VA
400:1	0.3 W,X,M,Y,Z,ZZ	3000 VA
400:1-1	0.3 W,X,M,Y,Z	1500 VA & 1500 VA
400/666.66:1	0.3 W,X,M,Y,Z	3000 VA
240:1	0.15 W,X,M,Y,Z	3000 VA
240/400:1	0.15 W,X,M,Y	3000 VA
400:1	0.15 W,X,M,Y,Z	3000 VA

Construction:

The core is built from high permeability grain oriented silicon steel laminations for low losses. The windings are copper wire with copper plate double isolation. The concentric distribution of the coils prevents magnetic flux leakage, achieving greater accuracy and higher capacity to withstand mechanical stresses in adverse operating conditions.

Secondary Terminals and Cover:

The secondary terminals are furnished with brass quick connectors. The secondary terminal cover is made of plastic material and sealed with 4 screw type lugs.

Base Plates:

The transformers are furnished with galvanized steel base plates.

Primary Terminal:

The primary terminal consists of brass threaded rod that easily accommodates connectors such asTE-4T, NEMA 2 hole or NEMA 4 hole utilizing the H1-H2 polarity markings.

Nameplate:

Each VT ships with an engraved steel nameplate affixed to the VT base plate using rivets. The nameplate contains production serial number as well as all data required by the latest revision of ANSI C57.13.

Polarity Marking:

Polarity marking is accomplished by using white silicon dots on both the primary and secondary sides.

Testing:

The VRU-52 design has undergone design type testing in accordance with IEEE C57.13 (latest edition), Section 8. The test report is included with this submittal. Furthermore, all units produced undergo production testing to verify accuracy and phase angle error in accordance with Section 8, C57.13 (latest edition). A sample production test report is included with this submittal.

Nº **14016587** # TESTS CERTIFICATE

CUSTOMER: ARTECHE TyT,	VOLTAGE TRANSFO (S) QUANTITY: 2
CUSTOMER'S REF.: IBERDROLA PROTOTYPES	TYPE: VRU-52 HIGHEST VOLTAGE: 48.3 KV.

PRIMARY (V)	SECONDARY (V)	BURD. (VA)	CLASS	THER B.
46000 (H1-H2)	115 (x1-x2)	ZZ	0,3	3000

	ROUTINE TESTS
STANDARD: IEEE C57.13/2008	POWER-FREQUENCY TEST: P/S+E: 95 KV.
FREQUENCY: 60 Hz	INDUCED OVERVOLTAGE TEST: 95 KV.
RATED VOLT. FACTOR: 1.1Un	POWER-FREQUENCY TEST: S/E: 2.5 KV. S/S: KV.
SEC. INTERDEPENDENCE: ( )	PARTIAL DISCHARGES ≤ 50 pC 50,7 KV.
TEMP: -40º/+40ºC	VERIFICATION OF TERMINALS MARKINGS AND POLARITY

ACCURACY TEST

TRANSFOR . Nº.	RATIO	TERMIN.	BURDEN (VA)			% OF RATED VOLTAGE	± PORCEN VOLTAGE ERROR	± PHASE DISPL. IN MIN.
			x1-x2					
14016587/ 2	46000/115	x1-x2	0			110	+0.24	0
						100	+0.24	0
						90	+0.24	0
			W			110	+0.23	0
						100	+0.23	0
						90	+0.23	0
			X			110	+0.22	-1
						100	+0.22	-1
						90	+0.22	-1
			M			110	+0.21	0
						100	+0.21	0
						90	+0.21	0
			Y			110	+0.17	-2
						100	+0.17	-2
						90	+0.17	-2
			Z			110	-0.05	-4
						100	-0.05	-4
						90	-0.04	-4
			ZZ			110	-0.15	-8
						100	-0.15	-8
						90	-0.15	-8

JLAS
3/10/14

Date: 30/09/14 Certified Correct: ECC.

000025

arteche

Transformadores y Tecnología, S.A. de C.V.
Km. 73.54 Ant. Carretera México – Querétaro
42850 Tepeji Del Río de Ocampo. Estado de Hidalgo.
T.+52 55 41 47 60 42 F. +52 77 37330366

F-LE-018
PARTIAL DISCHARGES TEST ***** 1 OF 1 SHEET *****

F-LE-003

	SERIALNUMBER: 14016587	TYPE: VRU-52		Max System Voltage = 48.3 KV					
NUMBER	PRIOR DIELECTRIC TEST			AFTER DIELECTRIC TEST 50.7 KV					
SERIAL NUMBER	CONSEC UTIVE	INICIAL VOLTAGE	LAST VOLTAGE	q max (PC) Vmax	INICIAL VOLTAGE	LAST VOLTAGE	PC LEVEL	DATE	INSPECTOR	OBSERVATIONS
	2				———	———	1 pC	03/10/2014	RRM	
POWER FREQUENCY APPLIED VOLTAGE TEST(95 kV rms)		60Hz.	60Seg.							

INSPECTOR
JOSE LUIS ARRIETA SANCHEZ

Initials JLAS
Date 3/10/14
INS. 010

SUPERVISOR ARTECHE
GUSTAVO ALCANTAR MAGAÑA.

000037

N° 14016587

TESTS CERTIFICATE

CUSTOMER: ARTECHE TyT,	VOLTAGE TRANSFO (S) QUANTITY: 1
CUSTOMER'S REF.: IBERDROLA PROTOTYPES	TYPE: VRJ-52 [illegible] HIGHEST VOLTAGE: 48.3 KV.

PRIMARY (V)		SECONDARY (V)		BURD. (VA)	CLASS	THER B.
46000	(H1-H2)	115	(x1-x2)	ZZ	0,3	3000

STANDARD.	ROUTINE TESTS	
IEEE C57.13/2008	POWER-FREQUENCY TEST: P/S-E: [illegible]	KV.
FREQUENCY: 60 Hz	INDUCED OVERVOLTAGE TEST: 97	KV.
RATED VOLT. FACTOR: 1.1Un	POWER-FREQUENCY TEST: S/E: [illegible]	KV.
	S/S:	KV.
SEC. INTERDEPENDENCE: ( )	PARTIAL DISCHARGES ≤ [illegible] pC [illegible]	KV.
TEMP: -40°/+40°C	VERIFICATION OF TERMINALS MARKINGS AND POLARITY	

ACCURACY TEST

TRANSFOR. N°.	RATIO	TERMIN.	BURDEN (VA)			% OF RATED VOLTAGE	± PORCEN VOLTAGE ERROR	± PHASE DISPL IN MIN
			x1-x2					
14016587/ 2	46000/115	x1-x2	0			110	+0.25	-1
						100	+0.25	-1
						90	+0.25	0
			W			110	+0.23	0
						100	+0.23	0
						90	+0.24	0
			X			110	+0.21	-1
						100	+0.21	-1
						90	+0.22	-1
			M			110	+0.19	0
						100	+0.21	0
						90	+0.21	0
			Y			110	+0.16	-1
						100	+0.17	-2
						90	+0.17	-2
			Z			110	-0.04	-4
						100	-0.05	-4
						90	-0.03	-4
			ZZ			110	-0.17	-8
						100	-0.16	-8
						90	-0.16	-8

Date: 30/09/14 Certified Correct:

JLAS
3/10/14

arteche

ARTECHE USA.

TEST REPORT- MV VOLTAGE TRANSFORMER

MODEL:	VRU-52		
RATIO:	400:1-1	**QTY:**	1
ACCURACY:	0.3 Z	**CODE:**	757982400
SERIAL NUMBER:	14000439		

UNIT N°	RATIO	BURDEN	60 Hz METERING ACCURACY						DIELECTRIC TEST						
			110%		100%		90%		H1-HIPOT	P.D.	P.D	H2-HIPOT	P.D.	P.D.	TESTED
			R.F.C	P.A	R.F.C	P.A	R.F.C	P.A	LEVEL	pC	INCEPTION	LEVEL	pC	INCEPTION	DATE
10	X1-X2 400:1V	0	0.9975	0	0.9975	0	0.9975	0	48.3	0		48.3	0		23/02/14
		W	0.9978	0	0.9978	0	0.9978	0							
		X	0.9982	0	0.9982	0	0.9982	0							
		M	0.9983	+1	0.9983	+1	0.9983	+1			40			40	E.C.C.
		Y	0.9993	-2	0.9993	-2	0.9993	-2							
		Z	1.0023	-6	1.0023	-6	1.0023	-6							
		ZZ							33.5	0		33.5	0		
	Y1-Y2 400:1V	0	0.9975	0	0.9975	0	0.9975	0							
		W	0.9978	0	0.9978	0	0.9978	0							
		X	0.9982	0	0.9982	0	0.9982	0							
		M	0.9983	+1	0.9983	+1	0.9983	+1							
		Y	0.9994	-3	0.9994	-3	0.9994	-3							
		Z	1.0025	-7	1.0025	-7	1.0025	-7							
		ZZ													

POWER DIELECTRIC TEST, PRIMARY WINDING, 1minute @ 60 Hz 98 **KV**

POWER DIELECTRIC TEST, SECONDARY WINDING,1 minute @ 60 Hz 2.5 **KV**

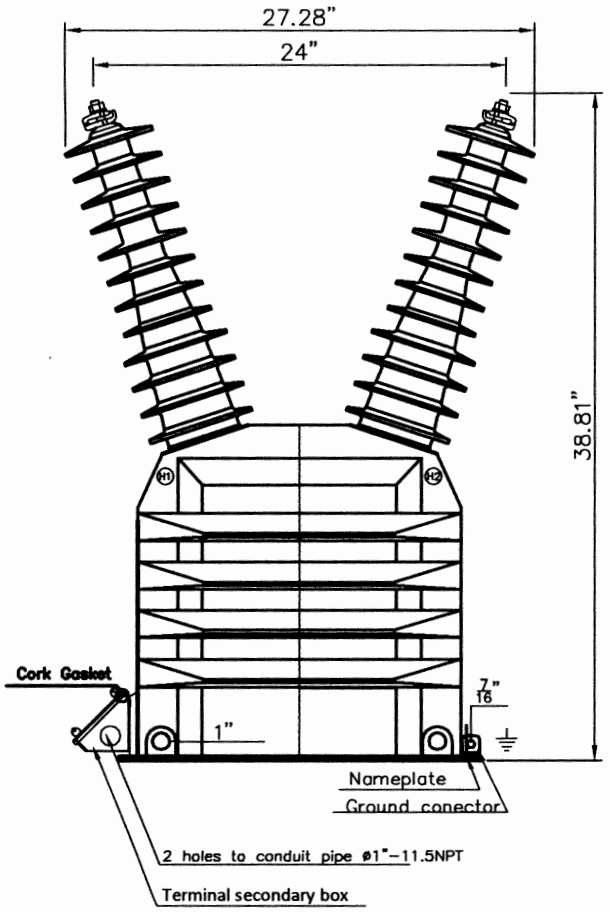
INDUCED VOLTAGE TEST. 95000 **VOLTS @** 180 **Hz FOR** 40 **SECONDS**

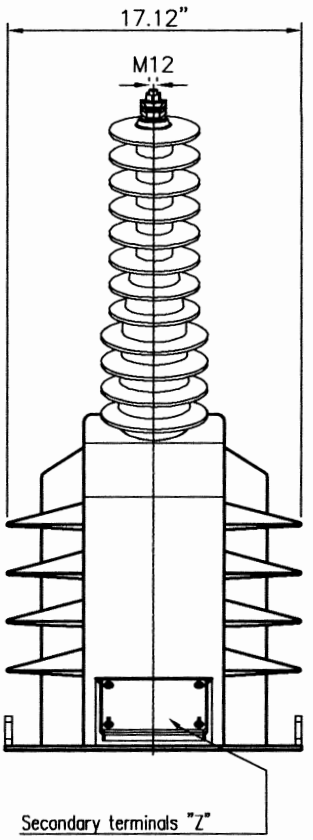
E.C.C.

Reviewer, Aproval.

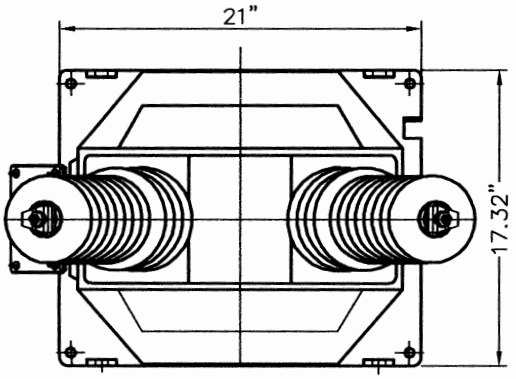
Made in Mexico By:

arteche

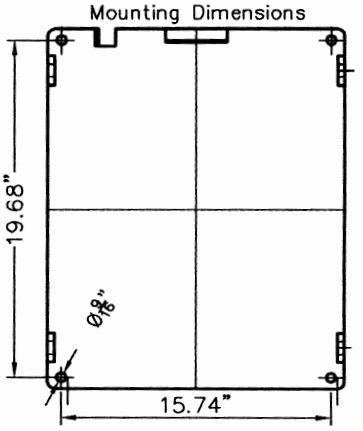


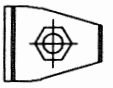


TE-12-250
GROUND
CONNECTOR



Mounting Dimensions





TE-4T
PRIMARY
TERMINAL

Secondary terminals detail

APPROX. WEIGHT
394Lbs.

STRIKE DISTANCE
24 In.

CREEP DISTANCE
61.41 In.

TOLERANCE AS ISO-2768-1-V

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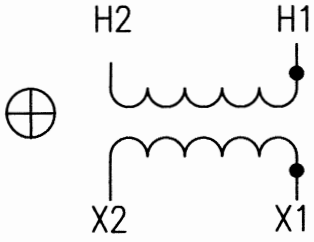
Approximate dimensions in inches

VOLTAGE TRANSFORMER VRU-52

Date	Approved	Drawing Nº
15.03.12	R.E.S.	9449540 G

arteche



SERIAL NUMBER

TYPE: VRU–52 VOLTAGE TRANSFORMER

N.S.V. 46 kV CAT.N° 757981400
B.I.L. 250 kV FW 60 Hz

VOLTAGE		RATIO	ACCURACY @60Hz	THERMAL @30°C
PRI.	SEC.			
H1–H2 46000V	115V	400:1	0.3 W,X,M,Y,Z,ZZ	3000VA

INDUSTRY CANADA APPROVAL No. AE–

arteche

NAMEPLATE

VT VRU–52

AREA: Oficina de Sistemas de Distribución

REPORT Nr.: K3421-238D-2014

CLIENT: **ARTECHE**
TRANSFORMADORES Y TECNOLOGÍA S. A. DE C. V.

ADDRESS: Km. 73.540 Antigua Carretera México-Querétaro Tepeji de Río
de Ocampo Estado de Hidalgo, C.P. 42850
Tel: +52(773)73 32 034

TITLE: Prototype test on voltage transformer VRU-52 brand ARTECHE.

SUMMARY:

OBJECT TESTED

Voltage transformer type VRU-52, Nr. 14016587001, Ratio: 400:1, NSV: 46 kV, BIL: 250 kV, Frequency: 60 Hz. Thermal burden: 3000 VA, Accuracy Class: 0.3 W,X,M,Y,Z,ZZ, Primary H1-H2: 46000 V, Secondary X1-X2: 115 V Brand ARTECHE.

Test Performed:

Wet 60 Hz 10 s withstand test
Impulse (BIL) Test
Temperature Rise Test

Standards:

IEEE Std C57.13-2008

Result: SATISFACTORY

Remark: - This report and results cover the tested sample only and no contain the totality type tests. Confidential document.

DATE: 2014/10/20	FILE: K3421-238	APPROVED BY:	REVISED BY:
PREPARED BY:		DOCUMENTO FIRMADO ELECTRÓNICAMENTE **ING. JAIME ENCINAS ROSAS** JEFE DE LA OFICINA DE SISTEMAS DE DISTRIBUCIÓN	DOCUMENTO FIRMADO ELECTRÓNICAMENTE **ING. RICARDO MARTÍNEZ TORRES** JEFE DE DEPARTAMENTO DE DISTRIBUCIÓN
DOCUMENTO FIRMADO ELECTRÓNICAMENTE **ING. RUBEN VARGAS LLAVACIO** SIGNATARIO			

DEPARTAMENTO DE DISTRIBUCIÓN
OFICINA DE SISTEMAS DE DISTRIBUCIÓN

CHARACTERISTICS
Voltage transformer type VRU-52
Serial: 14016587001
NSV: 46 kV
BIL: 250 kV
Frequency: 60 Hz

VOLTAGE				RATIO	Accuracy @	THERMAL
PRIMARY		SECONDARY			60 Hz	@ 30°C
H1-H2	46000 V	X1-X2	115 V	_400:1	0.3 ZZ	3000VA

Wet 60 Hz 10 seconds withstand test.
Voltage applied to: H1-H2
Grounded: X1-X2-Frame
Voltage test: 95 kV
Time test: 10 seconds
Result: Satisfactory

Impulse (BIL) test

Impulse	Up (kV)	T1(µs)	T2(µs)	Tc(µs)
1	195.7	1.13	50.4	
2	285.5	1.01		3.56
3	285.8	1.1		3.66
4	261.4	1.14	50.4	
5	195.2	1.13	50.4	
6	284.6	1.01		3.56
7	284.8	1.1		3.66
8	254.2	1.14	50.4	

Equipment test:
Impulse generator 750 kV, Haefely, Nr. GA2006.
Impulse voltage resistive divider 600 kV, serial Nr. 061000547061000547.10.1, Haefely.
Oscilloscope Nr. D55980.
High Voltage test equipment 60 Hz, 300 kV, Nr. 1972416.
Temperature Recorder YEW serial D55090 calibrated.
Resistance Meter brand TETTEX serial 156078 calibrated
Uncentainty
With a k=2 for confidence level of 95%
AC Voltage Uncertainty: ±0.7 %
Impulse Voltage Uncertainty: ±1.7 %
Temperature Uncertainty: ±1.98 %

DOCUMENTO FIRMADO ELECTRONICAMENTE

Tested By: **Ruben Jaramillo Vacio**
Ingeniero de Pruebas

DOCUMENTO FIRMADO ELECTRONICAMENTE

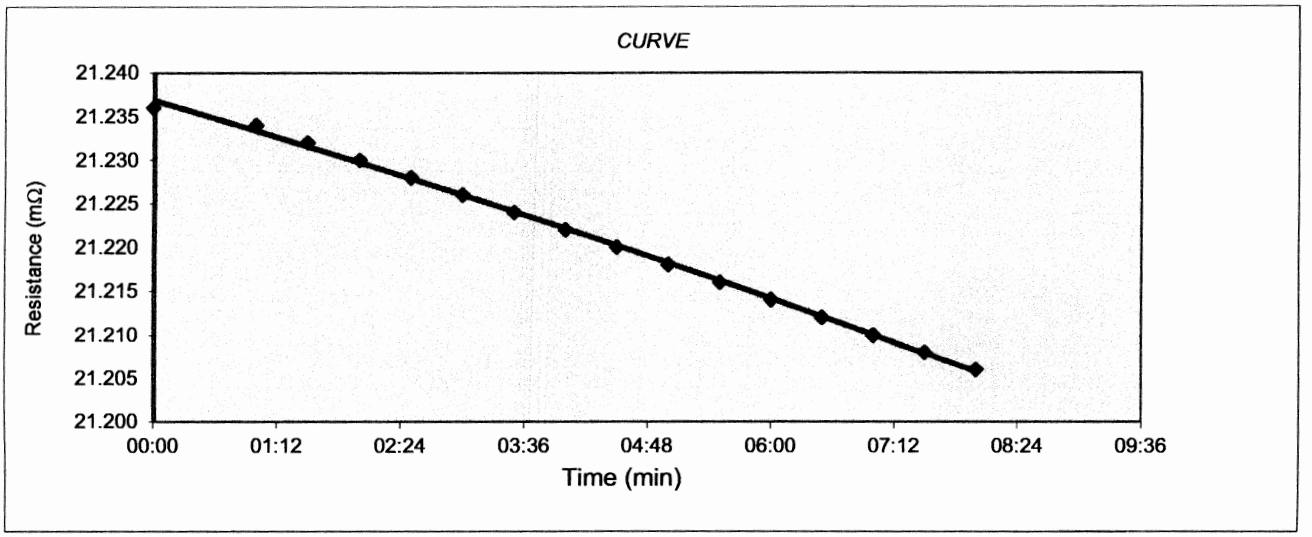
Checked By **Jaime Encinas Rosas**
Encargado de Oficina de Sistemas de Distribución

Report Nr: K3421-238D-2014
Sheet: 3 of 6
Date: 17/10/2014

DEPARTAMENTO DE DISTRIBUCIÓN
OFICINA DE SISTEMAS DE DISTRIBUCIÓN

Temperature rise test, winding X1-X2

Nr.	Time	Resistance
/	min	mΩ
/	00:00	21.2360
1	01:00	21.2340
2	01:30	21.2320
3	02:00	21.2300
4	02:30	21.2280
5	03:00	21.2260
6	03:30	21.2240
7	04:00	21.2220
8	04:30	21.2200
9	05:00	21.2180
10	05:30	21.2160
11	06:00	21.2140
12	06:30	21.2120
13	07:00	21.2100
14	07:30	21.2080
15	08:00	21.2060



R_0 =	Reference resistance of the winding	18.227	mΩ
R =	Resistance of the winding at the time of shutdown	21.236	mΩ
Θ_0 =	Temperature in degree Celsius correspondig to the reference resistance of the winding	24	°C
Θ =	Ambient temperature corresponding at the time of shutdown	22	°C
Θk =	Temperature in the degree Celsius corresponding to the resistance of the winding at time of shutdown	66.67	°C
$\Delta\Theta$ / ambient	Average temperature rise of a winding	**44.67**	**°C < 80°C a 1780 mosl Satisfactory**

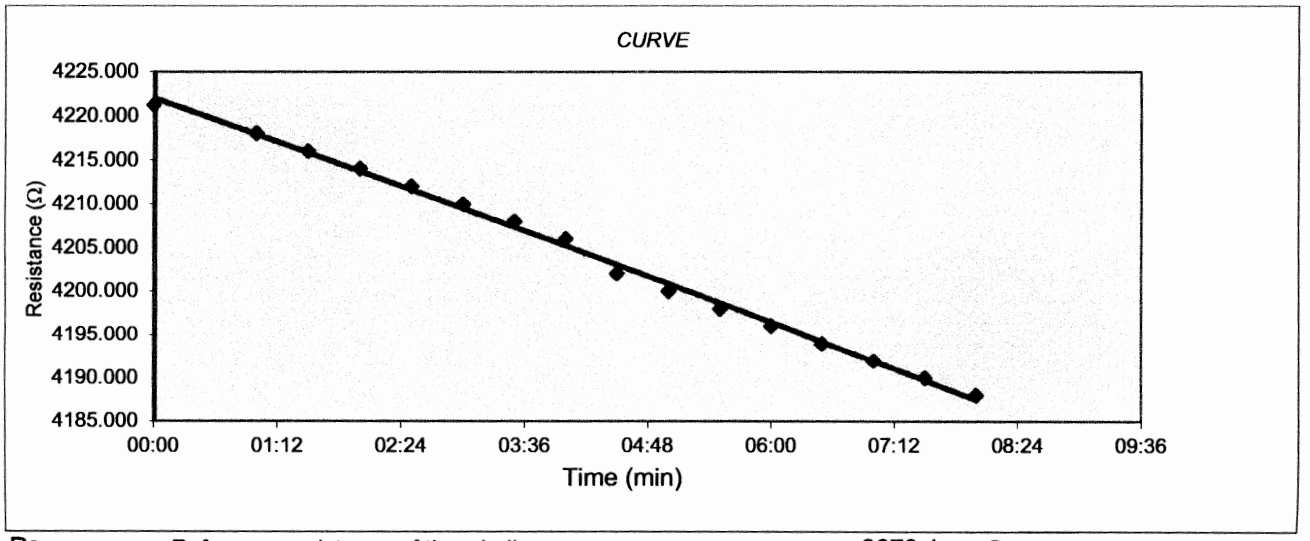
Voltage test: 46000V, thermal burden: 3000 VA

Report Nr: K3421-238D-2014
Sheet: 4 of 6
Date: 17/10/2014

DEPARTAMENTO DE DISTRIBUCIÓN
OFICINA DE SISTEMAS DE DISTRIBUCIÓN

Temperature rise test, winding H1-H2

Nr.	Time	Resistance
/	min	Ω
/	00:00	4221.2
1	01:00	4218.0
2	01:30	4216.0
3	02:00	4214.0
4	02:30	4212.0
5	03:00	4210.0
6	03:30	4208.0
7	04:00	4206.0
8	04:30	4202.0
9	05:00	4200.0
10	05:30	4198.0
11	06:00	4196.0
12	06:30	4194.0
13	07:00	4192.0
14	07:30	4190.0
15	08:00	4188.0



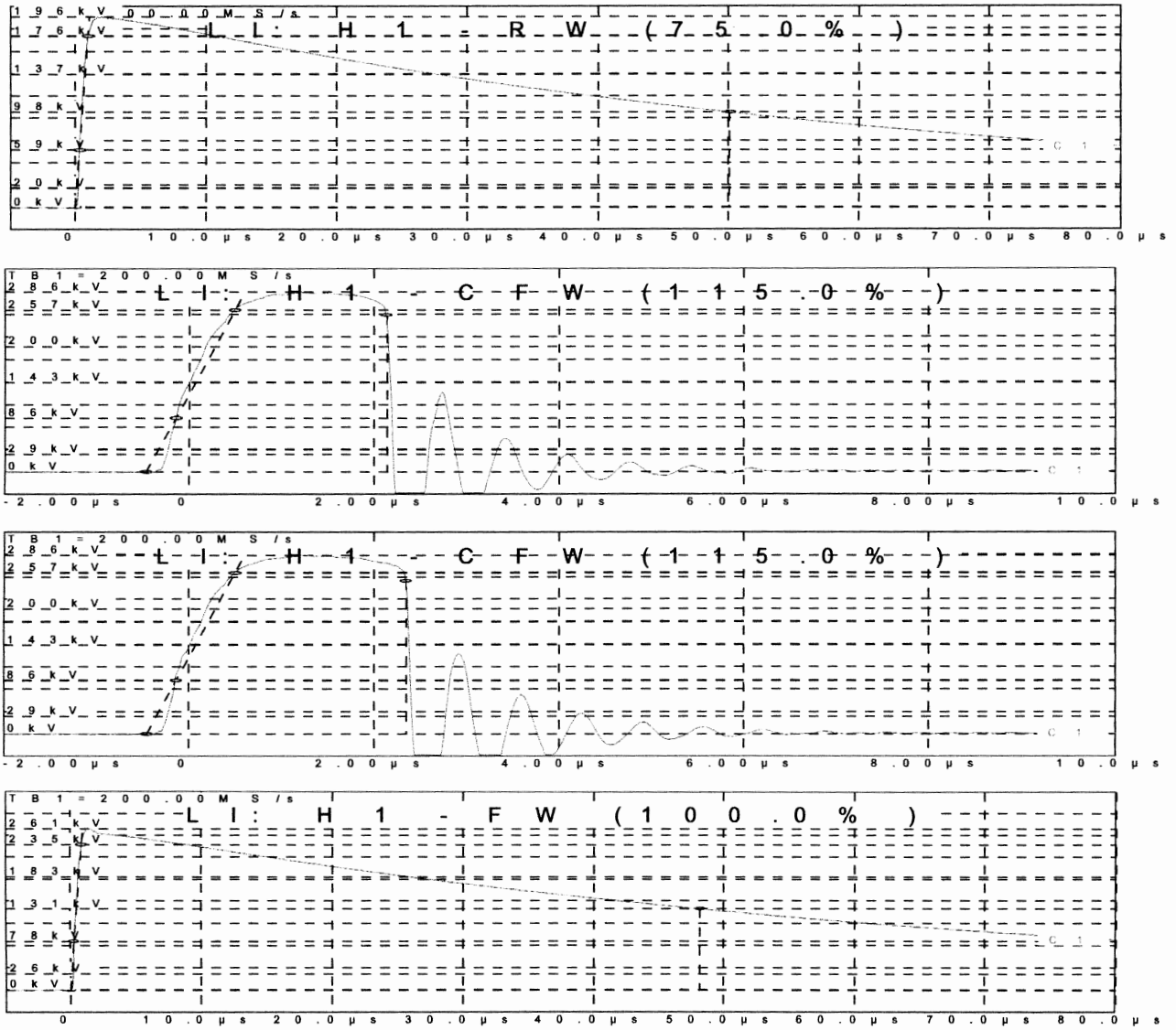
R0 =	Reference resistance of the winding	3873.1	Ω
R =	Resistance of the winding at the time of shutdown	4221.2	Ω
Θ0 =	Temperature in degree Celsius correspondig to the reference resistance of the winding	24	ºC
Θ =	Ambient temperature corresponding at the time of shutdown	23	ºC
Θk =	Temperature in the degree Celsius corresponding to the resistance of the winding at time of shutdown	47.23	ºC
Δ Θ / ambient	Average temperature rise of a winding	**24.23**	**ºC < 80ºC a 1780 mosl Satisfactory**

Voltage test: 27600V, thermal burden: 3000 VA

DEPARTAMENTO DE DISTRIBUCIÓN
OFICINA DE SISTEMAS DE DISTRIBUCIÓN

Impulse (BIL) test

Voltage applied to: H1
Grounded: X1-X2-Frame



Result: Satisfactory

Tested By: **Ruben Jaramillo Vacio**
Ingeniero de Pruebas

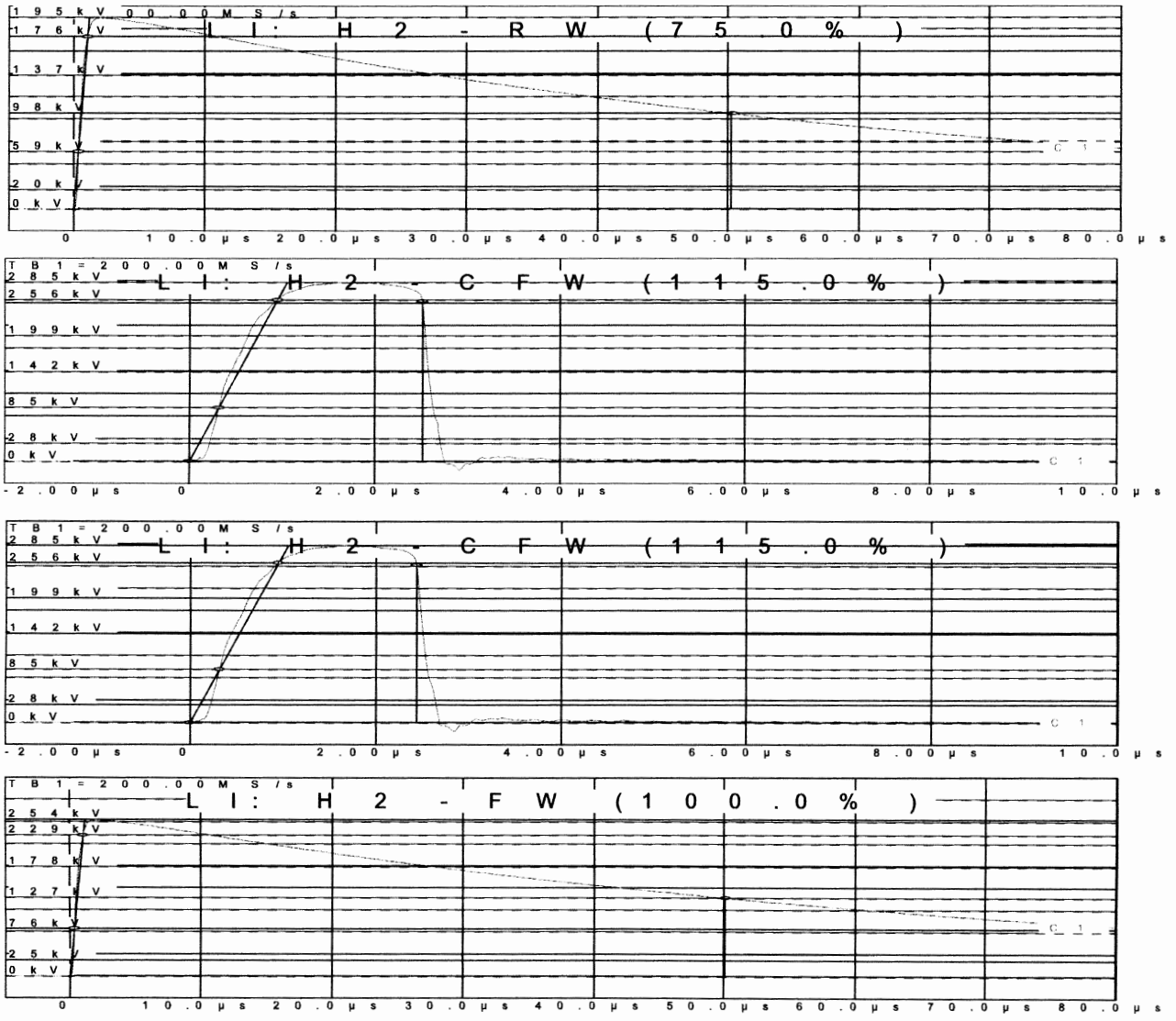
Checked By **Jaime Encinas Rosas**
Encargado de Oficina de Sistemas de Distribución

Report Nr: K3421-238D-2014
Sheet: 6 of 6
Date: 13/10/2014

DEPARTAMENTO DE DISTRIBUCIÓN
OFICINA DE SISTEMAS DE DISTRIBUCIÓN

Impulse (BIL) test

Voltage applied to: H2
Grounded: X1-X2-Frame



Result: Satisfactory

Tested By: **Ruben Jaramillo Vacio**
Ingeniero de Pruebas

Checked By **Jaime Encinas Rosas**
Encargado de Oficina de Sistemas de Distribución

ANNEX

KV Consulting

METROLOGICAL LABORATORY

Certificate of Calibration

Current Transformer Test System

KNOPP CT Test Set GTC-1-918, ID: 4200-LLB
ZERA Accuracy Bridge WM3031, ID: 9504-ICRI

Calibration of the above referenced instrument in accordance with ANSI/NCSL Z540.3-2006 has been accomplished at the ARTECHE TyT Tepeji del Rio, Mexico facility, using standards whose accuracies are traceable to the National Institute of Standards and Technology (NIST).

Test System components comply with the accuracy requirements as specified in 8.1 of the IEEE Std C57.13-2008. The Test System is certified for testing current transformers of accuracy classes 0.15S per IEEE Std C57.13.6 and 0.1 per IEC 61869-2 at secondary currents from 0.05A through 10A.

Supporting documentation relative to traceability is available for inspection upon request.

Calibration Due: October 2016

Certified by V. Khalin
Vladimir Khalin, MSEE, CQA

Date: 10-01-2014

KV Consulting

Report of Calibration

CURRENT TRANSFORMER TEST SYSTEM

KNOPP CT Test Set GTC-1-918, ID: 4200-LLB

ZERA Accuracy Bridge WM3031, ID: 9504-ICRI

Submitted by: Arteche TyT MT

BURDEN	AMP	Ratio 100/5	Ratio 200:5	Ratio 250:5
B-0.1	0.05	0.0171 / -1.4	0.0173 / -1.2	0.0155 / -1.2
	0.25	0.0064 / -0.5	0.0063 / -0.2	0.0036 / -0.1
	0.5	0.0057 / -0.4	0.0049 / -0.2	0.0021 / -0.1
	5.0	0.0048 / -0.3	0.0041 / -0.1	0.0013 / -0.2
		Ratio 500:5	**Ratio 1000/5**	**Ratio 5000:5**
B-0.1	0.05	0.0153 / -1.2	0.0151 / -1.4	0.0148 / -1.4
	0.25	0.0036 / -0.2	0.0056 / -0.4	0.0051 / -0.4
	0.5	0.0021 / -0.2	0.0045 / -0.4	0.0040 / -0.3
	5.0	0.0013 / -0.1	0.0052 / -0.3	

The above referenced systems have been metrologically verified using the Standard CT Ser. No VK090910, traceable to the National Institute of Standards and Technology (NIST). The total uncertainties of the this calibration are estimated to be not more than ± 0.01% in the Ratio Error and ± 0.5 minutes in the Phase Error (95% confidence level).

Certified by V. Khalin

Vladimir Khalin

Date: *October 1, 2014*

KV Consulting

METROLOGICAL LABORATORY

Certificate of Calibration

ZERA Electronic Standard Current Burden ESCB200-7
ID: 9534-HCAE

Calibration of the above referenced instrument in accordance with ANSI/NCSL Z540.3-2006 has been accomplished at the ARTECHE TyT Tepeji del Rio, Mexico facility, using standards whose accuracies are traceable to the National Institute of Standards and Technology (NIST).

The Burden accuracy complies with the impedance tolerance requirements as specified in 6.2 (Table 9) of the IEEE Std C57.13-2008.

Supporting documentation relative to traceability is available for inspection upon request.

Calibration Due: October 2016

Certified by V. Khalin
Vladimir Khalin, MSEE, CQA

Date: 10-01-2014

KV Consulting

Report of Calibration

ZERA Electronic Standard Burden ESCB200-7

ID: 9534-HCAE

Submitted by: Arteche TyT MT

Nominal Power, VA	Metering Burden	Current, A	Voltage, V	Impedance, Ω	Error, %
2.5	B-0.1	5.030	0.515	0.102	2.38
		1.020	0.104	0.102	2.18
5.0	B-0.2	5.032	1.027	0.204	2.05
		1.031	0.210	0.204	2.00
12.5	B-0.5	5.075	2.584	0.509	1.83
		1.024	0.521	0.509	1.80
22.5	B-0.9	5.034	4.611	0.916	1.77
		1.026	0.938	0.915	1.71
45.0	B-1.8	5.071	9.263	1.827	1.46
		1.025	1.8.72	1.826	1.46

The above referenced instrument have been metrologically verified using EXTECH Dual Channel MultiMeter 380900, Serial No. 06010102, traceable to the National Institute of Standards and Technology (NIST). Impedance Errors are well within the allowable range (-0% through +5%) as defined in 6.2 of the IEEE Std C57.13.

Certified by V. Khalin

Vladimir Khalin

Date: *October 1, 2014*

KV Consulting

Instrument transformer on-site testing

With market deregulation expanding throughout the United States and Canada, there is an increased need for metering of power facilities and transmission points. This has increased focus on upgrading metering at these locations to provide reliable data for power flow. KV Consulting has developed tests specific to each site situation and has test equipment and standards certified traceable to National Institute of Standard and Technology (NIST) and National Research Council of Canada (NRCC). We have performed tests on hundreds of installed instrument transformers in various applications and provided certified test reports.

Testing overview

On-site testing includes:

In-service testing of current transformers (CTs) to identify excitation performance
De-energized accuracy testing without disassembly of any CT
Measurement of actual burden connected into circuit
Calibration of user laboratory test equipment to NIST/NRCC standards
Calibration of user standard transformers to NIST/NRCC standards
Transformer failure analysis and design information

In-service on-site testing

As a service to the power generation industry, and because traditional testing methods all require the generator or substation be de-energized, we provide custom substation CT, bushing current transformer (BCT), and generator current transformer (GCT) in-service testing . Fast and efficient, only two to four minutes per CT. Plant operations normal – at power. Field proven – no plant trips.
Tests for all known failure modes of CT

De-energized on-site testing

With the need to accurately meter generation facilities and limited space to locate free-standing CTs, more power generators are opting to use internal BCTs for metering needs. These transformers must be accuracy tested to confirm revenue metering performance. KV Consulting offers on-site de-energized accuracy testing that identifies the metering accuracies, per IEEE 57.13, at burden rating for all CTs. In addition, voltage comparator accuracy testing is also available for VTs at full voltage up to 34.5 kV applications. Testing can check CTs in place, mounted in power transformers or generators, and on circuit breakers. Access for CT testing in power transformers and generators is at the CT secondary terminal block. For circuit breaker CT testing,

For a quotation on any of our services, please contact us at (704) 246-6227 or vkhalin@msn.com

NYSEG

September 15, 2014

Jeffrey C. Cohen
Acting Secretary
Department of Public Service
Three Empire State Plaza
Albany, NY 12227

Dear Secretary Cohen,

It is our understanding that Arteche, a manufacturer of revenue grade instrument transformers, pursuant to New York State 16 NYCRR Part 93 regulations is submitting an approval request. The purpose of this letter is to inform you that if approved, we intend to add Arteche on our approved supplier list, allowing them participation in future bidding initiatives. The Arteche products we intend to use are listed below:

Voltage Transformers:

Types: UCE-17, VCE-17, VRL-17, URL-17, URJ-17, VRJ-17,
URS-36, VRS-36, URU-52, VRU-52

Current Transformers:

Types: CID-17, CRF-36, CRB-17, CRH-36

Please do not hesitate to call or email me if you have any questions.

Sincerely,

Peter C. Kourliouros, P.E.
NYSEG Meter Services
Phone: (607) 762-4989
Fax: (607) 762-4801
Email: pkourliouros@nyseg.com

xc: Angela Capps